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Populus: A Bibliography of World Literature, 1975-1988



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Compiled by M. E. Ostry and F.L. Henderson
USDA Forest Service
North Central Forest Experiment Station

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INTRODUCTION

This bibliography is intended to be a comprehensive reference of the world's literature on Populus published during the period 1975 through 1988. Research on poplars has dramatically increased since the publication of the last bibliography in 1976¹. Research on intensive culture of poplars for fuel and fiber has accounted for much of this increased activity. Poplars are also increasingly the subject of research using cell and tissue culture techniques.

Most of the major data bases in the field of agriculture were used in compiling this bibliography. Efforts were made to avoid duplication and to include all references available through 1988. The last computer search was completed in January, 1990.

The bibliography is arranged by subject-matter, but unlike the previous edition, it was not possible to separate the literature by Populus species because of the many papers dealing with multiple poplar species and hybrids. Entries are listed in chronological order and alphabetically by author. When abstracts were available, they were annotated. The reader should be aware that an entry may cover more than one subject area but every effort was made to include it under the primary subject covered.

¹Southern Forest Experiment Station. 1976. Populus: a bibliography of world literature, 1964-1974. South. For. Exp. Stn., New Orleans, LA. 227 p. (USDA For. Serv. Res. Pap. SO-124)

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CELL AND TISSUE CULTURE

1975

Chalupa, V. 1975. Tissue cultures of forest tree species. Abstract Bulletin of the Institute of Paper Chemistry. 47(2801): 83 p.

A review of studies of the growth in vitro of tissues of forest trees. With some species of Populus, Betula, and Ulmus, whole trees were obtained from unorganized callus tissues.

Fukuda, Tadanori; Oota, Michiko; Terashima, Noritsugu; Kanda, Takashi. 1975. Studies on tissue culture of tree-cambium. II. On the physical and chemical properties of lignin from poplar callus tissue. Journal of the Japan Wood Research Society. 21(3): 157-163.

Heilungkiang Institute of Forestry, Tree Improvement Laboratory. 1975. Induction of haploid poplar plants from anther culture in vitro. Scientia Sinica. 18(6): 769-777.

Plantlets were obtained with the greatest frequency from in vitro culture of anthers of Populus simonii X P. nigra and with a lower frequency from P. ussuriensis, but no callus formation was obtained in P. alba X P. davidiana. In organ differentiation, roots grew from the upper part of the callus and shoots from the lower part. Calluses which formed shoots first could generally grow roots afterwards but calluses which rooted first generally failed to shoot. Albinos were seldom found.

Oota, Michiko; Fukuda, Tadanori; Terashima, Noritsugu; Kanda, Takashi. 1975. Studies on tissue culture of tree-cambium. I. Growth of callus tissue from poplar-cambium in vitro. Journal of the Japan Wood Research Society. 21(2): 82-86.

The callus tissues derived from cambium of Italian poplar (Populus euramericana cv. 'I-214') had been cultured for two months on a modified Steinhart's medium. The tissues were transferred into new medium containing 0.1 ppm 2,4-D at roughly two-months intervals. The tissues, after a year of subculture, were subjected to a further series of experiments.

Riou, Andre; Harada, Hiroshi; Taxis, Bernard. 1975. Development of complete plants from free cells of Populus callus. C. R. Academy of Science, Serie D. 280(23): 2657-2659.

Riou, Andre; Harada, Hiroshi; Taxis, Bernard. 1975. Histophysiologie vegetale. - Production de plantes entieres a partir de cellules separees de cals de Populus. C.R. Academy Science, Paris. 280(23): 2657-2659.

Riou, Andre; Harada, Hiroshi; Taxis, Bernard. 1975. Successful in vitro culture of Melampsora allii-populina Kleb. using a synthetic medium containing free cells of callus of Populus X euramericana (Dode) Guinier cv. 'Robusta'. C. R. Academy of Science, Serie D. 280(24): 2765-2767.

Wang, Ching-Chu; Chu, Zhih-Ching; Sun, Ching-San. 1975. The induction of Populus pollen-plants. *Acta Botanica Sinica* (Chih-Wu-Hsueh Pao). 17(1): 56-59.
 Haploid plantlets were successfully induced from Populus nigra anthers.

Wolter, Karl E.; Gordon, John C. 1975. Peroxidases as indicators of growth and differentiation in aspen callus cultures. *Physiologia Plantarum*. 33(3): 219-223.

Aspen (Populus tremuloides Michx.) callus tissue grown on a synthetic medium containing either an auxin (2,4-dichloro-phenoxyacetic acid) or cytokinin [6-(3-methyl-2-butenylamino) purine] differed in growth rate, total peroxidase activity, peroxidase isoenzyme expression, and in lignin, cell wall sugars and extractive content. Tissue treated with auxin increased more rapidly in fresh weight, but stopped growing sooner than did the cytokinin-treated tissues. Lignification also proceeded more rapidly, and lignin formed a greater fraction of the cell wall weight in auxin-treated tissue. For both treatments, peroxidase activity and growth rate were positively related ($r=0.96$). Polyacrylamide gel electrophoresis showed some quantitative, but few qualitative, isoenzyme differences with hormonal treatment and growth rate.

1976

Chalupa, V. 1976. The use of regenerants from tissue culture of forest trees in tree breeding. In: Novak, Fransisek J., ed. *Vyuziti kultur rostlinnych explantaty ve slechteni: sbornik mezinarodniho symposia; 1976 January 6-11; Olumouc, CSSR: 183-193.*

Many forest tree species have some disadvantageous properties from the point of tree breeding which seriously delay the breeding work. This is notably a late beginning of the seed formation. Presently many plus trees are selected in Czechoslovakia and it is very important to test their genetic value. The vegetative propagation of these plus trees would be a considerable contribution for the tree breeding work. For this purpose we try to apply the method of tissue culture which possesses many priorities, such as the use of only small twigs as the starting material to obtain sufficient number of callus pieces.

Dujickova, M.; Chalupa, V.; Fikacova, J. 1976. Rust a morfogenese kalusovych tkani Populus euramericana (Dode) Guinier cv. 'Robusta'. In: Novak, Fransisek J., ed. *Vyuziti kultur rostlinnych explantaty ve slechteni: Sbornik mezinarodniho symposia; 1976 January 6-11; Olomouc, CSSR: 81-89.*

Fukuda, Tadanori. 1976. Studies on tissue culture of tree cambium. VI. Formation of lignin in poplar callus in suspension culture. *Journal of the Japan Wood Research Society*. 22(11): 638-643.

Two media for cell suspension culture of poplar were compared and the formation of lignin in the cell walls of the callus was studied. Lignin was prepared from the callus cell suspension culture and was shown to be similar in properties to callus milled wood lignin.

Fukuda, Tadanori; Kanda, Takashi. 1976. Studies on tissue culture of tree-cambium. III. Separation of lignin-carbohydrate-protein complex from poplar callus tissue. Journal of the Japan Wood Research Society. 22(2): 112-118.

Homogenized fresh callus from poplar was incubated with a protease enzyme solution which removed protein from the callus. Experiments with electrophoresis and gel filtration suggested that a lignin-carbohydrate-protein complex existed in the poplar callus.

Fukuda, Tadanori; Kanda, Takashi. 1976. Studies on tissue culture of tree-cambium. IV. On the chemical compositions of lignin-carbohydrate-protein complex in poplar callus tissue. Journal of the Japan Wood Research Society. 22(10): 564-569.

The chemical composition of the lignin-carbohydrate-protein complexes (LCPC) prepared from callus, cambium and xylem tissues were compared with one another and with the composition of callus cell walls. The results indicate a significant correlation between the compositions of callus cell wall and callus LCPC.

Fukuda, Tadanori; Tomimura, Yooiti. 1976. Studies on tissue culture of tree-cambium. V. Enzymic hydrolysis of lignin-carbohydrate-protein complex in poplar cambium tissue. Journal of the Japan Wood Research Society. 22(10): 570-574.

Fractionation of the LCPC by gel filtration yielded a high and a low molecular weight fraction. Treatment of the former with a cellulase enzyme gave a product of molecular weight ca. 1000. The results suggest that chemical linkages exist between the components of the complex in poplar cambium tissue.

Heilungkiang Institute of Forestry, Breeding Laboratory. 1976. Haploid plants of poplar induced from anther cultured *in vitro*. Acta Genetica Sinica. 3(2): 145-149.

Plants of Populus ussuriensis, Populus simonii, Populus nigra L. hybrid were obtained from poplar anther culture *in vitro* on BN medium containing kinetin and auxin. Callus was better induced from anther on BN medium supplemented with 2 ppm 2,4-D and 1 ppm kinetin, and differentiation and germination of callus were promoted when BN medium supplemented with 3 ppm kinetin and 0.5 ppm IAA or alternatively with 2 ppm kinetin and 0.3 ppm IAA. In anther culture, performance of different species and hybrid combinations varied markedly.

Saito, A. 1976. Isolation of protoplasts from mesophyll cells of Paulownia fortunei Hemsl. and Populus euramericana cv, I-45/51. Journal of the Japanese Forestry Society. 58(8): 301-305.

Protoplasts 13 μ m in diameter were isolated from young leaves of Populus euramericana 'I-45/51'.

Van Kraayenoord, C.W.S. 1976. Poplar culture. In: Proceedings, 23rd Northeast Forest Tree Improvement Conference; 1975 August 4-7; New Brunswick, NJ: 128-142.

1977

Burkot, T.R.; Benjamin, D.M. 1977. The bionomics of the cottonwood leaf beetle, Chrysomela scripta Fab., on tissue culture hybrid poplars. In: Proceedings of the 13th Lake States forest tree improvement conference; 1977 August 17-18; St. Paul, MN. Gen. Tech. Rep. NC-50. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 131-135.

Tissue culture methods are applied to poplars of the Aigeiros group in attempts to overcome premature decline thought to be associated with viral infections. Hybrid selections from such cultures outplanted in 1975 at the F. G. Wilson Nursery in Boscobel, Wisconsin subsequently were severely infested by the Cottonwood Leaf Beetle, Chrysomela scripta Fab. Beetle populations built up rapidly in spring 1977 and severe defoliation occurred; an average of 45 percent of the terminal buds were destroyed and 73 percent of the tips of a preferred clone were fed upon. Younger foliage appeared preferred and certain clones sustained more feeding in field and laboratory studies. Plants receiving greater amounts of overhead irrigation were least defoliated. Rapid increases in the numbers of the insect in Wisconsin are reflected in the following facts. The Cottonwood Leaf Beetle has a rapid life cycle (19 days at 27degC). Consequently, the insect undergoes 4-5 generations per year in Wisconsin where it exhibits a high fecundity of approximately 510 eggs. Finally, because of the larval defensive secretion, salicylaldehyde, the insect has few natural enemies; mainly predatory pentatomids on larvae and adults, and Shizonotus latus Walker, a pupal parasite.

Lester, D.T.; Berbee, J.G. 1977. Within-clone variation among black poplar trees derived from callus culture. *Forest Science*. 23(1): 122-131.

Several trees were produced by tissue culture of shoot tips from each of 5 putative euramericana hybrid poplar clones (Populus X euramericana (Dode) Guinier) and one Lombardy poplar clone (P. nigra cv. 'italica'). A wide range of variation was found for height, number of branches, and leaf traits after one growing season.

North Eastern Forestry Academy, Tree Breeding Group. 1977. Induction of haploid poplar plantlets from pollen. *Acta Genetica Sinica*. 4(1): 49-54.

Haploid plantlets were successfully grown from anthers of Populus berolinensis, P. simonii X P. nigra, P. harbinensis X P. pyramidalis, and P. canadensis X P. koreana on specified media.

Peking Institute of Botany, Research Group of Phytohormone. 1977. Interaction of auxin and kinetin on the organ differentiation of Populus callus tissue. *Acta Botanica Sinica*. 19(1): 95-97.

Thompson, D.G.; Gordon, J.C. 1977. Propagation of poplars by shoot apex culture and nutrient film technique. In: Proceedings TAPPI Forest Biology Wood Chemistry Conference; June 20-22; Madison, WI: 77-82.

Large-scale, economical propagation of poplars and other fast-growing hardwood species will be necessary if high-yielding, intensive wood fiber production systems employing high planting densities are to become practical. For poplar, a modification of conventional propagation techniques that uses

apex culture and Nutrient Film Technique (NFT) may present an improved way of producing large quantities of plantable clonal material. For our system, shoot apices were excised from resting buds and placed on a modified Murashige and Skoog agar medium with varying auxin and cytokinin levels. At certain hormone concentrations, good production of adventitious shoots was obtained within 4-6 weeks. Apices then were transplanted to a rooting medium and subsequently to peat pellets. The rooted apices in peat pellets were grown to plantable size in plastic troughs containing recirculating nutrient solution (NFT), thus automating the growing operation.

Whitehead, H.C.M.; Giles, K.L. 1977. Rapid propagation of poplars by tissue culture methods. *New Zealand Journal of Forestry Sciences*. 7(1): 40-43.

Populus nigra 'Italica', P. deltoides X P. nigra 'Flevo' and P. yunnanensis could be rapidly propagated by tissue culture from axillary buds. P. nigra produced the fewest adventitious buds and P. yunnanensis produced most shoots.

1978

Blanarikova, Vitazoslava; Karacsonyi, S. 1978. The isolation of tissue culture of Populus alba L. 'pyramidalis'. *Biologia Plantarum (Praha)*. 20(1): 14-18.

Bychenkova, E.A.; David, A. 1978. Callus formation and organogenesis in tissues of leaves of Populus balsamifera L. cultivated in vitro. *Soviet Plant Physiology (Fiziologiya Rastenii)*. 25(2): 274-282. Plenum Publishing Corporation: 216-222.

We studied callus formation and organogenesis in tissues of balsam poplar leaves cultivated on Murashige-Skoog, Gautheret's, and Heller's media. Growth stimulants were added to the media in two variants: 1) 2,4-D; and 2) NAA + kinetin. Cultures were incubated in the dark and under light. Intensive callus formation was observed on Murashige-Skoog medium containing 2,4-D, while intensive callus formation and rhizogenesis were recorded on the same medium containing NAA + kinetin, rhizogenesis being observed both on the leaf disk and on the callus here. On Gautheret's and Heller's media, callus formation was weak on media containing 2,4-D and absent on media containing NAA + kinetin, while rhizogenesis was weaker than on Murashige-Skoog medium. Callus tissue was cultivated in transplant cultures on Murashige-Skoog, Gautheret's, and Darzan's media containing different concentrations and combinations of auxins and cytokinins. On media containing 2,4-D, only intensive growth of undifferentiated callus tissue was obtained invariably; on media containing NAA + Kinetin, only rhizogenesis was obtained; and on media containing NAA + BAP, rhizogenesis was obtained on Gautheret's and Murashige-Skoog media, while rhizogenesis or rhizogenesis and bud and shoot formation were obtained on Darzan's medium. Induced roots and shoots were separated from the callus tissue and cultivated on Murashige-Skoog medium and Gautheret's medium containing special additives. Rooting of induced shoots was obtained on Murashige-Skoog medium.

Christie, C.B. 1978. Rapid propagation of aspens and silver poplars using tissue culture techniques. *Proceedings of International Plant Propagation Society*. 28: 255-260.

Fukuda, Tadanori. 1978. Studies on tissue culture of tree-cambium. VII. Sugar composition of cell wall polysaccharides of suspension-cultured poplar cells. *Journal of the Japan Wood Research Society*. 24(10): 677-682.

Poplar cells were grown in suspension culture at three different growth stages. Harvested fresh cells and culture media were fractionated into cell wall, extracellular polysaccharide and organic solvent-unextractable material fractions. Polysaccharides in each fraction were hydrolyzed, and converted to their respective alditol acetates. These derivatives were quantitatively assayed by gas chromatography.

Simson, B.W.; Timell, T.E. 1978. Polysaccharides in cambial tissues of Populus tremuloides and Tilia americana. V. cellulose. *Cellulose Chemistry and Technology*. 12(2): 137-141.

Celluloses have been isolated from aspen and basswood cambial tissues by extraction of all other polysaccharides or by nitration of the tissue and recovery of pure cellulose nitrates. The results indicate that the two materials contained 24 ± 2 percent cellulose. The cellulose in the primary walls of the cambial zone in aspen had a degree of polymerization of 4,200 and was polydisperse, while the cellulose in the secondary walls of the wood had a D. P. of 9,200. These results confirm those obtained by Marx-Figini with cotton and Valonia celluloses.

1979

Bilisics, L.; Karacsonyi, S.; Kubackova, Marta. 1979. A simple procedure of the preparation of suspensions suitable for an estimate of cell number in established tissue culture of white poplar (Populus alba L. 'pyramidalis'). *Biologia Plantarum (Praha)*. 21(5): 390-394.

A simple maceration procedure for cell suspension preparation from white poplar tissue culture has been devised which makes it possible to count cell number from microphotographs reliably. The results obtained are suitable for quantitative evaluation of cell proliferation tissue growth.

Burkot, T.R.; Benjamin, D.M. 1979. The biology and ecology of the cottonwood leaf beetle Chrysomela scripta (Coleoptera: Chrysomelidae), on tissue cultured hybrid Aigeiros (Populus x euramericana) subclones in Wisconsin. *The Canadian Entomologist*. 111(5): 551-556.

Adults and larvae of the cottonwood leaf beetle, Chrysomela scripta Fab., defoliated tissue cultured Aigeiros (Populus x euramericana (Dode) Guinier) subclones and destroyed apical tips. Fecundity was 510 ± 153 eggs ($\bar{X} \pm S$). Four generations occurred between May and September in southern Wisconsin. Maximal insect numbers and damage occurred in the third generation. The minimal developmental threshold was 10.8degC with a mean 257 ± 26 day-degree (degC) required per generation. Important biological control agents included Coleomegilla maculata, which consumed up to 25 percent of the eggs, and Shizonatus latus, a pteromalid parasite, which destroyed up to 26 percent of the pupae.

Chalupa, Vladimir. 1979. In vitro propagation of some broad-leaved forest trees. *Communicationes Instituti Forestalis Cechosloveniae*. 11: 159-170.

In vitro propagation of deciduous forest trees by axillary and adventitious buds and by shoot tips has been tested. Shoots grown from buds were cut into short segments and shoot tips. New shoots produced from axillary and adventitious buds and from the callused base of segments were used for further multiplication. Regenerated trees showed a genetic uniformity.

Chen, Wei-Iun; Wang, Hong-xin; Yang, Shan-ying; Cui, Cheng. 1979. Rapid propagation of Populus davidiana X P. bolleana Loucne hybrid by tissue culture. K'o hsueh t'ung pao. Kexue Tongbao. 24(16): 758-760.

The callus from shoot-tip explant of Populus davidiana X P. bolleana Loucne hybrid has been differentiated into shoots in a modified Wolter-Skoog medium (1966) supplemented with BA 0.5, NAA 0.05 mg/l. Shoots and roots will grow from segments of these shoots in Murashige-Skoog medium (1962) without any plant hormone but containing glutathione 100 mg/l. The plantlets have been transplanted into soil and vermiculite. One single bud can grow 1 X 5" plantlets within one year.

Li, C.C.; Chang, L.; Kuo, F.; Chang, K.C. 1979. Bud culture in vitro of a new variety of poplar, Populus davidiana Dode x Populus bolleana Louche. Yichuan IHeriditas. 1(4): 27-28.

1980

Chen, Daoming; Huang, Minren. 1980. Culture of the apical tissue of Populus nigra cv. Blanc de Garonne and the variation of their isoenzymes. Journal of Nanjing Technological College of Forest Products. 3: 104-107.

Suitable media are described for culturing apical tissue to produce callus and for differentiation of stems and leaves. In the process of plantlet formation from callus the isoenzyme patterns of the tissue changed.

Chen, Wei-lun; Guo, Dong-hong; Yang, Shan-ying; Tsui, Cheng. 1980. Organogenesis of leaf explant of Populus davidiana x P. bolleana Loucne hybrid and effect of growth regulators on organogenesis. Acta Botanica Sinica. 22(4): 311-315.

This report describes the organogenesis of Populus davidiana X P. bolleana Loucne hybrid leaf explant from plantlet in vitro and the effects of different factors on its organogenesis. It was found that shoot induction of lower leaf segments with petiole was easier than those of the middle and top segments. When leaf explants were incubated on a MS medium with cytokinin (zeatin 1×10^{-6} M, 2×10^{-6} M or benzyladenine 2×10^{-6} M) and auxin (IAA 4×10^{-8} M, 1×10^{-6} M or NAA, NAAoxy 4×10^{-8} M, 4×10^{-7} M), the frequency of shoot differentiation would be 70--100 percent. Kinetin had no activity on shoot formation and 2,4-D showed serious inhibition. ABA, GA₃, and Ethrel all prevented shoot production. Since higher frequency of shoot differentiation could be obtained, a lot of shoots were produced on each leaf explant and shoots could be proliferated by axillary buds, so this system could be used for rapid propagation.

Lin, Jing-fang; Dong, Mao-shan; Huang, Qin-cai. 1980. Tissue culture of three species of Sect. Leuce Duby (genus Populus). Scientia Silvae Sinicae. 16: 58-64. Suppl.

Tissue culture experiments were carried out with Populus hopeiensis, P. tomentosa, and P. alba, all of sect Leuce Duby.

Mehra, P.N.; Cheema, G.S. 1980. Clonal multiplication in vitro of Himalayan poplar (Populus ciliata). Phytomorphology. 30: 336-343.

Multiple shoots were induced on immature lamina-discs of female Himalayan poplar on MS medium with optimal amount of BAP through the formation of adventitious buds. Discs from male plants under identical conditions did not respond. Apical bud sprouts also proliferated on MS medium containing BAP. Twigs with axillary buds and dormant apical buds callused on media supplemented with appropriate amount of NAA. These calli differentiated numerous shoots when subcultured on MS medium containing BAP and with or without a small amount of IBA. Shoots formed were isolated and rooted in culture vessels on NAA medium. These plantlets have been transferred to soil in pots for field trial.

Saito, Akiro. 1980. Effects of inorganic elements in the medium on shoot differentiation from Populus callus. Journal of the Japanese Forestry Society. 62(4): 147-149.

Saito, Akira. 1980. Fusion of protoplasts isolated from somatic cells of tree species. Bulletin Forestry and Forest Products Research Institute. 309: 7-12.

Induction of fusion between protoplasts isolated from expanding young leaves of Populus and Paulownia seedlings grown in the open air was developed. It was found that polyethylene glycol (PEG) had the effect of causing aggregation of high frequency at 1 by 1, in the case of mixed protoplasts of 2 different species, even between cells of different individuals or strains within same species. Consequently, complete fusions of cells between different strains in Populus or different individuals in Paulownia were observed. However, a specific phenomenon was found out in aggregation of cells between Populus and Paulownia. Cytoplasm within protoplast of Populus were transferred to the inside of protoplast of Paulownia in a moment, but cell membrane of Populus was left behind for ever.

Saito, Akira. 1980. Isolation of protoplasts from mesophyll cells of Paulownia and Populus. Bulletin Forestry and Forest Products Research Institute. 309: 1-6.

Expanding young leaves of Paulownia and Populus seedlings grown in the open air were cut into pieces. Fresh pieces were incubated in the renewed enzyme solution containing pectinase, hemicellulase, and cellulase every 20 min for Paulownia and 30 min for Populus at 30degC with shaking. The intact cells contained in each liquid after the 3rd period of shaking were resuspended in fresh enzyme solution in a water-bath at 30degC without shaking for 30 min for the former and 60 min for the latter. The protoplasts of 700×10^4 pieces of 40 u in diameter from the former and $560,1200 \times 10^4$ pieces of 13 u in diameter from the latter were thus isolated from 2 g in fresh weight of excised leaves.

Saito, Akira. 1980. Medium for shoot formation from somatic callus tissue in Populus. Journal of the Japanese Forestry Society. 62(7): 270-272.

Yang, Y.P.; Wang, S.L.; Zeng, S.Y.; Jin, Y.H. 1980. The ways of poplar pollen development and the effect of some factors in vitro. Scientia Silvae Sinicae. 16(4): 257-263.

The induction of haploid callus from anthers cultured in MS medium with various combinations of growth regulators is described. Different species and varieties of Populus required different culture media, and the frequency of callus induction was increased by adding yeast RNA to the medium. Differentiation of rootless plantlets (shootlets) from callus, and of rootlets from shootlets was induced by transfers to different media.

Zhu, Xiang-yu; Wang, Rui-ling; Liang, Yan. 1980. Induction of poplar pollen plantlets. Scientia Silvae Sinicae. 16(3): 190-197.

Experimental results are reported on anther culture of 14 species of Populus (including varieties and hybrids) using various media and growth regulators. Some 900 plants were raised and transplanted to seed beds or pots, some attaining a height of 3.9 m in 3 years. Chromosome analysis of root tip cells showed that most plants were haploid, i.e. of pollen origin.

1981

Badia, N. 1981. Obtention de plantules o partir de bourgeons adventils sur feuilles de perpler (Serotira de Chalpahre' - '/214') cultives in vitro. In: Proceedings IUFRO-AFOCEL Colloque International sur la culture in vitro Des Essences Forestieres; 1981 August 31-September 4: 236.

Binder, parW.D.; Zaerr, J.B. 1981. Effets de deux agents chelatants sur la croissance de suspensions cellulaires de peuplier et de douglas. In: Touzet, G., ed. Colloque International sur la culture In Vitro des Essence Forestieres. AFOCEL: 254-260.

Binder, W.D.; Zaerr, J.B. 1981. Effet du dmso et du glycerol sur la croissance de suspensions cellulaires de douglas et de peuplier. In: Touzet, G., ed. Colloque International sur la culture In Vitro des Essences Forestieres. AFOCEL: 261-268.

Chalupa, Vladimir. 1981. Clonal propagation of broad-leaved forest trees in vitro. Communicationes Instituti Forestalis Cechosloveniae. 12: 255-271.

Short stem segments with a node were cultured on 1 of 4 modified Murashige and Skoog media containing a low concentration (0.2-0.6 p.p.m.) of BAP (6-benzylaminopurine). The technique was successfully applied to 13 central European broadleaved species (with minor modifications) for accelerated production of nursery stock.

Kim, Jae Hun; Lee, Suk Koo; Chun, Young Woo. 1981. Mass propagation of tree species through in vitro culture. I. Bud culture of Populus alba x P. glandulosa. Research Report of the Institute of Forest Genetics, Korea. 17: 57-63.

Axillary buds of Populus alba X P. glandulosa F₁ hybrids were cultured in test tubes for mass propagation of these hybrids.

Krawiarz, K.; Przybyl, K. 1981. Changes in the poplar callus tissue of the in vitro culture caused by the bacteria Xanthomonas populi (Ride) and Pseudomonas syringae Van Hall. In: International Poplar Commission; IUFRO, Joint symposium on resistance mechanisms in poplar diseases, 1980 September 1-5; Kornik, Poland. Angers, France: INRA: 163-167.

Kubackova, Marta; Karacsonyi, Stefan; Bilisics, Ladislav; Liskova, Desana; Janecek, Frantisek. 1981. Chemical composition of the tissue culture cell walls of poplar (Populus alba L. 'pyramidalis') during its growth. Drevarsky Vyskum. 26(2): 1-17.

Lubrano, par Letizia. 1981. Micropropagation du peuplier. In: Proceedings colloque international sur la culture in vitro du essence forestieres. AFOCEL: 81-86.

With a view to having a rapid propagation method available for some Populus X euramericana clones ('Guardi', 'Luisa Avanzo' and 'Tiepolo') recently selected at the Agricultural and Forest Research Centre of Rome, a micropropagation technique has been perfected on the basis of Whitehead and Giles's method, duly modified. The initial explant is made up of axillary buds removed over the growing season from cuttings rooted in greenhouse. After two transfers into Murashige and Skoog with 0.5 mg/l BAP, Murashige and Skoog suitably modified is used as a proliferation medium, containing 0.20 mg/l NAA and 0.4-0.5 mg/l BAP. Propagation is followed by a lengthening stage, which can be carried out either in a basal or a proliferation medium added with charcoal (0.03 percent). Finally, rooting occurs 'in vitro' in the presence of 0.1 mg/l NAA and 0.5 mg/l IBA. The plantlets so obtained have been transplanted in greenhouse throughout the year, using a peat- and perlite-based layer. Over the acclimatization phase in greenhouse, a special care has been taken of moisture conditions, utilizing a mist apparatus. The first plantlets obtained 'in vitro' have been outplanted in spring 1981.

Saito, Akira; Kawanobe, Kimihiro. 1981. Shoot formation in Populus callus tissues precultured in vitro on some different media. Bulletin of Forestry and Forest Products Research Institute, Japan. 316: 117-123.

The effect of 4 kinds of synthetic media containing various inorganic and organic compounds, and auxins subjected to an earlier subculture of callus tissues upon the frequency of shoot regeneration in callus tissues derived from juvenile cambial parts was investigated. Sixty-eight days after the callus tissues were subcultured to these media, they were transferred to a medium already found to be effective for shoot regeneration from Populus callus tissues, and incubated: (1) under a dark condition for 30 days and subsequently under a fluorescent illumination of about 5,000 lx for 16 hr daily for 57 days, and (2) under only the above mentioned illumination for 16 hr daily for 87 days without a dark treatment. The frequency of shoot regeneration varied among test media subjected to subculturing callus tissues and between illumination conditions of the medium. Certain media (Medium-3 and -2) subjected to a subculture of callus tissues were found to be effective for shoot formation. Moreover, the shoot formation frequency was increased by

dark treatment of the callus tissues. The pattern of analytical thin layer gel electrofocusing of peroxidase extracted from callus tissue grown on synthetic media subjected to an earlier subculture showed some quantitative and qualitative iso-enzyme differences with the media.

Sato, Toru. 1981. Effects of the amount of NH_4NO_3 and the concentration of zeatin on shoot formation in aspen callus cultures. *Journal of the Japanese Forestry Society*. 63(2): 46-50.

A shoot formation study on woody plant tissues was conducted with aspen calluses subculturing for about six months following the commencement of callus formation. The amount of NH_4NO_3 in the Wolter and Skoog's (WS) medium was modified in order to obtain the medium constituent suitable for organogenesis in aspen callus. As a result, optimum shoot formation was induced on the WS-median N medium (676 mg/l NH_4NO_3) which included 6-(4-hydroxy-3-methyl-2-trans-butenylamino) purine (Zeatin) and α -naphthaleneacetic acid (NAA), but the WS-standard (50 mg/l NH_4NO_3) and the WS-abundant N (1,637 mg/l NH_4NO_3) media resulted in lower percentages of shoot formation. Shoots were initiated by the addition of Zeatin to the modified WS media in the presence of 10^{-7} M NAA. The optimum formations occurred at 3.16×10^{-6} and at 10^{-5} M of Zeatin in the WS-median N medium, but no shoots formed at a low concentration (10^{-6} M) of Zeatin, and a higher concentration (3.16×10^{-5} M) was inhibitory.

1982

Ahuja, M.R. 1982. Isolation, culture, and fusion of protoplasts: problems and prospects. *Silvae Genetica*. 31(2-3): 66-77.

Ahuja, M.R.; Muhs, H.J. 1982. Control of growth and differentiation in tissues and protoplast derived callus in different genotypes of aspen. In: Fujiwara, Akio, ed. *Plant tissue culture 1982: Proceedings, 5th International Congress of Plant Tissue and Cell Culture; 1982 July 11-16; Tokyo and Lake Yamanake, Japan*. Tokyo, Japan: Japanese Association for Plant Tissue Culture: 177-178.

Bellarosa, R. 1982. Cultivation of forest species in vitro. *Cellulosa e Carta*. 33: 29-36.

Blanarikova, Vitazoslava; Blanarik, Peter; Karacsonyi, Stefan. 1982. Ultrastructure of tissue culture cells of white poplar (*Populus alba* L., *pyramidalis*). *Drevarsky Vyskum*. 27(2): 1-10.

The young cells of the callus tissue, prevailing in the culture 10-20 days after inoculation, were found to contain more cytoplasm and more organelles than older cells.

Douglas, Gerard. 1982. Protoplast isolation from totipotent cell-cultures of *Populus* hybrid TT32. In: Fujiwara, Akio, ed. *Plant tissue culture 1982: Proceedings, 5th International Congress of Plant Tissue and Cell Culture; 1982 July 11-16; Tokyo and Lake Yamanake, Japan*. Tokyo, Japan: Japanese Association for Plant Tissue Culture: 605-606.

Evers, P.W. 1982. Propagation of forest trees by tissue culture: in vitro plant development for forestry requirements. *Jaargang*. 54(9): 267-277.

Frohlich, H.J. 1982. Fortschritte bei der vegetativen Vermehrung. *Forstarchiv*. 53(1): 3-9.

Harrell, M.O.; Benjamin, D.M.; Berbee, J.G.; Burkot, T.R. 1982. Consumption and utilization of leaf tissue of tissue-cultured Populus x Euramericana by the cottonwood leaf beetle Chrysomela scripta (Coleoptera: Chrysomelidae). *The Canadian Entomologist*. 114(8): 743-749.

Chrysomela scripta Fabricius adults showed a feeding preference for the youngest, most succulent leaves of tissue-cultured Populus X euramericana. Larvae fed equally on all leaves with water contents greater than 73 percent. Larvae chose shoot bark for feeding after all leaves with water contents greater than 70 percent had been consumed. Larvae reared on immature foliage had shorter developmental times and higher prepupal weights than those reared on mature foliage.

Ho, Rong H. 1982. Haploid plant culture in poplar. In: Proceedings 7th North American forest biology workshop; 1982 July 26-28; Lexington, KY. Lexington, KY: University of Kentucky: 210-213.

Anthers of Populus x euramericana cv. eugenei, P. x jackii (P. tacamahaca x deltoides), and P. maximowiczii x deltoides were cultured on MS medium and calli were produced from the 3 hybrids. Plantlets were regenerated from calli of P. maximowiczii x deltoides. It was confirmed with karyotype analysis that the calli were derived from pollen and the plantlets had 19 chromosomes.

Kim, Jae Hun; Shim, Sang Yung; Noh, Eun Woon; Park, Jae In. 1982. Mass production of selected poplar clones through bud culture. Research Report of the Institute of Forest Genetics, Korea. 18: 80-85.

As a mass propagation system through tissue culture, poplar trees could be propagated by the following stages; induction of multiple shoots, mass production of multiple shoots, rooting of the excised shoots, and outplanting of the plantlets.

Kubackova, Marta; Karacsonyi, Stefan; Bilisics, Ladislav; Zakutna, Libusa; Blanarikova, Vitazoslava. 1982. Chemical constitution and structure of tissue culture cell walls of poplar (Populus alba L. 'pyramidalis'). *Drevarsky Vyskum*. 27(1): 1-20.

Microscopy showed that the cell walls of green tissue culture of P. alba var. pyramidalis were primary walls. A chemical analysis showed them to consist of: approximately 80 percent polysaccharides (cellulose, pectic substances, and hemicellulose); 12.1 percent protein; and 4.8 percent lignin-like material. Spectrophotometry showed that 9.9 percent of the cell wall was made up of xyloglucan, the main constituent of the hemicelluloses.

Singh, S.J.; Heather, W.A. 1982. Assessment in vitro of resistance in cultivars of Populus to Melampsora medusae Thum. leaf rust. *Australian Forest Research*. 12(1): 37-45.

1983

Ahuja, M.R. 1983. Short note: isolation and culture of mega and normal protoplasts in aspen. *Silvae Genetica*. 32(5/6): 225-227.

Exceptionally large mesophyll protoplasts were isolated from young leaves of Populus tremula. Mega protoplasts were 2-4 times greater in diameter and 8-64 times greater in volume than normal protoplasts.

Ahuja, M.R. 1983. Somatic cell differentiation and rapid clonal propagation of aspen. *Silvae Genetica*. 32(3/4): 131-135.

Bud, stem, leaf, and root explants from 48 Populus tremula, P. tremuloides and hybrid clones were cultured on modified woody plant medium. Twenty-two of the clones exhibited growth and differentiation, while the remaining 26 showed little or no growth, indicating differences of regenerative capacities between clones.

Chalupa, Vladimir. 1983. Micropropagation of conifer and broadleaved forest trees. *Communicationes Instituti Forestalis, Cechosloveniae*. 13: 7-39.

Axillary buds were induced on shoot tips and formation of adventitious buds was induced on cotyledons and embryos of conifer species cultured on modified MS media and on WPM supplemented with low concentration of cytokinin (BAP). The development of induced buds into shoots occurred on media lacking cytokinin. Shoots were rooted either on agar media or in non-sterile solid substrate under high humidity. For rapid multiplication of broadleaved trees multiple shoot cultures were used. Nodal explants placed on agar media supplemented with low concentration of BAP produced multiple shoots within 2-5 months. High multiplication rates were achieved on MS, BTM, WPM containing low level of BAP. Shoots were rooted on low salt agar media supplemented with low level of auxins (IBA, NAA).

Ho, Rong H.; Raj, A. Yesoda; Zsuffa, Louis. 1983. Poplar plants through anther culture. In: *Proceedings, 28th Northeastern forest tree improvement conference; 1984 July 18-20; Morgantown, WV*. Durham, NH: University of New Hampshire: 294-300.

Twenty-three clones of several poplar species and interspecific hybrids were subjected to anther culture for production of haploids in 1981. The calli were induced on MS basal medium supplemented with 1 mg/l kinetin + 2 mg/l 2,4-D. Leafy structure was regenerated from calli in P. angulata X P. simonii, and (P. trichocarpa X P. angulata) X (P. balsamifera X P. deltoides) on the basal medium plus 1 mg/l BAP and 0.2 mg/l NAA while roots were produced from those in P. balsamifera X P. deltoides, P. X euramericana cv. eugenei and P. deltoides. P. maximowiczii X P. deltoides was the only clone whose calli produced adventitious shoots. The shoots were rooted in the basal medium plus 0.02 mg/l NAA in 10 days.

In 1982, 12 clones representing a variety of poplar species and interspecific hybrids were tested on 2 different kinds of cytokinins in combination with two different kinds of auxins to evaluate their efficiencies on callus induction. All but one responded to the treatments, but Leuce poplars were less responsive than Aigeiros and Tacamahaca poplars.

Kim, Jae Hun; Noh, Eun Woon; Park, Jae In. 1983. Haploid plantlets formation through anther culture of Populus glandulosa. Research Report of the Institute of Forest Genetics, Korea. 19: 93-98.

Haploid plantlets were successfully induced through anther culture of Populus glandulosa.

Li, Wen-Dian; Wang, Rui-Ling; Zhu, Xiang-Yu. 1983. On the embryonic development and ovule culture of interspecific hybrids between Populus simonii Carr and P. pyramidalis Borkh. Acta Botanica Sinica. 25(5): 409-417.

A description is given of the development of embryos of P. pyramidalis [P. nigra 'Italica'] X P. simonii (with P. nigra 'Italica' as the male parent) to various stages. Many pro-embryos and early embryos were abortive but some developed normally to a mature stage. Ovules containing immature embryos 19, 22, 26, and 29 days old were excised and cultured on nutrient agar; the best medium was M110 (1/2 MS with 0.01 mg/l IAA, 0.1 mg/l BA and 2 percent sucrose). Some normal plantlets were produced from various developmental stages.

Lin, J.F.; Dong, M.S.; Huang, Q.C. 1983. Tissue culture of Populus adenopoda and P. grandidentata. Beijing, China: Chinese Academy of Forest Science; Plant Physiology Communications. 2: 37.

In experiments conducted in Beijing, China, 3-4 mm long stem segments of the species were cultured on 0.5 MS medium with added BA (0.3 mg/litre), NAA (0.5 mg/litre) and sucrose (26 g/litre). For rooting, NAA (0.02 mg/litre) and sucrose (15 g/litre) were added to the same medium under light of 1500-2000 lux and at 25 plus or minus 2degC. Tube seedlings of both species transplanted to the nursery in 1981 grew well, and no morphological changes were recorded.

Raj, A. Yesoda; Ho, Rong H.; Zsuffa, L. 1983. In vitro propagation of forest trees by tissue culture. In: Proceedings, 28th northeastern forest tree improvement conference; 1982 July 7-9; Durham, NH: University of New Hampshire: 281-290.

Verma, Devi C.; Wann, S.R. 1983. Isolation of high yields of viable protoplasts from quaking aspen seedlings and cultured loblolly pine cell suspensions. In: Potrykus, I.; Harms, C.T.; Hinnen, A.; et al., eds. Proceedings, 6th International protoplast symposium; 1983 August 12-16; Basel, Switzerland. Basel, Switzerland: Birkhauser, Verlag: 10-11.

Research on protoplasts of woody species was initiated to produce novel cell lines so as to unfold their regeneration potential. Protoplast isolation schemes were developed which enable unprecedented yields of viable protoplasts from Quaking aspen (Populus tremuloides) seedlings and loblolly pine (Pinus taeda) cell suspensions. Factors which may lead to successful culture of these protoplasts were investigated.

Xu, Gui-Fang; Niu, Yu-Xian; Tang, Ding-Tai; Zhang, Jing-Lan. 1983. The relationships between activities of indoleacetic acid oxidase, peroxidase and isoenzymes in four kinds of calli. Acta Botanica Sinica. 25(6): 551-555.

In callus cultures of (a) aspen, (b) Hami melon, (c) soyabean and (d) tobacco on Miller's solid medium + 4 mg IAA + 0.5 mg kinetin/l, activities of

IAA oxidase and peroxidase after up to 25 days growth were highest in (b) and lowest in (d). Activities of both enzymes were highest after 10 days growth.

1984

Ahuja, M.R. 1984. Protoplast research in woody plants. *Silvae Genetica*. 33(1): 32-37.

The status of woody plant protoplast research is reviewed. Protoplasts have been isolated and cultured from several woody plant genera of angiosperms and gymnosperms. Sustained cell divisions, colon/callus formation have been observed in the protoplast cultures of a few woody species. With the exception of Citrus species, plant regeneration from the protoplast cultures of other woody plants has not been achieved so far. Protoplast fusions have been attempted in a few woody genera. Somatic hybridization techniques seemingly offer new options for combining genotypes, isolation of novel and new genotypes, understanding of growth and differentiation, and genetic improvement of woody plants.

Ahuja, M.R. 1984. Short note: A commercially feasible micropropagation method for aspen. *Silvae Genetica*. 33(4/5): 174-176.

Meristematic explants from buds of Populus tremula, P. tremuloides and their hybrids are cultured on a modified Woody Plant Medium, supplemented with small amounts of adenine sulphate, benzylaminopurine and NAA. Following shoot differentiation and proliferation on the bud explants of the responsive aspen clones, the microshoots are rooted in soil-free potting mixture.

Bychenkova, E.A.; Lazda, E.E. 1984. Studies of the early stages of cell differentiation and xylogenesis in tissue culture of balsam poplar. *Khimiya Drevesiny*. 3: 45-51.

Pieces of 2-yr-old branches of balsam poplar [Populus balsamifera] were placed on a Murashige and Skoog medium and differentiation was induced by 2,4-D, NAA, or kinetin.

Chun, Young Woo. 1984. Mass-propagation of Populus alba X P. grandidentata through in vitro culture. Ames, IA: Iowa State University. 65 p. M.S. thesis.

Chun, Young Woo; Hall, Richard B. 1984. Survival and early growth of Populus alba X P. grandidentata in vitro culture plantlets in soil. *Journal of the Korean Forestry Society*. 66: 1-7.

Plantlets were produced by axillary bud culture of 3 clones, some of which were subcultured to produce multiple shoots. Plantlets grew normally compared with regular cuttings, and there were no morphological differences between those originating from multiple shoots and the others.

Douglas, G.C. 1984. Formation of adventitious buds in stem internodes of Populus spp. cultured in vitro on basal medium: Influence of endogenous properties of explants. *Journal of Plant Physiology*. 116(4): 313-321.

Stem-internodes of the following poplar species formed adventitious buds when cultured in vivo on basal medium in the absence of exogenous growth regulators: Populus nigra, P. deltoides, P. tacamahaca, P. trichocarpa, P.

alba, P. wilsonii, and Populus hybrid TT32 (P. trichocarpa X P. tacamahaca). The number of buds formed per internodal explant varied with each genotype. Adventitious buds differentiated in tissue produced by cambium and phloem cells.

Evers, P.; Prat, A. 1984. Propagation research with poplars in plant raising tubes. *Populier* (Netherlands). 21(1): 17-20.

Hyun, S.K.; Kim, J.H.; Noh, E.W.; Park, J.I. 1984. Induction of haploid plants of Populus species. Plant tissue culture and its agriculture application. In: Proceedings, 41st conference Easiken school series in agriculture science; University of Nottingham: 40. Abstract.

Kakoniova, D.; Liskova, D. 1984. The protoplast isolation from woody tissue cultures. International Symposium on Plant Tissue and Cell Culture Application to Crop Improvement. 80. Abstract.

Kouider, Mohamed; Skirvin, Robert M.; Saladin, K. Paul; Dawson, Jeffrey O.; Jokela, Jalmer J. 1984. A method to culture immature embryos of Populus deltoides in vitro. *Canadian Journal of Forest Research*. 14(6): 956-958.

Immature embryos were excised from capsules resulting from the artificial pollination of female branches maintained in moist soil. Embryos excised 10-21 days after pollination produced multiple shoots (2-30) when cultured on a modified Murashige and Skoog medium while 28-35 day embryos produced single or multiple shoots. It is suggested that these methods may be useful in rescuing embryos resulting from artificial hybridization in cases where they might otherwise be lost.

Ksiazek, Malgorzata; Wozny, Adam; Mlodzianowski, Fortunat. 1984. Effect of $Pb(NO_3)_2$ on poplar tissue culture and the ultrastructural localization of lead in culture cells. *Forestecology and Management*. 8(2): 95-105.

In tissue cultures of Populus maximowiczii, $Pb(NO_3)_2$ had a restraining effect on fresh weight increase and anthocyanin content.

Lee, Kyung Joon; Lee, Jae Soon; Lee, Suk Koo. 1984. Callus formation from suspension-cultured cells of Pinus rigida x P. taeda and cell suspension culture of Populus alba x P. glandulosa. Research Report of the Institute of Forest Genetics, Korea. 20: 108-115.

Populus alba X P. glandulosa and Pinus rigida X taeda cells were cultured in various media supplemented with growth hormones to find out optimum conditions for rapid cell growth in suspension culture in both species and for colony and callus formation in the latter species.

Among the three media (Gresshoff and Doy, Murashige and Skoog, and Litvay Medium) tested for Populus alba X P. glandulosa culture, G.D. medium was better than two other media regardless of hormonal combination and concentration. The best cell growth was observed in G.D. medium supplemented with 0.5 ppm 2,4-D and 0.01 ppm BAP. During a third culture of 15 days, well-grown cultures contained 1.6×10^7 cells/l. The BAP at 0.1 ppm suppressed cell growth compared with BAP at 0.01 ppm. The G.D. medium produced deep brown-colored cells, while M.S. medium produced green-colored cells.

Li, J.; Chen, W.Y. 1984. Studies on screening of salt-tolerant cell lines of poplar and the regrowth of adventitious shoots. Liaoning, China: Poplar Research Institute; Forest Science and Technology. 1: 1-3.

Since 1982 studies have been conducted on development of new poplar varieties that are highly tolerant to saline soils. Succulent stems were taken from various hybrid poplar clones, and after surface disinfection, cut into pieces 5 mm long under sterile conditions. The stem pieces were grown in a tissue culture medium which prevents callus tissue from aging. Salt-tolerance limits of the clones were determined using 4 methods. Variation in salt tolerance was greatest in the dedifferentiation and redifferentiation phases, and increased with callus age. Salt-tolerant adventitious shoots were selected and the stems and leaves of these could be used to produce more salt-tolerant calluses.

Li, Y.Q.; Yang, S.H.; Xu, Q.Y.; Li, W.Y. 1984. Culture techniques for three clones of poplars of the Aigeiros group. Forest Science and Technology (Linze Keji Tongxun). 9: 17-19.

Lubrano, L. 1984. Micropropagation of forest trees at the agricultural and forest research centre of Rome: preliminary results on Eucalyptus x trabutii. Plant tissue culture and its agricultural application. In: Proceedings 41st Conference Easiken School Series in Agriculture Science, University of Nottingham: 21. Abstract.

Nelson, Neil D.; Haissig, Bruce E. 1984. Biotechnology in the Forest Service's North Central Forest Experiment Station. In: Proceedings of the International symposium of recent advances in forest biotechnology; 1984 June 10-13; Traverse City, MI. East Lansing, MI: Michigan Biotechnology Institute: 139-154.

Sommer, H.E.; Wetzstein, H.Y. 1984. Hardwoods. In: Handbook of plant cell culture. New York, NY: Macmillian Publishing Co.; 3: 511-540.

1985

Ahuja, M.R. 1985. Regenerative potential of aspen tissues. In: Advances in agricultural biotechnology: In vitro techniques: Propagation and long term storage; 1984 November 27-29; Braunschweig, West Germany. Dordrecht, The Netherlands: Martinus Nijhoff Publishers; 14: 187.

Barocka, K.H.; Baus, M.; Lontke, E.; Sievert, F. 1985. Tissue culture as a tool for in vitro-mass-propagation of aspen. Journal of Plant Breeding. 94(4): 340-343.

Boxus, Ph. 1985. Micropropagation of woody plants. Acta Botanica Neerlandica. 34: 236-238. Abstract.

Butt, Adrian D. 1985. A general method for the high-yield isolation of mesophyll protoplasts from deciduous tree species. Plant Science. 42: 55-59.

High yields ($1.2-8.0 \times 10^6$ g fresh wt.⁻¹) of viable leaf mesophyll protoplasts have been isolated from a range of mature deciduous woody-plant species (Betula pendula, Alnus glutinosa, Salix caprea var. Kuroyanagi, S. alba var. Tristis, Populus tacatricho (=P. tacamahacca X trichocarpa 32), Ulmus glabra var. camperdown), and juvenile glasshouse-grown material (B. pendula, B. pubescens, A. glutinosa). Protoplasts are only released if chopped leaf tissue is thoroughly washed prior to digestive enzyme addition. The nature of the washing requirement has been investigated and it has been demonstrated that water soluble compounds are released from chopped leaves which modify their cell-wall structure rendering them resistant to enzymic digestion. When analyzed by paper chromatography the leachate from B. pendula leaves was found to contain the hydroxycinnamic acids p-coumaric acid (PCA) and o-coumaric acid (OCA). Pre-incubation of B. pendula tissue (which is normally susceptible to enzymic digestion) in authentic samples of PCA and OCA prior to enzymic incubation, completely suppressed protoplast yields. The relevance of hydroxycinnamic acids to protoplast isolation and plant tissue culture is discussed.

Chun, Y.W. 1985. Isolation and culture of in vitro cultured Populus alba X P. grandidentata protoplasts. *Journal of the Korean Forestry Society*. 71: 45-49.

Leaf and petiole tissue was collected from 1-month-old plantlets cultured in vitro and from 4-month-old greenhouse-grown plants, and incubated for 15-20 h in solutions containing (a) 0.5 percent cellulose and 0.1 percent macerase or (b) 1.0 percent cellulase and 0.2 percent macerase. Protoplast yields were much higher with tissue from cultured plantlets: average yield with solution (a) was 4×10^6 protoplasts and 0.5×10^6 protoplasts with solution (b).

Douglas, G.C. 1985. Control and utilization of adventitious bud formation in Populus explants. In: *Advances in agricultural biotechnology*. Dordrecht, The Netherlands: Martinus Nijhoff Publishers. 14: 53-58.

Internodal stem-explants of a range of Populus species produced adventitious buds when cultured on basal medium in the absence of exogenous growth regulators. Explants showed polarity in this response. The physiological apical end of explants was most responsive. Small explants 2 mm in length failed to produce buds and morphogenic response was positively correlated with increasing length of explant. Explants irradiated prior to culture produced buds but at high doses (3000 rads) morphogenic capacity declined. Potentially mutant shoots were observed in irradiated explants.

Einspahr, D.W.; Wann, S.R. 1985. Use of tissue culture techniques in a hardwood tree improvement program. In: Schmidtling, R.C.; Griggs, M., ed. *Proceedings, 18th Southern forest tree improvement conference; May 21-23; Long Beach, MS. Gulf Park, MS: University of Southern Mississippi: 33-41.*

Evers, P.W. 1985. Vegetative propagation of forest trees in vitro. *Acta Botanica Neerlandica*. 34: 236-238. Abstract.

To prevent the outbreak of new diseases due to the use of a limited number of clones in forestry, tissue culture methods are adapted to multigenotypical applications. The main problems in culture are dormancy, lack of rejuvenation and lack of rooting.

Feirer, R.P.; Wann, S.R.; Einspahr, D.W. 1985. The effects of spermidine synthesis inhibitors on in-vitro plant development. *Plant Growth Regulation*. 3(3/4): 319-327.

The spermidine synthesis inhibitors methylglyonal bis-(guanylhydrazone) (MGBG) and dicyclohexylammonium sulfate (DCHA) were found to reduce growth and embryogenesis in wild carrot cultures. Cellular polyamine levels were also affected by the inhibitors with spermidine levels being especially reduced by DCHA. Similarly, MGBG reduced organogenetic development of shoots on excised aspen hypocotyls. These data suggest that the polyamines, especially spermidine, play an important role in the growth and development of plants.

Frohlich, H.J.; Weisgerber, H. 1985. Research on in vitro-techniques within the framework of poplar breeding--results and future trends. *Silvae Genetica*. 34(4/5): 132-137.

A review of work on in vitro propagation of poplars in W. Germany, particularly with Populus tremula and P. tremuloides.

Hisajima, S.; Arai, Y.; Thorpe, T.A. 1985. Sucrose synthesis in callus cultures. *Biologia Plantarum*. 27(1): 74-77.

Tracer studies with ¹⁴C-glucose indicated that sucrose synthesis via the sucrose phosphate synthase pathway occurred in tissue cultures of persimmon, soyabean, and Populus alba cells.

Ho, R.H.; Raj, Y. 1985. Haploid plant production through anther culture in poplars. *Forest Ecology and Management*. 13(3/4): 133-142.

Haploid plantlets were produced from pollen at the mononucleate stage by 4 of the 7 species and hybrids tested. Only callus produced in the anther cavity turned green and produced adventitious shoots and/or roots. Plantlets regenerated from P. maximowiczii X deltoides (an artificial hybrid) produced leaves with the form of either parent or with an intermediate form.

Hoffman, Sr. Angela; Miller, A. Raymond; Pengelly, William L. 1985. Characterization of polyphenols in cell walls of cultured Populus trichocarpa tissues. *Phytochemistry*. 24(11): 2685-2687.

The amount and composition of cell wall-bound polyphenol (lignin) in cultured Populus trichocarpa tissues which formed numerous xylem elements (xylogenic) or no xylem (non-xylogenic) were compared. Polyphenol accounted for ca 15 percent of the dry wt of the cell wall and did not differ significantly in amount in xylogenic and non-xylogenic tissues. The syringic acid derivative, 3,4,5-trimethoxybenzoic acid, was identified as one of the oxidation products of methylated cell walls and was recovered in similar amounts irrespective of xylem formation. In contrast, lignin from xylogenic cultures contained more p-coumaryl alcohol derivatives and less coniferyl alcohol derivatives than lignin from non-xylogenic cultures. In this respect the lignin composition of xylogenic tissues more closely resembled that from stems.

Kapusta, J.; Skibinska, A. 1985. Induction of morphogenesis and regeneration in the callus of Populus alba L. and P. nigra L. *Journal of Tree Sciences*. 4(2): 34-38.

Callus was induced on one year old lignified shoot of Populus alba and Populus nigra. Using a Murashige and Skoog medium regeneration in the callus was obtained for P. alba when adding BAP-0.7 mg/l, NAA -0.02 mg/l and for P. nigra when adding BAP-0.4 mg/l, NAA 0.02 mg/l. The regenerated plants readily rooted and were easy to acclimatize to soil conditions.

Kechel, von H.G.; Boden, E. 1985. A practice-orientated method of ensuring production - early testing in the in vitro phase. Forstarchiv. 56(1): 34-35.

Rooted and unrooted shoot cuttings of (a) Populus 'Forndorf', (b) P. 'Brabantica', and (c) P. '71/76', propagated on nutrient medium in petri dishes, were inoculated with a suspension of Xanthomonas populi ssp. populi. After 9 weeks incubation in covered dishes, the known susceptibility pattern was observed. Results indicate that this is a rapid method for testing clonal resistance to canker in Populus.

Kechel, von H.G.; Boden, E. 1985. Resistance tests on poplars raised by tissue culture. European Journal of Forest Pathology. 15(1): 45-51.

Four poplar standard clones of known resistance to canker (Xanthomonas populi ssp. populi) were propagated by tissue culture. Plants were inoculated at 1.5, 2, 4, and 6 weeks and 7 months. All controls reacted with quick and normal wound healing. Results suggest that this is a reliable method for testing clone related resistance to canker in plants only a few weeks old.

Kolevska-Pletikapic, Branka. 1985. Clonal propagation of leuce poplars by tissue culture technique. Topola. 29(145-146): 3-8.

The possibility of in vitro regeneration has been investigated on twenty genotypes of Leuce poplars hybrid species, produced by the crossing of P. tremula, P. tremuloides, P. alba, and P. grandidentata and two genotypes P. alba species. Parent plants used in the crossing were mostly of hybrid origin as well.

Kunneman, B.P.A.M. 1985. In vitro propagation of nursery stock. Acta Botanica Neerlandica. 34: 236-238. Abstract.

Since 1978 tissue culture techniques are used for vegetative propagation of woody species and some perennials. At this moment the research program includes vegetative propagation of Acer, Alnus, Malus, Paeonia, Rhododendron, Skimmia, Tilia, and Wisteria as well as in vitro selection for fireblight resistance in Pyracantha.

Li, Wendian; Li, Jiangshan. 1985. In vitro culture of hybrid ovules in Populus. Scientia Silvae Sinicae. 21(4): 339-346.

Hybrid ovules from Populus simonii X P. pyramidalis [P. nigra var. italica], P. simonii X P. euphratica, P. simonii X P. lasiocarpa, P. simonii X P. wilsonii, and P. X '741' reciprocal combinations containing immature embryos at various developmental stages were excised for culture. The optimum differentiating medium included 0.01 mg/litre IAA and 0.1 mg/litre BA.

Liskova, Desana; Kakoniova, Daniela. 1985. The regeneration -- forest trees in vitro. In: Prochazka, S.; Hradilik, J., eds. International symposium, Regulation of plant integrity; 1985 September 2-5; Brno, Czechoslovakia. Acta Universitatis Agriculturae. 33(3): 305-309.

Mehra, P.N.; Cheema, G.S. 1985. Differential response of male and female Himalayan poplar (Populus ciliata) and P. alba in vitro. *Phytomorphology*. 35(1/2): 151-154.

Otjen, Lewis; Blanchette, Robert A. 1985. Selective delignification of aspen wood blocks in vitro by three white rot basidiomycetes. *Applied and Environmental Microbiology*. 50(3): 568-572.

Aspen wood blocks were selectively delignified in the laboratory by Ischnoderma resinosa, Poria medulla-panis, and Xylobolus frustulatus. After 8 weeks only the outer surfaces of wood blocks were selectively delignified. The percentages of weight loss obtained after 4, 8, and 12 weeks showed that decay occurred at a relatively constant rate. Selectively delignified wood could be identified by using scanning electron microscopy only when lignin had been extensively removed from cell walls. X. frustulatus was able to form pockets of delignified wood throughout blocks after 12 weeks.

Russell, Julie A.; Zeldin, Eric L.; McCown, Brent H. 1985. Leaf grinding improves release of mesophyll protoplasts. *HortScience*. 20(3): 571. Abstract.

Sakamoto, Masahiro; Sumiya, Kazuo. 1985. Some fundamental problems on measurements of the bioelectrical potential of poplar (Populus nigra L.) callus. *Mokuzai Gakkaishi*. 31(8): 620-626.

Some fundamental problems on the measurements of the bioelectrical potential of poplar (Populus nigra L.) callus by the microelectrode method were considered. It was shown that it would be best to use 1 mM or less concentrations of phosphate solutions as the buffers in the measurements of the potential. It also was shown that the potential was lowered in the acidic pH region. In the range of over 1 mM concentration of inorganic cations, the potentials decreased in accordance with the Nernst equation. This suggested that these cations should be transported passively at their high concentrations. The response of callus was peculiar only to K^+ in the low concentrations of 1 mM or less, reflecting a living state and the ability of selective transportation cations in the poplar callus. The potential change was observed clearly by the addition of non-electrolyte, sugars. This change was the hyperpolarization which clarified to be a living response of poplar callus.

Savka, Michael A.; Jokela, Jalmer J.; Skirvin, Robert M.; Dawson, Jeffrey O. 1985. Action of 6-benzylamino purine and indole-3-butyric acid on development of immature embryos of Populus deltoides Bartr. In: Proceedings of the 4th North central tree improvement association meeting; 1985 August 12-14; East Lansing, MI. Madison, WI: Department of Forestry: 140-148.

In vitro culture of ovules containing an immature embryo of eastern cottonwood (Populus deltoides Bartr.) was investigated as a means to circumvent capsule and branch mortality associated with maintenance of detached fertile female branches in a greenhouse. Plantlets developed from 14 percent of the 31 to 40-day-old embryos on a modified Murashige and Skoog (MS) medium supplemented with indole-3-butyric acid (IBA). Plantlets developed from 19 percent of the 31 to 40-day-old embryos on a modified MS medium without growth regulators. The addition of 6-benzylamino purine to a modified

MS medium alone or in combination with IBA favored shoot development but inhibited root formation.

Savka, Michael A.; Skirvin, Robert M.; Jokela, Jalmer J.; Dawson, Jeffrey O. 1985. Culture of ovules containing immature embryos of eastern cottonwood in vitro. In: Dawson, Jeffrey, O.; Majerus, Kimberly A., ed. Proceedings, 5th Central hardwood forest conference; 1985 April 15-17; Urbana-Champaign, IL. SAF Publ. 85-05. Urbana-Champaign, IL: University of Illinois, Department of Forestry: 234-238.

Hybrid ovules containing immature embryos were excised from capsules on cut branches of eastern cottonwood (Populus deltoides Bartr.). Ovules in the less than 21-days post-pollination age-class produced callus only when cultured on a modified Murashige and Skoog medium. Single shoots developed from 35 percent and callus developed from 39 percent of ovules 21 to 40-days post-pollination. Ovules in the older than 40-days post-pollination age-class produced only single shoots. Adventitious leaves formed on hypocotyls and cotyledons of some single shoots.

Sellmer, James C.; Russell, Julie A.; Zeldin, Eric L.; McCown, Brent H. 1985. Utilization of cytokinin response curves in tissue evaluation of Populus for biotechnology research. HortScience. 20(3): 593. Abstract.

Uddin, M.R.; et al. 1985. Production of haploid and dihaploid plants for use in genetic studies and breeding of poplars. In: Guries, R.P., ed. Proceedings of the 4th North Central tree improvement conference; 1985 August 12-14; East Lansing, MI. Madison, WI: Department of Forestry: 157-166.

Youn, Yang; Lee, Jae Soon; Lee, Suk Koo. 1985. Isolation and culture of protoplasts from suspension-cultured cells of Populus alba x Populus glandulosa F₁. Research Report of the Institute of Forest Genetics, Korea. 21: 109-113.

In order to develop a procedure for isolation and culture of protoplasts from suspension-cultured cells of Populus alba X P. glandulosa F₁, calli induced from a stem segment of tissue cultured plantlets were further cultured in suspension. Cells in suspension were incubated in an enzyme solution consisted of cellulase Onozuka R-10 and macerozyme for six hours. Large number of viable protoplasts which did not contain chloroplasts were obtained. They were in high purity compared with protoplasts isolated from leaf mesophyll tissue. Isolated protoplasts were cultured in a medium containing basal salts of B₅ medium, vitamins, amino acids, organic acids, sugars, and growth hormones. The first protoplast cell division was observed after twenty-four hours in culture. The three-to four-cell stages occurred after four or five days, however no further cell division was observed.

1986

Ahuja, M.R. 1986. Aspen. In: Evans, D.A.; Sharp, W.R.; Ammirato, P.V., eds. Handbook of plant cell culture. New York, NY: MacMillian Publishing Company; London, England: Collier Macmillan Publishing. 4: 626-651.

Chen, Zhenghua. 1986. Induction of androgenesis in woody plants. Haploids of higher plants in vitro. Beijing, China: China Academic Publishers: 42-66.

The following topics are reviewed: (1) Chinese achievements in anther culture of woody plants (10 genera in which anther culture has been successful are listed; they include Populus, Hevea, Citrus, Vitis, and Malus); (2) possible uses of anther culture in genetic studies and breeding; (3) conditions for anther culture and the processes involved; (4) morphogenesis of pollen-derived plantlets; (5) procedures and culture media; and (6) variations in chromosome number in regenerated plants.

Chun, Young Woo; Hall, Richard B.; Stephens, Loren C. 1986. Influences of medium consistency and shoot density on in vitro shoot proliferation of Populus alba x Populus grandidentata. Plant Cell Tissue and Organ Culture. 5(3): 179-185.

Ettinger, T.L.; Ostry, M.E.; Hackett, W.P.; Read, P.E.; Skilling, D.D. 1986. Utilization of somaclonal variation in the development of Septoria musiva - resistant hybrid Populus. In: Somers, D.A.; Gengenbach, B.G.; Biesboer, D.D.; et al. eds. Proceedings of the 6th International congress of plant tissue and cell culture; 1986 August 3-8; Minneapolis, MN. Minneapolis, MN: University of Minnesota: 214. Abstract.

Evans, D.A.; Sharp, W.R.; Ammirato, P.V., eds. 1986. Handbook of plant cell culture. Vol 4. Techniques and applications. New York, NY: Macmillan Publishing Co. 698 p.

This volume begins with two special essays, "Plant breeding goals and strategies for the 1980s" by N.E. Borlaug and "The crown gall tumor problem: contributions to experimental oncology and genetics engineering" by A.C. Braun. Ten chapters by various authors comprise the second part, which deals with basic and specialized techniques of cell culture.

Fillatti, J.J.; McCown, B.H.; Sellmer, J.; Haissig, B. 1986. The introduction and expression of a gene conferring tolerance to the herbicide glyphosate in Populus NC5339. In: 1986 research and development conference: TAPPI Proceedings; 1986 September 28-October 1; Raleigh, NC. Atlanta, GA: TAPPI Press: 83-85.

We have developed a plant regeneration and gene transfer system for Populus NC5339, using Agrobacterium tumefaciens as a vector. Employing this system we introduced a gene for glyphosate tolerance (aroA) into Populus C5339 plants.

Fillatti, JoAnne J.; Sellmer, James C.; McCown, Brent H. 1986. Regeneration and transformation of Populus tissue. In: Proceedings, 12th International horticulture congress; 83d annual meeting of the American Society for Horticultural Science; 1986 August 10-18; Davis, CA. HortScience. 21(3): 773. Abstract.

Fillatti, J.J.; Sellmer, J.C.; McCown, B.H. 1986. Regeneration and transformation of Populus. In: Somers, D.A.; Gengenbach, B.G.; Biesboer, D.D.; et al, eds. Proceedings, 6th International congress of plant tissue and cell

culture; 1986 August 3-8; Minneapolis, MN. Minneapolis, MN: University of Minnesota: 127. Abstract.

Haissig, Bruce E. 1986. Tissue culture-based biotechnology for Populus clones. In: Klass, Donald L., ed. Proceedings, 10th annual symposium on energy from biomass and wastes; 1986 April 7; Washington, DC. Chicago, IL: Institute of Gas Technology: 155-175.

Biotechnology may be a genetic improvement strategy for poplars that will complement breeding.

Heslin, M.C.; Douglas, G.C. 1986. Effects of ectomycorrhizal fungi on growth and development of poplar plants derived from tissue culture. *Scientia Horticulturae*. 30(1-2): 143-149.

Hebeloma crustuliniforme, Paxillus involutus, and Thelephora terrestris were inoculated in peat/vermiculite mixture during the transition period in which Populus plants became adapted from conditions in vitro to conditions in a substrate in the greenhouse. Survival of inoculated plants was generally lower than that of uninoculated controls.

Joyce, Peter J.; Sellmer, James C.; McCown, Brent. 1986. Causes of differential responses of shoot of Populus to mineral medium formulations. In: 22nd International horticultural congress; 83d annual meeting of the American Society for Horticultural Science; 1986 August 10-18; Davis, CA. *HortScience*. 21(3): 262. Abstract.

Kim, Jae Hun; Moon, Heung Kyu; Park, Jae In. 1986. Haploid plantlet induction through anther culture of Populus maximowiczii. Research Report of the Institute of Forest Genetics, Korea. 22: 116-121.

This study has been conducted to obtain the haploid callus and haploid plantlet through anther culture of P. maximowiczii.

Kim, Jae Hun; Moon, Heung Kyu; Park, Jae In. 1986. Plantlet regeneration of callus derived from internodal tissue of Populus alba X P. glandulosa. Research Report of the Institute of Forest Genetics, Korea. 22: 122-127.

Plantlet regeneration with callus derived from juvenile internodal tissue of P. alba X P. glandulosa was described in this study. Callus formation was greatly influenced by supplemented growth regulators. High induction percentage (100 percent) of callus was obtained on MMS medium (modified Murashige and Skoog, 1962) supplemented with 0.1-0.5 mg/l kinetin and 0.1-0.5 mg/l 2,4-D. The frequency of shoot regeneration from callus was greatly affected by basic culture media as well as supplemented growth regulators. Optimum medium was WPM (Woody Plant Medium, Lloyd and McCown, 1981) supplemented with 1.0 mg/l BAP and 0.1-0.2 mg/l NAA. Chromosome analysis showed that all tested plantlets derived from callus were diploids ($2n=38$). Therefore it could be concluded that no chromosome aberration had occurred.

Lee, Byoung Sil; Youn, Yang; Kim, Young Jung. 1986. Variation in salt tolerance of hybrid poplars through in vitro culture. Research Report of the Institute of Forest Genetics, Korea. 22: 139-144.

In order to screen out the most resistant clone to salinity, the variations among hybrid poplars were investigated through shoot tip culture as

well as bud culture techniques on GD [Gresshoff and Doy] medium with added artificial seawater (ASW).

Lee, Seung Woo; Hackett, Wesley P.; Ettinger, Terry L.; Read, Paul E. 1986. Adventitious bud formation on hybrid Populus midrib and petiole segments cultured in vitro. In: Somers, D.A.; Gengenbach, B.G.; Biesboer, D.D.; et al., eds. Proceedings of the 6th International congress of plant tissue and cell culture; 1986 August 3-8; Minneapolis, MN. Minneapolis, MN: University of Minnesota: 398. Abstract.

Noh, Eui Rae; Koo, Yeong Bon; Lee, Soung Kyu. 1986. Hybridization between incompatible poplar species through ovary and embryo culture. Research Report of the Institute of Forest Genetics, Korea. 22: 9-14.

Fertilized ovaries or embryos were cultured in test tubes after pollination was made by pollen treated with n-hexane, in order to develop a hybrid between incompatible poplar sections.

Noh, Eun-Woon; Minocha, Subhash C. 1986. High efficiency shoot regeneration from callus of quaking aspen. Plant Cell Reports. 5(6): 464-467.

Callus was induced from leaf segments of aspen (Populus tremuloides Michx.) on modified B5 (mB5) medium with 0.1 mg/l benzyladenine (BA) and 0.5 mg/l 2,4-dichlorophenoxyacetic acid (2,4-D). The resulting callus was either subcultured to solidified Woody Plant Medium (WPM) with 0.5 mg/l BA directly for shoot regeneration or sieved into liquid mB5 medium for suspension culture. After 3 weeks of suspension culture, when the callus clumps grew to 3-4 mm in diameter, they were transferred onto solidified WPM with 0.5 mg/l BA for shoot regeneration. Almost 100 percent of the clumps formed shoots on WPM when subcultured directly from mB5 with an average number of 6 shoots per callus. When transferred from suspension culture in mB5 to WPM, an average of 6 shoots per callus were produced from 51 percent of calli. These shoots could be easily rooted on either mB5 or WPM with 0.2 mg/l indole-3-butyric acid (IBA) and transferred to pots. Transplanted plants were kept under intermittent mist for 2-4 weeks before normal growth in the greenhouse.

Ostry, M.E.; Ettinger, T.L.; Hackett, W.P.; Read, P.E.; Skilling, D.D. 1986. Development of bioassays to identify variant Populus cells and regenerated plants resistant to Septoria musiva. In: Somers, D.A.; Gengenbach, B.G.; Biesboer, D.D.; et al., eds. Proceedings of the 6th International congress of plant tissue and cell culture; 1986 August 3-8; Minneapolis, MN. Minneapolis, MN: University of Minnesota: 303. Abstract.

Park, Young Goo; Han, Kyung Hwan. 1986. Isolation and culture of mesophyll protoplasts from in vitro cultured Populus alba X P. glandulosa. Journal of Korean Forestry Society. 73: 33-42.

This study was carried out to investigate the optimum conditions for isolation and culture of mesophyll protoplasts from Populus alba X P. glandulosa. The results obtained from the experiments are as follows: 1) The suitable concentration of BAP for shoot multiplication was 0.4 mg/l. 2) High yield and viability of isolated protoplasts were obtained by our high enzyme-short time incubation method. 3) Optimum enzyme concentrations for mesophyll protoplast isolation were Cellulase 2 percent, Macerozyme 0.8

percent, Hemicellulase 1.2 percent, Driselase 2 percent, and Pectolyase Y-23 0.05 percent. 4) 0.6M mannitol in enzyme solution was the most effective for protoplast isolation and viability. 5) The most adequate pH level of enzyme solution was pH 5.6. 6) The effect of DTT and MES buffer was significant. 7) For protoplast purification, 0.6M sucrose was the most proper concentration. 8) The adding effect of Dextran T40 in floating solution was important. 9) The mesophyll protoplasts isolated through our high enzyme-short time incubation method revealed successful response to culture condition over 3 weeks of culture.

Park, Young Goo; Son, Sung Ho. 1986. Factors affecting the isolation of mesophyll protoplasts from Populus euramericana cv. I-214. Journal of the Korean Forestry Society. 74: 29-36.

A method isolating Populus euramericana cv. I-214 mesophyll protoplasts was developed to facilitate application of genetic engineering techniques to this species. The suitable medium for shoot multiplication in vitro was MS basal medium with 0.1 mg/l BAP. The effects of several factors influencing protoplast isolation could be evaluated quickly by using leaf in vitro and known volumes of maceration and washing media.

Parsons, Thomas J.; Sinkar, Vilas P.; Stettler, Reinhard F.; Nester, Eugene W.; Gordon, Milton P. 1986. Transformation of poplar by Agrobacterium tumefaciens. Bio/Technology. 4(6): 533-536.

The ability to regenerate plants from poplar cells cultured in vitro suggests that poplars may prove a valuable model system for the application of recombinant DNA technology to deciduous trees.

Rajora, O.P.; Zsuffa, L. 1986. Pollen viability of some Populus species as indicated by in-vitro pollen germination and tetrazolium chloride staining. Canadian Journal of Botany. 64(6): 1086-1088.

Russell, Julie A.; McCown, Brent H. 1986. Culture and regeneration of Populus leaf protoplasts isolated from non-seedling tissue. Plant Science. 46(2): 133-142.

Leaf protoplasts of Populus alba L. X P. grandidentata Michx. (NC-5339) were isolated from shoot cultures of non-seedling origin and cultured through plant regeneration. Complete protoplast development was dependent on providing a stress-free culture environment which included eliminating ammonium, agar, exudate build-up, and light during the culture period. Contact with a solid surface appeared to stimulate development and thus the protoplasts were cultured in a liquid floating-disc system in which they adhered to the fibers of a polyester screen. Protoplasts exhibited a slow, staged development which resulted in cell division 6 weeks following protoplast isolation. The resulting colonies proliferated rapidly and rooted spontaneously. Shoot regeneration occurred when the protoplast-derived calli were exposed to thidiazuron, and such shoots could be readily rooted. This is the first report of reproducible plant regeneration from leaf protoplasts of non-seedling origin of a tree species.

Russell, Julie A.; McCown, B.H. 1986. Isolation, culture, and regeneration of Populus mesophyll protoplasts. HortScience. 21(3): 699. Abstract.

Russell, Julie A.; McCown, Brent H. 1986. Techniques for enhanced release of leaf protoplasts in Populus. Plant Cell Reports. 5(4): 284-287.

Microscopic examination of Populus leaf tissue following enzyme treatment revealed two factors contributing to low protoplast yields: (1) poor penetration of the enzymes into the tissue, and (2) entrapment of protoplasts in leaf debris during protoplast purification procedures. A simple combination of rapid grinding of the tissue in an Omni-mixer prior to enzyme treatment and forceful washing of leaf-debris after digestion provided high exposure of the cells, uniform digestion, and high yields of protoplasts of two Populus clones. Protoplasts exhibited cell wall regeneration and long-term viability in culture. The relative yield advantages of the techniques varied with the inherent digestibility of each clone but could produce up to 600 percent greater protoplast yields in a woody plant species in which protoplast isolation was previously limited. The techniques were also applicable to an herbaceous species, Solanum tuberosum.

Russell, J.A.; McCown, B.H. 1986. Thidiazuron - stimulated shoot differentiation from protoplast - derived cells of Populus. In: Somers, D.A.; Gengenbach, B.G.; Biesboer, D.D.; et al., eds. Proceedings, 6th International congress of plant tissue and cell culture, Minneapolis, MN. Minneapolis, MN: University of Minnesota: 49. Abstract.

Wann, Steven Russell. 1986. In vitro isolation and propagation of mammatoxin-resistant aspen. Dissertation Abstracts International. 47/03-B: 873.

A method is described in which mammatoxin was used in vitro to screen tissue cultures of aspen for resistance to the necrotic effects of the toxin. By a novel organogenesis procedure, plants were regenerated and established in soil from surviving cultures. After 6-32 weeks of growth, challenge of these propagules with mammatoxin in a leaf puncture bioassay revealed that the resistance expressed in vitro was maintained in the plant.

Wann, S.R.; Einspahr, D.W. 1986. Reliable plantlet formation from seedling explants of Populus tremuloides (Michx.). Silvae Genetica. 35(1): 19-24.

P. tremuloides explants were removed from seed from full-sib crosses. The cotyledons and hypocotyls were excised and placed on media with different concentrations of NAA and BA. The seedling explants showed remarkable morphogenic capabilities which could be manipulated by hormonal regimes to form shoots, roots, or callus tissue. Investigation of 4 different P. tremuloides crosses revealed substantial variation in organogenic features both within and between crosses. This can be exploited to establish shoot cultures of individual seedlings, yielding a continuous harvest of rootable shoots at monthly intervals for up to 5 subculture periods.

Zeldin, Eric L.; McCown, Brent H. 1986. The dynamics of poplar root culture and the differentiation of shoots from cultured roots. HortScience. 21(3): 815. Abstract.

1987

Ahuja, M.R. 1987. In vitro propagation of poplar and aspen. Cell and tissue culture in forestry. In: Bonga, J.M.; Durzan, Don J., eds. Case histories: Gymnosperms, angiosperms and palms. Dordrecht, The Netherlands: Martinus Nijhoff Publishers. 3: 207-223.

Ahuja, M.R. 1987. Prospects and limitations of protoplast research and gene transfer in forest tree species. Swiss Biotechnology. 5(6): 19-20.

The fusion of protoplasts from sexually incompatible forest tree species is considered as a technique for gene transmission in trees that cannot overcome the long generation cycles which limit their improvement by traditional breeding methods. Despite some success with plant regeneration in protoplast cultures of Populus spp., better in vitro selection techniques are needed for recovering stable somatic hybrids.

Bednarek, S.Y.; Russell, J.A.; Sellmer, J.C.; McCown, B.H. 1987. Stable transformation of a woody plant by electric field-mediated gene transfer. In: 38th Annual meeting of the tissue culture association; 1987 May 27-30; Arlington, VA. In Vitro. 23(3): 66. Abstract.

Calgene, U.S.A.; University of Wisconsin, U.S.A. 1987. Herbicide resistance genetically engineered into poplars. Bioprocessing Technology. 9(4): 6.

Combined research at Calgene, the University of Wisconsin and the U.S. Forest Service has led to the insertion of a gene conferring resistance to glyphosate into poplars. The gene was introduced via Agrobacterium tumefaciens in plant tissue culture.

Cheema, G.S. 1987. Somatic embryogenesis and plant regeneration from tissue and cell suspension cultures of selected mature Himalayan poplar. In: Hanover, James W.; Keathley, Daniel E., eds. Proceedings, Conference on genetic manipulation of woody plants; 1987 June 21-25; East Lansing, MI. New York, NY: Plenum Press. (Basic Life Science.) 44: 461. Abstract.

Cultures of Himalayan poplar (Populus ciliata) were established from leaves of mature trees on Murashige and Skoog (MS) medium + 2 mg/l benzyladenine in total darkness. These cultures proliferated and showed high frequency regeneration for 8 years.

Choi, Wan Yong; Lee, Suk Koo; Lee, Byung Sil. 1987. Effects of aluminium on growth of Populus koreana X P. nigra var. italica through cell and callus culture in vitro. Research Report of the Institute of Forest Genetics, Korea. 23: 132-136.

Chun, Young Woo. 1987. Biotechnology applications of Populus micropropagation. Ames, IA: Iowa State University. 155 p. Ph.D. dissertation.

Chun, Young Woo; Hall, Richard B. 1987. Influence of subculturing period and different culture medium on cold storage of Populus alba x Populus grandidentata plantlets. In: Hanover, James W.; Keathley, Daniel E., eds. Proceedings, Conference on genetic manipulation of woody plants; 1987 June

21-25; East Lansing, MI. New York, NY: Plenum Press. (Basic Life Science.) 44: 462. Abstract.

In vitro cultured hybrid poplar, white poplar (Populus alba) X bigtooth aspen (Populus grandidentata), could be stored at 4 degree centigrade air temperature in darkness for 24 months without adversely affecting its potential for rapid multiplication. Nevertheless, the subculturing period preceding cold storage, plantlet condition, and culture medium had a significant influence on survival at 4 degree centigrade storage in darkness.

Chun, Y.W.; Klopfenstein, N.B.; Hall, R.B. 1987. Morphogenetic potential of leaf, internode, and root explants from Populus alba X Populus grandidentata plantlets. In: Hanover, James W.; Keathley, Daniel E., eds. Proceedings, Conference on genetic manipulation of woody plants; 1987 June 21-25; East Lansing, MI. New York, NY: Plenum Press. (Basic Life Science.) 44: 462-463. Abstract.

Morphogenetic responses of explants of hybrid poplar, white poplar (Populus alba) X bigtooth aspen (Populus grandidentata) plantlets depend significantly upon the explant source and the combination of exogenously applied plant growth regulators.

Fillatti, JoAnne J.; Haissig, Bruce; McCown, Brent; Comai, Luca; Riemenschneider, Don. 1987. Development of glyphosate-tolerant Populus plants through expression of a mutant aroA gene from Salmonella typhimurium. In: Hanover, James W.; Keathley, Daniel E., eds. Proceedings, Conference on genetic manipulation of woody plants; 1987 June 21-25; East Lansing, MI. New York, NY: Plenum Press. (Basic Life Science.) 44: 243-249.

Leaf explants of the poplar hybrid clone Populus alba X Populus grandidentata (NC-5339) were regenerated on Murashige and Skoog medium containing 3 percent sucrose, 1 mg/l benzyladenine (BA) and 1 mg/l zeatin.

Fillatti, JoAnne J.; Sellmer, James; McCown, Brent; Haissig, Bruce; Comai, Luca. 1987. Agrobacterium mediated transformation and regeneration of Populus. Molecular and General Genetics. 206(2): 192-199.

A plant transformation and regeneration system has been developed for Populus species. Leaf explants, from stabilized shoot cultures of a Populus hybrid NC-5339 (Populus alba X grandidentata), were co-cultivated with Agrobacterium tumefaciens on a tobacco nurse culture.

Hillson, Thomas D.; Schultz, Richard C. 1987. Using leaves from tissue culture propagated plants for protoplast isolation. In: Hanover, James W.; Keathley, Daniel E., eds. Proceedings, Conference on genetic manipulation of woody plants; 1987 June 21-25; East Lansing, MI. New York, NY: Plenum Press. (Basic Life Science.) 44: 470. Abstract.

Shoot tip propagation methods were used to establish several woody species in vitro (Acer, Populus, Quercus, and Fraxinus). These plants provided a source of sterile leaves for use in protoplast isolation, eliminating the need to sterilize the leaves and reducing the trauma to the cells.

Jang, Suk Seong; Lee, Jung Joo; Lee, Jae Soon; Lee, Suk Koo. 1987. Isolation, culture and fusion of protoplasts of Populus glandulosa Uyeki. Research Report of the Institute of Forest Genetics, Korea. 23: 137-142.

Klopfenstein, N.B.; Chun, Y.W.; McNabb, H.S., Jr.; Hall, R.B.; Hart, E.R.; Schultz, R.C.; Thornburg, R.W. 1987. Toward transformation of Populus species by Agrobacterium binary vector systems. In: Hanover, James W.; Keathley, Daniel E., eds. Proceedings, Conference on genetic manipulation of woody plants; 1987 June 21-25; East Lansing, MI. New York, NY: Plenum Press. (Basic Life Science.) 44: 474. Abstract.

The host range of wild-type Agrobacterium strains on various Populus clones, and the effective concentration of kanamycin for selection of transgenic tissue were evaluated in preliminary studies to facilitate transformation of Populus by Agrobacterium binary vector systems.

Lee, Jae Soon; Lee, Suk Koo; Jang, Suk Seong; Lee, Jung Joo. 1987. Plantlet regeneration from callus protoplasts of Populus nigra. Research Report of the Institute of Forest Genetics, Korea. 23: 143-148.

Lee-Stadelmann, O.Y.; Hackett, W.P.; Lee, S.W.; Read, P.E. 1987. Induction of adventitious buds from microthin cross section culture of midrib and petiole of hybrid Populus in vitro. In: Proceedings, 38th Annual meeting of the tissue culture association; 1987 May 27-30; Arlington, VA. In Vitro Cellular and Developmental Biology. 23(3): 46. Abstract.

Lee-Stadelmann, O.Y.; Hackett, W.P.; Lee, S.W.; Read, P.E. 1987. Microthin-cross section culture for studying bud morphogenesis in vitro. In: Greuter, W.; Zimmer, B.; Behnke, H.-D., eds. Proceedings of the 14th International botanical congress; 1987 July 24-August 1; Berlin, West Germany. Berlin-Dahlem: Botanical Museum: 92. Abstract.

McCown, Brent H.; Zeldin, Eric L.; Pinkalla, Hamilton A.; Dedolph, Richard R. 1987. Nodule culture: a developmental pathway with high potential for regeneration, automated micropropagation, and plant metabolite production from woody plants. In: Hanover, James W.; Keathley, Daniel E., eds. Proceedings, Conference on genetic manipulation of woody plants; 1987 June 21-25; East Lansing, MI. New York, NY: Plenum Press. (Basic Life Science.) 44: 149-166.

Nodules are most commonly seen in cultures of woody plant species being differentiated from dedifferentiated cells. Liquid culture systems were developed in which nodules were the predominant structures. The total time that tissues were kept in the callus or suspension stages was minimized. One of the most important variables was the hormone level in the medium. Poplar (Populus) cultures were more responsive to naphthaleneacetic acid (NAA) levels than to benzyladenine (BA) levels.

Michler, C.H.; Bauer, E. 1987. Selection for herbicide tolerance in Populus to sulfometuron methyl in vitro. In: Hanover, James W.; Keathley, Daniel E., eds. Proceedings, Conference on genetic manipulation of woody plants; 1987 June 21-25; East Lansing, MI. New York, NY: Plenum Press. (Basic Life Science). 44: 479-480. Abstract.

To allow weed control without killing poplars, sulfurometuron methyl-tolerant poplar plantlets have been selected in vitro. Leaf pieces of Populus maximowiczii X Populus trichocarpa (NC-11390) were explanted on Murashige and Skoog (MS) media supplemented with 1 mg/l benzyladenine (BA),

0.1 mg/l naphthaleneacetic acid, 20 g/l sucrose, and various concentrations of sulfometuron methyl (0, 10, 25, 50, 75, and 100 ppb).

Michler, C.; Bauer, E. 1987. Selection of somaclonal variants for herbicide tolerance in tissue cultured plantlets of Populus. In: Proceedings, 38th Annual meeting of the tissue culture association; 1987 May 27-30; Arlington, VA. In Vitro Cellular and Developmental Biology. 23(3, pt 2): 46A. Abstract.

Michler, C.; Bauer, E. 1987. Somatic embryogenesis in plant cell cultures of Populus. In: Proceedings, 38th Annual meeting of the tissue culture association; 1987 May 27-30; Arlington, VA. In Vitro Cellular and Developmental Biology. 23(3, pt. 2): 46A. Abstract

Moon, Heung Kyu; Shim, Woo Sub; Lee, Geun Soo. 1987. Clonal variation in callus cultures of P. alba X P. glandulosa. Research Report of the Institute of Forest Genetics, Korea. 23: 149-155.

Noh, Eun Woon. 1987. Tissue culture and genetic transformation of forest trees. Durham, NH: University of New Hampshire. 124 p. M.S. thesis.

Ostry, M.E. 1987. Application of biotechnology for the development of disease-resistant poplars. In: Lin, D.; Hubbes, M.; Zsuffa, L.; comps. Proceedings, IEA/BA task 2 workshop: biotechnology development; 1987 September 1; Uppsala, Sweden. Inf. Rep. 88:1. Toronto, Ontario, Canada: University of Toronto: 13-27.

Ostry, Michael E.; Skilling, Darroll D. 1987. Somaclonal variation for disease resistance in forest trees. In: Hanover, James W.; Keathley, Daniel E., eds. Proceedings, Conference on genetic manipulation of woody plants; 1987 June 21-25; East Lansing, MI. New York, NY: Plenum Press. (Basic Life Science.) 482. Abstract.

Ostry, M.E.; Skilling, D.D. 1987. Somaclonal variation in hybrid poplars for resistance to Septoria leaf spot. In: Proceedings of the 5th North central tree improvement conference; 1987 August 10-12; Fargo, North Dakota. Madison, WI: University of Wisconsin-Madison, Department of Forestry: 89-100.

Park, Y.G.; Son, S.H.; Han, K.-H. 1987. Isolation and culture of mesophyll protoplasts from Populus species. In: Hanover, James W.; Keathley, Daniel E., eds. Proceedings, Conference on genetic manipulation of woody plants; 1987 June 21-25; East Lansing, MI. New York, NY: Plenum Press. (Basic Life Science.) 44: 483. Abstract.

Factors affecting the isolation and culture of protoplasts from mesophyll were investigated in Populus alba X Populus glandulosa, P. glandulosa, and Populus davidiana. The best yields of mesophyll protoplasts were obtained using leaves in vitro with 0.2 percent cellulase P-10 (EC-3.2.1.4), 0.8 percent macerozyme R-10, 1.2 percent hemicellulase, 2.0 percent driselase, 0.5 percent pectolyase Y-23, and 0.6 percent M mannitol, in DTT and MES buffer adjusted to pH 5.6.

Prakash, C.S.; Thielges, B.A. 1987. Plantlets from leaf discs of Populus deltoides. In: Hanover, James W.; Keathley, Daniel E., eds. Proceedings, Conference on genetic manipulation of woody plants; 1987 June 21-25; East Lansing, MI. New York, NY: Plenum Press. (Basic Life Science.) 44: 485. Abstract.

Calli were initiated by incubating leaf disks of Populus deltoides cv. K417 on Murashige and Skoog (MS) medium with 1 uM 2,4-D, 0.1 uM benzyladenine (BA) in the dark, and were then subcultured on MS medium with 1 uM naphthaleneacetic acid (NAA) and 0.1 uM kinetin under a 16 hour photoperiod. Multiple shoot regeneration occurred when compact, green calli were transferred on MS or woody plant (WP) medium supplemented with 1 uM BAP (under a 12 hour photoperiod).

Pythoud, Francois; Sinkar, Vilas P.; Nester, Eugene W.; Gordon, Milton P. 1987. Increased virulence of Agrobacterium rhizogenes conferred by the vir region of pTiBo542: application to genetic engineering of poplar. Bio/Technology. 5(12): 1323-1327.

The ability of A. rhizogenes to transform plants is dramatically increased by the presence of pTVK291, a plasmid containing part of the vir region of pTiBo542, the supervirulent plasmid. The hybrid Populus trichocarpa X P. deltoides (clone H11) was stably transformed with supervirulent A. rhizogenes strains.

Saito, Akira; Hosoi, Yoshihisa; Ishii, Katsuaki; Sato, Toru. 1987. Callus formation from protoplasts of mesophyll cells of Populus plantlets. Journal of the Japanese Forestry Society. 69(12): 472-477.

Intact protoplasts were isolated from mesophyll cells of plantlets grown within glass vessel and induced by reorganization of callus cultures initiated from explants of mature Populus sieboldii MIQ. The protoplasts exhibited first-cell division the day after being cultured in a liquid medium. Colony formation was observed after a month of culturing, and the colony was transferred to an solid medium. Growing callus was obtained about 2 months after the transfer.

Savka, Michael A.; Dawson, Jeffrey O.; Jokela, Jalmer J.; Skirvin, Robert M. 1987. A liquid culture method for rescuing immature embryos of eastern cottonwood. Plant Cell, Tissue and Organ Culture. 10: 221-226.

A one-step method to rescue immature embryos of eastern cottonwood (Populus deltoides Bartr.) is described. Plantlets developed from 83 percent of 25-day-old embryos grown in shaken culture on Murashige and Skoog (MS) liquid medium with 2.2 um indole-3-acetic acid (IAA) and from 86 percent of embryos not supplemented with IAA. In contrast, when the MS medium was solidified with 0.8 percent agar, plantlets developed from 25 percent of 25-day-old embryos cultured on medium supplemented with IAA and from 28 percent of embryos in medium not supplemented with IAA. Eighty-eight percent of all plantlets survived a gradual acclimitization to peat plugs in a greenhouse. The one-step liquid-culture method is an effective means of rescuing immature embryos by ovule culture from excised artificially-pollinated female branches in our cottonwood breeding program.

Viss, Peter; Ruzin, Steven E. 1987. High efficiency regeneration of shoots from Populus tissue cultures. In: Hanover, James W.; Keathley, Daniel E., eds. Conference on genetic manipulation of woody plants; 1987 June 21-25; East Lansing, MI. New York, NY: Plenum Press. (Basic Life Science.) 44: 492. Abstract.

Shoots from callus and suspension cultures of 25 clones of Populus originating from 10 species and varieties have been regenerated. Callus cultured on 5 uM benzyladenine with 1 uM kinetin, in a DKW salt base on solid medium (regeneration medium) yielded shoots with at least 1 internode (versus nonelongated shoot buds) in 96 percent of the calli after 4 weeks in culture. The addition of either 3 percent maltose or glucose as the sole carbohydrate source increased the efficiency of regeneration from 20 percent to 64 percent in Populus clones that had been previously low or recalcitrant regenerators.

Xu, Miao-zhen. 1987. Propagation of aspen (Populus davidiana) vialled tissue culture. Journal of North-eastern Forestry Institute. 15(3): 24-29.

Methods are described for culturing terminal and axillary buds and callus derived from cambium tissue of P. davidiana [P. tremula var. davidiana].

1988

Ahuja, M.R.; Krusche, D.; Melchior, G.H. 1988. Determination of plantlet regeneration capacity of selected aspen clones in vitro. In: Ahuja, M.R., ed. Proceedings of the IUFRO Working party S2.04-07 Somatic cell genetics of woody plants; 1987 August 10-13; Grosshansdorf, Federal Republic of Germany. Dordrecht, The Netherlands: Kluwer Academic Publishers: 127-135.

Belanger, R.; Manion, P.; Griffin, D. 1988. A tissue culture system for assessing effects of moisture stress on Hypoxyylon mammatum ascospore infection of aspen clones. Phytopathology. 77(12): 1727. Abstract.

Six aspen clones were subjected to tissue culture to produce plantlets from dormant buds. One to two cm plantlets were moisture stressed by adding various concentrations of mannitol to the medium. Hypoxyylon mammatum ascospore inoculation of unwounded plantlets resulted in visible signs of mycelium after 3-4 days. The tissue culture system can provide insight into the interaction of water stress and aspen clone susceptibility to hypoxyylon canker.

Chun, Young Woo; Klopfenstein, Ned B.; McNabb, Harold S., Jr.; Hall, Richard B. 1988. Biotechnological applications in Populus species. Journal of Korean Forestry Society. 77(4): 467-483.

The development of tissue culture systems for Populus species, and the utilization of tissue culture biotechnology will be reviewed and discussed. Special emphasis will be placed on prospects for genetic transformation by Agrobacterium-mediated gene transfer methods.

Chun, Young Woo; Klopfenstein, Ned B.; McNabb, Harold S., Jr.; Hall, Richard B. 1988. Transformation of Populus species by an Agrobacterium binary vector system. Journal of Korean Forestry Society. 77(2): 199-207.

Three clones of Populus alba X P. grandidentata have been tested for susceptibility to Agrobacterium tumefaciens strains A281 and A348. We determined the optimum concentration of kanamycin sulfate for effective selection of leaf disc-derived, transgenic tissues transformed using Agrobacterium binary vector pGA472 containing a neomycin phosphotransferase gene (NPT-II) which confers kanamycin resistance. Of the wild type Ti plasmids contained in the two Agrobacterium strains, pTiBo542 of strain A281 appears to be best suited to serve as a helper plasmid for binary vector systems. A relatively low concentration (10mg/l) of kanamycin sulfate inhibited adventitious shoot initiation from leaf discs on regeneration medium. Transformed kanamycin-resistant calli were obtained by culturing Agrobacterium inoculated leaf discs on selective regeneration medium. The transformed kanamycin-resistant calli continued to grow on regeneration media supplemented with kanamycin sulfate to levels of 50 and 200mg/l. The growth of non-co-cultivated control calli was severely inhibited on regeneration medium containing 50mg/l kanamycin sulfate.

DeVerno, L.; Cheliak, W.M. 1988. In vivo transformation of hybrid poplars: clonal variation - a preliminary investigation. In: Cheliak, W.M.; Yapa, A.C., eds. Proceedings, 2d Workshop of the International Union of Forestry Research Organizations working party on molecular genetics; 1987 June 16-18; Chalk River, Ontario, Canada. Inf. Rep. PI-X-080. Chalk River, Ontario, Canada: Canadian Forestry Service, Petawawa National Forestry Institute: 48-53.

As a natural host of Agrobacterium tumefaciens, Populus is a model system for transferring foreign genes to woody perennials by Ti plasmid-mediated transformation. Here we report clonal variation in susceptibility to Agrobacterium tumefaciens strain A208 for four Populus deltoides x nigra clones and one clone of Populus nigra x maximowiczii, as demonstrated by gall formation, phytohormone-independent growth in vitro, and opine production.

Evers, P.W.; Donkers, J.; Prat, A.; Vermeer, E. 1988. Micropropagation of forest trees through tissue culture. Wageningen, The Netherlands: Centre for Agricultural Publishing and Documentation (Pudoc). 85 p.

Gupta, P.K. 1988. Advances in biotechnology of conifers - propagation, cryopreservation, protoplast technology, gene transmission, etc.; review. Current Science. 57(12): 630-637.

Biotechnology may be used in tree improvement in a number of ways. Recently, genetic transformation and expression of foreign genes have been reported in forest trees such as Populus and loblolly pine. Herbicide-resistant Populus plants have been regenerated.

Hu, Shih-Chang. 1988. Cottonwood (Populus deltoides Bartr.) a bibliography 1897-1986. Bul. No. 794. Baton Rouge, LA: Louisiana Agricultural Experiment Station. 129 p.

Iowa State University. 1988. Foreign gene helps poplar resist pests. Bioprocessing Technology. 10(9): 3,6.

Workers at Iowa State University have introduced an insecticidal gene into hybrid poplars. This gene is an antitrypsinase which works by interfering with the insects' ability to digest proteins.

Jang, Suk Seong; Lee, Jung Joo; Lee, Jae Soon; Lee, Suk Koo; Shim, Sang Yung. 1988. Plant regeneration from cell culture of Populus glandulosa Uyeki. Research Report of the Institute of Forest Genetics, Korea. 24: 107-113.

Kechel, H.G.; Boden, E. 1988. Early diagnosis of resistance properties by means of meristem culture. Allgemeine Forstzeitschrift. 43(49): 1353-1354.

Kirby, E.G.; David, A. 1988. Use of protoplasts and cell cultures for physiological and genetic studies of conifers - protoplast isolation, protoplast culture, somaclonal variation, etc. Basic Life Science. 44: 185-197.

Potential applications of protoplast technology to programs for genetic improvement of forest trees include somaclonal and gametoclonal variation, gene transfer, cell fusion, and cloning of selected phenotypes from single cells. Recent advances in protoplast culture techniques have enabled the establishment of a complete protoplast system for poplar (Populus).

Klimaszewska, K.; Cheliak, W.M. 1988. Selection for glyphosate-tolerant cell cultures in poplar. In: Ferm, A., ed. Proceedings of the IEA Task II meeting and workshops on cell culture and coppicing; 1987 August 24-29; Oulu, Finland. Finland: Metsantatkimus-laitoken Tiedonantoja. 304: 17-23.

Lindgren, Dale T.; Russell, Julie A.; McCown, Brent H. 1988. Greenhouse and field evaluation of protoplast-derived Populus trees. HortScience. 23(3, Sect. 2): 759. Abstract.

Plants differentiated from protoplast-derived calli of the poplar hybrid NC-5339 (Populus alba X Populus grandidentata) were grown in comparison with microculture-derived parental material in a greenhouse. The plants were rated for 17 morphological traits 10 weeks after transfer to the greenhouse. Fifty-two percent of the 164 protocloned evaluated differed from the parental material by at least 1 trait and 20 percent differed in 4 or more traits.

Michel, M.F.; Delmotte, F.; Depierreux, C. 1988. Transformation of hybrid Populus tremula X P. alba by Agrobacterium tumefaciens. In: Ahuja, M.R., ed. Proceedings of the IUFRO Working Party S2.04-07 somatic cell genetics of woody plants; 1987 August 10-13; Grosshansdorf, Federal Republic of Germany. Dordrecht, The Netherlands: Kluwer Academic Publishers: 81. Abstract.

Michler, C.H.; Bauer, E.O. 1988. Somaclonal variants of poplar that tolerate sulfometuron methyl. In vitro Cellular and Developmental Biology. 24(3, pt. 2): 52A. Abstract.

Hybrid poplar (Populus maximowiczii X P. trichocarpa) plantlets were produced from leaf disks plated on basal MS shoot regeneration medium supplemented with normally lethal levels of sulfometuron methyl (Oust, Du-Pont). Putative herbicide tolerant shoots were then rechallenged in vitro for 3 consecutive subcultures on herbicide with normally lethal doses to sensitive shoots. Thereafter, surviving tissue culture shoots were rooted ex vitro and grown as stock plants in the greenhouse.

Michler, C.H.; Haissig, B.E. 1988. Increased herbicide tolerance of in vitro selected hybrid poplar. In: Ahuja, M.R., ed. Proceedings of the IUFRO Working

Party S2.04-07 somatic cell genetics of woody plants; 1987 August 10-13; Grosshansdorf, Federal Republic of Germany. Dordrecht, The Netherlands: Kluwer Academic Publishers: 183-189.

Noh, Eui Rae; Lee, Soung Kyu; Koo, Young Bon; Chung, Kyung Ho. 1988. A mass propagation method of aspen (Populus davidiana Dode) using tissue culture and juvenile cutting techniques. Research Report of the Institute of Forest Genetics, Korea. 24: 20-27.

Oji-Paper, assignee. 1988. Mass propagation of woody plants - by shoot tip culture or protoplast culture. Patent No. GB 2195656. April 13. WPI Accession No.: 88-100398.

A process for the mass propagation of woody plants comprises: placing a shoot tip on an artificial medium containing inorganic salts and hormones and rotary culturing it under illumination to form shoot primordia; and stationary culturing the primordia in a liquid medium to regenerate shoots.

Ostry, M.E.; Skilling, D.D. 1988. Somatic variation in resistance of Populus to Septoria musiva. Plant Disease. 72(8): 724-727.

Tissue culture of hybrid poplars previously susceptible to leaf spot caused by Septoria musiva was used to obtain poplars with putative resistance. Stem internode explants were used to obtain proliferating callus cultures on which adventitious bud formation and shoot proliferation were induced. Elongated shoots were excised and rooted in a peat-perlite medium under high humidity and transferred to the greenhouse. Variant plants were selected among the regenerants using a leaf disk bioassay that distinguished resistant plants. The incidence of somaclonal variation differed among genotypes. Tissue culture of poplars is potentially useful in detecting and recovering somaclonal variation in resistance to Septoria.

Ostry, M.E.; Skilling, D.D. 1988. Use of tissue culture and in vitro bioassays for the development and selection of disease-resistant trees. Phytopathology. 78(12): 1608. Abstract.

Passage of plant cells through a tissue culture cycle can induce somaclonal variation (SCV). A potential benefit of SCV is the creation of useful genetic variability, such as disease resistance, without hybridization. Tissue culture has been used to obtain Populus spp. and Larix spp. variants that have putative resistance to Septoria musiva and Gremmeniella abietina, respectively.

Park, Young Goo; Son, Sung Ho. 1988. Culture and regeneration of Populus alba X glandulosa leaf protoplasts isolated from in vitro cultured explant. Journal of the Korean Forestry Society. 77(2): 208-215.

The leaf mesophyll protoplasts of Populus alba X glandulosa were isolated from the leaf of the plantlet in vitro and cultured for plant regeneration. The MS medium (minus NH_4NO_3) with 0.5 mg/l BAP and 2.0 mg/l 2,4-D showed the moderate frequency of dividing protoplasts cultured by the liquid plating method during the first week of culture. The percentage of colony formation revealed the highest frequency by the gauze contained semi-solid agar plating method after 5 weeks cultured. Ridding out the gauze, the micro-callus was formed on the same semi-solid medium in 8 weeks after protoplast culture. For

proliferation of callus, mini-callus was transferred on the MS solid medium with 0.5 mg/l 2,4-D and 0.1 mg/l BAP 12 weeks after culture. Shoot regeneration occurred when the calli derived from protoplasts were cultured on MS medium with 1.0 mg/l zeatin and such shoots could be readily rooted on the one half strength MS medium with non-phytohormone. Rooting shoots were planted in greenhouse 22 weeks after protoplast culture.

Park, Young Goo; Son, Sung Ho. 1988. In vitro organogenesis and somatic embryogenesis from punctured leaf of Populus nigra X P. maximowiczii. Plant Cell Tissue and Organ Culture. 15(2): 95-105.

Initial experiments indicated that punctured leaves of Populus nigra X Populus maximowiczii (cultured with adaxial contact) were better explants than non-punctured ones for callus growth and formation of shoots and roots on Murashige and Skoog (MS) medium containing hormones. After 6 weeks in culture, an average of 178 shoots, 129 roots, and 3.1 g fresh weight of callus were directly produced from the abaxial side of each punctured leaf.

Park, Young Goo; Son, Sung Ho. 1988. Regeneration of plantlets from cell suspension culture derived callus of white poplar (Populus alba L.). Plant Cell Reports. 7(7): 567-570.

Calli derived from the stem tissues of (Populus alba L.) were used to establish cell suspension cultures which were characterized for in vitro growth and regeneration capacity.

Riemenschneider, D.; Haissig, B.; Michler, C. 1988. Genetic effects on adventitious rooting in vitro in Populus deltoides. In Vitro. 24(3, Pt. 2): 52A. Abstract.

Greenhouse stock plants of 6 Populus deltoides clones were established by rooting dormant hardwood cuttings from 14-year-old trees. Shoot tips and subtending nodal sections were excised from 3 stock plants per clone. Stem sections with attached leaves were surface sterilized in 10 percent Chlorox, washed in sterile H₂O, and cultured on 1/4 strength Murashige-Skoog medium containing 1.0 mg/l naphthaleneacetic acid. Clonal selection could markedly improve in vitro adventitious rooting ability in Populus deltoides.

Russell, Julie A.; McCown, Brent H. 1988. Highly purified subpopulations of protoplasts show superior competency for use in genetic manipulations. HortScience. 23(3, Sect. 2): 780. Abstract.

Subpopulations of Populus spp. leaf protoplasts were separated through a discontinuous sucrose density gradient. Protoplasts characterized as having a high density (1.047-1.061 g cubic centimeter), small size (18 uM diameter), and many chloroplasts exhibited the most divisions and were cultured at low plating densities. The superior performance of this protoplast fraction, probably of mesophyll origin and highly differentiated, was discussed in relation to theories suggesting that dedifferentiated cell protoplasts have the highest competencies.

Russell, Julie A.; McCown, Brent H. 1988. Recovery of plants from leaf protoplasts of hybrid-poplar and aspen clones. Plant Cell Reports. 7(1): 59-62.

Leaf protoplasts were isolated from shoot cultures of two hybrid poplar clones (Populus alba X P. grandidentata 'Crandon', NC-5339, and P. nigra 'Betulifolia' X P. trichocarpa, NC-5331) and the Upright European Aspen (P. tremula 'Erecta') and were cultured in contact with screen discs floated in liquid medium. Protoplast culture was influenced by the growth medium of the source shoot cultures, the protoplast purification procedure, the plating density, and the presence or absence of a coconut water and casein hydrolysate supplement added to the culture medium.

Rutledge, Clare B.; Douglas, G.C. 1988. Culture of meristem tips and micropropagation of 12 commercial clones of poplar in vitro. *Physiologia Plantarum*. 72: 367-373.

Twelve commercial clones of poplar were cultured in vitro from meristem tips (0.3-0.5 mm diameter), shoot tips (4-6 mm long) and nodal segments (5-10 mm long). Shoot-producing cultures were obtained from 4.32 and 70 percent of meristem tips, shoot tips, and nodal segments within 12.6 and 4 weeks, respectively. The genotype of cultures had a greater influence on development of shoot-producing cultures than medium composition. Cultivars Max/Bet and Oxford had the highest rates of establishment in culture and subsequent shoot proliferation, while P. tacamahaca, P. trichocarpa, and cv. Robusta exhibited very low rates of establishment and low vigor in vitro. Shoot tip development was best on agar-solidified medium whereas liquid medium resulted in vitrification. Higher rates of axillary shoot production from established cultures were obtained with benzyladenine or zeatin than with 2-isopentenyladenine. Reducing the benzyladenine concentration from 4.4 to 1.1 μM , increased the production of elongated shoots suitable for rooting.

Saito, Akira; Hosoi, Yoshihisa; Ishii, Katsuaki; Sato, Toru. 1988. Protoplast isolation, somatic hybridization and eye-visible colony formation in different Populus species. *Journal of the Japanese Forestry Society*. 70(3): 119-126.

Stoehr, Michael U.; Zsuffa, Louis. 1988. Induction and evaluation of haploid and dihaploid lines in Populus maximowiczii. *Genome*. 30(Suppl. 1): 438. Abstract.

Anthers of Populus maximowiczii with microspores at the mononucleate stage were cultured in the dark at 20 degree centigrade on solid Murashige and Skoog's (MS) medium supplemented with 2,4-D and kinetin. After 60 days, anthers with emerging meristematic structures with 1 to several meristematic centers were transferred to MS medium supplemented with naphthaleneacetic acid (NAA) and benzyladenine (BA). Gametoclonal variation, somaclonal variation, segregation, and crossing-over were discussed.

Stoehr, Michael U.; Zsuffa, Louis; Eckenwalder, James E. 1988. Anomalous solitary flowers on anther-derived plants of Populus maximowiczii. *American Journal of Botany*. 75(4): 594-597.

In five of 66 anther-derived plants of Populus maximowiczii Henry (Salicaceae) unusual flowers were observed at ages six to eight months. Most flowers were male, occurring singly in a terminal position, and were characterized by cup-shaped, calyx-like floral discs bearing 14 to 18 stamens. The anthers failed to dehisce but did contain a few pollen grains when observed after squashing. One flower had, in addition to a set of

stamens, two stigmas emerging from undeveloped ovaries. These flowers in haploid or dihaploid plants are in some ways similar to ancestral flowers that have been hypothesized for the Salicaceae, and may give an indication of the evolutionary pathway in the genus Populus.

Sumiya, K.; Sunakawa, T.; Ishimoto, T.; Kasai, Z. 1988. Plant regeneration from long-term cultured callus of poplar (Populus nigra). Journal of the Japan Wood Research Society. 34(4): 354-358.

Uddin, M. Rafique; Meyer, Martin M., Jr.; Jokela, J.J. 1988. Plantlet production from anthers of Eastern cottonwood (Populus deltoides). Canadian Journal of Forest Research. 18: 937-941.

Plantlets were obtained by organogenesis from cultured anthers of Populus deltoides (Bartr.). Anthers formed callus in the dark on modified Murashige and Skoog medium supplemented with 9.0 uM 2,4-dichlorophenoxyacetic acid and 4.7 uM kinetin. Anther calli were differentiated into shoots by sequential transfer in the light onto Murashige and Skoog medium containing 4.4 uM benzylamino purine and 1.1 uM naphthaleneacetic acid for 4 weeks, followed by several transfers to woody plant medium with 2.2 uM benzylamino purine and 1.1 uM naphthaleneacetic acid. The shoots that formed were rooted by excising and transferring to woody plant medium supplemented with 1.0 uM indole-3-butyric acid. A few of these plants were found to be haploid. Two plants developed male terminal inflorescences, but died shortly thereafter.

Valentine, F.; Baker, S.; Belanger, R.; Manion, P.; Griffin, D. 1988. Screening for resistance to Hypoxyylon mammatum in Populus tremuloides callus and micropropagated plantlets. In: Ahuja, M.R., ed. Proceedings of the IUFRO Working Party S2.04-07 somatic cell genetics of woody plants; 1987 August 10-13; Grosshansdorf, Federal Republic of Germany. Dordrecht, The Netherlands, Kluwer Academic Publishers: 181. Abstract.

Wann, S.R.; Wyckoff, G.W.; Wyckoff, J.L. 1988. A tissue culture solution to a forestry problem - the propagation of a tetraploid European aspen. Tree Planters' Notes. 39(3): 28-30.

A simple tissue culture method based on the production of multiple shoots from dormant buds is described. The application of the method to tetraploid European aspen (Populus tremula L.) illustrates that in vitro propagation can be an attractive alternative when conventional methods prove unsuccessful.

DAMAGING AGENTS

1975

Abbey, E.; Ratcliffe, B. 1975. The crooked wood. Audubon. 77(6): 24-27.

Anderson, G.W.; Schipper, A.L., Jr. 1975. Variation among isolates of Hypoxyylon mammatum. European Journal of Forest Pathology. 5(4): 216-224.

Anselmi, N.; Cellerino, G.P.; Heather, W.A. 1975. Early diagnosis of poplar branches reaction to Marssonina brunnea disease produced in the laboratory. Preliminary study. Cellulosa e Carta. 26(5): 29-36.

Arru, G.M. 1975. Annotated list of the most important insects injurious to the cultivation of poplar in Italy. Cellulosa e Carta. 26(11): 47-50.

The species of insects attacking poplar in Italy are enumerated under the 3 headings of widespread pests causing economic damage each year against which treatments are applied on a large scale, pests limited to small areas and against which treatments are applied occasionally, and pests appearing occasionally and becoming injurious only under certain uncommon conditions.

Arru, G.M.; Cellerino, G.P.; Podger, F.D.; Hodges, C.S.; Reis, M.S.; Ivory, M.H.; Sen Sarma, P.K.; Pratap Singh, Sujana Singh; La, Y.J.; Yi, C.K. 1975. Pests and diseases of fast-growing hardwoods. 2nd FAO/IUFRO world technical consultation on forest diseases and insects; 1975 April 7-12; New Delhi, India.

Baeva, V.G. 1975. Biology of jumping plant lice (Homoptera, Psylloidea) damaging Populus pruinosa and Populus diversifolia in Tadzhikistan. In: Shchetkin, I.U.L.; Muminov, N.N., eds. Entomologiya Tadzhikistana: 38-41.

Bartkowiak, S.; Bialobok, S.; Rachwal, L. 1975. Evaluation of the degree of SO₂ damage to trees and shrubs for breeding purposes. Arboretum Kornickie. 20: 375-384.

A rapid test of acute damage was made by exposing cut shoots (placed in water) to 65-168 p.p.m. SO₂ in a fumigation chamber for 10 min, and then transferring to a greenhouse for symptoms to develop. Results are discussed for species and varieties of Larix, Populus, Forsythia, Ligustrum, and Syringa, showing considerable variation within each genus and between individual trees and shrubs.

Bassus, W.; Kost, F.; Zickermann, R. 1975. On the occurrence of bud- and shoot-mining insect pests of Poplar. Archiv fur Phytopathologie und Pflanzenschutz. 11(6): 421-434.

Studies were carried out in East Germany on the biology and ecology of Gypsonoma aceriana, G. oppressana, and G. sociana.

Blanchard, R.O. 1975. Electrotherapy: a new approach to wound healing. In: Proceedings of the American Phytopathological Society; 1: 133-134. Abstract.

Reports a study in which 6-month-old clonal cuttings of hybrid poplar were either (1) wounded on the central stem, and treated with pulsating direct

current for 4 or 16 hours at 2, 3, 4, or 5 days after wounding; or (2) treated with electric current for 4 or 16 hours and then wounded 2, 3, 4, or 5 days after treatment. Preliminary data indicated that electrotherapy for 16 hours, 2 days after wounding, and for 4 hours, 3 days after wounding, were the most effective treatments. Wound closures were complete with little or no discoloration.

Bolotina, I.N.; Mirchink, T.G. 1975. Manganese-oxidizing microorganisms inhabitants of plant surfaces. *Microbiology*. 44(5): 843-847.

Cavalcaselle, B. 1975. Possibility of using products based on Beauveria bassiana against the larvae of some wood-eating insects. *Mededelingen van de Faculteit Landbouwwetenschappen Rijksuniversiteit Gent*. 40(2,1): 437-442.

Larvae of Paranthrene [Sciapteron] tabaniformis could be infected with B. bassiana in poplar [Populus spp.] branches under laboratory conditions by treating with a conidial suspension the wood particles pushed by the larva to the entrance hole.

Chan, C.K.; Forbes, A.R. 1975. Life-cycle of a spiral gall aphid, Pemphigus spirothecae on poplar [Populus nigra] in British Columbia. *Journal of the Entomological Society of British Columbia*. 72: 26-30.

Chaudhry, M.I.; Ahmad, M.I. 1975. Population dynamics of two Poplar defoliators. Final Tech. Rep. Peshawar, Pakistan: Pakistan Forest Institute. 62 p.

Presents the results of an investigation, on the biology, distribution, injuriousness and control of (a) Eucosma (Gypsonoma) hapalosarca and (b) Pygaera (Ichthyura) anastomosis on Poplars (mainly Populus alba, P. X canadensis, P. euphratica and P. nigra) in Pakistan during 1967-1973.

Cheremisinov, N.A.; Fateev, A.I. 1975. Fungal parasites as tests for the establishment of quality differences in plants. *Referativnyi Zhurnal*. 91: 119-123.

In Populus tremula individual variation was found in resistance to Fomes igniarius and Melampsora pinitorqua; the green-barked form was the more resistant.

Ciesla, E.; Czajka, J.; Siwecki, R. 1975. Field observations on the resistance of poplars infested by Melampsora sp. *Arboretum Kornickie*. 20: 279-289.

The more susceptible and resistant clones and varieties of Populus spp. are listed and discussed, on the basis of observations in stool beds (in 1971-1973) and a nursery at Kornik, local plantations of hybrid black poplar [Populus x canadensis] and natural stands of black poplar (P. nigra) at 3 sites on the R. Vistula in 1973.

Daanje, A. 1975. Some special features of the leaf-rolling technique of Byctiscus populi L. *Behaviour*. 53: 285-316.

Observations in the Netherlands are described; the female B. populi usually makes shelters for its larvae from single rolled leaves of poplar, especially Populus tremula, but in spring a young shoot may be included along with one or more leaves. The making of these shoot rolls tends to stimulate the

development of new shoots in July/August, thus prolonging the insect's breeding season.

Dochinger, L.S. 1975. Marssonina blight of bigtooth aspen, Marssonina populi (Lib.) Magn. Agric. Handb. 470. Washington, DC: U.S. Department of Agriculture, Forest Service: 95-98.

Dochinger, L.S.; Jensen, K.F. 1975. Effects of chronic and acute exposure to sulphur dioxide on the growth of hybrid poplar cuttings. Environmental Pollution. 9(3): 219-229.

Hybrid poplar clones were fumigated in controlled-environment chambers with either 5 ppm sulphur dioxide for 1 1/2, 3, and 6 h or with 0.25 ppm sulphur dioxide for six weeks. Multivariate analyses were made from shoot-growth data before and after treatment and on the foliar injury induced by SO₂. Both short- and long-term fumigation produced similar plant-behaviour responses to the two SO₂ concentrations.

Drouin, J.A.; Wong, H.R. 1975. Biology, damage and chemical control of the poplar borer (Saperda calcarata) in the junction of the root and stem of balsam poplar in western Canada. Canadian Journal of Forest Research. 5(3): 433-439.

An account is given of the life-history of Saperda calcarata Say on poplar, with particular reference to the effect of the borer on young trees of Populus balsamifera growing on poor or disturbed sites in western Canada.

Estoup, G. 1975. The Poplar shoot moth Gypsonoma [Semasia] aceriana. Possible control measures. Revue Forestiere Francaise. 27(5): 357-361.

Briefly describes the life cycle in Aquitaine of this pest of Poplar nurseries and young plantations, illustrates the damage done (destruction of the leading shoot, with consequent loss of growth and formation of multiple leaders), and suggests possibilities of control by application of systemic and non-systemic insecticides in spring and summer.

Filer, T.H., Jr. 1975. Melampsora rust on cottonwood, Melampsora medusae Thum. Agric. Handb. 470. Washington, DC: U.S. Department of Agriculture, Forest Service: 99-100.

Filer, T.H., Jr. 1975. Septoria leaf spot and canker on cottonwood, Septoria musiva Peck. Agric. Handb. 470. Washington, DC: U.S. Department of Agriculture, Forest Service: 101-103.

Fourcaud, A. 1975. Plantifog 160 M, oily fungicide for Lophodermium control [Lophodermium pinastri on Pinus, Marssonina brunnea on Populus]. Mitt Bundesforschungsanst Forst Holzwirtschaft. 108: 169-172.

Freazzoni, I. 1975. Importance of the helicopter in protecting the poplar from Marssonina brunnea. Lotta Antiparassit. 27(3): 21-22.

French, J.R.; Hart, J.H. 1975. Variability of canker length on aspen clones following inoculation with Hypoxyylon mammatum. Proceedings of the American Phytopathological Society. 297. Abstract.

One hundred naturally occurring clones of Populus tremuloides and 13 of P. grandidentata were inoculated in situ in twelve areas of Michigan, USA, with two isolates of H. mammatum. Analysis of variance of canker lengths on P. tremuloides indicated significant clonal differences within ten of the areas.

French, J.R.; Manion, P.D. 1975. Variability of host and pathogen in Hypoxylon canker of aspen. Canadian Journal of Botany. 53(23): 2740-2744.

Differences are reported in susceptibility to canker enlargement in five natural clones of Populus tremuloides inoculated with mass and single-spore cultures of H. mammatum.

Funk, A; Zalasky, H. 1975. Rhytidiella baranyayi associated with cork-bark of aspen. Canadian Journal of Botany. 53(8): 752-755.

Giege, B; Stenmark, A. 1975. Experiments with repellents against hare and vole winter 1972--1973. Statens Vaxtskyddsanst Medd (Stockh). 16(164): 95-100.

Gokhale, A.A. 1975. Bacteria associated with wetwood in black cottonwood (Populus trichocarpa Torrey and Gray). Botanique. 6(1): 1-4.

Gronebaum-Turck, K.; Mathe, P. 1975. The effect of different concentrations of fluorine on the chloroplast pigments of poplar, elder and lilac occurring in the field. European Journal of Forest Pathology. 5(3): 183-184.

Heather, W.A.; Anselmi, N.; Cellerino, C.P. 1975. In vitro and in vivo germination of spores of Marssonina brunnea P. Magn. European Journal of Forest Pathology. 5(6): 321-328.

Hinds, T.E.; Krebill, R.G. 1975. Wounds and canker diseases on western aspen. For. Pest Leaflet. 152. Washington, DC: U.S. Department of Agriculture, Forest Service. 9 p.

Hocking, D. 1975. Effects on the forest of sulfur dioxide from a sulfur fire near Edson, Alberta. Inf. Rep. NOR-X-139. Edmonton, Alberta: Canadian Forestry Service. 8 p.

Sulfur was burnt in a sanitary landfill during August 9 and 10, 1974. Resulting sulfur dioxide impinged on the surrounding mixed forest for 29 h. This report describes the extent of injury, relative sensitivities of affected plant species, and recovery in the spring in 1975.

IAGdyev, A. 1975. Stem pests of the Asiatic poplar in Turkmenistan. Izv Akad Nauk Turkm SSR, Ser Biol Nauk. 6: 60-64.

Jennings, D.T.; Acciavatti, R.E. 1975. Sexing large aspen tortrix pupae. Res. Note RM-298. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 2 p.

Jensen, K.F. 1975. Sulfur content of hybrid poplar cuttings fumigated with sulfur dioxide. Res. Note NE-209. Delaware, OH: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 3 p.

Hybrid poplar cuttings were fumigated with sulfur dioxide ranging in concentration from 0.1 to 5 ppm for periods of 5 to 80 hours. At the end of the fumigation periods, the cuttings were harvested and the sulfur and chlorophyll contents of the leaves were measured.

Jensen, K.F.; Kozlowski, T.T. 1975. Absorption and translocation of sulfur dioxide by seedlings of four forest tree species. *Journal of Environmental Quality*. 4(3): 379-382.

Rates of absorption of SO₂ and translocation of absorbed sulfur were determined in sugar maple (*Acer saccharum*), bigtooth aspen (*Populus grandidentata*), white ash (*Fraxinus americana*) and yellow birch (*Betula alleghaniensis*).

Jodice, R.; Ferrara, R.; Scurti, J.C.; Fiussello, N.,; Obert, F.; Cortellezzi, G.C. 1975. Thermophilous fungi. I. Their isolation, metabolism and capacity for degrading organic matter. *Allionia*. 20: 53-73.

Reviews the literature on these fungi and gives results of tests on the behaviour of various species isolated from different substrates, including Poplar bark piled and fermented for 3 or 12 months.

Jovic, D. 1975. Appearance of bark cracking and process of healing of the cracks caused by low temperatures on trees of *Populus X euramericana* clone I-214. *Topola*. 18/19(103/106): 177-181.

Kam, M. de. 1975. Ascospore discharge in *Drepanopeziza punctiformis* in relation to infection of some poplar clones. *European Journal of Forest Pathology*. 5(5): 304-309.

Karnosky, D.F. 1975. Genetic variation in response of trembling aspen (*Populus tremuloides* Michx.) leaves and catkins to sulfur dioxide and ozone. *Dissertation Abstracts International*, B. 36(3): 997B.

Rooted cuttings from five clones each in three different ontogenic stages were fumigated with 0.8 p.p.m. sulphur dioxide and 0.15 p.p.m. ozone in separate fumigations. Significant interclonal variation was found in the response of ten clones to exposures of sulphur dioxide and ozone, alone and in combination.

Kim, M.H. 1975. Studies on the effect of sulfur dioxide gas on tree leaves. *Research Reports of the Forest Research Institute, Korea*. 22: 31-36.

Foliar S content was determined for *G. biloba*, *P. orientalis*, *Populus nigra* var. *italica* and *Ailanthus altissima* growing at different sites. The contents were significantly greater in areas of high traffic flow, and seasonal variations were also found.

Kuhne, H.; Becker, G. 1975. The biology and ecology of *Micromalthus debilis* LeConte. In: Becker, G.; Liese, W., eds. *Organisms and wood: international symposium Berlin-Dahlem. Material und Organismen*: 447-461.

The polymetabolic and paedogenetic developmental cycle of *Micromalthus debilis* Lec. is described from the literature; and the effects of temperature and wood decay on development are described from laboratory investigations.

Development occurred in the wood of pine, spruce, beech, apple, pear, and poplar, but undecayed wood was not attacked.

Kurkela, T. 1975. Colonization of Melampsora uredia on aspen [Populus] leaves by Cladosporium sp. Metsantutkimuslait Julk. 80(3): 14 p.

Louisier, J.D.; Elliott, M.J. 1975. Colonization of deciduous leaf litter by bacteria and testate amoebae. In: Biodegradation et humification; rapport du colloque international 1st: 98-107.

Magnani, G. 1975. An attack of Schizophyllum commune Fr. on young plants of white poplar. Cellulosa e Carta. 26(7/8): 55-61.

Malek, R.B.; Smolik, J.D. 1975. Effect of Xiphinema americanum on growth of shelterbelt trees. Plant Disease Reporter. 59(2): 144-148.

Mamontova, V.A. 1975. The beet root aphid. Zashchita Rastenii. 10: 33-35.

Pemphigus fuscicornis (Koch), an important pest of sugar-beet, was observed in the Soviet Union for the first time in 1959 and has since spread considerably. The corresponding species in North America, P. populivenerae Fitch (betae Doane), overwinters on three species of Populus before migrating to beet, but in Eurasia, Pemphigus fuscicornis has been observed breeding only on beet and wild chenopodiaceous plants.

Manion, P.D. 1975. Two infection sites of Hypoxyylon mammatum in trembling aspen (Populus tremuloides). Canadian Journal of Botany. 53(22): 2621-2624.

Manion, P.D.; Blume, M. 1975. Epidemiology of Hypoxyylon canker of aspen. Proceedings of the American Phytopathological Society. 2: 101.

Surveys conducted between 1969 and 1975 in five Populus plantations made up of 82 families of seedlings produced from crosses between parents representing the Adirondack population and crosses from the centre of New York State revealed that 10% of 2757 stems were cankered. Differences in the total percentage infection between individual families suggested genetic differences in resistance which could be used for developing improved varieties.

McKenzie, E.H.C. 1975. A quantitative comparison of fungal successions on decaying rust-infected and rust-free leaves. In: Biodegradation et humification; rapport du colloque international 1st: 66-74.

McKim, H.L.; Gatto, L.W.; Merry, C.J. 1975. Inundation damage to vegetation of selected New England flood control reservoirs. Special Rep. No. SR-220, Hanover, NH: U.S. Army Cold Regions Research and Engineering Laboratory. 49 pp.

Damage caused during flooding in June-July 1973 was assessed by colour infra-red photography and ground surveys. Much of the understory vegetation (poplar, basswood, and hornbeam) lost all leaves after inundation, but new buds and shoots had appeared by late Sept. 1973. In general, trees inundated for less than 90 h were not extensively damaged.

Misheneva, V.D. 1975. Prevention of bacterial diseases in Siberian poplar. *Lesnoe Khozaistvo*. 1: 77-78.

Młodzianowski, F.; Siwecki, R. 1975. Ultrastructural changes in chloroplasts of Populus tremula L., leaves affected by the fungus Melampsora pinitorqua Braun. *Rostr. Physiological Plant Pathology*. 6(1): 1-3.

Morris, R.C.; Filer, T.H.; Solomon, J.D.; McCracken, F.I.; Overgaard, N.A.; Weiss, M.J. 1975. Insects and diseases of cottonwood. Gen. Tech. Rep. S0-8. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 37 p.

Naidenov, I.A. 1975. Marssonina brunnea (Ell. Et Ev.) P. Magn.--a new disease of Euroamerican poplars in Bulgaria. *Gorskostop Nauka*. 12(1): 81-85.

Nail, M. le. 1975. A problem still unsolved: the destruction of mistletoe in poplars. *Foret Privee Francaise*. 107: 69-71.

Briefly summarizes the results of experiments on control of mistletoe (Viscum album var. abietis) on Abies alba by spraying with various preparations and in this context discusses the problem of controlling mistletoe on roadside poplars in France, which are increasingly subject to severe infestation.

Pinon, J. 1975. Presence in France of aspen canker (Hypoxyylon mammatum (Wahl.) Mill.). *Comptes Rendus des Seances de l'Academie d'Agriculture de France*. 61(12): 703-706.

The fungus was recorded on P. tremula X P. tremuloides and P. tremula X P. grandidentata, trees of all ages being attacked. Rings in the trunk showed that infections had occurred in 1966-1968 and in 1971-1972.

Pinon, J.; Morelet, M. 1975. Linospora ceuthocarpa (Fr.) Munk ex Morelet, a parasite of poplar leaves. *European Journal of Forest Pathology*. 5(6): 367-376.

Pinon, J.; Poissonnier, M. 1975. The epidemiology of Marssonina brunnea (Ell. Et Ev.) P. Magn., a [fungus] leaf parasite of cultivated poplars. *European Journal of Forest Pathology*. 5(2): 97-111.

Pukacka, S. 1975. Physiological and biochemical basis for the resistance of poplar hybrids to the fungus Dothichiza populea. *Arboretum Kornickie*. 20: 227-277.

A doctoral thesis on: the role of phenolic compounds in the resistance of poplars (Populus spp. and hybrids) to the bark pathogen D. populea [DP]; changes in enzyme activities (including peroxidase isoenzymes) in the bark after infection; and the degradation of cell-wall components by DP. Experiments were made on greenhouse plants of P. laurifolia, P. maximowiczii (both resistant), P. nigra var. italica (susceptible), and 4 hybrids between these species (and/or P. nigra), with resistance intermediate between the parents. The most fungistatic compounds tested against DP cultures were salicylic acid, gentisic acid and catechol. Decarboxylation of IAA was accelerated in infected bark tissues. Production of cellulase and pectinase

by DP was inhibited by bark phenolic constituents and their phenol-oxidase oxidation products. DP also decomposed lignin to some extent. It is concluded that poplars resistant to DP are characterized by a higher activity of o-diphenol oxidase which creates infection barriers; the highest activity was found in P. laurifolia and its hybrids.

Sachs, I.B.; Ward, J.C.; Kinney, R.E. 1975. Scanning electron microscopy of bacterial wetwood and normal heartwood in poplar trees. Scanning Electron Microscopy Proceedings Symposium; 2: 453-459.

Schier, G.A. 1975. Deterioration of aspen clones in the middle Rocky Mountains. Res. Pap. INT-170. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 14 p.

Schipper, A.L., Jr. 1975. Changes in dehydrogenase and peroxidase activities of aspen infected with Hypoxyylon mammatum. Phytopathology. 65(4): 440-445.

Schipper, A.L., Jr. 1975. Hypoxyylon pathotoxin necessary to the infection of aspen by Hypoxyylon mammatum. Proceedings of the American Phytopathology Society. 2: 46-47.

Sharma, J.K.; Heather, W.A. 1975. The occurrence of Taphrina rhizophora on Populus alba in Australia. A P P S Newsletter of the Australian Plant Pathology Society. 4(1): 4-5.

Sheridan, J.E.; Harper, J.E.; Stevenson, G. 1975. Note on epidemiology and control of poplar leaf rust. New Zealand Journal of Science. 18(2): 211-216.

Shmelev, G.P. 1975. Morphology and metamorphosis of Pulvinaria salicicola Borchs. (Homoptera, Coccoidea, Coccidae). In: Shchetkin, I.U.L.; Muminov, N.N., eds. Entomologiya Tadzhikistana: 86-93.

Sokolova, E.S. 1975. Brown spot of Poplar leaves. Zashchita Rastenii. 12: 42. Marssonina populi has become widespread in the Moscow district. The pathogen overwinters as apothecia. Spraying with 1% Bordeaux mixture or its substitutes from May to August is recommended.

Stewart, J.W.; Payne, T.L. 1975. Seasonal abundance and impact of the cottonwood twig borer on cottonwood trees. Journal of Econ. Entomology. 68(5): 599-602.

Strojny, W. 1975. Feeding of the adult of Saperda carcharias (L.) (Coleoptera, Cerambycidae) in the bark of shoots of Populus tremula L. Polskie Pismo Entomologiczne. 45(3/4): 625-632.

The feeding habits of the adults of Saperda carcharias (L.) on leaves and on the bark of young shoots of aspen (Populus tremula) in Poland are described, and also the oviposition behaviour, largely from observations on 7 young aspen trees felled at Wroclaw in 1973.

Suzuki, K. 1975. Quantitative changes in sugar level in poplar leaves at periodic intervals following inoculation with Melampsora larici-populina Kleb. Annals Phytopathological Society of Japan. 41(4): 378-382.

Suzuki, K. 1975. Studies on the susceptibility to poplar leaf rust influenced by different nutrient conditions. (IV) Some observations on the ultrastructure of poplar leaf cells, with special reference to the change of mitochondria. Journal of the Japanese Forestry Society. 57(8): 261-267.

Ultramicroscopic alternations in the cytoplasm were observed in the clone P. X japono-gigas, which is susceptible to Melampsora larici-populina, but not in the resistant P. X canadensis 'I154' some days after inoculation with the fungus.

Thielges, B.A.; Adams, J.C. 1975. Genetic variation and heritability of Melampsora leaf rust resistance in eastern cottonwood. Forest Science. 21: 278-282.

More than 200 clones were evaluated for field resistance. The genetic basis of variation in resistance is discussed with suggestions for applying the information to the genetic improvement of Populus.

Thomas, H. 1975. Control of Saperda carcharias L. Soz Forstwirtschaft. 25(5): 154-156.

Tomilova, V.N.; Kuznetsova, N.P. 1975. The mining chrysomelid of Poplar. Zashchita Rastenii. 9: 45.

Zeugophora turneri caused much damage to plantings of Populus spp. in the Irkutsk region of the Soviet Union in 1972-1974, especially to those 20-25 years old. The chrysomelid has one generation/year and the larvae overwinter in the soil until the end of May. Damage is particularly noticeable on city trees, as the leaves lose their decorative value and fall prematurely.

Tsilyurik, A.V.; Churikova, E.K. 1975. The resistance of aspen wood to tree-destroying fungi. Referativnyi Zhurnal. 130: 115-120.

Experiments have shown that the central part of the trunk is more resistant to Phellinus tremulae in green-barked aspens than in those with dark bark.

Varjas, L. 1975. Use of juvenoids against the satin moth, Stilpnotia salicis L. (Lepidoptera, Lymantriidae). In: 8th International Plant Protection Congress: Reports and informations. Sec. 5. Biological and genetic control; 1975; Moscow. Budapest, Hungary: Research Institute for Plant Protection: 209-210.

Laboratory tests in Hungary showed that topical applications of juvenile hormone analogues to last-instar larvae of Leucoma salicis (L.) (Stilpnotia salicis) resulted in larval-pupal intermediates and some larvae that passed through an extra instar.

Visser, S.; Parkinson, D. 1975. Fungal succession on aspen poplar leaf litter. Canadian Journal of Botany. 53(16): 1640-1651.

Visser, S.; Parkinson, D. 1975. Litter respiration and fungal growth under low temperature conditions. In: Biodegradation et humification; rapport du colloque international 1st: 88-97.

Vural, M. 1975. Fungi which attack leaves of poplars that are native or cultivated in Turkey. Yillik Bul Kavak Hizli Gelisen Orman Agaclarlari Arastirma Enst. 10: 1-240.

Wikstrom, C. 1975. Fungal decomposition of sapwood and heartwood of European aspen, Populus tremula L. European Journal of Forest Pathology. (6): 349-356.

Witter, J.A.; Mattson, W.J.; Kulman, H.M. 1975. Numerical analysis of a forest tent caterpillar (Lepidoptera: Lasiocampidae) outbreak in northern Minnesota. Canadian Entomologist. 107(8): 837-854.

Yagdyev, A. 1975. Trunk pests of turanga in Turkmenia. Izvestiya Akademii Nauk Turkmenskoi SSR, Biologicheskikh Nauk. 6: 60-64.

In Turkmenia, Populus diversifolia is attacked by the larvae of 11 species of trunk-boring Coleoptera, of which 6 are here recorded for the first time. Notes are given on their habits, from observations in 1970-1973.

Yildiz, N. 1975. Investigation on the distribution, biology, protection control methods of Saperda populnea L. Yillik Bul Kavak Hizli Gelisen Orman Agaclarlari Arastirma Enst. 10: 261-280.

Zaka-ur-Rab, M. 1975. Pemphigus bursarius Linn. Producing galls on Lombardy Poplar in Kashmir. Current Science. 44(6): 203-204.

Zazzu, G. 1975. Poplar [Populus] pest control. Rilancio Agric Vet Zootec. 7(2/3): 8, 10-11.

1976

1976. Pest: Euproctis chrysorrhoea (L.) (Nygmia phaeorrhoea (Don.)) (Lep., Lymantriidae) (Brown-tail moth). Host plants: fruit trees, elm, oak, poplar. London, UK: Common Institute Entomology. Distribution Maps of Pests, A: 362. 2 p.

Agnihotrudu, V. 1976. A leaf disease of Poplar from Kashmir. Current Science. 45(10): 389-390.

Cladosporium martianoffinum was identified as the cause of a leaf-spot disease on Populus alba in an apple orchard in the Kashmir valley.

Anderson, N.A.; Ostry, M.E.; Anderson, G.W. 1976. Hypoxylon canker of aspen associated with Saperda inornata galls. Res. Note NC-214. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 3 p.

Evidence is presented from investigations in Minnesota and Wisconsin since 1966 that hypoxylon canker can take place in aspens as a result of infection at galls caused by the cerambycid Saperda inornata Say.

Alekseev, V.A. 1976. Study of the relation between infection of Aspen stands by Phellinus tremulae and the content of mineral nutrient elements in the soil. Lesnoi Zhurnal. 5: 21-25.

The incidence of infection by Phellinus tremulae was investigated in Populus tremula stands of various ages in the Leningrad and Kalinin regions, in relation to the contents of N, P and K in the soil.

Atkinson, M.A.; Cooper, J.I. 1976. Ultrastructural changes in leaf cells of poplar naturally infected with poplar mosaic virus. Annals of Applied Biology. 83(3): 395-398.

In poplar (Populus X euramericana cv. 'Robusta') infected with the virus, rod shaped, virus like particles (c. 13 nm diam.) occurred singly or in loose bundles in the cytoplasm of cells in palisade and mesophyll tissue and in vascular parenchyma.

Baranchugov, E.G. 1976. Effect of the drought of 1972-73 on the growth and condition of poplars in the central Volga area. Lesovodstvo, les. kul'tury i pochvovedenie. 5: 41-46.

The species and varieties studied differed in the extent to which their growth rate was reduced by the drought. The most drought resistant was the Leningrad poplar (Populus deltoides X P. suaveolens) and the least resistant was P. maximowiczii.

Basham, H.G.; Cowling, E.B.; Baines, E.F.; Millbank, J.W.; Henningson, B. 1976. Physiology and ecology of wood-destroying microorganisms. In: Becker, G.; Liese, W., eds. Organisms and wood, International symposium; Berlin-Dahlem. Beihefte zu Material und Organismen. 3: 155-185.

Three papers from this section of the international symposium on 'Organisms and Wood'.

Behdad, E. 1976. Influence of soil amendments, water management and tree species on the growth of Rosellinia necatrix (Hart.) Berl., the cause of white root rot. Iranian Journal of Plant Pathology. 12(1/2): 24-25, 27-41.

In plots of 1-yr-old plane trees frequent irrigation led to reduced incidence of infection. Sour cherry (mahaleb) was the most susceptible fruit tree, while Populus deltoides clones were more susceptible (45%) than P. euramericana (18%) in naturally infested soil.

Berbee, J.G.; Omuemu, J.O.; Martin, R.R.; Castello, J.D. 1976. Detection and elimination of viruses in poplar. Gen. Tech. Rep. NC-21. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 85-91.

Boccardo, G.; Milne, R.G. 1976. Poplar mosaic virus: electron microscopy and polyacrylamide gel analysis. Phytopathologische Zeitschrift. 87(1): 120-131.

Bowersox, T.W.; Merrill, W. 1976. Stand density and height increment affect incidence of Septoria canker in hybrid poplar. Plant Disease Reporter. 60(10): 835-837.

Canker incidence was positively correlated with initial growing space/tree and 3rd yr height increment. Multiple correlation ($r = 0.64$) of the 4-yr-old

cankering incidence with 3rd yr height increment, initial growing space/tree and clone was significant.

Bruck, R.I.; Manion, P.D. 1976. Edaphic factors influencing the incidence of hypoxylon canker on trembling aspen. Proceedings of the American Phytopathological Society. 2: 95. Abstract.

The incidence of Hypoxylon mammatum cankers was surveyed in 7 stands of Populus tremuloides in one geomorphological area in central New York. The incidence was positively correlated with soil temperature and soil bulk density, negatively with available moisture, fine silt/clay content, available P and Ca, and highly negatively with total organic matter and available Mn.

Brunt, A.A.; Stace-Smith, R.; Leung, E. 1976. Cytological evidence supporting the inclusion of Poplar mosaic virus in the Carlavirus group of plant viruses. Intervirology. 7(4/5): 303-308.

Butin, H.; Schneider, R. 1976. Kabatina populi nov. Spec. Phytopathology Zhurnal. 85(1): 39-42.

Chang, S.C.; Chang, C.Y.; Chui, W. 1976. Studies on the Poplar leaf miner Leucoptera susinella Herrich-Schaffer. Acta Entomologica Sinica. 19(1): 67-71.

Details are given of the life history. Control measures include the removal of fallen leaves during winter and the application of 0.04% foliar sprays of dimethoate.

Cooper, D.T.; Filer, T.H., Jr. 1976. Geographic variation in Melampsora rust resistance in eastern cottonwood in the lower Mississippi valley. In: Proceedings, Central States Forest Tree Improvement Conference. 10: 146-151.

Cooper, D.T.; Filer, T.H., Jr. 1976. Resistance to Septoria leaf spot in eastern cottonwood. Plant Disease Reporter. 60(10): 812-814.

Of 320 randomly-collected Populus deltoides clones collected in the vicinity of the Mississippi River from 34 deg 55' to 33 deg 45' N, ten were resistant to Septoria musiva. Of 1120 clones originating from 33 deg 50' to 30 deg 30' N, none were resistant.

Cooper, J.I.; Sweet, J.B. 1976. The detection of viruses with nematode vectors in six woody hosts. Forestry. 49(1): 73-78.

Tests on Populus x euramericana cv. 'Robusta' indicated infection with soil-borne viruses. This is the first report of virus-transmission from H. helix and the first isolation of nematode-borne viruses from poplars.

Cumer, A.; Rauzi, G.M.; Biancardi, E.; Casalicchio, G. 1976/1977. The accumulation of pollutants in the bark of Populus spp. and of Robinia pseudoacacia. Esperienze Ric Nuova Ser Stn Sper Agrar For San Michele All'adige. 6: 223-271.

Dafaue, C. 1976. Susceptibility of clones of black poplar to attack by Cryptorhynchus lapathi L. (Col. Curculionidae). Boletín de la Estación Central de Ecología. 5(10): 39-66.

A detailed account is given of field and laboratory studies in Spain in which the feeding and oviposition preferences of Cryptorhynchus lapathi (L.) were studied in relation to 27 clones of poplar.

Dagenbach, H.; Schlenker, G. 1976. Susceptibility of different poplar varieties to Dothichiza in the Reichenberg populetum. Mitt Ver Forstl Standortskd Forstpflanzenzucht. 25: 26-32.

Davidson, R.M., Jr.; Byther, R.S. 1976. Poplar yellow leaf blister. EM Cooperative Extension Service College of Agriculture, Washington State University. 4048: 2 p.

Deliu, C.; Stirban, M. 1976. Annual dynamics of assimilatory pigments in Viscum album L. and in its host plant, Populus tremula L. Contributii Botanice, Gradina Botanica, Universitatea 'Babes-Bolyai' din Cluj-Napoca: 241-249.

The content of chlorophylls a and b was lower in V. album than in P. tremula leaves; in the host it followed a Gaussian curve over the vegetative period. Contents were highest in July in control P. tremula, in June in host P. tremula, and in July in V. album. The highest level of xanthophylls (neoxanthin, violaxanthin, and lutein) occurred in July in control P. tremula, in September in host P. tremula, and in October in V. album. The parasite had a higher content of xanthophylls than the host. Carotenoid content was greatest in V. album in October; the ratio to that in the host varied according to the time of year.

Dimitri, L.; Bogenschutz, H.; Konig, E.; Baule, H. 1976. Fertilizer use and plant health. In: Proceedings, 12th Colloquium of the International Potash Institute; Izmir, Turkey. Bern, Switzerland: International Potash Institute. 330 p.

Evers, F.H. 1976. The increase in the area of forest stands damaged by road de-icing salt. Forstwissenschaftliches Centralblatt. 95(5/6): 251-264.

Various aspects of the problem are discussed on the basis of observations in S.W. Germany and reports in the literature. Many broadleaved species, including some Poplars, and also Abies alba and Pinus sylvestris, are considered fairly tolerant where there is no spray effect. Methods of prevention by suitable road-construction measures are discussed.

Filer, T.H., Jr. 1976. Etiology, epidemiology, and control of cankers in cottonwood. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 226-233.

Filer, T.H., Jr.; McConnell, J.L. 1976. Severity of Alternaria tenuis on unrooted cottonwood cuttings. Proceedings of the American Phytopathological Society. 2: 134. Abstract.

Black stem rot produced 65-95% losses on green tip cuttings of improved Populus deltoides clones that were being rooted in mist beds. Benomyl reduced losses by 50% in 2 clones but gave no control in 11 others.

Foos, K. 1976. Natural gas in the region of the root system is actively noxious to poplars. *Zhurnal Pflanzenphysiol.* 79(3): 199-209.

Cuttings of *Populus* cv. Oxford were grown for three and seven weeks in an aerated nutrient solution. The plants were then treated with nitrogen and natural gas, the control being aerated as before. Natural gas inhibited growth more than did nitrogen.

French, J.R.; Hart, J.H. 1976. Variability of canker length on aspen clones following inoculation with *Hypoxyylon mammatum*. Proceedings of the American Phytopathological Society. 2: 97. Abstract.

Inoculations with two virulent isolates were made on 100 natural clones of *Populus tremuloides* and 13 of *P. grandidentata* in 12 geographic regions of Michigan in April/May 1975. Analysis of variance of canker lengths on *P. tremuloides* indicated significant clone differences within 10 regions. The amount of natural infection in each clone was not correlated with the length of artificially induced cankers.

French, J.R.; Manion, P.D. 1976. *Hypoxyylon mammatum* ascospore germination and mycelial growth on bark and wood media from young branches of trembling aspen. *Canadian Journal of Botany.* 54(13): 1438-1442.

Greenblatt, J.A.; Witter, J.A.; Wellington, W.G. 1976. Behavioral studies on *Malacosoma disstria* (Lepidoptera: Lasiocampidae). *Canadian Entomologist.* 108(11): 1225-1228.

First-instar larvae of *Malacosoma disstria* Hb. that had been reared in the laboratory in Michigan from eggs collected on *Populus tremuloides* in Ontario in 1974 were tested for the presence of types showing active or sluggish behaviour. Larvae capable of directed movement towards a 30-W light source were classified as active. Chi-square tests confirmed that the differences in response were not random. There was a tendency for some larvae to respond to light during the test and for others not to respond.

Gremmen, J. 1976. The significance of shoestring fungus in dieback of trees. *Ned Bosbouw Tijdschr.* 48(4): 103-106.

Gronebaum-Turck, K.; Mathe, P. 1976. The effect of different concentrations of fluorine on the content of chlorophylls a and b in poplar leaves. *European Journal of Forest Pathology.* 6(1): 57-59.

Hastings, A.R.; Renlund, D.W. 1976. The budworm situation in the Lake States-1974. Misc. Publ. 1327. Washington, DC: U.S. Department of Agriculture, Forest Service: 28-37.

Highley, T.L. 1976. Hemicellulases of white- and brown-rot fungi in relation to host preferences. *Material und Organismen.* 11(1): 33-46.

Coriolus versicolor, a white-rot fungus, and *Poria placenta*, a brown-rot fungus, were grown in liquid culture media containing milled wood of Bigtooth aspen (*Populus grandidentata*) or Engelmann spruce (*Picea engelmannii*). The hemicellulases contained in filtrates from these cultures were tested on a number of substances. No great or consistent differences were found in the activity of these enzymes.

Hinds, T.E. 1976. Aspen mortality in Rocky Mountain campgrounds. Res. Pap. RM-164. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 20 p.

A study of Populus tremuloides growing at 17 campgrounds in National Forests in Colorado.

Hinds, T.E. 1976. Diseases of western aspen. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 24-29.

Jernelov, A. 1976. Yellow leaves in aspen. Fauna och Flora. 71(1): 7-8.

Affected aspen trees were observed in S. Sweden in 1970-1974. Some healthy trees inoculated with homogenates from yellow leaves developed yellow leaves the same season and more turned yellow the following summer. Yellowing was apparently caused by a virus, possibly transmitted by sucking insects.

Joekla, J.J.; Paxton, J.D.; Zegar, E.J. 1976. Marssonina leaf spot and rust on eastern cottonwood. Plant Disease Reporter. 60(12): 1020-1024.

A clonal nursery was established in Illinois in May 1970 with rooted cutting of Populus deltoides from six areas, using 100 clones from each area derived from four randomly selected seedlings from 25 unrelated progenies of unselected wild trees. Data on the incidence of M. brunnea in association with Melampsora on trees from the six areas is graphically represented.

Karabanov, I.A.; Shelukhin, N.V. 1976. Effect of the mineral nutrient regime on the physiological condition and fume resistance of certain woody species. Lesovedenie. 4: 73-81.

The anatomical structure and physiological condition of the foliage of Pinus sylvestris, Betula verrucosa, and Populus tremula were studied in an area of natural forest, 15 years old, located near a chemical factory emitting SO₂ and F. The application of mineral fertilizers increased the resistance of the three species to atmospheric pollution.

Karnosky, D.F. 1976. Threshold levels for foliar injury to Populus tremuloides by sulphur dioxide and ozone. Canadian Journal of Forest Research. 6(2): 166-169.

The effects of daily 3-hour fumigations of 0.2...0.65 ppm SO₂; 0.05...0.2 ppm O₃; 0.2 ppm SO₂ plus 0.05 ppm O₃; and 0.35 ppm SO₂ plus 0.05 ppm O₃ were studied on Populus tremuloides grown from root cuttings of 5 Wisconsin clones. Thresholds varied between clones; for SO₂ they were between 0.35 and 0.65 ppm; and for O₃ they were between 0.05 ppm and 0.2 ppm. Fumigations of SO₂ with O₃ produced more injury than the additive effects of single gases.

Keller, T.; Bucher, J. 1976. SO₂ susceptibility of broadleaved species. Schweizerische Zeitschrift fur Forstwesen. 127(7): 476-484.

Young trees of 5 species were exposed to various concentrations of SO₂ (0.05, 0.1 and 0.2 ppm.) for varying lengths of time. Enzyme analysis of leaves of aspen (Populus tremula), showed the level of the detoxicating enzyme, peroxidase, to increase with time of exposure at all SO₂ concentrations tested, although no visible symptoms developed in aspen.

Kenerley, C.M.; Rogers, J.D. 1976. On Hypoxylon serpens in culture. Mycologia. 68(3): 688-691.

Keremidchiev, M.; Naidenov, I.A. 1976. A hazardous pest on poplars. Gorsko Stopanstvo. 32(8): 25-27.

Khan, M.W.; Malik, K.A.; Khan, A.M. 1976. Perithecial stage of certain powdery mildews including some new records - III. Indian Phytopathology. 28(2): 199-201.

Uncinula adunca is recorded on Salix caprea and Populus balsamifera for the first time in India.

Kharizanov, A. 1976. Argyrotaenia pulchellana Haw. - a new pest of vine. Rastitelna Zashchita. 24(7): 32.

Larvae of Argyrotaenia pulchellana (Haw.) were found on grapevine in the Plovdiv region of Bulgaria in autumn 1970, and the incidence of the Tortricid has increased and become more widespread since then. This species is polyphagous, feeding on Calamintha clinopodium, Calluna vulgaris, Genista sp., Trifolium sp., maize, blackberry, pear, plum, oak, poplar, pine, and other plants.

Klincsek, P. 1976. Investigations on the effect of cement dust on some common trees and shrubs. Kertgazdasag. 8(3): 71-76.

Seven species growing at various distances from a cement works were sampled for injury by dust. Cornus mas and Crataegus monogyna were sensitive to dust pollution, whereas Tamarix pentandra, Cerasus avium, Pinus nigra, Populus robusta, and P. alba were not very sensitive.

Kohut, R.J.; Davis, D.D.; Merrill, W. 1976. Response of hybrid poplar to simultaneous exposure to ozone and PAN. Plant Disease Reporter. 60(9): 777-780.

Hybrid poplars (Populus maximowiczii X trichocarpa) were exposed for 4 h under controlled conditions to either 353 $\mu\text{g}/\text{m}^3$ ozone, 890 $\mu\text{g}/\text{m}^3$ PAN or the 2 pollutants combined at these concentrations. No visible symptoms were produced by PAN alone. The ozone and ozone/PAN exposures produced a dark brown bifacial necrosis. This is the first demonstration that ozone and PAN can interact synergistically when producing injury to vegetation.

Laine, L. 1976. The occurrence of Heterobasidion annosum (Fr.) Bref. in woody plants in Finland. Metsantutkimuslaitoksen Julkaisuja. 90(3): 53 p.

Results from field studies show that the fungus is a serious pathogen of pine (Pinus sylvestris) as well as spruce (Picea abies) and also occurs on Betula pendula, B. pubescens, Alnus incana, and Juniperus communis in infected pine stands. It was also observed on Populus tremula, Sorbus aucuparia and some ericaceous shrubs; and in some plantations of 14 exotic species.

Lavallee, A. 1976. Ink-spot disease of Poplar. Biology and variations in the severity of attacks in Quebec. Rapport d'Information, Centre de Recherches Forestieres des Laurentides. LAU-X-16. 19 p.

Reviews existing knowledge on ink-spot leaf disease of Poplar, caused by Ciborinia whetzellii, in Quebec.

Legge, A.H.; Amundson, R.G.; Jaques, D.R.; Walker, R.B. 1976. Field studies of pine, spruce and aspen periodically subjected to sulfur gas emissions. Gen. Tech. Rep. NE-23. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station: 1033-1061.

Lindquist, O.H.; Miller, W.J. 1976. Keys to insect larvae feeding on aspen foliage in Ontario. Rep. O-X-247. Sault Ste. Marie, Ontario, Canada: Canadian Forest Service, Great Lakes Forest Research Centre. 32 p.

Presents a series of keys and drawings for the identification of 118 species or species groups of insect larvae that feed on the foliage of Populus tremuloides in Ontario. The seasonal occurrence of each larval stage is indicated.

Loginova, M.M. 1976. Psyllids of the genus Egeirotrioza (Homoptera, Triozidae). Zoologicheskii Zhurnal. 55(9): 1318-1328.

Psyllids of the genus Egeirotrioza, of which so far only four species have been known, are associated with poplars (turanaga) in desert or semidesert areas of the USSR.

Longo, N.; Moriondo, F.; Naldini Longo, B. 1976. Germination of teleutospores of Melampsora pinitorqua Rostr. European Journal of Forest Pathology. 6(1): 12-18.

Luisoni, E.; Boccardo, G.; Milne, R.G. 1976. Purification and some properties of an Italian isolate of poplar mosaic virus. Phytopathologische Zeitschrift. 85(1): 65-73.

L'vovskii, A.L. 1976. The willow cossid. Zashchita Rastenii. 12: 56.

Cossus cossus (L.) infests many broad-leaved trees in the USSR and in the Leningrad region causes much damage to willow, Apple, plum, and occasionally poplar and birch are also infested.

Maksimovic, M.; Politeo, I. 1976. Biology of Lymantria dispar on the island of Hvar. 2. Zastita Bilja. 27(135): 47-59.

The duration and season of larval development during 1970-1973 were compared in two parks on this Adriatic Island: (a) Stari Grad, with the less preferred host plants Pinus halepensis and Tamarix gallica; and (b) Jelsa, with the preferred host Populus nigra var. pyramidalis.

Mamontova, V.A.; Doroshina, L.P. 1976. The specific identity of the beet root aphid (Homoptera, Aphidoidea). Vestnik Zoologii. 4: 85-87.

It was shown by the results that the species from poplar (referred to as P. lichtensteini) migrates only to the annual E. falcata, and that aphids from the latter cannot colonize beet. The species that infests beet is P. fuscicornis, and there is no connection between it and P. lichtensteini, so that control cannot be based on counts on poplar, as has been suggested.

Manion, P.D.; Blume, M. 1976. Epidemiology of Hypoxylon canker of aspen. Proceedings of the American Phytopathological Society. 2: 101. Abstract.

The spread of natural canker infections of Hypoxylon mammatum was determined from partial surveys in 1969, 1973 and one total survey in 1975 of

5 aspen plantations (82 families of seedlings from specific crosses between parents of Adirondack and central New York provenance).

Mastro, V.C.; Payne, T.L. 1976. Laboratory rearing of the cottonwood twig borer on artificial diets. *Southwestern Entomologist*. 1(1): 13-20.

The suitability of 4 artificial diets (developed for other lepidopterous insects) for rearing Gypsonoma haimbachiana (Kearfott), a pest of cottonwood (Populus deltoides), was determined in laboratory tests in Texas.

McCracken, F.I. 1976. Etiology, epidemiology and control of decay of cottonwood. In: Thielges, B.A.; Land, S.B., Jr., eds. *Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 222-225.*

McKenzie, E.H.C.; Hudson, H.J. 1976. Mycoflora of rust-infected and non-infected plant material during decay. *Transactions of the British Mycological Society*. 66(2): 223-238.

Reports studies of fungal succession during the decay of uninfected or rust-infected leaves or stems of three plant species, including Populus X generosa leaves infected by Melampsora larici-populina. The succession of saprophytic fungi on infected leaves was different from that on uninfected leaves.

Mlodzianowski, F.; Siwecki, R. 1976. Ultrastructure of poplar leaves naturally infected by rust Melampsora larici-populina Kleb. *Arboretum Kornickie*. 21: 375-400.

In leaves of 6 poplar clones with well developed uredia the changes were greatest in the ultra-structure of the plastids and similar to those observed during degeneration as a result of senescence or injury.

Morris, R.C.; Oliveria, F.L. 1976. Insects of periodic importance in cottonwood. In: Thielges, B.A.; Land, S.B., Jr., eds. *Proceedings, Symposium on eastern cottonwood and related species; 1976 September 28-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 280-285.*

Notes are provided on the biology and injuriousness of 15 insects that are of periodic economic importance on young eastern cottonwood trees (Populus deltoides) in the USA.

Munoz Lopez, M.C.; Ruperez, A. 1976. Presence of Marssonina brunnea (Melaconiales) in Spain. *Boletin, Servicio de Defensa contra Plagas e Inspeccion Fitopatologica*. 2(2): 247-255.

Leaf samples of poplars from plantations in Huesca, Logrono, and Santander provinces that showed defoliation typical of attack by M. brunnea were examined and found to be affected by the fungus.

Myers, W.; Wilson, L.; Bassman, J. 1976. Impact of insects on trees planted for maximum fiber production. Gen. Tech. Rep. NC-21. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 92-95.

Navratil, S.; Basham, J.T. 1976. Wood defects and microflora in young second growth aspen stands of root sucker origin. Proceedings of the American Phytopathological Society. 2: 46. Abstract.

Wood defects and the frequency of isolated microflora were studied in (a) stems of 23-yr-old, and (b) root systems of 6- to 14-yr-old aspen (Populus tremuloides) stands in Ontario. Results suggest that the incidence of stem defect and root and butt rots in young aspen coppice may be less than is generally believed.

Neel, W.W.; Morris, R.C.; Head, R.B. 1976. Biology and natural control of the cottonwood leaf beetle, Chrysomela scripta. In: Thielges, B.A.; Land, S.B., Jr. eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 28-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 264-271.

In investigations on eastern cottonwood (Populus deltoides) in Mississippi, females of Chrysomela scripta F. were found to be capable of laying more than 800 eggs in a period of about one month. The highest mortality to all stages by predators occurred when the population of C. maculata was greatest. Peaks in populations of Chrysomela scripta occurred in April-May and mid-August on second-year trees, and in early July and mid-August on first-year trees. Peaks in predator populations occurred in May-June on second-year and mid-July on first-year trees.

Nef, L. 1976. Ecological studies on Telenomus nitidulus, parasite of the eggs of Stilpnotia (Leucoma) salicis. Zeitschrift fur Pflanzenkrankheiten und Pflanzenschutz. 83(1/2/3): 109-119.

During two outbreaks of the poplar pest Leucoma salicis (L.) (Stilpnotia salicis) in Belgium during 1957-1958 and 1968-1971 the temporal and spatial variations in the size of populations of the egg parasite Telenomus nitidulus Thoms. were studied.

Nef, L. 1976. Entomology. Congress Group 6. In: Proceedings, 16th IUFRO World Congress: Division 2: Forest plants and forest protection; 1976 June 20- July 2; Oslo, Norway. As, Norway: International Union of Forestry Research Organizations: 362-466.

Food quality of poplar leaves and population dynamics of Stilpnotia salicis.

Ostry, M.E.; Nicholls, T.H. 1976. How to identify and control sapsucker injury on trees. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 5 p.

A leaflet giving a brief description of the appearance, habits, and damage of the yellow-bellied sapsucker.

Page, M.; Lyon, R.L. 1976. Contact toxicity of insecticides applied to cottonwood leaf beetle. Journal Economic Entomology. 69(2): 147-148.

Pettersen, H. 1976. Schizontus sieboldi Ratzenburg 1852 (Hym., Pteromalidae) reared from Melasoma populi (L.) (Col. Chrysomelidae). Norwegian Journal of Entomology. 23(2): 206-207.

Schizonotus sieboldi (Ratz.), a species of Holarctic distribution, is recorded for the first time from Scandinavia, from adults of both sexes reared in 1972-1973 from parasitised larvae of Chrysomela populi L. (Melasoma populi) on Populus tremula in Norway, where the chrysomelid has one generation a year and overwinters in the adult stage.

Pieper, G.R.; Richmond, C.E. 1976. Residues of trichlorfon and lauroyl trichlorfon in Douglas fir, willow, grass, aspen foliage, and in creek water after aerial application. Bulletin of Environmental Contamination and Toxicology. 15(2): 250-256.

In investigations in Colorado in 1971 on the possible contamination of the environment with insecticides, trichlorfon and lauroyl trichlorfon [2,2,2-trichloro-1-(dimethoxyphosphinyl)ethyl dodecanoate], which had been under consideration for the control of the spruce budworm [Choristoneura fumiferana (Clem.)], were applied at a rate of 1 lb/ac from a helicopter to 4 wooded plots of 160 acres, each containing a creek. The residues on the foliage of Douglas fir [Pseudotsuga menziesii], willow [Salix], aspen [Populus tremuloides] and grasses, and in the water in the creeks, are described from samples taken 0, 1, 7, and 14 days after treatment. There was a fairly rapid decline in the residues on foliage. Greater exposure seemed to be positively correlated with faster disappearance of the insecticides. No residues were found in creek water after one day.

Pinon, J. 1976. A serious threat to the Alpine Aspen: Hypoxyylon mammatum canker. Revue Forestiere Francaise. 28(1): 30-34.

H. mammatum, well known for a century as the cause of a serious canker disease of Populus tremuloides and P. grandidentata in Canada and the USA, was first recorded in France on P. tremula in ca. 1960, and now poses a serious threat to stands of the Alpine form of this species throughout the French Alps at 1100-1850 m alt.

Pinon, J.; Cros, E.T. du. 1976. Susceptibility to rusts in different Poplar species. Annales des Sciences Forestieres. 33(2): 49-59.

A study of resistance to Melampsora spp. was made on nursery stock of many clones of Populus nigra, P. deltoides, P. X euramericana, and P. trichocarpa.

Prokhnenko, T.A. 1976. Cytosporosis incidence in aspen forests of the reservation "Stolby". Mikol Fitopatol. 10(3): 210-214.

Rafes, P.M.; Sokolov, V.K. 1976. Interactions of permanent foliar pests with their host tree. Dokl Akad Nauk SSSR. 228(1): 246-247.

Reddy, M.A.R.; Puri, Y.N.; Singh, S.; Pandey, P.C. 1976. Disease situation in Indian forests II. Potentially dangerous foliage diseases. Indian Phytopathology. 28(1): 41-45.

Among 9 economically important or potentially dangerous foliage diseases recorded on exotic and indigenous forest trees are new records for Cercospora populina and Sphaceloma populi on Populus spp.

Retnakaran, A.; Smith, L.; Tomkins, B. 1976. Application of Dimilin effectively controls forest tent caterpillar populations and affords foliage protection. *Bi-monthly Research Notes*. 32(5): 26-27.

A field trial of Dimilin (difluron) for the control of Malacosoma distria on Populus tremuloides was undertaken after successful laboratory trials. No defoliation or surviving larvae were found in the treated plot, whereas the untreated plot contained large populations and was almost completely defoliated.

Rishbeth, J. 1976. Chemical treatment and inoculation of hardwood stumps for control of Armillaria mellea. *Annals of Applied Biology*. 82(1): 57-70.

Describes field experiments in E. Anglia (UK) in which stumps were inoculated, within an hour of felling, with suspensions of basidiospores or mycelial fragments of several wood-rotting fungi, and laboratory experiments on stem sections.

Ross, W.D. 1976. Fungi associated with root diseases of aspen in Wyoming. *Canadian Journal of Botany*. 54(8): 734-744.

Ross, W.D. 1976. Host responses of aspen roots to decay columns containing Ganoderma applanatum, a Coprinus sp. or Fomes igniarius. *Proceedings of the American Phytopathological Society*. 2: 46. Abstract.

Bark was found to be an important defence mechanism preventing entry by F. igniarius into aspen (Populus tremuloides) roots and giving some protection to the outer layer of rootwood in exposed cross-sections.

Ross, W.D. 1976. Relation of aspen root size to infection by Ganoderma applanatum. *Canadian Journal of Botany*. 54(8): 745-751.

Ruperez, A.; Munoz, M.C. 1976. Damage to poplars caused by Fusarium. *Boletin, Servicio de Defensa contra Plazas e Inspeccion Fitopatologica*. 2(1): 89-96.

A report of the occurrence of widespread stem damage and frequent mortality in young poplar stands in Segovia province, attributable to attack by Fusarium sp. (probably F. javanicum [F. solani]), illustrated with colour photographs of the damage caused and the spores of the fungus isolated.

Sargent, T.D. 1976. *Legion of night. The underwing moths*. Amherst, MA: University of Massachusetts Press. 222 p.

This comprehensive treatment of the Catocala of eastern North America includes notes on the distribution, status, seasonal occurrence, and food-plants of 71 species, together with descriptions and coloured illustrations of the adults to assist in their identification. The larval food-plants include forest trees (especially hickories (Carya), walnuts (Juglans), oaks (Quercus), poplars (Populus) and willows (Salix)), fruit trees (including pear, apple, and plum) and bush fruits (including Vaccinium).

Schipper, A.L., Jr. 1976. Hypoxylon pathotoxin necessary to the infection of aspen by Hypoxylon mammatum. *Proceedings of the American Phytopathological Society*. 2: 46-47.

Inocula of a virulent isolate (mycelial type) and an avirulent isolate (conidial type of H. mammatum) were prepared so that half of each inoculum type

contained exogenous mammatoxin and the other half did not. Wounds on aspen (Populus tremuloides) were inoculated in the greenhouse. Both isolates with exogenous toxin infected P. tremuloides; no infection occurred when isolates lacked the toxin. This indicates that natural infection of P. tremuloides occurs only when the mycelium and the toxin are both present.

Schipper, A.L., Jr. 1976. Poplar plantation density influences foliage disease. Gen. Tech. Rep. NC-21. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 81-84.

Schipper, A.L., Jr.; Anderson, R.L. 1976. How to identify Hypoxylon canker of aspen. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 5 p.

Photos are presented to aid identification of the canker in the initial stage, and at 2 and 3 years after infection.

Shirnina, L.V.; Kureeva, S.V. 1976. Variability of morphological and cultural characters of Hypoxylon pruina Cke. Mikol Fitopatol. 10(2): 143-146.

Sirota, Y.; Onogi, S.; Ueda, K. 1976. Biological studies on Leucoma candida (Staudinger) (Lepidoptera:Lymantriidae) in Japan. 2. The timing mechanism of female calling. Applied Entomology and Zoology. 11(1): 22-26.

The timing mechanism of sexual calling by females of Leucoma candida (Stgr.) a lymantriid feeding on poplar leaves in Japan, was investigated in the laboratory at a constant temperature and relative humidity. Experiments with several photoperiods indicated that the timing of the adoption of the calling posture by females was primarily determined by the transition from light to darkness.

Sirota, Y.; Ueda, K.; Kuwana, Y.; Komai, F. 1976. Biological studies on Leucoma candida (Staudinger) (Lepidoptera, Lymantriidae) in Japan. 1. Biology and life history. Kontyu. 44(1): 85-92.

Leucoma candida (Stgr.), a species that was previously known in Japan only from Hokkaido and northern parts of Honshu, was discovered in 1971 in Osaka Prefecture, where it causes important injury to poplar (Populus italica (nigra var. italica)) and willow (Salix babylonica).

Sivanesan, A. 1976. Venturia populina. CMI Descriptions of Pathogenic Fungi and Bacteria. 483: 2 p.

Describes V. populina (conidial state - Pollaccia elegans), a cause of leaf and shoot blight or dieback of Poplars in the sections Tacamahaca and Aigeiros in Europe and N. America.

Smith, D.R. 1976. Sawflies of the Holarctic genus Platycampus Schioedte. Proceedings of the Entomological Society of Washington. 78(2): 202-207.

The 3 species of Platycampus are keyed and characterized. P. luridiventris is the only Eurasian species; it feeds on Alnus incana, A. glutinosa, and A. rotundifolia. P. albostigmus and P. americanus are transcontinental in Canada and the northern United States and attack Corylus and Populus tremuloides, respectively.

Spaic, I. 1976. A contribution to the knowledge of the goat willow sawfly Pteronidea pavid Lep. (Hym., Tenthredinidae). Acta Entomologica Jugoslavica. 11(1/2): 81-92.

Larvae completed their development satisfactorily on Salix caprea or S. alba, but Populus serotina was totally unsuitable for rearing.

Spiers, A.G. 1976. Fungicides for control of Poplar leaf rust and effects of control on growth of Populus nigra cv. 'Sempervirens' and P. X euramericana cv. 'I-214'. New Zealand Journal of Experimental Agriculture. 4(2): 249-254.

Reports trials of 13 fungicides to control Melampsora larici-populina on Populus nigra 'Sempervirens' and P. 'I-214' during the first year of growth from cuttings in New Zealand.

Spiers, A.G. 1976. Phoma leaf-blotch of Populus species in New Zealand. Plant Disease Reporter. 60(11): 981-984.

P. exigua was the cause of a new leaf blotch disease on Populus alba seedlings in New Zealand. Infection caused premature defoliation among susceptible seedlings.

Stewart, J.W.; Payne, T.L. 1976. Overwintering habits and winter mortality of the cottonwood twig borer. Southwestern Entomologist. 1(1): 9-12.

Studies in Texas on the overwintering of Gypsonoma haimbachiana, a pest of Populus deltoides, showed that early instar larvae formed overwintering hibernacula on the bark. The overwintering larvae were the brood source for infestation of new terminals in the following spring.

Stolina, M. 1976. Resistance potential of forest stands, an indicator of the degree of risk from injurious insects. Lesnictvi. 22(2): 157-170.

The resistance potential of stands of forest trees is described as the sum total of the factors or qualities that prevent or arrest the activity both of insect pests and of adverse abiotic factors. Canopy type and development may become important in inhibiting insect multiplication in mixed stands containing but not consisting solely of tree species suitable to the insect, while monocultures with little individual variation between trees favour outbreaks. The proportion of diseased or mechanically injured trees in a stand is influential in favouring or infections as a result of mechanical injuries to the live bark inflicted by thoughtless campers. Photographs of campgrounds and damaged trees are included; a desirable Aspen-type campsite can be degraded to a treeless site within 10-20 years.

Szabo, A. 1976. Data on radioactive contamination of tree leaves. Erdo. 25(2): 69-72.

Data are tabulated for leaves of robinia, poplar, chestnut, walnut, and pear sampled near Gyor, Hungary, in July 1975.

Tetrevnikova-Babaian, D.N. 1976. Review of Septoria Fr. species parasitizing plants from the family Salicaceae Mirbel. II. Biologicheskii Zhurnal Armenii. 29(2): 53-61.

Tibatina, I.A. 1976. The Microlepidoptera of broad-leaved forests of western Siberia. In: Zolotareno, G.S., ed. The fauna of helminths and arthropods of Siberia. 18: 347-357.

A list is given showing the food-plants and distribution in relation to vegetational zones of 156 species of Lepidoptera.

Toth, J. 1976. Problems of forest entomology in the Hungarian lowlands. Anzeiger fur Schadlingskunde, Pflanzenschutz, Umweltschutz. 49(9): 137-139.

An annotated list is given of the most important species of insect pests found in the lowland forests of Hungary in 1975, comprising 15 species feeding on conifers and 7 species on poplar. These have become increasingly injurious as a result of the planting of large monocultures of pines or poplars.

Vuola, M.; Korpela, S. 1976. The biology of the Finnish species of Sesiidae and Cossidae (Lepidoptera). I. Aegeria apiformis and A. melanocephala. Notulae Entomologicae. 56(4): 121-126.

It is reported that in Finland, the larvae of Trochilium apiforme (Cl.) (Aegeria apiformis) usually infest the roots or base of the trunk in large or medium-sized poplars (Populus) but have also been recorded from willow (Salix), lime (Tilia) and Pyrus.

Weatherston, I. 1976. Alternatives in forest pest control. Is the use of the sex pheromone a viable method for the control of pest Lepidoptera? Pont-de-la-Maye, France: Institut National de Recherches Agronomiques, Centre de Recherches de Bordeaux: 51-57.

For C. conflictana (Wlk.) defoliating aspen (Populus tremuloides), cis-11-tetradecenal was found to be a good attractant, although it may be only a component of the actual sex pheromone, and appears promising for control by disruption and possibly by trapping since aspen grows in small, often pure, stands.

Weatherston, J.; Percy, J.E.; MacDonald, L.M. 1976. Field testing of cis-11-tetradecenal as attractant or synergist in Tortricinae. Experientia. 32(2): 178-179.

It is concluded from field tests in stands of trembling aspen (Populus tremuloides) at three places in Ontario in June-July 1975 that cis-11-tetradecenal is an effective attractant for adult males of Choristoneura conflictana (Wlk.), a pest of aspen.

Weiss, M.J.; Collins, R.J.; Filer, T.H., Jr.; Peacher, P.H. 1976. Disease impact in cottonwood plantations [Mostly fungal disease, includes nematodes]. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 245-256.

Widin, K.D.; Schipper, A.L., Jr. 1976. Epidemiology and impact of Melampsora medusae leaf rust on hybrid poplars. Gen. Tech. Rep. NC-21. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 63-74.

Wikstrom, C. 1976. The occurrence of Phellinus tremulae Bond and Borisov as a primary parasite in Populus tremula L. European Journal of Forest Pathology. 6(6): 321-328.

After inoculation, P. tremulae grew well in the sapwood and inner wood of living aspen trees without other organisms being present. Planting experiments with wood meal from different parts of a sound tree showed very few propagules of micro-organisms in the sound wood, nor were any found in advance of the decay of P. tremulae. These results support the theory that the fungus is a primary parasite of aspen.

Wikstrom, C.; Unestam, T. 1976. The decay pattern of Phellinus tremulae (Bond.) Bond. et Borisov in Populus tremula L. European Journal of Forest Pathology. 6(5): 291-301.

Investigations indicated that the fungus occurs alone in most of the tree and that associated micro-organisms are independent or secondary invaders. The infection process, decay pattern, and the formation of heartwood are discussed.

Wilkinson, A.G.; Spiers, A.G. 1976. Introduction of the Poplar rusts Melampsora larici-populina and M. medusae to New Zealand and their subsequent distribution. New Zealand Journal of Science. 19(2): 195-198.

Both rust species are thought to have been introduced to New Zealand from Australia in March 1973 by trans-Tasman air currents, rather than by infected plant material. Their subsequent rapid dispersal and the differences in their distribution are discussed.

Wong, H.R.; Melvin, J.C.E. 1976. Biological observations and larval descriptions of Enargia decolor (Lepidoptera: Noctuidae) on trembling aspen in northern Alberta. Canadian Entomologist. 108(11): 1213-1220.

An account is given of the life history of Enargia decolor (Wlk.) on trembling aspen (Populus tremuloides) in northern Alberta, based on studies in 1972 and 1973, together with brief descriptions of the egg and the first five larval instars and a more detailed description of the sixth-instar larva, which is also figured.

Zalasky, H. 1976. Frost damage in poplar [Populus] on the prairies. Forestry Chronicle. 52(2): 61-64.

Ziennicka, J. 1976. A note on the cytoplasmic polyhedrosis virus of the satin moth Stilpnotia salicis L. (Lepidoptera: Lymantriidae). Bulletin de l'Academie Polonaise des Sciences, Sciences Biologiques. 24(8): 461-462.

Light and electron microscope studies showed that populations of Leucoma salicis (L.) (Stilpnotia salicis) collected in Poland, where the lymantriid is an important defoliator of poplar and willow, were infected by nuclear and cytoplasmic polyhedrosis viruses.

Ziennicka, J. 1976. The satin moth--a dangerous pest of willows and poplars. Ochr. Rosl. 20(5): 17-18.

1977

1977. Biology of Phassus excrescens and its control [Insect pest of Populus in China]. Chung-Kuo Lin Yek K'o Hsueh. 4: 50-55.

1977. Bionomics and control of Aegeria apiformis Cl [pests of Populus in China. Kun Chung Hseuh Pao Acta Entomologica Sinica. 20(4): 409-416.

Larvae of A. [Sesia] apiformis caused damage up to 96 percent of Populus trees in Yu-lin District, Shensi Province, China. Details of life history are given. Application of emulsions of fenitrothion (Sumithion) gave effective control.

1977. The effects of the 1976 drought on poplars. Bulletin Trimestriel, Societe Forestiere de Franche-Comte et des Provinces de l'Est. 38(6): 111.

Foliage and growth of 'white' poplars and aspen were relatively normal. Growth of 'black' and balsam poplars was completely arrested. Premature leaf-fall was widespread in plantations. Damage was especially severe on sites where normally the soil was damp. To mitigate the effects of drought, poplar sets should be widely spaced, planted deep, and kept free from competing vegetation.

1977. Pathogen: Valsa sordida Nits. Hosts: poplar. Commonwealth Mycological Institute. Distribution Maps of Plant Diseases. 416(2): 2 p.

1977. Willow shoot sawfly (Janus abbreviatus) - Mississippi. Cooperative Plant Pest Report. 2(31): 596.

Janus abbreviatus (Say) was recorded in Mississippi for the first time in June 1977, infesting young willow and cottonwood in nurseries in Washington County.

Abrahamson, L.P.; Morris, R.C.; Overgaard, N.A. 1977. Control of certain insect pests in cottonwood nurseries with the systemic insecticide carbofuran. Journal of Economic Entomology. 70(1): 89-91.

Alleyne, E.H.; Morrison, F.O. 1977. Some Canadian poplar aphid galls. Canadian Entomologist. 109(3): 321-328.

Galls and pseudogalls caused on poplars (Populus spp.) by pemphigine aphids are described; their development is discussed and a key for their identification is provided.

Anderson, G.W.; Hinds, T.E.; Knutson, D.M. 1977. Decay and discoloration of aspen. FIDL-149. Washington, DC: U.S. Department of Agriculture, Forest Service. 4 p.

Descriptions are given of decay caused by Fomes [Phellinus] igniarius var. populinus and other common decay fungi. Harvesting before decay and discoloration losses become excessive is recommended.

Anderson, N.A.; Ostry, M.E.; Anderson, G.W. 1977. Infection of aspen by Hypoxyton mammatum through galls formed by Saperda inornata. Proceedings of the American Phytopathological Society. 4: 110-111.

Andre, H. 1977. Note on the genus Mediolata and description of a new bark-inhabiting species. Acarologia. 18(3): 462-474.

Mediolata mariaefrancae sp.n. is described. A key is given for the separation of the adults. The literature on the systematics, ecology, and distribution is reviewed.

Arru, G.M. 1977. Populus deltoides Bartr. and insect problems in Italy. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 28-October 2, Greenville, MS. Baton Rouge, LA: Louisiana State University: 291-294.

Clones of P. deltoides and of hybrids between P. deltoides and other Populus species showing resistance are named.

Attard, G. 1977. A new predator of the poplar-shoot tortrix? Revue de Zoologie Agricole et de Pathologie Vegetale. 75(4): 132-133.

Gypsonoma aceriana (Dup.), by mining the leaves and destroying the terminal shoot causes bushy growth of lateral shoots and makes the young tree unmarketable. Few natural enemies are known, but in June 1975 a larva of Adalia bipunctata (L.) was observed preying on a mature larva of G. aceriana that had left its mine.

Auclair, D. 1977. Effects of dust on photosynthesis. II. Effect of pollutant particles on photosynthesis in Scots pine and poplar. Annales des Sciences Forestieres. 34(1): 47-57.

Young plants of pine and poplar in a controlled environment were sprayed with coal dust particles simulating conditions in factory areas. Photosynthesis was measured. In weak light photosynthesis was significantly inhibited, but in strong light the effect on pine was not significant. In poplar at maximum illumination, photosynthesis was unexpectedly greater in dusty than in clean plants. It is suggested that the increased temperature promoted photosynthesis.

Baker, J.B. 1977. Tolerance of planted hardwoods to spring flooding. Southern Journal of Applied Forestry. 1(3): 23-25.

Cuttings of (a) eastern cottonwood (Populus deltoides) and seedlings of (b) green ash (Fraxinus pennsylvanica), (c) sweetgum (Liquidambar styraciflua), (d) water tupelo (Nyssa aquatica), and (e) American sycamore (Platanus occidentalis) were subjected to spring flooding for 4 weeks, after foliation, under controlled field conditions. Results showed that the tolerance of (b), (d), and (e) was high; and that of (c) was intermediate; (a) was intolerant. All trees lost their leaves and died back to the root collar during flooding, regenerating from root collar sprouts, except for (b) which continued growing from the original stem.

Barron, J.R.; Bisdie, H.E. 1977. The final instar of Philositus enchophorus and notes on the classification of the genus. Annals of the Entomological Society of America. 70(1): 48-50.

Characters of the cephalic structure of the final-instar larva of Philositus enchophorus Townes are described. Examples were reared from Tioga aplastella Hulst (Tetralopha aplastella) on Populus tremuloides.

Bentley, B.L. 1977. Extrafloral nectaries and protection by pugnacious bodyguards. Annual Review of Ecology and Systematics. 8: 407-427.

A review of the taxonomic distribution of extrafloral nectaries [EN] in plants, the composition of the nectar, and evidence for the adaptive function of EN in a symbiosis with ants as guards against herbivores. The presence of the ants does result in positive protection of EN-bearing plants. In many Populus species only the first leaves of the season bear EN, except on suckers.

Biggs, A.R.; Davis, D.D.; Coppolino, J.B. 1977. Influence of SO₂ on 10 forest tree species with reference to relative susceptibility, leaf sulfur content, and stomatal response. Proceedings of the American Phytopathological Society. 4: 183 p.

Ten species of 2-3 year old tree seedlings were exposed biweekly to 2358. .mu.g/m³ SO₂ for 2 hours. Exposures were conducted in controlled environment chambers. Percent foliar tissue injury was evaluated 3 days after each exposure. Betula nigra was the most susceptible species, followed by Pinus sylvestris, B. lenta, B. papyrifera, B. pubescens, Prunus serotina, Fraxinus americana, Populus trichocarpa X P. maximowizii, Pinus strobus, and P. nigra were all more tolerant than B. nigra or P. sylvestris.

Buech, R.R. 1977. Radiosensitivity and recovery of tree crowns in a gamma-irradiated northern forest community. In: Zavitkovski, J., ed. Enterprise forest: radioecological studies. Oak Ridge, TN: USAEC Technical Information Center; 2: 79-90.

Crown mortality was observed on 13 tree species in a gamma-irradiated forest community located near Rhinelander, Wisconsin. Observations at the end of the first (1973) and second (1974) postirradiation growing seasons are presented for each species. The most resistant species were A. saccharum, O. virginiana, and Populus tremuloides; and the most sensitive were T. americana and U. americana. The tree stratum of the northern forest community was found to be more radiosensitive than lichen, grassland, or herbaceous communities in other irradiation studies.

Chaudhry, M.I.; Shah, B.H. 1977. Laboratory trials of Dipel against poplar defoliator - Ichthyura anastomosis Steph. Pakistan Journal of Forestry. 27(1): 29-32.

Third-instar larvae of I. anastomosis were released on poplar [Populus spp.] shoots sprayed with 0.1-2.0 percent Dipel (Bacillus thuringiensis and chitinase). One hundred percent mortality was obtained at all Dipel concentrations, within 2 days at 2.0 percent and within 6 days at 0.1 percent. Dipel could be used in place of the chemical insecticides currently used against the pest.

Chodjai, M. 1977. Poplar pests of Iran and the Mideast. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related

species; 1976 September 28-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 295-300.

An annotated list is provided of animals that infest poplars, especially Populus italica (nigra var. italica) and P. deltoides, in the Middle East. These include about 60 species of insects (Coleoptera, Lepidoptera, Hemiptera, and Hymenoptera) and one mite. It is suggested that the virulence of most pests results directly from non-adaptation of poplars to the site, from drought, and from the lack of proper culture and maintenance.

Cook, J.R.; Solomon, J.D. 1977. Damage, biology, and natural control of insect borers in cottonwood. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings: Symposium on eastern cottonwood and related species; 1976 September 28-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 272-279.

The biology, injuriousness, and natural enemies of about 12 species of insects that bore in cottonwood (Populus deltoides) in the USA and Canada are reviewed.

Crespo, A.; Manrique, E.; Barreno, E.; Serina, E. 1977. Evaluation of atmospheric contamination in the Madrid Urban area using bioindicators. Anales del Instituto Botanico A.J. Cavanilles. 34(1): 71-94.

The epiphytic lichen flora, mainly on Robinia pseudoacacia and Populus spp., were recorded at 40 sites. The Le Blanc and De Sloover (1970) index of atmospheric purity was calculated for each station.

Czeczuga, B. 1977. Carotenoids in leaves and their galls [Diplolepis on Quercus robur, Harmandia on Populus tremula, Pontania on Salix alba]. Marcellia. 40(1/4): 177-180.

Dafaue, C.; Cadahia, D. 1977. Host plant selection by Crytorrhynchus lapathi. In: Eucarpia/IOBC working group. Breeding for resistance to insects and mites: Report of the 1st meeting; 1976 December 7-9; Wageningen, The Netherlands. Bull. SROP3. Wageningen, The Netherlands: International Organization for Biological Control of Noxious Animals and Plants: 103-107.

A technique for assessing resistance under laboratory conditions is outlined.

Damanabi, K.; Kazemi, M.H.; Akrami, F. 1977. Melasoma populi L. Entomologie et Phytopathologie Appliquees. 45: 32-40.

An account is given of the results of observations made at Tabriz, Iran, in 1975, after a severe outbreak on the biology of Chrysomela populi L. (Melasoma populi), a pest of Populus nigra, P. alba, and Salix spp. The adults overwintered in the soil and their reappearance on the surface coincided with the development of the new leaves of poplar in spring. After mating, the eggs were laid on both sides of the leaves and sometimes on the bark. Older larvae consumed entire leaves, leaving only the midrib. In East Azerbaidzhan C. populi had 1 generation a year, but up to 3 generations were recorded from other countries. For chemical control, endosulfan (Thiodan), applied in spring at the beginning of hatching, is recommended.

Davis, D.D.; Kohut, R.J. 1977. Macroscopic response of three plant species to ozone, PAN, or ozone + PAN. PB U S Natl. Tech. Inf. Serv. 264233: 647-654.

de Kam, M.. 1977. A bacterial disease of Salix dasyclada, caused by a Xanthomonas species and its relation to Aplanobacter populi. European Journal of Forest Pathology. 7(5): 257-262.

A previously unreported bark necrosis affecting S. dasyclada [S. dasyclados] growing at Biesbos, SW Netherlands, is described. A bacterium identified as a Xanthomonas spp. was isolated from the infected tissues. Laboratory tests showed a close similarity between the Xanthomonas spp. and the poplar canker bacterium Aplanobacter populi, and it is suggested that A. populi may be a non-motile Xanthomonas species.

Dell, B. 1977. The collection of poplar rust spores by honey-bees. Western Australian Naturalist. 13(8): 199-201.

Urediospores of Melampsora larici-populina were identified from corbiculae of bees (Apis mellifera) collected in stands of Populus nigra var. italica heavily infected with the rust and from larval food reserves in a beehive near Kalamunda, Western Australia.

Dolgova, L.G.; Kuchma, V.N. 1977. The use of woody and shrub plants as indicators of thiocyanate pollution. Biologicheskije Nauki. 1(157): 92-95.

Leaves of Populus nigra, Robinia pseudoacacia, Ulmus pumila, Syringa vulgaris, Spiraea spp. and Ligustrum vulgare were analysed (by colorimetry) for thiocyanate content at 3 localities: an industrial site of the coal-gas by-products industry; a site 750 m away from it; and a non-industrial area. Thiocyanate concentration increased with increasing proximity to the industrial area and is therefore suggested to be an accurate indicator of the degree of pollution. The foliage acted as an effective biological filter for atmospheric thiocyanate.

Doom, D. 1977. Affect of insects and mites on poplar and willow in 1976 and methods to control the poplar clearwing. Populier. 14(2): 45.

Dosakhmetov, A.; Yakh'yaev, N.; Etamberdyev, G. 1977. Protection stands around reservoirs. Lesnoe Khozyaistvo. 6: 67-69.

An investigation was made of the growth and condition of stands around reservoirs in Soviet Central Asia. Over 20 reservoirs have been made to provide irrigation water for cotton-growing. Details are given of weeding, tending, survival, and growth rates. The best species for anti-erosion planting in northern Kirghizia is Ulmus pumila var. arborea; oak and birch grow well if watered. In Uzbekistan, Platanus orientalis is the main species used.

Dragsted, J. 1977. Relation of salt for melting highway snow in the winter to plant injuries. Ugeskr Agron Hortonomer Forstkandidater Licentiater. 122(3): 27-30.

Eiberle, K. 1977. Selective root consumption by Arvicola terrestris on poplar seedlings. Journal of Forest Suisse. 128(10): 814-819.

Fedorov, N.I.; Sherstnev, N.V. 1977. Effect of volatile excretions of some higher plants on the germination of basidiospores of Fomes igniarius. Bot (Issled) Beloruss Otd Vses Bot O'va. 19: 178-181.

Fluckiger, W.; Fluckiger-Keller, H.; Oertli, J.J.; Guggenheim, R. 1977. Pollution of leaf and needle surfaces near a motorway and its effect on stomatal diffusive resistance. *European Journal of Forest Pathology*. 7(6): 358-364.

Potted clones of birch (Betula pendula), ash (Fraxinus excelsior), aspen (Populus tremula), and alder (Alnus glutinosa) were placed on the central reservation of a motorway near Basel in Spring 1976. The stomatal diffusive resistance [SDR] of the plants was measured on warm, dry days in June and July. In all 4 species, the SDR of plants on the motorway was much lower than that of controls. This effect seemed unlikely to be due to a higher leaf temperature. It is suggested that toxic gases such as SO₂ and NO₂ may have damaged the stomatal closure mechanism. SEM photographs illustrate the deposition of dust on the leaves.

Gojkovic, G. 1977. Some results of chemical protection of poplar nurseries against the fungus Dothichaza populea Sacc. and Br. during 1975. *Topola*. 21(115/116): 27-30.

Gremmen, J.; de Kam, M. 1977. Ceratocystis fimbriata, a fungus associated with poplar canker in Poland. *European Journal of Forest Pathology*. 7(1): 44-47.

C. fimbriata, the cause of target canker in aspen (Populus tremuloides) in North America, is reported associated with similar cankers on some poplar hybrids of the so-called black balsam group (Aigeiros X Tacamahaca) in Poland. A short description of disease symptoms and perithecial and conidial states of the fungus is given.

Gustafsson, I.; Ramert, B. 1977. The lettuce root aphid Pemphigus bursarius (L). Observations and the results of experiments in 1977 in Skane. *Vaxtskyddsnotiser*. 41(5/6): 155-156.

The lettuce root aphid, overwinters on poplar and migrates to lettuce, its summer food-plant, in June. At first apterous forms feed on the leaves of the lettuce plants, but they later migrate to the roots, on which they feed and inhibit plant development by doing so. In order to define more closely the period of migration to lettuce, a wind trap was set up in southern Sweden in 1976. There was considerable difference in the resistance of lettuce varieties to infestation, two (Avoncrisp and Avondefiance) being practically immune.

Haines, J.H.; McKnight, K.H. 1977. Notes on two American Hyaloscyphaceae on aspen. *Mycotaxon*. 5(2): 423-431.

Hart, J.H. 1977. Influence of resin on the growth of some wood decay fungi. *Proceedings of the American Phytopathological Society*. 4: 111. (Abstract 135)

Normal branch tissue of Pinus sylvestris and gall tissue caused by Cronartium quercuum were compared for their rate of decay by Fomes annosus [Heterobasidion annosum], Coriolus versicolor, and Poria placenta, and for extractive contents. Gall tissue was significantly more decay resistant than normal tissue; highest decay rates in gall tissue corresponded with lowest amounts of heptane extractives (resins). Untreated and resin-treated filter paper or wafers of aspen [Populus tremuloides] wood were penetrated at similar

rates by the fungal mycelia, indicating that resin barriers alone are not significant in inhibiting growth of decay fungi.

Head, R.B.; Neel, W.W.; Morris, R.C. 1977. Seasonal occurrence of the cottonwood leaf beetle Chrysomela scripta and its principal insect predators in Mississippi, and notes on parasites. Journal of the Georgia Entomological Society. 12(2): 157-163.

Populations of Chrysomela scripta F. and its predators reached peak numbers from late May to early June in second year eastern cottonwoods (Populus deltoides) in mid-July in first year trees. Predator populations levelled off or rose only slightly in August and September, whereas C. scripta populations rose sharply during this time. Coleomegilla maculata (Deg.) was the most abundant and is thought to be the most important predator. Two parasites were less abundant and were considered to be of secondary importance.

Heather, W.A.; Sharma, J.K. 1977. Some aspects of poplar rust research in Australia. Australian Forestry. 40(1): 28-43.

In an area of an arboretum near Canberra, 40 clones of Populus spp. appeared to differ in their resistance to Melampsora medusae and M. larici-populina. Both rusts occurred at low and high altitudes in eastern Australia in 1975, but in mid-summer M. medusae was more common on clones at low altitudes while M. larici-populina was more frequent on the same clones at higher altitudes. Fungal hyperparasites were common in the field in autumn. The probable mechanisms for winter carryover of the rusts and the role of breeding programs for resistant poplar clones are discussed.

Hinds, T.E.; Wengert, E.M. 1977. Growth and decay losses in Colorado aspen. Res. Pap. RM-193. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 10 p.

Previous data on the type and amount of decay in Populus tremuloides in Colorado were reanalysed on a linear volume basis. The logs were reconstructed and scaled. The incidence of cull and tree age were linearly related. The main fungi responsible for cull and their relative importance are discussed.

Il'in, A.M. 1977. Phytopathological condition of naturally propagated Populus forests on oak soils. Izv Vyssh Uchebn Zaved Lesnoi Zhurnal. 6: 31-34.

Il'in, A.M. 1977. The phytopathological condition of secondary aspen stands on oak-forest soils. Lesnoi Zhurnal. 6: 31-34.

A survey was made of secondary aspen stands on former oak sites in the Voronezh region (S. central Russia) to determine the incidence of attack by Phellinus tremulae from the presence of fruiting bodies on the stem. The results show that stem rot damage in aspen increases with increasing wetness of the site, and that aspen can be damaged by rot at any age.

James, T.D.W.; Smith, D.W. 1977. Short-term effects of surface fire on the biomass and nutrient standing crop of Populus tremuloides in southern Ontario. Canadian Journal of Forest Research. 7(4): 666-679.

The standing crop of biomass and nutrients (N, P, K, Ca, and Mg) were estimated for Populus tremuloides trunk, lateral branch twig, and foliage in a

30-year-old open stand. Separate estimates were made for trees in areas subjected to light surface burning and in unburned areas. The relative importance of various tree components as nutrient accumulation sites followed the order leaves>twigs>lateral branches>trunk. Accumulation of nutrients in the trunk, lateral branches, and twigs was not appreciably altered by fire. Amounts of nutrients contained in leaf biomass were significantly changed after burning. Concentrations in leaves from burned areas were 24-42 percent higher than control levels. These substantial increases in leaf nutrient levels would have an important effect on those wildlife species utilizing the aspen as a food source.

Jodal, I. 1977. Two new harmful insects on broadleaved species. *Topola*. 21(115/116): 22-26.

Karnosky, D.F. 1977. Evidence for genetic control of response to sulfur dioxide and ozone in Populus tremuloides. *Canadian Journal of Forest Research*. 7(3): 437-440.

Among rooted cuttings from 11 randomly selected trees in central Wisconsin, significant interclonal variation was found in the response to 3 h exposures to sulphur dioxide, ozone, sulphur dioxide + ozone. Much of the variation between clones can be attributed to genetic differences in response to the gases.

Kayser, H. 1977. Conversion of [¹⁴C] beta -carotene to its 2-hydroxy and 3-hydroxy metabolites by two moth species. *Comparative Biochemistry and Physiology, B*. 58(2): 177-181.

In studies with Cerura vinula (L.) and Phalera bucephala (L.), beta -carotene labelled with ¹⁴C was fed to the larvae while these were feeding on leaves of their food-plants (Populus and Alnus, respectively). This compound is the presumed precursor of hydroxylated carotenoids found in insects of many orders. There was no difference between the 2 sexes of P. bucephala in the relative amounts of cryptoxanthin present. The capability of Lepidoptera to transform dietary carotenoids is discussed.

Kechel, H.G. 1977. Resistance of poplars to Aplanobacter populi. *Holzzucht*. 31(1-2): 10-16.

Some 124 balsam poplar clones and one black poplar clone were inoculated with A. populi in June 1975. The area of the resulting wounds and necrotic areas after 11 months are given in graph form. Bark and incision inoculations give similar results, but the bark inoculation 150 cm up the stem produced a more vigorous reaction than the one 30 cm up the stem.

Klingcsek, P. 1977. Observations on the shelter-belt planted around the Danube Cement Works. *Acta Agronomica*. 26(1/2): 191-197.

During 12 years of constant exposure to dust pollution in a shelter belt around the cement works, the species most suitable for the establishment of a green belt were shown to be Populus 'Robusta', Cerasus [Prunus] avium, Elaeagnus angustifolia, and Pinus sylvestris.

Kolomoets', T.P.; Zhyvylo, V.I. 1977. Major pests and diseases of Populus bolleana in beautification plantings in the Donets Basin. Introd Aklim Rosl Ukr Akad Nauk URSR. 11: 91-93.

Kovalevskaia, N.I. 1977. Food requirements and mass reproduction of some leaf-eating Lepidoptera attacking birch connected with the chemical composition of birch and aspen leaves. Zhurnal Obshch Biol. 38(3): 464-471.

Krzan, Z. 1977. The fungi microflora from the bark and bast lesions of two poplar clones. Arboretum Kornickie. 22: 161-171.

Legge, A.H.; Jaques, D.R.; Amundson, R.G.; Walker, R.B. 1977. Field studies of pine, spruce and aspen periodically subjected to sulfur gas emissions. Water, Air, and Soil Pollution. 8(1): 105-129.

Field studies of photosynthesis in Pinus contorta/Pinus banksiana (lodgepole pine/jack pine) hybrids, Picea glauca (white spruce) and Populus tremuloides (aspen) subjected to SO₂ and H₂S from a nearby natural gas processing plant were initiated near Whitecourt, Alberta, Canada during the summer of 1974. The photosynthetic rates measured were low for the conifers studied. The low maximum photosynthetic rate for aspen is thought to be attributable to the onset of autumn. Visible chronic SO₂ symptoms had a pronounced sunward or upward, orientation. A SO₂ concentration gradient occurred in the lodgepole pine/jack pine stand, with the SO₂ values above the canopy generally higher than below the canopy.

Lindsey, J.P.; Gilbertson, R.L. 1977. New species of corticioid fungi on quaking aspen. Mycotaxon. 5(1): 311-319.

Four new species of lignicolous basidiomycetes in the Corticiaceae are described. All are associated with a white rot of Populus tremuloides.

Lindsey, J.P.; Gilbertson, R.L. 1977. A new Steccherinum on quaking aspen. Mycologia. 69(1): 193-197.

Morelet, M. 1977. Comparative bio-morphological study of the causal agent of aspen scab and Venturia viennotii sp. nov. on Populus tremula. Paris, France: Societe Francaise de Phytopathologie: 255-261.

V. viennotii was recorded on overwintered aspen leaves in eastern France. Morphological and cultural characters were studied and compared. Ascospores of V. viennotii occur in nature from June to October, those of V. tremulae from March to June.

Morris, R.C. 1977. Biology and natural control of the cottonwood twig borer, Gypsonoma haimbachiana. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 28-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 257-263.

The biology, injuriousness and natural enemies of Gypsonoma haimbachiana (Kearfott) on cottonwood (Populus deltoides) are reviewed from the literature. Notes are also provided from the literature on natural enemies of G. aceriana (Dup.) and G. hapalosarca (Meyr.).

Movsesyan, L.I. 1977. Diseases of poplar. *Zashchita Rastenii*. 7: 30-31. Brief notes are given on diseases, their incidence and control.

Naidenov, Ya. 1977. Brown spot on the leaves of hybrid poplars in Bulgaria. *Gorsko Stopanstvo*. 33(12): 38-42.

The biology of Marssonina brunnea is discussed, and also its incidence on poplars in relation to climatic conditions in 1975 and 1976. The mean degree of attack by M. brunnea on 15 different clones is tabulated, and a map is given showing the present distribution of M. brunnea in Bulgaria. Some measures to control M. brunnea are outlined.

Nakano, K. 1977. A model for the problem of the effects of defoliation on plant growth. *Japanese Journal of Ecology*. 27(3): 227-247.

A mathematical model is presented for estimating the effects of defoliation on the accumulation of food reserves in deciduous trees or perennial herbs. For mulberry (Morus alba) and poplar (Populus cv. Japonogigas), the analysis clarified the significance of responses to defoliation such as suppression and resprouting. Average leaf longevity is shown to be an important indicator of the intensity of defoliation pressure.

Ocskay, S.; Clonaru, A.; Milea, I.; Raduca, C.; Radoi, D.; Raduca, M.; Mihailescu, A. 1977. Breeding poplar [Populus] and willow [Salix] species that are highly productive and resistant to biotic and abiotic factors. *Stud Cercet Silvic Inst Cercet Amenajari Silvice*. 34: 33-39.

Oliveria, F.L.; Abrahamson, L.P. 1977. Chemical control of cottonwood insects. In: Thielges, B.A.; Land, S.B., Jr., eds. *Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 308-316.*

The chemical and integrated control of insect pests of cottonwood (Populus deltoides) in the USA and Europe are reviewed, and the need to restrict chemical treatments to situations where pest populations are high enough to cause economic injury is emphasized.

Oliveria, F.L.; Cooper, D.T. 1977. Tolerance of cottonwood to damage by cottonwood leaf beetle. Pub. No. 36. In: *Proceedings, 14th Southern forest tree improvement conference; 1977 June 14-16; Gainesville, FL. Macon, GA: The Southern Forest Tree Improvement Committee: 213-217.*

Pagony, H. 1977. The importance for forestry of the controlled decaying of stumps. Translation, Environment Canada. (No. OOENV TR-1313): 5 p.

Palmberg, C. 1977. Selecting for rust resistance in poplars in Australia. In: *Plant Breeding Papers: International Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania. 3d(1): 4(a)-16--4(a)-20.*

Parkinson, D.; Visser, S.; Whittaker, J.B. 1977. Effects of Collembolan grazing on fungal colonization of leaf litter. *Ecological Bulletins*. 25: 75-79.

The effects of selective grazing by *Onychiurus subtenuis* Folsom on the colonization of L layer leaf litter from a Populus tremuloides Michx. forest in Alberta were studied in the laboratory. The effects of grazing in the presence of both fungi differed greatly from those in the presence of only one species.

Paul, R. 1977. Some possible effects of natural gas leaks on street trees in towns. *Annales de Gembloux*. 83(3): 159-174.

The effects of natural gas on soils and urban plants are discussed, with reference to resistant (Populus, Salix, Platanus) and susceptible genera (Carpinus, Sorbus, Prunus, Acer, Betula), treatment of affected trees and replanting.

Pereira, J.S.; Kozlowski, T.T. 1977. Variations among woody angiosperms in response to flooding. *Physiologia Plantarum*. 41(3): 184-192.

Effects of flooding on young plants of (a) Populus deltoides, (b) Salix nigra, (c) Eucalyptus camaldulensis, (d) E. globulus, and (e) Ulmus americana were studied in a controlled environment. Flooding induced stomatal closure, inhibition of root growth, alterations in morphology, formation of adventitious roots, and leaf senescence. The role of hormones in inducing flooding symptoms is discussed.

Perrenoud, S. 1977. Potassium and plant health. IPI Res. Topics 3. Bern-Worblaufen, Switzerland: International Potash Institute. 218 p.

A review of the effects of K on fungal diseases, insects, mites, nematodes, viruses, and bacteria.

Petty, J.L. 1977. Bionomics of two aspen bark beetles, Trypophloeus populi and Procryphalus mucronatus. *Great Basin Naturalist*. 37(1): 105-127.

Biology, adult behavior, and injuriousness of Trypophloeus [Cryphalus] populi and Procryphalus mucronatus infesting Populus tremuloides in USA are described. C. populi attacked green bark of unhealthy trees and Procryphalus mucronatus favored dead bark.

Petrushkevich, V.S. 1977. The aspen chrysomelid. *Zashchita Rastenii*. 7: 32-33.

Chrysomela tremula is an important pest of aspen [Populus tremula], poplar [Populus spp.] and willow [Salix spp.] in the Kursk region of the USSR both larvae and adults feed on young shoots. Its life history is described. Sprays of 0.3 percent fenitrothion (Metathion) or trichlorphon (chlorophos) were applied to sample trees and gave 96-100 percent larval mortality and 86-90 percent adult mortality.

Ploaie, P.G.; Petre, Z.; Mocanu, V.; Ionica, M. 1977. Poplar mosaic virus in Romania: identification and biological, morphological and serological properties. *Revue Roumaine de Biologie, Biologie Vegetale*. 22(1): 3-9.

Pizzolato, T.D. 1977. A tannic acid-ferric chloride-toluidine blue stain for wood amyloplasts embedded in epoxy resin. *Forest Science*. 24(1): 49-51.

A technique for staining wood amyloplasts was successfully tested in Tilia americana, Ulmus americana, Populus tremuloides, and Nyssa sylvatica.

Popravko, S.A. 1977. The chemico-taxonomic study of propolis. Pchelovodstvo. 2: 27-29.

The two types of propolis found in the Soviet Far East contain some of the same components as propolis from birch, black poplar, and aspen. In European parts of the country, bees collect from the buds of aspen (P. tremula) and mix it with materials from other sources. Conifer resin was found in only small quantities or not at all. It is suggested that it may contain substances which are harmful to honeybee larvae.

Przybyl, K. 1977. Bacteria from the genera Pseudomonas and Erwinia isolated from necrotic spots on the bark and phloem of two poplar clones - Populus 'Robusta' and Populus 'Serotina'. Arboretum Kornickie. 22: 173-183.

Isolates were taken at various levels of the infected stem between diseased and healthy tissues. Strs. of P. syringae and P. fluorescens differed in their ability to utilize sugars and alcohols. It is suggested that bacteria such as P. syringae, are less responsible than some fungi.

Ramert, B. 1977. The lettuce root aphid. Biology. Observations in Skane. Vaxtskyddsnotiser. 41(3): 83-87.

Pemphigus bursarius (L.) infests the roots of lettuce in Sweden and sometimes causes severe damage. The aphids secrete wax, which gives the root system and the surrounding soil a characteristic blueish-white discoloration. The winter food-plants of the aphids are poplar trees. When the migrant females leave the trees, they already contain mature embryos and can therefore reproduce immediately when they reach lettuce. The first nymphs to be deposited feed on the leaves and then migrate to the roots. Winged forms develop later and fly back to poplar. The oviparae lay their winter eggs in sheltered sites on the trees. Tests on varietal resistance showed that a variety found resistant in England was also resistant in Sweden.

Ride, M.; Ride, S.; Digat, B.; Poutier, J.C. 1977. Development of an inoculum of Aplanobacter populi Ride, artificially applied to a resistant and to a susceptible poplar clone: influence of biotic and abiotic factors. Annales de Phytopathologie. 9(1): 85.

In artificial inoculation experiments using a resistant clone of Populus nigra var. italica and the susceptible P. deltoides X P. trichocarpa 'S6-2', A. populi maintained its original population on the susceptible clone but could not be found 30-60 days after inoculation on the resistant clone. The leaves produced a waxy secretion containing flavonoid aglycones which inhibited A. populi.

Roberts, S.; Mitchell, D.T. 1977. Variations in pustule density, dry mass and total nitrogen in leaves of Populus canescens infected by Melampsora aecidioides. Phytophylactica. 9(4): 103-107.

In the south-western Cape, pustules appeared on leaves at the beginning of January during 1974-1975 and 1975-1976. Increase in pustule density was accompanied by higher dry masses and lower total N levels at the site of infection compared with healthy tissues.

Schipper, A.L., Jr. 1977. Foliage diseases of periodic importance to Populus deltoides and its hybrids. In: Thielges, B.A.; Land, S.B., Jr., eds.

Proceedings, Symposium on eastern cottonwood and related species; 1976 September 28-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 234-244.

Mention is made of clones with resistance to Marssonina; breeding for resistance to Melampsora regional evaluation of resistance; and resistance to Septoria.

Schvester, D. 1977. Insects damaging poplars in France. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 28-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 286-290.

Notes are provided on the biology, injuriousness, and control of about 12 species of insects that infest poplars in France.

Selim, A.A. 1977. Some notes on the activity of certain insects predators and parasites of the Hammam Al-Alil area. Mesopotamia Journal of Agriculture. 12(1): 65-73.

An annotated list is presented of species of predators and parasites observed at an experimental farm near Mosul, Iraq of potential interest for the biological control of insect pests in that country. The predators included Synharmonia conglobata (L.) (Coccinella conglobata), C. septempunctata L., and C. undecimpunctata L., Exochomus flavipes (Thnb.), Syrphus spp., Scymnus spp., Stethorus punctillum Weise, and Paederus spp.

Shain, L. 1977. Etiology, epidemiology and control of Melampsora rust of cottonwood. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 28-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 189-198.

Neither hypersensitivity nor preformed inhibitors appears to be involved in a major way in the resistance of clones of Populus deltoides to Melampsora larici-populina and M. medusae. Low amounts of K, and high amounts of sugar are related to susceptibility. It appears that selection and breeding offer the most promising means of control.

Sharma, J.K.; Heather, W.A. 1977. Infection of Populus alba var. hickeliana by Melampsora medusae Thum. European Journal of Forest Pathology. 7(2): 119-124.

Leaf discs from 4 clonal varieties of white poplar were inoculated with uredospores of M. medusae, collected from P. deltoides in 1975 and 1976. The morphology of uredospores of M. medusae was compared (by SEM) with those of other Melampsora spp. that infect P. alba. The implications of the results for breeding programs are discussed.

Shigo, A.L.; Shortle, W.; Garrett, P. 1977. Compartmentalization of discolored and decayed wood associated with injection-type wounds in hybrid poplar. Journal of Arboriculture. 3(6): 114-118.

Shortle, W.C. 1977. Compartmentalization of decay in red maple and hybrid poplar trees. Proceedings of the American Phytopathology Society. 4: 86.

Singh, P. 1977. Dothichiza canker of Lombardy poplar in Newfoundland. Bi-monthly Research Notes. 33(2): 12-13.

A preliminary survey made in 1975 and 1976 showed that this canker and dieback, caused by Cryptodiaporthe populea, is distributed all over Newfoundland on Populus nigra var. italica. The outbreak is causing serious damage and losses among Lombardy poplars planted as windbreaks or as ornamental trees.

Siwecki, R. 1977. Poplar diseases in Poland and northern Europe. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 28-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 214-221.

The poplar clones P.NE42, P.NE44, P.NE46, P.NE47, and P.NE52 are reported to be resistant to poplar mosaic virus in Poland; however P.NE44, P.NE46, P.NE47, and P.NE49 are susceptible to bacterial canker.

Solomon, J.D.; Cook, J.R.; Oliveria, F.L.; Filer, T.H. 1977. Insect and canker disease impact in cottonwood nurseries. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 28-October 2, Greenville, MS. Baton Rouge, LA: Louisiana State University: 301-307.

Insects, especially Chrysomela scripta F., reduced height growth of eastern cottonwood (Populus deltoides) in a forest nursery in Mississippi. In a survey of nine nursery plantings in Mississippi and Louisiana in 1975, cull due to borers and disease cankers reduced the number of potential cuttings.

Sturhan, D. 1977. First record of the Persian sessile nematode, Cacopaurus pestis Thorne, in Iran. Nematologia Mediterranea. 5(1): 125-126.

A single sample taken from the root zone of a Populus nigra at Tabriz, Iran, was found by the centrifugal flotation method to contain a few Cacopaurus pestis females.

Szontagh, P. 1977. Forest protection aspects of supplementing young Populus stands. Erdo. 26(8): 366-368.

Szontagh, P. 1977. Resistance of various poplar clones against insect pests. Erdeszeti Kut. 72(2): 49-54.

Taris, B.; Chauvin, B. 1977. The fungus Dothichiza populea, the most grave enemy of young poplar plants. Phytoma. 29(293): 13-15.

Taris, B.; Artaud, J.; Forestier, F. 1977. Remarks on the morphology and viability of urediospores of Populus rusts. Paris, France: Societe Francaise de Phytopathologie: 367-374.

The morphology of urediospores of the principal Melampsora spp. on poplar was studied in the scanning electron microscope. Viability was at least 7 months.

Tiedemann, G.; Bauch, J.; Bock, E. 1977. Occurrence and significance of bacteria in living trees of Populus nigra L. European Journal of Forest Pathology. 7(6): 364-374.

Erwinia, Xanthomonas, Agrobacterium, and Acinetobacter were isolated from sapwood and heartwood of living poplar trees. Most were able to attack milled

wood and pectin, hemicelluloses, and holocellulose. The capillary liquid in the xylem served as a nutrient. The significance of these bacteria for wetwood formation is discussed.

Toscano, N.C.; Kido, K.; Snyder, M.J.; Koehler, C.S.; Kennedy, G.C.; Sevacherian, V. 1977. Insecticides evaluated for lettuce root aphid control. California Agriculture. 31(4): 4-5.

Pemphigus bursarius (L.) occasionally causes serious damage to the roots of summer crops of lettuce in California. Since the lettuce-infesting aphids are the descendants of fundatrices that cause galls on the petioles of Lombardy poplar (Populus italica var. nigra), insecticides were applied on poplars at Lampoc in 1974. All treatments were significantly superior to no treatment.

Tyrrell, D. 1977. Transmission of Entomophthora egressa MacLeod and Tyrrell to Malacosoma disstria (Hbn.), a non-host species. Bi-monthly Research Notes. 33(1): 5.

It was found in greenhouse tests that fourth-instar larvae of Malacosoma disstria Hb. could readily be infected with Entomophthora egressa, a fungal pathogen of Lambdina fiscellaria fiscellaria (Gn.). In a small-scale field test protoplasts of E. egressa were released on aspen. Wild larvae of M. disstria became infected, but the pathogen failed to maintain itself in the wild population for more than about 2 weeks.

U.S. Department of Agriculture. 1977. Willow shoot sawfly (Janis abbreviatus) - Mississippi. Cooperative Plant Pest Report. 2(31): 596.

Janis abbreviatus (Say) was recorded in Mississippi for the first time in June 1977, infesting young willow and cottonwood in nurseries in Washington County.

Vuola, M.; Korpela, S. 1977. The biology of the Finnish species of Sesiidae and Cossidae. Notulae Entomologicae. 57(1): 3-8.

This further article in a series deals with the biology of 2 species that infest Salix and Populus.

Widen, K.D.; Schipper, A.L., Jr. 1977. Viability and germination of Melampsora medusae uredospores stored at 0, 4 and 25 deg C. Proceedings of the American Phytopathological Society. 3: 265. (Abstract 286)

Storage of uredospores of M. medusae at 0 and 4 degC reduced germination at 25 degC spores remained viable for only 10 days. Infection of poplars [Populus spp.] at these temperatures was similarly reduced. Uredospores of M. medusae lose viability rapidly at normal field temperatures and will not infect Populus spp. unless germination occurs within 2 weeks of production.

Wong, H.R. 1977. Fallocampus: a new sawfly genus for the Nearctic species of Platycampus Schioedte. Canadian Entomologist. 109(8): 1103-1107.

Fallocampus gen.n. is described. Notes are provided on the biology (including parasites) of these 2 species, which infest trembling aspen (Populus tremuloides) in Manitoba and Saskatchewan.

Wouters, L.J.A. 1977. The use of parasitic worms for the control of larvae of Sciapteron tabiniformis. Populier. 14(3): 59-60.

Zapol'skikh, O.V. 1977. A new type of hemocytes of Heterarthrus ochropodae. TSitologiya. 19(7): 818-820.

1978

1978. Pest: Euproctis chrysorrhoea (L.) (Porthesia chrysorrhoea (L.)) (Lep. Lymantriidae) (Brown-tail moth). Host plants: Prunus and other fruit trees, elm [Ulmus spp.], hawthorn [Crataegus spp.], oak [Quercus spp.] and poplar [Populus spp.]. Distribution Maps of Pests, A. 362 (Rev. ed.): 2 p.

1978. Pest: Euproctis similis (Fuessly) (Porthesia similis Fuessly) (Lep., Lymantriidae) (Gold-tail moth, tussock moth). Host plants: Rosaceae, especially Prunus; Citrus, maple [Acer spp.], oak [Quercus spp.], poplar [Populus spp.], Tilia. Distribution Maps of Pests, A. 388: 2 p.

1978. Phytosanitary protection of poplar. Encounter-debate on an update in the Emilia-Romagna region. Cellulosa E Carta. 29(2): 24-26.

1978. Studies on the occurrence of Melanophila decastigma and its control. Chung-Kuo Lin Yeh K'o Hsueh. 2: 37-41.

1978. The occurrence and control of Bhima idiota Graese. Chung-Kuo Lin Yeh K'o Hsueh. 2: 47-49.

Alleyne, E.H.; Morrison, F.O. 1978. Effect of temperature on reproduction of alates of the lettuce root aphid, Pemphigus bursarius (L.) in Quebec, Canada. Annals of the Entomological Society of Quebec. 23(1): 39-48.

In investigations on lettuce and Lombardy poplar [Populus italica], the rate of birth of young by the 2 types of alates of Pemphigus bursarius (L.) was influenced by temperature. Maximum reproduction occurred within the range of maximum ambient temperatures recorded at St. Anne de Bellevue, Quebec, during the migratory periods of the alates.

Alleyne, E.H.; Morrison, F.O. 1978. The natural enemies of the lettuce root aphid, Pemphigus bursarius in Quebec, Canada. Annals of the Entomological Society of Quebec. 22(3): 181-187.

Notes are provided on over 20 potential or actual natural enemies that were found in association with Pemphigus bursarius (L.) in Quebec in 1971-1974. This is the first known record of an association between aphids and these parasitic nematodes.

Anderson, R.L.; Anderson, N.A. 1978. Alternate host of jack pine needle rust in northern Minnesota. Res. Note NC-237. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 3 p.

The pine needle rust of jack pine on the Little Sioux Burn in northeastern Minnesota infected large-leaf aster but not goldenrod. The rust was most severe when asters were abundant on the plots. Less than 10 percent of the

jack pine were infected over a 3-year period when asters were more than 10 feet (3.05 m) from the mil-acre plots.

Anderson, N.A.; Ostry, M.E.; Anderson, G.W. 1978. Infection of aspen by Hypoxyylon mammatum through galls formed by Saperda inornata. Proceedings of the American Phytopathological Society. 4: 110-111.

Some additional observations of the same plantation of aspen (Populus tremuloides) at Rosemount, Minnesota, but also including accounts of H. mammatum cankers which started in galls on wild P. tremuloides in Minnesota and Michigan, and in Longland, Wisconsin.

Anderson, R.L.; Schipper, A.L., Jr. 1978. A system for predicting the amount of Phellinus igniarius rot in trembling aspen stands. Res. Note NC-232. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 4 p.

Incidence of P. igniarius decay was recorded along transects in 18 Populus tremuloides stands in 3 National forests: Ottawa (Upper Michigan); Chippewa (Minnesota); and Chequamegon (Wisconsin). A procedure is described for predicting the extent of total decay 6 or 12 years later. Practical examples are given for 2 stands, one where felling might soon be necessary, and one where it might be deferred.

Anselmi, N. 1978. Toxic effects on Salicaceae of hormone weedkillers used as herbicides in rice fields. *Cellulosa e Carta*. 29(4): 17-36.

Distorted and shriveled leaves and twisted shoots were observed on poplars and willows adjacent to rice fields in Lombardy and Piedmont during the summers 1975-1977. These effects were attributed to the use of weedkillers in the rice fields. In tests two commercial weedkillers were applied to pot-grown and young nursery stock of Populus 'I-214' and to young nursery stock of Salix alba clone SI 19/64. The younger the stock and the heavier the dose of weedkiller, the more severe was the damage.

Athias-Henriot, C. 1978. Definition of Dictyonotus nov. gen., with a description of two new species from southern France. *Entomophaga*. 23(2): 189-194.

The genus Dictyonotus gen.n. is defined. Amblyseius huron Chant & Hansell is transferred to it. Eight other species are recognised of which two are here described as new.

Attard, G. 1978. Extension of the damage caused by the poplar weevil in poplar plantations in Aquitaine. *Phytoma*. 30(298): 26.

Since 1973, infestation of Populus spp. in SW France by Cryptorhynchus lapathi has extended. Varieties with rough bark or corky excrescences are more susceptible to ovipositing females than smooth-barked ones. Notes are given on biology, damage caused, and control.

Biggs, A.R.; Davis, D.D.; Coppolino, J.B. 1978. The influence of SO₂ on 10 forest tree species with reference to relative susceptibility, leaf²-sulfur content, and stomatal response. Proceedings of the American Phytopathological Society. 4: 183.

Seedlings were exposed twice weekly to 0.9 p.p.m. SO₂ for 2 hours from May to September 1977, using controlled environment chambers. The most susceptible species was Betula nigra followed by Pinus sylvestris; more tolerant species were P. strobus, P. nigra, B. lenta, B. papyrifera, B. pubescens, Prunus serotina, Fraxinus americana, and Populus trichocarpa X P. maximowiczii. Typical symptoms were intervein necrosis on broadleaves and needle tip necrosis on conifers.

Bol'shova, N.I.; Moskaleva, V.E. 1978. Studies of aspen wood, infected by fungus Phellinus tremulae, by the method of luminescent microscopy. In: Starostin, I.V., ed. *Biopovrezhdeniia materialov i zashchita ot nikh*: 177-181.

Braun, G.; von Schonborn, A.; Weber, E. 1978. Investigations on the relative resistance of woody plants to de-icing salt. *Allgemeine Forst- und Jagdzeitung*. 149(2/3): 21-35.

In a greenhouse experiment in 1971-1974, 42 woody species were subjected to salt spray and/or salt contamination of the soil; 7 were also studied in the open. The following were distinguished: highly resistant, Alnus glutinosa, Hippophae rhamnoides, Populus 'Oxford', Salix purpurea, S. X rubens; resistant, Crataegus oxyacantha, Ligustrum vulgare, Populus 'Rochester', Robinia pseudoacacia, Salix alba var. vitellina, S. caprea, S. daphnoides, S. incana, S. viminalis. Most species were more susceptible to salt contamination of the soil than to salt spray.

Bruck, R.I.; Manion, P.D. 1978. Mammatoxin bioassay for genetic and environmental predisposition of aspen to cankering by Hypoxylon mammatum. *Proceedings of the American Phytopathological Society*. 4: 184.

A crude extract containing the fungal toxin mammatoxin, was made from the culture medium of H. mammatum; 5 µl was placed on pin-prick wounds of excised leaves from greenhouse-grown clones of aspen (Populus tremuloides). Size of the necrotic lesion after 18 hours was significantly affected by clone.

Bychkova, O.N.; Groshin, A.P. 1978. Effect of amenity plantations on the concentration of carbon monoxide on the highways and streets of Moscow. *Byulleten' Glavnogo Botanicheskogo Sada*. 109: 40-45.

The samples were taken (a) in the middle of the carriageway; (b) 11-27 m to the side of the road, behind one or more rows of trees bordering the river; and (c) on the other side of the road, about 50 m from (a), in front of buildings separated from the road by another belt of trees. In March/April (trees leafless) the CO concentration was generally lower in (b) than in (a), but in (c) it was sometimes higher. In June (trees in full leaf) the CO concentration in both (b) and (c) was lower than that in (a).

Cabral, M.T.E.C. 1978. Possibility of using microbiological control of Lymantria dispar L. and Euproctis chrysorrhoea L., two cork-oak pests by means of Bacillus thuringiensis. *Ciencia Biologica*. 3(1): 20B.

The effectiveness of a strain of Bacillus thuringiensis var. morrisoni for the control of Lymantria dispar (L.) and Euproctis chrysorrhoea (L.), both of which are pests of cork-oak (Quercus suber) there, was tested. It is concluded

that the leaves of Quercus contain some substance that inhibits the action of the bacillus.

Caldbeck, E.S.; McNabb, H.S., Jr.; Hart, E.R. 1978. Poplar clonal preferences of the cottonwood leaf beetle. *Journal of Economic Entomology*. 71(3): 518-520.

The relative susceptibilities of 33 poplar clones (Populus spp.) to Chrysomela scripta were measured in 1977 during a season of heavy infestation of the beetle in a clonal orchard in Iowa. Damage was estimated by using the criteria of shoots no longer usable for cuttings and leaf area lost. Other than P. alba, parentage had little influence on beetle preference. Shoot height growth was reduced as much as 80 percent in severely defoliated clones.

Cellerino, G.P. 1978. Reaction of 52 families of Populus deltoides to the early onset of low temperatures. *Cellulosa e Carta*. 29(5): 3-18.

Observations are reported on the height and d.b.h. growth of saplings of 52 families of P. deltoides in an experimental plantation at Casale Monferrato (N. Italy) at the end of their first year and on the effects on each family of the early onset of low temperatures in the autumn of that year. Statistical analysis of the measurements and observations of damage caused by the cold autumn showed clear evidence of the correlation between adaptation of the P. deltoides provenances to the conditions at Casale Monferrato and the geographical origin of the provenances. Selection of further clones for testing should be limited to provenances within the latitudinal range 37 degree -35 degree N.

Cellerino, G.P.; Anselmi, N.; Pinon, J. 1978. Influence of age on the susceptibility of poplar leaves to Marssonina brunnea. *European Journal of Forest Pathology*. 8(5/6): 273-279.

The development of infection was studied in leaves of Populus X euramericana [P. X canadensis aggr.] following inoculation with M. brunnea, at Casale, Monferrato, Italy, in a greenhouse, and at Champenoux, France, on detached leaves taken from nursery-grown and greenhouse-grown plants. In all, susceptibility was low during flushing, increasing rapidly as the leaves unfolded, decreasing in mature leaves, and finally increasing again in senescent leaves.

Danilewicz, K. 1978. The composition of epiphytic bacteria from poplar shoots, depending on diffusion exudates associated with the activity of the cambium. *Roczniki Nauk Rolniczych, E*. 8(1): 155-167.

On shoots cut from twelve varieties, of various species and hybrids, and maintained in a nutrient medium, the apical buds developed earliest in P. nigra and the varieties 'Robusta' and 'NE-49', and latest in 'NE-42' and 'Gelrica'. Glucose showed the highest concentration initially in exudates of 'Lons' and 'Kornik 7', but within a few days, was highest in that of 'Robusta'. Various aromatic compounds present, precursors of lignin, differed according to variety and phenological phase. The concentrations of these two types of exudate were reduced at various rates by the epiphytic bacteria present, mainly Pseudomonas species. Ps. syringae was capable of metabolizing completely the highest concentration of aromatic compounds found (that produced by the shoots of 'NE49'). Since earlier investigations had shown that resistance to Chondroplea (Dothichiza) populea depends on the

concentration of these substances, it was apparent that, even within one variety, resistance could vary with the phenophase and that the bacterial flora of the twigs was capable of modifying the expression of this type of resistance. The procedure described provided a means of monitoring this capacity.

Davis, D.D.; Miller, C.A.; Coppolino, J.B. 1978. Foliar response of eleven woody species to ozone with emphasis on black cherry. Proceedings of the American Phytopathological Society. 4: 185.

Plants (2 to 3 years old) of thornless honeylocust [Gleditsia triacanthos inermis], American sycamore [Platanus occidentalis], black elderberry [Sambucus melanocarpa], tulip poplar [Liriodendron tulipifera], ailanthus [Ailanthus altissima], black cherry [Prunus serotina], and hybrid poplar [Populus X canadensis] were all susceptible to 2-weekly exposure to 0.2 p.p.m. O₃ for 5 hours throughout the summer in 1976; Austrian pine [Pinus nigra], Virginia pine [P. virginiana], eastern white pine [P. strobus], and ponderosa pine [P. ponderosa] were all tolerant. Prunus serotina was similarly tested in 1977. Greatest sensitivity to O₃ occurred when current foliage was 4 to 8 weeks old, symptoms were a dark-brown intervein stipple on the adaxial leaf surface. It is concluded that P. serotina may be useful as a bio-indicator for O₃.

de Kam, M. 1978. Xanthomonas populi subsp. salicis, cause of bacterial canker in Salix dasyclada. European Journal of Forest Pathology. 8(5/6): 334-337.

Details are given of the symptoms of the disease of S. dasyclada [S. dasyclados] previously reported. Symptoms are similar to those of bacterial canker of poplar (Populus spp.). Cultural and biochemical characters are summarized.

Dickmann, D.I. 1978. Marked difference among poplar clones in winter browsing damage by cottontail rabbits. Canadian Journal of Forest Science. 8(3): 351-354.

Cottontail rabbits caused severe damage to 1-year-old shoots of Italian clones of Populus nigra in stool beds at East Lansing, Michigan, in the severe winter of 1976-1977. Over 80 percent of the stems were barked, compared with 0-4 percent in 26 other clones of poplar species and hybrids.

Digat, B. 1978. Antigen specificity in Agrobacterium radiobacter var. tumefaciens. In: Proceedings, 4th International conference on plant pathogenic bacteria. 1: 321-326.

Strain differentiation among pathogenic isolates of A. radiobacter var. tumefaciens [A. tumefaciens] from several host plants (peach, cherry, Populus bolleana, and dahlia) on the basis of biochemical reactions is inconsistent. Strain-specific antisera can be used in clearly differentiating these strains.

Doom, D. 1978. Insect attack on Populus and willow in 1977 and some measures taken to reduce the damage. Populier. 15(2): 32-33.

Dozsa-Farkas, K. 1978. Investigations on the feeding preferences of the Enchytraeid species Fridericia galba. Opuscula Zoologica. 15(1-2): 75-82.

Laboratory investigations were conducted between August 1976 and February 1977. The results showed that F. galba preferred the litter of the previous fall (including even oak and beech leaves) to the freshly fallen litter, even though the latter contained components which rapidly decomposed (hornbeam and lime). Ash litter was taken only in November. At about the same time Acer plantanoides became consumable, while Acer pseudoplatanus and Populus tremula were consumed only in February. It is important that hornbeam becomes consumable for the worms from November, although it is never the preferred choice.

Edel'man, N.M. 1978. The effect of diet on the development of the gypsy moth and the poplar leaf beetles. Translation, Fisheries and Environment Canada. OOENV TR-1452: 24 p.

Oak [Quercus robur], birch [Betula alba s.l.], poplar [Populus spp.], and bird cherry [Prunus avium] were used as food plants for the moths, and poplar and willow [Salix spp.] for the beetles [Chrysomela populi and C. tremulae]. The quality of food is evaluated according to survival rate and rate of development of larval phase, larval weight, content of water, fat, total N, lipase activity, and respiratory quotient.

Evans, L.S.; Gmur, N.F.; da Costa, F. 1978. Foliar response of six clones of hybrid poplar. *Phytopathology*. 68(6): 847-856.

After exposure to simulated acid rain at pH 2.7-3.4 lesions of several types were produced on foliage of 6 clones of Populus spp. hybrids. In general, percent leaf area with lesions and percent leaves injured were similar among all 6 clones at all pH levels tested. Lesions developed mostly near stomata and vascular tissues and occurred most frequently on leaves just prior to maximum leaf enlargement. The results support the hypothesis that the adaxial leaf surface is the most affected after exposure to simulated acid rain.

Filer, T.H., Jr.; Randall, W.K. 1978. Variation among cottonwood clones in susceptibility to Cytospora, Phomopsis and Fusarium. *Proceedings of the American Phytopathological Society*. 4: 83.

Significantly different numbers of stem cankers were produced by 25 clones of cottonwood (Populus deltoides) inoculated with C. chrysosperma in July, but not in November. Inoculations with F. solani and Phomopsis macrospora in July produced similar numbers of cankers, but P. macrospora produced most cankers in November inoculations.

Flueckiger, W.; Flueckiger-Keller, H.; Oertli, J.J. 1978. Inhibition of the regulatory ability of stomata caused by exhaust gases. *Experientia*. 34(10): 1274-1275.

It is demonstrated that very low concentrations of exhaust gases from a combustion engine inhibit the regulatory ability of stomata. However, when gas treatment was stopped, plants showed a quick recovery.

Fluckiger, W.; Oertli, J.J.; Fluckiger-Keller, H. 1978. The effect of wind gusts on leaf growth and foliar water relations of aspen. *Oecologia*. 34(1): 101-106.

Potted plants of various trees and shrubs (clones), exposed to the dividing strip and along the border of a motorway, showed an inhibition of leaf growth and a faster development of necrotic leaf areas, when suffering from water deficiency. In greenhouse experiments with potted aspen exposed to periodic artificial wind gusts, wind velocities of 6 m/s were sufficient to inhibit leaf growth by 50 percent. Measurements of water relations did not show obvious changes when aspen trees with 1.5-month-old leaves were exposed to gusts, but when plants were continuously exposed to wind (6 m/s) significant increases in stomatal diffusive resistances and transpiration rates were found as well as a significant decrease in water potential.

French, J.R.; Hart, J.H. 1978. Variation in resistance of trembling aspen to Hypoxylon mammatum identified by inoculating naturally occurring clones. Phytopathology. 68(3): 485-489.

Inoculation during 1974 of natural clones of Populus tremuloides in the field with single ascospore isolates of H. mammatum produced significant interclonal differences in length of cankers after 70 days. Significant interclonal variability in canker development occurred in 10 of 12 areas. The amount of natural infection in each clone was not correlated with the length of artificially induced cankers. P. grandidentata became infected with H. mammatum after inoculation, but some clones showed resistance by profuse callus production.

Funk, A. 1978. Seimatosporium etheridgei n.sp., associated with a new disease of aspen bark. European Journal of Forest Pathology. 8(1): 54-58.

An illustrated description is given of the fungus, which is found in association with the development of smooth, cushion-like swellings on the stems of Populus tremuloides in S. central British Columbia. The swellings could possibly act as infection courts for other fungi.

Garrec, J.P.; Vavasseur, A. 1978. Distribution of fluoride in Populus nigra in a polluted area. European Journal of Forest Pathology. 8(1): 37-43.

The concentration of F was determined in different parts of 4-year-old trees of P. nigra growing close to an aluminium works near Grenoble. The concentration of F was greatest in the leaves, decreasing down the branches to the upper stem. In the lower part of the trees, F concentration increased again, from the root collar to the fine roots. In both polluted and control trees, a logarithmic relationship was demonstrated between the concentrations of F and Ca in different parts of the plant. The results suggest that in polluted poplar trees, basipetal transport of F takes place, associated with the transport of Ca.

Gillespie, D.R.; Finlayson, T.; Tonks, N.V.; Ross, D.A. 1978. Occurrence of the winter moth, Operophtera brumata (Lepidoptera: Geometridae), on southern Vancouver Island, British Columbia. Canadian Entomologist. 110(2): 223-224.

A persistent outbreak of hardwood-defoliating geometrid larvae with an unexpectedly low level of parasitism present in southern Vancouver Island, British Columbia, since at least 1972 had been attributed to Operophtera bruceata (Hulst). The population did in fact consist of about 10 percent O. bruceata and 90 percent O. brumata (L.), a native of Europe. This is the

first record of O. brumata from western North America. It is suggested that O. brumata could have been introduced on nursery stock.

Gordh, G. 1978. Taxonomic notes on Zagrammosoma, a key to the Nearctic species and descriptions of new species from California. Proceedings of the Entomological Society of Washington. 80(3): 344-359.

A key is provided to the 9 species of Zagrammosoma known in the USA and Canada that parasitize lepidopterous pests of fruit and forest trees, and also notes on the distribution, host associations, and taxonomy of each of the parasite species.

Gregoire, J.C. 1978. Discrimination between Salix and Populus by Phyllodecta laticollis. In: Chapman, R.F.; Bernays, E.A., eds. Proceedings, 4th International symposium: insect and host plant; 1978 June 4-9; Fulmer Grange, Slough, England. Entomologia Experimentalis et Applicata 1978. 24(3): 375-381.

Feeding experiments were performed with Phyllodecta laticollis Suffr. using different extracts of Salix and Populus leaves. Specific polar phagostimulants are responsible for the choice of Populus by the insect. No effective deterrent was detected in Salix.

Greig, B.J.W.; Redfern, D.B.; Brasier, C.M.; Lonsdale, D. 1978. Report on forest research for the year ended March 1978. London, UK: Her Majesty's Stationery Office. 85 p.

B.J.W. Greig describes studies on Fomes annosus [Heterobasidion annosum]. Infection in Western hemlock [Tsuga heterophylla] increased from 14 percent in the Forest of Dean at 19 years old to 62 percent at 26 years old while in comparable grand fir [Abies grandis] only 4 percent were infected at the later date. D.B. Redfern investigated infection of Sitka spruce by H. annosum. b. In further studies on Dutch elm disease (Ceratocystis ulmi) C.M. Brasier notes that the aggressive strains probably entered Iran from the Russian border area and caused the serious outbreak of the disease in 1971. Greig estimated that c. 50 percent of the elms in southern England have been killed by the disease. Lonsdale found that the role of Cryptococcus fagi in beech bark disease is not limited to facilitating the entry of Nectria coccinea.

Gremmen, J. 1978. Research on Dothichiza bark necrosis in poplar. European Journal of Forest Pathology. 8(5/6): 362-368.

A brief review, covering the disease symptoms produced in poplars [Populus spp.]; the pathogen (C. populea); the infection process; and some inoculation experiments. Recommendations are made for suitable tending and silvicultural practices.

Grossbechler, F. 1978. Propagation of rust resistant poplars. Aust Parks Recreat: 19-20.

Harranger, J. 1978. The results of the 1976 drought on the vegetative development of many trees in 1977. Phytoma. 297: 25-26.

Adverse effects in Lorraine, France, in 1977 that followed the drought of 1976, are described on oak, poplar, apple, plum, elm, hornbeam, and coniferous trees.

Hassanein, F.A. 1978. On the morphology, biology and ecology of Anacampsis populella. Anzeiger fur Schadlingskunde Pflanzenschutz Umweltschutz. 51(2): 20-23.

Leaf-rolling Microlepidoptera heavily infesting birch trees on the Groebenzell moors west of Munich in Bavaria were studied in 1975-1976. The larvae fed mainly on birches and to a less extent on aspen (Populus tremula) but in the laboratory rejected other Populus species and also Salix spp. In the laboratory, 20 species of parasitic Hymenoptera were reared. The highest percentage of parasitism obtained was 59 percent.

Hibben, C.R.; Reese, J.; Bozarth, R.F. 1978. The identification of tobacco necrosis virus in deteriorating clones of aspen. Proceedings of the American Phytopathological Society. 4: 83.

Host range tests with a virus mechanically transmitted from aspen (Populus tremuloides) in a forest in Utah, revealed local-lesion infection similar to that caused by tobacco necrosis virus (TNV). A single infectious component was purified and reacted with TNV antisera, and antisera to it reacted with homologous antigen and with a strain of TNV. Its pathogenicity was demonstrated by mechanical inoculation of healthy trees.

Hinds, T.E.; Laurent, T.H. 1978. Common aspen diseases found in Alaska. Plant Disease Reporter. 62(11): 972-975.

The results of a general survey in S. central and interior Alaska in August 1977, giving disease collection data and locations. Four cankers (not previously recorded in Alaska) were common in most aspen stands; Phellinus tremulae, Peniophora polygonia, and P. rufa were widespread. Fungi causing root and butt rot, leafspot, and rough bark were also collected.

Il'kun, G.M.; Makhovskaya, M.A.; Tret'yak, N.P. 1978. Effect of mineral nutrition on the pollution resistance of urban tree plantings. Fiziologiya i Biokhimiya Kul'turnykh Rastenii. 10(2): 199-203.

In pot experiments, 2- to 3-year-old (a) horse chestnut [Aesculus hippocastanum], (b) small-leaved linden [Tilia cordata] and (c) poplar [Populus pyramidalis] trees were grown with or without NPK and were fumigated with SO₂. In outdoor trials 20- to 25-year-old roadside trees of (a) and (b) were irrigated and/or treated with NPK. In the pot experiments NPK applications increased resistance to SO₂. With the roadside trees, subsoil NPK application + irrigation markedly increased leaf chlorophyll and carotenoid contents.

Isaev, V.I. 1978. The increment of trees growing beside skidding trails after the first shelterwood felling. Lesnoe Khozyaistvo. 1: 42-43.

A study was made of the effect of soil compaction and damage to the root system on the increment of trees growing within 3 m of skidding trails. The stand was birch [Betula alba] with some spruce [Picea abies] and aspen [Populus tremula], and skidding was done with crawler tractors. The results indicate that near the trails where the tractors had made 26-50 trips, the increment of the trees was 20 percent below that of the other trees on soddy strongly podzolic medium clay-loam soil; on sandy-loam soils, increment was not affected in the proximity of the skidding trails.

Jensen, K.F. 1978. Sulfur dioxide affects growth of forest tree species. Proceedings of the American Phytopathological Society. 4: 89.

Seedlings of 8 species were fumigated with SO₂ for 90 days with either 0.15 p.p.m. (Acer saccharinum, Fraxinus americana, Liriodendron tulipifera, Picea glauca, Platanus occidentalis, and Populus deltoides) or 0.25 p.p.m. (Alnus glutinosa, F. pennsylvanica, L. tulipifera, P. deltoides, and Platanus occidentalis). Height increment was not altered by 0.15 p.p.m., but was significantly reduced by 0.25 in F. pennsylvanica, P. occidentalis, and Populus deltoides.

Jensen, K.F.; Hanks, L.F. 1978. Growth analysis of poplar cuttings fumigated with SO₂. Proceedings of the American Phytopathological Society. 3: 306.

Hybrid poplar [Populus spp.] cuttings were fumigated in greenhouse chambers for 9 weeks with SO₂, and leaf area and dry weight were measured. Changes in weight and area with time, relative growth rates (a), leaf-area variations (b), and unit leaf rates (c) were calculated. During treatment, (b) decreased while (a) and (c) increased initially, and then decreased. It is concluded that growth analysis is useful for analysing effects of pollution on growth when visible injury is lacking.

Jodal, I. 1978. A study of the relation between the amount of food consumed and the fecundity of the gypsy moth fed on the leaves of Populus X euramericana Guinier cl. I-214. Translation, Fisheries and Environment Canada. OOENV TR-1475: 8 p.

Juzwik, J.; Nishijima, W.T.; Hinds, T.E. 1978. Survey of aspen cankers in Colorado. Plant Disease Reporter. 62(10): 906-910.

Thirty sites within nine national forests of Colorado were sampled to determine the abundance and distribution of aspen diseases and wounds. Sooty bark canker was the most widely distributed canker and the most serious cause of mortality. Ceratocystis fimbriata was the most abundant canker disease on living aspen. Few sporophores of decay fungi were found.

Kemp, W.P.; Simmons, G.A. 1978. The influence of stand factors on parasitism of spruce budworm eggs by Trichogramma minutum. Environmental Entomology. 7(5): 685-688.

In studies on spruce budworm (Choristoneura fumiferana (Clem.)) and its egg parasite Trichogramma minutum Ril. in Maine, the data collected included intensive information on stand density, composition, age, crown closure, crown surface area, basal area, height, and associated vegetation. There were significantly higher numbers of egg-masses, viable eggs, non-viable eggs, parasitised eggs, and percentage parasitism in the upper crowns when compared to mid-crown levels. Parasitism rates rose with increasing density of tree species that are not fed on by C. fumiferana. It appears that increases in parasitism are due to greater numbers of alternative parasite hosts found in more diverse habitats.

Kern, K.G. 1978. The effects of flooding on diameter and height growth of poplars on the flood plain of the Rhine. Allgemeine Forst- und Jagdzeitung. 149(4): 57-62.

Diameter increment was measured on 4 *Populus 'Marilandica'* aged 35-40 years between the dyke and the river in 1967-1969 and 2 behind and 2 in front of the dyke in 1970-1973. Floods of a few days duration reduced growth, but long floods, increased it. Possible explanations are discussed.

Klincsek, P.; Torok, K. 1978. Response of trees and shrubs to salting of roads in winter. *Kertgazdasag*. 10(3): 39-50.

A review of the literature with the data summarized and presented in a tabulated form. Conifers were more sensitive to salt damage than Angiosperms. A list of 18 salt tolerant species is included.

Kolesnichenko, M.V.; Kryukov, V.V. 1978. The biochemical effect of certain local species and exotics on red oak. *Lesnoi Zhurnal*. 2: 27-30.

Laboratory experiments are described to determine the effect of volatile exudations from the leaves and roots of 10 different species on the performance of plants of *Quercus borealis* [*Q. rubra*] as measured by the rate of uptake of ^{32}P . The results indicate that all the native species tested (*Q. robur*, *Tilia cordata*, *Corylus avellana*, *Acer platanoides*, *Betula verrucosa* [*B. pendula*], *Populus tremula*, and *Pinus sylvestris*) had an inhibitory effect on *Q. rubra*. *Q. rubra* should be mixed with N. American exotics such as *G. triacanthos*, *P. strobus*, *F. pennsylvanica*, and *Pseudotsuga menziesii*. If *Q. rubra* is planted as a mixture with native species, the best arrangement is by alternate strips, so as to minimize the adverse effect of the associate species on the *Q. rubra*.

Kolomoets, T.P.; Sinel'nikova, A.M.; Kovalenko, V.M.; Danilkina, N.V. 1978. The great poplar clearwing. *Zashchita Rastenii*. 1: 36.

Sesia apiformis (Cl.) (*Aegeria apiformis*) has become an important pest of poplar in the basin of the river Don in the USSR and has infested several species commonly grown there. The larvae infest the trunks of the trees, and their galleries frequently permit the entry of disease organisms. The larvae are very mobile and enter the trunks at or below soil level forming galleries 20-50 cm long. For control, scraping the trunks to a height of 35 cm in mid-May and double treatment of the root and lower trunk area with 0.3 percent trichlorphon 2 weeks after the beginning of adult emergence are recommended. Further sprays can be applied in late September against larvae seeking hibernation sites.

Kolster, H.W. 1978. Problems with *Populus 'Rap'*. *Populier*. 15(4): 81.

On the stem and branches of this cultivar, which was first introduced commercially in 1972, small and large knob-like swellings have been observed since 1974. Trees with heavily affected stems show light-coloured, smaller leaves, reduced growth, and basal cankers. No relationship to micro-organisms or insects has been found. The cultivation of this variety is not recommended.

Kranjcev, R. 1978. *Synanthedon croaticus* sp.n. *Acta Entomologica Jugoslavica*. 14(1/2): 27-33.

Synanthedon croaticus sp.n. is described from the adults of both sexes. Notes are given on the bionomics of the aegerid and on characters by which it

can be differentiated from related species. The larvae pass 2 years in damp, hypertrophied cankers, and deep cracks in the bark.

Krause, C.R.; Jensen, K.F. 1978. Microtopographical changes in hybrid poplar leaves associated with air pollution exposure. *Scanning Electron Microscopy*. 1978/2: 755-758.

Cuttings of Populus deltoides X P. trichocarpa were exposed to (a) charcoal-filtered air (control); (b) 0.15 p.p.m. O₃; (c) 0.25 p.p.m. SO₂; or (d) both (b) and (c), for 12 hours daily for 21 days. No symptoms were observed on the adaxial or abaxial surfaces of leaves under any of the treatments. In (d), apparently crystalline inclusions were found in the bundle-sheath extension cells, and the mesophyll cells contained globules and had distorted chloroplasts.

Lapietra, G. 1978. Activity of decamethrin against the larvae of Stilpnotia salicis L. *Informatore Fitopatologico*. 28(3): 3-5.

The general tendency to reduce the number of chemical applications against insect pests on economic plants sometimes results, in poplar plantations in Italy, in defoliation caused by Leucoma salicis (L.) (Stilpnotia salicis) having reached 30-50 percent before treatment is begun. The synthetic pyrethroid decamethrin [(S)-cyano(S-phenoxyphenyl)methyl (1R-cis)-3-(2,2-dibromoethenyl)-2,2-dimethylcyclopropanecarboxylate] was tested in sprays applied to trees in the greenhouse, third-instar larvae of L. salicis being placed on the leaves 24-72 hours after treatment. At concentrations of 6.25 mg/litre or more, decamethrin showed remarkable knockdown activity, but larvae recovered when transferred to untreated trees. Treatment at 12.5 mg was considered sufficiently effective for decamethrin to be recommended for field application against L. salicis.

Lemoine, M.; Pinon, J. 1978. Clonal differences in poplars in susceptibility to the rusts Melampsora larici-populina and M. allii-populina. *Revue Forestiere Francaise*. 3: 181-185.

Development of Melampsora rusts was favoured by weekly watering of trial plots in France. Results are tabulated for 49 clones; at least half were reasonably resistant. Many clones were more susceptible to one type of rust than the other. Similarly, clones found to be resistant to M. medusae in Australia and New Zealand were spread throughout the range of susceptibility to European rusts.

Leontovyc, R. 1978. A contribution to knowledge of Chondroplea populea. Assessment of the susceptibility and resistance of various cultivars. *Vedecke Prace Vyskumneho Ustavu Lesneho Hospodarstva vo Zvolene*. 26: 89-118.

Trees were inoculated with a conidial suspension of the pathogen. The incidence of canker lesions provided an acceptable basis for differentiation. The Italian clones I105 and I109 appeared to be immune, while very low rates of infection were found in I214, I274, I501, Robusta, widely grown in Czechoslovakia, and Brabantica, from the German Democratic Republic. Clones differed in their relative resistance when inoculated at different dates.

Lindsey, J.P.; Gilbertson, R.L. 1978. Basidiomycetes that decay aspen in North America. Vaduz, Liechtenstein: J. Cramer. 406 p.

A checklist of the 260 species decaying Populus tremuloides and P. grandidentata is followed by keys to families and subfamilies and genera with descriptions of the fruitbodies, hyphal system, cystidia, basidia, basidiospores, and type of rot for each species. There is a glossary and an index.

Lukinich-Hartyani, K.; Verzar-Petri, G.; Pethes, E. 1978. Contribution to the pharmacognosy of Viscum album L. 1. Effect of host trees on choline content. *Acta Agronomica Academiae Scientiarum Hungaricae*. 27(3/4): 368-374.

Mistletoe from "softwood" host trees (Salix caprea, Tilia cordata, and Populus canadensis) contained considerably more choline than that from "hardwood" trees (Acer platanoides, Robinia pseud-acacia, Celtis occidentalis, and Juglans nigra). Content varied with tree habitat and was lowest in May and rose to a maximum in February.

Magnani, G. 1978. Observations on root rot in poplars. *Cellulosa e Carta*. 29(2): 17-23.

Armillaria mellea [Armillariella mellea] was recently observed in poplar [Populus spp.] plantations in central and Southern Italy, chiefly on soils recently cleared of forest or subjected to floods that transport infected wood residues. The fungus spread only slowly during the years following its first appearance. At present, control can only be effected by removing the root systems of infected trees and disinfecting the holes left in the ground with quicklime. Precautionary measures before planting include elimination of stumps and debris, and selection of healthy and vigorous planting stock.

Maksymov, J.K. 1978. Mass increase of the poplar bombyx Stilpnotia salicis L. in the Orbe plain. *Journal Forest Suisse*. 129(5): 424-430.

Matsuda, K. 1978. Feeding stimulation of flavonoids for various leaf beetles. *Applied Entomology and Zoology*. 13(3): 228-230.

In studies in Japan on possible feeding stimulation by flavonoids, six flavonoids (quercitrin, rutin, quercetin, myricitrin, myricetin, and morin) were tested with eight species of leaf beetles. All six compounds inhibited feeding by Phaedon brassicae Baly (which feeds on crucifers) and Oulema oryzae (Kuway.) (a pest of rice).

McCormick, L.H.; Steiner, K.C. 1978. Variation in aluminium tolerance among six genera of trees. *Forest Science*. 24(4): 565-568.

The sensitivity of 11 species to 0-280 ppm. Al was tested in a hydroponic system. Tolerance indices (based on root elongation in an Al solution versus a non-Al solution) ranged widely: Populus hybrid 'NE-388' and Elaeagnus umbellata were most sensitive, being injured by only 10-40 ppm Al.

McCracken, F.I. 1978. Canker diseases of southern hardwoods and their control. In: *Proceedings, 2nd symposium on southeastern hardwoods; 1977 April 20-22; Dothan, AL. Atlanta, GA: U.S. Department of Agriculture, Forest Service, Southeastern Area, State and Private Forestry*. 2: 101-106.

Mitchel, D.H.; Smith, A.H. 1978. Notes on Colorado fungi. III. New and interesting mushrooms from the Aspen zone. *Mycologia*. 70(5): 1040-1063.

Mitchell, M.J. 1978. Vertical and horizontal distribution of oribatid mites in an aspen woodland soil. *Ecology*. 59(3): 515-525.

Mlodzianowski, F.; Siwecki, R. 1978. Morphology and ultrastructure of uredospores of Melampsora larici-populina Kleb. *European Journal of Forest Pathology*. 8(1): 43-48.

A comparison was made of differently pigmented uredospores collected from Populus trichocarpa (yellow) and P. nigra (orange). No significant differences were found.

Mlodzianowski, F.; Werner, A.; Siwecki, R. 1978. Germination of Melampsora larici-populina uredospores on poplar leaves. *European Journal of Forest Pathology*. 8(2): 119-125.

Using scanning electron microscopy, germination of the uredospores was observed on the lower leaf surfaces of a susceptible clone of Populus trichocarpa and a resistant one of P. 'Serotina de Poitou'. In P. trichocarpa the epidermis was thrown into closer folds than in the other clone and the stomata were larger and more numerous. On P. 'Serotina de Poitou', germination generally lacked vigour and no hyphae were seen to have entered stomata.

Mohammed Omar; Heather, W.A. 1978. Electron microscope studies on the penetration phenomena of Melampsora larici-populina Kleb. *Australian Plant Pathology Newsletter*. 1, Supplement: 30. (Abstract)

Although direct fungal penetration occurred on leaves of both susceptible and immune poplar clones, dense trichomes appeared to prevent contact between fungal germ tubes and the leaf surface, reducing penetration.

Mukula, J.; Siltanen, H.; Rosenberg, C.; Idanpaan-Heikkila, J.; Lallukka, R. 1978. Phenoxy herbicide residues in cowberries, mushrooms and the twigs of some forest plants. *Annales Agriculturae Fenniae*. 17(1): 23-31.

Residues of 2,4-D and 2,4,5-T were determined in Vaccinium vitis-idaea fruit and leaves, wild mushrooms, and leaves from Populus tremula and Betula spp. in forest areas previously sprayed with herbicides to control brushwood.

Nesterov, V.G.; Vakulin, A.A.; Dzhovelikyan, Kh.A. 1978. The composition of trees planted in towns in relation to environmental pollution. *Doklady Vsesoyuznoi Ordena Lenina Akademii Sel'skokhozyaistvennykh Nauk Imeni V.I. Lenina*. 3: 13-16.

In Voronezh, environmental pollution decreased the photosynthetic productivity of Lombardy poplar [Populus nigra var. italica] by 20-30 percent. The foliar concentration of Mn, Ti, V, Ba, Ni, Cr, Zr, and Cu is tabulated for several susceptible species of broadleaved trees.

Petrenko, E.S.; Dryannykh, N.M. 1978. Biocoenotic relations in the utilization of food by leaf-feeding insects in the forests of the lower Angara region. In: Vladyshevskii, D.V., ed. *Ekologiya pitaniya lesnykh zhivotnykh*. Novosibirsk, USSR: 'Nauka', Sibirskoe Otdelenie: 76-88.

Studies were made in pine [Pinus sylvestris] forest near the right bank of the R. Angara in the Krasnoyarsk region of Siberia. The principal leaf-feeding insects included Phyllodecta laticollis on aspen (Populus

tremula). Insect utilization of leaves was almost 100 percent [incidence on individual leaves] towards the end of the season.

Petrov, S.A. 1978. Inbreeding in populations of forest trees. Referativnyi Zhurnal. 6.56.79: 400-401.

The coefficient of inbreeding was calculated from the equation $F = 1 - H/2pq$, where H is the relative proportion of heterozygous individuals in the population and p and q are the frequencies of dominant and recessive alleles. All populations from seed obtained by open pollination had very low coefficients of inbreeding. Inbreeding was more marked in the population from seed of the controlled cross Populus bachofeni f. typica X P. bachofeni 'Bolleana'. The distribution of genotypes with the typical and pyramidal crown in this population differed significantly from that theoretically expected. It is concluded that half sibs were involved in the hybridization.

Phillips, D.H. 1978. The EEC plant health directive and British forestry. For. Rec. 116. Surrey, UK: Forest Research Station, Alice Holt Lodge. 22 p.

A Directive laying down measures to protect the European Economic Community from the entry of foreign pests and diseases of plants was finally published in January 1977. The object of this paper is to explain the background to this Directive, it also contains notes on the more important pests of forest and related ornamental trees against which protection is sought.

Retnakaran, A. 1978. Conditioned feeding preference in the forest tent caterpillar. Bi-monthly Research Notes. 34(5): 32.

Malacosoma disstria Hb., first-instar larvae were fed for 10 days on an artificial diet or foliage of white birch (Betula papyrifera) and then given a choice of artificial diet or foliage of white birch, trembling aspen (Populus tremuloides), or sugar maple (Acer saccharum). At the end of 3-5 hours, the larvae tended to feed on maple, but after 24 hours most of the larvae that had been reared on artificial diet returned to that diet, and those reared on birch returned to birch. The conditioned response to a particular diet might partly explain the occurrence of larvae on particular tree species in mixed stands in the field.

Ride, M.; Ride, S. 1978. The causal agent of the bacterial canker of poplar: Xanthomonas populi or Xanthomonas campestris pathovar populi. In: Proceedings, 4th international conference on plant pathogenic bacteria. 1: 365-370.

Low NaCl tolerance, high temperature sensitivity, metabolic pattern of 6 C sources and pathogenic specialization on the genus Populus distinguish this organism from all other X. spp. described in Bergey's Manual.

Ride, M.; Ride, S. 1978. Xanthomonas populi comb. nov. specificity, variability and absence of relationship with Erwinia cancerogena Ur. European Journal of Forest Pathology. 8(5/6): 310-333.

Aplanobacter populi, causing bacterial canker of poplar, was transferred to X. as X. populi on the basis of morphological, cultural, biochemical and serological properties, thermal relationships, and pathogenicity to Populus. Pathogenicity to P., heat sensitivity, low tolerance of sodium chloride, and failure to use arabinose and cellobiose distinguish X. populi from the X. campestris group.

Rodriguez, M.R.; Bell, A.H. 1978. Three new species of Trichodoridae with observations on the vulva in Paratrichodorus. *Journal of Nematology*. 10(2): 132-141.

Examination of a paratype female of P. (A.) atlanticus showed that the vulva is pore-like, not a longitudinal slit as originally described. A paratype female of P. (Paratrichodorus) rhodesiensis was examined and shown to have the vulva as a longitudinal not transverse slit. Species of the subgenus Nanidorus were found to have the vulva as a short transverse slit. The 3 subgenera can therefore be characterized by the shape of the vulva.

Schipper, A.L., Jr. 1978. A Hypoxyton mammatum pathotoxin responsible for canker formation in quaking aspen. *Phytopathology*. 68(6): 866-872.

Cell-free extracts of H. mammatum culture medium and cankered host tissue caused inhibition of wound callus formation, bark necrosis and collapse, and distal vein necrosis in Populus tremuloides leaves. Of 27 plant species tested only P. tremuloides was highly sensitive to H. mammatum toxin.

Schipper, A.L., Jr.; Anderson, R.L. 1978. How to identify and minimize white trunk rot of aspen. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 2 p.

A leaflet describing the identification of Phellinus igniarius in standing stems of aspen [Populus tremuloides/P. grandifolia] in the Lake States. Procedures are outlined for estimating the extent and spread of the disease and for minimizing it by silvicultural control.

Schipper, A.L., Jr.; McCracken, F.I.; Widin, K.D. 1978. Spread of Melampsora medusae leaf rust in the Mississippi River Valley. *Phytopathology News*. 12(9): 168-169.

Schipper, A.L., Jr.; McNabb, H.S., Jr.; Haywood, W.F. 1978. Dothichiza and Phomopsis cankers of hybrid poplar in Iowa. *Proceedings of the American Phytopathological Society*. 4: 109-110.

Stems of hybrid poplars in experimental plots in Iowa were killed by D. populea and P. macrospora in 1976 after moisture stress following drought. Canker frequency on Populus 'Canada Blanc' (but not P. 'Wisconsin-5') was directly related to density of planting. It is concluded that poplars intended for moisture-stressed sites should be screened for resistance to stem and foliage diseases.

Serck-Hanssen, K.; Wikstrom, C. 1978. Novel 7-phenylheptan-3-ones from the fungus Phellinus tremulae. *Phytochemistry*. 17(9): 1678-1679.

An account of the fungitoxic products isolated from wood of Populus infected by P. tremulae.

Sharma, J.K.; Heather, W.A. 1978. A method for quantitative measurement of infection of Melampsora leaf rust of poplars. *Australian Plant Pathology Newsletter*. 1, Supplement: 25.

Sharma, J.K.; Heather, W.A. 1978. Occurrence of abnormal forms of urediniospores in Melampsora larici-populina. *Transactions of the British Mycological Society*. 71(1): 154-162.

During routine identifications of collections of M. larici-populina from various Populus clones and hybrids the occurrence of abnormal urediospores (of varied shapes and dimensions) was noted. The frequency appeared to be related to the clonal origin of the host and to time of sampling. Abnormal spores showed a germination potential of only 25 percent compared with 95 percent for normal spores.

Sharma, J.K.; Heather, W.A. 1978. Parasitism of urediospores of Melampsora larici-populina Kleb. by Cladosporium sp. European Journal of Forest Pathology. 8(1): 48-54.

Collections of urediospores of M. larici-populina made in Canberra in autumn frequently contained large numbers of conidia of Cladosporium spp. the presence of these conidia reduced the viability of the urediospores, and their ability to infect leaves of Populus nigra var. italica. The potential for control of poplar leaf rust by hyperparasitism is discussed.

Shortle, W.C. 1978. Compartmentalization of decay in red maple and hybrid poplar trees. Proceedings of the American Phytopathological Society. 4: 86.

Discoloration was initiated in red maple (Acer rubrum) and hybrid poplar (Populus deltoides X P. trichocarpa) by drill wounds. Marginal zones of both species had more soluble dry matter and phenols than sapwood or discoloured wood, and these phenols differed in their solubility in organic solvents, UV spectra, and chromatographic behaviour. It is suggested that the zones of high phenol content may limit spread of micro-organisms and account for compartmentalization of decay.

Simpson, B.; Hayes, A.J. 1978. Growth of Marssonina brunnea. Transactions of the British Mycological Society. 70(2): 249-255.

Solomon, J.D.; Randall, W.K. 1978. Biology and damage of the willow shoot sawfly in willow and cottonwood. Annals of the Entomological Society of America. 71(4): 654-657.

The sawfly Janus abbreviatus (Say) is a shoot-boring pest of willow and poplar. Adults girdled and killed terminals and branches with a series of punctures, and larvae tunnelled in shoots causing die-back and breakage. Shoot mortality caused by first-generation adults averaged 91 percent in a willow nursery, but the rate of injury dropped to 67 and 30 percent in the second and third generations due to parasites, disease, and a seasonal decline in shoot susceptibility. Cultural practices in the nursery can help minimize damage.

Spakhova, A.S.; Ryazantseva, L.A. 1978. Vulnerability of certain woody plants to sulfur dioxide damage. Soviet Plant Physiology. 25(2 part 2): 323-325.

Three-year-old plants were transplanted into pots and fumigated for 1 hour with 1 mg SO₂/m³ in May, June, and July. Photosynthesis and leaf injury data indicated that Pinus sylvestris, Picea abies, Larix sibirica, and Tilia cordata were susceptible to SO₂ injury while Acer platanoides, Quercus rubra, Thuja occidentalis, and Populus pyramidalis were resistant.

Spiers, A.G. 1978. An agar leaf-disc technique for screening the effectiveness and persistence of fungicides for control of Marssonina on Populus. Plant Disease Reporter. 62(2): 148-152.

Using the agar leaf-disc technique, Dichlone (2 percent), NIA 9102 (2.0 percent), zineb (2.0 percent) and captan (2.0 percent) effectively controlled infection of poplar leaves by Marssonina spp. for 7 days after spray application. Benomyl (1.0 percent), Zn-Fe-maneb complex (2.0 percent), and triforine controlled growth for 14 days, and captafol (1.5 percent), MBC (0.5 percent), and dodine (0.25 percent) for 21 days.

Spiers, A.G. 1978. An agar leaf-disc technique for screening poplars for resistance to Marssonina. Plant Disease Reporter. 62(2): 144-147.

Observations are made by inoculating fungal conidia on to leaf discs inserted in 2 percent water agar plates. Clones are classed as immune, resistant, susceptible or very susceptible according to the number of lesions per cm².

Stary, P.; Gonzalez, D. 1978. Parasitoid spectrum of Acyrtosiphon-aphids in central Asia. Entomologica Scandinavica. 9(2): 140-145.

The species of aphidiids that parasitise Acyrtosiphon pisum (Harris) in central Asia are reviewed. The species composition of the aphids and their parasites, and their relative abundance, vary between the lowland and mountain areas.

Swaillem, S.M.; Amin, A.H. 1978. On the biology and seasonal occurrence of the poplar gall-aphid Pemphigus lichtensteini Tulg. in Nineveh Governorate. Mesopotamia Journal of Agriculture. 13(1): 101-110.

Ten infested black poplar (Populus nigra) trees near Mosul, Iraq, were studied weekly during the period of aphid activity (late March to late November) from 1973 to 1976. The life cycle is outlined, including stages on the secondary host Bermuda grass (Cydonodon dactylon) during summer. Alate sexuparae return to the poplar galls in autumn.

Tamm, Yu.A. 1978. The diagnosis of heart rot of aspen. Mikologiya i Fitopatologiya. 12(4): 331-337.

Diagnosis should be based on both the numbers of fruit bodies of Phellinus tremulae and their location on the tree. Fruit bodies are usually found on aspens [Populus tremula] greater than 30 years old.

Underhill, E.W.; Steck, W.; Chisholm, M.D.; Worden, H.A.; Howe, J.A.G. 1978. A sex attractant for the cottonwood crown borer, Aegeria tibialis. Canadian Entomologist. 110(5): 495-498.

Sesia tibiale (Harris) (Aegeria tibiale) is a pest of poplars, including Populus deltoides, which is commonly grown for shade and as a windbreak in western Canada, and is especially injurious in cutting beds in nurseries. In field tests adult males were strongly attracted to virgin females and to mixtures of (3Z,13Z)-3,13-octadecadien-1-ol and its acetate. Extracts of female abdominal tips yielded 2 fractions stimulatory to male antennae. These corresponded to a C18 alcohol and a C18 acetate. Appreciable male antennal stimulation occurred only with C18 compounds having Z-unsaturation at

positions 3 or 13, the synthetic sex attractant may be the natural pheromone of the sesiid.

Uteberg, E.; Olsson, H. 1978. Insect damage to fastgrowing Salix and Populus species. Rep. SHU-IFSY-RU-103. Umeaa, Sweden: Skogshoegskolan. 101 p.

When certain insect damage was noted during work on the Swedish Energy Forestry Project (EFP), a special study project was initiated with the aim of studying this problem more closely. The main components included in the field work were: Collection of insects gathered by hand from the experimental shoots and collection using window traps.

Valentine, H.T. 1978. Estimating defoliation of hardwoods using blade-petiole relations. Res. Pap. NE-405. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 5 p.

van der Hout, H.M. 1978. Frost and storm damage in the Populus variety 'Dorskamp'. Populier. 15(1): 15.

VanEtten, H.D. 1978. Identification of additional habitats of Nectria haematococca mating population VI. Phytopathology. 68(11): 1552-1556.

Some 44 isolates of Fusarium solani (imperfect stage of N. haematococca) including 2 each from tuliptree (Liriodendron tulipifera), cottonwood (Populus deltoides), and mulberry (Morus alba) gave fertile crosses with 2 isolates of N. haematococca mating population (MP) VI (pathogenic on pea).

Vishnikova, T.A. 1978. Intensity of development of the gypsy moth on different food species. In: Vladyshevskii, D.V., ed. Ekologiya pitaniya lesnykh zivotnykh. Novosibirsk, USSR: 'Nauka', Sibirskoe Otdelenie: 88-96.

In tests in the Priangara region of the USSR in 1974-1975, groups of 20-50 larvae were caged on various types of foliage or directly on trees. The most favourable foods as regards speed of development proved to be willow, larch, birch, and Siberian sorbus, all of which are utilized by the moth in its Siberian area of occurrence. The foods most intensively utilized were the needles of larch and the leaves of willow, of which the latter permitted the greatest overall speed of larval development.

Wagn, O. 1978. Fomes annosus is feared by foresters: susceptibility of tree species to attack. Hedeselskabets Tidsskrift. 99(5): 100-102.

A report on a 15-year-old 'infection trial' established at Studsgard Research Station, Denmark, with some 70 shelterbelt species. Mortality in Pinus contorta, the most susceptible species, was 80 percent versus 25 percent in P. nigra (and also in Picea sitchensis). The most susceptible hardwoods were Sorbus aucuparia and wild pear [Pyrus communis]. Ulmus pumila was more susceptible than other elms. Species which so far showed no symptoms included small-leaved linden [Tilia cordata] and hybrid aspen [Populus tremula X P. tremuloides].

Werner, A.; Siwecki, R. 1978. Histological studies of infection processes by Dothichiza populea Sacc. et Briard in susceptible and resistant poplar clones. European Journal of Forest Pathology. 8(4): 217-226.

Histological studies with five clones with various degrees of resistance showed that two resistant clones of P. maximowiczii, in contrast to less resistant or susceptible clones, were characterized by (1) heavy lignification of the primary bark and (2) heavy suberization of the phellem.

Widin, K.D.; Schipper, A.L., Jr. 1978. Development of the uredium of Melampsora medusae. Proceedings of the American Phytopathological Society. 4: 109.

The development of the uredium was followed in leaves of poplar [Populus spp.] from 4-24 days after inoculation with M. medusae, by microscopic examination of thin sections. Uredia usually developed first on the underside of the leaf, and were visible in parenchyma cells adjacent to the host epidermis after 4 days.

Witter, J.A.; Waisanen, L.A. 1978. The effect of differential flushing times among trembling aspen clones on tortricid caterpillar populations. Environmental Entomology. 7(1): 139-143.

The effect of clonal variation of trembling aspen (Populus tremuloides) on tortricid caterpillar populations, primarily Choristoneura conflictana (Wlk.) and C. rosaceana (Harris), was studied in Michigan and Wisconsin during 1975 and 1976. There was a very significant linear relationship between the mean proportion of buds infested and the mean flushing date of the clone. The biology of C. conflictana as it relates to aspen phenology is presented. The importance of using the clone as a sampling unit when studying aspen insects is stressed.

Yagdyev, A. 1978. Discovery of the buprestid Agrilus tschitscherini Sem. on turanga in the valley of the River Ili. Izvestiya Akademii Nauk Turkmenskoi SSR, Biologicheskikh Nauk. 2: 90.

The buprestid Agrilus tschitscherini Sem. was found by the author on Populus (subgenus Turanga) in riparian woodland in the floodplain of the River Ili, USSR. Larvae make winding tunnels in branches of moderate size between the sapwood and the wood and overwinter in this stage. General emergence takes place in mid-June.

Zalasky, H. 1978. Stem and leaf spot infections caused by Septoria musiva and S. populicola on poplar seedlings. Phytoprotection. 59(1): 43-50.

S. musiva and S. populicola were isolated, respectively, from overwintered leaves of hybrid poplar and Populus balsamifera in Manitoba as perithecia of Mycosphaerella populorum and M. populicola. P. balsamifera seedlings were inoculated in the glasshouse. S. musiva caused the highest percentage of canker and leaf spot of these seedlings from all areas. S. musiva caused canker and leaf spots on one seed source sample (15 trees) of P. deltoides, on which S. populicola caused occasional leaf spot but no canker. Monitoring leaf infections and change of fungus activity from colonization to sporulation may help to time control measures in the nursery.

Zagorodneva, D.S.; Kuz'min, L.L. 1978. Some features of the horizontal distribution of nematodes in forest litter. Pedobiologia. 18(3): 180-187.

The distribution of nematodes in a 50 cm² area of bare soil subdivided into 49 squares in a mixed forest of Populus tremula, Tilia cordata, Carex

pilosa, and Picea abies in Vladimir, USSR, was studied. In the absence of vegetation and micro-relief, the nematodes react to other ecological factors.

1979

Attard, G. 1979. The poplar shoot tortricid and its life-cycle in the south-west. *Phytoma*. 305: 23-28.

Gypsonoma aceriana (Dup.) is an important pest of poplars [Populus] in south-western France, the larvae destroying the terminal buds of cuttings in nurseries and so rendering them useless for propagation. The life-history is described and divided into 8 phases, with special reference to the timing of insecticidal treatments against them. A program recommended in nurseries in south-western France is presented. The cost of the treatment is calculated and shown to be considerably less than that for the treatments used hitherto.

Bartkowiak, S.; Rachwal, L. 1979. Effect of cement dust on the girth increment of potted conifers and broadleaves. *Arboretum Kornickie*. 24: 283-296.

Growth was measured for 3 years on potted transplants dusted daily during the 160-day vegetative season with cement dust. Cement had no significant effect on growth of Scots pine or Pinus nigra, but significantly reduced growth of 3-year-old shoots of Larix decidua and of some shoots of Populus simonii 'Fastigiata'. Populus 'Robusta' was not sensitive to cement dust and showed a significant increase in growth during the first 2 years.

Burkot T.R.; Benjamin, D.M. 1979. Biology and ecology of the cottonwood leaf beetle, Chrysomela scripta on tissue cultured hybrid aigeiros (Populus x euramericana) subclones in Wisconsin. *Canadian Entomologist*. 111(5): 551-556.

Caramiello Lomagno, R.; Rovera, L.; Lomagno, P.A.; Piervittori, R. 1979/1982. Treatment of poplar diseases in Maira Valley. *Annali della Facolta di Scienze Agrarie della Universita degli Studi di Torino*. 12: 217-275.

Denbnovetskii, G.Yu.; Tsarev, A.P.; Menina, M.M. 1979. Fungistatic properties of extracts from the bark of poplar. *Mikologiya i Fitopatologiya*. 13(1): 64-68.

The fungistatic activity of aqueous extracts from 14 species, measured by the length of hyphae of Dothichiza populea developing in the extracts, differed according to the variety. Extracts from resistant varieties had the greatest fungistatic activity.

Dominik, T.; Ihnatowicz, A. 1979. Studies of the mycotrophy of poplars in experimental plantations established by the Institute of forest research in Szczecin Province. *Prace 544 p. Poland: Prace Instytutu Badawczego Lesnictwa*. 542/548: 67-112.

Lists of soil fungi in the rhizosphere are given for dry, intermediate and wet old-field sites in 3 forests in Poland based on observations in 1973-1975. Notes are given on some of the more interesting species isolated. Results are discussed in relation to ecological conditions and the distribution of species within the soil ecosystem.

Flores, G.; Hubbes, M. 1979. Phytoalexin production by aspen in response to infection by Hypoxyton mammatum (Wahl) Mill and Alternaria spp. European Journal of Forest Pathology. 9(5): 280-288.

Krawiarz, K.; Oleksyn, J.; Karolewski, P. 1979. Changes in chlorophyll a and b content in leaves of the poplar Populus 'Hybrida 275' subjected to action of SO₂ and in the needles of European larch treated with HF. Arboretum Kornickie. 24: 321-328.

Exposure to SO₂ increased the chlorophyll and reduced the phaeophytin and beta-carotene contents of leaves of P. 'Hybrida 275' (P. 'NE-42') before visual symptoms of injury appeared. In necrotic leaves, chlorophyll contents fell and phaeophytin contents increased indicating chlorophyll breakdown; there was no change in beta-carotene content. Short exposure of Larix decidua to HF dramatically reduced chlorophyll contents and increased phaeophytin content.

Kuno, H. 1979. Effects of photochemical oxidant on the growth of poplar cuttings. I. Changes with days and years on growth and leaf drop of poplar cuttings by filtered air method. Taiki Osen Gakkaishi. 14(7): 265-274.

In order to study the effects of air pollutants, especially photochemical oxidants, on the plant growth, poplar cuttings (Populus x euramericana cv. I'45/51') were grown in filtered air greenhouse and non-filtered air greenhouse in the suburbs of Tokyo. Growth ratio and net assimilation ratio of poplar cuttings were less in non-filtered air than in filtered air, but leaf area ratio was more in non-filtered air. There was a strong negative relationship between the ratio of growth amount and oxidant concentrations occurred in poplar growing season from 1974 to 1978. There was a strong positive relationship between leaf damage index and oxidant concentrations occurring from 1975 to 1978.

Laflamme, G. 1979. Discoloured wood of aspen caused by increment boring. European Journal of Forest Pathology. 9(1): 15-18.

Trembling aspen (Populus tremuloides) in Newfoundland is seriously affected by decay resulting from increment borings. Three years after 20 trees had been bored, none had healed. The discoloration extended about 2 cm on each side and about 50 cm above and below the wound. Peniophora polygonia was the most common fungus isolated.

Liu, Y.C.; Pai, K.W. 1979. A study of the gelechiid moths in Tai-ling forest areas of Heilongkiang Province. Scientia Silvae Sinicae. 15(4): 276-280.

Five species are recorded for the first time in China. All are forest pests and brief descriptions are given of their biology, host range, and geographical distribution.

Mercer, P.C. 1979. Phytotoxicity and fungitoxicity tests for tree wound paints. Annals of Applied Biology. 91(2): 199-202.

The tests were devised to assess rapidly the wide range of potential treatments for pruning wounds. The phytotoxicity test was based on the growth of poplar (Populus X euramericana cv. 'Robusta') callus and the fungitoxicity test on the inhibition of fungal growth on wood strips.

Ostry, M.E.; Anderson, N.A. 1979. Infection of Populus tremuloides by Hypoxyton mammatum at oviposition sites of cicadas. Phytopathology. 69(9): 1041.

Pinon, J. 1979. Origin and principal characters of French strains of Hypoxyton mammatum (Wahl.) Miller. European Journal of Forest Pathology. 9(3/4): 129-142.

Marked variability in in vitro morphological characters was observed in 16 French strains of H. mammatum and in one strain from Quebec, Canada, isolated from Populus tremula or P. tremula X P. tremuloides. Differences also regard cellulolytic activity and ability to decompose wood.

Riov, J.; Goren, R. 1979. Effect of ethylene on auxin transport and metabolism in midrib sections in relation to leaf abscission of woody plants. Plant, Cell and Environment. 2(1): 83-89.

Citrus sinensis leaves were more sensitive than Populus deltoides or Eucalyptus camaldulensis leaves to ethylene exposure, reaching 100 percent abscission in the shortest time. It is suggested that one of the main effects of ethylene in the leaf blade is to inhibit auxin movement in the veins thus reducing amounts reaching the abscission zone from the leaf blade.

Schmidt, E.L.; French, D.W. 1979. Spore germination of Gloeophyllum trabeum on wood in relation to mass of the sample. Plant Disease Reporter. 63(1): 30-31.

Wood cubes and 600- μ m wood sections of ponderosa pine (Pinus ponderosa) and aspen (Populus tremuloides) failed to support basidiospore germination of G. trabeum. It is concluded that the results of spore germination tests on thin wood sections may not apply to larger samples where the contents of wood voids may be inhibitory.

Shain, L. 1979. Long-term storage of Melampsora medusae urediospores after freeze-drying. Plant Disease Reporter. 63(5): 368-369.

Urediospores of M. medusae were collected from infected leaves of cottonwood (Populus deltoides) in Kentucky, using a cyclone separator, and then quick-frozen and sealed under vacuum. Germination was unaffected by heat shock after storage. Pathogenicity rankings of spores did not appear to change during storage.

Shain, L.; Cornelius, P.L. 1979. Quantitative inoculation of eastern cottonwood leaf tissue with Melampsora medusae under controlled conditions. Phytopathology. 69(3): 301-304.

Samples of M. medusae urediospore suspension in 0.1 percent water agar were placed on the underside of Populus deltoides leaf discs (17 mm diameter) on agar plates. Discs from leaf quadrants that had been washed briefly with 52 percent ethanol prior to inoculation had significantly greater infection than discs from unwashed or water-washed quadrants. The most efficient inoculum density was 1,250-5,000 urediospores per disc. Intraclonal variation existed in susceptibility.

Sharma, J.K.; Heather, W.A. 1979. Comparison of disease parameters for quantitative assessment of Melampsora leaf rust in clones of Populus spp. Transactions of the British Mycological Society. 72(3): 483-488.

Field infection by M. larici-populina and M. medusae in the Populus X euramericana clones I-154, I-214, and I-455, P. regenerata and the P. nigra cultivar Semi-evergreen was assessed by measuring sori per mm², uredospores per mm², and uredospores produced per sorus. Differential susceptibility and relative susceptibility was the same when the first two measurements were used for assessment. However, uredospores produced per mm² showed a few significant differences from conventional assessment based on sorus numbers. The advantages of employing uredospores produced per unit area as a measure of relative susceptibility in horizontally resistant clones and in tracing disease progress are considered.

Sharma, J.K.; Heather, W.A. 1979. A method for determining density of suspensions of urediniospores of Melampsora larici-populina causing leaf rust of poplar. Transactions of the British Mycological Society. 72(3): 479-482.

Uredospores of M. larici-populina were collected from leaves of field-grown poplar clones, suspended in distilled water and serially diluted. The number of spores per ml was linearly related to the optical density determined by formula. This standard curve was adequate for the estimation of the number of spores per ml in individual suspensions of rust spores prepared from the leaves of three Populus X euramericana clones.

Whitham, T.G. 1979. Territorial behaviour of Pemphigus gall aphids. Nature, UK. 279(5711): 324-325.

Although insects are known to defend nests, breeding sites, and females, the defense of feeding sites is less well documented. As the evolution of territoriality is thought to be directly related to competition for resources in short supply, such behaviour should be exhibited only when population densities approach the carrying capacity of the environment. An account is given of field studies carried out near Ogden, Utah, in the springs of 1976 and 1978 on the settling behaviour of the aphid Pemphigus betae Doane, which causes gall-formation of the leaf blade of narrowleaf cottonwood (Populus angustifolia), that showed that there were defended micro-territories, the production of a floater population and differential mortality of residents and floaters that favoured the evolution of territorial behaviour.

Wildman, H.G.; Parkinson, D. 1979. Micro-fungal succession on living leaves of Populus-tremuloides. Canadian Journal of Botany. 57(24): 2800-2811.

1980

Aboumandour, A.A. 1980. Investigations on cytokinins of parasitic origin .3. cytokinin-activities in melampyrum and lathraea and in galls on leaves of Populus, Fagus and Quercus. Zeitschrift fur Pflanzenphysiologie. 97(1): 59-66.

Aleksandrov, N.N.; Vdovin, B.I.; Shafranskaia, V.A. 1980. Incidence of poplar leaves by exhausts of aluminum oxide production. Leningrad: Trudy Zakavkazskogo Nauchno-issledovatel'skogo Gidrometeorologicheskogo Instituta. 66: 45-54.

Danilewicz, K. 1980. Studies on the epiphytic bacteria on Populus-tremula L. and Populus-alba L. at the time of optimal and minimal cambium activity and infection by venturia. *European Journal of Forest Pathology*. 10(5): 296-306.

Flores, G.; Hubbes, M. 1980. The nature and role of phytoalexin produced by aspen. *European Journal of Forest Pathology*. 10(2-3): 95-103.

Harrell, Mark Owen. 1980. The nutritional ecology of the cottonwood leaf beetle as influenced by hybrid poplar clonal foliage, with notes on the insects associated with tissue-cultured hybrid poplars in Wisconsin. *Dissertation Abstracts International*. 42/01-B: 57.

The cottonwood leaf beetle, Chrysomela scripta Fabricius, is the most serious pest of hybrid poplars in central and southern Wisconsin. Varying degrees of resistance to the beetle were found in the poplar clones with parentages in the Aigeiros and Tacamahaca sections. Adult beetles showed a significant feeding preference toward poplar clones with higher proportions of Tacamahaca parentage. One or more sugars may be partly responsible. Adults also showed a preference toward the youngest leaves of a shoot; larvae fed equally on all leaves with water contents greater than 70 percent. The poplar-and-willow borer, Cryptorhynchus lapathi Linnaeus might be involved in the transmission of the pathogen of a lethal stem canker disease.

Kozłowska, C.; Szumowski, B. 1980. A study of the relation between nutrients available for poplar shoot growth and the development of pathogenic fungi. *Prace Instytutu Badawczego Lesnictwa*. 565/572: 95-110.

Cuttings of (a) Populus 'Robusta', (b) P. 'Grandis', and (c) P. 'Hybrida 275' [P. 'NE-42'] were planted out in peat blocks supplied with a standard nutrient solution plus different combinations of micronutrients. Extracts of the bark of shoots produced by the cuttings were added to culture media to test their effect on the growth of Dothichiza [Cryptodiaporthe] populea. (a) was the least susceptible and (b) the most susceptible variety under the conditions used.

Kuno, H. 1980. Effects of photochemical oxidant on the growth of poplar cuttings. II. Effects of photochemical oxidant on chlorophyll contents, photosynthetic and dark respiratory rates, soluble carbohydrate and nitrogen contents in leaves of different ages. *Taiki Osen Gakkaishi*. 15(4): 155-162.

Two groups of poplar cuttings were grown. The first in ambient air of the Tokyo suburbs. The second in filtered air. The purpose of the study was to determine the effects of photochemical oxidants on the chlorophyll content, soluble carbohydrate content, nitrogen content, photosynthetic rate, and dark respiratory rate of poplar leaves in different stages of maturation.

Kuno, H. 1980. Effects of photochemical oxidant on the growth of poplar cuttings. III. Effects of ozone on photosynthesis, photorespiration and dark respiration. *Taiki Osen Gakkaishi*. 15(5): 207-212.

The effects of ozone on apparent photosynthesis, photorespiration, and dark respiration were determined in poplar (Populus x euramericana cv. I-45/51) leaves. The lower order leaves fumigated with ozone had apparent photosynthetic rates reduced after 5 hours exposure. Photosynthesis of the

upper order leaves were not affected with 0.10 or 0.20 ppm ozone for 5 hours exposure.

Newsome, L.; Solomon, J.D. 1980. Control of eriophyid mites on cottonwood foliar sprays, 1979. *Insecticide and Acaricide Tests*. 5: 187.

Paradellis, T.; Panayotakis, N. 1980. Bromine absorption from air by plant leaves. *Journal of Radioanal. Chemistry*. 59(1): 221-227.

Trace elements present in the leaves of Populus grown in the city of Athens are determined by XRF, and compared with leaves of trees grown far from the city. The results show a manyfold increase in the bromine content of the leaves in trees grown in the city. This is attributed entirely to the increase of the bromine content in the air of the city, due to car exhaust. The implication to public health of this finding is discussed.

Przybyl, K. 1980. Ceratocystis fimbriata - cause of a new poplar disease. *Sylwan*. 124(8): 47-54.

C. fimbriata was isolated in March from all of 11 cultivars suffering from bark peeling and 'target canker' (concentric layers of callus). P. 'NE-42' and P. 'Kornik 6' were the most frequently affected. A description of the species is given.

Salem, M.A.; Michail, S.H. 1980. Inonotus-pseudohispidus on Populus-nigra in Egypt. *Transactions of the British Mycological Society*. 74(2): 107-110.

Schnaiderowa, J. 1980. The dusky clearwing - Paranthrene tabaniformis. *Prace Instytutu Badawczego Lesnictwa*. 565/572: 47-74.

This serious pest is widespread in Poland and affects all species and varieties of Populus grown. A 50 percent aqueous emulsion of Lasochron (DDT + gamma-BHC) and a 1 percent aqueous solution of NRDC 143 (permethrin) both gave 100 percent control in 1-3 year old plantations.

Sharma, J.K.; Heather, W.A.; Winer, P. 1980. Effect of leaf maturity and shoot age of clones of Populus species on susceptibility to Melampsora-larici-populina. *Phytopathology*. 70(6): 548-554.

Szumowski, B. 1980. Effect of microelements on the development of necroses on poplar cuttings under laboratory conditions. *Prace Instytutu Badawczego Lesnictwa*. 565/572: 133-146.

Cuttings of P. 'Robusta' were grown in sand supplied with nutrient solution plus B, Mn, Cu, Zn, or Mo and artificially inoculated with Dothichiza [Cryptodiaporthe] populea paste either (a) on the surface or (b) after removal of discs of bark. Only Mn and B were effective in reducing fungal development.

Townley-Smith, L.J.; Redmann, R.E. 1980. Injury to aspen exposed to airborne salt from potash mines in Saskatchewan. *Canadian Journal of Botany*. 58(24): 2616-2623.

Branch tip death, leaf chlorosis and necrosis, leaf size, and leaf chloride content were measured in samples of aspen (Populus tremuloides) collected from stands around nine potash mine-refinery complexes in Saskatchewan. Branch tip

death and leaf chloride content were highest in stands near the mines. Most damage was confined to areas extending up to 6 km northwest and southwest of the mines and up to 3 km northeast and southwest. This pattern was related to prevailing wind directions. Branch tip death is the best indicator of injury from airborne salt.

White, T.A.; Rolfe, G.L. 1980. Differing effects of cadmium on 2 varieties of cottonwood Populus-deltoides Bartr. Environmental Pollution Series A-Ecological and Biological. 22(1): 29-38.

1981

Akhtar, M.S.; Jabeen, M. 1982. Influence of specimen size on the amount of wood consumed by termites. Pakistan Journal of Zoology. 13(1/2): 79-84.

Bhat, A.A.; Qadri, S.T. 1981. Significant insect pests of poplars in nurseries and avenue plantations. In: Singh, R.V., ed. Symposium proceedings, silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 144-150.

Bol'shova, N.I. 1981. Destruction of cell wall of aspen wood by different species of the pathogen of white rot. Mikologiya i fitopatologiya. 15(5): 432-434.

Chernysheva, N.K.; Knyazeva, V.V.; Barbakova, E.I.; Minkevich, I.I. 1981. Effect of rust fungi on the biochemical composition of poplar, birch, and willow leaves. Lesokhimiya i Podsochka. 3: 15-16.

A chemical analysis was made of poplar leaves infected with Melampsora populina, birch leaves infected with M. betulinum, willow leaves infected with M. salicina, and healthy leaves of each species.

Flores, Gil Henrique Andre. 1981. Studies on elicitation, biological and chemical properties of phytoalexins in Populus tremuloides Michx. Dissertation Abstracts International. 42/10-B: 3897.

Hypoxyylon mammatum (Wahl.) Mill. is the causal organism of Hypoxyylon canker, a major disease in aspen (Populus tremuloides Michx.). Phytoalexins are known to play an important role in the host-parasite relationship and are responsible for the inhibition of pathogens. The ability of the host to produce phytoalexins could be used as a useful tool in the production of resistant trees. Phytoalexin elicitation was achieved using metabolites of H. mammatum grown on 2 percent malt extract for six weeks. Macerated, autoclaved and non-autoclaved mycelium of H. mammatum was capable of inducing phytoalexins. Both high and low molecular weight compounds present in the protein-free culture filtrates of H. mammatum were capable of phytoalexin elicitation.

Gao, Y. 1981. Infection cycle of Melampsora larici-populina Kleb. and selection of poplar stocks resistant to rust. Journal of North-Eastern Forestry Institute. 3: 10-18.

This rust disease is common in Liaoning Province, infecting a number of poplar species. Inoculation of larch leaves with basidiospores showed that larch could act as alternate host, since it produced pycniospores and aeciospores. Younger poplar leaves were more susceptible to attack, suggesting that eradicating adventitious leafy buds on the trunks under the crowns may be useful for minimizing early infection sources.

Ghosh, A.K.; Chakrabarti, S.; Bhattacharya, D.K. 1981. Galls of Pemphiginae in the Indian region with description of a new species. Bulletin of the Zoological Survey of India. 4(3): 319-330.

Galls caused by 27 species of the aphids of the family Pemphigidae on trees and ornamental shrubs and herbaceous plants in India, Pakistan, and Afghanistan are described in a key and illustrated, with particular reference to galls on poplars and especially Populus ciliata, which is used in the Himalayan region to prevent soil erosion and to provide light wood for the match industry.

Gross, H.L.; Syme, P.D. 1981. Damage to aspen regeneration in northern Ontario by the ghost moth, Sthenopis quadriguttatus grote. Canadian Forestry Service Research Notes. 1(4): 30-31.

Harrell, M.O.; Benjamin, D.M.; Berbee, J.G. 1981. Insects associated with tissue-cultured Populus X euramericana in central and southern Wisconsin. For. Res. Notes 244. Madison, WI: University of Wisconsin, Department of Forestry. 4 p.

Twenty-two insect species are listed from collections in plots of 1- to 5-year-old mixed tissue-cultured subclones of P. X euramericana [P. X canadensis aggr.]. Chrysomela scripta and Chryptorhynchus [Cryptorrhynchus lapathi] are considered to be serious pests.

Ignataviciute, M. 1981. Melanconiales fungi in the Lithuanian SSR. 1. On Salicaceae. Serija V. 2. Serija C = Trudy - Akademiia Nauk Litovskoi SSR: Vilnius: 23-30.

Jensen, K.F. 1981. Air pollutants affect the relative growth rate of hardwood seedlings. Res. Pap. PB-81-175275. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 10 p.

One-year-old seedlings of yellow-poplar (Liriodendron tulipifera), eastern cottonwood (Populus deltoides), and white ash (Fraxinus americana) were divided into four groups. One group served as the control, and the other groups were fumigated with O₃, SO₂, or O₃ plus SO₂. Data on leaf area and new growth were transformed to natural logarithms and fitted with a linear regression model. Relative growth rate was positive in all, but varied with fumigation treatment. Relative leaf area growth rate of the cottonwood and yellow-poplar seedlings was reduced by all three fumigation treatments.

Jensen, K.F. 1981. Growth analysis of hybrid poplar cuttings fumigated with ozone and sulphur dioxide. Environmental Pollution. 26(4): 240-243

To measure the influence of air pollutants on the partitioning of photosynthate into leaves or stems and roots, softwood cuttings of a hybrid poplar clone (Populus deltoides Bartr. x P. trichocarpa Torr. and Gray) were

fumigated with either zero pollutants, ozone, sulphur dioxide, or O₃ plus SO₂. Cuttings were harvested at 3- or 4-day intervals and leaf area and dry weights of leaves, stems, and roots were determined. These results indicate that even though total biomass was reduced by air pollutants, the proportion of total available photosynthate used in leaf growth remained nearly constant.

Kimmerer, T.W.; Kozlowski, T.T. 1981. Stomatal conductance and sulfur uptake of five clones of Populus tremuloides exposed to sulfur dioxide. *Plant Physiology*. 67(5): 990-995.

Plants of five clones of Populus tremuloides Michx. were exposed to SO₂ for 8 hours in controlled environment chambers. Rates of recovery following fumigation varied with the clone, but the lower daytime diffusive conductance of all clones had returned to control values by the beginning of the night following fumigation. The results show that stomatal conductance is important in determining relative susceptibility of the clones to pollution stress.

Krinard, R.M.; Johnson, R.L. 1981. Flooding, beavers, and hardwood seedling survival. Res. Note SO-270. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 6 p.

Seedlings of Populus deltoides, Platanus occidentalis, Fraxinus pennsylvanica, Celtis laevigata, Liquidambar styraciflua, Quercus michauxii, Q. shumardii, and Carya illinoensis were planted on cleared ground near the Mississippi River in 1977-1979. In years with flooding (1978 and 1979) beavers [Castor canadensis] pulled up 24-25 percent of newly-planted seedlings and ate the root systems. After 3 years, survival varied from 63 percent (P. deltoides) to 97 percent (F. pennsylvanica). Q. shumardii was the most affected by flooding.

Krol, A. 1981. Occurrence of Saperda carcharias (L.), Saperda populnea (L.) (Cerambycidae: Coleoptera), and Paranthrene tabaniformis Rott. (Aegeriidae: Lepidoptera), on a fertilized plantation of Populus 'Robusta' in a filling sand pit at Sczakowa (Poland). *Zeszyty Naukowe. Lesnictwo*. 13(164): 93-103.

Li, Y.J.; et al. 1981. A preliminary report on insect pests of poplars in north-east China. Bull. 5. China: Institute of Forestry and Pedology, Academia Sinica: 97-122.

Lozano, F.C.; Morrison, I.K. 1981. Disruption of hardwood nutrition by sulfur dioxide, nickel, and copper air pollution near Sudbury, Canada. *Journal of Environmental Quality*. 10(2): 198-204.

Foliage from each of four hardwood species - white birch (Betula papyrifera Marsh.), red oak (Quercus rubra L.), red maple (Acer rubrum L.), and trembling aspen (Populus tremuloides Michx.) - growing on sites severely and moderately damaged by fumes and dustfall and on control sites near Sudbury, Ontario, and soil from beneath the trees were sampled and analyzed for various chemical constituents. On sites damaged by fumes and dustfall, soils were impoverished with respect to organic matter, exchangeable bases, and trace elements. Soils contained near toxic to toxic levels of Ni and Cu.

Mikhailov, L.E.; Rutkovskii, I.V.; Kazei, T.L. 1981. Electrophysiological peculiarities of aspen clones resistant and susceptible to Phellinus tremulae

(Breeding of Populus tremula for resistance to fungal diseases). Lesnoe Khozyaistvo. 1: 51-53.

Morin, M.D. 1981. Heavy metal concentrations in three-year old trees grown on sludge-amended surface mine soil. In: Graves, D.H., ed. Symposium on surface mining hydrology, sedimentology, and reclamation; 1981 December 7; Lexington, KY. Lexington, KY: University of Kentucky: 297-306.

Anaerobically digested sewage sludge from the Metropolitan Sanitary District of Greater Chicago was applied to an abandoned surface mined tract in southern Illinois. Third year leaf, stem, and root tissue of silver maple (Acer saccharinum L.), green ash (Fraxinus pennsylvanica Marsh.), Virginia pine (Pinus virginiana Mill.), river birch (Betula nigra L.), and eastern cottonwood (Populus deltoides Bartr. var. deltoides) were analyzed for concentrations of cadmium, copper, iron, manganese, nickel, and zinc in ug/g. Concentrations for samples indicated that roots and foliage have consistently higher metal contents than stems, the overall trend indicates concentrations in third year tissues are lower than first year tissues.

Patton, R.L. 1981. Effects of ozone and sulfur dioxide on height and stem specific gravity of Populus hybrids. Res. Pap. NE-471. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 4 p.

Unfumigated hybrid poplars (Populus spp.) were compared with poplars of the same nine clones fumigated with ozone or sulfur dioxide. After 102 days, plant height and stem specific gravity were measured. Multivariate statistical analysis of the data for each clone revealed that the height of one clone and the stem specific gravities of six clones were suppressed by ozone. Specific gravity may be a useful measure of the impact of air pollution on trees.

Rawat, B.S. 1981. Pests and diseases in poplar plantations in U.P. (Uttar Pradesh) tarai (Populus, India). In: Singh, R.V., ed. Symposium proceedings: silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 126-129.

Rehill, P.S.; Puri, Y.N. 1981. Diseases of poplars in India (Populus). In: Singh, R.V., ed. Symposium proceedings: silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 137-138.

Rhomberg, Lorenz Rudolf. 1981. The formation of atypical galls by the aphid Pemphigus populicaulis near the edge of its range. Dissertation Abstracts International. 42/12-B: 4671.

Fundatrices of the Eriosomatid aphid Pemphigus populitransversus make galls on petioles of cottonwood (Populus) leaves throughout eastern North America. Galls, fundatrices, and their parthenogenetically produced offspring from 30 localities in the Plains and eastern United States were subjected to morphometric analyses. Most intermediate galls were found near the Continental Divide. Alternative hypotheses explaining the production of atypical galls are discussed.

Rishi, N.D. 1981. Insect pests of poplars in Kashmir state (Populus, India). In: Singh, R.V., ed. Symposium proceedings: silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 123-125.

Sanagustin Sanz, M. 1981. Clonal sensitivity and climatic factors in relation with Marssonina brunnea (E&E) Magr, in Huesca (Populus, Spain). Boletín - Servicio de Defensa contra Plagas e Inspección Fitopatológica. 7(1/2): 99-106.

Schink, B.; Ward, J.C.; Zeikus, J.G. 1981. Microbiology of wetwood: importance of pectin degradation and Clostridium species in living trees. Applied Environmental Microbiology. 42(3): 526-532.

Wetwood samples from standing trees of eastern cottonwood (Populus deltoides), black poplar (Populus nigra), and American elm (Ulmus americana) contained high numbers of aerobic and anaerobic pectin-degrading bacteria. A prevalent pectin-degrading obligately anaerobic bacterium isolated from these wetwoods was identified as Clostridium butyricum.

Schneider, K.R.; Wittwer, R.F.; Carpenter, S.B. 1981. Trees respond to sewage sludges in reforestation of acid spoil. In: Graves, D.H., ed. Symposium on surface mining hydrology, sedimentology, and reclamation; 1981 December 7; Lexington, KY. Lexington, KY: University of Kentucky: 291-296.

Low and high metal sewage sludges were tested for nutrient and heavy metal effects on early growth of five species of trees. Seedlings (1-0) of European alder (Alnus glutinosa L.), black locust (Robinia pseudoacacia L.), cottonwood (Populus deltoides Bartr. ex Marsh.), and loblolly pine (Pinus taeda L.), and acorns of northern red oak (Quercus rubra L.) were planted in the spring of 1980. Leaf samples of all species except oak were collected and analyzed for tissue concentrations of heavy metals and nutrients. Survival increases due to sludge vs fertilizer additions were found for all species. Metal toxicity was not apparent from sludge treatments. The favorable responses of trees may be due to effects of sludges in mediating the impact of poor site conditions and low rainfall.

Sen-Sarma, P.K.; Gupta, B.K. 1981. Insect pests of poplars (Populus, India). In: Singh, R.V., ed. Symposium proceedings: silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 121-122.

Shcherbakova, L.N.; Ovcharov, D.V.; Aukstikal'nene, A.M. 1981. The susceptibility of lackey moths to bacterial preparations in relation to food-plant. Vilnius, USSR: Institut Zoologii i Parazitologii Akademii Nauk Litovskoi SSR: 174-178.

A study carried out in the USSR in 1978 on the susceptibility of Malacosoma neustria (L.) and M. parallela (Stgr.) to bacterial preparations showed that on oak (Quercus robur) mass mortality of larvae caused by Bacillus thuringiensis var. galleriae (Entobacterin) and B.t. var. thuringiensis (BTB-202) occurred 3-4 days after treatment. On poplar (Populus berolinensis), mass mortality caused by Entobacterin and BTB-202 occurred on the 2nd and 3rd days and that caused by exotoxin on the 4th and 5th days. It was concluded that susceptibility of these pests to bacterial preparations

depended on larval age, food-plant, and the phytocidal activity of the food-plant.

Shields, W.J., Jr.; Bockheim, J.G. 1981. Deterioration of (over-mature) trembling aspen clones in the Great Lakes region. *Canadian Journal of Forest Research*. 11(3): 530-537.

Fifty-nine clones of Populus tremuloides were sampled in Michigan, Wisconsin, Minnesota, and Ontario, and a longevity index (LI) calculated for each clone, based on the difference between predicted basal area (from normal yield tables), and measured basal area. Longevity decreased as mean annual air temperature increased. Correlations were also found between LI and monthly air temperature, latitude, and annual moisture index. Aspen growing on excessively drained sites and sites low in exchangeable Ca were most susceptible to early deterioration. Deterioration may also be affected by genetic differences between clones.

Singh, S.; Khan, S.N. 1981. Impact of diseases on success of poplar plantations in India. In: Singh, R.V., ed. *Symposium proceedings: silviculture, management and utilization of poplars*, 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 139-141.

Supuka, J. 1981. Barrier properties of woody plants against industrial dust. *Acta Dendrobiologica*. 3-4: 247-297.

The capacity of leaves of 20 species (in 18 genera) to intercept and retain dust was investigated in the laboratory and at 3 sites near a ferrous alloy works at Istebne na Orave, Czechoslovakia. Results show that the species most effective as dust barriers were Alnus incana, Larix decidua, Populus trichocarpa, and Sorbus aucuparia.

Thakur, M.L. 1981. New and little known insect pests of exotic poplars and their enemy complex in the Bhabar-tarai region, Uttar Pradesh (Populus, India). In: Singh, R.V., ed. *Symposium proceedings: silviculture, management and utilization of poplars*; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 130-136.

Wagner, G. 1981. Monitoring of airborne heavy metal pollution using selected accumulation indicators. In: *Proceedings, international conference; 1981 September 15-18; Amsterdam, Netherlands*. Edinburgh, UK: CEP Consultants Ltd.: 421-424.

The poplar Populus nigra 'Italica' is used as an example for demonstrating and discussing criteria for the selection and use of plants for indicating heavy metal pollution of the air.

Wang, T.Z.; Yue, H.; Jiang, C.F.; Zhang, M. 1981. A study on poplar canker Valsa sordida Nat. *Journal of North-Eastern Forestry Institute*. 1: 18-28.

Poplar canker causes severe damage in the western Heilongjiang province in late April to early June, and is caused here by V. sordida (imperfect stage Cytospora chrysosperma) which primarily attacks trees which are already weakened. Treatment with a mixture of Tuzet:mulch:water (1:50:200) in mid April to early June gave nearly 100 percent control.

Zhang, S.K.; Kao, Y. 1981. A report on the resistance of different poplar species to blister-type canker. *Forest Science and Technology*. 1: 25-26.

Zhou, J.X.; Liu, M.T.; Lu, Y.Z.; Yang, X.G. 1981. A preliminary study on Anoplophora nobilis Ganglbauer. *Scientia Silvae Sinicae*. 17(4): 413-418.

The life cycle is described of this poplar pest found in Shanxi, Gansu, Henan, and Hubei provinces and in Ningxia Autonomous Region. The larvae are borers which attack the stems of 10 species (in particular several poplar species) in which they overwinter twice. Integrated control measures are suggested, including the cleaning away of damaged trees, planting seedlings of new species, application of emulsions, or aqueous solutions to tunnel openings or as trunk sprays.

Ziemnicka, J. 1981. Studies on nuclear and cytoplasmic polyhedrosis viruses of the satin moth. *Prace Naukowe Instytutu Ochrony Roslin*. 23(1): 75-142.

The occurrence of nuclear and cytoplasmic polyhedrosis viruses of Stilpnotia salicis [Leucoma salicis], a pest of poplar (Populus spp.), willow (Salix spp.) and other trees, was studied in Poland in 1972-1978. These viruses were the most important pathogens limiting populations of the pest. The results indicated that the viruses may be used for the biological control of L. salicis; they can easily be mass-produced and applied.

1982

1982. Pests of poplars: Cytospora chrysosperma. *Informations Foret*. 4: 377-381.

C. chrysosperma [Valsa sordida] is generally found on young plants in poor nursery or stand conditions, i.e. it is a parasite of plants which are already weakened. Spores enter the tree through wounds, and the parasite causes the death of the affected part. V. sordida can survive as a parasite or a saprophyte.

Akinyemiju, O.A.; Dickmann, D.I. 1982. Contrasting effects of simazine on the photosynthetic physiology and leaf morphology of two Populus clones [P. 'I-45/51 and P. 'NE-388']. *Physiologia Plantarum*. 55(3): 402-406.

Archambault, L. 1982. Impact of Hypoxylon canker on the aspen of 2 forest stands in Quebec. *Forestry Chronicle*. 58(3): 139-142.

In 78 forest stands of Populus tremuloides at Portneuf and Grand-Portage, analyses were carried out on the frequency of the disease in relation to stand characteristics.

Bubnova, T.V. 1982. New data on the fauna of noctuids of the western Altai. In: Zolotareno, G.S., ed. *Poleznye i vrednye nasekomye Sibiri*. Novosibirsk, USSR: Izdatel'stvo "Nauka", Sibirskoe Otdelenie: 113-116.

On the basis of collections carried out between 1978 and 1980, 17 species of Noctuidae occurring in the western Altai Mountains of Siberia, USSR, are listed, 9 of which are new to the Altai fauna. This list brings the total number of noctuid species known to the study area to 393.

Caetano, M.F.F. 1982. Some data on a poplar disease due to Dothichiza populea Sacc. & Briard in Portugal. Agros. 67(1): 5-8.

Cryptodiaporthe populea was recorded on poplar. Symptoms and control measures are discussed.

Chandrashekar, M. 1982. Effect of some chemicals employed in the detached leaf culture of Populus on the infection of Melampsora larici-populina. European Journal of Forest Pathology. 12(6/7): 301-308.

Chen, Z.C.; Manion, P.D. 1982. Histoenzymological approach for detecting host-parasite interactions in forest trees caused by heart-rot diseases (Populus tremuloides, Phellinus tremulae). In: Heybroek, H.M.; Stephan, B.R.; von Weissenberg, K., eds. Resistance to diseases and pests in forest trees: Proceedings, 3d International workshop on genetics of host-parasite interactions in forestry; 1980 September 14-21; Wageningen, The Netherlands. Wageningen, The Netherlands: Centre for Agricultural Publishing and Documentation: 187-193.

Chlodny, J. 1982. Remarks on the threat of insect pests to forest stands and reafforestation in the Upper Silesian industrial region. Sylvan. 126(5): 19-26.

A review of studies in heavily polluted areas in this part of Poland shows that Brachonyx pineti caused most needle damage to Scots pine, Pissodes piniphilus, and Tomicus piniperda were the major secondary pests and Sirex sp., Trypodendron lineatum [Xyloterus lineatus], Crioccephalus rusticus [Arhopalus rusticus], and Monochamus galloprovincialis the major wood borers. Saperda populnea was a serious pest of Populus tremula and Adelges laricis the major pest of Larix decidua.

Figaj, J.; Stecki, Z. 1982. Influences of SO₂ on poplar clones selected in Kornik. Arboretum Kornickie. 26: 173-179.

Twenty-two Kornik clones and three of P. maximowiczii were subjected to 4-hour exposures of SO₂ in fumigation chambers. Results showed that P. 'Marilandica', P. 'Kornik 10' (P. maximowiczii X P. trichocarpa), P. 'Kornik 33' (P. maximowiczii X P. nigra), and P. 'Kornik 42' (P. pyramidalis X P. laurifolia) were subject to damage at all concentrations whereas P. maximowiczii 292, P. 'Kornik 6' (P. maximowiczii X P. trichocarpa) and P. 'Kornik 41' (P. angilata X P. berolinensis) showed reasonable resistance. Results also showed that SO₂ effects on growth do not always correspond to the degree of damage observed. Results are discussed in relation to methods of screening for SO₂ resistance.

Finet, Y.; Gregoire, J.C. 1982. A study of poplar resistance to Phratora (= Phyllodecta) vitellinae L. (Coleoptera: Chrysomelidae). 2. Field observations (Populus deltoides X nigra, Populus trichocarpa X deltoides). Journal of Applied Entomology. 94(4): 363-376.

Fletcher, R. 1982. Tree diseases--bane of aspen. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest Experiment Station. Forestry Research West: 12-14.

Gupta, V.K. 1982. Fungi involved in soil borne diseases of forest and fruit trees. In: Khosla, P.K., ed. Improvement of forest biomass: Symposium proceedings. Solan, India: Indian Society of Tree Scientists: 441-447.

Hardin, Edward Dennis. 1982. Patterns in floodplain herbaceous vegetation and some aspects of the population biology of Populus deltoides Bartr. on the Hocking River, Ohio. Dissertation Abstracts International. 43/12-B: 3833.

Periodic soil disturbance by floodwaters form depressions downstream of floodplain trees. Litter and debris accumulate upstream of trees. Disturbances around floodplain trees affect the dominant rhizomatous perennial, Laportea canadensis, in the vegetative regeneration phase of its life history, lowering stem density on the downstream side of trees at both ground level and 0.5 m above ground.

Harris, J.W.E. 1982. Poplar-and-willow borer. Pest Leaflet. FPL-7. Victoria, BC: Canadian Forest Service, Pacific Forest Research Centre. 4 p.

In North America, the introduced weevil Cryptorhynchus lapathi (L.) sometimes becomes a pest by deforming or killing willows (Salix spp.) and poplars (Populus spp.) in plantations, gardens, and parks. The distribution, food-plants, recognition, biology, injuriousness, and control of the weevil are described.

Heather, W.A.; Chandrashekar, M. 1982. Evolutionary, epidemiological and ecological implications of forms of resistance in Populus spp. to Melampsora leaf rust. Australian Forest Research. 12(3): 231-244.

Hu, Y.Y.; Dai, H.K.; Hu, C.S. 1982. A preliminary study on poplar scale-insect Quadrastpidiotus gigas (Thiem et Gerneck). Scientia Silvae Sinicae. 18(2): 160-169.

A description is given of the biology and life cycle of this important poplar pest in China. The chief species injured are Populus berolinensis and P. simonii. Plantations are devastated over a large area. The most effective insecticides for control of newly hatched larvae are (in descending order): calcium polysulphide, abietic acid, omethoate, and fussol.

Ives, W.G.H.; Muldrew, J.A.; Smith, R.M. 1982. Experimental aerial application of forest tent caterpillar baculovirus. Inf. Rep. NOR-X-240. Edmonton, AL: Canadian Forest Service, Northern Forest Research Centre. 9 p.

Nuclear polyhedrosis virus was sprayed in Alberta at various times in 1978, 1979, and 1980 for control of Malacosoma disstria on Populus tremuloides. Mortality varied with virus concentrations, time of application, and larval instar. Some treatments increased total larval mortality, but none provided any foliage protection.

Krawiarz, K.; Oleksyn, J.; Karolewski, P. 1982. Effect of NO₂ on photosynthetic pigments in the leaves of Populus 'Hybrida 280'. Arboretum Kornickie. 26: 163-172.

Poplar cuttings were exposed to NO₂, and pigment contents measured immediately or 24 hours after exposure. Chlorophylls a and b and phaeophytin contents increased with exposure up to 5 hours when necroses started to appear; thereafter chlorophyll contents decreased while phaeophytin content

continued to increase. The initial increase in chlorophylls may result from stimulation of their synthesis by nitrate which is later overtaken by chlorophyll degradation to phaeophytin in the acid environment.

Mann, G.S. 1982. First record from India of Pygaera restitura Walker as a pest of poplar, with observations on the biology of the pest. *International Journal of Entomology, India*. 1(1): 61-64.

An outbreak of Clostera restitura (Wlk.) (Pygaera restitura) is reported on poplar (Populus) at Ludhiana, Punjab, India, where the tree is an important planted ornamental. Larval feeding gave the trees a withered appearance. All stages in the life-history were present in September-December, 1975, indicating that there were overlapping generations.

Mann, G.S. 1982. Pygaera restitura Walker. A pest of poplars at Ludhiana, Punjab. *Indian Forester*. 108(3): 237-238.

The author describes all stages of Clostera restitura (Wlk.) (Pygaera restitura). Larvae of this notodontid were found causing severe damage to the foliage of poplars (Populus sp.) at Ludhiana in the Punjab, India, in October 1975. All stages were present from September to December, indicating overlapping of the generations.

McNabb, H.S., Jr.; Hall, R.B.; Ostry, M.E. 1982. Biological and physical modification of the environment and the resulting effect upon the host-parasite interactions in short-rotation tree crops. In: Heybroek, H.M.; Stephan, B.R.; von Weissenberg, K., eds. *Resistance to diseases and pests in forest trees: Proceedings, 3d International workshop on genetics of host-parasite interactions in forestry; 1980 September 14-21; Wageningen, The Netherlands*. Wageningen, The Netherlands: Centre for Agricultural Publishing and Documentation: 60-71.

Martynov, E.N. 1982. Effect of elk on the formation of young Populus tremula stands. *Lesovodstvo, Lesnye Kul'tury i Pochvovedenie*. 11: 34-45.

Damage by elk [Alces alces] was studied in stands of different age and composition in Leningrad province. Damage mainly involved browsing and was heavy in stands of low density falling to almost zero in dense stands. In stands up to 20 years old, damage averaged 50 percent, with up to 100 percent in stems of 2 cm diameter down to almost zero in stems over 10 cm diameter. Wounds take an average of 15 years to heal, and stem form tends to recover eventually. However, decay organisms which were present in nearly all wounds continue to develop.

Masutti, L. 1982. The insects of Euroamerican poplars and their original food-plants. Ecological aspects of problems of prevention and control. *Arboricoltura da Legno*. 25(5): 8 p.

In this study of plantations of rapidly growing hybrid poplars (a cross between Populus deltoides and P. nigra [P. canadensis]) in Italy and of the insects attacking them, the artificial nature of the habitat is emphasized. The clonal nature of the trees and the absence of underbrush can result in potential pests being better able to adapt to them than to other food-plants. The rapid growth of the hybrids is their one advantage, enabling them to

compensate for defoliation. Saperda carcharias (L.), causes more economic damage than any other pest.

Melekhov, E.I.; Anev, V.N.; Es'kin, A.B.; Melekhova, T.A. 1982. The significance of tumor growth in herbicidal effect of 2,4-D. Soviet Agricultural Sciences. 4: 30-32.

Munjal, R.L.; Kaul, J.L.; Thakur, M.S.; Gupta, V.K.; Dhanda, R.S.; Sharma, J.R.; Lakhanpal, T.N.; Sharma, N.K.; Nath, A.; Thapa, C.D.; Verma, T.D.; Dhaliwal, H.S.; Verma, A.K. 1982. Session-7. Pests and pathogens of trees. In: Khosla, P.K., ed. Symposium proceedings: Improvement of forest biomass; n.d.; Solan, India. Solan, India: Indian Society of Tree Scientists, H.P. Agricultural University: 435-468.

Six papers: Studies on diseases of olive in Himachal Pradesh. Fungi involved in soil borne diseases of forest and fruit trees. Preliminary observation on Eucalyptus hybrid against 'chlorosis' and dieback. Mycorrhiza-forming species in the family Boletaceae. Nematodes associated with forest nurseries. Insect-pest complex of poplars in India and its management.

Pesarini, F. 1982/1983. Hymenoptera Symphyta of the Piedmont plain in Lombardy. I. Faunistic survey. Bollettino di Zoologia Agraria e di Bachicoltura. 17: 63-113.

A list is given of 130 species of Hymenoptera Symphyta that were found in the high plain between the Olona and Adda Rivers in western Lombardy, Italy. Literature records and notes on biology and food-plants and distribution in the world and in Italy are given. The food-plants were mainly forest trees and wild flowering plants.

Ride, M. 1982. International bacterial canker testing programme on poplar. In: Heybroek, H.M.; Stephan, B.R.; von Weissenberg, K., eds. Resistance to diseases and pests in forest trees: Proceedings, 3d International workshop on genetics of host-parasite interactions in forestry; 1980 September 14-21; Wageningen, The Netherlands. Wageningen, The Netherlands: Centre for Agricultural Publishing and Documentation: 478-486.

Sachsse, H. 1982. Damage in living Populus 'Muhle-Larsen'. Holz als Roh- und Werkstoff. 40(12): 461-469.

Anatomical studies were made in N. Rhine-Westphalia in 1981-1982 on stem sections obtained from trees with boles exhibiting vertical fissures 30-40 mm long. Samples were from 13-14 year old P. 'Muhle-Larsen' and 16-year-old P. 'Androscoggin'. The cause of damage was determined to be rapid radial growth in early summer, leading to severe stresses in, and subsequent cracking of bark. Timber quality in damaged trees was reduced by callus formation and discoloration.

Sapio, F.J.; Wilson, L.F.; Ostry, M.E. 1982. A split-stem lesion on young hybrid Populus trees caused by the tarnished plant bug, Lygus lineolaris (Hemiptera (Heteroptera): Miridae) (Wisconsin). The Great Lakes Entomologist. 15(4): 237-246.

Semoradova, E.; Materna, J. 1982. Salt treatment of roads in winter: the response of trees and the content of chlorine in their assimilation organs. *Scientia Agriculturae Bohemoslovaca*. 14(4): 241-260.

To assess the likelihood of damage occurring as a result of road salting, pot trials were carried out to determine the mortality of seedlings of 15 tree species grown at different rates of salt application. Tree seedlings were also grown in roadside situations to compare mortality values. Picea excelsa, Larix europaea, Acer pseudoplatanus, and Sorbus aucuparia were highly sensitive to salt. Picea pungens, Pinus mugo, Quercus rubra, Quercus robur, and Robinia pseudoacacia were very resistant. Chlorine content of the assimilation organs showed a direct relationship with mortality in the pot trial.

Sharma, I.K.; Heather, W.A. 1982. Temperature sensitivity of the antagonism of Cladosporium species to races of Melampsora larici-populina Kleb. on cultivars of Populus x euramericana (Dode) Guinier. *Journal of Phytopathology*. 105(1): 61-70.

Sharma, N.K.; Nath, A.; Thapa, C.D. 1982. Nematode associated with forest nurseries. In: Khosla, P.K., ed. Improvement of forest biomass: symposium proceedings. Solan, India: Indian Society of Tree Scientists: 459-461.

Singh, S.J.; Heather, W.A. 1982. Assessment in vitro of resistance in cultivars of Populus to Melampsora medusae Thum. leaf rust. *Australian Forest Research*. 12(1): 37-45.

Singh, S.J.; Heather, W.A. 1982. Temperature-light sensitivity of infection types expressed by cultivars of Populus deltoides Marsh. to races of Melampsora medusae Thum. *European Journal of Forest Pathology*. 12(6/7): 327-331.

Siwecki, R.; Werner, A.; Krzan, Z.; Mlodzianowski, F. 1982. Resistance mechanisms in interactions between poplars and rust. In: Heybroek, H.M.; Stephan, B.R.; von Weissenberg, K., eds. Resistance to diseases and pests in forest trees: Proceedings, 3d International workshop on genetics of host-parasite interactions in forestry; 1980 September 14-21; Wageningen, The Netherlands. Wageningen, The Netherlands: Centre for Agricultural Publishing and Documentation: 130-142.

Starkey, D.A.; Mistretta, P.A.; Atkinson, K.L. 1982. Cottonwood decline and mortality along the Beaver River and tributaries in Texas County, Oklahoma. In: Proceedings of the 34th annual meeting, "Windbreaks: what are they worth?"; 1982 June; Dodge City, KS. Publ. 106. Lincoln, NE: Great Plains Agricultural Council: 220-232.

Tempere, G. The Rhamphus of the French fauna. Description of a new species (Col. Curculionidae). *Entomologiste*. 38(1): 9-16.

A key to the 4 species of Ramphus recorded from France is given. Only 2 species were known previously. Attention is now drawn to R. subaeneus Ill., which attacks mainly Crataegus spp. but also occasionally causes considerable damage to pear, and to a new species, which is described.

Walters, J.W.; Hinds, T.E.; Johnson, D.W.; Beatty, J. 1982. Effects of partial cutting on diseases, mortality, and regeneration of Rocky Mountain aspen stands. Res. Pap. RM-240. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 12 p.

Plots were established in 1974 and 1975 in commercial stands dominated by Populus tremuloides in N. New Mexico and S. Colorado, that had been partially felled in the previous 3 years. Unfelled plots were established in 1976. Logging wounds predisposed trees to attack by insects and diseases. Some 5-7 years after felling, 45 percent of aspens were infected with cankers (Ceratocystis fimbriata, Cenangium singulare, Cryptosphaeria populina, and Cytospora chrysosperma [Valsa sordida]), 20 percent had died and 30 percent were infested with wood borers.

Zhang, Z.Z.; Xia, N.B.; Wu, F.N. 1982. A preliminary study on the willow rusty notodontid Clostera rufa (Luh). *Scientia Silvae Sinicae*. 18(3): 279-288.

The life cycle and biology of C. rufa are described. The insect is a serious pest of poplar and willow (especially Populus yunnanensis and Salix heromera) in Yunnan Province. Effective insecticides were Sevin [carbaryl], phoxim, and Pipter.

Zhong, Z.K. 1982. Study on poplar canker caused by Dothichiza populea. *Journal of North-Eastern Forestry Institute*. 2: 63-69.

D. [Cryptodiaporthe] populea was isolated from canker on poplar trees and demonstrated as the causal agent of the disease by artificial inoculation in the laboratory and the field. The occurrence of the disease was closely linked with insect pests on the trunk and the resistance of the poplar species concerned. The best medium is malt powder and PDA.

1983

Ahmad, S.I.; Sen-Sarma, P.K. 1983. Investigation on a newly recorded nuclear polyhedrosis virus of Pygaera fulgurita Wlk. I. Nature of disease and insect-virus interactions. *Journal of Entomological Research*. 7(2): 150-153.

The characteristics of a nuclear polyhedrosis virus isolated from Clostera fulgurita (Wlk.) (Pygaera fulgurita), a pest of poplar (Populus) in northern India, were studied in the laboratory in Uttar Pradesh using field-collected diseased larvae. The disease was characterized by colour change and rapid disintegration of infected larvae. Healthy larvae could become infected by feeding on poplar leaves (P. deltoides) sprayed with a crude suspension of the virus.

Apel, K.H. 1983. Identification characteristics of important pests of stems of broadleaf trees. *Sozialistische Forstwirtschaft*. 33(4): 122-125.

An illustrated key to pests occurring in E. Germany, based on damage characteristics and morphology of insects breeding in oak, beech, ash, elm, birch, hornbeam, poplar/willow, etc.

Arshad, M.; Hafiz, I.A. 1983. Field incidence of Beauveria bassiana (Bals.) Vuill., on Indarbela quadrinotata Wlk., Pseudarbelidae: Lepidoptera. *Bulletin of Zoology*. 1: 11-16.

The fungus Beauveria bassiana was found infecting larvae of Indarbela quadrinotata Wlk. on Terminalia arjuna, Populus X canadensis (X euramericana) and P. nigra in Pakistan.

Biggs, A.R.; Davis, D.D.; Merrill, W. 1983. Cutting development and restriction of wound-associated infection in Populus. Canadian Journal of Plant Pathology. 5(4): 269-272.

Cuttings of P. hybrid NE-388 (P. maximowczii X trichocarpa) were inoculated at regular intervals after planting with mycelium of Cytospora chrysosperma [Valsa sordida]. Canker size after 1 week was correlated positively with preinoculation bark relative turgidity as well as root and shoot length, and negatively with preinoculation bark water potential.

Biggs, A.R.; Davis, D.D.; Merrill, W. 1983. Histopathology of cankers on Populus caused by Cytospora chrysosperma. Canadian Journal of Botany. 61(2): 563-574.

Bono, J.J.; Gas, G.; Boudet, A.M.; Fayret, J.; Delatour, C. 1983. Comparative study of the degradation of lignocelluloses by different isolates of Fomes annosus. Canadian Journal of Microbiology. 29(12): 1683-1688.

Although F. annosus [Heterobasidion annosum] occurs mainly on coniferous wood, poplar lignins were degraded more extensively than those of spruce (Picea abies). The rate of ligninolysis was increased on media with a low N content. Differences between H. annosum and other white rot fungi are indicated.

Boudier, B. 1983. Pests of Italian poplar. Control of leaf browning caused by Marssonina populi. P.H.M. - Revue horticole. 238. Paris, France: Syndicat National de la Presse Agricole: 35-42.

Burke, J.M. 1983. Micro-organisms infecting the large aspen tortrix, Choristoneura conflictana Wlk. Inf. Rep. FPM-X-61. Sault Ste. Marie, ON: Canadian Forest Service, Forest Pest Management Institute. 14 p.

Field-collected examples of Choristoneura conflictana, a pest of trembling aspen (Populus tremuloides) and other trees in Canada and the eastern USA, are infected with several microorganisms, including granulosis virus, entomopoxvirus, 3 species of microsporida and 3 species of fungi. Results demonstrated that widely separated geographic populations were affected by the same complement of microorganisms.

Brown-Skrobot, Susan Kay. 1983. Production of ethylene and carbon monoxide by Septoria musiva (fungi, plant pathogen, funga disease). Dissertation Abstracts International. 45/03-B: 778.

An investigation to determine the mechanism by which Septoria musiva causes the premature defoliation of cottonwood trees was undertaken. Gas chromatographic analysis of the atmosphere overlying the original culture indicated that this fungus produced significant quantities of ethylene and carbon monoxide. The addition of ashed leaves or metallic iron, zinc, or boron to a mineral salts medium containing methionine and glucose resulted in the production of both carbon monoxide and ethylene. Growth of S. musiva on cottonwood cuttings resulted in ethylene production and defoliation.

Capretti, P. 1983. Damage due to Hypoxylon mammatum Mill. on aspen. Informatore Fitopatologico. 33(7/8): 47-49.

An outbreak near Monticiano (Siena), probably influenced by the Mediterranean climate, is described.

Cavalcaselle, B.; de Bellis, E. 1983. Experiments with new low-toxicity insecticides against subcortical larvae of Cryptorhynchus and Saperda. Cellulosa e Carta. 34(5): 29-34.

Trials were performed between 1979 and 1982 to determine the effectiveness of 22 insecticides against newly hatched larvae of C. lapathi and S. carcharias, both of which are pests of poplars. Insecticide emulsions were sprayed on artificially-infested bark of 1-year-old Populus spp. Results show that trichlorfon, was one of the most effective and economical against C. lapathi. Chlorpyrifos-methyl and jodfenphos were more effective than trichlorfon against S. carcharias.

Chandrashekar, M. 1983. Climatic influences in the management of poplar leaf rust. Indian Forester. 109(9): 632-635.

Laboratory tests on detached leaves or leaf discs of several poplar (Populus deltoides) cultivars indicated that resistance to Melampsora larici-populina is differentially sensitive to temperature and light intensity. The results are discussed in relation to the effects of daily and seasonal fluctuations in temperature in the field in preventing one race of the pathogen becoming dominant at the expense of others and to the implications on natural ecosystems and the management of poplar groves.

Chandrashekar, M. 1983. The effect of temperature, light intensity and their interaction in the partial resistance of certain poplar cultivars to physiologic races of Melampsora larici-populina Kleb. Forestry Abstracts. 44(10): 599-600.

Chen, H.M.; Li, G.H. 1983. A preliminary observation on Orthosia incerta. Forest Science and Technology. 11: 23-24.

O. incerta is distributed in Heilongjiang, Taiwan, and the plains near the foothills of Tianshan Mountain in north Xinjiang, and attacks more than 10 tree species including poplars, Chinese ash [Fraxinus chinensis], and apple. The insect population may be partly reduced by digging out the larvae manually or using fluorescent lights to attract the moths. Spraying with crystals of Dipterex [trichlorphon], fenitrothion, and emulsion of 80 percent DDVP [dichlorvos] diluted to 500-1000 X gives larval control of over 95 percent.

Clarke, B.B. 1983. The impact of cadmium and ozone on foliar symptom development, mineral composition, growth, yield and quality of woody and herbaceous plants. Dissertation Abstracts International. 43/10-B: 3088.

The order of foliar susceptibility of 3 field-grown potato cv. to oxidants applied as soil drenches was Norland more than Norchip more than Green Mountain. Time of maximum plant sensitivity was also cv-dependent. Anti-oxidant EDU significantly reduced foliar symptoms but benomyl did not. Cd-treated Populus tremuloides was more susceptible to foliar ozone toxicity than untreated plants.

Coomans, A.; De Waele, D. 1983. Species of Aphanolaimus from Belgium. Hydrobiologia. 101(3): 165-178.

A. pseudoattenuatus n.sp. from wet soil around the roots of Populus at Assent in Belgium is described and figured. It differs from A. attenuatus in its greater body length, shape of the head and amphidial fovea and the larger cephalic setae. A. attentus and A. aquaticus are also fully described. The chief diagnostic characters are discussed and the position of the first and second body pores and the caudal gland system are described.

Domanski, S. 1983. Fungi that destroyed a Populus tremula stand in Lagow Lubuski. European Journal of Forest Pathology. 13(3): 166-173.

The decay of a 20-year-old P. tremula stand growing on old agricultural wasteland was observed each year in August, 1975-1981. Sixteen species of pathogenic and saprophytic fungi were found on dying and dead trees, which were usually infected by fungi attacking roots. Stand decay was thought to be due to an unfavourable site with sandy soil.

Egyed-Balint, K.; Terpo, A. 1983. Effect of red slurry on growth and element accumulation in some plant species. Kerteszeti Egyetem Kozlemenyei. 47: 127-136.

Red slurry arising as a byproduct of aluminium extraction contaminates the environment, especially when exposed to erosion by wind. In an experiment in Hungary, seeds were sown and rooted plants were planted on red slurry areas. Root suckers were formed by Ailanthus altissima, Populus alba, and Robinia pseudoacacia; fruit was borne by Amorpha fruticosa, Elaeagnus angustifolia, and R. pseudoacacia. Significant amounts of Na and Fe were accumulated by several tree species.

Finet, Y.; Pasteels, J.M.; Deligne, J. 1983. A study of poplar resistance to Phyllodecta vitellinae L. (Coleoptera, Chrysomelidae). 3. Laboratory experiments. Journal of Applied Entomology. 95(2): 122-133.

Frochot, H.; Pitsch, M.; Wehrlein, L. 1983. Herbicide efficiency in mistletoe (Viscum album Mali) growing on poplar. In: Compte Rendu de la 12e Conference du COLUMA. Tome I; Paris, France. Comite Francais de Lutte Contre les Mauvaises Herbes: 157-165.

Ways of improving the speed and reliability of herbicide activity against V. album were studied using parasitized poplar cuttings. Herbicides were sprayed before poplar bud burst. The results are provisional.

Furukawa, A. Katase, M.; Ushijima, T.; Totsuka, T. 1983. Inhibition of photosynthesis of poplar species by ozone. Journal of the Japanese Forestry Society. 65(9): 321-326.

Potted plants of 3 species (Populus 'I-214', P. 'FS-51' - P. maximowiczii X plantierensis, and P. 'Peace' - P. koreana X trichocarpa) grown from cuttings and differing widely in foliar susceptibility to O₃ were exposed to various O₃ concentrations for 2 hours in a cylindrical assimilation chamber. Rates of net photosynthesis and transpiration were measured simultaneously during and after exposure and estimates were made of diffusive resistances to CO₂ transfer. Photosynthesis was inhibited by O₃ in all 3 species. Transpiration was inhibited by O₃ in P. 'I-214' and P. 'FS-51' but not in P. 'Peace'.

Gallagher, P.W.; Sydnor, T.D. 1983. Promotion of wound closure in shade trees with exogenously-applied growth regulators. *Journal of Arboriculture*. 9(9): 229-232.

Wounds of diameter and depth 1 cm were made in roadside Acer rubrum in Ohio in May 1980 and covered with a strip of black plastic. Each wound was injected with 3 growth regulators. Injection of 2,4-D at 1000 mg/litre initially increased closure, but the effect was no longer significant by the end of the season. Ethephon and benzyladenine inhibited closure at 1000 mg/litre.

Goidanich, G. 1983. Adverse factors affecting ornamental trees. *Informatore Fitopatologico*. 33(5): 18-23.

In this 3rd part of a series on the pests and diseases affecting ornamental trees in Italy, the damage and wounds caused by cultural practices and inclement weather, the decay organisms to which old trees are subject, and 2 major beetle pests are discussed. Saperda carcharias (L.) is a severe pest of poplar. The main pest of elm is Xanthogaleruca luteola (Mull.) (Galerucella luteola), other related chrysomelids are listed that are minor pests of trees in avenues and urban parks.

Gonzalez, R.H.; Barria, P.G. 1983. Sex pheromone in the detection of the San Jose scale Quadraspidiotus perniciosus (Comst.). *Revista Fruticola*. 4(2): 43-47.

Details are given of studies in Chile in which traps baited with the sex pheromone of Quadraspidiotus perniciosus (Comst.) (7-methyl-3-methylene-7-octenyl propanoate) were used successfully in apple orchards to monitor populations, to detect cryptic foci of infestation and to determine the time of appearance of the adults in different localities. The authors also discuss the problem presented by the presence on some apples sent for export of the morphologically similar scale insect Diaspidiotus ancyclus (Putn.). Consignments of fruit have been rejected at ports because of the presence of this species, which develops mainly on Robinia pseudacacia and poplar [Populus].

Gorbunov, A.F.; Mishnev, A.K. 1983. Needle-eating pests of forest stands in southern Ukraine. *Lesovodstvo i Agrolesomelioratsiya*. 66: 53-58.

Surveys of insect pests were made in 1976-1981 in broadleaved stands in Kherson, Nikolaev, and Odessa provinces where the most important species are oak [Quercus robur], robinia, poplar, willow, and hornbeam. Information is given on the 6 major species. Natural population controls play a significant role in limiting damage in many cases. Spraying with a 0.5 percent aqueous suspension of Dendrobacillin [Bacillus thuringiensis var. dendrolimus] at 1200 litres/ha gave 75-90 percent control of 3-4th instars of E. chrysorrhoea and 85 percent control of 1-2nd instars of M. neustria.

Hall, R.J.; Still, G.N.; Crown, P.H. 1983. Mapping the distribution of aspen defoliation using Landsat color composites. *Canadian Journal of Remote Sensing*. 9(2): 86-91.

Annual monitoring of aspen [Populus] defoliation in central-western Canada (caused mainly by the forest tent caterpillar, Malacosoma disstria) is accomplished primarily by aerial observation and sketch-mapping surveys,

carried out by the Forest Insect and Disease Survey Unit of the Canadian Forest Service in conjunction with other agencies. These methods commonly give overestimates of affected areas and are impractical in remote localities. A study was therefore conducted to assess the applicability of visual image analysis of multirate Landsat colour composites for mapping defoliated areas. The affected areas were more accurately mapped by the Landsat method than the aerial survey map.

Hart, R.T. 1983. The effect of potash dust emissions on vegetation. In: McKercher, R.M., ed. Potash technology. Oxford, UK: Pergamon Press Ltd.: 835-840.

Research into the effect of KCl emissions on vegetation is briefly reviewed. Woody vegetation close to refineries is susceptible to damage due to aerial uptake of chloride. The impact on aspen (Populus tremuloides), the most common woody species in the vicinity of Saskatchewan potash refineries, and the interaction of environmental factors and emissions characteristics are discussed.

Heymans, P.; Deligne, J.; Nef, L. 1983. Influence of genetical and environmental factors on the resistance of poplars to attack by Gypsonoma aceriana Dup. Mededelingen van de Faculteit Landbouwwetenschappen, Rijksuniversiteit Gent. 48(2): 293-302.

Infestation by Gypsonoma aceriana (Dup.) of young poplars of clones from the 3 main groups Populus trichocarpa, P. trichocarpa X deltoides, and P. deltoides X nigra was studied in Belgium for 5 years. The difference between groups and between clones appears to be connected with the phenology of the trees, the clones with the leaves opening earliest being the most susceptible to attack. Clonal susceptibility was also correlated with growth percentages. Clones varied also in their reaction to feeding damage on the twigs, some efficiently sealing over injuries while others formed galls. Taller trees tended to be more heavily infested than shorter ones of the same age.

Jessop, L. 1983. The British species of Anthocoris. Entomologist's Monthly Magazine. 119(1432/1435): 221-223.

From nymphs found in galls of Pemphigus spyrothecae Pass. on poplars (Populus nigra var. italica (P. italica)) in London in 1980-1982, Anthocoris minki Dohrn is correctly recorded from the United Kingdom for the first time. A key is provided.

Kazemi, M.H.; Damanabi, K. 1983. Nyssia graecarius Stgr. a new pest of fruit trees in Iran. Entomologie et Phytopathologie Appliquees. 51(1/2): 11-16.

Nyssia graecarius (Stgr.) is recorded as a new leaf pest of various trees in Iran including rosaceous fruit trees, walnut, poplar, and elm. The pupae overwintered in the soil and were parasitized by Villa albifacies (Macq.).

Ke, L.S.; Xin, J.L. 1983. Notes on three new species of the genus Typhlodromus. Entomotaxonomia. 5(2): 185-188.

The authors describe 3 new species of the phytoseiid genus Typhlodromus, which were collected as females in north-western Yunnan, China, in 1980 - T. macrum sp.n., T. cannabis sp.n., and T. ribei sp.n.

Kechel, H.G. 1983. Pollaccia radiosa on poplars of section Leuce. Holzzucht. 37(3-4): 42-46.

Natural rates of infection of leaves, branches, and main stems by P. radiosa [perfect phase = Venturia tremulae] were studied in August 1979-1982 at Weserkamp Vaake (Hesse). Populus material included (a) P. tremula, (b) controlled crosses within P. tremula or P. tremuloides, and (c) seedlings of P. tremula resistance was greatest in (a), least in (c).

Kechel, H.G. 1983. Rust infection in Populus sections Aigeiros and Tacamahaca. Holzzucht. 37(3-4): 47-52.

Intensity of attack by Melampsora larici-populina in 1982-1983 is tabulated for 328 clones established at Weserkamp Vaake (Hesse). Resistance differed at the level of section, species, and clone.

Lastuvka, Z. 1983. A contribution to the biology of clear-wing moths. Acta Universitatis Agriculturae Brno, A (Facultas Agronomica). 31(1/2): 215-223.

Notes are given on the biology and ecology of some sesiids collected in Czechoslovakia in 1973-1980. Except for Paranthrene tabaniformis (Rott.) and Sesia apiformis (Cl.), which are pests of poplar [Populus], little was previously known of the biology and food-plants of these species. They included Pennisetia hylaeiformis (Laspeyres), Sesia bembeciformis (Hb.), Synanthedon scoliaeformis (Bkh.), S. spheciformis (Denis & Schiff.), and S. flaviventris (Stgr.).

Liu, R.K.; Shen, G.W.; Liu, X.J. 1983. A study on physiological responses of plants to SO₂ II. SO₂ injury and the protective effects of stomata and ABA. Plant Physiology Communications. 4: 25-28.

Using Viburnum sargentii, Ulmus pumila, Gleditsia japonica, Robinia pseudoacacia, Acer negundo, Fraxinus rhynchophylla, Prunus padus, Salix matsudana, Forsythia suspensa, Populus canadensis, Syringa vulgaris, and Ricinus communis as experimental materials, stomatal number, size, and soaking grade of leaves in relation to SO₂ injury were studied in Liaoning, China. There was a close correlation between SO₂ damage and soaking grade which could be used as an index of susceptibility. ABA could alleviate the injury, and caused a reduction in soaking grade by the regulative effects of ABA on the stomata.

Lodos, N.; Kalkandelen, A. 1983. Preliminary list of Auchenorrhyncha with notes on distribution and importance of species in Turkey. XII. Family Cicadellidae. Typhlocybinae: Empoascini. Turkiye Bitki Koruma Dergisi. 7(3): 153-165.

In this 12th part of a series on the Auchenorrhyncha fauna of Turkey an annotated list is given of 17 species belonging to 6 genera from the tribe Empoascini of the family Cicadellidae, which were collected recently in Turkey, with notes on their distribution in the world and in Turkey, synonymy, rare or common status, months of collection, and food-plants where known. Empoasca populi Edw., Austroasca vittata (Leth.), and Asymmetrasca paolii (Ossiannilsson) were all recorded for the first time in Turkey.

Lou, W.; Qan, F.Z.; Li, Q.Y.; Shan, X.D. 1983. Study on the chemical control technique of poplar and willow borer. Journal of North-Eastern Forestry Institute, China. 11(2): 50-58.

Cryptorrhynchus lapathi is a major pest in Heilongjiang Province, causing death of many plantation trees of poplar and willow. Control methods used at present are quarantine, selection of resistant poplar varieties, and treatment with insecticides. Insecticides have achieved an efficiency of 90 percent.

McCracken, F.I.; Vann, S.R. 1983. Sound can detect decay in standing hardwood trees. Res. Pap. SO-195. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 6 p.

A continuous magnetic vibrator at 100 Hz or 1 kHz produced greater signal amplitudes when heart rot was present in stems of cottonwood (Populus deltoides), green ash (Fraxinus pennsylvanica) and willow oak (Quercus phellos) than in healthy stems. Decay was also detected by an increased transit time of a 150 kHz or 54 kHz pulse signal. The possibility of developing the methods to estimate diameter of the decay column is considered.

Medvedev, L.N. 1983. Chrysomelidae from Iran. Senckenbergiana Biologica. 64(1/3): 133-140.

A list is presented of 22 species of Chrysomelidae collected in Iran in 1978. The species new to the Iranian fauna included Agelastica alni orientalis Baly and Altica brevicollis Foudras.

Melchior, G.H.; Stephan, B.R.; Mohrdiek, O. 1983. Growth performance and Marssonina attack of Populus deltoides Bartr. grown in northern Germany. Silvae Genetica. 32(3/4): 65-71.

A total of 253 single tree seed lots of P. deltoides from Canada and the USA were tested for growth performance and Marssonina brunnea attack in field trials near Hamburg, W. Germany. Best growth in d.b.h. was shown by provenances from central and northern Illinois, followed by Minnesota, Ohio, and Wisconsin. These results indicate that the Great Lakes region is a suitable source for P. deltoides to be grown in N. Germany. Those from the South were unsuitable for the conditions in N. Germany. In relation to tree breeding, selection within artificial crossings of parent trees from promising provenances was more successful than selection within open-pollinated progenies.

Melichar, M.W.; Geyer, W.A. Loucks, W.L.; Deneke, F.J. 1983. Effects of late-growing-season inundation on tree species in the Central Plains. Journal of Soil and Water Conservation. 38(2): 104-106.

Recreational sites and tree planting programs should take into account submersion tolerance of the trees. Sixteen species of trees that were completely or partially submerged following late-summer flooding in central Kansas were observed. Cottonwood, hackberry, honeylocust, and mulberry, normally tolerant species, had high death and/or stress rates, while black walnut, normally an intolerant species, had only four percent of the observed trees die following inundation. Complete inundation increased the number of dead and/or stressed trees compared with partial inundation. Tree damage was affected also by the dormancy state of the trees at the time of inundation.

Misra, A.K.; Shedha, M.D. 1983. Remote sensing for detection of poplar dieback and canker complex. *Indian Phytopathology*. 36(3): 457-461.

Using multispectral aerial photographs of the scale 1:10,000 and viewed on the additive color viewer with different combinations of color filters and different light intensities, it was possible to detect trees infected by Valsa sordida and Dothichiza populea.

Mooi, J. 1983. Responses of some poplar species to mixtures of SO₂, NO₂ and O₃. In: Proceedings of the 12th International meeting for specialists in air pollution damages in forests, IUFRO section 2.09: Air Pollution; 1982 August 23-30; Oulu, Finland. *Aquilo, Botanica*. 19: 189-196.

In fumigation experiments, poplar seedlings were exposed for periods between 2 weeks and 4 months to SO₂, O₃, and NO₂ alone or in combination. Low concentrations of treatments containing O₃ caused severe premature defoliation and reduction in DM production.

Moore, L.M.; Wilson, L.F. 1983. Recent advances in research of some pest problems of hybrid Populus in Michigan and Wisconsin. In: Hansen, E.A., comp. Intensive plantation culture: 12 years research. Gen. Tech. Rep. NC-91. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 94-101.

Poplar and willow borer (Cryptorhynchus lapathi), cottonwood leaf beetle (Chrysomela scripta), tarnished leaf bug (Lygus lineolaris), poplar gall sawyer (a beetle, Saperda inornata [concolor]), spotted poplar aphid (Aphis maculatae) and septoria leaf spot and canker (Septoria musiva) are discussed.

Morelet, M. 1983. Preliminary experimental study of Pollaccia allied with poplars of the Leuce section. *Bulletin Mensuel de la Societe Linneenne de Lyon*. 52(4): 104-107.

Mosseler, A.J.; Hubbes, M. 1983. Erwinia spp. and a new canker disease of hybrid poplars in Ontario. *European Journal of Forest Pathology*. 13(5/6): 261-278.

Two Erwinia species are associated with a newly reported branch canker and dieback disease of hybrid poplars in Ontario, Canada. One is similar to E. carotovora [species carotovora]; the other is a strain of E. herbicola. Inoculation into tobacco gave a hypersensitive response and temporary chlorosis, respectively. Inoculation failed to produce cankers over 1 growing season, but xylem tissues were discoloured and degraded. It is concluded that these opportunistic organisms may be poplar pathogens under certain conditions, and may initiate cankers by producing IAA from tryptophan.

Naidenov, Ya. 1983. The distribution and importance of Dothichiza populea Sacc. et Briard. *Gorsko Stopanstvo*. 39(7): 9-13.

D. populea occurs on poplars throughout Bulgaria, causing the greatest damage in plantations on sites that are not ideal for poplar. Resistant clones include Populus 'I-214', P. 'Weltheimeipappel', and P. 'Bg-4'. Standard 1-year plants should be planted at a depth of not less than 60 cm. Pruning should be done in April-June, and the pruned branches removed and burnt.

Niemela, P. 1983. Seasonal patterns in the incidence of specialism: macrolepidopteran larvae on Finnish deciduous trees. *Annales Zoologici Fennici*. 20(3): 199-202.

Deciduous trees exhibit seasonal variation in the production of new leaves. The trees of the so-called *Quercus*-type (e.g. *Q. robur* and *Prunus padus*) produce new leaves mainly in spring, while new foliage in trees of the *Populus*-type (e.g. *Populus*, *Betula*, *Alnus*) is produced late in the season. On both tree types, 70-85 percent of the macrolepidopterous fauna consisted of generalized feeders early in the season. It is suggested that the seasonal species richness patterns of herbivores are also affected by the differences in the seasonal production of allelochemicals between these 2 tree types.

Noh, E.R.; Lee, S.B. 1983. Selection of superior clones in newly introduced resistant poplars. Res. Rep. 19. Suweon, Korea: Institute of Forest Genetics: 28-35.

Ostry, M.E.; Anderson, N.A. 1983. Infection of trembling aspen by *Hypoxyylon mammatum* through cicada oviposition wounds. *Phytopathology*. 73(7): 1092-1096.

An outbreak of *Magicicada septendecim* in 1976 caused extensive oviposition injury to 1- and 2-year-old branch wood of *Populus tremuloides* in a plantation established from progeny of controlled crosses. By 1982, 78 percent of the new cankers were associated with cicada wounds. Branch infections developed into lethal cankers on the main stems of many trees. Susceptibility appeared to differ among the progeny. Cicada wounds were also associated with cankers on surrounding wild aspen. Periodic high rates of infection in localized areas may be attributed to wounding by this insect.

Ostry, M.E.; McNabb, H.S., Jr. 1983. Diseases of intensively cultured hybrid poplars: a summary of recent research in the north central region. In: Hansen, E.A., comp. Intensive plantation culture: 12 years research. Gen. Tech. Rep. NC-91. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 102-109.

Leaf and stem diseases caused by *Melampsora*, *Marssonina*, and *Septoria* were serious.

Palaniswamy, P.; Chisholm, M.D.; Underhill, E.W.; Reed, D.W.; Peesker, S.J. 1983. Disruption of forest tent caterpillar orientation to baited traps in aspen groves by air permeation with (5Z,7E)-5,7-dodecadienal. *Journal of Economic Entomology*. 76(5): 1159-1163.

The orientation of adult males of *Malacosoma disstria* Hb. to traps baited with live females or a 3-component lure ((5Z,7E)-5,7-dodecadienal, (5Z,7Z)-5,7-dodecadienal and (Z)-7-dodecenal) in plots in groves of trembling aspen [*Populus tremuloides*] in Saskatchewan in 1981-1982 was disrupted when the 1st component was released from various numbers of uniformly spaced releasers. Behavioural observations indicated that, at lower release rates disruption was partly due to confusion and partly due to a reduction in search effort by the moths; at higher release rates, disruption was mainly due to a reduction in search effort.

Palotas, F. 1983. *Populus X euramericana* Guinier cv. Pannonia: Pannonia poplar. *Erdeszeti Kutatasok*. 74: 7-17.

A description of this new female clone bred by F. Kopecky in Hungary in 1961 and registered by the International Poplar Commission in 1980. P. 'Pannonia' is highly disease resistant and resembles P. 'Robusta' in its narrow crown and relatively high wood density. In trials on marginal poplar sites in Hungary, production was similar to or greater than that of P. 'I-214' and much higher than that of P. 'Robusta'.

Pasteels, J.M.; Rowell-Rahier, M.; Braekman, J.C.; Dupont, A. 1983. Salicin from host plant as precursor of salicylaldehyde in defensive secretion of chrysomeline larvae. *Physiological Entomology*. 8(3): 307-314.

Phyllodecta vitellinae (L.) (Phratora vitellinae) and Chrysomela tremula F. feed on Salix or Populus species. Their larvae, secrete salicylaldehyde. The authors demonstrate that salicylaldehyde is derived from salicin, a phenylglucoside present in the leaves of the host plant. The transformation of salicin into salicylaldehyde occurs in the defence glands since the beta-glucosidase activity is 4 times higher in their glands than in the gut. For generalist predators, such as ants, salicylaldehyde is a more potent deterrent than saligenin or salicin.

Rachwal, L. 1983. Tolerance variability of trees and shrubs to high concentrations of SO₂ and heavy metals. In: Proceedings of the 12th International meeting for specialists in air pollution damages in forests, IUFRO Section 2.09: Air Pollution; 1982 August 23-30; Oulu, Finland. *Aquilo, Botanica*. 19: 342-353.

Some 270 species and varieties (including 120 poplar clones) were included in trials established in 1973-1978 at distances of 800-1400 m from a copper smelter in Poland. In one trial leaf injury ranged from 10 percent to 90 percent survival in 1978 of 40 percent was shown by Acer pseudoplatanus, Populus candicans, S. nigra, and P. 'Marilandica'.

Reade, A.E.; McQueen, R.E. 1983. Investigation of white-rot fungi for the conversion of poplar into a potential feedstuff for ruminants. *Canadian Journal of Microbiology*. 29(4): 457-463.

Five wood-rotting fungi were compared for their ability to increase the digestibility of Populus tremuloides wood shavings. The in vitro rumen digestibility was increased from 30 percent at the start of fermentation to 72 percent after incubation for 8 weeks with Polyporus anceps; 64 percent after 4 weeks with Ganoderma applanatum; 62 percent after 4 weeks with Phanerochaete chrysosporium; 61 percent after 3 weeks with Polyporus versicolor [Coriolus versicolor]; and 42 percent after 4 weeks with Fomitopsis ulmarius. An increase in digestibility was accompanied by a reduction in lignin content. The highest digestibility values were comparable with those of conventional roughage feeds.

Reich, P.B. 1983. Effects of low levels of ozone and sulfur dioxide on growth and physiology of hybrid poplar and soybean. Dissertation Abstracts International, B. 44(6): 1669.

Using a new technique, unenclosed soybean cv. Hark and hybrid poplar (Populus deltoides X trichocarpa) plants were exposed to 0.15 microl O₃ and/or SO₂/1 in the field. No significant interactions were found between pollutants. Exposure to either pollutant had negative linear effects on

productivity. O₃ was 3 times more toxic than SO₂. The significance of low-level O₃ pollution in the environment is discussed.

Schreiber, L.R.; Krause, C.R.; Mayer, J.S. 1983. Treatment of poplar cankers with chlorothalonil, 1982. American Phytopathological Society. 38: 184.

Sharma, I.K.; Heather, W.A. 1983. Light sensitivity of the antagonism of Cladosporium species to races of Melampsora larici-populina Kleb. on cultivars of Populus X euramericana (Dode) Guinier. *Phytopathologische Zeitschrift*. 107(2): 131-139.

Antagonism of 5 Cladosporium species to uredinial production by 3 races of M. larici-populina on leaf discs of 4 poplar cultivars was generally higher with races A and E (but lower with race D) at high light intensity (LI) than low LI. Colonization was reduced when LI was increased. C. tenuissimum was the most, and C. cladosporioides the least, antagonistic to uredinial production and aggressive in colonizing uredinia. Implications for epidemic development and disease predictions are discussed.

Sharma, I.K.; Heather, W.A. 1983. Sensitivity to Cladosporium species of the reactions of cultivars of Populus X euramericana to races of Melampsora larici-populina. *Forest Ecology and Management*. 7(1): 49-56.

All five species of Cladosporium tested were found to be antagonistic to the production of uredinia by three races of Melampsora larici-populina on leaf discs cut from four cultivars of Populus X euramericana [P. canadensis]. Of the species employed, C. tenuissimum was the most active antagonist and colonizer of the uredinia. The possible epidemiological significance of the results is discussed.

Shirnina, L.V. 1983. The role of saprophytic fungi in the pathogenesis of poplar bark. 1. The composition of fungi on the surface of branches. *Mikologiya i Fitopatologiya*. 17(4): 301-305.

On branches of trees infected by Dothichiza [Cryptodiaporthe] populea considerably more fungi were detected on resistant varieties of Populus trichocarpa than on susceptible varieties of P. pyramidalis. Most fungi were found in the spring and autumn.

Singh, S.; Khan, S.N.; Misra, B.M. 1983. Status of Melampsora rusts on poplars in India. *The Indian Forester*. 109(10): 743-747.

Smith, D.R. 1983. Xiphydria prolongata (Geoffroy) adventive in North America. *Proceedings of the Entomological Society of Washington*. 85(4): 860-861.

Xiphydria prolongata (Geoffr.), of which the larvae bore in the wood of Populus, Salix, Acer, Ulmus, Alnus, Quercus, Platanus, and Betula all over Europe, is recorded for the first time in the USA and in the whole of North America, being found in Michigan in 1980 and in New Jersey in 1982. Characters are described by which it can be differentiated from the other 8 species known in North America.

Spiers, A.G. 1983. Host range and pathogenicity studies of Marssonina brunnea to poplars. *European Journal of Forest Pathology*. 13(3): 181-196.

On inoculation by an agar-leaf disc technique the 13 New Zealand isolates of M. brunnea showed uniform pathogenicity to 34 poplar cultivars, which differed markedly in susceptibility. Adaxial and abaxial leaf surfaces were equally susceptible. Comparative tests of 3 NZ and 14 overseas isolates of M. brunnea on 38 cultivars revealed great differences in pathogenicity. Routine use of first generation isolates and adoption of a standard inoculation technique for screening for resistance is urged.

Spiers, A.G. 1983. Host range and pathogenicity studies of Marssonina castagnei to poplars. European Journal of Forest Pathology. 13(4): 218-227.

Using the agar leaf disc technique, it was found that M. castagnei was not specifically pathogenic to Populus alba but also to cultivars of the sections Aigeiros (A), Tacamahaca (T), A X T, Leuce (L) X A and L X T. Cultivars of P. alba were susceptible on the adaxial leaf surface, those of P. alba X P. deltoides or yunnanensis on the abaxial surface. Infection levels rose rapidly with increasing inoculum up to 10⁴ conidia/disc (2.5 cm diameter). The potential threat of this pathogen could be reduced by routine screening of new selections for resistance.

Spiers, A.G. 1983. Studies of Marssonina and Drepanopeziza species pathogenic to poplars. In: Proceedings, 31st session of the FAO International Poplar Commission; 1982 September 6-10; Casale Monferrato, Italy. Aokautere, New Zealand: Soil Conservation Centre; 4, 41 p.

The 5 papers in this publication were presented to the Working Party on Diseases at the 31st session of the FAO International Poplar Commission, Casale Monferrato, Italy, 6-10 September 1982: taxonomy of Marssonina and Drepanopeziza species; seed transmission of M. brunnea; and host range and pathogenicity studies of M. brunnea and M. castagnei were discussed.

Spiers, A.G.; Hopcroft, D.H. 1983. Ultrastructural study of the pathogenesis of Marssonina species to poplars. European Journal of Forest Pathology. 13(7): 414-427.

The pathogenesis of M. brunnea, M. castagnei, and M. populi to susceptible poplar cultivars was examined by light and electron microscopy from conidial germination until sporulation. Prior to germination, the 2 conidial cells were separated by septal pore plugging and wall overgrowth. Both could form germ tubes which penetrated leaves directly by enzyme activity and indirectly through stomata. Six days after inoculation, hyphae had ramified throughout palisade and mesophyll tissues, causing penetrated cells to become moribund. Conidia were released by rupture of the cuticle and upper epidermal wall.

Spiers, A.G.; Wenham, H.T. 1983. Fungicidal control of Marssonina brunnea on poplar seed. European Journal of Forest Pathology. 13(5/6): 344-348.

Prevention of M. brunnea infection of poplar seedlings was investigated by artificially contaminating seed of Populus deltoides cultivar NE 245 with conidia, dusting with fungicide and germinating it on blotters and in soil. Benomyl, captafol, chlorothalonil, dodine, thiophanate, and thiram prevented seedling infection when applied as full strength and in a 1:1 mixture with talc. Five guidelines are suggested for agencies dispatching and receiving poplar seed to minimize the spread of this and other poplar diseases around the world.

Spiers, A.G; Wenham, H.T. 1983. Poplar seed-transmission of Marssonina brunnea. European Journal of Forest Pathology. 13(5/6): 305-314.

Laboratory studies established that poplar seed became contaminated with conidia of M. brunnea during extraction from infected seed capsules. Of 23 imported Dutch Populus deltoides seedlings examined, 20 were contaminated with viable conidia and 10 of these produced infected seedlings on blotters and in soil, confirming M. brunnea as a seed-borne contaminant. It is hypothesized that M. brunnea entered New Zealand in 1975 on poplar seed from the Netherlands.

Srot, M. 1983. Factors reducing the population density of the large poplar borer (Saperda carcharias L.). Lesnictvi. 29(9): 785-804.

The biology and ecology of Saperda carcharias (L.) were studied in poplar plantations in Bohemia and Moravia (Czechoslovakia) in 1958-1968. Mortality was highest among the eggs and newly hatched larvae, the main cause being the healing over of the oviposition wounds in the trees; this resulted in these early stages becoming trapped. About 6.5 percent of the eggs were destroyed by Euderus caudatus Thoms., and about 5.5 percent of the larvae were attacked by parasites. In riverine forest, the great spotted woodpecker (Picoides major (Dendrocopos major)) destroyed about 10 percent of the larvae. Some 13 percent of the larvae were destroyed by Pseudomonas septica. It was calculated from these findings that in healthy plantations in suitable agronomic areas where the trees were well cared for, 95 percent of the borers were unable to complete their development to the adult stage, as compared with an average of 70 percent when the trees were growing under adverse conditions.

Sujan Singh; Khan, S.N.; Misra, B.M. 1983. Status of Melampsora rusts on poplars in India. Indian Forester. 109(10): 743-747.

As yet no exotic M. species has been recorded on exotic Populus species in India. M. ciliata (indigenous) which attacks P. ciliata in nurseries, plantations, and natural forests in the Himalayas has, however, been recorded in various clones of P. deltoides, P. alba, P. nigra, P. yunnanensis, P. trichocarpa, and many P. X euramericana cultivars. To check the inadvertant entry of exotic pathogens, a certificate from exporting countries stating that the cuttings have been collected from areas where rust pathogens do not exist should be obtained, in the plains of Uttar Pradesh, Punjab and Haryana, a restriction should be imposed that no cuttings from infested localities should be introduced.

Szaro, R.C.; Pase, C.P. 1983. Short-term changes in a cottonwood-ash-willow association on a grazed and ungrazed portion of Little Ash Creek in central Arizona. Journal of Range Management. 36(3): 382-384.

In a study commenced in 1975, grazing by cattle did not affect the growth of velvet ash (Fraxinus velutina), Fremont cottonwood (Populus fremontii), nor Goodding willow (Salix gooddingii) but the sparse 5 percent plant cover was affected by overgrazing and river flooding on both the areas studied. Percentage of herbaceous cover was significantly higher on ungrazed plots than on grazed plots.

Szontagh, P. 1983. Phytopathological evaluation of poplar stands irrigated with waste water. Erdeszeti Kutatasok. 74: 369-377.

Results of 3-year trials in poplar stands of various ages in Hungary showed that wastewater irrigation generally had no significant influence on the incidence and severity of the most important wood-boring insects. However, if waterlogging or increased salinity resulted from wastewater irrigation, there was a danger of increased damage from wood borers attacking weakened trees, notably Cryptorhynchus lapathi. The most damaging disease was caused by the bark necrosis fungus [Cryptodiaporthe populea] which was aggravated by wastewater irrigation in late autumn and winter. Populus 'I-214' has proved to be the poplar most resistant to pests and diseases in plantations irrigated with wastewater.

Wallner, W.E. 1983. Gypsy moth host interactions: a concept of room and board. In: Talerico, R.L.; Montgomery, M., coord. Proceedings, Forest defoliator-hosts interactions: a comparison between gypsy moth and spruce budworms; 1983 April 5-7; New Haven, CT. Gen. Tech. Rep. NE-85. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station: 5-8.

The influence of host type and condition on the ecology of Lymantria dispar is discussed from the viewpoint of food and other functions of the host. Trees in a mixed broadleaved stand in Connecticut 3 inches d.b.h. were burlap banded in 1980. Larvae found under the bands were marked with paint according to tree species. The greatest numbers of larvae/ft² of host b.a. were found on oak, hickory, and aspen [Populus tremuloides] and the fewest on red maple [Acer rubrum], dogwood [Cornus], and black birch. Susceptibility of larvae to nucleopolyhedrosis virus and survival value of insect resting sites with reference to risk of predation are discussed.

Whitham, T.G. 1983. Host manipulation of parasites: within-plant variation as a defense against rapidly evolving pests. In: Denno, R.F.; McClure, M.S., eds. Variable plants and herbivores in natural and managed systems. New York, NY: Academic Press: 15-41.

Wiersum, L.K.; Harmanny, K. 1983. Changes in the water-permeability of roots of some trees during drought stress and recovery, as related to problems of growth in urban environment. Plant and Soil. 75(3): 443-448.

In preliminary laboratory trials, Fraxinus excelsior and Quercus robur showed a slow decline in permeability during drought whereas Ulmus 'Groeneveld' and Acer pseudoplatanus responded rapidly. After rewatering, oak and elm showed quickest recovery whereas Populus 'Robusta' and ash were slow to respond.

Worrall, J. 1983. Cytospora canker of poplars and willows. California Plant Pathology. 64: 4-5

The disease, caused by Valsa sordida, which can cause more than 50 percent losses in cottonwood (Populus) propagation nurseries in California, is described and recommendations given.

Zakharieva, A. 1983. The phenology of Stilpnotia salicis in the Sofia and Burgas regions. Gorsko Stopanstvo. 39(4): 35-37.

Diagrams are given showing the phenology of S. [Leucoma] salicis (one of the most dangerous defoliators in poplar plantations) in the Burgas region of Bulgaria and in the Sofia region.

Zhao, J.Z.; Xue, M.X.; Wang, L.F. 1983. A study on the big spot type canker of poplars. II. Biological characteristics of the pathogen. *Forest Science and Technology*. 10: 24-27.

Growth and germination characteristics of conidia of Dothichiza [Cryptodiaporthe] populea were studied to provide data for control of the disease. Optimal temperature for mycelial growth was 20degC and the optimal pH 5.5. Maltose was the best carbon source and proteinaceous peptone the best nitrogen source. Conidial germination required an optimal temperature in the strict sense. The best pH was 5.0-9.0 and germination was inhibited by strong light. The highest conidial germination percentage was obtained in juice extracted from fresh poplar bark as nutrient medium. The conidia in each pycnidium numbered about 3.6-33 million.

1984

1984. Leaf spot disease of aspen caused by Cryptocline dubia. In: Perttu, K.L., ed. Ecology and management of forest biomass production systems. Rep. No. SLU-IEM-15. Uppsala, Sweden: Swedish University of Agricultural Sciences, Department of Ecology and Environmental Research: 375-381.

Cryptocline dubia (syn. Gloeosporium naevioides) is considered to be a virulent pathogen on young plants of Populus tremula. Symptoms are described and its taxonomic position is discussed.

Addison, P.A.; Malhotra, S.S.; Khan, A.A. 1984. Effect of sulfur dioxide on woody boreal forest species grown on native soils and tailings. *Journal of Environmental Quality*. 13(3): 333-336.

A study was carried out on the influence of 15.2 $\mu\text{mol m}^{-3}$ (0.34 ppm) (Canadian maximum acceptable limit) of SO₂ on net CO₂ assimilation rate (NAR) and visible symptom development of several boreal forest woody species. Fumigation with SO₂ significantly reduced NAR in all species. The decrease in NAR of deciduous species [aspen (Populus tremuloides Michx.), willow (Salix species), green alder [Alnus crispa (Ait.) Parsh], and paper birch [(Betula papyrifera Marsh)] was significantly more rapid than of conifers or an evergreen angiosperm [Labrador tea (Ledum groenlandicum Oeder)] when grown on a fertilized Brunisol. The response appeared to be related to differences in S uptake owing in part to higher gas exchange rates for deciduous species than for conifers.

Ahmad, I.; Afzal, M. 1984. A revision of the genus Sarju ghauri with description of a new species from Pakistan. *Turkiye Bitki Koruma Dergisi*. 8(3): 131-142.

The genus Sarju is revised and redescribed and a new species described as S. angulata sp. n. on Salix and Populus at Gilgit in northern Pakistan; 2 redescribed species. Two species recorded for the first time from Pakistan

and a key to the 5 known species and 3 subspecies of Sarju now known in Pakistan.

Babenko, A.S. 1984. Seasonal dynamics of the activity of staphylinids in the southern taiga zone of Western Siberia. *Biologicheskije Nauki*. 11: 38-42.

Activity was measured with sampling traps during 3 growing seasons (May-September 1979-1981) in 4 forest types in Tomsk and Kemerovo Provinces. Preliminary studies confirmed that most staphylinids overwintered as adults in the surface soil and litter. There were 2 seasonal peaks of activity: in June and in August/September. Staphylinids were particularly active in birch forests (with a litter/humus layer up to 8 cm deep) and were more active in aspen [Populus tremula] forest than in forests of Scots pine or fir [Abies sibirica].

Bagyanarayana, G.; Ramachar, P. 1984. New rusts on the genus Populus. *Current Science, India*. 53(4): 215-216.

Bagyanarayana, G.; Ramachar, P. 1984. New rusts on the genus Populus-II. *Current Science, India*. 53(16): 863-865.

Descriptions are given of the new species in Melampsora cumminsii on Populus and M. osmaniensis on P. sieboldii.

Biggs, A.R.; Merrill, W.; Davis, D.D. 1984. Discussion: Response of bark tissues to injury and infection. *Canadian Journal of Forest Research*. 14(3): 351-356.

Research on nonspecific defense processes in woody plants has focused on xylem. From these studies the concept of compartmentalization was developed. Responses of bark to injury and infection, however, are understood poorly. This discussion summarizes evidence for the occurrence of processes similar in function to xylem compartmentalization in bark.

Black, R.A.; Mack, R.N. 1984. A seasonal leaf abscission in Populus induced by volcanic ash. *Oecologia*. 64(3): 295-299.

Premature leaf abscission in Populus was observed in central Washington about two weeks after the 18 May 1980 ashfall from Mount St. Helens. Leaf abscission was probably a wounding response. Under glasshouse conditions simulating this environmental regime, by propelling ash or sand across plant surfaces with a sand-blaster, the leaf epidermis and often part of the mesophyll in Populus nigra var. italica were abraded, resulting in permanent loss of leaf turgor and decreased stomatal conductance.

Booij, C.J.H.; Voerman, S. 1984. Sex attractant for the poplar shoot-borer, Gypsonoma aceriana (Duponchel). *Zeitschrift fur Angewandte Entomologie*. 97(2): 176-179.

Screening experiments carried out in a poplar plantation (Populus balsamifera, P. nigra, and P. alba) in the Netherlands in 1982-1983 showed that a mixture of (E)-10-dodecenyl acetate and (E)-10-dodecen-1-ol at a ratio of 7:3 attracted numerous males of Gypsonoma aceriana (Dup.), which can cause serious damage to poplar plantations. Traps baited with this mixture could be used to monitor the activity of the pest.

Cavalcaselle, B.; Deseo, K.V. 1984. Control tests against the larvae of two xylophagous insect pests of poplar with entomopathogenic nematodes. *Atti Giornate Fitopatologiche*. 2: 393-402.

Tests on the control of Paranthrene tabaniformis and Cryptorhynchus lapathi on poplar by means of pathogenic nematodes were carried out in Italy in 1982-1983. In 1982, cotton-wool swabs soaked in a suspension containing infectious forms of Steinernema feltiae [Neoalectana carpocapsae] were inserted into the entrance of the larval galleries and resulted in 97.5 and 100 percent mortality of the 2 pest species, respectively. In 1983, the nematodes were tested against the larvae of C. lapathi. The highest mortality (75 percent) was given by N. bibionis, followed by one of the strains of N. carpocapsae (60 percent), but neither rate was considered sufficient for practical control.

Chen, L.S. 1984. A note on nuclear polyhedrosis virus of Stilpnotia salicis. *Forest Science and Technology*. 12: 27-28.

A description of a virus found in 1981 infecting S. [Leucoma] salicis, an important pest of poplars. The virus has potential as a control agent.

de Kam, M. 1984. Xanthomonas campestris pv. populi, the causal agent of bark necrosis in poplar. *Netherlands Journal of Plant Pathology*. 90(1): 13-22.

A bacterium was isolated from superficial bark necrosis on young poplars cv. Robusta in the Netherlands, and its pathogenicity demonstrated by inoculation experiments in which 11 out of 28 poplar plants developed disease symptoms. Characteristics showed the bacterium to belong to X. campestris. Cross-inoculations indicated a previously undescribed pathovar, and the designation X. campestris pv. populi is suggested.

Dittman, J.; Hoffel, I.; Muller, P.; Neunhoeffler, O. 1984. Use of poplar leaves for monitoring environmental beryllium. *Naturwissenschaften*. 71(7): 378-379.

Leaves of Populus nigra italica were analysed within a 30 km radius from power installations in Saarland and Ruhr. Concentrations of Be showed no correlations with distance or prevailing wind.

Dix, M.E.; Doolittle, R.E. 1984. Evaluation of attractant traps used for capturing male cossids. *Journal of the Georgia Entomological Society*. 19(4): 439-445.

Catches of the cossids Prionoxystus robiniae, a pest of many species of hardwoods, and Acosus centerensis, which attacks aspen (Populus tremuloides), in different types of traps were compared in mixed hardwood forests in Bottineau County, North Dakota, in the summers of 1977, 1978, and 1979. There were no significant differences in the number of P. robiniae males caught in traps. The diamond-carton trap was preferred because it was less expensive, easier to construct, store and transport, and had more surface area available for capturing males than the cylinder and cylinder-platform traps. The Pherocon 1C and cylinder traps caught more moths than the carton designs. The Pherocon 1C trap caught significantly more males per square centimeter of trapping surface than any of the other traps.

Drooz, A.T.; Solomon, J.D. 1984. Temporal cold storage of eggs of the poplar tent maker, Clostera inclusa prior to use in rearing the egg parasite, Ooencyrtus ennomophagus. Res. Note SO-304. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 2 p.

Fresh eggs from a colony of C. inclusa reared on the foliage of Populus deltoides and Salix nigra were stored at -10degC for up to 24 months. Egg samples were exposed to adult O. ennomophagus. An equation was developed to predict percent parasitism. Predicted values were 25 percent or better for up to 8 months storage, falling to below 16 percent for eggs stored for 12 months, 8 percent after 18 months and declining to 1 percent after 24 months.

Eslyn, W.E.; Lombard, F.F. 1984. Fungi associated with decayed wood in stored willow and cottonwood logs. *Mycologia*. 76(3): 548-550.

Fungi isolated from decayed Salix nigra and Populus deltoides pulpwood logs and the type of associated rot are tabulated.

Franz, J.M.; Zimmermann, G. 1984. Problems of forest protection in northern China, with special reference to biological measures. *Anzeiger fur Schadlingskunde, Pflanzenschutz, Umweltschutz*. 57(5): 81-87.

The results are given of a survey of the most important insect and vertebrate pests and diseases of forest trees in western China; 15 species of insects are listed. Chemical control was the main means of forest protection in China, silvicultural control was also practiced, and biological control was becoming widespread.

Freer-Smith, P.H. 1984. The responses of six broadleaved trees during long-term exposure to SO₂ and NO₂. *New Phytologist*. 97(1): 49-61.

Young trees were exposed to SO₂ and NO₂, alone or in combination for 5 days each week. Exposure of Populus nigra showed that greater than additive growth inhibitions occurred with SO₂ + NO₂ during the growing season. Exposure to SO₂ during dormancy delayed leaf growth in the following spring, but NO₂ had no effect. Inhibitory effects developed more rapidly with SO₂ + NO₂ than with SO₂ alone. The results are discussed in relation to changes in pollution sensitivity during growth. Foliar blemish, senescence, and abscission were the main symptoms of SO₂ and SO₂ + NO₂ injury.

Griffin, D.H.; Manion, P.D. 1984. Variation of Populus tremuloides reaction to toxic culture filtrates of Hypoxyylon mammatum. *Phytopathology*. 74(7): 840.

Griffin, D.H.; Manion, P.D.; Valentine, F.A.; Gustavson, L. 1984. Canker elongation, branch death, and callus formation as resistance or susceptibility responses in Populus tremuloides and virulence or avirulence characteristics of Hypoxyylon mammatum. *Phytopathology*. 74(6): 683-687.

Five single-ascospore isolates of H. mammatum were tested for virulence against 9 clones planted in a randomized complete block experiment. Canker length, branch death frequency, and callus formation frequency were measured over 16 months. There were significant differences among clones and isolates for all 3 measurements. The fungal isolates accounted for much more of the variation in canker lengths than did the clones. Canker length showed a moderately negative correlation with callus frequency and a moderately

positive correlation with branch death. The results are consistent with the hypothesis that branch death and canker length are indicators of virulence.

Grijpma, P. 1984. Host specificity of Telenomus nitidulus (Thomson) egg parasite of the satin moth, Leucoma salicis L. Nederlands Bosbouwtijdschrift. 56(7/8): 201-207.

In the context of possible biological control methods, experiments carried out during an outbreak of L. salicis on 11-year-old poplars and willows in Flevoland, Netherlands suggest that the parasite is host-specific. Eggs and larvae of the parasite were unable to survive in egg masses of L. salicis through the winter, but live females were found in bark from the trees in April.

Hall, R.J.; Crown, P.H.; Titus, S.J. 1984. Change detection methodology for aspen defoliation with Landsat MSS digital data. Canadian Journal of Remote Sensing. 10(2): 135-142.

A method was developed to detect defoliation without detailed field data based on expected spectral changes and digital analysis. The procedure included the creation of a 3-band multiband color composite image. Data were collected from an area in N. Alberta, defoliated by the forest tent caterpillar (Malacosoma disstria).

Harmsen, R.; Rose, M.R. 1984. Habitat effects on larval mortality in the forest tent caterpillar, Malacosoma disstria. Proceedings of the Entomological Society of Ontario. 114: 87-89.

Larvae of the forest pest Malacosoma disstria are difficult to find in the periods between outbreaks, and the authors were unable to collect them from dry upland areas in Canada between outbreaks but could collect them from wet lowland areas at the same stage of the cycle. Experiments with artificial infestations on aspen [Populus] in Ontario in 1978 indicated that survival was higher in a lowland habitat than in upland ones, possibly as a result of habitat selection on the part of parasites and predators.

Harniss, R.O.; Nelson, D.L. 1984. A severe epidemic of Marssonina leaf blight on quaking aspen in northern Utah. Res. Note INT-339. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 6 p.

An epidemic of M. populii attacking Populus tremuloides in 1981 in N. Utah and adjacent areas of Wyoming and Idaho was observed and mapped. Symptoms are described.

Harrington, Constance Ann. 1984. Morphological and physiological changes in red alder and black cottonwood seedlings during flooding and recovery. Dissertation Abstracts International. 45/05-B: 1336.

Responses of red alder (Alnus rubra Bong.) and black cottonwood (Populus trichocarpa Torr. and Gray) seedlings to artificial flooding were studied during a three-week flooding period and a three-week recovery period. Changes were periodically assessed.

Both species had 100 percent survival during the experiment and thus demonstrated tolerance to short-term flooding. The two species generally exhibited different morphological and physiological responses during the

flooding period. Based on all observed responses during the flooding and recovery periods, red alder seedlings were more tolerant of the experimental conditions than black cottonwood.

Hawrys, Z. 1984. Sensitivity of some deciduous trees to sulfur compounds and heavy metals. *Ekologia Polska*. 32(1): 103-124.

The effect of air pollution (sulphur dioxide and Zn, Pb, and Cd compounds) on the development of 8 deciduous trees (*Acer negundo*, *A. campestre*, *Alnus incana*, *Populus tremula*, *Betula verrucosa*, *Sorbus aucuparia*, *Quercus robur*, and *Q. rubra*) in a coniferous forest was investigated. Air pollution affected growth and survival of the trees, leaf phenology, and emission element content. The tree species were examined for their potential usefulness for protective afforestations.

Henderson, L.; Musil, K.J. 1984. Exotic woody plant invaders of the Transvaal. *Bothalia*. 15(1/2): 297-313.

The sampling method consisted of making continuous recordings of roadside and veld invaders from a moving vehicle, and of streambank invaders at water-course crossings. Ratings were based on frequency of encounter within each sample unit. Sixty-one invaders were encountered, of which the most important and aggressive were *Acacia dealbata*, *Populus* spp., *Melia azedarach*, *Opuntia ficus-indica*, *Salix babylonica*, and *Acacia mearnsii* patterns are discussed. Attention is drawn to the areas of greatest invasion and the areas that are liable to show the greatest expansion in the future.

Heymans, P.; Deligne, J.; Nef, L. 1984. Determination of the overwintering and pupation sites, and prospects of control, of the poplar twigborer, *Gypsonoma aceriana* Dup. Mededelingen van de Faculteit Landbouwwetenschappen, Rijksuniversiteit Gent. 49(3a): 709-717.

Observations were made in poplar plantations and nurseries in 2 localities in the Limburg region of Belgium to identify the overwintering and pupation sites of *Gypsonoma aceriana*. Ringing branches and trunks at different levels with birdlime showed that the larvae did not overwinter on the ground but hid in the bark crevices of young poplars and on a branch or the trunk of older trees. In early spring, they climbed higher up the trees and bored into the young twigs. The larvae dropped out of the galleries to pupate in the soil. A single larva could bore several successive galleries and thus induce gall formation on several parts of the twig. The most severe damage was caused in the spring when the larvae bored into the terminal shoot of young nursery trees. A ring of birdlime underneath and surrounding this shoot is proposed to protect the upper part of the tree.

Hiratsuka, Y. 1984. New leaf spot fungus, *Marssonina balsamiferae*, on *Populus balsamifera* in Manitoba and Ontario. *Mycotaxon*. 19: 133-136.

The species, which causes distinctive reddish-brown leaf spots, is described.

Hiratsuka, Y.; Loman, A.A. 1984. Decay of aspen and balsam poplar in Alberta. Inf. Rep. NOR-X-262. Edmonton, Alberta, Canada: Canadian Forestry Service, Northern Forest Research Centre. 19 p.

A review of major decay-causing agents and types of decay of aspen (Populus tremuloides) and balsam poplar (P. balsamifera), relations between decay and age, site and clone, decay management, and the significance of decay and discoloration to utilization. Phellinus tremulae is thought to be the most important decay organism.

Hirsh, A.; Williams, R.J.; Erbe, E.; Steere, R. 1984. Continued studies of intracellular glass-formation as a method of natural cryoprotection in superhardy Populus balsamifera V. virginiana. *Cryobiology*. 21(6): 684.

Hirsh, A.; Williams, R.J.; Erbe, E.; Steere, R.; Meryman, H.T. 1984. Intracellular glass-formation as a method of natural cryoprotection in superhardy Populus-balsamifera V.-Virginiana. *Biophysical Journal*. 45(2): 246.

Hodjat, S.H. 1984. Aphids of Salicaceae in Iran and keys to their species. *Entomologie et Phytopathologie Appliquees*. 52(1): 13-41.

In Iran, 27 species are recorded from Salicaceae, 9 being new records for that country. Keys are given. The 27 species are listed, with notes on biology and food-plants, and a separate list is given of the species of Populus and Salix involved, with the aphids found on each.

Ignatenko, A.A.; Chepizhenko, O.I. 1984. Ways of improving plant resistance to nitrogen-containing gases. *Introduktsiia i Akklimatizatsiia Rastenii*. 1: 55-58.

Ito, S.I.; Nakamura, N. 1984. An outbreak of white root-rot and its environmental conditions in the experimental arboretum. *Journal of the Japanese Forestry Society*. 66(7): 262-267.

Serious outbreaks of white root rot caused by Rosellinia necatrix were recorded from 1976 to 1979 in the Koishikawa Botanical Garden, University of Tokyo. The outbreaks were mostly concentrated in areas which had been poplar cultivation plots in the 1960's. The most susceptible species were Aesculus turbinatus [turbinata], Fagus crenata, and Ilex serrata. Resistant species included Cunninghamia lanceolata, Sasa veitchii, and Trachycarpus fortunei. Susceptible species were mostly shade intolerant while resistant species were tolerant. It is concluded that the remaining poplar roots acted as infection centres and that light deficiency caused by flourishing trees made shade-intolerant plants susceptible to rot.

Jamrich, V. 1984. Possibilities of classifying the resistance of woody plants to fluorine intoxication by means of visual damage symptoms. *Folia Dendrologica*. 11: 83-107.

A theoretical discussion of visual symptoms as an objective means of assessing resistance. The symptoms are characterized by form, type, and frequency. Four resistance categories are defined. Long-term observations [in Slovakia] have shown the following order of common tree species: Alnus glutinosa (most resistant) >Populus tremula >Quercus petraea >Pinus nigra >hornbeam >beech >Norway spruce and >Scots pine (least resistant).

Jensen, K.F.; Noble, R.D. 1984. Impact of ozone and sulfur dioxide on net photosynthesis of hybrid poplar cuttings. *Canadian Journal of Forest Research*. 14(3): 385-388.

Softwood cuttings of hybrid poplar clone No. 207 [Populus '207'] (P. deltoides X P. trichocarpa) were fumigated with either charcoal-filtered air (control) or SO₂ plus or minus O₃ for 12 hours each day for 3 weeks. Net photosynthetic rate and CO₂ compensation point were then measured in a closed-loop gas assimilation system with an IR gas analyzer. Net photosynthesis increased with an increase in light intensity and CO₂ concentration, but was significantly reduced by the SO₂ + O₃ treatment; the only treatment in which visible leaf injury occurred. Photosynthesis in the injured leaves may have been suppressed by an increase in the respiration rate and a reduction in the photosynthetic area.

Joshi, K.C.; Gurung, D.; Sarma, P.C. 1984. Insect pests of poplars in north-eastern region. *Indian Farming*. 34(4): 21-22.

Brief notes are given on the morphology and local biology (and in some case the control) of potential insect pests of the poplars [Populus spp.] that farmers in north-eastern regions of India are being encouraged to plant. The species mentioned include borer defoliators, the sucking species, and termites.

Jurik, T.W.; Weber, J.A.; Gates, D.M. 1984. Short-term effects of CO₂ on gas-exchange of leaves of bigtooth aspen in the field. *Plant Physiology*. 75(4): 1022-1026.

Juzwik, J.; Hinds, T.E. 1984. Ascospore germination, mycelial growth, and microconidial anamorphs of Encoelia pruinosa in culture. *Canadian Journal of Botany*. 62(9): 1916-1919.

The fungus causing sooty-bark of Populus tremuloides and its taxonomy discussed.

Kechel, H.G. 1984. Testing the resistance of poplars to bacterial cankers by means of artificial inoculation. *Forstarchiv*. 55(5): 178-182.

Studies were conducted in Hesse on various methods of inoculating clones of Populus sections. Tacamahaca and Aigeiros with Xanthomonas populi. The most reliable method involved inoculating wedge-shaped incisions on 1-year-old stems with a suspension (10⁸ bacteria/ml). After 3 years, the external and internal condition of the stem at the infection locus is used to evaluate differential clonal resistance to X. populi.

Kechel, H.G.; Boden, E. 1984. Cankers on clones of Populus section Leuce. *Holzzucht*. 38(1-2): 14-18.

In studies in W. Germany, clones derived from controlled pollinations within P. tremula, and crosses involving P. tremula X (P. X canescens) and P. tremula X P. tremuloides, were artificially inoculated with Xanthomonas populi in 1981. No general pattern of resistance was observed for Populus section Leuce; however, some clonal differentiation was observed.

Klimaszewski, S.M. 1984. New species of jumping plant lice from Mongolia. *Polskie Pismo Entomologiczne*. 52(1/2): 3-11.

Five new species of Psylloidea are described from Mongolia; found on shoots of Populus diversifolia in 1980.

Kling, G.W.; Grant, M.C. 1984. Acid precipitation in the Colorado Front Range: an overview with time predictions for significant effects. *Arctic and Alpine Research*. 16(3): 321-329.

The geology, pedology, vegetation, and climate interact to form a region that is potentially sensitive to acid precipitation. Alkalinity and pH decreased with increasing altitude, alpine regions being the most sensitive to continued input of acidic material. Vegetation canopies may strongly affect pH of throughfall and aspen [Populus tremuloides] in particular shows a strong ability to increase pH relative to clearfall. Effects of acid precipitation will become important in a matter of decades.

Klotz, J.H. 1984. Diel differences in foraging in two ant species. *Journal of the Kansas Entomological Society*. 57(1): 111-118.

The circadian patterns of foraging activity in Camponotus pennsylvanicus (Deg.) and Formica subsericea Say, were monitored in spring, summer, and autumn in a habitat in Kansas containing a cottonwood tree (Populus deltoides) infested by aphids, a standing dead elm tree (Ulmus americana), and several artificial feeding stations. Both species foraged for aphid honeydew on the cottonwood. F. subsericea was less resistant than C. pennsylvanicus to cold and foraged only by day in spring and autumn. F. subsericea foraged in a stealthy and unobtrusive manner, and in antagonistic encounters between the 2 species was less aggressive and was usually the species killed.

Kojwang, H.O.; Kurkela, T. 1984. Linospora ceuthocarpa on aspen in Finland. *Karstenia*. 24(1): 33-40.

The maturation of the perithecia of the pathogenic pyrenomycete L. ceuthocarpa, its spore liberation, mode of infection, and the development of symptoms on aspen leaves were investigated, with the histological examination of infected leaves and a description of the cultural characteristics of the fungus. Fast growing semimature leaves were most susceptible.

Kolomoets, T.P. 1984. Species composition of poplar pests in urban landscape plantings in Donetsk. *Byulleten' Glavnogo Botanicheskogo Sada*. 132: 85-86.

Data for 32 species of insects and one mite are tabulated on the basis of observations in the Ukraine in 1974-1981, showing the species of poplar affected, food-plant specialization, and severity of damage. Nearly all the major pests belonged to the Homoptera.

Kovalev, V.G. 1984. On Finnish and some other species of Lonchaea Fallen. *Annales Entomologici Fennici*. 50(1): 17-20.

The taxonomy of the group of Lonchaea peregrina Becker and some other species of the genus is dealt with, with special reference to the Finnish fauna. L. subneatosa Kovalev (the larvae of which feed on bast fibres under the bark of aspen [Populus tremula] and other trees) is reported as new to Finland. Keys to the European species are given. A hitherto unidentified species from Finland is probably L. bruggeri Morge.

Ksiazek, M.; Wozny, A.; Siwecki, R. 1984. The sensitivity of poplar leaves to lead nitrate and intracellular localization of lead. *European Journal of Forest Pathology*. 14(2): 113-122.

Detached leaves of 4 *Populus* species were incubated for 24 and 48 hours in Pb(NO₃)₂ solution. *P. maximowiczii* was the most sensitive and *P. nigra* least. The differences were possibly in part due to differences in mesophyll coherence in the leaf laminae. TEM studies showed that lead accumulated mostly in very small quantities in all elements of the vascular bundles. Transport was probably with the water stream. However, lead deposits in intercellular spaces and in the middle lamella of xylem cells showed that apoplastic transport may also have taken place.

Leibundgut, H. 1984. Susceptibility of poplar cultivars to attack by *Marssonina* leaf spot disease. *Schweizerische Zeitschrift für Forstwesen*. 135(1): 37-39.

Attack by *M. brunnea* on 40 *Populus* sect. *Aigeiros* hybrids and *P. alba* was assessed in 1974 in 5- to 10-year-old trees established on a drained site in Canton Zurich. Differences in susceptibility were observed.

Leisola, M.S.A.; Ulmer, D.C.; Fiechter, A. 1984. Factors affecting lignin degradation in lignocellulose by *Phanerochaete chrysosporium*. *Archives of Microbiology*. 137(2): 171-175.

Li, C. 1984. Two specialized forms of *Marssonina populi* (Lib.) Magn. *Journal of Nanjing Institute of Forestry*. 4: 10-17.

In E. China, *M. populi* causes high mortality of poplar seedlings and premature defoliation of plantation and shade trees. Two specialized forms are recognized. No water soluble inhibitor of germination is found on the surface of freshly collected spores. *Populus adenopoda*, *P. tomentosa* and hybrids of the section *Leuce* are susceptible to natural infection and to inoculation of detached leaves. The natural hosts include many species in the section *Aigeiros* and their hybrids and hybrids between *Aigeiros* species and those in the section *Tacamahaca*. Inoculation of detached leaves of all species examined was successful.

Li, J.J. 1984. The exposure of woody plants to O₃ and HF and stress ethylene release. *Scientia Silvae Sinicae*. 20(4): 359-365.

Trees and shrubs of 21 species were exposed to varying concentrations of O₃ and HF and ethylene release was measured. There was a close correlation between abnormal abscission of leaf blades and ethylene release due to stress. Drought injury also contributed to abnormal leaf abscission.

Li, X.Y. 1984. A preliminary observation on the bionomics of *Polyphyllo laticollis* Lewis. *Insect Knowledge (Kunchong Zhishi)*. 21(3): 117-118.

Studies were carried out in Fuxin Prefecture, Liaoning Province, China, in 1976-1982 on the biology of *Polyphyllo laticollis*, an important subterranean pest of yam. Adults fed on the leaves of maize, poplar, and elm and the needles of *Pinus thunbergii*. Larvae overwintered 3 times, and, in the 3rd instar, were destructive pests of yam.

Liepa, I.Ya.; Gaitnieks, T.Kh.; Reke, G.K. 1984. Evaluation of the influence of automobile transport on a forest planting. Soviet Journal of Ecology. 14(6): 333-337.

A methodology is described for studying the effects of vehicle exhausts on tree stand increment. An equation with empirical coefficients for different species (Alnus incana, A. glutinosa, Betula alba, Picea abies, Pinus sylvestris, and Populus tremula) is used to predict the increment of species under normal conditions. Results suggest that the decline in productivity of tree stands along highways can be partly compensated by silvicultural measures (draining, thinning) and that it is gradually reversed after the cessation of pollution (e.g. during road works).

Liu, L.R. 1984. Observations on the biology of Latoia ostia (Swinhoe). Kunchong Zhishi (Insect Knowledge). 21(6): 255-257.

The biology of the limacodid Latoia ostia [Parasa ostia] was studied in Yanyuan County, Sichuan, China, where it was a pest of fruit trees, poplars [Populus], willows [Salix], locust [Robinia pseudoacacia] and other trees, in 1977-1979. One generation was produced per year. Individuals which had overwintered as mature larvae began to pupate in late April, with peak pupation occurring from early May to early June. Serious damage to the leaves of food plants occurred in August and November. Mature larvae began overwintering in late October. The morphology of eggs, larvae, pupae, and adults is described.

Lodos, N.; Kalkandelen, A. 1984. Preliminary list of Auchenorrhyncha with notes on distribution and importance of species in Turkey. XV. Family-Cicadellidae: Typhlocybae: Erythroneurini (Part I). Turkiye Bitki Koruma Dergisi. 8(3): 159-168.

In this 15th part of a series on the Auchenorrhyncha fauna of Turkey, an annotated list is given of 17 species in 7 genera belonging to the tribe Erythroneurini of the subfamily Typhlocybae of the family Cicadellidae, which were collected recently in Turkey, with notes on their distribution, synonymy, rare or common status, months of collection and food-plants where known; 3 species were recorded for the first time in Turkey. The most economically important species was Arboridia adanae, which infested the leaves of grapevine and was very common and widespread in Turkey.

Lodos, N.; Kalkandelen, A. 1984. Preliminary list of Auchenorrhyncha with notes on distribution and importance of species in Turkey. XVI. Family Cicadellidae: Typhlocybae: Erythroneurini (Part II). Turkiye Bitki Koruma Dergisi. 8(4): 201-210.

In this 16th part of a series on the Auchenorrhyncha fauna of Turkey and the 2nd part of a series on the tribe Erythroneurini of the family Cicadellidae, an annotated list is given of 14 species in 2 genera that were collected recently in Turkey, with notes on their distribution, synonymy, rare or common status, months of collection, and food-plants where known.

Ma, E.P.; Li, Y.Q. 1984. A new species of the genus Cenopalpus from Xinjiang. Acta Entomologica Sinica. 27(3): 323-325.

Cenopalpus xini species n. is described; collected from Populus nigra var. thevestina [P. nigra] in Shilhezi, Xinjiang Province, China, in 1981.

Manuwoto, Syafrida. 1984. Feeding and growth of three Lepidoptera species as influenced by natural and altered nutrient and allelochemical concentration in their diet. Dissertation Abstracts International. 45/07-B: 2030.

The effects on various Lepidoptera of unsuitable food plants and the possible phytochemical mechanisms were investigated using fresh leaves, diet with incorporated freeze dried leaves and various extracts. Quaking aspen (Populus tremuloides Michx.), negatively affected larvae of promethea moth, Callosamia promethea Drury, and larvae of the southern armyworm, Spodoptera eridania Cramer. Commercial tannins were bioassayed. They did not appear to decrease approximate digestibility nor nitrogen utilization efficiency of penultimate instar of the southern armyworm. Reduced growth rates were instead due to decrease consumption rates and reduced conversion efficiencies.

Martineau, R. 1984. Insects harmful to forest trees. For. Tech. Rep. 32. Canadian Forestry Service. 261 p.

A book for use in E. Canada with 10 chapters on the most common and destructive insects harmful to spruce, larch, pine, fir, arborvitae (Thuja species), birch, oak, maple, elm, and poplar. Each chapter gives information on host trees and the pest attacking them in the order. Each pest is briefly discussed and most are illustrated. Indexes are provided to species.

Mauffette, Y.; Lechowicz, M.J.; Jobin, L. 1984. Host preferences of the gypsy moth, Lymantria dispar (L.), in southern Quebec. Canadian Journal of Forest Research. 13(1): 53-60.

Larval populations were monitored in June-July 1980 on 1870 trees representing 29 species at 13 different sites. At least some larvae were found on all tree species, but different larval preferences were evident.

McCracken, F.I.; Schipper, A.L.; Widin, K.D. 1984. Observations on occurrence of cottonwood leaf rust in central United States. European Journal of Forest Pathology. 14(4/5): 226-233.

Spore populations of Melampsora medusae on Populus species were metered with spore traps along a N.-S. axis. Urediospore numbers were related to temperature and rainfall.

Mikhailova, Z.A. 1984. The poplar midget. Zashchita Rastenii. 4: 38.

In recent years, the poplar midget [Phyllonorycter populifoliella] has been recorded causing considerable damage to poplar [Populus] in the area around Moscow, USSR. Notes are given on its biology. The larvae could be controlled effectively using 0.15 percent Rogor [dimethoate] in combination with 0.1 percent mineral oil. Adults could be controlled using 0.05 percent Rovikurt or 0.1 percent DDVP [dichlorvos].

Mikheev, A.V.; Kreslavskii, A.G.; Solomatin, V.M.; Gritsenko, V.V. 1984. Relations with food plants and structure of willow race of Lochmaea capreae. Zoologicheskii Zhurnal. 63(2): 209-217.

Field and laboratory studies in the Moscow district of the USSR showed that sympatric groups of Lochmaea caprea (L.) from different food-plants can be divided into 2 biological races (willow and birch) according to the food preferences of the adults and larvae, the ability of the larvae to develop on Betula pubescens and the level of reproductive isolation. The most abundant

groups within the willow race are considered as stable intrapopulation groups. Beetles from aspen are differentiated significantly more weakly and form only temporary groups, the existence of which is maintained by the constant colonization of the aspen.

Minkevich, I.I.; Bazova, S.V. 1984. The development of leaf rust of poplar in relation to weather conditions. *Mikologiya i Fitopatologiya*. 18(2): 149-152.

During the epiphytotic outbreaks of the rust Melampsora populina [M. populnea] on poplar in southern parts of the Russian republic, favoured by warm rainy winters, early symptoms appear in the second decade of June. The intensity of the disease depends on average monthly temperatures, RH, and amount of rain.

Muhammad, A.F.; Micko, M.M. 1984. Accumulation of calcium crystals in the decayed wood of aspen attacked by Fomes igniarius. *IAWA Bulletin*. 5(3): 237-241.

Spectrophotometry revealed that concentrations of K, Na, Ca, Mn, and Mg were highest in Populus tremuloides wood decayed by F. [Phellinus] igniarius, intermediate in discoloured wood and lowest in clear wood. Crystalline Ca accumulations were present only in decayed wood.

Naidenov, Ya. 1984. Bark necroses on poplars in Bulgaria. *Gorskostopanska Nauka*. 21(2): 38-47.

A summary account is given of studies in Bulgaria in 1972-1982. The most important bark necroses are caused by Dothichiza populea, Cytospora chrysosperma, Cytospora nivea, Cytospora foetida, Fusarium avenaceum, Fusarium sporotrichioides, and brown slime flux.

Ovcharov, D. 1984. Effect of 'phytoncides' on bacterial preparations used for biological control in forestry. *Gorskostopanska Nauka*. 21(1): 81-86.

Some tree species have been found to have a natural antibiotic activity (caused by volatile organic acids and aldehydes). Three insect pests were fed on leaves of oak, apple, bird cherry, poplar, willow, aspen, and alder, treated with Soviet bacterial preparations. Insect mortality figures indicated that four species (aspen, willow, bird cherry, and apple) had an antibiotic effect.

Palo, R.T. 1984. Distribution of birch, willow, and poplar secondary metabolites and their potential role as chemical defense against herbivores. *Journal of Chemical Ecology*. 10(3): 499-520.

Parpan, V.I.; Yukhimchuk, G.V. 1984. Chlorine accumulation by leaves of trees and shrubs in the Carpathian foothills. *Lesovodstvo i Agrolesomelioratsiya*. 68: 36-38.

Sixteen species were analyzed for foliage Cl content at 30 km from the Kalush industrial complex in SW Ukraine which emits chloride, HCl, and organic Cl compounds. Species were classed as high, medium, and low accumulators. Species suitable for planting within the complex were: Amorpha fruticosa, Salix caprea, Acer platanoides, A. saccharinum, A. negundo, and Fraxinus excelsior. The remaining species are suitable for protective screens around the complex: Tilia cordata, Salix babylonica, Aronia melanocarpa, Cornus

sanguinea, Quercus robur, Q. rubra, Betula pendula, Sorbus aucuparia, Physocarpus opulifolius, and Populus alba.

Pasteels, J.M.; Rowell-Rahier, M.; Braekman, J.C.; Daloze, D. 1984. Chemical defences in leaf beetles and their larvae: the ecological, evolutionary and taxonomic significance. *Biochemical Systematics and Ecology*. 12(4): 395-406.

The chemical defences of the Chrysomelinae are reviewed. Defensive secretions have evolved independently in larvae and adults, and faster than the morphology of the glands. The genera dealt with include Chrysomela, Leptinotarsa, Gastrophysa, Phaedon, Phratora, Paropsis and Chrysophtharta, and their food-plants include Populus, Salix, Juglans, Rumex, Brassica, and Eucalyptus. The volatile irritants produced by larvae are well suited to repel small arthropods such as ants, whereas poisons associated with aposematic coloration in adults could be directed against small vertebrates such as birds.

Pei, M.H.; Shang, R.Z. 1984. Study on the leaf rust of Cathay poplar caused by Melampsora larici-populina Kleb. *Journal of North-Eastern Forestry Institute, China*. 12(2): 40-49.

Leaf rust of Populus cathayana caused by M. larici-populina is one of the most damaging plantation diseases of N. China. The life history of the fungus is described. Optimal temperatures for spore germination are given, all need 100 percent humidity but no light. The best fungicide for control is Bordeaux mixture followed by chlorothalonil, carbendaxol, zineb, thiophanate, 'Tuzet', thiram, and thiophanate-methyl.

Pelkonen, P. 1984. Temperature response of electrical impedance in poplar cuttings: a preliminary concept. *Folia Forestalia* 604. Suonenjoki, Finland: Institutum Forestale Fenniae, Suonenjoki Research Station. 7 p.

A model is developed for predicting the frost hardiness of poplar based on measurements of electrical impedance of cuttings of clones sampled during October 1981-January 1982 in Ontario.

Perala, D.A. 1984. How endemic injuries affect early growth of aspen suckers. *Canadian Journal of Forest Research*. 14(6): 755-762.

The number and stem position of 3 endemic disease- and insect-caused injuries, shoot dieback, galls, and lesions, were monitored during the first 7 years of development of Populus tremuloides sucker stands on both a good and an excellent site in Minnesota. Dieback was caused mostly by Venturia macularis, galls by Saperda inornata, and lesions by oviposition activity, mechanical and animal damage, and cankers. Only shoot dieback clearly had a negative effect on height growth and tree class differentiation. The apparently high incidence of insect- and disease-induced injury is normal in aspen sucker stands. Tree mortality was caused by intraspecific suppression and was not enhanced by any of these injuries. Productivity of these stands should meet or exceed historical expectations.

Pinon, J. 1984. Biological properties of the toxin of Hypoxyylon mammatum, parasite of poplars in the Leuce section. *Revue de Cytologie et de Biologie Vegetales le Botaniste*. 7(3): 271-277.

The toxin was produced by all isolates. Differential reactions of poplars to the toxin in a leaf bioassay depended on origin of the isolate. A certain similarity was observed between the reaction of poplars to the toxin and their susceptibility in nature, but some exceptions were found. Reaction to the toxin was closely linked to the host genotype.

Pinon, J.D. 1984. Management of diseases of poplars. *European Journal of Forest Pathology*. 14(7): 415-425.

Resistance is the cornerstone of management of diseases of poplar. Maximization requires proper sites, selection, silvicultural practices, and sometimes direct or chemical control.

Pinon, J. 1984. Poplar diseases: from cuttings to wood. *Cultivar*. 177: 79-80.

Pinon, J.; Bachacou, J. 1984. Existence of two groups of isolates of Melampsora larici-populina Kleb. differing in their pathogenicity. *Comptes Rendus des Seances de l'Academie d'Agriculture de France*. 70(1): 114-122.

Differences were noted in virulence (poplar clone-race interaction) and aggressiveness (higher pathogenicity of the Belgian isolates). The clone Beaupre was immune, with exclusively vertical resistance, while 1-154 had an effective horizontal resistance, and 145-51 had low horizontal resistance. In Rap there was a very clear differential reaction, possibly due to a predominance of vertical resistance.

Plant, A.R. 1984. The cause of green islands induced by the Nepticulidae. *Proceedings and transactions of the British Entomological and Natural History Society*. 17(pt.3/4): 82-83.

Prakash, C.S.; Heather, W.A. 1984. Effect of gamma irradiation on germination and infection potential of urediniospores of Melampsora medusae. *Australasian Plant Pathology*. 13(4): 60-62.

Germination of urediniospores of races 1A and 5A exceeded 65 percent after exposure to irradiation levels 1200 Gray (Gy) (1 Gy=10 rads); but spores exposed to such levels did not successfully infect *Populus* leaf disks. Results are discussed and compared with similar studies.

Przybyl, K. 1984. Development of the fungus Ceratocystis fimbriata in shoots of poplar clones with differing resistance. *European Journal of Forest Pathology*. 14(3): 177-183.

C. fimbriata development was observed 1, 4, 14, 30, and 60 days after inoculation into wounded shoots of 4 clones: NE-42 (susceptible), Populus trichocarpa 6209 and PK 127 (moderately resistant), and P. nigra cv. Ostromecko (resistant). Intra- and intercellular hyphae elongated through the xylem and phloem elements of the susceptible and moderately resistant clones, whereas the vascular tissue of the resistant clone was free from hyphae.

Przybyl, K. 1984. Disease of poplar caused by Ceratocystis fimbriata Ell. et Halst. I. Isolation of C. fimbriata, symptoms of the disease and evaluation of resistance of poplar clones resulting from artificial infection. *Arboretum Kornickie*. 29: 89-103.

The fungus was isolated from 17 trees in 7 hybrid clones in the sections Tacamahaca, Aigeiros X Tacamahaca and Tacamahaca X Aigeiros. Disease development is described. Aigeiros poplars were less susceptible than Tacamahaca and the hybrids.

Przybyl, K. 1984. Disease of poplar caused by the fungus Ceratocystis fimbriata Ell. et Halst. II. Morphology of the pathogen. Arboretum Kornickie. 29: 105-118.

Studies on the 3 types of conidia, the perithecia and ascospores, and the cell organelles of hyphae are described for 38 isolates.

Przybyl, K. 1984. Pathological changes and defense responses in poplar tissues caused by Ceratocystis fimbriata. European Journal of Forest Pathology. 14(3): 183-191.

Pathological changes in 4-month-old shoots of 4 poplar clones differing in their degree of resistance to C. fimbriata were observed 1, 2, 4, 14, 30, and 60 days after inoculation. Plastids in necrotic tissue showed more plastoglobules and degenerated thylakoids. Spread of the fungus was inhibited by a cork layer and cells filled with tannins. Starch grains were few in the resistant clone in comparison with the susceptible or moderately resistant ones in which relatively large amounts of starch were found in cells where the front of penetrating hyphae was visible.

Pulkkinen, M.; Yang, Z.Q. 1984. The parasitoids and predators of Saperda populnea (Linnaeus) in Finland. Annales Entomologici Fennici. 50(1): 7-12.

The parasites and predators of Saperda populnea (L.) were investigated in southern Finland in 1982-1983. Four parasites and one predator species were reared in the laboratory from 947 galls of the cerambycid collected on aspen (Populus tremula) and Salix spp. in the field. The few natural enemies seemed to play a relatively large role in regulating numbers of the cerambycid. Together they destroyed 29 percent of the eggs, larvae, and pupae. The chief enemy was the predacious fly Odinia xanthocera Collin.

Puplysis, R.K. 1984. Contribution to the knowledge of pigmy moths of the genus Stigmella Schrank of Lithuania. Acta Entomologica Lituanica. 7: 72-85.

During surveys of Nepticulidae carried out in various regions of the Lithuanian SSR, USSR, in 1980-1982, about 50 species including 40 of Stigmella were collected, 12 of which are described. These include several species, the larvae of which are miners of forest trees. A key is provided for the separation of the 4 species mining rowan.

Reich, P.B.; Lassoie, J.P. 1984. Effects of low level O₃ exposure on leaf diffusive conductance and water-use efficiency in hybrid poplar. Plant, Cell and Environment. 7(9): 661-668.

Young, amphistomatous hybrid poplar (Populus deltoides X trichocarpa) plants were exposed daily to either background or elevated concentrations of O₃. Levels of abaxial and adaxial leaf conductance were affected interactively by pollutant treatment, leaf age, and photon fluence rate. Overall, the data indicate that exposure to O₃ resulted in impaired stomatal function.

Reich, P.B.; Lassoie, P.; Amundson, R.G. 1984. Reduction in growth of hybrid poplar following field exposure to low levels of O₃ and (or) SO₂. Canadian Journal of Botany. 62(12): 2835-2841.

A field fumigation system was modified from one described elsewhere, and used to expose unenclosed hybrid poplar plants (Populus deltoides X trichocarpa) to low levels of O₃ and/or SO₂. Pollutant treatments included exposure to ambient air or to ambient air + additional O₃ and SO₂ for 5-6 hours a day. Fumigations resulted in reductions in growth, dry matter accumulation, and leaf longevity. No significant interactions between the pollutants were observed. All significant pollutant effects were linear with respect to total dose or average exposure concentration. The negative impact of low doses of O₃ suggests a need for concern, since low level O₃ pollution is chronic during the growing season in much of eastern N. America.

Rhomberg, L. 1984. Inferring habitat selection by aphids from the dispersion of their galls over the tree. The American Naturalist. 124(5): 751-756.

Rishi, N.D.; Lone, M.A. 1984. Description of a new species of Protaphelinus Mackauer parasitic on gall forming aphid, Pemphigus bursarius Linn. infesting Populus nigra var. italica Muench. in Kashmir. Journal of Entomological Research. 8(2): 132-136.

Protaphelinus dargahae sp. n. is described from adult females and males collected from galls caused by Pemphigus bursarius on Populus nigra var. italica in the Kashmir Valley, India, in 1979. A key to the 2 species of Protaphelinus is given.

Roberti, R.; Di Marco, S. 1984. Control of insects, mites and nematodes. La Difesa delle Piante. 7(2): 122-126.

Work is reviewed on new insecticides and other methods of control against insect, mite, and nematode pests of fruit trees, vines, citrus, ornamental or forest species of poplar [Populus] and plane [Platanus], ornamental flowering plants, greenhouse crops and maize. Thiodicarb, a stomach poison, was very effective. The effectiveness of flucythrinate, which had already been tested was confirmed against aphids and P. pyri on pear, leaf-miners on apple and vine moths.

Rowe, J.J. 1984. Grey squirrel bark-stripping damage to broadleaved trees in southern Britain up to 1983. Quarterly Journal of Forestry. 78(4): 230-236.

Results are given of a survey of private and state woodlands in 1983. Stands comprised beech, sycamore [Acer pseudoplatanus], oak, poplar, ash, or birch. Percent of stands damaged - beech 87, sycamore 85, oak 41, poplar 29, ash 36, birch 9. Age, stocking density, and ownership of the stands did not significantly affect the damage.

Rowell-Rahier, M. 1984. The food plant preferences of Phratora vitellinae. A. Field observations. Oecologia. 64(3): 369-374.

Food-plant preferences of Phratora vitellinae, a pest of plantations of willow (Salix spp.) and poplar (Populus spp.), were investigated at a site in the Upper Rhine Valley, France, with relatively undisturbed vegetation. The main food-plant was S. nigricans, but some populations were found on S. purpurea, P. tremula, and P. trichocarpa X P. deltoides. The chrysomelid was

never found on species of Salix with the lower surface of the leaves densely covered with trichomes. S. nigricans did not seem to respond to defoliation with induced resistance to Phratora vitellinae.

Rowell-Rahier, M. 1984. The food plant preferences of Phratora vitellinae. B. A laboratory comparison of geographically isolated populations and experiments on conditioning. *Oecologia*. 64(3): 375-380.

The food-plant preferences of populations of Phratora vitellinae derived from 2 places in central Europe (the Upper Rhine Valley, France) and 2 populations from Belgium were studied in the laboratory. The food-plants accepted by chrysomelids from France were, in decreasing order of preference, Salix nigricans, S. purpurea, Populus nigra, P. tremula, S. alba, S. caprea, and S. cinerea. Leaves of S. nigricans were the richest in salicin, and the 3 least acceptable species had the lower surface of the leaves covered with trichomes. Preferences could be induced by conditioning in the laboratory.

Schink, B.; Ward, J.C. 1984. Microaerobic and anaerobic bacterial activities involved in formation of wetwood and discoloured wood. *IAWA Bulletin New Series*. 5(2): 105-109.

Schmidt, J.O. 1984. Feeding preferences of Apis mellifera L.: individual versus mixed pollen species. *Journal of the Kansas Entomological Society*. 57(2): 323-327.

In feeding preference tests young worker honeybees were given a choice between 2 pollen diets: one consisted of pure pollen from Populus fremontii, Prunus dulcis, Larrea tridentata, Cereus gigantea, or Prosopis velutina, and the other consisted of a mixture of equal weights of these 5 species. The pollen mixture was significantly preferred over Populus, Prunus, and Larrea pollens. These results indicate that A. mellifera exhibits a preference for pollen polyphagy rather than monophagy.

Schoenfeld, P.H.; van den Burg, J. 1984. Premature shedding of leaves and checked growth of 'Heidemij' poplar in roadside plantings. *Nederlands Bosbouw tijdschrift*. 56(1): 12-21.

In autumn 1978, premature leaf fall and necrotic foliage were observed in plantings alongside motorways. In autumn 1979, both healthy and affected trees were examined to determine soil profile, rooting pattern, groundwater regime, height growth pattern, soil chemistry, and foliage chemistry. Results identified 3 main causes for poor growth and condition: volume occupied by roots too small, low soil fertility, and high soil salinity.

Schönherr, J.; Sprich, L.; Lucking, M. 1984. The cause of black patches on the leaves of balsam poplars. *Allgemeine Forstzeitschrift*. 9/10: 230-231.

The life cycle of Paraleucoptera sinuella [P. susinella] is outlined, and damage symptoms described. Caterpillars excavate leaves of Populus balsamifera (especially P. 'Rochester'), leaving patches of brown to blackish dead tissue. Control may be affected by burning leaf litter containing overwintering 2nd generation pupae. Reports of damage by the pest in other parts of Europe are discussed.

Scott, E.S. 1984. Detection of wetwood in living poplar trees by electrical resistance measurements. *European Journal of Forest Pathology*. 14(6): 334-339.

Wetwood was detected by determining the electrical resistance patterns across the stem of 17-year-old trees with a Shigometer. Resistance to a pulsed current was low compared with that of healthy sapwood. Bacteria were isolated from wood with low resistance, but rarely from wood with high resistance.

Scott, E.S. 1984. Populations of bacteria in poplar stems. *European Journal of Forest Pathology*. 14(2): 103-112.

The distribution of bacteria in wood of Populus x euramericana trees was discontinuous in both radial and axial directions. Populations were larger and more diverse in wetwood than in sapwood. Of 13 isolates characterized, 2 Clostridium spp. and 1 Edwardsiella spp. were found only in wetwood while 1 Micrococcus spp. occurred only in sapwood. The remaining bacteria were found in both wetwood and sapwood. All isolates were capable of altering wood components. These bacteria may be important in wetwood formation and development.

Sen-Sarma, P.K.; Ahmad, S.I. 1984. A polyhedral virus infecting poplar defoliator Pygaera fulcurita (Walk.). *Indian Journal of Entomology*. 46(pt. 1): 112-114.

Shang, R.Z.; Pei, M.H. 1984. Study on the leaf rust of Davids European aspen caused by Melampsora larici-tremulae Kleb. *Journal of North-Eastern Forestry Institute, China*. 12(1): 47-55.

The life history of M. larici-tremulae [M. populnea] is described - spermatia and aeciospores are produced on larch and urediospores, teliospores, and basidiospores on Populus davidiana [P. tremula davidiana]. Optimal temperatures for spore germination are given; all need 100 percent humidity. The urediospores cannot germinate overwinter and are, therefore, not an infection source. Species of sections Aigeiros or Tacamahaca, and hybrids in or between them are not infected.

Shirnina, L.V.; Nechaeva, M.Yu. 1984. The role of saprotrophic fungi in the pathogenesis of poplar bark. II. Interaction between germinating spores of epiphytic saprotrophic fungi and the pathogen Dothichiza populea Sacc. & Br. *Mikologiya i Fitopatologiya*. 18(2): 112-116.

Saprotrophic fungi were generally more inhibitory to D. [Cryptodiaporthe] populea than vice versa. Among 8 antagonistic isolates 2 of A. tenuis (A. alternata), 1 of Stachybotrys alternans and 3 of Stemphylium spp. were the most active, decreasing spore germination of C. populea by 21.3-68.3 percent and germ tube length by 12.9-53.2 percent.

Slyunyaev, V.P.; Agafonova, N.V.; Malysheva, O.N.; Saplina, V.I. 1984. Study of wood decomposition caused by the fungus Lenzites betulina. In: Kiprianov, A.I.; et al., eds. *Chemical treatment of wood*. Leningrad, USSR: Leningradskaya Lesotekhnicheskaya Akademiya: 12-16.

Aspen (Populus) sawdust was decomposed with and without activated sludge hydrolysate to produce fodder. Sawdust with activated sludge decomposed

faster than that without sludge. After 30 days exposure to the fungus; amount of easily hydrolysed sugars dropped by 16.2 and 19.6 percent, respectively.

Sokolova, E.S.; Kobel'kov, M.E. 1984. Poplar diseases. *Zashchita Rastenii*. 5: 26-28.

Spiers, A.G. 1984. Comparative studies of host specificity and symptoms exhibited by poplars infected with Marssonina brunnea, Marssonina castagnei and Marssonina populi. *European Journal of Forest Pathology*. 14(4/5): 202-218.

On inoculating leaf discs of Populus spp. and clones with conidia of M. spp., 2 ff.sp. of M. brunnea could be distinguished: f.sp. brunnea pathogenic to P. deltoides and P. X euramericana and f.sp. trepidae infecting P. tremula and/or P. tremuloides. Symptoms induced by M. brunnea, M. castagnei, and M. populi overlapped, varying from discrete spots to blotches. Dendritic lesions were peculiar to M. populi and host specific.

Spiers, A.G.; Hopcroft, D.H. 1984. Influence of leaf age, leaf surface and frequency of stomata on the susceptibility of poplar cultivars to Marssonina brunnea. *European Journal of Forest Pathology*. 14(4/5): 270-282.

Leaf age was a significant factor in the resistance of cultivars to the pathogen. Leaf surface (adaxial/abaxial) was not significant for P. nigra, P. deltoides, and P. X euramericana but was for several miscellaneous cultivars. There was no significant correlation between stomatal frequency and M. brunnea infection level. The higher resistance of mature leaves was attributed to differences in cell wall ultrastructure. Differential resistance of the two leaf surfaces of mature leaves of P. candicans was attributed to the strong cutinization of the epidermal cell wall of the highly resistant adaxial surface.

Steiner, K.C.; Barbour, J.R.; McCormick, L.H. 1984. Response of Populus hybrids to aluminum toxicity. *Forest Science*. 30(2): 404-410.

Stem cuttings from 22 clones, derived from crosses among 6 species (P. deltoides, P. nigra, P. trichocarpa, P. balsamifera, P. maximowiczii, and P. laurifolia) were tested in solution culture for response to 3 p.p.m. Al in the form of AlCl₃. Root length was measured before and after. Mean clonal responses varied from nil to 93 percent reduction in root elongation compared with controls. Hybrids derived at least in part from species in section *Tacamahaca* had significantly higher tolerances than those derived entirely from species in section *Aigeiros* (P. deltoides, P. nigra). Tolerance to Al toxicity is particularly important in plants used for revegetating coal mine spoils.

Stermer, B.A.; Scheffer, R.P.; Hart, J.H. 1984. Isolation of toxins of Hypoxyylon mammatum and demonstration of some toxin effects on selected clones of Populus tremuloides. *Phytopathology*. 74(6): 654-658.

The host-specific toxins were partially purified by extraction with solvents, absorption on charcoal, gel filtration, chromatography on silicic acid and DEAE columns, and HPLC. The relative proportions of the toxic acidic metabolites changed with the age of cultures. The most resistant clone tolerated 1000-fold higher toxin concentrations than a sensitive clone. Sensitivity/tolerance of stem tissue was correlated with leaf response. For

leaf bioassays, drops (10 microl) were applied to a leaf wound or to the cut ends of petioles. The latter bioassay, which distributed toxins throughout the leaf blade, was more sensitive. The toxins caused increases in O₂ uptake by leaves, followed by necrosis and electrolyte leakage.

Suberkropp, K.; Arsuffi, T.L. 1984. Degradation, growth, and changes in palatability of leaves colonized by six aquatic hyphomycete species. *Mycologia*. 76(3): 398-407.

Sunarjo, P.I.; Hsia, M.T.S. 1984. Bioactive components of quaking aspen and tulip tree leaves against southern armyworm larvae. Abstracts of Papers of the American Chemical Society. 188(8): 108.

Tao, D.; Li, P.H.; Carter, J.V.; Ostry, M.E. 1984. Relationship of environmental stress and Cytospora chrysosperma infection to spring dieback of poplar shoots. *Forest Science*. 30(3): 645-651.

Shoots of Populus 'Pioneer', P. 'Opera', P. pekingensis [tomentosa], and P. canadensis (including cv. 'Serotina', 'Robusta', and 'Polska 15-A') were collected at intervals in January-April 1978 from a nursery in E. Inner Mongolia, and moisture content and viability determined. Moisture content of shoot sections was always much higher than the lethal moisture content and all sections were viable. Moisture content of shoots decreased rapidly after canker development. In a series of trials in spring 1981, shoots of P. canadensis were tested for resistance to freezing, heat (IR radiation) and heating/freezing cycles, and given a series of treatments with or without inoculation with V. sordida, designed to simulate early spring injury. The relation between environmental stress and secondary infection by Valsa is discussed.

Templado, J. 1984. Food preferences of European notodontids. *Graellsia*. 39: 175-179.

The author presents an analysis, based on the literature, of the feeding preferences of larvae of notodontids in Europe. A clear preference for Salicaceae (especially Populus and Salix), Betulaceae (especially Betula), and Fagaceae (especially Quercus) is evident.

Tian, N.X.; Wang, X.L.; Zhao, X.Z. 1984. Experimental control of rust of Populus euphratica at seedling stages with Bayleton. *Forest Science and Technology (Linze Keji Tongxun)*. 4: 26-27.

Bayleton [triadimefon] was applied to seeds in powder form, or to seedlings by soaking roots in fungicide solution for 40 or 60 minutes before transplanting, or by spraying. Spraying also proved to be very effective. Control was 100 percent after 32 days and 83.77 percent after 63 days.

Tonneijck, A.E.G.; Floor, H. 1984. Effects of ozone on plants. *Bedrijfsontwikkeling*. 15(5): 440-443.

Data were collected on ozone damage to leaves of the sensitive tobacco cv. Bel W3 distributed throughout the Netherlands in 1982 and a map of the results was compared with measurements of mean O₃ concentration during the same year. The data indicated that damaging levels of O₃ occurred on a wide scale in the Netherlands.

van den Burg, J. 1984. Salt tolerance of poplars and willows. *Populier*. 21(2): 42-47.

A review of literature covering tolerance in various species and cultivars in roadside and street plantings, threshold values, and tolerance against salt or brackish groundwater.

Veer, V.; Chandra, A. 1984. Insect pests in nurseries and plantations of Populus deltoides in Assam and Bengal. *Indian Forester*. 110(7): 640-643.

Ten species are reported of which 5 are new records on poplars in India.

Veijalainen, H.; Reinikainen, A.; Kolari, K.K. 1984. Nutritional growth disturbances of forest trees in Finland. Interim report. *Folia Forestalia* 601. Suonenjoki, Finland: Institutum Forestale Fenniae, Suonenjoki Research Station. 41 p.

The report summarizes results from earlier papers on studies during 1976-1981 of growth disturbances (loss of apical dominance and dieback) in Pinus sylvestris, Picea abies, Betula spp., Populus tremula, Salix spp., and Alnus spp. in Finland. Methods to prevent the disturbances are discussed.

Verenini, M. 1984. The poplar pests Cryptorrhynchus lapathi L. and Saperda carcharias L. *Informatore Fitopatologico*. 34(6): 31-34.

Notes are given on the morphology, biology, food-plants, and control of Cryptorrhynchus lapathi and Saperda carcharias in Italy, both of which bore into the wood of Populus and Salix spp. The 1st species is best controlled preventively by spraying or removal of bushes near young poplars in nurseries. A single application of parathion or methyl-parathion [parathion-methyl] sprayed up the trunk and branches to a height of 4-5 m, is recommended. Infestation by the 2nd species is prevented by removal of infested branches and logs from the poplar plantations and collection of adults by shaking the trees.

Vyskot, M. 1984. Effect of water-management practices on the diameter increment of floodplain forest tree species. *Lesnictvi*. 30(9): 737-765.

Auxanometer measurements at b.h. were made from 1965 onwards at Lednický Luh on the lower Dyje in Czechoslovakia. Annual spring flooding was sometimes prolonged but ceased after stream regulation works in 1972 which also lowered the water table. As a result of the stream regulation, increment was reduced in poplar (Populus nigra), slightly reduced in ash, n.s.d. in elm (Ulmus laevis), and linden (Tilia cordata) and slightly increased (allowing for a simultaneous decrease in rainfall) in oak. Results suggest that water management could be used to create high-quality oak stands.

Wagner, G. 1984. Analysis of standardized poplar leaf samples to control the burdening of the environment by persistent pollutants. *Zeitschrift für Analytische Chemie*. 317(3-4): 491-493.

Data for Pb, Cd, and Zn showed that Populus nigra 'Italica' is especially suitable for the determination of pollution trends in large areas.

Wang, H.F.; Zhang, W.G. 1984. Description of a new species of the genus Bryobia from Xinjiang. *Acta Zootaxonomica Sinica*. 9(1): 41-43.

Bryobia populi sp.n. is described from adult females collected from Populus spp. in China, in 1981.

Wang, T.Z.; Chen, D.P. 1984. Notes on the damage done by Anoplophora chinensis to Cryptomeria japonica. Forest Science and Technology (Linze Keji Tongxun). 6: 26-27.

A. chinensis is an important pest damaging various broadleaved tree species especially citrus, poplar, and willow. A description is given of its life history and habits and the symptoms of trees damaged. Methods of control included insecticide use.

Wolting, H.G.; Mooi, J. 1984. Effects of air pollution on the growth and yield of plants. Bedrijfsontwikkeling. 15(5): 449-454.

Seedlings of Populus X euramericana, P. X interamericana, P. trichocarpa, P. nigra, Medicago sativa, and 3 Trifolium species were fumigated with 7-23 microg NO or 2-58 microg NO₂/m³ by day or by night in combination with 0 or 58 microg O₃ and/or 3 or 60 microg SO₂/m³. Pairs of pollutants reduced yields by 0-20 percent and all 3 pollutants by 40-60 percent. In Populus species the symptoms of O₃ damage resembled those due to other causes (herbicides, nutrient deficiency, or attack by mites or aphids).

Wool, D. 1984. Gall-forming aphids. In: Ananthakrishnan, T.N., ed. Biology of gall insects. London, UK: Edward Arnold: 11-58.

This review of the biology of gall-forming aphids includes a table showing the genera of plants used as primary hosts by the 3 families and 5 subfamilies of these insects (including Picea for Adelgidae; Quercus, Carya and Vitis for Phylloxeridae; Ulmus for Eriosomatinae and Populus for Pemphiginae) and an appendix providing an annotated list of about 100 species of gall-forming aphids. Topics discussed include taxonomy, distribution, gall morphology, life cycles, host-parasite relationships, population ecology, parasites, predators, behaviour, and genetics.

Wu, W.N.; Li, Z.Q. 1984. Three new species of Phytoseiidae from Shennongjia, Hubei Province. Acta Zootaxonomica Sinica. 9(1): 44-48.

The author deals with 3 new species of Phytoseiidae found in Shennongjia, Hubei Province, China, in 1981. Typhlodromus cervix sp.n. is described collected on Pinus massoniana, Phytoseius nudus sp.n. from Rosa spp. and Populus wilsonii, and Amblyseius subplebeius sp.n. on soyabean, Quercus variabilis, and walnut.

Xiang, Y.Y. 1984. On the biological control of important diseases of poplar. Acta Phytopathologica Sinica. 14(1): 8.

Xiang, Y.Y.; Zhang, H.L. 1984. A study on the characteristics of poplar mosaic virus. Forest Science and Technology (Linze Keji Tongxun). 3: 24-27.

A study including virus purification, grafting of affected buds, virus inoculation, the appraisal of disease resistance, and dilution metering. Symptoms are described. Results showed that many other plants are vulnerable to the virus. The virus was killed at a temperature of 75-80 degree C.

Xiang, Y.Y.; Xi, Z.X.; Zhang, H.L. 1984. A study on the properties of poplar mosaic virus. *Scientia Silvae Sinicae*. 20(4): 441-446.

Poplar mosaic virus, which produces light brown necrotic streaks on poplar foliage, or black-brown spots after inoculation, is a new disease to China. Tests of poplar clones showed that 12 clones were resistant, 6 were highly susceptible, and 2 were moderately susceptible. The cultivar 'Harvard' was very susceptible; volume growth in infected trees could be 30 percent below normal.

Xu, S.Q.; Yuan, S.Z.; Chen, X.C. 1984. Study on the pathogenic fungus of poplar leaf-blight. *Journal of North-Eastern Forestry Institute, China*. 12(1): 56-64.

A. tenuis [A. alternata] isolated from poplar leaves demonstrated as causal agent of the disease by artificial inoculation in the laboratory. The fungus overwinters in fallen leaves or in buds. Optimal temperatures for conidial germination was 26-28 degree C and optional pH 5.6; RH 93 percent was required. Mycelial growth was rapid in PDA medium.

Xu, Z.G.; Li, J.M.; Cai, Y.H.; Wu, H.Y.; Gu, X.Y. 1984. Bionomics and control measure of the poplar-trunk clearwing. *Scientia Silvae Sinicae*. 20(2): 165-170.

The life cycle is described of this new and important poplar pest in Qinghai Province. Control measures include spraying trunks with phosphamidon (to kill new larvae) and injecting Rogor [dimethoate] or dichlorvos crude emulsion into burrows on trunks (to kill older larvae).

Yang, Z.Q. 1984. Notes on the larva and puparium of Odinia xanthocera Collin. *Annales Entomologici Fennici*. 50(3): 93-94.

Odinia xanthocera has recently been shown to be a natural enemy of the wood-boring cerambycid Saperda populnea in poplar (Populus) and willow (Salix) in Finland. The young larvae feed on larval frass of the cerambycid, and older larvae prey on the pupae, but cannibalism is also common.

Zareh, N.; Ahmadi, A.A.; Alishah, A. 1984. Evaluation of feeding response, age specific survival and longevity of poplar leaf beetle Chrysomela populi L. on five host plants. *Iran Agricultural Research*. 3(2): 129-138.

Field and laboratory studies were carried out in Iran on the food consumption by weight and age-specific survival and lifespan of Chrysomela populi on Salix babylonica, S. nigra, S. alba, Populus nigra, and P. alba. Age-specific survival differed significantly on poplars and on S. alba, but age-specific lifespan did not differ significantly between these food-plants. Almost 3 times as much food was consumed by the larvae on poplars as on willows. The results indicated the presence of feeding deterrents in S. nigra and S. babylonica.

Zhang, J.J.; Na, S.M.; Yu, M.X.; Xiang, W.N. 1984. Identification of biotype and plasmid type of several strains of Agrobacterium tumefaciens isolated from the vicinity of Beijing. *Acta Microbiologica Sinica*. 24(4): 375-380.

Six strains of the bacterium were isolated from crown galls on peach, pear, and poplar trees in the Beijing suburbs. Typical tumours were induced on inoculation of young plants of sunflower, tomato, and Kalanchoe.

Zhao, J.Z.; Wang, L.F.; Xue, M.X. 1984. A study on the big spot type canker of poplars - Part III: a preliminary study on the law of disease incidence. Forest Science and Technology (Linze Keji Tongxun). 6: 29-30.

Experiments investigated the time of occurrence of Dothichiza [Cryptodiaporthe] populea, sources and sites of infection, and occurrence and spread of the disease infecting trees through wounds and natural ostioles. Its distribution was related to precipitation and RH.

Zhong, Z.K. 1984. Further report of study on poplar canker caused by Dothichiza populea. Acta Phytopathologica Sinica. 14(2): 120-122.

Zhou, J.X.; Zhang, K.B.; Lu, Y.Z. 1984. Studies on the behaviour and its mechanism of the adult Anoplophora nobilis Ganglbauer. Scientia Silvae Sinicae. 20(4): 372-379.

A. nobilis is one of the most important pests of poplar in Shannxi and Gansu Provinces, China and in Ningxia Hui autonomous region. Activity was highest at 16-28degC and became irregular at 10degC or 32degC. They preferred trees with d.b.h. 7-12 cm for oviposition. For feeding and oviposition, poplars in sections Aigeiros and Tacamahaca were preferred. Some resistance was found in section Leuce, and in Paulownia, and tree of heaven [Ailanthus]. Populus X dakuanensis appeared to emit a chemical that attracted the pest to feed and lay eggs.

1985

1985. Summaries of the papers for presentation at the Plant Disease Meeting 1985. Gewasbescherming. 16(1): 10-22.

The topics discussed in these abstracts of papers prepared for presentation at a meeting in the Netherlands in 1985 on the protection of crops there, from pests and diseases include the integrated control of the apple pest Phyllonorycter blancardella, pheromone trapping of injurious sesiids, baculoviruses as a possible means of controlling Leucoma salicis on poplars [Populus], Neoaplectana bibionis for the control of noctuid larvae such as Agrotis segetum in the soil of crop fields, the effectiveness of avermectin B1 for the control of Tetranychus urticae and Liriomyza trifolii on glasshouse ornamental plants and flowers.

Akers, Rodney Cliff. 1985. Reproductive biology of the bronze birch borer, Agrilus anxius Gory, in Ohio. Dissertation Abstracts International. 46/03-B: 745.

Studies were designed to investigate the reproductive biology of the bronze birch borer, Agrilus anxius Gory. Two approaches were taken: (1) to learn to manipulate beetle emergence and mating; (2) to determine host foliage effects on reproduction. Infested birch wood was subjected to 4 post-felling treatments to delay or expediate adult emergence. Significantly more emergence occurred from SW quadrants of trees than from other quadrants. Adult emergence can be predicted using a heat unit summation model. Beetles reproduced when fed Betula, Populus, Quercus, and Salix foliage. Three- to five-day-old beetles mated more readily than newly emerged beetles. These

experiments demonstrate that A. anxius can be successfully manipulated in the laboratory. Host quality is extremely important in beetle reproduction.

Arshad, M.; Hafiz, I.A. 1985. Efficacy of Beauveria bassiana Vuill. fungus against the larvae of Apriona cinerea Chev. Pakistan Journal of Zoology. 15(2): 207-211.

Laboratory investigations on the pathogenicity of Beauveria bassiana to Apriona cinerea on poplar in Pakistan, and on the possibility of using it effectively for biological control, showed that the fungus killed 22.5-47.5 percent of the larvae.

Arshad, M.; Hafiz, I.A. 1985. Microbial trials of a pathogenic fungus, Beauveria bassiana Vuill. against the adults of Aeolesthes sarta Solsky. Pakistan Journal of Zoology. 15(2): 213-215.

In Pakistan, Aeolesthes sarta is a serious pest of poplars, which are important for wood used in various industries. Beauveria bassiana induced 94.3 percent adult mortality without causing irritability or increased movement in the insects.

Bagaev, E.S. 1985. Structural features of aspen having differing resistance to heart rot. Lesnoe Khozyaistvo. 11: 61-63.

Correlations were sought between various structural features of the trees and resistance to heart rot caused by Phellinus tremulae in various clones of aspen in the Kostroma region of the USSR. It is concluded that butt rot in aspen can be taken as a reliable indicator of the degree of resistance to rot diseases. The presence of butt rots in aspen 10-15 years old was closely correlated with the spread of stem rots at 25-30 years.

Bailey, A.W.; Arthur, R.L. 1985. Cattle use of aspen suckers encroaching into native fescue rangeland. University of Alberta, Agriculture and Forestry Bulletin. 6: 83-84. [June, special issue.]

This paper was published in the 64th Annual Feeders' Day Report, June, 1985. Aspen [Populus sp.] suckers were subjected to 4 grazing treatments by beef cattle during 1973-1981. For best sucker control, it was recommended that the rangelands should be rotationally grazed, moderately for 4 years then heavily in the 5th year. Two years later the suckers at the forest edge should be sprayed, mowed, or burnt.

Bailey, A.W.; Irving, B.D.; Willms, W.D. 1985. Effect of 2,4-D and fire on mortality of aspen. University of Alberta, Agriculture and Forestry Bulletin. 6: 81-82. [June, special issue.]

This paper was published in the 64th Annual Feeders' Day Report, June, 1985. The effects of 2,4-D and fire in clearing aspen [Populus spp.] forests were studied. It took 3 years for the treatment to achieve a satisfactory kill. Additional fire treatments could be used to kill surviving trees and burn fallen trees.

Baldwin, R.C.; Streisel, R.C. 1985. Detection of fungal degradation at low weight loss by differential scanning calorimetry. Wood and Fiber Science. 17(3): 315-326.

A thermo-analytical method was used to detect incipient fungal degradation. Hybrid poplar (Populus maximowiczii X trichocarpa) specimens were degraded by the brown-rot fungus Lenzites trabea [Gloeophyllum trabeum] and analysed at 5 sequential, 3-day intervals to a weight loss of 5 percent. DPw changes of both holo- and alpha-cellulose were significant with regard to decay interval. Analysis revealed that this methodology was a reliable means of evaluating fungal degradation in the decayed wood but not in the whole wood.

Bassman, J.H.; Dickmann, D.I. 1985. Effects of defoliation in the developing leaf zone on young Populus X euramericana plants. II. Distribution of ¹⁴C-photosynthate after defoliation. *Forest Science*. 31(2): 358-366.

P. X euramericana [P. canadensis] cuttings were defoliated in the developing leaf zone by removing all the leaf lamina except a 2mm strip either side of the midrib. Translocation patterns were altered within 24 hours of defoliation. When leaves below or remaining tissue of leaves within the defoliation zone were exposed to ¹⁴CO₂, a greater percentage of ¹⁴C-photosynthate was transported to the expanding shoot and lateral branches and less to the roots in defoliated plants compared with undefoliated controls. By 5 weeks after defoliation there was little difference in ¹⁴C-distribution patterns between defoliated and control plants.

Buchheim, M.P.; MacLean, A.L.; Lillesand, T.M. 1985. Forest cover type mapping and spruce budworm defoliation detection using simulated imagery. *Photogrammetric Engineering and Remote Sensing*. 51(8): 1115-1122.

A paper presented at the 1984 SPOT symposium, Scottsdale, Arizona, 20-23 May, 1984. A SPOT (Systeme Probatoire d'Observation de la Terre) simulated image for an area in N. Wisconsin taken in June 1983 was analyzed using both manual and computer assisted interpretation techniques. Results indicated that there was potential for substantial improvement in the accuracy and specificity of cover type mapping, compared with landsat multispectral scanning images. Visual discrimination to species was possible over most of the image using multispectral data. The system could provide information currently obtained from medium and high altitude aerial photography. Added advantages are that the data are amenable to computer processing and that the analysis can integrate manual and digital analysis techniques.

Chakrabarti, S.; Dey, K.; Ghosh, A.K. 1985. Galls of pemphigine aphids in north west Himalaya and some hitherto not known facts on the biology of some species infesting poplar plants. *Cecidologia Internationale*. 6(1/3): 19-25.

The gall-forming Pemphiginae and their host association in India are described. The biology, ecology, gall initiation, and intraspecific competition of Epipemphigus imaicus and Pemphigus mordwilkoii on their primary hosts poplar (Populus sp.) in the north-western Himalayas are also discussed.

Chaudhry, M.I.; Hanif Gul. 1985. Efficacy of antimoultants against poplar defoliator Ichthyura anastomosis Steph. and shisham defoliator Plecoptera reflexa Guen. *Pakistan Journal of Forestry*. 35(4): 181-186.

Poplar shoots were sprayed with Dimilin [diflubenzuron] or Alsystin [triflumuron] in the laboratory and larvae of I. anastomosis [Clostera anastomosis] added. After 96 hours mortality was 80-100 percent of insects

exposed to Dimilin or Alstylin, compared with 13-23 percent mortality in untreated controls.

Chaukiyal, S.P.; Sharma, H.P. 1985. Effect of spacing in planting on the erectness, susceptibility to shoot borers attack, branchiness and height-diameter growth of Populus ciliata plants in nurseries. *Indian Journal of Forestry*. 8(4): 274-275.

Shoot cuttings were planted in March 1982 in nursery beds near Solan (Himachal Pradesh) at 6 spacings. A spacing of 45X45 cm gave the highest percentages of erect, healthy plants with 2nd greatest height and basal diameter.

Deseo, K.V.; Docci, R. 1985. Microbiological control against Zeuzera pyrina L. *Difesa delle Piante*. 8(2): 285-291.

Zeuzera pyrina is an important pest of apple, pear, and poplar [Populus] in Italy. Since chemical control of the young larvae is not feasible during the fruit harvest, the possibility of biological control by means of the nematodes Steinernema bibionis [Neoaplectana bibionis], S. feltiae [N. feltiae] and Heterorhabditis sp. was investigated in several apple orchards. Suspensions containing the nematodes were either applied by means of a motor sprayer or used to soak cotton buds that were inserted into the entrance holes of larval galleries. The first method resulted in 70-100 mortality and the second in 90-95 percent. Cotton buds were also soaked in suspensions of the fungi Beauveria bassiana and Metarhizium anisopliae or of the bacterium Bacillus thuringiensis and gave 95-99 percent larval mortality of Z. pyrina in the galleries.

Dharmadhikari, P.R.; Ramaseshiah, G.; Achan, P.D. 1985. Survey of Lymantria obfuscata and its natural enemies in India. *Entomophaga*. 30(4): 399-408.

A survey conducted between 1961 and 1966 in 3 sites in Kashmir and Himachal Pradesh, India, revealed that the larvae of Lymantria obfuscata fed upon leaves of Populus spp., Salix spp., Quercus spp., Alnus nitida and false acacia (Robinia pseudacacia) and caused damage to apples, pears, plums, cherries, mulberries, walnuts, and roses when their numbers were high. Observations on the mating and oviposition behaviour of the adults and development of the immature stages are given. Eggs were parasitized by 2 species of eupelmids. Two species of dermestid were observed preying upon eggs. A nematode was also recorded parasitizing larvae. A nuclear polyhedrosis virus caused mortality of larvae in the field. Information on the incidence and biology of some of these natural enemies is given.

Dix, M.E.; Doolittle, R.E. 1985. Acosus centerensis response to attractant dispenser and trap height, and determination of seasonal flight. *Journal of Economic Entomology*. 78(4): 802-805.

In trap tests in a mixed hardwood forest in South Dakota in 1978-1980, Conrel hollow polymeric fibres with emission rates of (3E,5E)-3,5-tetradecadienyl acetate of 9 and 36 microg/day attracted significantly more males of Acosus centerensis, a pest of quaking aspen (Populus tremuloides), than did rubber septum or cotton wick dispensers baited with 500 microg of (3E,5E)-3,5-tetradecadienyl acetate. Catches increased linearly with trap height.

Dixon, W.N.; Foltz, J.L. 1985. The gypsy moth, Lymantria dispar (L.). Entomol. Circ. 270. Gainesville, FL: Florida Department of Agriculture and Consumer Services, Division of Plant Industry. 4 p.

Information is given on the history, morphology, geographical distribution, food-plants, biology, detection (by means of pheromone traps), and control of Lymantria dispar, which was originally introduced from Europe into the USA as a commercial source of silk but became a defoliator of forest trees. It has been found in Florida. It presents a threat to the large forests containing oaks and other preferred trees such as birch (Betula), poplar (Populus), and willow (Salix), especially those which are weakened by other causes. Details are given of a domestic quarantine and control program. Biological insecticides, insect growth regulators, toxic chemicals, physical barriers, and release of natural enemies are all listed as available for the control of the lymantriid.

Doganlar, M.; Doken, T. 1985. Gypsonoma minutana and its natural enemies in eastern Anatolia. Turkiye Bitki Koruma Dergisi. 9(4): 199-206.

The tortricid Gypsonoma minutana is recorded for the first time in Turkey, from Populus nigra var. italica in the Tortum district of eastern Anatolia. The pathogenic fungus Beauveria bassiana is recorded for the first time from this host, and a tachinid parasite, Phytomyptera nitidiventris [P. nigrina], is recorded for the first time both from this host and from Turkey.

Du, J.W.; Xu, S.F.; Dai, X.J.; Zhang, X. 1985. Strategies for control of poplar clearwing moth Paranthrene tabaniformis Root by mass trapping. Contributions from Shanghai Institute of Entomology. 5: 19-24.

Strategies for controlling the sesiid Paranthrene tabaniformis, a pest of poplar (Populus), by mass trapping using (3E,13Z)-3,13-octadecadien-1-ol as an attractant were evaluated in field studies in China. Mass trapping resulted in a 76.9-94.7 percent reduction in the next generation at low densities of the pest, 78.4-80.0 percent at moderate densities, and 57.0-85.7 percent at high densities. There was a perfect curvilinear relationship between population density and control efficiency.

Fang, H.L.; Lian, Y.Y.; Tong, P.Y. 1985. A preliminary study on Adoretus sinicus. Forest Science and Technology (Linze Keji Tongxun). 2: 26-28.

A. sinicus is an important pest of several plant species such as tallow trees, Liquidambar taiwaniana, white poplar, and hickory trees [Carya]. Morphology and characteristics as well as life cycle and habits are described. Methods proposed for control include tilling soil, nursery irrigation, chemical control using Dipterex [trichlorfon] or 0-diethyl-phosphorothioate [cyanthoate], and biological control. Natural enemies so far found are frogs and toads, Beauveria bassiana, and green muscardene fungus.

Funk, A. 1985. The anamorph of Leciographa gallicola. Canadian Journal of Botany. 63(2): 365.

Seimatosporium etheridgei found on bark proliferations of aspen boles (Populus tremuloides) is shown to be the anamorph of L. gallicola, commonly found on galls of aspen.

Gallo, L.A.; Stephan, B.R.; Krusche, D. 1985. Genetic variation of Melampsora leaf rust resistance in progenies of crossings between and within Populus tremula and P. tremuloides clones. Silvae Genetica. 34(6): 208-214.

Forty-nine families of controlled crosses were studied for their resistance to Melampsora leaf rust, thought to be caused by M. magnusiana. Assessment of leaf rust attack at the end of both the first and second growing seasons showed highly significant variation between the interspecific crossings. The P. tremuloides families showed the highest resistance, the P. tremula families were severely attacked, and the interspecific hybrid families showed an intermediate behaviour. Melampsora leaf rust resistance could be incorporated successfully into breeding programs.

Gaiova, V.P. 1985. Characteristics of the morphological variability of Valsa species. Ukrains'kii Botanichnii Zhurnal. 42(2): 95-96.

In studies on Valsa sordida and Leucostoma [V.] nivea from Populus spp., the size of the Cytospora anamorphs was stable within certain limits and could be used to distinguish the species.

Gansner, D.A.; Herrick, O.W. 1985. Host preferences of gypsy moth on a new frontier of infestation. Res. Note NE-330. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 3 p.

Chestnut oak [Quercus prinus] was the species most heavily defoliated by gypsy moth [Lymantria dispar] in Pennsylvania during 1978-1983.

Gao, R.T.; Qin, X.X.; Li, J.Z.; Hao, W.Q.; Wang, X.Z. 1985. A preliminary study on the relationship between artificial defoliation of poplar trees and their growth. Scientia Silvae Sinicae. 21(2): 199-205.

Poplars were 0, 25, 75, and 100 percent defoliated to simulate feeding damage by Clostera anachoreta, one of the most important insect pests of poplar. Defoliation of 75 percent and 100 percent resulted in a decrease of 21.2 percent and 50.8 percent in diameter, and 20.5 percent and 44.7 percent in height of the test tree, respectively.

Griffin, D.H.; Manion, P.D. 1985. Host-pathogen interactions as measured by bioassay of metabolites as produced by Hypoxyylon mammatum with its host Populus tremuloides. Phytopathology. 75(6): 674-678.

Five single-ascospore H. mammatum isolates produced metabolites in a chemically defined broth medium and in grain culture. After treatment to remove high-molecular-weight materials, the culture filtrates and grain culture extracts were concentrated and tested for toxic activity against 9 P. tremuloides clones by using a leaf-puncture bioassay. The intensity of the reaction was measured by testing serial dilutions of the samples, and sensitivity of the host was measured according to the size of lesion produced at each dilution. The clones could be classified into 3 sensitivity groups by the bioassay, high, medium, and low. Analysis of variance indicated that horizontal response (clone main effects) was most important, but significant vertical response mechanisms (clone by isolate interactions) were also present. The host reactions showed negative correlation with canker length and positive correlation with frequency of callus formation. These correlations suggest that the bioassay of the sensitivity to the metabolites

produced in culture by these methods measures the ability of the aspen clones to respond to elicitors.

Guderian, R.; Koppers, K.; Six, R. 1985. Effects of O₃, SO₂ and NO₂ on spruce and poplar supplied with various rates of Mg and Ca, and on the lichen Hypogymnia physodes. In: Forest dieback influencing factors and their evaluation: Proceedings of a symposium; 1985 June 18-20; Goslar, West Germany. VDI-Berichte. 560: 657-701.

Growth chamber and greenhouse studies were made on seedlings of Norway spruce (initially 4 years old) and Populus interamericana var. Donk [P. 'Donk'] grown in sand or soil substrate and exposed to 'realistic' concentrations of pollutant gases over a 2-year period. Seedlings were much less sensitive to individual gases than to the combinations O₃/SO₂ or especially) O₃/SO₂/NO₂. Seedlings exposed to high concentrations of O₃, in combination with SO₂, exhibited mottling characteristic of O₃ damage. Minor deficiencies in Mg and Ca led to increased sensitivity to pollutant damage, but pollutant damage effects were less severe with more pronounced nutrient deficiency.

Guillaumin, J.J.; Lung, B. 1985. Study of the specialization of Armillaria mellea (Vahl) Kumm. and Armillaria obscura (Secr.) Herink in the saprophytic phase and in the parasitic phase. European Journal of Forest Pathology. 15(5/6): 342-349.

Young plants of 7 woody species (grapevine, peach, Quercus borealis, Picea abies, Pinus pinaster, Populus X euramericana, and Eucalyptus dalrympleana) were inoculated with 2 isolates of each A. sp. A. mellea was more aggressive than A. obscura towards grapevine, peach, and oak; A. obscura was the more aggressive towards spruce and pine; and P. X euramericana and E. dalrympleana seemed to be fairly resistant to both A. spp.

Haugen, Dennis Allen. 1985. Oviposition preference of the cottonwood leaf beetle, Chrysomela scripta F., on poplar clones, Populus spp. Dissertation Abstracts International. 46/09-B: 2930.

Oviposition preference of the cottonwood leaf beetle, Chrysomela scripta F., was determined for 12 Populus clones. Oviposition preference was quantified by number of egg masses and mean number of eggs/mass for each clone. Significant differences were found for number of egg masses among the clones. No significant differences were found for mean number of eggs/mass among the clones. Populus clones in the Aigeiros and Tacamahaca sections were more preferred for oviposition than Leuce clones. Oviposition preference was compared with results for other studies of cottonwood leaf beetle activities.

Hemptinne, J.L. 1985. The overwintering sites of the coccinellid Adalia bipunctata (L.) in Belgium. Acta Oecologica, Oecologia Applicata. 6(1): 3-13.

Observations carried out in the north of the province of Hainault, Belgium, over 4 successive winters showed that overwintering populations of the coccinellid Adalia bipunctata, studied mainly on poplars [Populus], preferred sites facing from east to south-west. Details are given of the contagious distribution of A. bipunctata.

Heymans, P.; Deligne, J.; Nef, L. 1985. Occurrence of Gypsonoma aceriana Dup. on various poplar clones. Zeitschrift fur Angewandte Entomologie. 99(3): 216-223.

The spring activity of Gypsonoma aceriana and the frequency of attacks on various poplar clones of the groups Populus deltoides X P. nigra, P. trichocarpa, and P. trichocarpa X P. deltoides were studied in Belgium. The larvae were found to make several successive mines in the shoots. The best correlations were with the length of the growth period, and particularly with the beginning of spring growth.

Hinds, T.E.; Ryan, M.G. 1985. Expansion of sooty-bark and Ceratocystis cankers on aspen. Plant Disease. 69(10): 842-844.

Expansion of sooty-bark cankers, caused by Encoelia pruinosa (Cenangium singulare) was measured on 143 aspen (Populus tremuloides) to predict years to tree death. The mean vertical expansion of 87 cankers was 44.9 plus or minus 3.7 cm/year. Tree longevity can be predicted by dividing the circumference of the trunk not yet invaded by the canker by the horizontal expansion rate of the canker and adding 1 year.

Hirsh, A.G.; Williams, R.J.; Meryman, H.T. 1985. A novel method of natural cryoprotection - intracellular glass-formation in deeply frozen Populus. Plant Physiology. 79(1): 41-56.

Holsten, E.H.; Hard, J. 1985. Efficacy of Bacillus thuringiensis Berliner for suppressing populations of large aspen tortrix in Alaska. Canadian Entomologist. 117(5): 587-591.

In a trial of Bacillus thuringiensis against Choristoneura conflictana on trembling aspen (Populus tremuloides) in Alaska in the spring of 1981, a concentration of 4 X 10⁹ IU/378.5 litres of water was applied to infested trees using a hydraulic sprayer. Treatments with Dipel 4L [B.t. var. kurstaki] and Thuricide 32LV [B.t. var. thuringiensis] resulted in population reductions of 69 and 76 percent, respectively. Both showed significant foliage protection. The timing of treatment was critical.

Hsiang, T. 1985. Variation in resistance and virulence in the disease interaction between Melampsora rust and black cottonwood. Forestry Abstracts. 46(10): 637.

Hsiang, T.; Van der Kamp, B.J. 1985. Variation in rust virulence and host resistance of Melampsora on black cottonwood. Canadian Journal of Plant Pathology. 7(3): 247-252.

Disease severity, as expressed by spore production rate, was compared in a test of 14 clones of Populus trichocarpa inoculated with 10 isolates of M. occidentalis. Spore production rate was measured by average daily production on leaf discs over a period 2 times the latent period. Clones as well as isolates differed significantly in their contributions to spore production, but there was no differential interaction between clones and isolates. Analysis of variance of total spore production, total pustules, and latent period gave the same results. The number of urediospores/uredium varied significantly between clones but not between isolates. Qualitative interactions do not play a major role in disease in this natural pathosystem.

This resistance of cultivated black cottonwood to M. rust is unlikely to be readily overcome in genetically uniform plantations.

Hu, Y.Y.; Liu, K.Y.; Wang, L.C.; Zhang, J.W.; Jiang, Y.H.; Huang, Z.F.; Fu, G.B. 1985. A discussion on the control threshold of poplar scale insect Quadraspidiotus gigas. Journal of North-East Forestry University, China. 13(4): 43-49.

Relations between timber volume loss (percent) and scale population density were analysed and a linear regression equation calculated.

Jager, H.-J.; Bender, J.; Grunhage, L. 1985. Metabolic responses of plants differing in SO₂ sensitivity towards SO₂ fumigation. Environmental Pollution, A. 39(4): 317-335.

SO₂ exposure showed the pea cv. Spaths Violetta (SV) to be more sensitive to the pollutant than Wunder von Kelvedon (WvK, Kelvedon Wonder). In comparison to SV, WvK showed increases in yield at lower SO₂ concentrations, S accumulation in roots, and higher putrescine concentration. After a short-term fumigation with SO₂/m³ differences between the cultivars could be recognised in sulphite and malondialdehyde contents and in the activities of superoxide dismutase and peroxidase. In a fumigation experiment Tilia cordata proved more sensitive to SO₂ than Populus nigra. The results showed that SO₂ tolerant plants have a more effective mechanism for the compensation of injurious reactions in metabolism than non-tolerant plants.

Karolewski, P. 1985. The role of free proline in the sensitivity of poplar (Populus 'Robusta') plants to the action of SO₂. European Journal of Forest Pathology. 15(4): 199-206.

A statistically significant reduction was observed of total and colloiddally bound water and of chlorophylls a and b in leaves of poplar cv. Robusta cuttings with increasing length of exposure to SO₂. An increase in the free proline level was observed simultaneously. Treatment of poplar leaves with solutions of proline and betaine before exposing them to SO₂ partially protected the plants against these changes. The magnitude of the protective effect depended on the concentration of the solution used.

Krauss, A.; Raczkowski, J. 1985. Resistance of various wood species to the action of sea water substitute. Holzforschung und Holzverwertung. 37(4): 71-75.

Samples of 14 timbers were exposed to a sea water substitute of 3.5 percent salinity. An exponential equation was derived describing the kinetics of wood degradation in sea water. High resistance to the action of sea water was exhibited by larch, Robinia, oak, red oak, and alder. Poor resistance was exhibited by Pinus strobus, Tilia, and Populus. Resistance to effects of sea water tended to increase with increasing wood density.

Krivosheina, N.P. 1985. Contribution to the biology of the metallic wood borer Acmaeodera chotanica Sem. Izvestiya Akademii Nauk Turkmenskoi SSR, Biologicheskikh Nauk. 6: 67.

Notes are given on the biology of the buprestid Acmaeodera chotanica occurring on Gleditsia in a protective belt around orchards in the Turkmen SSR, USSR; also on Populus diversifolia.

Kwon, Y.J. 1985. Classification of the leafhopper-pests of the subfamily Idiocerinae from Korea. Korean Journal of Entomology. 15(1): 61-73.

An annotated list is given of 15 species of Idiocerinae from Korea, with keys to the 3 genera involved and to species of Tautocerus and Idiocerus, with information on morphology, distribution, and food-plants where known (mostly Salix and Populus spp.), and with illustrations of facial and genital characters. The species included 3 new to science and 3 species recorded for the first time in Korea.

Lameris, A.M.C.; Ziemnicka, J.; Peters, D.; Grijpma, P.; Vlak, J.M. 1985. Potential of baculoviruses for control of the satin moth, Leucoma salicis L. Mededelingen van de Faculteit Landbouwwetenschappen, Rijksuniversiteit Gent. 50(2a): 431-439.

Since chemical insecticides applied for the control of Leucoma salicis infesting poplar [Populus] and willow [Salix] plantations in the Netherlands (especially in the Flevopolder District) kill many non-target insects, alternative methods of control are under investigation. The authors examined the possibility of combining baculoviruses and sex pheromones in open traps. The techniques used in rearing L. salicis, screening for baculoviruses, isolation, purification and preparation of polyhedra, electron microscopy, and bioassay are described. The isolate from Poland appeared to be about 7 times as infective as the one from Yugoslavia to the lymantriid.

Lapierre, L.E. 1985. Persistence of Fenitrothion insecticide in poplar Populus tremuloides and gray birch Betula populifolia. Bulletin of Environmental Contamination and Toxicology. 35(4): 471-475.

Lapietra, G.; Allegro, G. 1985. Lispthrips crassipes Jabl., a new pest of poplar in northern Italy. Accademia Nazionale Italiana di Entomologia: 95-101.

Lispthrips crassipes, which sucks the sap from the cell plasma of shoots and leaves of young poplars and also attacks the outer wood layers, causing a corky appearance of the bark, is recorded for the first time in Italy, where it attacked both planted-out and nursery trees. Control measures are preventive and cultural, to create and maintain conditions as good as possible for the young poplars.

Lecce, E. 1985. European Lepidoptera. Nymphalis antiopa Linnaeus, 1758. Hobby Fauna. 1(7/9): 55-56.

Notes are given in Italian and English on the distribution, morphology, biology, and food-plants of Nymphalis antiopa, which is widespread although not common in Europe and is also found in Asia and North America. The larvae fed on birches [Betula spp.], poplars [Populus spp.] and willows [Salix spp.], sometimes being observed in large numbers in late spring or early summer. The adults sucked the sap of willows and oaks [Quercus spp.], and at the end of the summer they invaded fruit orchards but did not damage the trees or the fruits still on them, preferring rotting fallen fruit on the ground. Populations from different countries were remarkably uniform morphologically.

Liu, K.Y.; Liu, G. 1985. Study on the spatial distribution pattern of Quadraspidiotus gigas and its practical significance. Journal of North-East Forestry University, China. 13(4): 50-54.

A study of the use of mean crowding and mean density to describe the aggregated distribution of the poplar scale.

Longo, B.N.; Longo, N.; Moriondo, F.; Drovandi, F. 1985. Observations on some Italian provenances of Melampsora populnea. I. Studies for identification of Melampsora pinitorqua and M. larici-tremulae. European Journal of Forest Pathology. 15(7): 432-444.

Two provenances of the M. populnea 'complex', M. pinitorqua on Populus tremula from Tuscany and M. larici-tremulae on P. tremula from the central Alps were inoculated on the same pycnio-aecial host range and some aspects of their pathogenicity and morphology compared. The provenances differed in host range, pathogenicity, infection localization, and some morphological features. Results indicate that the rusts can usefully be considered as 2 separate species as they differ in pathogenicity.

Ma, R.L.; Cui, B.Q. 1985. A preliminary observation on Orthosia incerta (Hufnagel). Insect Knowledge (Kunchong Zhishi). 22(3): 158-160.

The biology and ecology of the noctuid Orthosia incerta, a pest of trees, was studied in Shihezi Prefecture, Xinjiang, China, in 1981-1982. The morphology of its adult, egg, larva, and pupa are described. Females laid eggs in bark cracks and on the twigs of trees, including ash [Fraxinus], poplar [Populus], elm [Ulmus] and apple. Control measures are suggested.

Macara, A.M. 1985. Two new species of Longidorus associated with forest plants in Portugal. Nematologica. 31(4): 410-423.

L. lusitanicus n.sp. is described from the rhizosphere of Populus sp. in Portugal.

Mackie, K.L.; Brownell, H.H.; West, K.L.; Saddler, J.N. 1985. Effect of sulphur dioxide and sulphuric acid on steam explosion of aspenwood. Journal of Wood Chemistry and Technology. 5(3): 405-425.

The addition of 1.6 percent SO₂ (dry weight) or 0.58 percent H₂SO₄ substantially improved the survival of pentose sugars during steam explosion of Populus tremuloides. H₂SO₄ reduces the extent to which lignin may be extracted by NaOH from the water-washed exploded substrates. Acid-impregnated steam-exploded substrates were more easily saccharified than those steam-exploded without acid impregnation.

Makhovskaya, M.A.; Zemkova, R.I.; Kruglikov, S.A. 1985. Effect of industrial pollutants on the ash composition of leaves from woody plants and their infestation by arthropods. Soviet Journal of Ecology. 15(3): 115-119.

Leaves were sampled from broadleaved trees planted in front of 2 factories in the central Ukraine and at distances of 0.5-7 km. The main pollutants being respectively Fe oxides and F compounds. Data are tabulated on the contents of ash, F, Fe, Mn, Pb, and Zn accumulated in the leaves, and the populations of spider mites [Tetranychidae] and their phytoseiid predators, on Ulmus pinnato-ramosa [U. pumila var. arborea], Populus deltoides s.l. [including P. X canadensis], Bolle's poplar [Populus alba var. pyramidalis] and robinia. Recommendations are made on tree plantings both in the inner zone (suitable for P. deltoides s.l.) and in the moderately polluted zone at 1-3 km, where U. pumila should no longer be used.

Mallett, K.I.; Hiratsuka, Y. 1985. The 'trap-log' method to survey the distribution of Armillaria mellea in forest soils. Canadian Journal of Forest Research. 15(6): 1191-1193.

A total of 121 sharpened trembling aspen logs were pounded into the ground 1m apart in a 10X10 m grid in a 6-year-old lodgepole pine stand in Alberta. Evidence of colonization by A. mellea appeared in 31 logs. A map was drawn to show relationships of colonized logs to diseased and healthy trees as well as to stumps within the plot. Eight distinctive patches were found within the plot. Logs did not become infected in 2 plots with no visual evidence of A. mellea infection.

Manuwoto, S.; Scriber, J.M.; Hsia, M.T.; Sunarjo, P. 1985.

Antibiosis/antixenosis in tulip tree and quaking aspen leaves against the polyphagous southern armyworm, Spodoptera eridania. Oecologia. 67(1): 1-7.

Tannin-containing leaves of the tulip tree (Liriodendron tulipifera) and quaking aspen (Populus tremuloides) were generally toxic to newly hatched larvae of the highly polyphagous noctuid Spodoptera eridania. For later larval instars, growth suppression occurred but was not due to a reduction in digestibility but to suppressed rates of consumption and greatly increased metabolic costs.

Martinez, M.; Gumez, J.L.; Munnier, P. 1985. A little-known pest: the poplar cambium mining fly. Phytoma. 372: 51-53.

The results are presented of investigations in the Aisne district of France in 1981-1983 on the recognition, biology, and injuriousness of the agromyzid Phytobia cambii on poplars in nurseries. The food-plants are reviewed. Larvae of P. cambii develop only on poplars (Populus) and willows (Salix). The biology in other countries is reviewed. Overwintering took place as a pupa in the soil, and there was one generation a year. Prospects for control are discussed.

Matsuda, K.; Matsuo, H. 1985. A flavonoid, luteolin-7-glucoside, as well as salicin and populin, stimulating the feeding of leaf beetles attacking salicaceous plants. Applied Entomology and Zoology. 20(3): 305-313.

Luteolin 7-glucoside was isolated as a feeding stimulant to Chrysomela vigintipunctata costella and Plagioderma versicolora distincta [P. versicolora] in addition to salicin from the leaves of Salix gracilistyla. The feeding response varied according to species. Salicin was found in all of 10 species of Salix examined, and populin was always accompanied by salicin in Populus. These results suggest that the host specificity of C.v. costella and Plagioderma versicolora depends on the presence of salicin and populin as well as luteolin 7-glucoside. The cue substance for L. caprea appeared to be the flavonoid luteolin 7-glucoside.

Miao, J.C.; Jiang, R.H.; Xu, B.R.; Han, W.X.; Su, G.Q.; Li, W.H.; Deng, L.W. 1985. Experiments on the sex pheromone of the poplar clearwing moth Paranthrene tabaniformis and technique of application. Journal of North-East Forestry University, China. 13(3): 123-127.

A report on field trials in China.

Montermini, A.; Cortellini, W.; Deseo, K.V. 1985. Microbiological control of Hyphantria cunea Drury in North Italy. *Difesa delle Piante*. 8(2): 345-351.

Hyphantria cunea is a comparatively new pest in Italy. It is most in evidence on ornamental and fruit trees in urban and suburban areas, so that chemical control is not usually feasible. Bacillus thuringiensis was tested with populations reared on poplar or persimmon leaves from pupae collected in the field in Italy. B. thuringiensis gave 45-100 percent mortality according to the product and to the age of the larvae at application. On mulberry these preparations gave 60-91 percent control. Laboratory tests with the pathogenic fungi Beauveria bassiana and Metarhizium anisopliae were promising but, in a preliminary field test on Morus alba, B. bassiana gave no more than 23 percent kill of larvae.

Moore, Terry A. 1985. Seasonal fungal biomass dynamics in an interior Alaskan paper birch and quaking aspen stand and effects of long-term fertilization ecosystem(s). *Dissertation Abstracts International*. 47/03-B: 925.

Standing crop fungal biomass was measured at bi-weekly intervals for two successive field seasons in contiguous, 50-year-old stands of quaking aspen (Populus tremuloides Michx.) and paper birch (Betula papyrifera Marsh.) and in contiguous stands of aspen and birch undergoing long-term fertilization by yearly application of inorganic nitrogen, phosphorus, and potassium fertilizers. Results show that seasonal biomass for both control and fertilized sites was closely correlated with soil moisture and exhibited little or negative correlation with soil temperature. Unamended aspen soils supported significantly greater fungal biomass than birch soils due to increased soil moisture, a more favorable chemical environment, and production of organic matter more conducive to growth of soil fungi. Fertilization significantly decreased fungal biomass in aspen soils indicating the long-term treatment with inorganic fertilizers could be detrimental to mineral cycling in this forest type. Fertilization significantly increased fungal biomass in birch soils due to increased soil organic matter content and increased soil moisture. The effects of vegetation type and fertilization on soil temperature, moisture, and bulk density are discussed.

Morelet, M. 1985. Venturia species on poplars of the section Leuce. I. Taxonomy. *Cryptogamie, Mycologie*. 6(2): 101-117.

Taxa recognized on Populus are V. viennotii vars. viennotii and levispora; V. tremulae vars. tremulae (anamorph Pollacia radiosa var. radiosa), populi-albae (P. radiosa var. populi-albae) and grandidentatae (P. radiosa var. lethifera), V. macularis, and V. ditricha. A key is given.

Naidenov, Ya. 1985. Marssonina castagnei P. Magn. on poplars of Sect. Leuce in Bulgaria. *Gorskostopanska Nauka*. 22(2): 51-57.

M. castagnei occurs quite frequently on white and grey poplars and aspen in Bulgaria, causing grey-brown spotting and premature leaf-fall. Details are given of symptoms, conidiospores, development and spread, and chemical control. The Dutch clone Populus alba 'Raket' is highly susceptible.

Naidenov, Ya. 1985. Some factors affecting intensity of brown slime flux disease in poplar plantations in Bulgaria. *Gorskostopanska Nauka*. 22(3): 51-56.

A summary account of investigations in 1973-1983 on the distribution, incidence, and severity of the disease. Severity was determined on a 5-point scale from (1) healthy, no spots or epicormics, to (5) over 15 spots/stem with over 1/3 of the stem covered with epicormics. Infestation is greatest in dense plantations. Resistance to the disease decreases with age, infestation being greatest after age 15-16. In Bulgaria the clones Populus 'I-214' and P. 'Weltheimeipappel' are resistant to brown slime flux, while clones of the 'Robusta' group such as 'Bachelieri' and 'Vernirubens' are highly susceptible.

Nebeker, T.E.; Schmitt, J.J.; Solomon, J.D.; Honea, C.R. 1985. Clonal resistance to and incidence of the poplar borer in southern cottonwood plantations. In: 3d Biennial southern silvicultural research conference; 1984 November 7-8; Atlanta, GA. Gen. Tech. Rep. SO-54. New Orleans, LA: U. S. Department of Agriculture, Forest Service, Southern Forest Experiment Station: 247-251.

Neel, W.W.; Solomon, J.D. 1985. Collection, storage and release of predaceous coccinellids in young cottonwood plantations. *Journal of Agricultural Entomology*. 2(2): 212-214.

Preliminary studies were carried out in Mississippi in 1979-1981 to determine whether coccinellid predators could be successfully collected, stored, and released in young plantations of cottonwood [Populus sp.] for the control of Chrysomela scripta. The results showed that Coleomegilla maculata could be successfully collected from hibernation and cold-stored.

Nef, L. 1985. Relationship between some characteristics of poplars and the abundance of phytophagous insects. *Zeitschrift fur Angewandte Entomologie*. 99(2): 160-170.

A study was carried out in Belgium to assess the insect resistance of some new poplar clones and to attempt to explain the differences observed. A principal component analysis of the chemical and physiological data indicated 3 major groups of clones. These were Populus deltoides X P. nigra hybrids, Populus trichocarpa clones, and P. trichocarpa X P. deltoides hybrids. It is concluded that poplar trees appear to have distinct defense mechanisms against the various insect species, these mechanisms being closely related to physiology. As a result of this diversity it is impossible at present to find a clone that is resistant to all the insects studied.

Nienhaus, F. 1985. Parasitic infection of forest trees by viruses and primitive microorganisms. *Allgemeine Forstzeitschrift*. 6: 119-124.

A review of European and N. American literature, with a discussion of preliminary results of a joint research program in W. Germany on the relation of these organisms to forest dieback. Host trees discussed include Ulmus, Fraxinus, Betula, Populus, Quercus, Fagus, Larix, Picea, and Pinus spp. In most cases, there is so far no indication of initiation of dieback by these organisms. The 'decline spiral' of Manion is discussed, as modified to include secondary factors in the syndrome.

Ostry, M.E.; McNabb, H.S., Jr. 1985. Susceptibility of Populus species and hybrids to disease in the north central United States. *Plant Disease*: 69(9): 755-757.

In test plantings of hybrid poplars in Iowa, Minnesota, and Wisconsin during 1976-1982, three foliar diseases and one canker disease were common and severe enough to be potentially damaging to yield. Disease incidence and severity varied by clone and location. Premature defoliation was caused by Melampsora medusae, Marssonina brunnea (Drepanopeziza punctitiformis), and Septoria musiva (Mycosphaerella populorum). Highly susceptible trees were predisposed to infection by stress-related fungi. Successful plantation establishment and high biomass yields will require selection of disease-resistant clones.

Otjen, L.; Blanchette, R.A. 1985. Selective delignification of aspen wood blocks in vitro by three white rot basidiomycetes. *Applied and Environmental Microbiology*. 50(3): 568-572.

Aspen (Populus tremuloides) wood blocks were selectively delignified in the laboratory by Ischnoderma resinorum, Poria medulla-panis, and Xylobolus frustulatus. After 8 weeks only the outer surfaces of the wood blocks were selectively delignified. X. frustulatus was able to form pockets of delignified wood throughout blocks after 12 weeks.

Pantaleoni, R.A. 1985. Neuroptera Planipennia of the territory of the Valli di Comacchio: the neuropterocoenoses of the Holly-Oak Wood and of Populus nigra pyramidalis. *Bollettino dell'Istituto di Entomologia 'Guido Grandi' della Universita degli Studi di Bologna*. 39: 61-74.

In the Valli di Comacchio in the Province of Ferrara, Italy, 2 relict woodland sites (a row of Populus nigra pyramidalis [P. nigra] and a patch of the ancient oak wood known as the Quercetum ilicis and consisting mainly of Quercus ilex) were surveyed as habitats for Neuroptera. Notes are given on ecology and voltinism, 2 species new to the area are reported, the species composition and distribution are discussed.

Patton, Roy Lee. 1985. Studies on the use of foliar peroxidase activity as a predictor of relative sensitivity to ozone among selected groups of Populus hybrids and other trees. *Dissertation Abstracts International*. 46/03-B: 720.

This research investigated the use of foliar peroxidase activity to predict whether trees were sensitive or resistant to fumigations with ozone. Four selected clones of hybrid poplar were fumigated for up to six weeks in open-topped field chambers with ozone. Two clones were designated ozone-sensitive and two clones were designated ozone-resistant according to the amount of foliar injury that developed. Foliar peroxidase activity was assayed. Foliar peroxidase activity occurred in fractions designated as buffer extractable peroxidase (BEP) and salt extractable peroxidase (SEP). The ozone-sensitive clones had more peroxidase activity in fraction BEP than in fraction SEP while the ozone-resistant clones had more peroxidase activity in fraction SEP than in fraction BEP. Peroxidase activity in leaf disks floated on water and fumigated with ozone was used to predict the sensitivity to ozone of trees from which the disks were removed. Leaf age strongly influenced the amount of ozone-induced injury and the predictions about sensitivity to ozone. The amount of ozone-induced injury could be altered by floating disks on solutions of ascorbic acid, sugars, and inhibitors of enzyme synthesis. It was concluded that predictions about sensitivity to ozone based on peroxidase activity in extractable fractions do not reflect absolutely the

sensitivity of trees to ozone. Foliar peroxidase activity, however, is a useful parameter to consider when studying the relative sensitivities to ozone that exists among trees.

Pogue, M.G. 1985. Parasite complex of Archips argyrospilus, Choristoneura rosaceana and Anacamptis innocuella in Wyoming shelterbelts. Entomological News. 96(2): 83-86.

Larvae and pupae of Archips argyrospilus, a polyphagous species, Choristoneura rosaceana, the main food-plant of which is American elm (Ulmus americana), and Anacamptis innocuella, which feeds mainly on the plains cottonwood (Populus sergentii), were collected from the foliage of shelterbelt plantings in Platte County, Wyoming, during 1979 and kept for parasite emergence. Eleven hymenopterous parasite species were reared with Itoplectis conquisitor being parasitic on all 3 species. No dipterous parasites were found. New host and state distribution records for the parasites are given.

Prakash, C.S.; Heather, W.A. 1985. A leaf replica technique to isolate avirulent biotypes in leaf rusts. Transactions of the British Mycological Society. 84(4): 754-755.

A leaf disc replica inoculation from a susceptible to a resistant cultivar of poplar (Populus) was used in vitro to isolate avirulent biotypes of Melampsora medusae from virulent biotypes.

Prakash, C.S.; Heather, W.A. 1985. Induction of rapid and synchronous germination of urediniospores of Melampsora medusae. European Journal of Forest Pathology. 15(2): 126-128.

Inoculum of M. medusae was multiplied on detached leaves of Populus X euramericana and a urediospore suspension was homogenized in buffer using a high frequency disperser. Spores were deposited uniformly by vacuum suction on a membrane filter which was incubated on moist filter paper in a petri dish at 4degC for 60 min then at 16 plus or minus 1degC under diffused light for up to 4 hours. Germination was repeatedly obtained by this method which is considered useful in electrophoretic and other physiological studies of rust fungi.

Prakash, C.S.; Heather, W.A. 1985. Reaction of cultivars of Populus spp. to radiation-induced virulent mutants of Melampsora medusae. Euphytica. 34(2): 309-315.

Prisedskii, Yu.G. 1985. Effect of air pollution with hydrogen fluoride on the content of pigments in leaves of woody plants. Lesnoi Zhurnal. 1: 35-38.

Experiments were made on cut branches of 10 different tree species in a fumigation chamber with 10 mg/m³ HF for 8 hours. The content of pigments was determined 1 and 24 hours after the end of treatment. Resistant species (Ulmus pumila var. arborea, Gleditsia triacanthos, Acer saccharinum, Aesculus hippocastanum, and 'Canadian poplar') exhibited stronger linking of chlorophyll with the lipo-protein complex than less resistant species (Betula pendula, Salix alba, Philadelphus coronarius, Fraxinus excelsior, and F. pennsylvanica). The resistant species exhibited intensified carotene formation, apparently a defense reaction. It is concluded that the pigment

complex of leaves can be used to diagnose sensitivity of plants to fluoride pollution.

Przybyl, K. 1985. Fungal flora of poplar stems affected by brown spot and target canker. *Arboretum Kornickie*. 30: 269-283.

Fungi were isolated from 47 badly affected trees from sections Aigeiros, and Tacamahaca and hybrids of Aigeiros X Tacamahaca in central and northern Poland. Pathogenicity tests on 4 month old shoots of *Populus* 'Kornik 23' showed that brown spot was mainly caused by strains of *Fusarium solani*, but that symptoms can be intensified by the presence of other *Fusarium* spp. and *Geotrichum* sp. Strains of *F. solani* incapable of producing brown spot were found associated with the main causal agent of target canker, *Ceratocystis fimbriata*. Some strains of *F. solani* can cause degeneration of *C. fimbriata* hyphae and conidia.

Raspi, A. 1985. Contributions to the knowledge of Diptera Chamaemyiidae. III. Considerations on *Leucopis palumbii* Rondani and description of *Leucopis gloriae* n. sp. *Frustula Entomologica*. 6: 351-367.

Larvae of *Leucopis palumbii* were observed in the Provinces of Pisa and Leghorn, Italy, preying on gall-forming aphids (*Eriosoma lanuginosum*, *E. pyricola*, and *Tetraneura ulmi* on elms and *Aploneura lentisci* on *Pistacia lentiscus*). The eggs of the predator were laid on the outside of the gall, and the larva on hatching entered the gall to feed on the aphids, remaining there for pupation and hibernation. Another species that was found feeding on *A. lentisci* is *L. gloriae* sp. n. Lists are given of Homoptera recorded as producing galls on elm, poplar, *Pistacia* spp., and grapevine, with the species of *Leucopis* preying on them.

Reich, P.B.; Amundson, R.G. 1985. Ambient levels of ozone reduce net photosynthesis in tree and crop species. *Science*. 230(4725): 566-570.

In tests with O₃ concentration representative of those found in clean ambient air, mildly-moderately polluted air (such as occurs in USA in summer) and more heavily polluted air (though lower than that regularly occurring in the Los Angeles area), exposure to increased O₃ lowered the net photosynthesis in all the species tested (oak, pine, poplar, sugar maple, soyabean, red clover, and wheat). Acid rain had no negative effect on photosynthesis and no interaction between O₃ and acid rain was observed. O₃-induced reductions in photosynthesis were related to declines in growth or yield. Species with higher stomatal conductances exhibited greater negative responses to similar O₃ treatments. Reduced photosynthetic rates may be occurring all over the country.

Reich, P.B.; Lassoie, J.P. 1985. Influence of low concentrations of ozone on growth, biomass partitioning and leaf senescence in young hybrid poplar plants. *Environmental Pollution, Series A*. 39(1): 39-51.

Chronic exposure to low concentrations of ozone (O₃) reduced growth and dry matter accumulation and increased leaf senescence in hybrid poplar *Populus deltoides* X *trichocarpa*. Plants were grown in controlled environment chambers and for 10 weeks were exposed daily for 5.5 hours to O₃. No treatment effects were observed during the first 6 weeks of exposure, during the final 4 weeks elevated O₃ treatments resulted in reduced relative height and diameter growth

rates as well as increased leaf senescence. By the end of the study O₃ exposure had resulted in decreased plant height and diameter and number of leaves per plant, and in decreased leaf, stem, root, and total dry mass per plant. Ozone treatments had no effect on partitioning of dry matter. The effects of O₃ were linear with respect to treatment concentration.

Rishi, N.D.; Shah, K.A. 1985. Survey and bioecological studies on the natural enemy complex of Indian gypsy moth, Lymantria obfuscata Walker. *Journal of Entomological Research*. 9(1): 82-93.

A survey of the natural enemies of Lymantria obfuscata, a potential pest of deciduous fruit and forest trees in Kashmir and Himachal Pradesh, India, was conducted in 1980-1983. Developmental stages of the pest were collected from infested trees of Salix babylonica, Populus nigra, apple, Prunus communis [P. dulcis] and walnut at various localities. The biology of the most promising natural enemies was studied in the laboratory and field. These species were widely distributed in all host-inhabited niches and their numbers remained markedly stable. The biotic potential and possibilities of their integration as biological control agents is discussed.

Samedov, N.G.; Mirzoeva, N.B. 1985. A review of the leaf-beetles of the tugai forests of Azerbaijan. *Entomologicheskoe Obozrenie*. 64(4): 705-715.

The tugai (floodland) forest in the Azerbaijan SSR, USSR, today mainly consists of Populus hybrida, P. nigra, Salix australior, Ulmus carpinifolia [U. minor], Berberis, Pistacia, wild vine, lianas, and beside streams, Tamarix spp., but where it consists only of shrubs, Elaeagnus caspica, E. angustifolia, T. ramosissima, Berberis spp., and Pyracantha coccinea occur. The ecological conditions are characterized by extremely low atmospheric humidity. Coleoptera form a major element of the insect pest fauna, and Chrysomelidae cause significant damage. Seventy-five species in 34 genera and 10 subfamilies of Chrysomelidae have been found in the tugai forest, and comprise elements of 10 zoogeographical groups. An annotated list of the species is provided.

Sareen, M.L.; Thukral, D.; Kuldip, K. 1985. Histochemical and biochemical studies on the ovary of the bug, Halys parvus Fabr. *Research Bulletin of the Panjab University, Science*. 36(3/4): 267-270.

Females of Halys parvus were collected in May-October from poplars and Cassia assamia in Chandigarh, India, and detailed laboratory studies were carried out on the ovary of this species as an example of the hemipteran ovary. The authors deal with histochemistry in the oocyte and the quantitative biochemical analysis of the ovary.

Scholz, F.; Vornweg, A.; Stephan, B.R. 1985. Effects of air pollutants on the pollen germination of forest trees. *Forstarchiv*. 56(3): 121-124.

Results are presented of 2 studies on the effect of exposure to SO₂ on pollen germination. In (a), in vivo studies were made on 2 crosses involving Populus tremula and P. tremuloides clones given SO₂ treatment both during initial anthesis and after pollination or only after pollination. In (b), in vitro studies were made on germination on agar of pollen collected in 1983 from 11 Scots pine clones; 4-day exposure to SO₂ was applied. In (a), SO₂ exposure markedly reduced percent pollen germination (especially with

pre-pollination exposure); the amount of reduction depended on the cross. In (b), exposure to 400 microg/m³ SO₂ led to severe and in some cases complete inhibition of germination; at lower SO₂ levels significant differences were found among clones. Short-term exposure to SO₂ during the flowering period can have important effects on the genetic structure of tree populations.

Setzer, R.W. 1985. Spatio-temporal patterns of mortality in Pemphigus populicaulis and P. populitransversus on cottonwoods. Oecologia. 67(3): 310-321.

Galls of the aphid species Pemphigus populitransversus and P. populicaulis on an eastern cottonwood tree (Populus deltoides) in New York State were examined for mortality about every 10 days in the summer of 1978. Pemphigus populitransversus had significantly higher survival than P. populicaulis, mortality of both species increased late in the season. Neighbouring galls tended to die at about the same time. The chamaemyiid fly Leucopis sp. and the bug Anthocoris sp. preyed on both species, Leucopis tending to be found more frequently in galls of P. populicaulis than in those of P. populitransversus.

Sharma, A.K. 1985. A new species of Uncinula from Kashmir. Current Science, India. 54(5): 237-239.

U. populi is described on Populus nigra compared with U. adunca from Salix spp. and P. balsamifera.

Sierpinski, Z. 1985. Air pollution and forest pests. Zeitschrift fur Angewandte Entomologie. 99(1): 1-6.

The relationship between air pollution and arthropod pests of forest trees in Europe is reviewed and discussed with particular reference to pests of Scots pine (Pinus sylvestris), Norway spruce (Picea excelsa [P. abies]), silver fir (Abies alba), European larch (Larix decidua), alder (Alnus glutinosa and A. incana), white birch (Betula verrucosa), poplar (Populus spp.), and aspen (P. tremula). Some pest species can be used as bioindicators of air pollution; these are Zeiraphera griseana [Z. diniana], Cephalcia fallenii and Pristiphora abietina, Dreyfusia nordmanniana, Taeniothrips laricivorus, and Exoteleia dodecella.

Singh, Pratap; Prasad, G. 1985. Poplar stem borer Apriona cineria Chevrolat its biology and control. The Indian Forester. 111(7): 517-524.

The distribution (in India and Pakistan), host plants and nature of damage of A. cinerea, a serious wood-boring pest of poplars and apples is described. Biology, life cycle, and control measure (silvicultural and chemical) are discussed.

Solomon, J.D. 1985. Impact of insects on growth and development of young cottonwood plantations. Res. Pap. SO-217. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 6 p.

Spiers, A.G. 1985. Factors affecting basidiospore release by Chondrostereum purpureum in New Zealand. European Journal of Forest Pathology. 15(2): 111-126.

Discharge from sporophores on naturally infected stools of Populus alba and Salix matsudana began several hours after rain and continued until the water content of sporophores fell 75 percent. The duration of the spore release period and the number of spores released were correlated with total rainfall and hours of RH 75 percent. In the laboratory, temperature affected spore production, the optimal being 18degC. In the field, temperature correlated poorly with duration of spore release and the number of spores discharged. Laboratory studies showed that alternating photoperiods resulted in greater spore production due to time lag, light stimulated subsequent spore production in the dark. Field studies supported these observations although it was not possible to separate the influence of light from that of RH and rainfall. Sporophores could produce basidiospores for at least 1 year following formation. Regression equations were derived to predict the amount and duration of spore discharge.

Spiers, A.G.; Hopcroft, D.H. 1985. Ultrastructural studies of pathogenesis and uredinial development of Melampsora larici-populina and M. medusae on poplar and M. coleosporioides and M. epitea on willow. New Zealand Journal of Botany. 23(1): 117-133.

Pathogenesis and uredinial development in Populus or Salix hosts were similar for each of the 4 rust species. Hyphae ramified intercellularly throughout the leaf tissue and haustoria were formed from mother cells which adhered closely to the cell walls. Penetration pegs invaginated the host cell plasma membrane and extensive wall deposits occasionally formed. The wall of the haustorial body was bilayered and its cytoplasm was identical with that of intercellular hyphae. Haustoria in invaded cells were surrounded with a ribosome-studded endoplasmic reticulum. Uredia developed from a layer of subepidermal initial cells which divided 2 or 3 times across the vertical axis. Urediospore and paraphysis formation is described.

Srivastava, A.S.; Masoodi, M.A. 1985. Influence of host plants on the development and survival of Lymantyrina obfuscata. FAO Plant Protection Bulletin. 33(2): 67-69.

In laboratory studies in India, larvae of Lymantria obfuscata were reared on the leaves of 15 species of fruit and forest trees to determine the influence of food-plant on development and survival. Development was faster and survival higher on Salix alba, Populus nigra, and the apple varieties Red Delicious and American Apirouge. Development was slower and survival lower on almond, cherry, apricot, walnut, and P. alba. Larvae failed to survive on the pear varieties William and Sand. Larvae initially reared on S. alba for 3 days had a prolonged larval period and low survival on apricot and cherry.

Stanosz, Glen Robert. 1985. The development of Armillaria root rot in aspen sprout stands after clearcutting. Dissertation Abstracts International. 47/01-B: 28.

Reports of Armillaria mellea isolation from aspen suckers prompted a study of the saprophytic buildup, rhizomorph occurrence, and colonization of suckers by this root rot fungus. The frequency and degree of stump colonization was quantified by examination of 185 bulldozed aspen stumps, 2 or 5 years after cutting. All of the 5-year-old stumps and 94 percent of the 2-year-old stumps were colonized. Mycelial fans and decay extended from stumps into roots.

Rhizomorph assays were conducted around stumps in two series of stands at increasing intervals (up to 16.5 years) after harvest. Quantities (both lengths and weights) of rhizomorphs obtained generally increased as a function of time after cutting, except for the oldest stands.

Examination of rhizomorph structure revealed a central zone comprised of both filamentous, fiber-hyphae and broader, tube-like hyphae. This was surrounded by an area with only fiber hyphae, a zone of broad, thin-walled cells, and an outer rind of thick-walled, fused cells.

Root rot incidence increased as a function of time, with >70 percent of sampled trees affected in the 15-year-old stands. In Ontario and Minnesota trees were sampled in short-rotation plots which had undergone successive cycles of harvest and regeneration from the same root system. High levels of root rot were observed and are coincident with decreases in both stem number and size.

Results indicate widespread saprophytic buildup, prolonged production of rhizomorphs, and early infection in potential crop trees. Armillaria root rot may be a major cause of loss or decline in aspen suckers in the long interval between stand origin and harvest, or in limiting the number of times aspen may be regenerated from an increasingly decadent root system.

Sunarjo, Pius Ibrahim. 1985. Phytochemical studies of quaking aspen and tulip tree leaves and metabolism of precocene II in rats via the mercapturic acid pathway. Dissertation Abstracts International. 46/12-B: 4118.

Quaking aspen leaves are the favorite food plant for tiger swallowtail northern subspecies (Papilio glaucus canadensis), but unsuitable for southern subspecies (P. g. glaucus). Conversely, tulip tree leaves are preferred by the southern subspecies but unsuitable for the northern subspecies. Allelochemicals of both plants were investigated, using armyworm larvae in antifeeding test. The significance of the allelochemicals in food plant specialization in insects was discussed.

Szontagh, P. 1985. Health of poplar varieties: a lecture delivered at the 2nd [Hungarian] Conference on Forest Protection. Erdo. 34(9): 402-404.

The frequency of damage by pests and diseases in Hungary is discussed with reference to stand age and variety. The insects mentioned are Aegeria apiformis, Agrilus suvorovi populneus (especially on Populus 'I-214'), Cryptorrhynchus lapathi (P. 'Marilandica'), Paranthrene tabaniformis, Saperda carcharias (with Aegeria apiformis), and S. populnea. The diseases are Marssonina brunnea (P. 'Marilandica'; less severe on new varieties) and cankers (P. X canadensis). General incidence of pests and diseases is estimated at 30 percent at 5-10 years old; 50 percent average incidence of wood borers is observed at final felling.

Togashi, I. 1985. The sawfly genus Trichiocampus in Japan. Proceedings of the Entomological Society of Washington. 87(4): 884-888.

As a result of the discovery of a new species of Trichiocampus on Populus in Hokkaido, Japan, a key to the 3 species of this tenthredinid genus found in that country is given. The new species is described as T. flaviventris sp.n. on Populus nigra var. italica.

Trlica, M.J.; Child, R.D.; Bauerle, B.A. 1985. Leaf injury and elemental concentrations in vegetation near a coal-fired power plant. *Water, Air and Soil Pollution*. 24(4): 375-396.

Leaf injury of two native grasses, needleandthread (*Stipa comata* Trin. and Rupr.) and prairie sandreed (*Calamovilfa longifolia* [Hook.] Scribn.), and plains cottonwood (*Populus sargentii* Dode) were slightly greater in a downwind direction from a coal-fired power plant in central Wyoming. A controlled experiment utilizing pinto beans grown within phytometers also indicated greatest leaf injury near and downwind from the power station. Elevated levels of Fe and fluoride in foliage samples were found. However, no significant increases in Hg, Pb, and Cd were found for plants growing near the power plant. Significant positive correlations were found for leaf injury and the Fe and fluoride concentrations of foliage with average daily sulfation rates. However, no significant correlation between sulfation rates and sulfate concentrations in foliage was found. It is suspected SO₂ may act synergistically with fluorides or other emission products, resulting in the slightly elevated leaf injury downwind from the power station.

van Dam, B.C. 1985. New problems with poplar rusts. *Populier*. 22(2): 28-31.

In tests with *Melampsora larici-populina* originating from French, Belgian, and Dutch sources carried out on 10 hybrid poplar clones under controlled conditions 'Robusta' proved highly susceptible to all rust sources, 4 cultivars were resistant, 4 (including 'Rap' and 'Spijk') were infected slightly by French and heavily by Dutch and Belgian sources, and one was slightly infected by the Belgian source only. The tests are thought to show that there are at least two physiological races of the rust in Western Europe and that some cultivars are susceptible to both, some to one of them, and some to neither.

Wickremasinghe, U.K.; Heather, W.A.; Griffin, D.M. 1985. Comparative study of methods for the quantification of fungal spores at the leaf surfaces of *Populus x euramericana*. *Plant and Soil*. 85(3): 447-449.

The removal of fungal spores (urediniospores of *Melampsora medusae* and conidia of *Pestalozzia* sp.) from the leaf surfaces of *Populus x euramericana* was assessed using three cultural techniques conventionally employed in phylloplane studies. The method of removal and the original density of spore deposition, but not the interaction of these factors, were significant determinants of variability in spore removal. The leaf print method (leaf pressing onto solidified water agar followed by microscope counts) was the most, and the leaf washing technique (leaf shaking in water agar) the least, efficient means of spore removal from the leaf surface.

Wilson, L.F.; Moore, L.M. 1985. Vulnerability of hybrid *Populus* nursery stock to injury by the tarnished plant bug, *Lygus lineolaris*. *Great Lakes Entomologist*. 18(1): 19-23.

In 1983, *Lygus lineolaris* injured 21 *Populus* clones in a nursery in Michigan. Percentage injury ranged from 0.5 to 82.0. The clone Wisconsin 5 sustained the heaviest attack, followed by Imperial Carolina poplar. Wisconsin 5 was salvaged by accepting shorter cutting stock for outplanting.

Zhang, G.X.; Zhong, T.S. 1985. New species and new records of Pemphigidae from Yunnan, China. Acta Entomologica Sinica. 28(1): 94-96.

The authors deal with 4 species of Pemphigidae from Yunnan Province, China. Two are described as new to science, and these include Pemphigus circellatus sp.n., which was collected from a gall on a branch of Populus tremula davidiana in Lijian Xian in May 1980. Pachypappa populi and P. tremulae, which were also collected from Populus t. davidiana in Lijiang, were recorded from the province for the first time.

Zhang, G.X.; Zhong, T.S. 1985. Two new species of Hormaphididae from Yunnan, China. Acta Zootaxonomica Sinica. 10(2): 193-195.

The authors describe 2 new species of Hormaphididae from trees in Yunnan Province, China. Ceratoglyphina populisucta sp.n., was collected as apterous viviparous females on Populus sp. in Lijiang County in May 1980, and Cornaphis viscisucta sp.n., as fundatrices on Viscum album in Kunming City in March 1982.

Zhong, Z.K. 1985. A newly found canker of poplars. Forest Science and Technology (Linze Keji Tongxun). 2: 24-25.

A pathogenic fungus belonging to the genus Botryodiplodia was found to cause serious damage to young stands of Populus pyramidalis [P. nigra 'Italica'] X cathayana, P. X euramericana [P. canadensis] and P. xiaozhuanica xinmin no. 2 in Liaoning Province. The symptoms of infected trees and characteristics (the pycnidium, conidium, and conidiophore) are described. The death of many young trees is also related to compound infection of this fungus and rot disease.

1986

Arzone, A.; Vidano, C. 1986. Investigations on Phloeomyzus passerinii (Sign.) in Piedmont. Annali della Facolta di Scienze Agrarie della Universita degli Studi di Torino. 13: 337-356.

Investigations on the life-history and habits of Phloeomyzus passerinii, which causes heavy infestations of poplar [Populus spp.] in Piedmont, Italy, showed that the phytomyzid usually developed anholocyclically by means of apterae virginoparae, had 12 generations a year and overwintered as newly hatched nymphs in the field; in the laboratory, at temperatures permitting normal growth of poplar cuttings, it had 33 generations in a year without diapause. Male and female alates appeared as the trees began to decline under the stress of infestation, but they produced eggs only rarely. Damage included cracks in the bark, necrosis of the wood, and interruption of the sap flow, which hindered normal plant growth. Trees 6-8 years old were the most susceptible to colonization. Wide spacing in sunny places (away from water) and the cultivation of resistant poplar varieties appear to be the main cultural methods of limiting the spread of P. passerinii.

Berrang, P.; Karnosky, D.F.; Mickler, R.A.; Bennett, J.P. 1986. Natural selection for ozone tolerance in Populus tremuloides. Canadian Journal of Forest Research. 16(6): 1214-1216.

Samples were collected in summer and autumn 1983 from 11-14 clones in each of 5 populations of P. tremuloides in national parks in NE USA, with annual average ozone concentration of 14-65 p.p.b. (maximum daily 1-hour average). Individuals were vegetatively propagated from root segments, grown in a single greenhouse, and fumigated with ozone for 6 hours in May 1984 and 1985. There was a strong negative association between average injury and ambient ozone concentration in the park. Trees from the most polluted park were injured significantly less than those from the least polluted park. Differences among clones within populations were highly significant and larger than differences between populations. Results suggest that natural selection for ozone tolerance may have occurred in some P. tremuloides populations in eastern USA.

Bertucci, B.M. 1986. Paranthrene tabaniformis of poplar-tree. Informatore Fitopatologico. 36(11): 29-34.

Bingham, B.; Sokal, R.R. 1986. Host tree effects on the morphology of Pemphigus populitransversus. Journal of the Kansas Entomological Society. 59(2): 287-295.

The effect of genetic differences between food-plants on the morphology of the aphid Pemphigus populitransversus (which has 2 distinct forms, 'elongate' and 'globular,' with asynchronous life cycles) was studied in the Botanic Gardens of the University of Michigan. Individual trees of Populus deltoides, some native to Michigan and others from Mississippi (which were presumed to differ genetically) were infested by the same aphid population. Tree effects on the morphology of aphid galls, fundatrices, and alate fundatrigeniae were detected by means of univariate and multivariate analyses of variance. Fundatrices and globular-morph galls from Mississippi trees were larger and the globular morph of Pemphigus populitransversus was more sensitive than the elongate morph to tree differences. Patterns are discussed, and also the influence of food-plant genetics on the existing patterns of geographic variation in this aphid species.

Blanchette, R.A.; Reid, I.D. 1986. Ultrastructural aspects of wood delignification by Phlebia tremellosus. Applied and Environmental Microbiology. 52(2): 239-245.

Wood from aspen (Populus tremuloides) and birch (Betula papyrifera) that had been decayed for 12 weeks by P. tremellosus had 30 and 31 percent average weight loss, respectively, and 70 percent average lignin loss. Average digestibility increased from 21 and 13 percent for sound to 54 and 51 percent for decayed aspen and birch. Wood sugar analyses of decayed birch blocks indicated an average loss of 10 percent glucose, 45 percent xylose, and 19 percent mannose. Electron microscopy with wood showed that lignin was progressively removed first from the secondary cell wall layers, beginning at the lumen surface, and later from the compound middle lamella. Extensive degradation of lignin was found throughout the secondary wall and middle lamella region between cells. In cells with advanced decay, the middle lamella between cells was completely degraded, but cell corner regions remained.

Briggs, G.M.; Jurik, T.W.; Gates, D.M. 1986. A comparison of rates of aboveground growth and carbon dioxide assimilation by aspen on sites of high and low quality. *Tree Physiology*. 2(1/3): 29-34.

Net CO₂ assimilation rates in Populus grandidentata, Quercus rubra, and Acer rubrum and aboveground production of leaves, wood, bark, and branches by P. grandidentata were determined in 10-year-old naturally regenerated stands on 2 sites in northern lower Michigan. CO₂ assimilation rates were significantly higher in all species on the better site. Assimilation rate was highest in the aspen and lowest in red maple. On a leaf weight basis aboveground production by aspen on the better site was over twice that on the poorer site while maximum CO₂ assimilation was only 48 percent higher. A hypothesis that site-related differences in aboveground production depend solely on differences in rates of CO₂ assimilation was thus rejected. Soil respiration rates on the two sites were similar, suggesting that differences may be partly attributable to a difference in the proportion of assimilate allocated below ground.

Canfield, M.L.; Baca, S.; Moore, L.W. 1986. Isolation of Pseudomonas syringae from 40 cultivars of diseased woody plants with tip dieback in Pacific Northwest nurseries. *Plant Disease*. 70(7): 647-650.

Bacteria were isolated from 40 cultivars of woody plants with tip dieback during 1981 and 1982. Plants most severely affected were Acer spp., Cornus florida, Corylus avellana, Vaccinium corymbosum, Magnolia spp., Syringa sp., oriental pear (Pyrus pyrifolia), Populus tremuloides, and Tilia americana. Eighty-four percent were fluorescent and sixty-five percent of the fluorescent strains were identified as P. syringae.

Chaudhry, M.I.; Hanif Gul. 1986. Some observations on entomophagous Neoaplectana on poplar stem borer, Apriona cinerea Chev. in NWFP. *Pakistan Journal of Forestry*. 36(3): 119-123.

In a survey of the natural enemies of A. cinerea in Swat, a small number of borers were found to be infected with nematodes of the Neoaplectana group. In healthy larvae sprayed with a suspension of crushed infected larvae, 20-35 percent became infected within 4 days.

Cooper, J.I.; Edwards, M.L.; Siwecki, R. 1986. The detection of poplar mosaic virus and its occurrence in a range of clones in England and Poland. *European Journal of Forest Pathology*. 16(2): 116-125.

Of 598 stooled poplar clones examined, 37 percent were infected with PMV as evidenced by foliar symptoms, ELISA and bioassay (infectivity tests). Incidence was greater (53 percent) in species and intraspecific hybrids having Aigeiros (especially as the female) parents than in those of Tacamahaca parentage (11 percent). The overall prevalence of the virus in clones growing in England was less (24 percent) than in clones growing in Poland (56 percent). Whereas symptoms on PMV-infected Populus deltoides were prominent and common; on P. nigra they were indistinct and rare. There may be sources of field resistance in P. nigra and some Tacamahaca species. Evidence of PMV inferred from ELISA alone was found in only one aspen of 52 tested clones in the sections Leuce, Leuce X Leuce, and Leucoides. A PMV isolate from a symptomless clone of P. maximowiczii grown in Poland was serologically closely related to an English isolate from P. [X euramericana cv.] Robusta.

Crouch, R.J.; Honeyman, M.N. 1986. The relative salt tolerance of willow cuttings. *Journal of Soil Conservation, New South Wales.* 42(2): 103-104.

In pot trials pencil cuttings of 29 Salix species and cultivars and of Populus nigra italica were grown in soil with salt solutions of electrical conductivities of 0, 0.5, 1, 2, or 4 ms/cm and the growth of the cuttings assessed over 8 weeks. The most resistant Salix species were S. matsudana pendula, S. fragilis, S. matsudana tortuosa, and S. purpurea cultivar Pohangina. P. nigra italica was more tolerant than any Salix.

Degen, A.A.; Gersani, M.; Avivi, Y.; Weisbrot, N. 1986. Honeydew intake of the weaver ant Polyrhachis simplex attending the aphid Chaitophorous populiabae. *Insectes Sociaux.* 33(2): 211-215.

Polyrhachis simplex, which inhabits areas characterized by high ambient temperatures, open water sources available throughout the year and plants harbouring Homoptera, was observed on the bank of a river near the Dead Sea in Israel migrating to a poplar tree (Populus euphratica) and collecting honeydew from a colony of the aphid Chaitophorus populiabae infesting the tree. The daily energy expenditure by the formicid when attending the aphid was estimated and its daily energy intake from the honeydew was 4.4-9.4 times its energy requirement.

Du, J.W.; Xu, S.F.; Dai, X.J.; Zhang, X. 1986. Field test on controlling poplar clearwing moth Paranthrene tabaniformis root by mass trapping. *Contributions from Shanghai Institute of Entomology.* 4: 53-58.

Mass trapping of males of the sesiid Paranthrene tabaniformis was conducted in poplar forests in China in 1982 using traps baited with 500 microg of E-3,Z-13-18:OH [(3E,13Z)-3,13-octadecadien-1-ol]. The mating rate was reduced by 77.4 percent and population density was reduced by 86.4 percent compared with the control plots. It was concluded that mass trapping was effective in reducing populations to below a commercially acceptable level.

Eastham, A.M.; Ormrod, D.P. 1986. Visible injury and growth responses of young cuttings of Populus canadensis and P. nigra to nitrogen dioxide and sulphur dioxide. *Canadian Journal of Forest Research.* 16(6): 1289-1292.

Rooted hardwood cuttings were exposed to NO₂ and/or SO₂ (both at concentrations of 0.5 and 1.0 microlitre/litre) for 1 hour. Plants were placed in growth chambers and, 3 weeks after exposure, visible foliar injury and growth responses were recorded. The combination of NO₂ and SO₂ was the only treatment that resulted in visible foliar injury. P. nigra was more sensitive than P. canadensis based on visible injury. Leaf growth in both species was significantly stimulated by NO₂ at 0.5 microlitre/litre and stem growth significantly reduced by NO₂ at 1.0 microlitre/litre. Results suggest that growth effects cannot be predicted from symptoms of foliar injury.

Edwards, M.L.; Cooper, J.I.; Siweki, R. 1986. The identification of sources of field immunity from poplar mosaic virus. *Monograph, British Crop Protection Council.* 33: 199-203.

Three methods of detecting poplar mosaic virus (PMV) were compared using a range of poplar genotypes from the UK and Poland. Visual inspection of foliar symptoms and infectivity assays for PMV in leaf extracts inoculated to Nicotiana megalosiphon were less reliable indicators of infection than were

ELISA tests for viral antigens. Infection was common in Aigeiros species or hybrids, particularly in Populus deltoides. Bioassays rarely detected PMV either in the mainly symptomless Tacamahaca clones or when P. nigra was the Aigeiros parent. The leaves of Tacamahaca species manually inoculated were not infected and results of the challenge by chip bud inoculation with a source of PMV in P. nigra are awaited.

Erd, A.; Tynisson, Yu.; Tonisson, J. 1986. Elk damage to young Scots pine stands in Estonia and possibilities for its reduction. *Metsanduslikud Uurimused, Estonian SSR*. 21: 7-25.

A survey of damage by Alces in 1975-1979 showed that 21 200 ha or 17 percent of all stands of 0-20 years old were badly damaged of which 8,700 ha were severely affected (over 50 percent of merchantable stems lost). Trees under 5 years old and over 18 years old were generally undamaged, with most damage in 10-15 year old stands. Damage was most severe on alder/birch swamp sites and Filipendula sites. Stands of site classes II-III had more than double the damage of site classes IV-V and stands near arable land appeared most susceptible. Increasing planting density tends to reduce incidence of damage. Control is best achieved by limiting numbers according to the fodder capacity and by improving availability of preferred species (willow and Populus tremula) where possible. More information on numbers and fodder capacity are needed.

Eriksson, O. 1986. Lahmia Korber (= Parkerella A. Funk) a misinterpreted genus with isolated position. *Mycotaxon*. 27: 347-360.

Gagne, R.J. 1986. Revision of Prodiplosis with descriptions of three new species. *Annals of the Entomological Society of America*. 79(1): 235-245.

Prodiplosis, a close relative of Contarinia in the tribe Cecidomyiini, is found in the Americas and Europe. Its species damage buds of many plants including aspen [Populus tremula], sycamore (Platanus), blueberries, melons, potatoes, and tomatoes. The genus is remarkable for the wide host range and extreme specializations of antennae and male genitalia of some species. Three new species are described: Prodiplosis platani sp.n., Prodiplosis longifila sp.n., and Prodiplosis falcata sp.n. The remaining 6 American species are redescribed. A key to the Nearctic species of Prodiplosis is provided. Information on the species dealt with includes notes on their biology, especially food-plants.

Ganter, P.F.; Starmer, W.T.; Lachance, M.A.; Phaff, H.J. 1986. Yeast communities from host plants and associated Drosophila in southern Arizona: new isolations and analysis of the relative importance of hosts and vectors on community composition. *Oecologia*. 70(3): 386-392.

The yeast communities from slime fluxes of mesquites (Prosopis juliflora), cottonwoods (Populus fremontii), and emory oaks (Quercus emoryi) and necroses of the cacti Opuntia phaeacantha and Carnegiea gigantea were surveyed in the region of Tucson, Arizona, as were the yeasts carried by the flies Drosophila carbonaria, D. brooksae, D. nigrospiracula, D. mettleri, and Aulacigaster leucopeza which were associated with them. The results indicated that each host sampled had a distinct community of yeasts associated with it. The drosophilids deposited yeasts from other sources in addition to those found on

their associated plants. It is argued that plant physiology was relatively more important than the activity of the vector in determining yeast community composition. It is hypothesized that the vector may affect the number of species per individual flux or rot, and that the number is lower than the substrate could potentially support.

Gardenfors, U. 1986. Taxonomic and biological revision of Palearctic Ephedrus Haliday. Entomologica Scandinavica, Supplement. 27: 95 p.

The taxonomy and biology of the Palearctic species of Ephedrus is reviewed. Keys to the 18 recognized species are presented. Four new species are described, including E. chaitophori sp.n. from the aphids Chaitophorus tremulae on Populus tremula and another species of Chaitophorus on Salix spp. in Sweden, and E. vaccinii sp.n. from aphids on Vaccinium spp. in Sweden. Four new synonymies are given. Notes on the biology, distribution, hosts, and sex ratios based on reared material are given, where known, for each species. Introductory sections discuss evolution, phylogeny, adaptations, host specificity, intraspecific variation, and morphology as related classification. A catalogue of hosts is given. Hyperparasites are also listed.

Golovko, A.I. 1986. Specialization of the group of false tinder fungi. Doklady Akademii Nauk BSSR. 30(3): 270-272.

In the laboratory, Phellinus nigricans, P. igniarius f.sp. Betulae, P. igniarius f.sp. igniarius, P. populicola, P. tremulae, and P. robustus destroyed wood of other broad-leaved trees as well as the species from which each had been isolated. Aspen and willow were the most susceptible, birch and hornbeam more resistant.

Gonzalez, R.H. 1986. Pests of kiwi fruit in Chile. Revista Fruticola. 7(1): 13-27.

Notes are given on the arthropod pests of kiwi fruit (Actinidia chinensis) in Chile, many of which spread from vines (with which Actinidia is often intercropped), windbreaks (especially Robinia pseudoacacia, Populus spp., and Fraxinus excelsior) or other nearby plants. Information is provided on the external morphology, injuriousness, and control of the major arthropod pests, which include the aleyrodid Trialeurodes vaporariorum and the mite Tetranychus urticae in the nurseries and the tortricids Proeulia chrysopteris and P. auraria and the diaspidids Hemiberlesia rapax, Quadraspidotus perniciosus, Aspidiotus nerii, and H. lataniae in the field.

Griffin, D.H.; Manion, P.D. 1986. Ordination, a multivariate method for estimating relative resistance of Populus tremuloides and virulence of Hypoxylon mammatum. Phytopathology. 76(12): 1289-1293.

An ordination technique using modified q-correlations as measures of similarity has been developed and applied to data from virulence testing with H. mammatum, which causes stem canker on this tree. The ordination produces linear vectors of the aspen clones or the fungal isolates that are correlated to the underlying measurement variables in a consistent fashion such that 1 pole of the ordination can be interpreted as representing susceptibility of the clones or low virulence of the isolates, and the opposite pole representing resistance of the clones or high virulence of the isolates. The

ordination process can use both quantitative and quantal variables and effectively summarizes the information contained in these variables into a unified scale of resistance or virulence. The complex of data for the host clones or pathogen isolates compared by the ordinations can be dissected to determine how the variables relate to the response gradient. Isolate specific responses of the aspen clones, vertical resistance, were indicated by reversals in the ordinations of the clones by different isolates. Some clones were consistently placed at either the resistant or susceptible ends indicating horizontal resistance mechanisms as well.

Grijpma, P. 1986. Host specificity in Telenomus nitidulus, an egg parasite of the satin moth. Gewasbescherming. 17(4): 112-113.

This is a summary of a paper presented at the spring meeting of the Nederlandse Planteziektenkundige Vereniging, held in Wageningen in April 1986. In an outbreak in the Netherlands in 1981-1984, many eggs of Leucoma salicis were parasitized by the scelionid Telenomus nitidulus. The results are summarized of field and laboratory experiments on the biology of the parasite in L. salicis on poplar [Populus]. Evidence was found that T. nitidulus overwinters in the adult stage and that adults can survive for 12 months, covering the period from one generation of eggs of L. salicis to the next. A possible source of food for adult parasites is honeydew produced by aphids on poplars.

Guan, L.R.; Xu, Y.X.; Mao, Y.D.; Wang, W. 1986. The sandfly fauna and its role in transmission of kala azar in four landscape zones of Aksu Region, Xinjiang. Journal of Parasitology and Parasitic Diseases. 4(3): 169-172.

In 1984, a survey of the Phlebotominae in the Aksu Region of Xinjiang, China, revealed that the species composition and proportional representation differed between four physiological zones with different types of soil. In montane areas and oasis Phlebotomus chinensis longiductus [P. longiductus] formed 91.1 and 92.5 percent of the phlebotomine population, respectively. In the desert soil in the stony piedmont area, P. alexandri comprised 91.5 percent of the total. In the soil of scrubby meadow with Populus diversifolia and Tamarix spp., Phlebotomus major wui represented 60.9 percent of total population and no examples of P. longiductus or P. alexandri were found. It is suggested that soil type is the main factor influencing the distribution of these flies, all of which were shown to play a role in transmission of kala-azar in the Aksu Region.

Gurov, A.V.; Petrenko, N.M. 1986. Utilization of foliage by phyllophagous insects in young stands of Scots pine and broadleaves. Lesovedenie. 4: 15-22.

An investigation was made in 1978-1981 during the growing season in the Krasnoyarsk Region of the USSR. The young trees studied were Scots pine, and birch, aspen, goat willow, and Asian cherry [Prunus padus var. pubescens], and the sites included the middle and the margins of clumps, and thinned bio-groups. Data are presented on insect feeding in the upper, middle, and lower part of the crown. In general, in the first half of the growing season, almost all the leaves (and in pine practically all the shoots) bore traces of feeding. Repeat utilization was observed and this increased in the second half of the growing season. Although feeding activity was widespread over the food base, the total foliage surface area eliminated was insignificant.

Halperin, J. 1986. Braconidae associated with forest and ornamental trees and shrubs in Israel. *Phytoparasitica*. 14(2): 119-135.

Data are presented on the occurrence of Braconidae parasitizing insects associated with forest and ornamental trees and shrubs in Israel. Fifty-five genera of plants are listed, the richest in braconid fauna being Tamarix (9 species), Acacia, pistachio, and poplar (Populus) (8 species each), carob and oak (Quercus) (7 species each). Thirty-eight species are new to the fauna of Israel, and at least 3 are new to science.

Halperin, J. 1986. Otiorhynchus - a genus of Coleoptera new to Israel. *Phytoparasitica*. 14(2): 147.

The curculionid Otiorhynchus ovalipennis was found in Israel in spring 1983 as a pest of Laurus nobilis, but also defoliated Fraxinus syriaca, Rhaphiolepis umbellata, and Rosa. Their lifespan was approximately 18 months. In the laboratory, the adults fed on leaves of many trees and shrubs, but rejected many others, particularly conifers. Preferred plants (in alphabetical order) were: Acacia saligna, Ficus nitida [F. benjamina], Ligustrum ovalifolium, Pistacia palaestina, Platanus orientalis, Populus nigra (but not P. alba), and Schinus terebinthifolius. Also consumed were Ailanthus, Callistemon, Ceratonia, Dodonaea, Eucalyptus camaldulensis (only young leaves), Eugenia, Pittosporum, Punica, Pyracantha, Quercus calliprinos, Rhamnus alaternus, and R. palaestina.

Hassall, M.; Visser, S.; Parkinson, D. 1986. Vertical migration of Onychiurus subtenuis (Collembola) in relation to rainfall and microbial activity. *Pedobiologia*. 29(3): 175-182.

Changes in the vertical distribution of the Collembolan Onychiurus subtenuis were observed in the litter layers of a Populus tremuloides woodland in Alberta, Canada during summer and autumn. Field studies showed that the Collembola moved down into the deeper horizons of the litter profile during the dry summer months, but that a significant proportion of the population returned to the surface litter layers within a few hours after summer rain storms and remained to feed there until the litter dried out again. Experiments showed that this vertical migration occurred in response to the presence of micro-organisms growing on the surfaces of leaves in the litter layer. The laboratory experiments also revealed that O. subtenuis responds differently to different groups of micro-organisms. Significantly more Collembola moved into leaves inoculated with yeasts, than into leaves inoculated with Mortierella or bacteria. Leaves inoculated with Basidiomycete 290 were repellent to the Collembola. Laboratory experiments suggest that the reasons for the vertical migrations observed after summer rainstorms are related to the presence in the litter layer of micro-organisms which have a higher nutritional quality than those growing in the humus layer.

Hawksworth, F.G.; Scharpf, R.F. 1986. Spread of European mistletoe in California, USA. *European Journal of Forest Pathology*. 16(1): 1-5.

V. album was introduced in about 1900 into an area North of San Francisco, California. ²By 1984, the gross area covered by the parasite had spread to about 114 km². V. album occurs on at least 22 hosts in California, the most common of which are Acer saccharinum, Malus sylvestris, Robinia pseudoacacia, Alnus rubra, Populus fremontii, and Salix lasiandra.

He, Y.L.; Jia, X.F. 1986. Effect of air pollution by chlorine and sulphur dioxide on the soluble carbohydrate in common tree leaves in north China. *Plant Physiology Communications* (Zhiwu Shenglixue Tongxun). 1: 22-24.

The concentration of soluble sugars in the leaves of Salix matsudana, Ulmus pumila, Populus berolinensis, and Acer negundo decreased considerably when exposed to an average of 0.266 mg/m³ Cl or 0.150 mg/m³ SO₂ per day. The reduction in sugar concentration varied with resistance. U. pumila was more resistant than A. negundo, which was followed by P. berolinensis and then S. matsudana.

Hirsh, A.; Takahashi, T.; Williams, R. 1986. Identification and characterization of the glass forming cryoprotectants in Populus. *Biophysical Journal*. 49(2): 503.

Hu, Y.Y.; Fu, G.B.; Li, C.D. 1986. Study on the laws of the occurrence, distribution, dispersal and spread of poplar scale-insect in Suihua district. *Journal of North-East Forestry University, China*. 14(3): 1-6.

Quadraspidiotus gigas has been a serious pest in North China over the last 20 years. Its distribution and spread are related to poplar variation, tree age, altitude, wind speed and direction, the location of shelterbelts, felling, pruning, grazing, and other aspects of management.

Ivanova, T.S.; Shagalina, L.M. 1986. New species of nematodes from the family Criconematidae Thorne, 1949. *Izvestiya Akademii Nauk Turkmenskoi SSR, Biologicheskikh Nauk*. 1: 67-70.

Two new species of Criconematidae are described and figured. Nothocriconemella cylindracea n.sp. was found in the rhizosphere of Populus pruinosa in the Dzhilikul' Region of the Tajik SSR and in that of Glycyrrhiza glabra in the Ashkhabad Region, Turkmen SSR. It differs from N. mutabile and N. kovacsi in the larger size, number of cuticular rings, stylet length, and in the position of the excretory pore. Criconemella heliophilus n.sp. was found in the rhizosphere of Eremosparton flaccidum in a sandy-desert area in the Chardzhousk Region of the Turkmen SSR. It differs from C. teres and C. humilis in the larger size and stylet length. No males of either species were found.

Juzwik, J.; Hubbes, M. 1986. Bacteria associated with tarnished plant bug stem lesions on hybrid poplars in Ontario. *European Journal of Forest Pathology*. 16(7): 390-400.

The association of bacteria with different sizes of Lygus lineolaris lesions on current year stems of 3 poplar hybrids was investigated through isolation and microscopic studies. Bacteria were recovered under aerobic conditions from all of 47 medium and large lesions tested, but from only 7 out of 51 healthy stems. Facultatively anaerobic rod-shaped bacteria were consistently associated with stem damage. Results suggest bacteria may be introduced during L. lineolaris feeding on poplar stems. Disrupted tissues resulting from insect stylet penetration were highly compartmentalized. Proliferation and packing of extremely thick-walled xylem fibers were observed. Light and scanning electron microscopy revealed that bacteria were concentrated in these areas, suggesting the bacteria are involved in fiber degradation. Bacteria were not associated with deterioration of parenchyma

cells or pit membranes. However, the role of bacteria in lesion initiation and development is still not clear.

Juzwik, J.; French, D.W.; Hinds, T.E. 1986. Encoelia pruinosa on Populus tremuloides in Minnesota: occurrence, pathogenicity, and comparison with Colorado isolates. Canadian Journal of Botany. 64(11): 2728-2731.

The fungus is widely distributed in Minnesota, where apothecia were collected from P. tremuloides in 8 counties. The optimal temperature for mycelial growth of all isolates was 22degC. Colonization of recently cut aspen stem sections by Colorado and Minnesota isolates after 2 months was greatest for Colorado isolates. Sections of aspen from Colorado were more readily colonized than sections from aspen in Minnesota. It is hypothesized that Colorado isolates are more virulent than Minnesota isolates and that Minnesota native aspen is more resistant to colonization than Colorado native aspen.

Kankina, V.K.; Ivanova, T.S. 1986. A new species of nematode from the genus Longidorus Micoletzky, 1922 in southern Tajikistan. Izvestiya Akademii Nauk Tadzhikskoi SSR, Biologicheskikh Nauk. 2: 60-62.

L. arenosus n.sp., found in the rhizosphere of Calligonum microcarpum and of Haloxylon persicum and Populus pruinosa in the Karadum sands, Tajik SSR, is described and figured. It differs from L. attenuatus in the longer body and odontostyle, shorter tail and longer prerectum, and in the frequent occurrence of males. From L. cohni the new species differs in head shape, shorter stylet, tail and prerectum, and from L. proximus and L. vineacola in the long and slender body, in head shape and in the conical tail, and further, from L. vineacola males, in spicule length and in the presence of 10 pairs of genital papillae.

Kostylev, A.S. 1986. Organization of management for healthy aspen. Lesnoe Khozyaistvo. 5: 61-63.

An account is given of Russian investigations on the effect of the fungi Fomes (Phellinus) igniarius and Phellinus tremulae on aspen. P. tremulae penetrated into trees mainly via the axils of dead branches. The incidence of stem and butt rots was analysed in stands after thinnings, with or without the removal of dead branches. The best way to grow healthy aspen stands is to carry out a silvicultural thinning preferably at 13-14 years (not later than 25 years), and to knock off the dead branches on the best trees. Branch removal does not affect butt rots, which are caused by other fungi penetrating via insect tunnels.

Kukor, J.J.; Martin, M.M. 1986. The transformation of Saperda calcarata into a cellulose digester through the inclusion of fungal enzymes in its diet. Oecologia. 71(1): 138-141.

L'Hirondelle, S.J.; Addison, P.A.; Huebert, D.B. 1986. Growth and physiological responses of aspen and jack pine to intermittent SO₂ fumigation episodes. Canadian Journal of Botany. 64(11): 2421-2427.

Long, R.; Bowersox, T.W.; Merrill, W. 1986. Artificial inoculation of Populus hybrids with Septoria musiva. Canadian Journal of Forest Research. 16(2): 405-407.

Cuttings of Populus 'NE-388' were inoculated with mycelium of S. musiva [Mycosphaerella populorum] at three potential infection courts. Cankers developed within 17-30 and 18-22 days when inoculations were made at, respectively, stipule/petiole excision wounds and bud excision wounds. Infection declined from 100 percent in 16-week-old cuttings to 30 percent in 18-week-old plants. Cuttings inoculated with an atomized conidial spray developed leaf spots after 18-23 days, but no stem cankers developed.

Luley, Christopher John. 1986. Epidemiology of Mycosphaerella populorum Thompson on the foliage and stems of Populus species. Dissertation Abstracts International. 47/08-B: 3193.

Spermagonia and ascocarps of Mycosphaerella populorum, Thompson were produced in vitro on a poplar leaf decoction agar. Ascospore and conidial release and infection of foliage and stems of two Populus clones by the pathogen were monitored in a hybrid Populus plantation. When using a Burkhard spore trap, most ascospores were trapped during daylight after rains. Vaseline coated slide traps collected most conidia in weeks with low levels of rain, while a water collection spore trap monitored highest conidial levels in periods with high rain fall.

Foliar infection of a susceptible clone was found whenever measurable levels of conidia or ascospores were collected. Foliar infection ratings were highly correlated with ascospore densities while correlations with conidial densities were generally nonsignificant. Stem infection of a susceptible clone (NC5272) occurred in periods of peak ascospore and conidial release while a moderately resistant clone (NC5271) was infected only during peak periods of ascospore collection. Environmental parameters were highly correlated with foliar and stem infection and were used to develop regression equations.

Bottoms of leaves were more susceptible to infection than tops of leaves of both clones. Inoculation of foliage and stems with various inoculum densities showed that significant isolate-clonal interactions were present on the moderately resistant clone. These interactions were generally nonsignificant on the susceptible clone.

Manion, P.D.; Griffin, D.H. 1986. Sixty-five years of research on Hypoxyylon canker of aspen. Plant Disease. 70(8): 803-808.

The disease of Populus spp. caused by H. mammatum is reviewed.

Martin Bernal, E.; Padro Simarro, A. 1986. Pterocomma populeum Kaltenbach, a new pest of poplars. Boletín de Sanidad Vegetal, Plagas. 12(2): 291-296.

An infestation of the aphid Pterocomma populeum was recorded in May 1985 in young plantations of the hybrid poplar Populus canadensis in the municipal district of Pastriz, Zaragoza, Spain. This is the first time that the aphid has been reported in this country. The biology, distribution, and natural enemies of the aphid are discussed. The infestation was controlled using dimethoate.

Masoodi, M.A.; Trali, A.R.; Bhat, A.M.; Tikoo, R.K.; Nehru, R.K. 1986. Incidence of parasites of Lymantria obfuscata in Kashmir. *Entomophaga*. 31(4): 401-404.

The incidence of parasites of Lymantria obfuscata was studied in sites composed of favored hosts of the pest, including apple, willow [Salix], and poplar [Populus], in Kashmir, India, during 1983 and 1984. The only egg parasite reared was the eupelmid Anastatus kashmirensis. From 15 study sites, as many as 10,475 larvae in different instars and pupae were collected and reared in the laboratory.

Maurer, P.; Pinon, J.; Genetet, I. 1986. Method for measuring the leaf area injured by Marssonina brunnea. *Annales des Sciences Forestieres*. 43(3): 403-406.

A method for measuring the infected area of poplar leaves is described, based on the difference in optical density between infected and healthy tissue. The difference is accentuated by discoloration with DMSO, and calculated by an image analyser.

Miller, W.E. 1986. Epinotia nisella: an unrecorded host and mode of feeding. *Great Lakes Entomologist*. 19(4): 205-207.

Larvae of Epinotia nisella were recorded feeding in gall-like structures on Populus balsamifera, for the first time, in Minnesota, USA. Feeding behavior is described.

Moore, L.M.; Wilson, L.F. 1986. Impact of the poplar-gall sawfly, Saperda inornata on a hybrid Populus plantation in Michigan. *Great Lakes Entomologist*. 19(3): 163-167.

Saperda inornata attacks on a mixed hybrid outplanting of Populus in Michigan were monitored for 4 years (1979-1982) after planting. More than 60 percent of the whips were attacked during the 1st year. Branch attacks superseded stem attacks in the 3rd and 4th years. Injury significantly reduced tree height because of leader breakage after the 2nd-year attacks, but such injured trees grew rapidly and recovered much of their height in the 3rd and 4th years. S. inornata, at the population levels examined, did not seem to affect greatly hybrid Populus growth or to reduce biomass.

Mori, T.; Inoue, T. 1986. Pine-wood nematode-induced ethylene production in pine stems and cellulase as an inducer. *Journal of the Japanese Forestry Society*. 68(2): 43-50.

Resistant and susceptible pines (including Pinus densiflora and P. elliottii) were inoculated with Bursaphelenchus xylophilus nematodes (live or a frozen dead suspension, including cellulase) or commercial cellulases. Susceptible pines such as P. thunbergii produced 2 peaks of ethylene production in response to live nematodes. Resistant trees such as P. jeffreyi and P. taeda, and susceptible trees that eventually recovered from the disease, only produced the first peak. The amount of ethylene production stimulated depended on the physiological condition of both host and parasite. It is suggested that the stimulation was due to nematode migration. Frozen nematode suspensions and commercial cellulase also induced ethylene production when applied to the cambial zones of isolated pine or poplar (Populus maximowiczii X P. nigra) stems. It is concluded that ethylene production

induced by live nematodes was caused by cellulase excreted by them. There were no clear differences between resistant and susceptible pines in ethylene production.

Muller-Stoll, W.R.; Zenker, R. 1986. Decomposition of the cell wall substance of poplar tension wood fibres by wood-destroying fungi with special regard to the G-layer. *Drevarsky Vyskum*. 110: 1-12.

The thick gelatinous layer of poplar tension wood fibers is easily destroyed by wood-rotting ascomycetes and basidiomycetes. It is thus different from the highly resistant tertiary wall of normal wood fibers. A thin lamella lies close to the G-layer. This lamella, which is considerably more resistant to fungi than the thick layer of tension wood, was stained by ruthenium red.

Najdenov, Y. 1986. Distribution of some Taphrina Sadev species on woody vegetation in Bulgaria. *Gorskostopanska Nauka*. 23(5): 35-40.

The most widely distributed and harmful were T. aurea on poplars and willows, T. deformans attacking peach, T. rhizophora and T. johansonii on poplars, and T. caerulescens on oak.

Niyo, K.A.; McNabb, H.S., Jr.; Tiffany, L.H. 1986. Ultrastructure of the ascocarps, asci, and ascospores of Mycospharella populorum. *Mycologia*. 78(2): 202-212.

Ascocarps of this pathogen developing in overwintered poplar leaves exhibit characteristics typical of the Dothideales. Each pseudothecium develops a locule containing a fascicle of bitunicate asci which arise asynchronously from basal ascogenous cells. Ascospore-delimiting membranes seem to arise from the ascus plasmalemma. Mature ascospores are 1-septate with a central pore. The ascospores usually germinate by a germ tube from each cell. The germ tubes seem to penetrate the leaf only through stomata.

Noh, E.R.; Lee, S.K.; Koo, Y.B. 1986. Compartmentalizing ability of poplar clones for discoloration and decay associated with artificial wounds. *Res. Rep.* 22. Suweon, Korea: The Institute of Forest Genetics: 21-25.

Ostry, M.E. 1986. Association of Parkerella populi with declining hybrid aspen in Wisconsin. *Canadian Journal of Botany*. 64(8): 1834-1835.

Ostry, M.E.; Skilling, D.D.; Ettinger, T.L.; Hackett, W.P.; Read, P.E. 1986. Selection for resistance to Septoria musiva in Populus utilizing somaclonal variation. *Phytopathology*. 76(10): 1119.

Otjen, L.; Blanchette, R.A. 1986. Selective delignification of birch wood by Hirschioporus pargamensis in the field and laboratory. *Holzforschung*. 40(3): 183-189.

H. pargamensis causes a white pocket rot in sapwood of birch (Betula papyrifera) and aspen (Populus tremuloides) logs in the forest. Sound birch blocks inoculated with H. pargamensis and incubated for 12 weeks at 27degC and 80 percent RH had patterns of decay macroscopically similar to those that occurred naturally in the forest. Chemical analyses showed lignin to be selectively removed within white pockets. Sound birch contained 70 percent

total sugars and 20 percent lignin, whereas wood selectively delignified by H. pargamenus in the field contained over 91 percent total sugars and less than 4 percent lignin. H. pargamenus also caused a typical white rot resulting in simultaneous removal of all cell wall components in cells surrounding delignified wood. Areas of darker wood contained a thin web of hyphae that appeared to restrict decomposition. The formation of white pockets in wood and the process of selective lignin removal were shown to result from the action of a single fungus.

Padaiga, V. 1986. Measures for protecting forest stands from elk damage. *Metsanduslikud Uurimused, Estonian SSR*. 21: 26-37.

Statistical analyses were made of elk [Alces alces] inventory data collected in 1977 in Lithuania where young Scots pine and aspen [Populus tremula] stands are the most important winter forage areas. Significant negative correlations were found between the abundance of pine and aspen and damage intensity, the area of young pine forest per elk and the total number of damaged trees, and the density of pine stands and the number of damaged trees. Positive correlations were found between elk density and the number of oak and ash trees with severe bark damage. Measures proposed for control are: increasing planting density; reducing or eliminating thinning before 20 years old; improving elk forage; reducing elk numbers; fencing; and repellents. Four fencing styles are described and is only economic for areas over 16 ha. The repellent Zhlyuge developed at the author's institute has proved 91-100 percent effective in trials. Mechanical and chemical protection should only be considered as secondary to other control measures.

Papaioannou-Soulioti, P. 1986. Phytophagous mites of the family Tenuipalpidae in Greece and description of three new species. *Chronika Benaki Phytopathological Institute*. 15(1): 11-28.

Park, K.T.; Kim, K.I. 1986. Identification of a stem-borer, Compsidia populnea L. on Populus alba X glandulosa. *Korean Journal of Plant Protection*. 24(4): 191-194.

The main stem-borer attacking Populus alba X P. glandulosa in the Korea Republic was identified as Compsidia populnea [Saperda populnea], which was also found in China, Japan, USSR, Europe, and North America. Morphology, food-plants, biology, and distribution were compared with those of a related cerambycid, C. balsamifera [S. balsamifera], was limited to Korea and China and attacked Salix as well as Populus.

Park, K.T.; Paik, H.R. 1986. Seasonal fluctuation, reproduction, development and damaging behavior of Compsidia populnea L. on Populus alba X glandulosa. *Korean Journal of Plant Protection*. 24(4): 195-201.

Field and laboratory studies of the life history of Compsidia populnea [Saperda populnea], the main wood-boring species infesting Populus alba X P. glandulosa in the Korea Republic, showed that the cerambycid had 1 generation a year and an emergence peak in May near Chuncheon. The female had an average adult lifespan of 13.8 days, the male lifespan averaged 11 days. The eggs were laid singly under U-shaped scars in the bark previously made by the female. The egg stage lasted 8-11 days at 25degC constant temperature and 7-14 days under field conditions. The newly hatched larvae remained for 2-3

weeks under the scars and then bored into the xylem, causing the formation of galls. The larvae became full-fed in early October and overwintered in the mines. Pupation took place in early April, and the pupal stage averaged 11 days at 25degC.

Patton, R.L.; Garraway, M.O. 1986. Ozone-induced necrosis and increased peroxidase activity in hybrid poplar leaves. *Environmental and Experimental Botany*. 26(2): 137-141.

Peroxidase activity was assayed in leaves from two positions (nodes 5 and 15) along the stems of four clones of hybrid poplar (Populus spp.) that had been fumigated with ozone at 0.15 $\mu\text{l/l}$ for up to 6 weeks. Two clones were designated ozone-sensitive, and two were designated ozone-resistant according to injury. Ozone-induced lesions were seen on leaves at both sampled nodes of the sensitive clones and on the leaves at node 15 on one of the resistant clones. Peroxidase activity was higher in leaves from the sensitive clones and higher in old (node 15) leaves than in young (node 5) leaves. Results are discussed in terms of a possible mediating effect of peroxidase activity on ozone-induced foliar injury.

Pechak, D.G.; Noble, R.D.; Dochinger, L. 1986. Ozone and sulfur dioxide effects on the ultrastructure of the chloroplasts of hybrid poplar leaves. *Bulletin of Environmental Contamination Toxicology*. 36(3): 421-428.

This report is concerned with the effects of ozone and sulfur dioxide, alone and in combination, on leaf chloroplasts of a deciduous woody plant. Populus deltoides represents one of the few deciduous plants to be studied for the effects of these two common air pollutants. This report details the results of these pollutants on hybrid poplar leaf mesophyll cells processed for conventional transmission electron microscopy.

Pinon, J. 1986. Test of inhibition of cambial activity of poplar by Hypoxyton mammatum development and application. *European Journal of Forest Pathology*. 16(4): 230-238.

An in vitro test was developed to estimate inhibition of cambial activity in different Populus clones: internodes from twigs were inserted in a tissue culture medium containing H. mammatum culture filtrate and cambial activity observed. Good agreement was obtained between this test and a leaf test performed on 34 clones. Cambial activity was normal or slightly inhibited in non-host or field resistant clones (e.g., P. alba) whereas rapid cambial necrosis occurred with susceptible clones (P. tremula). Toxicity of the culture filtrate appeared to be selective but not necessarily specific, indicating that purified toxins would be necessary to decide whether one or more is specific and thus suitable for use in an early test for resistance.

Prakash, C.S. 1986. Antagonistic interaction of races of Melampsora-medusae on cultivars of Populus. *Phytopathology*. 76(10): 1085-1086.

Prakash, C.S.; Heather, W.A. 1986. Adaptation of Melampsora medusae to increasing temperature and light intensities on a clone of Populus deltoides. *Canadian Journal of Botany*. 64(4): 834-841.

Race 4A of M. medusae produces an incompatible reaction on P. deltoides cv. W-79/307 when incubated at high temperature and low light intensity (26degC

and 100 microE.m-2.s-1) or low temperature and high light intensity (17deg and 700 microE), but a compatible one at low temperature and low light intensity (17deg and 100 microE). When population of this race was sequentially cultured on detached leaves, at increasing temperature or light intensities, isolates that were adapted to each of these regimes were selected. Such isolates exhibited some specificity to their "own" environments, although isolates selected at 26deg and 500 microE were most aggressive at all temperatures and light intensity regimes, respectively. Adaptation appeared to result from pathogen response to host-mediated environmental selection pressure. This rust demonstrates considerable ability to adapt to varying environmental conditions. Thus physical environmental variables may be important selective forces in the regulation of this pathosystem, as spatial and temporal heterogeneity of the environment in nature may result in polymorphism of the pathogen by disruptive selection.

Prakash, C.S.; Heather, W.A. 1986. Effects of changing temperature regimes on resistance to races of Melampsora medusae in a cultivar of poplar. *Annals of Applied Biology*. 108(2): 403-407.

Leaf discs of Populus deltoides cv. W-79/307, inoculated with race 4-C of M. medusae, give a compatible reaction when incubated at 16degC (LT), but an incompatible reaction at 26deg (HT). When, over 12 days sets of inoculated leaf discs were reciprocally transferred between the temperature regimes, incubation for as short as 15 hours at HT resulted in incompatibility which was not reversed by subsequent incubation at LT. In contrast, incubation of the inoculated discs at LT for at least 4 days was necessary for the development of a compatible reaction following transfer to HT. The rapidity, irreversibility, and epistatic nature of the temperature-induced incompatibility suggests that initial recognition in this pathosystem may be for incompatibility. The significance of these results in this host/pathogen system is discussed.

Prakash, C.S.; Heather, W.A. 1986. Relationship between increased virulence and the aggressiveness traits of Melampsora medusae. *Phytopathology*. 76(3): 266-269.

Five radiation-induced, mono-uredium derived mutants of the pathogen were compared with the wild-type race 5A (from which they were derived) for certain traits of aggressiveness (period to flecking, formation of first uredium, production of 50 percent of the uredia; number of uredia, and urediospores produced/unit leaf area; and number of uredia produced/day) on leaf discs of both a resistant poplar (T-173 on which the mutants are virulent) and the susceptible I-488 (on which the mutants can arise). On the susceptible poplar, the wild type was more aggressive than the mutants; hence, the traits of aggressiveness, other than the latent period, were negatively correlated with the increase in virulence. Although there were quantitative differences among the mutants for traits of aggressiveness on I-488, when ranked for these traits the mutants formed a cluster distinctly removed from the wild type. Hence, with these isolates, the range in aggressiveness appears to be related to the virulence makeup of the genotype. It is concluded that virulent races are relatively less fit to survive on the susceptible cultivar, while their fitness on resistant cultivars depends on the background genotypes of the host.

Prakash, C.S.; Heather, W.A. 1986. Response to gamma irradiation and induced virulent mutation in Melampsora medusae of poplars. *Journal of Phytopathology* (formerly *Phytopathologische Zeitschrift*). 115(1): 89-96.

When the urediospores of 3 races of M. medusae were exposed to ⁶⁰Co gamma-irradiation in the range 100-1000 Gy, there were significant differences in the radiosensitivity of the races as assessed, in vitro, by incubation period to flecking on Populus X euramericana cv. I-488 leaf discs and survival of uredinia. In race 5A the frequency of mutation to virulence on P. deltoides cv. T-173, normally resistant, was greatest at an irradiation dose of 400 Gy. Importance of mutations and the usefulness of artificially induced mutations in studying host-pathogen interactions are discussed.

Radjabi, G.; Rezwani, A. 1986. Eulecanium tiliae (L.) in Iran. *Entomologie et Phytopathologie Appliquees*. 53(1-2): Pe 49-55; en 9-10.

Eulecanium tiliae is recorded for the first time in Iran, where it was found to infest apple, plum, sour cherry [Prunus cerasus], poplar [Populus], willow [Salix], and wild rose [Rosa], the first 2 food-plants being preferred. The proportion of males in a population increased with decreasing altitude of the habitat. Females laid up to 1,792 eggs, and the number laid was greater on younger than on older branches. The dates of the beginning of oviposition, beginning and end of hatching, and beginning of settling of the nymphs on branches varied slightly from year to year but not usually by more than 3 weeks.

Ren, G.J.; Wang, S.W.; Li, H.Y.; Wang, P.S. 1986. Study on Cryptorhynchus lapathi Linne in Baoji region of Shanxi province. *Journal of North-East Forestry University, China*. 14(3): 7-10.

C. lapathi was found to be causing serious damage on poplars in 1979. Preliminary results of field work in 1980-1985 covering distribution, hosts, habits, damage, flight behaviour, number of instars, and control are summarized.

Ride, M.; Ride, S.; Steenackers, M.; Steenackers, V. 1986. Artificial infection of different poplar clones with different geographical isolates of Xanthomonas populi. *Mededelingen van de Faculteit Landbouwwetenschappen Rijksuniversiteit Gent*. 51(3b): 1331-1345.

Preliminary results are presented of inoculation trials with 52 isolates of X. populi collected in 1983 and 1984 from Populus in different areas of Belgium and The Netherlands. A wide range of aggressiveness was observed in the clone-isolate combinations tested.

Rosnev, B.; Naidenov, Ya. 1986. Species of Marssonina parasitizing poplars, walnut and roses. *Gorskostopanska Nauka*. 23(1): 53-61.

Details are given of the distribution and bio-ecology of M. brunnea, M. castagnei, M. populi-nigrae, M. juglandis [Gnomonia leptostyla] and M. rosae in Bulgaria, and of the damage that they cause. For their development, M. brunnea requires temperatures of 17-18degC and precipitation of at least 24 mm/wk during the growing season; M. populi-nigrae requires temperatures above 15degC and humidity over 75 percent; M. castagnei temperatures of 25-30degC and humidity over 75 percent; and M. juglandis temperatures of 15-30degC, frequent precipitation, and humidity over 65 percent.

Runge, A. 1986. Succession of fungi during the final stage on poplar stumps. *Zeitschrift fur Mykologie*. 52(1): 217-224.

Schmidt, O. 1986. Investigation on the influence of wood-inhabiting bacteria on the pH-value in trees. *European Journal of Forest Pathology*. 16(3): 181-189.

Aerobic and facultatively anaerobic bacteria from Abies grandis and Populus nigra wetwood, polluted Picea abies and Fagus sylvatica trees, and Pycnanthus angolensis discoloured timber were able to acidify aerobically sugar-containing substrates by organic acid production and to increase the pH of protein substrates by ammonia production. The pH changes occurred in laboratory media and also in the capillary liquids and wood flours of A. alba, P. nigra, and P. abies.

Schoeneman, Rita Sonnelitter. 1986. Cultural practices and leaf rust resistance in integrated pest management of Populus plantations. Dissertation Abstracts International. 47/05-B: 1813.

A 3,500 tree plantation of poplar seedlings and clones established in The Netherlands in 1980 was observed to detail aspects of Melampsora species leaf rust epidemiology. Potential for increasing resistance through tree improvement is evidenced. Resistance to Melampsora leaf rust was greatest in P. maximowiczii seedlings. P. deltoides imparted rust resistance to its progeny, P. trichocarpa, and P. nigra imparted susceptibility to their progeny.

Poplar clones of superior resistance may be used in mixed or mosaic plantations with clones of reduced resistance to provide genetic and physical barriers to pathogen population spread.

Semichaevskii, V.D. 1986. Adsorption of cellulase from the wood-destroying fungus Coriolus versicolor (Fr.) Quel. on lignocellulose materials. *Khimiya Drevesiny*. 2: 101-104, 128.

Adsorption on cellulose is known to increase the stability of cellulases. Cellulase prepared from C. versicolor was adsorbed on columns of aspen [Populus tremula] sawdust or hydrolysis lignin at pH 4.1. The columns retained both the enzyme and its capacity to hydrolyse soluble cellulose (Na carboxymethylcellulose) to reducing sugars during elution for 32 hours. No significant hydrolysis of the insoluble cellulose of aspen occurred under the experimental conditions; only after static incubation for 24 hours. Results suggest that adsorption of extracellular cellulases may play a role in natural wood decay.

Sen-Sarma, P.K.; Ahmad, S.I. 1986. A polyhedral virus infecting poplar defoliator Pygaera fulgurita (Walk.). *Indian Journal of Entomology*. 46(1): 112-114.

In June 1982, some larvae of Pygaera fulgurita [Clostera fulgurita] infesting poplar [Populus] in Uttar Pradesh, India, were found to be infected by a polyhedral virus. This was the first record.

Sharma, A.K.; Cousin, M.T. 1986. Mycoplasma-like organisms (MLOs) associated with the witches' broom disease of poplar. *Journal of Phytopathology*. 117(4): 349-356.

Symptom development and disease progress are described. A survey showed disease incidence to be high along main roads in and around Paris, France. TEM investigation of 350 nm thick sieve tube sections revealed the presence of wall-less MLOs in diseased samples of Populus alba var. nivea, not found in healthy trees.

Shirnina, L.V. 1986. Role of saprotrophic fungi in the pathogenesis of poplar bark. IV. Antagonistic activity of saprotrophic fungi on Dothichiza populea Sacc. & Br. Mikologiya i Fitopatologiya. 20(5): 424-429.

Poplar cuttings were inoculated with D. [Cryptodiaporthe] populea, with or without the antagonists. Spore inoculation with Alternaria tenuis [A. alternata] str. 56, Stachybotrys alternans and Trichothecium roseum inhibited C. populea.

Shirnina, L.V.; Nechaeva, M.Yu. 1986. Role of saprotrophic fungi in the pathogenesis of poplar bark. III. Interaction of epiphytic saprotrophic fungi and the pathogen Dothichiza populea Sacc. & Br. Mikologiya i Fitopatologiya. 20(4): 309-312.

In mixed culture, Trichoderma lignorum [T. viride] str. 35 and Mucor spp. str. 93 inhibited the growth of Dothichiza [Cryptodiaporthe] populea. Considerable inhibition was shown by 4 isolates of Alternaria tenuis, mycelium and spores of the saprotrophic fungus being formed on colonies of the pathogen.

Shrivastava, M.; Shrivastava, M.B.; Lal, C.B. 1986. Diseases and insect--pests management of poplars. In: Khosla, P.K.; Sunil Puri, ed. Proceedings of the Satellite seminar on "Agroforestry systems--a new challenge"; 1984 January 2; Ranchi, India. Solan, India: Indian Society of Tree Scientists: 241-268.

Singh, Pratap; Singh, Sujana. 1986. Insect pests and diseases of poplars. Dehra Dun, India: Forest Research Institute and Colleges, Printing and Publication Branch. 74 p.

A popular field guide for poplar growers in northern India. Descriptions are given of 15 insect pests and 18 diseases and methods of their control. There are profuse illustrations but a minimum of technical detail. Precautions to be followed in the use of fungicides and insecticides are given at the end of the booklet.

Sivaramakrishnan, V.R. 1986. Ceroplastes ceriferus Anderson--a new pest of poplars. Indian Journal of Forestry. 9(4): 353-354.

Solomon, J.D. 1986. Early impact and control of aphid infestations on young cottonwood plantations in the Mississippi Delta. Res. Note SO-326. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 4 p.

Spielman, L.J.; Hubbes, M.; Lin, D. 1986. Septoria musiva on hybrid poplar in southern Ontario. Plant Disease. 70(10): 968-971.

S. canker (Mycosphaerella populorum) was found in plantations of hybrid poplar [Populus] at 3 locations in Southern Ontario in 1983 and 1984. This disease had not been found in surveys between 1978 and 1982. Isolates from

Ontario and the USA were similar in cultural morphology, temperature requirements, and virulence in inoculation tests.

Spiers, A.G.; Hopcroft, D.H. 1986. Studies of microconidia of Marssonina brunnea and apothecia of Drepanopeziza tremulae. European Journal of Forest Pathology. 16(2): 65-82.

Microconidia of M. brunnea (the anamorph of D. tremulae) were induced on 15 percent V8 juice agar and Populus x euramericana cv. Robusta leaf discs at 24degC for 10 hours then 6deg for 14 hours, both in continuous dark and under a 10/14 hour light/dark photoperiod. The morphology and development of apothecia and stromata are described. Apothecial development was markedly influenced by incubation temperature. Length and breadth of asci and ascospores were not significantly affected by temperature.

Stanenite, A.P. 1986. Eighteen species of Hymenoptera Chalcidoidea new to the Lithuanian SSR, found in 1968-1983. In: Ionaitis, V., ed. Novye i redkie dlya Litovskoi SSR vidy nasekomykh. Soobshcheniya i opisaniya 1984 goda. Vilnius, USSR: Institut Zoologii i Parazitologii Akademii Nauk Litovskoi SSR: 41-50.

The 18 species of Chalcidoidea contained in this list that were recorded as new to the fauna of the Lithuanian SSR, USSR, in 1968-1983 include Pteromalus dispar, reared on Salix, Macrocentrus species, and Anthonomus pomorum; Pnigalio pectinicornis, reared on Alnus incana, Lithocolletis species [Phyllonorycter species] and L. blancardella [P. blancardella]; Sympiesis xanthostoma, reared on Tilia and Cirrospilus vittatus, reared on Populus nigra.

Storozhenko, V.G.; Mikhailov, L.E. 1986. Volume indices of the fungal infection of aspen stands. Lesnoe Khozyaistvo. 8: 41-42.

Details are given in graphs and tables of the volume lost in butt and stem rot in aspen stands in relation to the degree of infection and age, in the Kalinin and Kostroma regions of the USSR. The data can be used to correct stand assortment tables for aspen.

Taris, B. 1986. The animal enemies of poplars. Phytoma. 376: 51-55.

Notes are provided on the recognition, biology, injuriousness, and control of pests of poplars [Populus] in France.

Van der Kamp, B.J. 1986. Nitrogen fixation in cottonwood wetwood. Canadian Journal of Forest Research. 16(5): 1118-1120.

Verma, T.D.; Khurana, D.K. 1986. Bionomics and control of poplar stem borer, Apriona cinerea Chevrolat in agroforestry plantations. In: Khosla, P.K.; Sunil Puri, eds. Proceedings of the Satellite seminar on "Agroforestry systems--a new challenge"; 1984 January 2; Ranchi, India. Solan, India: Indian Society of Tree Scientists: 237-240.

Verstraeten, C.; Gaspar, C.; Lagrange, B.; Anselot, P. 1986. Population development of diurnal Lepidoptera in Belgium from 1950 to 1983. I. Nymphalidae. Bulletin et Annales de la Societe Royale Belge d'Entomologie. 122(4/6): 55-79.

In order to determine any endangered species, the population development of 31 species of Nymphalidae in Belgium during 1950-1983 was examined, and distribution maps for some of them are provided. Three disappeared since 1973 and 22 being limited to certain regions. Among the species in regression, many developed on wild plants, but Limnitis populi, Apatura illia, Nymphalis antiopa, and N. polychloros fed on forest trees, mainly Betula pendula, Populus tremula, Salix, and Ulmus spp.

Voron, V.P. 1986. Effect of cement dust on woody vegetation. *Lesovodstvo i Agrolesomeliorsiya*. 72: 41-45.

Studies of cement effects on several species showed that cell sap becomes more alkaline by 0.5-3.0 pH units, leaf ash content increases, and metabolism breaks down leading to chlorosis and necroses, early leaf fall, and general debility. Increases in alkalinity intensify through the growing season. The best species for planting in the Carpathian foothills (Ukraine) are: Populus simonii, P. berlinensis, P. alba, P. tremula, Syringa vulgaris, Ligustrum vulgare, Euonymus europaeus, Caragana arborescens, Amorpha fruticosa, and robinia (resistant) and P. nigra, Sorbus aucuparia, Crataegus oxyacantha, Picea pungens, Salix fragilis, and ash (comparatively resistant).

Vovlas, N.; Inserra, R.N. 1986. Morphometrics, illustration, and histopathology of Sphaeronema rumicis on cottonwood in Utah. *Journal of Nematology*. 18(2): 239-246.

S. rumicis, male and female, is described from Populus angustifolia from Utah, USA. This is the first report of males of the species and is the first report from the USA. S. rumicis induced the formation of syncytia originating from the proliferated pericyclic cells. These syncytia were characterized by thick outer walls, wall protruberances, absence of cell wall ingrowths, dense cytoplasm, and hypertrophied nuclei.

Wang, D.; Bormann, F.H.; Karnosky, D.F. 1986. Regional tree growth reductions due to ambient ozone: evidence from field experiments. *Environmental Science & Technology*. 20(11): 1122-1125.

Experimental evidence from open-top chamber field studies indicated that ambient ozone at levels below the ambient air quality standard (235 microg/m³) causes significant reductions in the growth of sapling poplars (hybrid Populus). Demonstration of this effect under field conditions is critical to the establishment of ozone standards. Growth reductions for P. deltoides and Robinia pseudoacacia were not significant. Reductions in productivity and height growth occurred without visible symptoms of foliar injury and at ozone concentrations below current standards. The extent of ozone-induced forest damage may be greatly underestimated and that additional field studies on a regional basis are needed.

Wang, D.; Karnosky, D.F.; Bormann, F.H. 1986. Effects of ambient ozone on the productivity of Populus tremuloides Michx. grown under field conditions. *Canadian Journal of Forest Research*. 16(1): 47-55.

In field experiments at a rural site in Millbrook, New York, during 1982-1984, four clones (sensitive to leaf injury or relatively tolerant) were exposed to charcoal-filtered or ambient air in open-top chambers. Ambient air caused a significant reduction in production of above-ground dry matter and

modified tree morphology, root/shoot ratios, and rates of leaf senescence. The two clones that were selected for relative tolerance to ozone showed reductions in biomass without visible foliar symptoms. There may be a widespread, asymptomatic depression of forest productivity in the USA.

Wilson, L.F.; Moore, L.M. 1986. Preference for some nursery-grown hybrid Populus trees by the spotted poplar aphid and its suppression by insecticidal soaps. Great Lakes Entomologist. 19(1): 21-26.

In tests in a nursery in Michigan in 1979-1981, the susceptibility ranking of more than 50 clones of hybrid Populus whips to Aphis maculatae showed a wide range of attack, ranging from none to very heavy. Clones with P. X jackii [P. balsamifera X P. deltoides] parentage were the most susceptible, whereas Carolina poplar (P. X euramericana [P. X canadensis]) was unscathed. Growth loss differed little between whips. Two insecticidal soaps adequately controlled the aphid, but one was phytotoxic.

Xiang, C.T.; Jiang, L.; Yan, S.Z. 1986. Study on the Coryneum swollen stem canker of poplars. Journal of North-East Forestry University, China. 14(1): 1-10.

A description of a serious, previously unreported problem, caused by C. populinum. Infection was found to be via wounds or directly through the epidermis. The pathogen survives the winter as conidia, which are dispersed by wind or rain. Spraying with 75 percent 'Bravo' [chlorothalonil], 50 percent 'Bovistin' ['Bavistin' - carbendazim], 65 percent 'Dithane' or 70 percent 'Topsin-M' [thiophanate] in late June-early July controlled the disease effectively.

Zhong, Z.K. 1986. Study on poplar canker caused by Botriodiplodia sp. (I) On the pathogenesis of the causal organism (Botriodiplodia sp.) of the canker on poplar. Journal of North-East Forestry University, China 1986. 14(2): 62-65.

Populus pyramidalis [P. nigra] X P. cathayana, P. 'Robusta', and P. xiaozhuanica were particularly affected by the canker.

1987

Baca, S.; Canfield, M.L.; Moore, L.W. 1987. Variability in ice nucleation strains of Pseudomonas syringae isolated from diseased woody plants in Pacific Northwest nurseries. Plant Disease. 71(5): 412-415.

P. syringae infection of many woody plants has been reported by nursery operators in the Pacific Northwest. In several cases, it was reported that episodes of light freezing temperatures (0 to -5degC) preceded or were associated with initial symptom development in aspen (Populus tremuloides) and Magnolia soulangiana. Because ice nucleation induced by P. syringae has been implicated as a predisposing factor to infection of other woody hosts, the association was examined. Of the strains isolated from Tilia cordata, lilac, Cornus florida, and magnolia, 85 percent or more were ice nucleation active (INA) at -5deg; 76 percent of those from aspen were similarly active, but only 30 percent of those from Japanese pear and 24 percent of those from red maple. The P. syringae strains also varied in their ability to induce a hypersensitive response in tobacco and to infect green fruit of yellow pear

tomato. The range of hypersensitive responses varied from 100 percent in aspen to 57 percent in Japanese pear and in pathogenicity from 100 percent in aspen to 36 percent in magnolia.

Bains, B.S.; Wang, E.I.C.; Cyr, N.; Spilda, I.; Micko, M.M. 1987. Effect of heart rot on the chemical properties of aspen. *Journal of the Indian Academy of Wood Science*. 15(2): 51-59.

Wood chemistry was studied on b.h. discs from Populus tremuloides stands infected with Fomes igniarius [Phellinus igniarius] in Alberta. Holocellulose content was similar in clear and decayed wood. Proportions of non-crystalline cellulose, lignin, and ash increased with progression of decay. Minerals were evenly distributed in clear wood but were concentrated in heartwood in decayed stems. Concentration of Zn, P, and Mn were reduced in decayed trees, while large amounts of Ca accumulated in decayed heartwood.

Batzer, H.O.; Benzie, J.W.; Popp, M.P. 1987. Spruce budworm damage in aspen/balsam fir stands affected by cutting methods. *Northern Journal of Applied Forestry*. 4(2): 73-75.

In 1976, spruce budworm [Choristoneura fumiferana] infested plots in a stand in northern Wisconsin where aspen and paper birch [Populus, Betula papyrifera] had been thinned from above or below or clear felled in 1950 (36 years old), thinned from below in 1953 or commercially or completely clear felled in 1961. Measurements in 1975 and 1981 showed that mortality and growth loss of balsam fir were directly related to the amount of aspen removed from the overstory. Clear felling of the aspen produced 60 percent more balsam fir b.a. than on control plots by 1975. Thinning from above had less balsam fir mortality and approximately 40 percent of b.a. of the overstory was non-host trees. Plots thinned from below and control plots had 60 percent non-host trees and 32 percent mortality of balsam fir.

Bodo, B.; Davoust, D.; Lecommandeur, D.; Rebuffat, S.; Genetet, I.; Pinon, J. 1987. Hymatoxin A, a diterpene sulfate phytotoxin of Hypoxylon mammatum, parasite of aspen. *Tetrahedron Letters*. 28(21): 2355-2358.

Brennan, E.; Harkov, R.S.; Wang, D.; Bormann, F.H.; Karnosky, D.F. 1987. Comment on "Regional tree growth reductions due to ambient ozone: evidence from field experiments". *Environmental Science and Technology*. 21(6): 606-608.

Bryant, J.P.; Clausen, T.P.; Reichardt, P.B.; McCarthy, M.C.; Werner, A. 1987. Effect of nitrogen fertilization upon the secondary chemistry and nutritional value of quaking aspen leaves for the large aspen tortrix. *Oecologia*. 73(4): 513-517.

Chengjie, Liang; Ling, Zhao. 1987. Bionomics and control of Hegesidemus harbus Darke. *Scientia Silvae Sinicae*. 23(3): 376-382.

Chamuris, G.P.; Falk, S.P. 1987. The population structure of Peniophora rufa in an aspen plantation. *Mycologia*. 79(3): 451-457.

Coleman, J.S.; Jones, C.G.; Smith, W.H. 1987. The effect of ozone on cottonwood - leaf rust interactions: independence of abiotic stress, genotype, and leaf ontogeny. *Canadian Journal of Botany*. 65(5): 949-953.

The interaction of an acute ozone dose, plant genotype, and leaf ontogeny on the development of Melampsora medusae on eastern cottonwood (Populus deltoides) was investigated. A rust-resistant (ST 66) and a rust-susceptible (ST 109) clone were exposed to charcoal-filtered air or were fumigated with ozone for 5 hours. After 40 hours leaf material of different developmental ages was inoculated with M. medusae uredispores and uredia production was measured after 10 days. Ozone fumigation significantly reduced uredia production by M. medusae on both clones and at all leaf ages without causing visible leaf injury or measurable changes in cottonwood height growth, leaf production, leaf length, or root/shoot biomass. Uredia production was strongly affected by ozone treatment, cottonwood genotype, and leaf age.

Cookson, L.J. 1987. ^{14}C -Lignin degradation by three Australian termite species. Isoptera: Mastotermitidae, Rhinotermitidae, Termitidae. *Wood Science and Technology*. 21(1): 11-25.

Stems of 3 hardwoods (Eucalyptus regnans, Acer rubrum, and Populus tremuloides) and 2 softwoods (Pinus radiata and Pseudotsuga menziesii) were infused with a labelled lignin precursor to prepare ^{14}C -(lignin)-lignocelluloses. Nasutitermes exitiosus was able to degrade the lignin component of hardwood lignocelluloses (4-6.5 percent breakdown), but not that of softwood lignocelluloses. Coptotermes acinaciformis and Mastotermes darwiniensis were less able to degrade lignin.

Danilova, M.F.; Kravkina, I.M.; Crang, R.E.; Pechak, D. 1987. Ultrastructure of stomata and leaf surface in Populus deltoides under SO_2 influence. *Botanicheskii Zhurnal*. 72(9): 1187-1192.

Dapeng, Zeng; Yifan, Han; Yongchang, Dong. 1987. Selection of poplars resistant to two leaf rust fungi Puccinia triticina. *Forest Science and Technology*. 11: 7-9.

de Kam, M.; Heisterkamp, S.H. 1987. Comparison of two methods to measure the susceptibility of poplar clones to Xanthomonas populi. *European Journal of Forest Pathology*. 17(1): 33-46.

Populus clones were inoculated by the conventional leaf-scar method in September and by stipule-scar inoculation in May-June. A statistical method for evaluating the resulting disease expression is presented. The clones for which susceptibility to bacterial canker was not known were classified by comparison with the reference clones. With both methods the least and most susceptible clones were easily distinguished but those of moderate susceptibility (MR) were more difficult to classify. Comparison of the results with the data on field resistance indicated that the stipule-scar method reflected the field susceptibility of the MR clones better than the leaf-scar method.

Derevyankin, P.; Keldysh, M. 1987. Formation of the species composition of viruses in arid-zone ecosystems in the RSFSR and western Kazakhstan. *Trudy Latviiskoi Sel'skokhozyaistvennoi Akademii*. 236: 26-42.

Observations are reported on a range of woody species commonly planted, especially in shelterbelts, in the northern kalmyk ASSR and in Ural'sk Province. Virus infections were rare or absent in shelterbelts but were frequent on most of the species planted in forest stands or arboreta in ravines and other sites near water. In some cases, the infections were of types not normally found on these hosts. Results suggest that the infections were derived from fruit orchards and ornamental plantings in these areas. Tree nurseries should therefore be isolated from such sources of virus infection.

Giasson, L.; Lalonde, M. 1987. Analysis of a linear plasmid isolated from the pathogenic fungus Ceratocystis fimbriata Ell. & Halst. *Current Genetics*. 11(4): 331-334.

Gremmen, J. 1987. Notes on the Mayapple and the life history of the fungus Septotinia podophyllina. *Mycotaxon*. 28(1): 255-256.

The life history of S. podophyllina in eastern North America is described. Introduction of P. peltatum into Europe because of its medical and pharmaceutical interest has led to the spread of the fungus to Populus species, Salix species, and Prunus serotina.

Heather, W.A.; Sharma, I.K. 1987. Physiologic specialisation in the hyperparasitism of races of Melampsora larici-populina by isolates of Cladosporium tenuissimum. *European Journal of Forest Pathology*. 17(3): 185-188.

Three isolates of C. tenuissimum were prepared by culturing a field isolate separately on 3 races of M. larici-populina. Production of uredinia on 3 cultivars of Populus X euramericana was usually lowest in the presence of the isolate of C. tenuissimum which had been cultured on that particular race. This apparent adaptation of the hyperparasite was confirmed by a significant race X isolate interaction in analysis of variance.

Hirsh, A.; Williams, R.J.; Erbe, E. 1987. Warming induces intracellular freezing in frozen tender Populus. *Biophysical Journal*. 51(2): 176.

Hirsh, A.G.; Williams, R.J.; Erbe, E.; Bent, T.J. 1987. Warming induces intracellular freezing in frozen tender Populus. *Cryobiology*. 24(6): 567.

Hu, Y.Y.; Xue, P.; Yang, X.L. 1987. Characteristic of biology and ecology natural control over host of parasitic aphid chalcid Prospaltella sp. *Journal of North-East Forestry University, China*. 15(3): 1-7.

A description of the life history of Prospaltella species, an important parasitoid of the poplar scale insect Quadraspidiotus gigas, in Heilongjiang.

Jin, L.; Chow, S.; Herring, F.G.; Phillips, P.S.; Swan, E.P.; Wilson, J.W. 1987. Electron-spin-resonance and dispa study of free-radical formation in trembling aspen wood decayed by Fomes igniarius. *Cellulose Chemistry and Technology*. 21(6): 621-628.

Keating, S.T.; Yendol, W.G. 1987. Influence of selected host plants on gypsy moth larval mortality caused by a baculovirus. *Environmental Entomology*. 16(2): 459-462.

Larvae of Lymantria dispar were fed L. dispar nuclear polyhedrosis virus on selected food-plants to study the influence of the plants on larval mortality. Larvae consuming the virus on red oak (Quercus rubra) or red maple (Acer rubrum) showed significantly lower mean mortality due to the virus than did larvae fed virus on quaking aspen (Populus tremuloides) or pitch pine (Pinus rigida).

Kreslavskii, A.G.; Mikheev, A.V.; Solomatin, V.M.; Gritsenko, V.V. 1987. Exchange and ecologo-genetic differentiation in sympatric population system of Lochmaea capreae. *Zoologicheskii Zhurnal*. 66(7): 1045-1054.

Krupinsky, J.M.; Cunningham, R.A. 1987. Septoria musiva and Marssonina brunnea leaf spots of Populus spp. in windbreaks in the northern Great Plains. *Proceedings of the North Dakota Academy of Science*. 41(79th): 71.

Luley, C.J.; Tiffany, L.H.; McNabb, H.S., Jr. 1987. In vitro production of Mycosphaerella populorum ascomata. *Mycologia*. 79(4): 654-658.

Maurer, P.; Dreyer, E.; Pinon, J. 1987. Photosynthesis of poplar infected with Marssonina brunnea: comparison of 3 clones. *Annales des Sciences Forestieres*. 44(2): 135-152.

Shoot cuttings of Populus 'Robusta' (fairly resistant to M. brunnea [Drepanopeziza punctiformis]), P. 'I-214' (susceptible) and P. 'Magister geant' (very susceptible) were inoculated with solutions of 50,000 and 100,000 conidia/ml, and gas exchange was measured daily under controlled conditions until fungal sporulation. There was a sharp decline in net CO₂ assimilation and stomatal conductance about 4 days after inoculation. In a second stage, photosynthetic activity remained constant or decreased slightly. Description of photosynthesis was least in P. 'Robusta' and greatest in P. 'Magister geant'. At an inoculation rate of 50,000 conidia/ml, there was no sporulation in P. 'Robusta', sporulation on some infected tissue of P. 'I-214' and on all infected tissues of P. 'Magister geant'. Infected tissues of all 3 clones produced spores at 100,000 conidia/ml. It is suggested that tolerance to infection may be related to a reduction in the sporulation capacity of the fungus and maintenance of higher photosynthetic activity.

Miller, W.E. 1987. Change in nutritional quality of detached aspen and willow foliage used as insect food in the laboratory. *The Great Lakes Entomologist*. 20(1): 41-45.

Moraal, L.G. 1987. Cremnodes atricapillus, a new parasitoid of the cambium miner fly, Phytobia cambii, with notes on Symphya spp. *Entomologische Berichten*. 47(1): 5-8.

Pupae of Phytobia cambii from young poplars (Populus) and willows (Salix) in the Netherlands in 1983 and 1984 were found to be parasitized by Symphya ringens, S. hians, and Cremnodes atricapillus. Most of the parasitized pupae were brown, were lighter in weight than unparasitized ones and floated in water.

Moraal, L.G.; Grijpma, P. 1987. The cambium miner, Phytobia cambii: research on relations between larval tunnels and bark necroses in young poplars in the nursery. Nederlands Bosbouw tijdschrift. 59(6): 201-210.

Following the observation of bark necroses being frequent on 2-3 year old Populus 'Robusta', P. 'Zeeland', P. 'Flevo', P. 'Dorskamp', and P. canescens, attacked by Phytobia cambii, insecticide trials were carried out on 1-year Populus 'Zeeland' with carbofuran, deltamethrin, Soveurode (a glue) and tetrachlorvinphos. Treatment with carbofuran had a positive effect on growth, but a second trial indicated that necroses and canker formation still occurred on the trees.

Morelet, M. 1987. Venturia species on poplars of the section Leuce. II. Biology in culture. European Journal of Forest Pathology. 17(2): 85-93.

Single-spore isolates of V. macularis, V. viennotii, and V. tremulae var. tremulae, var. populi-albae, and var. grandidentatae were compared in vitro on corn meal agar for their growth and fruitbody induction under different light and temperature conditions. Optimum growth temperature was 20degC for all taxa except V. tremulae var. grandidentatae (25deg) and lethal temperature was 30deg in each case. V. macularis and V. viennotii formed ascospores in continuous light at 21deg. V. tremulae formed ascospores at 6deg in both light and darkness and formed conidia under continuous light after 1 week at 21deg or 2 at 6deg. V. macularis was homothallic, the other 2 species heterothallic. Genetic recombination readily occurred between the European vars. tremulae and populi-albae of V. tremulae.

Nesme, X.; Michel, M.F.; Digat, B. 1987. Population heterogeneity of Agrobacterium tumefaciens in galls of Populus L. from a single nursery. Applied and Environmental Microbiology. 53(4): 655-659.

Soil effects on crown gall frequency in a French nursery plot were detected, indicating that contamination was due to a resident population of the pathogen which was present before the seedlings were planted. The crown gall frequency on poplar progenies varied from 3 to 67 percent. Of 129 tumour isolates, 128 were pathogenic. These were of biotype 1 or 2. Biochemical, serological, and antibiotic resistance typing results concurred, indicating the presence of 4 biotype 1 and 2 biotype 2 resident subpopulations. No significant change was noticed from one year to another. Pathogenic subpopulations both in vitro and in planta were susceptible to Kerr K84. There were no serological cross-reactions between K84 and the pathogenic subpopulations.

Normand, P.; Simonet, P.; Giasson, L.; Ravel-Chapius, P.; Fortin, J.A.; Lalonde, M. 1987. Presence of a linear plasmid-like DNA molecule in the fungal pathogen Ceratocystis fimbriata Ell. & Halst. Current Genetics. 11(4): 335-338.

Ostry, M.E. 1987. Biology of Septoria musiva and Marssonina brunnea in hybrid Populus plantations and control of Septoria canker in nurseries. European Journal of Forest Pathology. 17(3): 158-165.

The life cycles of S. musiva (Mycosphaerella populorum) and Marssonina brunnea (Drepanopeziza punctiformis) were clarified for North Central USA. Ascospores of both species were present at the time of leaf flush. Primary

Septoria leaf spots were caused by ascospores, but early Marssonina leaf spots could have been caused by conidia which overwintered in shoot lesions or ascospores discharged from leaf debris. Benomyl applied bimonthly reduced the incidence of Septoria canker of susceptible clones in a nursery to near that of resistant clones. Cultivation to remove inoculum on fallen leaf debris in the spring, however, failed to reduce disease incidence or severity. The use of resistant clones is considered to be the most effective strategy against Septoria canker, with the possible use of fungicides in nurseries.

Peiheng, Wu; Zhenyu, Li; Kangnian, Wei. 1987. Studies on the biological characteristics and sex pheromone, utilized for the control of poplar twig clearwing moth. *Scientia Silvae Sinicae*. 23(4): 491-497.

Pinon, J.; van Dam, B.C.; Genetet, I.; de Kam, M. 1987. Two pathogenic races of Melampsora larici-populina in north-western Europe. *European Journal of Forest Pathology*. 17(1): 47-53.

Three collections of M. larici-populina from Belgium, France, and The Netherlands were compared for their pathogenicity on detached leaves of 11 poplar clones. After purification of the French isolate, qualitative differences in pathogenicity were obtained, suggesting the existence of 2 pathogenic races which were designated E1 and E2. Race E2 was able to infect some clones previously considered to be resistant.

Prakash, C.S. 1987. Aspects of genetics of host pathogen interaction in Populus-Melampsora medusae system. *Forestry Abstracts*. 48(4): 243.

Prakash, C.S.; Thielges, B.A. 1987. Pathogenic variation in Melampsora medusae leaf rust of poplars. *Euphytica*. 36(2): 563-570.

Nineteen isolates of Melampsora medusae (Thum.), collected from natural stands of Populus deltoides (Bartr.) along the lower Mississippi River Valley, were tested for the occurrence of physiologic races by inoculation of nine poplar clones. Eight distinct races were identified based upon differential responses on these clones.

Sage, R.F.; Sharkey, T.D. 1987. The effect of temperature on the occurrence of O₂ and CO₂ insensitive photosynthesis in field grown plants. *Plant Physiology*. 84(3): 658-664.

The sensitivity of photosynthesis to O₂ and CO₂ was measured in leaves from field grown plants of 6 species (Phaseolus vulgaris cv. Linden, Capsicum annum, tomato, Scrophularia desertorum, Cardaria draba, and Populus fremontii) at 5 to 35degC using gas-exchange techniques. In all species but Phaseolus, photosynthesis was insensitive to O₂ in normal air below a species-dependent temperature. CO₂ insensitivity occurred under the same conditions that resulted in O₂ insensitivity. In tomato and Populus, O₂ and CO₂ insensitivity occurred under conditions regularly encountered in the field during the cooler parts of the day. Because O₂ insensitivity is an indicator of feedback limited photosynthesis, these results indicate that feedback limitations can play a role in determining the diurnal carbon gain in the field. At higher partial pressures of CO₂ the temperature at which O₂ insensitivity occurred was higher, indicating that feedback limitations in the

field become more important as the CO₂ concentration in the atmosphere increases.

Schmidt, O.; Nagashima, Y.; Liese, W.; Schmitt, U. 1987. Bacterial wood degradation studies under laboratory conditions and in lakes. *Holzforschung*. 41(3): 137-140.

Laboratory experiments were undertaken with pure cultures of 57 bacterial strains and samples of the sapwood of beech, poplar, spruce, and Scots pine and, to test likely cellulose decomposition, tension wood of Ailanthus altissima, which has unlignified G-layers. Wood samples were also enclosed in polyester bags with a 30 microm pore size and submerged in 2 freshwater lakes for 1-12 months. In the laboratory experiments, none of the 57 strains showed any sign of degrading the sample cell walls. Experiments with submerged samples revealed bacterial attack of the softwoods and bacterial attack, with fungi participating, in the hardwoods. TEM micrographs showed the degradation progressing from the tertiary into the secondary wall. Isolations from within holes in the cell walls yielded mostly rod-shaped bacteria which were either surrounded by granular to amorphous substances or were present in distinct cavities.

Shain, L.; Jarlfors, U. 1987. Ultrastructure of eastern cottonwood clones susceptible or resistant to leaf rust. *Canadian Journal of Botany*. 65(8): 1586-1598.

Sharma, I.K.; Heather, W.A. 1987. Temperature-light intensity effect on the antagonism of species of Cladosporium to Melampsora-larici-populina on cultivars of Populus X euramericana (Dode) Guinier. *Journal of Phytopathology-Phytopathologische Zeitschrift*. 120(2): 158-165.

Singh, Sharanjit. 1987. Effect of variation in host, pathogen and environmental factors on leaf rust in poplar caused by Melampsora medusae Thum. *Forestry Abstracts*. 48(4): 243-244.

Smith, S.M.; Hubbes, M.; Carrow, J.R. 1987. Ground releases of Trichogramma minutum Riley (Hymenoptera: Trichogrammatidae) against the spruce budworm (Lepidoptera: Tortricidae). *The Canadian Entomologist*. 119(3): 251-263.

Stanosz, G.R.; Patton, R.F.; Spear, R.N. 1987. Structure of Armillaria rhizomorpha from Wisconsin aspen stands. *Canadian Journal of Botany*. 65(10): 2124-2127.

Strasser, R.J.; Schwarz, B.; Bucher, J.B. 1987. Simultaneous measurement of chlorophyll fluorescence kinetics at different wavelengths as a rapid method for the early detection of air pollution damage on trees: ozone effects on beech and poplar. *European Journal of Forest Pathology*. 17(3): 149-157.

A method is reported which allows detection of damage before any symptoms are visible. An adaptation index AP, a measure of the ability of leaves to adapt to variations in light conditions, is defined and calculated from fluorescence measurements at 2 different wavelengths. AP values enabled the effects of treating Fagus sylvatica and Populus X euramericana to be detected before the known vitality index Rfd deviated from that of untreated material.

Trench, T.N.; Baxter, A.P.; Churchill, H. 1987. Report of Melampsora medusae on Populus-deltoides in southern-Africa. Plant Disease. 71(8): 761.

Ximeng, Wang; Wen, Lu; Zhen, Zhang. 1987. The resistance of the poplar species to the harmful effect of Anoplophora nobilis Gaglianone. Scientia Silvae Sinicae. 23(1): 95-99.

Youwen, Luo; Hutian, Xing; Lin, Zhou. 1987. Studies on the epidemiology of poplar rust and its control. Acta Phytomycol Sinica. 14(3): 185-190.

Zailin, Yu; Guicheng, Wang. 1987. The purification and analysis of some features of nuclear polyhedrosis virus of Apocheima cinerarius. Scientia Silvae Sinicae. 23(2): 221-226.

1988

Basham, J.T. 1988. Decay and stain 10 years later in aspen suckers subjected to scarification at age 3. Canadian Journal of Forest Research. 18(12): 1507-1521.

David, M.B.; Cote, B.; Vance, G.F. 1988. Aluminum in foliage and bark of black alder, eastern cottonwood, and white basswood. For. Res. Rep. 88-7. Urbana, IL: University of Illinois, Agricultural Experiment Station. 6 p.

Gingas, V.M.; Sydnor, T.D.; Weidensaul, T.C. 1988. The effects of simulated acid rain on cadmium mobilization in soils and subsequent uptake and accumulation in poplar and sunflower. Journal of the American Society of Horticulture Science. 113(2): 258-261.

Haworth, R.H.; Spiers, A.G. 1988. Characterization of bacteria from poplars and willows exhibiting leaf spotting and stem cankering in New Zealand. European Journal of Forest Pathology. 18(7): 426-436.

Haworth, R.H.; Spiers, A.G. 1988. Stem necrosis of Populus deltoides X Populus trichocarpa in New Zealand caused by Xanthomonas campestris pathovar populi. European Journal of Forest Pathology. 18(3-4): 200-206.

One-year-old nursery-grown trees of Populus deltoides X P. trichocarpa parentage exhibited stem necrosis and lesioning during the unusually moist 1985-1986 growing season. This is the first recorded outbreak in New Zealand of stem necrosis of poplars caused by X. campestris pv. populi.

He, W.; Kurkela, T. 1988. Marssonina leaf spot of poplar in Finland. Karstenia. 28(2): 87-92.

The host range of Marssonina populi and M. castagnei, and the relative susceptibility of various poplars to these fungi, were determined through laboratory inoculation tests and a field study.

Idzikowska, K. 1988. Preliminary research on lead absorption and translocation in root tip cells of Populus nigra 'Italica' Moench. Acta Societatis Botanicorum Poloniae. 57(2): 217-222.

Keating, S.T.; Yendol, W.G.; Schultz, J.C. 1988. Relationship between susceptibility of gypsy moth larvae (Lepidoptera: Lymantriidae) to a Baculovirus and host plant foliage constituents. *Environmental Entomology*. 17(6): 952-958.

The susceptibility of gypsy moth, Lymantria dispar L., larvae to the gypsy moth nuclear polyhedrosis virus was significantly altered when larvae were fed different host plants in conjunction with the virus. Larvae consuming the virus on the foliage of oak species suffered lower mortality rates than did larvae consuming the virus-contaminated foliage of aspen species.

Khan, S.N.; Rehill, P.S.; Tivari, R.K.; Rawat, D.S.; Misra, B.M. 1988. Control of poplar rust, Melampsora ciliata in nurseries. *Indian Journal of Forestry*. 11(1): 77-79.

Khan, S.N.; Rehill, P.S.; Tiwari, R.K.; Rawat, D.S.; Misra, B.M. 1988. Control of poplar rust, Melampsora ciliata in nurseries. *Indian Journal of Forestry*. 11(3): 253-255.

Kuo, M.L.; Stokke, D.D.; McNabb, H.S., Jr. 1988. Microscopy of progressive decay of cottonwood by the brown-rot fungus Gloeophyllum trabeum. *Wood and Fiber Science*. 20(4): 405-414.

Menken, S.B.J.; Wiebosch-Steeman, M. 1988. Clonal diversity, population structure, and dispersal in the parthenogenetic moth Ectoedemia argyropeza. *Entomologia Experimentalis et Applicata*. 49(1/2): 141-152.

Nef, L. 1988. Interactions between the leaf miner Phyllocnistis suffusella and poplars. In: Mattson, W.J.; Levieux, J.; Bernard-Dagan, C., eds. *Mechanisms of woody plant defenses against insects: Search for pattern; 1st International symposium; 1986 August 26-29; Orleans, France*. New York, NY: Springer-Verlag, Inc.: 239-252.

Ostry, M.E.; Skilling, D.D. 1988. Somatic variation in resistance of Populus to Septoria musiva. *Plant Disease*. 72(8): 724-727.

Tissue culture of hybrid poplars previously susceptible to leaf spot caused by Septoria musiva was used to obtain poplars with putative resistance.

Ostry, M.E.; McRoberts, R.E.; Ward, K.T.; Resendez, R. 1988. Screening hybrid poplars in vitro for resistance of leaf spot caused by Septoria musiva. *Plant Disease*. 72(6): 497-499.

An in vitro bioassay was developed to screen hybrid poplars (Populus spp.) for resistance to leaf spot caused by Septoria musiva. Leaf discs of clones inoculated with conidia of S. musiva displayed disease resistance similar to that found in field trials.

Shain, L. 1988. Evidence for formae speciales in the poplar leaf rust fungus, Melampsora medusae. *Mycologia*. 80(5): 729-732.

Shain, L.; Miller, J.B. 1988. Ethylene production by excised sapwood of clonal eastern cottonwood and the compartmentalization and closure of seasonal wounds. *Phytopathology*. 78(10): 1261-1265.

Increment cores were removed from ramets of six clones of eastern cottonwood at 3 month intervals starting either in November, at the beginning of the dormant season, or in May, at the beginning of the growing season. By offsetting the two wounding series by 6 months, it was possible to separate the effect of wound age from the effect of season of wounding with regard to dynamic host responses and the fungi that colonize such wounds.

Zhu, Huiqian. 1988. A study on the parasites of poplar (white) leaf miner from Jinci, Taiyuan. *Natural Enemies of Insects*. 1: 52-55.

ECOLOGY

1975

Brown, L.E.; Birkenholz, D.E. 1975. Ecological notes on isolated stands of quaking aspen in central Illinois. *Translations of the Illinois State Academy of Science*. 68(1): 24-25.

Ffolliott, P.F.; Thorud, D.B. 1975. Water yield improvement by vegetation management: focus on Arizona. Rep. PB-246 055. Springfield, VA: National Technical Information Service. 800 p.

This assessment of the potentials for increasing water yield in Arizona by means of vegetation management is based on a review of the Arizona Watershed Program, which began in 1957.

Fralish, J.S. 1975. Ecological and historical aspects of aspen succession in northern Wisconsin. *Transactions of the Wisconsin Academy of Science, Arts, and Letters*. 63: 54-65.

Fralish, J.S.; Loucks, O.L. 1975. Site quality evaluation models for aspen in Wisconsin. *Canadian Journal of Forest Research*. 5(4): 523-528.

Gullion, G.W. 1975. Aspen in forest-type mapping. *Journal of Forestry*. 73(10): 665.

Hanley, D.P.; Schmidt, W.C.; Blade, G.M. 1975. Stand structure and successional status of two spruce-fir forests in southern Utah. Res. Pap. INT-176. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 16 p.

Age-class distribution was studied in stands typical of the *Picea engelmannii*-*Abies lasiocarpa* forests at two high-altitude sites by a random sampling method with concentric circular plots for different diameter classes.

Nikolovski, T.; Matvejeva, J. 1975. Contribution to the knowledge of ecologico-taxonomic situation of the aspen in Macedonia. *Topola*. 18/19(103/106): 122-124.

Schoenfeld, P.H. 1975. A method for site-growth research in a stand of *Populus* cv. *Gelrica*. *Ned Bosbouw Tijdschr*. 47(6): 159-163.

Sosa Cedillo, R. 1975. Investigations on the adaptation of forest tree species in the former basin of Lake Texcoco. *Boletín Divulgativo, Instituto Nacional de Investigaciones Forestales, Mexico*. 37: 30 p.

The 14,500-ha expanse of Lake Texcoco has until recently been covered in the rainy season by a thin sheet of water; evaporation and drainage schemes have led to its exposure for much of the year. Problems involved are discussed, and a description is given of the proposed pattern of hexagonal 'modules' to be established, each consisting essentially of a 12-ha central area for agriculture surrounded by a ridge planted with trees.

Vallee, G. 1975. Poplars for controlling (soil) erosion. *Ressources*. 6(6): 8-11.

Waksman, G.; Menard, M.; Belanger, J. 1975. Factorial analysis of relations between the environment and production: study of the aspen groves of the Laurentian section. *Canadian Journal of Forest Research*. 5(4): 662-680.

1976

Bocharov, V.S. 1976. Evapotranspiration on sites with different afforestation in forest-steppe with small groves of aspen or birch. *Vestn S-kh Nauki Kaz*. 6: 88-91.

Borsuk, D.V.; Krok, B.A. 1976. Radiation regime of forest stands and meadows. *Aktual'n. vopr. sovrem. botan.* 47-52.

Daily mean data are presented for the radiation balance, on clear days in August 1973, of 15-year-old plantations of (a) Pinus sylvestris, (b) Populus nigra, and (c) meadow of steppe timothy and mixed herbs, in the L'vov region (Ukraine).

Boyce, S.G. 1976. Ecology of natural stands of cottonwood. In: Thielges, B.A.; Land, S.B., Jr., eds. *Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 11-19.*

Chlebek, A.; Zeleny, V. 1976. Poplars and shore vegetation [in relation to their effects on the environment]. *Lesn Prace*. 55(9): 406-409.

Corns, I.G.W.; la Roi, G.H. 1976. A comparison of mature with recently clear cut and scarified Lodgepole pine forests in the lower foothills of Alberta. *Canadian Journal of Forest Research*. 6(1): 20-32.

The vegetation was studied in mature stands of Pinus contorta var. latifolia and on naturally regenerated areas that had been clear-felled 6-12 years before the study.

Fechner, G.H.; Barrows, J.S. 1976. Aspen stands as wildfire fuel breaks. *Eisenhower Consortium Bulletin*. 4: 29 p.

Fire ignition rates in Populus tremuloides stands are less than half those for all other cover types in Colorado. These stands do not support intense fires or fires that spread rapidly.

Fillipov, M.F. 1976. Effect of small aspen and birch forests on the microclimate and yield of forage herbs in the Kulunda steppe of the Altai Territory. *Sib Vestn S-kh Nauk*. 1: 67-72.

Hoffmann, G.R.; Alexander, R.R. 1976. Forest vegetation of the Bighorn Mountains, Wyoming: a habitat type classification. Res. Pap. RM-170. Fort Collins, CO; U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 38 p.

A vegetation classification based on concepts and methods developed by Daubenmire was used to identify 14 habitat types and related phases in these mountains. A key for identification of the habitat types is provided, and notes are included on the implications of each type for forest management.

Johnson, W.C.; Burgess, R.L.; Keammerer, W.R. 1976. Forest overstory vegetation and environment on the Missouri river floodplain in North Dakota. *Ecological Monograph*. 46(1): 59-84.

The study area includes the most extensive remnant of floodplain forest in the Dakotas. It is also hypothesized that the lack of seedling-sapling stands of Populus in the region is the result of a presumed reduction in the meandering rate of the river following reservoir construction and poor seedbed conditions in the absence of flooding.

Lacoursiere, E.; Pontbriand, P.; Dumas, J.P. 1976. The first stage in the ecological succession of the Ile aux Sternes, Quebec. *Naturaliste Canadien*. 103(3): 169-189.

The vegetation, soils, and avian fauna of Ile aux Sternes, an island in the St. Lawrence River, created in 1965 by dredging at Port Saint-Francois, were studied in 1970-1974. The 175 species of plants found on the island in these 4 successive years are tabulated, and vegetation groupings (mapped) are established using the methods of Braun-Blanquet. The influences of the vegetation on soil characteristics on avian populations are discussed.

Menard, M.; Belanger, J. 1976. Factor analysis of correlations between environmental variables and forest production. *Memoire, Quebec: Service de la Recherche, Ministere des Terres et Forets*. 24: 73 p.

Results from a previous study of the Laurentian Forest Section, Quebec, were used to obtain data on 9 environmental and 9 production variables for 85 transition communities of Populus tremuloides. The data were analyzed by a form of multivariate analysis, or ordination, involving the use of 3-dimensional graphs.

Mueggler, W.F. 1976. Type variability and succession in Rocky Mountain aspen. *Gen. Tech. Rep. RM-29*. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Range and Experiment Station: 16-19.

Orekhovskii, A.R. 1976. Effect of the forest belt along the North Crimean canal on percolation water levels. *Lesovodstvo i agrolesomelior. Resp. mezhved. temat. nauch. sb.* 46: 35-41.

Observations over 3 years showed that the reduction in levels of percolating groundwater under stands 11-12 years old of Robinia (Robinia pseudoacacia), elm (Ulmus pumila var. arborea) and poplars (Populus spp.) was most marked where the water table was 1-3 m below the soil surface.

Pasche, A.; Zachariassen, K.E. 1976. Colydium elongatum Fabr. (Col., Colydiidae) new to Norway. *Norwegian Journal of Entomology*. 23(2): 207.

Colydium elongatum (F.), a beetle that lives under the bark of dead deciduous trees, where it feeds on xylophagous beetles, is recorded for the first time from Norway, from a single adult collected in June 1976 on a standing ring-barked aspen (Populus tremula).

Poliakova, L.P.; Poliakov, N.E. 1976. Dynamics of the herbaceous cover in a felling area of Pinetum oxalidosum aspen forest. Bot (Issled) Beloruss Otd Vses Bot O-va. 18: 57-62.

Rodionov, B.S. 1976. The intrazonal differentiation of the vegetation of the northern macroslope of the central part of the Trans-Ili Alatau [range]. Botanicheskii Zhurnal. 61(2): 200-210.

Gives a detailed tabular analysis of the incidence of forest, shrub, meadow, and steppe communities by altitudinal zones from 900 to 1,800 m altitude in the Trans-Ili Alatau mountain range in Soviet Kazakhstan. A scheme is presented of the intrazonal differentiation of the forest/meadow belt in this mountain range.

Severson, K.E.; Kranz, J.J. 1976. Understory production not predictable from aspen basal area or density. Res. Note RM-314. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Range and Experiment Station. 4 p.

The stocking density and basal area of aspen (Populus tremuloides) accounted for less than 50 percent and less than 30 percent of the variation in understory production in 2 consecutive years in plots in South Dakota and Wyoming. Data from aspen/ponderosa pine (Pinus ponderosa) stands indicated good correlations of understory production with pine basal area and total basal area. It is suggested that aspen root biomass, total biomass, and growth rate may be related to understory production.

Severson, K.E.; Thilenius, J.F. 1976. Classification of quaking aspen stands in the Black Hills and Bear Lodge Mountains. Res. Pap. RM-166. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Range and Experiment Station. 24 p.

Singh, Teja. 1976. Yields of dissolved solids from aspen-grassland and spruce-fir watersheds in southwestern Alberta. Journal of Range Management. 29(5): 401-405.

Dissolved solid concentrations and rate of stream flow were determined over a 1-year period for (a) a Picea engelmannii/P. glauca/Abies lasiocarpa catchment (watershed) at Marmot Creek (1,500-2,800 m altitude) and (b) a Populus tremuloides/grassland watershed at Streeter Creek (1,300-1,700 m altitude).

Singh, T.; Kalra, Y.P. 1976. Water quality of a range watershed in southwestern Alberta prior to aspen clearing. Inf. Rep. NOR-X-168. Alberta, Canada: Northern Forest Research Centre. 14 p.

Data on conductance and concentrations of Ca, Mg, Na, K, HCO₃, SO₄, and Cl are presented for 1967-1968. Concentrations of some ions, e.g., HCO₃ were already greater than those recommended for some uses. Changes are being monitored after clearing of aspen (Populus tremuloides) in 1976 and subsequent slash burning.

Siren, G.; Sivertsson, E. 1976. Survival and dry matter production of some high-yield clones of Salix and Populus selected for forest industry and energy

production. Pilot study. SHS-IFSY-RU-83. Stockholm, Sweden: Skogshoegskolan. 39 p.

The report deals with questions on how fast-growing Salix and Populus clones survive and can be produced for forest industry and energy purposes.

Usol'tsev, V.A. 1976. Application of regressive analysis in study of age dynamics of birch and aspen phytomass. *Lesovedenie*. 1: 35-39.

Verry, E.S. 1976. Estimating water yield differences between hardwood and pine forests: an application of net precipitation data. Res. Pap. NC-128. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 12 p.

Data on net precipitation (throughfall plus streamflow) are compiled for one mature stand of aspen (Populus tremuloides/P. grandidentata) and 3 stands of red pine (Pinus resinosa) in north central Minnesota.

Wray, P.H.; Promnitz, L.C. 1976. Controlled-environment selection of Populus clones. Gen. Tech. Rep. NC-21. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 19-24.

Zavitkovski, J. 1976. Biomass studies in intensively managed forest stands. Gen. Tech. Rep. NC-21. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 32-38.

1977

Baker, J.B.; Broadfoot, W.M. 1977. A practical field method of site evaluation for eight important southern hardwoods. Gen. Tech. Rep. SO-14. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 31 p.

A new technique is described in which the site index at 50 years old (30 years for cottonwood) is found by summing all the site quality ratings (SQR) for 23 separate factors of soil physical condition, moisture and nutrient availability, and aeration. SQR for different soil/site conditions are tabulated for green ash (Fraxinus pennsylvanica), sweetgum (Liquidambar styraciflua), cherrybark oak (Quercus falcata), water oak (Q. nigra), Nuttall oak (Q. nuttallii), willow oak (Q. phellos), sycamore (Platanus occidentalis), and cottonwood (Populus deltoides) in the southern USA.

Case, J.W. 1977. Lichens on Populus tremuloides in western central Alberta, Canada. *Bryologist*. 80(1): 48-70.

Dichenkov, N.A. 1977. The relative number of fires in different forest formations and forest types. *Lesnoe Khozyaistvo*. 9: 88-89.

An analysis was made of the numbers and extent of forest fires in Belorussia in relation to major forest types. Taking the values for pine types as unity, relative numbers are presented for the number and area of fires in the other species types.

Gladyshev, A.I.; Rodin, L.E. 1977. The structure and distribution of phytomass in riparian forest communities in the flood plain of the middle Amu-Dar'ya River (Turkmen SSR). *Botanicheskii Zhurnal*. 62(1): 3-14.

The composition and distribution of the aerial and underground phytomass and total organic material were analyzed in nearly pure stands of Salix songarica, Elaeagnus orientalis, and Populus pruinosa up to 20 years old at two sites in 1971.

Hoffman, G.R.; Boe, A.A. 1977. Ecological study of epiphytic cryptogams on Populus deltoides in northeastern South Dakota and adjacent Minnesota. *Bryologist*. 80(1): 32-47.

Johnston, R.S.; Bartos, D.L. 1977. Summary of nutrient and biomass data from two aspen sites in western United States. Res. Note INT-227. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 15 p.

Total above-ground biomass and the biomass and nutrient concentrations of various tree components are tabulated for 20 Populus tremuloides trees of different ages and sizes from three clones at two sites in Utah and Wyoming. Equations are given relating d.b.h. to total above-ground biomass. The major portion of the above-ground biomass was contained in the bole (48.7-60.7 percent) and the bole, bark, and branches together accounted for 87.4-94.3 percent.

Marx, D.H. 1977. Tree host range and world distribution of the ectomycorrhizal fungus Pisolithus tinctorius. *Canadian Journal of Microbiology*. 23(3): 217-223.

The natural occurrence of Pisolithus tinctorius has been confirmed in 33 countries and in 38 states in the United States. This ectomycorrhizal fungus is associated with various tree species in nurseries, urban areas, orchards, forests, and strip-mined spoils.

Matveev, N.M. 1977. Allelopathic activity of woody and shrub plants in the steppe zone. *Botanicheskie Nauki*. 2(158): 77-81.

The allelopathic activity of the water-soluble and volatile parts of the leaves of 47 species of trees and shrubs was compared at two locations.

Matveev, N.M. 1977. Features of the allelopathic regime in forest stands in the steppes of the Trans-Volga region. *Lesnoi Zhurnal*. 3: 21-25.

Litter samples were taken on 17 different plots in various plantations and natural ravine stands in the steppe zone.

Nakano, K. 1977. A numerical index of defoliation pressure: definition and application. *Japanese Journal of Ecology*. 27(4): 253-261.

The index of defoliation pressure (DPX) is based on a comparison of the average leaf longevity of defoliated and control plants. To illustrate the applicability of the index, DPX values were calculated from published data on defoliation experiments with Larix laricina. A clear negative correlation was demonstrated between DPX and wood volume increment. The relationship between DPX and leaf area in the year following defoliation is also briefly discussed, for pot-grown poplar and mulberry.

Nemky, E. 1977. Ecophysiology of Populus acorns and seedlings as the basis of natural reforestation of oak forests in Hungary. Agrartud Kozl. 36(1/3): 264-280.

Ohmart, R.D.; Deason, W.O.; Burke, C. 1977. A riparian case history: the Colorado River. Gen. Tech. Rep. RM-43. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 35-47.

Simola, P. 1977. The biomass of small-sized hardwood trees. Folia Forests. 302: 16 p.

Tremolieres, M.; Carbiener, R. 1977. Natural pollution of continental waters by antioxygen effect of phytomelanin genesis in aqueous extracts of autumn leaves, particularly poplars. C. R. Hebd Seances Academy of Science, Ser D Sci Nat. 284(24): 2561-2564.

van den Burg, J. 1977. Growth of Euramerican poplar and nitrogen content of soil organic matter. Populier. 14(3): 55-58.

1978

Bouchard, A.; Maycock, P.F. 1978. Deciduous and mixed forests of the Appalachian region of southern Quebec. Naturaliste Canadien. 105(5): 383-415.

Sampling was done in 91 Appalachian northern conifer/broadleaved stands. Species distribution in the area is related mainly to moisture regime, successional status and altitude.

Chesnokov, N.I.; Dolgosheev, V.M. 1978. Evaluating the oxygen-producing function of forests. Lesnoe Khozyaistvo. 7: 32-34.

A table is presented showing the volume of oxygen liberated into the atmosphere during the formation of the annual increment of the main forest species of the USSR.

DeByle, N.V. 1978. Our western aspen ecosystem--quest for management. Western Wildlands. 4(3): 18-23.

Eremeev, A.G. 1978. Change in the species composition of forests. Lesnoe Khozyaistvo. 7: 63-64.

An analysis is made of the change in the area under forest, in the species composition, and in the age-classes of each species in the Moscow region. Data are presented from inventories in 1940, 1948, 1958, 1968, and 1974, and extrapolations are made to the year 2000.

Gorev, G.I. 1978. Natural regeneration of spruce forests. Lesnoe Khozyaistvo. 3: 20-24.

Classical theories on the natural development of secondary hardwood/spruce stands are discussed, with special reference to the process of succession towards spruce.

Il'kun, H.M.; Makhovs'ka, M.O. 1978. Purification of air from lead compounds by plants. Ukr Bot Zhurnal. 35(3): 246-248.

Inman, J.C.; Parker, G.R. 1978. Decomposition and heavy metal dynamics of forest litter in northwestern Indiana. Environmental Pollution. 17(1): 39-51.

Janke, R.A.; McKaig, D.; Raymond, R. 1978. Comparison of presettlement and modern upland boreal forests on Isle Royale National Park. Forest Science. 24(1): 115-121.

The composition of the original upland boreal forest of Isle Royale National Park, Upper Michigan, was reconstructed from original survey notes of 1848-1948 and compared with the forest as sampled in 1974. A drastic reduction in Abies balsamea (originally dominant) and increases in Betula papyrifera and Populus tremuloides were attributed to a high frequency of fire.

Jaynes, R.A. 1978. A hydrologic model of aspen-conifer succession in the western United States. Res. Pap. INT-213. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 17 p.

Kulyanda, S.S. 1978. The distribution of ground-beetles in forests of western Podolia. Vestnik Zoologii. 1: 55-57.

Each type of forest is found to be associated with a definite group of beetles, determined primarily by microclimatic and edaphic conditions, so that the carabid fauna could be used to diagnose soil-vegetational conditions.

Theander, O. 1978. Leaf litter of some forest trees (Pinus sylvestris, Picea abies, Populus tremula): chemical composition and microbiological activity. TAPPI. 61(4): 69-72.

Vygodskaya, N.N.; Zaitseva, I.I.; Krasnikova, N.V.; et al. 1978. The amount of direct solar radiation reaching open and forested slopes in the south of the Maritime Province. Lesovedenie. 1: 27-38.

A method is proposed for calculating the amount of direct solar radiation reaching a slope, and the technique of hemispherical photography is applied to determining the effect of a forest canopy in reducing the amount of sunlight reaching the ground.

1979

Johnston, P.A.; Branble, W.C.; Arner, D. 1979. Vegetation distribution associated with right-of-way habitats in New York. In: 2d Symposium on environmental concerns in rights-of-way management; 1979 October 16; Ann Arbor, MI: 44.1-44.15.

An analysis was made of vegetation distribution in relation to habitat and forest region on 20 rights-of-way in New York State.

Noble, M.G. 1979. Origin of Populus deltoides and Salix interior zones on point bars along the Minnesota River. American Midland Naturalist. 102(1): 59-67.

1980

Adams, D.E.; Anderson, R.C. 1980. Species response to a moisture gradient in central Illinois forests. American Journal of Botany. 67(3): 381-392.

Polar and Gaussian ordination applied to data collected from 37 forest sites showed a continuous and gradual change in species composition along a moisture gradient.

Mitton, J.B.; Grant, M.C. 1980. Observations on the ecology and evolution of quaking aspen, Populus tremuloides, in the Colorado Front Range. American Journal of Botany. 67(2): 202-209.

Neenan, M.; Neenan, M.; Lyons, G., eds. 1980. Ecological basis for selection of species. In: Production of energy from short rotation forestry. Dublin, Ireland: An Foras Taluntais: 4-7.

The selection of species for short rotation energy plantations is primarily dictated by the land type which is available. For the Irish trials, sites were chosen from the four habitats in which land for biomass is most likely to be. A short list of the major trial species is presented, and includes Salix, Populus, Betula, and Alnus with Pinus contorta and Picea sitchensis as controls because their performance on a wide variety of soils is already known.

1981

Molotovskii, Yu.I.; Nikolaev, F.I. 1981. A concise outline of the vegetation of the Aral-Paigambar Reserve. Botanicheskii Zhurnal. 66(5): 741-744.

This island reserve of 3,000 ha near Termez, Uzbek SSR, contains one of the few remnants of Central Asian riparian woodland in the valley of the Amu-Dar'ya River. It has been heavily damaged by human influence. Elaeagnus angustifolia is found as a thicket-forming pioneer species on new alluvial deposits. Populus pruinosa thickets occur further inland.

Pasternak, P.S. 1981. Using forests as a means of environmental protection. Lesovodstvo i Agrolesomelioratsiya. 60: 7-11.

Studies in Ukraine have shown that woodland belts planted in arable catchments perpendicular to the flow of runoff reduce losses of N by 2.5-7X and P by 5.5-32X. Woodland absorbs surface runoff, converting it to subsurface runoff, this capacity being much greater in broadleaf stands.

Squiers, E.R.; Klosterman, J.E. 1981. Spatial patterning and competition in an aspen-white pine successional system. American Journal of Botany. 68(6): 790-794.

Patterning and competition between established large-toothed aspen (Populus grandidentata) and invading white pine (Pinus strobus) were examined

in a 65-year-old community in Michigan. Several indices of dispersion were used to assess pattern, and regression analysis of the relation between nearest neighbor distance and tree diameter gave an index of competition.

1982

Chen, D.K.; Zhou, X.F.; Zhao, H.X.; Wang, Y.H.; Jing, Y.Y. 1982. Study on the structure, function and succession of the four types in natural secondary forests. *Journal of North-Eastern Forestry Institute, China*. 2: 1-20.

The 4 community types found in the large area of natural secondary forests in Heilongjiang are dominated by: Quercus mongolica, Fraxinus mandshurica/Juglans mandshurica, Populus davidiana, Tilia amurensis, and P. tremula var. davidiana. The general characteristics of the types (life forms, stratification of the community, etc.) are described.

Cogbill, Charles Van Horn. 1982. Analysis of vegetation, environment, and dynamics in the boreal forests of the Laurentian Highlands, Quebec.

Dissertation Abstracts International. 44/03-B: 691.

A comprehensive analysis of factors associated with patterns observed in the forests in central Quebec, Canada. Vegetation is quantitatively sampled by point-centered quarter tree survey and understory quadrats at 145 scattered sites. Tree cores, soil samples, and soil temperatures were obtained in each stand for forest history, edaphic condition, and microclimate analyses, respectively.

Currier, Paul Jon. 1982. The floodplain vegetation of the Platte River: phytosociology, forest development, and seedling establishment (Nebraska).

Dissertation Abstracts International. 43/11-B: 3464.

A vegetation inventory was conducted along 200 miles of the North Platte and Platte Rivers in Nebraska. Twelve major vegetation types were identified using Twinspan, a computerized reciprocal averaging ordination technique. The effects of hydrology on the radial growth of Populus deltoides, Salix rigida, and Juniperus virginiana were assessed by comparing growth (mm) of these species during periods of low mean discharge (1930-1939 and 1967-1970) with growth (mm) during periods of high mean discharge (1920-1929 and 1971-1974). Populus incremental growth did not differ significantly during periods of high and low discharge.

Harniss, R.O.; Harper, K.T. 1982. Tree dynamics in seral and stable aspen stands of central Utah. Res. Pap. INT-297. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 7 p.

Age and d.b.h. were recorded in sample plots, in 48 Populus tremuloides stands in 1969 and 1977. The number of aspens declined in stable stands (where conifers were not increasing) but the aspen basal area was not affected. In seral stands, both number and basal area of aspens decreased, while conifers increased in both number and basal area.

Jobidon, R.; Thibault, J.R. 1982. Allelopathic growth inhibition of nodulated and unnodulated Alnus crispa seedlings by Populus balsamifera. American Journal of Botany. 69(8): 1213-1223.

Aqueous extracts of fresh leaves, buds and leaf litter of P. balsamifera were tested for allelopathic effects on nodulation, nitrogenase activity and growth of seedlings of A. crispa growing in styroblocks in a growth chamber. All extracts inhibited height growth, root elongation, and dry weight increment of nodulated (inoculated with Frankia) and un-nodulated seedlings over a 2-month period. Ecological implications are discussed.

Khurana, D.K.; Khosla, P.K. 1982. Studies in Populus ciliata Wall. ex. Royle III. Phenotypic variation in relation to ecological blocks. Journal of Tree Sciences. 1(1/2): 35-45.

Phenotypic variation in 25 natural stands in the Himalayas grouped into four ecological blocks was analyzed in relation to sex. Five trees of each sex were analyzed at each site for seven characters (height, diameter, bole and clear bole lengths, taper, wood density, and fiber length).

Lenk, Cecilia. 1982. The post-glacial population dynamics of Fagus grandifolia Ehrh. in the region of its northern limit. Dissertation Abstracts International. 43/09-B: 2792.

Analysis of composition, structure, and regeneration in forest stands containing Fagus grandifolia at its northern limit in Main, Quebec, and New Brunswick and the post-glacial history of beech in that area indicates the importance of chance and history in shaping forests. The stands include ones in which beech is dominant as well as stands in which this species is a minor component. Both disturbed stands and old-growth stands were sampled. Although one or more of Fagus grandifolia, Acer saccharum, A. rubrum, Betula spp., Populus spp., or Abies balsamea dominate individual stands, principal components analysis indicates these forests are a continuum.

McComb, W.C.; Noble, R.E. 1982. Understory vegetation in a Populus deltoides plantation. Castanea. 47(2): 132-136.

The composition of understory vegetation in a plantation established in 1966 on the Mississippi River flood plain was compared with data from a previous study in a nearby broadleaved, bottomland forest. The plantation was dominated by early successional species and those with persistent root systems. It is suggested that differences in species composition between the two stands are because of better light in the plantation and site alterations resulting from preparation before planting.

Nelson, Robert Edward. 1982. Late quaternary environments of the western Arctic Slope, Alaska. Dissertation Abstracts International. 43/06-B: 1775.

Sediments of late Pleistocene and Holocene age have been investigated from sites on the Ikpikpuk and Titaluk Rivers in the western Arctic Slope of Alaska. Sediments studied range in age from 42,000 to ca. 25,000 years B.P., 9,700 B.P., and from about 2,500 B.P. to the present. Stratigraphic studies have been combined with analysis of fossil pollen, plant macrofossils, and fossil insects to yield a multifaceted paleoenvironmental and paleoclimatic reconstruction. At 9,700 B.P., Populus balsamifera grew almost 150 km N of

its modern distributional limit. At least eight other species of organisms also were present north of their modern limits.

Vitousek, P.M.; Gosz, J.R.; Grier, C.C.; Melillo, J.M.; Reiners, W.A. 1982. A comparative analysis of potential nitrification and nitrate mobility in forest ecosystems. *Ecological Monographs*. 52(2): 155-177.

In studies of nitrogen losses following soil disturbance, trenched plot experiments were performed in 10 coniferous and 7 broadleaved forests in Washington, Oregon, New Mexico, New Hampshire, Massachusetts, and Indiana. Laboratory incubation studies of potential ammonium and nitrate production were made on soils from 14 of the sites. The site with the greatest potential for nitrate production in the laboratory was a New Hampshire northern broadleaved forest. New Hampshire balsam fir, New Mexico aspen (Populus tremuloides), and Oregon western hemlock also had a high nitrate production.

Wiseman, James Benedict, Jr. 1982. A study of the composition, successional relationships and floristics of Mississippi River floodplain forests in parts of Washington, Bolivar and Sharkey Counties, Mississippi. Dissertation Abstracts International. 43/03-B: 613.

Twenty-one forest stands in batture and non-batture (interior) areas of the study region were sampled to determine arborescent species composition and community attributes. Three strata were sampled: trees, shrubs and saplings, and woody seedlings. Definite compositional differences occurred between sampled batture and interior stands. The most important tree species in the batture were Celtis laevigata, Salix nigra, Populus deltoides, Acer negundo, Carya illinoensis, Fraxinus pennsylvanica, Ulmus americana, and Liquidambar styraciflua. The most important tree species in interior stands were Fraxinus pennsylvanica, Ulmus americana, Quercus phellos, Q. nuttallii, Q. lyrata, Celtis laevigata, and Liquidambar styraciflua.

1983

Bartos, D.L.; Ward, F.R.; Innis, G.S. 1983. Aspen succession in the Intermountain West: a deterministic model. Gen. Tech. Rep. INT-153. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 60 p.

A computer model of succession Populus tremuloides forests for the western USA is described. The model is based in part on existing data, but good estimates are not available for many of the required parameters. Sensitivity to changes in parameter values was analyzed. The model was found to be insensitive to many estimates, allowing simplification, but quite sensitive to some parameters of unknown value, indicating useful areas of research. The model responds realistically to various management operations.

Chapin, F.S., III; Tryon, P.R. 1983. Habitat and leaf habit as determinants of growth, nutrient absorption, and nutrient use by Alaskan taiga forest species. *Canadian Journal of Forest Research*. 13(5): 818-826.

Four evergreen (Linnaea borealis, Picea glauca, P. mariana, and Ledum groenlandicum) and four deciduous (Populus tremuloides, Betula papyrifera, Vaccinium uliginosum, and Larix laricina) trees and shrubs were sampled from

habitats with differing soil temperature regimes. Leaf habit was the primary determinant of shoot growth, with deciduous species producing leaf area and leaf biomass earlier in the season than evergreens. Deciduous trees produced more biomass than evergreens.

Corns, I.G.W. 1983. Forest community types of west-central Alberta in relation to selected environmental factors. Canadian Journal of Forest Research. 13(5): 995-1010.

The forests of the Wapiti map area were studied to ascertain relationships among forest growth, plant community distribution, and environmental factors within the western boreal and subalpine forests. Quantitative data on tree productivity, vegetation, and soils were collected from 137 plots.

Foote, M.J. 1983. Classification, description, and dynamics of plant communities after fire in the taiga of interior Alaska. Res. Pap. PNW-307. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 108 p.

Forest stands burned one month to 200 years previously were sampled and described. Communities were grouped according to successional series (tending towards white or black spruce--Picea glauca, P. mariana--climax communities) and six developmental stages: (1) newly burned, (2) moss-herb, (3) tall shrub-sapling, (4) dense trees, (5) broadleaved trees or broadleaved-spruce trees, and (6) spruce. Stands 50-200 years old were grouped into 12 mature forest community types dominated by Populus tremuloides, Betula papyrifera, P. balsamifera, Picea glauca, P. mariana, or mixtures of these species.

Hoffman, G.R.; Alexander, R.R. 1983. Forest vegetation of the White River National Forest in western Colorado: a habitat type classification. Res. Pap. RM-249. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 36 p.

During a study in 1979-1981, 11 forest habitat types were identified: 5 in the Populus tremuloides series, 2 in the Abies lasiocarpa series, and 1 each in the Pseudotsuga menziesii, Pinus edullis, Picea pungens, and Quercus gambelii series. All types are described and their management discussed and a key is given for identifying them.

Mital, D.; Sucoff, E. 1983. Simulated water deficits in Minnesota aspen stands 1930-1975. In: Thielges, B.A., ed. Proceedings, 7th North American forest biology workshop: Physiology and genetics of intensive culture. Lexington, KY: University of Kentucky: 440-445.

Predicted evapotranspiration (ETp) and transpiration deficit (TD) were simulated for 1930-1975 in Populus tremuloides stands using the model Thirsty in which $TD = kPE - ETp$ where k is the crop coefficient, and PE is Thornthwaite and Mather potential evaporation. Simulations included actual or hypothetical soils and climates; alternative k 's and phenologies were also tried.

Roberts, Mark Richard. 1983. Variability and mechanisms of secondary forest succession in the aspen ecosystems of northern lower Michigan. Dissertation Abstracts International. 44/10-B: 2948.

Successional patterns in large tooth and trembling aspen (Populus grandidentata and P. tremuloides) forests are described through an analysis of the population patterns of woody species. Two approaches were employed: (1) an extensive survey of forest stands of different ages, and (2) an analysis of permanent plots which provided a continuous record of change over a 41-year period.

Rominger, J.M.; Paulik, L.A. 1983. A floristic inventory of the plant communities of the San Francisco Peaks Research Natural Area. Gen. Tech. Rep. RM-96. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 9 p.

In an area of 1,024 acres in Arizona, 129 vascular species were found in nine alpine and subalpine plant communities including some dominated by Picea engelmannii, Abies lasiocarpa, Pinus aristata, and Populus tremuloides.

Santamour, F.S., Jr. 1983. Woody-plant succession in the urban forest: filling cracks and crevices. *Journal of Arboriculture*. 9(10): 267-270.

Brick kilns in Washington, DC, abandoned in 1972, were surveyed 10 years later and the number of woody species recorded. Trees and shrubs of 16 genera were found. The most successful species were cottonwood (Populus deltoides) and ailanthus (Ailanthus altissima).

Strong, W.L.; la Roi, G.H. 1983. Rooting depths and successional development of selected boreal forest communities. *Canadian Journal of Forest Research*. 13(4): 577-588.

The root density and depth patterns of four boreal forest age sequences in Alberta were analyzed for successional trends. Rooting depths increased with age on sandy substrates which supported aspen (Populus tremuloides) and jack pine (Pinus banksiana) communities. Rooting depth did not change in an aspen series on fine-textured substrates (clay loam) or in a black spruce (Picea mariana) series growing on organic substrates.

Strong, W.L.; la Roi, G.H. 1983. Root-system morphology of common boreal forest trees in Alberta, Canada. *Canadian Journal of Forest Research*. 13(6): 1164-1173.

Twenty-four specimens of six boreal tree species were excavated: eight Pinus banksiana, five Populus tremuloides, four Picea glauca, three P. mariana, two Abies balsamea, and two Larix laricina. Root systems were described, and percent biomass determined for above- and below-ground components for half these specimens. The data suggested that roots may be important in boreal succession processes through two related mechanisms: nutrient and water deprivation occurring through preemptive growth of tree roots from climax species over roots of seral species, and through interception by mosses; and niche partitioning occurring below ground between seral and climax, and among climax tree species, by vertical separation of the root systems.

Tyurin, E.G. 1983. Advance growth coverage in northern forests. *Lesnoe Khozyaistvo*. 4: 36-38.

Considerable replacement of conifers by broadleaves has become a serious problem in this important production region. Coniferous stands have

regenerated on only half of the total logged area and on only a quarter of the area logged in the last 10 years. This failure is blamed mainly on the destruction of advance growth and seed trees during commercial logging in violation of silvicultural regulations.

van Cleve, K.; Dyrness, C.T.; Viereck, L.A.; et al. 1983. Taiga ecosystems in interior Alaska. *BioScience*. 33(1): 39-44.

A general account of the findings of a joint USDA Forest Service/University of Alaska research project studying taiga ecosystems, especially the black spruce type. Black spruce forests are the most nutrient poor and least productive forest type, with stands of 120-150 years²old having a m.a.i. of approximately 110 g/m² compared with an average 460 g/m² for white spruce, Betula papyrifera, Populus tremuloides, and P. balsamifera.

1984

Boiko, M.F. 1984. Bryoflora of the Buzuluk pinewoods. *Biologicheskie Nauki*. 5: 81-85.

The list of 3 species of liverworts and 53 of mosses (mainly boreal and nemoral) collected in 1979-1981 also indicates species presence in five forest types of which birch and Scots pine types were the richest in bryophytes.

Clary, W.P.; Ffolliott, P.F.; Larson, F.R. 1984. Producer-consumer biomass in montane forests on the Arizona Mogollon Plateau. *Great Basin Naturalist*. 44(4): 627-634.

A substantially complete estimate was obtained using published and unpublished data from 2 reference stands dominated by ponderosa pine but also containing gambel oak (Quercus gambelii), alligator juniper (Juniperus deppeana) and occasional quaking aspen (Populus tremuloides). Estimates are given of biomass responses of different producer and consumer components to reductions in stand density (by thinning, fire, or logging).

Gifford, G.F.; Humphries, W.; Jaynes, R.A. 1984. A preliminary quantification of the impacts of aspen to conifer succession on water yield--II. Modeling results. *Water Resources Bulletin*. 20(2): 181-186.

Heat pulse velocity techniques were developed for effective monitoring of water movement in aspen (Populus tremuloides), subalpine fir (Abies lasiocarpa), and Englemann spruce (Picea engelmannii). Water loss was monitored in replicated trees of each species for one year. Results of the modeling indicate 18.6 cm net loss of moisture available for streamflow when spruce replaced aspen, and a loss of 7.2 cm when fir forests replaced aspen. The aspen to conifer successional trend appears, therefore, to be significantly reducing water yields in the western United States.

Hansen, P.L.; Hoffman, G.R.; Bjugstad, A.J. 1984. The vegetation of Theodore Roosevelt National Park, North Dakota: a habitat type classification. Gen. Tech. Rep. RM-113. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 35 p.

Vegetation of the Theodore Roosevelt National Park was characterized according to habitat type based on concepts and methods developed by

Daubenmire. The report includes a key to the habitat types, a discussion of species diversity, tabulated stand data, and tree population and soil analyses.

Humphries, W.; Gifford, G.F. 1984. A preliminary quantification of the impacts of aspen to conifer succession on water yield--I. Heat pulse methodology for model calibration. *Water Resources Bulletin*. 20(2): 173-179.

Twenty-six aspen (Populus tremuloides), 20 subalpine fir (Abies lasiocarpa), and 20 Engelmann spruce (Picea engelmannii) of various sizes were cut under water and suspended in permanent reservoirs at a northern Utah site. The reservoirs were sealed so that all water loss was due to consumption by the trees. Sap velocities, as computed from heat pulse velocities, were related to conducting areas of the tree trunks. Computed transpiration volumes were then correlated with actual water losses from the reservoirs. Assumptions and limitations of the heat pulse velocity techniques are also outlined.

Johnston, R.S. 1984. Effect of small aspen clearcuts on water yield and water quality. Res. Pap. INT-333. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 9 p.

Streamflow and water quality were monitored in a paired watershed study involving the removal of 20 percent of the aspen in five small clearcuts. No significant changes in peak flow, timing, or annual yield were found during the 4 years of post treatment monitoring. Significant changes in water quality the second year after cutting may have been, at least in part, due to the chemistry of the snowfall.

Li, S.Z. 1984. Fuzzy cluster analysis of ecological groups of valuable deciduous trees in the mountains of east Liaoning. *Journal of North-Eastern Forestry Institute, China*. 12(3): 53-58.

Analysis of natural stands distinguished five groups: Fraxinus rhynchophylla with F. mandshurica; Maackia amurensis with Phellodendron amurense; Betula costata with F. rhynchophylla and Populus davidiana (P. tremula var. davidiana); and Acer mono with Ulmus laciniata. It is recommended that these groups be used for selecting species for mixed plantations and for semi-natural communities.

MacDonald, Glen Michael. 1984. Postglacial plant migration and vegetation development in the western Canadian boreal forest. *Dissertation Abstracts International*. 46/05-B: 1433.

Sediment cores were obtained from nine small lakes located along a broad latitudinal transect extending from central Alberta to the middle Mackenzie River Valley, Northwest Territories. The radiocarbon dated fossil pollen records from these cores provided data for the reconstruction of postglacial vegetation development in the western Canadian Boreal Forest.

Payandeh, B. 1984. Dimensional relationships for several tree species from the spruce-fir forest types of northwestern Ontario. *Canadian Forestry Service Research Notes*. 4(2): 18-20.

Measurements of d.b.h., height, and crown diameter and length were made on 526 trees in 193 semi-permanent growth plots established in 1970-1974 in three

locations in Ontario. Tree age was determined from increment cores, and total and merchantable volumes calculated using Honer's volume equations. Plot site indexes were calculated on the basis of existing equations for important Canadian species. Data are tabulated showing the maximum, minimum, and mean values for all seven tree variables, with their s.d. and coefficient of variation, for the five species (Picea glauca, P. mariana, Abies balsamea, Populus balsamifera, and P. tremuloides) for which data on 30 trees were available.

Tartarino, P. 1984. Associations of light-demanding broadleaves in the foothills of the Daunia Mountains. First report. *Italia Forestale e Montana*. 39(4): 201-214.

Data are presented on the climate, geolithology, hydrogeology, and morphology of the area, and the plant associations of forestry interest are described.

Wang, X. 1984. The population dynamics in the process of the progressing succession of the forest vegetations in the Maxian Mountains Forest Region. *Scientia Silvae Sinicae*. 20(2): 212-216.

A statistical analysis of succession, proposing mathematical models. Four stages are defined for the region: shrub, small broadleaf, mixed forest, and coniferous forest.

Williams, B.D.; Johnston, R.S. 1984. Natural establishment of aspen from seed on a phosphate mine dump. *Journal of Range Management*. 37(6): 521-522.

The natural reproduction of aspen (Populus tremuloides Michx.) from seed was discovered on a phosphate mine dump in southeastern Idaho. Aspen survival and growth was monitored for four growing seasons.

Yurtsev, B.A. 1984. Forest-steppe mesolandscapes of south-facing slopes in northern taiga regions of eastern Alaska. *Botanicheskii Zhurnal*. 69(7): 881-889.

Three types of steppe community found in forest-steppe landscapes are described, including one dominated by the dwarf subshrub Artemisia frigida (height 25-35 cm). Also described are isolated groves of aspen (Populus tremuloides) or poplar (P. balsamifera) with a more or less dense understory of various low shrubs (Rosa acicularis, etc.), and a steppe-margin community dominated by the dwarf shrub Arctostaphylos uva-ursi subspecies adenotricha and commonly found on the upper margins of spruce (Picea glauca) groves. These communities may be relics from the late Pleistocene tundra-steppe of Beringia.

1985

Alexander, R.R. 1985. Major habitat types, community types, and plant communities in the Rocky Mountains. Gen. Tech. Rep. RM-123. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 105 p.

Data are tabulated on the habitat types, community types, and plant communities where interior Pinus ponderosa, interior Douglas fir, interior

Abies concolor, Picea pungens, Populus tremuloides, Pinus contorta, Picea engelmannii, and Abies lasiocarpa are the major climax, co-climax, minor climax, or major seral species. Location, site, principal tree, and understory species, successional status, and authority are also given for each classification.

Batzer, H.O.; Popp, M.P. 1985. Forest succession following a spruce budworm outbreak in Minnesota. *Forestry Chronicle*. 61(2): 75-80.

Plots in 24 stands dominated by Abies balsamea and Picea glauca, established in 1957 or 1960 during an outbreak of Choristoneura fumiferana, were remeasured in 1979. The net effect of the outbreak was to convert the overstory to an earlier successional stage in which aspen (Populus tremuloides) and white birch (Betula papyrifera) predominated.

Eckenwalder, J.E. 1985. Evolutionary consequences of natural hybridization in Populus L. *American Journal of Botany*. 72(6): 952.

Edwards, M.E.; Dunwiddie, P.W. 1985. Dendrochronological and palynological observations on Populus balsamifera in northern Alaska, USA. *Arctic and Alpine Research*. 17(3): 271-277.

Farjon, A.; Bogaers, P. 1985. Vegetation zonation and primary succession along the Porcupine River in interior Alaska. *Phytocoenologia*. 13(4): 465-504.

Descriptions are given of three different seres all leading to the climax vegetation, a moss-rich Picea glauca forest. Sere I occurs on broad sandbars, usually on inner curves of meanders, where there is rapid sedimentation and decreasing influence of the river. Populus balsamifera is present in a pioneer stage. Sere II occurs in both thermokarst and oxbow lakes and is little influenced by the river. An aquatic vegetation develops into riparian types. Sere III occurs on the banks of the river where flooding is frequent. An open pioneer vegetation is followed by a Salix interior facies, which is followed by a S. alaxensis wood poor in species. P. balsamifera is absent in this sere.

Girard, Michele Marie; 1985. Native woodland ecology and habitat type classification of southwestern North Dakota (woody draws, riparian). *Dissertation Abstracts International*. 46/06-B: 1798.

Native woodlands are a component of the vegetation mosaic of the mixed grass prairie of southwestern North Dakota. Due to a semi-arid climate, these woodlands are restricted to areas of increased moisture: drainageways, streams, springs, floodplains, north-facing slopes, and "scoria" buttes. A number of factors in addition to climate influence the woodlands: microenvironment, logging, fire, competition, wildlife, livestock, disease, and insects. A habitat type classification system for these woodlands was developed from research conducted from 1981 to 1983, to provide a framework for future management.

Morris, D.M.; Farmer, R.E., Jr. 1985. Species interactions in seedling populations of Populus tremuloides and Populus balsamifera: effects of density and species ratios. *Canadian Journal of Forest Research*. 15(3): 593-595.

A deWit replacement series was combined with a Nelder's design to study the interaction of trembling aspen (P. tremuloides) and balsam poplar (P. balsamifera) seedlings growing in pots in a greenhouse at 7 relatively high densities for nine weeks (a period equal to one growing season in northwest Ontario) after germination. Height was measured weekly from three weeks after sowing and survival and shoot dry weight at the end of the study. Aspen dominated in all mixes and at all densities. The results are of relevance to the natural regeneration of the two species in the mixed boreal forest of northwest Ontario.

Ruark, G.A. 1985. Biomass, net primary production, and nutrient distribution in successional Populus tremuloides Michx. stands on an entic haplorthod in north-central Wisconsin. Madison, WI: University of Wisconsin. 251 p. Thesis.

The Richards function was used to predict above-ground biomass and net primary production (NPP) for nine aspen stands situated on the Vilas soil series.

Schimpf, D.J.; MacMahon, J.A. 1985. Insect communities and faunas of a rocky mountain subalpine sere. *Great Basin Naturalist*. 45(1): 37-60.

Insect faunas and communities are characterized for herbaceous and tree canopy layers in meadow, aspen (Populus tremuloides), and spruce (Picea engelmannii)-fir (Abies lasiocarpa) stages of a northern Utah sere.

Svistula, G.E.; Tarasenko, I.M. 1985. Increasing the ecological capacity of the lower Dnepr sands. *Lesovodstvo i Agrolesomelioratsiya*. 70: 13-16.

Measures taken to increase the ecological diversity of established Scots pine stands in this part of Ukraine are described. Artificial ponds were created and surrounded by mainly broadleaved trees and shrubs to provide shelter, browse, and berries for mammals and birds.

1986

Fyles, J.W.; Bell, M.A.M. 1986. Vegetation colonizing river gravel bars in the Rocky Mountains of southeastern British Columbia. *Northwest Science*. 60(1): 8-14.

Vegetation of gravel bars in the Blaeberry River, near Golden, was classified into six community types that were differentiated on the presence or absence of six species groups. The distribution of the communities appeared to be controlled by variations in soil texture and water-table depth. Successional development of communities on stable bars led to a community including Populus trichocarpa and Picea glauca, which are species common to the climax floodplain forest of the area.

Jurik, T.W. 1986. Temporal and spatial patterns of specific leaf weight in successional northern hardwood tree species. *American Journal of Botany*. 73(8): 1088-1092.

Diurnal and seasonal patterns of specific leaf weight (SLW) were measured on deciduous tree species in the understory and the canopy at five sites at the University of Michigan Biological Station, near Pellston. Populus

grandidentata dominated the canopy at all sites, with Acer rubrum and Quercus rubra as important canopy species.

Kooiman, M; Linhart, Y.B. 1986. Structure and change in herbaceous communities of four ecosystems in the Front Range Colorado, U.S.A. Arctic and Alpine Research. 18(1): 97-110.

The structure of the herbaceous community in 1981 was compared with that in 1953 in four areas in the Front Range: a ponderosa pine stand at 2,200 m where considerable mortality had occurred in the tree canopy; a Douglas fir/ponderosa pine stand at 2,600 m where some changes in the tree population had occurred; a Populus tremuloides stand at 3,050 m where successional changes to Englemann spruce and Abies lasiocarpa had occurred; and a Kobresia meadow at 3,750 m. Changes in the frequency and composition of herbaceous species are discussed in relation to disturbances in the tree canopy.

Lee, K.J.; Koo, C.D. 1986. Taxonomic distribution of ecto- and endomycorrhizae among woody species in Korea. Journal of Korean Forestry Society. 59: 37-45.

Root samples were collected of 102 species in 63 genera (32 families), mostly from Gwangneung, Gyeonggi-do. Ectomycorrhizae were observed in 13 genera: Pinus, Larix, Picea, Abies (Pinaceae); Populus, Salix (Salicaceae); Alnus, Betula, Carpinus, Corylus (Betulaceae); Quercus, Castanea (Fagaceae); and Tilia (Tiliaceae). Endomycorrhizae were observed in Populus (the only genus with both ecto- and endomycorrhizae) and the remaining 49 genera.

Noh, E.R. 1986. Studies on the growth range and optimum site determination of the tree species using climatological factors in Korea. Journal of Korean Forestry Society. 62: 1-18.

Data recorded at 26 weather stations in 1951-1980 were obtained and mapped. The country was divided into six regions by trends in temperature variation, and regression equations were produced for each region to estimate the sum of daily average minimum temperature during the growing season (March-October), and the sum of daily average temperature during the dormant season (November-February) for sites where tree planting is planned. The geographical range suitable for a variety of tree species were determined from published results.

Sokal, R.R.; Crovello, T.J.; Unnasch, R.S. 1986. Geographic variation of vegetative characters of Populus deltoides. Systematic Botany. 11(3): 419-432.

van der Kamp, B.J. 1986. Nitrogen fixation in cottonwood wetwood. Canadian Journal of Forest Research. 16(5): 1118-1120.

Samples of wetwood, taken near the sapwood/wetwood boundary of discs cut at five heights from four living Populus trichocarpa near Vancouver, were incubated anaerobically with C₂H₂. Significant C₂H₂ reduction was detected in all trees, with a maximum daily reduction of 5.16 nmol/g. Acetylene reduction was greater at stem height 7, 10, and 14 m where wetwood was an even olive green than at 1 and 4 m height where wetwood showed rusty brown or black bands. Results suggest that wetwood of P. trichocarpa harbors N-fixing bacteria that may contribute to the total N input of forest ecosystems.

Walker, L.R.; Chapin, F.S., III. 1986. Physiological controls over seedling growth in primary succession on an Alaskan floodplain. *Ecology*. 67(6): 1508-1523.

Competitive interactions were more important than facilitative processes in controlling seedling growth in primary succession on the Tanana River floodplain in interior Alaska. Physiological differences among the study species help explain their changing dominance through succession.

Webb, Sara Lynn. 1986. Windstorms and the dynamics of two northern forests. *Dissertation Abstracts International*. 47/08-B: 3223.

Thunderstorm winds (estimated at 25-35 m/sec) often damage scattered trees in two northwestern Minnesota forest stands (Itasca State Park, Clearwater County). Windstorms have different consequences for populations of shade-intolerant trees in the two stands. This work illustrates two problems with the concept of ecological disturbance. First, many definitions of "disturbance" are based upon biotic responses and would include windstorms in the pine-fir stand but would exclude windstorms in the pine-maple stand where species diversity is not enriched. Second, fires and windstorms, both generally considered disturbances, have very different consequences and are not sufficiently analogous to be grouped together.

1987

Lee, K.J.; Kim, Y.S. 1987. Host specificity and distribution of putative ectomycorrhizal fungi in pure stands of twelve tree species in Korea. *Korean Journal of Mycology*. 15(1): 48-69.

A total of 196 ectomycorrhizal fungal species was collected from forest stands of pine, Picea, Larch, Abies, Populus, chestnut, oak, and Betula. The 48 genera represented included Russula, Amanita, Lactarius, Laccaria, Cantharellus, and Boletus. The fungi were classified into three groups with wide, intermediate, and narrow host ranges. Most of the tree hosts appeared to have low fungus specificity for ectomycorrhizal formation.

Looman, J. 1987. The vegetation of the Canadian prairie provinces. IV. The woody vegetation, part 3. Deciduous woods and forests. *Phytocoenologia*. 15(1): 51-84.

More than 180,000 km², about 25 percent of the total forested area of the provinces of Alberta, Saskatchewan and Manitoba, consists of or is dominated by broadleaved tree growth, predominantly Populus tremuloides. The broadleaved woods and forests are placed in 1 class, Betulo-Populetea, divided into 3 orders, 5 alliances, 15 associations, and 4 subassociations.

Nelson, R.E.; Carter, L.D. 1987. Paleoenvironmental analysis of insects and extralimital Populus from an early holocene site on the arctic slope of Alaska, USA. *Arctic and Alpine Research*. 19(3): 230-241.

Schuster, W.S.; Hutnik, R.J. 1987. Community development on 35-year-old planted minespoil banks in Pennsylvania. *Reclamation Revegetation Research (Netherlands)*. 6(2): 109-120.

Invading plant communities were studied in 1982 on a series of 35-year-old strip mine test plantings in the main bituminous region of Pennsylvania. The sites varied in mean pH, in survival and basal area of the planted trees and in the species planted. The study involved 24 plots of the following species: eastern white pine (Pinus strobus), red pine (Pinus resinosa), Japanese larch (Larix leptolepis), red oak (Quercus rubra), black locust (Robinia pseudoacacia), white ash (Fraxinus americana), green ash (Fraxinus pennsylvanica), and hybrid poplar (Populus hybrid) and seven plots where plantings were unsuccessful (control plots).

Zasada, J.C.; Norum, R.A.; Teutsch, C.E.; Densmore, R. 1987. Survival and growth of planted black spruce, alder, aspen and willow after fire on black spruce/feather moss sites in interior Alaska. *Forestry Chronicle*. 63(2): 84-88.

A black spruce stand with a small broadleaved component was burned in July 1978. Dormant seedlings of black spruce, quaking aspen (Populus tremuloides), American green alder (Alnus crispa), and greyleaf willow (Salix glauca), and unrooted stem cuttings of feltleaf willow (S. alaxensis) and balsam poplar (P. balsamifera) were planted in autumn 1978 (spruce only) and early summer 1979 on five areas burned with varying severity. Survival was recorded after 1, 3, and 6 years and seedling height after 3 and 6 years. Both height growth and survival were relatively good for all seedlings. Spruce survival was significantly greater than that of the broadleaved species, but height growth was always less. Survival of unrooted cuttings was poor. Burn severity apparently affected (increased) height growth but not seedling survival.

ECONOMICS

1975

Borsdorf, W. 1975. Advances in determining the sort of old trees of economically interesting poplars. *Beitr Forstwirtschaft*. 9(3): 134-136.

Herpka, I.; Knezevic, I. 1975. Cost-return function analyses in the poplar (Populus) growing activities. *Topola*. 19(107/108): 17-27.

Vallee, G. 1975. Research and development on poplar in the eastern Quebec region. V.-Profitability of thirteen management options for plantations. No. 22. Quebec, Canada: Memoire, Service de la Recherche, Ministere des Terres et Forets. 115 p.

Evaluates the profitability of 13 high-forest or coppice management systems for plantations of hybrid poplars, assuming different rates of m.a.i. and initial investment, costs, and prices. High-forest plantations with 1,480-3,360 stems/ha (rotation 20-25 years) for pulpwood and saw logs are the management options offering greatest security of investment. Greatest profitability, however, can be obtained from a coppice stand of 3,360 stems/ha, with a good market for pulpwood.

1976

. 1976. Profitability of Populus cultivation. *Ned Bosbouw Tijdschr*. 48(9): 184-187.

Bosschap. 1976. Profitability of poplar grown on short rotations. *Populier*. 13(3): 35-38.

Presents 12 models showing costs, volume yield, financial yield (taking subsidies into account) and internal rate of return for (a) "average" actual commercial poplars grown at spacings of from 3x3 m to 5x5 m and rotations of 12 to 18 years, and (b) the fast growing Populus 'Dorskamp' grown at spacings of from 4x4 m to 6x6 m and rotations of 12 to 15 years. Results indicate the superiority of 'Dorskamp' over the 'average poplar', and the greater profitability of wider spacings and longer rotations.

Bowersox, T.W. 1976. Short-rotation, fiber production system for hybrid poplar. University Park, PA: Pennsylvania State University. 107 p. Ph.D. thesis.

Rapid growth and high unit weight yield suggest that Populus hybrids are potentially good trees to be used in a short-rotation wood fiber production system. Clone NE-388 appears to be the best clone for the production of fiber on rotations of less than five years. The lowest cost of producing and harvesting wood fiber in two rotations over a 7-year period was for clone NE-388 trees planted at 5 ft² per tree. Producing and harvesting costs could be reduced if the plantation were fertilized.

Bowersox, T.W.; Ward, W.W. 1976. Economic analysis of a short-rotation fiber production system for hybrid Poplar. *Journal of Forestry*. 74(11): 750-753.

The cost of producing and harvesting fiber was evaluated for three clones planted on abandoned fields in central Pennsylvania (Populus 'NE-49', P. 'NE-252', and P. 'NE-388').

Bowersox, T.W.; Ward, W.W. 1976. Short-rotation, fiber production system for hybrid poplar. Research Briefs. 10(1): 1-4. [University Park, PA: Pennsylvania State University, School of Forest Resources.]

A brief version of work already noticed on short-rotation fiber production by Populus hybrids: clones NE-49 (P. maximowiczii X 'Berolinensis'), NE-252 (P. 'Angulata' X trichocarpa) and NE-388 (P. maximowiczii X trichocarpa). The lowest cost per ton of fiber in two rotations in a 7-year period, was achieved by NE-388 trees planted at 5 ft² per tree.

Dutrow, G. 1976. Cottonwood plantations and the question of profit. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 432-437.

Groenhuis, B. 1976. Financial results of poplar growing (in The Netherlands). Populier. 13(2): 19-21.

Summarizes a thesis on the establishment, tending and harvesting costs, and the expected profits, when Poplars are grown at narrow spacing (4x4 m) on various rotations (15, 30, or 35 years) and sites.

Makukha, N.E.; Kasaya, G.S.; Birbrover, N.M.; Karpova, E.V.; Dobrynin, N.A.; Sidorova, I.I. 1976. The (economic) effectiveness of manufacturing sulphate viscose-grade pulp from hardwoods. Bumazhnaya Promyshlennost'. 7: 29-30. [Ru, BLL]

Discusses the results of semi-industrial trials made with aspen and birch wood, showing that the pulps obtained are suitable for the production of staple fibers, at a cost of 15 percent lower than that of equivalent pulps from softwoods.

Musnier, A. 1976. Research development on poplar in the eastern Quebec region. VII. Study on financing and managing poplar farms. Memoire, Service de la Recherche, Ministers des Terres et Forets, Quebec. 31: 368 p.

Models of four profitable poplar farm management alternatives, identified from a previous study, are analyzed: planting and clearfelling on a 12-year rotation; coppice (on a four year cycle) with standard clear-felled and renewed at 25-year-old; planting and clearfelling on a 20 year rotation, with intermediate thinnings; and dense coppice on a 4 year rotation.

Picron, G.; Gosse, P.; Scouvemont, F. 1976. Criteria for the exploitable age of poplars. Bulletin de la Societe Royale Forestiere de Belgique. 83(5): 221-247.

Factors affecting the growth of poplars in Belgium (soil, spacing, variety), their decline (pests, diseases, and climate) and their economic management are detailed. The most important general conclusions are that stands should be felled before the first signs of decline appear and that, since financial return is directly proportional to timber volume and quality,

sufficient expenditure to allow high standards of planting and maintenance is an essential prerequisite for maximum profit.

Prevosto, M. 1976. The economics of extensive poplar culture in Italy. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 438-445.

Prevosto, M. 1976. The economics of extensive poplar growing in Italy. *Cellulosa e Carta*. 27(10): 31-40.

Presents a short account of the various conditions under which poplars are grown extensively in Italy. Discusses the yield and quality of the wood and its utilization by various industries.

Prevosto, M. 1976. The economy of poplar in relation to the problem of production of timber in Italy. *Cellulosa e Carta*. 27(3): 3-16.

Szabo, K. 1976. Value classification of the products of primary wood-processing industries. Budapest, Hungary: Faip. Kutato Intezet: 155-174.

Estimated data are tabulated for the roundwood assortment yields and economically optimum volumes of sawmilling products (lumber, parquet strips, cooperage, etc.), plywood, etc. in Hungary separately for oak (Quercus spp.), beech (Fagus sylvatica), and poplar (Populus spp.). Basic data were collected on the assortment and grade structure of logs of all species produced in Hungary during 1958-1968, product composition in certain periods, and product value in 1973 world market prices.

Vrataric, P.; Sikora, J. 1976. Economic effectiveness of mechanized and manual hole for deep planting poplar seedlings. *Topola*. 20(109/110): 20-26.

1977

Kalchev, P. 1977. Economic studies on two methods of removing poplar stumps. *Gorskostopanska Nauka*. 14(2): 64-69.

A comparative study was made of two methods of removing poplar stumps in Bulgaria, viz. (1) a S-100 tractor with a D-210V root-grubber, and (2) the Italian Rotor Levaceppi machine which reduces the stump to chips. (2) is superior in terms of time taken per stump and number of stumps removed per hour, except with stumps less than 20 cm diameter, and is cheaper; it is recommended for use in Bulgaria.

Prevosto, M. 1977. The costs of planting some timber-producing species. *Cellulosa e Carta*. 28(11): 3-27.

An investigation was made on the costs of planting some fast-growing timber species (poplars [Populus spp.], eucalyptus [Eucalyptus spp.], and pines [Pinus spp.]) on plains sites and on gentle and moderately steep mountain slopes in Italy. The results of trials with new equipment indicate that in operations like poplar planting - already highly mechanized - the labor force required could be reduced by 30-40 percent.

Prevosto, M. 1977. Utilization of young poplar wood. *Cellulosa e Carta*. 28(3): 3-13.

Results are given of a study on (1) the yield of timber in northern Italy from stands of *Populus* 'I-214' grown from cuttings or rooted stock on irrigated soils of average fertility at densities ranging from 10,400 to 250 trees/ha, and (2) the revenue obtainable, based on the prices of existing commercial assortments and on production costs.

Stredicke, R. 1977. Economic considerations on narrow and wide spacings in poplars. *Holzzucht*. 31(1-2): 16-17.

A study of costs and returns from 20-, 30-, and 40-year-old stands of black poplar planted at 5x5 m spacing (400 trees/ha) and thinned according to the yield tables of Ratzel. Results suggest that planting at a wider spacing (8x8 or 8x9 m) would be much more profitable. The spacing of balsam poplars is briefly discussed.

van der Meiden, H.A. 1977. Official support for poplar growing. *Populier*. 14(2): 43-44.

A brief review of subsidies, loans, or tax concessions available to Poplar growers in Austria, Belgium, Canada, France, Italy, Japan, The Netherlands, New Zealand, Spain and USA, as of 1975.

1978

Baskerville, G.; Weetman, G.F.; Armson, K.A.; Crossley, D.I.; Smith, J.H.G. 1978. Forest management in Canada, Volume II. case studies. In: Reed, F.L.C., ed. *Forest Management in Canada*. Vol. 1. A study to improve the basis for policy formulation, planning and practice in intensive forest management. Inf. Rep. FMR-X-103. Canada: Forest Management Institute. 176 p.

Management of hybrid poplar. A general survey of poplar (*Populus* spp., all sections) growing and hybrid poplar trials throughout Canada.

Marinkovic, B. 1977. The market development of poplar wood in the world. *Topola*. 21(115/116): 45-48.

Mohrdiek, O. 1978. Are there differences in the economically important characteristics between male and female hybrid aspens? *Holzzucht*. 32(1/2): 10-12.

van der Meiden, H.A. 1978. Economics of poplar breeding. In: Brown, A.G.; Palmberg, C.M., eds. *Third world consultation of forest tree breeding*. Session 5. Analysing benefits and costs of tree improvement. Canberra, Australia: CSIRO: 1125-1131.

1980

Hodam, R.; Lew V.; Dickinson, W.C.; Cheremisinoff, P.N., eds. 1980. *Solar energy technology handbook*. Part A. Engineering fundamentals. New York: Marcel Dekkar, Inc: 589-614.

The proposed plants and economics of energy farming are reviewed. Individual plants considered are described in some detail: sorghums and sudangrass, kenaf, sugar cane, sunflower, eucalyptus, euphorbia and guayule, American sycamore, loblolly pine, Populus species, red alder, water hyacinths, microalgae, and kelp.

1982

Arru, G.; Prevosto, M. 1982. Economic and social implications of poplar cultivation in hilly areas. *Cellulosa e Carta*. 5: 3-22.

1983

Hiremath, B.N. 1983. Post-reclamation use of surface-mined lands in Kentucky. *Dissertation Abstracts International*, A. 43(11): 3659.

The study evaluates the potential on-site monetary returns to the surface landowner from agricultural and forestry uses under different levels of reclamation of surface mined lands in Kentucky. Results indicate that on fully reclaimed area-mine and mountaintop sites, grain crops are profitable, at all discount rates when labor supplies were not limiting. On all partially reclaimed sites cottonwood pure-stand was the most profitable enterprise at 3 percent discount rate irrespective of labor supplies. Under limited labor supplies a combination of alfalfa and a forest crop resulted in the maximum net returns. At 10 percent discount rate all tree mixtures had negative net returns. On area-mine and mountaintop sites full reclamation had higher returns than partial reclamation.

Huber, H.A.; Rosen, H.N.; Stewart, H.A.; Harsh, S.B. 1983. A financial analysis of furniture parts from short bolts. *Forest Products Journal*. 33(9): 55-58.

A computer program, the Furniture Bolt Cutting Program, was developed to provide information on cost, yields, and quantities of 4/4 (1-inch) parts produced by a manufacturer of furniture dimension stock from short logs of black walnut, black cherry (Prunus serotina), yellow poplar, soft maple (Acer saccharinum), and aspen (Populus sp.).

Ismail, A.A.; Yarborough, D.E.; Skinner, S.P. 1983. Efficacy and economics of mechanical and chemical control of five weed species in native lowbush blueberry fields. In: *Proceedings of the 37th Annual meeting of the Northeastern Weed Science Society*: 248.

The following treatments were compared for control of Acer rubrum, Prunus spp., Salix spp., Populus spp., and Betula spp.: cutting 1, 2, or 3 times at monthly intervals; cutting plus a stump spray of 0.5, 2, or 4 percent 2,4-D in oil (v/v); 1, 2, or 4 hexazinone pellets.

Lothner, D.C. 1983. Economic investigations of short rotation intensively cultured hybrid poplars. In: Hansen, E.A., ed. *Intensive plantation culture: 12 years research*. Gen. Tech. Rep. NC-91. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 138-148.

Sakkas, G.A. 1983. A cost-benefit analysis of irrigated poplar plantations in Greece. *Foret Mediterraneenne*. 5(1): 57-62, 116, 118-119.

Sampson, G.R.; Ruppert, F.A. 1983. Potential for economical recovery of fuel from land clearing residue in interior Alaska. Res. Pap. PNW-308. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 11 p.

Experimental fuel logs (3 inches diameter x 10 inches long) were manufactured from four types of land clearing residue: (a) black spruce (*Picea mariana*), (b) moss, (c) a mixture of paper birch (*Betula papyrifera*) and aspen (*Populus tremuloides*), and (d) a mixture of moss and black spruce. Except for very fine moss all materials densified well and there was no evidence of fuel log breakage during transport.

Strauss, C.H.; Grado, S.C.; Blankenhorn, P.R.; Bowersox, T.W.; Robertson, D., eds. 1983. Costs of establishing dense plantations for short rotation management systems. In: Proceedings of FPRS industrial wood energy forum '83; 1983 September 19; Nashville, TN. Madison, WI: Forest Products Research Society. 1(7): 122-128.

Financial and energy investments necessary to establish dense plantations of *Populus* under four management strategies have been determined for two dissimilar sites. Management strategies were control, fertilization, irrigation, and fertilization/irrigation and the two sites represented favorable and unfavorable inherent growth conditions.

1984

Banoun, F. 1984. Is growing poplars profitable? Views from France and Greece. *Unasylyva*. 36(3): 27-28.

Fedoseev, I.A. 1984. Evaluating the consumer properties of aspen. *Lesnoe Khozyaistvo*. 10: 30-34.

A discussion of the scope for increased utilization and consumption of aspen in the USSR, especially in the European part where this species has been increasing in area and standing volume. The silvicultural characteristics of aspen are discussed, and also its wood properties, with special reference to its suitability for pulp and paper and the economics of such utilization.

Kalchev, P. 1984. Changes in the technical and economic indices of poplar plantations with age. *Gorsko Stopanstvo*. 40(10): 27-30.

Comparative data are tabulated on the economics of three different poplar plantations in Bulgaria: (1) *Populus* 'I-214', spacing 6x6 m, on a typical poplar site near the Danube; (2) *Populus* 'Robusta', spacing 5x5 m, on a typical poplar site near the Danube; and (3) *Populus* 'I-214', spacing 4x4 m, on a site well away from the river. The economic data are tabulated annually for ages 6-15, 6-17, and 6-12 years respectively.

Kreysa, J. 1984. Economic criteria for the evaluation of smallwood as an energy source. *Forstarchiv*. 55(4): 143-146.

A stochastic simulation model ('MONTE') for the establishment of short-rotation energy plantations (of poplar in West Germany) is described. The model is designed to indicate whether proposed projects will meet the economic requirements of fuelwood producers (based on minimum price obtainable) and buyers (maximum price allowable). Results of a trial case were subjected to sensitivity and other analyses, e.g. to determine the probability of specified internal rates of return.

Sibal, P.V.; Bowyer, J.L.; Bradley, D.P. 1984. Log merchandising in aspen. *Journal of Forestry*. 82(7): 420-425.

A study of the feasibility of log merchandising - sorting timber according to suitability for various products, to maximize economic returns - in northern Minnesota. Aspen (Populus) logs were sampled and a discounted cash flow analysis was made of 3 mobile and 4 fixed-site systems.

Strauss, C.H.; Blakenhorn, P.R.; Bowersox, T.W.; Grado, S.C. 1984. Net financial and energy analyses for producing Populus hybrid under four management strategies. In: Klass, D.L., ed. *Energy from biomass and wastes 8*; 1984 January 30-February 3; Lake Buena Vista, FL. Chicago, IL: Institute of Gas Technology: 251-270.

Results are presented of trials with 4 strategies on 2 sites representing good and bad growth conditions viz. (a) control, (b) irrigation, (c) fertilizer, and (d) irrigation and fertilizer. All aspects of plantation establishment and maintenance were cost analyzed and a linear model was used to determine the most economical and energy efficient management option for the first rotation (4 years).

1985

Anderson, W.C.; Krinard, R.M. 1985. The investment potential of cottonwood sawtimber plantations. In: 3d Biennial southern silvicultural research conference; 1984 November 7-8; Atlanta, GA. Gen. Tech. Rep. SO-54. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station: 190-197.

Apfelbeck, R. 1985. Possibilities of relieving the EEC agricultural market through energy production e.g. rape and short-rotation forestry. In: Palz, W.; Coombs, J.; Hall, D.O., eds. *Proceedings, Energy from biomass: 3d E.C. Conference*; 1985 March 25-29; Venice, Italy. London, UK: Elsevier Applied Science Publishers: 1034-1038.

The production of poplar plantations in Hesse was investigated as an alternative to agricultural crops. Cuttings were planted at 10,000-12,000/ha, weeded and treated with fertilizer for 2 years, and harvested for chips every 5 years. Annual production was 10-15 t/ha in 1979-1983. Capital and running costs were estimated and the value of wood chips used locally for fuel (at a rate of 260 DM/t dry weight) was calculated. An annual production of 15 t/ha was required for profitability. The best varieties reached 25-30 t/ha.

Blankenhorn, P.R.; Bowersox, T.W.; Strauss, C.H.; et al. 1985. Net financial and energy analyses for producing Populus hybrid under four management

strategies, first rotation. Final rept. to the U.S. Dept. of Energy from the School of Forest Resources, Pennsylvania State Univ., University Park, PA. 263 p.

Biomass yield and growth rate data for Populus hybrid grown under four management strategies on two dissimilar sites were obtained. Biomass production data, combined with fuel and chemical properties, were expanded into complete net financial and energy analyses in order to recommend a management/conversion strategy with the most favorable financial and energy considerations.

Graham, G.M.; Betters, D.R. 1985. A simulation model for economic analysis of timber/forage production alternatives in Rocky Mountain aspen stands. *Forest Ecology and Management*. 10(4): 313-321.

Given harvest possibilities from timber yield tables and site characteristics, the model estimates the production of timber and forage and makes an economic analysis based on present net worth and financial maturity criteria.

Kalchev, P. 1985. Effect of planting density on the technical and economic indices of poplar plantations. *Gorskostopanska Nauka*. 22(2): 37-44.

Data are presented on wood production, assortment structure, costs, revenue, and profitability for plantations of Populus 'I-214' established at various spacings, viz. 3x1.5, 3x3, 4x4, 5x5, and 6x6 m, on typical poplar sites in Bulgaria.

Kneissl, F. 1985. Evaluation of the operational economics of fuel plantations in comparison with agricultural land use. *Allgemeine Forstzeitung*. 96(11): 293-294.

An economic analysis was made of the use of farm land in Austria for: intensive poplar silviculture on 3-year rotations, assuming prices obtainable for wood chips of (a) 303 or (b) 143 sch/m³ (stacked); intensive Alnus incana silviculture on 17-year rotations, with wood chip prices of (c) 303 or (d) 143 sch/m³; or (e) pasture for dairy cattle.

Moran, L.A.; Nautiyal, J.C. 1985. Present and future feasibility of short-rotation energy farms in Ontario. *Forest Ecology and Management*. 10(4): 323-338.

Evaluation of the economics of energy farming with Populus 'I-45/51' for direct combustion or for methanol production showed that 3-year rotations with 16,000-35,000 stumps/ha coppice for 5-6 rotations could be attractive, in about 15 years for direct combustion; methanol production could be feasible in about 35 years.

Neenan, M.; Lyons, G. 1985. Production of energy from short rotation forestry. EUR-9959-EN. Luxembourg: Commission of the European Communities, Directorate-General for Information, Market and Innovation. 168 p.

Thirty-two species or clones of trees have been tested on a series of soil types over a period of 6 years. At least one species/clone has been found which gives an economic yield at each location. The factors most critical to the economic feasibility of s.r.f. plantations are expected fuel price, management input costs, and biomass yield.

Rawat, J.K.; Nautiyal, J.C. 1985. An application of a production function for juvenile hybrid poplar to intensive forest management. *Forest Science*. 31(1): 143-156.

Data from a trial in central Ontario (1972-1981) were used to estimate a production function for Populus X euramericana (P. canadensis) clone I-45/51. Results indicated that biomass production on a 2- to 3-year rotation system could be economical only if planting costs are reduced and/or yield values increased substantially.

Ubeda, L.E. 1985. Comparative profitability of poplar plantations in the Parana Delta and the dune area of Buenos Aires Province. *Catedra de Administracion Rural*. 16: 65 p.

Site characteristics are given for two 1,000 ha Populus deltoides plantations in Argentina. Details of plantation management are presented, and costs of site preparation, planting, tending, weeding, salaries, and machinery are given. Two management strategies were compared for each site: (a) short rotation (10 yr), with coppicing for pulpwood; and (b) longer rotation for large diameter timber (i.e., 6.5 in.) for plywood production, with thinnings used for pulpwood and saw logs. At both sites, longer rotations appeared to have greater profitability.

Weisgerber, H. 1985. Timber yields and economic evaluation of trials with rapid-growing tree species in West Germany. *Allg. Forstztg. (Austria)*. 96(11): 286-289.

Topics discussed include: silvicultural and harvesting techniques; intensive silviculture of Populus balsamifera, P. trichocarpa and hybrids; operational economics; consequences for agriculture, and wood utilization (for fuel, pulping, panels, etc.). The need is stressed for detailed studies on the economic results of intensive silviculture.

Wippermann, H.J. 1985. Economic utilization of forest residues. 1. *Holz-Zentralblatt*. 111(95): 1389-1391.

A report based on studies made in W. Germany in 1980-1984 on the utilization of smallwood and slash for production of wood chips in the forests. Costs for production of wood chips in the forest are estimated at 20-30 DM/m³ in private forests and 25-35 DM/m³ in government-owned forests.

Wippermann, H.J. 1985. Economic utilization of forest residues. 2. *Holz-Zentralblatt*. 111(96/97): 1408, 1410.

Wippermann, H.J. 1985. Economic utilization of forest residues. 3. *Holz-Zentralblatt*. 111(98): 1418, 1420.

1986

1986. At current market prices, is the cultivation of high quality poplar still profitable? *Foret-Entreprise*. 33: 10-72.

The proceedings of a conference held at Compiègne, France on October 1-3, 1985 by the 'Poplar' Working Party of the French Institute for Forestry

Development, to discuss the economics of poplar production in the light of increasing production costs and decreasing sale prices. Reports are given from various regions of France.

Chandra, J.P. 1986. Poplar - a cash crop for North Indian farmers. *Indian Forester*. 112(8): 698-710.

Silviculture, site and clone selection, yield, nursery practice, planting, irrigation, pruning, pests, diseases, and agroforestry are discussed. Costs and yearly returns (for 8 years) are tabulated for poplar plantations in Uttar Pradesh, planted at 5x5 m spacing and intercropped with species such as turmeric.

Culhane, J.C.; Gunter, J.E. 1986. Biological and financial rotation age of established aspen stands. Res. Rep. 478. East Lansing, MI: Michigan State University, Agricultural Experiment Station. 8 p.

Jackson, M.; Akerlund, G.; Falk, B. 1986. Highest profit materials in the North-American aspen. *Papier*. 40(5): 204.

Lothner, D.C.; Hoganson, H.M.; Rubin, P.A. 1986. Examining short-rotation hybrid poplar investments by using stochastic simulation. *Canadian Journal of Forest Research*. 16(6): 1207-1213.

Standard discounted cash flow and stochastic simulation were used to examine the financial performance of poplar plantations, established at 8x8 ft. spacing and without irrigation or fertilization during two 15-year rotations in the Lake States.

Novak, F.S.; Lerohl, M.L. 1986. An economic assessment of mechanical clearing versus spray and burn in aspen parklands. *Lighter*. 56(4): 23-28.

Mechanical clearing and spray and burning were compared for controlling aspen (*Populus* spp.) invasion of rangeland. An economic analysis of beef production showed that the spray and burn method was more profitable due to less capital outlay and the earlier benefits of improved forage production.

Sagwal, S.S. 1986. Grow poplars for profit. *Indian Farming*. 36(9): 27, 29-31.

The advantages of using poplars in agroforestry systems in India are outlined. Costs of planting and tending 1 ha and gross and net profits for a 12-year rotation are tabulated.

Stewart, H.T.L.; Salmon, G.R. 1986. Irrigation of tree plantations with recycled water. 2. Some economic analyses. *Australian Forestry*. 49(2): 89-96.

Strauss, C.H.; Blankenhorn, P.R.; Bowersox, T.W.; Grado, S.C. 1986. Cost analysis of alternate biomass supply systems. In: *Proceedings, 21st Intersociety energy conversion engineering conference; 1986 August 25; San Diego, CA*. Washington, DC: American Chemical Society: 193-198.

A series of short rotation *Populus* plantations were financially evaluated as biomass production centers. The plantation used *Populus* hybrid NE-388, a tree spacing of 0.6 m x 0.8 and a first rotation length of 4 years. Four plantation strategies (control, irrigation, fertilization, and

fertilization-irrigation) were employed on favorable and unfavorable growing sites.

1987

Bukiewicz, H. 1987. Economic aspects of weed occurrence in poplar plantations. *Ochrona Roslin*. 31(7): 12-14.

Weed control in approximately 20-year-old poplar plantations is discussed with reference to the effect of weeds on poplar trees, trends and methods of weed control, chemical weed control using Lontrel (clopyralid) 300 or Casoron G (dichlobenil), and the economic benefits of chemical weed control.

Hedin, R.S. 1987. Consequences of strip mine reclamation: vegetation and economics of reclaimed and unreclaimed sites in west-central Pennsylvania. New Brunswick, NJ: Rutgers, The State University of New Jersey. 327 p. Ph.D. thesis.

A survey was conducted of the vegetation on 36 strip mines which varied in reclamation effort and age. Six sites, all older than 30-years-old, were closed canopy woodlots dominated by either planted Pinus or volunteer Populus. Three sites 15-23 years old that had undergone repeated liming and fertilization efforts before abandonment were also dominated by planted Pinus or volunteer Populus and had stem densities quite similar to woodlot sites. All other sites less than 30 years old had open canopies and ground cover dominated by Cladonia, Polytrichum, Andropogon virginicus, Danthonia spicata, and bare soil. An economic analysis of the costs and benefits of minimal and total reclamation was performed.

Strauss, C.H.; Blankenhorn, P.R.; Bowersox, T.W.; Grado, S.C. 1987. Production costs for first rotation biomass plantations. *Biomass (United Kingdom)*. 12(3): 215-226.

A series of short rotation Populus plantations involving alternate management strategies were evaluated in terms of the financial and energy costs required in the production process. The plantations used hybrid poplar NE-388 (Populus maximowiczii x trichocarpa), a tree spacing of 0.6 m x 0.8 m and a rotation length of 4 years. Four production strategies (control, irrigation, fertilization, and fertilization-irrigation) were employed on sites representing favorable and unfavorable growing conditions.

1988

Strauss, C.H.; Grado, S.C.; Blankenhorn, P.R.; Bowersox, T.W. 1988. Economic evaluations of multiple rotation SRIC biomass plantations. In: Coleman, M.J., ed. Proceedings of an annual meeting, American Solar Energy Society; 1988 June 20-24; Cambridge, MA. Boulder, CO: The American Solar Energy Society, Inc.: 445-450.

GENERAL

1975

1975. Great Plains cottonwood research needs. Great Plains Agricultural Council Publication No. 76. 3 p.

1975. Plant studies in the People's Republic of China: a trip report of the American Plant Studies Delegation. Washington, DC: National Academy of Sciences: 109-114.

A general review based on interviews with officials of the Academy of Agricultural and Forestry Sciences, Peking, and incidental observations. Afforestation has been promoted since 1958 when clearing of forest for agriculture was curtailed: shelterbelts in the north mainly used poplars (Populus maximowiczii, P. simonii, etc.) and willow (Salix matsudana).

Arnaudov, P. 1975. Present state of Populus plantation economy in the Plovdiv region. *Gorsko Stopanstvo*. 31(11): 19-22.

Boehner, A.W.; Gertjejansen, R.O. 1975. Effect of three species of logging slash. *Forest Products Journal*. 25(12): 36-42.

Clement, A.; Nys, C. 1975. Comparison of two calcium analytical spectrometric methods. Effect of phosphorus interference according to their host plants. *Annales des Sciences Forestieres*. 32(3): 169-174.

Delabraze, P. 1975. Notes on the possible use of Krenite in forests. *Compte Rendu de la 8e, Conference duCOLUMA*: 130-142.

A report is given of preliminary trials with Krenite (ammonium ethyl carbamoyl phosphonate) in French silviculture. The relative immunity of conifers to the product suggests it may be used for release in young conifer plantations. In NE France Krenite from 3 to 7 or 8 litres product/ha applied between July and October killed birch trees (Betula spp.) and caused moderate to severe growth check in hornbeam (Carpinus betulus), ash (Fraxinus excelsior), and aspen (Populus tremula). Arbutus unedo L. was the most susceptible species in this area.

Deneke, F.J.; Geyer, W.A. 1975. Kansas State University forestry research: background and current status. Great Plains Agricultural Council Publication No. 76. 6 p.

Figaj, J.; Stecki, Z. 1975. Populus trichocarpa--a poplar species little known in Poland. *Sylwan*. 119(4): 63-66.

Fullerton, R.A.; Menzies, S.A. 1975. The taxonomic status of the genus Bauerella in shelter belts. *Aust Journal of Agricultural Economics*. 2(4): 429-431.

Ganchev, P. 1975. Populus without the "powderpuff". *Priroda (Sofia)*. 24(2): 64-65.

- Gaspar-Hantos, G. 1975. The state of Populus forest management in Hungary, tasks in relation to satisfying demands for paper producing wood. ERFA (Erdogazdasag Faipar). 12: 1-2.
- Guba, I.T. 1975. Preliminary results of variety testing of Populus species in the floodplain of the lower Dnieper. Lesovod Agrolesomeliior. 42: 61-64.
- Horgan, R.; Hewett, E.W.; Horgan, J.M.; Purse, J.; Wareing, P.F. 1975. A new cytokinin from Populus X 'Robusta'. Phytochemistry. 14(4): 1005-1008.
- Jennings, N.E. 1975. Nebraska's cottonwood resource. Great Plains Agricultural Council Publication No. 76. 3 p.
- Jodice, R.; Porta-Puglia, A. 1975. Humification of poplar bark piles. II. Composition of the atmosphere in the piles and microbiological characteristics in an industrial plant. Allionia. 20: 109-120.
Describes changes in the microflora and chemical composition of a large pile of poplar bark (20x40x7 m), processed for humification for 10 months at an industrial plant, with particular reference to the effects of turning the mass of piled bark.
- Kallio, P.; Makinen, Y. 1975. Vascular flora of Inari Lapland. 3. Salicaceae. Rep. 12. Finland: Kevo Subarctic Research Station: 66-105.
An account of the distribution of 18 species of Salix and of Populus tremula, with notes on their morphology, taxonomy, variation, and hybridization. Special attention is paid to the variation in S. caprea, S. hastata, and S. xerophila, and to the differences between S. borealis and S. nigricans. A few previously unknown intermediates are described. A large clone is described of the triploid Populus tremula f. gigas, which was found in the northeast part of the area.
- Kaufert, F.H. 1975. Redwoods to "popple"--aladdins in the forests. Agric. Yearb. Washington, DC: U.S. Department of Agriculture, Forest Service: 191-200.
- Kunimasa, K.; Kishimoto, J. 1975. Measurement of sap flow by heat pulse method. Bulletin Tottori University of Forestry. 8: 101-106.
- Meeuse, A.D.J. 1975. Taxonomic relationships of Salicaceae and Flacourtiaceae: their bearings on interpretative floral morphology and dilleniid phylogeny. Acta Botanica Neerlandica. 24(5/6): 437-457.
The phylogenetic relations between Populus and Salix are discussed.
- Sancho, R.; Alonzo, A.; Fernandez, A. 1975. Preliminary report on new Populus clones obtained at the Parana River Delta. IDIA Supplement. 8: 95-101.
- Sannikov, G.P.; Motuzinskii, N.F. 1975. The effectiveness and the sanitary-hygienic conditions of application of arboricides in winter. Khimiya v Sel'skom Khozyaistve. 13(1): 49-53.
2,4-D-butyl at 5 kg/ha in oil solution was sprayed over willow (Salix spp.)/alder (Alnus spp.)/birch (Betula spp.) brush up to 4 m high and granular

Dybar (Fenuron) 60 kg, Tordon 10K (picloram-potassium) 15 kg and Tandex (karbutilate) 20 kg/ha were broadcast over snow in brush dominated by Alnus spp. in winter. 2,4-D gave 97-99 percent control of Alnus spp., Betula spp., and aspen (Populus tremula) and 86 percent control of Salix spp. The granular materials were practically as effective with winter as with spring application. The granular materials were less toxic to grasses with winter than with spring application. Granular materials persisted almost unchanged in the snow but 2,4-D degraded more quickly and disappeared from the top soil in 2 months. Contamination of the atmosphere and operators' hands and clothes by 2,4-D was very high and residues of 2,4-D and karbutilate on hands were not completely removed even after careful washing with soap. Strict adherence to safety precautions in the spraying of 2,4-D is urged.

Stromquist, L.H. 1975. Propagation of Scots pine by cuttings. Sver Skogwardsforb Tidskr. 73(5): 427-432.

Szekely, Gy. 1975. Dozsa's people and the Populus werboezianus--class struggles about the nation-concept 1514-1711. Agrartort Sz. 17(1/2): 1-24.

Thompson, A.G.; Horgan, R.; Heald, J.K. 1975. A quantitative analysis of cytokinin using single-ion-current-monitoring. Planta. 124(2): 207-210.

Trujillo, D.P. 1975. Preparing aspen increment cores for ring counts. Journal of Forestry. 73(7): 428.

Vita, A. 1975. Poplar growing. Manual 4. Facultad de Ciencias Forestales. Santiago, Chile: Universidad de Chili. 23 p.

A short account is given of the importance, ecological requirements, propagation, and growth of poplars in Chile. The characteristics and merits of nine poplar species or cultivars planted in Chile are briefly considered.

Vlasyuk, V.N. 1975. Study of the phytocidal and ionizing properties of the principal tree species in the Moscow green belt. 'Nauk. dumka'. 301-308. Referativnyi Zhurnal. (1975) 12.56.87. Ru. BLL.

Reports further studies giving comparative data on the antimicrobial activity (highest in mid-July to August in conifers and in June to July in broadleaved species) and ionizing properties of Pinus sylvestris, Larix sibirica, Picea abies, Betula verrucosa, Populus balsamifera, and Quercus robur. The planting of phytocidal and ionizing species (particularly L. sibirica) in these green-belt forests is urged.

1976

1976. Forest trees. Belgium: Annual report of the Gembloux State Agronomic Research Centre, 1975. 158 p.

Of three poplar varieties, 'I-214' had the finest and fewest vessels and 'Robusta' had the narrowest fibers, was the most susceptible to environmental conditions as regards fiber length, and had the densest young wood.

1976. Solar energy: its potential contribution within the United Kingdom. Energy Pap. 16. London, UK: HMSO, Department of Energy. 81 p.

Included in this assessment of the potential contribution of solar energy to the UK energy budget is a brief discussion of the biomass production of some forest types, including 'short rotation hardwoods' (Plantanus spp., Populus spp., and Alnus spp.) and Eucalyptus spp.

1976. Tree Farmer 1976. Caulfield South, Victoria, Australia: G.&M. Wilson. 98 p.

The first edition of an annual review.

Ahlgren, C.E. 1976. Regeneration of red pine and white pine following wildfire and logging in northeastern Minnesota. Journal of Forestry. 74(3): 135-140.

Reviews the silvicultural requirements of Pinus resinosa and P. strobus, and reports the results of a study to evaluate the extent to which optimum conditions for regeneration of these species (1) occurred naturally in undisturbed natural stands in the past and (2) occur after logging or destruction by fire today. It is concluded that the widespread increase in distribution and frequency of Populus tremuloides, the incidence of blister rust (Cronartium ribicola) and the lack of abundant seed-trees prevent re-creation of the natural conditions formerly favorable to the establishment of Pinus resinosa and P. strobus. Data from seven areas are given.

Altherr, E.; Unfried, P.; Hradetzky, J.; Hradetzky, V. 1976. Statistical bark relations as an aid to assortment formation and measurement of unbarked stemwood. Part III. Weymouth pine, Robinia, mountain elm, birch, Marilandica and Robusta poplars. Mitteilungen der Forstlichen Versuchs-Und Forschungsanstalt, Baden-Wurttemberg. 78: 115.

A further collection of data on bark thickness and bark percentages, for Pinus strobus, Robinia pseudoacacia, Ulmus glabra, Betula alba, Populus 'Marilandica' and P. 'Robusta'. It is noted that 'Marilandica' poplar has a much higher bark percentage than 'Robusta'.

Barring, U. 1976. Experiment in the control of forest undergrowth. In: Proceedings, Nord-Europeiska Ograssymposiet i Dickursby; Tikkurila, Finland: D14-32.

Experiments in 1970-1974 for the chemical control of aspen (Populus tremula) and birch (Betula spp.) 1-3 m high, with application in July-August, are reviewed in southern, central, and northern Sweden. Rates of 2 kg/ha gave about 80-85 percent top kill. 2,4,5-T was better than MCPA which was better than 2,4-D, all applied at 2 kg/ha, for the prevention of the resprouting of birch stumps. 2,4-D at 0.9-1.4 kg + picloram 0.3-0.4 kg/ha was better than 2,4,5-T in the prevention of stump sprouting and suckering and glyphosate 1.5-2 kg/ha was better than 2,4,5-T. Glyphosate gave as good a kill of aspen and birch foliage as did 2,4,5-T.

Barring, U. 1976. Results of trials in forestry. In: Proceedings, Weed and weed control: 17th Swedish weed conference. Uppsala, Sweden: Lantbrukshogskolan; 1: 1-8.

In trials to compare MCPA and 2,4,5-T, each at 2 kg/ha, for control of Betula spp. and Populus tremula it was found that control of Betula was less

good with MCPA. Among products tested to replace aminotriazole (now banned) for weed control, atrazine at 0.1-0.3 kg/ha, phenmedipham at 1 kg/ha and terbuthylazine at 0.2 to 0.4 kg/ha proved effective in pine (Pinus sylvestris). In spruce atrazine at 0.2 kg/ha proved more selective than in pine; desmetryne at 0.75 and pyrazone at 2 kg/ha also were tolerated by spruce seedlings.

Benayoun, J.; Sachs, T. 1976. Unusual xylem differentiation below mature leaves of Melia. Israel Journal of Botany. 25(3/4): 184-194.

Xylem differentiation was studied in branches of M. azedarach from which all young leaves and shoot apices had been removed, leaving only 4 mature leaves. The volume of xylem tissue produced was greater than usual, and it had an abnormal structure (shown in photomicrographs), with narrow vessels, no fibers, very large vascular rays, and parenchyma that did not lignify until late summer. More normal xylem differentiation was obtained when IAA, GA₃, or both, were added to stems above the mature leaves. Results obtained with Ailanthus altissima (which were similar to those with M. azedarach), Cercis siliquastrum and Populus alba are briefly described.

Bialobok, S., ed. 1976. The poplars - Populus L. Translated from Topole - Populus L. (Nasze Drzewa Lesne) Vol. 12. 424 p.

Boerwinkel, H.W.J.; Broekhuizen-Bos, G.E. 1976. The 'consumer's' image of poplars and other tree species. Nederlands Bosbouw Tijdschrift. 48(10): 189-200.

An analysis of replies to a questionnaire in the Netherlands in 1974. More people thought that too many poplars were planted than not enough. Their acceptability rating was higher for productive plantations than for roadside or amenity planting. One aspect causing adverse reactions is thought to be the uniformity and hence monotony of clonal stands or rows.

Bonilla, J. 1976. The nutrition of promising forest tree species for NW Argentina, and possible statistical designs and analyses. Lilloa. 34(9): 121-164.

The basic relations between the growth of plants and their nutritive media are outlined, and a review of selected literature on this subject is given with special reference to five Pinus species, Araucaria angustifolia, A. cunninghamii, six Eucalyptus species, Populus 'I-214' and Cedrela mexicana.

Boratynska, K. 1976. Distributions of Populus tremula L. in southwestern Asia. Arboretum Kornickie. 21: 9-14.

Bowes, G. 1976. Control of aspen poplar, balsam poplar, and prickly rose by picloram alone and in mixtures with 2,4-D. Journal of Range Management. 29(2): 148-150.

Weedkillers were applied in June 1967 or 1968 to range land in Saskatchewan on which aspen poplar (Populus tremuloides), balsam poplar (P. balsamifera), and Rosa acicularis were becoming re-established after bulldozing for range improvement. Picloram at 1 lb/acre or picloram + 2,4-D at 1+2 lbs/acre effectively controlled both poplars. R. acicularis was

controlled by picloram at 0.25 lb/acre. The dosages necessary to control the woody species almost completely eliminated alfalfa (Medicago sativa).

Burkhardt, E.C.; Krinard, R.M. 1976. Summary of the 1976 cottonwood plantation survey. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2, Greenville, MS. Baton Rouge, LA: Louisiana State University: 428-431.

Byrne, T.G.; Doss, R.P. 1976. Processed paper pads for greenhouse cooling. Flower and Nursery Report. January/February: 6-7.

Some characteristics were compared for the traditional aspen (Populus spp.) fiber evaporative pad and a new cellulose paper pad, used in greenhouse cooling systems. The paper pad appeared to provide a more uniform air flow.

Crawford, D.W. 1976. Aspen resource in the Southwest. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 10-11.

Cutter, E.G.; Hislop, E.C; Smith, W.H.; et al. 1976. Microbiology of aerial plant surfaces. In: Dickinson, C.H.; Preece, T.F., eds. London, UK: Academic Press, Inc. 669 p.

Proceedings of an international meeting held at the University of Leeds in September, 1975. The contents record progress in work on the aerial surfaces of plants during the years 1970-1975 and extend the review provided by the proceedings of a similar meeting held in 1970. Thirty-one papers were presented.

Deryagin, V.T. 1976. Aerial chemical tending of young mixed stands. Lesnoe Khozyaistvo. 11: 28-30.

An account of experience in the USSR in the aerial application of 2,4-D to control the broad leaved species in young natural stands consisting of Picea (obovata), Abies (sibirica), birch, aspen, and linden. The chemical was applied at rates of 2.1-2.5 kg a.i./ha in 22-25 litres spray. Data are tabulated on injury to the five tree species, the percentage distribution of the trees in the canopy by damage categories 3 years after the treatment and costs.

Gray, P.D. 1976. Perspectives on Rocky Mountain aspen resource: forest industry. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 6-7.

Gunzl, L. 1976. Which poplar varieties have been preserved in Austria up to 1975? Holzzucht. 30(2/4): 30-34.

Hart, E.D., comp. 1976. Populus: a bibliography of world literature 1964-1974. Res. Pap. SO-124. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 227 p.

Hoffer, R.M. 1976. Techniques and applications for computer-aided analysis of multispectral scanner data. In: Proceedings of the symposium: 16th IUFRO World

Congress: Remote sensing in forestry; 1976 June 21-26; Oslo, Norway. Freiburg, German Federal Republic: IUFRO: 103-113.

The techniques described were applied in a mountainous test area of about one million ha in SW Colorado. Coniferous, deciduous, and other major cover types were mapped with about 85 percent accuracy and individual forest cover types with about 70 percent accuracy using LANDSAT and SKYLAB data.

Hronek, B.B. 1976. Aspen potential--a land manager's viewpoint. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 12-14.

Il'inskaia, I.A. 1976. New fossil species of Populus and Ampelopsis from Zaysan depression. Bot. Zhurnal. 61(11): 1580-1581.

Kemperman, J.A. 1976. Clone size in American aspens. Canadian Journal of Botany. 54(22): 2603-2607.

It is considered, following an aerial photographic survey and field study of morphological characters, that the large area of many clonal stands of Populus tremuloides and P. grandidentata in western North America is probably due to the establishment of few seedlings, periodic fires which promote suckering, a long period of expansion, and little competition.

Khattack, G.M. 1976. History of forest management in Pakistan -- III. Irrigated plantation and riverain forests. Pakistan Journal of Forestry. 26(4): 231-241.

The irrigated plantations of the Punjab have been managed under the two-storied high forest system, with an understory of shisham (Dalbergia sissoo) and mulberry (Morus alba) and an overstory of D. sissoo. The riverain forests of the Punjab comprise scattered areas of uncultivable land; the main species are D. sissoo and bahan (Populus euphratica), with some A. arabica. It is proposed to convert these areas either to irrigated plantations or to high forest.

Kovacic, D.; Maurin, Z. 1976. Thriving of European-American poplars in the Pozega valley. Sumar List. 100(1/2): 19-34.

Krinard, R.M.; Johnson, R.L. 1976. 21-year growth and development of baldcypress planted on a flood-prone site. Res. Note. SO-217. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 4 p.

Cypress (Taxodium distichum) was planted in 1955 in the Delta Experimental Forest, Mississippi, on a clay site where cottonwood (Populus deltoides) had repeatedly failed.

Langhammer, A. 1976. Future of the genus Populus in Norway. Holzzucht. 30(2/4): 22-24.

Mathison, R.S. 1976. Aspen in perspective in Colorado. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 8-9.

Menghini, A.; Mincigrucchi, G. 1976. Italian medicinal plants of moist environments. *Annali della Facolta di Agraria*. 31: 43-80.

The biogeographical characters of some 100 plants (including Salix alba, S. purpurea, Populus tremula, P. alba, P. nigra, and Alnus glutinosa) are described, with details of the drugs prepared from them.

Michel, M.F. 1976. Preliminary note on the presence of antibiotic substances in some forest tree species. *Annales des Sciences Forestieres*. 33(3): 151-159.

Tests were made of the inhibitory effect on four bacteria of extracts from the leaves of Chamaecyparis nutkaensis (nootkatensis), Thuja (Thuja) plicata, Abies alba, Cedrus atlantica, Pinus sylvestris, Larix decidua, Populus trichocarpa, and Sorbus aucuparia. Positive results were obtained for all tree species, although one bacterium, Escherichia coli, was resistant to all extracts. Two of the tree species were already known to produce the antibiotic substances, nootkatine and thujaplicine.

Miller, W.A. 1976. Fifty years of poplar. *Quarterly Journal of Forestry*. 70(4): 201-206.

Difficulties in importing sufficient match timber during the 1914-1918 war persuaded Bryant and May, a British matchmaking company, to establish home supplies of timber. Bryant and May began their own regulated planting program in East Anglia, Herefordshire and Bedfordshire which has been successfully sustained.

Nikolovski, T. 1976. River bank forest of white poplar with silk vines in Macedonia. *Bulletin of Science, Section A. Science Nat. Tech. Med. Akad. Savet. FNRJ*. 21(10/12): 224-226.

Pizzolato, T.D. 1976. Preparation and flattening of thick epoxy sections for light microscopy. *Canadian Journal of Botany*. 54(20): 2405-2407.

Pourtet, J. 1976. The International Poplar Commission--its role in world poplar culture. In: *Proceedings, Symposium on eastern cottonwood and related species*: 31-37.

Raschke, G. 1976. Comparison of balsam poplars and black poplar hybrids. Preliminary assessment of a trial plot after 8 years' growth. *Holz-Zentralblatt*. 102(109): 1473-1474.

Observations were made in 1974 of a small-scale test on a good poplar site in the Danndorf District, German Federal Republic, planted with three balsam cultivars ('Androscoggin', 'Oxford', and 'Rochester') and five black poplar hybrid varieties ('Dromling', 'Forndorf', 'Gelrica', 'Grandis', and 'Marilandica'). The balsam poplars, especially 'Androscoggin', were greatly superior in growth, health, and stem form.

Rummukainen, U. 1976. Control of forest undergrowth in Finland. In: *Proceedings, Nord-Europeiska Ograssymposiet: Dickursby; Tikkurila, Finland: D1-D4*.

Helicopter spraying in 1975 of forest regrowth cost M140/ha compared with M200-600/ha for mechanical treatment and allowed the treatment of 50 ha/day; application in a foam formulation reduced drift. In summer 1973, the best

control (60-70 percent) of roadside regrowth was effected with esters of 2,4-D + 2,4,5-T at 2.5 kg/ha. The effectiveness of 2,4,5-T was reduced by application at the end of July. Birch (Betula spp.) was controlled by all chemicals, aspen (Populus tremula), and willow (Salix spp.) by the ester mixture and by MCPA-ester and rowan (Sorbus aucuparia) by 2,4-D-salt. In summer 1975, MCPA iso-octyl ester was the best treatment. In summer 1976, glyphosate at 2 kg/ha was effective and safe to conifer seedlings.

Sanders, C.J.; Weatherston, J. 1976. Sex pheromone of the eastern spruce budworm (Lepidoptera: Tortricidae): optimum blend of trans- and cis-11-tetradecenal. *Canadian Entomologist*. 108(11): 1285-1290.

In 1975, in tests in Ontario and in tests on balsam fir (Abies balsamea), red spruce (P. rubens) and white spruce in New Brunswick, hemlock (Tsuga canadensis) in Pennsylvania and in a stand of mixed spruce, aspen (Populus spp.) and balsam fir in Alberta, a mixture containing 2-5 percent cis-isomer attracted most males.

Shain, L.; Krzan, Z.; Cellerino, G.P.; et al. 1976. In: Thielges, B.A.; Land, S.B., Jr. eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 28-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University. 485 p.

Includes 60 papers presented at this conference on Populus deltoides and other Populus species.

Sheikh, M.I. 1976. Performance of hybrid poplars in Pakistan. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 414-419.

Snyder, L.C. 1976. Poplars and willows. *Arbor. Rev.* 28. St. Paul, MN: University of Minnesota, Agricultural Extension Service. 4 p.

Sternitzke, H.S. 1976. The poplar resource in the United States--with special reference to cottonwood in the Mississippi Delta. In: Thielges, B.A.; Land, S.B., Jr. eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 28-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 6-10.

Van Kraayenoord, C.W.S.; Wilkinson, A.G. 1976. The role of Populus deltoides in New Zealand. In: Thielges, B.A.; Land, S.B., Jr. eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 28-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 176-188.

Viart, M. 1976. Poplar research in France. *Holzzucht*. 30(2/4): 24-25.

Vorontsova, T.A.; Gadalina, Yu.I.; Tkachuk, A.K. 1976. A contribution to the study of the epidemiology of tick-borne encephalitis at the southern limit of its area of occurrence. *Meditsinskaya Parazitologiya i Parazitarnye Bolezni*. 45(6): 709-714.

From serological examination and statements of 1,928 subjects in 22 villages in forest-steppe areas on the left bank of the Volga in the USSR, 525

subjects in 6 villages in the Samara Bend and 352 subjects in the town of Zhigulevsk, it was found that the percentage of subjects immune to tick-borne encephalitis and the percentage that had been in contact with ticks in the first of the areas were 14.2 and 11.1, respectively. The percentage of inhabitants that were immune varied from 1.0 to 47.9, the lowest value being found in villages close to linden (Tilia) and aspen (Populus tremula) forests, and the highest in those near oak forests.

Weisgerber, H. 1976. The role of Populus deltoides and its hybrids in the Federal Republic of Germany. In: Thielges, B.A.; Land, S.B., Jr. eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 28-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 420-427.

Wengert, E.M. 1976. A quick method to distinguish aspen heartwood and sapwood. Wood and Fiber. 8(2): 114-115.

Sapwood of aspen (Populus tremuloides, P. grandidentata) absorbs ethanol or isopropanol more readily than heartwood, which is less permeable. Sapwood remains wet for 15 minutes after application of the alcohol; dye can be added to stain the sapwood for a longer period.

Wengert, E.M. 1976. Perspectives on Rocky Mountain aspen resource: an overview. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 2-5.

Zavitkovski, J. 1976. Ground vegetation biomass, production, and efficiency of energy utilization in some northern Wisconsin forest ecosystems. Ecology. 57(4): 694-706.

Data are given for above-ground biomass, root biomass, and solar radiation of the ground vegetation in aspen (Populus tremuloides), maple (Acer rubrum)/aspen/birch (Betula papyrifera), birch, northern hardwood, and logging road communities within the Enterprise Radiation Forest before the area was irradiated.

1977

1977. A book of trees. Vol. 3. Exotic forest trees grown in Argentina for ornamental and/or industrial purposes. Buenos Aires, Argentina: Celulosa Argentina S.A. 174 p.

Descriptions are given of timber species of major importance and 50 of minor importance; a short section describes the plantation silviculture of conifers, Eucalyptus spp., and poplars and willows.

1977. Birch, aspen and alder: a guide to practical forestry. As, Norway: Institutt for Skogskjoetsel, NLH. 112 p. Rev. Norsk Skogbruk. 23(8): 25, 32.

A small practical manual summarizing present-day knowledge on the treatment of broadleaved forest. It recommends breaking with traditional

methods of treatment in favor of simpler, more radical ones, especially for birch and aspen.

1977. Plant introduction of Populus X euramericana Guinier cv. Chung-Kuo Lin Yeh K'o Hsueh. 4: 32-37.

Anderson, H.W.; Zsuffa, L. 1977. Farming hybrid poplar for food and fiber: an exploratory study of the seasonal above-ground biomass. For. Res. Rep. 103. Ontario, Canada: Ministry of Natural Resources. 8 p.

The entire living sprout growth of one stool from each of five Populus clones was harvested at two-week intervals between July 2 and October 8. The only aspen in the test, GA88 (P. grandidentata X alba), had the greatest oven-dry biomass.

Auber, R. 1977. The point on the Fritzi Pauley poplar. French Agriculture. 33(1694): 25-26.

Barring, U. 1977. Results of trials in forestry. In: Weed and weed control: 18th Swedish weed conference; Uppsala, Sweden. Uppsala, Sweden: Lantbrukshogskolan; 1: M1-7.

Among herbicides tested in forestry in recent years the most promising was glyphosate at 1.5 kg/ha; applied to aspen (Populus tremula) and birch (Betula alba) it was as effective against the aerial parts as 2,4,5-T at 2 kg/ha while reducing sprouting and suckering more effectively than 2,4,5-T. Results with Krenite (ammonium ethyl carbamoylphosphonate) at 8 kg/ha were unsatisfactory. Triclopyr (Dowco 233) at 1.8 kg/ha controlled Quercus petraea as well as 2,4,5-T and was more effective in preventing stump sprouting.

Bauer, E. 1977. The history of the Palatinate forest and the forest school of Rhineland-Palatinate, taking the demonstration forest trippstadt/Kaiserlautern as an example. Allgemeine Forst- und Jagdzeitung. 148(8/9): 165-174.

The Palatinate forest, the largest continuous forest tract in Germany, was possibly Roman state forest and became royal and subsequently imperial forest. The first forest description of about 1,600 mentions the predominance of broadleaved species, with oak (Quercus spp.) and beech (Fagus sylvatica) as primary species and hornbeam (Carpinus betulus), birch (Betula spp.), alder (Alnus spp.), willow (Salix spp.) and aspen (Populus tremula) as secondary species.

Bischoff, M. 1977. Patent protection for varieties of forest tree species. Holzzucht. 31(1/2): 1-4.

Varieties within the genera of poplar (Populus), willow (Salix), spruce (Picea), larch (Larix), and Douglas fir (Pseudotsuga) can be protected by patent in the German Federal Republic and in member countries of UPOV (Union Internationale pour la Protection des Obtentions Vegetales) since the introduction of a patent protection law for tree varieties in 1968 and the foundation of the Bundessortenamt (Federal Bureau of Cultivars) in 1976. Patent fees for tree cultivars are listed.

Buech, R.R. 1977. Tree-shoot elongation patterns in a gamma-irradiated northern forest community. In: Zavitkouski, J., ed. The Enterprise, Wisconsin,

Radiation Forest: Radioecological studies. Oak Ridge, TN: USAEC, Technical Information Center; 2: 91-106.

Shoot elongation in the upper crowns of seven tree species was studied in a gamma-irradiated northern forest community near Rhinelander, Wisconsin. The gymnosperm Abies balsamea was the most radiosensitive species. Acer rubrum, Betula papyrifera, Populus tremuloides, Quercus rubra, and Tilia americana were intermediate in radiosensitivity. Observed responses to radiation were alteration in the elongation pattern, suppression of internodal elongation, and death. Retardation of initial elongation was characteristic of all species. The results suggest that bud differentiation and morphology and dependency on food reserves contributed to the lag in manifestation of radiation damage.

Cannell, R.Q.; Gill, C.J. 1977. Applied biology. In: Coaker, T.H., ed. Vol. 2. London, UK: Academic Press, Inc. 272 p.

The second volume of a review series on applied biology. Four papers are presented of which two, both dealing with the physical environment, are of forestry interest.

Cellerino, G.P.; Lapietra, G. 1977. Interpretation of small-scale air photographs for making surveys of poplar plantations. *Cellulosa e Carta*. 28(3): 15-25.

Tests in northern Italy on the use of small-scale air photographs for identifying and recording the condition of poplar plantations showed that poplar stands of different ages could be identified, whatever the kind of film used, but that poplars were most easily separated from willows and conifers when infra-red color film was used.

de Paratesi, S.G. 1977. The use of aerial photography for the classification and inventory of the agricultural resources in Europe. *Euro Abstracts Section 1*. 16: 659.

The AGRESTE Project, being carried out at the Joint Research Centre, Ispra, Italy, in collaboration with the Directorates of Agriculture; Development and Cooperation; and Research Science and Education of the European Community, is investigating the use of remote sensing methods (including LANDSAT satellite data) for various studies of European agricultural and forestry resources.

Dimitrijevic, Z. 1977. Twenty years of activity of the Yugoslav National Poplar Commission. *Topola*. 21(115/116): 4-21.

Dwyer, J.E. 1977. Quacking aspen. *Garden (N Y)*. 1(4): 36.

Eckenwalder, J.E. 1977. North American cottonwoods of sections Abaso and Aigeiros. *Journal of the Arnold Arboretum*. 58(3): 193-208.

Changes in name for several cottonwoods are required as a result of taxonomic decisions taken by the author, based on research on Populus in SW North America (including Mexico). A key is provided to the world sections of Populus. This is followed by a description of the new section Abaso.

Ehrenberg, C. 1977. Research with deciduous trees. Rapp Uppsats Res Notes Stockh Skogshogsk Inst Skogsgenet. 26: 41-50.

Eldridge, K.G.; Brown, A.G.; Matheson, A.C. 1977. Genetic gain from a Pinus radiata seed orchard [near Canberra, Australia]. In: 3rd International congress of the Society for the advancement of breeding researches in Asia and Oceania in association with Australian plant breeding conference; 1977 February; Canberra, Australia. Plant Breeding Papers Vol. 2, Section 13: Advances in forest tree breeding. Canberra, Australia: SABRAO: 13-1 - 13-27.

Forest, P.; Legault, A. 1977. Analysis of the vascular flora in the Great Whale River area, Quebec. Naturaliste Canadien. 104(6): 543-566.

The taxa of the area are listed with an indication of their life forms, geographical distribution, habitats, and relative abundance. Trees and shrubs include Larix laricina, Picea glauca, P. mariana, Juniperus communis, Populus spp., Salix spp., Alnus spp., and Betula spp.

Gambill, W.G., Jr. 1977. America's vagabond tree. American Horticulturist. 56(5): 18-20, 44.

Griffin, A.R. 1977. Replication of radiata pine [Pinus radiata] progeny tests in time and space. In: 3rd International congress of the Society for the advancement of breeding researches in Asia and Oceania in association with Australian plant breeding conference; 1977 February; Canberra, Australia. Plant Breeding Papers Vol. 2, Section 13: Advances in forest tree breeding. Canberra, Australia: SABRAO: 13-1 - 13-27.

Hagblom, P.; Unestam, T.; Ekbohm, G. 1977. Killing effect and translocation of picloram in the stem of aspen, Populus tremula. European Journal of Forest Pathology. 7(4): 220-229.

Picloram was injected into the stems of aspen trees in summer and spring and the wilting effect on the foliage was studied in relation to rate of herbicide, stem diameter, surface area, and volume of the tree and depth of placement of the herbicide. Application in the phloem region was the most effective. Translocation to the leaves took place in both the phloem and the xylem. Young leaves seemed to be the primary target of the herbicide and this was clearly evident at bud-burst in the spring. In vitro experiments with excised shoots and aspen callus supported this conclusion.

Hilado, C.J.; Gall, L.A. 1977. Relative toxicity of pyrolysis products of some wood samples. Journal of Combustion Technology. 4: 193-199.

Data are given on toxicity to mice under simulated fire conditions for nine wood species. Differences between species were not significant, but beech (Fagus grandifolia) was the most toxic and southern yellow pine (Pinus rigida) the least.

Hyun, S.K. 1977. Breeding of blister-rust-resistant synthetic clones of Korean pine (Pinus koraiensis S. and Z.). In: 3rd International congress of the Society for the advancement of breeding researches in Asia and Oceania in association with Australian plant breeding conference; 1977 February;

Canberra, Australia. Plant Breeding Papers Vol. 2, Section 13: Advances in forest tree breeding. Canberra, Australia: SABRAO: 13-1 - 13-27.

Kiss, L. 1977. The role of Pleurotus ostreatus in the reforestation of Populus stands and the use of waste woods. *Erdo*. 26(7): 319-321.

Kuminova, A.V. 1977. The structure of the vegetation of Khakasiya, and methods used to investigate it. *Botanicheskii Zhurnal*. 62(4): 465-480.

The results are given of a vegetational survey of the Khakasian autonomous region which is in the southwestern part of the Krasnoyarsk District, central Siberia. Five altitudinal belts of vegetation were recognized. A diagram shows the distribution with respect to altitude and humidity of 48 vegetational sub-units within the main belts, and the relative area occupied by each subunit.

Lanz, W. 1977. Results of glyphosate trials in forestry. In: Proceedings of EWRS symposium on different methods of weed control and their integration; Uppsala, Sweden; 2: 15-23.

In trials, glyphosate applied in forest plantations was effective against broad leaved weeds, shrubs, most grasses and bracken (Pteridium aquilinum) and was consistently superior to 2,4,5-T. Glyphosate was also effective in unplanted areas. At 1 kg/ha applied to dormant conifers, it controlled undesirable trees and shrubs, including Betula spp. and Populus spp.

Lapietra, G.; Megier, J. 1977. Acreage estimation of poplar planted areas from Landsat satellite data in northern Italy. In: Remote sensing in forestry: Proceedings, 16th IUFRO World Congress Symposium; 1976 June 21-26; Oslo, Norway. Freiburg, German Federal Republic: IUFRO: 157-170.

Lapietra, G.; Megier, J. 1977. Estimation of the area under poplar plantations in northern Italy, using data from the satellite Landsat. *Cellulosa e Carta*. 28(3): 26-36.

Computer classification of data from Landsat 2 enabled area measurements and maps to be made of poplar plantations in two zones along the Po River. The results show that the classification method used is applicable to field work even in difficult conditions such as those prevailing in Italy, where poplar plantations are numerous and often very small.

Lee, P.W.; Lee, H.H. 1977. Anatomical studies of major tree barks grown in Korea. III. Anatomy of Populus barks. *Soul Taehakkyo Nonghak Yonku College Agriculture Bulletin*. 2(1): 423-432.

Lenderink, H. 1977. Poplars in Vlaardingen. *Populier*. 14(1): 18-22.

Lenderink, H. 1977. Report of the journey of the Stichting "Poplar" to the recreation area "Rottemeren". *Populier*. 14(2): 39-42.

Mead, D.A. 1977. Aspen--the ugly duckling. *Forestry Chronicle*. 56(3): 353-354.

Muller, R. 1977. The future of the European poplar industry. Study and explanation based on a dissertation. *Allgemeine Forstzeitschrift*. 32(40): 1003-1004.

Muller, R.; Hoffman, E.; Lange. 1977. Poplars in W. German forestry. *Allgemeine Forstzeitschrift*. 32(40): 1003-1005, 1007-1008.

Murphy, P.G.; Sharitz, R.R. 1977. Response of a forest ecotone to ionizing radiation. Progress report, October 15, 1976-October 14, 1977. 14 p.

Compositional and structural characteristics of three forest types, including aspen dominated, maple-birch dominated, and an intervening ecotone, were studied before and after irradiation in northern Wisconsin. The overall density of seedlings of Populus tremuloides and Acer rubrum increased markedly in the three areas and P. tremuloides invaded some areas in which it had not been found prior to irradiation. In most respects the ecotone has shown properties and responses to radiation intermediate to those observed in the aspen and maple-birch areas. The rate and compositional characteristics of succession in the ecotone relative to aspen and maple-birch forest types is presently under study.

Naudet, H. 1977. The poplars. *Foret Privee Francaise*. 113: 21-27.

The three most favored clones in France are 'I-214', 'Robusta', and 'Fritzi' Pauley, the growing of which is discussed.

Palmberg, C. 1977. Selecting for rust resistance in poplars in Australia. In: 3rd International congress of the Society for the advancement of breeding researches in Asia and Oceania in association with Australian plant breeding conference; 1977 February; Canberra, Australia. *Plant Breeding Papers Vol. 1*. Canberra, Australia: SABRAO: (Sections 1-4): 4(a) - 17-20.

Pederick, L.A. 1977. Growth of Pinus radiata trees from orchard and routine seed sources at four [Australian] locations. In: 3rd International congress of the Society for the advancement of breeding researches in Asia and Oceania in association with Australian plant breeding conference; 1977 February; Canberra, Australia. *Plant Breeding Papers Vol. 2, Section 13: Advances in forest tree breeding*. Canberra, Australia: SABRAO: 13-1 - 13-27.

Perala, D.A. 1977. Aspen in the north-central States. Gen. Tech. Rep. NC-36. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 30 p.

Ritchie, J.C. 1977. The modern and late Quaternary vegetation of the Campbell-Dolomite uplands, near Inuvik, N.W.T. Canada. *Ecological Monographs*. 47(4): 401-423.

Pollen analysis and ¹⁴C dating of a 12,000-year-old core of lake sediment from the subarctic region of the Beringian floristic province suggest the following sequence of pollen assemblage zones: (1) Salix/Gramineae/Artemisia, (2) Betula (shrub)/Salix/Gramineae/Artemisia, (3) Betula/Populus, (4) Betula/Populus/Juniperus, (5) Picea/Betula/Juniperus, (6) Picea/Betula/Alnus. The changes in pollen spectra suggest a migration, in chronological order, of willow, herbs, dwarf birch, and poplar from adjacent unglaciated Megaberingia.

Sakai, K.I.; Hayashi, S. 1977. Further studies on genetics in natural stands of Pinus thunbergii. In: 3rd International congress of the Society for the advancement of breeding researches in Asia and Oceania in association with Australian plant breeding conference; 1977 February; Canberra, Australia. Plant Breeding Papers Vol. 1. Canberra, Australia: SABRAO: (Sections 1-4): 1(a) - 25-27.

Salmonson, B.J. 1977. Increase in radiosensitivity with increase in age of Populus tremuloides seed. In: Zavitkovski, J. ed. The Enterprise, Wisconsin, Radiation Forest: Radioecological studies. Oak Ridge, TN: USAEC, Technical Information Center; 2: 185-188.

Populus tremuloides seeds from one tree were irradiated with a ^{137}Cs gamma source to exposures of 0.47, 0.94, 1.4, 1.8, 3.7, 7.5, 15, 22, 30, 45, and 60 kr at increasing time intervals after seed collection. Two methods of seed storage were used prior to irradiation, refrigerator storage at 5degC and freezer storage at -19degC with vacuum desiccation. Gamma radiation had no effect upon germination percentage. However, marked decreases in the LD_{50-30} of Populus tremuloides seedlings, grown from seed that was gamma irradiated at increasing time intervals after seed collection, indicated that the seed radiosensitivity increases with increasing age of the seed. Seed storage under vacuum desiccation in a freezer at -19degC prolonged the viable storage life of the seed over refrigerator storage.

Salmonson, B.J.; Crow, T.R.; Buech, R.R.; et al. 1977. In: Zavitkovski, J., ed. The Enterprise, Wisconsin, Radiation Forest: Radioecological studies. Oak Ridge, TN: USAEC, Technical Information Center. 211 p.

A summary of radioecological studies carried out after exposure of the Enterprise Forest to ionizing radiation for one growing season.

Schotveld, A. 1977. Poplar and willow in the area of Flevopolders. Populier. 14(4): 78-80.

Sepp, R.; Tamm, U. 1977. Technique of determining the bark color of the aspen. Metsanduslikud Uurimused. 13: 270-311.

Shafizadeh, F.; Chin, P.P.S.; DeGroot, W.F. 1977. Effective heat content of green forest fuels. Forest Science. 23(1): 81-89.

Unextracted, ether extracted, and benzene-ethanol extracted foliage samples of Douglas fir (Pseudotsuga menziesii), Ponderosa pine (Pinus ponderosa), aspen (Populus tremuloides), gallberry (Ilex glabra), manzanita (Arctostaphylos totula), and saw-palmetto (Serenoa repens) were analyzed by thermal evolution analysis, GLC and thermogravimetric analysis, to determine their effective heat content (heat released by combustion of evolved gases) and gasification profiles (the rate of heat release as a function of temperature).

Sheikh, M.I. 1977. Comparison of six poplar clones for growth and survival. Pakistan Journal of Forestry. 27(2): 101-108.

Shelbourne, C.J.A. 1977. Genetic gains in 7-year-old Pinus radiata from seed orchard and control-pollinated progenies. In: 3rd International congress of

the Society for the advancement of breeding researches in Asia and Oceania in association with Australian plant breeding conference; 1977 February; Canberra, Australia. Plant Breeding Papers Vol. 2, Section 13: Advances in forest tree breeding. Canberra, Australia: SABRAO: 13-1 - 13-27.

Shortle, W.S.; Shigo, A.L.; Berry, P.; Abusamra, J. 1977. Electrical resistance in tree cambium zone: relationship to rates of growth and wound closure. *Forest Science*. 23(7): 326-329.

The relationship was investigated within clones of (a) red maple (*Acer rubrum*) coppice and (b) 25-year-old hybrid poplars derived from various *Populus* spp. Electrical resistance (ER) was measured by the Shigometer and tree vigor by d.b.h. Wound healing - only studied in (b) - was measured as percent occlusion of 1.4-cm-diameter drill wounds in the butt and extent of internal discoloration of the wood later in the season. Results showed that ER was inversely proportional to growth rate. In (b), ER was also inversely proportional to the rate of wound closure but not to the amount of discolored wood.

Sipkens, J.; Eppenga, R. 1977. How can one cubic meter of poplar wood become a ton? *Populier*. 14(1): 17.

Slee, M.U. 1977. Breeding *Pinus caribaea* for the central lowland tropics. In: 3rd International congress of the Society for the advancement of breeding researches in Asia and Oceania in association with Australian plant breeding conference; 1977 February; Canberra, Australia. Plant Breeding Papers Vol. 2, Section 13: Advances in forest tree breeding. Canberra, Australia: SABRAO: 13-1 - 13-27.

Smilga, J. 1977. Giant *Populus* trees in the Latvian SSR. *Mezsaimn Mezrupnieciba*. 1: 26-27.

Takats, T. 1977. Utilization of poplar wood by *Pleurotus ostreatus*. Kummer in the presence of thiamine, urea and lime. In: Szegi, J., ed. *Soil biology and conservation of the biosphere*: 277-286.

Thielges, B.A.; Land, S.B., Jr. eds. *Proceedings: Symposium on eastern cottonwood and related species*; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 485 p.

This report of a symposium on eastern cottonwood (*Populus deltoides*) and other species of *Populus* and hybrids, held in Greenville, Mississippi in September-October 1976, includes a section devoted to a session on diseases and insect pests of cottonwood.

Tsinovskis, R. 1977. Two rare half-forgotten species of the genus *Populus* L. from the northwestern part of North America and related species and hybrids in Latvia. In: Ozolin'sh, U.K., ed. *Botanicheskie sady Pribaltiki, Okhrana rastenii*: 175-196.

van der Meiden, H.A. 1977. Support for poplar cultivation. *Populier*. 14(2): 43-44.

van Heeswijk, H.A. Poplars and willows grown in urban areas--Helmond. *Populier*. 14(3): 61-64.

van Iersel, H.A. 1977. Poplar and willow in the urban area of 's-Hertogenbosch. *Populier*. 14(4): 73-75.

Zavitkovski, J.; Buech, R.R.; Rudolph, T.D.; Bauer, E.O. 1977. Patterns of radial and short growth of five tree species in a gamma-irradiated northern Wisconsin forest. In: Zavitkovski, J., ed. *The Enterprise, Wisconsin, Radiation Forest: Radioecological studies*. Oak Ridge, TN: USREC, Technical Information Center; 2: 107-118.

Patterns of radial and shoot growth of Abies balsamea, Acer rubrum, A. saccharum, Betula papyrifera, and Populus tremuloides were observed before (1970) and during (1972) gamma-irradiation of forest communities in the Enterprise Radiation Forest.

1978

Bajuk, L.A.; Gordon, J.C.; Promnitz, L.C. 1978. Greenhouse evaluation of the growth potential of Alnus glutinosa clones. *Iowa State Journal of Research*. 52(3): 341-349.

Growth rate of superior A. glutinosa clones equaled or exceeded that of the fast-growing clone Populus X euramericana cv. Wisconsin No. 5.

Devoy, J. 1978. Poplars and willows. *GC HTJ*. 184(9): 31-32.

Foote, K.C.; Schaedle, M. 1978. The contribution of aspen bark photosynthesis to the energy balance of the stem. *Forest Science*. 24(4): 569-573.

Photosynthetic and respiratory rates were measured weekly for 3 months in 6- to 8-year-old aspen (Populus tremuloides) growing in boxes in central New York. The rate of bark photosynthesis (BP) was 11-25 percent of leaf photosynthesis. It is concluded that BP can contribute significantly to the stem energy balance of defoliated P. tremuloides.

Giesen, T.G.; Kwak, R. 1978. Populus forest in the "Zompe". *Populier*. 15(3): 67-68.

Karabaev, V.A.; Pavlova, I.E.; Kukushkin, A.K. 1978. The effect of illumination conditions during cultivation on the induction of fluorescence of tree leaves. *Fiziol Rast (Mosk)*. 25(4): 798-802.

Lee, D.K.; Promnitz, L.C. 1978. Sampling and estimation of hybrid poplar root systems. *Iowa State Journal of Research*. 53(1): 1-12.

Soil core samples (Diameter 2 cm, depth 45 cm) were taken at increasing distances (stratified sampling) from selected trees in a 2-year-old Populus X euramericana (P. X canadensis aggr.) plantation (2 clones, 5,000, 10,000, and 15,000 trees/acre), and from 8-week-old rooted cuttings in boxes; numbers, length, and dry weight of sampled roots were measured.

Li, P.H.; Sakai, A., eds. 1978. Proceedings, International plant cold hardiness and freezing stress: mechanisms and crop implications; 1977 November 2-4; St. Paul, MN. New York, NY: Academic Press. 416 p.

The proceedings of an International Plant Cold Hardiness Seminar held in St. Paul, Minnesota, November 2-4, 1977, of which 6 papers are of forestry interest.

Mott, R.J. 1978. Populus in late-Pleistocene pollen spectra. Canadian Journal of Botany. 56(8): 1021-1031.

Muir, N. 1978. Spring equinox - green haze. GC & HTJ. 183(21): 24-25, 27-28.

An examination of early-leaving trees for use in urban landscapes, including Populus simonii, P. maximowiczii, Salix spp., Tilia spp., Nothofagus spp., Ulmus spp., and Quercus spp.

Pirazzi, R.; Cavalcaselle, B.; Ricci, G. 1978. Cultivation of Pleurotus ostreatus on waste logs of poplar. Cellulosa e Carta. 29(3): 9-15.

The edible fungus P. ostreatus, which produces its fruit bodies in winter, can be grown on various woods including beech, hornbeam, willow, and elm as well as poplar. Two techniques for growing the fungus on small waste logs of poplar (Populus spp.) are described.

Rudolph, T.D. 1978. Seed yield and quality in Populus tremuloides following pollination with gamma-irradiated pollen. Canadian Journal of Botany. 56(23): 2967-2972.

A pollen mixture from three male quaking aspen (Populus tremuloides Michx.) trees was irradiated at exposures of 484; 968; 1,453; 1,937; 3,874; 7,747; and 15,494 R and used to control-pollinate cut branches from three female trees. The pollen LD₅₀ exposure varied with the end point evaluated, ranging from 255 R for number of 50-mesh seed per catkin to 8,800 R for total seeds per catkin. The mean LD₅₀ for nine seed yield and seed quality end points was 3,995 R. A significant stimulatory response in seed yield was noted at low pollen irradiation levels, particularly at the 484-R exposure. The LD₁₀₀ was approached but not reached at 15,494 R. Irradiated quaking aspen pollen may be useful in breeding experiments.

Sayn-Wittgenstein, L. 1978. Recognition of tree species on aerial photographs. Inf. Rep. FMR-X-118. Ontario, Canada: Forest Management Institute. 97 p.

A manual for the identification of the most important Canadian tree species by aerial photography. The manual describes 22 coniferous and 20 broadleaved species, with many photographs, and general keys for the eastern conifers, and for broadleaves in summer.

Shifley, S.R.; Brown, K.M. 1978. Elm-ash-cottonwood forest type bibliography. Gen. Tech. Rep. NC-42. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 56 p.

This bibliography on the lowland forest type of American elm (Ulmus americana), green ash (Fraxinus pennsylvanica), eastern cottonwood (Populus deltoides) and/or silver maple (Acer saccharinum), is based on Forestry Abstracts volume 24 (1963) to 37 (1976) with additional references from primary sources.

Siltanen, H.; Rosenberg, C. 1978. Analysis of 2,4-D and 2,4,5-T in lingonberries, wild mushrooms, birch and aspen foliage. *Bulletin of Environmental Contamination and Toxicology*. 19(2): 177-182.

The analytical procedure described has a detection limit of 0.05 p.p.m. for 2,4-D, and of 0.02 p.p.m. for 2,4,5-T.

Stott, K.G.; Belcher, A.R. 1978. Living windbreaks: a review of work at Long Ashton. In: Report 1977. UK: Bristol University; Long Ashton Research Station: 204-218.

The merits as windbreaks of species and varieties of poplar, willow, alder, and some conifers are described.

Tsarev, A.P. 1978. Key for identifying the most widespread poplars under cultivation in the temperate zone. *Referativnyi Zhurnal*. (1978) 12.56.108.

The key contains 82 names.

Vis, J. 1978. Populus and willow in eastern Flevoland. *Populier*. 15(2): 39-44.

Watts, T. 1978. Wind in the willows. *GC & HTJ*. 183(3): 26-28.

An account of willow (Salix spp.) production, mainly for cricket bat clefts, and also for shelterbelts and ornamental screens at the Edgar Watts Ltd. Nursery, Bungay, Suffolk, UK. A total of 60-70 Salix and Populus cultivars are grown.

Weaver, T. 1978. Auxin regulation of branch abscission by aspen. *Northwest Science*. 52(3 Part 1): 168-170.

Abscission of cut-back 1-year-old twigs of P. tremuloides was delayed by application of lanolin pastes containing 0.1 and 1 percent IAA to the cut end of the twig. Abscission rates were considerably slower after cutting back in winter than in summer. Defoliation also stimulated abscission, but less than cutting back.

1979

Bowersox, T.W.; Blankenhorn, P.R.; Murphy, W.K. 1979. Heat of combustion, ash content, nutrient content, and chemical content of Populus hybrids. *Wood Science*. 11(4): 257-262.

Analyses were made of specimens containing (a) stem wood and bark from 4-year-old trees of 7 Populus hybrids; and (b) root wood, (c) stem wood and bark from 1-, 2-, 3- and 4-year-old trees, (d) bark 1- to 4-year-old, and (e) 4-year-old leaves, from 1 hybrid, 'NE-388'. There were significant differences in macronutrient and chemical content between the 7 hybrids, and significant differences in macronutrient, chemical, and ash content between the different tissues of hybrid 'NE-388'.

Engel-Wilson, R.W.; Ohmart, R.D. 1979. Floral and attendant faunal changes on the lower Rio Grande between Fort Quitman and Presidio, Texas. In: Symposium on Strategies for protection and management of floodplain wetlands and other riparian ecosystems; 1978 December 11-13; Callaway Gardens, GA. Gen. Tech.

Rep. WO-12. Washington, DC: U.S. Department of Agriculture, Forest Service: 139-147.

Hiladco, C.J.; Brauer, D.P. 1979. Effect of air flow on toxicity of pyrolysis gases from wood in USF toxicity tests. *Combustion Toxicology*. 6: 37-43.

In tests on the pyrolysis of Populus tremuloides, Fagus grandifolia, Quercus rubra, Thuja plicata, Pseudotsuga menziesii, Tsuga heterophylla, and Pinus strobus, there was no significance difference in toxicity between gases from the various species when delivered to mice in exposure chambers.

Ragsdale, H.L.; Skeen, J.N. 1979. Non-commercial woody plants as potential biomass fuel producers: an ecological rationale for their selection. In: 3d Annual biomass energy systems conference; 1979 June 5; Golden, CO: 381-386.

It appears likely that large-scale biomass energy plantations as presently envisioned (i.e., efforts involving such commercially-important species as Populus, Pinus, Alnus, and Platanus) could eventually prove cost-ineffective owing to the intensity of management required and the corresponding loss of highly productive lands to food crop orientation. A viable alternative to this dilemma is woody species selection program directed toward successional species, toward exotic and/or rapidly colonizing urban species, and toward species inhabiting extreme or unfavorable habitats. Data from preliminary germination, propagation, and culturing trials involving the more prominent species is presented and their implications discussed.

Sipkes, C. 1979. The history of a dune recreation area. *Tijdschrift der Koninklijke Nederlandsche Heidemaatschappij*. 90(6): 267-272.

Starting in the 1930's, efforts were made to combine nature conservation and the promotion of recreation amenities in a dune landscape near Rotterdam by stimulating natural vegetation and planting trees, viz. poplars (Populus spp.) and alders (Alnus glutinosa) as well as Pinus nigra in areas unsuitable for broadleaves. It was possible to develop a greatly enriched ground flora despite heavy recreational use.

Zasada, J.C.; Densmore, R. 1979. Trap to measure Populus and Salix seedfall. *Canadian Field Naturalist*. 93(1): 77-79.

1980

Brodziak, L.; Wazny, J. 1980. Methods of cultivating fruit bodies of Lentinus edodes. II. Culture on small logs. *Sylvan*. 124(10): 19-25.

Small logs of beech, hornbeam, Scots pine, Quercus robur, Betula pendula, and Populus nigra were inoculated with L. edodes and set leaning against frames under forest canopies in central Poland. Beech gave the best results with up to 112.53 g DM per log per season in 1977-1978 and an average 5.4 fruit bodies per log.

Czekalski, M. 1980. Adventitious roots in decaying tree stems. *Rocznik Sekcji Dendrologicznej Polskiego Towarzystwa Botanicznego*. 33: 91-101.

This phenomenon was observed in 34 species of trees and shrubs in Poland (mainly in parks) over a 10-year period. The roots developed from calluses at

points of damage and sometimes formed complex root systems filling the decayed space. Such roots, which may partly substitute the declining underground root system in old specimen trees, were most frequent in Acer platanoides, Aesculus hippocastanum, Populus 'Serotina', 'Robinia', willows, and lindens, and were very rare in conifers.

Katenin, A.E. 1980. The American species Populus balsamifera and Viburnum edule in the south-east of the Chukotka Peninsula. Botanicheskii Zhurnal. 65(3): 414-421.

These two species are new to the flora of the USSR. Their habitat and the tundra communities in which they occur are described, and a hypothesis is advanced as to how and when they entered Chukotka from the American continent.

Kudela, M. 1980. Cleaning treatments using chemicals. Sbornik Vedeckeho Lesnickeho Ustavu Vysoke Skoly Zemedelske v Praze. 23: 89-114.

Young plantations (3 to 16 years old) of Norway spruce and Scots pine infested with weed trees and shrubs on 14 sites in the beech, silver fir, or oak zones of Czechoslovakia, were sprayed with Arboricid EC 50 (50 percent 2,4,5-T n-butyl ester) or Krenite (42 percent fosamine), either in spring (before flushing of the conifers) or in autumn. With Arboricid, most of the weed species (birch, Salix caprea, Sambucus racemosa, Rubus fruticosus, R. idaeus, and coppice broadleaves) were controlled at a rate of 3-4 litres/ha in both seasons, but the more resistant Sorbus aucuparia was controlled at 5-6 litres/ha only in spring and Populus tremula at 3-6 litres/ha only in autumn. Higher rates of Arboricid were toxic to the conifers.

Lu, S.X.; Xu, X.Z. 1980. Populus deltoides and their prospect of being introduced from abroad. Journal of Nanjing Technological College of Forest Products. 3: 13-21.

A report of the introduction of American poplar clones (via the Poplar Research Institute at Casale Monferrato in Italy) into Jiangsu Province. The four clones tested were Populus 'Harvard', P. 'Lux', P. 'San Martino', and P. 'I-214'. The clones adapt readily to the climatic conditions south of Zhangjiang R., particularly along its lower reaches.

Morgenstern, E.K. 1980. Interactions between genotype, site and silvicultural treatment. Inf. Rep. PI-X-14. Ontario, Canada: Petawawa National Forestry Institute. 18 p.

A review of the literature, in which findings on interactions are tabulated for 38 experiments on 21 species: Alnus glutinosa, Larix leptolepis, Picea spp., Pinus spp., Populus spp., Pseudotsuga menziesii, and Quercus rubra.

Seth, S.K. 1980. Poplar trials in Uttar Pradesh. Uttar Pradesh Forest Bulletin, Forest Department. 34: 105 p.

Suszka, J.; Przybyl, K., comps. 1980. Poplar bibliography: list of papers published by scientists of the Institute of Dendrology, Polish Academy of Sciences, within the period 1930-1980. Kornik, Poland: Institute of Dendrology, Polish Academy of Sciences. 38 p.

Tarasenko, I.M.; Svistula, G.E. 1980. Survival and growth of broadleaves in soil-protective plantings on the lower Dnepr sands. *Lesovodstvo i Agrolesomelioratsiya*. 58: 27-34.

Several broadleaves were planted in 1975 in trials to select suitable subjects for protective plantations. Best initial survival (over 75 percent) was with 'Robinia', Amorpha fruticosa, Gleditsia triacanthoides, Calligonum aphyllum, and Elaeagnus angustifolia. Height growth after 3 years are given for 15 species. The hummock/hollow relief of the area is unsuitable for mixed pine/broadleaf plantations, but trials have shown that belts of 'Robinia', Populus nigra var. italica and 'Toropogritsky's poplar' can be successfully established around Scots pine plantations for fire protection and to increase their value for recreation and wildlife.

1981

Bakhtin, A.A. 1981. Studies of natural regeneration and formation of young Norway spruce stands on burnt areas in Arkhangel'sk province. *Lesovodstvo, Lesnye Kul'tury i Pochvovedenie*. 10: 37-39.

Natural regeneration following forest fires consisted of 11,900 healthy spruce stems/ha, 400 Scots pine, 25,000 birch, and 900 Populus tremula. A scheme for the formation of spruce stands is proposed involving thinning in two stages: one at 20-30 years old to weed and clean the conifer species and to adjust their relative numbers, and a second at 40-60 years old, removing 30-40 percent of stems or 20-30 percent of standing volume.

Bankova, V.; Popov, S.; Marekov, N. 1981. Flavonoids from propolis. In: *Proceedings of the 1st International conference on chemistry and biotechnology of biologically active natural products*; Varna, Bulgaria: 3(1): 104-110.

Flavonoids obtained by column chromatography of propolis were identified as pinocembrin, chrysin, galangin, quercetin, isorhamnetin, and tectochrysin; pinocembrin was present in the greatest quantity. The flavonoid content of Populus nigra buds was very similar to that of samples of Bulgarian propolis.

Bowes, G. 1981. Improving aspen poplar and prickly rose-covered rangeland with herbicides and fertilizer. *Canadian Journal of Plant Science*. 61(2): 401-405.

Catesson, A.M. 1981. Seasonal cycle in cambial cells in several leafy trees. In: *Meeting on Cytological, cytophysiological and metabolic variations in plants, in relation to seasonal cycles*; 1980 March 14; Paris, France. *Bulletin de la Societe Botanique de France: Actualites Botaniques*. 128(2): 43-51.

Il'in, A.M. 1981. Change of areas covered by aspen. *Lesnoe Khozyaistvo*. 4: 41-43.

Naidenov, V.I.; Bogdanov, V.K. 1981. Calculating the energy potential of wood. *Lesn. Prom-st (USSR)*. 6:23-24.

A formula is presented for determining the calorie equivalent E, i.e., the ratio of the lowest heat of combustion of a solid cubic meter of wood to the heat of combustion of a ton of standard fuel. Graphs are presented showing E

for sound stemwood and for rotten wood of birch, pine, aspen (Populus tremula), and spruce in relation to moisture content and ash content.

Ohmann, L.F.; Grigal, D.F.; Rogers, L.L. 1981. Estimating plant biomass for undergrowth species of northeastern Minnesota forest communities. Gen. Tech. Rep. NC-61. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 10 p.

Rebane, Kh.K. 1981. Effect of aspen and birch litter on the germination rate of spruce seed. *Lesovedenie*. 2: 42-51.

1982

Alemdag, I.S. 1982. Biomass of the merchantable and unmerchantable portions of the stem. Inf. Rep. PI-X-20. Ontario, Canada: Petawawa National Forestry Institute. 20 p.

Sample data were obtained from Pinus resinosa, P. banksiana, Picea mariana, P. glauca, Abies balsamea, Populus tremuloides, P. grandidentata, Betula papyrifera, and Quercus rubra in Ontario. Equations were derived for estimating oven-dry mass (stem and/or bark) of the merchantable and unmerchantable (stump and top) portions of the stem, defined by various height and diameter components. Examples are given of the application of the equations to various types of data.

Alexander, M.E. 1982. Fire behavior in aspen slash fuels as related to the Canadian Fire Weather index. *Canadian Journal of Forest Research*. 12(4): 1028-1029.

Bartos, D.L.; Mueggler, W.F. 1982. Early succession following clearcutting of aspen communities in northern Utah. *Journal of Range Management*. 35(6): 764-768.

Bowes, G.G. 1982. Changes in the yield of forage following the use of herbicides to control aspen poplar. *Journal of Range Management*. 35(2): 246-248.

Yields of forage were measured 3 to 5 years after application of brush control treatments in 1967-1969 to rangeland in Saskatchewan infested with regrowth of Populus tremuloides.

Chardenon, J. 1982. The poplar: present and future. Paris, France: Institut pour le Developpement Forestier. 280 p.

A comprehensive, detailed, and practical guide to poplar cultivation.

Cheliak, W.M.; Dancik, B.P. 1982. Genic diversity of natural populations of a clone-forming tree Populus tremuloides. *Canadian Journal of Genetics and Cytology*. 24(5): 611-616.

Dhawan, A.K.; Malik, C.P.; Dua, I.S.; et al. 1982. Session 6. Tree biology. In: Khosla, P.K., ed. *Symposium Proceedings: Improvement of forest biomass*;

Solan, India: Indian Society of Tree Scientists, H.P. Agricultural University: 329-434.

Ten papers.

Domir, S.C.; Wuertz, D.E. 1982. Retardation of tree growth by injection of plant growth regulators. *Plant Growth Regulation*. 1(2): 85-92.

Evdokimov, A.P. 1982. Experimental establishment of Karelian birch in the northwestern RSFSR. *Lesovodstvo, Lesnye Kul'tury i Pochvovedenie*. 11: 88-94.

Trials of Karelian birch (*Betula pendula carelica*) were made in 1971-1980 in Leningrad province and Karelia. Establishment was most successful with seedlings 35-45 cm tall with root collar diameter of 3-5 cm and root length 20-30 cm. Site type was very important to growth of young stands. Competition from natural regrowth of birch and aspen (*Populus tremula*) can seriously limit growth. Survival and growth were good on worked out peat bogs in pure stands and in mixtures with Scots pine.

Gaude, T.; Fumex, B.; Dumas, C. 1983. Are lectin-like compounds involved in stigma-pollen adhesion and/or recognition in *Populus* and *Brassica*. In: Mulcahy, D.L.; Ottaviano, E., eds. *Pollen: Biology and implications for plant breeding: Proceedings of the symposium; 1982 June 23-26; Lake Garda, Italy*. New York, NY: Elsevier Science Publishing Co., Inc: 265-272.

Haemagglutination techniques were applied to material of *B. napus* cv. Jet 9 and *B. oleracea* var. *acalypha* with a view to determining whether lectin-like compounds are present on the pollen grain surface. Results suggested that nondiffusible cell adhesion molecules (CAMS) may be present on the surface of the pollen wall. Whether the pollen CAMS are lectins remains to be determined.

Gingerich, L.L. 1982. Glyphosate for forestry and brush control - summary of 1982 results. In: *Proceedings, North Central weed control conference; Indianapolis, IN: North Central Weed Control Conference, Inc: 127-128*. Abstract.

Twenty-four sites, sprayed with glyphosate (1.125-1.5 lb/ac) by helicopter in autumn 1981 for conifer release were assessed in summer 1982. Of the 28 brush species evaluated, 23 species were susceptible, four were intermediate and one was resistant to glyphosate.

Goffinet, M.C.; Larson, P.R. 1982. Lamina abortion in terminal bud-scale leaves of *Populus deltoides* during dormancy induction. *Botanical Gazette*. 143(3): 331-340.

Hughes, S.J. 1982. *Dactylosporium macropus* (fungi, description, grown on decaying wood and collected from *Populus tremuloides*, distribution in Alberta). *Fungi Canadenses*. May(226): 2 p.

Iakushenko, I.K. 1982. Water exchange in promising for cultivation species, forms and hybrids of poplar. *Botanika (issledovaniia)*. 24: 79-88.

Jin, Z.C. 1982. A set of examples on the plant anatomy applied in the field of forestry research. Journal of North-Eastern Forestry Institute. March(1): 110-120.

Khosla, P.K.; Khurana, D.K. 1982. Evolution of genus Populus Linn. and systematic placement of P. iciliata Wall. ex Royle. Journal of Tree Sciences. 1(1/2): 81-87.

The fossil history, origin, systematics, and phylogeny of the genus Populus are briefly described. The genus has about 30 living species and is one of the more archaic angiosperms dating back to the Triassic. Diversification of morphological and floral characters has led to five sections. A new section Ciliata is proposed.

Loomis, R.M. 1982. Seasonal variations in ash content of some Michigan forest floor fuels. Res. Note. NC-279. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 3 p.

Total ash and silica-free ash contents were measured of the dead litter fuels of Quercus alba, Q. rubra, Q. ellipsoidalis, Fagus grandifolia, Populus grandidentata, Acer saccharum, Carya ovata, Pinus resinosa, P. banksiana, and bracken (Pteridium aquilinum) in Lower Michigan mixed broadleaf stands. Differences in ash content between species were generally more important than seasonal differences for predicting fire behavior.

Martynov, A.N.; Krasnovidov, A.N. 1982. Chemical tending of spruce in areas subject to frost damage. Lesnoe Khozyaistvo. 4: 50-51.

In 1977-1980, 7-year-old spruce/broadleaved stands were sprayed with the arboricide Krenite (fosamine) at 2 and 7 kg/ha to control the broadleaved nurse trees (birch and aspen). The application of 2 kg/ha provided the necessary release with minimum damage from late frosts; this treatment depressed the height growth of broadleaves while causing little mortality. The higher dosage gave better release but the resulting frost damage was severe.

Popravko, S.A.; Sokolov, I.V.; Torgov, I.V. 1982. New natural phenolic triglycerides. Chemistry of Natural Compounds. 18(2): 153-157.

A method is described for the isolation (from an ethanolic extract of propolis) and identification of phenolic triglycerides. Extracts of Populus tremula buds were also analyzed. Two new compounds were found in both extracts.

Richard, Y.; Moreau, G. 1982. Use of leaves of different tree species by the benthic fauna in oligotrophic waters of the Canadian Shield. Hydrobiologia. 96(1): 77-89.

Richard, Y.; Laflamme, N.; Moreau, G. 1982. Colonization by microorganisms, chemical development of the leaves of different tree species in oligotrophic waters of the Canadian Shield, and effect on their use by macroinvertebrates. Hydrobiologia. 96(1): 65-75.

Rijmenams, J. 1982. Ecological indicator species, vegetation of Populus robusta in the Holsbeek (Brabant) population. Bulletin de la Societe Royale Forestiere de Belgique. 89(5): 204-222.

Schier, G.A. 1982. Sucker regeneration in some deteriorating Utah aspen stands: development of independent root systems. Canadian Journal of Forest Research. 12(4): 1032-1035.

Severson, K.E. 1982. Production and nutritive value of aspen understory, Black Hills (South Dakota, Wyoming, Populus tremuloides). Journal of Range Management. 35(6): 786-789.

Singh, R.V.; Kashyap, S.D. 1982. Sucker development from Populus ciliata roots. Indian Journal of Forestry. 5(3): 165-170.

Tikhonov, A.S. 1982. A new method of tending spruce plantations overgrown with birch and aspen. Lesnoi Zhurnal. 6: 35-38.

Investigations were made of the effectiveness of treatments to reduce competition by birch and aspen weed trees in a young plantation of Norway spruce, planted on a clear-felled area in 1966. The treatments involved cutting all the broadleaves within 1.5 m of the rows of spruce at a height of 1, 1.5, or 2 m, using a light axe or secateurs. Data are presented on the regrowth of the broadleaves and the growth response of the spruce. The best release and growth of the spruce were on the plots where the broadleaves had been cut at a height of 1 m. The method could be mechanized by using a 'tree-mower' to cut the broadleaves in strips 3 m wide.

Zou, H.Y.; Cheng, L.M. 1982. A study on the role of water conservation of the forest vegetation in Huanglong Mountain, Shensi Province. Scientia Silvae Sinicae. 18(1): 20-28.

Data are given on the depth and moisture content of the forest litter layer under various forest types, and on soil water under different vegetation types - including forests of Quercus liaotungensis and Populus tremula var. daurica, plantations of Robinia pseudoacacia and Caragana microphylla, and an area cultivated with Astragalus adsurgens.

1983

Alekseev, V.A. 1983. Effect of Alar on the growth of woody species in young stands. Lesnoe Khozyaistvo. 10: 52-54.

In May 1980 a trial was made with the growth retardant Alar (daminozide), sprayed at 15 kg/ha (in an aqueous solution at 500 litres/ha) on the crowns of a young mixed stand 6-7 years old, 1.5-2 m high, of birch/pine with some spruce and aspen. In the first year after treatment height increment of the birch and aspen was reduced by almost 40 percent, whereas that of the pine and spruce increased somewhat.

Alekseev, V.A. 1983. The effect of Kamposan on the increment of trees in young stands. Lesnoi Zhurnal. 3: 10-13.

In trials in June 1981, the crowns of trees in young mixed stands (birch/pine, and aspen/birch) were sprayed with aqueous solutions (50, 100, and 200 ml of Kamposan in 5 litres per 0.01 ha). Kamposan significantly retarded growth of the broadleaved species but had little or no effect on the pine. In a comparative trial, Kamposan proved to be much more effective as a growth retardant than chlormequat at 10 kg a.i./ha. Kamposan is recommended for treating young stands at doses not exceeding 10 litres/ha.

Arbuzov, L.D. 1983. Weeding by injection of arboricides. Lesnoe Khozyaistvo. 3: 57-58.

Trials were made in the Soviet Far East with injecting 2,4-D and Tordon 22K (picloram) to release the conifers in plantations of Pinus koraiensis/Populus suaveolens and Pinus sylvestris/Fraxinus mandshurica, and also to kill native hardwoods invading young plantations of Pinus koraiensis. Excellent kills were obtained on poplar, ash, and Betula costata; Acer barbinerve was resistant to 2,4-D but was completely killed by 0.5 cm³ of Tordon applied in a notch; Quercus mongolica was the most resistant. Spring application is best.

Arshad, M.; Hafiz, I.A. 1983. Efficacy of Beauveria bassiana (Bals.) Vull. fungus against the larvae of Apriona cinerea Chev (Lamiidae: Coleoptera). Pakistan Journal of Zoology. 15(2): 207-211.

Arshad, M. Hafiz, I.A. 1983. Microbial trials of a pathogenic fungus Beauveria bassiana (Bals.) Vull. against the adults of Aeolesthes sarta Solsky (Cerambycidae: Coleoptera). Pakistan Journal of Zoology. 15(2): 213-215.

Baldwin, I.T.; Schultz, J.C. 1983. Rapid changes in tree leaf chemistry induced by damage: evidence for communication between plants. Science. 221(4607): 277-279.

Barnes, J.P.; Putnam, A.R. 1983. Rye residues contribute weed suppression in no-tillage cropping systems. Journal of Chemical Ecology. 9(8): 1045-1057.

A living cover of spring-sown rye reduced early season biomass of Chenopodium album, Digitaria sanguinalis, and Ambrosia artemisiifolia by 98, 42, and 90 percent, respectively, over control plots with no rye. Residues of autumn-sown, spring-killed rye reduced total weed biomass compared with bare-ground controls.

Blakely, A.D. 1983. Monoammonium phosphate: effect on flammability of excelsior and pine needles. Res. Pap. INT-313. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 17 p.

Fuel beds of Pinus ponderosa needles and aspen (Populus) excelsior were sprayed with samples of monoammonium phosphate manufactured in different ways, to test their potential effectiveness as forest fire retardants. Measurements of flame spread and weight loss showed no significant difference among the retarding abilities of the samples.

Bowes, G. 1983. Aspen poplar control with 2,4-D (Dichlorophenoxyacetic acid) formulations. Canadian Journal of Plant Science. 63(1): 323-325.

Chandrashekar, M. 1983. Climatic influences in the management of poplar leaf rust. *The Indian Forester*. 109(9): 632-635.

Chaturvedi, A.N. 1983. Poplars for farm forestry in Uttar Pradesh. *The Indian Forester*. 109(9): 661-664.

Dalal, S.S.; Trigotra, R.C. 1983. Experiences in poplar cultivation outside forests. *The Indian Forester*. 109(10): 726-736.

Danda, R.S. 1983. Trials of poplars in Punjab. *The Indian Forester*. 109(10): 767-772.

Deol, G.S.; Khosla, P.K. 1983. Effect of size of stem cuttings on juvenile growth of Populus ciliata Wall. ex Royle. *The Indian Forester*. 109(10): 762-766.

Dickson, R.; Killian, S.P., III; MacLeod, J.M.; et al. 1983. Proceedings of the TAPPI 1983 annual meeting; 1983 March 2-4; Atlanta, GA. Atlanta, GA: TAPPI. 366 p.

Forty-eight papers presented.

Dulloo, J.N. 1983. Poplars for economic development. *The Indian Forester*. 109(10): 717-725.

Farkas, L. 1983. Utilization of stumps in pulpwood poplar stands for mushroom growing. *Erdo*. 32(10): 441-445.

Harvested stumps on sandy soil on the Great Hungarian Plain are inoculated with Pleurotus ostreatus and covered with black plastic film at 5-10 percent of the cost of stump grubbing. Up to 2 kg of mushrooms are collected annually from stumps of 20-25 cm diameter over a period of 3 to 6 years. The sales revenue is greater than that obtained from the poplars. Instead of coppice shoots, root suckers are formed which can be marketed cheaply as rooted planting stock. Medicinal plants can also be grown in order to increase plantation revenue to a total value of 14 ft/m².

Fedoryuk, A.T. 1983. Taxonomic composition of Populus x canadensis Moench in Belorussia. *Byulleten' Glavnogo Botanicheskogo Sada*. 129: 39-43.

Specimens growing throughout the republic were surveyed over a 10-year period. The growing stock was classified phenotypically into five types: Populus 'Eugenei', P. 'Marilandica', P. 'Regenerata', P. 'Robusta', and P. 'Serotina'. Notes are given on the origin, history, local distribution, and growth characteristics of each type.

Fotidar, A.N. 1983. Some observations on poplars in Jammu and Kashmir state. *The Indian Forester*. 109(10): 737-742.

Gifford, G.F.; Humphries, W.; Jaynes, R.A. 1983. All trees are not equal. *Utah Science*. 44(2): 50-55.

Il'in, A.I. 1983. Replacement of oak by aspen in the forest steppe zone. *Lesnoe Khozyaistvo*. 7: 24-26.

Jones, K.L. 1983. Current knowledge of the effects of cattle grazing on aspen in the Alberta Parkland. *Rangelands*. 5(2): 59-60.

Kapoor, M.L.; Sharma, V.K. 1983. Evolving genetically improved clones of poplars by mutation breeding. *The Indian Forester*. 109(10): 748-754.

Kaul, O.N.; Sharma, K.K. 1983. Biomass production systems of poplars and willows in India. *The Indian Forester*. 109(9): 645-654.

Species used with some biomass estimates under different conditions.

Maass, D.I. 1983. Herbicides applied in bands to control brush prior to conifer planting. In: Proceedings of the 37th Annual meeting of the Northeastern Weed Science Society: 273-275.

Band applications of 3.7 and 4.69 lb hexazinone/ac to hardwood regrowth on a cutover site had no effect when made in autumn. Spring applications controlled Acer rubrum, Populus spp., and Prunus pennsylvanica in the treated bands but although beech (Fagus spp.) and ash (Fraxinus spp.) sprouted; they showed scorch and reduced growth. The most successful treatment was 4 lb. picloram + 5.56 lb. triclopyr/ac which controlled most hardwood species as well as ferns and grasses within the bands and had some effect between the sprayed bands.

Maass, D.I. 1983. Timing--species--herbicide interactions for tree injection treatments. In: Proceedings of the 37th Annual meeting of the Northeastern Weed Science Society: 268-272.

Eight herbicides were injected into 5 hardwood and 2 conifer species in spring and summer of 1981 and winter of 1981-1982. The easiest species to control were Abies balsamea and Populus spp. Acer rubrum and Picea spp. were the most resistant. Dicamba and cacodylic acid had the best response overall followed in descending order by glyphosate, picloram, glyphosate plus triclopyr, triclopyr alone, hexazinone and 2,4-D. Spring treatments had the highest ratings and winter the lowest.

Marletto, F. 1983. Characteristics of propolis in terms of its floral origin and its use by honeybees. *Apicoltore Moderno*. 74(5): 187-191.

In the hills and plains of northern Italy, bees collect propolis almost entirely from poplar (Populus) buds. Laboratory tests on propolis samples from honeybee corbiculae showed that its solubility in ethanol and in chloroform was similar to that of resins from poplar buds and from horse chestnut (Aesculus hippocastanum) buds.

Mathur, R.S.; Sharma, K.K. 1983. Poplars in India. *The Indian Forester*. 109(9): 591-631.

An account of the propagation, management, growth, yield, and economics of exotic poplars in various states, and including a list of species and clones (with sources) introduced since 1958 by the Forest Research Institute.

Mathur, R.S.; Sharma, K.K.; Joshi, S.R. 1983. Effect of size of shoot cuttings on the growth of Populus x euramericana '72/58'. *The Indian Forester*. 109(9): 665-674.

For raising plants in 1 growing season it was found that cuttings should be not less than 20 cm long and about 1.5 cm diam.

Mathur, R.S.; Sharma, K.K.; Sood, O.P. 1983. Reproduction of poplars by seed - nursery trials. *The Indian Forester*. 109(10): 699-705.

Molles, M.C.; Gosz, J.R.; Cates, R.G. 1983. Effects of recreation on the forest floor and associated streams of aspen and conifer forests. Albuquerque, NM: University of New Mexico. 57 p. [Title in] *Journal of Forestry*. 82(11): 695.

Naglova, G.I.; Naglov, V.A. 1983. Data on the distribution and ecology of *Ixodes trianguliceps* (Ixodidae) in the Kharkov region. *Parazitologiya*. 17(5): 409-410.

Surveys carried out in the Kharkov region of the Ukraine, USSR, between 1967 and 1981 showed that *Ixodes trianguliceps* Bir. was distributed within the limits of the forest-steppe zone from the western border to the valley of the Seversky Donets River; the species reached the steppe zone through the forests along the river. The tick was most abundant in aspen forests and its main host was *Clethrionomys glareolus*. Its peak of abundance was recorded in June.

Padro, A. 1983. Types of plants in reforestations with black poplar. *Agricultura*. 52(614): 654-657.

Parker, A.J.; Parker, K.C. 1983. Comparative successional roles of trembling aspen and lodgepole pine in the southern Rocky Mountains. *The Great Basin Naturalist*. 43(3): 447-455.

Perala, D.A.; Russell, J. 1983. Aspen. In: Burns, Russell, M., tech. comp. *Silvicultural systems for the major forest types of the United States*. Agric. Handb. 445. Washington, DC: U.S. Department of Agriculture, Forest Service: 113-115.

Radcliffe, J.E. 1983. Fodder trees--an option for dry hill country. Spec. Publ. 26. Canterbury, New Zealand: Lincoln College, Centre of Resource Management: 49-57.

In trials at Canterbury on three sites, DM yields of the fodder trees *Chamaecytisus palmensis*, *Medicago arborea*, *Populus X euramericana* cv. Flevo, *Salix matsudana X alba* cv. Tangoio, *S. matsudana*, and *S. viminalis* cv. Gigantea were compared. *Populus* and *Salix* spp. were more productive after 2-3 seasons of cutting.

Rai, A.K.; Sharma, Y.K. 1983. Poplars for paper making. *The Indian Forester*. 109(9): 655-660.

Ronco, F., Jr.; Gottfried, G.J.; Shaffer, R. 1983. Southwestern mixed conifers. In: Burns, Russell, M., tech. comp. *Silvicultural systems for the major forest types of the United States*. Agric. Handb. 445. Washington, DC: U.S. Department of Agriculture, Forest Service: 73-76.

Sant, D.; Gislerod, H.R.; Selmer-Olsen, A.R.; Solbraa, K.; Caballero, A. 1983. Utilization of composted barks in the cultivation of *Chrysanthemum* White Horim. Primer Congreso Nacional. 1: 73-83.

Rooted cuttings were planted in various media consisting of 100 percent peat (controls) or peat plus composted bark of *Picea abies*, *Pinus insignis*, *P. pinea*, *P. sylvestris*, or a mixture of *Betula*, *Fraxinus*, *Populus*, and *Quercus*, in a peat:bark ratio of 1:2 (v:v).

Santas, L.A. 1983. Insects producing honeydew exploited by bees in Greece. *Apidologie*. 14(2): 93-103.

More than 65 percent of honey produced in Greece is from sources of honeydew. Their main host plants were *Pinus* spp. Also important were *Abies* spp, and other host plants included species of *Populus*, *Tilia*, *Quercus*, *Crataegus*, and also *Gossypium* and *Trifolium* spp.

Shepperd, W.D.; Engelby, O. 1983. Rocky Mountain aspen. In: Burns, Russell, M., tech. comp. Silvicultural systems for the major forest types of the United States. Agric. Handb. 445. Washington, DC: U.S. Department of Agriculture, Forest Service: 77-79.

Shoshin, V.I. 1983. Peculiarities of poplar and birch growth in field shelterbelts in an arid steppe. *Biologicheskije Osnovy Zashchitnogo Lesorazvedeniia v Zapadnoi Sibiri*: 84-92.

Singh, Pratap; Rawat, D.S.; Misra, R.M.; Fasih, Masarrat; Prasad, G.; Tyagi, B.D.S. 1983. Epidemic defoliation of poplars and its control in Tarai Central Forest Division, Uttar Pradesh. *The Indian Forester*. 109(9): 675-693.

Accounts of the biology and damage caused by *Pygaera fulgurita* and *P. cupreata*, and their control by aerial spraying with carbaryl.

Singh, R.V. 1983. Nursery technology of *Populus ciliata*. *The Indian Forester*. 109(10): 706-716.

Singh, Sujan; Khan, S.N.; Misra, B.M. 1983. Some new and noteworthy diseases of poplars in India. *The Indian Forester*. 109(9): 636-644.

Botryodiplodia palmarum set rot, *Alternaria* tip blight, *Cladosporium humile* leaf spot, *Fusarium* pink incrustation of stems and branches, *Ganoderma* root rot, foliage rusts (*Melampsora* spp.), and various cankers.

Singh, S.P.; Mittal, M.C. 1983. Growth of poplar plantations in Tarai Region of Uttar Pradesh. *The Indian Forester*. 109(10): 755-761.

Smith, J.K.; Laven, R.D.; Omi, P.N. 1983. Fire behavior measurements on prescribed burns in aspen clones of Colorado's Front Range. In: 7th Conference on fire and forest meteorology; 1983 April 25-28; Ft. Collins, CO. Boston, MA: American Meteorological Society: 58-61.

Steere, R.L.; Erbe, E.F. 1983. Supporting freeze-etch specimens with "Lexan" while dissolving biological remains in acids. In: Proceedings, 41st meeting of the Electron Microscopy Society of America; 1983. San Francisco, CA: San Francisco Press, Inc.: 618-619.

Tiwari, K.M. 1983. First nursery trials of Australian poplar clones in India. *The Indian Forester*. 109(10): 697-698.

Westwood, Arthur Richard. 1983. The use of plant phenology and analyses of larval sampling techniques in a control strategy for spring *Aedes* mosquitoes. *Dissertation Abstracts International*. 44/06-B: 1714.

Phenological stages of 29 species of herbaceous plants, shrubs, and trees were found to correspond to egg hatch, presence of first instar larvae and the 2.3 to 3.3 mean larval instar of *Aedes stimulans*; *Aedes provocans* (Walker); *Aedes euedes* (Howard, Dyar, and Knab); *Aedes excrucians* (Walker); *Aedes fitchii* (Felt and Young); and *Aedes canadensis* (Theobald) inhabiting woodland, open field and cedar bog pools near Guelph, Ontario.

Wittberg, R.A.; Eckert, R.T. 1983. Xylem morphology and discoloration in bigtooth aspen. In: *Proceedings, 28th Northeastern forest tree improvement conference; 1983*. Durham, NH: The Northeastern Forest Tree Improvement Conference: 118-125.

Zasada, J.C.; Argyle, D. 1983. Interior Alaska white spruce-hardwoods. In: Burns, Russell, M., tech. comp. *Silvicultural systems for the major forest types of the United States*. Agric. Handb. 445. Washington, DC: U.S. Department of Agriculture, Forest Service: 33-36.

Zhurova, O.N. 1983. Epidermal complex of representatives of genus *Populus* L. *Izvestiia Akademiia Nauk Azerbaidzhanskoi SSR. Serii Biologicheskikh Nauk*. 6: 9-17.

1984

1984. Netherlands, 'De Dorschkamp', Netherlands, Nationale Populieren. Wageningen, The Netherlands. 2: 40 p. Suppl. in *Populier*. 21(3).

Contains information on 13 clones which have been in commercial use for a considerable time.

1984. *Proceedings aspen symposium; 1984 May 22-24; Colorado Springs, CO*. [Lakewood, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Region.] 126 p.

Akkermans, A.D.L.; Baker, D.; Huss-Danell, K.; Tjepkema, J.D., eds. 1984. *Frankia symbioses*. In: *Proceedings of a workshop; 1983 September 1; Noordwijkerhout: 1983 September 5-6; Wageningen, The Netherlands*. The Hague, Netherlands: Martinus Nijhoff/Dr. W. Junk Publishers. 258 p. First published as *Plant and Soil*. 78(1/2): 1-258.

Twenty-two papers were presented.

Alekseev, V.A. 1984. An effective group of growth regulators of woody plants. *Lesnoi Zhurnal*. 5: 17-21.

Details are given of the growth retardant Kamposan and its derivatives *Gidrel* and *Digidrel*, and the results of trials on *Populus tremula* and *Alnus incana* regrowth.

Badhwar, G.D.; MacDonald, R.B.; Hall, F.G.; Carnes, J.G. 1984. Special characterization of biophysical characteristics in a boreal forest: relationship between thematic mapper band reflectance and leaf area index for aspen. In: Proceedings, IGAARS '84 symposium; Strasbourg: 111-115.

Measurements made over pure stands of aspen in the Superior National Forest of northern Minnesota indicate that reflectance may be sensitive to LAI early in the season. The sensitivity disappears as the season progresses. Sensitivity to the aspen overstory is dependent on the amount of understory present.

Banoun, F.; Morgan, D.; Viart, M.; Zsuffa, L. 1984. The poplar: a multi-purpose tree for forestry development. *Unasylva*. 36(145): 23-33.

A set of four papers.

Boskos, Th.L. 1984. Poplar cultivation in Greece. *Dasiki Erevna*. 5(2): 127-146.

Chen, Q.Z.; Li, C.B.; Wang, S.C. 1984. Studies on the growth of main dominant forest species in Sichuan province. *Scientia Silvae Sinicae*. 20(3): 242-251.

Data were collected from 3,000 trees over 33 years. Species studied included: Picea purpurea, P. likiangensis, P. brachytyla, P. balfouriana, Abies faxoniana, A. georgei, A. squamata, Tsuga chinensis, Larix potaninii, Pinus tabulaeformis, P. densata, P. yunnanensis, P. armandii, P. massoniana, Cunninghamia lanceolata, Cupressus funebris, Betula albo-sinensis, Schima sinensis, Cyclobalanopsis (Quercus) glauca, Populus davidiana (P. tremula var. davidiana), and Castanopsis platyacantha. The management of the area is discussed.

Crosswhite, F.S. 1984. John C. Fremont: Explorer, plant collector and politician. *Desert Plants*. 6(1): 59-62.

Historic role in exploration of the western lands of the USA, discoverer of a number of previously unknown trees, shrubs, and other plants example being Populus fremontii.

Dunwiddie, P.W.; Edwards, M.E. 1984. The dendrochronological potential of Populus balsamifera in northern Alaska. *Tree Ring Bulletin*. 44: 45-51.

Fitzgerald, R.D.; Bailey, A.W. 1984. Control of aspen regrowth by grazing with cattle. *Journal of Range Management*. 37(2): 156-158.

Hepburn, H.R.; Kurstjens, S.P. 1984. On the strength of propolis. *Naturwissenschaften*. 71(11): 591 (B).

The tensile properties of samples of propolis collected by honeybees in an apiary at Pretoria, South Africa, were measured over the range 25-45 degC. The botanical origins of the propolis were unknown, although Populus deltoides and Acacia karroo, both propolis sources, were known to grow nearby.

Hulden, L. 1984. Observations on an egg parasite of Cicadella viridis. *Notulae Entomologicae*. 64(2): 84-85.

Hussain, R. 1984. Forest planning with particular reference to forecasting and model selection as exemplified by growth models. *Forestry Abstracts*. 45(7): 381-382. Thesis summary.

Ivanov, A.F. 1984. Protection forests in the Kulunda steppe. *Lesnoe Khozyaistvo*. 9: 41-43.

A review is given of experience with field and railway shelterbelts and other protection stands of various species, established since ca. 1940 in the Kulunda steppe. Data are tabulated on growth rates of Pinus sylvestris, Larix sibirica, Populus balsamifera, Siberian poplar, Acer negundo, Ulmus pumila var. arborea, U. laevis, and Betula pendula. General recommendations are made.

Kirkland, G.L., Jr.; Malinowski, E.A. 1984. Biogeography of sympatric *Peromyscus* in Northern New York. *The Canadian Field-Naturalist*. 98(4): 440-443.

Koryakin, V.N.; Grek, V.S.; Romanova, N.V. 1984. Forest regeneration in Pinus koraiensis stands after a high-intensity fire. *Lesnoe Khozyaistvo*. 5: 26-28.

In 1976, serious fires occurred even in the Pinus koraiensis/broadleaved forests in the Soviet Far East, which are considered to be comparatively fire-resistant. Investigations were made in 1978 and 1981 on regeneration in two stands: one virgin and one logged over. All the trees had been killed, and very little regrowth was evident in 1978, only occasional sparse coppicing of Tilia amurensis or sprouts of Populus tremula var. dauriana. It is concluded that intense fires completely destroy the original biocoenoses, and there is no immediate prospect of regeneration of valuable conifers (Pinus koraiensis and also spruce and fir).

Krasny, M.E.; Vogt, K.A. 1984. Root and shoot biomass and mycorrhizal development of white spruce seedlings naturally regenerating in interior Alaskan floodplain communities. *Canadian Journal of Forest Research*. 14(4): 554-558.

Measurements were made in plots in 4 study sites on the Tanana River floodplain SW of Fairbanks. Sites were in 2 willow communities (Salix alaxensis/Populus balsamifera and an open community of S. interior), an alder community (Alnus tenuifolia) and a spruce community (Picea glauca/A. tenuifolia).

Kuroda, K.; Shimaji, K. 1984. The pinning method for marking xylem growth in hardwood species. *Forest Science*. 30(2): 548-554.

Metal pins (diameter 400 or 250 microm) were inserted into the stems of three Populus euramericana (canadensis) and one black locust (Robinia pseudoacacia) in May-June 1980 and removed immediately. Sample blocks of wood were collected and examined every 3-4 days for 1 month and again in November. Immature xylem cells in the primary wall zone enlarged and proliferated abnormally around the gap formed by pinning, gradually closing the gap. The stripes of wall residue of immature cells that had been crushed and packed together on both sides of the gap were broken by cambial divisions. The site of secondary wall initiation at the time of pinning was also detectable. It

is concluded that the method works as well or better with broadleaved trees compared with conifers.

Lombard, A.; Buffa, M.; Manino, A.; Patetta, A. 1984. Identification of raffinose in honeydew. *Experientia*. 40(2): 178-180 (B).

The presence of small amounts of raffinose in honeydew was demonstrated by means of TLC and GLC after invertase hydrolysis. The method allows the detection of this sugar even in the presence of a high percentage of melezitose.

Mikhailov, L.E.; Bagaev, S.N.; Storozhenko, V.G. 1984. Principles of organization and management of a forestry enterprise for aspen as the main tree species. *Lesnoe Khozyaistvo*. 2: 9-13.

Morley, P.M. 1984. The tree that grew up. *The Forestry Chronicle*. 60(4): 236-238.

Nelson, R.M., Jr. 1984. A method for describing equilibrium moisture content of forest fuels. *Canadian Journal of Forest Research*. 14(4): 597-600.

The isothermal absorption and desorption of water vapor by forest fuels is represented with a 2-parameter model based on an exponential relationship between Gibbs free energy change and e.m.c. The model is applied to 5 sets of forest fuel sorption data (slash pine, southern red oak (Quercus falcata), wiregrass (Aristida spp.), Canadian broadleaves (av. values for Populus tremuloides and Acer saccharum) and ponderosa pine) in the literature to illustrate goodness of fit.

Pylypec, B.; Redmann, R.E. 1984. Acid-buffering capacity of foliage from boreal forest species. *Canadian Journal of Botany*. 62(12): 2650-2653.

Richer-Leclerc, C.; Chong, C.; Binns, M.R. 1984. Rooting of two evergreens species in response to photoperiod and plant extract treatments. *Plant Propagator*. 30(4): 9-11.

Rooting of Juniperus sabina and Thuja occidentalis terminal cuttings was 3 times higher (64 and 79 percent, respectively) under extended (16 h) than under normal (9.0 to 9.5 h) photoperiods. Under extended photoperiods rooting of both species was stimulated by treatments with crude water extracts of willow and poplar twigs, especially when applied in conjunction with IBA.

Ritty, P.M.; Welker, J.G. 1984. Development of triclopyr herbicides for conifer release in Lakes States forestry. In: Proceedings, North Central weed control conference. Winnipeg, Manitoba, Canada. 39: 74-75.

Overall applications of 1.5 and 2 lb triclopyr/ac restrained hardwood competition sufficiently to allow conifer seedlings to develop without injury. Species controlled included Acer spp., Populus spp., Quercus spp. and Corylus spp. Control appeared directly related to age, size, and intensity of the competition.

Robertson, A. 1984. An introduction to European willows. Inf. Rep. N-X-226. Canada: Newfoundland Forest Research Centre. 41 p.

A brief historical note is followed by descriptions of the main species and hybrids.

Roller, K.J. 1984. A guide to the identification of poplar clones in Ontario. Ontario, Canada: Ontario Tree Improvement and Forest Biomass Institute, Ministry of Natural Resources. 98 p.

A key based mainly on leaf morphology, but including twigs, buds and leaf scars, branching and bark, is followed by detailed morphological descriptions of 32 poplar clones grown in Ontario.

Runge, F. 1984. Wind-formed trees in Westphalia. *Decheniana*. 137: 22-24.

Studies indicated that the 'wind forming' (windlean and windbend) of individual trees growing on flat sites is less affected by predominant wind direction than by direction of the strongest storm winds. Hybrid poplars are particularly sensitive indicators of this phenomenon, and provide evidence of the SW to WSW direction of high winds in this region.

Scholefield, P.J.; McIntosh, J. 1984. A further addition to the mosquitoes of Alberta. *Mosquito News*. 44(3): 423-424.

Adults of *Aedes hendersoni* were collected in light traps at Medicine Hat, Alberta, in 1981-1983. Larvae were found in a tree-hole in balsam poplar (*Populus balsamifera*) at Medicine Hat in July 1983. This is the first record of a tree-hole mosquito in Alberta.

Shanfield, A.N. 1984. Alder, cottonwood, and sycamore distribution and regeneration along the Nacimiento River, California. In: Warner, Richard E.; Hendrix, Kathleen M., eds. California riparian systems: Ecology, conservation, and productive management. Berkeley, CA: University of California Press: 196-202.

Shostak, V.P. 1984. Burrs, a valuable natural resource as a raw material for the art industry. *Lesnoe Khozyaistvo*. 2: 18-20.

An account is given of the various forms of stem burrs and basal burrs and similar formations, occurring on birch and also on *Acer negundo* and *Populus nigra*. The use of burr wood with its attractive 'bird's-eye' grain for artistic uses is pointed out. Recommendations are made for harvesting burr wood and also for inducing the formation of burrs.

Sidel'nikov, A.N.; Shafranovskii, V.A. 1984. The effect of the eruption of the Tolbachik volcano in 1975-1976 on vegetation. Wellington, New Zealand: Department of Internal Affairs. 33 p.

The effects of this fissure eruption were observed during 1976-1979. Lava flowed over an area of 40 km² after an explosive phase in which 1 km³ of ash was deposited over a wide area. The ash destroyed all vegetation over a radius of 4-14 km. Results include descriptions of the natural vegetation of *Larix kurilensis* (*L. kamtschatica*) and *Betula ermanii* forests at 73-600 m alt. and old post-fire successions. Damage usually consisted of dieback and poor foliage development, trees with well-developed crowns suffering most. Colonization of ash and scoria deposits was also studied.

Sidorskii, A.G. 1984 Effect of extracts from the vegetative and reproductive organs of dioecious plants on the frequency of mutagen-induced chromosome aberrations and the mutational process in plants. *Genetika, USSR*. 20(9): 1507-1510.

Seeds of Allium fistulosum cv. Maiskii 7 and grains of the barley Viner were soaked in aqueous extracts from leaves of female, male, and monoecious plants of spinach, from female and male inflorescences of spinach and aspen and from bisexual inflorescence of spinach before treatment with gaseous dimethyl sulphate (DMS). Extracts from female organs reduced the DMS-induced aberration frequency in A. fistulosum and the M2 mutation frequency in barley, while those from male organs increased it.

Szemeredy, M. 1984. Changes in the expansion of poplar growing in Hungary. *Erdo*. 32(10): 435-440.

Between 1953 and 1980 the area of poplars in Hungary increased from 17,600 ha to 126,000 ha, owing to afforestation of areas unsuited to conifers, and now forms 10.7 percent of the forest area. Some 80 percent of the poplar area is planted with hybrid black poplars. Since 1960, native poplars have enjoyed a revival for amenity and nature/wildlife conservation. The white poplar (Populus alba) hybrid 'I-58/57' is now being tried for commercial pulpwood on marginal poplar sites as a substitute for P. 'Robusta'.

Viart, M. 1984. Four decades of activity in poplars: a portrait of the International Poplar Commission. *Unasylva*. 36(3): 24-26.

Vierheller, T.L.; Wistendahl, W.A. 1984. Spatial pattern and delineation of clones of Populus grandidentata in southeastern Ohio. *Ohio Journal of Science*. 84(2): 10.

Voynick, S.M. 1984. Trouble in the Quakies. *American Forests*. 90(5): 17-19, 57.

Warren, L.E.; Vomocil, M.; Newton, M.; Belz, D. 1984. Control of bigleaf maple and associated hardwoods in conifer forests with Garlong. *Down to Earth*. 40(2): 8-12.

Herbicides were applied to stem wounds of Acer macrophyllum, Alnus rubra, Prunus virginiana, Salix spp., Populus spp., Rhamnus purshiana, Pseudotsuga menziesii, Tsuga heterophylla, and cedars (Thuja plicata and Libocedrus decurrens). Treatments were: DMA-4, 2,4-D at 4 lb/gal a.e., Tordon 101 mixture.

Welker, J.G. 1984. Cut stubble applications of triclopyr and picloram herbicides following mechanical brush removal on rights-of-way. In: *Proceedings, North Central weed control conference*. Winnipeg, Manitoba, Canada. 39: 69-71.

Field trials in the Lake States showed that resprouting brush stubble can be controlled with picloram and triclopyr. Populus spp. was controlled by 9 lb triclopyr/acre, provided treatment was made 1 day after mowing; 1.5 lb picloram/acre controlled it regardless of the period between mowing and spraying. Treatments in conjunction with mechanical brush removal offer less expensive maintenance of rights-of-way.

Woo, B.M.; Kwon, T.H.; Ma, H.S.; Lee, H.H.; Lee, J.H. 1984. Evaluation of the degree of green naturalness in the middle part of Korea - with the case study in area of Gongju and Yeongi-gun, Choongnam-do. *Journal of Korean Forestry Society*. 64: 64-73.

An area in the Korea Republic was surveyed in summer 1983 and land use classified into 11 categories, designated by the integers 0-10 inclusive (the 'Degree of Green Naturalness', DGN). The data were collected to form a basis for planning nature conservation policy.

1985

Aizpuru Oyarbide, J.I.; Catalan Rodriguez, P.; Catalan Calvo, M. 1985. Nitrogen composition of plants from the Somontano oscence. *Anales de la Estacion Experimental de Aula Dei*. 17(3-4): 264-277.

In late spring and summer the CP, ash, and DM contents were determined in 25 wild forage plants belonging to 12 botanical families and in cultivated barley, Medicago sativa and Vicia sativa. V. sativa and Atriplex halimus had higher CP contents than cultivated plants. Other wild species with high CP contents included Silene vulgaris, Populus deltoides, Melilotus alba, and Euphorbia serrata. During regrowth, CP increased with development.

Alban, D.H. 1985. Seasonal changes in nutrient concentration and content of aspen suckers in Minnesota. *Forest Science*. 31(3): 785-794.

Populus tremuloides suckers were sampled 6-7 times p.a. for 3 years (1978-1980) from their fifth season onwards, and oven-dry biomass, P, N, K, Ca, and Mg contents were determined for foliage, branches, bole wood, and bole bark. Foliage showed particularly large seasonal variation in N and P because these are translocated from perennial tissue (primarily bark) to foliage in the spring and back again in the autumn. The most suitable time to sample perennial tissues for nutrient content is during the leafless period, when seasonal fluctuations are at a minimum.

Alm, A.A.; Whorton, J.M. 1985. Hexazinone application over red pine in Minnesota. In: Proceedings, North Central weed control conference. St. Louis, MO. 40: 28.

The effect of 1 and 2 gal hexazinone/acre broadcast or spot sprayed on 25 April, 25 May, or 25 July 1983 over 3-0 Pinus resinosa planted in spring 1982 on loamy fine sand was tested. Spot treatment proved too toxic. Neither rate controlled Corylus cornuta but Populus spp., Prunus spp., and Amelanchier spp. were controlled by 1 gal/acre regardless of spraying date.

Brown, J.K. 1985. Role and use of fire in aspen. In: Proceedings, Society of American Foresters national convention. Bethesda, MD: The Society of American Foresters: 101-105.

Dawson, J.O.; Khawaja, M.A. 1985. Change in street-tree composition of two Urbana, Illinois neighborhoods after fifty years: 1932-1982. *Journal of Arboriculture*. 11(11): 344-348.

Inventories for 1932 and 1982, including d.b.h. data, were used to calculate total basal area for each species by year. Surviving trees are

listed by basal area. In 1932 tree species with the greatest total basal area were American and red elms (Ulmus americana, U. rubra), cottonwood (Populus deltoides), and silver maple (Acer saccharinum). The dominance of elms had given way to a more uniform distribution of basal area and a greater variety of species. Changes probably occurred because of Dutch elm disease, varying tree growth and mortality, and changes in trees selected for planting.

DeByle, N.V. 1985. Environment of Populus tremuloides. In: Proceedings, Society of American Foresters national convention. Bethesda, MD: The Society of American Foresters: 87-91.

DeByle, N.V. 1985. The role of fire in aspen ecology. In: Symposium and workshop on wilderness fire; 1983 November 15-18; Missoula, MT. Gen. Tech. Rep. INT-182. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 326.

DeByle, N.V.; Winokur, R.P., eds. Aspen: ecology and management in the western United States. Gen. Tech. Rep. RM-119. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 283 p.

A collection of papers by 21 authors, reviewing the ecology and management of Populus tremuloides of interior western USA and, to a lesser extent, Canada.

Dobson, J.B.; Peoples, T.R.; VanCantfort, A.M.; VanWinkle, D. 1985. AC 252,925: a new multipurpose herbicide for vegetation control. In: Proceedings, 39th Annual meeting of the Northeastern Weed Science Society: 228 p.

The new broad spectrum herbicide AC 252,925 (imazapyr) for use in nurseries, Christmas tree plantations, and industrial sites is described. It is suitable for control of problem weeds such as Rhus spp., Rubus spp., Campsis radicans, Rosa multiflora, Acer spp., Fraxinus spp., Populus spp., and Prunus spp.

Edwards, M.E.; Dunwiddie, P.W. 1985. Dendrochronological and palynological observations on Populus balsamifera in northern Alaska, U.S.A. Arctic and Alpine Research. 17(3): 271-278.

A survey of a gradually expanding and an even-aged clone showed that sexual reproduction and root suckering is occurring on the Alaskan N. Slope, though moose browsing is inhibiting survival beyond the sampling stage. Trees attain ages of 230 years, but are slender because of slow diameter growth. Ring width was most strongly correlated with June temperatures. Moss polster samples indicated that, although abundant pollen is produced by P. balsamifera, little is found in surface samples 30 m from the trees.

Eppenga, R. 1985. Damage to roads by poplar roots. Populier. 22(4): 72-73.

Includes a description of the use of polythene foil as barriers and a special root cutter for root pruning suitable for roots up to 30 cm in thickness and 60 cm in depth.

Fenner, P.; Brady, W.W.; Patton, D.R. 1985. Effects of regulated water flows on regeneration of fremont cottonwood. *Journal of Range Management*. 38(2): 135-138.

Fletcher, R. 1985. Regenerating aspen. In: *Forestry Research West*. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 16-19.

Harper, K.T. 1985. Predicting successional rates in Utah aspen forests. In: *Proceedings, Society of American Foresters national convention*. Bethesda, MD: Society of American Foresters: 96-100.

Hong, S.C.; Cho, H.J.; Yun, Y.W.; Kim, J.H. 1985. Forest vegetation of Mt. Pal-Gong. *Journal of Korean Forestry Society*. 70: 17-27.

A survey of woody plants in 17 communities, including those dominated by Cephalotaxus koreana, Populus davidiana (P. tremula var. davidiana) and Alnus hirsuta var. sibirica. Results showed that at an altitude of 750 m, Pinus densiflora stands were dominant, mixed stands at 750-950 m, and deciduous broadleaved stands at 950 m.

Irving, B.D.; Bailey, A.W. 1985. Control of woody sucker regrowth in clear and break vs spray and burn. *Agriculture and Forestry Bulletin*, University of Alberta. (June, Special issue): 78-79.

The control of woody sucker growth in cleared aspen (Populus spp.) parkland was investigated. After clearance and cultivation a grass/Medicago sativa was sown and rotationally grazed. Cultivation controlled sucker growth better than spraying and burning but promoted establishment of Symphoricarpos occidentalis. Grazing reduced the density of aspen and Rubus idaeus but had no effect on Rosa spp. or S. occidentalis. Of the four sucker control treatments, 2,4-D gave the best control but killed M. sativa, while burning or mowing gave good control but had little effect on R. idaeus, Rosa spp. or S. occidentalis.

Iverson, R.D.; Butler-Fasteland, M.C. 1985. Herbicide efficacy for Lake States forestry - results from a user survey. In: *Proceedings, North Central weed control conference*. 40: 29. Abstract.

Results from 40 respondents to a mail questionnaire sent out to forestry herbicide users in Minnesota and Wisconsin showed that glyphosate and hexazinone were the most frequently used herbicides and Populus tremuloides and Corylus spp. were the commonest weeds.

Iverson, R.; Sanborn, S.M. 1985. A site preparation trial with imazapyr on red pine and white spruce in Minnesota. In: *Proceedings, North Central weed control conference*. 40: 27. Abstract.

On a sandy loam site, 0.5-1.5 lb imazapyr/acre was applied in September 1984 before planting Pinus resinosa and Picea glauca seedlings in May 1985. At 1 lb/ac, control of Aster macrophyllus, Cyperus spp., Populus tremuloides, and Corylus cornuta was good.

Johansson, T. 1985. Herbicide injections into stumps of aspen and birch to prevent regrowth. *Weed Research*, UK. 25(1): 39-45.

Stumps of Betula spp. and Populus tremula in thinning stands and on clear-felled areas were injected with herbicides using a modified bolt gun. Picloram, glyphosate or 2,4-D were formed into tablets containing 170 mg herbicide, 4 mg Mg stearate and 15 mg gelatin and placed in a wedge of nylon. The wedge was fired into the stem, with the tablet placed close to the cambium, where it dissolved. Injected stumps of both species produced fewer and shorter suckers than untreated stumps.

Johnson, C.W.; Brown, T.C.; Timmons, M.L. 1985. Esthetics and landscaping. Gen Tech. Rep. RM-119. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 185-188.

Julkunen-Tiitto, R. 1985. Chemotaxonomical screening of phenolic glycosides in northern willow twigs by capillary gas chromatography. *Journal of Chromatography: Biomedical Applications*. 324(1): 129-139.

Kalyakin, A.B.; Morozov, I.I. 1985. The growth of Norway spruce plantations after weeding with the KOK-2 roller. *Lesnoe Khozyaistvo*. 10: 39-40.

Details are given of trials in 11-year-old plantations of Norway spruce, and of the condition of weeds (hazel, aspen, willow, alder) 3 years after treatment.

Klein, P. 1985. Dendrochronological studies on paintings on panels and musical instruments. *Dendrochronologia*. 3: 25-44.

A review of the literature. Dendrochronological dating can be used successfully with oak and beech panels, but cannot be used with poplar panels as there are insufficient growth rings.

Konig, B. 1985. Plant sources of propolis. *Bee World*. 66(4): 136-139.

The main known sources of propolis in Europe are various poplar (Populus) species; birch, oak, alder, willow, and hazel are of secondary importance. In the USA pine is a propolis source. In tropical areas the following have been reported as, or may be, propolis sources: Populus deltoides and Acacia karroo (S. Africa); Plumeria acuminata, Plumeria acutifolia, Eucalyptus sideroxylon, Schinus terebinthifolius, and Psidium guajava (Hawaii); Eucalyptus spp., Xanthorrhoea pressii, and X. australis (Australia).

Kuroda, K.; Shimaji, K. 1985. Wound effects on cytodifferentiation in hardwood xylem. *IAWA Bulletin*. 6(2): 107-118.

The wound effects were studied in the wood of Populus euramericana (P. canadensis) by means of periodic observation of wound tissue formation following the insertion of a pin into the stem. The mitotic reactivation of ray parenchyma cells was similar to that in conifers. A description is given of the various abnormalities found in the differentiation of those fusiform cells that were situated in the zone of xylem mother cells at the time of wounding and those originating from cambial initials for several days after wounding.

Lameris, A.M.C.; Ziemnicka, J.; Peters, D.; Grijpma, P.; Vlak, J.M. 1985. Potential of baculoviruses for control of the satin moth, Leucoma salicis L.

(Lepidoptera: Lymantriidae). Mededelingen van de Faculteit Landbouwwetenschappen Rijksuniversiteit. 50(2): 431-439.

Lapietra, G.; Sampietro, L.; Coaloa, D. 1985. Present trends in poplar production in Lombardy. Forestale/Istituto di Sperimentazione per la Pioppicoltura, Italy. 7: 22 p.

An aerial survey in 1984 of 584,526 ha was compared with one in 1977-1978. Between the two surveys, poplar stands had increased by about 6,000 ha. It is expected that poplar production in Lombardy will remain at about 1.26 million m³/yr until 1988, and will drop to 0.96 million m³/yr between 1989 and 1991 and 0.54 million between 1992 and 1994.

Lauscher, F. 1985. Phenology of vegetatively propagated plants of homogenous origin. Observations in phenological plantations in Norway, 1963-1982. Phytion: Annales rei botanicae. 25(2): 253-272.

Lepofsky, D.; Turner, N.J.; Kuhnlein, H.V. 1985. Determining the availability of traditional wild plant foods: an example of Nuxalk foods, Bella Coola, British Columbia. Ecology of Food and Nutrition. 16(3): 223-241.

Forty-two plant foods known to have been used in the past by native people of the Nuxalk Nation, Bella Coola, British Columbia, Canada, were studied. To estimate the availability of the most prominent plant food resources, field estimates were made using modifications of standard techniques for quantifying plant species. Twenty species were selected as being the most readily available food resources, and therefore good candidates for nutritional research and promotion.

Liu, Y.J.; Li, Y.D. 1985. Data of the ignition temperatures and the heat values of fourteen Chinese hardwoods. Scientia Silvae Sinicae. 21(4): 432-434.

Results showed that the ignition temperature of the species of Paulownia was 256-268 degC, higher than that of Gossampinus malabaricus and Populus tomentosa.

Lositskii, K.B. 1985. The climatic constant of forest annual increment. Vestnik Sel'skokhozyaistvennoi Nauki. 2: 123-127.

Analyses of productivity and climatic data for Norway spruce showed that volume m.a.i. values in m³/ha expressed per unit of energy input (in kg/cm² per year) or per 100 degC of active temperature sum are fairly similar in different taiga and mixed forest zones of the USSR. When productivity is converted to kg/ha DM, values for Scots pine, Norway spruce, oak, Betula alba, Populus tremula, and Alnus glutinosa are 25+ 2 kg per unit of energy input or 130+ 18 kg per 100 degC of active temperature sum. Much of this variation results from variations in density values rather than in the relation with energy input. Published data for wheat gives a value of 138 (132-143) kg per 100 degC active temperature sum. A potential productivity value (P) of plant matter is thus generated and this can be modified using 'coefficients of ecological conformity' which express the m.a.i. under given conditions as a proportion of the maximum potential m.a.i. Examples of values of the coefficient are given for Scots pine on different soil types, site types, and site classes. Potential productivity values can be used to calculate the productivity that can be expected from any site.

Lund-Hoie, K. 1985. From foliage spraying to stump spraying. *Norsk Skogbruk*. 31(5): 11-12.

Preventive control of broadleaf coppicing or suckering is advocated, carried out for preference with a special knapsack spray gun with a telescopic pipe. Glyphosate gave good control of stump shoots of oak and aspen suckers. Because of root contacts between aspens in pure aspen or aspen/conifer stands, treatment of 20-25 percent of stems was sufficient to kill all aspen trees and prevent most regrowth.

McWhorter, C.G.; Derting, C.W. 1985. Methods of application of glyphosate. In: Grossbard, E.; Atkinson, D., eds. *The herbicide glyphosate*: 241-259.

Spray solutions of glyphosate should be mixed, stored, and applied only in containers of stainless steel, aluminum, fiberglass, plastic, or plastic-lined steel. Tree species such as Populus, Quercus, Platanus, and Liquidambar are effectively controlled by glyphosate injected into the cambium or in frills cut through the bark.

Morelet, M. 1985. The genus Venturia on Populus species of Section Leuce. 1. Taxonomy. *Cryptogamie Mycologie*. 6(2): 101-117.

Mueggler, W.F. 1985. Aspen communities in the interior west. In: *Proceedings of the Society of American Foresters national convention*. Bethesda, MD: The Society of American Foresters: 106-111.

Perala, D.A. 1985. Using glyphosate herbicide in converting aspen to conifers. Res. Pap. NC-259. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 5 p.

Pokhriyal, T.C.; Raturi, A.S. 1985. A study of nitrate reductase activity in the Populus deltoides leaves. *Indian Forester*. 111(2): 82-89.

As a step to study the in vivo nitrate reductase activity in poplar leaves during the growth and development of the plant under different soil moisture regimes, standardization of the method for estimation of in vivo assay of nitrate reductase activity and the pattern of variation of enzyme activity from leaf to leaf in seedlings is reported.

Ridd, M.K.; Merola, J.A.; Harniss, R.O. 1985. Forest succession detection with landsat MSS data as an indicator of ecological degradation. In: *Technical papers 1984 world conference on remote sensing; 1984 October 8-10; Bayreuth, West Germany*. [Bayreuth, West Germany: University of Bayreuth]: 193-213.

Sakai, A.K.; Burris, T.A. 1985. Growth in male and female aspen clones: a twenty-five-year longitudinal study. *Ecology*. 66(6): 1921-1927.

Sakamoto, M.; Sumiya, K. 1985. Some fundamental problems on measurements of the bioelectrical potential of poplar callus. *Mokuzai Gakkaishi*. 31(8): 620-626.

Schaalje, G.B.; Wilkinson, P.R. 1985. Discriminate analysis of vegetational and topographical factors associated with the focal distribution of Rocky

Mountain wood ticks, Dermacentor andersoni, on cattle range. *Journal of Medical Entomology*. 22(3): 315-320.

In a study lasting 2 years in south-central British Columbia, the presence or absence of Dermacentor andersoni was compared with indices of abundance of certain plants and topographical features, and also with the presence or absence of host animal tracks or faeces. Although the process selected a different set of indicator variables each year, abundance of rose and saskatoon (Amelanchier) bushes and absence of aspen (Populus) trees proved useful as predictors in both years, the ticks observed in each year confirming the prediction for that year on 76 percent of the plots examined.

Schier, G.A. 1985. Aspen reproduction. In: Proceedings of the Society of American Foresters national convention. Bethesda, MD: The Society of American Foresters: 92-95.

Schmidt, J.O. 1985. Phagostimulants in pollen. *Journal of Apicultural Research*. 24(2): 107-114.

Several pure species (Cereus giganteus, Simmondsia chinensis, Prunus dulcis, Larrea tridentata, Populus fremontii) of pollen collected by honeybees, plus mixtures of bee-collected pollen, were analyzed for the presence of phagostimulants by feeding extracts of them mixed with candy to caged bees and measuring the amounts consumed in comparison with a reference food. All species and mixes of pollen, even the poorly nutritive and unpreferred cottonwood pollen (P. fremontii) contained phagostimulants. Pollen consumption by bees is probably induced by the cumulative effects of numerous compounds in pollen in the absence of specific repellents, rather than by one or a few specific compounds.

Shen, S.S.; Badhwar, G.D.; Carnes, J.G. 1985. Separability of boreal forest species in the Lake Jennette area, Minnesota. *Photogrammetric Engineering and Remote Sensing*. 51(11): 1775-1783.

Color IR aerial photographs (scale 1:24,000) and simulated Thematic Mapper (TMS) data were collected on three flights in 1983. Analysis showed that coniferous and broadleaved stands can be separated well using nadir view TMS data on clear days, with band 4 providing the best separability. The best separation was provided in early June before the understory had fully developed, which is also when nadir view data has maximum sensitivity to leaf area index.

Sheppard, W.D. 1985. Aspen ecology and management in the central and southern Rocky Mountains. In: Proceedings of the Society of American Foresters national convention. Bethesda, MD: The Society of American Foresters: 233-236.

Simmerman, D.G.; Brown, J.K. 1985. Fuel classification in aspen forest. In: Symposium and workshop on wilderness fire; 1983 November 15-18; Missoula, MT. Gen. Tech. Rep. INT-182. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 377.

Smirnoff, W.A. 1985. Field tests of a highly concentrated formulation of Bacillus thuringiensis against spruce budworm (Choristoneura fumiferana: Lepidoptera: Tortricidae). *The Canadian Entomologist*. 117(7): 877-881.

Sterrett, J.P.; Tworkoski, T.J. 1985. Response of trees to injections of flurprimidol and paclobutrazol. In: Proceedings, 39th Annual meeting of the Northeastern Weed Science Society: 215. Abstract.

Hydroponically-grown apples injected from above the rootstock with 2.5 mg flurprimidol or 0.5 mg paclobutrazol showed shoot growth inhibition after 4 weeks. Growth of all species was significantly inhibited by both compounds throughout June. Neither compound was phytotoxic.

Stiell, W.M.; Berry, A.B. 1985. Limiting white pine weevil attacks by side shade. *Forestry Chronicle*. 61(1): 5-9.

An experiment to limit damage by Pissodes strobi was carried out at the Petawawa National Forestry Institute from 1964 to 1982. Pinus strobus was planted in strips cut in a north-south direction in 3 stand types (mixed P. strobus/P. resinosa/Populus tremuloides/Betula papyrifera; deciduous P. tremuloides/B. papyrifera/tolerant broadleaves; and pure Pinus banksiana).

Swenson, E.A.; Mullins, C.L. 1985. Revegetating riparian trees in southwestern floodplains. In: Conference on Riparian ecosystems and their management: Reconciling conflicting uses; 1985 April 16-18; Tucson, AZ. Gen. Tech. Rep. RM-120. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 135-138.

Vakurov, A.D. 1985. Conversion of aspen stands in recreation forests in the Moscow region. *Lesovedenie*. 1: 40-43.

Studies in low-grade mature and over-mature aspen stands near Moscow in 1958-1983 have shown that the best way to rehabilitate them is by making maximum use of any birch, oak, and line in them. The aspen should be removed, some time after preliminary girdling of the standing trees so as to prevent the mass formation of suckers. Protection from game animals and trampling is necessary.

van der Meiden, H.A.; Eppenga, R.; Lenderink, H. 1985. Recreation, wood production and poplars. *Populier*. 22(2): 32-36.

Briefly describes establishment, dual purpose management, and forecasts of growth and yield in one older and one very recent recreation area with special reference to poplars as fast growing pioneer species.

1986

Armolaitis, K.E. 1986. The role of horticultural shelterbelts in reducing environmental pollution. *Lesnoe Khozyaistvo*. 8: 33-35.

Investigations were made of the effectiveness of shelterbelts along busy roads and around large commercial orchards, in intercepting atmospheric pollutants emitted by vehicles or by pesticide spraying. The results indicate that the belts are effective in countering pollution. Belts 3 rows wide are recommended, 2 rows of conifers (e.g. Norway spruce), and 1 of birch or poplar.

Bradley, C.E.; Smith, D.G. 1986. Plains cottonwood recruitment and survival on a prairie meandering river floodplain, Milk River, southern Alberta and northern Montana. *Canadian Journal of Botany*. 64(7): 1433-1442.

Chauvet, E.; Fustec, E.; Gas, G. 1986. Experimental study of the degradation of poplar lignins in an alluvial soil and in the water of a river. *Comptes Rendus del'Academie des Sciences. Serie III. Sciences de la Vie*. 302(3): 87-90.

Cote, B.; Camire, C. 1986. Determining the extension of edge effect in small plots using type I and type II error rates. *Canadian Journal of Forest Research*. 16(4): 710-712.

Data on dry weight at 3 years old were collected from pure and mixed plantings of Alnus glutinosa and Populus nigra X P. trichocarpa, established at spacings of 33x33 cm on 5x5 m plots at Laval University, Canada. The data were used to illustrate a simple statistical procedure to assess the extension of edge effects in small plots.

Dean, K.G.; Kodama, Y.; Wendler, G. 1986. Comparison of leaf and canopy reflectance of subarctic forests. *Photogrammetric Engineering and Remote Sensing*. 52(6): 809-811.

Reflectance of foliage and canopies of forests near Fairbanks, Alaska were measured at wavelengths of 0.285-2.8 microm with emphasis on Landsat Thematic Mapper bands. Canopies of Picea mariana and Populus tremuloides had reflectance values similar to their respective foliage. Reflectance values of Betula papyrifera canopy and foliage showed large differences. Canopy structure and understory vegetation appeared to be the main factors affecting the similarity of canopy and foliage reflectance. Results suggest that measurements by satellite of reflectance of the canopies of some species will be close to laboratory measurements of foliage after atmospheric corrections are made.

Dickson, R.E. 1986. Carbon partitioning in red oak: UC transport within the plant and among different chemical fractions of one-flush seedlings. In: Annual meeting of the American Society of Plant Physiologists; 1986 June 8-12; Baton Rouge, LA. *Plant Physiology*. 80(4): 74 p.

In contrast to cottonwood (Populus deltoides) with indeterminate growth (continuous leaf production, red oak (Quercus rubra L.) displays a semi-determinate or flushing growth habit, in which stem and leaf growth and carbon transport have cyclic patterns. UC transport from source leaves and partitioning among different leaf chemical fractions indicate that red oak leaves do not mature physiologically for some time after full leaf expansion.

Donaubauer, Edwin, div. coord. 1986. Poplars and willows in Yugoslavia. In: Proceedings, 18th IUFRO World Congress, 1986 September 7-21; Ljubljana, Yugoslavia: Yugoslav IUFRO World Congress. 295 p.

A monograph reviewing the major results of research over the last 30 years.

Du Cros, E. Teissier. 1986. Black and balsam poplars. *Revue Forestiere Francaise*. 0(Special issue): 153-155.

Dunwiddie, P.W.; Edwards, M.E. 1986. The dendrochronological potential of Populus balsamifera in northern Alaska. Tree-Ring Bulletin. 44: 45-52.

Two or three increment cores were examined from each of 115 trees representing both sexes in various areas along Cache Creek. The rings could be readily cross-dated. Balsam poplar showed qualities that make it an excellent subject for further dendroclimatic studies.

Fakiro, V. 1986. Natural root grafting in hybrid black poplars. Gorsko Stopanstvo Gorska Promishlenost. 42(10): 19-20.

Studies were made of the root systems in plantations of Populus 'Regenerata', 'I-214', and 'Robusta' at various spacings (from 3x3 to 8x8 m) up to 8 years old. It is concluded that natural root grafting was quite rare, did not differ significantly between clones, and was observed mainly at the closest spacings.

Fitzgerald, R.D.; Hudson, R.J.; Bailey, A.W. 1986. Grazing preferences of cattle in regenerating aspen forests. Journal of Range Management. 39(1): 13-18.

The relative preferences of cattle for the major plant species in regenerating Populus tremuloides forest following burning were studied to assist in developing strategies for controlling P. tremuloides regrowth by grazing with cattle.

Frants, T.G.; Mertvetsova, O.A. 1986. Associations of yeasts and mosquitoes of genus Aedes Mg. (Diptera, Culicidae) from the Ob River area in the Tomsk Region. Biologicheskie Nauki: Nauchnye Doklady Vysshei Shkoly. 4: 94-98.

Hagen, Robert Harvey. 1986. The evolution of host-plant use by the tiger swallowtail butterfly, Papilio glaucus. Dissertation Abstracts International. 47/08-B: 3225.

P. glaucus larvae from populations sampled along a latitudinal transect through eastern North America showed variation in ability to feed on some, but not all, host-plants tested. Larvae from northern populations survived on Populus and Betula species, but not on Liriodendron tulipifera. Southern larvae survived on Liriodendron, but died on Populus and Betula.

Heslin, M.C.; Douglas, G.C. 1986. Synthesis of poplar mycorrhizas. Transactions of the British Mycological Society. 86(pt.1): 117-122.

Hoyt, Catherine Marie. 1986. Studies in shepherd's crook of aspen. Masters Abstracts. 25/01: 57.

Kaiimov, A.K.; Kormil'tsev, M.V. 1986. Shelterbelt planting - an important factor in intensifying cotton production in Turkmenistan. Lesnoe Khozyaistvo. 10: 38-40.

An account is given of the recent developments in Soviet Turkmenistan, and the importance of shelterbelts. The main species used are Ulmus pumila var. arborea, hybrid poplars, Ailanthus altissima, and Gleditsia triacanthos. The increase in cotton yield as a result of shelter was 9 percent, and it is intended to develop the system of shelterbelts to protect all cotton-growing areas. Calculations are given of the financial benefits.

Kashkovskii, V. 1986. Honeydew producers of Siberia. *Pchelovodstvo*. 3: 19-20(B).

The life cycles of some aphids are described and the conditions necessary for a honeydew flow to occur are discussed. The properties and composition of honeydew honeys are described briefly. Honey from aspen (*Populus tremula*) is clear, dark, almost without aroma, and with the taste of apple jam. Willow (*Salix* spp.) honeydew honey is light brown, with a pleasant aroma. Honeybees do not collect honeydew from aphids on poplar, birch, cedar, pine, acacia, or bird-cherry.

Lemoine, M. 1986. Poplars of the Section Leuce. *Revue Forestiere Francaise*. 0(Special issue): 155-156.

Lindroth, R.L.; Scriber, J.M.; Hsia, M.T.S. 1986. Differential responses of tiger swallowtail subspecies to secondary metabolites from tulip tree and quaking aspen. *Oecologia*. 70(1): 13-19.

Loft, E.R.; Menke, J.W.; Kie, J.G. 1986. Interaction of cattle and deer on mountain rangeland. *California Agriculture Experiment Station*. 40(1/2): 6-9.

Maass, D.; Arsenault, D. 1986. Testing basal applications of triclopyr in conjunction with conifer spacings. In: Proceedings, 40th annual meeting of the Northeastern Weed Science Society: 213-216.

Basal applications of triclopyr ester were made in May, July, and August 1985 to competing hardwoods in two naturally regenerated stands of *Abies balsamea* and *Picea* spp. before and after the softwoods were thinned by brushsaws. Hardwood control was not affected by application date or method. The order of susceptibility was *Prunus pennsylvanica*, *Acer rubrum*, *Populus tremuloides*, *Betula populifolia*, *B. papyrifera*, *B. alleghaniensis*.

Maass, D.; Prouty, R. 1986. Efficacy and timing of metsulfuron methyl in forestry in Maine. In: Proceedings, 40th Annual meeting of the Northeastern Weed Science Society: 230-232.

In trials in Maine in 1985, 0.5, 1.0, or 2.0 oz metsulfuron methyl/acre was applied to a *Pinus banksiana*/*P. resinosa*/*Picea mariana* plantation and a *Larix leptolepis* plantation. All treatments controlled *Rubus* spp., *Acer rubrum*, *Populus* spp., *A. saccharum*, *Prunus pennsylvanica*, *Sambucus pubens*, and *Salix* spp., but no treatment was effective against *Betula* spp.

Manchester, S.R.; Dilcher, D.L.; Tidwell, W.D. 1986. Interconnected reproductive and vegetative remains of *Populus* from the Middle Eocene Green River formation, northeastern Utah. *American Journal of Botany*. 73(1): 156-160.

A description is given of a twig with several leaves of *Populus wilmattae* and a fruiting raceme attached. The fossil differs from extant *Populus* species in having basically palmate leaf venation and in bearing the fruiting axis on a young twig.

Martynov, A.N. 1986. Early chemical weeding for spruce and pine plantations. *Lesnoe Khozyaistvo*. 2: 46-48.

Butyl ester of 2,4-D was sprayed to control invasive birch and aspen in young plantations of Scots pine and Norway spruce. The results clearly show that early spraying is much more effective than spraying delayed until competition becomes noticeable.

McElroy, G.H.; Dawson, W.M. 1986. Biomass from short-rotation coppice willow on marginal land. *Biomass (United Kingdom)*. 10(3): 225-240.

A study to determine the economic feasibility of production and utilization of biomass from short-rotation coppice willow is described. Candidate species of Salix, from breeding programs in New Zealand, Finland, Sweden, and North America, and a range of Alnus, Populus, and Fraxinus species are being evaluated.

Medina, A.L. 1986. Riparian plant communities of the Fort Bayard watershed in southwestern New Mexico. *The Southwestern Naturalist*. 31(3): 345-359.

Mueggler, W.F.; Campbell, R.B., Jr. 1986. Aspen community types of Utah. Res. Pap. INT-362. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 69 p.

Orlov, A.Ya.; Petrov-Spiridonov, A.A. 1986. Phytomass accumulation and litter fall in the Betuletum oxalidoso-myrtillosum and on a clear-felled area. *Lesovedenie*. 5: 30-38.

Investigations were made in a 50-year-old birch/aspen stand (230 m³/ha) with numerous spruce natural regeneration (ca. 10,000 plants/ha, about 20 years old and 1-1.5 m high). In 1977, an area was clear-felled (preserving ca. 80 percent of the spruce advance growth), and the rates of phytomass accumulation and litter fall on the two sites were compared over the period 1977-1983.

Ovrebo, C.L.; Halling, R.E. 1986. Tricholoma fulvimarginatum (Tricholomataceae): a new species from North America associated with cottonwood. *Brittonia*. 38(3): 260-263.

Pielou, E.C.; Campbell, J.S.; Lieffers, V.J. 1986. Comparison of the structures of even-aged aspen stands in three geographic regions. *Canadian Journal of Botany*. 64(1): 122-129.

Probozsný, M. 1986. Litter decomposition processes in hornbeam-oak forests with regard to diplopods. *Opuscula Zoologica*. 22: 77-84.

Comparative studies were carried out on the food preference and feeding activities of five species of diplopods (Chromatoiulus projectus, Leptoiulus proximus, Cylindroiulus luridus, C. boleti, Unciger foetidus) predominantly occurring in hornbeam-oak stands in Hungary. The specimens of each species were fed with fallen leaves collected monthly (Carpinus betulus, Tilia platyphyllos, Fraxinus excelsior, Populus nigra, Quercus petraea, Q. cerris, Q. robur, Fagus sylvatica). All of the animals preferred without exception the weathered leaves of the tested plant species.

Reynolds, P.E.; MacKay, T.S.; McCormack, M.L., Jr. 1986. One year results for a hexazinone conifer release trial. In: Proceedings, 40th Annual meeting of the Northeastern Weed Science Society: 218-222.

A two-year-old New Brunswick Picea mariana plantation was aerially sprayed with 2, 3, or 4 kg hexazinone/ha in late August 1984. Prior to treatment, weeds were 1 m high and included Rubus idaeus, Acer spp., Betula spp., and Populus tremuloides. Foliar application of hexazinone did not give good weed control except against R. idaeus, Prunus pennsylvanica, and Acer pennsylvanicum. Control of other Acer spp. was in the order A. spicatum, A. rubrum, A. saccharum.

Rodale, R. 1986. Your farm is worth more than ever. *The New Farm*. 8(1): 22-24.

Roemer, K. 1986. Early and late leaves of apple. *Erwerbsobstbau*. 28(7): 195-199.

It was shown that apple belongs to the Populus-type, with shoots having two types of leaves: early leaves developing from primordia after a period of winter rest and late leaves developing without dormancy.

Rouse, C. 1986. Fire effects in northeastern forests: aspen. Gen. Tech. Rep. NC-102. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 8 p.

Saiovich, K.F. 1986. Aboveground phytomass of the lower layer vegetation in aspen-Aegopodium podagrata forests. *Vestsi Akademii Navuk BSSR. Seriya Biologicheskikh Nauk*. 2: 6-8.

Seryakov, A.D.; Il'yushenko, A.F. 1986. Reaction of small-diameter spruce trees to thinning of the broadleaved canopy. *Lesovedenie*. 5: 25-29.

A stand of birch/aspen/spruce (6/2/2), where the birch and aspen were 85-90 years old and the spruce 90-100 years old, was logged, removing all trees more than or equal to 24 cm in diameter. The residual spruce were very slow to adapt to the changed conditions. It is recommended that residual small-diameter spruce should not be preserved when felling dense broadleaved/spruce stands; it would be better to clear fell, retaining the young spruce advance growth, which quickly adapts to the new circumstances.

Sheikh, M.I.; Hussain, R.W.; Saliheen, Khan. 1986. Match industry in Pakistan - past and present consumption with future requirements. *Pakistan Journal of Forestry*. 36(4): 205-210.

After partition, Pakistan was left with only two match factories. Consequently an acute shortage of safety matches developed in 1971, when supplies were no longer available from East Pakistan. Prices rose sharply and imports were made from various other countries, putting pressure on the country's exchange resources. In the beginning these were cottage industries, using paper, wax thread, and cardboard but some used chir or blue pine (Pinus roxburghii or P. wallichiana). Later, cheaper resin-free wood was used from hybrid poplars.

Sheriff, D.W.; Nambiar, E.K.S.; Fife, D.N. 1986. Relationships between nutrient status, carbon assimilation and water use efficiency in Pinus radiata (D. Don) needles. *Tree Physiology*. 2(1/3): 73-88.

A discussion of the seasonal variation in nutrients in foliage and the effects of nutrient supply and growth on nutrient content is followed by an account of a factorial experiment on the effects of N and P fertilization on foliage nutrient status and tree growth. Fertilizer was applied annually for 5 years to a thinned P. radiata stand. Greater folia N and P resulted in increased water use efficiency. Estimated trends in whole tree assimilation were similar to those in aboveground biomass accumulation.

Sutherland, W.J.; Watkinson, A.R. 1986. Do plants evolve differently? *Nature*, UK. 320(6060): 305.

Starting from the premise that plants, unlike animals, consist of a mosaic of genetically different parts, it is argued that there is the possibility of genetic variation within an individual plant and, as a consequence, variation in fitness between "growth modules".

White, J.M.; Mathewes, R.W. 1986. Postglacial vegetation and climatic change in the upper Peace River district, Alberta. *Canadian Journal of Botany*. 64(10): 2305-2318.

Whitham, T.G. 1986. Costs and benefits of territoriality: behavioral and reproductive release by competing aphids. *Ecology*. 67(1): 139-147.

Williams, A.G.; Whitham, T.G. 1986. Premature leaf abscission: an induced plant defense against gall aphids. *Ecology*. 67(6): 1619-1627.

Wong, K.K.Y.; Tan, L.U.L.; Saddler, J.N.; Yaguchi, M. 1986. Purification of a third distinct xylanase from the xylanolytic system of Trichoderma harzianum. *Canadian Journal of Microbiology*. 32(7): 570-576.

Ziombra, M.; Gapinski, M. 1986. Effect of substrate and pasteurization on oyster mushroom, Pleurotus ostreatus Kumm., mycelium growth. *Roczniki Akademii Rolniczej w Poznaniu, Ogrodnictwo*. 165(13): 175-189.

Mycelium growth on 14 substrates was compared. Pasteurized cereal or maize straw, poplar, alder, beech, birch or pine sawdust, and beech or pine bark were suitable as substrates.

1987

Buehrer, J. 1987. The aspen rustlers. *American Forests*. 93(3/4): 43-44.

Clatterbuck, W.K.; Oliver, C.D.; Burkhardt, E.C. 1987. The silvicultural potential of mixed stands of cherrybark oak and American sycamore: spacing is the key. *Southern Journal of Applied Forestry*. 11(3): 158-161.

During winter 1962-1963, 4 rows of each of sycamore (Platanus occidentalis), cherrybark oak (Quercus falcata var. pagodifolia), and cottonwood (Populus deltoides) were planted in a repeating pattern on the flood plain of a small stream in Arkansas. Survival of cottonwood was poor

and only a few isolated trees were present. There was progressive increase in height, diameter, and crown class of oaks with increasing distance from dominant sycamores.

DeByle, N.V.; Bevins, C.D.; Fischer, W.C. 1987. Wildfire occurrence in aspen in the interior western United States. *Western Journal of Applied Forestry*. 2(3): 73-76.

The western United States contains 7 million acres of Populus tremuloides, most of which are even-aged stands resulting from root suckering after fires during the last 150 years. Fires no longer appear to be killing and regenerating such stands. It is recommended that prescribed fires should be burned in these stands to maintain the aspen for wildlife habitat, forage, yields of high-quality water and aesthetics.

Dickmann, D.; Baer, J.; Bowersox, T.; Drew, A.; Monroe, M.; Ostry, M.; Rousseau, R.; Solomon, J.; Weber, P.; Wright, L. 1987. Super trees or prima donnas? The truth about poplars. *American Nurseryman*. 165(3): 109-112, 114, 116-117.

Gendel's, T.V. 1987. A method of preparation for clearing leaves to study their venation. *Botanicheskii Zhurnal*. 72(3): 393-396.

Hilbig, W. 1987. Problems of the primary forest distribution in the Mongolian People's Republic. *Flora: Morphologie, Geobotanik, Oekophysiologie*. 179(1): 1-15.

Hoekman, D.H. 1987. Measurements of the backscatter and attenuation properties of forest stands at X-, C-, and L-band. *Remote Sensing of Environment*. 23(3): 397-416.

Hoganson, H.M.; Rose, D.M. 1987. A model for recognizing forestwide risk in timber management scheduling. *Forest Science*. 33(2): 268-282.

The general problem of uncertainty in timber management planning is briefly described in terms of a specific type of mathematical programming problem that recognizes uncertainty. The risk model is solved using a decomposed dual approach. The model was applied to scheduling red pine (Pinus resinosa) and aspen (Populus spp.) harvests in a hypothetical forest in the Lake States. Results were examined to identify potential shortcomings and possible improvements in the proposed approach.

Layton, P.A.; Wright, L.L. 1987. Energy crop research advances the fundamentals of forest biology. In: Southern forest biomass working group; 1987 June 8; Biloxi, MS. 18 p.

The Short Rotation Woody Crops Program sponsors research on tree and crop physiology, genetic improvement, and biotechnology. Genetic improvement of cottonwoods (Populus spp.) has produced clones with average yields of 25 dry Mg/ha/y. Models have been developed to describe both individual and stand growth in an effort to determine productivity and identify tree ideotypes that grow well in short-rotation intensive culture systems.

Nelson, R.E.; Carter, L.D. 1987. Paleoenvironmental analysis of insects and extralimital Populus from an early Holocene site on the Arctic slope of Alaska, U.S.A. Arctic and Alpine Research. 19(3): 230-241.

Bulk peat, containing well-preserved leaves of Populus balsamifera, was collected from 9,400-year-old fluvial deposits along the Ikpikpuk River. Analysis of pollen, and plant and insect macrofossils permitted reconstruction of the diversity of habitats present at that time.

Petrenko, N.M. 1987. Ecology of the leaf beetle Phratora laticollis Suffr. in the Angara lowlands. The Soviet Journal of Ecology. 17(4): 229-232.

Schmid, A.; Buchala, A.J. 1987. An examination of the growth substance activity of vitamin D₃. Journal of Plant Growth Regulation. 5(3): 175-180.

Taniguchi, T.; Herada, H. 1987. Characterization of calcium oxalate crystals in woody plants by X-ray microarea diffractometry. Experientia. 43(9): 1006-1008.

Tham, C. 1987. The Selective method - a new chemical method of treating deciduous trees in forestry. In: Weeds and weed control: 28th Swedish weed conference; 1987 January 28-29; Uppsala, Sweden; 1: 108-117.

The Selective is a motorized manual cutter which cuts stems up to 10 cm diameter, at the same time applying herbicide to the cut stumps via specially designed cushions at a rate of 1 ml/stem. Solutions of 96 and 192 g glyphosate/litre gave, respectively, 100 percent control of Betula pubescens and B. pendula after three growing periods and 80 percent control of Populus tremula after one growing season; imazapyr was also effective.

Visser, S.; Parkinson, D.; Hassall, M. 1987. Fungi associated with Onychiurus subtenuis in an aspen woodland. Canadian Journal of Botany. 65(4): 635-642.

Waddington, J. Bittman, S. 1987. Control of brush regrowth in northeastern Saskatchewan by several concentrations of herbicides applied with a roller. Canadian Journal of Plant Science. 67(2): 467-475.

A carpet-covered roller was used to apply 2,4-D, 2,4-D + picloram (9:1) and glyphosate at several concentrations on three pasture sites to control regrowth of Populus tremuloides, P. balsamifera, and Salix spp. growing with an understory of Rosa woodsii and Amelanchier alniflora, and to Symphoricarpos occidentalis. The treatments were not satisfactory on S. occidentalis because of poor coverage. The percentage of leaf area wetted was only about 10 percent, and evidence is presented that better coverage will result in better brush control with more dilute herbicide. Forage species suffered only minor and temporary damage.

Waddington, J.; Bittman, S. 1987. Effect of number of passes with a roller-applicator using dilute herbicide solutions on control of brush regrowth in northeastern Saskatchewan. Canadian Journal of Plant Science. 67(3): 845-848.

Experiments to control regrowth of Populus tremuloides and Salix spp. were conducted. Applying increasing amounts of several herbicide mixtures (2,4-D alone, 2,4-D + picloram (9:1) and glyphosate) by several passes with a

roller-applicator in different directions produced damage approximately in proportion to the number of passes made. At the rates used the three herbicide mixtures were equally effective on P. tremuloides, but Salix showed a better recovery the year following treatment with glyphosate.

Wilkinson, A.G. 1987. The return of the poplar. *Streamland*. 52: 4 p.

Before 1973, large numbers of poplars were planted every year in New Zealand for soil conservation and for horticultural and farm shelter. In that year, two poplar leaf rust fungi, Melampsora larici-populina and M. medusae, arrived and in succeeding years disease epidemics caused by these fungi severely affected growth and survival of many of the most common poplar varieties.

Zeng Dapeng; He Zhengxing. 1987. Studies on biological control of oil tea anthracnose. *Scientia Silvae Sinicae*. 23(2): 144-150.

1988

Balogh, J.C.; Grigal, D.F. 1988. Tall shrub dynamics in northern Minnesota aspen and conifer forests. Res. Pap. NC-283. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 15 p.

Gilman, E.F. 1988. Tree root spread in relation to branch dripline and harvestable root ball. *American Nurseryman*. 168(11): 85.

Johansson, T. 1988. Preventing stump regrowth with a herbicide-applying tree cutter. *Weed Research*. 28(5): 353-358.

Rauscher, H.M.; Isebrands, J.G.; Crow, T.R.; Dickson, R.E.; Dickman, D.I.; Michael, D.A. 1988. Simulating the influence of temperature and light on the growth of juvenile poplars in their establishment year. In: Conference on Forest growth modelling and prediction; 1987 August 23-27; Minneapolis, MN. Gen. Tech. Rep. NC-120. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 1: 331-339.

Rogstad, S.H.; Patton, J.C., II; Schaal, B.A. 1988. M13 repeat probe detects DNA minisatellite-like sequences in gymnosperms and angiosperms. *Proceedings of the National academy of sciences of the United States of America*. 85(23): 9176-9178.

Sauter, J.J.; van Cleve, B.; Apel, K. 1988. Protein bodies in ray cells of Populus x canadensis Moench 'Robusta'. *Planta*. 173(1): 31-34.

Tremolieres, M. 1988. Deoxygenating effect and toxicity of ground-up dried coniferous needles and deciduous leaves of Canadian trees in water: a preliminary study in comparison with litter of European trees. *Water Research*. 22(1): 21-28.

Two of the processes responsible for the harmful effects of leaf litter on the aquatic environment were studied, namely (i) deoxygenation of the water by the polyphenoloxidase-polyphenol system present in leaves, followed by

microbiological deoxygenation (such pollution, due to organic matter, being common), and (ii) direct toxicity for fish, probably of leaf compounds such as terpenes saponosides or phenols. These effects were compared for dried foliage from two poplars (Populus balsamifera and P. tremuloides) and from conifers harvested in summer.

Van Auken, O.W. 1988. Dynamics of establishment, growth, and development of black willow and cottonwood in the San Antonio River forest. *The Texas Journal of Science*. 40(3): 269-277.

Villar, M.; Gaget, M.; Dumas, C. 1988. Micro-isoelectric focusing of proteins from single stigmas of Populus. *Canadian Journal of Forest Research*. 18(10): 1261-1264.

Wherland, S.; Farver, O.; Pecht, I. 1988. Three-dimensional model of stellacyanin and its implications for electron transfer reactivity. *Journal of Molecular Biology*. 204(2): 407-415.

GENETICS

1975

Baker, J.B.; Randall, W.K. 1975. Foliar nitrogen and potassium variation in cottonwood as affected by genetic and site factors. In: Proceedings, 9th Central States forest tree improvement conference: 106-111.

Barnes, B.V. 1975. Phenotypic variation of trembling aspen in western North America. *Forest Science*. 21(3): 319-328.

Destremau, D.X.; Bellefontaine, R.; Pitcher, J.A. 1975. Forest genetics resources information - No. 4. FAO Forestry Occasional Paper. 1: 68 p.

Most of this issue is concerned with the "Proposals for a global program for improved use of forest genetic resources" approved by the FAO panel of experts on forest genetics resources in May 1974.

Guzina, V. 1975. Genetic polymorphism of the isoenzymes of peroxidase and esterase in Populus deltoides. *Topola*. 18/19(103/106): 170-176.

The incidence is reported of 6 isoperoxidases and 2 isoesterases in the leaves of 34 half-sib families from 11 states of the USA grown at Novi Sad, Yugoslavia.

Jones, A.G.; Seigler, D.S. 1975. Flavonoid data and populational observations in support of hybrid status for Populus acuminata. *Biochemical Systematics and Ecology*. 2(3/4): 201-206.

Data from the collection sites of several samples of P. acuminata suggest that this taxon is a hybrid between P. angustifolia (section Tacamahaca) and any one of two or three different species of the section Aigeiros. The foliage is characterized by morphological intermediacy and an additive flavonoid profile compared with the parental taxa.

Petrov, S.A. 1975. The heritability of height in forest trees. *Genet., Seleksiya, Semenovodstvo i Introduktsiya les. Porod*, 2: 7-15. *Referativnyi Zhurnal*. (1976) 11.55.148.

A study of the heritability of linear growth rate in populations of Quercus robur, Betula verrucosa, and Populus species revealed that the additive effect of genes controlling the character was small, indicating that mass selection by phenotype in these populations without subsequent testing of seed progeny would be ineffective.

Sekawin, M. 1975. Genetics of Populus alba. *Annales Forestales*. 6(6): 159-189.

The characteristics of Populus alba are reviewed, including systematics, distribution, wood characteristics, pests and diseases, methods of reproduction, cytology, and hybridization. Details are given of improvement programs.

Smilga, J. 1975. Variation in the morphological characters of aspen. *Jaunakais Mezsaimnieciba*. 18: 27-35. *Referativnyi Zhurnal*. (1976) 4.55.408.

Data are presented from a study (1972) of variation in height, trunk, and branch diameter and timber density, and also of the heritability of these characters and of the combining ability of parental forms.

Smilga, Ya.Ya. 1975. Variation in anatomical characters of the wood in aspen. Genet. issled. drevesn: 68-79. Referativnyi Zhurnal. (1976) 4.55.407.

In a study of the vessels, medullary rays and libriform fibers of a vegetative progeny aged 1-5 and a sexual progeny aged 2-6 years, differences were found between separate families and clones in the anatomical characters studied.

Tamm, Yu.A.; Yarvekyul'g, L.Ya. 1975. Results of studies of triploid aspen in the Estonian SSR. Lesovedenie. 6: 19-26.

The methods and results are described of a cytological analysis which has shown that the largest and most productive aspens in Estonia are triploids. Though the triploids had, in general, longer stomata in the leaves than the diploids, this character alone proved unreliable as an indirect indication of polyploidy. The triploids exceeded the diploids in such measurements as length and width of the leaf blade.

Valentine, F.A. 1975. Genetic control of sex ratio, earliness and frequency of flowering in Populus tremuloides. In: Proceedings, 22d Northeastern tree improvement conference: 111-129.

Wollenweber, E. 1975. Flavonoid pattern as a systematic character in the genus Populus. Biochemical Systematics and Ecology. 3(1): 35-45.

The compounds found in the lipophilic coating secreted by buds of 80 taxa of Populus have been examined. Thirty compounds have been identified and their distribution related to the taxonomy of the genus. Flavonoid patterns allow species of the sections Aigeiros and Tacamahaca and some hybrids to be characterized, provided several individuals are examined.

1976

1976. Genetic improvement of forest tree species in Quebec.

No. 30. Quebec, Canada: Memoire, Service de la Recherche, Ministere des Terres et Forets. 217 p. [Forestry Abstracts (1979) 40(3): Abst. 840.]

Introductory chapters of this report deal with the organization of forest tree breeding in Quebec. Available knowledge is then reviewed with reference to species from the following genera: Juglans, Quercus, Populus, Betula, Fraxinus, Acer, Pinus, Picea, Abies, and Larix.

Farmer, R.E., Jr. 1976. Relationships between genetic differences in yield of deciduous tree species and variation in canopy size, structure and duration. In: Cannell, M.G.R.; Last, F.T., eds. Tree physiology and yield improvement--shoot and cambial growth. London, UK: Academic Press: 119-137.

This area of forest genetics is reviewed under the headings: (1) canopy characteristics, (2) ecological studies, (3) shoot and foliage development, and (4) genetic variation, with particular reference to Juglans nigra, Populus, Quercus, Fagus, Liquidambar styraciflua, and Acer.

Fechner, G.H. 1976. Development of unpollinated ovules of quaking aspen. In: Proceedings, 23d Northeastern forest tree improvement conference: 150-157.

Ganchev, P. 1976. Genetic studies of some aspen and hybrid forms obtained by treating the seeds with gamma rays and colchicine solution. Gorskostopanska Nauka. 13(1): 3-15.

Seeds of P. alba, P. tremula, and their hybrid were treated with various doses of gamma rays and colchicine solutions. All plants obtained by gamma irradiation were diploid, but many had morphological and anatomical mutations affecting the leaf, such as increases in leaf size and deformed palisade cells. In some tetraploids and diploids, aberrations were observed during mitosis, including lagging chromosomes in metaphase and bridges in anaphase.

Garrett, P.W.; Shigo, A.L.; Carter, J. 1976. Variation in diameter of central columns of discoloration in six hybrid Poplar clones. Canadian Journal of Forest Research. 6(4): 475-477.

The percent of the stem diameter that was discolored in 24-year-old poplar clones grown in Maine varied by clones from 55.8 to 85. Individual clone is more important than parentage. The cause of discoloration is not discussed except to note that it is often the first stage of decay.

Grudzinskaya, L.M. 1976. Intraspecific variation and the structure of natural populations of Populus pruinosa Schrenk. Nauka: 21-22. Referativnyi Zhurnal. (1977) 1.56.121.

Under unfavorable conditions the variation in morphological characters increased and the population tended to separate into forms differing in their degree of adaptation. The marked ecological variation in the characters studied indicated the possibility of distinguishing edaphotypes within a population.

Hamilton, D.; Langridge, P. 1976. Trinucleate pollen in the genus Populus. Experientia. 32(4): 467-468.

By means of light microscopy on whole pollen grains following staining with lactoporphonic-orcein, and microspectrophotometric determinations of DNA content, it was found that predominantly trinucleate pollen is produced in Populus nigra var. italica, P. yunnanensis, P. deltoides var. angulata, and P. alba var. bolleana.

Maiorchik, I.B. 1976. Endogenous variation in poplars of the subgenus Leuce and their hybrids. Tr. In-ta ekol. rast. i zhivotnykh, Ural'sk. Nauch. tsentr AN SSSR. 94: 127-131. Referativnyi Zhurnal. (1976) 6.55.383.

A study was made of variation in the characters of the leaf in Populus alba, P. bolleana, P. tremula, P. alba X P. bolleana, and P. tremula X P. bolleana.

Maiorchik, I.B. 1976. Inheritance of morphological characters of the leaves in poplar hybrids. Nauch. tr. Tyumen. un-t. 23: 146-148.

Nine characters were studied in 20-year-old progenies of Populus alba X P. bolleana, and P. tremula X P. bolleana. In some characters the first hybrid was intermediate, in others it resembled one of its parents and in others it was different from its parents. In the progeny of the second hybrid, many

transitional forms were found. In most cases the hybrids combined the parental characters.

Matheson, A.C.; Brown, A.H.D.; Hartney, V.J.; et al. 1976. Genetics. In: Research activities, annual report 1975-1976. Canberra, ACT, Australia: Commonwealth Scientific and Industrial Research Organization, Division of Forest Research: 30-39.

Brief summaries are given of research in progress.

Nepveu, G. 1976. Wood quality juvenile mature correlations. Cestas, France: INRA: 203-204.

Studies of phenotypic, genetic, and genotypic juvenile/mature correlations in Pinus pinaster, different Populus clones, Abies alba, Terminalia ivorensis, and Pseudotsuga menziesii.

Petrov, M. 1976. Features of the inheritance of some characters in the hybrid progeny of Populus nigra L. cv. Schipka and Populus simonii Carr. var. pendula Schn. Gorskostopanaka Nauka. 13(4): 3-12.

The F1 interspecific hybrid inherited the pyramidal crown of its female parent, P. nigra. The differences in the extent of the pyramidal habit in the hybrids indicated the cumulative effect of polygenes. Bark color was not intermediate in all the hybrids; the results obtained indicate that it is controlled by the complementary action of nonallelic genes.

Stettler, R.F.; Guries, R.P. 1976. The mentor pollen phenomenon in black cottonwood. Canadian Journal of Botany. 54(9): 820-830.

Populus trichocarpa pollen irradiated with 0.4, 1.0, 10, and 100 kR of gamma rays was indistinguishable from normal pollen in germination and tube growth in situ and promoted fruit development on cut branches. However, it failed to set seed after the highest dosage. Mixtures of 20, 40, and 80 kR-irradiated P. alba pollen with foreign pollen resulted in good fruit development but little seed set. Hybrid seedlings were weak and susceptible to early mortality.

Stettler, R.F.; Illies, Z.M.; Bawa, K.S.; et al. 1976. Forest genetics. Proceedings, Congress Group 4. In: 14th IUFRO world congress: Division 2; 1976 June 20-July 2; Oslo, Norway. As, Norway: IUFRO: 260-308.

Willing, R.R.; Pryor, L.D. 1976. Interspecific hybridization in poplar. Theoretical Applied Genetics. 47(3): 141-151.

Ying, C.C.; Bagley, W.T. 1976. Genetic variation of eastern cottonwood in an eastern Nebraska provenance study. Silvae Genetica. 25(2): 67-73.

Clones derived from 116 families of 11 American provenances of Populus deltoides were established in eastern Nebraska at 40degN latitude in 1966 and observed for 7 years. Over 90 percent of the clones from south of 33degN latitude died or suffered severe winter injury. Ranking in total height among provenances did not vary much after the third growing season. Eastern provenances were characterized by rough thick bark, coarse branching, and large leaves with many glands. Leaf flushing and anthesis were highly

correlated. The number of male and female clones was nearly equal and no vegetative differences were detected between the sexes.

1977

Cooper, D.T.; Ferguson, R.B. 1977. Removal of competition bias from forest genetics experiments. In: Proceedings, 14th Southern forest tree improvement conference: 70-77.

du Cros, E.T. 1977. A brief account of the hereditary transmission of some juvenile characteristics in Populus nigra. Annales des Sciences Forestieres. 34(4): 311-322.

One female P. nigra was chosen at random from each of 21 stands in the French Alps and seed was collected from them. The trees were free-pollinated, but each from within its own stand; the male parents were therefore different in each case. Vegetatively propagated plants of each mother tree and its descendants were compared in a nursery at Orleans. There are indications that phenological characters and susceptibility to Melampsora larici-populina have high heritability. These characters have a high parent-offspring correlation. In relation to possibilities for selection it was found that high growth rates were correlated with late flushing, but also with susceptibility to M. larici-populina. Wide branching angles were also correlated with late flushing.

du Cross, E.T. 1977. Some aspects of the inheritance of a few juvenile characteristics in Populus nigra L. Annales des Sciences Forestieres. 34(4): 311-322.

Karnosky, D.F. 1977. Evidence for genetic control of response to sulfur dioxide and ozone in Populus tremuloides. Canadian Journal of Forest Research. 7(3): 437-440.

Luomajoki, A. 1977. Effects of temperature on spermatophyte male meiosis. Hereditas. 85(1): 33-48.

Eleven forest-tree species were studied to investigate the duration of the diacinesis and telophase II phases of meiosis and to gather information on the sensitivity of the PMCs to extreme temperatures. Different methods for studying the duration of meiosis are compared and criticized. On the evidence of the material presented, meiosis in Populus tremula proceeds faster than that in any other species studied. It is considered that the idea that any phase of meiosis is similar in duration in different spermatophyte species should be discarded. It is shown, at least for conifers, that the relative duration of some phases of meiosis is different from that for cereals.

Popnikola, N. 1977. Contribution to the study of variability of the aspen in the area of Bitola. Topola. 21(113/114): 11-19.

Shigo, A.L.; Shortle, W.C.; Garrett, P.W. 1977. Genetic control suggested in compartmentalization of discolored wood associated with tree wounds. Forest Science. 23(2): 179-182.

Sixty 25-year-old trees of nine hybrid clones from the cross Populus deltoides X P. trichocarpa were wounded in 1975. After six months, nine trees in three clones had effectively walled off the discolored wood associated with wounds. It is suggested that the walling off process may be under genetic control.

1978

. 1978. A study on types of Populus tomentosa Carr. Chung-Kuo Lin Yeh K'o Hsueh. 1: 14-20.

Frankel, O.H.; Keiding, H.; Kemp, R.H.; et al. 1978. In: Brown, A.G.; Palmberg, C.M., eds. Third world consultation on forest tree breeding. Session 1. Exploration, utilization and conservation of gene resources. Canberra, Australia: CSIRO: 1-112.

Four invited special papers on genetic conservation.

Hattemer, H.H. 1978. The importance for forestry of genetic diversity in forest trees. Forstarchiv. 49(12): 249-256.

The tendency for the genetic diversity of tree plantations to be reduced is illustrated by contrasting the number of clones of poplar in W. German populations over the period 1955-1975 with the considerably greater number of potato varieties under cultivation during this period. The potential use of polymorphic gene loci as markers for genetic selection is discussed, and illustrated by published data for Norway spruce provenances.

Murkaite, R.I.; Ramanauskas, V.I. 1978. Clonal structure and diversity of forms in aspen in the Lithuanian SSR. Seleksiya drevenn: 89-96. Referativnyi Zhurnal. (1979) 6.56.121.

Information is presented on Lithuanian clones of P. tremula.

Pesina, K. 1978. Meiosis and the distribution of chromosomes in tetraploid aspen. Genetika a Slechteni. 14(4): 241-249.

Diploid male specimens of Populus tremula normally had 19II or, very rarely, 18II plus 2I. Tetraploids varied around a mean of 7IV plus 24II. When, in quadrivalents, the coorientation of centromeres on the spindle was unfavorable, lagging chromosomes occurred, and separation of the chromosomes was unequal in about 22 percent of microsporocytes. Five or six pollen grains were formed from such cells instead of the normal tetrad, and 35 percent of all pollen grains possessed fewer than 38 chromosomes.

Ronald, W.G. 1978. Irregular flowering bud conformation in a hybrid poplar. Canadian Journal of Botany. 56(3): 369-370.

1980

Cheliak, W.M. 1980. Genetic variation in natural populations of Populus tremuloides. Genetics. 94: 4 p.

Vegetative reproduction results in a mosaic of clones throughout the extensive natural range of this species. An electrophoretic survey of 26 loci in 222 trees from 7 natural populations in Alberta demonstrated great variability. Results of the survey conformed to those predicted by the model for a population with a rate of sexual establishment greater than $1/N$, where N is the population size. The model states that under these conditions, vegetative reproduction has no effect on the population. Therefore, the high level of observed variation is not an artifact of the mode of natural reproduction.

1982

Dhir, K.K.; Chark, K.S.; Khurana, D.K.; Dua, I.S. 1982. Changes in the protein bands in pollen grains of Populus ciliata during storage and its effect on their viability and germination. *Silvae Genetica*. 31(1): 6-8.

Gallagher, Peter Wilmer. 1982. Genetic variation and growth regulator effects on wound response among Acer and Populus taxa. Dissertation Abstracts International. 43/01-B: 5.

In a trial of 3 growth regulators 4 concentrations on wounds of Acer rubrum 'Bowhall', 2,4-dichlorophenoxyacetic acid (2,4-D) at 1,000 mg/l H₂O provided only an initial increase in closure rate. Ethephon and benzyl adenine were ineffective at lower concentrations and inhibitory to closure at 1,000 mg/l. Results of a follow up study indicated a phytotoxic response upon application of 2,4-D at 10,000 mg/l. Tape applied to wounds significantly increased closure rate over untaped control wounds. 2,4-D, IAA, IBA, and dicamba at 1,000 mg/l and picloram at 10 mg/l provided an initial stimulatory effect on closure rate of Populus X androsocoggin wounds. Picloram was phytotoxic above the 10 mg/l rate.

Lehn, G.A.; Higginbotham, K.O. 1982. Natural variation in merchantable stem biomass and volume among clones of Populus tremuloides Michx. *Canadian Journal of Forest Research*. 12(1): 83-89.

Stand density and biomass and volume of merchantable stems were determined and compared for six clones on each of two different sites in Alberta. Broad sense heritability estimates suggest that approximately one-third of the variation in biomass and volume of trees growing on each site was genetically based.

Prudic, Z. 1982. Hypothesis to explanation of various forms of frequency polygons of heights of aspen seedlings. *Communicationes Instituti Forestalis Cechosloveniae*. 12: 159-170.

Eight types of frequency 'polygon' (distribution) were regularly observed in the height variation of 1-year-old F1 progenies of hybrid aspen (Populus tremula X P. tremuloides). These were interpreted as the result of two Mendelian characters for height growth and height variance. The double recessive appeared to be fast-growing and less variable. Results suggest that the inheritance of quantitative characters may depend on only a few genes.

Ronald, W.G. 1982. Intersectional hybridization of Populus sections, Leuce-Aigeiros and Leuce-Tacamahaca. *Silvae Genetica*. 31(2/3): 94-99.

Viart, M. 1982. Usefulness of forest genetics to extension of poplar farming in India. *Journal of Tree Science (France)*. 1(1/2): 8-16.

Poplar farming is traditional in Kashmir and has recently been extended southwards (to latitude 28degN) using a few exotic cultivars. Initial results are promising but a careful study of the problems involved is recommended. These include the identity and distribution of the Indian species of Populus, the nomenclature, and the kinds of improvement programs needed in India. The exchange of living material between countries is briefly discussed with particular reference to phytosanitary measures.

Wang, M.X.; Huang, M.R.; Chen, D.M.; et al. 1982. Isozyme analysis in clone identification of Aigeiros poplars. *Journal of Nanjing Technological College of Forest Products*. 1: 105-111.

The results of an analysis of peroxidase isozymes in 13 clones of Populus nigra, P. deltoides, and P. X euramericana (P. canadensis). Numbers and RF values of bands separating on polyacrylamide gel electrophoresis were characteristic of each clone and suitable for use in identification.

1983

Friend, M.M. 1983. Genetic variation in juvenile traits of eastern cottonwood from the southern United States. *Forestry Abstracts*. 44(10): 611-612.

Noh, E.R.; Lee, S.K. 1983. Reselection of Populus alba X Populus glandulosa F1 clones using stability analysis. Res. Rep. 19. Suweon, Korea: The Institute of Forest Genetics: 20-27.

Reddy, K.V. 1983. Variation in specific gravity within and between trees and clones of Populus deltoides Bartr. *Forest Products Abstracts*. 6(11): 323-324.

Schalk, P.H. 1983. Twenty years testing of clones of European black poplar, Populus nigra L. *Populier*. 20(4): 91-99.

A report on a study of 205 clones planted in 20 plantations between 1966 and 1976. Form and growth, flushing and the occurrence of adventitious shoots were assessed. Good clones were found to equal P. 'Robusta' in growth. Seven clones have been released to the trade.

Wang, M.X.; Huang, M.R.; Chen, D.M.; Chen, T.H.; Xu, N.; Zhu, H. 1983. A genetic analysis of peroxidase isoenzymes in poplars. *Journal of Nanjing Technological College of Forest Products*. 3: 137-140.

Peroxidase isozymes were analyzed in poplar parents and controlled pollination hybrid progeny, as part of an investigation to find a fast and reliable method of identifying hybrids and evaluating genetic variation. Isozymes in the combinations Populus 'I-69/55' X P. simonii and P. 'I-69/55' X P. maximowiczii were those of the combined parents, and showed a regular variation.

1984

Brissette, J.C.; Barnes, B.V. 1984. Juvenile height growth of aspen species and hybrids in southeastern Michigan. *Canadian Journal of Forest Research*. 14(6): 959-961.

The possibility that Populus grandidentata and P. tremuloides may eventually form a hybrid swarm through their hybrid (P. X smithii) and backcrosses was studied. The competitive relationships among the taxa were examined by comparing their juvenile growth. The F1 hybrid and backcrosses to either parent grew in height nearly as well as P. tremuloides through their second year from seed. P. grandidentata was outgrown by the hybrids and backcrosses for the first year but grew to approximately the same total height by the end of the second season. Seedlings of hybrids and backcrosses exhibited neither hybrid vigor nor marked growth inferiority compared with those of the parents. It is concluded that eventual 'swamping out' of the parents might be possible.

Brissette, J.C.; Burton, V.B. 1984. Comparisons of phenology and growth of Michigan and western North American sources of Populus tremuloides. *Canadian Journal of Forest Research*. 14(6): 789-793.

Progeny from 13 local clones and from 12 clones from 5 locations in Alaska, Alberta, and Utah were grown at a nursery in southeastern Michigan. The progeny of the western clones broke bud as much as 2 weeks before, and stopped growth up to 2 months earlier than local clones. After 2 years the western progeny averaged only 26-38 percent of the height of the Michigan progeny. In an earlier study (previously unreported) survival and growth of ramets from 49 clones collected from British Columbia to Colorado and planted in southeastern Michigan were studied after 7 years. Only 30 percent of the 116 ramets and 39 percent of the clones survived. It is suggested that the poor performance of western clones in both experiments is probably due to their adaptation to longer photoperiods and/or lower growing season minimum temperatures than occur in southeastern Michigan.

Cheliak, W.M.; Pitel, J.A. 1984. Electrophoretic identification of clones in trembling aspen. *Canadian Journal of Forest Research*. 14(5): 740-743.

An electrophoretic technique which can be used to aid the identification of clones is described. An example using members (putative ramets) from 10 morphologically distinct putative clones of Populus tremuloides is presented. It was demonstrated that phenotypically uniform groups of trees (putative clones) can actually be composed of several electrophoretically distinct genotypes.

Eckenwalder, J.E. 1984. Natural intersectional hybridization between North American species of Populus in sections Aigeiros and Tachamahaca. 1. Population studies of P. X parryi. *Canadian Journal of Botany*. 62(2): 317-324.

Eckenwalder, J.E. 1984. Natural intersectional hybridization between North American species of Populus in sections Aigeiros and Tachamahaca. 2. Taxonomy. *Canadian Journal of Botany*. 62(2): 325-335.

Eckenwalder, J.E. 1984. Natural intersectional hybridization between North American species of Populus in sections Aigeiros and Tachamahaca. 3. Paleobotany and evolution. Canadian Journal of Botany. 62(2): 336-342.

Eriksson, G.; Gullberg, U.; Kang, H.; et al. 1984. Genetic research in connection with short-rotation forestry. In: Perttu, K.L., ed. Ecology and management of forest biomass production systems. Lantbruksuniversitet. 15: 199-281.

Four papers.

Gulyaeva, E.M.; Mashkina, O.S.; Sivolapov, A.I. 1984. Variability in poplar induced by chemical mutagens. Soviet Genetics. 20(4): 495-503.

Guries, R.P. 1984. Genetic variation and population differentiation in forest trees. In: Lanner, Ronald M., ed., comp. Proceedings, 8th North American forest biology workshop; 1984 July 30-August 1; Logan, UT. Logan, UT: Utah State University, Department of Forest Resources: 119-131.

Heilman, P.E. 1984. Short-rotation poplar culture in the Pacific Northwest: components of a genetic program. In: Perttu, K.L., ed. Ecology and management of forest biomass production systems. Lantbruksuniversitet. 15: 217-232.

A genetic program is described concerned with the development of black cottonwood clones (Populus trichocarpa T. and G.) to be grown in short-rotation intensive culture for fuel, fiber, and structural uses. Emphasis is placed on developing materials adaptable to varied and somewhat unpredictable environments. The program combines interspecific hybridization of P. trichocarpa and P. deltoides with careful evaluation in a three-phase testing procedure. The importance of parallel genetic studies in natural populations and plantations derived from them, is recognized.

Hyun, J.O. 1984. Inheritance of isoenzymes in root tips of trembling aspen. Journal of Korean Forestry Society. 64: 20-25.

Electrophoretic analysis of 7 enzymes extracted from young roots of 5 parental clones and their full-sib progeny, at 7 weeks old, indicated that the isoenzyme variants of every isoenzyme zone were under the control of codominant alleles at a single locus. Segregation data showed that none of the loci were linked.

Kaul, R.B.; Kaul, M.N. 1984. Sex-ratios of Populus deltoides and Salix amygdaloides in Nebraska. Southwestern Naturalist. 29(3): 265-269.

Khalil, M.A.K. 1984. The potential of poplars in the boreal regions. II. Genotypic stability and productive quality of clones. Silvae Genetica. 33(1): 8-11.

The data from a four site clonal trial of poplar species and hybrids in Newfoundland, Canada, were analyzed to quantify site X clone interaction and to identify superior clones on the basis of genotypic stability and productive quality of the tested clones. Site X clone interaction was significant for all clones, and the following were selected as suitable for planting in boreal regions: Populus euramericana (P. canadensis) from W. Germany and Italy, P. deltoides from Newfoundland and P. canescens X (alba X grandidentata) (P.

canescens from Czechoslovakia, P. alba X P. grandidentata from Ontario, Canada).

Luomajoki, A. 1984. The tetrad phase of microsporogenesis in trees with reference to the annual cycle. *Hereditas*. 101(2): 179-197.

Reighard, Gregory Lynn. 1984. Physiological genetics studies of Populus grandidentata, Populus tremuloides, and their hybrid, Populus X smithii. Dissertation Abstracts International. 45/12-B: 3718.

Populus tremuloides (trembling aspen) and P. grandidentata (bigtooth aspen) are sympatric Michigan species which occasionally hybridize. The best planting method was placing the seedling root collars 15 cm below the soil surface and using the preemergent herbicide, simazine. The herbicides diuron and linuron were not effective in controlling weeds.

Wang, M.X.; Huang, M.R.; Ni, W.T.; Xu, N.; Yuang, M.Z.; Chen, D.M. 1984. Relationship between the fatty acid contents in the cell membrane and the frost resistance of Populus clones. *Journal of Nanjing Institute of Forestry*. 4: 29-34.

Results of studies on the hybrid progenies of P. simonii (as male parent), including P. 'Lux' ('I-69/55') X P. simonii, indicated that the ratio of linoleic to linolenic acids could be used as an index of frost resistance.

Yanchuk, A.D.; Dancik, B.P.; Micko, M.M. 1984. Variation and heritability of wood density and fibre length of trembling aspen in Alberta, Canada. *Silvae Genetica*. 33(1): 11-16.

Fifteen Populus tremuloides clones in north-central Alberta were sampled by taking large increment cores from the southern radius at diameter height. Wood density measurements were made on 4-year sections of the cores, and fiber lengths were measured on every second 4-year section. There were significant clonal differences for both wood density and fiber length. Fiber length was short near the heart and increased towards the bark. There was a slight negative phenotypic correlation between wood density and growth rate, and a slight positive phenotypic correlation between fiber length and growth rate.

1985

Barns, B.V.; Pregitzer, K.S. 1985. Occurrence of hybrids between bigtooth and trembling aspen in Michigan. *Canadian Journal of Botany*. 63(10): 1888-1890.

Bloese, P.; Fechner, G.H. 1985. Variation and heritability of growth and rooting characteristics in narrowleaf cottonwood in Colorado. In: Proceedings, 4th North Central tree improvement conference. Madison, WI: University of Wisconsin-Madison, Department of Forestry: 149-156.

Gallo, L.A. 1985. Genetic and environmental variation in aspen. Part 1. Germination and weight of seed. *Silvae Genetica*. 34(4/5): 171-181.

The genetic and environmental variation of seed weight, germination capacity, germination rate, and 'pre- and post-germination abnormalities' were investigated in 49 full sib families of aspen (Populus tremula and P.

tremuloides) in a complete factorial crossing design. The maternal variance component was clearly greater than the paternal one for germination capacity and pre- and post-germination abnormalities, but this difference was not found for seed weight or germination rate. Seed weight, germination rate, and germination capacity were only correlated with plant height at the end of the third month.

Heilman, P.E. 1985. Sampling and genetic variation of foliar nitrogen in black cottonwood and its hybrids in short rotation. *Canadian Journal of Forest Research*. 15(6): 1137-1141.

A trial was established in 1979 near Sumner, Washington with cuttings from 5 trees in 10 stands representing major populations of Populus trichocarpa. Cuttings were also included from three new P. trichocarpa X P. deltoides hybrids, P. 'Robusta' and a clone from Oregon (Cottage Grove). Significant interactions occurred between populations and year and between clones and year. N concentration was greater in leaves from the upper and middle crown than in those low in the crown. A significant decline in N occurred in most clones from mid-August to mid-October, and from first year to sixth year.

Heilman, P.E.; Stettler, R.F. 1985. Genetic variation and productivity of Populus trichocarpa and its hybrids. II. Biomass production in a 4-year plantation. *Canadian Journal of Forest Research*. 15(2): 384-388.

Productivities of 5 black cottonwood clones from each of 10 source populations were compared at one plantation site in western Washington. The source populations were located west of the Cascade Mountains, between central Oregon and southern British Columbia. Southwestern clones were generally more productive. The high yields in this experiment are attributed to favorable climate, cultural treatments, and the genetic constitution of certain clones. The data promise substantial gains in short-rotation productivity from combining clonal selection with interspecific hybridization.

Khurana, D.K. 1985. Sexual dimorphism in Populus ciliata Wall. ex Royle. *Journal of Tree Sciences*. 4(1): 57-60.

Lu, Z.H.; Liu, Y.X.; Zhang, P.G. 1985. A study on the spontaneous doubling of chromosome number of poplar pollen plants. *Scientia Silvae Sinicae*. 21(3): 227-233.

Haploid plants were obtained by in vitro culture of anthers collected from a hybrid between Populus simonii X P. nigra and P. berolinensis Dippel. Results indicated that from being a chimaera dominated by haploid cells, the plants had become gradually quantitatively dominated by diploid cells. The number of chromosome had doubled by the age of 7-8 years and the plants became completely diploid.

Noh, E.R.; Lee, S.K.; Koo, Y.B.; Byun, K.O.; Kim, J.J. 1985. Repeatabilities and genetic gains of some characters in Populus alba X Populus glandulosa F1 clones. Res. Rep. 21. Suweon, Korea: The Institute of Forest Genetics: 27-36.

Pang, G.C.; Han, Y.F.; Yang, Z.X.; Tong, Y.C. 1985. The immunochemical analysis of the fertilizing process of double male parent of Populus 'Popularis'. *Scientia Silvae Sinicae*. 21(3): 281-285.

P. 'Popularis' is a hybrid of P. simonii fertilized by a pollen mixture of P. nigra var. italica and Salix matsudana (in the ratio 1:8). For investigation of the function of the second male in the fertilizing process, the genetic mechanism of P. 'Popularis' was analyzed using immunochemical techniques. It is suggested that fertilizing with pollen from 2 males is a feasible method for obtaining a hybrid which integrated DNA fragments from the second male.

Reighard, G.L.; Hanover, J.W. 1985. Genetic analyses of physiological and morphological traits in Populus grandidentata, P. tremuloides, and their hybrids. In: Proceedings, 4th North Central tree improvement conference. Madison, WI: University of Wisconsin-Madison, Department of Forestry: 124-139.

Said, C.; Zandonella, P.; Gaude, T.; Dumas, C. 1985. Cytochemistry of the stigma surface components using the print technique. In: Willemse, M.T.M.; van Went, J.L., comps. Proceedings, 8th International symposium: Sexual reproduction in seed plants, ferns and mosses; 1984 August 20-24; Wageningen, The Netherlands. Wageningen, The Netherlands: Pudoc: 83 p.

Son, D.S.; Joo, S.H. 1985. Inheritance of four isozymes (GOT, ACP, MDH, and ADH) in Populus alba X P. glandulosa F1 hybrids. Journal of Korean Forestry Society. 71: 90-98.

Uddin, M.R.; Jokela, J.J.; Myer, M.M., Jr. 1985. Production of haploid and dihaploid plants for use in genetic studies and breeding of poplars. In: Proceedings, 4th North Central tree improvement conference. Madison, WI: University of Wisconsin-Madison, Department of Forestry: 157-166.

Weber, J.C.; Stettler, R.F.; Heilman, P.E. 1985. Genetic variation and productivity of Populus trichocarpa and its hybrids. I. Morphology and phenology of 50 native clones. Canadian Journal of Forest Research. 15(2): 376-383.

Morphological and phenological variation among 5 black cottonwood clones from each of 10 natural populations were studied at one plantation site in western Washington. The 50 clones displayed a large range of variation in 15 leaf, branch, and phenology characters studied from 1979 to 1982. Clones and populations differed significantly in 14 and 10 characters, respectively. The most consistent genetic clone followed a geographic gradient from southwest to northeast: southwestern clones developed smaller leaves on more numerous and more erect branches, and continued growth later in the autumn. The results point to the great potential of clonal selection for black cottonwood improvement.

1986

Ahuja, M.R. 1986. Storage of forest tree germplasm in liquid nitrogen. *Silvae Genetica*. 35(5/6): 249-251.

Seeds of Abies alba, Picea abies, Pinus sylvestris, Larix decidua, Fagus sylvatica, and Populus tremula X P. tremuloides were stored for 1 and 6 days in liquid nitrogen (-196degC). Comparison with seeds stored at 0degC showed

that there was no significant loss of viability after storage in liquid nitrogen, except in F. sylvatica. Relatively large seeds, such as those of F. sylvatica, may be more prone to freezing/thawing injury than small seeds.

Comtois, P.; Simon, J.P.; Payette, S. 1986. Clonal constitution and sex-ratio in northern populations of balsam poplar Populus balsamifera. Holarctic Ecology. 9(4): 251-260.

Dobrinov, I.; Gagov, V. 1986. A case of polygamic sex distribution in poplars. Gorskostopanska Nauka. 23(1): 79-82.

A note is given on a rare case in which three types of aments (male, female, and mixed) formed during the development of an individual poplar hybrid (Populus alba X P. tremula).

Farmer, R.E., Jr.; Reinholt, R.W. 1986. Genetic variation in dormancy relations of balsam poplar along a latitudinal transect in northwestern Ontario. Silvae Genetica. 35(1): 38-42.

Populus balsamifera clones from five populations along a transect from N. Wisconsin, USA, to Hudson's Bay, Canada, were examined in a forcing study. The plants showed unconditional physiological dormancy in autumn, but required a relatively short chilling period to overcome this dormancy. Bud break was promoted by a range of temperatures which were equally effective in terms of response to degree hours.

Hommo, L.M.; Sarkilahti, E.M. 1986. A method of counting chromosomes of hardwood trees using root tips and young leaves. Canadian Journal of Forest Research. 16(2): 401-403.

Double staining with Feulgen and Giemsa stains allowed counting of mitotic chromosomes of normal and colchiploid forms of Betula papyrifera and natural diploid and triploid forms of Populus tremula.

Lee, S.K.; Noh, E.R.; Koo, Y.B. 1986. Intergenotypic competition of hybrid poplar in nursery. Res. Rep. 22. Suweon, Korea: The Institute of Forest Genetics: 26-29.

Rajora, O.P.; Zsuffa, L. 1986. Sporophytic and gametophytic gene expression in Populus deltoides Marsh; Populus nigra L., and Populus maximowiczii Henry. Canadian Journal of Genetics and Cytology. 28(3): 476-482.

Rajora, O.M. Prakash. 1986. Studies on genetics and relationships of Populus deltoides Marsh; P. nigra L. and P. maximowiczii Henry using isozymes, pollen competition and leaf morphology. Dissertation Abstracts International. 47/10-B: 4021.

The genetic structure of P. deltoides, P. nigra, and P. maximowiczii clones was studied based on allozymes of 12 enzymes assayed by starch gel electrophoresis in root tips. The zymograms of each enzyme system in the three species were interpreted and described. The allelic variation parameters were determined in clones of each species. The inheritance of isozymes at loci coding for 12 enzymes was studied. Results showed Mendelian single-gene control of the isozyme variants at each of 35 loci studied in P. deltoides, 35 loci in P. maximowiczii, and 37 loci in P. nigra.

Ridge, C.R.; Hinckley, T.M.; Stettler, R.F.; van Volkenburgh, E. 1986. Leaf growth characteristics of fast-growing poplar hybrids (Populus trichocarpa X P. deltoides). Tree Physiology. 1(2): 209-216.

Weekly measurements of leaf length and width, and tree height and girth were made during May-October 1984-1985 on first year shoots on 1- and 2-year-old clonal rootstocks and 4-year-old seedling rootstocks of 7 provenances of P. deltoides, 4 of P. trichocarpa, and 3 hybrids between them growing near Sumner, Washington. Hybrids had larger leaves than either parent. Measurements showed that the hybrids inherited larger cell size from P. trichocarpa and larger cell number from P. deltoides.

Rood, S.B.; Campbell, J.S.; Despins, T. 1986. Natural poplar hybrids from southern Alberta Canada I. Continuous variation for foliar characteristics. Canadian Journal of Botany. 64(7): 1382-1388.

Shoot cuttings were collected from 56 poplars naturally occurring in riparian sites in southern Alberta and southeastern British Columbia and rooted in a greenhouse. Subsequently, the clones were established in a nursery plot at Lethbridge, Alta., and after 2 growing seasons, fully expanded late leaves from long shoots were collected. Continuous variation was observed for the hybrid leaf forms that were intermediate between the parental forms. This continuous variation for Populus leaf form indicates that the 3 species interbreed freely in southern Alberta, producing a single, dissectional, trispecific, hybrid swarm.

Son, D.S.; Kim, K.S. 1986. Variation and heredity of stomatal frequency, stomatal size and transpiration in Populus alba X P. glandulosa and its parents. Journal of Korean Forestry Society. 75: 51-54.

Stomatal density, length and width, and transpiration rate were determined for the hybrid and its parents and for P. davidiana (P. tremula var. davidiana). The hybrid showed intermediate values between those of its parents. It is suggested that the relatively high transpiration rate of the hybrid (and hence high demand for soil water) explains the poor hybrid growth on upper slopes where soil moisture is limited.

Souleres, G. 1986. Poplar groups. Foret-Entreprise. 38: 8-23.

The principle characteristics of the poplar groups Populus nigra, P. deltoides, P. X euramericana (P. canadensis), P. trichocarpa, interamerican poplar (P. deltoides X P. trichocarpa), P. maximowiczii X P. (Aigeiros), balsam poplar (P. balsamifera) are described.

1987

Avramenko, R.S. 1987. Intraclonal and interclonal differentiation of some black poplar hybrids serological study. Lesovedenie. 0(6): 81-86.

Antigenic spectra of water-soluble proteins of tissue in poplar clones were studied using an immunoelectrophoretic method. Interclonal variability is proposed to result from mutation, displayed in prolonged vegetative reproduction.

Bisoffi, S.; Gemignani, G.; Gras, M.A.; May, S.; Mughini, G. 1987. Establishment of Populus nigra genetic reserves in Italy. *Genetica Agraria*. 41(2): 105-114.

P. nigra is disappearing in Italy due to natural hybridization with P. deltoides and P. X euramericana (P. canadensis) and to the gradual reduction of natural populations as a result of human activities. To limit the risks of genetic contamination with P. deltoides and P. canadensis, old trees were selected which were far from widely-cultivated poplar areas. A data card was compiled for each tree containing dendrometric data, a description of the phenotype and health status, and the geographic parameters of the site.

Hommo, L.; Valanne, T. 1987. Cytological and morphological analyses of grafted triploid aspens from the Nonabeljavri area in Finnish Lapland. Reports from the Kevo Subarctic Research Station. 20: 21-25.

Hyun, J.O.; Rajora, O.P.; Zsuffa, L. 1987. Inheritance and linkage of isozymes in Populus tremuloides. *Genome*. 29(2): 384-388.

Stettler, R.F.; Heilman, P.E.; Dunlap, J.M.; Rogers, D.L. 1987. Breeding of North American poplars for short rotation intensive culture. In: 14th International Botanical Congress; 1987 July 24-August 1; Berlin, West Germany. International Botanical Congress Abstracts: 17: 164.

Tang, Z.Y.; Su, H.Y. 1987. Analysis of isoperoxidases of Populus plants in Heilongjiang Province. *Journal of Northeast Forestry University, China*. 15(3): 41-43.

A study of petiole isozymes of P. nakaii, P. maximowiczii, P. simonii, P. koreana, P. suaveolens, P. alba, P. harbinensis, P. ussuriensis, P. pseudosimonii, P. canadensis, P. davidiana (P. tremula), P. berolinensis, P. nigra, and P. pyramidalis (P. nigra).

1988

Foster, G.S.; Shaw, D.V. 1988. Using clonal replicates to explore genetic variation in a perennial plant species. *Theoretical and Applied Genetics*. 76(5): 788-794.

Mitchell, C.P.; Sennerby-Forsse, L.; Zsuffa, L. 1988. Biomass qualities and potential for genetic improvement in poplars and willows. *Biomass*. 17(1): 21-37.

Potential uses for woody lignocellulosic biomass are outlined. The role of genetics and subcultural manipulation in generating new and more appropriate feed stocks is discussed.

Pichot, C.; du Cros, E.T. 1988. Estimation of genetic parameters in the European black poplar Populus nigra L. consequence on the breeding strategy. *Annales des Sciences Forestieres* (Paris). 45(3): 223-238.

Poplars bred for the future by INRA will include 2 North American species: eastern and black cottonwood, and the European black poplar.

Breeding strategies, now in discussion, need to be based on the genetic and economic properties of the species.

Steenackers, M. 1988. Breeding poplars for rust resistance recent advances. In: 40th International symposium on crop protection, Part A. Meded Fac. Landbouwwet Rijksuniv Gent. 53(2, pt. A): 417-422.

Viart, M. 1988. Short historical account of the international exchanges of the poplars of the section Aigeiros. Comptes rendus des Sances - Academie d'agriculture de France. 74(5): 55-62.

The development and the extension of poplar cultivation in the world have been made possible through the creation of new genetic types.

GROWTH AND YIELD

1975

Anagnostopoulos, K; Panetsos, K. 1975. Volume tables and comparative growth of seven poplar clones. Instituton Dasikon Ereunon, 'Upourgeion Georgias. 75: 17 p.

Presents o.b. and u.b. volume tables for plantation-grown trees of d.b.h. up to 24 cm and height up to 16 m for the seven poplar clones 'I-214', 'I-262', 'I-455', 'I-154', 'Robusta', 'CV-114', and 'CV-161', based on measurement of 260 trees thinned from 6-year-old plantations in central Greece, giving the regression equations from which the tables were constructed. A comparison is also made of the total volume of the trees (ca. 40) representing each clone.

Bailly, C.; Brunck, F.; Malvos, C. 1975. The influence of maintenance measures on the vitality and growth of poplars in Madagascar. Bois Forets Trop. 164(Nov/Dec): 15-24.

Bella, I.E. 1975. Growth-density relations in young aspen sucker stands. Inf. Rep. NOR-X-124. Edmonton, Alberta, Canada: Northern Forest Research Centre. 12 p.

Bowersox, T.W.; Murphey, W.K. 1975. Tree weight estimates for small-sized trees. TAPPI. 58(1): 130-131.

Crist, J.B.; Dawson, D.H. 1975. Anatomy and dry weight yields of two Populus clones grown under intensive culture. Res. Pap. NC-113. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 6 p.

Dukhovnikov, I.U.; Iliev, A.; Donovan, V.; et al. 1975. Growth and productivity of some Populus clones in Bulgaria. Gorsko Smoiansmbo. 31(2): 7-13.

Faber, P.J.; Tiemens, F. 1975. Yield levels of poplar. Uitvoer Versl Sticht Bosbouwproefstn Dorschkamp. 13(1): 117 p.

Guba, I.T. 1975. Preliminary results of a varietal trial of poplars in the flood plain of the lower Dnepr. Lesovodstvo i agrolesomeliior. Resp. mezhved. temat. nauch. sb. 42: 61-64. Referativny Zhurnal. (1975) 10.56.132.

Of the 51 forms tested in the above area of the Ukrainian SSR, the best in growth rate were those of Populus nigra.

Halupa, L.; Kiss, R. 1975. Model yield tables for poplar stands. 2. Erdeszeti Kut. (Hungary). 71(1): 105-124.

New yield tables on the same lines are presented for Populus 'Robusta', P. 'Marilandica', and P. 'I-214' in Hungary.

Herpka, I.; Markovic, J. 1975. Results of studies on comparative trials of poplars. Topola. 18/19(103/106): 183-193.

Increment and growth data are presented for seven clones in a 13-year-old trial in Yugoslavia. The total value for mean annual increment was consistently higher on clay soils compared with sandy soils and decreased in the order Populus 'I-214', P. 'Jacometti', P. 'Ostia', P. 'I-154', P. 'Robusta', P. 'Serotina', and P. 'Marilandica'.

Jones, J.R.; Trujillo, D.P. 1975. Height-growth comparisons of some quaking aspen clones in Arizona. Res. Note RM-282. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 4 p.

Jovic, D.; Vasung, V. 1975. Volume of wood and the current and average increment of Populus X euramericana clone 'I-214', Populus X euramericana cv. 'Robusta', and some other clones and cultivars after 12 years of rotation at the poplar experimental plantation of Veliko Polje. Topola. 18/19(103/106): 129-134.

Krol, I. 1975. Analysis of the dynamics of growth of some poplar hybrids in plantation cultivation in the Klenica forest tract. Prace Komisji Nauk Rolniczych i Komisji Nauk Lesnych PTPN. 40: 43-55.

In nine years of trials of five poplar hybrids on brown fen soil, 'Robusta' was the tallest and had the greatest diameter at breast height and the greatest timber volume at all times from the fifth year onwards.

Mottl, J.; Prudic, Z. 1975. Evaluation of the growth of hybrid aspen in trial plots in the Czech Socialist Republic. Prace Vyzkumneho Ustavu Lesniho Hospodarstvi a Myslivosti. 46: 29-44.

In trials at five sites, involving plots established for up to 15 years, 13 hybrid populations all surpassed stands of standard Populus tremula in rate of growth and timber content at various ages. At the most favorable site, Hlubocek, the intraspecific P. tremula hybrid L021, of complex diploid X triploid origin, gave yields exceeding by several times the present mean yield of Czechoslovakian plantations.

Orekhovskii, A.R.; Dzedziulia, A.A.; Gavrilov, A.V. 1975. Growth of locust, elm and poplar in protective plantings along the North Crimean Channel and its relation to the depth of the groundwater surface. Lesovod Agrolesomelior. 43: 70-79.

Simon, M. 1975. Yield evaluation in a Populus 'I-214' plantation at wide spacing and approaching rotation age. Erdo. 24(6): 241-246.

An experimental felling was made in a 14-year-old plantation established in pits 80 cm deep on a sandy site in the Danube/Tisza region at a spacing of 8x8 m. Minimum depth to water table (in spring) was 124 cm. Inter-row cultivation was done three times annually up to 6 years of age; the stems were pruned twice. The volume of growing stock was 304 m³/ha, with a mean stem of height 27 m and d.b.h. 44 cm. The merchantable volume was 82.5 percent, of which half was sawtimber. The results show the possibilities of intensive silviculture on these sites typical of many parts of Hungary.

Yakushenko, I.K. 1975. The dynamics of shoot growth in local and introduced poplar varieties in the White Russian SSR. *Lesovedenie i les. kh-vo.* 10: 65-72. *Referativny Zhurnal.* (1975) 6.56.121.

The results are presented of a four-year study. The varieties studied differed in the length of their growth periods (110-150 days). They fell into three groups according to duration of growth.

Ying, C.C.; Bagley, W.T. 1975. Variation in growth rate and time of flowering and foliation of eastern cottonwood. In: 9th Central States Forest Tree Improvement Conference: 95-105.

1976

Alexander, D.S. 1976. Growth and yield of cottonwood plantations prediction and realization. In: Thielges, B.A.; Land, S.B., Jr., eds. *Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2: Greenville, MS. Baton Rouge, LA: Louisiana State University: 405-413.*

Apykhtin, G.V.; Kakushkin, V.N. 1976. Phenology and dynamics of growth in poplars in the Engels forest nursery. *Sb. nauch. rabot. Saratov. s.-kh. in-t.* 79: 59-67. *Referativny Zhurnal.* (1978) 2.56.113.

A study was made of the first year's growth in six clones propagated by cuttings in the Saratov area of the USSR, viz. (1) Populus balsamifera X P. canescens '4B', (2) P. trichocarpa, (3) P. nigra var. pyramidalis, (4) P. nigra X P. suaveolens '85', (5) P. nigra X P. pyramidalis '121', and (6) P. nigra X P. berolinensis. The longest growing season was found in (2) and the shortest in (4) - 179 and 140 days, respectively. Clones 4, 6, 1, and 2 began growing early in May and clones 3 and 5 late in May. Clones 4, 6, 1, and 2 had their most rapid growth rate in spring and the other clones in summer. The greatest height increment (170 cm) was shown by clone 2 and the least (108 cm) by clone 5.

Baranchugov, E.G.; Napalkov, N.V. 1976. Yield of poplars in the Tatar ASSR. *Referativnyi Zhurnal.* (1977) 1.56.241.

Of the forms studied, the best in the plateau area were 5B and Oxford 278 and in the flood-plain area Populus trichocarpa.

Bowersox, T.W.; Ward, W.W. 1976. Growth and yield of close-spaced, young hybrid poplars. *Forest Science.* 22(4): 449-454.

Rapid growth and high yield suggest that Populus hybrids are good trees to be used in a short-rotation wood fiber production system. Of the three clones tested on an Edom silt loam soil, clone NE-388 appeared to be best for rotations of at least 4 years.

Dawson, D.H.; Isebrands, J.G.; Gordon, J.C. 1976. Growth, dry weight yields, and specific gravity of 3-year-old Populus grown under intensive culture. *Res. Pap. NC-122.* St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 7 p.

Populus 'Tristis No. 1' was grown from cuttings, under near optimum conditions, in an irrigated nursery in Wisconsin in 1970-1972. Three plant

spacings were tested: 9x9 in., 12x12 in., and 24x24 in. The most widely spaced trees attained the greatest height, but the most closely spaced trees gave the greatest annual production of wood, over 4 tons/acre, and had the highest ratio of stem:total dry weight. The yields obtained exceed those reported for natural and planted Populus stands. Wood density was unrelated to stocking.

Ek, A.R.; Dawson, D.H. 1976. Actual and projected growths and yields of Populus 'Tristis No. 1' under intensive culture. Canadian Journal of Forest Research. 6(2): 132-144.

The growth of P. 'Tristis No. 1' was studied for 4 years in plots established from cuttings spaced at 0.75x0.75, 1x1, and 2x2 ft on a prepared site in Wisconsin. The results were used to derive expressions for height and diameter growth; for the relations between competition, realized growth and potential growth (competition index); and for the relation between competitive status and the probability of survival. From these expressions, growth and yield were projected using the FOREST model. Stand development was projected for periods of up to 25 years for the original spacings and for 4-, 8-, and 12.7-foot spacings, obtained by assigning new coordinates to the data. Actual and projected stand development showed close agreement. The limitations of the projections are discussed. The projected yield for the 4-foot spacing is about 5.8 times that possible from natural aspen stands.

Ek, A.R.; Dawson, D.H. 1976. Yields of intensively growth Populus: actual and projected. In: Hansen, E.A., ed. Intensive plantation culture: five years research. Gen. Tech. Rep. NC-21. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 5-9.

Fakirov, V. 1976. Influence of growth surface on the average growth height of poplar cultures. Gorskostop Nauka. 13(4): 51-63.

Galvans, U.I. 1976. Aboveground biomass of trees harvested in thinnings. In: 16th International Congress of IUFRO; 1976 June 22; Oslo, Norway. Orono, ME: University of Maine, College of Life Sciences and Agriculture: 117-128.

Regression equations and tables are presented relating biomass of stem, leaves and branches to d.b.h. for thinnings of Populus tremula, Betula pendula, and Alnus incana from sites of classes I and II in Latvia.

Hennessey, T.C. 1976. A comparison of field and growth chamber productivity of three poplar clones. Dissertation Abstracts International, B. 37(6): 2591B.

Hybrid clones with latitudinally disparate origins were studied. In the growth chamber, only the photoperiod was varied. Ranking of clones in the growth chamber and the field was consistent for most of the seven plant traits measured. Variability in the field over three growing seasons was not sufficient to disrupt these rankings. In the growth chamber, the greatest differences between clones was obtained under the longest photoperiod, 15 hours.

Hyun, S.K.; Son, D.S. 1976. Studies on the growth and characteristics of Populus nigra var. italica x P. maximowiczii. Korean Journal of Breeding. 8(3): 121-136.

Three F1 clones from P. nigra var. italica X P. maximowiczii showed a higher increase in volume up to age 9 years than P. euramericana 'I-476' but a slightly lower density of timber, and showed differences among themselves in growth and heterosis of growth rate in rooted cuttings. Leaf width and length were intermediate between the parental values. The upper leaf surface resembled that of the maternal parent, and the lower that of the paternal parent.

Il'in, A.M. 1976. Diurnal periodicity of height growth of one-year suckers of aspen. *Lesnoi Zhurnal*. 2: 155-156.

Fourteen healthy one year Populus tremula suckers, unshaded and growing on a felled area, were examined and their height increment was measured daily at sunrise and sunset from August 1 to August 10, 1974. The accuracy of measurement was 0.1 mm. Air temperatures were also measured, and subsequently the diameter of the suckers, and of the roots of the parent trees 3 cm on either side of the sucker, were determined. Growth rate was considerable by day and by night, but the increment by day was twice that at night. The diurnal periodicity of growth depended little on changing temperature conditions. Sucker diameter was closely and positively correlated with the thickness of the parent root; this relationship could be of practical significance for the deliberate formation of young aspen stands.

Jakobsen, B. 1976. Hybrid aspen (Populus tremula L. X P. tremuloides Michx.). *Forstlige Forsogsvaesen i Danmark*. 34(4): 317-338.

Data are presented from 26 temporary sample plots of 0.1-0.2 ha in stands 9-23 years old throughout Denmark. A yield table is given for ages 9-38 years in 3 site classes. Graphs show height, volume, basal area, diameter, c.a.i., and bark thickness in relation to age and distinguish between figures based on the data and extrapolations. The silvicultural potential of the hybrid in Denmark is discussed.

Khalil, M.A.K. 1976. Preliminary results of a trial of exotic and hybrid poplars in Newfoundland. Inf. Rep. N-X-142. Canada: Newfoundland Forest Research Centre. 14 p.

Data are given on the survival and height growth of rooted and unrooted cuttings of 34 Populus clones. Height growth after 2 years was the same for rooted and unrooted cuttings. The 16 fastest growing clones, which include P. alba hybrids, P. balsamifera X deltoides and P. canadensis are considered to have potential for increasing wood and fiber production.

Kurjatko, S.; Pozgaj, A. 1976. Pulpwood density of some poplars grown in Slovakia. *Drev. Vysk*. 21(1): 17-30.

Maynard, C.A. 1976. Rapid growth and high survival shown in (Populus alba X Populus grandidentata) X Populus tremuloides seedlings. In: Beineke, W.F., ed. *Proceedings, 10th Central States forest tree improvement conference; 1976 September 22-23; West Lafayette, IN*. West Lafayette, IN: Purdue University, Department of Forestry and Natural Resources: 30-34.

Prudic, Z. 1976. Causes of the variability of the growth of some two year cultivars of poplars in various conditions of central Europe. Pr VULHM (Vyzk Ustav Lesn Hospod Myslivosti). 49: 59-72.

Prudic, Z. 1976. Growth of aspen in some population of forest types. Lesnictvi. 22(6): 439-450.

Reva, M.L.; Borozenets, V.A. 1976. Growth of trees on the industrial site of the Slavyansk ceramic works. Byulleten' Glavnogo Botanicheskogo Sada. 102: 14-18.

The growth and appearance of Robinia pseudoacacia, R. pseudoacacia var. umbraculifera, Salix alba 'Pendula', Acer negundo, Tilia cordata, Populus bolleana (P. alba var. pyramidalis) and P. nigra under industrial conditions in the Ukraine were observed over a period of 8-19 years. Height and diameter increments are tabulated. S. alba 'Pendula' grew exceptionally well (height 12.9 m at 14 years old); only T. cordata grew poorly.

Siren, G.; Sivertsson, E. 1976. Survival and dry matter production of some high-yield clones of Salix and Populus selected for forest industry and energy production. Pilot study. Rep. No. SHS-IFSY-RU-3. Stockholm, Sweden: Skogshoegskolan. 46 p.

Questions on how fast-growing Salix and Populus clones survive and can be produced for forest industry and energy purposes were studied. In connection with the production of cuttings of fast-growing poplars and willows the volume and dry matter production of selected clones were measured.

Stenecker, G.A. 1976. Early performance of poplar clones in Manitoba. Inf. Rep. NOR-X-156. Canada: Northern Forest Research Centre. 25 p.

Cuttings from 28 clones from a nursery in Saskatchewan and seedlings of native Populus tremuloides were planted in 3 areas of Manitoba to assess their relative potential for timber and amenity uses. Survival and growth were measured between 1965-1969 and 1973, and tree and stem form were awarded ratings. The best performance for both uses was that of the 4 clones: 'Walker', 'Northwest', 'Brooks No. 1', and 'Berolinensis'.

Toth, B. 1976. Information from comparative varietal trials of poplar on heavy soils of the Great Hungarian Plain. Erdeszeti Kutatasok. 71(1): 79-91.

Results of 10-11 years' experiments on the site requirements and growth of the Populus euramericana clones 'I-214', 'Robusta', 'Marilandica', 'Serotina', 'Regenerata', 'Gelrica', and 'H-381' are analyzed.

Tribunskaya, V.M.; Shcherbakova, L.B. 1976. The yield of protection stands. Lesnoe Khozyaistvo. 6: 28-30.

In investigations on shelterbelts on chernozem soils in N. Kazakhstan, three belts all 31 years old and consisting mainly of the elm were examined. Growth and wood production of elm were unsatisfactory, and Populus laurifolia should be preferred.

Weisgerber, H. 1976. Investigations on the growth of aspen hybrids in unfavorable forest sites in Germany. Holzzucht. 30(2/4): 48-53.

Wengert, E.M. 1976. Lumber yield from Rocky Mountain aspen. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 69 p.

1977

Carriere, C.; van der Werf, D. 1977. Plant growth on pollard willows and other pollard trees. Wet Meded K N N V (K Ned Naturhist Ver). 123: 75 p.

Doucet, R. 1977. Biomass of a 6-year-old trembling aspen plantation. Note 7. Quebec, Canada: Ministere des Terres et Forets, Service de la Recherche. 8 p.

Equations were derived from data collected from six trees in a 6-year-old stand in Quebec to relate the fresh and dry weight of the stem, branches, and foliage of Populus tremuloides to d.b.h. Biomass/ha was calculated by applying the equations to stand tables for the region. The biomass was 9,100 kg/ha, of which the stems comprised 76 percent and leaves and branches 12 percent each.

Edminster, C.B.; Getter, J.R.; Story, D.R. 1977. Past diameters and gross volumes of plains cottonwood in eastern Colorado. Res. Note RM-351. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 4 p.

Fasehun, F.E.; Gordon, J.C. 1977. Difference in growth response to light intensity by Populus X euramericana clones. Iowa State Journal of Research. 51(3): 265-270.

In greenhouse experiments with artificial shading, giving 37, 75, and 100 percent full light, of four clones of P. deltoides X P. nigra, total dry weights of all clones increased with increasing light intensity. Clone 5321 had the best height growth under the lowest light intensity, clones 5326 and 5328 grew best in full light, and clone 5323 grew well under all light intensities. There was a direct relationship between shoot and root growth; clone 5321 had the best developed root system under the lowest light intensity and the poorest when grown in full light.

Garrett, H.E. 1977. First year, root-shoot growth observations of eastern cottonwood seedlings and cuttings. Tree Planters' Notes. 28(1): 27-28, 41.

Seedlings and cuttings of Populus deltoides were planted at 10- or 20-inch depth in Illinois and harvested after 1 year. Root and shoot growth and survival were similar for seedlings and cuttings; oven-dry weight of roots and shoots was slightly greater for seedlings. Ten-inch plantings showed greater root development, growth in height and diameter, and oven-dry weight than 20-inch plantings. Ten-inch plantings are recommended where soil retains surface moisture during the summer months.

Guba, I.T. 1977. Effect of stand density on growth of 10-year-old crop of Canadian poplars in the lower Dnieper floodplain. Lesovod Agrolesomelior. 45: 22-27.

Janson, L. 1977. Growth of poplar hybrids at the age of up to 20 years. *Sylvan.* 121(4): 43-53.

Khatamian, H.; Hilton, R.J. 1976. The relationship between shoot growth and area of trunk cross-section in several woody plant species. *HortScience.* 12(3): 255-257.

A curvilinear relationship between shoot growth and cross-sectional area of the stem 30 cm above ground was shown by Populus 'Eugenei' and 4 species of fruit tree grown in rhizotron compartments. Statistical analysis showed that rapid estimates of tree vigor could be obtained from measurements of the stem cross-sectional area.

Kolarov, D. 1977. Studies of growth and wood of local form of white poplar. *Gorsko Stopanstvo.* 33(11): 22-24.

Marcet, E. 1977. Studies of structural morphology in the early stages of development of 'Robusta' poplar. *Mitteilungen, Eidgenossische Anstalt fur das Forstliche Versuchswesen.* 53(3): 109-160.

The growth of 1- and 2-year-old cuttings and stump plants of Populus 'Robusta' was observed in a nursery in 1975-1976. The differences between sylleptic and regular lateral shoots are discussed in detail. Sylleptic lateral shoots grow vigorously only in their first year: their growth is bicyclic, and is inhibited by apical dominance until the leader growth exceeds a certain threshold which is lower in the shoots of rooted cuttings, particularly stumped cuttings, than in seedlings. The normal pattern of lateral shoot growth (starting in the second year) is dependent on bud inhibition after summer and winter dormancy, causing the youngest buds to grow the most vigorously and form whorls.

Mottl, J.; Prudic, Z. 1977. The growth of poplars in the Czech hill country. *Prace Vyzkumneho Ustavu Lesniho Hospodarstvi a Myslivosti.* 50: 95-114.

In trials of 18 species, varieties, and interspecific hybrids at 17 sites in Bohemia and Moravia, 'Gelrica', 'Androscoggin', and 'Virginia de Frignicourt', in forest stands, made the fastest early growth in diameter, but 'Marilandica' and 'Grandis' in height. When grown for scenic value or land reclamation, 'P-275' and 'Generosa' attained the greatest diameter, height, and timber volume by the 8th year but by the 16th year diameter and timber volume were greatest in 'Virginia de Frignicourt', and height in 'Grandis'. At all ages up to 22 years, the ratio of timber volume to d.b.h. was greatest in 'Robusta'.

Nesterov, V.G.; Vakulin, A.A.; Abramov, B.A.; Semenov, B.S. 1977. Yield of forest trees irrigated with sewage from chemical plants. *Doklady Vsesoyuznoi Ordena Lenina Akademii Sel'skokhozyaistvennykh Nauk Imeni V. I. Lenina.* 10: 13-14.

In order to establish the form most responsive to irrigation with sewage, a 3-year trial was carried out with 17 species, clones, and hybrids of poplar.

Randall, W.K. 1977. Growth correlations of cottonwood clones developed from mature wood cuttings. *Silvae Genetica.* 26(2/3): 119-120.

Randall, W.K.; Krinard, R.M. 1977. First-year growth and survival of long cottonwood cuttings. Res. Note SO-222. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 3 p.

Long cuttings (height 5-10 feet) of Populus deltoides are a possible means of ensuring 90 percent survival of plantations made at wide spacing. It is concluded that it is feasible to plant long rooted cuttings (in holes 3 feet deep) on sites where early survival is important.

Sheikh, M.I. 1977. Comparison of six poplar clones for growth and survival. Pakistan Journal of Forestry. 27(2): 101-108.

One-year-old plants of Populus deltoides (5 clones) and P. euramericana were planted in a roadside plot near Peshawar in February 1973. Height and diameter measurements were made until December 1976, when the trees were harvested and their volume determined. P. deltoides 'I-63/51' ranked highest for all three growth parameters. It is therefore recommended that this clone should be planted in Peshawar valley, rather than the extensively-used P. X canadensis 'I-214'.

Tsarev, A.P. 1977. Minimum age for the evaluation of growth rate in poplars during varietal trials. Lesovedenie. 3: 67-71.

The values of height, diameter at a height of 1.3 m and trunk volume at the ages of 11, 15, and 19 years were correlated with the values for these characters at the age of 4 to 5 years. It is concluded that the minimum age for evaluating growth rate in trials is 4 to 5 years.

Vuokila, Y. 1977. Growth capacity of aspen stands on good sites. Folia For. 299: 11 p.

Zubareva, L.M. 1977. Seasonal development and growth rhythm in poplar varieties in the northern Caucasus. Tr. Sev.-Kavkaz. les. opyt. st. 13: 52-58.

The 30 varieties, clones, and species studied over 10 years differed by 13-30 days in date of onset of early phases of development, the date varying most in those that began growth early. Three groups were distinguished: those with an early onset and early end of growth (growth ending in the middle of July), those with a late onset and late end of growth (growth ending at the end of August or beginning of September), and intermediate forms with growth ending in the first half of August.

1978

Bajuk, L.A.; Gordon, J.C.; Promnitz, L.C. 1978. Greenhouse evaluation of the growth potential of Alnus glutinosa clones. Iowa State Journal of Research. 52(3): 341-349.

Growth rate of superior A. glutinosa clones equalled or exceeded that of the fast-growing clone Populus X euramericana cv. 'Wisconsin No. 5'.

Bartos, D.L.; Johnston, R.S. 1978. Biomass and nutrient content of quaking aspen at two sites in the western United States. Forest Science. 24(2): 273-280.

A total of 20 trees of Populus tremuloides from 3 different clones were felled at 2 sites at 2,300 m altitude in Wyoming and at 2,400 m altitude in Utah.

Cooley, J.H. 1978. Survival and early growth of selected trees on waste water application sites. Res. Note NC-231. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 4 p.

Plots of seedlings of Populus canescens X P. grandidentata, Larix leptolepis, Liriodendron tulipifera, Quercus rubra, Fraxinus pennsylvanica, Thuja occidentalis, and Populus deltoides X P. nigra were irrigated with oxidation pond effluent during the growing seasons of 1972-1976 and were given intensive weed control. Irrigation increased the survival of L. tulipifera and P. deltoides X P. nigra and increased the height and dry weight of P. deltoides X P. nigra, F. pennsylvanica, and T. occidentalis compared with controls.

Crow, T.R. 1978. Biomass and production in three contiguous forests in northern Wisconsin. Ecology. 59(2): 265-273.

A study in three forest types in northern Wisconsin: aspen (Populus tremuloides/P. grandidentata); aspen/maple (Acer rubrum and A. saccharum)/birch (Betula papyrifera); and maple/birch/aspen.

Frison, G. 1978. Growth of poplar as a function of the diameter class of the transplants. 1. Cellulosa e Carta. 29(1): 9-29.

Two-year-old saplings of Populus 'I-214' were planted in 1971 in northern Italy in two trials at each of three experimental sites differing in soil characteristics, to evaluate differences in the growth of planting stock of four commercial diameter classes. Well developed dominant young poplars should be used as planting stock.

Kolarov, D. 1978. Introduction of poplars. Gorsko Stopanstvo. 34(7): 21-26.

A survey is given of experience in the introduction of poplars on various sites in Bulgaria, and comparisons are made with experience in other countries. The growth of certain hybrid black poplar clones is compared with that in Italy. In general growth rates appear to be a little slower in Bulgaria.

Lebedeva, E.P. 1978. Effect of weather conditions on growth in some poplar varieties in the Mari ASSR. Referativnyi Zhurnal. (1979) 4.56.137.

An analysis of variance indicated that variation in growth rate in the varieties and hybrids studied was 20-25 percent due to the effect of weather conditions and 11-24 percent due to the effect of genotype.

Sheikh, M.I. 1978. Survival and growth of six poplar clones in Pakistan. Cellulosa e Carta. 29(3): 17-22.

In a comparative 4-year study near Peshawar, Pakistan, P. 'I-63/51' showed the best growth. The other five clones in order of merit were P. 'I-214', P. 'I-90/60', P. 'I-72/51', P. 'I-69/55', and P. 'I-18/62'. All six clones showed very good survival.

Yakushenko, I.K. 1978. Growth and productivity of poplar varieties in the flood plain of the Pripyat'. Zapovedniki Belorussii. 2: 139-145.

In a 10-year study of 69 clones in Belorussia, the best growth rate was shown by Brabantica (clones 174, 175, and 176), 'Robusta', 'Bachelieri', and 'Vernirubens' from the German Democratic Republic; Gelrica from Hungary and Czechoslovakia; Pioneer from the All-Union Institute of Forestry; and Populus fremontii.

1979

Grant, M.C.; Mitton, J.B. 1979. Elevational gradients in adult sex ratios and sexual differentiation in vegetative growth rates of Populus tremuloides Michx. Evolution. 33(3): 914-918.

Kern, K.G. 1979. Studies on the growth pattern of poplars on Rhine alluvial sites in the Palatinate. Allgemeine Forst- und Jagdzeitung. 150(3): 53-64.

Results show that the effects of individual climatic and moisture factors vary considerably between different growing seasons, and that there is no 'standard' growth pattern.

1980

Bella, I.E.; De Franceschi, J.P. 1980. Biomass productivity of young aspen stands in western Canada. Inf. Rep. NOR-X-219. Alberta, Canada: Canadian Forestry Service. 29 p.

Equations and tables are presented for estimating above-ground tree component dry weights for fully stocked aspen (Populus tremuloides Michx.) stands up to 40 years old growing on different sites in the mixedwood forests of Alberta and Saskatchewan.

Koerper, G.J.; Richardson, C.J. 1980. Biomass and net annual primary production regressions for Populus grandidentata on 3 sites in northern Lower Michigan. Canadian Journal of Forest Research. 10(1): 92-101.

1981

Cherniavskii, V.S. 1981. Growth and formation peculiarities of aspen tree stands. Lesnoe Khozyaistvo. 5: 44-45.

Demeritt, M.E., Jr. 1981. Growth of hybrid poplars in Pennsylvania and Maryland clonal tests. Res. Note NE-302. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 2 p.

Average height at 4 years old of 199 clones established as dormant cuttings on agricultural land were 5.1-26 feet in Pennsylvania and 5.6-22.7 feet in Maryland. Height growth was affected by interactions of clone and location. The 12 clones which grew best at both sites (m.a.i. 4-6 feet) were Populus 'NE-14', 'NE-17', 'NE-19', 'NE-20', 'NE-41', 'NE-308', 'NE-310', 'NE-316', 'NE-359', 'NE-381', 'I-262', and 'I-45/51'.

- Hussain, M.J.; Hussain, M. 1981. Comparative growth rates of Populus nigra cv. 'Italica' and Populus deltoides. In: Singh, R.V., ed. Symposium proceedings: Silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 109-110.
- Jain, K.K.; Bhalla, T.C. 1981. Seasonal variation in wood formation in Populus ciliata Wall. In: Singh, R.V., ed. Symposium proceedings: Silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 114-120.
- Joshi, P.C.; Pande, D.C. 1981. A note on growth performance of Populus ciliata Uttar Pradesh (India). In: Singh, R.V., ed. Symposium proceedings: Silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 103-105.
- Kawosa, M.A. 1981. Comparative growth of exotic poplars in Chiternar populatum. In: Singh, R.V., ed. Symposium proceedings: Silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 111-113.
- Krinard, R.M.; Kennedy, H.E., Jr. 1981. Growth and yields of 5-year-old planted hardwoods on Sharkey clay soil. Res. Note SO-271. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 3 p.
- Populus deltoides, Platanus occidentalis, Fraxinus pennsylvanica, Liquidambar styraciflua, and Quercus nuttallii were planted on a site in the midsouth in 1970 and plots mowed or disced for 5 growing seasons. All trees were measured and some felled and weighed in March 1976. Yields ranked in the order: Populus deltoides>Platanus occidentalis>Fraxinus pennsylvanica>Liquidambar styraciflua approximately equal to Q. nuttallii. By species, per acre volume of stemwood ranged from 29 to 446 ft³ and total aboveground dry weight ranged from 1.08 to 7.68 tons. Growth and yield were less than published values for other midsouthern soils.
- Lohani, D.N. 1981. Performance of exotic poplars in Uttar Pradesh. In: Singh, R.V., ed. Symposium proceedings: Silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 12-16.
- Pastor, J.; Bockheim, J.G. 1981. Biomass and production of an aspen-mixed hardwood-spodosol ecosystem in northern Wisconsin. Canadian Journal of Forest Research. 11(1): 132-138.
- Total biomass was 197 tons per hectare and net primary production 11.5 tons per hectare per year. Populus tremuloides accounted for 60 percent of the total biomass and 56 percent of annual production; Acer saccharum for 25 percent and 28 percent respectively, bole wood 63 percent and 33 percent, bole bark 12 percent and 7 percent.
- Qadri, S.T. 1981. Performance of exotic poplars in Kashmir Valley. In: Singh, R.V., ed. Symposium proceedings: Silviculture, management and utilization of

poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 106-107.

Qadri, S.T.; Rather, M.S. 1981. Growth rate of Populus ciliata Wall. in Kashmir Valley. In: Singh, R.V., ed. Symposium proceedings: Silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 108.

Sharma, K.C.; Kashyap, S.D. 1981. Diameter growth rate in Populus ciliata Wall. in Himachal Pradesh. In: Singh, R.V., ed. Symposium proceedings: Silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 101-102.

Smilga, J. 1981. First aspen plantations in Latvia. Jaunakais Mezsaimnieciba. 23: 26-34.

Zhou, X.F.; Wang, Y.N.; Zhao, H.X. 1981. Growth rhythm of some important tree species. Journal of North-Eastern Forestry Institute, China. 2: 49-60.

Observations are reported on the seasonal course of growth of the 10 principal tree species of NE China over 2 years.

1982

Abbas, S.H. 1982. Growth of hybrid poplar (PXE cv 'I-214'). Pakistan Journal of Forestry. 32(3): 95-98.

The results are reported of stem analyses performed on five 9-year-old trees grown in a demonstration plot at the Pakistan Forest Institute, Peshawar. Values are given for d.b.h., height, and volume and for c.a.i. and m.a.i. of each at 1-9 years old. The growth of P. 'I-214' in Pakistan was much less than that in Italy.

Arnoldussen, A.H. 1982. Some impressions on the functioning of the poplar in the IJsselmeer polders. Populier. 19(1): 10-13.

Babos, K. 1982. Examination of annual ring widths in some new poplar hybrids. Botanikai Kozlemlenyek. 69(1/2): 137-144.

Bakhar, I. 1982. Growth and productivity of poplar plantations on the Bazhigansk sands in the Terek/Kuma interfluvial area. Lesovodstvo, Lesnye Kul'tury i Pochvovedenie (USSR). 11: 110-115.

Mensurational data are given for 30 plots of Populus nigra, P. simonii, P. alba, P. euramericana/canadensis, and P. nigra 'Italica' established on semidesert sites in Stavropol Province. All are suitable for stabilizing sands. Productivity was high on many sites. Growth and productivity appear to decrease after 20 years old.

Birkenhager, B. 1982. Assessment and selection of Populus canescens clones, mainly for the IJsselmeerpolders. Populier. 19(2): 35-40.

In 68 clones planted in 5 trial plantations (4 on IJsselmeerpolders) from 1960 to 1972, tree form and volume production varied considerably between

sites for the same clones. Five promising new clones (not then available commercially) were selected.

Freedman, B.; Duinker, P.N.; Barclay, H.; Morash, R.; Prager, U. 1982. Forest biomass and nutrient studies in central Nova Scotia. Inf. Rep. M-X-134. Canada: Maritimes Forest Research Centre. 126 p.

Logarithmic and quadratic equations are given for estimating the fresh and dry weights and nutrient contents (N, P, K, Ca, and Mg) for various components of 10 tree species: (Abies balsamea, Picea glauca, P. mariana, P. rubens, Acer rubrum, A. saccharum, Betula lutea (alleghaniensis), B. papyrifera, Populus grandidentata, and P. tremuloides). The distributions of biomass and nutrient content among the various components are described for each species.

Herpka, I. 1982. Productive characteristics of experimental polyclonal plantations of Populus deltoides Bartr., planted at dense space. Topola. 26(135/136): 3-14.

Hocker, H.W., Jr. 1982. Effects of thinning on biomass growth in young Populus tremuloides plots. Canadian Journal of Forest Research. 12(4): 731-737.

Isebrands, J.G.; Ek, A.R.; Meldahl, R.S. 1982. Comparison of growth model and harvest yields of short rotation intensively cultured Populus: a case study. Canadian Journal of Forest Research. 12(1): 58-63.

Growth model projections were compared with actual harvest data of 5-year-old short rotation intensively cultured Populus.

Lee, D.K.; Hyun, S.K.; Noh, E.R.; Shim, S.Y. 1982. Biomass growth and production of Populus hybrids in Korea. Res. Rep. 18. Suweon, Korea: The Institute of Forest Genetics: 9-16.

Padro, A. 1982. Productivity curves of clone 'I-214' on irrigated land with R2 T2 plants and 6x6 m spacing in the Ebro Central Valley. Serie Forestal 6. Madrid, Spain: Anales del Instituto Nacional de Investigaciones Agrarias: 63-73.

1983

Buchman, R.G. 1983. Survival predictions for major Lake States tree species. Res. Pap. NC-233. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 7 p.

Coefficients were developed for predicting the survival rates of 10 species (Pinus banksiana, P. resinosa, P. strobus, Abies balsamea, Acer rubrum, A. saccharum, Ulmus americana, Tilia americana, Populus tremuloides, and Betula papyrifera) using a model based on diameter growth rate and d.b.h. Comparisons of measured and predicted rates suggest that the model can be used in most conditions throughout the Lake States, except on sites with many small trees.

Buchman, R.G.; Pederson, S.P.; Walters, N.R. 1983. A tree survival model with application to species of the Great Lakes region. *Canadian Journal of Forest Research*. 13(4): 601-608.

The survival model presented relates annual survival rate to tree size (d.b.h.) and vigor (diameter growth rate). The seven coefficients of the equation are given for five major Great Lakes species (Pinus banksiana, P. resinosa, Abies balsamea, Populus tremuloides, and Acer saccharum).

Burk, T.E.; Nelson, N.D.; Isebrands, J.G. 1983. Crown architecture of short-rotation, intensively cultured Populus. III. A model of first-order branch architecture. *Canadian Journal of Forest Research*. 13(6): 1107-1116.

Using data from various Populus clones a model was developed which had four basic components describing branch location along the stem, orientation of the branch in the plane in which it arises, taper of the branch, and the relation between leaf surface area supported by the branch and branch size. Branch arrangement along the stem was found to be symmetrical for portions of the stem containing branches. Branch orientation was well described by assuming curvature to be constant, and branch taper was successfully modelled using a simple power function. Branch surface area was determined to be the most appropriate predictor of leaf surface area supported by the branch. Combining the four model components in a computer program allows an analysis of the dynamics of Populus crowns not previously possible.

Chung, S.H.; Choi, M.G.; Lee, G.S. 1983. A study on the diameter increment of major hardwood in middle area of Korea. *Journal of Korean Forestry Society*. 60: 24-29.

A study of seven species in natural stands (aged 6-65 years) showed that diameter increment by age or diameter class could be ranked in the order: Juglans mandshurica, Cornus controversa, Betula platyphylla, Tilia amurensis, Fraxinus mandshurica, Populus davidiana, and Ulmus davidiana. M.a.i. decreased at an earlier age in P. davidiana and U. davidiana than in the other species.

Danda, R.S. 1983. Trials of poplars in Punjab. *The Indian Forester*. 109(10): 767-772.

Dewar, S.W.; Berglund, E.R. 1983. First-year survival and growth of willow and poplar cuttings on taconite tailings in Minnesota. In: Graves, Donald H., ed. *Proceedings, Symposium on Surface mining, hydrology, sedimentology and reclamation*; 1983 November 28-December 2; Lexington, KY. Lexington, KY: University of Kentucky, College of Engineering, OES Publications: 141-147.

Ek, A.R.; Lenarz, J.E.; Dudek, A. 1983. Growth and yield of Populus coppice stands grown under intensive culture. In: Hansen, E.A., comp. *Intensive plantation culture: 12 years research*. Gen. Tech. Rep. NC-91. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 64-71.

Data collected from various clones established in Wisconsin in 1973, harvested in December 1977, and examined in April and October 1979, and November 1980.

Faltonson, R.; Thompson, D.; Zuuring, H.; Wray, P.; Hennessey, T. 1983. Methods of rapid, early selection of poplar clones for maximum yield potential: a manual of procedures. In: Gordon, J.C.; Promnitz, L., eds. Gen. Tech. Rep. NC-81. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 49 p.

Contains four articles describing ways of using controlled environments to select clones that have a high probability of rapid growth in the field.

Ganchev, P.; Iovov, D. 1983. Growth and productivity of some balsam poplars grown and managed in montane conditions. *Gorskostopanska Nauka*. 20(6): 60-63.

A note is given of trials with 14 different balsam poplars (*Populus* sect. *Tacamahaca*) at 1,350 m altitude in the Rhodope Mts. of Bulgaria (brown forest soil, fresh to moist, medium deep, mean annual precipitation 750-1,000 mm). Data are tabulated on the dimensions of the poplars at age 15. The best three were P. 'Kreuzung', P. 'Androscoggin', and P. 'Geneva' (m.a.i. 26.1, 25.7, and 24.5 m³/ha, respectively).

Halupa, L.; Markus, L. 1983. Growth in volume and value of P. X euramericana cv. 'Robusta' and P. X euramericana cv. 'I-214'. *Erdeszeti Kutatasok*. 74: 225-235.

The volume c.a.i. and m.a.i. of poplar plantations at narrow spacing culminate earlier on rather poor sites than on good sites. At wide spacing (6x6 m), on the basis of increment curves and growth models developed in Hungary, the felling age of P. X canadensis 'Robusta' should be 20 years and that of P. 'I-214' 16 years for maximum volume production on all sites. However, the net value per m³ of harvested assortments reaches a maximum at a mean d.b.h. of 40-44 cm. The rotation age for maximum revenue, depending on site quality, is 20-30 years for P. 'Robusta' and 15-20 years for P. 'I-214'.

Heidt, J. 1983. Clonal variation in height growth of trembling aspen in central Alberta. *Agriculture and Forestry Bulletin*, University of Alberta. 6(3): 20-23.

Iliev, S. 1983. Growth and productivity of some poplar cultivars in plantations on the banks of Danube River. *Nauchni Trudove. Seria Gorsko Stopanstvo*. 27-28: 65-71.

Kaul, O.N.; Sharma, D.C.; Tandon, V.N. 1983. Biomass distribution and productivity in a poplar plantation. *The Indian Forester*. 109(11): 822-828.

Massie, M.R.C.; Manning, G.H.; McCloskey, K.R. 1983. Metric single-tree total volume tables for the Yukon territory. Inf. Rep. BC-X-242. Canada: Pacific Forest Research Centre. 19 p.

Tables are given for Picea glauca, P. mariana, P. contorta, and Populus tremuloides. Total stem volume u.b. is shown as a function of total height and d.b.h. outside bark.

Murray, M.D.; Harrington, C.A. 1983. Growth and yield of a 24-year-old black cottonwood plantation in western Washington. *Tree Planters' Notes*. 34(2): 3-5.

Populus trichocarpa trees in a plantation established in 1958 were measured in autumn 1981. Total stem volume was 7,242 ft³/ac. Dominant trees were 115-122 feet tall, with diameters of 13-16 inches.

Perala, D.A. 1983. Modeling aspen and red pine shoot growth to daily weather variations. Res. Pap. NC-236. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 11 p.

Daily shoot growth of Populus tremuloides (1-3 years old) and Pinus resinosa (13-14 years old) in plantations near Grand Rapids, Minnesota, was quantified in relation to variations in air temperature, soil moisture content, solar radiation, evapotranspiration and inherent seasonal plant growth rhythms. The potential application of the growth equations are discussed and areas for improvement identified.

Pieters, G.A. 1983. Growth of Populus euramericana. *Physiologia Plantarum*. 57(4): 455-462.

Growth curves of successive leaves of P. 'Robusta' were determined. With ample supply of water and nutrients P. 'Robusta' shoots have an initial logarithmic acceleration phase followed by a stationary phase in which leaves of equal size are produced at a constant rate. Analysis of growth curves of leaves enabled the growth curves of leaf primordia to be predicted. The increase in length of successive leaves in the acceleration phase of growth continues for a longer period at high than at low irradiance.

Sheikh, M.I. 1983. Growth pattern of poplar clones. *Pakistan Journal of Forestry*. 33(4): 217-220.

The growth of 14 poplar clones (Populus deltoides and hybrids) from Italy, Australia, and Yugoslavia, and of P. nigra 'Molza' was compared over 7 years.

Simon, M. 1983. Effect of silvicultural technology on the wood yield and profitability of Populus X canadensis cv. 'I-214'. *Erdeszeti Kutatasok*. 74: 19-26.

Plantations established at 6x6 m spacing with either 1/1 rooted cuttings or large-sized (2/3) stock were evaluated at the time of final felling at 14 years old. In the plantation established with large-sized stock, the total volume was higher by 12 percent, the yield of board-industry and veneer logs by 47 percent, and the revenue per ha by 14 percent (which corresponded to the price of 1,500 kg of wheat or maize grain). The gross surplus revenue was derived partly (69 percent) from the higher wood yield and 31 percent from the more valuable assortment yield.

Singh, S.P.; Mittal, M.C. 1983. Growth of poplar plantations in Tarai region of Uttar Pradesh. *The Indian Forester*. 109(10): 755-761.

Singh, T. 1983. Weight tables for important tree species in the Northwest Territories. *For. Manage. Note 27*. Canada: Northern Forest Research Centre. 4 p.

Whole tree aboveground biomass (kg) with or without foliage is given for trees with d.b.h. 6 to 34-40 cm, height 6 to 24-28 m of Populus balsamifera, Picea mariana, Pinus banksiana, Larix laricina, Populus tremuloides, and Picea glauca.

Steenackers, V.; Van Slycken, J. 1983. The "Unal"-poplars--some first results. *Verbondsnieuws voor de Belgische Sierteelt*. 27(20): 999-1001.

Data are presented on the relative growth of several ornamental poplar clones in the Unal series (raised in Belgium), compared with the standard green clone of cv. 'Robusta', assessed from several trials with trees up to 11 years old, in different places. The clonal series concerned comprised the eight original Unal clones (crosses involving Populus nigra), six Euramerican Unal hybrid clones (P. deltoides X P. nigra), five inter-American Unal hybrid clones (P. trichocarpa X P. deltoides), and two Unal P. trichocarpa clones. The growth of all clones except four in the original series exceeded that of the 'Robusta' green clone.

van Broekhuizen, J.T.M. 1983. New impressions from Haarweg populetum. *Populier*. 20(3): 78-81.

Data are presented on basal area development of 11 varieties of Populus X euramericana (P. X canadensis) planted in 1955 at 8x9 m spacing and measured at ages 15, 20, 24, and 29 years. 'I-214' and 'Agathe F' were the fastest growing.

Varga, L. 1983. Influence of spacing on growth and sanitary condition of the 'I-214' poplar. *Lesnický Casopis*. 29(5): 379-393.

1984

Anderson, B.W.; Disano, J.; Bocks, D.L.; Ohmart, R.D. 1984. Mortality and growth of cottonwood on dredge-spoil. In: Warner, Richard E.; Hendrix, Kathleen M., eds. *California riparian systems: ecology, conservation, and productive management*. Berkeley, CA: University of California Press: 438-444.

Bredenkamp, B.V.; Loveday, N.C. 1984. Volume equations for diameter measurements in millimeters. *South African Forestry Journal*. 130: 40.

Revised coefficients are presented for 13 species, to amend currently available volume equations using diameter measurements in cm.

Christersson, L.; von Fircks, H.A. 1984. Production losses in intensively cultivated energy plantations. In: Perttu, K.L., ed. *Ecology and management of forest biomass production systems*. Rapport, Institutionen for Ekologi och Miljovard, Sveriges Lantbruksuniversitet. 15: 363-373.

Cobb, S.W.; Miller, A.E. 1984. Early growth of yellow poplar and scarlet oak stump sprouts on Piedmont uplands. *For. Res. Ser. 39*. Clemson, SC: Clemson University, College of Forest and Recreation Resources. 8 p.

Eriksson, H. 1984. Yield of aspen and poplars in Sweden. In: Perttu, K.L., ed. *Ecology and management of forest biomass production systems*. Rapport, Institutionen for Ekologi och Miljovard, Sveriges Lantbruksuniversitet. 15: 393-419.

Gunnerbeck, E.; Constantinescu, O. 1984. A leaf-spot disease of aspen caused by Cryptocline dubia. In: Perttu, K.L., ed. *Ecology and management of forest*

biomass production systems. Rapport, Institutionen for Ekologi och Miljovard, Sveriges Lantbruksuniversitet. 15: 375-381.

Hari, P.; Arovaara, H. 1984. Trend-like changes in environmental factors and tree ring analysis. In: Perttu, K.L., ed. Ecology and management of forest biomass production systems. Rapport, Institutionen for Ekologi och Miljovard, Sveriges Lantbruksuniversitet. 15: 421-427.

Increase in atmospheric CO₂ and acid rain.

Harrington, C.A.; DeBell, D.S. 1984. Effects of irrigation, pulp mill sludge, and repeated coppicing on growth and yield of black cottonwood and red alder. Canadian Journal of Forest Research. 14(6): 844-849.

Khalil, M.A.K. 1984. The potential of poplars in the boreal regions. I. Survival and growth. *Silvae Genetica*. 33(1): 1-8.

The results are reported of a two-stage trial of 32 clones of poplar species and their hybrids in a nursery from 1972 to 1974 and 4 replicated field experiments during 1978-1981 in Newfoundland, Canada.

Kowalik, P.J. 1984. Mathematical modelling of energy forest growth: an outline. In: Perttu, K.L., ed. Ecology and management of forest biomass production systems. Rapport, Institutionen for Ekologi och Miljovard, Sveriges Lantbruksuniversitet. 15: 429-459.

Krinard, R.M.; Johnson, R.L. 1984. Cottonwood plantation growth through 20 years. Res. Pap. SO-212. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 11 p.

Lieffers, V.J.; Campbell, J.S. 1984. Biomass and growth of Populus tremuloides in northeastern Alberta: estimates using hierarchy in tree size. Canadian Journal of Forest Research. 14(5): 610-616.

Biomass and growth (productivity) were determined from measurements made in 20x20 m plots in 39 even-aged stands, these included d.b.h., increment core analysis, and height and weight determinations on felled trees. In each stand, the periodic annual basal area increment (1977-1981) of 10-16 sample trees was proportional to the square of the diameter of each tree. This relationship was used to estimate the change in diameter of each tree in the stand for the 5-year period. The current biomass and the biomass per tree 5 years earlier were determined from an allometric equation of tree biomass vs. diameter.

Nilsson, L.O. 1984. Aspects on willow leaf area measurement procedures. In: Perttu, K.L., ed. Ecology and management of forest biomass production systems. Rapport, Institutionen for Ekologi och Miljovard, Sveriges Lantbruksuniversitet. 15: 461-466.

Perttu, K.; Eckersten, H.; Kowalik, P.J.; Nilsson, L.O. 1984. Modelling potential energy forest production. In: Perttu, K.L., ed. Ecology and management of forest biomass production systems. Rapport, Institutionen for Ekologi och Miljovard, Sveriges Lantbruksuniversitet. 15: 467-480.

Sennerby-Forsse, L.; Berggren, B.; Brunkener, L.; Fjell, I. 1984. Growth behaviour and anatomy of meristems in *Salix*. In: Perttu, K.L., ed. Ecology and management of forest biomass production systems. Rapport, Institutionen for Ekologi och Miljovard, Sveriges Lantbruksuniversitet. 15: 481-501.

Sievanen, R. 1984. Simulation model for photosynthesis and growth in short-rotation plantations. In: Perttu, K.L., ed. Ecology and management of forest biomass production systems. Rapport, Institutionen for Ekologi och Miljovard, Sveriges Lantbruksuniversitet. 15: 503-510.

Singh, T. 1984. Biomass equations for six major tree species of the Northwest Territories. Inf. Rep. NOR-X-257. Canada: Northern Forest Research Centre. 22 p.

Biomass data were collected in summer 1981 and used to derive regression equations for estimating oven-dry biomass for stem and non-stem components from d.b.h., o.b., and total height. Equations were derived for merchantable and nonmerchantable stem, live large branches, and live small branches including foliage, for *Picea glauca*, *P. mariana*, *Pinus banksiana*, *Larix laricina*, *Populus tremuloides*, and *P. balsamifera*. Equations are included for predicting total oven-dry biomass above ground with and without foliage.

Singh, T. 1984. Conversion of tree volume to biomass in the prairie provinces. For. Manage. Note 28. Canada: Northern Forest Research Centre. 7 p.

Tables are given for converting volume (m^3) to whole tree (including foliage) aboveground dry weight (kg) for *Abies lasiocarpa*, *A. balsamea*, *Populus balsamifera*, *P. tremuloides*, *Picea mariana*, *P. glauca*, *Pinus banksiana*, *P. contorta*, *Larix laricina*, and *Betula papyrifera*.

Toky, O.P.; Khosla, P.K. 1984. Comparative growth of agroforestry trees (indigenous vs. exotic) in subtropical western Himalaya. Journal of Tree Sciences. 3(1/2): 93-98.

Data are presented on the height, diameter, and estimated bole volume of 6-year-old trees of 41 indigenous and 5 exotic species raised in the Agroforestry Arboretum at Dhaulakuan in the Himalayan foothills. Best height growth was shown by *Grevillea robusta* (9.2 m), *Eucalyptus globulus*, *Populus X euramericana* '65/27', *Albizia lebbek*, and *Melia azedarach*.

Weisgerber, H. 1984. Increased yields from the use of fast-growing tree species. Forstarchiv. 55(4): 123-127.

A review of studies in W. Germany on the growth of *Populus* species and clones, and various provenances of *Pseudotsuga menziesii*, *Abies grandis*, *Larix leptolepis*, *Picea sitchensis*, and *Pinus strobus*.

Wiren, A.; Larsson, S. 1984. Preferences of insects for different willow clones: a case study with *Galerucella lineola* (Col., Chrysomelidae). In: Perttu, K.L., ed. Ecology and management of forest biomass production systems. Rapport, Institutionen for Ekologi och Miljovard, Sveriges Lantbruksuniversitet. 15: 383-389.

1985

Alban, D.H. 1985. Volume comparison of pine, spruce, and aspen growing side by side. Res. Note NC-327. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 6 p.

Bowersox, T.W.; Stover, L.R.; Blankenhorn, P.R.; Strauss, C.H.; Robertson, D., eds. 1985. Biomass yields from dense plantations. Proceedings of FPRS industrial wood energy forum '83; 1983 September 19; Nashville, TN. Madison, WI: Forest Product Research Society. 7(1): 129-133.

Biomass yield and energy data for dense plantations of a Populus hybrid, grown under four management strategies on two dissimilar sites, have been determined for ages 1 through 3 years.

Demeritt, M.E., Jr. 1985. Survival of hybrid poplar at Camp Edwards, Cape Cod, MA. In: Proceedings, 29th Northeastern forest tree improvement conference. Durham, NH: Northeastern Forest Tree Improvement Conference: 1-4.

Faber, P.J. 1985. Growth and spacing of 'Rap' poplar in a Nelder experiment. *Nederlands Bosbouw tijdschrift*. 57(5/6): 157-166.

In a Nelder planting experiment established in 1974, height and basal area increment were measured annually from 1976 to 1985. Correlations with theoretical growing space, real available growing space, occupied growing space, and competition stresses are discussed.

Geyer, W.A.; Naughton, G.G.; Melichar, M.W. 1985. Biomass gains in coppicing trees for energy crops. In: Palz, W.; Coombs, J.; Hall, D.O., eds. Energy from biomass: 3d European Communities Conference; 1985 March 25-29; Venice, Italy. London, UK: Elsevier Applied Science Publishers: 269-273.

A summary of a series of experiments established in 1968 in the central Great Plains area of the USA with Acer negundo, Platanus occidentalis, Salix exigua, Populus var. 'Siouxland' and 30 Populus clones, Alnus glutinosa, and Acer saccharinum at several spacings using 2- to 4-year felling cycles over several rotations.

Krinard, R.M. 1985. Cottonwood development through 19 years in a Nelder's design. Res. Note SO-322. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 4 p.

Krinard, R.M. 1985. Ten years' growth of pruned and unpruned cottonwood planted at 40- by 40-foot spacing. Res. Note SO-316. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 5 p.

Ma, C.; Fu, C.X.; Liu, B.L.; et al. 1985. Analysis of the possibility of high speed growth and high harvest of ussuri poplar plantation. *Journal of North-Eastern Forestry College, China*. 13(1): 47-56.

Data were collected throughout one rotation of a plantation in a mountainous area in E. Heilongjiang Province, China. It is recommended that management intensity, stand structure, seedling selection, etc. simulate those of a natural stand as far as possible.

Pezeshki, S.R.; Oliver, C.D. 1985. Early growth patterns of red alder and black cottonwood in mixed species plantations. *Forest Science*. 31(1): 190-200.

Populus trichocarpa cuttings and Alnus rubra wildings (1 or 2 years old) were planted in March 1980 on low altitude glacial till soils in W. Washington. Growth patterns were recorded for 1 year. P. trichocarpa height growth occurred early, with 88 percent of its height achieved by late July (Julian day 210) while A. rubra growth continued longer with 55 percent of its height growth achieved after day 210. Leaf area ratios were consistently higher throughout the season for P. trichocarpa than for A. rubra, with maximum values of 42 cm²/g and 29 cm²/g, respectively. Growth in both species was adversely affected during drought. Biomass production for the first year was low - 0.04 t/ha for P. trichocarpa and 0.74 t/ha for A. rubra.

Sheikh, M.I. 1985. Biomass production from Salicaceae - part II. *Pakistan Journal of Forestry*. 35(2): 77-88.

Biomass production was recorded for 1-, 2-, and 6-year-old clones of Populus euramericana grown in Peshawar and a 10-year-old clone grown in Changa Manga.

Sheikh, M.I.; Hussain, R.W.; Khan, M. 1985. Comparison of growth of four tree species grown under agro-forestry systems. *Pakistan Journal of Forestry*. 35(1): 13-14.

Plants of Populus deltoides 'I-63/51' and Eucalyptus citriodora, and cuttings of Dalbergia sissoo and Salmalia malabarica were planted at 4x4 m spacing in plots in Peshawar in February 1978. Sesamum indicum, maize, and wheat were planted between tree rows. Height and diameter were recorded in December 1983. P. deltoides produced the best growth (average height 21.1 m, average d.b.h. 16.6 cm), followed by B. malabaricum (average height 19.8 m, average d.b.h. 9.2 cm).

1986

Bella, I.E. 1986. Tree growth response along seismic lines in Alberta. *Forestry Chronicle*. 62(1): 29-34.

Multiple linear regression techniques were used to analyze data on radial increment collected from 2,000 trees, representing the major species, along 192 transects at right angles to seismic lines. Stands were age 10-100 years and represented the range of site conditions in western Alberta. Seismic lines had been established at least 10 years before sampling. Line clearing resulted in significant and consistent increases in radial increment at breast height for lodgepole pine, white spruce, and black spruce, but the magnitude of response was much less than that required to replace wood lost by clearing. Salvaging timber from cut lines would reduce the wood loss during the current rotation. Aspen showed no significant stimulation in growth from line clearing.

Fakirov, V. 1986. Production on riverside poplar sites. *Gorsko Stopanstvo Gorska Promishlenost*. 42(8): 6-9.

A review is given of experience in Bulgaria in the performance of poplars on 4 types of riverside sites: typical willow, willow/poplar, typical poplar,

and drained poplar sites. Most of the data relate to Populus 'I-214', and mean yields were 4.8, 7.3, 11.8, and 9.7 m³/ha respectively on the 4 site types.

Hansen, E.A.; Klass, D.L. 1986. Research strategy for attaining high yielding Populus energy plantations. In: Energy from biomass and waste 10; 1986 April 7; Washington, DC. Chicago, IL: Institute of Gas Technology: 121-132.

Large production increases of 3-5x have been attained during the last 20 years through application of agronomic principles to forest plantations. Yields of 15-20 Mg/ha₁/yr₁ from test plots are not uncommon. But high yields attained in small plot trials have not been achieved in larger plantations elsewhere because of three factors: poor adaptation of the genotype to site (generally poor moisture stress tolerance): disease susceptibility: and, weed competition. Past yield studies have been directed towards achieving high yields by optimizing environmental variables. High yields have been obtained in those instances when the correct genotype (clone) was planted on the proper site, good weed control was practiced and no disease problem occurred. However, the costs of intensive culture of tree plantations are high and the risks of low yields or failure are great. New hybrid clones are needed to reduce the occurrences of failure and bring average yields closer to the potentials observed in test plantations. New efforts in traditional breeding and in biotechnology hold promise for developing high yield genotypes that are both herbicide and disease resistant and tolerant of low levels of soil moisture.

Hussian, R.W.; Sheikh, M.I. 1986. Biomass production by different species and clones of poplar. Pakistan Journal of Forestry. 36(4): 197-204.

A plantation of 4 poplar clones (Populus 'I-69/55', P. 'I-90/60', P. 'I-72/58', and P. 'I-4/64') and 3 other species (Eucalyptus camaldulensis, Salmalia malabarica, and Morus alba) was established with 1-year-old seedlings at Peshawar in August 1977. It was thinned in 1980 and 1984. Using regression equations established for each species, tables were drawn up giving estimates of stem, branch + leaf, and total biomass in 1-cm d.b.h. classes of 6-30 cm (poplars) or 6-40 cm (other species).

Kr'stanov, K.N.; Fakirov, V.; Belyakov, P.; Ganchev, P.; Tsakov, K. 1986. Mechanisms in the productivity of poplar plantations. Gorskostop Nauka. 23(3): 27-36.

Two clones of euramerican poplars (Populus 'I-214' and P. 'Robusta') were studied in experimental areas and two habitats. Regular characteristics were noted in changes in the tree's reserves, these changes depending on the clone, habitat conditions, and plantation density of the poplar. These three factors also affected productivity.

Maruyama, K.; Kamitani, T.; Fukumoto, Y. 1986. Daily radial growth, expansion, and contraction of tree stems of some deciduous broadleaved species and the controlling factors. Journal of the Japanese Forestry Society. 68(6): 244-248.

Maximum trunk radius was measured daily from early May 1983 until late August, mid-September, and mid-October for Paulownia tomentosa, Pterocarya rhoifolia, and Populus sieboldii, respectively. The peak daily radial growth (d.r.g., the difference between maximum stem radius on successive days)

appeared in mid-June for Paulownia tomentosa and in early July for the others. Stepwise multiple regression with a range of environmental variables showed that daily air temperature difference and 5-day total precipitation were important to d.r.g. Factors affecting internal water balance such as saturation deficit and hours of sunshine were important in daily expansion and contraction.

Mowrer, H.T. 1986. Site productivity estimates for aspen in the central Rocky Mountains. Western Journal of Applied Forestry. 1(3): 89-91.

Equations are presented for estimating net m.a.i. of total and merchantable volume at culmination of growth, using data from 100 temporary growth plots in mature stands of Populus tremuloides in Colorado, Wyoming, and Utah. Such equations can be used to estimate net maximum productive potential of stands using site index alone or in conjunction with assumed future stocking at the time of volume culmination.

Naidenova, Ts.; Garelkov, D. 1986. Studies on the yield of Platanus orientalis and the possibility of using it for intensive plantations. Gorskostopanska Nauka. 23(1): 29-36.

Data are given on the performance of P. orientalis aged 22 years in a plantation established at a spacing of 2x1.5 m and aged 4 years in another plantation at 2x1 m, on good alluvial valley sites in Bulgaria. Comparative data are given for Gleditsia triacanthos and Fraxinus oxycarpa at 2x1.5 m and Populus 'Regenerata' at 3x4 m. At 22 years, standing volume of the plane and the poplar was the same (226 m³/ha), and nearly double that of ash and gleditsia. M.a.i. of plane in the last 5 years was 13.0 m³/ha, this being superior to the poplar.

Pieters, G.A. 1986. Dimensions of the growing shoot and the absolute growth rate of a poplar shoot. Tree Physiology. 2(1/3): 283-288.

Populus euramericana 'Robusta' (P. 'Robusta') was grown in sub-irrigated, gravel-filled containers with constant temperature (22degC) and irradiance (30 W/m²). Lengths of leaves and diameter and length of internodes were measured 3 times a week. Growing shoot (GS) was defined as that length of the axis above the most recently matured internode. Length of GS increased with plant age. There was a clear correlation between mature leaf length and length of GS, and between diameter and length of GS.

Sheikh, M.I. 1986. Growth rate of tree species. Pakistan Journal of Forestry. 36(1): 17-18.

Eight-month-old root and shoot cuttings of Dalbergia sissoo and Salmalia malabarica and 1-year-old seedlings of Eucalyptus citriodora and Populus deltoides 'I-63/51' were planted out in Peshawar in February 1978. Stands were irrigated and a variety of crops were sown between the rows of trees. Height and d.b.h. were recorded annually until 1985. P. 'Harvard' produced the greatest height (17.87 m in 1985), followed by E. citriodora (16.37 m), while B. malabaricum produced the greatest d.b.h. (25.2 cm) followed by P. 'Harvard' (23.6 cm).

Sheikh, M.I.; Raza-ul-Haq. 1986. Performance of poplar clones in Pakistan. Pakistan Journal of Forestry. 36(2): 79-82.

Height and diameter were recorded for a Populus tomentosa clone from China and for 5 clones from the USA (S7C3, S7C20, ST 92, ST 67, and ST 109), all grown in Peshawar. P. tomentosa had significantly lower height and diameter growth than the others, and ST 67 had lower diameter growth than ST 109, S7C3, and S7C20. S7C20, which produced the greatest diameter growth, is recommended for planting in the Peshawar Valley.

1987

Lee, D.K.; Gordon, J.C.; Promnitz, L.C. 1987. 3-year growth and yield of Populus hybrids grown under intensive culture. Biomass. 13(2): 117-124.

Lev, D.J.; Jacoby, G.C., Jr.; Hornbeck, J.W., comps. 1987. Biological inference from growth-climate correlations in balsam poplar in Alaska. In: Proceedings of the International symposium on ecological aspects of tree-ring analysis; 1986 August 17; Tarrytown, NY: 80-89.

Correlations between tree-ring growth and climate have been used to infer phenology and suggest testable hypotheses about the physiological ecology of balsam poplar. Balsam poplar was studied at three locations spanning its latitudinal range in Alaska: high elevation sites in the Brooks Range and the Alaska Range and a low elevation site on the floodplain of the Chena River, near Fairbanks. Increment cores from each location were cross dated and measured. Standardized growth indices were correlated with climate data summarized by 5-day periods. Timing of positive correlation were used to infer phenological events. Inferred dates of budbreak and initiation of growth period are similar at all locations. Bud set, however, is inferred to occur several weeks later at lower latitude sites than at high latitude sites. The longest growing period is inferred to occur at the low elevation site. Climate data and physiological literature are reviewed to construct hypotheses about how the species responds to environmental conditions.

Pezeshki, S.R. 1987. Survival and early growth of Alnus rubra, Eucalyptus macarthurii, E. viminalis, and Populus trichocarpa in the Pacific Northwest. Tree Planters' Notes. 38(4): 27-30.

Ruark, G.A.; Bockheim, J.G. 1987. Below-ground biomass of 10-, 20-, and 32-year-old Populus tremuloides in Wisconsin. Pedobiologia. 30(3): 207-217.

Biomass of small (3 mm) and large (3-30 mm) aspen roots, aspen stumps, and roots of understory vegetation was measured in 3 age classes of trembling aspen. Regression equations were constructed for prediction of biomass of stumps and large roots lying under stems from bole diameter at 1.35 m.

Ruark, G.A.; Martin, G.L.; Bockheim, J.G. 1987. Comparison of constant and variable allometric ratios for estimating Populus tremuloides biomass. Forest Science. 33(2): 294-300.

Biomass data were collected from 39 dominant and codominant trees and 6 intermediate trees, 8-63 years old, felled on 9 sites in north-central Wisconsin. An allometric model incorporating a variable allometric ratio was fitted to data for stem wood, stem bark, live branch, leaf and current twig components of biomass.

Stringer, J.W.; Shain, L.; Wittwer, R.F. 1987. Growth and survival of eastern cottonwood in Kentucky. *Southern Journal of Applied Forestry*. 11(2): 73-76.

Nine clones of Populus deltoides were planted in April 1973 at sites in the Ohio River Valley and in the inner Bluegrass region of western and central Kentucky, respectively. Height and diameter of all trees were measured after 5 and 10 years and crown vigor was assessed after 10 years. Five of the six clones from an improvement program at Stoneville, MS, performed well for the first 5 years, but the survival and growth of some of these superior clones was significantly less than that of others in the second 5 years. These same clones exhibited low crown vigor and many stems had cankers associated with Fusarium solani. It is concluded that early growth indices may not be valid predictors of the potential of a given clone. Significant differences between the 2 sites indicate that selection of genotypes for specific sites may be more effective than development of a genotype that performs well on a variety of sites.

Van Hooren, D.L.; Columbus, M.J. 1987. Two year growth and biomass yield of hybrid poplar. Preliminary report. Toronto, Canada: Ontario Ministry of Agriculture and Food, Agricultural Energy Centre. 18 p.

Hybrid poplar was investigated to determine its potential as a renewable and dependable source of fuel energy for a greenhouse operation. Six clones of hybrid poplar were planted in May 1984. After 2 years' growth, the main stem diameter of the different clones ranged from 1.6 to 3.1 cm and the main stem height from 175 to 361 cm. The clones were harvested with a modified maize forage harvester in April 1986. The moisture content of the tree biomass at harvest ranged from 55 to 61 percent wet basis. The biomass yield of the different clones ranged from 2.10 to 7.69 oven dry tonnes/ha.

HARVESTING

1975

Erdos, L. 1975. Tasks and problems of Populus logging in large scale agricultural enterprises. ERFA (Erdogazdasag Faipar). 4: 2-3.

Telegdy, P. 1975. Examining the first logging of populus in cooperative forests. Erdo. 24(2): 76-80.

1976

DeByle, N.V. 1976. The aspen forest after harvest. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 35-40.

Groff, W.H. 1976. Problems and opportunities associated with aspen logging systems. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 91-94.

Hittenrauch, H.R. 1976. Response of aspen to various harvest techniques. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 41-44.

Jones, J.R. 1976. Aspen harvesting and reproduction (thinning, harvesting, skidding). Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 30-34.

Warren, N.J.; Weber, W.P. 1976. Cottonwood harvesting systems. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 446-450.

1977

Herpay, I. 1977. Analysis of machine-system models applicable in Populus stands. Erdo. 26(12): 543-548.

1982

Jeglum, J.K. 1982. Strip cutting in shallow-soil upland black spruce near Nipigon, Ontario. II. Regeneration in the first study area. Inf. Rep. O-X-337. Ontario, Canada: Great Lakes Forest Research Centre. 24 p.

There were no significant differences in black spruce regeneration among strips 20, 40, and 80 m wide. Composition has changed from black spruce dominant in the pre-felled forest to a black spruce/white birch (Betula

papyrifera)/trembling aspen (Populus tremuloides) mixture in the regenerated first-cut strips.

1983

Crouch, G.L. 1983. Effects of commercial clearcutting of aspen on understory vegetation and wildlife habitat values in southwestern Colorado. Res. Pap. RM-246. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 8 p.

Studies in the San Juan National Forest in SW Colorado during 1979 showed that the DM understory production of all woody plants increased significantly after removing the aspen overstory. However, aspen sprouts were the dominant visual growth form in clearings. Cover of the 2 most common grasses, Poa pratensis and Elymus glaucus was diminished by logging and had not recovered within 5 years. The cover of 27 forb species was also measured; annual mean cover for 6 of the 10 most common species were lower for 5 years after clearing.

Ondro, W.J.; Stewart, H.M. 1983. Harvesting forest biomass with a Dika side cutter. For. Manage. Note 23. Canada: Northern Forest Research Centre. 2 p.

Two stands of trembling aspen (Populus tremuloides) in Alberta, 37 and 58 years old, were harvested in March 1981, half with the cutter, and half with a chain saw. The cost of harvesting and piling in the younger stand was \$28.60/t (oven dry) for the side cutter and \$39.30/t for the chain saw, 37 percent higher. In the older stand the cost of harvesting by chain saw was 34 percent higher.

Strong, T.F.; Zavitkovski, J. 1983. Effect of harvesting season on hybrid poplar coppicing. In: Hansen, E.A., comp. Intensive plantation culture: 12 years research. Gen. Tech. Rep. NC-91. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 54-57.

1985

Grammel, R.H. 1985. Harvesting fast-growing timber plantations in South America. Holz-Zentralblatt. 111(113): 1596-1597.

A review of: investment policies for plantation establishment, species used, forest work aspects, harvesting methods, and prospects. Felling is generally by chain saw, with trimming at the felling site, usually by hand.

Hendrickson, O.Q.; Chatarpaul, L.; Robinson, J.B. 1985. Effects of two methods of timber harvesting on microbial processes in forest soil. Soil Science Society of America Journal. 49(3): 739-746.

Microbial populations and activities in a mature, mixed conifer, and hardwood stand were compared with those in similar adjacent stands harvested by conventional (CH) and whole-tree (WTH) methods.

Sobolev, V.A.; Glushkov, V.P.; Vaisman, A.A. 1985. The influence of tree species on the probability of injury in felling. Lesnoi Zhurnal. 3: 117-118.

Results of a statistical analysis show that the probability of an accident is very much greater when felling aspen than when felling birch, spruce, pine, or other species.

1986

Bella, I.E. 1986. Logging practices and subsequent development of aspen stands in east-central Saskatchewan. *Forestry Chronicle*. 62(2): 81-83.

Stands of Populus tremuloides aged 70-80 years were clear felled in March 1966 or July 1967 and harvested by whole-stem or whole-tree logging. Further measurements of stand development were made in May 1983. It is concluded that flexibility may be exercised in harvest scheduling and method of logging in aspen stands.

IMPROVEMENT

1975

1975. Extracts from the National Register of Forest Clones. Collana Verde. 34: 219-229.

Arru, G.M. 1975. Resistance of poplars to some insect pests according to observations made in Italy during the years 1930-72. Cellulosa e Carta. 26(12): 45-49.

Atakhanova, S.A. 1975. Effect of impulse-concentrated sunlight on the growth of hybrid seedlings. Nauch. tr. Kazakhsk. s.-kh. in-t. 18(2): 5-8. Referativnyi Zhurnal. (1976) 5.55.358.

Forest-tree seedlings obtained by pollination with irradiated pollen reached each stage of development 2-3 days earlier than the control forms. Treatment with impulse-concentrated sunlight during hybridization increased variation in hybrid poplar seedlings, enabling promising forms to be selected.

Besschetnov, P.P. 1975. Introgressive hybridization and its importance in the formation of new poplar species. Nauch. tr. Kazakhsk. s.-kh. in-t. 18(2): 8-15. Referativnyi Zhurnal. (1976) 4.55.55.

In areas where closely related species have overlapped, hybrids have arisen which differ in several characters from the initial forms. As a result of natural selection, this is the origin of Populus canescens along the river Ural, of P. talassica and of the hybrid between P. alba and P. tremula. These relatively young species represent useful material for breeding.

Besschetnov, P.P. 1975. Role of introgressive hybridization in the formation of new poplar species. Tr. In-ta ekol. rast. i zhivotnykh. Ural'sk. Nauch. tsentr AN SSR. 91: 3-8. Referativnyi Zhurnal. (1975) 12.55.60.

As a result of studies of geographical and intrapopulational variation in the subgenus Turanga, the series Albidae and Trepidae and the section Aigeiri, together with experiments involving their hybridization, the occurrence of introgressive hybridization in the genus was confirmed, especially in populations of Populus canescens. It was demonstrated that the genetic isolation of the subgenus Turanga is a result of its adaptation to particular ecological conditions.

Cannell, M.G.R.; Last, F.T., eds. 1975. Tree physiology and yield improvement. London, UK: Academic Press: 1-306.

A compendium of papers given at a conference held near Edinburgh in July 1975 to examine the physiological and morphological characteristics that limit wood yield, and to consider their heritability and application in tree breeding. Thirty papers are presented.

Destremau, D.X.; Bellefontaine, R. 1975. Activities of the tree improvement section, Forest Research Institute, Rabat, Morocco. Forestry Occasional Paper, Forest Genetic Resources Information - No. 4: 55-58.

Work is reported for nine species of Pinus, Cedrus atlantica, Cupressus atlantica, Eucalyptus camaldulensis, E. gomphocephala, E. grandis, and Populus alba.

Dhir, N.K. 1975. A comparative study of inter- and intra-provenance crosses of eastern cottonwood. Dissertation Abstracts International, B. 35(12): 5731B-5732B.

Five promising sources of diverse geographic origins were crossed in diallel and eight morphological and developmental traits studied. The crosses within sources had significant variation for most of the traits whereas crosses between sources showed significant variation for all traits. General combining ability effects as well as specific combining ability effects were important to crosses between sources.

Dimitrov, Kh.; Kolarov, D. 1975. New imported poplar clones and prospects for their practical use. Gorsko Smoiansmbo. 31(2): 28-32.

Fu, Y.C.; Wang, C.H. 1975. A new variety of the species Populus tomentosa Carr. Acta Phytotaxonom Sinica. 13(3): 95-96.

Gancev, P. 1975. Poplar hybridization of the section Leuce. Topola. 18/19(103/106): 89-94.

Ganchev, P. 1975. Hybridization and experimental mutagenesis in some Populus species of the section Leuce as a method for genetic studies and breeding new forms. Gorskostopanska Nauka. 12(2): 3-15.

The results are presented of a study of the hybrids P. tremula X P. tremuloides and P. alba X P. tremula, and of mutants induced in the latter hybrid and its parents by colchicine and gamma irradiation. The hybrids showed mainly intermediate inheritance. In some cases heterosis was observed for height, diameter of trunk, and leaf size. Five useful tetraploids were induced in P. tremula by treating germinated seed with colchicine.

Handziuk, V.H. 1975. On the resistance of Populus to Cytospora infection in the Donets Basin. Visn Sil's'kohspod Nauki. 5: 66-71.

Herpka, I. 1975. Methodology of early testing in poplars. Topola. 18/19(103/106). 194-200.

A study is reported of multiple-regression correlations between juvenile and adult characters in a 13-year-old trial of Populus nigra hybrids. Stem volume increment in trials can be predicted at a plantation age of 2-3 years. Similarly, selection for height can be carried out at 4-6 years old, and for wood basic density at 2-4 years old.

Ivannikov, S.P. 1975. Importance in breeding work of spontaneous polyploid aspens in the USSR. Tr. In-ta ekol. rast. i zivotnykh. Ural'sk Nauch. tsentr AN SSSR. 91: 26-29. Referativnyi Zhurnal. (1975) 12.55.329.

A study of natural plantations revealed marked polymorphism in such characters as growth rate, timber quality, and resistance to Ganoderma applanatum. The triploid forms had a high growth rate and resistance to G.

applanatum. The tetraploids were mostly represented by dwarf forms, but they were especially useful in hybridization.

Kosichenko, N.E. 1975. Anatomical and histochemical method for the early diagnosis of winter hardiness in poplar hybrids. Genet., Seleksiya, semenovodstvo i introduksiya les. porod, 2: 162-168. Referativnyi Zhurnal. (1976) 9.56.124.

Anatomical characters which showed a close correlation with hardiness in the hybrids studied included the degree of lignification and suberization of the shoots. The hardy forms completed the process earliest. The main histochemical character correlated with hardiness was the ratio between lipid and starch content; the hardy forms had a higher content of lipids and a lower starch content in winter.

Koster, R. 1975. Populus. Forestry Occasional Paper, Forest Genetic Resources Information - No. 4: 58.

The activities of the IUFRO working party on poplar provenance samples during 1974 are briefly reported. Seed collection and distribution was undertaken from the USA for P. trichocarpa and from Belgium for this species and P. deltoides and P. nigra.

Ragonese, A.E.; Rial Alberti, F. 1975. Resistance of Populus cultivars belonging to the Aigeiros section to mildew attacks. IDIA Supplement. 8: 40-46.

Rutkovskii, I.V.; Dokuchaeva, M.I.; Pavlova, T.S. 1975. Rapid evaluation of the properties of forest trees during breeding work. Referativnyi Zhurnal. (1976) 1.55.326.

Measurements were made of the electrical conductivity of the tissues, the difference in potentials (DP) and the coefficient of polarization in pine species of the section Cembra, both own-rooted and grafted on to Scots pine, and in poplar. Own-rooted pines had a more marked reaction to changes in the environment than those grafted on to Scots pine. Plants with a greater increase in height had higher values for DP. The dynamics are given of the electrical conductivity of the tissues in poplars with high and low growth increments.

Rzedowski, J. 1975. Three new Mexican dicotyledons of possible ornamental interest. Boletín de la Sociedad Botánica de México. 35: 37-49.

Describes three new species from the states of Guerrero and Mexico, viz. the trees Populus simaroa and Montanoa gigas and the annual herb Castilleja venusta. P. simaroa may be related to P. grandidentata; it is remarkable for its phenology, remaining leafless during the rainy season and coming into leaf at the beginning of the dry season. M. gigas, a tree up to 20 m high, belongs to the M. quadrangularis group and may be distinguished from M. hexagona mainly by the morphology of the bracts in its fructifications.

Schreiner, E.J. 1975. Early distribution of the northeastern hybrid poplars, 1930-1954. In: Proceedings, 22d Northeastern Forest Tree Improvement Conference: 190-200.

Thielges, B.A.; Adams, J.C. 1975. Genetic variation and heritability of Melampsora leaf rust resistance in eastern cottonwood. *Forest Science*. 21: 278-282. (Also printed in *Journal of Forestry*. (1976). 7(1): 45.)

More than 200 clones were evaluated. The genetic basis of variation in resistance is discussed with suggestions for applying the information to the genetic improvement of Populus.

Thielges, B.A.; Beck, R.C. 1975. Control of bud break and its inheritance in Populus deltoides. In: Cannell, M.G.R.; Last, F.T., eds. *Tree physiology and yield improvement--shoot and cambial growth*. London, UK: Academic Press: 253-259.

Results of studies using 100 branch-wood cuttings from each of 23 clones drawn from northern states of the USA indicate that apical bud dormancy is more effectively broken by low temperatures than by extended photoperiods. Once dormancy is broken bud break appears to be stimulated by growth substances synthesized in the roots in response to increased temperatures.

Vasilenko, I.D. 1975. The hybridization of poplars. *Referativnyi Zhurnal*. (1975) 10.56.131.

The results are given of three years' work on interspecific hybridization. In several cross combinations, heterotic forms were obtained which markedly exceeded their parents in height and the thickness of the trunk.

Wilkinson, A.G. 1975. Poplar breeding and selection. *Soil Water*. 11(3): 41-42, 48.

1976

1976. Genetic improvement of forest tree species in Quebec. Quebec, Canada: Ministere des Terres et Forets, Service de la Recherche, Comite de Recherche en genetique forestiere. 30: 217 p.

Introductory chapters deal with the institutional and other infrastructure concerned with the improvement of forest trees in Quebec. The main part of the report is a review of available knowledge on the subject for Betula spp., Acer spp., Fraxinus spp., Abies balsamea, Juglans spp., Quercus spp., Populus spp., Picea spp., Larix spp., and Pinus spp. Recommendations are made relating in particular to: priorities as to species for improvement, determination of desired degree of improvement, and installation of the necessary infrastructure.

1976. Wanted--an Australian poplar. *Rural Research*, Australia. 92: 17-18.

The breeding of Populus deltoides and P. nigra strains suitable for Australian conditions is reviewed. The introduction and rapid spread of Melampsora medusae from North America and of M. larici populina has necessitated the breeding of resistant clones.

Arru, G.M. 1976. Resistance to Pseudaulacaspis pentagona in poplar. *Cellulosa e Carta*. 17(10): 41-44.

The clones 'I-CB7' (Populus X euramericana), 'I-63/51' (Populus deltoides) and 'I-58/57' (Populus alba) differed little from each other in response to Pseudaulacaspis pentagona, and all were less susceptible than the most widely grown clone 'I-214' (P. X euramericana) and 'I-69/55' (P. deltoides).

Arru, G.M. 1976. The resistance of Poplars to Mulberry scale: Preliminary trials. Cellulosa e Carta. 27(10): 41-44.

Two clones of Populus X canadensis (P. 'I-214' and P. 'I-CB7'), two of P. deltoides (P. 'I-69/55' or 'Lux' and P. 'I-63/51' or 'Harvard') and one of P. alba (P. 'I-58/57') were tested for resistance to P. pentagona. Of the five clones, P. 'I-214' was the most susceptible. The other three clones did not differ significantly in susceptibility, and were only very slightly attacked.

Baranchugov, E.G.; Khusnutdinova, N.B. 1976. Hardiness in poplars introduced into the Tatar ASSR. Referativnyi Zhurnal. (1977) 1.56.120.

The forms studied are listed in groups according to the extent of their cold resistance.

Beineke, W.F., ed. 1976. Proceedings of the 10th Central States forest tree improvement conference; 1976 September 22-23; West Lafayette, IN. West Lafayette, IN: Purdue University, Department of Forestry and Natural Resources. 187 p.

Four technical sessions (17 papers) are presented on general tree improvement studies (including Carya spp., Populus spp., Pinus spp., Fraxinus spp., Betula alleghaniensis, Juglans nigra, Thuja occidentalis, and Quercus rubra), one session on sampling and data recording and analysis, and one session on the priorities of tree improvement and studies in particular areas.

Besschetnov, P.P.; Atakhanova, S.A. 1976. Use of impulse-concentrated sunlight in poplar breeding. (Nauch. tr.) Kazakhsk. s-kh. in-t. 18(1): 244-254. Referativnyi Zhurnal. (1976) 6.55.384.

Irradiation with impulse-concentrated sunlight accelerated the development rate of the flower by 1-3 days. Irradiation of the pollen at the archesporial stage markedly increased the percentage of large pollen grains. Pollination with this pollen increased the morphological variation in the hybrids. Irradiation of the reproductive buds led to an increase in the percentage of fast-growing trees.

Borsdorf, W. 1976, Anatomy of the secondary phloem and bark of cultivated poplar varieties. Flora. 165(4): 325-353.

A study of some 30 varieties and species grown in East Germany, mostly of sections Aigeiros and Tacamahaca, revealed useful diagnostic differences in the formation of expansion tissues, especially in young, strongly growing shoots, and in the structure of the outer bark. It is noted that varieties known to be susceptible to Dothichiza populea belong to the types with poor phellem development in the outer bark.

Cooper, D.T.; Filer, T.H., Jr. 1976. Resistance to Septoria leaf spot in eastern cottonwood. Plant Disease Reporter. 60(10): 812-814.

Ten of 320 random clones of Populus deltoides, originating from stands along the Mississippi River from Memphis, Tennessee to Rosedale, Mississippi,

were resistant to S. musiva in a nursery near Greenville, Mississippi. None of 1,120 random clones was resistant.

Dagenbach, H.; Schlenker, G. 1976. Dothichiza resistance of different poplar varieties in the Reichenberg Populetum. *Mitteilungen, Verein für Forstliche Standortskunde und Forstpflanzenzüchtung*. 25: 26-32.

During 1962-1971, a Dothichiza populea epidemic spread through this Populetum (75 Populus clones and populations) in the Neckar Valley. Trees were observed for their resistance to attack and the behavior of individual clones is discussed. P. 'Androscoggin', P. 'Oxford', and P. 'Rochester' showed little or no attack, whereas P. nigra clones were very severely attacked. Balsam poplars (section Tacamahaca) and black poplars (section Aigeiros) and hybrids within and between these sections showed wide variation between clones in resistance to attack. Some general recommendations are made on the planting of black poplars and balsam poplars in affected areas.

Dhir, N.K.; Mohn, C.A. 1976. A comparative study of crosses between and within two geographically diverse sources of eastern cottonwood. *Canadian Journal of Forest Research*. 6(3): 400-405.

Controlled pollinations were made within and between two stocks of Populus deltoides, one from Minnesota and one from Missouri; each stock acted in turn as the seed parent. Data on seven characters are tabulated; interprovenance crosses were significantly superior for six of them. Problems arising from diecism are discussed.

Dietrichson, J.; Krutzsch, P.; Shelbourne, C.J.A.; et al. 1976. Provenances. Congress Group 2. In: *Proceedings, Division 2: Forest plants and forest protection: 16th IUFRO World Congress; 1976 June 20-July 2; Oslo, Norway*. As, Norway: International Union of Forestry Research Organizations: 126-214.

Einspahr, D.W.; Winton, L.L. 1976. Genetics of quaking aspen. Res. Pap. WO-25. Washington, DC: U.S. Department of Agriculture, Forest Service. 23 p.

Predicted improvements from selection and first generation intraspecific breeding of quaking aspen (Populus tremuloides) are 20-30 percent in volume growth, 2-5 percent in density, 5-7 percent in fiber length and 40-50 percent in resistance to Hypoxylon cankers; improvements through polyploidy and hybridization are expected to be twice as great. It is concluded that breeding programs should aim to produce a disease-resistant, rapidly growing tree with dense juvenile wood for pulpwood and chip production in short-rotation plantations.

Fechner, G.H. 1976. Development of unpollinated ovules of quaking aspen. In: *Proceedings, 23d Northeastern forest tree improvement conference: 150-157*.

The development of unpollinated and control-pollinated ovules of Populus tremuloides was studied from the bud stage to the fully extended female ament. Following fertilization, aments, pistils, and ovules elongated rapidly and fully-differentiated embryos appeared within 20 days. In unpollinated material, ovules began to abort about 1 week after fertilization would have occurred; this occurred about 2 days later in unfertilized ovules in pollinated ovaries.

Gordon, J.C.; Promnitz, L.C. 1976. Photosynthetic and enzymatic criteria for the early selection of fast-growing Populus clones. In: Cannell, M.G.R.; Last, F.T., eds. Tree physiology and yield improvement--carbon fixation efficiency. London, UK: Academic Press: 79-97.

This review encompasses the following topics: (1) choosing physiological variables, (2) clonal differences in net carbon fixation, (3) clonal differences in peroxidase and nitrate reductase activities, and (4) multivariate methods.

Guries, R.P.; Stettler, R.F. 1976. Pre-fertilization barriers to hybridization in the poplars. Silvae Genetica. 25(2): 37-44.

Investigations were carried out into the causes of infertility in 28 crosses between the three Tacamahaca species Populus trichocarpa, P. balsamifera, P. maximowiczii, the two Aigeiros species P. deltoides and P. nigra v. italica, and the two Leuce species P. alba and P. tremuloides. The results showed that several pre-fertilization barriers operated to impair or prevent crossing between certain species pairs. Inhibition of pollen-tube growth was a common barrier in Tacamahaca X Leuce and Aigeiros X Leuce crosses, and in P. alba when Aigeiros or Tacamahaca species were the pollen parents.

Guries, R.P. 1976. Crossing barriers in the poplars and the mentor-pollen phenomenon. Dissertation Abstracts International, B. 37(2): 542B. Abstract.

Irradiated compatible pollen promoted catkin retention in Populus trichocarpa equal to that with normal pollen, but without concomitant embryogeny. Parthenocarpy was observed in species from the section Leuce.

Harder, M.; Verhagen, S.; Winton, L.; Einspahr, D. 1976. Tetraploid aspen production using unreduced pollen from triploid males. Forest Science. 22(3): 329-330.

A note reporting a successful back-cross from a precociously flowering putative tetraploid of quaking aspen (Populus tremuloides) confirming the effectiveness of the unreduced pollen-grain technique.

Hilf, H.H.; Frohlich, H.J.; Schreiner, E.J.; et al. 1976. Progress in poplar breeding and poplar growing. Holzzucht. 30(2/4): 15-46, 48-53.

A special number on the occasion of the journal's 30th anniversary which contains 15 papers from 14 different countries.

Holzer, K.; Radu, S.; Kriebel, H.B.; Starova, N.V.; Kots, S.P. 1976. Forest tree breeding. Congress Group 3. In: Proceedings, Division 2: Forest plants and forest protection: 16th IUFRO World Congress; 1976 June 20-July 2; Oslo, Norway. As, Norway: International Union of Forestry Research Organizations: 216-257.

Hyun, S.K.; Son, D.S. 1976. New poplar hybrids for the Korean highland. Holzzucht. 30(2/4): 40-43.

Jokela, J.J.; Lovett, W.R. 1976. Selection and breeding eastern cottonwood for resistance to foliage diseases. In: Morgenstern, E.K., ed. Proceedings of the 15th meeting of the Canadian Tree Improvement Association. Part 2. 12th Lake

States forest tree improvement conference. Ottawa, Canada: Canadian Forestry Service: 95. Abstract.

The incidence and effects of Melampsora rust and Marssonina spot on Populus deltoides in the central USA are discussed and attention is drawn to the urgent need for selection and breeding for resistance.

Koski, V. 1976. Proposed tree breeding programme in Finland, 1976-1985. Abbreviation of the report issued by the Tree Breeding Committee. Folia Forestalia, Institutum Forestale Fenniae. 266: 24 p.

The program includes Pinus sylvestris, Picea abies, Betula verrucosa, B. pubescens, Populus tremula, Alnus glutinosa, A. incana, Salix spp., Larix spp., and Pinus contorta var. latifolia. Properties to be improved include rate of growth, adaptation and resistance, stem form and wood quality.

Koster, R. 1976. Prospects of poplar breeding in the Netherlands. Holzzucht. 30(2/4): 26-28.

Lapietra, G. 1976. Resistance to insects of ten poplar clones during their first year in the nursery. Cellulosa e Carta. 27(11): 22-30.

Gives results of tests in 1970 and 1971 on the susceptibility to Leucoptera sinuella, Phyllocnistis suffusella, Gypsonoma aceriana, and Paranthrene tabaniformis on one-year-old nursery stock of 10 poplar clones of very different genetic origins. The data suggest that the measured variables have a definite genetic basis. In general, differences in susceptibility among the clones were consistent and significant in both tests.

Larson, P.R. 1976. The leaf-cambium relation and some prospects for genetic improvement. In: Cannell, M.G.R.; Last, F.T., eds. Tree physiology and yield improvement. London, UK: Academic Press: 261-282.

Mohrdiek, O. 1976. Progeny studies in poplars of the sections Aigeiros, Tacamahaca and Leuce, with recommendations for further breeding work. German Federal Republic: Georg-August-Universitat Gottingen. 168 p. Thesis.

Performance was assessed in trial stands more than 10 years old situated throughout the German Federal Republic. Among numerous clones of sections Aigeiros and Tacamahaca, the Aigeiros clones 56/50/33, 'I-45/51', Ostia, and Jac.78B and the Tacamahaca clones Muhle-Larsen, Scott Pauley, Bruhl 5, 6, and 8, 'Oxford', 'Rochester' and trich.43/54 showed particularly vigorous growth.

Mohrdiek, O.; Melchior, G.H. 1976. Combined hybrid and polyploid breeding as a promising method for poplars of the section Leuce: comparison of diploid and triploid grey poplars of the same progenies. Holzzucht. 30(1): 7-10.

Progeny trials were planted at Schmalenbeck, W. Germany, in 1958 using clonal plants derived from either triploid or diploid progeny of eight crosses between: a genetically anomalous grey poplar (Populus canescens) as the pollen parent; and itself, other P. canescens, P. alba, and P. tremula as the seed parents. The d.b.h. of the triploids was $\frac{7}{38}$ percent greater than that of the diploids from the same cross. A program for further breeding work in section Leuce is outlined.

Nepveu, G.; du Cros, E.T. 1976. Juvenile selection for wood quality in euramerican poplars. In: International Union of Forest Research Organizations: advanced generation breeding: Proceedings, IUFRO joint meeting of working parties on population and ecological genetics, breeding theory and progeny testing; 1976 June 14-18; Bordeaux, France. Cestas, France: INRA: 204-205. Abstract.

Ozolin, G.P. 1976. Achievements of tree breeding and selection in protection forestry. *Lesnoe Khozyaistvo*. 2: 52-56.

A review of progress in the breeding of forest trees for rapid growth in the USSR, with special reference to shelterbelt planting and achievements since the 1930's. Details are given of the results of hybridization and breeding work on larches, pines, poplars, birches, oak, ash, elm, maple, and Robinia.

Palmberg, C. 1976. Introduction and breeding improvement of poplars in Australia. *Holzzucht*. 30(2/4): 43-46.

Palmberg, C. 1976. Selecting for rust resistance in poplars in Australia. In: Proceedings, 3d International Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania (SABRAO). Plant Breeding Papers: 1. Canberra, Australia: 16-20.

An outline is given of the introduction of Populus into Australia. Trials for resistance to Melampsora medusae and M. larici-populina revealed relatively high stable resistance among clones derived from seedlings of mother trees of the Populus deltoides PC/67 series 024, 040, 005, 007, and 028.

Petrov, M. 1976. Features of the heritability by their hybrid progeny of certain characters of Populus nigra cv. 'Schipka' and P. simonii var. pendula. *Gorskostopanska Nauka*. 13(4): 3-12.

Genetic investigations were made on the F1 hybrid progeny of P. nigra cv. 'Schipka' X P. simonii var. pendula. The female parent, cv. 'Schipka', had a pyramidal crown, and the male parent, var. pendula, had a broad crown. Different degrees of pyramidal habit were observed in the hybrid progeny. Petiole color, vein color, and indentation of the leaf margins in the hybrid progeny, were intermediate between those of the parents.

Promnitz, L.C.; Wray, P.H. 1976. Rapid selection techniques for identifying superior clones. Gen. Tech. Rep. NC-21. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 25-31.

Rommel, M. 1976. Natural triploids of Populus species in plant breeding. *Genetika, Yugoslavia*. 8(3): 183-186.

Natural triploids have been reported only in section Leuce. Seedlings of P. canescens, P. tremula, and P. tremuloides, derived from controlled crosses at Hann, Munden, were screened and examined by an aceto-orcein smear technique to determine chromosome numbers at mitosis in young leaves. No triploids were found, but a few plants were chimeras.

Schipper, A.L., Jr. 1976. Hybrid poplar diseases and disease resistance. Gen. Tech. Rep. NC-21. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 75-80.

Schlenker, G. 1976. Forest tree breeding in Baden-Wurttemberg. Mitteilungen, Verein fur Forstliche Standortkunde und Forstpflanzenzuchtung. 25: 3-7.

A summary of work since 1947, based at Stuttgart, on tree improvement with special reference to site relations. Two main trials are in progress: clonal poplar (Populus spp.) trials in different climatic regions and on a variety of soils; and long-term improvement of larch (Larix) by selection and propagation (by cuttings) of individuals from hybrid populations of L. decidua and L. kaempferi (L. leptolepis) for their suitability on a wide range of sites.

Shchepot'ev, F.L. 1976. Radiation breeding--an important method of producing new forms of trees and shrubs. Referativnyi Zhurnal. (1977) 1.55.278.

In a 10-year breeding program involving radiation-induced mutagenesis, over 60 mutant forms of the following species were obtained, selected, and tested under cultivation: Quercus robur, Populus trichocarpa, Aesculus hippocastanum, Acer saccharinum, Ailanthus glandulosa, Biota orientalis, Rosa cinnamomea, and Chaenomeles japonica.

Valentine, F.A.; Manion, P.D.; Moore, K.E. 1976. Genetic control of resistance to Hypoxylon infection and canker development in Populus tremuloides. In: Morgenstern, E.K., ed. Proceedings, 15th meeting of the Canadian Tree Improvement Association. Part 2. 12th Lake States forest tree improvement conference. Ottawa, Canada: Canadian Forestry Service: 104. Abstract.

The responses of six groups, each of four maternal half-sibling families, to four sources of H. mammatum were studied. Three resistance mechanisms were observed: (1) callus formation, (2) branch death, and (3) resistance through retardation of canker growth. Evidence suggests that a few major genes control resistance and are the basis for Mendelian ratios within families and discrete differences between groups of half-sibling families.

Weisgerber, H. 1976. Advances in forest-tree breeding, particularly with regard to improving timber quality. Berichte uber Landwirtschaft. 54(1): 91-103.

Breeding programs in Germany are described. The importance of the choice of material from suitable places of origin is demonstrated for Norway spruce (Picea abies), European larch (Larix decidua) and Douglas fir (Pseudotsuga menziesii). A small number of trials have been undertaken, particularly with poplar (Populus spp.) clones, to estimate genetic influence on the anatomical, physical, and chemical characteristics of the wood.

Willing, R.R.; Pryor, L.D. 1976. Interspecific hybridization in poplar. Theoretical and Applied Genetics. 47(3): 141-151.

Crosses between pairs of species normally found to be incompatible were accomplished after treatment of the pollen or stigma, or both, with organic solvents. Treatment with hexane or ethyl acetate was particularly successful. The fact that the incompatibility reaction can be prevented by either stigma or pollen treatment suggests that two factors are involved, one

attached to the pollen (P) and one to the stigma (S) and that the incompatibility process is inactivated by the absence of either.

Zsuffa, L. 1976. Bases and prospects of poplar breeding in Ontario, Canada. *Holzzucht*. 30(2/4): 37-40.

1977

1977. Poplar. Annual report of the State Agronomic Research Centre, Ghent. Ghent, Belgium: State Agronomic Research Centre. 235 p.

Populus gelrica and P. serotina 'De Champagne' were more drought resistant than P. robusta or P. regenerata. Selected clones of P. deltoides had resistance to the principal viral and fungal leaf diseases; some had in addition resistance to Aplanobacter populi. Hybrids involving P. trichocarpa also had resistance to A. populi combined with resistance to M. allii-populina.

1977. Progress in selection and breeding of Populus in China. *Chung-Kuo Lin Yeah K'o Hsueh*. 4: 20-25.

Alonzo, A.E. 1977. Populus deltoides in Argentinian poplar culture. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University; 1: 60-65.

Information is presented on local and introduced clones and hybrids in Argentina, and their suitability for cultivation in different regions of the country.

Avanzo, E. 1977. The use of Populus deltoides Bartr. in the Mediterranean Region. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University; 1: 44-46.

The history of the spread of P. deltoides 'Carolínians', which is of unknown origin, in southern Europe is outlined. This variety together with the introduced US varieties Harvard, Onda, and Lux are grown in Italy because of their resistance to Marssonina brunnea.

Bakulin, V.T. 1977. Production of polyploid forms in some species of Populus with the aid of colchicine. *Ser. Biol. Nauk*. 10: 68-75.

Bojarczuk, T.; Bugala, W. 1977. Comparative studies of selected poplar clones from the section Aigeiros. *Arboretum Kornickie*. 22: 39-56.

Data are tabulated on 36 clones for cultivation in the Wielkopolska region, Poland. The incidence of Melampsora and Marssonina spp. was assessed on a 5-point scale.

Bugala, W. 1977. The cultivation of Populus deltoides and some of its hybrids in Poland. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University; 1: 165-169.

An account is given of the history of hybridization work involving P. deltoides and hybrids of P. nigra with other Populus species.

Clonaru, A.; Naji Mohammed Saeed. 1977. The role of Populus deltoides in the Middle East. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University; 1: 50-59.

Information is presented on the taxonomy of Populus species occurring in the Middle East and the improvement of these species by introduction and selection, and on the performance of P. deltoides clones from the USA.

Cooper, D.T. 1977. Cottonwood breeding strategies for the future. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University; 1: 151-155.

A systematic, long-term breeding program for Populus deltoides is outlined.

Dafaue, C.; Cadahia, D. 1977. Host plant selection by Cryptorrhynchus lapathi L. In: de Ponti, O.M.B., convenor. Eucarpia/OILB working group breeding for resistance to insects and mites: Report of the 1st meeting; 1976 December 7-9; Wageningen, The Netherlands. Bulletin SR0P: 103-107.

Farmer, R.E., Jr. 1977. Sexual reproduction of eastern cottonwood. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University; 1: 89-98.

Literature on flowering, controlled-crossing techniques, interspecific hybridization, seed germination, and seedling establishment in Populus deltoides is reviewed.

Garrett, P.W. 1977. Interspecific hybridization: the American experience. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University; 1: 156-164.

An account is given of hybridization work with species of Populus from 1775 until the present.

Herpka, I. 1977. The use of Populus deltoides in Danube Valley. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University; 1: 47-49.

Brief information is presented on adaptability, success in the rooting of cuttings, resistance to diseases, variation in wood density, survival, shade tolerance, and the self-pruning character among clones introduced from the USA for cultivation in the Danube Valley, Yugoslavia.

Jokela, J.J.; Mohn, C.A. 1977. Geographic variation in eastern cottonwood. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University; 1: 109-125.

The first systematic sampling of wild populations of Populus deltoides was made between 1947 and 1950. Photoperiodic studies based on these materials established the adaptation of subpopulations to habitats differing in length of frost-free season and the influence of day length on the onset of dormancy. It is concluded that provenance tests established during the past decade, notably the NC-99 tests and those established abroad with seed collected by the Poplar Council, do not adequately sample the species range and may have design weaknesses.

Kemperman, J.A. 1977. Aspen clones: development, variability and identification. For. Res. Inf. Pap. 101. Ontario, Canada: Ministry of Natural Resources. 11 p.

This paper discusses: the biology of the development of aspen (Populus tremuloides and P. grandidentata) clones, clonal variability and its effect on the design of research experiments, the main characteristics for field identification of aspen clones, and the potential uses of aspen clones in forest management.

Koster, R. 1977. Observations on Populus deltoides provenances grown in Holland. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University; 1: 126-133.

Two-year-old seedlings of P. deltoides representing 70 seed sources from 15 states of the USA were studied in one nursery following seed collection in 1967. Another eight seed sources were collected from Oklahoma in 1969. It is tentatively suggested from the data obtained that differences between seed sources in mean numbers of branches per m of stem length can be used as a criterion for delimitation of areas of genetic variability within the natural range of the species.

Krzan, Z. 1977. Resistance of Populus deltoides clones to Melampsora larici-populina in Poland. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University; 2: 199-204.

A large collection of clones of P. deltoides and its hybrids was evaluated for resistance to M. larici-populina in 1975. The most resistant clones were P. deltoides subsp. angulata and P. deltoides X P. nigra. The stability of this resistance was substantiated by several years of observations and it is presumed to be under genetic control. The most susceptible clones were hybrids of P. deltoides X P. trichocarpa. Results of studies over many years suggest the possibility of obtaining poplar clones adapted to the climatic conditions of Poland and resistant to the existing strains of M. larici-populina.

Lindquist, C.H.; Cram, W.H.; Howe, J.A.G. 1977. Walker poplar. Canadian Journal of Plant Science. 57(3): 1019.

Selected from open-pollinated seedlings of Populus deltoides, Walker is better than other clones in Saskatchewan in growth and disease and insect resistance. It was selected for vigorous growth and resistance to Melampsora.

Mahmood Iqbal Sheikh. 1977. Performance of hybrid poplars in Pakistan. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University; 2: 414-419.

Growth data are presented from clonal trials of Populus deltoides and some of its hybrids with other Populus species from three regions of Pakistan.

Milewski, J. 1977. Studies on the growth, health and productivity of Populus varieties on alluvial soils of the Odra floodplain. Prace Instytutu Badawczego Lesnictwa, Poland. 537/541: 3-54.

Data collected over 15 years (1959-1973) near Opole, southern Poland, were used to rank 38 varieties according to productivity and health on a numerical scale covering survival, frost tolerance, and disease resistance.

Mohrdiek, O. 1977. Hybrid aspen for marginal forest sites. Forstarchiv. 48(8): 158-163.

Muhs, H.J. 1977. Aims and possibilities of forest free breeding with a view to ensuring timber supply. Forstarchiv. 48(9): 174-178.

Two examples, one from provenance research and one from cross breeding research, are used to show the aims of forest tree breeding. The international IUFRO provenance trial with Norway spruce contain some 1100 provenances grown on two locations. Results from height growth measured at age ten demonstrate a high variability of the provenances from southern Germany and Austria. Very good height growth show provenances from Westerhof (region west of the Harz Mountains), Poland, Czechoslovakia, and the Carpathian Mountains. The last ones are superior to the German special provenances. The concept of the clinal variation of height growth cannot favored longer considering the whole natural area of the species. It is replaced by another one considering the four refuges and the ways of post glacial migration. Yield increment of about 20 percent can be expected by choosing suitable provenances.

New hybrid progenies of European and American aspen have been shown to exceed pure aspen species. They seem to be suitable for sites with extreme conditions like podzolic, acid, and even permanent wet soils.

Results are discussed concerning a steady industrial wood supply. In contrast to other measures like silvicultural ones, which are also able to increase the yield, results of forest tree breeding applied did not cause additional costs in practical forestry. There is a need for forest tree breeding increasing the efficiency of forestry.

In addition, some projects in forest tree breeding to be worked on urgently are summarized.

Murkaite, R. 1977. Forms of aspen in Lithuania. Liet. Misku ukio moksl. tyrimo inst. darbai. 17: 122-127. Referativnyi Zhurnal. (1977) 10.56.133.

Twelve main and several intermediate morphological and biological forms were found, including a form with yellow catkins.

Palmberg, C. 1977. Introduction and improvement of poplars in Australia. Australian Forestry. 40(1): 20-27.

Trials carried out in recent years have led to the selection of rust-resistant, fast-growing clones. In southern parts of New South Wales and in Victoria, a further selection criterion used is resistance to damage by honeybees. In these areas bees collect the sticky protective layers from the buds of some clones; the resulting damage ranges from perforation of leaves to complete destruction of buds, which causes severe deformation.

Pogorelova, R.F.; Tsarev, A.P. 1977. Comparative evaluation of the winter hardiness of some species and hybrid varieties of poplar. Referativnyi Zhurnal. (1978) 6.65.594.

Eight species and hybrid varieties differing in hardiness were selected from 176 clones by means of a luminescence technique for evaluating hardiness.

Randall, W.K. 1977. Growth correlations of cottonwood clones developed from mature wood cuttings. *Silvae Genetica*. 26(2/3): 119-120.

Cuttings from 24 clones developed from mature ortets of Populus deltoides, studied for eight years, had higher estimated heritabilities for diameter than for height. Genotypic and phenotypic correlations of 8-year diameter and 5-year volume with diameters and heights at various ages increased as the trees aged. Two clones, selected for height at age seven, diameter at age eight or volume at age five, gave genotypic gains of 8, 17, and 40 percent over the means respectively.

Randall, W.K. 1977. Progress in breeding the Aigeiros poplars. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings: Symposium on eastern cottonwood and related species. Baton Rouge, LA: Louisiana State University; 1: 140-150.

The history of breeding poplar species belonging to sect. Aigeiros is reviewed, characters of importance in improvement programs are outlined, and research techniques and problems are considered. Data are presented on heritability, genotype X environmental interactions and hybridization between Populus deltoides and P. nigra.

Randall, W.K.; Blackmon, B.G. 1977. Evaluation of clone-nitrogen interactions in Populus deltoides. Proceedings, 14th Southern forest tree improvement conference: 294-298.

Sekawin, M. 1977. Poplar breeding in northern Italy, including Populus deltoides. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University; 1: 170-175.

Following an account of the introduction of exotic poplars into Italy, particularly Populus deltoides, information is presented on the performance of clones of this species in northern Italy.

Shchepot'ev, F.L.; Osipova, L.M.; Shchepot'eva, A.I. 1977. Variation in Populus trichocarpa after treatment with gamma radiation from ^{60}Co . Referativnyi Zhurnal. (1978) 5.65.675.

Cuttings were treated with 50-150 R doses. Forms obtained in the progeny of irradiated material included weeping, dwarf, narrow-leaved and variegated chlorophyll mutants. The last type included a golden-leaved variegated form

which has been called Donetskii zolotoi (Donetsk Golden). It can be readily propagated by cuttings.

Shevernozhuk, R.G. 1977. Study of electrical reactions to some stimuli in forest trees in relation to early breeding evaluation. Referativnyi Zhurnal. (1978) 5.65.665.

Using various stimuli, viz. growth regulators, light, darkness, a sucrose solution and a toxic filtrate of the fungus Hypoxylon, the coefficient of electrical reaction in various pine clones and poplar varieties was determined by measuring electrical potential. Drought-resistant pines had higher values for the coefficient than susceptible ones when sucrose was used. Fungus-resistant poplar varieties also showed higher values than susceptible ones when Hypoxylon filtrate was used as the stimulus.

Starova, N.V. 1977. Interspecific hybridization and hybrid vigour of poplars. Lesovodstvo i Agrolesomeliorsiya. 48: 52-57.

A hybridization chart of 16 species of poplar (Populus spp.) based on work at UkrNIILKha (Kharkov) is presented. Many hybrids within subgenera showed mass hybrid vigor, but few of those between them. Some hybrids between sections Tacamahaca and Aigeiros showed promise in producing some very tall individuals, although the average height of hybrids did not exceed that of controls; the hybrids therefore respond well to further selection. Hybrids between these sections and section Leuce (in a different subgenus) did not show hybrid vigor. Some hybrids of particular value were P. tremula X P. alba and P. suaveolens X P. nigra.

Thielges, B.A.; Land, S.B., Jr. 1977. Selection and breeding of cottonwood for resistance to diseases and insects. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University; 2: 317-327.

Following a general account of selection and breeding in Populus deltoides, an example of a breeding program is presented which is designed to develop and maintain both horizontal and vertical resistance to pests and diseases, utilizing both sexual and asexual reproduction to propagate selections and hybrids previously screened by artificial and field-testing techniques.

Toth, B.; Palotas, F.; Simon, M. 1977. Promising poplar and willow clones. Erdo. 26(5): 208-212.

van Kraayenoord, C.W.S.; Wilkinson, A.G. 1977. The role of P. deltoides in New Zealand. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University; 1: 176-188.

Following an account of criteria used for selection of Populus deltoides in New Zealand, initial results with respect to resistance to Melampsora, Marssonina, and wind damage are presented. Although southern USA provenance samples have faster growth rates and show a greater resistance to rusts, it is thought that, because of their greater resistance to wind damage, selections of central and northern USA provenance will be more promising.

Vasilenko, I.D. 1977. Diversity of forms in poplar hybrids. Lesovodstvo i agrolesomelior. Resp. Mezhd. temat. Nauch. sb. 48: 64-70. Referativnyi Zhurnal. (1977) 9.55.328.

As a result of artificial crosses made on excised branches in the greenhouse between 1971 and 1975 in the Kirovograd and Poltava provinces of the Ukraine, several single and complex hybrids were obtained. Forms with a new crown shape, leaf color, and leaf shape were obtained.

Weisgerber, H. 1977. The role of Populus deltoides and its hybrids in the Federal Republic of Germany. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 2: 420-427.

Several unnamed clones of P. deltoides have been selected which may be suitable for official registration in addition to Lincoln, Marquette, and Peoria introduced from the USA, which are already registered.

1978

Apykhtin, G.V. 1978. Growth and resistance to pests and diseases in poplar saplings. Byul. VNII agrolesomelior. 2: 17-19. Referativnyi Zhurnal. (1978) 6.79.138.

The results are presented of a study of resistance to the main pests and fungal diseases in promising hybrids and species in the Saratov province of the USSR.

Bakulin, V.T. 1978. Producing polyploid forms of some poplar species by means of colchicine treatment. Izv. Sib. otd. AN SSSR, ser. biol. N. 2: 68-75. Referativnyi Zhurnal. (1978) 2.56.114.

Germinating seeds of various species and hybrids were treated with a 0.1 percent aqueous solution. Some 4.1 percent tetraploid forms were obtained, the best results being obtained after treatment for 15-20 hours. Compared with diploid forms, the tetraploids had a slower growth rate, wide, thicker, and often malformed leaf blades, larger guard cells and fewer stomata per unit of leaf area.

Figaj, J. 1978. Comparison of early and late selection of poplars exemplified by hybrid progeny Populus maximowiczii Henry X P. pyramidalis Roz. Arboretum Kornickie. 23: 207-218.

This cross between a mother tree of P. maximowiczii at Kornik, Poland, with P. pyramidalis (P. nigra var. italica) as the pollen parent was made in 1954; the progeny were planted out in 1956. Results showed that trees should be selected by an overall estimate of characteristics and that height was less important than diameter. Negative selection was more reliable than selection of the best specimens which did not emerge until the 6th year in the field. Minus trees could not be reliably identified until the 3rd growing season.

Holubcik, M. 1978. Possibilities in the breeding of forest trees for resistance to biotic and abiotic factors. Vedecke Prace Vyskumneho Ustavu Lesneho Hospodarstva vo Zvolene. 26: 213-232.

In the light of a review of the relevant literature, the author points out that, though breeding for resistance to adverse conditions of the physical; environment, through direct or indirect selection or hybridization, is fairly straightforward, the development of resistance to pests and diseases is complicated by the capacity for adaptation or coevolution which these organisms may possess. Examples of successes achieved with this approach are quoted from the literature.

Kechel, H.G. 1978. Securing production by breeding for resistance. In: Fast-growing tree species: the Hessian Forestry Association seminar; 1978 June 14-15; Hann, Muden: Schnellwachsende Baumarten: Fortbildungstagung des Hess. Forstvereins am. 14/15.6.

Khalil, M.A.K. 1978. Preliminary results of a trial of exotic and hybrid poplars in Newfoundland. Inf. Rep. N-X-142. St. Johns, Newfoundland: Newfoundland Forest Research Center: 14 p.

Of 34 clones tested, the 16 fastest growing and most promising included hybrids from the cross Populus balsamifera X P. deltoides, hybrids involving P. alba, and also forms of P. canadensis.

Molotkov, P.I.; Efimov, Yu.P.; Yarkin, V.P.; et al. 1978. All-union scientific and technical conference on the formation of a permanent seed resource on the basis of forest genetics and breeding. Lesnoe Khozyaistvo. 2: 59-76.

The texts of 14 short papers given at the conference.

Nepveu, G.; Keller, R.; Teissier du Cros, E. 1978. Juvenile selection for wood quality in Populus nigra and Populus euramericana. Annals of Science Forestry. 35(1): 69-92.

Shchepot'ev, F.L.; Osipova, L.M. 1978. Breeding Populus trichocarpa Hook in the Donbass. Referativnyi Zhurnal. (1978) 5.65.673.

A new mutant with variegated leaves is described. It was obtained by gamma irradiating cuttings and has been called Donetskii zolotoi (Donetsk Golden).

Shepherd, K.R., comp. 1978. Forest tree breeding in Australia. Div. Rep. 2. Division of Forest Research, CSIRO. 2: 29 p.

The importance of native forests and plantations for wood production in Australia is described.

Whitehead, M.J. 1978. A new poplar. Garden, UK: 103(3): 106-107.

A golden-leaved sport of Populus nigra cv. Italica, named Lombardy Gold, is described. The sport is considered promising for planting as a landscape ornamental but is unsuitable for small gardens.

1979

Ostrolucka, M.G. 1979. Interaction between pollen and stigma in the genus Salix. Biologia, Czechoslovakia, A. 34(1): 15-21.

In the course of attempts at hybridization, it was established that pollen of S. caprea, S. daphnoides, and S. dasyclados would germinate on stigmas not only of their own species but of the other two also. S. dasyclados pollen germinated on S. apenina in 1976 but not in 1975. None of these crosses produced hybrid seed.

Sterba, S. 1979. Taper, leaning and deviating growth of the stem in some poplar cultivars. Prace Vyzkumneho Ustavu Lesniho Hospodarstvi a Myslivosti. 54: 175-185.

Stems of 11 fast-growing cultivars in lowland Czechoslovakia were measured at 12-years old by a photographic method. Taper was characterized by the series of artificial form quotients at 1, 3, 5, and 7 m above ground. Lean was measured by the length of the ground projection of the stem between 1 m and 5 m height. 'Deviating growth' was defined as the azimuth angle of the direction of lean and was clearly related to the direction of the prevailing winds. Taper and lean differed significantly between cultivars, suggesting a genetic origin. The three characteristics were not mutually correlated.

1980

Bagley, W.T. 1980. Provenance research for tree crops. In: Tree crops for energy co-production on farms; 1980 November 12; Estes Park, CO: 191-196.

Provenance testing provides information for selection and breeding of tree and shrub species for increased growth and fruitfulness. Potential for success is greatest for those plants which grow naturally over a large geographic area. Improvement has been realized for Populus species, black and Persian walnut, pecan and several pine and other coniferous species but much more research is needed with all woody species including those which have been domesticated for thousands of years.

Bakulin, V.T. 1980. New poplar hybrids. Lesnoe Khozyaistvo. 12: 28-30.

In 1970-1971, 22 crosses were made at Novosibirsk with 12 species and forms, and a total of 16,430 hybrid seeds were obtained. Only 3 of the hybrids proved valuable. Details are given of their appearance and growth rate.

Kozłowska, C. 1980. Study of passive disease resistance in several poplar cultivars. Prace Instytutu Badawczego Lesnictwa, Poland. 565/572: 111-131.

Aqueous bark extracts and fresh sap expressed from twigs of 18 cultivars were added to culture media to test their effects on the growth of Dothichiza (Cryptodiaporthe) populea. Greatest inhibition of fungal growth was with P. 'Kornik 6', P. 'Robusta', P. 'Robusta Gostynin', P. 'Oxford', P. 'H-381', P. tremula '236', and P. canescens.

Nassi, M.O. 1980. Present state of affairs and problems of breeding forest trees. Sementi Elette (Italy). 26(4): 17-20.

Forest tree breeding methods in Italy are briefly discussed with particular reference to Pinus, Populus, and Eucalyptus.

Stecki, Z. 1980. Four new poplar hybrids selected in Kornik. Arboretum Kornickie. 25: 117-133.

Morphological features, site requirements and preliminary growth data are given for: Populus 'Kornik 1' (P. maximowiczii X P. nigra 'Italica'); P. 'Kornik 6' and P. 'Kornik 8' (P. maximowiczii X P. trichocarpa); and P. 'Kornik 23' (P. angulata cordata X P. berolinensis). P. 'Kornik 1' is a good shade tree. P. 'Kornik 6' cannot be used on sites with high groundwater levels. P. 'Kornik 23' ends its growth two weeks earlier than other cultivars making it more resistant to frost injury in northern and eastern Poland. Growth of all 4 cultivars compared favorably with the widely grown P. 'Gelrica' and P. 'NE-42'.

Stettler, R.F.; Heilman, P.E. 1980. Evaluation and genetic improvement of black cottonwood for short-rotation coppice culture. In: Proceedings of the Bio-energy '80 world congress and exposition; 1980 April 21; Atlanta, GA: 574-575.

In the context of a 6-year research program, clonal and seedling material was selected from ten major natural populations of black cottonwood west of the Cascade Range, between southern British Columbia and Central Oregon. The fastest growing clones kept pace with a selected hybrid (P. trichocarpa X P. deltoides). Considerable morphological variation was found providing excellent opportunities for rapid genetic improvement.

Wyckoff, G.W. 1980. Air-pollination chamber for use in Populus breeding. Tree Planters' Notes. 31(3): 5.

1981

Cooper, D.T.; Ferguson, R.B. 1981. Evaluation of bole straightness in cottonwood using visual scores. Res. Note SO-277. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 3 p.

Straightness of 385 trees in a 7-year-old cottonwood plantation was scored (on a scale of 1 to 9) by two observers standing 9 m from the base of the tree; scores were made from north, south, east, and west directions. The plantation contained cloned open-pollinated progeny from female parent trees selected for phenotypic features including straightness, and cloned trees randomly selected. Cloned trees derived from selected parents averaged nearly one unit straighter than random clones.

Kedharnath, S. 1981. Evolving genetically improved clones of poplars for planting in India. In: Singh, R.V., ed. Symposium proceedings: Silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 67-71.

Khosla, P.K.; Khurana, D.K. 1981. Provenance delimitation and provenance trials in Populus ciliata Wall. ex Royle. In: Singh, R.V., ed. Symposium proceedings: Silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 72-81.

Khurana, D.K.; Sebgal, R.N.; Khosla, P.K. 1981. Some aspects of poplar breeding. In: Singh, R.V., ed. Symposium proceedings: Silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 86-91.

TSarev, A.P. 1981. New approach to cultivar testing and its application in poplar growing. *Lesovedenie*. 2: 74-81.

TSarev, A.P. 1981. Variety testing and plantation growing of poplars in France. *Lesnoe Khozyaistvo*. 4: 70-73.

Upadhyaya, M.D. 1981. Unconventional approaches for the improvement of poplars in India. In: Singh, R.V., ed. Symposium proceedings: Silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 82-85.

Wang, S.T. 1981. Studies on the breeding of poplar hybrids. *Forest Science and Technology*. 3: 4-6, 27.

1982

Kechel, H.G. 1982. Studies on the resistance of poplars to the poplar canker fungus, Xanthomonas populi ssp. populi. Munich, German Federal Republic: Ludwig-Maximilians-Universitat. 154 p.

Tests on the infection of Populus Aigeiros and P. Tacamahaca cones with Xanthomonas populi ssp. populi. There were clear differences in resistance between individuals but not between species and sections.

Khurana, D.K.; Khosla, P.K. 1982. Concept of provenance testing and provenance trials in Populus ciliata Wall. ex Royle. In: Khosla, P.K., ed. Proceedings, Improvement of forest biomass. Solan, India: Indian Society of Tree Scientists: 131-137.

Mann, H.S.; Saxena, S.K.; Singh, R.P.; et al. 1982. Session 5. Improvement of agroforestry/energy resources. In: Khosla, P.K., ed. Proceedings, Improvement of forest biomass. Solan, India: Indian Society of Tree Scientists, H.P. Agricultural University: 281-327.

Seven papers.

Miklos, S. 1982. New poplar clones in Hungary. *Topola*. 26(135/136): 25-28.

Pryor, L.D.; Willing, R.R. 1982. Growing and breeding poplar in Australia. Red Hill, ALT, Australia. 56 p.

A general description of silvicultural and breeding practices developed for Australian conditions, including vegetative propagation, and growth rates and costs of growing poplars.

Souleres, G. 1982. Development and diversification of French poplar cultivation. *Revue Forestiere Francaise*. 34(6): 412-418.

Souleres, G. 1982. Information on five new poplar cultivars. Bulletin d'information du CEMAGREF - Centre National du Machinisme Agricole. August/September(295/296): 21-22.

Venkatesh, C.S.; Muthana, K.D.; Kaushal, A.N.; et al. 1982. Session 2. Selection practices in forestry. In: Khosla, P.K., ed. Proceedings, Improvement of forest biomass. Solan, India: Indian Society of Tree Scientists: 97-151.

Six papers.

Wang, M.X.; Huang, M.R.; Chen, D.M.; Xu, N. 1982. A study of cold resistance of clones of Aigeiros poplars. Journal of Nanjing Technological College of Forest Products. 4: 105-110.

Water loss, internal stem structure and permeability of the cytoplasmic membrane were measured in 5 clones (P. 'I-63', P. 'I-69', P. 'I-72', P. 'I-214' and P. 'Blanc de Garonne') to assess cold resistance during dormancy. Clones varied greatly in water loss. The cell cytoplasmic membrane becomes more permeable after low temperature injury. Clones with higher resistance had wider stem xylem and a small pith and cortex layers, while those of lower resistance had the opposite anatomical characters.

1983

Demeritt, M.E., Jr. 1983. Six-year results of hybrid poplar clonal tests in Pennsylvania and Maryland. In: Proceedings, 28th Northeastern forest tree improvement conference. Durham, NH: Northeastern Forest Tree Improvement Conference: 102-109.

Ernst, S.G.; Fechner, G.H. 1983. Variation in rooting and juvenile growth phenology of narrowleaf cottonwood in Colorado. In: Guries, R.P., ed. Proceedings of the 2d North Central tree improvement conference; 1981 August 5-7; Lincoln, NE. Madison, WI: University of Wisconsin, Department of Forestry: 111-118.

Hardwood cuttings of Populus angustifolia, obtained from various Colorado sources, were highly variable in relation to number and length of roots produced, length of the 1980 growing season, and total and daily height growth. Number of roots per cm did not vary significantly among sources.

Figaj, J. 1983. Review of selection criteria and methods applied in poplar breeding in Kornik after a twenty-year period of investigation. Arboretum Kornickie. 28: 159-218.

Gergacz, J. 1983. Results of breeding poplars for resistance. Erdeszeti Kutatasok. 74: 351-359.

Data are tabulated on the growth (at 13 years old) and the survival and resistance to cankers and Marssonina (at 3 years old) of the most promising clones of Populus deltoides and P. X canadensis at five trial sites in Hungary.

Gladysz, A. 1983. Quality of aspen seed produced in greenhouses. *Sylvan*. 127(2): 9-20.

The effect was studied of twig size, twig mass/inflorescence and nutrient concentrations in the culture medium on characteristics of seeds produced by crossing cultivars of Populus tremula and of P. tremula and P. tremuloides. Seed length and shape were determined more by heredity and seed width and weight more by physiological and external conditions.

Hathaway, R.L.; Wilkinson, A.G.; Sheppard, J.S.; Van Kraayenoord, C.W.S. 1983. Soil conservation. In: Wratt, G.S.; Smith, H.C., eds. *Plant breeding in New Zealand*. Wellington, N.Z.: Butterworths: 195-206.

Kapoor, M.L.; Sharma, V.K. 1983. Evolving genetically improved clones of poplars by mutation breeding. *The Indian Forester*. 109(10): 748-754.

Kechel, H.G. 1983. Disease resistance of poplar clones in N. Rhine-Westphalia. *Holzucht*. 37(1/2): 25-30.

A report on the resistance to stem and/or branch canker and brown spot (Cryptodiaporthe populea) of 112 clones belonging to sections Aigeiros, Tacamahaca, and Leuce grown at a total of 8 sites. The occurrence of Xanthomonas populi in cankers is discussed.

Kim, G.T.; Lee, D.K. 1983. A technique for selecting superior Populus alba X Populus glandulosa F1 clones with some physiological characters. *Journal of Korean Forestry Society*. 59: 15-30.

Height, d.b.h., dry weight, leaf area, leaf chlorophyll content, and photosynthetic ability were recorded for 13 clones aged 1 year and 15 clones aged 2 years, growing in a nursery in the Korea Republic. There were significant correlations between leaf area and total dry weight, leaf chlorophyll content and dry weight, and photosynthetic ability and dry weight. It is concluded that yield could be estimated from either leaf area per tree or chlorophyll content per tree.

Mohn, C.A.; Radcliffe, W. 1983. Geographic variation in the Rosemount, Minnesota NC-99 eastern cottonwood provenance test--a final report. In: *Proceedings, 3d North Central tree improvement conference*. Madison, WI: University of Wisconsin-Madison, Department of Forestry: 62-70.

Mohrdiek, O. 1983. Discussion: future possibilities for poplar breeding. *Canadian Journal of Forest Research*. 13(3): 465-471.

Souleres, G. 1983. Three new cultivars obtained from Italy. *Revue Forestiere Francaise*. 35(6): 460-461.

Willing, R.R. 1983. Poplar breeding. In: *Combined proceedings, International Plant Propagators' Society*. Boulder, CO: International Plant Propagators' Society; 32: 58-65.

1984

Cain, N.P.; Ormrod, D.P. 1984. Hybrid vigor as indicated by early growth characteristics of Populus deltoides, Populus nigra, and Populus X euramericana. Canadian Journal of Botany. 62(1): 1-8.

du Cros, E.T. 1984. Breeding strategies with poplars in Europe. Forest Ecology and Management. 8(1): 23-39.

Selection characteristics are classified in different groups: vegetative propagation ability, vigor, adaptation to sites and climate, resistance to diseases and insect pests, wood quality, and coppicing ability. The most efficient long term strategies involve constitution of base populations, selection of parents for intra- and interspecific hybridization, selection within progenies, and vegetative propagation.

Figaj, J. 1984. Evaluation of selection criteria and methods used in poplar breeding at Kornik after a 20-year investigation. Arboretum Kornickie. 28: 159-218.

Growth was analyzed of (a) five hybrid progenies of female Populus maximowiczii pollinated with species of section Tacamahaca, Aigeiros, and Tacamahaca X Aigeiros, and (b) three grey poplar (P. tremula X P. alba) progenies. Dense branching of young ortets was found to be no indication of subsequent growth rate, nor of wood density. Growth of seedlings of (a) and their vegetative progeny were not the same and selection of ortets must be made with ramets. Current selection criteria and future possibilities are discussed: resistance to bark diseases appears to be the greatest priority.

Gaget, M.; Said, C.; Dumas, C.; Knox, R.B. 1984. Pollen-pistil interactions in interspecific crosses of Populus--pollen adhesion, hydration and callose responses. Journal of Cell Science. 72(Dec.): 173-184.

Lee, K.H.; Lee, D.K. 1984. Morphological characters of superior Populus alba X Populus glandulosa F1 clones under intensive culture. Journal of Korean Forestry Society. 64: 1-10.

Plantations of four clones (the fast growing 65-29-19 and 66-6-8 and the less fast growing 66-14-29 and 66-14-99) were established in spring 1982 and 1983 in a nursery in Suweon using 1-or 2-year-old plants, to identify morphological characters related to high biomass yield. There were highly significant correlations between total leaf area per tree and total dry weight, and between total branch length per tree and total dry weight in 2-year-old plants. Characters identified as desirable in fast growing clones were: high shoot/root ratio; high leaf surface area per tree; long leaf retention period; and many small leaves and compact crown architecture in the upper part of the crown.

Mattis, G.Ya. 1984. Breeding, selection and seed production of woody species for protection forestry. Lesnoe Khozyaistvo. 3: 36-40.

A review is made of recent work by the VNIALMI organization on the production of superior plants for shelterbelts in the USSR. The breeding and selection work reviewed involves mainly hybridization of oaks, elms, pines,

ashes, and poplars, and details are given of some of the promising hybrids obtained.

Noh, E.R.; Huyn, S.K.; Jo, J.M.; et al. 1984. Activities related to poplar breeding, cultivation, exploitation and utilization (1980-1984). Res. Rep. 20. Suweon, Korea: The Institute of Forest Genetics: 16-45.

Salle, G.; Armillotta, A.; Frochot, H. 1984. Mechanisms of resistance of four cultivars of poplar against Viscum labum L. In: Proceedings of the 3d International symposium on parasitic weeds. Aleppo, Syria: International Center for Agricultural Research in the Dry Areas: 22-30.

Poplar cv. Fritzi Pauley proved very susceptible to parasitism by V. album, whereas cv. 'Blanc de Garonne' was resistant and 'I-214' and Bergerac were intermediate in response. Poplar susceptibility was correlated with increased thickness of the phellum, cell wall lignification, and increased polyphenol secretion following attack by the parasite.

Stettler, R.F.; Heilman, P.E. 1984. Genetic improvement of Populus trichocarpa for short-rotation coppice culture. In: Egneus, H.; Ellegard, A., eds. Proceedings, Bioenergy 84; 1984 June 15-21; Goteborg, Sweden. Barking, UK: Elsevier Applied Science Publishers; 2: 149.

A brief report of work under progress with 10 black cottonwood clones from sources between southern British Columbia and central Oregon grown in pure stands and as 1:1 mixtures with red alder (Alnus rubra). Tests are also being carried out on hybrids between selected cottonwood trees and superior P. deltoides clones from sources along the Mississippi River from Minnesota to Louisiana.

Tkachenko, B.V. 1984. Raising promising poplar hybrids at the Trostyanets Selection Station. Lesovodstvo i Agrolesomeliorsiya. 69: 17-20.

Artificial crosses were made in the greenhouse with material collected in Sumi province, Ukraine, of Populus alba X P. tremula, P. tremula X P. alba, P. suaveolens X P. balsamifera, P. suaveolens X P. laurifolia, P. balsamifera X P. laurifolia and P. deltoides X P. balsamifera. These hybrids do not root easily from stem cuttings, but green cuttings from suckers root well.

Wang, S.Y. 1984. A preliminary report on selection of superior clones of Populus alba X P. bolleana. Ningxia Agricultural Science and Technology (Ningxia Nongye Keji). 4: 25-27, 51.

A system of three nurseries (hybrid, clone screening, and original stock) at Luhuatai, NW of Yinchuan, Ningxia, was adopted to screen desirable clones of P. alba X P. bolleana (P. alba var. pyramidalis). Strictly applied selection criteria fell into four categories: morphology, growth rate, adversity resistance and survival rate in the nursery; morphology was the most important criterion. Preliminary results showed that superior clones had a higher growth rate, a higher survival rate in the nursery and a higher resistance to low temperature after being planted.

Xu, W.Y.; Tong, Y.C. 1984. A new hybrid--'Popularis'. Scientia Silvae Sinicae. 20(2): 122-131.

During investigations to breed a fast-growing species with high tolerance to the less favorable environments of north and northwest China, Populus simonii as female parent was crossed in 1957 with pollen of P. pyramidalis (P. nigra var. italica) applied as a 1:8 mixture of P. nigra var. italica and Salix matsudana pollens. The hybrid was fast-growing, photosynthetically efficient, tolerant to saline alkaline soil, resistant to drought, *Cytospora* and *Dothiorella*, and had good quality timber. It is claimed that isozyme and immunochemical tests showed that S. matsudana played a part in the cross.

Zhao, S.X.; Li, W.Y. 1984. Studies on introduction and cultivation of six clones of poplars of Aigeiros group. Forest Science and Technology (Linze Keji Tongxun). 8: 4-6.

Six clones of the Aigeiros group (including Populus 'I-214', 'I-45', 'I-72', 'I-63' and 'I-69') were introduced and cultivated near the Dongting Lake (a subtropical area in Hunan). Investigations showed that 3 clones, 'I-63', 'I-69' and 'I-72', adapted very well to the climate and soil and produced better results than other clones or local fast-growing species.

1985

Bach, I. 1985. New state-certified plant varieties for forestry. Erdo. 34(1): 16-18.

Notes are given on four improved tree varieties. Populus 'I-273' is a male clone similar to P. 'I-214' but with wood of better quality. The other three were bred in Hungary: Larix decidua 'Dunantul-1', a fast-growing, freely seeding strain yielding 61 percent more than control stands; Pinus nigra 'Kal', a high-quality Austrian pine and P. sylvestris 'Cikota-2', an improvement on 'Cikota-1'.

Halupa, L.; Simon, M. 1985. The 'I-214' poplar. Budapest, Hungary: Akademiai Kiado. 132 p.

A monograph on the growing of this cultivar in Hungary, where it accounts for 40 percent of the area of poplar plantations. Its volume m.a.i. per hectare is twice that of other cultivars of Populus X canadensis.

Melchior, G.H. 1985. Breeding of aspen and hybrid aspen and importance for practical use. Allgemeine Forst- und Jagdzeitung. 156(6/7): 112-122.

A discussion of the potential of aspen crosses, e.g. between the central European Populus tremula and the North American P. tremuloides, using new techniques such as tissue culture.

Nelson, C.D.; Mohn, C.A. 1985. Inter- and intra-provenance hybrids of eastern cottonwood. In: Proceedings, 4th North Central tree improvement conference. Madison, WI: University of Wisconsin-Madison, Department of Forestry: 62-69.

Olson, J.R.; Jourdain, C.J.; Rousseau, R.J. 1985. Selection for cellulose content, specific gravity, and volume in young Populus deltoides clones. Canadian Journal of Forest Research. 15(2): 393-396.

Seventy-five eastern cottonwood (Populus deltoides Bartr.) clones, selected from tests representing the top one-third of clones tested throughout

the Lower Mississippi River Valley, were analyzed for α cellulose content, specific gravity, and volume after three growing seasons. All traits were found to differ significantly among clones. Specific gravity was highly inherited, while α cellulose content was found to be moderately heritable. Negative genetic correlations between volume and both wood properties indicate that using a selection index to simultaneously improve all three traits is currently not possible.

Popova, N.M. 1985. The relative activity of water as an index of drought resistance of plants. *Lesnoi Zhurnal*. 5: 117-118.

A note on transpiration rate, water deficit, venation density, and relative activity of water for leaves of Robinia pseudoacacia, Populus balsamifera, Betula pendula, and Tilia cordata. R.a. was determined by weighing with torsion balances at constant temperature and humidity and proved to be an excellent index of drought resistance.

Reighard, G.L.; Hanover, J.W. 1985. Progeny testing of native aspens and their hybrids for biomass production in Michigan. In: Proceedings, 29th Northeastern forest tree improvement conference. Durham, NH: Northeastern Forest Tree Improvement Conference: 5-22.

Sagwal, S.S. 1985. Clone selection of poplar in Palam valley of Himachal Pradesh. *Indian Journal of Forestry*. 8(3): 173-175.

Cuttings were collected in January 1980 from plus trees on 8 sites in Himachal Pradesh and planted in February in an experimental area in Pelampur. Trees were felled in 1982 and 5-cm stumps left to coppice. All clones grew well and were resistant to hazards. No significant differences were found among them and it was concluded they all belonged to P. ciliata. Recommendations are made for large-scale plantings in the area.

Schneck, H. 1985. New selections for an increase of yield of aspen tree on medium pleistocene sites in the German Democratic Republic. *Beitrag fur die Forstwirtschaft*. 19(2): 74-77.

In studies at Waldsieversdorf, height and volume growth, wood density, and stem form were evaluated up to age 10 years in progenies of selected Populus tremula. Two crosses with superior characteristics are discussed.

Thielges, B.A. 1985. Breeding poplars for disease resistance. FAO For. Pap. 56. Lexington, KY: University of Kentucky, College of Agriculture. 66 p.

A review is presented of past and current research with particular reference to diseases caused by Melampsora spp. (leaf rusts), Marssonina spp. (anthracnose/leaf spot), Xanthomonas populi (canker), Dothichiza (Cryptodiaporthe) populea (canker), Septoria musiva (Mycosphaerella populorum) (leaf spot/canker), Venturia populina (scab), and poplar mosaic virus. A breeding strategy is proposed which emphasizes a broad genetic base for initial parental selections; conservation of indigenous wild stands; maintenance of genetic variability, breeding and production populations; and breeding with maximum genetic recombination.

Tsareva, R.P. 1985. Evaluation of some poplar hybrids in the course of selection for resistance to sodium chloride salinity. Referativnyi Zhurnal. (1985) 5.65.373.

Tzschacksch, O. 1985. Results of growing relatively smoke resistant types of trees and their practical use. Tech. Umweltschutz (German Democratic Republic). 31: 140-150.

Achievements in cultivating sulfur dioxide resistant conifers in the German Democratic Republic are summarized. These conifers will be planted in afforestation programs in smoke damage zones I, i.e. in conifer forests at high elevations with maximum pollution damage. Smoke resistant varieties of the common spruce Picea abies (L.) show vigorous growth in smoke damage zone I. Suitable pines are Pinus contorta Dougl. ex Loud. (Murray pine), Pinus mugo Turra, and others; resistant larches are Larix decidua and Larix leptolepis. Deciduous trees being cultivated for afforestation are aspens (Populus tremula L.) and mountain ash (Sorbus aucuparia L.).

1986

Bakulin, V.T. 1986. New ornamental poplar hybrids. Biologicheskikh Nauk. 18(3): 10-14. Referativnyi Zhurnal. (1987) 3.55.775.

Three crosses were made and in each cross one parent was of Siberian provenance. From 2 crosses, Populus alba X P. bolleana (P. alba) and (P. nigra X P. pyramidalis (P. nigra)) X P. nigra, four outstanding cultivars were selected. F1 hybrids of P. laurifolia X P. pyramidalis were winter hardy, but inherited the wide crown and poor resistance of leaves to rust (Melampsora spp.) of P. laurifolia and are not considered promising for cultivation.

Foster, G.S. 1986. Provenance variation of eastern cottonwood in the lower Mississippi Valley. Silvae Genetica. 35(1): 32-38.

Variation patterns were analyzed for 11 traits in a provenance study of Populus deltoides planted in Mississippi, USA. Two models of variation patterns were used to analyze the data: stands and clones-within-stands; and clones pooled across stands. Broad-sense heritabilities were larger for stands than clones-within-stands. Heritabilities for clones pooled across stands were generally intermediate between those for stands and clones-within-stands. Predicted gain was greater for clonal selection than for stand and clone-within-stand selection for all traits except beetle damage. Genetic correlations showed that selection for volume at age 4 years would select 89 percent of the plants which would be selected at age 7 years.

Kolster, H.W. 1986. New Belgian cultivars and their potential uses in the Netherlands. Populier. 23(2): 36-39.

Discusses the growth of 14 new commercial varieties (including Populus X canadensis, P. trichocarpa and P. deltoides X P. trichocarpa cultivars) in Belgium with special reference to susceptibility to rust and Marssonina infections.

Layton, P.A.; Wright, L.L. 1986. Role of genetic improvement in the Short Rotation Woody Crops Program. In: 10th Annual symposium on energy from biomass and wastes; 1986 April 7; Washington, DC. 32 p.

A major effort in the Short Rotation Woody Crops Program (SRWCP) is species screening and genetic improvement of selected species. Range-wide seed collections of 12 species were provenance tested; these include Platanus occidentalis (sycamore), Alnus glutinosa (European black alder), and Robinia pseudoacacia (black locust). The technique of somaclonal screening and genetic engineering are being evaluated for their usefulness in the SRIC improvement program. Currently, salt-tolerant Atriplex canescens (four-wing saltbush) and herbicide-resistant Populus spp. are being sought via somaclonal screening.

Li, W.D.; Zhu, T. 1986. Incompatible barriers to the distant hybridization between Populus euphratica Oliv. and P. simonii Carr. *Scientia Silvae Sinicae*. 22(1): 1-9.

Incompatibility was mainly due to the uncoordinated development of the male and female gametes and the abortion of embryos and endosperms.

Liu, Y.X.; Lu, Z.H.; Zhang, P.K. 1986. Study on pollen plant fertility of poplar. *Journal of North-East Forestry University, China*. 14(1): 20-25.

Pollen plants produced by another culture began to flower at 7-9 years old, when they produced all male flowers. The germination capacity of the pollen produced was higher than that of a P. simonii X P. nigra ortet. Cuttings from the pollen plants flowered earlier than those from the corresponding ortet.

Ostry, M.E.; McNabb, H.S. 1986. Populus species and hybrid clones resistant to Melampsora, Marssonina, and Septoria. Res. Pap. NC-272. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 6 p.

Prakash, C.S.; Heather, W.A. 1986. Inheritance of resistance to races of Melampsora medusae in Populus deltoides. *Silvae Genetica*. 35(2/3): 74-77.

The F1 progeny of a P. '60/122' X P. 'T-173' cross and the parents were analyzed for their reaction to 6 races of M. medusae. From the results, it appeared that resistance was inherited as dominant against 3 races, recessive against 2 races, and codominant, additive or quantitative to one race, and was controlled by a single gene or 2 genes acting in a complementary or duplicate manner depending on the race.

Rajora, O.P.; Zsuffa, L. 1986. Atypical seedlings of Populus L.: their genetic significance and value in breeding. *Silvae Genetica*. 35(2/3): 122-124.

The incidence of abnormal, albino, and chlorophyll-deficient seedlings, pleiocotyly and polyembryony is reported in crosses of P. deltoides, P. nigra, and P. maximowiczii. The possible use and significance of these atypical phenomena in poplar breeding are briefly discussed.

Qin, X.X.; Gao, R.T.; Li, J.Z.; Hao, W.Q.; Liu, K.J. 1986. A preliminary investigation on the resistance of different clones of poplars to Anoplophora glabripennis (Motsch.). *Scientia Silvae Sinicae*. 21(3): 310-314.

A study of 28 clones using cluster analysis showed that they were divided into three groups according to resistance. Populus X euramericana (canadensis) cv. 'Robusta' and P. canadensis cv. 'Sacrau 79', etc. were highly resistant; P. nigra var. italica, P. nigra, P. canadensis, cv. 'I-214' and P. X simopyraidalis were of low or intermediate resistance. It is suggested that for the establishment of poplar plantations, insect resistant clones should be selected. However, small numbers of insect-susceptible clones may be planted at plantation edges as lures, attracting the insects in order to eliminate them.

1987

1987. Genetic improvement of energy crops. *Journal of Forestry*. 85(9): 26-28.

Two major efforts are under way to improve SRIC energy crops genetically. One effort is the improvement of the model species American sycamore, black locust, silver maple, and sweetgum. The other effort is led by a consortium conducted research and development on Populus in physiology, ideotype development, growth modeling, genetic improvement, and monoculture viability. In Populus, the ideal traits emerging as important are narrow crowns with small limbs, larger upper leaves and smaller lower leaves, indeterminate growth, pest resistance, and drought tolerance.

Layton, P.A.; Wright, L.L.; Klass, D.L. 1987. The role of genetic improvement in the Short Rotation Woody Crops Program. In: 10th Annual symposium on energy from biomass and wastes; 1986 April 7; Washington, DC: 133-154.

The U.S. Department of Energy is sponsoring a long-range research program, the Short Rotation Woody Crops Program (SRWCP), to develop short-rotation intensive culture (SRIC) approaches to woody biomass energy production. In addition to breeding, the techniques of somaclonal screening and genetic engineering are being evaluated for their usefulness in the SRIC improvement program.

MARKETING

1975

Kurtenacker, R.S. 1975. Wood-base panel products for pallet decks. Res. Pap. FPL-273. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 17 p.

Nine-block (four-sided-entry), single-deck nailed pallets of two standard sizes were made with decks of various board materials ca. 1/2 inch thick, viz. experimental hardboards made from used pallets or from virgin Populus tremuloides fibre, a commercial hardboard, a commercial particle board and an experimental particle board. The properties of the materials and the performance of the pallets in strength tests were compared with those of similar control pallets having decks of plywood or 3/8-inch knife-cut veneer.

van der Meiden. H.A. 1975. Development of the poplar wood market. Wageningen, The Netherlands: Stichting Industrie-Hout. 24 p.

Data are given on: the area occupied by natural and planted stands of poplars; the species and cultivars involved; measures adopted to stimulate poplar growing in publicly and privately owned forests and stands; quantities, prices and utilization of poplar wood; structure of the poplar wood consuming industries; and specifications of poplar wood required by the consumer.

1976

Anderson, W.C. 1976. Cottonwood: markets unlimited. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 451-455.

Koepke, M.S. 1976. Aspen market opportunities: lumber, excelsior, and residue. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 47-52.

Kostylev, A.S. 1976. Raising highly-marketable aspen from natural young stands. Lesnoe Khozyaistvo. 12: 58-60.

Loring, T.J. 1976. Rocky Mountain aspen for pulp: some market opportunities and limitations. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 59-60.

Runyon, G.K. 1976. Lumber markets for Rocky Mountain aspen. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Range and Forest Experiment Station: 40.

U.S. Department of Agriculture, Forest Service. 1976. Utilization and marketing as tools for aspen management in the Rocky Mountains: Proceedings of the symposium; 1976 September 8-9; Fort Collins, CO. Gen. Tech. Rep. RM-29.

Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 120 p.

Wengert, E.M. 1976. Market opportunities and limitations for Rocky Mountain aspen. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Range and Forest Experiment Station: 53.

Wilcox, W.R. 1976. Symposium summary. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Range and Forest Experiment Station: 114-115.

1984

Wagemann, N. 1984. Prices for poplar timber in N. Rhine-Westphalia. Holz-Zentralblatt. 110(33): 512.

Price statistics for 1975-1980 from the Rhineland and Westfalen-Lippe regions are analyzed. It is concluded that there is an assured future market for poplar in this region of West Germany.

1985

Hartmann, T. 1985. 25 years' development and expected trends in the primary wood industry in Hungary up to the turn of the millennium. Erdeszeti es Faipari Tudomanyos Kozlemanyek. 1-2: 131-135.

Priggel, B. 1985. Auctioning and sale by tender of stemwood in the Rhineland. Allgemeine Forstzeitschrift. 7: 147-148.

A discussion of public sales, beginning in 1976, of various timbers (oak, beech, poplar, other hardwoods, and softwoods, mainly Norway spruce) in three 'timber market regions' under the auspices of the Rhineland Forest Administration Board. Sales of standing timber were introduced in 1982.

MENSURATION

1975

Karkkainen, M. 1975. Measurement of the cross-sectional area of birch and aspen logs. *Silva Fenn.* 9(3): 212-232.

Schlaegel, B.E. 1975. Estimating aspen volume and weight for individual trees, diameter classes, or entire stands. Gen. Tech. Rep. NC-20. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 16 p.

Presents allometric equations and tables, based on a sample of 491 Populus tremuloides trees from 47 stands in northern Minnesota, to estimate gross volume, green weight, and dry weight for individual trees, diameter classes, or whole stands. Estimates can be made for stem wood only, for stem wood and bark, or for whole trees including branches. Estimates can also be made for wood and bark to top diameters of from 2 to 7 inches. The tables are correct for a form factor of 0.413 and a relative density of 0.391. If different values for these parameters can be obtained for the stands being measured, corrections to the tables can be made on a simple proportional basis.

1976

Hann, D.W. 1976. Relationship of stump diameter to diameter at breast height for seven tree species in Arizona and New Mexico. Res. Note INT-212. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 16 p.

Equations and tables are presented for estimating d.b.h. from stump diameter (computed as the average of the long and short axes of the stump cross-section) for 'yellow' and 'blackjack' pines (two bark-color types of Pinus ponderosa), Douglas fir (Pseudotsuga menziesii var. glauca), aspen (Populus tremuloides), white fir (Abies concolor) southwestern white pine (Pinus flexilis var. reflexa) and from combined data for Engelmann spruce (Picea engelmannii) and corkbark fir (A. lasiocarpa var. arizonica). Data were taken from trees felled in 5 national forests and were analysed by weighted least-squares regression techniques (using the reciprocal of stump diameter as the weight).

Kairyukshtis, L.; Yuodval'kis, A. 1976. Reference standards for birch and aspen stands of maximum yield, and how to form them. Vilnius, Lithuania: Mokslas. 14 p.

Tables are presented showing maximum total crown projection area, mean tree diameter, number of trees/ha, and standing volume for stands of birch and of aspen at ages 10-60 years. On this basis, tables are compiled as 'ideal yield tables' or 'tables of optimum stand development'; showing the development of single-storied and two-storied stands with maximum yield, with periodic thinnings.

Karkkainen, M. 1976. Auxiliary observations on the measurement of the cross-sectional area of aspen logs. *Silva Fenn.* 10(4): 257-265.

Ker, M.F. 1976. Metric yield tables for the major forest cover types of Newfoundland. Inf. Rep. N-X-141. Newfoundland, Canada: Canadian Forestry Service, Newfoundland Forest Research Centre. 79 p.

Yield tables are given for the following cover types: Abies balsamea, Picea mariana, hardwood/softwood, softwood/hardwood, Populus tremuloides, and Betula papyrifera. The tables are prepared by converting the regression equations of the former tables in imperial units to metric equivalents, with a taper allowance for changing basal height from 4 feet 6 inches to 1.30 m.

1977

Decei, I. 1977. Form and wood volume of Euro-American poplars from the clone R.16. Rev Padurilor Ind Lemnului Celul Hirtie Silvic Exploatarea Padurilor. 92(1): 27-29.

Fassi, B.; et al. 1977. Experimental poplar inventory in the Cunio low-plains belt (Italy). Industria della Carta. 15(8/9): 283-297.

Lee, C.K. 1977. Preparation of stem volume tables for five species besides Italian poplar. Res. Rep. 20. Seoul, South Korea: Forest Research Institute: 35-91.

Stem volume for P. euramericana, red pine, Korean white pine, pitch pine, and Quercus spp. in Korea, obtained from volume tables based on a form factor of 0.45, was shown to differ significantly from volume obtained from actual stem measurements. New tables, based on the measurements, are given for each species.

Lee, S.Y.; Lee, H.K. 1977. A study on the yield and growth of Italian poplar stand. Res. Rep. 20. Seoul, South Korea: Forest Research Institute: 93-100.

Yield tables for Italian poplar are given, based on measurements of 181 sample plots in a stand in Korea.

Lohani, D.N.; Sharma, R.P. 1977. Regional volume tables for poplar. Indian Forester. 103(12): 818-821.

Tingle, A.C.; Van Laar, A. 1977. Revised volume and utilization tables for Populus deltoides. South African Forestry Journal. 100: 14-21.

A revision of Tingle's tables made by improved computing methods, and necessitated by changes in utilization.

Usol'tsev, V.A.; Usol'tseva, R.F. 1977. Approximation of the aboveground phytomass of birch and aspen by the stem diameter and height. Vestn S-kh Nauki Kaz. 7: 83-89.

1978

Hann, D.W.; Bare, B.B. 1978. Comprehensive tree volume equations for major species of New Mexico and Arizona. I. Results and methodology. Res. Pap. INT-209. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 43 p.

Stolyarov, D.P.; Kuznetsova, V.G. 1978. Model for showing the development of spruce diameter classes after selection fellings. Lesnoe Khozyaistvo. 1: 47-52.

Observations were made on the development of spruce stands selectively logged 40 years ago, and experimental selective fellings were made in stands of site class III in the Leningrad region, containing spruce/birch/aspens, density 0.9, mean standing volume 250 m³/ha. Tabular model is presented showing the condition of the stand immediately after a selective felling removing 30 percent of the standing volume, and also 10 and 20 years later.

Weihe, J.; Maessen, L. 1978. Volume tables for Regenerata and Robusta poplars in NW Germany. Dusseldorf, Germany: Landesanstalt fuer Oekologie, Landschaftsentwicklung und Forstplanung. 5 p.

Total and merchantable volumes for stemwood o.b. and u.b. are given with special reference to the Muenster district. Comparisons with existing German tables show considerable regional differences; Populus 'Robusta' locally has unusually low form factors (lower than those of P. 'Regenerata').

Winkelman, T. 1978. Weight of poplar wood as a trade measurement. Populier. 15(4): 82-83.

The weight/volume ratio of billets of several varieties was determined by water displacement. Data are presented for first and second thinnings felled in spring or in winter. Regression equations are presented for the weight/volume ratio of Populus 'Robusta' in terms of storage time.

1979

Mikhov, I.; Lazarov, E. 1979. Models of yield tables for broadleaved tree species. Gorsko Stopanstvo. 35(3): 19-20.

Seven different mathematical models were tested for obtaining volume per ha from mean stand height. The accuracy of the models was tested against various German, Bulgarian, and Russian yield tables for high-forest beech, pendunculate oak, aspen, and lime, and also for coppice stands of beech, pendunculate oak, sessile oak, Turkey oak, lime, and eastern hornbeam. The best model for each of the forest types is identified and listed.

Nokoe, S.; Kozak, A. 1979. Obtaining a composite volume-age function with the Gompertz model. Northwest Science. 53(1): 12-17.

The procedure is illustrated by obtaining a composite volume/age function from site index and stand density (percent of average basal area/ha) for five interior British Columbia species: Pinus contorta, Picea sitchensis, Populus tremuloides, Pseudotsuga menziesii, and Abies balsamea.

Tamm, Yu.; Ross, V. 1979. Above-ground biomass of aspen stands in Estonia. *Metsanduslikud Uurimused*. 15: 81-108.

Data were collected from 140 trees felled at different ages and relations between different mass and linear dimensions analyzed.

1981

Halupa, L. 1981. Graphic timber growth models for hybrid black poplar and their application. *Erdo*. 30(6): 274-278.

The yield model is represented in the form of a nomogram linking age/site index curves with stand volume, basal area and volume c.a.i., and mean d.b.h. for Populus 'I-214'.

Ozolin'sh, R.K. 1981. Determination of form characteristics of tree stems by the method of perturbation of relative diameters. *Trudy, Latviiskaya Sel'skokhozyaistvennaya Akademiya*. 194: 65-69.

Multiple perturbation of diameter outside bark and height data were used to develop 6th-order polynomials for predicting average form of stems of Scots pine, Norway spruce, Betula alba, Alnus glutinosa, A. incana, Populus tremula, Quercus robur, Fraxinus excelsior, Acer [platanoides], and Tilia cordata in Latvia.

Raile, G.K. 1981. A net volume equation for northeastern Minnesota. Gen. Tech. Rep. NC-66. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 8 p.

1982

Ceulemans, R.; Impens, I. 1982. ECOPASS (ecological passport)--a multivariate model used as an index of growth performance of poplar clones. *Forest Science*. 28(4): 862-867.

Edminster, C.B.; Mowrer, H.T.; Hinds, T.E. 1982. Volume tables and point-sampling factors for aspen in Colorado. Res. Pap. RM-232. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 16 p.

Hahn, J.T.; Carmean, W.H. 1982. Lake States site index curves formulated. Gen. Tech. Rep. NC-88. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 5 p.

Published data were used to develop functions and parameters for calculating site index and total height of dominant and co-dominant trees for 21 species (Abies balsamea, Acer rubrum, A. saccharum, Betula alleghaniensis, B. papyrifera, Fagus grandifolia, Fraxinus americana, F. nigra, Larix laricina, Picea glauca, P. mariana, Pinus banksiana, P. resinosa, P. strobus, Populus, Prunus serotina, Quercus alba, Q. rubra, Thuja occidentalis, Tilia americana, and Ulmus americana).

Krusche, D.; Raschke, G., Jr. 1982. A stem volume table for Populus tremula x P. tremuloides. Allgemeine Forst- und Jagdzeitung. 153(6): 105-110.

A table is given for stemwood volume outside bark at 29 years old for one family raised at 5 locations in the German Federal Republic. Regression models showed a very high correlation for logarithm (volume) with logarithm (d.b.h.) and logarithm (height). Estimation of total stand volume based on a representative sample was greatly improved when data from the table were included.

Lavigne, M.B. 1982. Tree mass equations for common species of Newfoundland. Inf. Rep. N-X-213. Newfoundland, Canada: Canadian Forestry Service, Newfoundland Forest Research Centre. 40 p.

Biomass equations are given for bole, wood, bark, branches, foliage, and twigs, and whole trees of Abies balsamea, Picea mariana, P. glauca, Larix laricina, Betula papyrifera, B. alleghaniensis, and Populus tremuloides, for central, western, eastern, and the whole of Newfoundland. All equations are based on d.b.h. 2Xht. Details of sampling techniques and the accuracy of the equations (plots of residuals) are also provided.

Shifley, S.R.; Moser, J.W., Jr.; Brown, K.M. 1982. Growth and yield model for the elm-ash-cottonwood type in Indiana. Res. Pap. NC-218. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 16 p.

A series of differential equations were developed to simulate the recruitment, mortality, and survivor growth components in bottomland forest stands dominated by Fraxinus pennsylvanica, Populus deltoides, Acer saccharinum, or Acer rubrum, either singly or in any combination. Simulated yield tables are given for up to 25 years starting from initial densities of 20-220 stems/acre and initial basal area up to 140 ft²/ac. A program listing in FORTRAN is appended.

Tritton, L.M.; Hornbeck, J.W. 1982. Biomass equations for major tree species of the northeast. Gen. Tech. Rep. NE-69. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 46 p.

A collection of 178 sets of published equations and estimates of aboveground biomass for trees of d.b.h. 2.5-50 cm are tabulated for Abies balsamea, Acer rubrum, A. saccharum, Betula alleghaniensis, B. lenta, B. papyrifera, B. populifolia, Carya spp., Fagus grandifolia, Fraxinus americana, Liriodendron tulipifera, Picea spp., Pinus resinosa, P. strobus, Populus spp., Prunus pennsylvanica, P. serotina, Quercus alba, Q. coccinea, Q. prinus, Q. velutina, and Tsuga canadensis in the USA.

Van Laar, A. 1982. A case study in Populus canescens to estimate the leaf area index. South African Forestry Journal. 123: 19-23.

Voropanov, P.V. 1982. Determining the under-bark volume of a growing tree. Lesnoi Zhurnal. 5: 20-23.

Analysis of volume-table data for Scots pine showed that stem volume u.b. and o.b. were related by the simple ratio of u.b. and o.b. diameters (K) at a height of 1 m. Further analysis of volume tables showed that the relation for Norway spruce was K-0.05; for oak, K-0.09; and for birch and aspen, K-0.004.

1983

Evert, F. 1983. A national system of equations for estimating oven-dry mass of trembling aspen Populus tremuloides Michx. Inf. Rep. PI-X-24. Canada: Petawawa National Forestry Institute. 23 p.

The equations are for estimating the above-ground mass of single trees and of their individual components. They are based on data from 6 geographical regions across Canada. When applied to the sample data from individual geographic regions, estimates of aggregate oven-dry mass of all sample trees in any of the 6 regions differed from observed values by not more than 6 percent, with approximately half of the estimates being within 2 percent of observed values.

Fitzgerald, R.D. 1983. An indirect method to estimate the aerial biomass of small single-stemmed woody plants. *Journal of Range Management*. 36(6): 757-759.

Han, F.Q.; Lu, S.X. 1983. A study of the growth index of some Aigeiros clones. *Journal of Nanjing Technological College of Forest Products*. 2: 60-67.

Height and d.b.h. of 6 Aigeiros clones (Populus 'Harvard', P. 'Lux', P. 'San Martino', P. 'I-214', P. 'I-45/51', and P. 'Blanc de Garonne') 1-6 years old were measured. The trees grew well in Jiangsu, Zhejiang, Shandong, Henan, Jiangxi, Hunan, and Hubei provinces. A growth model used to calculate the growth index showed a close approximation to actual data. The method could be applied to trees growing in open or sparse woods under various conditions.

Heidt, J. 1983. Clonal variation in height growth of trembling aspen in central Alberta. *Agriculture and Forestry Bulletin*, Alberta University. 6(3): 20-23.

Honer, T.G.; Ker, M.F.; Alemdag, I.S. 1983. Metric timber tables for the commercial tree species of central and eastern Canada. Inf. Rep. M-X-140. Victoria, BC: Canadian Forestry Service, Maritimes Forest Research Centre. 139 p.

Four types of tables are presented for 21 major commercial species: (a) total volume, (b) merchantable volume, (c) ratios of (b) and (a) for various stump heights, top diameters and merchantable lengths, and (d) diameter u.b. and diameter o.b. for stump height, b.h. and sections of the lower bole. The tables are derived from the former tables in imperial units; the conversions to the metric system are explained.

Manning, G.H.; Massie, M.R.C.; Rudd, J. 1983. Metric single-tree weight tables for the Yukon Territory. Inf. Rep. BC-X-250. British Columbia, Canada: Canadian Forestry Service, Pacific Forest Research Centre. 60 p.

Weight by component is shown as a function of d.b.h. and height for white spruce, black spruce, lodgepole pine, and trembling aspen (Populus tremuloides).

Massie, M.R.C.; Manning, G.H.; McCloskey, K.R. 1983. Metric single-tree total volume tables for the Yukon Territory. BC-X-242. Victoria, British Columbia, Canada: Canadian Forestry Service, Pacific Forest Research Centre. 19 p.

Ouellet, D. 1983. Biomass prediction equations for twelve commercial species in Quebec. Inf. Rep. LAU-X-62E. Canada: Laurentian Forest Research Centre. 34 p.

Equations are presented for predicting green and oven dry mass of total above-ground tree, stem, merchantable stem, wood and bark of the merchantable stem, and crown for: Pinus strobus, P. resinosa, P. banksiana, Abies balsamea, Picea glauca, P. rubens, Larix laricina, Populus tremuloides, Betula alleghaniensis, B. papyrifera, Acer saccharum, and A. rubrum.

Perala, D.A. 1983. Modeling aspen and red pine shoot growth to daily weather variations. Res. Pap. NC-236. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 11 p.

Solakov, E.; Dimitrov, E.T. 1983. Nomogram for determining the standing volume of some broadleaved stands. Gorskostopanska Nauka. 20(4): 21-25.

Regression equations are presented for calculating the standing volume of various broadleaved stands from mean height and density, viz. for coppice oak, poplar, robinia, aspen, ash, alder, willow, birch, Carpinus orientalis, and coppice beech. Nomograms are also presented for determining standing volume with an accuracy acceptable for practical use.

Usol'tsev, V.A. 1983. Changes in wood density and dry matter content in aspen stands. Lesovedenie. 6: 42-49.

From an analysis of 70 sample trees from 7 sample plots aged 10-50 years and relative stand density 0.6-1.7, mathematical models were constructed for density and dry matter content in relation to age, relative stand density, tree diameter ranking, and height of sample in the stem. On this basis, whole-stem values were calculated for two inputs (stem age and diameter) for closed aspen stands of site class III. A table is presented giving green density, content of oven-dry matter, and nominal density for trees aged 10, 20, 30, 40, and 50 years, and 3 or 4 diameter classes within each age-class.

Voropanov, P.V. 1983. Determining the number of trees in stands. Lesnoi Zhurnal. 4: 13-19.

A table is compiled showing the dimensions (diameter and volume) of the mean trees that die, as a percent of the dimensions of the stand mean tree, for stand ages 20, 30, 40, ...120 years, for pine, spruce, larch, and oak of seedling origin, and also for oak, birch, aspen, and lime of coppice origin. A formula is presented for calculating the number of trees previously in the stand from the number of trees present at the moment, and the ratio of the mean stand diameters.

1984

Bonduelle, P. 1984. Short rotation poplar coppice. Weight tables. Paris, France: Association Foret-Cellulose: 374-401.

Details are given of the construction of the tables. Two tables are presented, both in terms of d.b.h. and total height, one for total biomass, and one for the weight of the stem up to a diameter of 4 cm (about 80 percent

of total biomass). Tables based on fresh weight are presented in an appendix for diameters of 14-60 cm and height of 6-20 m.

Gao, L.C.; Zhao, R.T. 1984. The construction of a stocking volume table for four clones of the Aigeiros poplars. *Journal of Nanjing Institute of Forestry*. 1: 131-138.

A combined volume table is constructed for the four clones - Populus 'Harvard' (P. 'I-63/51'), P. 'Lux' (P. I-69/55), P. 'San Martino' (P. I-72/58'), and P. 'I-214'. Values are also given for empirical and artificial form factors of the four species, both separately and combined. There is very little difference between the clones, average values of the factors being 0.34 and 0.43, respectively.

Gottschalk, Kurt William. 1984. Growth, biomass yield, crown development, and gas exchange of four intensively cultured Populus clones in southern Michigan. *Dissertation Abstracts International*. 45/08-B: 2384.

A small plot research plantation was established in 1977 using cultural practices determined at that time to best approximate the most practical and productive system for industrial users. Measurements of the growth, biomass yield, crown development, and gas exchange (stomatal conductance and photosynthesis) of these four clonal stands were taken for two years in an effort to understand the process of woody biomass production. The major influence on all of the growth processes of the four clones was drought stress. Two minor drought periods in the first year caused only small reductions in growth, however, two major drought periods in the second year resulted in large growth reductions and reduced gas exchange rates. NE-48 appeared to be more drought tolerant than the other clones used in this study.

Hamann, R.; Johnson, W.; Moody, N; Meyer, M. 1984. Small scale 35 mm aerial photography for aspen delineation. Res. Rep. 84-3. St. Paul, MN: University of Minnesota, Institute of Agriculture, Forestry, and Home Economics, Remote Sensing Laboratory. 23 p.

Ker, M.F. 1984. Biomass equations for seven major maritimes tree species. Inf. Rep. M-X-148. Canada: Maritimes Forest Research Centre. 54 p.

Equations are given for estimating fresh and oven-dry weights of biomass components for Abies balsamea, Picea glauca, P. rubens/P. mariana, Pinus banksiana, Acer rubrum, Betula papyrifera, and Populus tremuloides, based on 1,400 sample trees from throughout New Brunswick and Nova Scotia. Two equations are given for each component, one using d.b.h. alone as the independent variable, and one using d.b.h. and height. A set of stump biomass equations are included which use d.b.h. and stump height as independent variables. Stem disc and branch samples were oven-dried and used to estimate oven-dry/fresh weight ratios for each sample tree. A FORTRAN subroutine is included to assist in tree biomass calculations.

Kr'stanov, K.N.; Fakirov, V.; Belyakov, P.; Ganchev, P. 1984. Form structure in poplar plantations as regards the compilation of volume tables. *Gorskostopanska Nauka*. 21(3): 24-37.

Measurements were made on 3,770 sample trees in Bulgaria. Tables are presented showing basal area ratios and normal form factors outside bark for

three poplar clones (Populus 'Regenerata', P. 'Robusta', and P. 'I-214') for two different ages (under and over 10 years) and for two different plantation densities (under and over 20 m² growing space per tree). From these data, volume tables are constructed and presented for each of the clones, age-groups, and densities, showing volume in m³ for heights 5, 6, 7, ... 35 m and d.b.h. 6, 10, 14, ... 54 cm.

Meldahl, R.S.; Nordheim, E.V.; Ek, A.R. 1984. Alternative methods for determining edge effect on small sample plots. *Canadian Journal of Forest Research*. 14(6): 874-878.

The effect of plot edge on tree growth on four uniformly spaced plots in a Wisconsin nursery was assessed before using the data for development of growth simulation models. The plots were established with hybrid poplar (Populus balsamifera X P. tristis) cuttings at square spacings of 1, 2, 4, and 8 feet with a larger open space to separate the plots. The survival, diameter, and height of individual trees were determined annually for 5 years. Data from the narrowest spacing and at 5 years old were used to describe attempts to determine the extent of any edge effect. The methodology involved the examination of diameter and survival trends across the plots. Regression analysis was also used to determine a uniform interior region with d.b.h. as the dependent variable, and location, number of live neighbors, and a measure of competition as possible independent variables. Each of the methods has limitations, but all of them provide some evidence as to the number of trees affected by the border.

Pastor, J.; Aber, J.D.; Melillo, J.M. 1984. Biomass prediction using generalized allometric regressions for some Northeast tree species. *Forest Ecology and Management*. 7(4): 265-274.

Regressions relating weight of stem, branch, and total above ground biomass to d.b.h. were compiled for six species from the literature and used to generate new generalized regressions by species and plant part. Mean differences between values predicted by the generalized regressions and estimates from original regressions for total above ground weight were generally within the range of errors of estimate reported for individual regressions, but for stem and branch weights were considerably higher. Tests against field data indicate excellent prediction by generalized maple regressions for sugar maple but somewhat less accurate predictions by generalized aspen regressions for aspen.

Shepperd, W.D.; Mowrer, H.T. 1984. Whole stand volume tables for quaking aspen in the Rocky Mountains. Res. Note RM-440. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 5 p.

Singh, T. 1984. Biomass equations for six major tree species of the Northwest Territories. Inf. Rep. NOR-X-257. Edmonton, Alberta, Canada: Northern Forest Research Centre. 22 p.

Steinhilb, H.M.; Arola, R.A.; Winsauer, S.A. 1984. Green weight tables for eight tree species in northern Michigan. Gen. Tech. Rep. NC-95. St. Paul, MN:

U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 23 p.

Tables are given of total green weight, bole weight, and residue weight of Populus tremuloides, Acer saccharum, A. rubrum, Betula papyrifera, Quercus rubra, Pinus resinosa, Picea glauca, and Abies balsamea. Regression equations, based on d.b.h. and total height or d.b.h. and bole height, are included.

Van Hooser, D.D.; Chojnacky, D.C. 1984. Tree diameter measurements at English and metric standard heights: a comparison. Res. Pap. INT-327. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 7 p.

Data from an inventory of stands in Colorado with six species (Pseudotsuga menziesii, Picea engelmannii, Pinus contorta, Abies lasiocarpa, Populus tremuloides, and P. angustifolia) were used to compare diameter and volume determination based on English (1.37 m) vs. metric (1.3 m) d.b.h. Results indicated that the difference between diameter measurements taken at the 2 points averaged roughly 1 percent. An equation is given for converting from English to metric d.b.h.

Weih, R.C.; Nord, G.D.; Meyer, M.P. 1984. Application of 35 mm aerial photography to evaluate post-harvest aspen regeneration. Res. Rep. 84-2. St. Paul, MN: University of Minnesota, Institute of Agriculture, Forestry, and Home Economics, Remote Sensing Laboratory. 23 p.

Williams, R.A.; McClenahan, J.R. 1984. Biomass prediction equations for seedlings, sprouts, and saplings of ten central hardwood species. Forest Science. 30(2): 523-527.

Seedlings, seedling sprouts, or stump sprouts were sampled from sites in E. and S. Ohio, 1, 2, or 4 years after whole-tree harvesting. Linear regression techniques were used to relate dry weight to diameter and height for Quercus alba, Q. velutina, Acer rubrum, A. saccharum, Nyssa sylvatica, Prunus serotina, Fraxinus americana, Sassafras albidum, Liriodendron tulipifera, and Populus grandidentata. The equations for species with similar oven-dry specific gravities fell into three groups, which could be combined.

1985

Campbell, J.S.; Lieffers, V.J.; Pielou, E.C. 1985. Regression equations for estimating single tree biomass of trembling aspen: assessing their applicability to more than one population. Forest Ecology and Management. 11(4): 283-295.

Two options are examined for obtaining an equation without the expense of developing one: a generalized biomass equation for a species and a region; or matching characteristics such as bole geometry and wood density of the trees to be measured with those of trees for which a regression equation is available. It is concluded that the latter will give a more accurate biomass prediction, particularly in stands that differ from the regional average.

Edminster, C.B.; Mowrer, H.T. 1985. RMYLD update: new growth and yield relationships for aspen. In: Conference on growth and yield and other mensurational tricks; 1984 November 6-7; Logan, UT. Gen. Tech. Rep. INT-193. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 37-43.

Gal, J.; Smith, J.H.G. 1985. Effects of age, sample characteristics and equation form on three non-linear models for volume yields. *Forestry Chronicle*. 61(1): 14-18.

Inventory data from the British Columbia Ministry of Forests for 9 species groups (Douglas fir, white pine, western larch, red cedar, hemlock, balsam fir, white spruce, lodgepole pine, and aspen) and 3 site classes (good, medium, and poor) were analysed to determine the effect of including mature stand data with immature yields (up to 135 years old) to improve volume estimates of unmanaged natural stands. The available data varied by species group. Three nonlinear functions (Chapman-Richards, modified Weibull, and Gompertz) were used to provide estimates of maximum yield for immature and immature plus mature groups by site class. The results were evaluated by comparing maximum yields and ages at the culmination of m.a.i., calculating standard errors of the estimates, and testing the significance of including mature stand data. Performance of the models was similar. Changes in the curve for culmination of m.a.i. with site suggested that gains could be made by harmonizing the coefficients of each class. Effects of sample size were not consistent, although large samples were generally best. Including mature stand data made considerable differences to the shape of the curve. Some of the predicted culmination ages were unrealistic. It is concluded that nonlinear models should not be applied routinely for estimation of growth and yield.

Miller, D.R.; Lin, J.D. 1985. Canopy architecture of a red maple edge stand measured by a point drop method. In: Hutchison, B.A.; Hicks, B.B., eds. *The forest-atmosphere interaction: Proceedings of the forest environmental measurements conference*; 1983 October 23-28; Oak Ridge, TN. Dordrecht, Netherlands: D. Reidel Publishing Co.: 59-70

The stand studied, in Connecticut, consisted of 30-year-old Acer rubrum with occasional trees of Pinus strobus and Populus tremuloides at the edges. The aim of the study was to provide data on canopy structure needed for turbulent flow measurements and modeling studies.

Mowrer, H.T.; Edminster, C.B. 1985. Estimating past breast height diameters and bark thickness of aspen in the Central Rocky Mountains. Res. Note RM-456. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 2 p.

Usol'tsev, V.A. 1985. Multi-factor regression evaluation of the aerial phytomass of birch and aspen in forest outliers in Kazakhstan and Siberia. *Lesovedenie*. 1: 3-12.

Regression models are presented for the change in phytomass of birch and aspen trees as a function of age, site class, stand density, and stem diameter, in outlying 'islands' of forest in the steppe and forest-steppe zone of S. Siberia and N. Kazakhstan, and stand weights of foliage, wood and bark

of branches, and wood and bark of stem as a function of age, site class, and stand density.

1986

Alemdag, I.S. 1986. Estimating oven-dry mass of trembling aspen and white birch using measurements from aerial photographs. *Canadian Journal of Forest Research*. 16(1): 163-165.

A pilot study tested the estimation of stem, crown, or whole-tree biomass of single Populus tremuloides and Betula papyrifera from measurements of total height and crown area taken from large-scale aerial photographs of the research forest at Petawawa National Forestry Institute. Results indicated the feasibility of the method, providing that photographs are taken after snowmelt in April and before leaf flushing in mid-May, or between leaf-fall and the first snowfall in the autumn.

MacDonald, G.B.; Forslund, R.R. 1986. Application of a geometrical volume equation to species with different bole forms. *Canadian Journal of Forest Research*. 16(2): 311-314.

Accurate estimates of the true volume of 20 Abies balsamea, 68 Picea mariana, 19 P. glauca, 31 Populus tremuloides, and 37 Betula papyrifera were obtained from measurements on discs cut at basal height and at 1 m intervals.

Mowrer, H.T. 1986. ASPNORM: a normal diameter distribution growth and yield model for aspen in the Central Rocky Mountains. Res. Pap. RM-264. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 12 p.

Popovich, S. 1986. Hybrid poplar--the first form factor and volume tables for Quebec. Inf. Rep. LAU-X-71E. Sainte-Foy, Canada: Laurentian Forest Research Centre. 15 p.

Richards, C.H.; Reed, D.D. 1986. A volume estimation system for four northern hardwood species. *Northern Journal of Applied Forestry*. 3(1): 25-28.

A volume estimation system based on Schumacher's total volume equation is developed for sugar maple, red maple, yellow birch, and aspen in upper Michigan. From measurements of d.b.h. and height, the system provides a method of predicting total tree volume, upper stem diameter to any height and merchantable volume to any height or diameter limit. Coefficients are given for volume estimates o.b. and u.b. An example demonstrates the potential of the system.

Rosenfield, G.H. 1986. Analysis of thematic map classification error matrices. *Photogrammetric Engineering and Remote Sensing*. 52(6): 681-686.

Results of the analysis indicated that 2 interpreters were classifying four categories of forest type in the same manner at 95 percent probability level except for oak/cottonwood which was misinterpreted in the same manner at 59 percent probability level. Pine and cedar could be distinguished from each other and from oak and cottonwood.

1987

McGrath, T.P. 1987. Forest biomass accumulations: a parametric approach. *Forestry Abstracts*. 48(4): 247. Thesis Summary.

Mowrer, H.T.; Sheppard, W.D. 1987. Field measurement of age in quaking aspen in the Central Rocky Mountains. Res. Note RM-476. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 4 p.

Ruark, G.A.; Martin, G.L.; Bockheim, J.G. 1987. Comparison of constant and variable allometric ratios for estimating Populus tremuloides biomass. *Forest Science*. 33(2): 294-300.

White, W.B.; Morse, B.W. 1987. ASPENEX: an expert system interface to a geographic information system for aspen management. *AI Applications in Natural Resource Management*. 1(2): 49-53.

1988

Brand, G.J.; Leary, R.A. 1988. Evaluating growth models by estimating A-line location in stocking guides. In: Conference on forest growth modelling and prediction; 1987 August 23-27; Minneapolis, MN. Gen. Tech. Rep. NC-120. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 2: 580-587.

Brown, K.M.; Mugasha, A.G. 1988. A two-stage method for horizontal point sampling in young forest stands. *Canadian Journal of Forest Research*. 18(10): 1340-1343.

Larson, F.D.; Winterberger, K.C. 1988. Tables and equations for estimating volumes of trees in the Susitna River Basin, Alaska. Res. Note PNW-478. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 20 p.

Randall, B.L.; Ek, A.R.; Hahn, J.T.; Buchman, R.G. 1988. STEMS model projection capability with incomplete tree list input data. *Northern Journal of Applied Forestry*. 5(3): 190-194.

Ruark, G.A. 1988. Estimating crown biomass of shade tolerant and intolerant tree species with a variable allometric ratio. In: Conference on forest growth modelling and prediction; 1987 August 23-27; Minneapolis, MN. Gen. Tech. Rep. 120. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 2: 1045-1052.

San Miguel, A.; Fernandez, Cancio A.; Yague, S. 1988. Current biomass estimation equations for short rotation intensively cultured poplars. *Invest. Agar Prod. Prot. Veg.* 3(1): 85-98.

Current biomass estimation equations constitute a valuable tool for forestry research and management in coppice forests. Equations for short

rotation (2-4 years) coppices of poplars (Populus X euramericana 'I-214') are presented.

PHYSIOLOGY

1975

Bhattacharya, N.C.; Bhattacharya, S.; Nanda, K.K. 1975. Changes in the pattern of glutamate dehydrogenase isoenzymes associated with the rooting of etiolated stem segments of Populus nigra. *Biochemie und Physiologie der Pflanzen BPP*. 167(1): 109-113.

Bhattacharya, N.C.; Kaur, N.P.; Nanda, K.K. 1975. Transients in isoperoxidases during rooting of etiolated stem segments of Populus nigra. *Biochemie und Physiologie der Pflanzen BPP*. 167(2): 159-164.

Bylinska, Ewa. 1975. The relationship of winter transpiration of selected species from the genera Viburnum, Populus and Lonicera to the northern boundary of their geographical distribution. Warszawa: Panstwowe Wydawn. Naukowe. 59 p.

Chemarina, O.V. 1975. Rate of photosynthesis in diploid and triploid clones of aspen. Genet., selektsiya, semenovodstvo i introduktsiya les. porod. 69-75. Referativnyi Zhurnal. (1976) 1.55.332.

In the Moscow province of the USSR a comparative study was made of a number of clones, which differed in their rates of photosynthesis and in their reaction to changes in environmental conditions.

Chirkova, T.V. 1975. Metabolism of ethanol and lactate in the tissues of trees with different resistance to oxygen deficiency. *Fiziologiya Rastenii (Mosk)*. 22(5): 952-957.

Covington, W.W. 1975. Altitudinal variation of chlorophyll concentration and reflectance of the bark of Populus tremuloides. *Ecology*. 56(3): 715-720.

Denev, D.A. 1975. Water consumption and nutrient absorption by some poplar clones. *Gorskostop Nauka*. 12(1): 30-39.

Dickmann, D.I.; Gordon, J.C. 1975. Incorporation of photosynthate-C-14 into protein during leaf development in young Populus plants. *Plant Physiology*. 56(1): 23-27.

Dickmann, D.I.; Gordon, J.C. 1975. Incorporation of photosynthate into protein during leaf development in young Populus plants. *Plant Physiology*. 56(2): 60.

Dickson, R.E.; Larson, P.R. 1975. Incorporation of ¹⁴C-photosynthate into major chemical fractions of source and sink leaves of cottonwood. *Plant Physiology*. 56: 185-193.

Dickson, R.E.; Larson, P.R.; Isebrands, J.G. 1975. Does rapid growth rate alter the chemical composition of Populus wood? *Poplar Council News*: 5.

Dimitrov, Kh. 1975. Investigations on light requirements for poplars. *Gorskostop Nauka*. 12(3): 3-15.

Durmishidze, S.V.; Ugrekhelidze, D.Sh. 1975. Assimilation and transformation of methane by plants. *Fiziologiya Rastenii* (Mosk). 22(1): 70-73.

Fasehun, F.E. 1975. Effect of light intensity on growth, photosynthesis and nitrate reductase in hybrid poplars. *Dissertation Abstracts International*, B. 36(5): 1988B.

Four Populus X euramericana clones selected to exhibit differences in growth rate when grown under full sunlight were studied. The results showed that the clones differed significantly in growth response to light intensity. The clone with the best growth had the lowest nitrate reductase activity in the roots when grown under the highest light intensity.

Furukawa, A. 1975. Comparison of photosynthesis, postillumination CO₂ outburst, and CO₂ compensation in poplar varieties, sunflower, and bean. *Journal of the Japanese Forestry Society*. 57(8): 268-274.

In a study of four varieties of poplar, a photosynthetic rate of 27 mgCO₂dm⁻²h⁻¹ was recorded in LK83 (Populus euramericana 'Hardtwalden') at 25degC with an air flow rate of 5 l/min and rates of between 20 to 25 mgCO₂dm⁻²h⁻¹ were recorded in 2n and 4n strains of NM101 (P. nigra X P. maximowiczii) and OP44 (P. maximowiczii X P. trichocarpa). When the air flow rate was 0.5 l/min, the photosynthetic rates in these varieties were 7-8 mgCO₂dm⁻²h⁻¹. Their CO₂ compensation points were between 50 and 57 p.p.m. Postillumination CO₂ outburst was between 1 and 3 mgCO₂dm⁻²h⁻¹ and the mean gross photosynthesis rate was 28 mgCO₂dm⁻²h⁻¹, with a maximum of 34.1 mgCO₂dm⁻²h⁻¹ in LK83.

Gjerstad, D.H. 1975. Photosynthesis, photorespiration and dark respiration in Populus X euramericana: effects of genotype and leaf age. *Dissertation Abstracts International*, B. 36(5): 1988B-1989B.

Three clones differing widely in growth rate were studied. Physiological differences among the clones indicated that 5328 differed markedly in genetic control of plant development from 5321 and 5326.

Gjerstad, D.H.; Dickmann, D.I. 1975. Effect of leaf age on glycolate oxidase activity and photorespiration in Populus X euramericana. *Plant Physiology*. 56(2): 26.

Golovchenko, G.G. 1975. Wind energetics of plants. *Soviet Plant Physiology*. 21(4): 714-716.

Jaskonis, J. Cepulienė, G.; Spokauskienė, O. 1975. Accumulation of essential oil in organs of Pinus sylvestris L. and Populus balsamifera L. and its toxicity for Rhizoctonia aderholdii Kolosch. *Darb, C Ser Biol Mokslaij Liet TSR Mokslu Akad.* 2: 31-37.

Kolesnichenko, M.V.; Chumakov, V.V. 1975. Reasons for the change in the physiological condition of 'Canadian Poplar' in mixed plantations. *Fiziologiya-biokhim. osnovy vzaimodeistviya rast. v fitotsenozakh.* 6: 44-49. *Referativnyi Zhurnal.* (1976) 1.56.155 Ru. BLL.

Describes field, pot, and laboratory trials made in the Voronezh region to investigate the biochemical interaction of various tree and shrub species with

Populus deltoides. Results showed that Betula verrucosa, Ulmus pumila var. arborea and Sambucus racemosa reduced the vitality and growth of the poplar, while Caragana arborescens, Lonicera tatarica, Alnus glutinosa and Rhus cotinus increased it.

Kosichenko, N.E.; Petrov, S.A. 1975. Anatomical and physiological features of leaves of the chimaera Populus 'Kazakhstanskii-272' and of the components of the graft. *Botanicheskii Zhurnal*. 60(9): 1331-1335.

Compares the anatomical structure and physiological properties of the chimaera and of the graft components. In most respects the chimaera is closer to the rootstock, P. nigra var. italica than to the scion.

Larson, P.R. 1975. Development and organization of the primary vascular system in Populus deltoides according to phyllotaxy. *American Journal of Botany*. 62(10): 1084-1099.

Lebedeva, E.P. 1975. Leaf mass, surface area and photosynthetic productivity in some poplar varieties. *Lesovodstvo, les. Kul'tury: pochvovedenie*. IV. 78-82. *Referativnyi Zhurnal*. (1976) 6.56.122.

A study was made of Populus balsamifera, P. trichocarpa, P. laurifolia, and hybrid 85. The largest leaf surface area, the highest photosynthetic productivity, and the fastest growth rate were shown by P. trichocarpa and hybrid 85.

Liani, A. 1975. Distribution of phosphate in the crown and growth of the root system after injection of P-32 in young poplars. *Pubblicazioni del Centro di Sperimentazione Agricola e Forestale*. 13(1): 35-42.

A radioisotope technique was devised for determining both qualitatively and quantitatively the position in the soil of the root system of 1-year-old Populus 'I-214' trees, without the need for excavation. Radioactive phosphate (³²P) was injected into the stems, and radiometric analyses of leaf samples were made at various times after injection in order to determine the length of time required for P to be uniformly distributed throughout the tree. The results show that the root system of a tree can be studied in the open without lengthy and difficult excavation provided that the roots are properly radioactivated and that the soil allows numerous cores to be taken.

Liani, A. 1975. Potential evapotranspiration estimates of young poplar trees by lysimeters. *Monti Boschi*. 26(3): 11-17.

Malkina, I.S. 1975. Stretching of mesophyll cells in seedlings of different shade-endurance. *Lesovedenie*. 4: 69-74.

Nakos, G. 1975. Seasonal changes in foliar nutrient concentrations of forest species in the nursery. I. Conifers. Publ. 73. Athens, Greece: Institouton Dasikon Ereunon, 'Upourgeion Georgias. 24 p.

Nakos, G. 1975. Seasonal changes in foliar nutrient concentrations of forest species in the nursery. II. Poplar hybrids. Publ. 74. Athens, Greece: Institouton Dasikon Ereunon, 'Upourgeion Georgias. 20 p.

Reports parallel studies made over two consecutive growing seasons on Populus 'I-214', P. 'I-45/51', P. 'Campeador', and P. 'I/64'.

Odani, K. 1975. Transport of indoleacetic acid in dormant shoots of Populus deltoides. Nippon Rin Gakkai-Shi (Japan). 57(5): 144-147.

IAA-¹⁴C transport was investigated in non-chilled dormant internode segments of Populus deltoides. A polar transport was operative and seemed to be metabolically regulated. The transporting activity increased during 12 days after transfer to a 25degC condition, although the changes in anatomical features could not be observed by the light microscope. Callose disappearance was also observed in non-chilled shoots. Therefore, the reactivation of sieve tubes in Populus deltoides seemed to precede the initiation of new sieve tubes. Relationship between IAA-transport and initiation of cambial activity was discussed.

Ohta, K.; Furukawa, A. 1975. Root formation in poplar cuttings: the effect of the leaf on root formation. Journal of the Japanese Forestry Society. 57(12): 420-424.

Pieters, G.A.; Zima, M. 1975. Photosynthesis of desiccating leaves of poplar. Physiologia Plantarum. 34(1): 56-61.

Promnitz, L.C. 1975. A photosynthate allocation model for tree growth. Photosynthetica. 9(1): 1-15.

Regehr, D.L.; Bazzaz, F.A.; Boggess, W.R. 1975. Photosynthesis, transpiration and leaf conductance of Populus deltoides in relation to flooding and drought. Photosynthetica. 9(1): 52-61.

Roa, R.L.; Pickard, W.F. 1975. The applicability of the magnetohydrodynamic technique to water flux measurements in forest trees. Journal of Experimental Botany. 26(92): 469-475.

Roshchina, V.D. 1975. The amount of carbon dioxide in gaseous mixture extracted from vegetative tissues of woody plants. Nauch Dokl Vyssh Shk, Biol Nauk. 5: 80-85.

Ryazantseva, P.A. 1975. Variation in the indices of water balance in hybrid poplars in the south of Kazakhstan. Referativnyi Zhurnal. (1975) 11.52.124. Kazakhstan aul saruasylyk gylymynyn habarsysy. 6: 104-106.

Compared with those from the section Aegiri, hybrid forms from the section Albidae had a lower water-retaining capacity of the leaves and content of free water and a higher concentration of cell sap and content of bound water.

Shepard, R.K., Jr. 1975. Radial distribution of corticular photosynthate in stems of bigtooth and trembling aspen. Forest Science. 21(4): 370-372.

Tarsia, N. 1975. Formula for the measurement of potential evapotranspiration. Cellulosa e Carta. 26(5): 21-27.

Terashima, N.; Mori, I.; Kanda, T. 1975. Biosynthesis of p-hydroxybenzoic acid in poplar lignin. *Phytochemistry*. 14(9): 1991-1992.

Tsel'niker, I.U.L. 1975. Effect of light intensity on the number and dimensions of the chloroplasts in trees. *Fiziologiya Rastenii (Mosk)*. 22(2): 262-269.

Wray, P.H. 1975. Peroxidase and growth in hybrid poplar. Dissertation Abstracts International, B. 35(8): 3692B-3693B.

Three clones were grown in growth chambers under photoperiods of 12 and 18 hours. Electrophoresis of leaf extracts showed differences in peroxidase isoenzyme patterns between clones. Internodes of Wisconsin 5 showed a consistently darker band in the 12 h compared with the 18 h photoperiod. In a second experiment, three clones having widely differing growth rates were grown in the greenhouse and subjected to peroxidase analyses at intervals of two weeks. Initially, the fastest growing clones had the lowest total peroxidase activity, while the slowest growing clones had the highest total peroxidase activity. At the final three harvest times, the reverse was true. The data indicate that peroxidase analyses can be used as a tool in the selection of rapidly growing Populus clones.

1976

Bhattacharya, N.C.; Parmar, S.S.; Nanda, K.K. 1976. Isoenzyme polymorphism of amylase and catalase in relation to rooting etiolated stem segments of Populus nigra. *Biochem. Physiol Pflanz*. 170(2): 133-142.

Dickson, R.E. 1976. Xylem translocation of C-14-labeled amino acids from roots of Populus deltoides seedlings. *Plant Physiology*. 57(5): 78.

Dickson, R.E.; Larson, P.R. 1976. Leaf chemical composition of twenty-one Populus hybrid clones grown under intensive culture. Proceedings, 10th Central States Forest Tree Improvement Conference: 20-29.

Edwards, W.R.N.; Robertson, A.G. 1976. Water status and growth initiation in Populus. *New Zealand Journal of Forest Science*. 5(3): 287-295.

Federer, C.A. 1976. Differing diffusive resistance and leaf development may cause differing transpiration among hardwoods in spring. *Forest Science*. 22(3): 359-364.

The diffusive resistance of leaves of 10 species was measured periodically with a diffusion porometer during the 1973 growing season in New Hampshire. It is concluded that cuticular resistance is high in newly unfolded leaves in most species, that both leaf area and diffusive resistance can limit transpiration in spring, and that a rapid-transpiring forest of shade-intolerant species can reduce streamflow during May and June by 30-40 mm compared with an oak wood.

Footo, K.C.; Schaedle, M. 1976. Diurnal and seasonal patterns of photosynthesis and respiration by stems of Populus tremuloides Michx. *Plant Physiology*. 58(5): 651-655.

Foote, K.C.; Shaedle, M. 1975. Physiological characteristics of photosynthesis and respiration in stems of Populus tremuloides Michx. *Plant Physiology*. 58(1): 91-94.

Grace, J.; Wilson, J. 1976. The boundary layer over a Populus leaf. *Journal of Experimental Botany*. 27(97): 231-241.

Describes experiments with leaves of Populus X euramericana cv. 'I-78' in a wind tunnel (in which the air flow was either laminar or experimentally modified to produce turbulent conditions similar to those prevailing in the wake of stems and leaves in the field) to determine whether laminar or turbulent conditions normally prevail in the boundary layer of the leaves. The implications of the results for gas exchange are discussed with reference to evaporation.

Hollwarth, M. 1976. Seasonal changes of nitrogen metabolism and its relation to temperature in the bark of poplars. *Z Pflanzenphysiol*. 80(3): 215-224.

Jankiewicz, L.S.; Stecki, Z.J. 1976. Some mechanisms responsible for differences in tree form. In: Cannell, M.G.R., Last, F.T., eds. *Tree physiology and yield improvement: carbon fixation efficiency*. London, UK: Academic Press: 157-172.

Khashes, Ts.M.; Choni, L.I.; Mikhlina, L.B. 1976. Anatomical and morphological features of the development of shoots of various woody species within the bud. *Lesovedenie*. 6: 44-49.

The literature on the intra-bud development of shoots is reviewed, and the results are given of studies on the anatomical and morphological changes in the terminal meristem of the shoot during the period of growth within the bud. The studies were made on trees growing in identical conditions, 16-18 years old, of Populus bolleana (P. alba var. pyramidalis) which has monocyclic shoot growth; Quercus robur, which has interrupted polycyclic shoot growth; and Fraxinus excelsior and Acer platanoides which have short period of monocyclic shoot growth.

Laisk, A.; Oja, V. 1976. Potential intensity of foliar-photosynthesis determined by the reactions of ribulose diphosphate resynthesis. *Toim, Biol Eesti NSV Tead Akad*. 25(2): 146-150.

Larson, P.R. 1976. Development and organization of the secondary vessel system in Populus grandidentata. *American Journal of Botany*. 63(3): 369-381.

Microscopic analysis of serial sections taken from the bud and apical portion of a dormant first-year coppice shoot of P. grandidentata showed that a total of 15 nodes was present and that there were 14 foliar primordia in the bud. The vascular traces in the lower portion of the stem conformed to a 2/5 phyllotaxy whereas those of the upper stem and bud conformed to a 3/8 phyllotaxy. The phyllotactic transition occurred in a precise and systematic pattern, which is described. The characteristics and development of the metaxylem are also described. The distribution of vessels in the secondary xylem is shown to be explicable in terms of the production and distribution of metaxylem vessels in the primary body.

Larson, P.R. 1976. Procambium vs. cambium and protoxylem vs. metaxylem in Populus deltoides seedlings. *American Journal of Botany*. 63(10): 1332-1348.

The developmental processes contributing to primary xylem formation in P. deltoides were studied in serial sections of bud and stem tissues.

Larson, P.R.; Dickson, R.E.; Isebrands, J.G. 1976. Some physiological applications for intensive culture. Gen. Tech. Rep. NC-21. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 10-18.

Luukkanen, O. 1976. Relationship between the CO₂ compensation point and carbon fixation efficiency in trees. In: Cannell, M.G.R.; Last, F.T., eds. *Tree physiology and yield improvement: carbon fixation efficiency*. London, UK: Academic Press: 111-118.

Following accounts of studies with clonal material of Populus and Picea and of population analyses it is concluded that in some instances the carbon dioxide compensation point is probably an inherent characteristic and is inversely related to carbon-fixation efficiency in such instances. Environmental factors are liable to obscure the relationship. Available evidence supports the suggestion to introduce large-scale screening for low carbon dioxide compensation points by a rapid and simple technique such as the carbon dioxide starvation method.

Mgaloblishvili, M.P.; Kandelaki, R.A.; Sanadze, G.A. 1976. Photophosphorylation in isolated chloroplasts of poplar leaves. *Izv Akad Nauk Gruz SSR Ser Biol Kaia Proc. Acad. Sci. Georgian SSR Biol. Ser.* 2(5): 422-428.

Mullis, R.H.; Thompson, N.S.; Parham, R.A. 1976. The localization of pentosans within the cell wall of aspen by high resolution autoradiography. *Planta*. 132(3): 241-248.

Naidenova, Ts. 1976. Water balance in the leaves of some forms of poplar. *Gorskostopanska Nauka*. 13(5): 36-42.

In pot experiments with 2-year-old saplings of 6 forms, an inverse correlation was found between soil moisture content and the water-retaining capacity of the leaves. Among the forms studied, the highest water-retaining capacity was shown by the leaves of Populus vernirubens and P. bachelieri.

Okoro, O.O.; Grace, J. 1976. The physiology of rooting Populus cuttings. I. Carbohydrates and photosynthesis. *Physiologia Plantarum*. 36(2): 133-136.

Sagisaka, S. 1976. The occurrence of peroxide in a perennial plant, Populus 'Gelrica'. *Plant Physiology*. 57(2): 308-309.

Large amounts of peroxide were found in the xylem and living bark of poplar twigs growing under natural conditions in the field. Amounts were respectively 1.2 and 0.5 micromoles/g dry weight, and the peroxide served as substrate for both catalase and cytochrome c peroxidase.

Schier, G.A. 1976. Physiological and environmental factors controlling vegetative regeneration of aspen. Gen. Tech. Rep. RM-29. Fort Collins, CO:

U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 20-23.

Smilga, J. 1976. Morphological properties of aspen hybrids. *Jaunak Mezsaimn.* 18: 17-35.

Zalasky, H. 1976. Phragmoid cells of leaf and twig scars on Northwest Poplar. *Bi-monthly Research Notes.* 32(5): 24-25.

The scars were studied on a cultivated tree after frost, and on a greenhouse seedling after induced abscission. The corky tissues contained a band or group of irregularly elongate phragmoid cells (shown in photomicrographs), subdivided by mainly transverse septa. The rest of the corky tissue consisted of angular isodiametric thin-walled cells, with a few sclereid-like cells similar to those already noticed.

1977

Brown, R.W.; McDonough, W.T. 1977. Thermocouple psychrometer for in situ leaf water potential determinations. *Plant and Soil.* 48(1): 5-10.

An in situ thermocouple psychrometer was tested to determine its capability for tracking the changing leaf water potentials of aspen (Populus tremuloides) under controlled conditions and in the field. The results agreed with theoretical expectations - a sharp decline in leaf water potential during the photoperiods and recovery during the dark periods, each to progressively lower levels during a soil drying cycle.

Dalessandro, G.; Northcote, D.H. 1977. Changes in enzymic activities of nucleoside diphosphate sugar interconversions during differentiation of cambium to xylem in sycamore and poplar. *Biochem Journal.* 162(2): 267-279.

Dickson, R.E. 1977. EDTA-promoted exudation of ^{14}C -labeled compounds from detached cottonwood and bean leaves as related to translocation. *Canadian Journal of Forest Research.* 7(2): 277-284.

Mature and developing cottonwood (Populus deltoides) and bean leaves were photosynthetically labeled for 30 minutes with $^{14}\text{C}\text{O}_2$. Radioactive compounds in exudate obtained by placing cut petioles in 20 mM Na_2EDTA for 6 hours in the dark were compared with those found in chloroform/methanol/water extracts of leaf lamina and petiole.

Dimitrov, Kh. 1977. Investigations on the rate of photosynthesis and transpiration of Populus euramericana cv. 'I-214' with various levels of nutrient elements and moisture in the soil. *Gorskostopanska Nauka.* 14(4): 3-11.

Pot trials were made in which Populus 'I-214' was grown for one year with or without the application of NPK fertilizers, and at seven different soil moisture contents, viz. 40, 50, 60, 70, 80, 90, and 100 percent of maximum water-holding capacity. Fertilizers increased the biomass accumulation by increasing the leaf area, but did not increase the rate of photosynthesis except in the soils with 90 and 100 percent moisture content.

Eller, B.M.; Koch, W. 1977. Global radiation in gas exchange chambers and outside. *Photosynthetica*. 11(3): 268-275.

Federer, C.A. 1977. Leaf resistance and xylem potential differ among broadleaved species. *Forest Science*. 23(4): 411-419.

Mean leaf diffusive resistance in unstressed trees and shrubs of 27 species in New Hampshire and Maine was 2.5-4.5 s/cm (at 15 mbar vapor pressure deficit). In Spiraea latifolia resistance was 5.8 s/cm. During water stress, stomata partially closed at xylem pressure potentials that differed among genera, averaging -15 bar for Betula, -17 for Populus, -21 for Quercus and -23 for Prunus. The potentials did not decrease further as resistances increased. Stressed Quercus and Prunus seedlings had lower potentials than did larger trees.

Fujii, T.; Harada, H.; Saiki, H. 1977. Ultrastructure of expanding ray parenchyma cell wall in poplar. *Bulletin of Kyoto University of Forestry Kyoto Daigaku Enshurin*. 49: 127-131.

Gordon, J.C.; Promnitz, L.C. 1977. A physiological approach to cottonwood yield improvement. In: Thielges, B.A.; Land, S.B., Jr. eds. *Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University; 1: 66-88.*

Information is reviewed on plant ideotype, photosynthesis, respiration, and transpiration in Populus deltoides, and on the effects of density of stand on the three physiological processes. It is shown that multivariate techniques and simulation models may be used to construct ideotypes from laboratory and field data in respect of physiological processes.

Isebrands, J.G.; Larson, P.R. 1977. Organization and ontogeny of the vascular system in the petiole of eastern cottonwood. *American Journal of Botany*. 64(1): 65-77.

The development of the vascular system in the petiole of Populus deltoides was studied in leaves at leaf plastochron index 4-6 from plants harvested when they reached a plastochron index of 16. The topologic arrangement of petiolar bundles varied along the petiole. Each petiolar bundle was formed by the subdivision and aggregation of acropetally differentiating subsidiary bundles, which provide fascicular continuity between the stem and specific portions of the leaf lamina.

Isebrands, J.G.; Larson, P.R. 1977. Vascular anatomy of the nodal region in Populus deltoides Bartr. *American Journal of Botany*. 64(9): 1066-1077.

Isebrands, J.G.; Promnitz, L.C.; Dawson, D.H. 1977. Leaf area development in short rotation intensive cultured Populus plots. In: TAPPI forest biology, wood chemistry conference: 201-210.

Kim, S.K.; Lee, S.K.; Sun, S.W. 1977. Photosynthesis of X Populus albaglandulosa in relation to leaf age. *Journal of the Korean Forestry Society*. 34: 63-71.

Photosynthetic rates were measured by infra-red gas analysis in young, mature, and old leaves of P. X albaglandulosa grown under controlled planting

density in Korea. Variations with leaf age were found in the rate of net photosynthesis, the temperature for maximum net photosynthesis, and the saturating light intensity.

Kulygin, A.A. 1977. Biology of flowering and fruiting in Populus pyramidalis. Referativnyi Zhurnal. (1978) 7.56.126. Sb. Statei. Novocherkas. inzh. - Melior. in-t. 17(3): 24-26.

At Novocherkassk, in the Rostov province of the USSR, male trees flowered 6-7 days before female ones.

Larson, P.R. 1977. Phyllotactic transitions in the vascular system of Populus deltoides Bartr. as determined by ¹⁴C labeling. Planta. 134(3): 241-249.

Larson, P.R.; Pizzolato, T.D. 1977. Axillary bud development in Populus deltoides. I. Origin and early ontogeny. American Journal of Botany. 64(6): 835-848.

Maiorchik, I.B. 1977. Some characteristics of root formation in cuttings of Populus of the Leuce section. Tr. Inst. Ekol. Rast. Zhivotn. Ural. Nauchn. Tsent: 95-99.

Marcet, E. 1977. Studies of structural morphology in early development stages of Robusta poplars. Mitt. Eidg. Anst. Forstl. Versuchswes. 53(3): 107-160.

Mariaux, A.; Gueneau, P.; Serra, J. 1977. An attempt at a quantitative anatomical study of some woods, using the texture analyser. Bois et Forets des Tropiques. 171: 17-30.

Methods have been developed for microscopic television scanning of wood, including the use of a geometric scanning unit of hexagonal shape which can interpret various combinations of black or white points. Examples are given of the application to transverse sections of beech and poplar wood.

Pavlova, I.E. 1977. Effect of illumination conditions on photochemical activity of chloroplasts from the leaves of woody plants. Soviet Plant Physiology. 24(2, Pt. 1): 184-188.

Pereira, J.S.; Kozlowski, T.T. 1977. Variations among woody angiosperms in response to flooding. Physiologia Plantarum. 41(3): 184-192.

Effects of flooding on young Populus deltoides, Salix nigra, Eucalyptus camaldulensis, E. globulus, Ulmus americana, Quercus rubra, and Fraxinus pennsylvanica plants were studied. Flooding variously induced several sequential physiological disturbances, with stomatal closure being among the earliest responses. In both long- and short-term experiments, flooding did not significantly increase plant water stress.

Pizzolato, T.D.; Larson, P.R. 1977. Axillary bud development in Populus deltoides. II. Late ontogeny and vascularization. American Journal of botany. 64(6): 849-860.

Salmonson, B.J. 1977. Gas exchange, dry weights, and chlorophyll contents of Populus tremuloides seedlings grown from gamma-irradiated seeds. In:

Zavitkovski, J., ed. The Enterprise, Wisconsin Radiation Forest. Radioecological studies. Oak Ridge, TN: USAEC, Technical Information Center. 2:189-195.

Photosynthesis and respiration rates of Populus tremuloides seedlings grown from seeds acutely irradiated with gamma rays (at levels of 0, 0.47, 0.94, 1.8, 3.7, 7.5, and 15 kr) were measured using a closed system and infrared (IR) gas analyzer. Dry weights of seedling roots and shoots and chlorophyll contents were also determined. In general, gamma irradiation of seed had little effect on subsequent gas-exchange processes in the plant. Net photosynthesis and dark respiration rates of the seedling at any radiation level were not significantly different from those of the control group.

Sanadze, G.A.; Tevzadze, I.T.; Tarkhnishvili, G.M. 1977. Changes in the $^{13}\text{C}^{18}\text{O}_2/^{12}\text{C}^{18}\text{O}_2$ ratio in the atmosphere of enclosed chambers during photosynthesis. Soviet Plant Physiology. 24(3, Pt. 2): 529-530.

Sanadze, G.A.; Dzotsenidze, T.S.G.; Tarkhnishvili, G.M.; Pkhachiashvili, S.Sh. 1977. Changes in the specific activity of $^{14}\text{C}^{18}\text{O}_2$ and isoprene at the compensation point. Doklady, Botanical Science Akademiia, Nauk SSSR. 232/234: 39-40.

Shive, J.B.; Brown, K.W. 1977. Quaking and gas exchange in leaves of cottonwood. Plant Physiology, 59(6): 61.

Starova, N.V. 1977. Photosynthesis and transpiration of hybrid poplars in relation to hybrid vigor. Lesovodstvo i Agrolesomeliorsiya. 48: 57-63.

Photosynthetic rate and transpiration rate were measured on selected poplar hybrids grown in the Lubny and Kremenchug forests, Poltava region, Ukraine.

Tamm, Yu.A.; Khannus, Ya.M. 1977. Morphometry of the leaf in aspen. Referativnyi Zhurnal. (1977) 12.56.150.

A study of 68 male and female trees showed that variation in the morphometric characters of the leaf was greater in the male than in the female individuals. In almost all characters except dry-matter content and the ratio of leaf length to leaf width, the male trees exceeded the female. In particular, leaf area, width of leaf blade, and length of petiole were almost always greater in the male trees.

Tevzadze, I.T.; Tarkhnishvili, G.M.; Sanadze, G.A. 1977. Effect of oxygen on changes of the $^{13}\text{C}^{18}\text{O}_2/^{12}\text{C}^{18}\text{O}_2$ isotope ratio in the atmosphere of closed chambers during photosynthesis. Soviet Plant Physiology. 24(5, Pt. 2): 867-869.

Tsel'niker, Yu.L. 1977. Regulation of processes of CO_2 exchange and morphogenesis in seedlings of forest trees under conditions of shading. Soviet Plant Physiology. 24(1, Pt. 1): 43-48.

Two- to four-year-old seedlings of Betula pendula and Populus tremula (shade-intolerant), Fraxinus pennsylvanica and Acer platanoides (moderately shade tolerant) and Aesculus hippocastanum (very shade-tolerant) were grown in a nursery near Moscow at 0.5-90 percent of full light. The results are

presented of measurements of the rate of photosynthesis as a function of light intensity, of the rate of dark respiration, and of leaf area.

Tyree, M.T.; Cameron, S.I. 1977. A new technique for measuring oscillatory and diurnal changes in leaf thickness. *Canadian Journal of Forest Research*. 7(3): 540-544.

The method described is a direct electromechanical technique using a commercial linear variable distance transducer. Recordings made on mature leaves of *Populus deltoides* X *nigra* showed that they underwent diurnal or oscillatory changes in thickness of up to 20 μ m in amplitude; the changes appeared to be correlated with predicted water stress.

Uvarov, L.A.; Tsarev, A.P.; Rusin, N.S. 1977. Water balance in some poplar varieties in the central forest steppe. Dep. 3573-77. Voronezh, USSR: N.-i. institut lesnoi genetiki i selektsii. 18 p. *Referativnyi Zhurnal*. (1977) 12.56.148.

Quantitative and qualitative differences between 14 varieties were found in the water balance of the leaves and shoots and in the water-retaining capacity (WRC) and concentration of cell sap (CCS) in the leaves. As regards WRC, three groups were found: (1) varieties with low WRC throughout the growing season, (2) varieties with low WRC at the stage of vigorous growth and high WRC in the second part of the growing season, and (3) varieties with high WRC throughout the growing season. As regards CCS, three groups were also found: (1) varieties in which CCS rose rapidly at the end of the stage of vigorous growth, (2) varieties with a gradual increase in CCS throughout the growing season, and (3) varieties in which CCS rose only at the end of the growing season.

Viil, J.; Laisk, A.; Oja, V.; Parnik, T. 1977. Enhancement of photosynthesis caused by oxygen under saturating irradiance and high CO₂ concentrations kidney beans. *Photosynthetica*. 11(3): 251-259.

1978

Ames, I.H.; Tepper, H.B. 1978. Seasonal changes in the ultrastructure of aspen bark chloroplasts. *Photosynthetica*. 12(1): 70-72.

Bengston, C. Linder, S. 1978. Literature study of the eco-physiological aspects of gas exchange in *Populus* and *Salix*. Rep. SLU-ESO-TR-1. Uppsala, Sweden: Sveriges Lantbruksuniversitet. 38 p.

This report summarizes a literature investigation. It describes the different factors which might influence the gas exchange (i.e. photosynthesis, respiration, and transpiration) of the genera *Salix* and *Populus*. The influence of light, temperature, water, and mineral nutrients (ion) on gas exchange under normal conditions and under different forms of stress are described and discussed.

Ceulemans, R.; Impens, I.; Lemeur, R.; Moermans, R.; Samsuddin, Z. 1978. Water movement in the soil-poplar-atmosphere system. I. Comparative study of stomatal morphology and anatomy, and the influence of stomatal density and

dimensions on the leaf diffusion characteristics in different poplar clones. *Oecologia Plantarum*. 13(1): 1-12.

Ceulemans, R.; Impens, I.; Lemeur, R.; Moermans, R.; Samsuddin, Z. 1978. Water movement in the soil-poplar-atmosphere system. II. Comparative study of transpiration regulation during water stress situations in four different poplar clones. *Oecologia Plantarum*. 13(2): 139-146.

The material comprised two Unal clones (hybrids from Populus trichocarpa X P. deltoides), a P. robusta clone and P. trichocarpa 'V-235', studied under increasing water stress. The two Unal clones had the largest leaves and the highest total leaf area per plant; P. trichocarpa had a markedly smaller total leaf area. The two Unal clones had lower transpiration rates per unit leaf area and higher stomatal diffusion resistances than the other two clones. These characters are determined by stomatal density and size.

Charriereladreix, Y. 1978. Subcellular distribution and properties of phenylalanine ammoniac lyase from flavonic glands of Populus nigra L. *Physiologie Vegetale*. 16(3): 547-562.

Curtis, J.D.; Lersten, N.R. 1978. Heterophylly in Populus grandidentata with emphasis on resin glands and extrafloral nectaries. *American Journal of Botany*. 65(9): 1003-1010.

Seasonal changes in certain morphological (and anatomical) features of the leaves are described in specimens of bigtooth aspen from Michigan, emphasizing the distinction between early and late leaves.

Drew, A.P.; Bazzaz, F.A. 1978. Variation in distribution of assimilate among plant parts in three populations of Populus deltoides. *Silvae Genetica*. 27(5): 189-193.

In March 1976 1-year-old branches were taken from 6-year-old trees of P. deltoides at 3 sites: (a) Diamond Bluff, Wisconsin; (b) Fulton, Illinois; and (c) Baton Rouge, Louisiana. The cuttings were planted out at Urbana, Illinois in April 1976. Height, leaf area, and shoot and root dry weight were sampled at 3-week intervals in the first growing season. The (a) provenance grew fastest and had thinner leaves with a greater surface area. This faster growth was not maintained; type (b) was tallest at 5-years-old. Studies on detached shoots showed that (a) transpired and photosynthesized more than (b) at high light intensity, and may therefore suffer from moisture stress.

Fasehun, F.E. 1978. Effect of irradiance on growth and photosynthesis of Populus X euramericana clones. *Canadian Journal of Forest Research*. 8(1): 94-99.

Greenhouse and laboratory experiments were conducted to determine the effect of irradiance level on growth and photosynthesis of three Populus X euramericana clones selected to exhibit differences in growth rate when under full sunlight.

Johnson, L.C.; Critchfield, W.B. 1978. The production of functional pollen and ovules by pine seedlings less than 1 year old. *Forest Science*. 24(4): 467-468.

Three seedlings of Pinus contorta and 16 F⁴ P. contorta X banksiana hybrids growing in the Forest Genetics Nursery in California, produced

functional pollen and ovules, respectively, as less than 1-year-old. None of their offspring flowered until 2-years-old or more.

King, D.; Loucks, O.L. 1978. The theory of tree bole and branch form. *Radiat Environ. Biophys.* 15(2): 141-165.

Larson, P.R.; Isebrands, J.G. 1978. Functional significance of the nodal constricted zone in Populus deltoides. *Canadian Journal of Botany.* 56(7): 801-804.

Okafo, O.A.; Hanover, J.W. 1978. Comparative photosynthesis and respiration of trembling and bigtooth aspens in relation to growth and development. *Forest Science.* 24(1): 103-109.

Photosynthesis and respiration under controlled environments were compared in Michigan provenances of (a) Populus grandidentata and (b) P. tremuloides for whole plants and single attached leaves. Net photosynthesis per unit leaf area was similar for both species; (b) showed significantly higher net CO₂ uptake per plant. At rates near maximum photosynthetic capacity, (b) showed a higher net photosynthetic rate (PR). The leaf net PR of both species was four times that of whole seedlings, partly owing to shading and variable leaf age within seedlings. A negative correlation between whole-plant net PR and total leaf area was observed. Dark respiration rates were not significantly different between species, or between leaves and seedlings. CO₂ compensation points determined for single leaves were not significantly different between the species.

Okoro, O.O.; Grace, J. 1978. Physiology of rooting Populus cuttings. 2. Cytokinin activity in leafless hardwood cuttings. *Physiologia Plantarum.* 44(3): 167-170.

Pavlova, I.E.; Matorin, D.N.; Venediktov, P.S. 1978. Investigation of delayed fluorescence in leaves of woody plants grown under different illumination conditions. *Soviet Plant Physiology.* 25(1, Pt. 1): 71-78.

Pavlova, I.E.; Matorin, D.N.; Venediktov, P.S. 1978. Study on delayed fluorescence of the leaves of trees grown under different conditions of illumination. *Fiziologiya Rastenii (Mosk).* 25(1): 97-105.

Rakhi, M.O.; Zavadskaya, I.G.; Bobrovskaya, N.I. 1978. Errors in determining the components of the water potential of leaves by a pressure chamber. *Fiziologiya Rastenii (Mosk).* 25(4): 869-877.

Shive, J.B., Jr.; Brown, K.W. 1978. Quaking and gas exchange in leaves of cottonwood. *Plant Physiology.* 61(3): 331-333.

Tyree, M.T.; Cheung, Y.N.S.; MacGregor, M.E.; Talbot, A.J.B. 1978. The characteristics of seasonal and ontogenetic changes in the tissue-water relations of Acer, Populus, Tsuga, and Picea. *Canadian Journal of Botany.* 56(6): 635-647.

1979

1979. Nutritional research within the Energy Forestry Project: growth and production at Bogesund, Sweden. In: Ericsson, T.; Perttu, K., eds. Proceedings, International energy agency (IEA) planning group on growth and production; 1979 September 24, Bogesund, Sweden. Stockholm, Sweden: 45-50.

Experiments on nutritional demands of fast growing Populus and Salix species gave very similar results. Both Populus and Salix were sensitive to high nutrient concentrations. The ability to absorb mineral elements was very high, i.e., these plants were able to utilize all elements down to negligible concentration, without affecting the growth rate.

Bassman, J.H.; Dickmann, D.I. 1979. Growth and dry-weight of young Populus trees subjected to defoliation in the developing leaf zone. HortScience. 14(3): 427.

Bassman, J.H.; Dickmann, D.I. 1979. Growth and dry-weight of young Populus trees subjected to defoliation in the developing leaf zone. Plant Physiology. 63(5): 106.

Brayman, A.; Schaedle, M. 1979. Stem photosynthesis in current-growth stems of Populus tremuloides Michx. HortScience. 14(3): 22.

Brayman, A.; Schaedle, M. 1979. Stem photosynthesis in current-growth stems of Populus tremuloides Michx. Plant Physiology. 63(5): 74.

Charriereladreix, Y. 1979. Endoplasmic O-methyltransferase of Populus nigra. Phytochemistry. 18(1): 43-45.

Cheng, W.W.; Benseid, D.W. 1979. Anatomical properties of selected Populus clones grown under intensive culture. Wood Science. 11(3): 182-187.

Cheng, W.W.; Benseid, D.W. 1979. Influence of nitrogen on stem anatomy of 2 Populus clones. Wood Science. 11(3): 176-181.

Chua, M.G.S.; Wayman, M. 1979. Characterization of autohydrolysis aspen lignins. 1. Composition and molecular weight distribution of extracted autohydrolysis lignin. Canadian Journal of Chemistry. 57(10): 1141-1149.

Chua, M.G.S.; Wayman, M. 1979. Characterization of autohydrolysis aspen lignins. 3. Infrared and ultraviolet studies of extracted autohydrolysis lignin. Canadian Journal of Chemistry. 57(19). 2603-2611.

Drew, A.P.; Bazzaz, F.A. 1979. Response of stomatal resistance and photosynthesis to night temperature in Populus deltoides. Oecologia. 41(1): 89-98.

Gottschalk, K.W.; Dickmann, D.I. 1979. Environmental effects on photosynthesis and stomatal conductance of 4, 2-year-old Populus clones grown in the field. HortScience. 14(3): 451.

Gottschalk, K.W.; Dickmann, D.I. 1979. Environmental effects on photosynthesis and stomatal conductance of 4, 2-year-old Populus clones grown in the field. *Plant Physiology*. 63(5): 127.

Hansen, E.A.; Dickson, R.E. 1979. Water and mineral nutrient transfer between root systems of juvenile Populus. *Forest Science*. 25(2): 247-252.

Khosla, P.K.; Dhall, S.P.; Khurana, D.K. 1979. Studies in Populus ciliata Wall ex Royle. 1. Correlation of phenotypic observation with sex of trees. *Silvae Genetica*. 28(1): 21-23.

Larson, P.R. 1979. Establishment of the vascular system in seedlings of Populus deltoides Bartr. *American Journal of Botany*. 66(4): 452-462.

Olsson, L.; Flower-Ellis, J.G.K. [1979.] Structure and some dimensional relations of six clones of Salix and clone of Populus from a clonal trial at Studsvik, Sweden. Sveriges Lantbruksuniversitet, Uppsala. 48 p.

The morphology and dimensional relations of current shoots on two-year-old stools of six Salix and one Populus clone were studied. The aims of the study were (a) to describe the structure of the shoot population, (b) to surface area from non-destructive measurements. Results were intended to give guidance in the preparation of sampling system for actively growing stand. Since most of the relationships found were specific for individual clones, they should be used with caution for estimates in clones not included in the present material or differing in respect e.g. of stool age.

Pallardy, S.G.; Kozlowski, T.T. 1979. Early root and shoot growth of Populus clones. *Silvae Genetica*. 28(4): 153-156.

A greenhouse study was conducted to observe early patterns of shoot growth, root elongation, and leaf area growth of rooted leafy tip cuttings of 4 Populus clones of varied growth rate. Clones differed in total plant dry weight, dry weight distribution among plant parts, and estimated net assimilation rate (NAR) after 5 weeks growth.

Pallardy, S.G.; Kozlowski, T.T. 1979. Frequency and length of stomata of 21 Populus clones. *Canadian Journal of Botany*. 57(22): 2519-2523.

Frequency and length of stomata of field-grown plants of 21 Populus clones were studied. Although differences in stomatal frequency and length were observed in some cases between early and late leaves of a clone, pore area differences were small because of the tendency for leaves with fewer stomata to have larger stomata. Cluster analysis indicated that stomatal characteristics were related to parentage.

Pallardy, S.G.; Kozlowski, T.T. 1979. Relationships of leaf diffusion resistance of Populus clones to leaf water potential and environment. *Oecologia*. 40(3): 371-380.

Pallardy, S.G.; Kozlowski, T.T. 1979. Stomatal response of Populus clones to light intensity and vapor pressure deficit. *Plant Physiology*. 64(1): 112-114.

Stomata of P. candicans X P. berolinensis proved more sensitive to vapor pressure deficit and light intensity than did stomata of P. deltoides X P.

caudina. The drought resistance of P. berolinensis may influence the sensitivity of the stomata P. candicans X P. berolinensis.

Prudic, Z.; Sterba, S. 1979. Phenological observations on poplars and their variability. *Prace Vyzkumneho Ustavu Lesniho Hospodarstvi a Myslivosti*. 54: 49-67.

Flushing and leaf fall were observed in 1974-1975 on 960 trees in a 12-year-old collection of poplar clones planted in a lowland district of Czechoslovakia. The 10 most numerous clones were classified into 3 main types according to the pattern of phenological variation. In some clones, flushing and leaf fall conformed to different phenological types.

Sivakumaran, S.; Hall, M.A. 1979. Hormones in relation to stress recovery in Populus robusta cuttings. *Journal of Experimental Botany*. 30(114): 53-63.

Tselniker, Y.L.; Mai, V.V. 1979. Growth processes and photosynthetic activity in the leaf of aspen. *Soviet Plant Physiology*. 26(5): 859-864.

1980

Eliasson, L.; Brunel, L. 1980. Light effects on root formation in aspen and willow cuttings. *Physiologia Plantarum*. 48(2): 261-265.

Isebrands, J.G.; Larson, P.R. 1980. Ontogeny of major veins in the lamina of Populus deltoides Bartr. *American Journal of Botany*. 67(1): 23-33.

Larson, P.R.; Isebrands, J.G.; Dickson, R.E. 1980. Sink to source transition of Populus leaves. *Berichte der Deutschen Botanischen Gesellschaft*. 93(1): 79-90.

McCull, J.G. 1980. Seasonal nutrient variation in trembling aspen. *Plant and Soil*. 54(2): 323-328.

Variation in the concentrations of N, K, Mg, and Ca in vegetative buds, leaves, twigs, and male catkins of Populus tremuloides, determined throughout a growing season in central Minnesota, reflected the different physiological roles of the nutrients. Little leaching or retranslocation of Ca or Mg in leaves occurred during the growing season. The concentration of Ca increased in leaves and twigs prior to leaf abscission. Catkins showed increases in K, Mg, and K in the early spring, followed by decreases in summer.

Pallardy, S.G.; Kozlowski, T.T. 1980. Cuticle development in the stomatal region of Populus clones. *New Phytologist*. 85(3): 363-368.

Pregitzer, K.S.; Barnes, B.V. 1980. Flowering phenology of Populus tremuloides and Populus grandidentata and the potential for hybridization. *Canadian Journal of Forest Research*. 10(2): 218-223.

Sivakumaran, S.; Horgan, R.; Heald, J.; Hall, M.A. 1980. Effect of water stress on metabolism of abscisic acid in Populus robusta X schnied and Euphorbia lathyris L. *Plant Cell and Environment*. 3(3): 163-173.

1981

Chang, Y.P.; Wei, S.M.; Zhou, Y.L.; Yang, B.C. 1981. Studies on the formation of bark and its chemical composition of Populus tomentosa Carr. *Scientia Silvae Sinicae*. 17(4): 351-362.

The developmental anatomy of P. tomentosa bark is described and data given on the isolation and characterization of some important chemical constituents, including lignin, chlorophyll, glucosides, and phenolic acids. Isozyme contents of male and female bark were compared.

Ezidakova, L.A.; Mezheumova, L.V. 1981. Manganese content and distribution in woody plants in relation to site. *Biologicheskije Nauki*. 10: 71-75.

Variations in the Mn concentrations of leaves and stems during the growing season are shown in graphs for Scots pine, Betula pendula, Populus nigra, and Tilia cordata in 2 urban areas of Lipetsk and Vladimir Provinces, Russia, in 1977 and 1978. Mn concentrations were higher in leaves than stems and higher in a warm dry summer than in a normal summer, suggesting that Mn increases drought resistance. The Mn contents were much higher at the rural site than at the urban sites. Results suggest that Mn can be harmlessly accumulated and is not involved in growth depression by metallurgical air pollution in the city of Lipetsk.

Goffinet, M.C.; Larson, P.R. 1981. Structural changes in Populus deltoides terminal buds and in the vascular transitional zone of the stems during dormancy induction. *American Journal of Botany*. 68(1): 118-129.

Lapa, I. 1981. Phenolic compounds in male and female aspen trees. Lapa, I. In: Krugman, Stanley L.; Katsuta, Masaki, eds. *Proceedings of the Symposium on flowering physiology at the 17th IUFRO World Congress; 1981; Kyoto, Japan*: 91-97.

Mgaloblishvili, M.P.; Litvinov, A.I.; Sanadze, G.A. 1981. Photosynthetic activity of poplar (Populus deltoides Marsh.) mesophyll protoplasts (Yield of protoplasts as related to plant growing conditions). In: *Proceedings of the Academy of Sciences of the Georgian SSR. Biological Series*. 7(5): 442-450.

Musselman, K.; Hocker, H.W., Jr. 1981. Caloric values of eight New Hampshire forest tree species. *Canadian Journal of Forest Research*. 11: 409-412.

Caloric values were determined for bole and branches and for foliage of Acer saccharum Marsh., Betula alleghaniensis Britton, Fraxinus americana L., Acer rubrum L., Quercus rubra L., Betula papyrifera Marsh., Pinus strobus L., and Populus tremuloides Michx. For each of the hardwood species, caloric values did not differ significantly between samples with and without bark or between bole and branch components. For Pinus strobus L. there was a 5 percent significant difference between branch with bark and branch without bark samples and between pooled bole and pooled branch components.

Nanda, K.K.; Sethi, R. 1981. Populus as a tool in understanding the physiology of adventitious root formation. In: Singh, R.V., ed. *Symposium proceedings: silviculture, management and utilization of poplars; 1979 October 15-18; Srinager. Delhi, India: Controller of Publications*: 43-61.

Nelson, E.A.; Dickson, R.E. 1981. Accumulation of food reserves in cottonwood stems during dormancy induction. *Canadian Journal of Forest Research*. 11(1): 145-154.

When Populus deltoides seedlings attained a plastochron index (PI) of 12, dormancy was induced by 8-hour photoperiods and 20deg/14degC temperature regimes. Tissue samples were taken at 4 stem positions for 8 weeks under short days. Cottonwood, though previously considered a lipid-storing tree, stores primarily carbohydrate; initial starch stores are converted to soluble sugars under cold conditions.

Pallardy, S.G.; Kozlowski, T.T. 1981. Water relations of Populus clones. *Ecology*. 62(1): 159-169.

Stomatal aperture and water balance in the field of eight Populus clones varying in growth rate were closely related to environmental factors and clonal differences were clearly expressed. Leaf water potential (psi) was influenced by solar radiation, leaf conductance, evaporative demand, and soil moisture content. The effects of soil moisture on psi were greatly modified by atmospheric conditions and stomatal conductance. Stomata of all clones responded to changes in light intensity and vapor pressure gradient. Seasonal maximum leaf conductance was positively related to growth in several clones, suggesting that rapidly growing clones possess the capacity to carry on higher rates of gas exchange under favorable conditions.

Vasil'ev, B.R.; Pautov, A.A. 1981. Structure of an annual shoot of Populus alba (Salicaceae). *Vestnik Leningradskogo Universiteta*. 1(Feb.): 38-43.

1982

Burger, C.P.; Hall, R.B.; Johnson, D.B.; Baryeh, E.; Faltonson, R.R. 1982. Strain gauges measure growth characteristics of trees. *Transactions of the American Society of Agricultural Engineers*. 25(6): 1685-1690.

The effects of light and temperature on the stem diametral growth of young trees was investigated by the use of a strain gauge dendrograph. Sixteen different tests were conducted, each lasting 4 days. The general conclusion was that stem diametral growth increases both with light intensity and temperature over the range considered.

Catesson, A.M. 1982. Cell wall architecture in the secondary sieve tubes of Acer and Populus. *Annals of Botany*. 49(1): 131-134.

Dickson, R.E.; Nelson, E.A. 1982. Fixation and distribution of ¹⁴C in Populus deltoides during dormancy induction. *Physiologia Plantarum*. 54(4): 393-401.

Dickson, R.E.; Shive, J.B., Jr. 1982. ¹⁴C₂ fixation, translocation, and carbon metabolism in rapidly expanding leaves of Populus deltoides. *Annals of Botany*. 50(1): 37-47.

Shoot tips of young plants (plastochron index PI 25) were cut under water and placed in an artificial sap solution, and treated with ¹⁴C₂ in continuous or pulse-chase experiments. After 30 minutes fixation, specific activity in the leaf tip increased with age. Specific activity in the lower lamina

increased slowly with age. Studies of older leaves showed that the extreme tip began to export photosynthate at about LPI 4 or 5 on a 2⁴-leaf plant.

Isebrands, J.G.; Nelson, N.D. 1982. Crown architecture of short-rotation, intensively cultured Populus. II. Branch morphology and distribution of leaves within the crown of Populus 'Tristis' as related to biomass production. Canadian Journal of Forest Research. 12(4): 853-864.

Jain, M.K. 1982. Some physiological aspects of rooting of cutting in forest trees (Populus nigra, Salix tetrasperma). In: Khosla, P.K., ed. Symposium Proceedings, Improvement of forest biomass. Solan, India: Indian Society of Tree Scientists: 161-168.

Kaufmann, M.R. 1982. Evaluation of season, temperature, and water stress effects on stomata using a leaf conductance model. Plant Physiology. 69(5): 1023-1026.

A model was developed earlier describing leaf conductance of Abies lasiocarpa, Pinus contorta var. latifolia, Picea engelmannii, and Populus tremuloides in terms of photosynthetic photon flux density (PPFD) and absolute humidity difference from leaf to air (DAH). Using residual analysis techniques it was determined from the data previously collected that no seasonal or temperature effects existed that were not taken into account by PPFD and DAH.

Kaufmann, M.R. 1982. Leaf conductance as a function of photosynthetic photon flux density and absolute humidity difference from leaf to air. Plant Physiology. 69(5): 1018-1022.

Leaf conductance, photosynthetic photon flux density (PPFD) and absolute humidity difference from leaf to air (DAH) were measured on one tree of each of four species in subalpine forest in the Fraser Experimental Forest, Colorado in 1980. Species were Abies lasiocarpa, Pinus contorta var. latifolia, Picea engelmannii, and Populus tremuloides. Conductance was represented for all species by an equation containing 3 functions of PPFD and DAH each with a species-specific regression coefficient. It is proposed that PPFD and DAH are primary factors controlling the stomatal function of plants growing in their natural range, and that secondary factors such as temperature and water stress affect conductance only intermittently, except when plants are growing outside their normal environmental conditions.

Kaufmann, M.R. 1982. Leaf conductance during the final season of a senescing aspen branch. Plant Physiology. 70(3): 655-657.

Leaf conductance, transpiration, and experimental conditions were measured on two Populus tremuloides branches on a tree in the Fraser Experimental Forest, Colorado. Leaves on one branch senesced about 10 days early, allowing a comparison between normal and senescing branches. Terminal bud development was retarded on the senescent branch. No visual symptoms of senescence were observed until September, but stomatal behavior was atypical shortly after the leaves were fully expanded.

Kaufmann, M.R.; Edminster, C.B.; Troendle, C.A. 1982. Leaf area determinations for subalpine tree species in the central Rocky Mountains. Res. Pap. RM-238.

Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 7 p.

Picea engelmannii, Abies lasiocarpa, Pinus contorta, and Populus tremuloides trees in the Fraser Experimental Forest (Colorado) were felled and measured in August and September 1979 and 1980. The data were used to produce equations for estimating leaf area from d.b.h. or tree height, and for calculating leaf area index from stand basal area.

Li, W.D.; Fan, R.W.; Mai, X.L. 1982. On the embryological observations of the seed development of Populus simonii Carr. *Scientia Silvae Sinicae*. 18(2): 113-119.

Nelson, N.D.; Dickmann, D.I.; Gottschalk, K.W. 1982. Autumnal photosynthesis in short-rotation intensively cultured Populus clones. *Photosynthetica*. 16(3): 321-333.

Nelson, N.D.; Michael, D. 1982. Photosynthesis, leaf conductance, and specific leaf weight in long and short shoots of Populus 'Tristis' grown under intensive culture. *Forest Science*. 28(4): 737-744.

Pezeshki, Sadrocin Reza. 1982. A comparative study of physiological characteristics, growth patterns, and biomass production of artificially regenerated red alder and black cottonwood. *Dissertation Abstracts International*. 43/06-B: 1677.

Field and controlled environment experiments were conducted to study physiological and developmental patterns of red alder wildlings and black cottonwood cuttings in response to available soil moisture soon after outplanting. The objective was to describe species reaction to outplanting under two soil moisture regimes. As soil moisture availability declined during the drought period, both the maximum and the average daily leaf conductances declined for both species. Stomata of cottonwood appear more responsive to water deficits than alder. Pressure-volume studies indicated that alder and cottonwood are capable of seasonally regulating leaf osmotic potential. Controlled environment experiments indicated that: (1) soil drought resulted in reduction of stomatal conductance and stronger stomatal response to lower vapor pressure gradients in both species; and, (2) photosynthesis in both species was strongly correlated with leaf conductance. Results suggest: (1) cottonwood's growth as unrooted cuttings is slower than planted wildlings of alder in early stages of stand initiation; and (2) cottonwood has greater drought avoidance characteristics than alder.

Pezeshki, S.R.; Hinckley, T.M. 1982. The stomatal response of red alder and black cottonwood to changing water status (Alnus rubra, Populus trichocarpa). *Canadian Journal of Forest Research*. 12(4): 761-771.

Richards, J.H.; Larson, P.R. 1982. The initiation and development of secondary xylem in axillary branches of Populus deltoides. *Annals of Botany*. 49(2): 149-163.

Salleo, S.; Rosso, R.; Lo Gullo, M.A. 1982. Hydraulic architecture of Vitis vinifera L. and Populus deltoides Bartr. 1-year-old twigs: I. Hydraulic

conductivity (LSC) and water potential gradients. *Giornale Botanico Italiano*. 116(1/2): 15-27.

Leaf specific conductivity was greater in internodal than in nodal segments of year-old twigs, especially in grapevine. The nodes could thus be regarded as hydraulic constriction zones in the stem. Their resistance to flow increased acropetally in both species causing characteristic hyperbolic behavior of the water potential gradient along the twig. This trend was less marked in poplar than in vine.

Salleo, S.; Rosso, R.; Lo Gullo, M.A. 1982. Hydraulic architecture of Vitis vinifera L. and Populus deltoides Bartr. 1-year-old twigs: II. The nodal regions as "constriction zones" of the xylem system. *Giornale Botanico Italiano*. 116(1/2): 29-40.

The higher resistance to flow exhibited by the nodal (compared with the internodal) regions of year-old twigs appeared to result from the lower number of large-diameter vessels in the nodes in both species and also the greater number of narrow-diameter vessels in poplar.

Soffinet, M.C.; Larson, P.R. 1982. Xylary union between the new shoot and old stem during terminal bud break in Populus deltoides. *American Journal of Botany*. 69(3): 432-446.

A morphological and anatomical investigation of greenhouse-grown plants at various stages of bud burst and stem extension.

Tobiessen, P. 1982. Dark opening of stomata in successional trees. *Oecologia*. 52(3): 356-359.

Dark opening of stomata was found in shade intolerant tree species in three sets of experiments. In the field, leaves of eight successional species were darkened in light-proof bags and leaf resistance was measured with a diffusion porometer. The stomata of all sampled shade intolerant species showed a dark opening response, often to leaf resistance levels typical of illuminated leaves. Shade tolerant species did not. Evidence suggests that this response is endogenous and could contribute to the morning opening of the stomata of species under moderate water stress growing in well illuminated habitats.

Tyree, M.T.; Richter, H. 1982. Alternate methods of analysing water potential isotherms: some cautions and clarifications. II. Curvilinearity in water potential isotherms. *Canadian Journal of Botany*. 60(6): 911-916.

The Hammel pressure bomb technique was used to obtain measurements of water potential, PSI, and relative water content R^* , on single leaves of Populus spp., Helianthus annuus, and Fraxinus ornus. In theory, curvature can appear in the PSI versus $1/R^*$ transformation whenever a significant fraction of tissue water is contained in the apoplast, and this theoretical prediction can be demonstrated by some of the data in this paper. The presence or absence of curvature in the two transformations can also be due to apoplast compressibility, the development of negative turgor pressure in living cells or the nonideality of the osmotic solutions in living cells.

Vasil'ev, A.E.; Kreng, R.E.; Miroslavov, E.A.; Yun, D.S. 1982. Cellular ultrastructure of minor veins in Populus trichocarpa leaves. *Botanicheskii Zhurnal*. 67(3): 278-284.

An EM study showed that the minor veins of poplar leaves usually contain both tracheal and sieve elements; the latter have a typical structure but very small diameter. There is no distinct boundary between xylem and phloem. Mesophyll cells are generally connected with each other and with sheath cells by single plasmodesmata. The overall number of plasmodesmata is relatively small. The results are discussed in relation to photosynthate transport from the mesophyll into vascular tissues.

Wang, S.J.; Min, Z.Q.; Liu, Y.R.; Liu, F.J.; Wang, S. 1982. Studies on water relations of ten species and hybrids of Populus. Scientia Silvae Sinicae. 18(1): 6-14.

Measurements were made on seedlings under controlled conditions in the greenhouse and in the field in 1979 and 1980. Aspects studied included: diurnal and seasonal changes in transpiration rates, water loss of excised leaves, estimates of water consumption per ha, ratio of rates of transpiration and photosynthesis, stomatal size and distribution, and the control of stomatal apertures. Species were classified into 5 groups according to drought tolerance and related physiological characteristics.

Zeiger, E.; Schwartz, A. 1982. Longevity of guard cell chloroplasts in falling leaves: implication for stomatal function and cellular aging. Science, USA. 218(4573): 680-682.

Guard cell chloroplasts in senescing leaves from 12 species of trees (mostly fruit trees but also including Populus spp., Diospyros virginiana, Quercus spp., and Ginkgo biloba) and 3 annuals survived considerably longer than those from mesophyll cells.

Zhang, Y.B.; Zheng, H.M.; Long, R.Z.; Yang, B.C. 1982. Seasonal cambial activity and formation of phloem and xylem in eight forest tree species grown in north China. Scientia Silvae Sinicae. 18(4): 366-379.

Samples were collected periodically during 1979 and 1980 from trunks and crown branches of 8 tree species (Pinus bungeana, P. tabulaeformis, Salix babylonica, Populus tomentosa, Eucommia ulmoides, Paulownia elongata, Sophora japonica, and Ulmus pumila) typical of conifers and diffuse- or ring-porous broadleaves. The ring-porous species showed quite a different pattern of development to the other 2 groups, including a resumption of cambial activity in the trunk during spring which much preceded that in crown branches.

1983

Appleby, R.F.; Davies, W.J. 1983. A possible evaporation site in the guard cell wall and the influence of leaf structure on the humidity response by stomata of woody plants. Oecologia. 56(1): 30-40.

Gas exchange measurements made with single leaves from Wych elm (Ulmus glabra), Lombardy poplar (Populus nigra 'Italica') and common oak (Quercus robur) seedlings grown at high irradiance showed significant interspecific differences in the stomatal response to variation in atmospheric humidity. Elm and poplar seedlings showed low conductances at high vapor pressure differences (VPD), while the stomatal conductance of oak was little influenced by an increase in VPD between the leaf and the surrounding air.

Appleby, R.F.; Davies, W.J. 1983. The structure and orientation of guard cells in plants showing stomatal responses to changing vapour pressure difference (Quercus robur, Populus nigra, Pinus sylvestris). *Annals of Botany*. 52(4): 459-468.

Benayoun, J. 1983. A cytochemical study of cell wall hydrolysis in the secondary xylem of poplar. *Annals of Botany*. 52(2): 189-200.

An examination of treated sections of [P. nigra var. italica] samples taken in April from the stem from near the 2nd internode down to the 5th internode from the bud suggested that the plasmalemma played an important part in differentiation.

Ceulemans, R.; Impens, I. 1983. Net CO₂ (carbon dioxide) exchange rate and shoot growth of young poplar (Populus) clones. *Journal of Experimental Botany*. 34(144): 866-870.

Ciamporova, M. 1983. An ultrastructural study of reserve lipid mobilization in stem root primordia and poplar (Populus niger). *The New Phytologist*. 95(1): 19-27.

Deol, G.S.; Khosla, P.K. 1983. Esterase isozyme variation in Populus ciliata wall in relation to sex and altitudinal clones. *Indian Journal of Plant Physiology*. 26(3): 301-304.

Duda, U.; Kacperska, A. 1983. Frost tolerance estimation in callus derived from poplar and winter rape plants using three different methods (Populus nigra, Brassica napus var. oleifera, estimation of injuries). *International Journal of Plant Physiology*. 111(1): 69-73.

Fan, R.W.; Huang, J.S. 1983. Ultrastructure and development of pollen grains in Populus deltoides Bartr. var. deltoides cv. Harvard. *Journal of Nanjing Technological College of Forest Products*. 3: 13-18.

Fisher, D.G.; Larson, P.R. 1983. Structure of leaf/branch gap parenchyma and associated vascular tissues in Populus deltoides. *Botanical Gazette*. 144(1): 73-85.

Fisher, D.G.; Larson, P.R.; Dickson, R.E. 1983. Phloem translocation from a leaf to its nodal region and axillary branch in Populus deltoides. *Botanical Gazette*. 144(4): 481-490.

Fitzgerald, R.D.; Hoddinott, J. 1983. The utilization of carbohydrates in aspen roots following partial or complete top removal. *Canadian Journal of Forest Research*. 13(4): 685-689.

The decline in carbohydrates in roots of aspen (Populus tremuloides) as a consequence of shoot production from root suckers and the contribution of new shoots to root carbohydrate levels was investigated as part of a study of the factors controlling aspen regrowth following top removal. Shoot growth in darkness was greater from roots taken from plots where clipping had been conducted in midseason rather than later in the season, suggesting that some carbohydrate replenishment had taken place in those plots. While shoots in

normal and shade quality light were not phenologically different, shoots in normal light had greater leaf development than shoots in shade light and were heavier, presumably because of the greater leaf development leading to a greater net photosynthesis.

Isebrands, J.G.; Nelson, N.D. 1983. Distribution of (¹⁴C)-labeled photosynthates within intensively cultured Populus clones [P. 'Tristis No. 1' and P. eugenei] during the establishment year. *Physiologia Plantarum*. 59(1): 9-18.

Isebrands, J.G.; Nelson, N.D.; Dickmann, D.I.; Michael, D.A. 1983. Yield physiology of short rotation intensively cultured poplars. In: Hansen, E.A., comp. Intensive plantation culture: 12 years research. Gen. Tech. Rep. NC-91. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 77-93.

A summary and discussion of published and unpublished results of a program established in Wisconsin in 1978 which investigated crown architecture and canopy density and various aspects of photosynthesis in relation to growth in different poplar clones. Silvicultural and genetic implications are outlined.

Larson, P.R.; Fisher, D.G. 1983. Xylary union between elongating lateral branches and the main stem in Populus deltoides (continuous transport system). *Canadian Journal of Botany*. 61(4): 1040-1051.

Li, Y.F.; Wu, D.Q. 1983. The wood structure, property and use of Xinjiang diversiform-leaved poplar. *Journal of Nanjing Technological College of Forest Products*. 4: 65-74.

The structure, chemical composition, and fiber pattern of Populus euphratica from Xinjiang are described. Both macro- and micro-structure were examined and analyses and comparisons made between morphological characteristics, development patterns, wood structure, and chemical composition of branches of P. euphratica and other Populus species (P. tremula, P. tomentosa, P. yunnanensis, P. ussuriensis, P. nigra var. thevestina, and P. lasiocarpa).

Liu, Y.R.; Liu, F.J.; Wang, S.; Wang, S.J. 1983. Studies on seedling growth and photosynthetic characteristics of four poplar hybrids. *Scientia Silvae Sinicae*. 19(3): 269-276.

Studies were made under controlled conditions in the greenhouse and in the field during 1979-1981, using Populus 'Lux', P. 'I-214', (Aigeiros clones) and P. X Opera (I-69) [P. 'Opera'] and P. X popularis [P. 'Popularis'], both hybrids of P. simonii. Measurements were made of light compensation and light saturation points, dark respiration rates, and net photosynthesis. It is suggested that growth potential of Populus seedlings may be determined from net photosynthetic rate or total leaf area.

Meicenheimer, R.D.; Larson, P.R. 1983. Empirical models for xylogenesis in Populus deltoides. *Annals of Botany*. 51(4): 491-502.

Plants were grown from seed at day/night temperatures of 26/21degC with a 16 hour photoperiod and sampled at PI (plastochron index) 24. Stems were sectioned to give lengths of leaf primordia and heights of primordial

insertion below the shoot apex. Measurements were then used in mathematical models describing temporal and spatial changes in vessel characteristics of metaxylem and secondary xylem.

Mlodzianowski, F.; Wozny, A.; Siwecki, R.; Ksiazek, M. 1983. Anatomy and ultrastructure of poplar leaves I. Leaf surface of four parental trees. *Journal of Tree Sciences*. 2(1/2): 4-9.

Earlier studies demonstrated differences in the surface morphology of the epidermis of poplars resistant (P. X 'Serotina de Poitou') and susceptible (P. trichocarpa) to rust (Melampsora larici-populina). In this paper the leaf surfaces of 4 other poplar species (P. nigra 'Italica' [P. n. italica], P. maximowiczii, P. laurifolia, and P. nigra) varying in rust resistance were scanned by SEM. Stranded ridging was earlier (in P. trichocarpa) suggested to be associated with ease of penetration of the rust fungus, but since P. maximowiczii is resistant to rust, this suggestion no longer holds.

Nelson, N.D.; Isebrands, J.G. 1983. Late-season photosynthesis and photosynthate distribution in an intensively cultured Populus nigra x laurifolia clone. *Photosynthetica*. 17(4): 537-549.

Pezeshki, S.R. 1983. A comparative study of physiological characteristics, growth patterns, and biomass production of artificially regenerated red alder and black cottonwood. *Forestry Abstracts*. 44(11): 698.

Pieters, G.A. 1983. Growth of Populus euramericana (growth curve of leaves, leaf area, axis growth, mathematical models). *Physiologia Plantarum*. 57(4): 455-462.

Purohit, A.N.; Negi, D.C.S.; Bhatt, R.M.; Sharma, M.C.; Dhyani, P.P. 1983. Diurnal changes in water-vapour transfer and energy balance in broadleaf tree species from varying altitudes. *Proceedings of the Indian National Science Academy, B*. 49(6): 667-674.

Diurnal changes in water vapor transfer and leaf energy balance were studied on clear days in August and September 1981 in a few broadleaf tree species from varying altitudes grown at 550 m elevation for 9-10 months. In all the species, except Betula utilis, leaf temperatures were slightly below air temperature in the morning and evening hours and above air temperature during the intervening hours. In Betula, Alnus, Populus, and Cedrella a sharp increase in the transpiration rate was recorded at 08.00 hours in the morning and that was almost the maximum rate observed in these species. The species showing minimum increase in the leaf temperature showed maximum increase in transpiration and those with highest increase in the temperature showed minimum increase in transpiration. The eco-physiological significance of the results is discussed in terms of adaptation.

Riech, P.B. 1983. Effects of low concentrations of O₃ (ozone) on net photosynthesis, dark respiration, and chlorophyll contents in aging hybrid poplar leaves. *Plant Physiology*. 73(2): 291-296.

Singh, R.V.; Kashyap, S.D. 1983. Correlation of leaf area with length and width of leaves of Populus ciliata (photosynthesis). Indian Journal of Ecology. 10(2): 335-336.

Sun, J.X. 1983. A preliminary report on ecological and physiological characters of Populus euphratica. Forest Science and Technology (LinYE Keji Tongxun). 8: 19-21.

A study on 16-year-old female plants in the vicinity of the Research Center of the Dengkou Experimental Forest Department (Chinese Academy of Forest Sciences) showed that the net photosynthetic rate was positively correlated only with light intensity, and was much less influenced by changes of stomata, air temperature, and humidity. The transpiration rate was positively correlated with the percentage of opened stomata, extent of stomatal opening, air temperature, and light intensity, yet it was negatively correlated with water potential and relative humidity. The species is highly tolerant to alkaline conditions and waterlogging; it did not suffer from root rot even at a soil moisture of 21.1 percent, but its growth slowed down at an excessive soil salinity and moisture content.

Sundberg, M. 1983. Vascular development in the transition region of Populus deltoides Bartr. ex Marsh. seedlings. American Journal of Botany. 70(5): 735-743.

Embryo anatomy was reconstructed from 7-microm serial transverse sections of mature seeds. Results showed that the procambial template was well established in the dormant embryo. With the onset of germination there was rapid elongation of both root and hypocotyl. Relations between procambium, initiating layer and metacambium and their derivatives are similar to those described for shoots of this species.

Tryon, P.R.; Chapin, F.S., III. 1983. Temperature control over root growth and root biomass in taiga forest trees. Canadian Journal of Forest Research. 13(5): 827-833.

Root elongation of greenhouse-grown Alaskan taiga tree seedlings increased with increasing root temperature in 6 species (black and white spruce, Picea mariana and P. glauca; aspen, Populus tremuloides; balsam poplar, P. balsamifera; birch, Betula papyrifera var. humilis; and larch, Larix laricina) examined and was most temperature sensitive in warm-adapted aspen. Root biomass of 25-year-old aspen and 60-year-old poplar sites (517 and 5,385 g/m², respectively) comprised a greater proportion (57 percent in poplar) of total tree biomass than in spruce.

Tselniker, Y.L.; Chetverikov, A.G.; Andreeva, T.F. 1983. Effects of irradiance on photosynthesis, ribulose 1,5-bisphosphate carboxylase activity and photosynthetic unit in Populus tremula L. Photosynthetica. 17(4): 550-556.

Wang, S.J.; Liu, F.J.; Liu, Y.R.; Wang, S. 1983. Diurnal growth rhythm and water regime in poplar seedlings. Plant Physiology Communications (Zhiwu Shenglixue Tongxun). 3: 39-41.

In an experiment conducted in Beijing in 1979-1980, saplings grown from cuttings of the hydrophilous and fast-growing hybrid Populus 'I-214' and the drought-tolerant hybrid P. 'Hezuoyang' were studied under normal field

conditions. The rhythm of height increase measured on 2 successive days in each month from June to August was the same in the 2 hybrids.

1984

Baazov, D.I.; Sanddze, G.A. 1984. Spectrum of photosynthesis action in poplar leaves. In: Proceedings of the Academy of Sciences of the Georgian SSR. Biological Series. 10(2): 137-139.

Bak, J.H.; Jung, H.S. 1984. Effect of vapor gradients on lateral diffusion in hybrid aspen sapwood in transverse directions. Wood Science and Technology (Mogjae-gonghak). 12(5): 3-12.

Specimens 0.5 cm thick were suspended over saturated salt solutions and rate of adsorption and diffusion coefficients were measured at different RH. Rates of adsorption were greater in high RH than in low RH. There was a parabolic relationship between rate of adsorption and time. Diffusion coefficients in transverse directions increased with increasing moisture gradients. In low moisture gradient ranges there was no significant difference between radial and tangential diffusion coefficients, but in high moisture gradient ranges, the radial diffusion coefficient was 1.5 times greater than the tangential diffusion coefficient.

Ceulemans, R.; Impens, I.; Steenackers, V. 1984. Stomatal and anatomical leaf characteristics of 10 Populus clones. Canadian Journal of Botany. 62(3): 513-518.

DeGroote, D.K.; Larson, P.R. 1984. Correlations between net auxin and secondary xylem development in young Populus deltoides. Physiologia Plantarum. 60(4): 459-466.

Edwards, W.R.N.; Booker, R.E. 1984. Radial variation in the axial conductivity of Populus and its significance in heat pulse velocity measurement. Journal of Experimental Botany. 35(153): 551-561.

Fan, R.W. 1984. A comparison study of the development of the ovule and embryo sac of clones of Aigeiros poplars. Journal of Nanjing Institute of Forestry. 3: 44-50.

Fattakhova, F.Z.; Solomina, E.I. 1984. Photochemical activity in chloroplasts of hybrid and parental forms of poplars. Genet.-selekts.: 93-94. Referativnyi Zhurnal. (1985) 5.65.124. Ru. CGB.

The photochemical activity (PCA) of isolated chloroplasts differed significantly between Populus 'Novoberlinskii 7' (P. nigra var. italica X P. laurifolia) [P. X berolinensis] and its parents, although there were similarities between the PCA of the hybrid and the seed parent [P. nigra].

Fege, A.S.; Brown, G.N. 1984. Carbohydrate distribution in dormant Populus shoots and hardwood cuttings. Forest Science. 30(4): 999-1010.

Stems from 2 hybrid clones in a nursery in Wisconsin were collected at intervals from September 1980 to May 1981, to determine the effects of

harvesting data and sampling position on carbohydrate availability. The maximum starch content was recorded in early October in one clone and in early September in the other. Concentration of sugars and starch were significantly greater at upper shoot positions, although total quantities of sugars and starch were greatest in the larger basal stem sections and thus in cuttings harvested from lower shoot positions. Starch content was higher and sugar content lower in cuttings stored at 2deg and -3degC for 5-7 months, compared with those stored at -10 or -20degC.

Galimova, I.V.; Ishtiryakova, F.K. 1984. A study of the activity and molecular heterogeneity of nitrate reductase in poplar hybrids showing heterosis. Genet.-selekts.: 107-108. Referativnyi Zhurnal. (1985) 5.65.133. Ru. CGB.

Enzyme activities and isoenzyme patterns were compared in the rootlets and leaves of Populus 'Novoberlinskii 7' (P. X berolinensis) and P. 'Druzhba 8' (P. trichocarpa X P. laurifolia) and of their parent species.

George, M.F.; Burke, M.J. 1984. Supercooling of tissue water to extreme low temperature in overwintering plants. Trends in Biochemical Sciences. 9(5): 211-214.

Hui-jun, J.; Ingestad, T. 1984. Nutrient requirements and stress response of Populus simonii and Paulownia tomentosa. Physiologia Plantarum. 62(2): 117-124.

Hunt, E.R., Jr.; Weber, J.A.; Gates, D.M. 1984. Differences between tree species in hydraulic press calibration of leaf water potential are correlated with specific leaf area. Plant, Cell and Environment. 7(8): 597-600.

To determine its usefulness in estimating leaf water potential, the J-14 Hydraulic Press (Campbell Scientific, Inc., Logan, Utah) was calibrated against a Scholander-type pressure chamber for leaves of various tree species. The species tested were: Acer saccharum, Acer negundo, Acer rubrum, Populus tremuloides, Populus grandidentata, Quercus rubra, and Brassaia actinophylla (Schefflera). There were no significant differences between species of the calibration lines within the genera Acer and Populus. These data may indicate that leaves with lower SLA resist mechanical compression by the hydraulic press, causing the J-14 Press to be less sensitive to differences of leaf water potential. Therefore the J-14 Press is only a relative measure of leaf water status and does not measure leaf water potential.

Jia, H.J.; Ingestad, T. 1984. Nutrient requirements and stress response of Populus simonii and Paulownia tomentosa. Physiologia Plantarum. 62(2): 117-124.

Kaufmann, M.R. 1984. A canopy model (RM-CWU) for determining transpiration of subalpine forests. I. Model development. Canadian Journal of Forest Research. 14(2): 218-226.

A model has been developed for calculating consumptive water use of the 4 major subalpine species (Picea engelmannii, Abies lasiocarpa, Pinus contorta var. latifolia, and Populus tremuloides) in the Rocky Mountains. The model, RM-CWU, is based upon the use of a submodel of stomatal behavior in which

stomatal activity is predicted from photosynthetic photon flux density (PPFD) and the absolute humidity difference from leaf to air (DAH). In preliminary applications, conductances calculated with RM-CWU varied with physiographic features of the site, date and time, position in the canopy, and weather conditions, through effects on PPFD and DAH. Consumption water use, calculated for entire stands using leaf areas predicted from basal area measurements, also varied with stand composition.

Leszczynska, D.; Schneider, Z.; Tomaszewski, M.; Mackowiak, M. 1984. Comparative studies on adenosine nucleosidase occurrence in plants. *Annals of Botany*. 54(6): 847-849.

A survey of adenine salvage metabolism in cultivated and wild species was made by assessing the levels of adenosine nucleosidase. The enzyme level ranged from 0.005 (undetectable) in 3 species including Populus alba to 80 $\mu\text{mol min}^{-1} \text{g}^{-1}$ in the cherry cv. Schattenmorelle. The enzyme remained at a high level in tree leaves (in contrast to barley and other cereals) throughout the whole vegetative period.

Martin-Shultz, Kenneth Gail F. 1984. Single crystal x-ray diffraction structural determination of heterophyllin and phenyl iodone. Dissertation Abstracts International. 44/08-B: 2431.

The crystal and molecular structures of heterophyllin, a water soluble diterpene isolated from Populus heterophylla L., and phenyl(N,N'-dimethylbarbituryl)iodone were solved by single crystal x-ray diffraction methods.

Michael, Donald Andrew. 1984. Growth and photosynthesis of two field-grown Populus clones during the establishment year. Dissertation Abstracts International. 45/06-B: 1637.

Photosynthesis and growth under field conditions were monitored for Populus X euramericana cv. "Eugenei" (Eugenei) and P. tristis X P. balsamifera cov. 'Tristis No. 1' (Tristis) during their first growing season. Photosynthetic rates were measured using a portable (^{14}C) apparatus which allowed intensive sampling within individual trees.

Miura, G.A.; Shih, T.M. 1984. Cholinergic constituents in plants: Characterization and distribution of acetylcholine and choline. *Physiologia Plantarum*. 61(3): 417-421.

Acetylcholine levels in leaves ranged from 0.14 ± 0.05 nmol/g fresh weight in I. opaca to 53 ± 6.6 nmol/g in P. aureus. Acetylcholine was found in all tissues examined regardless of the organ or developmental stage. For P. aureus, continuous light exposure increased acetylcholine levels in leaves and decreased levels in stems when compared with dark controls. With these findings, three of the four components of the cholinergic system of animals have now been identified in plants.

Miura, G.A.; Shih, T.M. 1984. Identification of proprionylcholine in higher plants. *Physiologia Plantarum*. 62(3): 341-343.

Nakagawara, S.; Sagisaka, S. 1984. Increase in enzyme activities related to ascorbate metabolism during cold acclimation in poplar twigs. *Plant and Cell Physiology*. 25(6): 899-906.

Nelson, N.D.; Ehlers, P. 1984. Comparative carbon dioxide exchange for two Populus clones grown in growth room, greenhouse, and field environments. *Canadian Journal of Forest Research*. 14(6): 924-932.

Light-saturated net photosynthetic rates per unit leaf area were 1.6-2.1 X greater for the photosynthetically mature leaves of plants of 2 hybrid Populus clones (P. 'Tristis No. 1' and P. eugenei) grown in pots in the field than in comparable plants from a controlled environment growth room and a winter greenhouse. When net photosynthetic rates (Ps) were corrected for the differences in specific leaf weights to derive net photosynthetic rate per unit leaf dry weight, the values were similar for plants from the 3 environments. Internal leaf CO₂ concentration, and photorespiration and dark respiration rates per unit leaf area were not related to growth environment. However, photorespiration rate as a percentage of net photosynthetic rate was lower in the field trees. Net photosynthetic rate was shown to be under strong genetic control in these clones. It is concluded that the effects of growth environment on variables of carbon exchange are sensitive to the basis of expression of those variables.

Pautov, A.A. 1984. Structure of long and short shoots of Populus alba L. (Salicaceae). *Vestnik Leningradskogo Universiteta*. 3(Aug.): 43-53.

Reich, P.B. 1984. Leaf stomatal density and diffusive conductance in three amphistomatous hybrid poplar cultivars [Populus maximowiczii X trichocarpa, Populus deltoides X trichocarpa, Populus maximowiczii X incrassata]. *The New Phytologist*. 98(2): 231-239.

Reich, P.B. 1984. Loss of stomatal function in ageing hybrid poplar leaves. *Annals of Botany*. 53(5): 691-698.

Leaves of NE cv. 41 (P. maximowiczii X P. trichocarpa), NE cv. 207 (P. deltoides X P. trichocarpa) and NE cv. 308 (P. maximowiczii X P. incrassata), 12, 24, 36, or 48 days old, were kept in growth chambers at day/night temperatures of 25/20degC. The conductance of older leaves oscillated more frequently and the oscillations were more random than in younger leaves. The conductance of older leaves was higher in the dark and following excision, and lower in the light than that of younger leaves.

Reich, P.B. 1984. Oscillations in stomatal conductance of hybrid poplar leaves in the light and dark. *Physiologia Plantarum*. 61(4): 541-548.

Reich, P.B. 1984. Relationships between leaf age, irradiance, leaf conductance, CO₂ exchange, and water use efficiency in hybrid poplar. *Phytosynthetica*. 18(4): 445-453.

Variations in stomatal diffusive conductance (gs), net photosynthetic rate (PN), and water use efficiency (WUE) in chamber-grown hybrid poplar (Populus deltoides X trichocarpa) were determined under differing irradiances (I) and for leaves of various ages. An unusual bimodal pattern of gs was observed both in the light and dark as a function of leaf age. The observed

relationships between gs, PN, and WUE were consistent with the idea that hybrid poplar stomata behave so as to maximize CO₂ uptake while minimizing water loss.

Russin, William Allan. 1984. Structural and plasmolytic studies on the leaf of Populus deltoides. Dissertation Abstracts International. 45/05-B: 1364.

Structural studies of the leaf of Populus deltoides Bartr. ex Marsh. with light and electron microscopes were complemented with plasmolytic studies in an attempt to reveal structure-function relationships within the leaf. The broad aims of these studies were to determine: (1) the vasculature and the spatial relationships of the various tissues of the leaf, (2) whether there are any changes in sieve-tube cross-sectional area that may impose constraints on assimilate transport, and (3) the possible pathways followed by photosynthates from mesophyll cells to sieve tubes of minor veins.

Russin, W.A.; Evert, R.F. 1984. Studies on the leaf of Populus deltoides: morphology and anatomy. American Journal of Botany. 71(10): 1398-1415.

Mature leaves from field-grown trees and mature and immature leaves from plants grown in a growth chamber were compared. Differences were quantitative, with leaves of plants in growth chambers having thinner blades, a higher proportion of air space, and greater interveinal distances than leaves of field-grown trees.

Sakamoto, M.; Sumiya, K.; Yamada, T. 1984. The bioelectrical potentials of young woody plants. Wood Research, Kyoto University. 70: 42-46.

The electric potentials were measured, by microelectrodes inserted in the shoots, petioles, and leaves of Cryptomeria japonica and Populus nigra plants with or without illumination of about 7,000 lux. Generally, turning the light on resulted in a small, temporary increase in potential and turning it off resulted in a temporary reduction. In whole plants and rootless poplar shoots in water, the potential rapidly returned to its resting value after the on/off switch, whereas in rootless poplar shoots in 0.25M sucrose solution it did not.

Salleo, S. 1984. Functional aspects of water conduction pathways in vascular plants. Giornale Botanico Italiano. 118(1/2): 53-65.

Wood is a multi-compartmented system with different internal pressures not in equilibrium with each other, and having highly complex physical properties. The subject of water conduction is reviewed under the headings: wood as a non-ideal water conducting system; experimental measurement of hydraulic conductivity in tree stems; functional significance of vessel size - efficiency and safety of water conduction in wood; and hydraulic architecture in trees.

Salleo, S.; LoGullo, M.A.; Siracusano, L. 1984. Distribution of vessel ends in stems of some diffuse- and ring-porous trees: the nodal regions as 'safety zones' of the water conducting system. Annals of Botany. 54(4): 543-552.

One-year-old twigs of Vitis vinifera, Populus deltoides, Olea europaea (diffuse porous), Juglans nigra, Castanea sativa, and Sophora japonica (ring porous) were collected in September-October 1982 and 1983 from trees over 30 years old, grown in Messina. In all 3 diffuse-porous species, a significantly

higher proportion of vessel ends was found at the nodes than in the internodes, although there was no significant difference between nodes and internodes in ring-porous species.

Sharma, C.M.; Gaur, R.D. 1984. Sprouting and developmental behaviour of the leaves in leader branch of Populus X euramericana var. regenerata. Journal of Tree Sciences. 3(1/2): 53-58.

The development of leaves from buds on the lower, middle, and upper portions of leader branches was observed in two 4-year-old trees of P. X euramericana var. regenerata [P. 'Regenerata'] in the experimental garden and nursery of Garhwal University. Leaves emerged from the base of the branch first and development continued towards the apex. Data are given on color, size, and chlorophyll contents of leaves at different stages of development.

Vlcek, J.; Cheung, E. 1984. Spectral radiation balance of poplar leaves using video techniques. Canadian Journal of Forest Research. 14(5): 712-716.

A simple method is described to measure spectral radiation absorptance of leaves using video imaging in combination with narrow band-pass filters. Individual leaves can be measured in situ or several detached leaves can be measured at once to speed up the work. Data from 10 poplar clones sampled from open and closed canopy positions over a period of approximately 3 weeks showed significant radiation absorption differences between the clones.

Zhang, X.Z.; Feng, X.G.; Liu, F.Y. 1984. A preliminary discussion on NPK contents in the leaves of five tree species and the regular changes effected. Forest Science and Technology (LinYE Keji tongxun). 10: 9-10, 27.

Results of tests with Populus simonii X P. nigra, P. pseudosimonii X P. nigra, P. beichensis, P. simonii, and Pinus sylvestris var. mongolica showed that NPK contents and regular changes are closely related to species. NPK contents of all poplars were higher than those of P. sylvestris. P content was lower than N and K contents in all species tested.

1985

Bassman, J.H.; Dickmann, D.I. 1985. Effects of defoliation in the developing leaf zone on young Populus X euramericana plants. II. Distribution of UC-photosynthate after defoliation. Forest Science. 31(2): 358-366.

Patterns of UC-photosynthate distribution in growth chamber-grown Populus X euramericana cv. Negrito de Granada were determined 24 hours, 3 weeks, and 5 weeks after defoliation in the developing leaf zone. When leaves below or remaining tissue of leaves within the zone of defoliation were exposed to UC02, a greater percentage of UC-photosynthate was transported to the expanding shoot and lateral branches and less to the roots in defoliated plants compared to controls. By 5 weeks after defoliation there was little difference in patterns of UC distribution between defoliated and control plants. These results substantiate biomass partitioning data which showed that a single defoliation of young poplar plants did not affect diameter or height growth, whereas leaf growth was stimulated and root growth reduced.

Braun, H.J. 1985. The quantitative differences of the vessel hydrosystem and its accessory tissues in roots and trunk - example Populus. Berichte der Deutschen Botanischen Gesellschaft. 98(3-4): 239-244.

Catsky, J.; Ticha, I. 1985. Photorespiration during leaf ontogeny. In: Sestak, Z., ed. Photosynthesis during leaf development. Dordrecht, Netherlands: Dr W. Junk: 250-262.

Measurements of photorespiration and increases in its rate in C₃ and C₄ plants during leaf ontogeny are described with reference to experimental work with Phaseolus vulgaris, soyabeans, wheat, Medicago sativa, tobacco, sorghum, maize, Capsicum annum, Hevea brasiliensis, and Populus euroamericana.

Ceulemans, R.; Impens, I.; Steenackers, V. 1985. Poplar: an ecophysiological approach. Nederlands Bosbouw tijdschrift. 57(2): 48-59.

A review of fundamental research on CO₂ and water vapor exchange processes of individual poplar leaves and their relations to growth and productivity of different poplar clones, carried out at the University of Antwerp and the Rijksstation voor Populiereenteelt, Geraardsbergen (Belgium). Results suggest that the maximal photosynthetic CO₂ uptake can be used as a reliable and predictive index for growth and/or productivity and may provide information of importance for poplar breeding and selection.

Dickson, R.E.; Vogelmann, T.C.; Larson, P.R. 1985. Glutamine transfer from xylem to phloem and translocation to developing leaves of Populus deltoides. Plant Physiology. 77(2): 412-417.

Dorenstouter, H.; Pieters, G.A.; Findenegg, G.R. 1985. Distribution of magnesium between chlorophyll and other photosynthetic functions in magnesium deficient "sun" and "shade" leaves of poplar. Journal of Plant Nutrition. 8(12): 1089-1101.

Photosynthesis of attached sun and shade grown leaves of poplar (Populus euramericana (Dode) Guinier cv. 'Robusta') has been measured at 0.03 and 0.5 percent CO₂ at light limitation and light saturation. Photosynthetic rates at high CO₂ level were affected at Mg concentration lower than about 50 $\mu\text{moles/g}$ dry leaf tissue at both photosynthetic irradiations. Shade leaves contain more chlorophyll per unit leaf weight than sun leaves but the percentage decrease of chlorophyll in Mg deficient leaves is similar for sun and shade leaves at the same Mg leaf concentration. As a consequence, in Mg deficient shade leaves extraordinarily high portions of leaf Mg are bound to chlorophyll.

Fan, R.W. 1985. Anatomical observations on leaves of Aigeiros and Cathay poplars. Journal of Nanjing Institute of Forestry. 2: 40-46.

The selection and breeding of superior clones is discussed on the basis of anatomical features.

Fukazawa, K.; Ujiie, M.; Lee, K.Y.; Ishii, T. 1985. Inorganic constituents in wood in relation to wetwood and crystal formation. In: Proceedings, Vol. 1; Symposium on forest products research international - achievements and the future; 1985 April 22-26; Pretoria, South Africa. Pap. No. 16-15. South Africa: Council for Scientific and Industrial Research. 9 p.

Inorganic constituents of wood and sap from different heights in the stem were examined for Abies sachalinensis. Crystal formation was investigated in the wood of Populus maximowiczii. Calcium carbonate crystals were found in the wetwood of poplar. The possible contribution of bacteria in the formation of wetwood is discussed.

Furuno, T. 1985. Anatomy of North American woods. An atlas of light and scanning electron micrographs. (I). Hardwoods. Studies of the San'in Region, Research data and Source Material, Center for Studies of the San'in Region, Shimane University. 1: 151 p.

Eight micrographs per species are presented for 71 species of commercial importance in Japan.

Grand, C.; Sarni, F.; Boudet, A.M. 1985. Inhibition of cinnamyl-alcohol-dehydrogenase activity and lignin synthesis in poplar tissues by 2 organic compounds. *Planta*. 163(2). 232-237.

Gray, H.R.; Erickson, P.I.; Stone, J.F. 1985. An improved thermoelectric probe for measurements of apparent sap flow velocity in intact plant stems. *Journal of Experimental Botany*. 36(169): 1320-1324.

An improved thermoelectric technique for non-intensive, non-destructive, and direct sensing of the apparent velocity of sap flow in intact plant stems is presented. Success of the probe was partly due to the design of the probe which included remotely selectable spacing between heater and thermistor and adequate insulation and shielding of the probe and sensed portion of the stem.

Hirsh, Allen Gene. 1985. The state of water and cell morphology in deeply frozen Populus. *Dissertation Abstracts International*. 47/02-B: 460.

By using differential scanning calorimetry, electron microscopy, light microscopy, and freezing survival experiments, it is shown that superhardy Populus balsamifera v. Virginiana (Sarg.) is capable of withstanding liquid nitrogen (LN(,2)) temperatures because of the formation during cooling, at a temperature of about -30degC and cooling rates less than 30degC/hr, of aqueous glasses in the intracellular solutions.

Imberty, A.; Goldberg, R.; Catesson, A.M. 1985. Isolation and characterization of Populus isoperoxidases involved in the last step of lignin formation. *Planta*. 164(2): 221-226.

Kazaryan, V.V. 1985. Daily amplitude of the content of assimilates in the leaves of introduced woody plants. *Byulleten' Glavnogo Botanicheskogo Sada*. 138: 30-33.

Total and soluble carbohydrates, total and protein nitrogen, and total and organic P were determined at 6 hour intervals in the leaves of 14 broadleaved ornamental species growing in the Erevan Botanical Garden, Soviet Armenia. The daily amplitude of synthesis of carbohydrates and other compounds in the leaves can be regarded as an index of photosynthetic productivity and hence of adaptation to new conditions.

Kaufmann, M.R. 1985. Annual transpiration in subalpine forests: large differences among four tree species. *Forest Ecology and Management*. 13(3/4): 235-246.

The canopy transpiration model, RM-CWU, was used to estimate the annual transpiration of major subalpine species (*Picea engelmannii*, *Abies lasiocarpa*, *Pinus contorta*, and *Populus tremuloides*) in two catchments in the Fraser Experimental Forest, Colorado. Results indicated significant differences between species. Differences were attributed to variation between species in leaf conduction and temperature, leaf area index, and length of the transpiration season. It is concluded that manipulation of stand composition and density is a viable approach to influence water yield from subalpine catchments.

Kazantsev, I.Ya. 1985. Transpiration in poplar plantations. *Lesnoe Khozyaistvo*. 1: 39-41.

Investigations were made on water consumption of 5-year plantations of *Populus* 'Brabantica 175' in the Volga floodplain north of Astrakhan.

Kikuta, S.B.; Kyriakopoulous, E.; Richter, H. 1985. Leaf hygrometer v. pressure chamber: a comparison of pressure-volume curve data obtained on single leaves by alternating measurements. *Plant, Cell and Environment*. 8(5): 363-367.

Data for construction of pressure-volume curves were obtained by measuring water potentials of detached *Crataegus monogyna*, *Viburnum opulus*, *Triticum durum* cv. Grandur and *Populus tremula* leaves repeatedly and alternately, using a pressure chamber and a leaf hygrometer. Regression lines on values after turgor loss were more negative for thermocouple data.

Lee, D.K.; Kim, G.T.; Lee, K.J. 1985. Variations in peroxidase and nitrate reductase activities and growth of *Populus alba* X *Populus glandulosa* F1 clones. *Journal of Korean Forestry Society*. 70: 63-71.

Growth and some growth related enzyme activities were examined for 2- and 3-year-old trees grown in the Seoul National University nursery at Suwon. Clonal differences in total dry weight per tree and leaf surface area per tree were significant at 5 percent. Significant correlations were found between total dry weight per tree and leaf surface area per tree, between leaf peroxidase activity per tree and total dry weight, and between leaf nitrate reductase activity per tree and total dry weight.

Maruyama, K.; Fukumoto, Y.; Kamitani, T. 1985. The daily radial fluctuation of trunks of some deciduous broad-leaved trees and its controlling factors. *Journal of the Japanese Forestry Society*. 67(4): 148-152.

Daily fluctuations in the trunk radii of 3 test trees (*Paulownia tomentosa*, *Pterocarya rhoifolia*, and *Populus sieboldii*) were measured for 125 days in the 1983 growing season using a dial-gauge dendrometer. Fluctuations were considerably affected by weather conditions with mean values on fine days 1.3-1.9 times larger than on rainy days. They showed significant correlations with daily air-temperature differences, daily maximum vapor pressure deficits and air temperature, and duration of sunshine.

Mazzoleni, Stefano. 1985. Growth and water relations of two Populus clones under changing levels of water stress. Masters Abstracts. 24/01: 36.

The stomatal behavior of two species of Populus and hybrids in response to changes in leaf water potential was studied. When cuttings of P. trichocarpa were grown under well-watered conditions, the leaf conductance remained high in spite of the loss of turgor pressure from desiccating leaves. A period of water stress modified stomatal reactivity such that partial closure of stomata occurred at low water potential. A period of water stress leading to wilting of foliage produced complete closure of stomata in P. deltoides and hybrid clones.

Meichenheimer, R.D.; Larson, P.R. 1985. Exogenous auxin and N-1-Naphthylphthalamic acid effects on Populus deltoides xylogenesis. Journal of Experimental Botany. 36(163): 320-329.

Michael, D.A.; Dickmann, D.I.; Gottschalk, K.W.; Nelson, N.D.; Isebrands, J.G. 1985. Determining photosynthesis of tree leaves in the field using a portable $^{14}\text{CO}_2$ apparatus: procedures and problems. Photosynthetica. 19(1): 98-108.

Nelson, N.D. 1985. Photosynthetic life span of attached poplar leaves under favorable controlled environmental conditions. Forest Science. 31(3): 700-705.

Net rate of photosynthesis, stomatal, and mesophyll resistances to CO_2 and internal CO_2 concentrations in the leaf were monitored in leaves of Populus 'Tristis No. 1' cuttings in a greenhouse with an 18 hour day. Half of the leaves monitored were treated with 0.001 M 6-benzylaminopurine to try to delay senescence. Mesophyll resistance to CO_2 changed inversely with photosynthetic rate, to reach values extremely limiting to photosynthesis. Internal leaf CO_2 concentrations increased near the end of the monitoring period. It was concluded that caution is advisable when using yellowing as a criterion of leaf senescence.

O'Connor, J.M.; Dickmann, D.I. 1985. Effects of site stress on water relations and leaf morphology of two hybrid poplar clones in Northern Michigan. Michigan Academician. 17(2): 137-147.

Park, S.J.; Kang, S.K.; Jo, J.M. 1985. Anatomical diagnoses derived from the adventitious buds and dimples in the Populus alba X P. glandulosa. Journal of Korean Forestry Society. 71: 55-58.

A study of wood anatomy, comparing tissue around adventitious buds and dimples with normal tissue using light microscopy.

Pieters, G.A.; Van den Noort, M.E. 1985. Leaf area coefficient of some Populus euramericana cultivars grown at various irradiances and NO_3 -supply. Photosynthetica. 19(2): 188-193.

Pokhriyal, T.C.; Raturi, A.S. 1985. A study of nitrate reductase activity in the Populus deltoides leaves. Indian Forester. 111(2): 82-89.

As a step to study the in vivo nitrate reductase activity in poplar leaves during the growth and development of the plant under different soil moisture regimes, standardization of the method for estimation of in vivo assay of

nitrate reductase activity and the pattern of variation of enzyme activity from leaf to leaf in seedlings is reported.

Polyakov, V.V.; Orlov, V.K.; Shukenova, R.Z.; Mullaeva, N.I. 1985. Carboxylic acids of Populus balsamifera. *Khimiya Prirodnykh Soedinenii*. 6: 834.

Russin, W.A.; Evert, R.F. 1985. Studies on the leaf of Populus deltoides: quantitative aspects, and solute concentrations of the sieve-tube members. *American Journal of Botany*. 72(4): 487-500.

The vascular system of the leaf was examined quantitatively by electron microscopy of vein samples from various leaf locations. Plasmolytic studies were carried out to determine solute concentrations in the sieve-tube members at various locations in the leaf. These showed positive concentration gradients across the lamina from the minor veins and tips of secondary veins to the bases of secondary veins and their associated subjacent midvein bundles, and from the upper to the lower portions of the median bundle of the midvein.

Russin, W.A.; Evert, R.F. 1985. Studies on the leaf of Populus deltoides: ultrastructure, plasmodesmatal frequency, and solute concentrations. *American Journal of Botany*. 72(8): 1232-1247.

The minor veins and contiguous tissues of mature leaves were examined by electron microscopy to determine the ultrastructural characteristics of the component cells, and the structure, distribution, and frequency of plasmodesmata between the various cell types. Plasmolytic studies were carried out to determine the solute concentrations in the various cell types of the minor veins and contiguous tissues.

Sagisaka, S. 1985. Injuries of cold acclimatized poplar twigs resulting from enzyme inactivation and substrate depression during frozen storage at ambient temperatures for a long period. *Plant and Cell Physiology*. 26(6): 1135-1145.

Salleo, S.; LoGullo, M.A.; Oliveri, F. 1985. Hydraulic parameters measured in 1-year-old twigs of some Mediterranean species with diffuse-porous wood: changes in hydraulic conductivity and their possible functional significance. *Journal of Experimental Botany*. 36(162): 1-11.

Hydraulic conductivity was measured in 1-year-old twigs of Vitis vinifera, Olea europaea, and Populus deltoides. Whole xylem hydraulic conductivity (Lx), vessel lumina hydraulic conductivity (Lxv), and leaf specific conductivity (LSC) were calculated, and were linearly related to each other.

Vogelmann, T.C.; Dickson, R.E.; Larson, P.R. 1985. Comparative distribution and metabolism of xylem-borne amino compounds and sucrose in shoots of Populus deltoides. *Plant Physiology*. 77(2): 418-428.

Zeng, Q.Y.; Fu, X.Z.; Bao, X.R.; Lu, H.R. 1985. Quantitative comparison of wood anatomy between two poplar species by an automatic image analyser. *Scientia Silvae Sinicae*. 21(1): 53-60.

Measurements were made on microscopic transverse sections of the stems of 18-year-old trees of Populus pseudosimonii and P. X xiaozhuanica. The difference in the proportion of rays in these two species was not

significant. The ratio of vessel lumen area to cell wall in P. X xiaozhuanica was larger than that in P. pseudosimonii.

1986

Amthor, J.S. 1986. Evolution and applicability of a whole plant respiration model. *Journal of Theoretical biology*. 122(4): 473-490.

History and applicability of the whole plant respiration model, in which growth respiration, maintenance respiration, and ion uptake are the 3 constituents of whole plant respiration, are discussed. The maintenance component is expanded into 2 separate components which are then used to interpret some existing data for respiration. Additional facets of higher plant respiration are identified.

Blake, T.J.; Atkinson, S.M. 1986. The physiological role of abscisic acid in the rooting of poplar and aspen stump sprouts. *Physiologia Plantarum*. 67(4): 638-643.

Blake, T.J.; Tschaplinski, T.J. 1986. Role of water relations and photosynthesis in the release of buds from apical dominance and the early reinvigoration of decapitated poplars. *Physiologia Plantarum*. 68(2): 287-293.

A decrease in xylem pressure potential starting 1 hour after decapitation of young hybrid poplars (Populus deltoides Bartr. X Populus nigra L. cv. DN22). Reduced stomatal conductance and transpiration rates for the first 3 days after decapitation. This early moisture stress was alleviated 4 to 5 days after decapitation, resulting in substantial increases in stomatal aperture, transpiration, and net photosynthetic rates which continued for the remainder of the one week measurement period.

Briggs, G.M.; Jurik, T.W.; Gates, D.M. 1986. Non-stomatal limitation of CO₂ assimilation in three tree species during natural drought conditions. *Physiologia Plantarum*. 66(3): 521-526.

Ceulemans, R.; Kockelbergh, F.; Impens, I. 1986. A fast, low cost and low power requiring device for improving closed loop CO₂ measuring systems. *Journal of Experimental Botany*. 37(181): 1234-1244.

An improved and fast version of a closed loop system for measuring net CO₂ exchange rates (NCER) in the field using a portable IR gas analyzer is described. The measurement interval was sufficiently short that no environmental control in the perspex mini-cuvette was needed. NCER measurements obtained under field and greenhouse conditions for poplar, sugarbeet, and winter wheat are presented.

Ceulemans, R.; Impens, I.; Steenackers, V. 1986. Variations in photosynthetic, anatomical, and enzymatic leaf traits and correlations with growth in recently selected Populus hybrids. *Canadian Journal of Forest Research*. 17(4): 273-283.

Leaf traits and growth performance were studied in 1980-1984 in twenty 1- and 2-year-old fast growing clones representing interspecific hybrids of P. deltoides, P. trichocarpa, and P. maximowiczii, using container-grown plants and for 5 years in the field.

Cherepanova, V.E.; Levin, E.D. 1986. The representativeness of samples for investigating prostaglandins in the buds of Populus balsamifera. Lesnoi Zhurnal. 3: 110-111.

A note is given showing that a sample of 4 trees is adequate for quantitative determination of prostaglandins in the buds of balsam poplar.

Coleman, J.S. 1986. Leaf development and leaf stress: increased susceptibility associated with sink-source transition. Tree Physiology. 2(1/3): 289-299.

Anatomical, physiological, and biochemical events associated with sink-source transition in leaves are discussed with reference to Populus. General patterns of age-related susceptibility of leaves to fungal pathogens, insect pests, and ozone damage are described.

Cote, B.; Dawson, J.O. 1986. Autumnal changes in total nitrogen, salt-extractable proteins and amino acids in leaves and adjacent bark of black alder, eastern cottonwood and white basswood. Physiologia Plantarum. 67(1): 102-108.

Fahn, A. 1986. Structural and functional properties of trichomes of xeromorphic leaves. Annals of Botany. 57(5): 631-637.

The stains Sudan IV and Sudan black were applied to the trichomes of xeromorphic leaves of 12 species (Banksia speciosa, Corokia buddleioides, Correa backhousiana, Lavandula officinalis [angustifolia], Leucospermum grandiflorum, Metrosideros excelsa, Olea europaea, Olearia rotundifolia, Pittosporum crassifolium, Pittosporum spp., Rosmarinus officinalis, Senecio cineraria) and trichomes of mesomorphic leaves of five species (Achimenes grandiflora, Geum urbanum, Gynura aurantiaca, Populus alba, and Styrax officinalis). It is suggested that the basal or stalk cells in the xeromorphic leaves prevent apoplastic water flow into the trichomes.

Goulet, F.; Bellefleur, P. 1986. Leaf morphology plasticity in response to light environment in deciduous tree species and its implication on forest succession. Canadian Journal of Forest Research. 16(6): 1192-1195.

In studies on Betula alleghaniensis, Fagus grandifolia, Populus tremuloides, Acer rubrum, and A. saccharum in Duchesney Experimental Forest, Quebec, data on thickness, area and density thickness (fresh weight/unit area) were collected on leaves that developed: under artificial shading from buds produced in direct sunlight (shaded leaves); in direct sun from buds produced in the sun (sun leaves); from buds produced under shade but exposed to the sun by cutting branches (unshaded leaves); and from buds that developed and remained in dense shade (shade leaves).

Govindjee; Barber, J.; Cramer, W.A.; Goedheer, J.H.C.; Lvorel, J.; Marcelle, R.; Zilinskas, B., eds. 1986. Excitation energy and electron transfer in photosynthesis. Photosynthesis Research. 10(3): 146-518.

This special issue, presents 39 papers and reviews by different authors.

Gross, E.L.; Draheim, J.E.; Anderson, G.P.; Sanderson, D.G.; Ketchner, S.L. 1986. pH dependent conformational changes and electrostatic effects in plastocyanin. In: Govindjee; et al., eds. Excitation energy and electron

transfer in photosynthesis. Dordrecht, Netherlands: M. Nijhoff: 291-298. Reprinted from: Photosynthesis Research. 10(3): 437-444.

Ikeda, T.; Suzaki, T. 1986. Influence of hydraulic conductance of xylem on water status in cuttings. Canadian Journal of Forest Research. 16(1): 98-102.

Jurik, T.W. 1986. Seasonal patterns of leaf photosynthetic capacity in successional northern hardwood tree species. American Journal of Botany. 73(1): 131-138.

Gas exchange of single attached leaves was monitored in natural habitats at 2 sites at the University of Michigan Biological Station, near Pellston. Leaves of Populus grandidentata and Quercus rubra at the top of the canopy had higher maximum CO₂ exchange rate (CER) than leaves of Acer saccharum, A. rubrum, Q. rubra, and Fagus grandifolia in the understory. In all leaves, CER measured at light-saturation increased to maximum near the completion of leaf expansion in early June, was constant until mid-September, and then declined rapidly until leaf death. Leaf conductance was constant during most of leaf lifespan, with some decline in autumn.

Kim, J.K.; Hong, B.W. 1986. Studies on the ray parenchyma of Salicaceae in Korea. Journal of Korean Forestry Society. 65: 74-79.

Samples of stem xylem tissue of 6 Populus spp. (P. davidiana [P. tremula var. davidiana], P. alba, P. maximowiczii, P. koreana, P. nigra var. italica, P. deltoides) and 5 Salix spp. (S. glandulosa, S. koreensis, S. dependens, S. matsudana for. tortuosa, S. gracilistyla), growing in the Korea Republic, were examined and the types and dimensions of ray parenchyma cells recorded.

Lapa, I.K.; Udre, V.Y. 1986. Phenolic compounds in developing generative buds of male and female aspen trees. Soviet Plant Physiology. 33(6, pt. 1): 844-851. Translated from: Fiziologiya Rastenii. 33(6): 1104-1112.

Lin, T.Y.; Sucoff, E.; Brenner, M. 1986. Abscisic acid content and components of water status in leaves of Populus deltoides. Canadian Journal of Botany. 64(10): 2295-2298.

Sagisaka, S. 1986. Limited survival period of cold acclimatized trees in frozen ambient temperatures. Plant and Cell Physiology. 27(6): 1209-1212.

Sagisaka, S.; Asada, M. 1986. Cytochemical evidence for the occurrence in plants of a novel microbody that contains peroxidase. Plant and Cell Physiology. 27(8): 1599-1602.

Sanadze, G.A.; Tarkhnishvili, G.M. 1986. Effect of molecular oxygen on the process of isoprene biosynthesis in leaves. Botanical Sciences. 286/288: 142-144. Translated from: Akademiia Nauk SSR Doklady. 286(2): 501-503.

Sanadze, G.A.; Mgaloblishvili, M.P.; Dalakishvili, K.G. 1986. Independence of carbon conversion pathways in reactions of the Benson-Calvin cycle and the isoprene effect. Soviet Plant Physiology. 33(5, pt. 1): 653-658. Translated from: Fiziologiya Rastenii. 33(5): 856-863.

Sauter, J.J.; Kloth, S. 1986. Plasmodesmatal frequency and radial translocation rates in ray cells of poplar. *Planta*. 168(3): 377-380.

The minimum radial sugar translocation rate was determined from the starch-accumulation rate for the wood rays and was related to the ultrastructure of the cell walls. Values for the minimum radial flux of sugars through the tangential walls, pit fields, and plasmodesmata excluded a transmembrane flux mechanism and indicated that radial translocation proceeded via plasmodesmata.

Scarascia-Mugnozza, G.; Hinckley, T.M.; Stettler, R.F. 1986. Evidence for nonstomatal inhibition of net photosynthesis in rapidly dehydrated shoots of *Populus*. *Canadian Journal of Forest Research*. 16(6): 1371-1375.

Results are presented on the decline of net photosynthesis during the application of rapid water stress to excised, 1-year-old shoots of 4 clones of *P. trichocarpa* and 1 clone each of *P. deltoides* and *P. trichocarpa* X *P. deltoides*. Data on leaf conductance showed that stomata remained open in the 2 most productive *P. trichocarpa* clones and in the hybrid. In all studied clones, the point of rapid decrease in net photosynthesis coincided with the point of turgor loss.

Schaedle, M.; Brayman, A.A. 1986. Ribulose-1,5-bisphosphate carboxylase activity of *Populus tremuloides* Michx. bark tissues. *Tree Physiology*. 1(1): 53-56.

Ribulose-1,5-bisphosphate (RubP) carboxylase was isolated from stem tissues of 3-month-old ramets by column chromatography. Young cortical tissues are photosynthetically competent and contain sufficient RubP carboxylase to account for reported rates of photosynthesis.

Tsel'niker, Yu.L.; Malkina, I.S. 1986. Organic matter balance in leaf ontogenesis of deciduous trees. *Soviet Plant Physiology*. 33(5,II): 719-725.

Rates of photosynthesis and respiration and increase in organic matter were measured during ontogenesis in 6 to 15-year-old trees of *Quercus robur*, *Acer platanoides*, *Populus tremula*, and *Betula pendula*.

1987

Baazov, D.I.; Sanadze, G.A. 1987. Action spectrum and enhancement effect of isoprene production in poplar leaves. *Soviet Plant Physiology*. 34(2, pt. 1): 169-175. Translated from: *Fiziologiya Rastenii*. 34(2): 213-220.

Bonicel, A. 1987. The physiological basis of rapid rotation cropping of poplar. *Forestry Abstracts*. 48(4): 245-246.

Bonicel, A.; Haddad, G.; Gagnaire, J. 1987. Seasonal variations of starch and major soluble sugars in the different organs of young poplars. *Plant Physiol. Biochem. (Paris)*. 25(4): 451-460.

Changes in the concentration of the major water-soluble carbohydrates (sucrose, glucose, fructose) and of starch during a vegetative cycle was studied in the aerial and underground parts of young poplars (*Populus trichocarpa* X *Populus deltoides*, cv. Raspalje).

Ceulemans, R.; Impens, I.; Steenackers, V. 1987. Variations in photosynthetic, anatomical, and enzymatic leaf traits and correlations with growth in recently selected Populus hybrids. Canadian Journal of Forest Research. 17(4): 273-283.

Demmig, B.; Winter, K.; Kruger, A.; Czygan, F.C. 1987. Photoinhibition and zeaxanthin formation in intact leaves. A possible role of the xanthophyll cycle in the dissipation of excess light energy. Plant Physiology. 84(2): 218-224.

Comparative studies of chlorophyll-a fluorescence, measured with a pulse amplitude modulated fluorometer, and of the pigment composition of leaves, suggest a specific role of zeaxanthin, a carotenoid formed in the xanthophyll cycle, in protecting the photosynthetic apparatus against the adverse effects of excessive light.

Dickson, R.E. 1987. Diurnal changes in leaf chemical constituents and ^{14}C -partitioning in cottonwood. Tree Physiology. 3(2): 157-171.

Populus deltoides seedlings were exposed to 0.5 hour bursts of $^{14}\text{CO}_2$ at various times during the 14-hour photoperiod and leaves harvested and analysed immediately after treatment or 2 or 4 hours later. During the light period, leaf weight per unit area increased (by up to 30 percent), primarily as a result of the accumulation of starch and sugars, and to a lesser extent, because of an increase in amino acid concentrations and in pigments and lipids.

Dimitrov, M.I.; Egorov, T.A.; Donchev, A.A.; Atanassov, B.P. 1987. Primary structure of plastocyanine-B from poplar Populus nigra. Doklady Bolgarskoi Akademii Nauk. 40(11): 115-118.

Fiserova, M.; Katuscakova, G. 1987. Morphological properties of poplar and spruce wood. Drevarsky Vyskum. 112: 35-44.

An account is given of the numbers and dimensions of fibers, vessels, and wood parenchyma in stems, branches, and roots of Populus 'I-214', and of tracheids and parenchyma in stems, branches, and roots of Picea abies.

Galimova, I.V. 1987. Study of the activity and molecular heterogeneity of acid phosphatase in poplar heterotic hybrids. Physiology and Biochemistry of Cultivated Plants. 19(2): 119-124.

Isaeva, E.V.; Levin, E.D. 1987. Composition of arachidonic acid in buds of Populus balsamifera during the annual cycle. Khimiya Prirodnykh Soedinenii. (4): 513-516.

Kimmerer, T.W. 1987. Alcohol dehydrogenase and pyruvate decarboxylase activity in leaves and roots of eastern cottonwood and soyabean. Plant Physiology. 84(4): 1210-1213.

In developing soyabean embryos alcohol dehydrogenase (ADH) activity increased upon imbibition and then declined exponentially with development, and was undetectable in leaves by 30 days after imbibition. Pyruvate decarboxylase (PDC) was not detectable in soyabean leaves. In contrast, ADH activity remained high in developing cottonwood seedlings, with no decline in activity during development.

Lindroth, R.L.; Hsia, M.T.S., Scriber, J.M. 1987. Seasonal patterns in the phytochemistry of 3 Populus species. *Biochemical systematics and ecology*. 15(6): 681-686.

Paramonova, N.W.; Chkhaidze, N.G.; Sanadze, G.A. 1987. Ultrastructure of Populus deltoides Marsh. chloroplasts in conditions of enhanced formation of isoprene. *Fiziologiya Rastenii*. 34(5): 933-942.

Pissis, P.; Anagnostopoulou-Konsta, A.; Apekis, L. 1987. A dielectric study of the state of water in plant stems. *Journal of Experimental Botany*. 38(194): 1528-1540.

Studies are reported on thermally stimulated depolarization current measurements on plant stems of six different species in the temperature range of 77-300 K and over a wide range of water contents, in an attempt to determine the binding modes of water molecules. The species comprised Olea europaea subspecies oleaster, Eucalyptus globulus, Populus canadensis, Citrus limon, Nerium oleander, and Jasminum fruticans.

Sage, R.F.; Sharkey, T.D. 1987. Effect of temperature on the occurrence of O₂ and CO₂ insensitive photosynthesis in field grown plants. In: Annual meeting of the American Society of Plant Physiologists; 1987 July 19; St. Louis, MO. Supplement 2. *Plant Physiology*. 83(4): 68 p.

The sensitivity of photosynthesis to O₂ and CO₂ was measured in field grown plants of six species (Phaseolus vulgaris, Capsicum annum, Lycopersicon esculentum, Scrophularia desertorum, Cardaria draba, and Populus Fremontii) from 5degC to 35degC. In Lycopersicon and Populus, O₂ and CO₂ insensitivity occurred under conditions regularly encountered during the cooler portions of the day. At higher partial pressures of CO₂ the temperature at which O₂ insensitivity occurred was higher, indicating that feedback limitations in the field will become more important as the CO₂ concentration in the atmosphere increases.

Sage, R.F.; Sharkey, T.D. 1987. Effect of temperature on the occurrence of O₂ and CO₂ insensitive photosynthesis in field grown plants. *Plant Physiology*. 84(3): 658-664.

The sensitivity of photosynthesis to O₂ and CO₂ was measured in leaves from field grown plants of six species (Phaseolus vulgaris, Capsicum annum, Lycopersicon esculentum, Scrophularia desertorum, Cardaria draba, and Populus Fremontii) from 5degC to 35degC using gas-exchange techniques. In Lycopersicon and Populus, O₂ and CO₂ insensitivity occurred under conditions regularly encountered during the cooler portions of the day. Because O₂ insensitivity is an indicator of feedback limited photosynthesis, these results indicate that feedback limitations can play a role in determining the diurnal carbon gain in the field. At higher partial pressures of CO₂ the temperature at which O₂ insensitivity occurred was higher.

Sauter, J.J.; Kloth, S. 1987. Changes in carbohydrates and ultrastructure in xylem ray cells of Populus in response to chilling. *Protoplasma*. 137(1): 45-55.

Schulte, P.J.; Hinckley, T.M. 1987. Abscisic acid relations and the response of Populus trichocarpa stomata to leaf water potential. *Tree Physiology*. 3(2): 103-113.

Foliage ABA content was recorded in water-stressed and unstressed cuttings of 2 P. trichocarpa and 2 P. deltoides clones and a hybrid. Endogenous foliage concentrations of ABA increased significantly with drought in all samples. Application of ABA to epidermal strips appeared to cause solute leakage, although the stomata of P. trichocarpa remained partially open even when the guard cells were plasmolysed.

Schulte, P.J.; Hinckley, T.M. 1987. The relationship between guard cell water potential and the aperture of stomata in Populus. *Plant Cell and Environment*. 10(4): 313-318.

Schulte, P.J.; Hinckley, T.M.; Stettler, R.F. 1987. Stomatal responses of Populus to leaf water potential. *Canadian Journal of Botany*. 65(2): 255-260.

Villar, M.; Gaget, M.; Dumas, C. 1987. The route of the pollen tube from stigma to ovule in Populus nigra: a new look. *Annales des Sciences Forestieres*. 44(2): 259-264.

Villar, M.; Gaget, M.; Said, C.; Knox, R.B.; Dumas, C. 1987. Incompatibility in Populus - Structural and cytochemical characteristics of the receptive stigmas of Populus alba and P. nigra. *Journal of Cell Science*. 87(4): 483-490.

Wang, Shiji; Liu, Fengjue; Liu, Yarong. 1987. Study on water relations of five poplar clones during winter season. *Scientia Silvae Sinicae*. 23(3): 364-369.

1988

Brugnoli, E.; Hubick, K.T.; Von Caemmerer, S.; Wong, S.C.; Farquhar, G.D. 1988. Correlation between the carbon isotope discrimination in leaf starch and sugars of C₃ plants and the ratio of intercellular and atmospheric partial pressures of carbon dioxide. *Plant Physiology*. 88(4): 1418-1424.

Demmig, B.; Winter, K. 1988. Characterisation of three components of non-photochemical fluorescence quenching and their response to photoinhibition. *Australian Journal of Plant Physiology*. 15(1/2): 163-177.

Demmig, B.; Winter, K. 1988. Light response of CO₂ assimilation, reduction state of Q, and radiationless energy dissipation in intact leaves. *Australian Journal of Plant Physiology*. 15(1/2): 151-162.

Havaux, M.; Erne, M.; Panneels, P.; Winterberg, A.; Lannoye, R. 1988. Measurement of light and heat emission in plant leaves: rapid quantitative methods for monitoring stress and herbicide effects on crop plants - determination of tolerance to drought, heat, cold, and high light by fluorescence and photoacoustic measurements. *Meded. Fac. Landbouwwet. Rijksuniv. Gent*. 53(4a): 1739-1946.

The use of in vivo fluorescence-photoacoustic measurements for rapid estimation of stress tolerance in crop plants, and its applicability to the study of herbicide effects were demonstrated. Photoacoustic measurements of non-radioactive de-excitation of the excited pigments facilitated the separation of poplar (Populus spp.) clones apparently resistant to photoinhibition from clones less adapted to high-lights.

Pezeshki, S.R.; Hinckley, T.M. 1988. Water relations characteristics of Alnus rubra and Populus trichocarpa: responses to field drought. Canadian Journal of Forest Research. 18(9): 1159-1166.

Sauter, J.J.; Vancleve, B.; Apel, K. 1988. Protein bodies in ray cells of Populus X canadensis Moench Robusta. Planta. 173(1): 31-34.

PROCESSING

1975

Akkerman, A.S.; Volkova, V.D.; Petri, V.N.; Lazareva, A.; Abrosimov, S.P.; Ivanov, V.I. 1975. Lignocarbhydrate plastic from guza-paya without the use of binders. *Izvestiya Akademii Nauk Kirgizskoi SSR*. 6: 70-74.

A comparison of the components of wood of pine (*Pinus sylvestris*), birch (*Betula alba*), and aspen (*Populus tremula*) with those of guza-paya indicated that guza-paya contained large amounts of reactive lignin and water-soluble or easily-hydrolysed polysaccharides, making it suitable for producing moulded products without a binder.

Bello, E.D. 1975. Effects of temperature and moisture content on tensile strain at fracture in the tangential direction of northern red oak and aspen. *Pterocarpus*. 1: 6-13.

Another version of part of work on the kiln drying of boards of *Quercus rubra* and *Populus tremuloides*.

Cho, N.S.; Jo, J.; Ahn, W.Y. 1975. On the manufacturing of WPC with heat-catalyst polymerization. (II) On the characteristics of composites from monomer styrene and MMA and several commercial woods in Korea. Res. Rep. 22. Seoul, South Korea: Forest Research Institute: 85-95.

Impregnation characteristics, polymerization time, and physical and mechanical properties were determined for wood-polymer composites (WPC) of *Alnus japonica*, *Carpinus laxiflora*, and *Populus euramericana* (*P. X canadensis* aggr.) with styrene or methylmethacrylate. There was no difference in polymer loading between the species. All the WPC's tested had mechanical properties suitable for the manufacture of shuttles and bobbins.

Cooper, G.A.; Barham, S.H. 1975. Effects of soaking in extractives and prefreezing on the drying behavior of eastern cottonwood. *Wood Science*. 7(4): 267-269.

Draganova, R.; Nedelcheva, M.; Bencheva, S.; Khristova, E.; Neikova, K.; Nikolova, M. 1975. Suitability of local poplars for manufacture of high-quality Kraft dissolving pulp. (1) chemical and physical characteristics of wood from *Populus* 'I-214', *P.* 'Bachelieri', and *P.* 'Vernirubens'. *Tseluloza Khartiya*. 6(2): 22-25.

Presents results of analyses of chemical composition and density in relation to moisture content. Wood of *P.* 'I-214' was the least dense and had a higher content of pentosans and a lower content of cellulose than that of the other species, which differed little in their chemical composition.

Draganova, R.; Nedelcheva, M.; Bencheva, S.; Khristova, E.; Neikova, K.; Nikolova, M. 1975. Suitability of domestic poplars for the manufacture of viscose-grade Kraft pulp. (2) Quantitative and qualitative changes in the wood composition of *Populus* 'I-214', *P.* 'Bachelieri', and *P.* 'Vernirubens' under conditions of aqueous prehydrolysis. *Tseluloza Khartiya*. 6(3): 20-23.

Samples of the three clones were subjected to aqueous prehydrolysis under conditions for rapid dissolution of pentosans with little degradation of

cellulose. Results show the yield of wood residue, the pentosan content, the acidity of the hydrolysate, the amount of pentosans in the residue as a function of the time of prehydrolysis and the contents of pentosans, lignin, and cellulose in the prehydrolysed material after removal of the desired amount of pentosan. As the prehydrolysed materials did not differ significantly in their composition and yield, it is concluded that they can be prehydrolysed together.

Hudson, L.E.; Robins, D.E.; Plahutnik, F., Jr.; Williams, E.T. 1975. Segregation of aspen bark/wood chip mixtures using the Cartesian-diver principle. TAPPI. 58(7): 162-163.

Bark and wood chips of Populus tremuloides were separated by flotation and pressurization/flotation techniques. The procedure appears promising also for Acer saccharum, Pinus taeda, and Alnus rubra but not for Pinus banksiana, Acer macrophyllum, Pinus resinosa, and Betula papyrifera.

Jodice, R.; Ferrara, R.; Scurti, J.C.; Fiussello, N.; Obert, F.; Cortellezzi, G.C. 1975. Thermophilous mycetes. I. Contribution on their isolation, metabolism and capacity for degrading organic matter. Allionia. 20: 53-73.

Kalinski, B. 1975. Production of moulded objects and panels from bark without adhesives. Przemysl Drzewny. 26(7/8): 34-36.

Describes a method of producing decorative mouldings by hot pressing of comminuted but chemically unmodified bark. The mouldings were comparable in strength to other methods, but their water resistance was poor and their specific gravity was relatively high. The bark of Pinus sylvestris and poplar (either separately or mixed) was judged best for this purpose. Trials were also made on birch and oak.

Kirpicheva, L.M.; Chudakov, M.I.; Sannikov, G.P. 1975. Breakdown of the wood of broadleaved species treated with arboricides. Lesnoi Zhurnal. 6: 109-111.

Granular Tordon 10K (picloram) was applied to kill birch and aspen on areas in the Leningrad and Novgorod regions. The chemical composition of the wood of dead trees was determined at intervals up to 41 months after treatment, and compared with wood from untreated areas. Results showed no significant differences after 3, 12, and 15 months, but later the contents of cold- and hot-water extractives increased compared with those of controls, and these differences are attributed to differences in attack by wood-rotting fungi. Cooking schedules for pulping wood of trees treated with arboricides must therefore be modified in accordance with the degree of wood decay.

Kopnin, B.N.; Ioffe, L.O. 1975. On the kinetics of delignification of plant raw material by the method of oxidative ammonolysis. Khimiya Drevesiny. 1: 82-87.

Mattson, J.A. 1975. Debarking chips from whole trees in the Lake States. Res. Pap. NC-115. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 9 p.

An assessment of the effectiveness of compression debarking, alone or in combination with presteaming and mechanical attrition (hammermilling) treatments, in removing bark from whole-tree chips of Populus tremuloides,

Acer saccharum, and Pinus banksiana, cut at different seasons in 1973-1974. Presteaming followed by compression debarking removed 55-90 percent of bark from the chips of all three species. The application of a hammermilling treatment to the size fraction that was smaller than 5/8-inch after compression debarking, and elimination of the 3/16-inch size fraction, reduced the residual bark content to 3 percent or less for all three species, i.e., chips produced by this process are suitable for use in the majority of pulping operations. Though more wood is lost by this method, than in conventional debarking, the amount of fiber recoverable per acre is higher for whole-tree chips than for conventional chips the reject material from the debarking process may be used in a secondary product, or as fuel.

Molotkov, L.K.; Dolinko, V.V.; Gugin, Yu.A.; Farafontov, M.M.; Zheltova, G.I. 1975. Effect on Kraft pulp properties of storage of chips from aspen logs with heart-rot. *Tsellyulozno-Bumazhnoi Promyshlennosti*. 67: 4-14.

Chips from sapwood, heartwood, and heartwood affected by Phellinus tremulae were stored for up to 6 months at 25deg and 55degC. Pulp yield was less after storage, except for heartwood chips at 25degC. The reduction in yield is attributed to a reduction in contents of low-molecular-weight carbohydrate fractions.

Molotkov, L.K.; Ospishcheva, M.V.; Smirnova, L.A.; Grigor'eva, E.D.; Makova, L.I.; Goryunova, R.V. 1975. Preparation of hardwood for the manufacture of dissolving pulp. (3). Effect of felling time on changes of aspenwood during storage. *Tsellyulozno-Bumazhnoi Promyshlennosti*. 67: 14-25.

Aspens (Populus tremula) were felled, in the same stand, in December, March, July, and September, and chips were made from their sapwood. Changes in physical and chemical properties and types of fungi developing in stored chips depended mainly on storage temperature and only slightly on felling time. Changes in wood color depended on felling time, evidently because of changes in enzyme activity and oxidation of extractives. It is recommended that if chips are stored in order to reduce pitch problems it should be done in self-heating heaps for 1-1.5 months.

Nedelcheva, M.; Draganova, R.; Vulchev, V.; Khristov, Ts.; Khristova, E.; Neikova, K.; Bencheva, S.; Nikolova, M. 1975. Suitability of domestic [Bulgarian] poplars for manufacture of viscose-grade Kraft pulps. (3) Manufacture of dissolving Kraft pulp with a high content of alpha-cellulose from P. 'Bachelieri', P. 'Vernirubens', and P. 'I-214' poplars. *Tseluloza Kartiya*. 6(4): 22-26.

The conditions are described for Kraft pulping Populus 'Bachelieri', P. 'Vernirubens', and P. 'I-214' and for bleaching. Satisfactory results were obtained for pulping and bleaching the species alone or together.

Silitonga, T.; McGovern, J.N. 1975. Experimental holopulping of several temperate and tropical hardwoods. *TAPPI*. 58(7): 125-128.

Skamla, J.; Rybarik, I. 1975. Degradation of poplar lignin with thioacetic acid. I. *Drevarsky Vyskum*. 20(2/3): 107-112.

Describes the degradation of poplar lignin by a mild hydrolysis technique involving pretreatment with thioacetic acid and BF₃, the isolation of 15

heterogeneous fractions of degradation products, and the identification of the structure of six products.

Tsarev, A.P. 1975. Selection of aspen for length of wood fiber. Referativnyi Zhurnal. 3.55.64.

As a result of micrometric studies, a rare form has been found with a fiber length unusually large (1.42 mm at age 39). It will be useful in the paper-making industry.

1976

Baker, A.J. 1976. Recommendations on processing and storage of aspen residue. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 98-100.

Becher, J.J.; Hoffman, G.R.; Swanson, J.W. 1976. Improved bonding in groundwood furnishes. TAPPI. 59(1): 104-107.

Bello, E.D. 1976. The effects of temperature and moisture content on the elastic and residual deformations in the tangential direction of northern red oak and aspen. Pterocarpus. 2(1): 76-85.

Elastic strain and residual strain were measured at temperatures of 80-170 degF and moisture content of 6-18 percent. Results are presented in tables and graphs, with a regression analysis. At low temperatures and moisture content the elastic strain component was greater than the residual component, while the reverse occurred at high temperatures and moisture content. With increasing temperature or moisture content, residual strain increased more rapidly than elastic strain, and more rapidly in oak than aspen. It is concluded that in the drying of wood, surface checking can be avoided by using higher temperatures during the early stages, provided the wood surface remains moist, thus allowing greater tensile strains to take place by plastic flow without fracture.

Bil, Z. 1976. Processing of hardwood mixtures into semi-chemical pulps for manufacture of corrugating medium. Przegląd Papierniczy. 32(6): 197-202.

A study of the use of mixtures of Polish domestic hardwoods for the manufacture of NSSC pulps. At present these pulps are produced from birch (Betula spp.) or poplar (Populus spp.). The mixtures studied included birch/beechness (Fagus sylvatica), birch/hornbeam (Carpinus betulus), birch/alder (Alnus spp.), and birch/oak (Quercus spp.); Birch constituted 60-80 percent of the blend. Only alder had an impregnability comparable with that of birch. Because of lower impregnability, higher concentrations of sodium sulphite were used for mixtures with beech, hornbeam, or oak. Under conditions of good impregnation, all mixtures gave pulps of satisfactory beatability; the mechanical properties of these pulps were lower than those of pure birch pulp. Hornbeam had the least effect on handsheet properties, but lower impregnability. Mixtures with oak are not recommended for NSSC pulping. Handsheets prepared from mixtures of birch NSSC pulp and waste-paper stock had better properties than those from mixed hardwood pulps.

Boone, R.S.; Gjovik, L.R.; Davidson, H.L. 1976. Sawn hardwood stock treated by double-diffusion and modified double-diffusion. Res. Pap. FPL-265. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 11 p.

Sawn stock of Quercus alba, Q. rubra, Populus grandidentata, Acer rubrum, and Pinus resinosa was subjected to two conventional double diffusion treatments and five modified (heated solution) double diffusion treatments using CuSO_4 and Na_2HAsO_4 as preservatives. Only the modified treatments proved satisfactory. A full-cell pressure treatment was included for comparison.

Canonne, A.; Tyrode, N. 1976. Research on papermaking use of short-rotation coppice wood. ATIP Revue. 30(5): 171-173.

The concept of the short rotation (1-4 years) coppice system is discussed as a means of accelerating the production of wood fiber for paper. Data are given on the influence of leaves on the pulping of 3-year-old eucalypt coppice shoots, on the properties of pulp from poplar as a function of age, on the ratio of dry wood to bleached pulp as a function of poplar age and on the increased energy and chemical costs of producing bleached pulp of poplar from 1- to 4-year-old trees rather than from adult trees.

Chase, A.J. 1976. Potential of deciduous weed species and softwood thinnings as sources of wood pulp. Applied Polymer Symposium. 28: 503-515.

Pulping studies were made on weed trees and shrubs of relatively small size (Betula populifolia, Acer rubrum, Salix gracilis (petiolaris), Alnus rugosa, Prunus pennsylvanica, and Populus tremuloides) and small softwood trees from thinnings (Pinus strobus, Tsuga canadensis, Abies balsamea, Picea abies, Pinus resinosa, Larix laricina, and Thuja occidentalis). The pulps compared favorably with standard pulps except for S. petiolaris, Picea abies, and L. laricina. Bark and leaves did not yield useful pulps.

Chase, A.J.; Young, H.E. 1976. Corrugating pulps from puckerbrush. Research in the Life Sciences. 23(10): 9 p.

A corrugating-medium grade of pulp was produced by the NSSC process from 100 percent grey birch (Betula populifolia) and mixtures of grey birch, aspen (Populus tremuloides) and red maple (Acer rubrum) using different amounts of chemical and different time/temperature cycles. The optimum conditions were 0.18 pounds Na_2O /lb wood; 5 minutes presteaming; and 30 minutes cooking. Strength of beaten pulps was comparable to that of commercial pulps in properties important to corrugating medium.

Cooper, P.A. 1976. Pressure-preservative treatment of poplar lumber. Forest Products Journal. 26(7): 28-31.

Gives results of experiments to assess the preservative retention of 3- to 4-foot lengths of 2- x 4-inch dimension lumber (of Populus balsamifera from Alberta and British Columbia and P. tremuloides from Alberta) commercially pressure-treated with creosote or ammoniacal copper arsenate (ACA). Specimens of both species accepted heavy preservative loadings and differences are not thought to warrant segregation of the species for preservation treatment. Boards containing collapse or honeycomb checking did not retain as much preservative as clear boards.

Diev, V.A. 1976. Processing the waste from match manufacture into industrial chips. *Derevoobrabatyvayushchaya Promyshlennost'*. 9: 29-30.

Annual consumption of wood (Populus tremula and Tilia cordata) in the Soviet match industry is about 750,000 m³, with a recovery of only 40 percent. Hitherto, most of the waste (veneer scraps and cores) has been used as fuel. A system has been developed at Cherepovets for comminuting and grading the waste, with a good yield of satisfactory chips suitable for board manufacture.

Eglais, I.Ya.; Berzin'sh, G.V. 1976. Strength and dynamic modulus of elasticity in bending in certain natural species of wood and wood modified with ammonia. *Lesnoi Zhurnal*. 5: 142-144.

Specimens of birch (Betula alba), alder (Alnus glutinosa), and aspen (Populus tremula) were tested in three different conditions: (N) natural; (A) treated with gaseous ammonia for 36 hours; and (U) treated with gaseous ammonia and then compressed by application of a pressure of 0.5 kgf/cm². Results indicated that the ammonia treatment caused an increase in the dynamic modulus of elasticity in bending.

Erickson, J.R. 1976. Steaming chips facilitates bark removal. Res. Note NC-216. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 4 p.

Whole-tree chips of Populus tremuloides, Acer saccharum, and Pinus banksiana, harvested in different months during the year, were screened and given steaming treatments of 2-14 lb/in² gauge for 1 to 10 minutes before running the chip mass through a compression debarker and re-screening. Steaming improved bark removal but increased wood loss for all species. Bark removal was nearly the same from smooth and knurled rolls but wood loss was significantly greater from the knurled roll. Chips held on a 3/8-inch screen had a very low bark content, but chips held on a 3/16-inch screen had a considerable bark content.

Fiano, E. N. 1976. Summary of studies conducted in Argentina on willows and poplars. *Investigacion y Tecnica del Papel*. 13(50): 1073-1085.

Pulping properties were examined in four willow species (Salix spp.), three poplar species (Populus spp.) and nine hybrids from plantations in the Parana River Delta. Salix babylonica var. sacramenta was outstanding with higher fiber length/width ratio and higher density.

Geimer, R.L. 1976. Perspective on particleboards from Populus spp. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 87-90.

Giordano, E.; Avanzo, E.; Rossi Marcelli, A. 1976. Total use of poplar: present observations on a poplar plantation of Populus X euramericana 'I-476'. *Cellulosa e Carta*. 27(4): 23-26.

Griffioen, K. 1976. Assessing the quality of poplar wood for use in the paper and cardboard industries. *Populier*. 13(2): 27-28.

Summarizes the results of studies designed to obtain a representative value for the mean basic density of a tree by a non-destructive method.

Results indicated that the density of the outer half of an increment core taken at breast height gives a good approximate value which is only slightly below the mean for the whole stem. Mean basic densities of whole stems and of the outer half of increment cores taken at breast height are tabulated for seven poplar clones.

Hoshi, T. 1976. Properties of the important Japanese woods. Cutting properties by rotating knife. VI. Cutting properties of the woods grown in South Kanto district. Bull. 287. Tokyo, Japan: Government Forest Experiment Station, Meguro: 85-96.

The cutting force (P) was determined for 14 species. The relationship between P and feed per knife (f) was $P = a + \alpha f$; values of the constants a and alpha for each species are tabulated. The effects of cutting angle and of feed per knife on surface quality were determined for sugi (Cryptomeria japonica), akamatsu (Pinus densiflora), and guimatsu (Larix dahurica (gmelinii) var. japonica) and are summarized in a table.

Huffman, D.R.; Cech, M.Y. 1976. Kiln-drying 1-inch aspen. Canadian Forest Industries. 96(8): 27-35.

Presents results of a study to compare a series of experimental kiln schedules (designed to reduce variability in the final moisture content, and to minimize or eliminate collapse) with a current commercial kiln drying schedule for 1-inch Populus tremuloides and P. grandidentata. A high-temperature drying schedule reduced drying time by 40 percent, but degrade was increased by 70 percent. Low-temperature pre-drying before high-temperature drying resulted in a marked decrease in final moisture content variation and a 35 percent reduction in degrade, but it required a 50 percent increase in drying time. A combination schedule resulted in least degrade; value losses were reduced by 70 percent with no increase in drying time, but variability in the final moisture content was greater than for conventional drying. Work continues, with special emphasis on modifications of the combination schedule to reduce variation in the final moisture content and to allow the schedule to be used in existing conventional kilns.

Hunt, K.; Hatton, J.V. 1976. Increased pulp production by use of hardwoods in softwood Kraft mills. Pulp and Paper Canada. 77(12): 119-123.

Two softwood species: white spruce (Picea glauca) and western hemlock (Tsuga heterophylla) were pulped with 10 percent and 20 percent by weight of three hardwood species: red alder (Alnus rubra); yellow birch (Betula alleghaniensis), and trembling aspen (Populus tremuloides), each mixture containing one species of each type. There was an increase in pulp yield from mixtures compared with softwoods alone. Yields were higher from hemlock/hardwood mixtures than from spruce/hardwood mixtures. The strength of pulps was not affected by the inclusion of hardwood, except for a slight reduction from 80 percent spruce/20 percent hardwood. Pulps from mixtures were easier to beat than softwood pulps. Mixtures required a shorter cooking time; their permanganate numbers are lower than those for the corresponding softwood by itself.

Janci, J. 1976. Suitability of various poplar species for semichemical pulp production. Vyskumne Prace z Odboru Papiera a Celulozy. 21: V49-V52.

Morphological and chemical properties are given for the main species of poplar growing in southern Slovakia (Populus 'Robusta', P. 'Marilandica', P. nigra, and P. canescens). P. nigra and P. canescens contained more cellulose than P. 'Robusta' and P. 'Marilandica', and required longer cooking times for the same yield. P. canescens gave pulp with lower strength than those of the other species.

Janin, G.; Letzelter, B. 1976. Development of paper making qualities of young poplar plants, preceding planting of the cutting. *Papeterie*. 9: 419-424, 427.

Karkkainen, M. 1976. Further observations on the measurement of the cross-sectional area of aspen logs. *Silva Fennica*. 10(4): 257-265.

Results from a study of 174 discs of aspen (Populus tremula) in Finland confirmed the results of an earlier study.

Kirpicheva, L.M.; Chudakov, M.I.; Sannikov, G.P. 1976. Obtaining sulphate pulp for acetylation from wood killed by arboricides. *Lesnoi Zhurnal*. 1: 101-104.

Gives the results of studies on the quality of pre-hydrolysis sulphate pulps obtained from the wood of birch, aspen, and alder trees killed by arboricide treatment, and also a mixture of the three species. The wood was pulped at intervals after the arboricide treatment. Unbleached pulp samples were bleached; a trial acetylation was carried out, and the quality of the acetate obtained was determined. In general, acceptable pulps could be obtained from wood up to 27 months after treatment with arboricides.

Kirpicheva, L.M.; Chudakov, M.I.; Sannikov, G.P. 1976. Producing viscose pulp from wood of trees killed by arboricides. *Lesnoi Zhurnal*. 3: 96-100.

Tabulates data on the properties of bleached and unbleached pulps produced from wood of birch, aspen, alder, and from a mixture of the three species, killed by arboricides. The results indicate that the wood of trees of these species killed by arboricides can produce pulp suitable for viscose up to 27 months after the arboricidal treatment.

Kohan, S. 1976. Possibilities of using some nonflooded sites for the production of poplar pulpwood. *Les (Bratisl)*. 32(3): 110-114.

Lajos, H. 1976. Celluloz-nyarasok nevelese. II. Growing poplar for cellulose. II. ERFA (Erdogazdasag Faipar). 1: 6-8.

Lim, K.P.; Kong, Y.T.; Jo, J.M.; Shin, D.S.; Chun, P.C. 1976. Studies on the pulping characteristics of mini-rotation woods. 1. The Kraft pulping characteristics of young Pinus rigida, Populus alba X glandulosa and Quercus acutissima of four age classes. Res. Rep.23. Seoul, South Korea: Forest Research Institute: 49-56.

Studies of the Kraft pulps from Pinus rigida and Q. acutissima of four age classes showed that the minimum harvesting ages for the two species are 15 and 12 years, respectively. Younger trees gave lower yields and had lower densities and shorter fiber length.

Lonnberg, B. 1976. Short-rotation hardwood species as whole-tree raw material for pulp and paper. 3. Chemical pulping. *Paperi ja Puu*. 58(3): 113-124.

Sulphate pulps from whole-tree leafless samples of 3- to 5-year-old, 10- to 15-year-old and 20- to 25-year-old Populus tremula, Alnus incana, Salix caprea, and Betula pubescens, and 9-year-old Populus tremula X P. tremuloides required more alkali and gave lower yields than barked materials. Soda/oxygen pulps were not satisfactory. It is thought that 25 percent of young whole-tree hardwood chips would be acceptable.

Lonnberg, B. 1976. Short-rotation hardwood species as whole-tree raw material for pulp and paper. 4. Effect of bark upon chemical pulping. *Paperi ja Puu*. 58(4a): 181-197.

Data are tabulated and discussed from pulping, beating, and washing experiments on pulps including various proportions of the bark and leaves of four species: aspen (Populus tremula), sallow (Salix caprea), white birch (Betula pubescens), and grey alder (Alnus incana). Leaves were found to be unsuitable as a raw material, but the yields and strength of pulps including bark were satisfactory. The main problem in the use of these pulps is their bad drainage characteristics. An economic analysis indicates that it is best to use unbarked stems of these species at age 20-25.

Lonnberg, B. 1976. Short-rotation hardwood species as whole-tree raw material for pulp and paper. 6. Chemi-mechanical pulps. *Paperi ja Puu*. 58(9): 630-648.

Neutral sulphite pulps from whole-tree leafless samples of 3- to 5-year-old aspen (Populus tremula), grey alder (Alnus incana), sallow (Salix caprea), and white birch (Betula pubescens) were not suitable for corrugating medium; whole-tree chips mixed with normal birch chips might provide acceptable pulp. Refiner chemi-mechanical pulps of grey alder and white birch showed strength properties similar to those of spruce groundwood pulps. Data are tabulated on the properties of the various pulps.

Mackay, J.F.G. 1976. Delayed shrinkage after surfacing of high-temperature kiln-dried northern aspen dimension lumber. *Forest Products Journal*. 26(2): 33-36.

Nikolova, T. 1976. Axial biological stresses in the wood of Populus 'Vernirubens'. *D"rvoobrabotvashcha i Mebelna Promishlenost*. 19(7): 207-209.

Deformations were measured in boards sawn with the pith on one side, during production and air seasoning over 2.5 months. The axial internal stress increased from the base towards the top of the tree, and decreased with decreasing moisture content below fiber saturation, and with decreasing site quality. No relation to wood density was found.

Nikolov, S.; Abrashev, G. 1976. Equilibrium moisture content of modified wood. *D"rvoobrabotvashcha i Mebelna Promishlenost*. 19(8): 230-234.

The equilibrium moisture content of the wood of Quercus cerris and Populus 'Regenerata', modified with 'PPR-I' PF resin, is shown in two diagrams in relation to RH and polymer content.

Peters, C.C.; Panzer, H.R.; Mergen, A.F. 1976. Low-speed effects on thick slicing. *Forest Products Journal*. 26(5): 56-57.

In further experiments to determine the effects of cutting speed on the quality of the product (measured in terms of knife-and bar-side fracture

depth), slices of Quercus rubra, Populus grandidentata and southern pine, 1/2- and 1-inch thick, were cut at 0.05, 0.5, and 5.0 ft/min on a modified metal milling machine. Results showed that the quality of the slices changed very little with decreasing velocity, except for the quality of 1-inch Q. rubra, which improved. No relation was found between the speed of cutting and the uniformity of thickness of the cut pieces.

Stevens, M.; Dewispelaere, W.; Schalck, J. 1976. Influence of different impregnation techniques on the dimensional stability of poplar, spruce and beech. Meded Rijksuniv Fac Landbouwwet. 41(3/4): 1765-1776.

Tsel'millere, M.Ya.; Dubinskaya, N.A.; Znudova, M.B. 1976. Distribution of preservative in wood. Khimiya Drevesiny. 5: 95-100.

Green and air-dry specimens of Betula verrucosa and Populus tremula sapwood were pressure-impregnated with a Dohnalit-type F-Cr-As preservative. Air-dry specimens were also treated by soaking. The most uniform distribution was achieved by pressure impregnation of green wood. In the pressure-impregnated air-dry specimens, the preservative was concentrated near the surface, and in the air-dry specimens treated by soaking, almost all of the preservative was concentrated in the first 2 mm, particularly in the radial direction.

Unger, A.; Reichelt, L. 1976. Wood/plastic combinations and the technology of their manufacture. Holzindustrie. 29(11): 324-327.

An abridged version of a pamphlet by V.F. Annenkov published (in Russian) in 1974. A classification of the various wood/plastic combinations is presented which has two principal groups; modified wood (impreg) and stabilized compressed wood (compreg) subdivided according to the type of impregnating agent. Strength data are given for impreg of birch (Betula verrucosa), aspen (Populus tremula), and pine (Pinus sylvestris) with various plastics and for compreg made with PF resin.

Viktorin, Z.; Koberle, M.; Drahos, V.; et al. 1976. Special number on wood seasoning. Drevo. 31: 353-374.

Eight papers: Present state of research on drying and future developments in wood seasoning research; Development of new driers for the wood industry in Czechoslovakia; Air seasoning of sawn timber; Main trends in the technology and technique of sawn timber seasoning in the USSR; New waste-gas kiln in Poland; Control system for the sawn timber seasoning process; Grading of seasoned sawn timber according to the occurrence of checks; and Transverse warping of spruce wood in relation to conditions.

Ward, J.C. 1976. Kiln drying characteristics of studs from Rocky Mountain aspen and Wisconsin aspen. Gen. Tech. Rep. RM-29. Ft. Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 73-74.

Young, R.A. 1976. Wettability of wood pulp fibers: applicability of methodology. Wood and Fiber. 8(2): 120-128.

The wettability of fibers of (a) Kraft (Pseudotsuga menziesii), (b) thermomechanical (Abies balsamea) and (c) NSSC (Populus tremuloides) pulp was

determined by measurement of the initial weight increase caused by partially immersing the fibers in water. Grafting of fibers of (a) and (c) with styrene decreased wettability.

Zhukov, V.P.; Filonov, A.A.; Belova, T.P.; Shcherbinin, A.A. 1976. Influence of wood species and some technological factors on the residual deformation of particle boards after pressing for surface lamination.

Derevoobrabatyvayushchaya Promyshlennost'. 11: 7-9.

Residual deformation (R) after lamination, owing to irreversible compression, causes variations in the thickness of the finished board. R measured on boards of various densities was lowest with alder (Alnus spp.) and spruce (Picea spp.) and highest with pine (Pinus sylvestris) and aspen (Populus tremula), the other species being birch (Betula alba) and lime (Tilia spp.). The species mixtures normally used in the factory are tabulated for different regions of the USSR. It is concluded that R can be reduced by simultaneously increasing board density and reducing the resin content.

Zoch, L.L., Jr.; Springer, E.L.; Hahny, G.J. 1976. Storage of aspen whole-tree chips under laboratory conditions. Res. Pap. FPL-288. Madison, WI: U.S. Department of Agriculture, Forest Products Laboratory. 6 p.

1977

Babkin, V.A.; Vasianovich, G.P.; Zaitseva, L.A. 1977. Group chemical composition of lyes obtained during delignification of aspen wood with oxidizing ammonolysis. Khimiya Drevesiny. 4: 42-44.

Bailey, G.R.; Dobie, J. 1977. Alberta poplars - tree and log quality. Inf. Rep. VP-X-155. Canada: Western Forest Products Laboratory. 8 p.

In the Lesser Slave Lake region, decay in trembling aspen (Populus tremuloides) increased with age, from about 6 percent of gross volume in trees less than 60 years old to about 12 percent in those over 90 years. In balsam poplar (P. balsamifera) there was about 5 to 6 percent decay at all ages. When conks, scars, and rotten knots were used as indicators, decayed trees were correctly identified in about 70 percent of cases. A 3-grade tree-quality system was derived using d.b.h. and decay indicators. A satisfactory 4-grade log-quality system used log top diameter, percent decay, and a measure of sweep.

Behr, E.A. 1977. Final results of 15-year post study of treatment with powdered reagents. Forest Products Journal. 27(11): 20-25.

Freshly peeled posts of Pinus banksiana, Populus tremuloides, and Ulmus americana were treated on part of the below-ground portion with powdered CuSO_4 followed by various combinations of Na_2HAsO_4 , $\text{Na}_2\text{Cr}_2\text{O}_7$, NaBO_2 , and borax. Posts were kept outdoors in central Michigan, USA, and were inspected for decay over a 15-year period. Best results were obtained with Cu treatment followed by As in P. banksiana and P. tremuloides (estimated life 24 years). Cu followed by borax was an effective treatment. This treatment is not potentially poisonous as are treatments containing Cu and As.

Bois, P.J. 1977. Constructing and operating a small solar-heated lumber dryer. For. Prod. Util. Tech. Rep. 7. Madison, WI: U.S. Department of Agriculture, Forest Service, State and Private Forestry, Division of Cooperative Forestry. 11 p.

Instructions are given on how to build and operate this small-scale kiln (wind-powered solar-heated lumber dryer). Drying times are given for several species.

Butcher, J.A.; Hedley, M.E.; Drysdale, J. 1977. Comparison of a quaternary ammonium compound and copper-chrome-arsenate as wood preservatives. Forest Products Journal. 27(7): 22-25.

Alkyl dimethyl benzyl ammonium chloride was compared with CCA in soil/block tests with cultures of basidiomycetes (including Coniophora puteana) and in sand/veneer or soil/veneer tests at 30 degC with soft rot fungi (Chaetomium globosum and Hemicola spp.). The wood specimens were of Pinus radiata, Eucalyptus regnans, and Populus 'Robusta'. Basidiomycete attack was prevented by 0.4 percent CCA in all but one case, whereas 1.0 percent quaternary NH₄ compound was necessary to prevent attack. Treatment with 1.33 percent CCA was ineffective.

Dewispelaere, W.; van Raemdonck, J.; Stevens, M. 1977. Decay resistance of wood treated for dimensional stabilization with monomers and formaldehyde. Material und Organismen. 12(3): 211-222.

Wood of Populus 'Robusta' and Pinus sylvestris was treated with methyl methacrylate (MMA) or MMA/solvent/water mixtures or with formaldehyde vapor with SO₂ as a catalyst. Test fungi used were Polystictus (Coriolus) versicolor on P. 'Robusta' and Coniophora puteana and Poria monticola on P. sylvestris. Treatment with MMA and MMA/solvent/water mixtures reduced decay by 11-38 percent and 13-42 percent respectively. Formaldehyde treatment reduced decay by 93-96 percent.

Donchev, G. 1977. On the consumption of raw materials for the production of wood fiberboards after the wet method. D"rvoobrabotvashcha i Mebelna Promishlenost. 20(8): 236-239.

Data are presented for the amount of wood used to produce one ton of fiberboard, using the wet method, for beech (Fagus sylvatica), poplar (Populus spp.), common oak (Quercus robur), and Turkey oak (Quercus cerris).

Esenther, G.R. 1977. Nutritive supplement method to evaluate resistance of natural or preservative-treated wood to subterranean termites. Journal of Economic Entomology. 70(3): 341-346.

A bioassay that uses a small amount of Populus grandidentata sawdust as a nutrient supplement was developed for determining resistance of wood samples to Reticulitermes flavipes and R. virginicus. The bioassay was used to assess the antitermitic properties of 2 oil-borne and 2 water-borne preservatives and of untreated samples from 21 timber species. Except for the toxic effect of PCP, antitermitic properties of the preservatives and timbers were primarily due to repellancy or feeding deterrency factors.

Higuchi, T.; Shimada, M.; Yamasaki, T.; et al. 1977. Wood and needle chemistry. In: TAPPI conference papers: Forest biology, wood chemistry conference; 1977 June 20-22; Madison, WI. Technical Association of the Pulp and Paper Industry. 69 p.

Johns, W.E.; Nguyen, T. 1977. Peroxyacetic acid bonding of wood. Forest Products Journal. 27(1): 17-23.

Peroxyacetic acid was used in lamination of white fir (Abies concolor), sugar pine (Pinus lambertiana), and aspen (Populus tremuloides) by direct oxidative bond formation between the wood surfaces. HCl and H₃PO₄ were used at three different molecular concentrations in relation to two concentrations of H₂O₂. The wide range of variability in the resulting bond strengths seemed to be related to the lack of gap-filling capability inherent in peroxyacetic acid bonding.

Kavalov, A.; Gankov, B.; Romanov, B.; Lechev, S. 1977. Investigations on the sanding of poplar plywood. D"rvoobrabotvashcha i Mebelna Promishlenost. 20(8): 231-234.

Three-layer, 4-mm thick Euroamerican poplar (Populus X canadensis) plywood was sanded with sandpaper of 4 different coarsenesses and at 4 different grinding pressures. Correlations were obtained between rate of removal of stock and pressure applied and sandpaper coarseness and smoothness.

Keith, C.T. 1977. A method for differentiating heartwood and sapwood in unseasoned timber. Bi-monthly Research Notes. 33(3): 24-25.

The use of differential surface drying to distinguish heartwood and sapwood in green cross-sections, developed initially for aspen (Populus tremuloides), has been extended to a variety of softwoods and hardwoods. The heartwood shows up as a dry zone owing to its lower permeability.

Korotkiya, G.Ya.; Berzin'sh, G.V. 1977. Increasing the bio-resistance and reducing the inflammability of plasticized wood. Lesnoi Zhurnal. 4: 157-160.

Test-pieces of green birch (Betula alba) and aspen (Populus tremula) of 65-70 percent moisture content were impregnated with solutions containing B (borax, boric acid) and then treated with gaseous ammonia, compressed, and dried by superheated steam. The resistance of the test-pieces to biological agencies was tested by exposure to the fungus Coniophora cerebella, and their fire-resistance was determined by the flame-tube method. The results indicate that aspen is impregnated better and more uniformly than birch, and that the use of solutions containing boron is an appropriate method of protecting plasticized wood to be used indoors.

Kosik, M.; Repka, J.; Reiser, V.; Grman, D.; Hrdlicka, L. 1977. Modification of the properties of wood with the aid of derivatives of polyethylene glycol. Holztechnologie. 18(1): 29-33.

Wood of Populus 'Marilandica' was impregnated with polyethylene glycol (PEG) of molecular weight 600 and with a mixture of PEG and triphenylphosphite. Wood treated with the modified PEG exhibited similar permanent swelling to wood treated with PEG alone, and possessed greater durability, reduced leachability of the components and greater fire resistance.

Lee, M.C.; Jo, B.M.; Lim, K.P.; Chun, P.C. 1977. Studies on the mechanical and semichemical pulp manufacture of improved Populus in Korea. Research Report of the Institute of Forest Genetics, Korea. 21: 171-186.

Trials were made with Populus alba X glandulifera, P. euramericana 'I-214', and P. euramericana 'I-476'. All three poplars yielded good-quality groundwood pulp and neutral sulphite, semichemical kraft, and semichemical soda methods were all found suitable for semichemical pulp manufacture. Physical and chemical properties are tabulated.

Mackay, J.F.G.; Hamm, E.A.; Foschi, R.O. 1977. Reducing crook in kiln-dried northern aspen studs. Forest Products Journal. 27(3): 33-38.

A method has been developed for straightening 8-foot x 2- x 4-inch studs of trembling aspen (Populus tremuloides) and balsam poplar (P. balsamifera) which develop excessive crook during kiln-drying. Studs are steamed for 3 hours, then a load is applied at mid length to deflect them in the direction opposite to their crook, by an amount equal to two or three times the amount of crook. The deflection decreases until, ideally, the residual deflection is equal to, but in the opposite direction to, the original crook; the studs are then straight. Equations are presented to allow calculation of the time required for stress relaxation when the deflection is arbitrarily selected.

Moroz, I.K.; Strunnikov, V.N.; Medyantsev, V.E. 1977. Hardwood extractives and their changes during alkaline pulping. I. Fatty acids of Poplar. Khimiya Drevesiny. 2: 66-70.

Pearl, I.A.; Darling, S.F. 1977. Hot water extractives of leaves of Populus heterophylla L. Abstracts of Papers of the American Chemical Society. 172: 57.

Pearl, I.A.; Dickey, E.E. 1977. Effect of oxygen-alkali pulping conditions on the tall oil components of southern pinewood: comparison of conditions. TAPPI. 60(10): 126-129.

The first phase of a long-range research program is presented that should determine whether the lucrative pine wood extractives could be salvaged in oxygen-alkali pulping or whether the valuable extractives would have to be removed from the wood prior to pulping. Loblolly pine (Pinus taeda) chips were subjected to low and high-yield kraft, soda, and soda-oxygen cooking in laboratory digesters, and the crude tall oil in the combined filtrates and fiberized chip washings was determined and evaluated. Poor tall oil yields from the soda cook suggested that a first-stage soda cook in a two-stage oxygen-soda process may be unsatisfactory for the commercial production of tall oil. When the procedure was applied to aspen (Populus tremuloides) and to normal slash pine (Pinus elliotii), the total crude tall oil indicated that only minor losses of potential tall oil, based on saponified wood extractives had occurred. The recovery of tall oil from resin-soaked and nonresin-soaked samples of paraquat-treated slash pine wood was less efficient. With the exception of the resin-soaked sample, the largest fraction of the extractable tall oil was recovered from the fiberized chip washings.

Robinson, K.W. 1977. SEM study of tension wood fiber morphology and its effect on paper properties. In: Proceedings, 35th annual meeting: Electron Microscopy

Society of America; 1977 August; Boston, MA. Baton Rouge, LA. Claitor Publishing Division: 308-309.

Populus 'Tristis No. 1' tension wood (TW) and normal wood (NW) were kraft pulped and made into separate handsheets. TW sheets were less strong, and more porous than NW sheets, and they had different optical characteristics. The differences were considered to be due to the degree of cell collapse. TW and NW pulps had similar hemicellulose contents.

Rutkowski, J.; Szopinski, R. 1977. Industrial tests on processing poplar and aspen woods into bleached kraft pulps. *Przeglad Papierniczy*. 33(4): 149-151.

Pulping and bleaching conditions are described and properties of the pulps are tabulated for pine (Pinus sylvestris)/poplar (Populus spp.) mixtures and poplar/aspen (Populus tremuloides) mixtures pulped by the Kraft process for the manufacture of high quality white papers. Good quality was obtained with respectively 50, 12, and 25-35 percent of poplar/aspen mixture in the furnish.

Shamaev, V.A.; Smetarina, L.N.; Gavrilov, G.K. 1977. Strength and deformation of wood modified with urea. *Lesnoi Zhurnal*. 6: 97-101.

Specimens of birch (Betula alba), aspen (Populus tremula) and pine (Pinus sylvestris) wood were impregnated with urea (hot and cold baths), dried, compressed, and heated for 4-6 hours at 433-453 degK. The results indicate that the modification with urea increases the strength and dimensional stability of the wood. The process of stress relaxation is considerably accelerated in the modified wood.

Simionescu, C.; Cernatescu-Asandei, A.; Andriescu, P.; et al. 1977. Chemical study of Romanian poplar. (7). Preliminary experiments on the paper making evaluation of juvenile poplarwood. *Celuloza si Hirtie*. 26(2): 75-81.

Anatomical, chemical, and kraft pulpability data were gathered for juvenile wood of Romanian hybrid poplars (Populus 'I-45/51', P. 'I-488', P. 'R-16', and P. simonii) and of Paulownia imperialis and (for comparison) for mature wood of Populus alba, P. nigra, and P. 'Robusta'. Laboratory-prepared kraft pulp from juvenile poplars showed much better beatability while giving sheet properties within the same limits as those obtained from mature-wood pulp.

Sokol'skii, I.A. 1977. A shop for overall processing of aspen. *Lesn Prom-st*. 2: 18.

Sorokin, V.I.; Bakina, G.G. 1977. Selectiveness of delignification and dissolution of pentosanes during nitric acid cooking of aspen wood. *Khimiya Drevesiny*. 4: 37-41.

Stevens, M.; Schalck, J. 1977. Effect of processing conditions on the chemical interaction in wood/plastic combinations. *Holz als Roh- und Werkstoff*. 35(8): 301-306.

Wood-polymer composites were prepared from wood of Populus euramericana and methylmethacrylate or styrene, using three impregnation techniques with different cell wall accessibility and two polymerization techniques with different degrees of reactivity. It was concluded that copolymerization

between polymer and cellulose and/or lignin occurs, and conditions favoring this were established.

Surewicz, W.; Wandelt, P.; Kryczka, M. 1977. High-quality bleached sulphate pulps from hardwood mixtures. *Przeglad Papierniczy*. 12: 437-444.

Results are reported of laboratory, pilot, and commercial-scale experiments on the production of bleached sulphate pulps from mixtures of miscellaneous hardwoods with proportions of beech, oak, hornbeam, black alder, birch, and poplar. It is concluded that paper of satisfactory quality can be produced from pulps containing up to 50 percent of miscellaneous hardwood fibers.

Treander, O. 1977. Chemistry and microbiology of the litter of some forest trees. In: TAPPI conference papers: Forest biology, wood chemistry conference; 1977 June 20-22; Madison, WI. Technical Association of the Pulp and Paper Industry: 37-45.

Wilkinson, J.J. 1977. Better results with hardwood pulp. *Pulp and Paper International*. 19(7): 46-48, 54.

An unnamed Italian pulp and paper mill processes poplar wood wastes (random-sized mixed veneer offcuts and end-of-grain chips) into a chemimechanical refiner pulp of 69-71 degrees (Photovolt) brightness, having strength properties superior to high-yield thermochemical pulp from short-rotation fresh poplar chips, while consuming significantly less power than a TMP process. The novel approach involves pretreating the disk-fractionated chips with a liquor containing 4 percent NaOH, 2 percent hydrogen peroxide, and 3 percent Na silicate prior to refining. The pretreatment combines bleaching action with some hemicellulose softening and lignin solubilization.

1978

Al-Rabbat, M.F.; Heaney, D.P. 1978. The effects of anhydrous ammonia treatment of wheat straw and steam cooking of aspen wood on their feeding value and on ruminal microbial activity. 1. Feeding value assessments using sheep. *Canadian Journal of Animal Science*. 58(3): 443-451.

Steam-cooked aspen (*Populus* spp.) wood, untreated wheat straw or wheat straw treated with anhydrous NH₃, with constant amounts of lucerne hay, cottonseed meal, minerals and vitamins, were fed to mature wethers. Steam-cooked aspen wood had an energy digestibility near that of lucerne hay, but intake was less than expected from the digestibility. Anhydrous NH₃ treatment of straw increased its energy digestibility from 34 to 61 percent.

Bonduelle, P. 1978. Silvicultural and pulping results of a first coppicing of poplar. Paris, France: AFOCEL: 296-338.

Cuttings of *Populus* 'Rochester' and *P. trichocarpa* 'Koreana 39' were planted at Drambon, Cote d'Or, in spring 1970, cut back 2 years later and harvested in winter 1976-1977. Data are given on production. High bark and juvenile fiber content makes short-rotation coppice less good than adult poplar. Bark can be reduced to less than 10 percent by compression barking

after steaming. The pulp characteristics were similar for both clones and all three densities. The optimum planting density is thought to be between 2,000 and 6,000/ha.

Butcher, J.A.; Drysdale, J. 1978. Soft-rot control in hardwoods treated with chromated copper arsenate preservatives. IV. Toxic thresholds for Chaetomium globosum in twelve hardwoods. *Material und Organismen*. 13(3): 187-196.

Some six sapwood blocks of each species were treated with chromated copper arsenate (CCA) and exposed to C. globosum attack, after fixation for 14 days, air-drying, and leaching for 14 days. Toxic thresholds and toxic levels of copper needed to control soft rot caused by C. globosum are tabulated and compared with those in part III. The hardwoods are placed in four broad categories according to the levels of copper needed to prevent attack.

Canonne, A.; Tyrode, N. 1978. Research on papermaking use of short-rotation coppice wood. Translation from: *ATIP Revue*. 30(5): 171-173.

Chase, A.I. 1978. Pulping, biomass and nutrient studies of woody shrubs and shrub sizes of tree species. Bull. 749. Orono, ME: University of Maine, Life Sciences and Agriculture Experiment Station. 36 p.

The following nine species of shrubs, including branches, twigs, bark, and some foliage were pulped by the sulphate process: striped maple (Acer pensylvanicum), basswood (Tilia americana), beaked hazelnut (Corylus cornuta), yellow birch (Betula alleghaniensis), hophornbeam (Ostrya virginiana), sugar maple (Acer saccharum), beech (Fagus grandifolia), sumac (Rhus typhina), and willow (Salix bebbiana). Yield of acceptable pulp was 35-40 percent, willow giving the highest, sumac the lowest. Burst, tear and tensile strength of the pulps were generally lower than those for commercial pulps, but were comparable in the case of yellow birch, hazelnut, and hophornbeam.

Chen, R.; Garceau, J.J.; Kokta, B.V. 1978. Hardwood mixed with softwood in kraft pulping. *TAPPI*. 61(7): 35-38.

Dallons, V. 1978. Pollution from several wood species in hardboard production. *Forest Products Journal*. 28(1): 42-47.

Chips of aspen (Populus tremuloides), southern yellow pine (Pinus 'Southern'), Oregon white oak (Quercus garryana) and Douglas fir (Pseudotsuga menziesii) were pulped under varying conditions and the properties of the waste water were determined. BOD and COD values were greatest under the severe pulping conditions used in S2S (smooth 2 sides) hardboard manufacture. The amount of suspended solids varied with species (greatest in Q. garryana). Unnecessarily severe cooking conditions in mills should be modified, particularly for S2S manufacture and for chips of Q. garryana.

Gahin, M.; Krause, T. 1978. Refiner pulp from wood chips pretreated with acrylic acid. *Papier*. 32(10): 429-436.

Beech (Fagus sylvatica) chips were treated with hot water (150, 160, or 170 degC) or hot 2.5 percent, 5 percent, or 10 percent solution of acrylic acid, disintegrated in a disc refiner, and beaten in a Jokro mill. In some cases, strength could be considerably improved with only slight reduction in

yield. Similar results were obtained from poplar (Populus spp.) wood, but pine (Pinus sylvestris) wood was not influenced so much.

Hilado, C.J.; Murphy, R.M. 1978. Ignition and flash-fire studies of cellulosic materials. *Fire and Materials*. 2(4): 173-176.

Time to ignition appeared to be primarily a function of heat flux and material density, rather than of type of wood or cellulosic board. At heat fluxes from 5.8 to 10.5 W/cm², time to ignition was shortest for fiberboard followed by Thuja plicata solid wood, Pinus strobus, Pinus 'Southern', Pseudotsuga menziesii, and longest for hardboard. Boron-treated materials had a reduced flash-fire magnitude.

Hunt, K.; Basham, J.T.; Kemperman, J.A. 1978. Kraft-pulping evaluation of decayed trembling aspen from Ontario. *Canadian Journal of Forest Research*. 8(2): 181-187.

Samples of sound and decayed wood from five Ontario clones of P. tremuloides were used for kraft-pulping. (Decay was due to Fomes (Phellinus) igniarius, Radulum casearium, or Peniophora polygonia.) A decrease of 11.5 percent was obtained when advanced decays were considered. Pulp strengths from incipient-decayed wood differed little from those from sound wood, but those from advanced-decay wood showed substantial decreases.

Mackay, J.F.G. 1978. Drying trembling aspen lumber in direct-fired kilns. *Forest Products Journal*. 28(1): 21-22.

Lumber (2- x 4-inch) of trembling aspen (Populus tremuloides) was dried in a direct-fired kiln using a 96-hour schedule with a temperature rise of 2.5 degF/hr over 68 hours and 28 hours at maximum temperature (240 degrees F) or a 96-hour schedule with a temperature rise of 2.0 degF/hr over 85 hours, and 11 hours at maximum temperature. Both schedules showed a much lower incidence of delayed shrinkage (after 6 months) than previous studies using high temperature schedules in steam kilns and they are recommended for direct-fired kilns with automatic cam-control equipment.

Mathews, J.F.; Pepper, J.M. 1978. Steam treatment of aspen poplar to increase digestibility for ruminants. *Canadian Journal of Animal Science*. 58(3): 521-523.

Steaming for five minutes at 190 degC gave a product without weight loss and with c. 56 percent digestible DM. Steaming for longer times led to loss of pentosans and increased free acid content.

Rusinya, N.A.; Balod, V.V. 1978. Trial preservation of small-sized timber: posts of broadleaved and coniferous species. *Latvijas PSR Zinatnu Akademijas Vestis*. 3: 122-125.

Stakes such as those used for livestock enclosures were treated with diffusion pastes of Dohnalit UA or Celcure, or were impregnated with KhM-5 waterborne preservative at high temperature and pressure. Data are tabulated for birch (Betula alba), aspen (Populus tremula), alder (Alnus glutinosa), pine (Pinus sylvestris), and spruce (Picea abies). Despite the marked differences in penetration, all the treated stakes gave equally satisfactory performance (probable life 12-13 years), whereas untreated controls lasted only about five years (broadleaves) or 7 years (conifers).

Salmen, N.L.; Back, E.L. 1978. Effect of temperature on stress-strain properties of dry papers. *Sven Papperstidn.* 81(10): 341-346.

Shamaev, V.A. 1978. Using low-grade wood for the manufacture of sliding bearings. *Lesnoi Zhurnal.* 2: 80-83.

The method developed at the Problems Research Laboratory of the Voronezh Wood Technology Institute for manufacturing bearings of densified wood is described. Poles of softwooded species are cut into sections 200 mm long, and drilled through the pith so as to form tubular blanks; the green blanks are given a hot/cold impregnation treatment with urea; the impregnated blanks are dried to 15-20 percent moisture content in 30 hours, heated to 120-125 degC for 20 minutes and coated with a graphite/oil mixture before compression into cylindrical moulds in a hydraulic press. The compressed blanks are then dried to 3-5 percent moisture content at 120-125 degC for 3 hours, and cooled to room temperature before machining to the required size. Data are tabulated on the physical and mechanical properties of birch (Betula alba), aspen (Populus tremula), and pine (Pinus sylvestris) compressed by this method.

Stevens, M.; Schalck, J. 1978. Improvement of the hygroscopic properties of veneer sheets treated with three vinyl monomer systems. *Holzforschung und Holzverwertung.* 30(1): 18-21.

Veneers of Populus euramericana (P. X canadensis aggr.), Fagus sylvatica, and Pycnanthus kombo were impregnated with three monomer mixtures, which were then polymerized. An exchange impregnation technique which increased the cell-wall accessibility resulted in improved hygroscopic and dimensional properties of the veneer, and greater permanence of the stabilization.

Wang, D.L.K.; Patt, R. 1978. Investigations on the utilization of domestic hardwoods for pulp manufacture. 1. Pulping birch, beech, oak, and poplar by the magnesium bisulphite and the acid magnesium bisulphite process. *Papier.* 32(1): 9-16.

Birch (Betula alba), beech (Fagus sylvatica), oak (Quercus robur) and poplar (Populus spp.) were pulped by the magnesium bisulphite process at pH 4 and the acid magnesium bisulphite process at pH 1.4. The yields were the same for both processes. Better strength and brightness resulted at pH 4, but the hulps digested at pH 1.4 had good refining characteristics and low shive content. Poplar gave the highest yields, with birch, beech, and oak following in that order. In decreasing order of strength, they were birch, poplar, beech, and oak.

Wayman, M.; Lora, J.H. 1978. Aspen autohydrolysis: the effects of 2-naphthol and other aromatic compounds. *TAPPI.* 61(6): 55-57.

Welte, M.; Patt, R. 1978. Studies of the use of domestic hardwood for pulp production. (2). Pulping birch, beech, oak and poplar with and without bark by the Kraft process. *Papier.* 32(3): 101-107.

Birch (Betula alba), beech (Fagus sylvatica), oak (Quercus spp.) and poplar (Populus spp.) chips, both barked and unbarked, were pulped by the Kraft process singly or in mixtures. Yields were higher with debarked woods. The presence of bark lengthened the time required for pulping and increased the consumption of chemicals. Pulp containing bark were more suitable for

refining, but their papermaking properties were poorer. Beech pulps were the weakest.

1979

1979. Measuring industrial wood by weight: conversion factors for wood used as raw material for particle board. *Wald und Holz*. 60(5): 281-286.

A semi-popular technical account of practical methods of calculating the dry weight of wood deliveries, with definitions of volume and density units, corrections for bark, etc. Data are tabulated for the basic density and bulk density o.b. or u.b., and other conversion factors, for 16 commercial wood species in Switzerland. Practical conversion factors are given for heavy hardwoods, light hardwoods or conifers, delivered as mixed species by cubic volume or stacked volume.

Ishihara, T.; Ishihara, M. 1979. Enzymic hydrolysis of woods. IV. The effect of pretreatment with aqueous ammonia. *Mokuzai Gakkaishi* (Japan). 25(12): 804-807.

In the hydrolysis of Betula platyphylla, B. maximowiczii, and Populus maximowiczii with cellulase (I) at room temperature, treatment with five percent NH_4OH resulted in the formation of reducing sugars corresponding to approximately half of the amount of wood polysaccharides.

Sharma, H.R.; Forsberg, N.E. Guenter, W. 1979. Nutritive-value of pressure-steamed aspen for mature sheep. *Canadian Journal of Animal Science*. 59(2): 303-312.

Shen, K.C.; Fung, D.P.C. 1979. Aspen particleboards bonded with spent sulphite liquor powder treated with sulfuric acid. *Forest Products Journal*. 29(3): 34-39.

Aspen (Populus tremuloides) particleboards were made with various combinations of: acidity, binder content, or board density. At 10 percent binder content, binders containing a.e. of from 9 to 10 percent resulted in particleboards with reasonably high MOR, suitable for exterior applications.

Wayman, M.; Chua, M.G.S. 1979. Characterization of autohydrolysis aspen lignins. 2. Alkaline nitrobenzene oxidation studies of extracted autohydrolysis lignin. *Canadian Journal of Chemistry*. 57(19): 2599-2602.

Wayman, M.; Chua, M.G.S. 1979. Characterization of autohydrolysis aspen lignins. 4. Residual autohydrolysis lignin. *Canadian Journal of Chemistry*. 57(19): 2612-2616.

1980

1980. Study of poplar wood plastic composites. *Scientia Silvae Sinicae*. 16(Suppl.): 18-36.

The process is described for composites made from Chinese white poplar (Populus tomentosa) and Canadian poplar (P. canadensis) using styrene with various additives.

Winkler, A. 1980. Bark boards with diisocyanate binder. *Erdo*. 29(1): 39-43.

Trial boards were made from barking wastes of Norway spruce and poplar pulpwood, using a special polyurethane-type DIC adhesive. The poplar bark boards were of better quality than the spruce bark boards owing to the more favorable dimensions of the milled bark particles. The high cost of the adhesive is the main disadvantage.

1981

Antonoplis, R.A.; Blanch, H.W.; Wilke, C.R. 1981. High-pressure HCl conversion of cellulose to glucose. Berkeley, CA: Lawrence Berkeley Laboratory. 96 p. Thesis.

Glucose may be obtained from wood following acid hydrolysis saturating wood particles with HCl gas under pressure was an effective pretreatment before subjecting the wood to dilute acid hydrolysis. HCl gas makes the cellulose more susceptible to hydrolysis and the glucose yield is doubled when dilute acid hydrolysis is preceded by HCl saturation at high pressure. The saturation was most effectively performed in a fluidized bed reactor. HCl was found to form a stable adduct with the lignin residue in the wood. The adduct was broken upon the addition of water. A process design and economic evaluation for a plant to produce 214 tons per day of glucose from air-dried ground Populus tristi gave an estimated glucose cost of 15.14 cents per pound. Key factors contributing to the cost of glucose production were unrecovered HCl, and the cost of wood.

Gadda, L.; Bruun, H. 1981. Soda pulping of European aspen, effect of anthraquinone on delignification. *Paperi ja Puu*. (Finland). 63(11): 717-718, 721-723.

In the soda pulping of wood (Populus tremula) with and without addition of anthraquinone (I), and rapid initial change in the absorbance of wood fibers was observed, and a satisfactory correlation between absorbance and Halse lignin (II) level of fibers was obtained during the first 30 minutes of pulping. (I) increased considerably the delignification of secondary wall and middle lamella of aspen fibers during pulping.

Joseleau, J.P.; Gancet, C. 1981. Selective degradations of the lignin-carbohydrate complex from aspen wood. *Sven. Papperstidn* (Sweden). 84(15): R123-R127.

The carbohydrate moiety of a lignin carbohydrate complex from Populus tremula has been sequentially and selectively degraded using successively a crude xylanase mixture, alkaline hydrolysis and mild acid hydrolysis. Examination indicated that polysaccharides of the arabinan type, crosslinking lignin and glucuronoxylans, may be present in a junction zone between lignin macromolecules and polysaccharides.

Knappert, D.; Grethlein, H.; Converse, A. 1981. Partial acid hydrolysis of poplar wood as a pretreatment for enzymatic hydrolysis. In: Scott, C.D., ed. Proceedings, 3d Symposium on biotechnology in energy production and conservation; 1981 May 12-15; Gatlinburg, TN. New York, NY: Wiley: 67-77.

Lampert, D.T.A.; Hardt, H.; Smith, G.; Mohrlök, S.; Hawley, M.C.; Chapman, R.; Selke, S.; Palz, W.; Chartier, P.; Hall, D.O., eds. 1981. HF saccharification: the key to ethanol from wood. In: Energy from biomass; 1980 November 4; Brighton, UK. London, UK: Applied Science Publishers: 292-297.

Hydrogen fluoride attacks, via solvolysis, polysaccharides including cellulose rapidly at circumambient temperatures to yield glycosyl fluorides which are hydrolysed to the free sugars when the HF contains traces of water. We use as a source of sugars as chemical feedstock for fermentation or synthesis. Standardized wood chips of bigtooth aspen (Populus grandidentata) exposed to HF. Most of the fluoride retained after evacuation was in the water soluble fraction. The wood ash content may account for some or all of the fluoride retained. Removal of HF led to extensive sugar repolymerization. The reversion products were mainly water soluble oligosaccharides. After neutralization of the post hydrolysis products with calcium carbonate, and filtration, yeast fermented the wood sugar, with ethanol as the major distillation product.

Liao, P.Y.; Hu, Z.L.; Ji, W.L.; Wang, L.Q.; Quan, J.Y. 1981. Studies on the chemical components, fiber dimensions and pulping properties of sixteen species of fast-growing wood. Journal of Nanjing Technological College of Forest Products. 4: 16-25.

Data are presented for Populus '158', P. 'Robusta', P. euramericana (P. canadensis), P. 'I-69', P. 'I-72', P. 'I-72/58', P. euphratica, P. nigra var. italica, Paulownia fortunei, Robinia pseudoacacia, Eucalyptus 'Leizhou No. 1', E. 'Tsaauluh No. 2', E. exserta, Metasequoia glyptostroboides, and Pinus pinaster. The results indicated that the best wood for papermaking was from the fast-growing species M. glyptostroboides, P. 'I-69', and 'I-72'.

Marosvolgyi, B.; Winkler, A. 1981. Production of chips from hybrid black poplar branchwood for particleboard manufacture. Erdo. 30(4): 165-168.

Green chips were produced from slash of Populus 'Robusta' after final felling or after thinning with a processor in Hungary. After air-drying for two days the chips were converted into particles in a Maier MK 2 turboflaker at the board mill with little formation of dust. Trial particleboards of satisfactory quality were prepared from the green particles with UF, UF/MF, or PF adhesives.

Miller, I.J.; Fellows, S.K. 1981. Liquefaction of biomass as a source of fuels or chemicals. Nature (London). 289(5796): 398-399.

Softwood (chips of radiata pine), hardwood (powdered aspen (Populus) (Leuce spp.) and cellulose were converted to liquid by heating to 350degC with phenol, water and H₂ or N₂ at 3.4 MPa pressure within 30 minutes in the presence of an acid² or base catalyst, primarily by depolymerization. Each biomass source gave similar neutral products, the most common being xanthene, 2-methylbenzofuran, anisole, benzofuran, dibenzofuran, xanthone, and diphenylether in varying proportions according to the catalyst used. Crude

feedstocks for fuels or chemicals could be produced in small satellite units for more economical transport.

Rugevitsa, A. 1981. Studies of the effect of magnesium perchlorate on the process of acetylation of wood. *Raksti, Latvijas Lauksaimniecibas Akademija*. 185: 33-35.

Use of Mg (ClO₄)₂ as a catalyst in the acetylation of Scots pine, birch, aspen (Populus tremula) and linden wood with acetic anhydride reduced process time by 5-6 times and increased the degree of acetylation achieved.

1982

Arreghini, R.I. 1982. Preservative treatment of poplar posts with various concentrations of pentachlorophenol. Mendoza, Argentina: Universidad Nacional de Cuyo. 22(2): 41-44.

Populus nigra 'Chile' posts were treated with PCP, or left untreated. After a 10-year graveyard test in Argentina, 100 percent of treated posts were still in good condition, compared with 70.8 percent of the untreated posts.

Beer, D.C. 1982. Flaking high density species for structural board. In: Proceedings of the ... Washington State University international symposium on particleboard; 16: 135-160.

Carlson, U.; Samuelson, O. 1982. Soda cooking of wood meal pretreated with nitrogen dioxide. *Journal of Wood Chemistry and Technology*. 2(2): 147-159.

Chum, H.L. 1982. Biomass electrochemical research at SERI. In: SERI biomass program principal investigators review meeting; 1982 June 23; Washington, DC. Golden, CO: Solar Energy Research Institute. 14 p.

Electrochemical processing is being applied to biomass and derived materials to upgrade their energy content thereby generating fuels (or additives) or petrochemical substitutes, or increasing their reactivity and value for a variety of applications of the polymeric materials. The utilization of the following are addressed: (1) lignin polymers, (2) carboxylic acids, and (3) the upgrading of waste streams from biomass processing.

Fukazawa, K.; Revol, J.F.; Jurasek, L.; Goring, D.A.I. 1982. Relationship between ball milling and the susceptibility of wood to digestion by cellulase. *Wood Science and Technology*. 16(4): 279-285.

Gertjejansen, R.; Hedquist, D. 1982. Influence of paper birch on the properties of aspen waferboard: a mill trial. *Forest Products Journal*. 32(11/12): 33-34.

Hardt, H.; Lamport, D.J.A. 1982. Hydrogen fluoride saccharification of wood: lignin fluoride content, isolation of ..cap alpha..-D-glucopyranosyl fluoride and posthydrolysis of reversion products. *Biotechnology Bioengineering*. 24(4): 903-918.

Wood chips from bigtooth aspen (Populus grandidentata Michx.) were saccharified by reaction with hydrogen fluoride either anhydrous or containing up to 10 percent v/v water. The reaction products were separated into a solid lignin fraction and a water-soluble saccharide fraction. The fluoride content of the lignin was lowered by grinding and washing. Thus little or no chemical binding of fluoride to lignin occurred during hydrogen fluoride (HF) solvolysis.

Johns, W.E. 1982. Isocyanate bonded aspen flakeboard. *Forest Products Journal*. 32(11/12): 47-50.

Kumar, A.; Mann, R.S. 1982. Pyrolysis bark. *Journal Annals Applied Pyrolysis*. 4(3): 219-226.

Bark of Canadian hybrid poplar was shredded, dried, and pyrolysed at 573-1023 K. Below 773 K the main products were CO, CO₂, and methane; H₂ was produced above 773 K. Gas yields increased with temperature. Caloric values of the gas mixtures and carbon conversion increased with increasing temperature. A chemical reaction model for bark pyrolysis was developed on the assumption that the production of a particular gas is a first-order reaction. Formation of CO, CO₂, and methane could be predicted fairly reasonably, but more data are needed for predicting the rate of H₂ formation.

Lapierre, C.; Lallemand, J.Y.; Monties, B. 1982. Evidence of poplar lignin heterogeneity by combination of ¹³C and ¹H NMR spectroscopy. *Holzforschung*. 36(6): 275-282.

Lignin fractions were isolated by progressive extractions from poplar (Populus trichocarpa) milled wood. A first fraction, LM, was obtained by direct and exhaustive extraction with dioxane:water (9:1) and purified by precipitation. The extracted residue was treated with commercial cellulase. A second fraction, LE, was prepared by the same procedure. As the methods of extraction were very mild this result is taken as evidence of the heterogeneity of poplar lignin in situ.

MacLeod, J.M.; Berlyn, R.W.; Gooding, R.W.; Cyr, N. 1982. Upgrading decayed aspen: chemical pulping. In: *Proceedings, 1982 TAPPI pulping conference; 1982 October 25-27; Toronto, Canada*. Atlanta, GA: Technical Association of the Pulp and Paper Industry: 75-80.

The PAPRIFER chip improvement process was used to upgrade Populus tremuloides chips for pulping. By agitation, the process removes and separates low density bark, foliage, and heart rot material from the sound wood chips. Physical properties of the upgraded chip pulps were comparable to those of sound wood pulps.

Mazzocco, P. 1982. Treatment of poplar bark with caustic soda to produce animal fodder. *Annali della Facolta di Scienze Agrarie della Universita degli Studi di Torino*. 12: 277-286.

Poplar bark, a by-product of the pulp and paper industry, was treated with varying doses of NaOH up to 6 percent by dry weight and kept for up to 90 days. This had no significant effect on the fibers, but increased cellulase activity. The results show that this treatment is not economically justified.

Ozolin'sh, A.P.; Rusinya, N.A.; Kreitus, A.E.; Shenkohf, E.L.; Korotkiya, G.Ya. 1982. MB-1, a preparation for increasing the fire resistance of particleboards. *Latvijas PSR Zinatnu Akademijas Vestis*. 4: 95-100.

MB-1 is a combined fire retardant and wood preservative developed at the authors' institute and contains CuSO_4 , ammonium carbonate, borax and boric acid. Trial boards were prepared from aspen (*Populus tremula*)/birch particles by impregnating the outer layer of particles with MB-1 solution before pressing. Data are presented on the fire resistance, static bending strength, density, and water absorption of the boards. An industrial flowchart for board manufacture is presented.

Singh, S.V.; Bharati, B.; Guha, S.R.D. 1982 Neutral sulphite semichemical pulping of poplar. *Cellulose Chemistry and Technology*. 16(5): 503-510.

Sokolova, M.I.; Uzlov, G.A.; Popova, L.G. 1982. Separating Kraft soap in the processing of deciduous woods. *Hydrolysis and Wood Chemistry USSR*. 4: 23-26.

Steiner, P.R.; Andersen, A.W. 1982. Effects of veneer preheating temperature, press and assembly time on aspen LVL. *Forest Products Journal*. 32(10): 39-44.

Valtcheva, E.; Ikonopisova, B.; Valtchev, V. 1982. The adsorption stage in the sulphate poplar and spruce cooking. *Cellulose Chemistry and Technology*. 6(3): 337-345.

1983

Agodin, V.I. 1983. Integrated processing of foliage biomass in the USSR. *Holztechnologie*. 24(4): 220-225.

A system for the complete chemical conversion of conifer foliage into various products is described and the combined use of conifer and broadleaf (*Betula*, *Populus tremula*) foliage is discussed.

Arola, R.A.; Radcliffe, R.C.; Winsauer, S.A. 1983. Prototype wood chunker used on *Populus 'Tristis'*. In: Hansen, E.A., comp. *Intensive plantation culture: 12 years research*. Gen. Tech. Rep. NC-91. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 125-130.

A machine is described for cutting small trees into chunks 2 to 5 inches long. These may be more suitable than chips since they have longer fibers. Production rates and energy requirements are given.

Beckman, D.; Boocock, D.G. 1983. Liquefaction of wood by rapid hydrolysis. *Canadian Journal of Chemical Engineering*. 61(1): 80-86.

Studies were conducted on the rapid hydrolytic liquefaction of hybrid poplar (*Populus canadensis*) wood.

Blackburn, J.; Chen, R.; Kokta, B.V.; Valade, J.L. 1983. Bleaching of sulphite chemi-mechanical pulps from mixtures of hardwoods. *Pulp & Paper Canada*. 84(10): 63-68.

Bohme, P.; Lorenz, U.; Wagenfuhr, R. 1983. On the international state of the manufacture and processing of thin veneers. *Holztechnologie*. 24(1): 39-42.

A literature review relating to the manufacture of veneers and to their use as overlays. European timbers suitable for manufacture of thin veneer include maple, birch, alder, beech, walnut, and Populus nigra.

Bonn, G.; Concin, R.; Bobleter, O. 1983. Hydrothermolysis--a new process for the utilization of biomass. *Wood Science and Technology*. 17(3): 195-202.

Boocock, D.G.B.; Kallury, R.K.M.R.; Tidwell, T.T. 1983. Analysis of oil fractions derived from hydrogenation of aspen wood. *Analytical Chemistry*. 55(11): 1689-1694.

The carboxylic, phenolic, basic and neutral fractions, resulting from fractionation of 4 oil samples derived by hydrogenating Populus wood, were analysed by: IR, C13 NMR, vapor phase chromatography, high-pressure liquid chromatography, GS/mass spectrometry, and chemical ionization mass spectra.

Chiang, V.L.; Sarkanen, K.V. 1983. Ammonium sulfide organosolv pulping. *Wood Science and Technology*. 17(3): 217-226.

Dziedzic, L. 1983. Effect of using microparticles for external layers of 3-layered particleboard on static bending strength perpendicular to the surface plane. *Prace Instytutu Technologii Drewna, Poland*. 30(1/2): 141-149.

Experimental particleboards were manufactured using microparticles of Pinus sylvestris for the external layers and ordinary chips of oak, beech, birch (Betula pendula) and poplar (Populus nigra) in the internal layers. Performance was compared with that of boards having pine flakes in the external layers instead of microparticles. Static bending strength was about 20 percent less in the microparticle boards.

El'bert, A.A.; Kovrizhnykh, L.P.; Vasil'ev, V.V.; Tsvetkov, M.V. 1983. Study of the interaction of phenol formaldehyde adhesives and wood. *Khimiya Drevesiny*. 5: 105-111. Translation, Environment Canada, OOENV TR-2378. 12 p.

Ge, M.Y.; Peng, H.Y.; Dai, C.Y.; Li, J. 1983. Studies on the heating process for wood plastic combination. *Scientia Silvae Sinicae*. 19(1): 64-73.

The injection of Populus simonii timber with styrene and maleic anhydride and its processing to produce wood plastic composite are described. The mechanical properties were significantly better than those of untreated timber.

Giebeler, E. 1983. Dimensional stabilization of wood by moisture/heat/pressure treatment. *Holz als Roh- und Werkstoff*. 41(3):87-94.

Preliminary small-scale tests on dimensional stabilization of wood were carried out in a pilot reactor. Results are presented for experiments with beech, birch, poplar, pine, spruce wood, particleboard, and plywood, showing reduced swelling, shrinkage, and improved resistance to fungi and insects after treatment.

- Hatakka, A.I.; Uusi-Rauva, A.K. 1983. Degradation of ^{14}C (carbon isotope)-labelled poplar wood lignin by selected white-rot fungi. *European Journal of Applied Microbiology and Biotechnology*. 17(4): 235-242.
- Heitner, C.; Atack, D. 1983. Ultra-high-yield pulping of aspen, effects of ion content. *Pulp & Paper Canada*. 84(11): 59-64.
- Hunt, K.; Hatton, J.V. 1983. Determining the individual bleaching response of the components of a pulp mixture. *TAPPI Journal*. 66(10): 103-104.
- Klimentov, A.S.; Vysotskaya, I.F.; Shakhanova, R.K.; Stepanova, I.N.; Evdokimov, P.D.; Novikov, V.I.; Bystrov, V.F. 1983. A study of wood decomposed by radiation. 4. Effect of gamma-irradiation on the composition of aspen wood and its digestibility by ruminants. *Khimiya Drevesiny*. 5: 83-87, 126.
- Irradiation of aspen (*Populus tremula*) sawdust with MGr increased the solubility of the wood carbohydrates and alcohol/benzene extractives and the digestibility and nutritive energy value of the wood. Addition of the irradiated wood to the normal feed ration of lactating cows improved and normalized the blood physiological indices in proportion to the radiation dose.
- Krysinski, J.; Michalski, E.; Szczepaniak, J. 1983. Slicing hardwoods without waste in the production of shooks. *Prace Instytutu Technologii Drewna, Poland*. 30(3/4): 91-104.
- Slicing poplar, alder, birch, and beech into shooks 3, 5, and 8 mm thick gave a 8-12 percent higher yield than band sawing and resulted in shooks with characteristics suitable for use in producing clipped packaging boxes.
- Kumar, A.; Mann, R.S. 1983. Experimental laboratory fixed-bed study on the atmospheric pressure gasification of poplar bark with steam. *Canadian Journal of Chemical Engineering*. 61(2): 223-226.
- Poplar bark particles, exposed to a helium/water vapor atmosphere, were gasified in a fixed-bed reactor with or without a silica catalyst. The effect of temperature on gas yields, calorific value, and carbon conversion was evaluated for both the pyrolytic conversion stage and the steam-char gasification stage.
- Labrecque, R.; Kallaguine, S.; Grandmalson, J.L. 1983. Supercritical gas extraction of wood with methanol. *Industrial and Engineering Chemistry, Product Research and Development*. 23(1): 177-182.
- A semicontinuous 'spinning basket' type of reactor was designed and built for the supercritical-gas extraction of wood in a flowing solvent. Experiments were carried out to study the extraction of *Populus tremuloides* in methanol. The most important factors were shown to be temperature, pressure, and solvent flow rate; the size of the wood particles was significant at low pressures.
- Law, K.N.; Lapointe, M. 1983. Chemimechanical pulping of boles and branches of white spruce, white birch, and trembling aspen. *Canadian Journal of Forest Research*. 13(3): 412-418.

Very high yield bisulfite pulps were prepared from Picea glauca, Betula papyrifera, and Populus tremuloides. In general, the branches produced 5-7 percent less pulp than the boles and showed weaker mechanical properties. The mediocre performance may be attributable to the differences in dimension of fibers and vessel elements and the relative proportion of these cells in the wood.

Law, K.N.; Valade, J.L.; Lapointe, M. 1983. Production of CTMP (Chemithermomechanical pulp) from aspen. In: International mechanical pulping conference; 1983 June 13-17; Washington, DC. Atlanta, GA: TAPPI Press: 259-270.

MacLeod, J.M.; Berlyn R.W.; Gooding, R.W.; Cyr, N. 1983. Upgrading decayed aspen: chemical pulping. I. In: 1983 Annual meeting; 1983 March 2-4; Atlanta, GA. Atlanta, GA: TAPPI Press: 45-50.

Morozov, A. 1983. Characteristics of acetylation of comminuted wood with acetic anhydride. Trudy, Latviiskaya Sel'skokhozyaistvennaya Akademija. 206: 5-11.

The effect was studied of variation in 10 reaction variables on the percent acetylation of comminuted Populus tremula wood. Activation with acetic acid of maximum concentration at room temperature gave best results, but presence of acetic acid during the subsequent acetylation should be avoided. The use of HCl and H₂SO₄ as catalysts caused color changes during acetylation and drying. The ratios of acetic acid to wood during activation and acetic anhydride to wood during acetylation should both be at least 10:1.

Nault, G.; Lo, S.N.; Valade, J.L. 1983. Very high-yield sulphite pulp from a mixture of aspen and birch. Pulp & Paper Canada. 84(6): TR55-TR60.

Pel'nya, K.; Ziedin'sh, I.; Lielpeteris, U.; Martsin'sh, Ya. 1983. Modification of wood fiberboards with formaldehyde and ammonia during pressing. Trudy, Latviiskaya Sel'skokhozyaistvennaya Akademija. 206: 33-42.

Hardwood fibers (90 percent Betula alba, 10 percent Populus tremula) were pressed into boards following modification with a mixture of formaldehyde, ammonia and ammonium chloride and boards were thermally treated. A mathematical model of the process was used to examine the effects of concentrations of the three ingredients and thermal treatment on board properties. Modification increased strength and reduced swelling, and thermal treatment reduced swelling by 2.3-3.4 times.

Philipp, B.; Lang, H.; Schleicher, H.; Anders, W.; Magister, G.; Fischer, K. 1983. Studies on the use of hardwood pulps for chemical processing. Khimiya Drevesiny. 6: 41-48, 124.

Viscose manufacturers prefer softwood pulps to the cheaper hardwood pulps for technical reasons. Viscose pulp is currently produced from beech in Europe; problems in the use of birch and poplar have been largely overcome. Differences between viscose pulps are discussed and experiments are reviewed on ways of improving the yield and quality of beech viscose pulp, including chip pretreatment by high-energy irradiation.

Preston, A.F.; McKaig, P.A.; Walcheski, P.J. 1983. The use of laboratory, fungus cellar and field tests in the development of wood preservatives. In: Proceedings, annual meeting - American Wood-Preservers' Association. Stevensville, MD: American Wood-Preservers' Association; 79: 207-212.

Reade, A.E.; McQueen, R.E. 1983. Investigation of white-rot fungi for the conversion of poplar into a potential feedstuff for ruminants. *Canadian Journal of Microbiology*. 29(4): 457-463.

Five isolates of wood-rotting fungi were compared for their ability to increase the digestibility of poplar shavings.

Reid, I.D. 1983. Effects of nitrogen supplements on degradation of aspen wood lignin and carbohydrate components by Phanerochaete chrysosporium. *Applied and Environmental Microbiology*. 45(3): 830-837.

Saddler, J.N.; Mes-Hartree, M.; Yu, E.K.C.; Brownell, H.H. 1983. Enzymatic hydrolysis of various pretreated lignocellulosic substrates and the fermentation of the liberated sugars to ethanol and butanediol. In: 5th Symposium on biotechnology for fuels and chemicals; 1983 May 10-13; Gatlinburg, TN. New York, NY: John Wiley & Sons: 225-238.

Silitonga, Toga Mulia. 1983. Moisture transport rate and energy consumption for convective drying of fuelwood chips. *Dissertation Abstracts International*. 44/03-B: 656.

Moisture loss as a function of drying time and drying energy consumption for a convective drying of aspen (Populus tremuloides Michx.), balsam fir (Abies balsamea L. Mill.), and red pine (Pinus resinosa Air.) chips were determined for several combinations of drying conditions. A semi-empirical model was developed to relate the evaporable moisture content and elapsed drying time throughout the drying process. It was found that air temperature, chip size, airflow rate, and wood species, in that order, significantly affect the drying rate. The amount of energy consumption for convective chip drying is significantly affected by chip size, air temperature, airflow rate, and wood species.

Simionescu, C.I.; Aly, H.I.; Rozmarin, G. 1983. Possibilities of using juvenile poplarwood in the paper and fermentation industries. (2). Hydrolytic potential of juvenile poplarwood. *Celuloza si Hirtie*. 32(1): 2-6.

A study was performed to determine the hydrolytic capacity of 1-, 6-, and 8-year-old juvenile poplar wood (Populus euramericana (P. canadensis)). The wood was subjected to chemimechanical treatment in a vibratory mill. Results show that chemimechanical treatment at a low liquor ratio increases the hydrolytic capacity of juvenile poplar wood. Optimum conditions for obtaining the maximum yield of reducing substances were determined. Binary regression equations are given to show the effect of grinding time on the various chemical components of juvenile poplar wood.

Sturos, J.B.; Coyer, L.A.; Arola, R.A. 1983. Air drying of chunkwood and chips. Res. Note NC-293. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 4 p.

Preliminary measurements under uncontrolled ambient room temperature and RH showed that aspen (Populus spp.) and red maple (Acer rubrum) chunkwood dried much faster than conventional pulp-size chips with natural convective air flow, whereas the reverse was true with forced air flow. However, the saving in fan energy more than compensated for the slower drying time.

Surewicz, W. 1983. Wood as a pulping material. *Khimiya Drevesiny*. 6: 33-40, 124.

Seven wood species of Poland are compared with regard to their fiber properties, wood density, and chemical composition: Scots pine, Norway spruce/silver fir, poplar, birch, beech (or hornbeam), and oak. The most rational processes and end uses are listed for each species. The optimum use for beech pulpwood is in the viscose industry.

Tikhonova, M.V. 1983. Consumption of light hardwood in the production of single-layer parquet panels. *Derevoobrabatyvayushchaya Promyshlennost'*. 4: 12-13.

The panels are made from strips of birch or aspen (Populus tremula) laid side by side and joined by dowels glued to the end grain. Data are tabulated on the outturn of panels and of the raw material from birch or aspen logs.

Yin, S.C.; Wang, W.H.; Gao, H.H. 1983. Studies on the wood pH and buffering capacity of hybrid poplars. *Journal of Nanjing Technological College of Forest Products*. 3: 143-157.

Wood pH and buffering capacity influence the gluability of wood and knowledge of them is therefore important for plywood and particleboard manufacture. Measurements of pH were made on aqueous extracts of wood samples of four poplars and the results were analysed by the graphical equilibrium method. Regression analyses of the pH variations of wood extract solutions added to H₂SO₄ or NaOH are also given in graphs and equations.

Yin, S.C.; Wang, W.H. 1983. Improving durability of poplar plywood with vapor phase acetylation of veneer. *Scientia Silvae Sinicae*. 19(2): 168-172.

Samples of poplar wood (Populus 'Harvard', P. 'San Martino', and P. tomentosa) and plywood and of ash (Fraxinus mandshurica) and basswood (Tilia amurensis) were exposed to Lenzites trabea for 1-1/2 months in a standard soil block test. Weight loss of the plywood was three times greater than that of ash and basswood. Poplar veneer was treated with acetic anhydride and DMF as swelling agent.

1984

Bains, B.; Antal, M.; Cyr, N.; Wang, E.; Micko, M. 1984. Modification of aspen woodmeal with quaternary ammonium functional groups-1. Isolation of substituted hemicelluloses. *Journal of the Indian Academy of Wood Science*. 15(1): 12-18.

Woodmeal was reacted with 3-chloro-2-hydroxypropyl trimethyl ammonium chloride in an alkaline medium. Spectroscopy confirmed the presence of bonded quaternary ammonium groups on the various wood constituents. The spectra of water-soluble fractions indicated the existence of lignin-free, almost pure

trimethyl ammonium hydroxylpropyl derivatives of hemicelluloses which are commercially important, especially in the pulp and paper industry.

Barnet, D.; Excoffier, G.; Gagnaire, D.; Nava Saucedo, J.E.; Vignon, M. 1984. Flash hydrolysis of Populus tremuloides: separation and identification of substances extracted by water. In: Subgroup 3.5. Hydrolysis and pyrolysis. Paris, France: Ministere de la Recherche et de la Technologie: 395-402.

Fractionation of samples of P. tremuloides obtained by flash hydrolysis gave 4 fractions.

Bol'shova, N.I.; Otmennikova, Yu.N.; Safronova, N.V. 1984. Determining the quantity of aspen and birch fibers in pulp. *Bumazhnaya Promyshlennost'*. 7: 9-10.

A method was developed for determining the ratio of aspen and birch fibers in a pulp from mixtures of these hardwoods. Aspen wood and birch wood differ in their vessel structure. Whereas, aspen possesses simple perforation plates with a single rounded aperture, birch has scalariform perforation plates with up to 16-30 thin cross bars. Under a microscope, the different vessel segments are counted on a cross-hair grid and the average percent aspen and birch in the pulp is calculated.

Boone, R.S. 1984. High-temperature kiln-drying of 4/4 lumber from 12 hardwood species. *Forest Products Journal*. 34(3): 10-18.

Eight-foot samples of 1-inch lumber of 12 hardwood species was kiln dried by one of two schedules: (a) 230 degF from green to 6-8 percent moisture content in 50-55 h; and (b) conventional temperature (less than 180 degF) from green to about 20 percent moisture content, then dried to 6-8 percent moisture content at 230 degF. Schedule (b) resulted in less drying degrade, but higher kiln residence time than (a). However, kiln residence time was improved over that of conventional drying.

Bourgeois, J.P. 1984. Advantages and prospects of a 'torrefied wood' industry. In: Subgroup 3.5. Hydrolysis and pyrolysis. Paris, France: Ministere de la Recherche et de la Technologie: 469-478.

Torrefied wood is an intermediate stage between wood and charcoal, produced at around 250 degC. This makes it particularly suitable for fuel, gasification, and reduction of minerals.

Brownell, H.H.; Saddler, J.N. 1984. Steam-explosion pretreatment for enzymatic hydrolysis. In: 6th Symposium on biotechnology for fuels and chemicals; 1984 May 15-18; Gatlinburg, TN. New York, NY: John Wiley & Sons: 55-68.

Chen, R.L.; Kokta, B.V.; Valade, J.L. 1984. Bleaching of very-high-yield sulphite pulps from hardwoods. *Pulp & Paper Canada*. 85(12): 131-135.

Choi, D.H.; Shin, D.S.; Ahn, W.Y. 1984. Effect of monosaccharides extracted by saturated Portland cement solution on the setting of lignocellulosic-cement composite. *Wood Science and Technology (Mogjae-gonghak)*. 12(3): 25-34.

Monosaccharides were extracted by Portland cement from six Korean reforestation species and two agricultural waste products and analysed for xylan, mannan, arabinan, galactan, and glucan. Inhibitory index increased

with an increasing ratio of hexose:pentose. The amounts of xylose and mannose present in the lignocellulose significantly affected the inhibitory index, but there was no correlation between inhibitory index and glucose. The results suggest that P. rigida and P. densiflora would be suitable for wood-cement composites.

Christopherson, N.S. 1984. Removing single limbs using a rotary auger cutter. Res. Note NC-311. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 5 p.

A rotary auger cutter was mounted on a conventional horizontal milling machine and tested with 6 species: Acer saccharum, A. rubrum, Populus tremuloides, Betula papyrifera, Abies balsamea, and Pinus banksiana. The power required to cut single branches was highly dependent on species and relative cutter rotation direction. For all species the power requirement was low, particularly when delimiting from butt to top.

Chum, H.L.; Ratcliff, M.; Schroeder, H.A.; Sopher, D.W. 1984. Electrochemistry of biomass-derived materials. I. Characterization, practionation, and reductive electrolysis of ethanol-extracted explosively-depressurized aspen lignin. Journal of Wood Chemistry and Technology. 4(4): 505-532.

Conner, A.H. 1984. Kinetic modeling of hardwood prehydrolysis. Part I. Xylan removal by water prehydrolysis. Wood and Fiber Science. 16(2): 268-277.

The kinetics of xylan removal from quaking aspen (Populus tremuloides), paper birch (Betula papyrifera), American elm (Ulmus americana), and red maple (Acer rubrum) by water prehydrolysis was reevaluated and additional data for the water prehydrolysis of southern red oak (Quercus falcata) were obtained. Xylan removal from these hardwood species can be modelled kinetically as the sum of two parallel first-order reactions - one fast and one slow.

Deglise, X.; Martin, G. 1984. Flash pyrolysis of strips of beech and Douglas fir. In: Subgroup 3.5. Hydrolysis and pyrolysis. Paris, France: Ministere de la Recherche et de la Technologie: 421-435.

Sheets of beech and Douglas fir were gasified to 40-80 percent. The gasification percent increased with temperature.

Doat, J.; Deglise, X. 1984. Gasification of some tropical woods by flash pyrolysis at various temperatures. Comparison of flash pyrolysis with conventional slow pyrolysis. In: Subgroup 3.5. Hydrolysis and pyrolysis. Paris, France: Ministere de la Recherche et de la Technologie: 403-420.

Du Sault, A. 1984. Evaluation of crushing rolls configurations to process woody biomass. In: Robertson, Doris, proc. coord; White, Julia, ed. assist. Comminution of wood and bark; 1984 October 1-3; Chicago, IL. Madison, WI: Forest Products Research Society: 193-200.

El Ghezal, L.; Hemati, M.; Laguerie, C. 1984. Flash pyrolysis of wood in a fluidized bed. In: Subgroup 3.5. Hydrolysis and pyrolysis. Paris, France: Ministere de la Recherche et de la Technologie: 455-467.

Tests were carried out on the pyrolysis of fir sawdust in electrically-heated sand held in nitrogen, water vapor or a mixture of these.

Filipov, G.; Genchev, G. 1984. Investigation of the influence of blade thickness in the chipless cutting of natural wood. Nauchni Trudove, Vissh Lesotekhnicheski Institut, Sofiya, Mekhanichna Tekhnologiya na D"rvesinate. 27/28: 155-160.

Experiments were made on the cutting of wood without the formation of chips. The woods used were Scots pine, poplar, and beech. There was a linear relationship between blade thickness and cutting force, and equations are presented describing this relationship for each species.

Frank, M.E.; Mednick, R.L. 1984. Utilization of five carbon sugars in the cellulose to ethanol process. In: Proceedings, 6th International symposium on alcohol fuels technology; 1984 May 21-25; Ottawa, Canada: 3/434-3/446.

Johnson, D.K.; Black, S.; Ratcliff, M.; Chum, H.L.; Burnett, C.A.; Glasser, W.G. 1984. Reductive electrolysis of explosively depressurized aspen lignin. Journal of the Electrochemical Society. 131(3): 106.

Kashmoula, T.; Sabharwal, H.S.; Abdulmajid, N.; Radwan, N.F. 1984. Pulping characteristics of Populus nigra grown in middle region of Iraq. Iraqi Journal of Agricultural Sciences 'Zanco'. 2(2): 75-83.

Kubes, G.J. 1984. The effect of wood species on kraft recovery furnace operation - an investigation using differential thermal analysis. Journal of Pulp and Paper Science. 10(3): 63-68.

Activation energies of spent liquors were calculated for the following Canadian species: black spruce, jack pine, balsam fir, coastal western hemlock and Douglas fir, interior red cedar (Juniperus virginiana), poplar, sugar maple, and white birch (Betula papyrifera) and 3 mixtures. Red cedar and jack pine had higher activation energies than other softwoods. Sugar maple and white birch had lower activation energies than poplar.

Lapierre, C.; Monties, B.; Guittet, E.; Lallemand, J.Y. 1984. Photosynthetically ¹³C-labelled poplar lignins: ¹³C NMR experiments. Holzforschung. 38(6): 333-342.

Poplars were grown from cuttings under air containing CO₂ with C for three months. ¹³C-labelled lignin fractions were isolated and characterized by ¹³C NMR spectroscopy.

Lede, J.; Verzaro, F.; Antoine, B.; Villermaux, J. 1984. Recent progress in the development of reactors for flash pyrolysis of wood. In: Subgroup 3.5. Hydrolysis and pyrolysis. Paris, France: Ministere de la Recherche et de la Technologie: 437-454.

The advantages of the cyclone reactor are discussed.

Li, J.; Song, J.D.; Sun, N.C. 1984. Study on improving dimensional stabilization of wood. Journal of North-Eastern Forestry Institute, China. 12(4): 76-81.

Samples of Pinus massoniana, Schima superba, Eucalyptus umbellata, E. robusta, Larix dahurica (gmelinii), and Populus simonii were treated by acetylation, metal oxide, or polyethylene glycol. Acetylation was the most effective treatment against shrinkage.

Li, Q.Z.; Xu, X.W.; Gu, J.Y. 1984. Study on technology of making particleboard using DN-1 low-poisonous urea-formaldehyde resin. Journal of North-Eastern Forestry Institute, China. 12(1): 72-77.

Tests are reported on making grade I particleboards from wood shavings of Korean pine (Pinus koraiensis), birch, aspen (Populus tremula), elm, alder, Masson's pine (Pinus massoniana), China fir (Cunninghamia lanceolata), and larch.

Li, Y.G.; Liu, S.S.; Li, J.G.; Ren, X.M.; Dung, A.F.; Fang, G.H. 1984. Analysis of the chemical constitution for main species of woods in Northeast Region. Journal of North-Eastern Forestry Institute, China. 12(3): 149-151.

Results are given for samples of Chosenia arbutifolia, Betula costata, Pinus sylvestris var. mongolica, Populus suaveolens, Prunus maackii, Maackia amurensis, Malus baccata, Alnus hirsuta, Acer triflorum, and Ulmus laciniata, collected in China.

Lo, S.N.; Law, K.N.; Koran, Z.; Valade, J.L. 1984. Very high-yield pulps from aspen and birch. In: Ricker, N. Lawrence, ed. Application of chemical engineering in the forest products industry. AIChE Symposium Series. 232(80): 34-39.

Mahmood, A.; Mahmood, T. 1984. Estimation of holocellulose, alpha-cellulose and lignan contents of wood of some Populus species growing in Pakistan. Pakistan Journal of Botany. 16(1): 43-48.

P. ciliata, P. deltoides, P. euphratica, and P. euramericana had higher holocellulose content and lower extractives content than conifers, and similar lignin contents, and are considered suitable for pulping.

Min, D.S.; Lee, J.G. 1984. Studies on the catalytic pyrolysis products of hardwood. Journal of Korean Forestry Society. 65: 12-23.

Samples from 5- to 12-year-old trees of Alnus hirsuta, Quercus acutissima, Robinia pseudoacacia, and Populus tomentiglandulosa treated with monobasic ammonium phosphate, ammonium sulphate, ammonium chloride or urea, and untreated samples were pyrolysed. Charcoal yield increased as catalyst concentrations and species lignin content increased.

Monzie, P.; Pichon, M.; Lombardo, G.; Schwob, Y. 1984. The flash hydrolysis technique: performance and prospective uses. In: Subgroup 3.5. Hydrolysis and pyrolysis. Paris, France: Ministere de la Recherche et de la Technologie: 365-394.

Experiments with a pilot flash hydrolysis plant showed that the yield of the process was dependent on the length of treatment and the pressure in the reactor.

Ostrovski, C.M.; Aitken, J.; Free, D.; Egneus, H.; Ellegard, A. 1984. New developments in fuel ethanol production by gaseous anhydrous hydrofluoric acid hydrolysis of hardwood, Populus tremuloides. In: Egneus, H.; Ellegard, A., eds. Bioenergy '84: Proceedings of conference; 1984 June 15-21; Goteborg, Sweden. Barking, UK: Elsevier Applied Science Publishers: 181-187.

Anhydrous hydrofluoric acid (HF) in the gaseous phase was utilized to hydrolyze poplar wood to produce monomeric sugars for fermentation to fuel

ethanol. Test results have shown that sugar yields for hexose and pentose consistently exceeded those of other hydrolysis technologies.

Puls, J.; Poutanen, K.; Viikari, L. 1984. The effect of steaming pretreatment on the biotechnical utilization of wood components. In: Egneus, H.; Ellegard, A., eds. Bioenergy '84: Proceedings of conference; 1984 June 15-21; Goteborg, Sweden. Barking, UK: Elsevier Applied Science Publishers; 3: 173-180.

Wood chips of poplar, birch, and eucalyptus, or chopped residues of various annual plants (wheat and rice straw, sugar cane, bagasse) were treated in a laboratory defibrator with saturated steam. The fiber fractions were subjected to enzymatic hydrolysis with Trichoderma reesei cellulase and Aspergillus niger beta-glucosidase. The steaming pretreatments were successful in increasing the accessibility of the cellulose in the fiber fractions to enzymatic degradation. Data are also reported on ethanol production from fermentation of the pentose fraction by Fusarium oxysporum.

Roy, C.; Lalancette, A.; de Caumia, B.; Blanchette, D.; Cote, B.; Renaud, M.; Rivard, P. 1984. The vacuum pyrolysis of biomass for the production of chemicals and oils. In: Egneus, H.; Ellegard, A., eds. Bioenergy '84: Proceedings of conference; 1984 June 15-21; Goteborg, Sweden. Barking, UK: Elsevier Applied Science Publishers; 3: 31-37.

A process is described in which oils and chemicals are continuously produced by thermal decomposition of poplar wood (Populus 'I-45/51') particles under reduced pressure. Preliminary economic data are reported for a plant processing 10 t/h of wood with moisture content of 10 percent.

Samkova, M.; Farkas, J. 1984. Chemical characteristics of hardwood species for processing to kraft pulp. Drevarsky Vyskum. 29(2): 31-41.

The chemical composition, cooking times for the preparation of bleached and unbleached pulps, and their properties were investigated for: Robinia, Quercus robur, Q. cerris, beech, hornbeam, Betula pendula, Populus tremula, Salix alba, Tilia cordata, and Alnus glutinosa.

Santosa, Krishna Agung. 1984. Protein and fiber studies in ruminant animals. Dissertation Abstracts International. 45/03-B: 735.

Two studies were conducted to determine protein and fiber disappearance from the rumen. The first part of these studies was designed to evaluate protein utilization of dehydrated alfalfa by ruminants and to measure effects of heating (120 C under 1 kg/cm² steam pressure) on ruminal degradation of alfalfa protein. The second part of these studies involved evaluation of effect of moisture content, sodium hydroxide, and anhydrous ammonia treatments on in vitro fiber digestion of aspen (Populus tremuloides).

Scott, D.S.; Piskorz, J. 1984. Production of liquids from biomass by continuous flash pyrolysis. In: Egneus, H.; Ellegard, A. eds. Bioenergy '84: Proceedings of conference; 1984 June 15-21; Goteborg, Sweden. Barking, UK: Elsevier Applied Science Publishers; 3: 15-22.

Data are presented on the yields and physical and chemical characters of pyrolysis oils produced from various types of biomass feed (bark free wood or whole tree samples from 8-year-old Populus canescens, and wheat straw, as various sized particles). Yields of organic liquids of 65 percent were

routinely obtained from poplar; yields from straw were lower. The oils were suitable for use as low-grade fuel.

Scott, R.W.; Libkie, K.A.; Springer, E.L. 1984. Comparison of a gravimetric CO₂ method for uronic anhydride with a colorimetric method. *Journal of Wood Chemistry and Technology*. 4(4): 497-504.

Colorimetry gave consistently lower uronic anhydride values than did measurement by evolved CO₂, for samples of Populus tremuloides, Quercus falcata, Pinus elliottii, and Pseudotsuga taxifolia (P. menziesii). Because the colorimetric method is more selective it is concluded that it is the more accurate method.

Schubert, B.; Wienhaus, O. 1984. Measurement of the course of hydration temperature as a test method in the manufacture of wood cement products. *Holztechnologie*. 25(3): 118-122.

Studies were made on various wood/cement mixtures incorporating any of 14 types of cement manufactured in E. Germany and Scots pine or poplar wood wool, with or without addition of MgCl₂ as a hardening accelerator. Satisfactory hardening could be obtained with pine-cement mixtures, a blast furnace cement was unsuitable. Poplar-cement mixtures required the addition of MgCl₂.

Sturos, J.B. 1984. Characterization and air drying of chunkwood and chips. Res. Note NC-308. St. Paul, MN. U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 6 p.

Chunkwood of aspen (Populus spp.) and sugar maple comprised a few large particles and many small particles, but large particles constituted almost half the total weight. For both species, chunks dried faster than chips to 20 percent moisture content.

Ward, J.C. 1984. Influence of wetwood on pulsed-current resistances in lumber before and during kiln-drying. *Wood and Fiber Science*. 16(4): 598-617.

Measurements of resistance to a pulsed electric current were lower in wetwood ('sinkerheart') of aspen (Populus tremuloides) and white fir (Abies concolor) than in normal wood both before and during kiln-drying. The physicochemical properties of wetwood associated with lower resistances are apparently due to invasion of the living tree by bacteria. Wetwood also caused discrepancies in the estimation of fiber saturation point from measurements of shrinkage and of pulsed-current resistances taken during kiln-drying.

Wayman, M.; Tallevi, A.; Winsborrow, B. 1984. Hydrolysis of biomass by sulphur dioxide. *Biomass*. 6(1/2): 183-191.

Results of hydrolysis of several types of cellulosic biomass, namely pine sawmill residues, aspen poplar chips, sugarcane bagasse, wheat straw, and maize cobs, are presented in which sulphur dioxide was the hydrolysis catalyst. Some economic consequences of this process are discussed. Yields of ethanol, butanol, and furfural from these raw materials were estimated.

Wayman, M.; Tallevi, A.; Winsborrow, B. 1984. Hydrolysis of cellulose to fermentable sugars by sulphur dioxide. In: *Proceedings, 6th International*

symposium on alcohol fuels technology; 1984 May 21-25; Ottawa, Canada: 2/239-2/245.

Yu, E.K.C.; Deschatelets, L.; Saddler, J.N. 1984. Combined enzymatic hydrolysis and fermentation approach to butanediol production from cellulose and hemicellulose carbohydrates of wood and agricultural residues. In: Proceedings, 6th symposium on biotechnology for fuels and chemicals; 1984 May 15-18; Gatlinburg, TN. New York, NY: John Wiley & Sons: 341-352.

A combined enzymatic hydrolysis and fermentation (CHF) approach was established for the bioconversion of wood and agricultural residues to butanediol and ethanol. The final butanediol levels obtained from aspenwood xylan or solka floc by the CHF approach were 40-68 percent greater than with the conventional sequential hydrolysis and fermentation approach.

1985

Antal, M.; Cyr, N.; Micko, M.M. 1985. Isolation of substituted hemicelluloses from aspen. Agriculture & Forestry Bulletin-Alberta University. 8(1): 55-57.

Bas, F.J.; Ehle, F.R.; Goodrich, R.D. 1985. Evaluation of pelleted aspen foliage as a ruminant feedstuff. Journal of Animal Science. 61(5): 1030-1036.

Growth and digestion trials were made to determine the nutritive value of pelleted aspen (Populus tremuloides) foliage as a dietary ingredient for sheep. Lambs offered diets without or with 25, 50, and 75 percent aspen leaves, with lucerne as the other dietary ingredient, ate less and gained less weight as the proportion of aspen leaves in the diet increased (P 0.05).

Bestue-Labazuy, C.; Soyer, N.; Bruneau, C.; Brault, A. 1985. Study of the direct liquefaction of wood in the presence of iron additives. In: Palz, W.; Coombs, J.; Hall, D.O., eds. Proceedings, Energy from biomass: 3d E.C. conference; 1985 March 25-29; Venice, Italy. London, UK: Elsevier Applied Science Publishers: 924-928.

Dry Populus 'Robusta' wood was heated with FeSO₄, FeCl₂, FeCl₃, Fe₃O₄, Fe oxalate, ferric hydroxide, or Fe powder in water with a H/He mixture at a pressure of 1-63 bar. Fe powder was found to catalyze the production of an acceptable oil.

Blechsmidt, J.; Blossfeld, O.; Fritzsching, H.; Engert, P. 1985. Importance of raw wood quality for groundwood production. Zellstoff und Papier. 34(2): 64-66.

The moisture content of wood for grinding should be at least 30-35 percent; methods for reactivating dry wood are examined. Pine is more suitable than spruce or poplar for mechanical pulps.

Bonn, G.; Schwald, W.; Bobleter, O.; Benea, V.I. 1985. Hydrothermolysis of short rotation forestry plants. In: Palz, W.; Coombs, J.; Hall, D.O., eds. Proceedings, Energy from biomass: 3d E.C. conference; 1985 March 25-29; Venice, Italy. London, UK: Elsevier Applied Science Publishers: 953-958

A new method for obtaining compounds of low molecular weight such as glucose, xylose, cellobiose, and further degradation products such as furfural and hydroxymethylfurfural.

Boocock, D.G.B.; Sherman, K.M. 1985. Further aspects of powdered poplar wood liquefaction by aqueous pyrolysis. *Canadian Journal of Chemical Engineering*. 63(4): 627-633.

Yields of oil from liquefaction of powdered poplar wood by rapid pyrolysis in water were improved by reactor pressurization, in contrast to liquefaction of wood chips.

Boocock, D.G.B.; Agblevor, F.; Holysh, M.; et al. 1985. Liquefaction of poplar chips by aqueous thermolysis. In: Klass, Donald L., chair. *Energy from biomass and wastes 9*; 1985 January 28-February 1; Lake Buena Vista, FL. Chicago, IL: The Institute of Gas Technology: 1107-1127.

Brebner, K.I.; Schneider, M.H. 1985. Wood-polymer combinations: bonding of alkoxysilane coupling agents to wood. *Wood Science and Technology*. 19(1): 75-81.

Trembling aspen (Populus tremuloides) was impregnated with the coupling agent gamma-methacryloxypropyltrimethoxysilane and the hygroscopicity and anti-shrink efficiency measured before and after water extraction. There was a reduction in hygroscopicity with treatment. There was limited reversibility after water extraction. There was a diversity of sorption environments within the wood-silane complex.

Cermak, J.; Bozdech, J. 1985. Wood density tables for softwoods and hardwoods. Bratislava, Czechoslovakia: Alfa Technical and Economic Literature. [Review in *ABIPC* 56: 9046].

Density is tabulated for all commercially important species in Czechoslovakia: spruce, fir, pine, oak, beech, hornbeam, ash, maple, elm, locust (Robinia pseudoacacia), birch, aspen (Populus), poplar, willow, alder, and linden.

Chen, Z.J.; Zhu, K.J. 1985. Optimization of hot pressing of compound plywood. *Journal of Nanjing Forestry Institute*. 1: 137-141.

Optimal values were calculated for parameters associated with pressing Populus 'I-69' plywood.

Chum, H.L.; Johnson, D.K.; Ratcliff, M.; Black, S.; Oiticica, B.; Wallace, K.; Schroeder, H.A.; Robert, D.; Sarkanen, K.V. 1985. Lignin characterization research: a progress report. In: *Biochemical conversion program semi-annual review meeting*; 1985 June 10; Golden, CO. Golden, CO: Solar Energy Research Institute: 25-52.

A comparison between lignins isolated in wood pretreatments of steam explosion and organic/aqueous solvent delignification (organosolv) with lignin isolated by mild wood ball milling is presented for aspen (Populus tremuloides) and black cottonwood (Populus trichocarpa). The comparative ability of steam-exploded and organosolv lignins with that of conventional kraft (hardwoods and softwoods, with and without previous activation by

reaction with formaldehyde) to replace phenol in phenol-formaldehyde thermosetting resins is examined.

Connor, A.H.; Libkie, K.; Springer, E.L. 1985. Kinetic modeling of hardwood prehydrolysis. Part II. Xylan removal by dilute hydrochloric acid prehydrolysis. *Wood and Fiber Science*. 17(4): 540-548.

A study was made of the kinetics of xylan hemicellulose removal with HCl from quaking aspen (Populus tremuloides), paper birch (Betula papyrifera), American elm (Ulmus americana), red maple (Acer rubrum), and southern red oak (Quercus falcata). The mathematical model developed in Part I to describe the kinetics of xylan removal by water prehydrolysis of these species could be used to model xylan removal with dilute hydrochloric acid. Xylan removal could thus be modelled as the sum of two parallel first-order reactions - one fast and one slow. The model thus provides a good approximation of xylan removal from any temperate hardwood with dilute hydrochloric acid at the reaction conditions studied.

Garrett, L.D. 1985. Delayed processing of felled trees to reduce wood moisture content. *Forest Products Journal*. 35(3): 55-59.

Live New England hardwood and softwood trees were felled and their moisture content monitored over a 14-day period. The hardwoods were Fraxinus americana, Acer saccharum, Betula populifolia, Betula alleghaniensis, Fagus grandifolia, Acer rubrum, Populus tremuloides, Alnus rubra, and Prunus serotina. The softwoods were Pinus strobus, Picea rubens, Tsuga canadensis, and Abies balsamea. The greatest losses occurred in soft hardwood species. The 3 to 5 percent total moisture loss observed could reduce transport and handling costs, and increase energy yields of wood used in energy production.

Geimer, R.L. 1985. Steam-injection pressing of isocyanate-bonded aspen flakeboards. Latitudes and limitations. Res. Pap. FPL-456. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 16 p.

Injection of steam into the flakeboard mat during pressing can significantly reduce press time. In laboratory tests with a commercial-scale press it was shown that flakeboard could be cured in 60 s by injecting 99 Btu of steam per pound weight of board. Blisters formed in high-density thin boards and temperature variation was high in low-density thick boards but these could be compensated for by using press cycles individually suited to each combination of board thickness and relative density.

Gertejansen, R.; Panning, D. 1985. Method for waferizing balsam poplar. *Forest Products Journal*. 35(4): 53-54.

When waferizing balsam poplar (Populus balsamifera), waferizer knives eventually can become wrapped with gelatinous fibers which reduces their effectiveness and results in poor quality wafers and an increased amount of fines. It was found that waferizing balsam poplar alternately with paper birch (Betula papyrifera) improved wafer quality because the fiber-wrapped knives were cleaned when they came in contact with the high density birch.

Hatton-Head, J.V. 1985. Kraft pulping of mixtures of hardwood chips and softwood fines. In: *Pulping conference; 1985 November 3-7; Hollywood, FL.* Atlanta, GA: TAPPI Press: 19-22.

Jackson, M.; Falk, B.; Akerlund, G. 1985. High-yield pulp from North American aspen. *Tappi Journal*. 68(11): 62-66.

Kai, Y. 1985. Bleaching of blue stain in aspen wood. *Bull.* 35. Shizuoka, Japan: Shizuoka University, Faculty of Agriculture: 43-47.

Stained Populus tremuloides wood was given 1 of 11 chemical treatments. Of these the most effective were Na chlorite followed by hydrogen peroxide.

Koval'chuk, L.M.; Zhukova, A.S.; Netushil, N.E. 1985. Penetrating power of glues during wood gluing. *Derevoobrabatyvayushchaya Promyshlennost'*. 9: 3-4.

PF glue penetration into wood was compared in Norway spruce, birch, and aspen (Populus tremula) with a 'holding open' time delay of up to 60 minutes between glue application and joining. Strength variability increased with increased holding-open time, but only to a small extent with 2-sided application which gave generally stronger joints. Results suggest that joints should be closed before penetration is complete so that excess glue remains to lubricate the joint.

Lange, H.; Simatupang, M.H. 1985. Manufacture of wood cement from Norway spruce and poplar particles: interaction of five factors and their effect on board strength. *Holz als Roh- und Werkstoff*. 43(6): 229-236.

Studies were made on the effect of various materials and process factors on the bending and IB strength of spruce-cement and poplar-cement boards. Prolonged press time generally improved board strength. Results indicated that the optimal ratio of 'effective' water:cement should be determined individually for each given set of manufacturing conditions.

Liu, Z.; Haygreen, J.G. 1985. Drying rates of wood chips during compression drying. *Wood and Fiber Science*. 17(2): 214-227.

Compression drying is basically a process of forcing the free water in wood to move under high hydrostatic pressure through a solid structure. A study was conducted to provide an initial evaluation of the effect of pressure, wood density, and particle (chip) size on free water extraction. Five species - aspen (Populus spp.), balsam fir, jack pine, red maple (Acer rubrum), and red oak - were tested. The analysis of variance for species showed highly significant differences in final moisture content. Size of chips had a significant effect on final moisture content. Compressed density of hammermilled chips was slightly higher than that of unrefined chips. High density chips required higher pressure to initiate effective drying rates.

MacLeod, J.M. 1985. Alkaline sulfite-anthraquinone pulp from aspen. In: *Pulping conference; 1985 November 3-7; Hollywood, FL. Atlanta, GA: TAPPI Press: 479-485.*

Mathews, J.F.; Tepylo, M.G.; Eager, R.L.; Pepper, J.M. 1985. Upgrading of aspen poplar wood oil over HZSM-5 zeolite catalyst. *Canadian Journal of Chemical Engineering*. 63(4): 686-689.

Liquefaction oils from Populus tremuloides were treated with HZSM-5 zeolite catalyst to give products rich in benzene, toluene, xylenes, and aromatics.

Nyars, J. 1985. Experiments in particleboard manufacture. *Faipar*. 35(1): 16-18.

Particle binding materials with properties different from those of UF adhesives were tried in order to improve the moisture resistance of boards for the building industry. Best results were given by a binder with an isocyanate content of 29-32 percent (free from solvent), density 1.235 g/cm³ and viscosity 500 mPa s.

Ostrovski, C.M.; Aitken, J.C.; Hayes, R.D. 1985. Hydrolysis of poplar wood using hydrofluoric acid for the production of fuel ethanol. In: Klass, Donald L., chair. *Energy from biomass and wastes 9*; 1985 January 28-February 1; Lake Buena Vista, FL. Chicago, IL: The Institute of Gas Technology: 895-914.

Otjen, L.; Blanchette, R.A. 1985. Selective delignification of aspen wood blocks in vitro by three white rot basidiomycetes. *Applied and Environmental Microbiology*. 50(3): 568-572.

Panning, D.J.; Gertjejansen, R.O. 1985. Balsam poplar as a raw material for waferboard. *Forest Products Journal*. 35(5): 49-54.

Results showed that frozen small diameter (5 inch) balsam poplar (*Populus balsamifera*) and aspen (*Populus tremuloides*) bolts both required approximately the same length of time to thaw, but for large diameter bolts (10 inch), a considerably longer time was required to thaw balsam poplar. Balsam poplar was difficult to waferize because of its high gelatinous fiber content.

Pepper, J.M.; Eager, R.L.; Roy, J.C.; Mathews, J.F. 1985. Studies on the mechanism of formation of the products of liquefaction of cellulose and aspen poplar wood. *Journal of Wood Chemistry and Technology*. 5(4): 491-511.

Preston, A.F.; Walcheski, P.J.; McKaig, P.A. 1985. Recent studies with ammoniacal copper carboxylate preservatives. *Proceedings, American Wood-Preservers' Association*. 81: 30-38.

Samples of white birch (*Betula papyrifera*), Douglas fir, aspen (*Populus tremuloides*), and southern yellow pine (*Pinus* spp.) were treated with different retentions of ammoniacal copper/octanoic acid and tested for decay (with *Poria placenta*, *Gloeophyllum trabeum*, and *Coriolus versicolor*). Results showed that ammoniacal Cu carboxylate performed as well as CCA and has good potential as a water-borne ground contact preservative.

Reid, I.D. 1985. Biological delignification of aspen wood by solid-state fermentation with the white-rot fungus *Merulius tremellosus*. *Applied and Environmental Microbiology*. 50(1): 133-139.

Solid-state fermentation of aspen (*Populus tremuloides*) wood with *M. tremellosus* for 8 weeks removed 52 percent of the lignin but only 12 percent of the total wood weight. Delignification was fastest at temperatures between 25 and 32.5 degC. Initial pH values between 4 and 6 were optimal.

Risenhoover, K.L.; Renecker, L.A.; Morgantini, L.E. 1985. Effects of secondary metabolites from balsam poplar and paper birch on cellulose digestion. *Journal of Range Management*. 38(4): 370-372.

Roy, C.; de Caumia, B.; Blanchette, D.; et al. 1985. Development of a biomass vacuum pyrolysis process for the production of liquid fuels and chemicals. In: Klass, Donald L., chair. Energy from biomass and wastes 9; 1985 January 28-February 1; Lake Buena Vista, FL. Chicago, IL: The Institute of Gas Technology: 1085-1105.

Saddler, J.N.; Yu, E.K.C.; Mes-Hartree, M.; Levitin, N.; Brownell, H.H. 1985. The fractionation of lignocellulosic substrates by steam explosion and the subsequent conversion of the various components to sugars, fuels and chemicals. In: Palz, W.; Coombs, J.; Hall, D.O., eds. Proceedings, Energy from biomass: 3d E.C. conference; 1985 March 25-29; Venice, Italy. London, UK: Elsevier Applied Science Publishers: 978-981.

Sasaki, H. 1985. Low-density particleboard with isocyanate adhesive. In: Proceedings: Symposium on forest products research international achievements and the future; 1985 April 22-26; Pretoria, South Africa. Pap. 9-13. South Africa: Council for Scientific and Industrial Research; 6: 12 p.

Particleboards with average density of 0.39 g/cm^3 were made with Shorea residues and an unemulsified isocyanate adhesive. Two density peaks were observed at a depth of 1 mm from the outside of both faces. The density gradient was steepest in boards manufactured under higher pressure and with longer pressing times. Boards with steep density gradients had greater thickness swelling and lower strength properties than boards with more uniform density profiles. It was found that bending strength in OSB boards was superior to that in randomly-oriented boards.

Schneider, M.H.; Brebner, K.I. 1985. Wood-polymer combinations: the chemical modification of wood by alkoxysilane coupling agents. Wood Science and Technology. 19(1): 67-73.

The coupling agent, gamma-methacryloxypropyltrimethoxysilane, was used to modify the wood of Populus tremuloides, Pinus strobus, and Betula papyrifera. The anti-shrink efficiency values of the modified wood compared well with those of southern pine treated with anhydrides, epoxides, and isocyanates.

Schroeder, P.; Parameswaran, N. 1985. Production and characterization of wood polymer composites based on low-viscosity epoxy resins. Part 1. Physical properties. Holzforschung. 39(4): 209-221.

Wood samples of Pinus radiata, Picea abies, Fagus sylvatica, and Populus marilandica, free of decay and failure, were impregnated with mixtures of a low-viscosity epoxy resin used as an embedding medium for electron microscopy. The wood samples were either dehydrated using acetone or were directly impregnated with the resin after oven-drying and subsequently polymerized thermocatalytically in situ. Analysis of density gradients and profiles showed regular, homogeneous penetration over the cross-sectional area and in the longitudinal direction.

Simatupang, M.H.; Lu, X.X. 1985. Effect of wood chemical components on the hardening of gypsum plaster and the manufacture of gypsum board. Holz als Roh- und Werkstoff. 43(8): 325-331.

The effects on plaster stiffening time, hydration time, and temperature were studied of aqueous extracts of 21 wood species and Norway spruce bark, 24

chemical compounds found in wood extracts, and 10 fractions isolated from aqueous extracts of Eucalyptus exserta and oak. Woods containing hydrolysable tannins had strong retardant effects on plaster hardening. Very weak solutions of conidendrin accelerated hardening, while a concentrated solution retarded hardening. Three-layer gypsum boards were made using Norway spruce, poplar, or birch particles and various amounts of tannin added as a retarder. Bending strength of finished boards was (generally) greatest in poplar-gypsum boards and lowest in birch-gypsum boards.

Sokolova, A.A.; Rozenberger, A.N.; Semakova, L.A.; Burlak, E.S.; Boddanovich, L.M. 1985. Analysis of spent liquors from oxygen-alkaline pulping of hardwood and spent tan. 1. Characteristics and group composition of organic substances in spent liquors. *Khimiya Drevesiny*. 2: 50-53, 122.

A method of proximal analysis into eight chemical fractions is described. Data are tabulated for waste liquors removed from either birch/aspen (Populus tremula) or aspen chips/spent tan mixtures at three stages of pulping.

Solantausta, Y. 1985. The solubility of wood in potentially wood derivable solvents. *Tutkimuksia, Valtion Teknillinen Tutkimuskeskus, Finland*. 376: 87 p.

The literature on basic aspects of wood liquefaction is reviewed and results are presented of an experimental investigation of the initial processes for making wood soluble by liquefaction. Populus deltoides wood was treated with: water, methanol, methanol/water, diethylene-glycol, phenol/water, and toluene. There was a correlation between swelling power of the solvent and the solubilization of hemicellulose.

Solov'ev, V.A.; Malysheva, O.N.; Maleva, I.L.; Saplina, V.I. 1985. Changes in the chemical composition of wood attacked by wood-destroying fungi. *Khimiya Drevesiny*. 6: 94-100, 128.

Small specimens of aspen (Populus tremula) sapwood were incubated with cultures of 42 strains of 13 species of white-rot fungi (Coriolus spp., etc.). In 12 of the species losses of cellulose and lignin were nearly equal. Several species, notably Inonotus rheades, removed lignin selectively in the early stages of decay. Only certain strains of Phanerochaete sanguinea were able to remove substantial amounts of lignin without loss of cellulose. Tests of P. sanguinea showed the greatest selectivity for lignin in birch and aspen, although some strains were fairly selective on spruce. Active strains began to degrade cellulose after removing 50-70 percent of the lignin. The application of P. sanguinea in wood pulping is suggested.

Teng, K.F.; Mutharasan, R. 1985. Kinetics of conversion of high-solids biomass slurries to glucose by acid hydrolysis. In: Klass, Donald L., chair. *Energy from biomass and wastes 9; 1985 January 28-February 1; Lake Buena Vista, FL. Chicago, IL: The Institute of Gas Technology: 873-894.*

Tikhonova, M.V. 1985. Yield of dimension stock for single-layer parquet boards. *Derevoobrabatyvayushchaya Promyshlennost'*. 10: 13-14.

Yields of blanks for flooring strips, in single or multiple lengths, were determined by sawing up unedged lumber of birch or aspen (Populus tremula) of various grades and sizes. Data are tabulated for flooring of nominal

thickness 27 or 16 mm, by lumber grades. The outturn of dimension stock was always higher for aspen than for birch.

Vinogradov, V.N.; Chudakov, M.I. 1985. Effect of phenolic extractives on the process of alkaline solubilization of lignin and delignification of wood. *Khimiya Drevesiny*. 2: 63-64, 124.

The catalytic effect of anthraquinone in the alkaline pulping of aspen wood (*Populus tremula*) was further increased by adding one percent of an alkaline extract of eucalypt wood (*Eucalyptus viminalis*). Results suggest that the extractives not only reduce anthraquinone to the more active anthrahydroquinone but are themselves catalytically active after oxidation to quinones.

Yasinskii, V.S.; Merkelov, V.M. 1985. Breakdown methods for low-grade aspen logs. *Derevoobrabatyvayushchaya Promyshlennost'*. 7: 10-11.

More than half of the aspen (*Populus tremula*) logs received at a group of sawmills in Leningrad Province, Russia, contained internal rot, usually in excess of that tolerated in hardwood saw logs. The possibility of converting such logs into dimension stock was investigated by computer simulation. Multiple regression equations are presented for yields of uniform dimension stock in terms of log diameter and stock dimensions. Typical volume yields of base strips for parquet from defective logs of diameter 20-24 cm were 22-29 percent.

Zakharenko, V.N.; Bondareva, T.A.; Mutovina, M.G. 1985. Studies on the whole-tree utilization of hardwoods. 4. Sulphate pulping of whole-tree birch and aspen with varying alkali consumption. *Khimiya Drevesiny*. 4: 46-50, 122.

Trials were made with 12-20 percent alkali on total biomass or debarked stemwood of both species. Total biomass yielded bleachable pulp of maximum strength at an alkali consumption of 16 percent. However, folding resistance was considerably lower than in pulp from debarked stemwood, especially in birch.

Zhou, D.G.; Mo, W.J.; Yao, Z. 1985. Mechanical aligning of strands in strandboards manufacturing. I. An orienting rail installation and its orienting effectiveness. *Journal of Nanjing Institute of Forestry*. 2: 79-85.

Boards were made from strands of *Populus* 'San Martino' ('I-72') using an orientation device. Average orientation was found to depend on vibration frequency, the distance (height) the strands were allowed to fall and the distance between the rail plates of the equipment.

1986

Ahmed, A.; Grandmaison, J.L.; Kaliaguine, S. 1986. Characterization of the solid residues of the supercritical extraction of *Populus tremuloides* in methanol. *Journal of Wood Chemistry and Technology*. 46(2): 219-248.

Antal, M.; Simkovic, I.; Ebringerova, A.; Micko, M.M. 1986. New aspects in cationization of lignocellulose materials. IV. Modification of aspen wood meal

with quarternary ammonium groups. *Journal of Applied Polymer Science*. 31(2): 621-625.

Bergeron, P.; Wright, J.D.; Werdene, P.J. 1986. Progressing-batch hydrolysis reactor single-stage experiments. In: Scott, Charles D., ed. 8th symposium on biotechnology for fuels and chemicals; 1986 May 13-16; Gatlinburg, TN. New York, NY: John Wiley & Sons: 33-51

Boocock, D.G.B.; Porretta, F. 1986. Physical aspects of the liquefaction of poplar chips by rapid aqueous thermolysis. *Journal of Wood Chemistry and Technology*. 6(1): 127-144.

Brownell, H.H.; Mes-Hartree, M.; Saddler, J.N. 1986. Steam pretreatment of aspenwood for enhanced enzymatic hydrolysis. In: Moo-Young, Murraray; Hasnain, Sadiq; Lamptey, Jonathan, eds. *Biotechnology and renewable energy*. London, UK: Elsevier Applied Science Publishers: 36-45.

Brownell, H.H.; Yu, E.K.C.; Saddler, J.N. 1986. Steam-explosion pretreatment of wood: effect of chip size, acid moisture content and pressure drop. *Biotechnology and Bioengineering*. 28(6): 792-801.

Material balances are presented for pentosan, lignin, and hexosan, for steam-explosion pretreatment of aspenwood (*Populus tremuloides*) under different conditions, and for subsequent water washing of the product. The moisture content of small chips was shown to have little effect on subsequent enzymatic hydrolysis. Impregnation with dilute acid did improve the solubilization of pentosan and gave a better substrate for enzymatic hydrolysis.

Chahal, D.S. 1986. A new approach in solid state fermentation for cellulase production. In: Moo-Young, Murraray; Hasnain, Sadiq; Lamptey, Jonathan, eds. *Biotechnology and renewable energy*. London, UK: Elsevier Applied Science Publishers: 57-69.

Cheong, J.C. 1986. Studies on the production of alcohol from woods. *Journal of the Korean Forestry Society*. 59: 67-91.

Samples of *Pinus densiflora*, *P. rigida*, *Larix leptolepis*, *Alnus japonica*, *Castanea crenata*, and *Populus euramericana* (*canadensis*) were chemically analyzed and optimum conditions for alcohol fermentation established.

Connor, A.H.; Libkie, K.; Springer, E.L. 1986. Kinetic modeling of hardwood prehydrolysis. Part 2. Xylan removal by dilute hydrochloric acid prehydrolysis. *Wood Fiber*. 17(4): 540-548.

A study was made of the kinetics of xylan-hemicellulose removal with 0.10 M HCl at 120 degC from quaking aspen (*Populus tremuloides*), paper birch (*Betula papyrifera*), American elm (*Ulmus americana*), red maple (*Acer rubrum*), and southern red oak (*Quercus falcata*). Xylan removal could be modelled as the sum of two parallel first-order reactions - one fast and one slow. The fact that one set of parameters could be used suggests that the same reactions are taking place on prehydrolysis and the chemical structure and physical morphology of the xylan hemicellulose were essentially the same in the species studied and probably in all temperate hardwood species. The model thus

provides a good approximation of xylan removal from any temperate hardwood with dilute hydrochloric acid at the reaction conditions studied.

DeGroot, W.F.; Richards, G.N. 1986. Chemistry of carbon-gasification reactions. Final report, July 1982-December 1985. 105 p.

Wood chars have been prepared from untreated wood of a well-characterized hardwood species (Populus trichocarpa), and from the same wood treated by ion exchange with selected catalytic species. The following order of effectiveness of ion-exchanged catalytic species has been found: Co > Ca > Ni > Mg, K, Na > Cu. Cobalt was found to be an exceptionally effective catalyst.

Dolk, M.; Pla, F.; Yan, J.F.; McCarthy, J.L. 1986. Lignin (22). Macromolecular characteristics of alkali lignin from western hemlock wood. *Macromolecules*. 19(5): 1464-1477.

Platelets of Tsuga heterophylla and Populus trichocarpa were delignified in a flow-through reactor with both acid and alkali solutions. Measurements of number-average and weight-average molecular weight indicate that lignins exist in wood as polymers with effectively tetrafunctional branching points.

Ershov, B.G.; Isakova, O.V.; Komarov, V.B.; Matyushkina, E.P. 1986. Radiation-chemical transformations of cellulose in plant materials. *Khimiya Drevesiny*. 5: 6-10, 120.

Aspen (Populus tremula) sawdust, wheat straw, and pure cellulose were oven-dried and then gamma-irradiated with ^{60}Co in a vacuum. Free radicals were mainly of the lignin type at low doses in plant material, the concentration of cellulose free radicals approached that of lignin free radicals at higher doses when the total concentration of free radicals became constant. Comparisons showed that cellulose was more resistant to irradiation in plant material than in the pure state, and that wood was similar to straw in this respect. Results suggest that lignin increases the resistance of cellulose to irradiation.

Genchev, G.; Iordanov, N. 1986. Investigations on the utility of universal band-saws. *Lesotekhnicheski Institut, Sofiya*. 30: 219-224.

Data are given on performance in three Bulgarian enterprises using universal bandsaws to produce beech parquet, oak barrel staves and bottoms, and poplar box shooks. Recommendations are made for improving quality and productivity.

Grohmann, K.; Torget, R.; Himmel, M. 1986. Dilute acid pretreatment of biomass at high solids concentrations. In: Scott, Charles D., ed. 8th Symposium on biotechnology for fuels and chemicals; 1986 May 13-16; Gatlinburg, TN. New York, NY: John Wiley & Sons: 135-151.

Green, J.D. 1986. Light-induced bleaching of high-yield pulps. I. Sensitized bleaching of pulp sheets. *Journal of Wood Chemistry and Technology*. 6(1): 45-71.

Hall, L.D.; Rajanayagam, V.; Stewart, W.A.; Steiner, P.R.; Chow, S. 1986. Detection of hidden morphology of wood by magnetic resonance imaging. *Canadian Journal of Forest Research*. 16(3): 684-687.

Hidden regions of decay in Populus tremuloides were highlighted using a whole-body NMR scanner.

Haluk, J.P.; Kimmel, F.; Metche, M. 1986. Delignification of poplar wood by ozone in an aqueous medium. *Holzforschung*. 40(4): 237-248.

Sawdust of Populus nigra var. robusta (Populus 'Robusta') was analyzed chemically before and after delignification by ozonolysis in an aqueous medium for up to 8 hours. The ozone acted preferentially on lignin resulting in a drop of 27 percent in lignin content. During ozonolysis carboxylic acids were formed, cellulose was degraded only very little and hemicelluloses released pentoses and an appreciable amount of uronic acids.

Hwang, J.; Moon, C.K. 1986. Correlation between determining values of sectional equilibrium moisture contents of Larix leptolepis and Populus euramericana I-476 grown in Mt. Jiri. *Journal of Korean Forestry Society*. 59: 63-66.

Moisture content values were determined by oven-drying, using an electronic moisture meter or estimated using a chemical equilibrium formula. There were significant correlations among all three estimates for L. leptolepis samples. In P. euramericana (canadensis) only values determined by oven-drying and by the meter were correlated.

James, W.L. 1986. Effect of transverse moisture content gradients on the longitudinal propagation of sound in wood. Res. Pap. FPL-466. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 8 p.

Sound propagation was measured during drying of 2 x 4- and 2 x 6-inch specimens of cottonwood (Populus spp.). Methods were developed to probe the wave front at the bottom of small holes bored into the end of the specimen. The wave front appeared to remain plane despite the transverse moisture gradients. The effective longitudinal speed of sound through a specimen whose length is 10x the greatest lateral dimension. It was concluded that the empirical relations between changes in apparent speed of sound and changes in average moisture content may be useful for monitoring drying progress in a kiln.

Jung, H.S.; Lee, P.W.; Lee, N.H. 1986. Study on movement in wood. *Wood Science and Technology (Mogjae-Gonghak)*, Korea Republic. 14(2): 36-42.

Results are presented of radial and tangential shrinkage of unheated specimens and heated/soaked specimens from green to air dry and from green to oven dry; losses in relative density and anti-shrink efficiencies for shrinkage from green to air dry or oven dry; e.m.c. at 90 and 60 percent RH for unheated specimens and those heated for 120 hours and 240 hours; and percent movement (radial and tangential) on transferring unheated and heated timber from 90 to 60 percent RH.

Klimentov, A.S.; Shakhanova, R.K.; Stepanova, I.N.; Vysotskaya, I.F. 1986. A study of wood decomposed by radiation. 5. Effect of low-energy accelerated electrons on the carbohydrate composition of aspen wood. *Khimiya Drevesiny*. 1: 88-91, 126.

Aspen (Populus tremula) sawdust was irradiated with electrons of energy 0.5 MeV. At the maximum dose of 0.56 MGr, the content of difficult-hydrolyzable polysaccharides decreased from 49 percent to 36 percent, while the content of water-soluble oligosaccharides increased 18 times. Soluble monosaccharides were not formed. Results suggest that xylose residues were formed by decarboxylation of saccharides oxidized by radiation.

Lamprey, J.; Moo-Young, M.; Robinson, C.W. 1986. Pretreatment of lignocellulosics for bioconversion applications: process options. In: Moo-Young, Murrari; Hasnain, Sadiq; Lamprey, Jonathan, eds. Biotechnology and renewable energy. London, UK: Elsevier Applied Science Publishers: 46-56.

Law, K.N.; Lapointe, M.; Valade, J.L. 1986. Chemithermomechanical pulping of mixtures of different species of hardwoods. TAPPI Journal. 69(7): 80-83.

Chemithermomechanical pulps (CTMP) were prepared from trembling aspen (Populus tremuloides), white birch (Betula papyrifera), and grey birch (B. populifolia), and from mixtures of the species from Quebec. Aspen produced better CTMP fibers than either birch species. In pulping mixtures of aspen and white birch, pulp quality was not affected by a proportion of white birch up to 50 percent. These pulps could be used to replace part of the expensive chemical pulp in newsprint furnish.

Lawford, G.R.; Charley, R.; Edamura, R.; et al. 1986. Scale-up of the Bio-hol process for the conversion of biomass to ethanol. In: Moo-Young, Murrari; Hasnain, Sadiq; Lamprey, Jonathan, eds. Biotechnology and renewable energy. London, UK: Elsevier Applied Science Publishers: 276-285.

Lyons, G.J. 1986. Harvesting, drying and storage of short-rotation forestry energy crops. In: Ferrero, G.L.; Grassi, G.; Williams, H.E., eds. Biomass energy from harvesting to storage; 1986 November 19-21; Marino, Rome. London, UK: Elsevier Applied Science: 100-108.

MacLeod, J.M. 1986. Alkaline sulfite-anthraquinone pulp from aspen. TAPPI Journal. 69(8): 106-109.

Merem'yanin, Yu.I. 1986. Measuring the moisture content of wood chips with the aid of the noise spectrum. Lesnoi Zhurnal. 3: 65-68.

An account is given of an acoustic method developed in the USSR for measuring the moisture content of chips in the flow-lines of particleboard factories. Chips fall from the conveyor into a chamber where they are crushed; the noise is picked up by a microphone linked to a frequency-spectrum analyzer, the scale of which is graduated in units of moisture content. Data are given on experiments on chips of birch and aspen.

Min, D.S.; Lee, J.G. 1986. Studies on the catalytic pyrolysis products of hardwood. Journal of Korean Forestry Society. 65: 12-23.

Samples from 5 to 12-year-old trees of Alnus hirsuta, Quercus acutissima, Robinia pseudoacacia, and Populus tomentiglandulosa treated with monobasic ammonium phosphate, ammonium sulphate ammonium chloride or urea, and untreated samples were pyrolysed. P. tomentiglandulosa had the highest percentage of

holocellulose and pentosan. Charcoal yield increased as catalyst concentration and species lignin content increased.

Myers, G.C. 1986. A comparison of hardboards manufactured by semidry-, dry-, and wet-formed processes. *Forest Products Journal*. 36(7/8): 49-56.

Aspen chips were fiberized in a pressurized refiner and used to produce water-felted fiber mats and mats air-felted at 65 or 35 percent moisture content (semi-dry) or 5 percent moisture content (dry). Fiber mats entering the hydraulic hot-press were water saturated. Semi-dry forming hardboards produced less liquid effluent than the wet-formed process and eliminated the dust hazard common to dry-forming operations. Strength properties of semi-dry formed hardboards were lower than those of wet-formed hardboards but higher than those of dry-formed hardboards. Semi-dry formed hardboards were more stable than hardboards formed by the other processes. A powdered phenolic resin tested in the semi-dry formed hardboards was less satisfactory than liquid phenolic resin.

Pranovich, A.V.; Prokhorchuk, T.I.; Sedykh, V.I.; Zhalina, V.A.; Kiprianov, A.I. 1986. Analysis of phenolic fractions of black sulphate liquors by gel permeation chromatography. *Khimiya Drevesiny*. 6: 88-92, 128.

Sulphate liquors were obtained from industrial pulping of Ukrainian aspen (Populus tremula), pilot-scale pulping of upper stems of larch, and laboratory pulping of larch main stems, spruce, Scots pine, and Siberian birch (Betula alba). Phenolic compounds were extracted with ether in acid solutions and separated into 4 fractions which were separately analyzed by gel chromatography.

Reid, I.D.; Deschamps, A.M. 1986. Biological delignification of aspen wood by solid-state fermentation with the selective lignin-degrading fungus Phlebia tremellosus white rot fungi. In: *Biotechnology in the pulp and paper industry: 3d International conference; 1986 June 16-19; Stockholm, Sweden*. Stockholm, Sweden: STFI: 49-50.

Rowell, R.M. 1986. Vapor phase acetylation of Southern pine, Douglas-fir, and aspen wood flakes. *Journal of Wood Chemistry and Technology*. 6(2): 293-309.

Rowell, R.M.; Tillman, A.M.; Liu, Z.T. 1986. Dimensional stabilization of flakeboard by chemical modification. *Wood Science and Technology*. 20(1): 83-95.

Flakes of southern pine, aspen (Populus tremuloides) and Douglas fir were reacted with (a) butylene oxide/triethylamine or (b) acetic anhydride/xylene and used to manufacture flakeboards which were tested in water swelling, water soaking, humidity, and IB-strength tests. Type (a) flakeboard absorbed 25 percent less water and had 50 percent less thickness swelling than untreated boards. Type (b) boards had 50 percent less water absorption and 85 percent less thickness swelling than untreated boards. The mechanism by which moisture uptake and thickness swelling are reduced is based on chemical bulking of the cell wall polymers and a reduction in their hydrophilic properties. Results of IB tests were inconsistent but did show that acetylation caused no reduction in IB and in some cases improved it.

Rowell, R.M.; Tillman, A.M.; Simonson, R. 1986. A simplified procedure for the acetylation of hardwood and softwood flakes for flakeboard production. *Journal of Wood Chemistry and Technology*. 6(3): 427-448.

Rowell, R.M.; Wang, R.H.S.; Hyatt, J.A. 1986. Flakeboards made from aspen and southern pine wood flakes reacted with gaseous ketene. *Journal of Wood Chemistry and Technology*. 6(3): 449-471.

Rubio Torres, M.; Heitz, M.; Chauvette, G.; Chornet, E. 1986. Conversion and solubilization profiles of a prototype hardwood following aqueous thermomechanical pre-treatment. *Biomass*. 10(2): 85-96.

This paper discusses the solubilization profiles of hemicelluloses, lignin, and cellulose during aqueous thermomechanical treatment of Populus tremuloides. The major finding is that solubilization of the hemicelluloses can be accomplished prior to that of cellulose by conducting the aqueous thermomechanical treatment at short reaction times. Lignin is progressively solubilized during the treatment and it appears unlikely that a selective separation of lignin and carbohydrate can be obtained in aqueous systems. Shear effects facilitate solubilization of the carbohydrates.

San Martin, R.; Blanch, H.W.; Wilke, C.R.; Schiamanna, A.F. 1986. Production of cellulase enzymes and hydrolysis of steam-exploded wood. *Biotechnology and Bioengineering*. 28(4): 564-569.

The enzymatic production of glucose from lignocellulosic materials was evaluated in the light of recent developments in the use of fed-batch cultivation of Trichoderma reesei (T. longibrachiatum) Rut C-30, a mutant, and in the use of less expensive steam-based pretreatments. Steam-exploded aspen (Populus) is examined as a candidate feedstock for both enzyme production and enzymatic hydrolysis.

Shkirando, T.P.; Sukhaya, T.V.; Reznikov, V.M. 1986. Chemical changes in wood during hot pressing fibreboards by the semi-dry method. *Lesnoi Zhurnal*. 2: 90-93.

Samples were taken from steamed aspen wood fiber, and also from the fiberboards during manufacture after 1, 3, 5, 6, and 7 minutes of the pressing process. Changes were greatest in the drying stage. Carbohydrates are mainly destroyed during the whole pressing cycle. Lignin is condensed during the first part of the process.

Shukla, K.S.; Rajawat, M.S.; Shurla, L.N. 1986. Plywood from Indian timbers. *Journal of the Timber Development Association of India*. 32(3): 13-23.

Trees of 1.2-1.3 m d.b.h. from Haldwani, Uttar Pradesh, were peeled to give veneers which were used to make 3- and 5-ply UF and PF-bonded plywood and 5-ply blockboard. Boards were treated and tested. Results of the tests showed that P. deltoides was suitable for plywood for general purposes, marine plywood, formwork, preservative-treated plywood, fire-retardant plywood, and blockboard. Plywood from Indian-grown P. deltoides compared well with that from Canadian-grown P. deltoides and was superior to that from P. deltoides from the USA.

Shul'ga, G.M.; Mozheiko, L.N.; Sergeeva, V.N. 1986. Effect of the nature of lignosulphonates on their capacity to form complexes with amine polymers. *Khimiya Drevesiny*. 1: 58-62, 122.

Various Na lignosulphonates (LS-Na) were prepared in the laboratory by sulphite pulping of Scots pine, Norway spruce, birch, and aspen (Populus tremula). Each LS-Na was characterized by its molecular weight (decreasing from pine to aspen), semi-empirical formula and equivalent weight. Results suggest that the hardwood LS-Na had a more branched structure which hindered the electrochemical reaction with polyamines.

Sim, J.H.; Jung, H.S. 1986. Drying rate and drying defects of Populus euramericana using the SDR process. *Mogjae Gonghak*. 14(3): 3-15.

Flitches of P. canadensis were rough-edged for compact stacking and then kiln-dried to 10 percent moisture content. Dimension stock was dried in the same run. Drying rate of dimension stock was slower than that of flitches. Average bowing, cupping, crooking, and twisting were reduced 20, 25, 54.9, and 13.4 percent, respectively, by the SDR process. Surface checking developed less in dimension stock than in flitches. There was more case hardening in dimension stock than in flitches.

Singh, S.K.; Walawender, W.P.; Fan, L.T.; Geyer, W.A. 1986. Steam gasification of cottonwood in a fluidized bed. *Wood and Fiber Science*. 18(2): 327-344.

Cottonwood (Populus deltoides) branches were gasified in the presence of steam in a bench-scale fluidized bed reactor, over a temperature range of 850 to 1075 K. The objective was to investigate the effect of reactor temperature on the produced gas composition, yield, heating value, energy recovery, and carbon conversion. The major components of the gas produced were CO, CO₂, H₂, and CH₄, which comprised over 90 percent of the gas. The gas yield, energy recovery, and carbon conversion all increased with increasing temperature.

Smith, W.B. 1986. Treatability of several northeastern species with chromated copper arsenate wood preservative. *Forest Products Journal*. 36(7/8): 63-69.

Boards (2x4 or 4x4 inch, 8 feet long) were cut from red pine (Pinus resinosa), eastern white pine, European larch (Larix decidua), Norway spruce, bigtooth aspen (Populus grandidentata) and eastern hemlock that was healthy or killed by gypsy moth. Each board was cut in half before kiln drying as end-matched pairs. After drying, one of each pair was incised and all boards were treated with CCA by the full-cell process. Retention was more variable in gypsy moth-killed than in healthy eastern hemlock. Bigtooth aspen showed overall good retention, but over a large range. Incising substantially improved retention and penetration in hemlock, spruce, and aspen.

Sutcliffe, R.; Saddler, J.N. 1986. The role of lignin in the adsorption of cellulases during enzymatic treatment of lignocellulosic material. In: Scott, Charles D., ed. 8th Symposium on biotechnology for fuels and chemicals; 1986 May 13-16; Gatlinburg, TN. New York, NY: John Wiley & Sons: 749-762.

Ward, J.C. 1986. The effect of wetwood on lumber drying times and rates: an exploratory evaluation with longitudinal gas permeability. *Wood and Fiber Science*. 18(2): 288-307.

To determine why lumber containing wetwood dries more slowly than sound wood, measurements of longitudinal gas permeability (LGP) were made in sapwood, heartwood, and wetwood from white fir (Abies concolor) and aspen (Populus tremuloides and P. grandidentata). Sapwood had highest average LGP values and fastest drying rates. Heartwood had lowest average LGP values and slow drying rates. Wetwood had longest drying times and slowest drying rates, but higher average LGP values than heartwood. Low LGP values and slow drying rates for heartwood and wetwood are due largely to aspiration of bordered pits in white fir tracheids and to tyloses formation in aspen vessels. Wetwood bacteria may increase LGP by destroying tori in aspirated pits of white fir and by aborting tyloses development in aspen.

Yanchuk, A.D.; Splida, I.; Micko, M.M. 1986. Natural variation of extractives in the wood of trembling aspen. Agriculture and Forestry Bulletin, University of Alberta. 9(4): 22-24.

One large increment core was collected at breast height on the southern radius from 5-9 trees of each of 13 clones of Populus tremuloides from central Alberta. Analysis of variance indicated significant clonal differences in extractive content, but estimates of broad-sense heritability suggested that extractive content was not under strong genetic control.

Yasinskii, V.S.; Merkelov, V.M. 1986. Determining the optimum thicknesses of boards to be sawn from log segments. Lesnoi Zhurnal. 4: 120-122.

A mathematical analysis is made of the optimum thickness of boards to be sawn from quartered logs of aspen containing heartrot. Optimum board thicknesses are shown for log diameter 24 cm and rot dimension $r = 0.35 R$ (where r is rot radius at top end, and R is log radius at top end).

Young, R.A.; Davis, J.L. 1986. Organic acid pulping of wood. Part II. Acetic acid pulping of aspen. Holzforschung. 40(2): 99-108.

Populus tremuloides chips were cooked in aqueous acetic acid for up to 2 hours at temperatures in the range of 160-185 degC. Good delignification was achieved with pulp yields of 50-60 percent. A useful guideline for optimum choice of the acetic acid concentration in the liquor is a Hildebrand solubility parameter of approximately 11.0. An acetone wash may be necessary to remove reprecipitated lignin after the cook. The pulps showed satisfactory to good water absorbency.

1987

Ahmed, A.; Adnot, A.; Kaliaguine, S. 1987. Esca study of the solid residues of supercritical extraction of Populus tremuloides in methanol. Journal of Applied Polymer Science, 34(1): 359-375.

Blazhkova, A.; Lapchik, L.; Grivikova, I. 1987. Kinetics of polymerization of monomers in solid wood. 2. Effect of extractives in poplar wood on the course of polymerization. Khimiya Drevesiny. 4: 83-86, 126.

The weight gain of small wood specimens after impregnation with 1,3-diphenyl-1-butene monomer and spontaneous polymerization was increased after preliminary extraction with water or ethanol/benzene, especially in

oven-dry wood. Impregnation of moist wood in an atmosphere of O₂ resulted in maximum weight gains whether or not the wood had been extracted with water.

Capek-Menard, E.; Preiss, B.; Bouchard, J.; Chronet, E.; Jaulin, L.; Overend, R.P. 1987. Enzymatic hydrolysis of a Populus deltoides substrate from a thermo-mechanical treatment of medium consistency slurries. Canadian Journal of Chemical Engineering. 65(4): 689-692.

Ground Populus deltoides was pretreated using a thermo-mechanical process in which shear forces are applied by rapid passage of concentrated slurries through homogenizing valves. The process permits accurate control of operational parameters to induce varying degrees of ultrastructure modification in the substrate.

Dodson, M.G.; Bohn, W.L.; Meyrant, P.; Kouk, R.S. 1987. Impact of sulfonation level on hydrogen peroxide bleaching response of hardwood and softwood high-yield pulps. In: Pulping conference; 1987 November 1-5, Washington, DC. Atlanta, GA: TAPPI Press; 3: 479-495.

Grandmaison, J.L.; Ahmed, A.; Kaliaguine, S. 1987. Analysis of partially converted lignocellulosic materials. In: 193rd National meeting of the American Chemical Society; 1987 April 5; Denver, CO. American Chemical Society, Division of Fuel Chemistry. 32(2): 157-166.

The systematic analysis of the solid residues of the supercritical methanol extraction of Populus tremuloides was performed for samples prepared at temperatures varying from 250 to 250°C and pressures from 3.4 to 17.2 MPa, using such analytical techniques as wet chemistry, chromatography, thermogravimetric analysis, diffuse reflectance FTIR spectroscopy, and photoelectron spectroscopy.

Korol'kov, I.I.; Kozlova, L.U.; Saraf, U.L.; Kunina, A.I.; Blinova, N.N. 1987. Kinetics of furfural formation from pentosan-containing plant raw materials. Khimiya Drevesiny. 3: 10-13, 120.

Furfural was obtained by heating aspen (Populus tremula) sawdust or a pentose hydrolysate with dilute acid. Maximum yield of furfural was obtained from the pentose hydrolysate heated in an ampoule at 230 degC. The presence of lignin was shown to have a negative influence on furfural yields. The lowest yields were obtained when sawdust was heated above 180 degC without acid.

Mes-Hartree, M.; Hogan, C.M.; Saddler, J.N. 1987. Recycle of enzymes and substrate following enzymatic hydrolysis of steam-pretreated aspenwood. Biotechnology and Bioengineering. 30(4): 558-564.

Mes-Hartree, M.; Yu, E.K.C.; Reid, I.D.; Saddler, J.N. 1987. Suitability of aspenwood biologically delignified with Pheblia tremellosus for fermentation to ethanol or butanediol. Applied Microbiology and Biotechnology. 26(2): 120-125.

Myers, G.C. 1987. Characterization of fiberboard pulp. Forest Products Journal. 37(2): 30-36.

Fiberboard pulps prepared from Populus tremuloides, sweetgum, eastern white pine, and southern yellow pine, each refined to 4 drainage rates, were characterized using 5 procedures. Drainage rates were slowed by refining because of reductions in the number of fiber bundles and in fiber length, and increases in numbers of broken fibers, fiber fragments, and splitting and fragmenting of fiber walls.

Parekh, S.R.; Parekh, R.S.; Wayman, M. 1987. Fermentation of wood-derived acid hydrolysates in a batch bioreactor and in a continuous dynamic immobilized cell bioreactor by Pichia stipitis R. *Process Biochemistry*. 22(3): 85-91.

Poirer, M.G.; Ahmed, A.; Grandmaison, J.L.; Kaliaguine, S.C.F. 1987. Supercritical gas extraction of wood with methanol in a tubular reactor. *Industrial Engineering and Chemical Research*. 26(9): 1738-1743.

A tubular type reactor has been designed and built for the supercritical extraction of Populus tremuloides in methanol. It is shown that for a given extraction temperature, an increase in pressure corresponds simultaneously to higher oil yield and higher molecular weight. At constant pressure, increasing the temperature results in higher oil yields and lower molecular weights. The nature of oils as a function of the temperature of extraction is also discussed.

Prusas, Z.C.; Rourke, M.J.; Uhrig, L.O. 1987. Variables in chemi-thermomechanical pulping of northern hardwoods. *TAPPI Journal*. 70(10): 91-95.

A study was undertaken to determine relationships between the main operating variables in a 2-stage CTMP process and the properties of the pulp obtained. The wood supply comprised 40 percent sugar maple, 20 percent white and yellow birch, 15 percent red maple, 10 percent aspen, and 15 percent linden, ash, elm, and cherry. In the first stage, varying the caustic charge had the greatest effect on refining energy and on the optical and physical properties of the pulp. In the second stage, the effect of S was significant particularly at high cooking temperatures.

Rahman, M.D.; Abrams, G.D.; Pepper, J.M. 1987. Lignin and related compounds. 10. The synthesis of dimeric-type compounds derived from lignin. *Journal of Wood Chemistry and Technology*. 7(2): 187-196.

Schmidt, E.L.; Hall, H.J.; Gertjejansen, R.O.; Carll, C.G. 1987. Assessment of preservative treated aspen waferboard after 30 months of field exposure. *Forest Products Journal*. 37(2): 62-66.

Experimental Populus tremuloides waferboards, bonded with liquid or powdered PF resin and treated with preservatives added during manufacture or by dipping in preservatives after manufacture, were exposed on test fences or buried to half their height in soil at sites in Mississippi and Minnesota. Inspection showed ammoniacal copper arsenate, added during manufacture, to be the best treatment in all exposures. Comparison of treatments using load at failure in compression parallel to the face was a more sensitive indicator of performance than either MOR or MOE.

Simatupang, M.H.; Lange, H.; Neubauer, A. 1987. Effect of storage of poplar, birch, oak and larch and addition of silica dust on bending strength of wood cement. *Holz als Roh- und Werkstoff*. 45(4): 131-136.

Wood chips were obtained from 1-m larch logs air-dried for 2 weeks, oak logs dried for 2 or 12 weeks, and birch and poplar dried for 2, 4, 8, 16, or 32 weeks. Laboratory-made wood cement boards were prepared using wood chips and PZ 35F cement, with or without addition of SiO₂ dust. Oak and larch are usually considered unsuitable for use in wood cement: results indicated that addition of silica dust would allow use of these and other species in wood cement manufacture. A list is given of the 27 wood cement factories in the world, with data on location, capacity, equipment, system and species used, and trade names.

Simkovic, I.; Ebringerova, A.; Antal, M.; Micko, M.M. 1987. New aspects in cationization of lignocellulose materials. 6. Modification of steam-exploded aspen wood chips with quarternary ammonium groups. *Journal of Applied Polymer Science*. 34(5): 1779-1783.

Stephens, R.S.; Kutscha, N.P. 1987. Effect of resin molecular weight on bonding flakeboard. *Wood and Fiber Science*. 19(4): 353-361.

Tuominen, R.; Pietarila, V. 1987. The effect of peroxide in pressurized grinding. *TAPPI Journal*. 70(2): 67-70.

Vasil'eva, L.V.; Medvedeva, S.A.; Yanilkin, V.V.; Babkin, V.A.; Gorokhova, V.G.; Nikiforov, V.P.; Antonova, L.I. 1987. Stability of bonds in lignocarbhydrate complexes of larch and aspen wood under conditions of acid or alkaline hydrolysis and electrochemical oxidation. *Khimiya Drevesiny*. 4: 59-67, 124.

Lignin-carbhydrate complexes were extracted from finely milled larch (*Larix sibirica*) and aspen (*Populus tremula*) wood with DMSO, after preliminary removal of dioxane lignin, and purified by gel filtration. Chemical tests suggested that both complexes contained ester bonds between carbhydrate hydroxyl and phenolic acid carboxyl groups.

Wayman, M.; Seagrave, C.; Parekh, S.R. 1987. Ethanol fermentation by *Pichia stipitis* of combined pentose and hexose sugars from lignocellulosics prehydrolysed by SO₂ and enzymatically saccharified. *Process Biochemistry*. 22(2): 55-59.

1988

Allen, L.H. 1988. Pitch control during the production of aspen kraft pulp. *Pulp & Paper Canada*. 89(10): 87-91.

Blanchette, R.A.; Burnes, T.A.; Leatham, G.F.; Effland, M.J. 1988. Selection of white-rot fungi for biopulping. *Biomass*. 15(2): 93-101.

Lignin degradation by white-rot fungi makes them ideally suited for industrial applications where lignin or various phenolic compounds must be altered or removed. Decay studies were completed with wood blocks of *Abies*

balsamea (balsam fir), Acer saccharum (sugar maple), Alnus rubra (red alder), Betula papyrifera (paper birch), Picea mariana (black spruce), Pinus resinosa (red pine), Pinus strobus (white pine), Populus tremuloides (trembling aspen), and Tilia americana (American basswood).

Brady, D.E.; Kamke, F.A. 1988. Effects of hot-pressing parameters on resin penetration. *Forest Products Journal*. 38(11/12): 63-68.

Aspen and Douglas-fir flakes were used with test parameters of temperature, time, pressure, and flake moisture content. Penetration was evaluated using fluorescence microscopy and a manual digitization technique.

Chum, H.L.; Johnson, D.K.; Black, S.; et al. 1988. Organosolv pretreatment for enzymatic hydrolysis of poplars: 1. Enzyme hydrolysis of cellulosic residues. *Biotechnology and Bioengineering*. 31(7): 643-649.

A systematic study of organosolv delignification of aspen (Populus tremuloides) and black cottonwood (Populus trichocarpa) chips in methanol-water systems is described.

Galliano, H.; Gas, G.; Durand, H. 1988. Lignocellulose biodegradation and ligninase excretion by mutant strains of Phanerochaete chrysosporium hyperproducing cellulases - degradation of poplar lignocellulose using a radiorespirometric method. *Biotechnology Letters*. 10(9): 655-660.

Phanerochaete chrysosporium ATCC 28326 and 2 mutant strains, F1 and C1-phi2 selected as cellulase (EC-3.2.1.4) hyperproducers, were used in studies of ligninolytic activity. Poplar (Populus spp.) twigs which had incorporated either ¹⁴C₂ by photosynthesis or U-¹⁴C-phenylalanine by absorption were labeled respectively on cell wall components or only on the lignin moiety.

Khan, A.W. 1988. Factors affecting the utilization of steam- and explosion-decompressed aspen wood by cellulolytic anaerobes. *Biomass*. 15(4): 269-279.

Acetivibrio cellulolyticus ATCC 33288 and Clostridium thermocellum DSM 1237 were unable to grow in medium containing 2 g/l of untreated steam-explosion decompressed aspen wood as a source of carbon. When cellulose (5 g/l) was added to the medium, growth of the anaerobes was comparable to that in medium with cellulose alone.

Lehtinen, J. 1988. The development of the condebelt-process. *Papier*. 42(10A): V154-V159.

Mes-Hartree, M.; Dale, B.E.; Craig, W.K. 1988. Comparison of steam and ammonia pretreatment for enzymatic hydrolysis of cellulose. *Applied Microbiology and Biotechnology*. 29(5): 462-468.

Wheat (Triticum aestivum) straw, wheat chaff, alfalfa (Medicago sativa) stem, and aspen (Populus spp.) wood were subjected to steam and to ammonium treatment. In the steam treatment, the agricultural residues were treated at 240 degrees for 60 seconds while the aspen wood was acid impregnated prior to treatment at 220 degrees for 60 seconds. Neither steaming nor ammonia was the best treatment for all substrates. Glucose production was a function of both the substrate and enzyme system used.

Mix, N. 1988. Pulping of aspen wood according to the alkaline sulfite process under additional use of anthraquinone and methanol. Hamburg, Federal Republic of Germany: Bundesforschungsanstalt fuer Forst- und Holzwirtschaft. 172 p.

Parekh, S.R.; Parekh, R.S.; Wayman, M. 1988. Ethanol and butanol production by fermentation of enzymatically saccharified SO₂-prehydrolyzed lignocellulosics--using Pichia stipitis and Clostridium acetobutylicum. *Enzyme Microbiology and Technology*. 10(11): 660-681.

The results of SO₂-catalyzed prehydrolysis of the lignocellulosics pine, aspen, and corn stover, and their direct saccharification by cellulolytic enzymes to produce a mixture of hemicellulose and cellulose sugars are reported.

Parekh, S.R.; Parekh, R.S.; Wayman, M. 1988. Fermentation of xylose and cellobiose by Pichia stipitis and Brettanomyces clausenii: scientific note - production of ethanol from aspen wood hydrolyzate. *Applied Biochemistry and Biotechnology*. 18: 325-338.

A mixed culture of Brettanomyces clausenii NRRL Y-1414 and Pichia stipitis CBS 5776, and enzymes were added to SO₂-treated aspen (Populus tremuloides) wood for cellobiose removal and xylose conversion to ethanol. P. stipitis R, an excellent xylose fermenter, was obtained by adapting the parent strain to wood hydrolyzates. Aspen wood chips were prehydrolyzed using 3 percent SO₂ at 150 degrees for 30 minutes.

Rahman, M.D.; Pepper, J.M. 1988. Lignin and related compounds, 12. Catalytic degradation of proto and isolated aspen lignins under initially alkaline conditions. *Journal of Wood Chemistry and Technology*. 8(3): 313-322.

Schwald, W.; Brownell, H.H.; Saddler, J.N. 1988. Enzymatic hydrolysis of steam treated aspen wood: influence of partial hemicellulose and lignin removal prior to pretreatment. *Journal of Wood Chemistry and Technology*. 8(4): 543-560.

Tatsumoto, K.; Baker, J.O.; Tucker, M.P.; et al. 1988. Digestion of pretreated aspen substrates: hydrolysis rates and adsorptive loss of cellulase enzymes--effect of substrate pretreatment. *Applied Biochemistry and Biotechnology*. 18: 159-174.

The adsorption-kinetics of cellulase (EC-3.2.1.4)-complex activities were investigated using 5 pretreated aspen substrates: dilute sulfuric acid treated aspen meal (DAA), ethanol extracted DAA, sodium hydroxide extracted DAA, cellulase-treated DAA, and steam exploded aspen chips (SEA).

Torget, R.; Himmel, M.; Wright, J.D.; Grohmann, K. 1988. Initial design of a dilute sulfuric acid pretreatment process for aspen wood chips. *Applied Biochemistry and Biotechnology*. 17: 89-104.

A preliminary process design for dilute sulfuric acid pretreatment of aspen wood chips in order to obtain fermentable sugars has been prepared and subjected to an economic evaluation.

Turick, C.E.; Jerger, D.E.; Chynoweth, D.P. 1988. Inhibition of methane production by hybrid poplar. Abstracts of the Annual Meeting of the American Society of Microbiology: 270. Abstract.

Woody biomass represents an abundant renewable feedstock for conversion to methane. Batch and semi-continuous anaerobic digester experiments have shown that the non-lignin fraction of hybrid poplar (Populus) (1-2 years old) can be converted to methane without pretreatments other than particle size reduction to the millimeter range.

Vick, C. 1988. An acid-catalyzed phenolic adhesive for radiofrequency laminating of hardwood composite framing. Forest Products Journal. 38(11/12): 8-14.

An acid-catalyzed phenolic resin, which is used in the foundry industry to bond sand into shell moldings and cores for metal castings, developed strong and highly durable bonds between hardwood veneer and flakeboard core edges in composite framing lumber.

Wayman, M.; Parekh, S.R. 1988. SO₂ prehydrolysis for high yield ethanol production from biomass. Applied Biochemistry and Biotechnology. 17: 33-43.

The advantages of the use of SO₂ in steam pretreatment are described.

Zare-Maivan, H.; Shearer, C.A. 1988. Wood decay activity and cellulase production by freshwater lignicolous fungi. International Biodeterioration. 24(6): 459-474.

Wood degradation and coupled cellulase production were studied in freshwater ascomycetes, fungi imperfecti and an oomycete. Wood degradation was assessed by weight changes in wood and bark blocks of ash and cottonwood (Populus trichocarpa) colonized by test fungi, and changes in wood components were measured.

PROPAGATION

1975

Bojarczuk, T.; Jankiewicz, L.S. 1975. Influence of phenolic substances on rooting of softwood cuttings of Populus alba L. and Populus canescens Sm. Acta Agrobot. 28(1): 121-129.

Bowersox, T.W. 1975. Influence of cutting size on juvenile growth and survival of hybrid poplar clone NE-388. Tree Planters' Notes. 21(4): 1-3.

The objective of this study was to examine the effects of cutting size on the resultant tree growth and survival of hybrid poplar clone NE-388, Populus maximowiczii x trichocarpa. Environmental factors may have a greater effect on the success and development of hybrid poplar clone-trees than the initial size of the planting stock.

Dahab, A.M.A.; Shafiq, Y.; Al-Kinany, A.; Yahya, M.D. 1975. Effect of seasonal variations in root formation and growth of cuttings of different trees and shrubs. Mesopotamia Journal of Agriculture. 10(1/2): 3-12.

Rooting trials with cuttings collected at different times of year in N. Iraq indicated that the best season for Populus nigra is mid January to March. Growth characteristics of rooted cuttings of Populus nigra were studied in more detail, i.e. shoot length, number and size of leaves, and number of roots, as well as survival rates, and the optimum date was found to be 1 January.

Dimimrov, Kh.; Kolarov, D. 1975. Methods for the propagation of Populus alba L. Gorskostop Nauka. 12(5): 34-42.

Il'in, A.M. 1975. Preliminary root sucker regeneration of Populus tremula and its condition. Izv Vyssh Uchebn Zaved Lesn Zh. 6: 26-28.

Ivannikov, S.P.; Kazantsev, I.Ya. 1975. Varietal trial and propagation of poplars on the lower Volga. Referativnyi Zhurnal. 12.56.209: 20-48.

Of the 27 clones tested, the best were Brabantica 175, Sacrau 59, Moshchnyi 236 [Vigorous 236], Vesennekrasnyi [Spring Red], Carolina 162, and Populus deltoides.

Schier, G.A. 1975. Promotion of sucker development on Populus tremuloides rootcuttings by an antiauxin. Canadian Journal of Forest Research. 5(2): 338-340.

1976

Aleem, A.; Sheikh, M.I. 1976. Factors affecting rooting of Populus deltoides clones. Pakistan Journal of Forestry. 26(2): 129-130.

Cuttings of 6 clones of P. deltoides and one of P. X canadensis (as control) were planted in a nursery at Peshawar, Pakistan, at 6 dates between early February and mid March 1974. The best rooting was obtained in cuttings planted in mid-late February or early March.

Duncalf, I. 1976. Propagation of aspen or trembling poplars. *Soil Water*. 12(5): 27-28.

Edwards, W.R.N.; Kisson, W.S. 1976. Effect of soaking and deep planting on vegetative propagation of Populus and Salix. *Populier*. 13(3): 41-44.

Describes experiments indicating that soaking before planting as practiced in New Zealand, when planting sets and one-year long cuttings for erosion control, improved establishment, and increased root and shoot growth.

Foos, K. 1976. An experimental container for quantitative recording of root growth of young trees under variable conditions in the root region. Translation, Environment Canada. (OOENV TR-1149): 10 p.

Habjoerg, A. 1976. Rapid production of trees. *Gartneryrket*. 66(5/6; 16/17): 70-73; 346-350.

Whips of Acer platanoides about 2 m tall were produced in southern Norway in one year by seed stratification and raising the seedlings in a plastic house. Seed was selected from Norwegian ecotypes. Trials were also carried out with Betula verrucosa, Populus trichocarpa, Picea, and Abies spp. and with other landscaping conifer species. In all trials growth was increased when plants were raised in a plastic house. For northern and high altitude strains it was important to maintain the critical daylength in these conditions.

Herrmann, S. 1976. Methods for conserving and maintaining the fertility of forest-tree pollen over several years. *Silvae Genetica*. 25(5/6): 223-229.

A method is described in which the pollen is sealed into glass ampoules under a 75 percent vacuum and stored at -17 to -18degC.

Jestaedt, M. 1976. Vegetative propagation of aspen and grey poplars. *Silvae Genetica*. 25(3/4): 141-147.

Cuttings were obtained from young mother plants, grafted plants, root cuttings, and sucker cuttings of different clones of aspen (Populus tremula and P. tremula X P. tremuloides) and grey poplar (Populus X canescens) and set in various rooting media. Rooting of grey poplars was not influenced by substrate or increased humidity. Percentage rooting of aspen varied between clones and with source of cutting (root cuttings, sucker cuttings, etc.).

Larsson, H.C. 1976. Technique of mass-producing Jackii poplar seed under greenhouse conditions. In: Proceedings, 23d Northeastern forest tree improvement conference: 158-165.

Initial results of tests of mass producing superior seedlings of Jackii poplar by controlled crossing of plus trees using severed branches of female Populus deltoides and male P. balsamifera. The best seed production occurred on branches which developed normally and remained healthy. Pre-rooting of the branches and application of appropriate biocides are recommended.

Maloy, A.; Whitehead, H.C.M.; Giles, K.L.; Goldie, G.N.; Fossard, R.A.de; Bourne, R.A.; Ellyard, R.K.; Caulfield, H.W. 1976. [Technical sessions: 5th annual meeting, New Zealand Chapter-at-Large, Levin, November 1976; 4th annual meeting, Australian region, Brisbane, October 1976.] In: Combined Proceedings, International Plant Propagators' Society. 26: 329-360; 361-416.

Petersen, L.A.; Phipps, H.M. 1976. Water soaking pretreatment improves rooting and early survival of hardwood cuttings of some Populus clones. Tree Planters' Notes. 27(1): 12, 22.

Phipps, H.M. 1976. Propagation research in the establishment of maximum yield plantations. Gen. Tech. Rep. NC-21. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 60-62.

Schier, G.A.; Campbell, R.B. 1976. Differences among Populus species in ability to form adventitious shoots and roots. Canadian Journal of Forest Research. 6(3): 253-261.

The propagation of root segments and sucker cuttings was compared in different clones of Poplars (P. angustifolia, P. deltoides, and P. balsamifera) and aspen (P. tremuloides) in Utah in early autumn 1974.

1977

1977. Propagating trees by means of woody winter cuttings. Verbondsnieuws voor de Belgische Sierteelt. 21(20): 677-679.

The rooting of cuttings from different parts of the shoot was investigated in test plants of the easy-rooting Populus nigra cv. Italica and Salix alba cv. Vitellina and the shy-rooting Plantanus X acerifolia cv. Hispanica. With Populus the quality of rooting was better with top cuttings than with basal cuttings. With Populus and Salix benomyl and IBA treatments had no effect on rooting.

1977. Studies to increase the survival rate of Populus tomentosa cuttings in propagation. Chung-Kuo Lin Yeh K'o Hsueh. 2: 37-43.

Danilin, M.A.; Grebennik, A.V. 1977. Grafts on trees in relation to sex. Lesnoe Khozyaistvo. 2: 56-57.

A note giving results of grafting trials with male and female scions on male and female rootstocks of Populus tremula, P. balsamifera, and Hippophae rhamnoides. Some of the scions used were treated with a solution of heteroauxin. In P. tremula the sex of the scion did not affect survival. Male rootstocks of P. tremula and H. rhamnoides gave better scion survival and sometimes also better scion growth in the first year. The mean increment of scions treated with heteroauxin was greater than that of controls.

Garrett, H.E. 1977. First year, root-shoot growth observations of eastern cottonwood seedlings and cuttings. Tree Planters' Notes. 28(1): 27-28, 41.

Ghosh, R.C.; Bhatnagar, H.P. 1977. Rooting response of branch cuttings of Populus gamblei Dode. Indian Forester. 103: 382-386.

Cuttings 20-25 cm long and 1.5-2.0 cm diameter were taken from trees growing in W. Bengal between November 1975 and April 1976. Before planting, the cuttings were dipped for 24 hour in aqueous solutions of different plant growth regulators. The best rooting was obtained with cuttings taken in November, those treated with 200 p.p.m. IAA or IBA giving the best response. No rooting was obtained with cuttings taken in February, March, or April.

Jestaedt, M. 1977. Factors influencing root development of cuttings from clones of North American eastern cottonwood. *Holzzucht*. 31(1-2): 4-9.

Truncheons cut from 8 clones (6 of *P. deltoides*, 2 of *P. X canadensis*) were planted in a peat/sand mixture in the greenhouse. In a (parallel) field experiment with 13 clones of *P. deltoides* and the 2 hybrids *P. 'Harff'* and *P. 'Robusta'* in northern Germany in 1976, only the use of plastic film tunnels (with watering) gave significantly better rooting of truncheons, after 2 months, compared with untreated controls. Soaking the truncheons for 48 hours before planting, and/or watering in the open, gave results of no significant difference from controls.

Levashev, B.G. 1977. Rooting capacity of stem cuttings of poplar. *Referativnyi Zhurnal*. 7: 50-51.

Of 39 clones and hybrids of different species, *Populus balsamifera*, *P. laurifolia*, and *P. trichocarpa* had the best rooting capacity (90 percent and over) and *P. deltoides* and *P. pyramidalis* the worst (both 46 percent).

Maiorchik, I.B. 1977. Some features of root formation in cuttings of poplars from the section Leuce. *Referativnyi Zhurnal*. 102: 95-99.

Information is presented on the rooting capacity of *Populus alba*, *P. bolleana*, *P. tremula*, and *P. alba X P. bolleana* in relation to age, origin, and the effect of growth stimulants.

Sivolapov, A. 1977. Forms of poplar from the subgenus Leuce and their propagation. *Referativnyi Zhurnal*. 2: 265.

After treatment of winter cuttings of the hybrid *Populus alba X P. tremula* for 5 hours with a 0.07 ml/l aqueous solution of ethylene glycol ethylcrotyl ether, 58 percent of the cuttings rooted compared with 0 percent in the control.

Thompson, D.G.; Gordon, J.C. 1977. Propagation of poplars by shoot apex culture and nutrient film technique. In: Forest biology, wood chemistry conference; 1977 June 20-22; Madison, WI. [Madison, WI]: TAPPI Press: 77-82.

Witztum, A.; Raviv, V. 1977. Introduction of adventitious shoots on roots of white poplars--an unplanned experiment in plant development. *La- Yaaran For Israel Forestry Association*. 27(1/4): 3-6.

Zsuffa, L. 1977. Vegetative propagation of cottonwood by rooting cuttings. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 2-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University Division of Continuing Education: 99-108.

The influences of genetical, morphological, physiological and environmental factors, and of genotype-environment interactions on rooting of *Populus deltoides* are reviewed and silvicultural practices for *P. deltoides* propagation are outlined.

1978

Concin, R.; Binder, H.; Brunner, P.; Bobleter, O. 1978. Growth chamber for the cultivation of woody plants in a radioactive carbon dioxide atmosphere. *Kerntechnik* (Federal Republic of Germany). 20(1): 32-38.

A growth chamber is described, suited for the production of uniformly C14-labelled plant material. Radioactive $^{14}\text{CO}_2$ is supplied by means of a manually operated bariumcarbonate-reactor. The cultivation of poplars (*Populus tremula*), larches (*Larix europea*), and Scots pines (*Pinus silvestris*) as well as their growth experiences are described.

Cutter, B.E.; Murphey, W.K. 1978. Effects of potassium on growth and wood anatomy of a *Populus* hybrid. *Wood and Fiber*. 9(4): 282-288.

Fasehun, F.E. 1978. Effect of irradiance on growth and photosynthesis of *Populus X euramericana* clones. *Canadian Journal of Forest Resources*. 8(1): 94-99.

Kumar, P. 1978. Sprouting and rooting response of stem cuttings of *Populus-nigra* and *Populus-robusta* in relation to auxins and photoperiods. *Indian Journal of Experimental Biology*. 16(11): 1207-1209.

Lux, A. 1978. Influence of the time factor on the rhizogenesis of poplar stem cuttings. *Biologia, A*. 33(1): 11-16.

Cuttings taken from different parts of the stem of *Populus* 'I-214', viz. (a) basal, (b) suprabasal, (c) central, and (d) subapical portions, were planted horizontally in sand (in darkness at 25degC) in December, March, and April. Latent root primordia in the outer xylem of the cuttings were most numerous in (c) and least in (d). The total number of roots formed increased from December to April, and decreased from (a) to (d) in Dec. and March; position had little effect in April, when (d) rooted as well as (a). Roots formed from callus were of minor importance. In April, the average number of xylem poles per root was (a) 7.0 and (d) 5.2.

Nicholson, E.; Demeritt, M.E. 1978. Cleaning *Populus* seed with a blender. *Silvae Genetica*. 27(5): 216.

P. deltoides catkins were allowed to open and dry in a paper bag. The seed-laden cotton was placed in a 7-speed Waring blender which was then operated at its lowest speed for 1-3 minutes: the seeds collected at the bottom. Output was about 100 seeds/min. Germination rates were not impaired.

Riedacker, A. 1978. Study of the deviation of horizontal or oblique roots of poplar cuttings encountering an obstacle: applications in container design. *Annales des Sciences Forestieres*. 35(1): 1-18.

The behaviour of lateral roots from a poplar cutting on meeting various obstacles in the soil is described. Results are discussed in relation to root direction in natural conditions, and a new 'M-shaped' container [i.e. in horizontal cross section two opposite sides are straight and the other two are reentrant V's], to avoid root coiling, is proposed.

Rudolph, T.D. 1978. Seed yield and quality in Populus tremuloides following pollination with gamma-irradiated pollen. Canadian Journal of Botany. 56(23): 2967-2972.

Schier, G.A. 1978. Variation in suckering capacity among and within lateral roots of an aspen clone. Res. Note INT-241. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 7 p.

Lateral root samples 1-2 cm in diameter were collected from a single Populus tremuloides clone in Utah and cut into segments of various lengths. Suckering was not related to root diameter or length of segment. Differences among lateral root sections of the same length were significant. Proximal halves of segments produced significantly more suckers than distal halves though there was no evidence of a gradient along the lengths of cut lateral roots.

Schier, G.A.; Campbell, R.B. 1978. Aspen sucker regeneration following burning and clearcutting on two sites in the Rocky Mountains. Forest Science. 24(2): 303-308.

The origin and development of suckers of Populus tremuloides was studied in August 1976 in 4 clones in Utah (after clear felling 1-2 years earlier) and in 4 in Wyoming (after controlled burning 2 years earlier). It is concluded that the best time to stimulate suckering by felling and burning is during periods of rapid growth when there are many small roots.

Schier, G.A.; Campbell, R.B. 1978. Effect of cold storage on development of suckers on aspen root cuttings. Res. Note INT-248. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 8 p.

Schier, G. A.; Campbell, R.B. 1978. Effect of ethephon on suckering of excised roots and rooting of cuttings in trembling aspen. Forest Science. 24(1): 66-72.

Ethephon, an ethylene-generating chemical, at 100 p.p.m. promoted development of shoots from pre-existing primordia on root segments of Populus tremuloides. Adventitious roots did not develop on any treated dormant stem cuttings, but several other effects on stems were noted, viz. accelerated budbreak, decreased foliation, increased abscission of new shoots, and inhibition of both callusing and decay of the cut ends.

Schmid, A. 1978. The influence of hydrocortisone on the rhizogenesis of herbaceous cuttings of Populus tremula L. in association with indolyl butyric acid or abscisic acid. C R Hebd Seances Acad. of Sci., Ser D Sci. Nat. 286(21): 1499-1502.

Shchepot'ev, F.L.; Osipova, L.M. 1978. Effect of growth regulators on the vegetative propagation of mutants of Populus trichocarpa. Lesovedenie. 2: 70-72.

Cuttings of P. trichocarpa were subjected to doses of 50, 100, and 150 R of gamma radiation from a ⁶⁰Co source, and a chlorophyll mutant with variegated golden leaves was obtained from one of the cuttings treated with 150 R. This

new form is called the Donetsk Golden poplar, and is being propagated at the Donetsk botanical garden as an ornamental. Cuttings are treated for 24 hours with an aqueous solution of heteroauxin (200 mg/litre) plus glucose (20 mg/litre), and this stimulates rooting and shoot growth.

Ying, C.C.; Bagley, W.T. 1978. Variation in rooting capability of Populus deltoides. Silvae Genetica. 26(5/6): 204-207.

In greenhouse and field tests in Nebraska, cuttings from clones of provenances from Nebraska and Minnesota-Wisconsin produced significantly more roots than did cuttings from clones of other provenances. The heritability of clonal means was 0.8-0.9. Cuttings from the basal part of the parent shoot produced more roots than those from the upper part.

1979

Hansen, E.A.; Phipps, H.M.; Tolsted, D.N. 1979. Rooting greenwood tip cuttings of a difficult-to-root Populus clone. Tree Planters' Notes. 30(2): 9-11.

Rooting of 70-100% was obtained in Populus alba X P. grandidentata when treated with 2000-4000 p.p.m. IBA/NAA at 24-29degC.

Kolarov, D. 1979. Effective method of vegetative propagation of poplars of section Leuce. Gorsko Stopanstvo. 35(4): 10-14.

An account is given of trials at the Svishchov Experiment Station for fast-growing species (Bulgaria). The method used involves root cuttings, treatment with NAA (0.50 and 0.75 percent), the use of plastic greenhouses, and fertilizer application. Some data are given on the heights of Populus alba and P. canescens.

Krinard, R.M.; Randall, W.K. 1979. Soaking aids survival of long, unrooted cottonwood cuttings. Tree Planters' Notes. 30(3): 16-18.

One-year-old cuttings of Populus deltoides soaked in water for 5 days before planting in the field in Mississippi had a first year survival rate of 96 percent compared with a rate of 86 percent for unsoaked cuttings.

1980

Myers, J.F.; Fechner, G.H. 1980. Seed hairs and seed germination in Populus. Tree Planters' Notes. 31(3): 3-4.

Seeds of 3 poplar species were germinated in boxes containing blotter germination pads with or without a mat of seed hairs. Boxes were watered with distilled water (controls) or water in which hairs had been soaked (seed hairboxes).

Phipps, H.M.; Hansen, E.A.; Tolsted, D.N. 1980. Rooting greenwood tip cuttings of several Populus clones hydroponically. Canadian Journal of Forest Research. 10(1): 107-110.

Greenwood cuttings of several Populus clones were successfully rooted with a relatively simple hydroponic method. Cuttings propagated by the hydroponic

procedure rooted faster and generally outgrew those produced by a standard method after being transplanted to pots and grown in the greenhouse.

Witkowska-Zuk, Leokadia. 1980. Growth potential of buds in the crown of young Populus x berolinensis Dipp. trees. Warszawa, Poland: Rozprawy Naukowe i Monografie; 1: 55 p.

Zasada, J.C.; Densmore, R. 1980. Alaskan willow and balsam poplar seed viability after 3 years' storage. Tree Planters' Notes. 31(2): 9-10.

Seeds of summer-dispersing species (Populus balsamifera, Salix alaxensis, S. bebbiana, and S. novae-angliae) were collected in Alaska in June 1974 and stored at -10degC; seeds of S. glauca (winter dispersing) were collected in September. After 2 years storage germination was reduced by 1.3-6.5 percent for all species except stratified S. glauca. Germination of stratified S. glauca seeds did not decline during storage, staying uniformly high (94-100 percent). Without stratification, values were low and decreased indicating that dormancy was not broken by storage at -10degC. Germination of P. balsamifera seeds was also uniformly high (88-99.5 percent).

1981

Ernst, S.G.; Fechner, G.H. 1981. Variation in rooting and juvenile growth phenology of narrowleaf cottonwood in Colorado. In: Proceedings, 2d North Central tree improvement conference. Madison, WI: University of Wisconsin-Madison, Department of Forestry: 111-118.

Ghosh, R.C.; Bhatnagar, H.P. 1981. Rooting Populus gamblei branch cuttings (India). In: Singh, R.V., ed. Symposium proceedings: Silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 41-42.

Hansen, E.A.; Tolsted, D.N. 1981. Effects of cutting diameter and stem or branch position on establishment of a difficult-to-root clone of a Populus alba hybrid. Canadian Journal of Forest Research. 11(3): 723-727.

A total of 357 hardwood cuttings 20 cm long were collected from 22 one and two-year-old trees of a difficult to root Populus alba x P. grandidentata clone. The cuttings were planted in book planters and grown in a greenhouse for 3 months; survivors were then transplanted into the field. After 2 months in the greenhouse, height growth was significantly related to diameter, but there was no effect after 2 months.

Pal, M.; Nanda, K.K. 1981. Rooting of etiolated stem segments of Populus robusta - interaction of temperature, catechol and sucrose in the presence of IAA. Physiologia Plantarum. 53(4): 540-542.

Phipps, H.M.; Netzer, D.A. 1981. The influence of collection time and storage temperature on Populus hardwood cutting development. Tree Planters' Notes. 32(4): 33-36.

One-year-old shoots were cut on 5 dates in November-March from 4 hybrid clones (2 Populus euramericana [P. canadensis] sources and a Populus spp.

which are easy to root, and P. alba X P. grandidentata which is normally hard to root) and planted in greenhouse containers. Additional cuttings taken in November were stored for 4 months at -17.8, -3.9, or 2.8 degC or for 2 months at 7.2 deg and 2 months at 2.8 degC. Rooting performance was recorded for up to 32 days after potting. Overall rooting performance (percent cuttings rooted, average roots/rooted cutting, and average longest root length) increased the later cuttings were collected.

Singh, R.V.; Gupta, K.C. 1981. Preliminary studies on germination of Populus ciliata seed (India). In: Singh, R.V., ed. Symposium proceedings: Silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 35-37.

1982

Chauhan, P.S.; Sehgal, R.N. 1982. Propagation of forest trees by stem cuttings. In: Khosla, P.K., ed. Session-3. Propagation of trees: Symposium proceedings: Improvement of forest biomass; Solan, India: Indian Society of Tree Scientists, H.P. Agricultural University: 155-159.

Cram, W.H.; Lindquist, C.H. 1982. Refrigerated storage for hardwood cuttings of willow and poplar. Tree Planters' Notes. 33(4): 3-5.

Cuttings were collected from 2 willow and 2 poplar clones in November 1967 and stored outdoors by heeling in, or indoors at -18, -4 or 2 degC over the winter. All cuttings, including others harvested in April were planted out in May 1968. Overall, rooting capacity was highest for cuttings heeled in over the winter, but rooting of those stored at -4 degC after harvesting in November or April was n.s.d. for poplar.

Fan, R.W.; Wu, Q.M. 1982. The embryological observation of the seed development of Populus adenopoda. Journal of Nanjing Technological College of Forest Products. 3(Sept): 116-128.

Frison, G.; Negro, G.; Bardelli, P. 1982. Research on water requirements of the poplar nursery irrigated by trickle irrigation. Cellulosa e Carta. 10: 3-28.

Matras, J. 1982. Suitability of shorter cuttings for poplar stock production. Sylvan. 126(6): 37-42.

Quality and size were measured of planting stock of Populus 'Robusta' and P. 'Hybrida 275' [P. 'NE-42'] raised from cuttings 20, 18, and 16 cm long. Root damage during lifting was considerably reduced in shorter cuttings, and it is suggested that the norm be reduced from 18-22 cm to 18-19 cm thereby enabling small tractors to be used in lifting and planting operations. The proposed norm reduces the range of cutting size giving the added advantage of more uniform planting stock.

Muller, C.; du Cros, E.T. 1982. Storage of Populus nigra seed for five years. Annales des Sciences Forestieres. 39(2): 179-185.

Seeds were collected from two trees, one with green and one with mature capsules. The seeds were dried in air to 10 percent moisture content or in a desiccator to 7-8 percent moisture content; they were put under partial vacuum in air or under water; and were stored at +4, -5, or -15degC. The seed from the green capsules had a better germination percent than that from mature capsules under all conditions.

Pal, M. 1982. Interaction between auxins and ethrel in root formation on stem cuttings of Populus robusta Schneid. In: Khosla, P.K., ed. Improvement of forest biomass: symposium proceedings. Solan, India: Indian Society of Tree Scientists: 169-173.

Singh, R.V.; Singh, V. 1982. Optimum time for the collection of Populus ciliata seed. Journal of the Society of Indian Foresters. 20(3/4): 74-76.

1983

Deol, G.S.; Khosla, P.K. 1983. Effect of size of stem cuttings on juvenile growth of Populus ciliata Wall. ex Royle. Indian Journal of Forestry. 6(3): 205-207.

One-year-old nursery stock was used to produce stem cuttings of mid-diameter 10, 14, or 18 mm and length 15, 22.5, or 30 cm. Cuttings were planted in a nursery at Shilli-Solan in March 1981 and growth observed for 6 months. Larger diameter and length cuttings had significantly more roots and leaves and greater root length and average leaf area.

Fege, A.S. 1983. The practice and physiological basis of collecting, storing and planting Populus hardwood cuttings. In: Hansen, E.A., ed. Intensive plantation culture: 12 years research. Gen. Tech. Rep. NC-91. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 1-11.

Gladysz, A.; Ochlewska, M. 1983. Effect of the embryo size of aspen seeds on seedling growth and development. Sylwan. 127(3): 31-37.

Seeds of Populus tremula 281 X P. tremuloides 252 were classified into large and small seeds and characteristics of the seed and resultant seedlings compared between the two groups. Highly significant differences were found in the dimensions of dry seeds, hydrated seeds, embryos of hydrated seeds, cotyledons, and hypocotyls of seedlings at 5 and 14 days old and height, leaf number, and DM of seedlings at 41 days old.

Kiermeier, P. 1983. Sucker formation in woody plants. Zeitschrift fur Vegetationstechnik im Landschafts- und Sportstattenbau. 6(2): 60-64.

Of 25 shrubs and trees observed for sucker formation, some (e.g. Viburnum lentago) produced suckers throughout their lifespan without outside influence, some (e.g. Rhus typhina) produced suckers when the main stem was cut, and others (e.g. Ailanthus altissima) produced suckers following root damage. The longest suckers occurred in Populus tremula (17.8 m), Prunus avium (15.6 m), and P. padus (10.4 m); and A. altissima formed one exceptionally long sucker (27 m).

Kochkarl, N.T. 1983. Fruiting of Populus nigra and variation in seed quality with age. Lesnoe Khozyaistvo. 2: 41-42.

Studies were made on two specimens of P. nigra aged 25 and 50 years; seeds were stored for 4 months in three different ways.

Krinard, R.M. 1983. Continued investigations in first-year survival of long cottonwood cuttings. Tree Planters' Notes. 34(3): 34-37.

Rooted or unrooted 1-year-old Populus cuttings, 8 feet or more long were planted in holes filled with sand or soil on sites in Mississippi in December, February, or March 1978, 1979, or 1980. Half of the cuttings were soaked in water for 3-9 days before planting. Survival was erratic in 1978 and 1979 where the ground was flooded. In 1978 only unrooted soaked cuttings planted in December showed 90 percent survival. In 1979, only rooted cuttings planted in December had 88-93 percent survival in July. In 1980, when flooding was not a problem, all treatments showed survival of 90 percent or more, except one (with 82 percent survival).

Kushal Singh; Bansal, G.L. 1983. A note on the rooting of stem cuttings of Populus deltoides in relation to sex of the mother plant. Journal of Tree Sciences. 2(1/2): 92-93.

Cuttings 20 cm long were made from 1-year-old branches of male and female trees growing at Solan after excising their apical parts and leaves. Female cuttings showed significantly greater rooting ability than males. Female cuttings contained more endogenous carbohydrates than male cuttings.

Mathur, R.S.; Sharma, K.K.; Joshi, S.R. 1983. Effect of size of shoot cuttings on the growth of Populus X Euramericana '72/58'. The Indian Forester. 109(9): 665-674.

Mathur, R.S.; Sharma, K.K.; Sood, O.P. 1983. Reproduction of poplars by seed--nursery trials. The Indian Forester. 109(10): 699-705.

Melchior, G.H.; Krusche, D.; Mohrdiek, O.; Muhs, H.J. 1983. Vegetative propagation of aspen by budding. Holzzucht. 37(3-4): 37-42.

Clones of Populus tremula 'Tapiiau' and hybrid aspen (P. tremula X P. tremuloides) were bud-grafted in August 1979 onto various rootstocks in a nursery in W. Germany, viz. seedlings from a P. tremula stand, a hybrid aspen half-sib family, a P. alba clone and a P. X canescens clone. Best results were obtained from grafts within the same species.

Noh, E.R.; Ahn, J.K.; Kim, Y.M. 1983. Hydroponic rooting of greenwood cuttings of some poplar clones. Res. Rep. 19. Suweon, Korea: The Institute of Forest Genetics: 36-45.

Phipps, H.M.; Hansen, E.A.; Fege, A.S. 1983. Preplant soaking of dormant Populus hardwood cuttings. Res. Pap. NC-241. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 8 p.

The effects were studied of soaking duration, soaking depth, temperature, and planting delays following soaking on the establishment and growth of 6 clones in growth chambers. Water soaking was found to improve survival and growth in the field over a wide range of soil moisture content.

Sakaguchi, S.; Sasaki, S. 1983. Proliferation technologies of biomass resources. *Farming Japan*. 17(5): 20-29.

Schier, G.A. 1983. Vegetative regeneration of Gambel oak and chokecherry from excised rhizomes. *Forest Science*. 29(3): 499-502.

Rhizomes of both species and roots of aspen (Populus tremuloides) were tested for shoot regeneration in light and dark conditions. Aspen shoot production was unaffected by light treatment.

Singh, K.; Bansal, G.L. 1983. A note on the rooting of stem cuttings of Populus deltoides in relation to sex of the mother plant. *Journal of Tree Sciences*. 2(1/2): 99-100.

Singh, R.V. 1983. Nursery technology of Populus ciliata. *The Indian Forester*. 109(10): 706-716.

Singh, R.V.; Chukiyal, S.P. 1983. A note on the effect of diameter of cuttings on establishment and growth of Populus ciliata plants in the nursery. *Journal of Tree Sciences*. 2(1/2): 88-89; 95-96.

Cuttings of 6 diameter classes and 22 cm long were taken from 1-year-old nursery plants and planted in nursery beds at Shilli, Himachal Pradesh, at 50x30 cm spacing in March 1982. Cuttings were regularly watered, weeded, and hoed where necessary. Height and basal diameter were measured at the beginning of every month. Time taken to sprout increased from a mean of 27 to 43 days with increase in diameter class. The number of plants produced increased from 69.6 to 100 percent with increase in diameter class, with all cuttings in the largest 2 diameter classes producing plants. There was no significant differences in plant height and basal diameter among the different diameter classes.

Tiwari, K.M. 1983. First nursery trials of Australian poplar clones in India. *The Indian Forester*. 109(10): 697-698.

1984

Cain, N.P.; Ormrod, D.P. 1984. Hybrid vigor as indicated by early growth characteristics of Populus deltoides, Populus nigra, and Populus X euramericana. *Canadian Journal of Botany*. 62(1): 1-8.

Campbell, R.B., Jr. 1984. Asexual vs. sexual propagation of quaking aspen. In: Murphy, P.M., comp. *The challenge of producing native plants for the Intermountain area: Proceedings, Intermountain Nurseryman's Association; 1983 August 8-11; Las Vegas, NE. Gen. Tech. Rep. INT-168. Logan, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 61-65.*

The advantages of sexual (seed) and asexual (root sucker) propagation of Populus tremuloides for ornamental, reclamation, and silvicultural use are discussed. Factors considered include clone selection, root and seed collection and storage, and propagation techniques.

Cunningham, T.W.; Farmer, R.E., Jr. 1984. Seasonal variation in propagability of dormant balsam poplar cuttings. *Plant Propagator*. 30(1): 13-15.

Cuttings were taken in October, November, January, February, and April from Populus balsamifera trees of less than 25 years old and trees over 40 years old growing at Thunder Bay, Ontario, and rooted in containers in a heated greenhouse with a 16-h photoperiod. IBA increased percent rooting from 41-66 percent for the October collection, but otherwise had no significant effect. Rooting percent averaged 76-82 percent for January material, rising to 83-88 percent for April.

Evers, P.; Prat, A. 1984. Propagation research with poplars in plant raising tubes. *Populier*. 21(1): 17-20.

A summary of research at 'De Dorschkamp' with in vitro techniques of mass propagation using micro-cuttings carried out since 1981 on P. trichocarpa, P. 'Robusta', P. deltoides, and on two P. alba X P. glandulosa hybrids.

Fege, A.S.; Phipps, H. 1984. Effect of collection date and storage conditions on field performance of Populus hardwood cuttings. *Canadian Journal of Forest Research*. 14(1): 119-123.

Survival and height growth of 7 hybrid clones were evaluated for 20-cm cuttings collected from September to December 1980 and stored at temperatures from -20 to 2degC. Field survival was less than 18 percent for cuttings of all clones collected in September and for cuttings of 4 clones collected in October and stored at -20degC. Field survival and height growth during the first growing season were not significantly different for all 7 clones collected from October to December and stored at -20 to 2degC. However, since shoots and roots had begun to emerge from cuttings held at -3 and 2degC at the end of the storage period, and cuttings at -20 and -10degC could be soaked in water for a week before root emergence and planting, nursery managers gain flexibility by storing cuttings at lower temperatures.

Frison, G.; Piotto, B. 1984. Influence of length of cuttings on their rooting ability and on the growth of young poplars in nurseries. *Cellulosa e Carta*. 35(5/6): 67-79.

Results of 2 series of experiments with 6 clones of Populus canadensis and the hybrid P. deltoides X P. maximowiczii showed that length of cuttings affects rooting and growth. Length of cutting had a considerable effect on growth during the first stages of development. Longer cuttings gave rise to an increase in the number of saplings belonging to commercial classes.

Georgi, E. 1984. Vegetative propagation of aspen. *Beitrag fur die Forstwirtschaft*. 18(2): 66-69.

Thirty-one hybrid clones (and one Populus canescens clone) were studied involving crosses of P. tremula and/or P. tremuloides, and P. canescens and/or P. grandidentata. Significant differences between clones were found in relation to rooting (varying from 25.0 to 94.6 percent), rooting intensity and length of root zone, and shoot length (with or without fertilizer treatment). Development of 3-bud and 5-bud cuttings is compared.

Gregorius, H.R.; Hattemer, H.H.; Bergmann, F. 1984. Achievements and limitations in 'identifying' forest propagation material. *Allgemeine Forst- und Jagdzeitung*. 155(9): 201-214.

Methods of testing the descent of reproductive material are described and their limitations discussed. Examples are given of the electrophoretic analysis of clones and provenances using enzymes extracted from aspen leaves, spruce buds, and the endosperm of spruce seeds.

Khromova, T.V. 1984. Effect of growth regulators on rooting of cuttings of woody plants. *Byulleten' Glavnogo Botanicheskogo Sada*. 130: 59-63.

Cuttings of 10 coniferous and 10 deciduous species were dipped in IBA at 0.01 percent of succinic acid at 0.002 percent for 24 hours (winter and spring cuttings) or 16 hours (summer cuttings). Cuttings treated with the growth regulators, especially IBA, rooted better than the controls except in the case of Populus X jablokowi and Rubus deliciosus.

Khurana, D.K.; Puri, S.; Khosla, P.K. 1984. Variation in rooting capabilities and root-shoot relationship in Populus ciliata Wall. ex Royle. *Journal of Tree Sciences*. 3(1/2): 105-110.

Mature wood cuttings (from side shoots) and terminal shoot cuttings of various provenances and clones of P. ciliata from the Shilly Forest, Himachal Pradesh, were planted and checked for rooting after 1 month. Mature wood cuttings rooted much more poorly than terminal shoot cuttings (average 20.4 percent vs. 44.8 percent).

Kochkar', N.T. 1984. Features of the fruiting of Populus nigra in a natural stand and in an avenue planting. *Lesovedenie*. 2: 88-91.

A comparison is made of the growth, fruiting, and seed quality of (a) 40-year-old trees in a natural stand, and (b) 15-year-old trees in an avenue established by planting 2-year rooted cuttings. Fruiting was more abundant in (b) but seed germination was superior in (a). Germination percent is greater in seeds from large trees.

Leclerc, C.R.; Chong, C. 1984. Influence of willow and poplar extracts on rooting cuttings. In: *Combined proceedings: International Plant Propagators' Society*. Boulder, CO: The International Plant Propagators' Society; 33: 528-536.

Luxova, M. 1984. The intergration of growth activity in vegetatively propagated poplar during the establishment year. *Biologia Plantarum*. 26(6): 433-440.

Lyubimov, V.B. 1984. A new method of vegetative propagation of Turanga poplars. *Byulleten' Glavnogo Botanicheskogo Sada*. 133: 67-68.

Trials were made at Mangyshlak to develop a practical technique of propagation by root cuttings. Root bundles growing beneath natural suckers were found to be a rich source of root cuttings. The cuttings were planted in autumn in vertical slits along irrigated furrows and grown for 2 years. The success rate was 61-63 percent in P. ariana and P. diversifolia (microspecies in the P. euphratica complex) and 75 percent in P. pruinosa.

Morin, M.J.; Demeritt, M.E., Jr. 1984. A nursery guide for propagating poplars. NE-INF-56-84. Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 19 p.

Pei, B.H.; Zheng, J.B. 1984. A study on rooting capability of stem cuttings of X Populus pekinensis. Scientia Silvae Sinicae. 20(1): 18-25.

A study of the seasonal variation in rooting capacity of P. pekinensis [P. tomentosa] cuttings in relation to hormone content and treatment. Endogenous hormones were extracted and isolated from buds and bark at different times of the year. The relation between hormone content and rooting capacity changed in different seasons. Cuttings with buds always rooted better than those without buds, and the effect of applied IBA was different in cuttings with or without buds and in different seasons.

Piao, R.C.; Meng, X.L.; Li, C.R. 1984. Application of melissyl alcohol to seedlings growing in nursery. Forest Science and Technology (Linze Keji Tongxun). 7: 10-12.

Results of trials showed that application of melissyl alcohol (at 0.1-0.15 p.p.m.) promoted the growth of seedlings of most of the species tested, including Pinus sylvestris var. mongolica, Populus nigra X P. simonii, and Larix gmelinii. Data on height and basal diameter and of variance analysis are given.

Rao, P.B.; Singh, R.P.; Singh, S.P. 1984. Seed germination studies on a pioneer Himalayan tree species. Geobios. 11(3): 137-139.

Rood, S.B.; Daicos, G.; Blake, T.J. 1984. Gibberellic acid induced growth acceleration in Populus hybrids. Canadian Journal of Forest Research. 14(6): 850-854.

Weekly applications of 0.4 mg gibberellic acid (GA) in 8 microl 95 percent ethanol micropipetted onto shoots of rooted cuttings increased height growth of P. euramericana (P. '45/51') by 54 percent and shoot dry weight by 25 percent after 21 days. Total leaf area increased by 21 percent. Root growth was unaffected by GA treatment. Owing to a substantial increase in the number and size of leaves, the leaf area ratio increased. Application of GA to shoots was more effective in promoting shoot growth than application through the roots. Direct GA application also promoted the growth of P. alba X P. grandidentata and P. X canescens X P. alba X P. grandidentata. It is concluded that GA can be used for hastening early growth of these trees under winter greenhouse conditions.

Singh, R.V.; Sharma, K.C.; Kaushal, P.S. 1984. Cuttings taken from bottom one-third part of Populus ciliata plants perform better. Indian Forester. 110(4): 375-380.

A comparison was made of the rootability and growth of cuttings taken from the bottom, middle, and top thirds of one-year-old plants. Cuttings of 22.5 cm from each part were planted in Shilly and Shillaru nurseries at a spacing of 50x30 cm during the last week of February, 1981. Sprouting percent of cuttings from the bottom third was higher in both nurseries. Plants obtained from the bottom third were significantly taller than those obtained from the top third in both nurseries. The basal diameter of plants obtained from the

bottom third was significantly greater than that of those from the top third in both nurseries.

Singh, S.S.; Paliwal, G.S. 1984. Effect of Niagara on sprouting and shoot growth of Populus deltoides Bartr. ex Marsh. Acta Botanica Indica. 12(2): 190-193.

White, T.A.; Rolfe, G.L. 1984. Comparative energy costs of stem cuttings, seedlings and seeds as propagules in woody biomass plantations. Biomass. 5(1): 55-64.

Wu, Q.M.; Fan, R.W. 1984. The development and life-span of the seed of Populus adenopoda Maxim. Journal of Nanjing Institute of Forestry. 1: 139-146.

The course of seed development is described from microscopic and X-ray photographic studies. Relations between the lifespan of the seed and its microenvironment are discussed based on observation and experimentation. Possible methods for prolonging the lifespan are suggested.

1985

Andersen, A.S. 1985. Rooting of cuttings - the influence of growth regulators. In: International symposium, Regulation of Plant Integrity; 1985 September; Brno, Czechoslovakia. Acta Universitatis Agriculturae. 33(3): 187-192.

The use of auxins for root initiation in cuttings is reviewed with reference to Scrophularia, gooseberries, Campanula isophylla, peas, Populus, Chrysanthemum, Phaseolus, Hedera, Malus, and Pinus.

Ankenhorn, P.R.; Bowersox, T.W.; Kuklewski, K.M.; Thielges, B.A., eds. 1985. Proceedings of North American forest biology workshop. 7. Physiology and genetics of intensive culture; 1982 July 25; Lexington, KY. Lexington, KY: University of Kentucky. no pages.

Biomass from intensively, cultured Populus plantations has promise as feedstock for energy or chemical conversion industries. Limited information is available on the within and among parentage variation of the physical and chemical properties critical to the conversion processes. Selected properties, as a function of biomass component, biomass age, rotation, and site conditions have been measured for three Populus parentages.

Blain, A.Q.M. 1985. Black polyethylene mulches as an aid in field propagation of hardwood cuttings. In: Combined Proceedings, International Plant Propagators' Society 1984: 34: 281-286.

Hardwood cuttings of Salix viminalis, S. fragilis cv. Basfordiana, S. alba cv. Lancashire Dicks, Populus trichocarpa X P. balsamifera cv. Clone 32, Populus X robusta [cv. Robusta] and P. nigra cv. Vereekens were propagated in 2 years of trials.

Douglas, G.C. 1985. Control and utilization of adventitious and formation in Populus explants. In: In vitro techniques: Propagation and long term storage; 1984 November 27-29; Braunschweig, West Germany. Advances in Agricultural Biotechnology; 14: 55-58.

Frison, G.; Facciotto, G. 1985. Effects of characteristics of cuttings on the establishment of poplar nurseries. Quaderni di Ricerca, Centro di Sperimentazione Agricola e Forestale/Istituto di Sperimentazione per la Pioppicoltura, Italy. 6: 21 p.

Studies were made of the effects on rooting ability of poplar cuttings from sets and the growth of seedlings of: the presence of primary buds or of secondary buds only on cuttings; set diameter; part of the set from which the cutting was taken, and cutting diameter; cutting length.

Minotta, G. 1985. Comparison of different substrates for the acclimatization of micropropagated plantlets of white poplar. *Culture Protette*. 14(4): 73-76.

Micropropagated P. alba plantlets were cultivated on either riverbed sand, fertilized, or unfertilized peat, or on combinations of sand, peat, and polystyrene granules. Two types of cultivated soil were also tested. All media were used with and without Hoagland nutrient solution at half-strength. The acclimatization period was 26 days under controlled conditions of light, temperature, and RH. The fertilized peat/sand/polystyrene granule mixture (1:1:1 by volume) without nutrient solution gave the best survival and growth. Sand treated with nutrient solution gave satisfactory results.

Schroeder, W.R. 1985. Field production of rooted poplar cuttings for prairie plantings. Gen. Tech. Rep. INT-185. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 111-112.

Stuhlinger, H.C.; Toliver, J.R. 1985. Variation in rooting ability among selected clones of eastern cottonwood in Southern Louisiana. *Tree Planters' Notes*. 36(2): 13-17.

Wang, X.L.; Tian, N.X.; Yu, X.F.; Wang, Y.M. 1985. Nursery technique of seeding Populus euphratica in nursery beds. *Forest Science and Technology (Linze Keji Tongxun)*. 1: 1-2.

Recommendations are given, covering seed collection from vigorous 10-year-old trees, ridge sowing of beds containing 0.5 percent salt, irrigation, weeding, application of urea and Ca superphosphate fertilizers, and control measures for [the rust] Melampsora pruinosa. Optimal temperatures for germination is 25-30degC. Root soaking in 200 p.p.m. Bayleton [triadimefon] for 1 hour before transplanting is also recommended.

York, J.C. 1985. Dormant stub planting techniques. In: Conference on Riparian ecosystems and their management: Reconciling conflicting uses; 1985 April 16-18; Tucson, AZ. Gen. Tech. Rep. RM-120. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 513-514.

1986

Burr, K.E. 1986. Greenhouse production of quaking aspen seedlings. In: Proceedings' Intermountain Nurseryman's Association meeting, 1985. Gen. Tech. Rep. RM-125. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 31-37.

An account of the best methods developed by Colorado State Forest Service nursery, Fort Collins, for the production of container-grown Populus tremuloides seedlings.

Chaukiyal, S.P.; Arya, S.R.; Singh, Ombir. 1986. Clonal reproduction of Populus ciliata - use of most suitable parts. Indian Forester. 112(2): 152-156.

Cuttings were taken from branches and from the top, middle, and lower thirds of the main stem of 1-year-old seedlings, and planted out in Uttar Pradesh in February 1984. Overall, cuttings from the middle and lower thirds of the main stem produced the best results.

Fisher, James T. 1986. Western aspen seedling production and establishment techniques for fuel breaks around high use recreation areas. New Mexico: New Mexico State University. 1: various foliations.

Gladysz, A. 1986. Quality of aspen seeds produced under greenhouse conditions. Translated from: Sylwan (1983). 127(2): 9-20.

Hansen, E.A.; Netzer, D.A. 1986. Hybrid poplar stool spacing: effects on hardwood cutting production. Res. Pap. NC-278. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 5 p.

Koo, Y.B.; Noh, E.R.; Lee, S.K.; Byoun, K.O. 1986. Effect of types and diameter of cuttings on growth and topophysis of rooted cuttings in Suwon poplar. Res. Rep. 22. Suweon, Korea: The Institute of Forest Genetics: 15-20.

Pythoud, F.; Buchala, A.J.; Schmid, A. 1986. Adventitious root-formation in green cuttings of Populus-tremula - characterization of the effect of vitamin-D3 and indolybutyric acid. Physiologia Plantarum. 68(1): 93-99.

Rajora, O.P. Zsuffa, L. 1986. Pollen viability of some Populus species as indicated by in vitro pollen germination and tetrazolium chloride staining. Canadian Journal of Botany. 64(6): 1086-1088.

Sagwal, S.S. 1986. Effect of different levels of irrigation on nursery stock production of Populus ciliata Wall. ex Royle. Indian Journal of Forestry. 9(3): 264-268.

Cuttings of standard size were planted in 1983 in a nursery experimental area at Palampur, Himachal Pradesh. Four irrigation treatments were applied: no irrigation (control), and irrigation when the ratio of depth of irrigation water (IW) to cumulative pan evaporation (CPE) reached values of 0.4, 0.6, or 0.8. All irrigation treatments increased growth, but best growth was recorded when irrigation was applied every 12 days at an IW/CPE ratio of 0.6.

Sharma, T.C.; Bardoloi, D.N. 1986. Observations on propagation and growth of poplar. Indian Forester. 112(9): 808-813.

Shoot cuttings, 35 cm long, were collected in 1982-1983 in March-May, June-August, September-November, and December-February and inserted in nursery beds in Jorhat (Assam). Shoot growth and survival were highest in cuttings planted in December-February (96.2 and 75.5 percent) followed by those

collected in September-November (96.1 and 66.2 percent respectively). Cuttings taken in February 1985 from the bottom third of branches had better survival (92.3 percent) height (3.24 m) and diameter (32.0 cm) after 5 months than those taken from the middle and top thirds. A plantation measured annually in 1980-1984, aged 1-4 years had m.a.i. of 2.62 m in height, 3.75 cm in d.b.h., and 8.92 kg/plant dry weight.

Singh, R.V.; Singh, A.K. 1986. Root studies on nursery grown Populus ciliata plants. *Journal of the Society of Indian Foresters*. 24(1/2): 29-30.

1987

Chong, C.; Lumis, G.P.; Cline, R.A.; Reissmann, H.J. 1987. Growth and chemical composition of Populus deltoides X nigra grown in field-grow fabric containers. *Journal of Environmental Horticulture*. 5(2): 45-48.

Radwan, M.A.; Kraft, J.M.; DeBell, D.S. 1987. Bud characteristics of unrooted stem cuttings affect establishment success of cottonwood. Res. Note PNW-461. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 8 p.

Schmid, A.; Buchala, A.J. 1987. An examination of the growth substance activity of vitamin D₃. *Journal of Plant Growth Regulation*. 5(3): 175-180.

Vitamin D₃ promoted adventitious root formation in Populus tremula cuttings, and germination in Grand Rapids lettuce seeds in darkness. It showed no effects in five other bioassays for growth substances.

Wang Ruiqin; Dongyuan. 1987. The origin and development of adventitious roots of root sucker 1-2 years old in Populus tomentosa Carr. *Journal of Beijing Forestry University*. 9(3): 249-254.

Zhao Yiyu. 1987. The seasonal growth and decline of endohormone in the cuttings of Hebei poplar and its relationship with rootability. *Scientia Silvae Sinicae*. 23(2): 208-213.

1988

Krasny, M.E.; Zasada, J.C.; Vogt, K.A. 1988. Adventitious rooting of four Salicaceae species in response to a flooding event. *Canadian Journal of Botany*. 66(12): 2597-2598.

Puri, S.; Shamet, G.S. 1988. Rooting of stem cuttings of some social forestry species. *The International Tree Crops Journal*. 5(1/2): 63-69.

PROPERTIES

1975

Boccone, A. 1975. Chemotaxonomic differences between species and clones of the poplar with respect to flavonoid content. *Cellulosa e Carta*. 26(11): 39-46.

Bochurova, N.V.; Minina, E.G.; Kharina, L.V. 1975. Growth substances in the shoots of different sexes in Populus balsamifera and Pinus sylvestris. *Lesovedenie*. 5: 45-51. Referativnyi Zhurnal. (1975) 12.56.120.

The content of auxins was determined in the tissues of the leaves and especially in the reproductive organs and was higher in the male shoots than the female ones.

Bonnemann, A. 1975. Some characteristic properties of poplar wood. *Holzzucht*. 29(2/4): 17-23.

Danilin, M.A. 1975. The moisture content and toughness of the wood in aspen in relation to sex. *Izv. vyssh. u cheb. zavedenii. Lesnoi Zhurnal*. 2: 34-37. Referativnyi Zhurnal. (1975) 10.56.136.

In a study of 850 male forms and 544 female forms, the wood of the female forms had a lower moisture content and a greater toughness than that of the male ones.

Dickson, R.E.; Larson, P.R.; Isebrands, J.G. 1975. Differences in cell-wall chemical composition among eighteen three-year-old Populus hybrid clones. In: *Proceedings, 9th Central States forest tree improvement conference*: 21-34.

Goto, T.; Harada, H.; Saiki, H. 1975. Cross-sectional view of microfibrils in gelatinous layer of poplar tension wood. *Mokuzai Gakkaishi (Journal of the Japan Wood Research Society)*. 21(10): 537-542.

Ultra-thin sections of tension wood of P. euramericana were negatively stained with uranyl acetate or shadowed with Pt-Pd and examined with an electron microscope having a specimen tilting apparatus. The interpretation of the electron micrographs is discussed.

Itoh, T. 1975. Cell wall organization of cortical parenchyma of angiosperms observed by the freeze etching technique. *Bot. Mag.* 88(1010): 145-156.

Itoh, T. 1975. Fine structure of the plasmalemma surface of poplar parenchyma cells observed by the freeze etching technique. *Bot. Mag.* 88(1010): 131-143.

Jung, H.S. 1975. Variation in wood fiber dimension in Italian poplar hybrid grown in Korea. *Soul Taehakkyo Nonmunjip, B Shang Nong Ge*. 25: 237-244.

King, C.A.; Williams, D.G. 1975. Cellulose fiber-to-fiber and fines-to-fiber flocculation: a dynamic comparison. *TAPPI Press*. 58(9): 138-141.

Lamiaux, R.; Tinto, J.C. 1975. A study of the technological properties of the wood of Poplars cultivated in Mendoza Province. *Instituto Forestal Nacional, Nota Tecnologica Forestal*. 28: 11 p.

Presents tabulated data on the physical and mechanical properties (density at 15 percent r.h., shrinkage, hardness, and strength in compression parallel and in static and dynamic bending) and working properties (sawing, planing, moulding, and finishing) of wood of Populus canescens and P. alba var. pyramidalis from plantations in western Argentina.

Littleford, T.W.; Roff, J.W. 1975. Evaluation of structural grades of lumber: the northern aspen species group. VP-X-148. Ottawa, Ontario: Environment Canada, Canadian Forestry Service. 19 p.

Mackay, J.F.G. 1975. Properties of northern aspen discolored wood related to drying problems. Wood and Fiber. 6(4): 319-326.

In a study on bolts from logs of Canadian Populus tremuloides and P. balsamifera, randomly selected at a sawmill in Alberta, discoloured wood isolated from the inner sapwood area shrank more and was weaker in compression perpendicular than adjacent normal sapwood.

Musha, Y.; Goring, D.A.I. 1975. Distribution of syringyl and guaiacyl moieties in hardwoods as indicated by ultraviolet microscopy. Wood Science and Technology. 9(1): 45-58.

The UV absorption of various morphological regions was measured on ultra-thin specimens of 2 softwood and 11 hardwood species by means of a UV microscope with a photo-multiplier attachment. It is deduced from the trends in absorbance and peak wavelength that syringyl residues become increasingly predominant in the walls of fibers and ray cells as the number of methoxyl groups per phenylpropane unit in the lignin (MeO/C9) increases.

Nepenin, Yu.N.; Buevskaya, A.D.; Gashkova, M.Ya.; Moshkalev, A.G. 1975. The physical properties and chemical composition of the wood forming the raw-material resource of the planned Tavdin Pulp and Paper Combine. Lesnoi Zhurnal. 6: 112-118.

Gives results of studies on samples of Pinus sylvestris, P. sibirica, Picea obovata, Abies sibirica, Betula alba s.l. and Populus tremula in the Sverdlovsk and Tyumen regions of the USSR. Data are tabulated on the percent of reaction wood, the density of the sapwood, heartwood, and wood with decay, and the chemical composition of the various species and assortments.

Nikolic, Momir. 1975. The dependence of physico-mechanical properties of Euro-American poplars and our domestic black poplar on some external and internal factors. Beograd: Univerzitet u Beogradu, Sumarski fakultet. 125 p.

Nikolic, M. 1975. Dependence of physical and mechanical properties of Eur-American poplars and our domestic black poplar on some external and internal factors. Blas Sumar Fak. 49: 127 p.

Nikolov, S.; Raichev, A.; Barzova, R. 1975. Specific heat of the wood and bark of some tree species. Nauchni Tr., Vissh Lesotekh. Inst., Sofia, Ser. Mekh. Tekhnol. Durv. 20: 29-33.

Tabulated data are given minimum, mean, and maximum values of the specific heat of wood of 13 tree species grown in Bulgaria, i.e. Fagus sylvatica, Quercus rubra, Fraxinus excelsor, Ulmus campestris, Acer platanoides, A.

negundo, Tilia tomentosa, Salix babylonica, Populus deltoides, P. nigra var. italica, Picea abies, Abies albs, and Pinus heldreichii.

Odabasi, Y.; Acar, O. 1975. Some investigations on the mechanical properties of Black poplar as a construction material. Yillik Bul Kavak Hizli Gelisen Orman Agacları Arastırma Enst. 10: 281-332.

Rangelov, K. 1975. Technical properties of Populus tremula wood of local origin. Gorsko Smoiansmbo. 31(5): 33-37.

Sachsse, H. 1975. A comparative of important wood properties of the Populus trichocarpa cultivar "Senior". Mitt Ver Forstl Standortskd Forstpflanzenzucht. 24: 68-77

Sterba, S. 1975. Contribution to the study of antigenic properties of poplar leaf extracts. Prace Vyzkumneho Ustavu Lesniho Hospodarstvi a Myslivosti. 46: 45-58.

Proteins of leaf extracts from three Populus nigra clones and a P. deltoides X P. nigra hybrid were tested by four different serological methods. Genotypic specificity was most clearly established by two-dimensional immunoelectrodifusion and by immunoelectrophoresis. Both methods distinguished the clones from each other and the clones as a group from the hybrid.

Zsombor, F. 1975. Some results of anatomical, physical and mechanical studies on new silvicultural varieties. Fajtakiserletezes - Fajtaminosités. 25: 505-528.

From an analysis of data on (1) annual ring width, (2) volume weight, (3) fiber length, (4) bending strength, (5) compression strength, (6) impact strength, and (7) shrinkage and swelling in three varieties each of poplar (Populus euramericana), willow (Salix alba and S. humboldtiana) and Robinia pseudoacacia, it is concluded that the first and last characters are varietally determined and that the other characters are of value in predicting mature timber yield and quality from data on young trees.

1976

Asakawa, Y.; Wollenweber, E. 1976. A novel phenolic acid derivative from buds of Populus lasiocarpa. Phytochemistry. 15(5): 811-812.

Charriere-Ladreix, Y. 1976. Intracellular localization of secretory flavonoids from Populus nigra. Planta. 129(2): 167-174.

Chow, P. 1976. Properties of medium-density dry-formed fiberboard from seven hardwood residues and bark. Forest Products Journal. 26(5): 48-55.

Describes a study to evaluate the suitability of seven dry mill residues and the bark of five important hardwood species as raw materials for the manufacture of dry-formed medium-density fiberboard; to compare the properties of particle board made from hammer-milled hardwood residues and residues refined by steam pressure; and to determine the effect of different resin

contents on the properties of various kinds of fiberboards. Fiberboards made from the bark of Populus spp. showed the lowest average expansion values and may be suitable for underlay or other interior uses.

Clement, A.; Janin, G. 1976. A comparative study of the distribution of the principal cations and of phosphorus in a stem of Populus 'Fritzi-Pauley'. Plant and Soil. 45(3): 543-554.

In a previous study, five wood zones in the stem of 15-year-old Populus trichocarpa 'Fritzi Pauley' were distinguished by their P content: crown wood, peripheral wood, sapwood, heartwood, and core wood. Using similar sampling techniques at least three zones were distinguished for all cations tested (Ca, Mg, K, Mn, Zn): sapwood, heartwood, and a central zone comprised mainly of core wood. In addition, K differentiated crown wood and peripheral wood. Observations confirmed that there is a redistribution of mineral ions when heartwood begins to form, with cations accumulating in the heartwood and the anion P becoming more concentrated in the sapwood. Concentrations of both P and mineral ions increased with age of ring; this is attributed to a process of accumulation rather than active retention. It is concluded that a single disc of wood ground to sawdust cannot be representative of the ion composition of the whole stem.

Coleman, G.E., III; Biblis, E.J. 1976. Properties of particleboard from southern yellow pine and cottonwood mixtures. Forest Products Journal. 26(1): 48-51.

Denbnovetskii, G.Yu.; Menina, M.M. 1976. Effect of aqueous extracts of intact tissues from the bark of some poplar varieties on spore germination in Dothichiza populea Sacc. et Briad. Referativnyi Zhurnal. (1976) 12.55.1732.

A close correlation was established between the degree of resistance of 10 varieties and the fungistatic properties of extracts from their healthy bark.

Diaconescu, V.; Riscuta, S. 1976. Composition and structure of principal hemicelluloses from sapwood of 5-year-old Populus 'Robusta'. Celuloza si Hirtie. 25(3): 94-104.

Experimental evidence is presented for the chemical structures of a xylan and a glucomannan.

Einspahr, D.W.; Harder, M. 1976. Hardwood bark properties important to the manufacture of fiber products. Forest Products Journal. 26(6): 28-31.

Presents a progress report on a study of the bark properties of 16 major pulpwood species, intended to enable the best use to be made (particularly by the paper industry) of wood fiber derived from full-tree chips. Examples of the type of data obtained are tabulated for Populus tremuloides, Acer saccharum, Betula papyrifera, Quercus rubera, Q. falcata, and unspecified northern and southern representatives of the White Oak group.

Gambi, G.; Stradaioli, G. 1976. Chemical analysis of poplar buds. Ann. Inst. Sper. Selvic. 5: 61-81.

Herpka, I. 1976. Variation patterns of wood basic density concerning different sample sources in poplar clones. Topola. 20(109/110): 3-16.

Heyne, D. 1976. Composite materials from cardboard and veneer. Holzindustrie. 29(3; 6): 78-79; 171. Part 2: properties. Part 3: application.

In tests on several boards of this type the best bending strength and resistance to puncture etc. were shown by a combination of Pinus sylvestris veneer with light-weight corrugated board. Poplar veneer made a slightly weaker composite. Economies in costs and materials, compared with plywood or lumber chests, are considerable.

Hoffmann, E.; Jaestedt, M.; Weisgerber H. 1976. Black poplar hybrid clones approved for sale; growth properties, resistance and recommendations for planting. Merkblatt, Forschungsinstitut für Pappelwirtschaft Hann. Münden. 7: 56 p.

Detailed descriptions, supported by illustrations of nursery stock and mature plants, of all of the 25 clones at present approved for sale in the German Federal Republic.

Itoh, T.; Shimaji, K. 1976. Orientation of microfibrils and microtubules in cortical parenchyma cells of poplar during elongation growth. Bot. Mag. 89(1016): 291-308.

Janin, G.; Keller, R. 1976. Physical, mechanical and paper-making properties of the wood of two hybrids between Populus tremula and P. tremuloides. France, Nancy: Station de Recherches sur la Qualité des Bois, Centre National de Recherches Forestières. 22 p.

The results showed that in comparison with other Populus spp. both hybrids produced a particularly homogeneous wood of high density and moderate shrinkage. Pulp yield was high (55 percent), while the Kappa number was low (20). Because the samples were taken from young trees (12-13 years old) mean fibre length was relatively short compared with that normally recorded for older trees.

Janin, G.; Letzelter, B. 1976. Development of the papermaking qualities of young Poplar trees before the first coppicing. France, Nancy: Station de Recherches sur la Qualité des Bois, Centre National de Recherches Forestières. 8 p.

The development of pulpmaking and papermaking quality was studied in 3- and 4-year-old stems of Populus 'I-45/51', P. 'I-214', and P. 'Fritzi Pauley' during the first rotation in stands in central France planted at close spacing for future management as coppice. For each clone, the proportions of stemwood, branchwood, twigs and bark in the total above-ground material are tabulated at 3 and 4 years old. P.'I-45/51' appeared to be the best clone owing to the more rapid increase in fibre length with age.

Kolarov, D. 1976. Study of the interrelationship between the anatomical structure, chemical composition and physical and mechanical properties of the timber in some Euramerican poplar clones. Gorskostopanska Nauka. 13(2): 74-80.

Of the four forms studied, the lowest timber density and strength was shown by I-214 and the highest by Bachelieri and Vernirubens. The most porous timber with the lowest cellulose content and the highest lignin content was characteristic of I-214. The size of the wood fibers also affected timber strength.

Nanassy, A.J. 1976. True dry-mass and moisture content of wood by NMR. *Wood Science*. 9(2): 104-109.

The nuclear magnetic resonance (NMR) spectra of six US woods were measured during a wetting and drying cycle to determine the analytical value of the narrow and broad components of the spectra. It was possible to optimize the spectral detection for the narrow component which represents the weakly bound water.

Nanko, H.; Saiki, H.; Harada, H. 1976. Cell wall development of chambered crystalliferous cells in the secondary phloem of Populus euramericana. *Bulletin of the Kyoto University Forests*. 48: 167-177.

Phloem fiber groups in P. euramericana are surrounded by cells, derived from parenchyma strands, containing crystals of calcium oxalate. The development of the crystalliferous cells was studied in wood from the stem of a 7-year-old tree at Kyoto.

Nepveu, G. 1976. Wood quality juvenile mature correlations. France, Nancy: Station de Recherches sur la Qualite des Bois, Centre National de Recherches Forestieres. 10 p.

French studies on correlations between juvenile and mature wood of Pinus pinaster, different clones of the genus Populus, Abies alba, Terminalia ivorensis, and Pseudotsuga menziesii are reviewed. In general, juvenile/mature genetic correlations for wood quality have a high and positive value, in contrast to correlations for characteristics associated with vigor.

Neuman, R.D. 1976. Pulp and paper characteristics of Populus hybrids. Gen. Tech. Rep. NC-21. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 112-114.

Nikolov, S.; Abrashev, G. 1976. Swelling of aspen wood in aqueous solutions. *Gorskostopanska Nauka*. 13(2): 81-88.

Specimens of Populus tremula wood, 30 x 30 x 10 mm, were treated for a period up to 720 hours at 20degC with aqueous solutions (of various concentrations) of ethyl alcohol, ammonia, H₂SO₄, NaCl, HCl, H₂O₂, NaOH, and sugar. Swelling was greatest in solutions of ethyl alcohol, reaching a maximum with alcohol concentrations of 40 to 50 percent. In all cases, concentration had a much greater effect on swelling in the tangential than in the radial direction.

Perekhozhikh, I.V.; Kulinichev, A.F. 1976. Physical and mechanical properties of wood of increased stability. *Lesnoi Zhurnal*. 5: 140-142.

Studies were made on the properties (strength, hardness, water absorption and dimensional stability) of densified wood of aspen (Populus tremula) and fir (Abies sibirica) produced by hot-pressing. The results show that the physical and mechanical properties of the compressed wood are sufficiently high to allow it to be used in bearing elements in construction and also in furniture.

Reck, S.; Dieterich, H. 1976. Some growth and wood characteristics in a crossing of Populus alba X Populus grandidentata compared with the hybrid Black Poplar 'Robusta'. *Silvae Genetica*. 25(2): 44-48.

Wood characteristics of vegetatively propagated P. 'Robusta' and F1 progeny of a P. alba x P. grandidentata cross, growing in a valley at 470 m altitude in Southern Germany, were determined from discs taken at breast height from trees felled at 20 years old. Mean height, d.b.h., and dry matter production were all about 15 percent greater, but wood density was 7 percent less in the cross than in P. 'Robusta'. It is concluded that selection and vegetative propagation of single good hybrid seedlings, yielding up to 80 percent more dry substance than P. 'Robusta', are feasible.

Sachsse, H. 1976. Comparative studies on the wood properties of the Poplar clones 'Rochester', 'Harff' and trichocarpa '603'. *Mitteilungen, Verein für Forstliche Standortskunde und Forstpflanzenzuchtung*. 25: 33-38.

The annual ring width, heartwood and tension wood, fibre length, density, compression and bending strength, shock resistance and veneer quality of one or two stems 14-16 years old of each clone grown in Baden-Württemberg are compared.

Sanadze, G.A.; Chiabrishvili, N.G.; Kalandadze, A.N. 1976. Identification of phytogenic isoprime by the method of spectroscopy of nuclear magnetic response. *Fiziologiya Rastenii (Mosk)*. 23(5): 1070-1072.

Smilga, J. 1976. Length of aspen wood fibre. *Jaunak Mezsaimn*. 19: 22-27.

Troxell, H.E. 1976. Aspen veneer and plywood. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 84-86.

Tsel'millere, M.Ya. 1976. Permeability of Betula verrucosa and Populus tremula wood. *Khimiya Drevesiny*. 5: 101-103.

Trials were made on the vacuum/pressure impregnation of green wood with a 3 to 4 percent solution of a Dohnalit-type preservative.

Walters, C.S.; Reiss, W.L. 1976. Predicting modulus of rupture from modulus of elasticity for small, clear specimens of oak and cottonwood. *Forest Products Journal*. 27(6): 51-53.

Data from a study on 2-inch lumber of (a) red oak (mainly Quercus rubra and Q. palustris) and (b) cottonwood (Populus deltoides) sampled from 15 sawmills in Illinois, showed significant correlation between the MOE and MOR of small clear specimens.

Wengert, E.M. 1976. Predicting average moisture content of wood in a changing environment. *Wood and Fiber*. 7(4): 264-273.

A computer model was developed to predict the average moisture content of wood under conditions of varying atmospheric RH and temperature. There was good general agreement between experimental values obtained by exposing wood of 9 species to various temperatures and RH regimes, and predicted values.

Wengert, E.M. 1976. A quick method to distinguish aspen heartwood and sapwood. *Wood and Fiber* 8(2): 114-115.

Wengert, E.M. 1976. Some properties and characteristics of aspen that affect utilization in the Rocky Mountains. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 62-67.

Young, R.A. 1976. Wettability of wood pulp fibers. Applicability of methodology. Wood and Fiber. 8(2): 120-128.

1977

1977. Poplar. Annual report of the State Agronomic Research Centre, Gembloux, 1976. 160 p.

Of a number of anatomical characters, fiber diameter varied most among clones. Variations in specific gravity were highly significant among clones in young wood but not in adult wood. The percentage of tension wood, the number of vessels per mm², fiber diameter, specific gravity, and shrinkage were under genetic control.

Akimov, Yu.A.; Balvochyute, Ya.P.; Morkunas, A.V. 1977. Sexual differences in composition of essential oil in Populus suaveolens. In: Dundina, N., ed. Physiological aspects of plant introduction. Riga, Latvian SSR: Zinatne: 18.

In male trees, hydrocarbons constituted about 50 percent of the essential oil in the leaf buds, while alcohols made up only 5-9 percent of the oil. In female trees, alcohols constituted 40-50 percent of the essential oil in the buds and hydrocarbons 20-30 percent. These differences were stable regardless of the age or habitat of the tree.

Asakawa, Y.; Takemoto, T.; Wollenweber, E.; Aratani, T. 1977. Lasiocarpin A, B and C, three novel phenolic triglycerides from Populus lasiocarpa. Phytochemistry. 16(11): 1791-2795.

Bailey, G.R.; Dobie, J. 1977. Alberta poplars--tree and log quality. Inf. Rep. VP-X-155. Vancouver, Canada: Western Forest Products Laboratory. 8 p.

Balvochyute, Ya.P.; Akimov, Yu.A.; Morkunas, A.V. 1977. Features of the composition of essential oils in the buds of some poplar species. In: Dundina, N., ed. Physiological aspects of plant introduction. Riga, Latvian SSR: Zinatne: 3-4.

The essential-oil composition of the leaf buds of 10 species showed intraspecific stability, regardless of the age and origin of the tree, but in Populus suaveolens, P. laurifolia, and P. nigra marked differences were observed in relation to the sex of the tree. The hybrid species P. berolinensis inherited the essential-oil composition of its maternal form, P. laurifolia.

Charriere-Ladreix, Y. 1977. Organelle interrelations within flavonoid glandular cells of Populus nigra L. Physiol. Veg. 15(4): 619-640.

Czaninski, Y. 1977. Vessel-associated cells. IAWA Bulletin. 3: 51-55.

A description is given of the cytological and chemical properties, and some possible functions of parenchyma cells associated with vessels.

Draganova, R.; Nikolova, T. 1977. Chemical composition of wood of Populus vernirubens in different site conditions. Gorsko Stopanstvo. 33(2): 29-33.

Stems of P. vernirubens were sampled from five different plots in Bulgaria, in plantations aged 9-15 years. Stem sections were taken at breast height and at heights of 5 and 10 m, and the chemical composition of the wood was determined. Data are presented on the contents of cellulose, lignin, pentosans, substances soluble in cold and hot water and in ether, and ash. The results indicate that the site conditions have a significant effect on the amounts of extractives and ash, but not on the main components, viz. cellulose, lignin, and pentosans.

Gertjejansen, R.O. 1977. Properties of particleboard from sunflower stalks and aspen planer shavings. Tech. Bull. 311. Minneapolis, MN: University of Minnesota, College of Forestry, Agricultural Experiment Station. 8 p.

In laboratory-scale tests on boards made from sunflower stalks and/or aspen (Populus tremuloides) planer shavings, MOR, IB strength, thickness dimensional stability and durability decreased with an increase in sunflower-stalk content, while MOE and linear dimensional stability increased.

Gladysz, A.; Janson, L.; Szczubialka, Z. 1977. Nutrient content in leaves of two years old quaking aspens. Sylvan. 121(3): 21-32.

Isebrands, J.G.; et al. 1977. Intensive cultivation - its effect on wood and pulp properties. In: Forest biology, wood chemistry conference; 1977 June 20-22; Madison, WI. Atlanta, GA: TAPPI Press. 36 p. Abstracts.

Jo, J.M.; Kang, S.G.; Lee, Y.D.; Jung, H.S.; Ahn, J.M.; Shim, C.S. (Sim, J.S.). 1977. Studies on the properties of Populus grown in Korea. For. Res. Rep. 21. Seoul, S. Korea: Forest Research Institute: 187-206.

Anatomical, physical, and mechanical properties are tabulated for woods of P. alba, P. alba x glandulosa, P. davidiana (P. tremula var. davidiana), P. deltoides, P. euramericana (P. x canadensis) (2 clones), P. koreana, P. maximoviczii (P. maximowiczii) and P. nigra var. italica.

Kim, C.S.; Kim, S.S. 1977. Variation in the pattern of isoperoxidase in genus Populus. 2. Patterns of isoperoxidase in the leaves of 15 clones of X Populus albuglandulosa. Journal of the Korean Forestry Society. 36: 1-4.

The clones could be distinguished by their banding patterns on zymograms prepared by starch gel electrophoresis.

Law, K.N.; Garceau, J.J.; Koran, Z. 1977. Measurement of intra-increment tensile strength by using a zero-span technique. Wood Science. 10(1): 24-28.

A report on trials of the Pulmac zero-span tester for measuring the tensile strength of thin tangential sections (microspecimens) cut from part of the annual ring, the clamped portion of the specimen being only 1.5 mm long. The microspecimens were taken at b.h. from a freshly felled white spruce (Picea glauca), a balsam fir (Abies balsamea), and a quaking aspen (Populus tremuloides), respectively 50, 48, and 36 years old, and tested at various span lengths.

Letham, D.S.; Parker, C.W.; Duke, C.C.; Summons, R.E.; MacLeod, J.K. 1977. O-glucosylzeatin and related compounds--a new group of cytokinin metabolites. *Ann. Bot.* 41(171): 261-263.

Mihajlovic, O. 1977. Comparative investigation of quality indicators of poplar heartwood coloring. *Sumarstvo.* 30(2): 21-32.

Murphey, W.K.; Holt, D.H.; Bowersox, T.W.; Blankenhorn, P.R.; Baldwin, R.C. 1977. Selected wood properties of young hybrid poplar. In: Forest biology, wood chemistry conference; 1977 June 20-22; Madison, WI. [Madison, WI]: TAPPI Press: 231-237.

Nanko, H.; Saiki, H.; Harada, H. 1977. Development and structure of the phloem fibers in the secondary phloem of Populus euramericana. *Mokuzai Gakkaishi* (Journal of the Japan Wood Research Society). 23(6): 267-272.

Transverse and radial sections prepared from samples containing differentiating phloem from a 7-year-old tree of P. euramericana were examined with the electron microscope. The differentiation of phloem fibers and their cell wall structure are described, and illustrated by electron micrographs.

Okumura, S.; Harada, H.; Saiki, H. 1977. Thickness variation of the G-layer along a mature and a differentiating tension wood fiber in Populus euramericana. *Wood Science and Technology.* 11(1): 23-32.

The thickness of the gelatinous layer and of the secondary wall layers was studied in serial transverse sections. In a mature gelatinous fiber, the thickness of the G-layer was greatest in the center of the fiber, decreasing towards the tips. The thickness of the S2 layer also decreased from the center to the tips, whereas that of the S1 layer was uniform throughout the fiber length. From observations of differentiating fibers, it was concluded that, at the earliest stage of its formation, the G-layer possesses a uniform thickness, and that the difference in thickness between the center and tips increases as the fiber develops. The thickening process of the secondary wall layers is discussed.

Palka, L.C.; Warren, W.G. 1977. Grouping of Canadian veneer species based on plywood rolling-shear properties. Inf. Rep. VP-X-163. Vancouver, Canada: Western Forest Products Laboratory. 38 p.

Tests were made on specimens from 7 veneer mills of plywood of each of 13 western and 10 eastern species made from 5.1-inch thick C-grade veneers bonded with PF glue. Three eastern groupings, 4 western groupings, and 7 combined national groupings (in which there is some overlap of limits) are proposed on the basis of average values of failure stress and modulus of rigidity. The best species were Pinus contorta, P. banksiana, P. resinosa, P. strobus, and Populus tremuloides.

Parham, R.A.; Robinson, K.W.; Isebrands, J.G. 1977. Effects of tension wood on kraft paper from a short-rotation hardwood. *Wood Science Technology.* 11(4): 291-303.

Kraft pulp yields of tension wood (TW) and normal wood (NW) from erect 5-year-old trees of P. 'Tristis No. 1' were 60 and 53 percent respectively. Strength properties of TW pulp were inferior to those of NW pulp when beaten

for 0-45 minutes. TW fibers resisted collapse during paper formation and produced thick, porous sheets of poorly bonded elements. The inferior properties of TW paper are due to the high proportion of gelatinous fibers, which are only moderately hygroscopic.

Pearl, I.A.; Darling, S.F. 1977. Hot-water extractives of the leaves of Populus heterophylla. Journal of Agricultural Food Chemistry. 25(4): 730-734.

Results from this species of the Leucoides section of Populus were entirely different from those obtained previously from all other sections of the genus. Salicin and salicortin were not found; tremulacin was found. C-glycosyl flavones such as vitexin and orientin were found for the first time in the Salicaceae.

Shamaev, V.A.; Verkhovets, A.K.; Popova, N.I.; Serdiuk, L.S. 1977. Study of aspen wood modified by urea. Khimiya Drevesiny. 4: 101-105.

Simionescu, C.; Cernatescu-Asandei, A.; Andriescu, P.; Papadopol, C.S. 1977. Research into the field of poplarwood. (6): Chemical composition of some juvenile poplar species. Cellulose Chemistry and Technology. 11(2): 141-153.

Juvenile woods showed relatively high extractives and low cellulose contents compared with wood from control trees.

Tsoumis, G.; Passialis, C. 1977. Effect of growth rate and abnormal growth on wood substance and cell wall density. Wood Science and Technology. 11(1): 33-38.

Studies of samples from wide and narrow growth rings of poplar (Populus 'I-214') and pine (Pinus halepensis), and from normal and tumour wood of spruce (Picea glauca) showed no definite relationship between fast or abnormal growth and density of the wood substance or of the cell wall (including voids) in the dry state. Voids were shown to comprise a very small volume.

1978

Bendtsen, J.A.; Haskell, J.H.; Galligan, W.L. 1978. Characterizing the stress-compression relationship of wood in compression perpendicular to grain. Wood Science. 10(3): 111-121.

A nonparametric statistical technique was developed to analyze the stress-compression behaviour of bolts using existing experimental data for aspen (Populus tremuloides), red oak (Quercus rubra), white fir (Abies spp.), and Douglas fir (Pseudotsuga menziesii).

Burrows, W.J. 1978. Evidence in support of biosynthesis de novo of free cytokinins. Planta. 138(1): 53-57.

Chaadaev, A.E.; Shamaev, V.A. 1978. Investigation of the anti-friction properties of compressed wood modified with urea. Lesnoi Zhurnal. 1: 74-77.

Samples of birch (Betula alba), aspen (Populus tremula), and pine (Pinus sylvestris) wood, impregnated with urea and compressed to a density of 1150-1200 kg/m³ were tested for friction and wear. The results indicate

that treatment with urea does not impair the anti-friction properties of the compressed wood.

Chou, M.; Yao, H.S. 1978. A comparison of the decay resistance of untreated poplar wood with that of its polymerized wood using scanning electron microscopy. *Chung-Kuo Lin Yeh K'o Hsueh*. 3: 47-51.

Chupov, V.S. 1978. Comparative immunoelectrophoretic analysis of the pollen proteins of some Amentiferae. *Botanicheskii Zhurnal*. 63(11): 1579-1585.

Antisera of the pollen of Corylus avellana and Populus tremula were tested against water extracts of the pollen of 22 species of angiosperms in 6 subclasses. Results suggest that the Betulales, Fagales, and Juglandales form a closely related group.

Goto, T.; Harada, H.; Saiki, H. 1978. Fine structure of cellulose microfibrils in poplar gelatinous layer and Valonia. *Wood Science and Technology*. 12(3): 223-231.

Fine structure of cellulose microfibrils in poplar (Populus euramericana) gelatinous layer and Valonia macrophysa cell walls was observed by electron microscopy. Microfibrils in the gelatinous layer in Populus appeared to have a crystalline core surrounded by a paracrystalline region, which was not observed in Valonia cells. Disintegration caused kinks and hydrolysis produced shortened microfibrils.

Graham, L.L.; Johnson, M.A. 1978. Sucrose synthetase from triploid quaking aspen callus. *Phytochemistry*. 17(8): 1231-1233.

Grozdzits, G.A.; Chauret, G. 1978. The distribution and form of deformation in transversely compressed wood. Rep. OPX204E. Ottawa, Ontario: Eastern Forest Products Laboratory. 47 p.

Deformation in Populus tremuloides, Acer saccharum, Betula papyrifera, Pinus strobus, and Picea glauca was greater at the surface than in the centre of green 13-mm cube samples, (12.4, 3.4, 2.7, 4.5, and 11.2 times greater respectively). Light and electron microscopy showed that vessel distribution, size and clustering had the greatest influence on the pattern of deformation.

Holt, D.H.; Murphey, W.K. 1978. Properties of hybrid poplar juvenile wood affected by silvicultural treatments. *Wood Science*. 10(4): 198-203.

Horn, R.A. 1978. Morphology of pulp fiber from hardwoods and influence on paper strength. Res. Pap. FPL-312. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 8 p.

Morphological measurements were made on pulps of various hardwood species before beating and physical properties were measured before and after beating. The species were: Acer saccharum, Alnus rubra, Betula papyrifera, Carya ovata, Fagus grandifolia, Liquidambar styraciflua, Nyssa sylvatica, Populus tremuloides, Quercus alba, and Ulmus americana.

James, T.D.W.; Smith, D.W. 1978. Seasonal changes in the caloric value of the leaves and twigs of Populus tremuloides. *Canadian Journal of Botany*. 56(15): 1804-1805.

Keith, C.T.; Chang, C.I. 1978. Properties of heat-darkened wood. 1. Hygroscopic properties. Rep. OPX213E. Ottawa, Ontario: Eastern Forest Products Laboratory. 20 p.

Samples of Fagus grandifolia, Acer saccharum, Ulmus thomasi, and Populus tremuloides were exposed to 180degC for 8, 16, and 32 h, 200degC for 2, 4, and 8 h, and 220degC for 1/2, 1, and 2 h in a forced-circulation laboratory oven. When subsequently exposed to controlled humidities, heat-treated samples showed a reduction in equilibrium moisture content proportional to treatment temperatures, reaching a maximum at 220degC for 2 hour. Heat treatment also led to lower rates of moisture sorption and less shrinkage and swelling with changes in moisture content.

Koperin, I.F.; Golovkov, S.I. 1978. Calorie equivalents of wood of different species. *Lesnaya Promyshlennost'*. 11: 20-21.

Data are tabulated on the calorie equivalents of sound freshly felled spruce (Picea sp.), larch (Larix sp.), fir (Abies sp.), pine (Pinus sibirica and P. sylvestris), willow (Salix sp.), linden (Tilia sp.), aspen (Populus tremula), alder (Alnus sp.), poplar (Populus sp.), birch (Betula verrucosa), beech (Fagus sylvatica), elm (Ulmus sp.), hornbeam (Carpinus sp.), oak (Quercus sp.), and maple (Acer sp.).

Nepveu, G.; Keller, R.; du Cros, E.T. 1978. Juvenile selection for wood quality in some black poplars. *Annales des Sciences Forestieres*. 35(1): 69-92.

Examination of one-year-old stems from 23 clones of Populus nigra and 28 of P. euramericana revealed considerable genetic variability for wood density and demonstrated that early selection for this character is possible without endangering yield, although indirect selection may occur for clones that show strong tangential shrinkage.

Nikolaeva, V.G.; Khokhlova, A.A. 1978. Antimicrobial activity of some plants used in the USSR folk medicine as antiseptics. *Rastitel'nye Resursy*. 14(2): 234-237.

Birch (Betula verrucosa) and poplar (Populus nigra) bud infusions showed very high antimicrobial activity.

Roland, J.C. 1978. Early differences between radial walls and tangential walls of actively growing cambial zone. *IAWA Bulletin*. 1: 7-11.

Simson, B.W.; Timell, T.E. 1978. Polysaccharides in cambial tissues of Populus tremuloides and Tilia americana. I. Isolation, fractionation, and chemical composition of the cambial tissues. *Cellulose Chemistry and Technology*. 12(1): 39-50.

Simson, B.W.; Timell, T.E. 1978. Polysaccharides in cambial tissues of Populus tremuloides and Tilia americana. II. Isolation and structure of a xyloglu can. *Cellulose Chemistry and Technology*. 12(1): 51-62.

Simson, B.W.; Timell, T.E. 1978. Polysaccharides in cambial tissues of Populus tremuloides and Tilia americana. III. Isolation and constitution of an arabinogalactan. *Cellulose Chemistry and Technology*. 12(1): 63-77.

Simson, B.W.; Timell, T.E. 1978. Polysaccharides in cambial tissues of Populus tremuloides and Tilia americana. IV. 4-O-methylglucuronoxylan and pectin. Cellulose Chemistry and Technology. 12(1): 70-84.

Stern, E.G. 1978. Performance of warehouse and exchange pallets made of six western woods. Bull. 156. Blacksburg, VA: Virginia Polytechnic Institute and State University. 48 p.

Tests for rigidity, stiffness, and load-carrying capacity were made on warehouse and exchange pallets made of green (or partially-seasoned), nailed or stapled western hardwoods or western softwood.

Streibl, M.; Stransky, K.; Herout, V. 1978. N-alkanes of some tree barks. Collection of Czechoslovakian Chemistry Communications. 43(1): 320-326.

1979

Bowersox, T.W.; Blankenhorn, P.R.; Murphey, W.K. 1979. Heat of combustion, ash content, nutrient content, and chemical content of Populus hybrids. Wood Science. 11(4): 257-262.

Composite wood and bark specimens from 4-year-old trees of seven Populus hybrids were analyzed for: OD gross heat of combustion, ash content, macronutrients, and selected chemicals. Similar analyses were conducted on segmental specimens (roots-no bark; wood and bark of 1, 2, 3, and 4 years of age; 1- to 4-year-old bark, and 4-year-old leaves) from one hybrid (NE-388).

Cheng, W.W.; Benseid, D.W. 1979. Anatomical properties of selected Populus clones grown under intensive culture. Wood Science. 11(3): 182-187.

Within-tree and among-clone variation were evaluated for anatomical characteristics and fiber quality of six Populus clones showing rapid growth rates. On the basis of fiber length, number of vessels, and percent of vessels, ray cells, normal fibers, gelatinous fibers and total fibers, clones 5339 (Populus alba X P. grandidentata) and 5260 (P. tristis X P. balsamifera) were considered most suitable for further intensive culture studies. The percent of gelatinous fibers in tension wood varied significantly among the six clones.

Cheng, W.W.; Benseid, D.W. 1979. Influence of nitrogen on stem anatomy of two Populus clones. Wood Science. 11(3): 176-181.

Cuttings from clones of Populus tristis X P. balsamifera and a natural hybrid P. deltoides X P. nigra were grown for 3 months in aerated nutrient solutions with 8 different concentrations of N (0-70 p.p.m.). Cuttings without N treatment showed a slower diameter and height growth, and had a larger number and percent of vessels, shorter fibers, and a lower percent of ray cells and G-fibers (fibers possessing a gelatinous (G-) layer). More than 10 p.p.m. N did not induce further significant changes in growth rate or stem anatomy. EM studies showed that the only significant difference in the structure of the G-fibers was in the thickness of the G-layer. The growth and anatomical responses of the 2 clones were significantly different.

Duke, C.C.; Letham, D.S.; Parker, C.W.; MacLeod, J.K.; Summons, R.E. 1979. Structure and synthesis of cytokinin metabolites. 4. Complex of O-glucosylzeatin derivatives formed in Populus species. *Phytochemistry*. 18(5): 819-824.

Enchev, E.A.; Bl"skova, G. (Blaskova, G.); Stoikov, Kh. (Stoikov, H.). 1979. Effect of age on the physical and mechanical properties of the wood in some Euramerican poplar clones. *Gorskostopanska Nauka*. 16(1): 28-35.

Of eight clones studied, Populus X euramericana 'I214' had the lowest density of wood at all ages (338-356 kg/m³); high densities (429-457 kg/m³) were shown by P. X euramericana 'B12', 'Weltheimer' and 'Vernirubens'. Crushing strength and bending strength, were highest in clones with the greatest density. Density, crushing strength and bending strength, all varied with age.

Murphey, W.K.; Bowersox, T.W.; Blankenhorn, P.R. 1980. Selected wood properties of young Populus hybrids. *Wood Science*. 11(4): 263-267.

The effects of planting density in intensively cultured Populus hybrids on selected physical, chemical, and anatomical properties are reported. Populus hybrids NE-49, NE-252, and NE-388 were grown for 4 years in central Pennsylvania at planting densities of 0.09 to 0.46 m²/tree.

1980

Geimer, R.L.; Crist, J.B. 1980. Structural flakeboard from short-rotation, intensively cultured hybrid Populus clones. *Forest Products Journal*. 30(6): 42-48.

Leclerq, A.; Lacroix, J.P. 1980. Study of the quality of radiation cured wood-polymer-combination. *Rev. IRE (Belgium)*. 4(2): 15-25.

The physical properties like density and the total volumetric shrinkage and the mechanical properties like the static and dynamic bending strength, the axial compressive and the transversal cohesive strength were investigated on three types of wood: the beech (Fagus sylvatica), the poplar (Populus spp.), and the Norwegian pine (Pinus sylvestris) with and without impregnation with methylmethacrylate.

Milea, I. 1980. Wood fibre dimensions for the estimation of juvenile poplar wood properties. *Industria Lemnului*. 31(4): 181-184.

Data are tabulated for Populus alba, P. nigra, P. tremula, P. euramericana (P. x canadensis) and, for comparison, Salix alba.

Sastry C.B.R.; Anderson, H.W. 1980. Clonal variation in gross heat of combustion of juvenile Populus hybrids. *Canadian Journal of Forest Research*. 10(3): 245-249.

Strong, T.F. 1980. Energy values of nine Populus clones. Res. Note. NC-257. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 3 p.

This paper compares calorific values for components of nine Populus clones. The components include stem wood, stem bark, and branches. Also compared are calorific values for clones of balsam poplar and black cottonwood parentages.

Zarges, R.V.; Neuman, R.D.; Crist, J.B. 1980. Kraft pulp and paper properties of Populus clones grown under short-rotation intensive culture. TAPPI Journal. 63(7): 91-94.

1981

Fujii, T.; Harada, H.; Saiki, H. 1981. Ultrastructure of the 'amorphous layer' in xylem parenchyma cell wall of Angiosperm species. Journal of the Japan Wood Research Society. 27(3): 149-156.

Ultra thin sections of Albizia julibrissin, Quercus serrata, Populus koreana, Tilia japonica, and Cryptomeria japonica were studied by SEM before and after treatment to remove the lignin, hemicelluloses, pectin, or total polysaccharides. It is proposed that the term 'amorphous layer' be applied to both the isotropic and the protective layer as it is so difficult to distinguish between them.

Kryczka, M.; Surewicz, W.; Wandelt, P. 1981. Comparison of bark and its components with hardwood pulpwood. Przemysl Drzewny. 32(2-3): 37-39.

Data are presented on the morphological and chemical properties of the inner and outer bark of beech, oak, birch, and poplar, and compared with those of pure wood of common pulpwood species. Significant differences were found between the bark of different species.

Kumar, K.; Karira, S.G.; Singh, M.M. 1981. Evaluation of poplar clones for pulp and paper manufacture. In: Singh, R.V., ed. Symposium proceedings: Silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 163-166.

Milea, I.; Benea, V. 1981. Density of juvenile poplar wood. Industria Lemnului. 32(2): 89-94.

Data are presented on the apparent density of juvenile wood from 51 clones of Populus tremula, P. nigra, P. alba, and P. euramericana (Populus X canadensis) from Romania, Italy, Germany, and Austria. Romanian and German poplars had higher densities ($387.3-394.6 \text{ kg/m}^3$) than Italian and Austrian specimens ($356.5-369.3 \text{ kg/m}^3$).

Mos, V.; Ghelmeziu, N.; Tocan, M. 1981. Wood properties of poplar clones 'Sacrau-79', 'I-214', and 'R-16' planted in Romania. Industria Lemnului. 32(2): 85-88.

Nagoda, L. 1981. Physical properties of aspen. Meldinger fra Norges Landbrukshogskole. 60(7): 194 p.

Results are reported from measurements of moisture content, heartwood, ring width, eccentricity, taper, density, volume shrinkage, DM percent, and fibre length in stem discs and sectors at stump height, breast height, 2 m, 4

m...up to diameter of 4-5 cm u.b. Samples were taken from 195 trees in 10 different locations in Southeastern Norway.

Nagoda, L. 1981. Mechanical properties of aspen. *Meldinger fra Norges Landbrukshogskole*. 60(8): 66 p.

Results are reported from measurements of shrinkage, strength (bending, MOE, compressive, impact bending, hardness and shear), nail-holding and screw-holding properties of small clear specimens from 32 trees from a stand in As, Norway.

1982

1982. Timber of Populus 'I-45/51', Populus 'Fritzi Pauley' and Populus 'F41'. General study CTB R373, No. 43. Paris, France: Centre Technique du Bois et de l'Ameublement. 59 p.

Data are tabulated for the three clones on: site and stand characteristics; felling details; dimensions of the logs; method of primary conversion; sawing and peeling characteristics; quality of the logs, sawn timber and veneer; and physical and mechanical properties of the solid wood and veneer.

Aijala, M. 1982. Utilization and processing of forest energy. Part 6. Properties and grinding of fast growing wood. No. 108. Tutkimuksia, Finland: Valtion Teknillinen Tutkimuskeskus. 42 p.

Fast grown (a) willow, (b) poplar, and (c) birch wood were compared. Wood density was: (a) 250-440 kg/m³, (b) 320-410, and (c) 440-470.

Araki, N.; Fujita, M.; Saiki, H.; Harada, H. 1982. Transition of the fibre wall structure from normal wood to tension wood in Robinia pseudoacacia L. and Populus euramericana Guinier. *Journal of the Japan Wood Research Society*. 28(5): 267-273.

Czaninski, Y.; Monties, B. 1982. An ultrastructural and cytochemical study of xylem cell wall from poplar after mild extraction. Paris, France: Gauthier-Villars: Serie 3. *Sciences de la Vie*. 295(9): 551-556.

Ferrand, J.C. 1982. Study of growth stresses. Part 1: Measurement method using increment cores. *Annales des Sciences Forestieres*. 39(2): 109-141.

It was shown that growth stresses of beech, poplar, and eucalyptus can be estimated from the measurement of the tangential diameter (TG) of an increment core in a saturated state. TG was smaller for samples taken from highly stressed trees. Studying the anatomy of the cores with an image processor showed that the presence of tension wood was associated with smaller TG.

Fougerousse, M.; Barray, R.; Deon, G. 1982. Resistance of plywood panels to decay: preliminary investigation on the effect of the thickness of the plies. *Bois et Forets des Tropiques*. 197: 61-71.

Resistance to decay of plywood specimens of similar thickness of Aucoumea klaineana, Dacryodes buettneri, Ceiba pentandra, and Populus spp. was investigated under laboratory conditions according to French Standard B 51

295. The results showed that, apart from C. pentandra, decay resistance increased as ply thickness decreased, and that where white rot fungi are concerned better resistance may be achieved by reducing ply thickness than by adding fungicides to the glue.

Gol'traf, E.I. 1982. A study of the wood of some Populus species by scanning electron microscopy. Botanicheskii Zhurnal. 67(8): 1070-1073.

A study of Populus tremula, P. alba, P. balsamifera, and P. x sovetica [P. alba 'Sovetica'] (P. alba x P. alba var. pyramidalis) confirmed the lack of inter-species variation in the wood of this genus.

Grzeczynski, T.; Piotrowski, Z.; Splawa-Neyman, S.; Wojciechowski, Z. 1982. Selected properties of Populus 'Robusta' wood from plantations irrigated with municipal sewage effluent. Prace Instytutu Technologii Drewna. 29(3/4(103/104)): 3-12.

Fiber dimensions, and physical and chemical properties were measured of wood from 25-yr-old trees in a plantation near Wroclaw, Poland. Butt diameter was 63 percent and top diameter 17 percent greater in irrigated plantations, but strength properties were reduced by 4-12 percent. Irrigation also increased fiber length and tracheid wall thickness.

Hall, H.J.; Gertjejansen, R.O.; Schmidt, E.L.; Carll, C.G.; DeGroot, R.C. 1982. Preservative treatment effects on mechanical and thickness swelling properties of aspen waferboard. Forest Products Journal. 32(11/12): 19-26.

Jahan-Latibari, A. 1982. The response of aspen flakes and flakeboard to flake surface modifications. In: Proceedings of the Washington State University International symposium on particleboard. Pullman, WA: Washington State University; International Symposium. 16: 331-351.

Kucera, L.J.; Bariska, M. 1982. On the fracture morphology in wood. I. A SEM (scanning electron microscopy)-study of deformation in wood of spruce and aspen upon ultimate axial compression load. Wood Science and Technology. 16(4): 241-259.

Kuklewski, K.M.; Blankenhorn, P.R. 1982. Comparison of selected physical and mechanical properties of red maple and aspen flakeboards. University Park, PA: Pennsylvania Agricultural Experiment Station. Research Briefs. 15(2): 31-33.

Li, Z.Z.; Yao, G.Y.; Zhang, D.T.; Liu, X.B. 1982. Studies on the fibre dimension and chemical components of Italian poplars. Journal of Nanjing Technological College of Forest Products. 3: 158-172.

Data are given on the fibre length and width, wall thickness, and lumen width for 4 species (Populus 'I-214', P. 'I-72/58', P. 'I-63/51', and P. 'I-69/55') determined by projection microscopy. Although the wood fibres were relatively short (1040-1130 microm) their length:width ratio was relatively large and Runkel ratio small. The woods have a high holocellulose content and low lignin content and are good material for pulp and papermaking.

Nanko, H.; Saiki, H.; Harada, H. 1982. Structural modification of secondary phloem fibers in the reaction phloem of Populus euramericana. Journal of the Japan Wood Research Society. 28(4): 202-207.

Onilude, Musiliu Ade. 1982. Quantitative anatomical characteristics of plantation grown loblolly pine and cottonwood and their relationships to mechanical properties. Dissertation Abstracts International. 43/12-B: 3800.

The anatomical properties of loblolly pine (Pinus taeda L.) and cottonwood (Populus deltoides Bart. ex Marsh.), both from intensively managed woodlands, were quantitatively characterized using the principles of stereology. Physical and mechanical properties were also determined for each growth increment of six sample trees of both species. The numerical values obtained for the anatomical properties were derived from simple counting measurements. The parameters were determined both in terms of within growth ring variability and in terms of changes from pith to bark within the species studied.

Ou, H.Y.; Hu, Z.L.; Le, M.L.; Song, J.L.; Xu, J.P.; Zhan, Y.S. 1982. An analysis of microelements in wood by atomic absorption spectroscopy. Journal of Nanjing Technological College of Forest Products. 2: 125-129.

Results are reported of quantitative measurements of Cu, Fe, Ca, Mg, and Zn in wood of Populus suphratica [euphratica].

Petrovici, V.; Florea, R.; Iancu, M.; Radu, E.; Boiagian, Z. 1982. Content and quality of vegetal tanning substances in the bark of indigenous wood species. Revista Padurilor-industria Lemnului, Celuloza si Hirtie: Industria Lemnului. 33(2): 73-78.

Phelps, J.E.; Isebrands, J.G.; Jowett, D. 1982. Raw material quality of short-rotation, intensively cultured Populus clones. I. A comparison of stem and branch properties at three spacings. IAWA Bulletin. 3(3/4): 193-200.

Poluboyarinov, O.I.; Nekrasova, G.N.; Fedorov, R.B. 1982. The interaction of wood moisture content and density in growing trees. Lesnoi Zhurnal. 2: 7-11.

Sample trees of Scots pine (11), Norway spruce (15), birch (15), and aspen (15) were felled (in the Leningrad region) in late June. Their stems were divided into 10 equal sections and wood density and moisture content were determined on discs taken from each section. Data are tabulated on the variation found in each species, and graphs are given showing the change in wood density and moisture content along the stem. A very close correlation was found between density and moisture content for the two conifers, and a moderately close correlation for birch, but no correlation was found for aspen, probably because of its susceptibility to heartrot.

Popravko, S.A.; Sokolov, I.V.; Torgov, I.V. 1982. New natural phenolic triglycerides. Chemistry of Natural Compounds. 18(2): 153-157.

Pujol, E.; Arreghini, R.I. 1982. Growth and physico-mechanical wood properties of poplars grown in Mendoza Province. Universidad Nacional de Cuyo. 22(2); 27-39.

Timber properties given on 'technological data sheets' for poplars grown in Argentina are discussed, and criteria used for designating timber quality

are outlined. An example is shown giving mensurational, growth, and timber properties information for Populus 'I-154'.

Rozmarin, G.; Aly, H.I.M.; Simionescu, C.I. 1982. Possibilities of using juvenile poplar wood in the paper and fermentation industries. (3). Statistical correlations between chemical-biometric properties of the wood and physical-mechanical characteristics of sulphate pulps. Celuloza si Hirtie. 32(2): 46-51.

Results of an experiment indicate that the physical properties (breaking length, burst strength, folding endurance, etc.) of kraft pulps made from juvenile wood of 1- to 9-year-old aspen or poplar wood (Populus deltoides and P. canadensis) depended significantly on the fiber structure and dimensions, and chemical composition (cellulose, lignin, pentosan, water- and alkali-extractable contents).

Scaramuzzi, G.; Ferrari, G. 1982. Early assessment of wood properties of Populus X euramericana. Cellulosa e Carta. 33(11/12): 53-61.

Wood density, fiber length and holocellulose and alpha-cellulose contents were assessed in 11-12 year old plants of 19 clones of Populus X euramericana (P. canadensis). Early assessment of wood density proved reliable from the 4th year after planting, with correlation coefficients of between 0.927 and 0.835. Coefficients for fiber length (0.710-0.841) and alpha-cellulose content (0.661-0.696) were also good, but those for holocellulose content were poor (0.223-0.441).

Tewfik, S.A.; Al-Dawoody, D.M. 1982. Anatomical features of some Iraqi Quercus and Populus woods. Res. Bull. 1804. Iraq, Egypt: Mosul University, College of Agriculture and Forestry. 14 p.

Sections were studied from dominant, straight-stemmed trees of Q. aegilops, Q. infectoria, P. nigra, and P. euphratica. A detailed account is given of their wood anatomy.

Torgovnikov, G.I. 1982. Dielectric properties of the wood of some major species in the UHF range. Derevoobrabatyvayushchaya Promyshlennost'. 5: 4-6.

Measurements were made on spruce (Picea abies s.l.), larch, birch, and aspen (Populus tremula). Data are tabulated for the dielectric constants and loss tangents perpendicular and parallel to grain at moisture contents ranging from green to oven-dry. Temperature (20deg or 70-90degC) and frequency (0.9 or 2.4 GHz) had relatively little effect on the data.

Yin, S.C.; Wang, W.H.; Gao, H.H. 1982. Studies on the wood pH and buffering capacity of hybrid poplars. Journal of Nanjing Technological College of Forest Products. 3: 143-157.

Zhang, Q.S.; Yang, P.; Ma, G.C.; Chen, G.; Wu, W.J. 1982. A study of Italian poplar plywood. Journal of Nanjing Technological College of Forest Products. 2: 44-64.

Plywood manufacturing properties were compared for saplings of 4 Italian species (Populus 'I-63/51', P. 'I-69/55', P. 'I-72/58', and P. 'I-214'), a Chinese species (P. tomentosa) and for Alniphyllum fortunei and Tilia

amurensis. The Italian poplars showed good veneer peeling, drying and bonding properties, and had no special processing or bonding requirements.

1983

1983. Study on the moisture content of green-wood and the acid-alkali properties of main species in north-east second-growth forest. Journal of North-Eastern Forestry Institute, China. 11(1): 33-42.

Measurements of moisture content, pH, and free acid content were made on samples taken along the radius and at various heights, from 6 species: Fraxinus mandshurica, Juglans mandshurica, Quercus mongolica, Betula platyphylla (B. mandshurica), Tilia mandshurica, and Populus simonii.

Avanzo, E.; Curro, P. 1983. Populus nigra - results from planting clones - wood production and characteristics. Cellulosa e Carta. 34(4): 21-32.

A comparative plantation was established in 1963 near Rome using clones 'GT 4', 'GT 8', 'GT10', '56/73', '56/75', 'Bordils', 'J. Pourtet', and 'Chili'. After 9 years growth was assessed for all clones and wood density, chemical composition and mechanical strength, and fiber length were determined for all except '56/75' and 'Bordils'.

Bach, L.; Wang, E.I.C.; Micko, M. 1983. Wood quality of Alberta aspen: mechanical strengths of clear, stained, and decayed wood. University of Alberta Agriculture and Forestry Bulletin. 6(3): 7-9.

The bending strength, compression strength parallel to the grain, hardness, density, and moisture content were tested for small green samples (60 cm bolts) of Populus tremuloides, classified into 4 groups: clear; stained, or with incipient decay; with intermediate decay; and with advanced decay. Results showed that as decay progressed, the density and mechanical strengths of the wood decreased.

Borodulin, A.M.; Karataev, S.G.; Kozhemyakina, N.P.; Chubov, A.B. 1983. The effect of the location of the knots on the strength of construction lumber. Lesnoi Zhurnal. 3: 82-87.

A theoretical analysis was made of the effect of the location of knots (represented by circular holes; the greatest strength reduction was assumed to occur at loose or rotten knots). Experiments were made on test pieces of pine, larch, and aspen (600x30x5 mm) having no holes, 1 hole 10 mm in diameter in the middle of the piece, or 2 holes arranged symmetrically along the axis of the piece at varying distances apart.

Brumm, D.B.; Radcliffe, R.C.; Sturos, J.A. 1983. Determining light transmittance characteristics of wood and bark chips. Res. Note NC-295. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 4 p.

An experimental setup was developed comprising an incandescent light source, a photometer, an interface amplifier, an analog-to-digital (A/D) converter and a mini computer. Samples of wood and bark chips of six species from the Lake States (Populus tremuloides, Abies balsamea, Pinus banksiana,

Picea glauca, Acer saccharum, and Pinus resinosa) were tested green and oven dry.

Carll, C.G.; Wang, P. 1983. Data for prediction of mechanical properties of aspen flakeboards. Res. Note FPL-246. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 8 p.

Two methods of producing uniform density boards were compared: the application of very high pressures to a cold mat and subsequent heating; and steam injection during pressing. The cold pressed boards had slightly lower IB than the steam-pressed boards, but other strength properties were very similar. The results suggest that the exertion of high pressure on cold mats does not, as was feared, weaken the boards substantially.

Chen, S.C.; Wang, W.H. 1983. Improvement of the durability of Italian poplars plywood and oriented flakeboard with CZC. Journal of Nanjing Technological College of Forest Products. 4: 111-118.

The decay (weight loss) of poplar plywood and oriented flakeboard by Lanzites trabea in a soil block test was only slightly less than that of solid wood blocks of Populus 'Harvard', P. 'San Martino', Fraxinus mandshurica, and Tilia amurensis. Treatment of the boards with chromated zinc chloride (CZC) at 1.5 g/litre reduced weight loss to below that for F. mandshurica and T. amurensis wood.

Cyr, N.; Schulz, K.F.; Micko, M.M. 1983. Degradation and the relative accessibility of carbohydrates in decayed aspen wood. Cellulose Chemistry and Technology. 17(5): 495-505.

Drake, E. 1983. A study of the bark volume in south and central Sweden. Rapport 149. Uppsala, Sweden: Institutionen for Virkeslara, Sveriges Lantbruksuniversitet. 81 p.

The results are presented of measurements of log diameter (with and without bark), bark damage and wood density for a total of 61,273 pulpwood logs, in 303 piles of pine, spruce, birch, aspen, and alder. Bark thickness and volume were calculated.

Eager, R.L.; Pepper, J.M.; Roy, J.C.; Mathews, J.F. 1983. Chemical studies on oils derived from aspen poplar wood, cellulose, and an isolated aspen poplar lignin. Canadian Journal of Chemistry. 61(9): 2010-2015.

A chemical analysis was made of the oil resulting from the interaction of Populus tremuloides wood, cellulose or an isolated lignin from P. tremuloides with water and CO in the presence of sodium carbonate at 360degC. The relative amounts of low mol. wt. phenolic compounds decreased from lignin to wood to cellulose.

Fiedler, H.J.; Schmidt, S. 1983. Effect of N-lignins on small woods. Dresden, East Germany: Wissenschaftliche Zeitschrift - Technische Universitat. 32(4): 195-200

Gladysz, A.; Janson, L.; Szczubialka, Z. 1983. Foliar nutrient content of two-year-old aspens. 00ENV TR-2325. Warsaw, Poland: Forest Research Institute.

21 p. (Translation, Environment Canada. Translation from Sylwan (1977) 121(3): 21-32.)

Goldberg, R.; Catesson, A.M.; Czaninski, Y. 1983. Some properties of syringaldazine oxidase, a peroxidase specifically involved in the lignification processes. *International Journal of Plant Physiology*. 110(3): 267-279.

Grand, C.; Boudet, A.; Boudet, A.M. 1983. Isoenzymes of hydroxycinnamate: CoA ligase from poplar stems properties and tissue distribution. *Planta*. 158(3): 225-229.

Hong, Z.G. 1983. A study of composite plywood. I. Influences of materials on properties of composite plywood. *Journal of Nanjing Technological College of Forest Products*. 1: 99-114.

Laboratory tests were made of 3-layered plywood manufactured from Populus 'I-69/55' using single-layer veneers for both surfaces and an oriented single-layer mat for the core. UF resin was used as binder and the 300x300x100 mm board made in 1 step. Seven basic properties (moisture content, density, MOR, MOE, IB strength, swelling properties, and nail holding strength) were tested using boards of different veneer thickness, strand size, and resin content. Suitable boards were obtained with face veneer 1.2-1.8 mm thick, strand sizes 70x5-7x0.45 mm and a resin content of 9 percent.

Hong, Z.L. 1983. A study of composite plywood. II. Influences of structural types on properties of composite plywood. *Journal of Nanjing Technological College of Forest Products*. 2: 92-106.

A study of composite plywood made from Populus 'I-69/55'. The influence of face veneer thickness, structural type of coremat, weight ratio of strands in a 3-ply oriented coremat and panel density on MOR, MOE, IB strength, swelling, and relative nail-holding power was evaluated. Properties were considerably affected by structural type. Ratios between MOR (and MOE) in parallel and perpendicular directions could be adjusted by changing the weight ratio between the surface and core layer strands in the 3-ply oriented coremat. Strands in the outer ply influenced MOR and MOE more than those in the inner ply.

Hruschka, A. 1983. Comparative studies of Austrian cultivated poplar species. Part 3. Pulp and paper making properties. *Holzforschung und Holzverwertung*. 35(4): 75-79.

Wood samples of 38 poplar species grown in Austria were examined for density, pulp yield, and mechanical strength of the pulp. There were significant differences in pulp yield and, to some extent, pulp strength between species.

Imura, S.; Moriya, K.; Minemura, N. 1983. Adhesion of lumber of different wood species. *Journal of the Hokkaido Forest Products Research Institute*. 373: 11-17.

Laminated wood was made from Japanese larch (Larix leptolepis), poplar, Japanese cedar (Cryptomeria japonica), white birch (Betula maximowicziana),

and oak (Quercus), glued with UF or RF (resorcinol-formaldehyde) adhesive. Under normal conditions, bonding properties of all the samples were adequate.

Khurana, D.K.; Kaushal, A.N.; Khosla, P.K. 1983. Studies in Populus ciliata Wall. ex. Royle IV. Variation in wood chemical analysis in relation to sex and ecological factors. *Journal of Tree Sciences*. 2(1/2): 63-73.

Cores 11 mmX10 cm were taken at breast height from 5 male and 5 female trees each of 18 provenances (average ages 21-59 years) grouped into 2 ecological blocks. The groups were: (1) scattered trees in temperate forests interspersed with coniferous and broadleaved species (13 provenances); and (2) pure stands in ravines/river flood basins (5 provenances). The wood samples were analysed for extractive, lignin, holocellulose, and ash contents after drying and grinding, and the results analysed statistically.

Krames, U.; Prazak, R. 1983. A comparative study of poplar cultivars grown in Austria. 2. Technological evaluation. *Holzforschung und Holzverwertung*. 35(2): 25-40.

Studies were made on wood samples taken from 40 poplar trees representing 36 taxa, viz. 14 Populus canadensis hybrids (sect. Aigeiros), 20 P. sect. Tacamahaca clones and hybrids, and P. tremula and P. canescens (sect. Leuce). Properties evaluated included: wood density, and density distribution in the stem and within annual growth rings; width of annual rings; percent of late wood; bending strength; MOE in bending; impact bending strength; compressive strength; radial and tangential swelling and shrinkage; and water sorption capacity.

Lapierre, C.; Rolando, C.; Monties, B. 1983. Characterization of poplar lignins acidolysis products: capillary gas-liquid and liquid-liquid chromatography of monomeric compounds. *Holzforschung*. 37(4): 189-198.

Lee, C.S. 1983. The chemical and physical properties of two-year short-rotation deciduous species. *Forest Products Abstracts*. 6(11): 322-323.

Lee, P.W.; Yoon, Y.W. 1983. Flexural properties of glued laminated veneers made from rotary cut-veneers of Populus and Platanus. *Wood Science and Technology, Korea Republic*. 11(6): 27-36.

Laminated veneers of single species or mixed Populus euramericana (P. canadensis) and Platanus occidentalis were constructed by different methods and tested for MOR and MOE. Values for MOR and MOE of cross-laminated veneers were about half those of solid sawnwood, whereas those of parallel laminated veneers were equal to or better than those of solid wood.

Levin, E.D.; Alaudinov, Sh.T.; Cherepanova, V.E. 1983. Identification of prostaglandin F₁α isolated from living tissues of Larix sibirica and Populus balsamifera. *Khimiya Drevesiny*. 5: 94-96, 128.

MacLeod, J.M.; Cyr, N. 1983. Soda-AQ pulps from hardwoods--physical properties and bleachability. *Pulp & Paper Canada*. 84(4): 29-32.

Miller, D.P. 1983. The effect of acetylated flake content on dimensional stability and strength properties of cottonwood flakeboard. *Forest Products Abstracts*. 6(11): 323.

Murmanis, L.; River, B.H.; Stewart, H. 1983. Microscopy of abrasive-planed and knife-planed surfaces in wood-adhesive bonds. *Wood and Fiber Science*. 15(2): 102-115.

Myers, G.C. 1983. Relationship of fiber preparation and characteristics to performance of medium-density hardboards. *Forest Products Journal*. 33(10): 43-51.

Four species, sweetgum, aspen (Populus tremuloides), eastern white pine, and southern yellow pine, were each refined to 4 different drainage rates. The resulting fiber was also characterized by fiber length, Bauer-McNett screen fractionation and SEM observations. Wet-formed MDF boards were prepared from the pulps and evaluated for static bending, IB, tensile strength parallel to the surface and dimensional movement between 50 and 90 percent RH and between 50 percent RH and water soak.

Okuyama, T.; Kawai, A.; Kikata, Y.; Sasaki, Y. 1983. Growth stresses and uneven gravitational-stimulus in trees containing reaction wood. *Journal of the Japan Wood Research Society*. 29(3): 190-196.

The relationship between gravitational stimulus and growth stresses was determined in (a) the compression wood of Cryptomeria japonica and (b) the tension wood of Populus 'Oxford', Quercus myrsinaefolia, and Q. crispula.

Orensanz, J.; Munoz, F.; Alibes, X. 1983. Note on the nutritive value of poplar leaves for ruminants. Quantitative and qualitative evaluation. *Informacion Tecnica Economica Agraria*. 14(50): 58-64.

Leaves and young stems of poplar (Populus nigra) were sampled before leaf-fall in autumn. Those leaves which were still green had a high nutritive value with an in vitro DM digestibility of 62.9 percent and a CP content of 11.4 percent; corresponding values for stems were 31.8 and 6.1 percent. Over a 6-week period DM digestibility of fallen leaves fell from 50.7 to 41.5 percent while CP content remained relatively stable (7.5-8 percent). The use of poplar plantations for wood production and for grazing is discussed.

Petrovici, V.; Chis, E.; Florea, R. 1983. Chemical composition of alkaline extracts from the bark of some wood species. *Industria Lemnului*. 34(3): 142-145.

Extracts were obtained from spruce, beech, and poplar bark using a 1 percent solution of NaOH.

Schmidt, E.L.; Hall, H.J.; Gertjejansen, R.O.; Carll, C.G.; DeGroot, R.C. 1983. Biodeterioration and strength reductions in preservative treated aspen waferboard. *Forest Products Journal*. 33(11/12): 45-53.

Shi, B.Z.; Ruan, X.G. 1983. Researches on sound velocity in wood I. The relations between sound velocity and compressive strength parallel to the grain and moisture content of wood. *Journal of Nanjing Technological College of Forest Products*. 3: 6-12.

Sound velocity was determined by the pulse method using wood samples of Tilia amurensis, Fraxinus mandshurica, and Populus 'I-69/55'. Differences were found in longitudinal, radial and tangential directions, and regression equations were developed for the relations between velocity and compressive strength parallel to the grain.

Skvortsov, S.V.; Klimentov, A.S.; Kraev, L.N. 1983. Effect of gamma irradiation on the chemical composition of wood from various parts of aspen trees. *Hydrolysis and Wood Chemistry USSR*. 2: 20-24.

Takahashi, M.; Kawaguchi, N.; Miyano, H.; Hasegawa, M. 1983. The wood properties of eight species imported from the USSR. *Journal of the Hokkaido Forest Products Research Institute*. 377: 1-9.

Water and moisture absorption, shrinkage, hardness and bending, tensile, compression, and shear strength were analyzed for: Larix gmelinii, Pinus sylvestris, P. koraiensis, Populus spp., Tilia spp., Betula spp., Ulmus spp., and Fraxinus spp.

Tamas, M.; Marinescu, I. 1983. Contents of flavonoids in poplar buds. *Studii si Cercetari de Biochimie*. 26(2): 182-185.

Usol'tsev, V.A. 1983. Dynamics of wood density and the content of dry matter in it in aspen stands. *Lesovedenie*. 6: 42-49.

Vargyai, K. 1983. Main properties of robinia, poplar and Turkey oak timbers from the viewpoint of wood preservation and their applications in relation to exposure. *Faipar*. 33(3): 80-81.

Poplar for exterior use should always be impregnated: false heartwood can be impregnated within 32 hours vacuum impregnation is possible. With proper preservation these species can be substituted for softwood in many applications.

Yanchuk, A.D.; Dancik, B.P.; Micko, M.M. 1983. Intraclonal variation in wood density of trembling aspen in Alberta. *Wood and Fiber Science*. 15(4): 387-394.

Four trees from each of three putative clones of trembling aspen (Populus tremuloides) at one sight in north-central Alberta were sampled to determine the patterns of wood density variation within stems and within clones. Although only 3 clones were sampled, there were significant differences (0.05 level) among clones.

Zhou, D.G. 1983. A study of the physical and mechanical properties of oriented strandboard. *Journal of Nanjing Technological College of Forest Products*. 1: 81-98.

A laboratory comparison of 9 basic properties (density, moisture content, MOR, MOE, IB, nail and screw holding strength, and swelling, thermal, and acoustic properties) of oriented and random strandboard made from Populus 'I-72' are discussed.

1984

1984. Small trusses made of hardwoods. Structures. Aging studies. CTB Study R-334. France: Centre Technique du Bois et de l'Ameublement. 50: 11 p.

Samples of fir (Abies alba), Scots pine, poplar, beech, and chestnut (Castanea sativa) joined using 3 types of metal plate connectors were exposed for one year either to indoor laboratory conditions, normal external weather conditions or "accelerated aging" using a saline mist.

Biblis. 1984. Structural durability of 3-layer oriented flakeboard from southern hardwoods. In: Workshop on the durability of structural panels; 1982 October 5-7; Pensacola, FL. Gen. Tech. Rep. SO-53. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station: 97-102.

Carll, C.G.; Wood, J.E. 1984. Effect of chip freezing on quality of ring-cut flakes. Forest Products Journal. 34(4): 35-36.

Frozen wood chips of aspen (Populus spp.), paper birch (Betula papyrifera), and red pine (Pinus resinosa) yielded flakes with a higher proportion of fines than comparable unfrozen chips.

Chow, P.; Janowiak, J.J. 1984. Durability evaluation of hardwood veneered flakeboard composites. In: Workshop on the durability of structural panels; 1982 October 5-7; Pensacola, FL. Gen. Tech. Rep. SO-53. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station: 119-126.

Einspahr, D.W. 1984. Production and utilization of triploid hybrid aspen. Iowa State Journal of Research. 58(4): 401-409.

A description of published work on growth rates, wood density, fibre length, and pulp properties of triploid hybrids produced by crossing diploid Populus tremuloides with a tetraploid P. tremula from Sweden.

Forwood, J.R.; Owensby, C.E. 1984. Nutritive value of tree leaves in the Kansas Flint Hills. Journal of Range Management. 38(1): 61-64.

Leaves of Quercus macrocarpa, Ulmus rubra, Maclura pomifera, and Populus deltoides collected near Manhattan, Kansas were analyzed for CP, in vitro DM digestibility and tannic acid equivalents from mid-September to late October, 1979-1980. CP content was significantly lower in P. deltoides than the other species except A. macrocarpa and decreased over the season in all species.

Grigoriou, A. 1984. Dimensional stability of various wood-based materials. Holzforschung und Holzverwertung. 36(6): 116-120.

Studies were made on: (a) 3-layer 16.0 mm UF pine/poplar particleboard; (b) 16.2 mm MDF; (c) 16.2 mm blockboard composed of okoume [Aucoumea klaineana]/daniellia [Daniellia] strips 1-2 mm wide and poplar strips 11 mm wide; (d) 7-ply 15.4 mm PF Aucoumea/Daniellia plywood; and (e) 9-ply 15.1 mm UF Aucoumea/Daniellia plywood.

Hall, H.J.; Gertjejansen, R.O.; Schmidt, E.L.; Carll, C.G.; DeGroot, R.C. 1984. Preservative treatment effects on mechanical and thickness swelling properties of aspen waferboard. In: Workshop on the durability of structural panels; 1982 October 5-7; Pensacola, FL. Gen. Tech. Rep. SO-53. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station: 143-152.

Hua, X.M. 1984. A study on the disinfecting action of trees on Tubercle bacilli. Scientia Silvae Sinicae. 20(4): 423-430.

Leaves of 20 tree species were placed in bottles containing tubes of bacterial cultures. Compared with controls, all species produced 100 percent inhibition of bacterial growth except Lagerstroemia indica (86 percent). The inhibiting effect increased with the quantity of leaves. It is concluded that volatile compounds emitted by the leaves were responsible.

Katuscak, S. 1984. Migration of colour substances in wood and a new method of its measurement. Drevarsky Vyskum. 29(1): 33-49.

A study was made of the migration (a secondary movement occurring after diffusion has taken place) of synthetic organic dyes in veneers of poplar (Populus marilandica), beech (Fagus sylvatica) and wawa (Triplochiton scleroxylon).

Koran, Z.; Lo, S.N.; Valade, J.L. 1984. Strength properties of birch and aspen sulphite pulps in the yield range of 77-94 percent. Pulp & Paper Canada. 85(2): 39-41.

Kovacs, Z. 1984. Strength behaviour of windows and furniture frames. Acta Facultatis Ligniensis, Hungary. 1: 41-53.

A method for measuring angle changes in member cross sections of a double tenon joint is described. Specimens tested included corner parts of unholstered furniture frames in spruce, white poplar (Populus alba), and black locust (Robinia pseudoacacia) and spruce window frames.

Kr"stanov, K.; Fakirov, B.; Belyakov, P.; Ganchev, P. 1984. Branches and bark of poplars. Gorsko Stopanstvo. 40(1): 20-23.

Sample trees of Populus 'Regenerata', P. 'Robusta' and P. 'I-214' were taken from stands of various age and density in different site conditions in Bulgaria. Data are tabulated on the branches and bark as percentages of stemwood.

Lange, H.; Simatupang, M.H. 1984. Effect of wood particle moisture content on the strength of wood cement boards. Holz als Roh- und Werkstoff. 42(11): 421-423.

Laboratory-made wood cement boards were prepared from 45 F Portland cement and poplar or Norway spruce particles of 3 types, viz. (a) unseasoned (25 percent moisture content), (b) air dried (to 10 percent moisture content), or (c) kiln dried (5 percent moisture content). Bending strength was measured 3, 10, and 28 days after board manufacture.

Lapierre, C.; Monties, B.; Rolando, C. 1984. Structural studies of lignins: estimation of arylglycerol-arylether bonds by means of thioacidolysis. Paris, France: Gauthier-Villars. Serie 3. Sciences de la Vie. 299(11): 441-444.

Laufenberg, T.L. 1984. Flakeboard fracture surface observations and correlations with orthotropic failure criteria. Journal of the Institute of Wood Science. 10(2): 57-65.

Random flakeboards were manufactured from Populus tremuloides flakes of 3 thicknesses and 3, 5, or 9 percent PF resin content and pressed at 300, 450, and 600 lb/inch² to a uniform density of 40 lb/ft³. Specimens were tested for maximum tensile load, tensile strength and MOE and then examined microscopically in order to characterize surface failure.

Leclerc, C.R.; Chong, C. 1984. Influence of willow and poplar extracts on rooting cuttings. In: International Plant Propagators' Society 1983. New York, NY: International Plant Propagators' Society; 33: 528-536.

Crude extracts were prepared from shoots (1 g freeze-dried powder in 25 ml water) of Salix alba var. 'Tristis' or Populus nigra cv. 'Italica' collected at intervals during the year. Extracts from both species, alone or combined with 5,000 or 20,000 mg/l IBA, inhibited rooting of Cotoneaster acutifolius cuttings.

Lee, P.W. 1984. Studies on the residual bending strength of burned wood treated with fire-retardant chemicals. Wood Science and Technology. 12(2): 10-19.

Lumber of Populus alba X P. glandulosa of different densities was treated with (a) ammonium sulphate, (b) monoammonium phosphate, (c) diammonium phosphate, or (d) aluminum chloride for 1, 15, 30, and 60 minutes and 1, 3, and 7 days. After burning at 1800degC for 5 minutes the specimens were assessed for rate of weight loss and residual bending strength as a function of amount of chemical absorbed.

Lee, P.W.; Kim, S.T. 1984. The effect of end-joint gap and spacing on bending strength of plywood. Wood Science and Technology. 12(6): 7-15.

In three-ply Populus euramericana (P. canadensis) plywood manufactured with a single butt joint but varying gap size in the middle lamination, stress at proportional limit (Spl), MOR and work per unit volume to proportional limit (Wpl) decreased as the joint gap increased.

Levin, E.D.; Alaudinov, S.T.; Cherepanova, V.E. 1984. Identification of prostaglandins of E-type isolated from living tissues of Larix sibirica and Populus balsamifera. Khimiya Prirodnykh Soedinenii. 5: 567-571.

McNatt, J.D. 1984. How cyclic humidity affects static bending and dimensional properties of some wood-base panel products. In: Workshop on the durability of structural panels, 1982 October 5-7; Pensacola, FL. Gen. Tech. Rep. SO-53. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station: 67-76.

Miljkovic, J. 1984. Chemical composition of sapwood and colored heartwood of some poplar species. Cellulose Chemistry and Technology. 18(1): 49-53.

The chemical composition was investigated of sapwood and heartwood from 3 Populus euramericana (P. canadensis) clones, viz., 'I-214', 'Ostia', and 'Robusta'. The analysis included a comparison of extractive and lignin contents, total carbohydrates, and ratios of particular sugars (galactose, glucose, mannose, arabinose, xylose).

Nagai, K.; Saiki, H.; Harada, H. 1984. The radial variations in fibril angle of fibers in several hardwood species. In: Sudo, S., ed. Proceedings, Pacific regional wood anatomy conference; 1984 October 1-7; Ibaraki, Japan. Ibaraki, Japan: Forestry and Forest Products Research Institute: 94-96.

SEM was used to study the variation in fibril angle and the length of wood fibres and vessel elements, from earlywood to latewood and pith to bark in: (a) Populus koreana, (b) Fagus crenata, (c) Cercidiphyllum japonicum, (d) Castanea crenata, and (e) Zelkova serrata.

Nakamura, H.; Sato, M.; Minemura, N. 1984. The properties of eight wood species imported from the USSR. Journal of the Hokkaido Forest Products Research Institute. 385: 8-14.

Adhesion properties, paintability, and abrasion resistance were tested for 8 species imported from the USSR into Japan, viz. dahurian larch (Larix dahurica), Scots pine, Korean pine (Pinus koraiensis), yamanarashi (Populus sieboldii), shinanoki (Tilia japonica), nire (Abies homolepis), and tamo (Fraxinus mandshurica). The properties were not substantially different from those of domestic species.

Robert, D.; Gagnaire, D. 1984. Contribution to the qualitative and quantitative study of the structure of various lignin samples by ¹³C NMR. Paris, France: Ministere de la Recherche et de la Technologie: 151-160.

The ¹³C NMR spectra were studied of acetylated and non-acetylated milled wood lignins of birch and lignin of exploded wood of aspen (Populus tremula). The spectra gave detailed pictures of each sample, identifying the numbers of various methoxyl groups.

Roland, J.C.; Mosiniak, M.; Czaninski, Y.; Vian, B.; Monties, B.; Catesson, A.M.; Lapiere, C. 1984. Subgroup 1.3: Ultrastructure and cytology. In: Mauge, J.P., chair. Groupe de travail no. 1. La matiere premiere. Colloque sciences et industries du bois; 1982 September 20-22; Grenoble. Paris, France: Ministere de la Recherche et de la Technologie: 113-145.

Results from studies on linden, wild cherry [Prunus avium], poplar, and Scots pine showed that changes in orientation were affected by internal plant rhythms.

Ronai, F.; Csupor, K. 1984. Creep properties of poplar species. Acta Facultatis Ligniensis, Hungary. 1: 5-13.

Equations describing the 'deformation surfaces' are presented that enable creep to be predicted and time-dependent behavior of poplar (Populus canadensis) wood to be compared with that of imported softwood, for which indigenous poplar wood is likely to be substituted if it meets strength and deformation requirements.

Sachsse, H.; Supraptono, B.; Melchior, G.H. 1984. Stem wood of the hybrid-aspen family '19/51' on two sites. *Holzforschung*. 38(6): 297-308.

Wood properties were analysed in 25 aspen trees, 30 years old, grown in experimental plots in N. and S. Germany. Models of stem growth were constructed from data on stem form, increment, knottiness, and zones of discoloration and decay in 2 of the stems.

Sarni, F.; Grand, C.; Boudet, A.M. 1984. Purification and properties of cinnamoyl-coa reductase and cinnamyl alcohol-dehydrogenase from poplar stems. *European Journal of Biochemistry*. 139(2): 259-265.

Sinclair, S.A.; Hassler, C.C.; Bolstad, K. 1984. Moisture loss in aspen logging residue. *Wood and Fiber Science*. 16(1): 93-96.

Two groups of aspen (Populus spp.) trees were harvested in northern Minnesota, one in April and one in July. The tops were left to dry in the open to simulate a clearcut harvest. During the time span of this study, moisture loss of the tops was most influenced by the number of days since harvest and the average temperature for the 30 days preceding chipping.

Singh, T. 1984. Variation in the oven-dry wood density of ten Prairie tree species. *Forestry Chronicle*. 60(4): 217-221.

Based on 10 discs from along the whole stem of 600 trees of Pinus banksiana, P. contorta, Abies lasiocarpa, A. balsamea, Picea glauca, P. mariana, Larix laricina, Populus balsamifera, P. tremuloides, and Betula papyrifera.

Terazawa, M.; Okuyama, H.; Miyake, M. 1984. Phenolic compounds in living tissue of woods. I. Phenolic beta-glucosides of 4-hydroxycinnamyl alcohol derivatives in the cambial sap of woods. *Journal of the Japan Wood Research Society*. 30(4): 322-328.

The sap of 19 angiosperms and 6 gymnosperms from Hokkaido was analyzed in this paper.

Terazawa, M.; Okuyama, H.; Miyake, M. 1984. Phenolic compounds in living tissue of woods. II. Seasonal variations of phenolic glycosides in the cambial sap of woods. *Journal of the Japan Wood Research Society*. 30(4): 329-334.

In this paper, sap from 3 of the species (1 gymnosperm, 1 angiosperm containing syringin and coniferin, and 1 angiosperm not containing these but having some characteristic glycosides) was further examined for seasonal variations.

Tremolieres, M.; Bieth, J.G. 1984. Isolation and characterization of the polyphenoloxidase from senescent leaves of black poplar. *Phytochemistry*. 23(3): 501-505.

1985

Bel'kova, L.P.; Gromov, V.S.; Mikhailov, A.I. 1985. Free-radical tracer study of the molecular dynamics of the components of wood substance. 2. The molecular dynamics of wood substance and the interaction of its components. *Khimiya Drevesiny*. 4: 3-8, 118.

The accumulation of free radicals was studied in wood specimens of 5 species gamma-irradiated at -196degC. Molecular mobility decreased in the order birch, aspen (Populus tremula), larch, Norway spruce, Scots pine, in the same order as their rates of nitric acid pulping. The lignin fraction accumulated 4 times as many free radicals as the polysaccharide fraction, suggesting that radiation energy is transferred from the polysaccharide to the (more mobile) lignin.

Bier, H. 1985. Structural properties of timber from two poplar varieties. *New Zealand Journal of Forestry Science*. 15(2): 223-232.

MOR and MOE were determined from bending tests on 60 specimens of 100X50 mm of each of Populus deltoides and P. 'Androscoggin', and 60 specimens of 150X50 mm P. 'Androscoggin' timber.

Blankenhorn, P.R.; Bowersox, T.W.; Kuklewski, K.M.; Stimely, G.L. 1985. Effects of rotation, site, and clone on the chemical composition of Populus hybrids. *Wood and Fiber Science*. 17(3): 351-360.

Chemical contents were determined for three Populus clones grown on two dissimilar sites, by component (wood, bark, and wood/bark specimens), tissue age (1-, 2-, and 4-years-old), and rotation. The clones studied were Populus 'NE-49', P. 'NE-252', and P. 'NE-388'. The chemical content values obtained included extractives, holocellulose, alpha-cellulose, and lignin.

Blankenhorn, P.R.; Bowersox, T.W.; Kuklewski, K.M.; et al. 1985. Comparison of selected fuel and chemical content values for seven Populus hybrid clones. *Wood and Fiber Science*. 17(2): 148-158.

Fuel and chemical content values were determined for seven Populus clones by component (wood, bark, and wood/bark specimens) and tissue age (1 to 8 years old). The clones studied were: NE-49, NE-245, NE-252, NE-279, NE-302, NE-350, and NE-388. The values obtained included: gross heat of combustion, extractives, holocellulose, alpha-cellulose, lignin, and ash.

Cyr, N.; Vodny, S.; Micko, M.M. 1985. Application of nuclear magnetic resonance spectroscopy for chemical characterization of aspen poplar lignin. Edmonton, Alberta, Canada: Alberta University, Faculty of Extension. *Agriculture & Forestry Bulletin*. 8(1): 46-47.

Eslyn, W.E.; Highley, T.L.; Lombard, F.F. 1985. Longevity of untreated wood in use above ground. *Forest Products Journal*. 35(5): 28-35.

Test crosses, constructed from 12 different softwoods and 9 different hardwoods, were exposed on test fences for 9 to 12 years in both southern Mississippi and Wisconsin. The woods tested in Mississippi were classified into aboveground decay resistance groups. The sapwood of lodgepole pine, basswood, balsam poplar (Populus balsamifera), red alder (Alnus rubra), and sweetgum and the heartwood of sugar maple, yellow birch (Betula

alleghaniensis), and basswood decayed within an average of 7 years and were classified as nonresistant.

Forwood, J.R.; Owensby, C.E. 1985. Nutritive value of tree leaves in the Kansas Flint Hills. *Journal of Range Management*. 38(1): 61-64.

Fukazawa, K.; Ujiie, M.; Lee, K.Y.; Ishii, T. 1985. Inorganic constituents in wood in relation to wetwood and crystal formation. In: Symposium on forest products research international--achievements and the future; 1985 April 22-26; Pretoria, South Africa. National Timber Research Institute of the South African Council for Scientific and In; 1: 16.15.1-16.15.9

Gertner, G.Z.; Jokela, J.J. 1985. Cost effective sampling for specific gravity. In: Dawson, Jeffrey O.; Majerus, Kimberly A., eds. 5th Central hardwood forest conference; 1985 April 15-17; Urbana-Champaign, IL. SAF Publ. 85-05. Urbana-Champaign, IL: University of Illinois, Department of Forestry: 90-93.

Hemmingson, J.A. 1985. Structural aspects of lignins from Eucalyptus regnans wood steam exploded by the Iotech and Siropulper processes. *Journal of Wood Chemistry and Technology*. 5(4): 513-534.

Hunt, M.O.; Hoover, W.L.; Fergus, D.A. 1985. Thick aspen structural flakeboard. *Forest Products Journal*. 35(4): 33-39.

Tests were done on five 2X8-foot, nominal 1 1/8-inch-thick, 3-layer laboratory flakeboard panels with a density of 47.3 lb/ft³; the dense face layers were composed of disk flakes that were 0.015 inches thick, 3 inches long and of random width, and the core layer was of 0.030-inch-thick ring flakes that were 3/4 inch long and of random width.

Imberty, A.; Goldberg, R.; Catesson, A.M. 1985. Isolation and characterization of Populus isoperoxidases involved in the last step of lignin formation. *Planta*. 164(2): 221-226.

Jokerst, R.W. 1985. Performance of oak cottonwood plywood bonded with a softwood plywood phenolic during 10 years of exterior exposure. *Forest Products Journal*. 35(4): 27-30.

To demonstrate the suitability of hardwoods for plywood manufacture, plywood panels were made from northern red oak (Quercus rubra) and eastern cottonwood (Populus deltoides). After 10 years of exposure, the adhesive bonds still exceeded the 85 percent minimum wood failure requirement of the US Product Standard PS 1-74.

Kasir, W.A.; Shahbaz, S.I. 1985. A study of mechanical properties of Populus alba grown in Ninevah plantation. *Iraqi Journal of Agricultural Sciences 'Zanco'*. 3(2): 61-74.

Data are given on the strength properties of P. alba, measured on air-dried samples of juvenile and mature wood taken from 3 trees at 3 heights (1.3 m, and 1/2 and 1/3 stem height). From the results it is suggested that the wood is suitable for posts and ties in the construction of small houses.

Kuklewski, K.M.; Blankenhorn, P.R.; Rishel, L.E. 1985. Comparison of selected physical and mechanical properties of red maple and aspen flakeboard. *Wood and Fiber Science*. 17(1): 11-21.

Wood from red maple (*Acer rubrum*) and aspen (*Populus grandidentata*) was processed and made into flakeboards with a target density of 50 lb/ft³. Within the study parameters, random and aligned flake orientations were compared for both species.

Kuroda, K.; Shimaji, K. 1985. Wound effects of cytodifferentiation in hardwood xylem. *IAWA Bulletin New Series*. 6(2): 107-118.

Levin, E.D.; Alaudinov, S.T.; Cherepanova, V.E. 1985. Identification of prostaglandins E isolated from the living tissues of *Larix sibirica* and *Populus balsamifera*. *Chemistry of Natural Compounds*. 20(5): 533-536. Translated from: *Khimiia Prirodnykh Soedinenii*: 567-571.

Nemeth, J. 1985. Effect of veneer density and of peeling cracks on the strength properties of technical veneers. *Faipar*. 35(2): 44-47.

Test samples were prepared from 1-mm and 2-mm peeled veneers of beech and poplar (*Populus x euramericana*) [*P. x canadensis*]. In order to clarify the relationship between strength properties and peeling cracks, two new indices were introduced: the cracking ratio f calculated from the area of cracks to be found on the examined veneer edge; and the critical crack F_{kr} equal to the maximum cross-sectional area of a single crack.

Nemeth, J. 1985. Effects of thickness compaction on certain strength properties of plywoods. *Faipar*. 35(5): 155-160.

Examination of veneers and plywoods of beech and poplar (*Populus x euramericana*) [*P. x canadensis*] showed that a significant (6-20 percent) compaction took place during gluing and pressing. Relationships were found between the applied pressure and compaction and also between the degree of compaction and the strength properties of plywoods.

Pak, S.B.; Ahn, W.Y. 1985. Comparative study on mechanical properties and dimensional stability of Staypak and wood-polymer composites from *Populus alba* X *P. glandulosa* wood. *Wood Science and Technology*. 13(2): 14-34.

Staypak, heat-stabilized compressed wood, was compared with a wood-polymer composite (WPC) manufactured with MMA monomer, containing benzoyl peroxide as an initiator, impregnated into the wood by a dipping or a vacuum method followed by polymerization on a hot press.

Passialis, C. 1985. The effect of radial and tangential load application on the flexural properties of *Abies cephalonica* X *A. alba*, *Populus hybridogenus* small beams. *Holzforschung und Holzverwertung*. 37(3): 49-50.

Studies were made on heartwood and sapwood samples (32X2X2 cm) of *Abies alba* X *A. cephalonica* [no mention is made of hybrid poplar].

Perng, W.R.; Brebner, K.I.; Schneider, M.H. 1985. Aspen wood anatomy and fluid transport. *Wood and Fiber Science*. 17(2): 281-289.

Measurements of vinyl monomer impregnation, air permeability, moisture diffusion, and extractives content were made on the wood of two aspen [Populus tremuloides] trees from northern New Brunswick.

Phelps, J.E.; Isebrands, J.G.; Einspahr, D.W.; Crist, J.B.; Sturos, J.A. 1985. Wood and paper properties of vacuum airlift segregated juvenile poplar whole-tree chips. *Wood and Fiber Science*. 17(4): 529-539.

Whole-tree chips from a hybrid poplar clone (Populus tristis '#1') grown under short-rotation, intensive culture (SRIC) were separated into three fractions using vacuum airlift segregation (VAS). Pulp and paper properties of the whole-tree chips, the VAS accepts and rejects, and a 50:50 mixture of accepts:rejects were similar and were only slightly lower quality than those of mature aspen (Populus) chips. These results suggest that whole-tree chips from SRIC poplar stands can be mixed with conifer chips to supplement furnishes for Kraft pulping.

Polge, H. 1985. Effect of pruning on heartwood formation, production of tension wood and some other wood properties of Populus 'I-214'. *Annales des Sciences Forestieres*. 42(3): 283-295.

Four increment cores were taken, at 1.30 m and 6.50 m height from the east and west sides, from each of 177 Populus 'I-214' under different pruning regimes. In trees with 65 percent pruning, there were more but narrower sapwood rings than in less severely pruned trees. Severely pruned trees had a higher percentage of heartwood.

Schulz, H. 1985. Hardness profiles as indicators of different strength systems in wood. *Holz als Roh- und Werkstoff*. 43(6): 215-222.

Observations are reported on 'hardness profiles' obtained after sandblasting (using angular glass or corundum particles) of softwood and hardwood cross-sections. Light micrographs are shown of treated samples of the following species: Abies grandis, Picea abies, Betula verrucosa (B. pendula), Prunus avium, Robinia pseudoacacia, Quercus robur, Fagus sylvatica, Tilia platyphyllos, Populus tremula, Acer pseudoplatanus, and Eucalyptus globulus.

Senft, J.F.; Bendtsen, B.A. 1985. Measuring microfibrillar angles using light microscopy. *Wood and Fiber Science*. 17(4): 564-567.

Shunming, W.; Yinlian, Z.; Yingpe, C. 1985. A preliminary study on the phenolic glucosides and phenolic acids from the bark of several species of poplar. *Chemistry and Industry of Forest Products*. 5(2): 1-8.

Two phenolic glucosides, isolated from hot-water extractives from the bark of Populus tomentosa, P. davidiana, (P. tremula var. davidiana), P. euphratica, and P. simonii, were identified as salicin and populin by TLC, melting point determination, elemental analysis, IR spectrometry, and mass spectrometry. Five phenolic acids, including p-hydroxybenzoic acid, were also detected by high-performance liquid chromatography.

Silker, A. 1985. Orthotropic strains in compression parallel to grain tests. *Forest Products Journal*. 35(11/12): 19-26.

Strains were measured in the radial, tangential, and longitudinal directions during loading of small wood columns (7X1.25X1.25 inches) in compression parallel to the grain. Eight species were represented: Thuja occidentalis, Pinus lambertiana, Pinus monticola, Populus spp., Tilia americana, Quercus spp., Fraxinus spp., and Liriodendron tulipifera.

Stimely, G.L.; Blankenhorn, P.R. 1985. Effects of species, specimen size, and heating rate on char yield and fuel properties. Wood and Fiber Science. 17(4): 477-489.

Char yields were examined from red maple (Acer rubrum), white oak (Quercus alba), longleaf pine (Pinus palustris), and hybrid poplar [Populus 'NE-388'] wood specimens of four different particle sizes carbonized in a flowing nitrogen atmosphere with heating rates of 5, 15, and 25degC/min up to 250, 400, and 600degC. An equation to calculate gross heat of combustion values of wood and char was developed through modification of Dulong's formula.

Tanner, Yu. A.; (Tanner, J.A.); Kaps, T.K.; Nikitchenko, L.N. 1985. Structure and properties of wood modified with DFK alkyl-resorcinol resins. Folia Forestalia Polonica, B (Drzewnictwo). 16: 25-30.

Birch and aspen (Populus tremula) wood modified with the resins DFK-12 and DFK-16 were studied by SEM.

Todorov, T. 1985. Effect of the concentration of phenol-formaldehyde resin and the amount of hardener on the physical and mechanical properties of particleboards made of poplar wood. Sofia, Bulgaria: Vissh Lesotekhnicheski Institut; 29: 65-69.

Details are given of trials to determine the effect of the resin concentrate (40, 43, or 46 percent) and amount of hardener (urotropin at 0, 1.5, or 3 percent) on the water absorption, swelling, bending strength, and bond strength of particleboards (single layer, 18 mm thick, density 720 kg/m³). The optimum board properties were obtained with resin of 43 percent concentrate and 1.5 percent urotropin.

Varga, M. 1985. Mechanical properties of sawdust. Acta Facultatis Ligniensis. 1: 65-75.

Frictional and cohesional properties of poplar sawdust particles were studied.

Wang, E.I.C.; Micko, M.M. 1985. Some strength properties of aspen wood affected by varying degrees of heart rot. Forest Products Journal. 35(2): 53-57.

Twenty specimens each from clear, discoloured, intermediate, and advanced decayed aspen heartwood were tested for their green static bending, green and oven-dry compression parallel to grain, and side hardness strengths. The four groups were distinctly different.

Wittmann, G. 1985. Influence of site conditions on the physical and mechanical properties of wood. Erdo. 34(7): 311-317.

The wood density of Scots pine, Austrian pine, Norway spruce, and Populus 'Robusta' in Hungary was estimated by a polynomial function of Szanto's

climate quality. The climate quality values of the site accounted for 37 to 100 percent of the variation in wood density.

1986

Bendtsen, B.A.; Senft, J. 1986. Mechanical and anatomical properties in individual growth rings of plantation-grown eastern cottonwood and loblolly pine. *Wood and Fiber Science*. 18(1): 23-38.

A study was undertaken to determine relationships between age and mechanical and anatomical properties, the average properties of juvenile and mature wood, the age of demarcation between juvenile and mature wood, and the projected proportions of juvenile and mature wood at various ages in plantation cottonwood (Populus deltoides) and loblolly pine. The mechanical properties of the pine were projected to approximate those of trees from natural forests at 30 to 60 years, depending on property, while those for cottonwood will not achieve comparability.

Boevskaya, I.A.; Portnik, Zh.I.; Merem'yanin, Yu.I. 1986. The influence of wood moisture content and density on its dielectric properties. *Lesnoi Zhurnal*. 1: 123-125.

Graphs are presented showing the relation of permittivity and tangent of the angle of dielectric losses to the density and moisture content of oak, pine, birch, and aspen, and compressed birch wood.

Ganchev, P.; Rangelov, K. 1986. Technical properties of the wood of some hybrid forms of grey poplar. *Gorsko Stopanstvo Gorska Promishlenost*. 42(2): 9-10.

Data are tabulated on the main physical and mechanical properties of the wood of 11 hybrid forms of Populus canescens aged 16 years. Density varied from 400 to 478 kg/m³.

Garmo, T.H. 1986. Chemical composition and in vitro dry matter digestibility of indigenous mountain pasture plants in different plant groups. Preliminary report. *Rangifer*. 6(1): 14-22.

Species of ferns + horsetails, lichens, conifers (juniper), tree leaves (Salix spp., Betula spp., Populus tremula, Sorbus aucuparia), heathers, grasses, rushes/sedges and forbs were collected in a mountain area of southern Norway during the growing season from 15 June until 15 September during 1982-1984. Mean values (percent of DM) of the different chemical constituents and in vitro DM digestibility of the different plant groups sampled throughout the growing season are given.

Geimer, R.L. 1986. Properties of structural flakeboard manufactured from 7-year-old intensively cultured poplar, tamarack, and pine. *Forest Products Journal*. 36(4): 42-46.

Flakeboards were made from Populus 'Crandon', P. 'NC-5351', tamarack, and jack pine growing in Wisconsin. Boards made from jack pine and tamarack were less durable and had poorer mechanical properties than boards made from the two Populus clones.

Hall, L.D.; Rajanayagam, V.; Stewart, W.A.; Steiner, P.R. 1986. Magnetic resonance imaging of wood. *Canadian Journal of Forest Research*. 16(2): 423-426.

A clinical scanner was used to give NMR images of a freshly cut sample of Populus tremuloides. Annual growth rings, knots, and heartwood were clearly delineated.

Iosifov, N.; V"lcheva, L. 1986. Weather resistance of particleboards of poplar wood in natural conditions. *Gorsko Stopanstvo Gorska Promishlenost*. 42(11): 13-15.

Boards were made from chips and PF resin with a press temperature of 170deg plus or minus 2degC, pressure 2.5 MPa, and duration 0.8 s/mm. Sample boards were exposed to the weather at a windy, high-rainfall site in Bulgaria. Data are shown on the changes in moisture content, density, thickness swelling, water absorption, modulus of linear deformation in bending, bending strength, and bond strength over the period.

Ivanov, Yu.M. 1986. Forced highly-elastic deformations of wood in compression perpendicular to grain. *Khimiya Drevesiny*. 5: 91-96, 126.

A theoretical discussion of changes in wood strength properties after industrial pressing, supplemented by results of laboratory tests on small wood specimens. Aspen (Populus tremula) wood, after compressing by 30 percent and then swelling in water to its original size, did not recover the initial linear phase of forced highly elastic deformation.

Julkunen-Tiitto, R. 1986. A chemotaxonomic survey of phenolics in leaves of northern Salicaceae species. *Phytochemistry*. 25(3): 663-667.

Kellogg, R.M.; Swan, E.P. 1986. Physical properties of black cottonwood and balsam poplar. *Canadian Journal of Forest Research*. 16(3): 491-496.

Samples of black cottonwood (Populus trichocarpa) and balsam poplar (P. balsamifera) were obtained from three sites in, respectively, British Columbia and Alberta. It is concluded that the marketplace discrimination against P. trichocarpa is not justified.

Kyokong, B.; Keenan, F.J.; Boyd, S.J. 1986. Fracture behavior of adhesive joints in poplar. *Wood and Fiber Science*. 18(4): 499-525.

As part of an investigation into the feasibility of using Populus tremuloides for glulam, three-point bending (TPB) specimens of 27 replications for each crack length (0, 3.2, 6.4, and 12.7 mm) were tested in flexure by the bending normal-to-glueline method.

Lange, H.; Lieber, T.; Simatupang, M.H. 1986. Relationship between strength and dimensional stability of wood cement boards. *Holz als Roh- und Werkstoff*. 44(4): 127-132.

Studies are reported on laboratory-made boards differing in relation to wood species used (Norway spruce, poplar), cement properties (four types used), and quartz content (0, 15, or 30 percent added to cement).

Lapa, I.K.; Udre, V.Yu. 1986. Phenolic compounds in developing generative buds of male and female aspen trees. *Soviet Plant Physiology*. 33(6, I): 844-851. Translated from: *Fiziologiya Rastenii*. 33(6, I): 1104-1112.

Bud samples were collected during the period July to October from 20- to 30-year-old Populus tremula trees growing in natural stands in the Elgava and Riga Regions of the Latvian SSR. During the course of differentiation, male buds contained a higher concentration of free phenolic acids while female buds contained a higher concentration of the glycoside forms, so that the ratio of free to glycoside forms differed between the sexes. Results showed that each part of the bud was characterized by a specific qualitative and quantitative mixture of phenolic compounds.

Lapierre, C.; Monties, B.; Bassal-Gonthier, A.; Dworkin, A. 1986. Differential calorimetric study of pine and poplar lignins between 300 and 525 K. *Journal of Applied Polymer Science*. 32(4): 4561-4572.

Murmanis, L.; Youngquist, J.A.; Myers, G.C. 1986. Electron microscopy study of hardboards. *Wood and Fiber Science*. 18(3): 369-375.

Wet-formed and dry-formed aspen (Populus) fibreboards were examined by TEM to obtain information on internal structure and fibre/resin interactions.

Nepenin, Yu.N.; Zhalina, V.A.; Krylov, V.N. 1986. Assessment of wood quality in wood raw material investigations. In: Gromou, U.S., ed. Leningrad, USSR: Kirov Academy of Wood Technology: 38-51.

The pulp and paper industry in the USSR is obliged to use an increasing variety of raw materials. Experience in the pulping of hardwoods, larch, and deadwood is discussed in relation to quality and resources. Birch has proved to be generally the best hardwood for pulping, but Betula davurica and Populus tremula from the Soviet Far East are among the least suitable, apparently owing to anatomical features rather than chemical composition.

Polyakov, V.V.; Orlov, V.K.; Shukenova, R.Zh.; Mullaeva, N.I. 1986. Carboxylic acids of Populus balsamifera. *Chemistry of Natural Compounds*. 21(6): 795. Translated from: *Khimiia Prirodnykh Soedinenii*: 834.

Roshchin, V.I.; Poverinova, O.Y.; Raldugin, V.A.; Pentegova, V.A. 1986. Triterpenic alcohols from Populus tremula leaves. *Khimiya Prirodnykh Soedinenii*. 4: 516-517.

Schroeder, P.; Parameswaran, N. 1986. Production and description of wood polymer composites based on low-viscosity epoxy resins. Part 1. Physical properties. Wellington, New Zealand: Department of Internal Affairs: 27 p. (Translated from *Holzforschung*. 39: 209-221; 1985.)

Schroeder, P.; Parameswaran, N. 1986. Production and characterization of wood polymer composites based on low-viscosity epoxy resins. Part 2. Strength properties. *Holzforschung*. 40(1): 51-54.

Wood polymer composites (WPC) of Picea abies, Pinus radiata, Fagus sylvatica, and Populus marilandica, produced by treatment with a low-viscosity epoxide resin, were analysed with respect to their strength properties.

Compression strength, MOE, bending strength, and Brinell hardness showed a general improvement compared with solid wood for all species.

Seth, R.S.; Soszynski, R.M.; Page, D.H. 1986. The effect of wood species on the edgewise compressive strength of paper. *Tappi Journal*. 69(10): 94-96.

Variations in sheet compressive strength for 5 softwoods (black spruce, western hemlock, loblolly pine, eastern white pine, and Douglas fir) and 4 hardwoods (yellow birch, trembling aspen, white birch, and sugar maple) are discussed in relation to fibre length and wall thickness, and fibril angle.

Shukla, N.K.; Sangal, S.K. 1986. Preliminary studies on strength properties of some exotic timbers. *Indian Forester*. 112(5): 459-465.

Physical and mechanical properties (including density, modulus of rupture, modulus of elasticity (static and impact bending), compression, surface hardness, and shear parallel to the grain) were recorded for samples of Acacia tortilis, Araucaria cunninghamia, Cupressus lusitanica, Khaya senegalensis, Leucaena leucocephala (grown in Uttar Pradesh, Rajasthan, and Gujarat), Pinus caribaea, P. patula, Populus 'Casale', P. deltoides, and P. 'Heidemij' and compared with those of teak.

Singh, T. 1986. Wood density variation of six major tree species of the Northwest Territories. *Canadian Journal of Forest Research*. 16(1): 127-129.

Wood density, on the basis of green and oven-dry volume, was measured at 10 different heights along stems of 4 diameter classes of Picea glauca, P. mariana, Pinus banksiana, Larix laricina, Populus tremuloides, and P. balsamifera. The species had highly significantly different wood density at each of the sampled heights.

Singh, T.; Kostecky, M.M. 1986. Calorific value variations in components of 10 Canadian tree species. *Canadian Journal of Forest Research*. 16(6): 1378-1381.

Tables show the calorific values of oven-dry stump, stem, treetop, bark, foliage, and branches of 6 conifers and 4 broadleaved species harvested in Manitoba.

Snook, S.K.; Labosky, P., Jr.; Bowersox, T.W.; Blankenhorn, P.R. 1986. Pulp and papermaking properties of a hybrid poplar clone grown under four management strategies and two soil sites. *Wood and Fiber Science*. 18(1): 157-167.

Short-rotation intensive culture (SRIC), 3-year-old, Populus 'NE-388' was grown under 4 management strategies (control, irrigation, fertilizer, and fertilizer/irrigation) on 2 sites in Pennsylvania that were favorable or unfavorable for high biomass yields. No large differences in total pulp yields were observed with management strategy, although the fertilizer/irrigation growth strategy produced debarked chips that gave slightly higher total pulp yields with lower permanganate numbers than did debarked chips obtained from the other strategies.

Swan, E.P.; Kellogg, R.M. 1986. Chemical properties of black cottonwood and balsam poplar. *Canadian Journal of Forest Research*. 16(3): 497-501.

Analyses were made of lignin and extractives contents, acidity, and pH of heartwood and sapwood from male and female black cottonwood (Populus

trichocarpa) from 3 sites in British Columbia and balsam poplar (P. balsamifera) from 3 sites in Alberta. Results showed no significant differences between species in lignin content, pH, and acidity. Results support the current taxonomic classification of black cottonwood and balsam poplar as subspecies of a single species, with the correct nomenclature of black cottonwood being P. balsamifera subsp. trichocarpa.

V'yukov, B.E.; Mishura, E.I. 1986. Evaluating the numerical values of the coefficients of thermal linear expansion of bark and wood. *Lesnoi Zhurnal*. 3: 63-65.

Experiments were made with a quartz dilatometer to determine the coefficients of thermal linear expansion along the grain for bark of spruce, pine, birch, beech, and aspen. The coefficients were also measured in the wood layers nearest to the bark on the same samples. The significance of these findings in relation to the barking of pulpwood is discussed.

Williams, D.; Simpson, I.; Bier, H. 1986. Properties of New Zealand-grown poplar. *FRI Bull.* 112. Rotorua, New Zealand: New Zealand Forest Service, Forest Research Institute. 26 p.

Youngquist, J.A.; Krzysik, A.; Rowell, R.M. 1986. Dimensional stability of acetylated aspen flakeboard. *Wood and Fiber Science*. 18(1): 90-98.

A study was conducted to determine if thickness swelling of flakeboards, which is much greater than that of plywood or solid wood, can be improved by chemical modification of the constituent wood flakes prior to board manufacture.

Youngquist, J.A.; Rowell, R.M.; Krzysik, A. 1986. Mechanical properties and dimensional stability of acetylated aspen flakeboard. *Holz als Roh- und Werkstoff*. 44(12): 453-457.

Aspen (Populus spp.) flakes were reacted with an acetic anhydride/xylene mixture to approximately 20 percent weight gain and pressed into flakeboards using a water-soluble phenolic resin. Properties are reported of untreated boards, and boards given vacuum-pressure soak-dry or accelerated aging treatment.

1987

Carll, C.G.; Feist, W.C. 1987. Weathering and decay of finished aspen waferboard. *Forest Products Journal*. 37(4): 27-30.

Specimens of commercial aspen (Populus tremuloides) waferboard were prepared with 5 pre-treatments. Panels were inspected annually for 5 years and graded for surface appearance and decay.

Greenaway, W.; Scaysbrook, T.; Whatley, F.R. 1987. The analysis of bud exudate of Populus X euramericana, and of propolis, by gas chromatography mass spectrometry. *Proceedings of the Royal Society of London, Series B-Biological Sciences*. 232(1268): 249-272.

Mattes, B.R.; Clausen, T.P.; Reichardt, P.B. 1987. Volatile constituents of balsam poplar: the phenol glycoside connection. *Phytochemistry*. 26(5): 1361-1366.

Ohta, S. 1987. Tension wood from the stems of poplars with various degrees of leaning. I. The macroscopic identification and distribution of tension wood within stems. *Journal of Japan Wood Research Society*. 25(9): 610-614.

Renaud, M.; Grandmaison, J.L.; Roy, C.; Kaliaguine, S. 1987. Conversion of vacuum pyrolysis oils from Populus deltoides over H-ZSM-5. Abstracts of Papers of the American Chemical Society. 193: 68. Abstract.

Renaud, M.; Grandmaison, J.L.; Roy, C.; Kaliaguine, S. 1987. Conversion of vacuum pyrolytic oils from Populus deltoides over H-ZSM-5. In: National meeting of the American Chemical Society; 1987 April 5; Denver, CO. American Chemical Society, Division of Fuel Chemistry. 32(2): 276-286.

As biomaterials are structurally and chemically complex, biomass thermochemical conversion processes produce complex fractions including a liquid fraction which, depending on the process, can be obtained in large or small yields. These liquids have found little utility because of their large contents in oxygen which implies low heat values, instability and corrosive properties. Two routes have been tested in order to produce hydrocarbons from these liquids. The first one involves hydrotreatment with either H_2 or $H_2 + CO$ over classical hydrotreatment catalysts. The second route is the simultaneous dehydration and decarboxylation over H-ZSM-5 zeolite catalyst in the absence of any reducing gas.

Tekely, P.; Vignon, M.R. 1987. Cross polarization/magic angle spinning ^{13}C -NMR characterization of steam exploded poplar wood. *Journal of Wood Chemistry and Technology*. 7(2): 215-228.

Wegner, T.H. 1987. Strength and optical properties of chemically pretreated aspen chip groundwood. *Tappi Journal*. 70(5): 119-130.

Wollenweber, E.; Asakawa, Y.; Schillo, D.; Lehmann, U.; Weigel, H. 1987. A novel caffeic acid-derivative and other constituents of Populus bud excretion and propolis (bee-glue). *Zeitschrift fur Naturforschung Section C-Biosciences*. 42(9/10): 1030-1034.

1988

Fukuda, T.; Terashima, N. 1988. Heterogeneity in formation of lignin, 12: Deposition of chemical components during the formation of cell walls of black pine and poplar. *Journal of the Japan Wood Research Society*. 34(7): 604-608.

Greenaway, W.; Scaysbrook, T.; Whatley, F.R. 1988. Phenolic analysis of bud exudate of Populus lasiocarpa by GC/MS. *Phytochemistry*. 27(11): 3513-3515.

- Levin, E.D.; Cherepanova, V.E.; Zimovtseva, I.A.; Sedlova, T.O. 1988. Prostaglandins: identification and content in higher plants. *Phytochemistry*. 27(10): 3241-3243.
- Levin, E.D.; Cherepanova, V.E.; Sedlova, T.O.; Zimovtseva, I.A.; Zinchenko, S.V. 1988. Detection of prostaglandin F2 alpha in tissues of Populus balsamifera and Larix sibirica. *Chemistry of Natural Compounds*. 24(3): 293-295. Translated from: *Khimiya Prirodnykh Soedinenii*. 24(3): 351-353.
- Reichardt, P.B.; Clausen, T.P.; Bryant, J.P. 1988. Phenol glycosides in plant defense against herbivores. ACS Symp. Ser. 380. Washington, DC: American Chemical Society: 130-142.
- Rood, S.B.; Bate, N.J.; Mander, L.N.; Pharis, R.P. 1988. Identification of Gibberellin-A1 and Gibberellin-A19 from Populus balsamifera X Populus deltoides. *Phytochemistry*. 27(1): 11-14.
- Sachsse, H.; Lohmann, J.; Melchior, G.H. 1988. Wood properties of the hybrid-aspen-family 194/61. *Holz als Roh- und Werkstoff*. 46(11): 426.

SILVICS

1975

Borsdorf, W. 1975. Advances in the varietal identification of old trees of commercial Poplars. *Beitrage fur die Forstwirtschaft*. 9(3): 134-136.

A key to 11 named (not numbered) varieties of hybrid black poplar and three balsam poplars (Populus trichocarpa 'Senior', P. 'Androscoggin', and P. 'Rochester') grown in East Germany, based on characters of the bark, crown, and foliage.

Brinkman, K.A.; Roe, E.I. 1975. Quaking aspen: silvics and management in the Lake States. *Agric. Handb.* 486. Washington, DC: U.S. Department of Agriculture, Forest Service. 52 p.

Populus tremuloides is the dominant species in the aspen stands that occupy more than 13 million acres in Minnesota, Wisconsin, and Michigan. Growth exceeds fellings, but fellings, mainly for pulp and particle board, are increasing. The best regeneration, which is from suckers, is obtained by clear fellings, includes information on wildlife (notably deer, beaver and ruffed grouse) and on pests and diseases.

Hathaway, R.L.; Penny, D. 1975. Root strength in some Populus and Salix clones. *New Zealand Journal of Botany*. 13(3): 333-344.

The tensile strength of the roots of four Populus and two Salix clones was investigated and related to anatomy and chemical composition. Since the amount of stele in the roots and its specific gravity are the most important factors determining tensile strength it should be possible to select strongly-rooted trees on the basis of these two characters for use in soil conservation measures.

Marks, P.L. 1975. On the relation between extension growth and successional status of deciduous trees of the northeastern United States. *Bulletin of the Torrey Botanical Club*. 102(4): 172-177.

Describes a study of the relations between shoot extension growth and the successional characteristics of 10 deciduous broadleaved species. Results showed that early successional species (Populus grandidentata, P. tremuloides, and Prunus pennsylvanica) grow during most of the frost-free season and have indeterminate and considerable extension growth.

Roer, H.F. 1975. Shoot system and terminal bud of Salicaceae. *Nytt Magasin for Botanik*. 22(1): 15-20.

1976

Cannell, M.G.R.; Willet, S.C. 1976. Shoot growth phenology, dry matter distribution and root/shoot ratios of provenances of Populus trichocarpa, Picea sitchensis and Pinus contorta growing in Scotland. *Silvae Genetica*. 25(2): 49-59.

Different provances of Picea sitchensis, Pinus contorta, and Populus trichocarpa, which have similar natural ranges and comparable photoperiodic

ecotypes, were grown in pots in a nursery in Southeast Scotland in 1972 and 1973. Periods of active shoot elongation were recorded, and seasonal changes in dry matter distribution between root and shoot were monitored by destructive sampling. For Picea sitchensis and Populus trichocarpa, the dates of cessation in height growth were inversely correlated with the latitude and altitude of the place of origin. Root/shoot ratios were negatively correlated with date of height growth cessation and positively with latitude of origin. The practical implications of these results are discussed with regard to selection for yield and wind stability in the U.K.

1977

Browicz, K. 1977. Chorology of Populus euphratica Olivier. Arboretum Kornickie. 22: 5-27.

Henry, R.M.; Barnes, B.V. 1977. Comparative reproductive ability of bigtooth and trembling aspen and their hybrid. Canadian Journal of Botany. 55(24): 3093-3098.

Hybrid clones of Populus tremuloides X P. gradidentata exhibited significantly lower seed production than that of their parents although some hybrid clones produced more seeds per shoot than certain parental clones. No strong barrier was found to prevent the continuous establishment and persistence of back crosses. It is considered that gene flow may occur under natural conditions, provided suitable disturbed sites are available for colonization.

Larson, P.R.; Pizzolato, D. 1977. Axillary bud development in Populus deltoides. I. Origin and early ontogeny. American Journal of Botany. 64(7): 835-848.

Pizzolato, T.D.; Larson, P.R. 1977. Axillary bud development in Populus deltoides. II. Late ontogeny and vascularization. American Journal of Botany. 64(7): 849-860.

1978

Ronald, W.G. 1978. Irregular flowering bud conformation in a hybrid poplar. Canadian Journal of Botany. 56(3): 369-370.

An unusual flowering condition in which vegetative and flowering buds occurred together at single nodes was found in a female of the complex hybrid Populus X canescens X (P. alba X P. gradidentata). The most frequent combinations consisted of vegetative buds with either one or two flowering buds.

1980

Sivolapov, A.I. 1980. Selection of commercially valuable forms of Populus alba. Lesnoe Khozyaistvo. 6: 30 p.

A note on investigations in the Central Chernozem region of the USSR on the natural variation in white poplar and on the selection of the best forms. Data are tabulated on the histological make-up of the wood tissues (percent vessels, percent libriform fibres, and percent primary rays), and on the dimensions of the libriform fibres in the peripheral layers.

Yarmishko, V.T. 1980. Characteristics of seasonal root growth in woody plants. *Botanicheskii Zhurnal*. 65(11): 1635-1639.

Roots of *Picea abies*, *Betula pendula*, *Alnus incana*, and *Populus tremula* growing on the same site in Leningrad Province were studied in relation to the growth of leading shoots.

1981

Belostokov, G.P. 1981. Structure of the root system in first year seedlings of woody plants. *Botanicheskii Zhurnal*. 66(3): 392-399.

Seedlings of 9 species (*Picea abies*, *Pinus sylvestris*, *Betula pendula*, *Ulmus laevis*, *Acer platanoides*, *Tilia cordata*, *Quercus robur*, *Juglans mandshurica*, and *Populus tremula*) were grown in Smolensk Province, Russia. Structural elements of the root systems and their morphological types are described with notes on growth forms, branching and depth of penetration into the soil.

Kashyap, S.D.; Singh, R.V.; Sharma, K.C. 1981. Crown characteristics of *Populus ciliata* Wall. In: Singh, R.V., ed. *Symposium proceedings: Silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 98-100.*

Singh, R.V. 1981. Silvics and ecology of *Populus ciliata* (India). In: Singh, R.V., ed. *Symposium proceedings: Silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 62-66.*

1982

Khosla, P.K.; Khurana, D.K. 1982. Evolution of genus *Populus* Linn. and systematic placement of *Populus ciliata* Wall. ex Royle. *Journal of Tree Sciences*. 1(1/2): 81-87.

Khurana, D.K.; Bhanwara, R.K. 1982. Ontogeny of catkin-drop and embryology of *Populus ciliata* and its crosses with *Populus deltoides*. In: Khosla, P.K., ed. *Proceedings, Improvement of forest biomass. Solan, India: Indian Society of Tree Scientists: 413-418.*

Padro, A.A. 1982. Clones of the black poplar. *Agricultura*. 51(605): 995-998.

Wang, C.; Tung, S.L. 1982. New taxa of *Populus*. II. (In China). *Bulletin of Botanical Research*. 2(2): 105-120.

Wang, Y.X. 1982. A new forma of Populus tomentosa from Shandong. Bulletin of Botanical Research. 2(4): 159-160.

1984

1984. Luisa Avanzo, Cima, Bellini: three new cultivars of poplars inscribed in the list of forest materials for controlled reproduction (Populus, performance, disease and frost resistance, technology). Paris: La Foret Privee. Jan/Feb (155): 69-78.

Fenner, P.; Brady, W.W.; Patton, D.R. 1984. Observations on seeds and seedlings of Fremont cottonwood. Desert Plants. 6(1): 55-58.

Zhmakin, A.S. 1984. Fruit bearing of a rot resistant form of aspen. Lesnoe Khozyaistvo. 1: 43-44.

1985

Braun, H.J. 1985. Quantitative differences of the vessel hydrosystem and its accessory tissues in roots and trunk, with Populus as an example. Berichte der Deutschen Botanischen Gesellschaft. 98(3/4): 239-244.

Hu, C.C.; Crovello, T.J.; Sokal, R.R. 1985. The numerical taxonomy of some species of Populus based only on vegetative characters. Taxon. 34(2): 197-206.

Kennedy, H.E., Jr. 1985. Cottonwood (Populus deltoides Bartr. ex Marsh. and P. trichocarpa Torr. & Gray). An American Wood. 231. 8 p. (revised)

Nelson, C.D. 1985. Genetic variation in juvenile characters of Populus deltoides Bartr. from the southwestern portion of its native range. Forestry Abstracts. 46(10): 659.

Perala, D.A.; Carpenter, E.M. 1985. Aspen (Populus tremuloides Michx. and Populus grandidentata Michx.). An American Wood. 217. 8 p. (revised)

Zhang, T.Z.; Li, Z.G.; Xie, J. 1985. A preliminary study on differences in growth of Populus tomentosa that shed leaves at different times. Forest Science and Technology. 3: 10-11.

Trees that shed more than half their leaves during the early frost period were designated as shedding leaves early, and growth of these and those shedding leaves late were compared. Results showed that average height of trees that shed leaves late was 2-12 percent greater and average d.b.h. and volume one tree were 28-56 percent and 67-145 percent greater, respectively, indicating that leaf-shedding period can be used as an index for selection of fast-growing varieties.

1986

Luomajoki, A. 1986. Timing of microsporogenesis in trees with reference to climatic adaptation. A review. *Acta Forestalia Fennica*. 196: 33 p.

A study of 16 tree species showed that, including yearly and latitudinal variation, the tetrad phase was reached from late March to early June in conifers and Populus tremula (correlated with heat sums) and in late July to mid August in Betulaceae (correlated with daylength). These differences were thought to be associated with seasonal adaptive strategies rather than taxonomic relationships.

1988

Pautov, A.A. 1988. Some problems of the phylogeny of white poplars. *Vestn. Leningr. Univ. Biol.* 0(4): 44-49.

Rajora, O.P. 1988. Allozymes as aids for identification and differentiation of some Populus maximowiczii Henry clonal varieties. *Biochemical Systematics and Ecology*. 16(7/8): 635-640.

Sakai, A.K.; Sharik, T.L. 1988. Clonal growth of male and female bigtooth aspen. *Ecology*. 69(6): 2031-2033.

SILVICULTURE

1975

Allegri, E. 1975. Poplar growing in the Po Valley. *Annali dell' Istituto Sperimentale per la Selvicoltura*. 6: 1-51.

Summarizes the results of a survey of poplar growing on about 80 estates in the Po Valley, made for the Italian Poplar Commission. Subjects discussed include: selection, soil preparation, planting method and depth, planting stock, plantation espacement and rotation, pruning, use of fertilizers, irrigation, protection against diseases and pests, and felling and extraction.

Avanzo, E. 1975. Growing of some clones of black poplar in four comparative plantations in central-southern Italy. *Cellulosa e Carta*. 26(12): 25-33.

Bailly, C.; Brunck, F.; Malvos, C. 1975. Influence of maintenance measures on the vitality and growth of poplars. *Bois et Forets des Tropiques*. 164: 15-24.

Preliminary trials showed that up to 100 percent success can be obtained with Carolina poplar cuttings, if the soil is kept at a humidity close to the maximum water-holding capacity, particularly from the end of September to the beginning of November. During 1971-1973, a superior height growth of young poplar plants was observed with comprehensive weeding treatments than with partial or no cultivation.

Bailly, C.; Brunck, F.; Malvos, C. 1975. The effect of upkeep techniques on the vitality and growth of poplars. In: *2e Symposium sur le Desherbage des Cultures Tropicales; 1974; Montpellier, France*. Paris, France: Comite Francais de Lutte contre les Mauvaises Herbes: 14-29.

In trials in Madagascar from 1969-1973 the competition offered by weeds to young poplars (*Populus deltoides*) was evaluated. Ploughing and regular weeding of the whole plantation area produced the best growth rate, lowest mortality and most homogeneous stand. Water content of the soil is critical, a high level being essential.

Barring, U. 1975. Herbicide experiments in forestry. In: *Weeds and weed control: Proceedings of the 16th Swedish weed conference*. Uppsala, Sweden: Lantbrukshogskolan. Part 1: E2.

Regrowth of *Populus tremula* and *Betula* spp. was sometimes greater following treatment with MCPA than after 2,4,5-T; MCPA was also less selective in pine (*Pinus* spp.) and spruce (*Picea* spp.). Regrowth of *P. tremula* following treatment with glyphosate at 0.75 to 3 kg/ha was very slight. In nurseries, phenmedipham at 1 kg/ha was approved for use in pine seedbeds. Atrazine and terbuthylazine at 0.1-0.2 kg/ha showed promise in seedbeds of pine and spruce.

Boccalari, F. 1975. Situation and prospects in the Italian poplar culture. *Arboric Legno*. 18(5): 113, 115, 117.

Bowes, G.G. 1975. Control of aspen and prickly rose in recently developed pastures in Saskatchewan. *Journal of Range Management*. 28(3): 227-229.

Two consecutive annual applications of 2,4-D at 2 lb/ac or a 2:1 mixture of 2,4-D + 2,4,5-T at 2 lb a.i./ac gave 5 years control of aspen (Populus tremuloides) regrowth following bulldozing and discing in Saskatchewan. Control of prickly rose (Rosa acicularis) with the mixture was variable.

Buttoud, G. 1975. French production of poplar and prospects of its development. Review of Forestry Fr. 27(1): 5-15.

Ek, A.R.; Brodie, J.D. 1975. A preliminary analysis of short-rotation aspen management. Canadian Journal of Forest Research. 5(2): 245-258.

Great Plains Agricultural Council, Research Committee. 1975. A cottonwood management program for Kansas. Publ. 76. Great Plains Agricultural Council. 4 p.

Halupa, L. 1975. Growing cellulose producing Populus. ERFA (Erdogazdasag Faipar). 12: 6-8.

Halupa, L. 1975. Tending of pulpwood poplar stands. Part 1. Erdogazdasag es Faipar. 28(12): 6-8.

Hennessey, T.C.; Gordon, J.C. 1975. A comparison of field and growth chamber productivity of three poplar clones. In: Proceedings of the 9th Central States forest tree improvement conference: 42-47.

Herpka, I. 1975. The experiences in planting stock production and poplar and willow cultivation. Topola. 19(107/108): 11-16.

Herpka, I.; Markovic, J. 1975. Research results on the crop-tree clonal test study. Topola. 18/19(103/106): 183-193.

Jestaedt, M. 1975. Tests of poplar clones of the section Leuce. Holzzucht. 29(2/4): 23-29.

Evaluations were made of dimensional and habit characters and of susceptibility to pests and diseases for 115 clones, and also one provenance type, all taken from West German trial plots at 4 to 18 years of age.

Jones, J.R. 1975. Regeneration on an aspen clearcut in Arizona. Res. Note RM-285. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 8 p.

Jones, J.R.; Trujillo, D.P. 1975. Development of some young aspen stands in Arizona. Res. Pap. RM-151. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 11 p.

Kennedy, H.E., Jr. 1975. Proper cultivation needed for good survival and growth of planted cottonwood. Res. Note SO-198. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 3 p.

Describes a study in Mississippi to assess the effects of good and poor cultivation techniques on the survival and early growth of cuttings of Populus

deltoides. Results show that survival, diameter growth, and height growth are much better with good than with poor cultivation.

Krinard, R.M.; Johnson, R.L. 1975. Ten-year results in a cottonwood plantation spacing study. Res. Pap. SO-106. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 10 p.

Lange, O. 1975. Poplar forestry and growing timber outside the forest in North Rhine-Westphalia. Forst Holzwirt. 30(24): 482-484.

Markovic, J. 1975. Dimensions of wood fibers and nominal volume weights of wood in dependance of two different silvicultural technologies, according to the age and height of the tree of clone I-214. Topola. 18/19 (103/106): 135-150.

Miller, D.R.; Rosenberg, N.J.; Bagley, W.T. 1975. Wind reduction by a highly permeable tree shelterbelts. Agricultural Meteorology. 14(3): 321-333.

Mlaka, J. 1975. Use of the assortment method in immature bred poplar stands. Lesnoe Cas. 21(1): 45-54.

Mullin, R.E. 1975. Underplanting tests with red and white pine in southern Ontario. For. Res. Note 2. Ontario, Canada: Ministry of Natural Resources. 4 p.

Pinus resinosa and P. strobus 2+0 stock were planted on two sites with overstories of Populus tremuloides/P. grandidentata of different densities, during 1955-1956 and 1958-1959. Four planting methods were compared: (a) Sandvik tool, (b) T-shaped cuts (round 'shovel'), (c) slit (round shovel), and (d) wedge (straight spade). At 15 years old, survival was better on the site with a less dense overstory. (D) gave the highest first-year survival of Pinus resinosa, and (a) resulted in the poorest height growth, especially in P. strobus. The use of large, sturdy plants, and spring planting, are recommended where the overstory is dense.

Ortisi, A. 1975. Poplar culture in Lombardy. Arboric. Legno. 18(9): 187-188.

Popova, O.S.; Il'inykh, L.A.; Popov, V.P. 1975. Forest belts of Populus in the Kulunda Steppes. Lesnoe Khozyaistvo. 3: 68.

Proni, G.; Prevosto, M. 1975. The problem of spacing of poplars in specialized stands in the Lombardy-Piedmont plain. Arboric. Legno. 18(2): 37, 39.

Prairie Farm Rehabilitation Administration. 1975. Chemical weed control for shelterbelt plantings: 1974 annual report of the tree nursery. Saskatchewan, Canada: Department of Regional Economic Expansion, Prairie Farm Rehabilitation Administration: 36-39.

Further trials were carried out with trifluralin as a pre-plant treatment for shelterbelts. Directed application of glyphosate at 2.5 lb/acre provided excellent top kill of weeds in 5-year-old poplars (Populus spp.).

Prudic, Z. 1975. Reclamation of dumps with [reforestation] of Populus. Lesnoe Prace. 54(3): 125-127.

Shipman, R.D. 1975. Preparing planting sites with herbicides. Tree Planters' Notes. 26(1): 1-4.

Of 11 herbicides tested for site preparation before planting 2-year-old Japanese larch seedlings (Larix leptolepis) and 1-year-old hybrid poplar (Populus maximowiczii X P. trichocarpa) diuron granules and granular formulations of picloram + diuron produced the greatest height increase in both species.

Svedarsky, W.D.; Buckley, P.E. 1975. Some interactions of fire, prairie and aspen in northwest Minnesota. In: Wali, M.K., ed. Prairie: a multiple view. Grand Forks, ND: University of North Dakota Press: 115-121.

Annual spring burning of prairie in N.W. Minnesota was effective in retarding trembling aspen (Populus tremuloides) sucker shoot growth and in favoring the growth of warm-season native grasses.

Sycheva, O.A. 1975. The genus Populus in Paleogene flora of Sakhalin. Botanicheskii Zhurnal. 60(12): 1755-1760.

Tauer, C.G. 1975. Competition between selected black cottonwood genotypes. Silvae Genetica. 24(2-3): 44-49.

From a 7-year-old plantation of 69 Populus trichocarpa clones, 10 were chosen as the experimental material. Competitive interactions of paired clones were investigated in a greenhouse using the newly developed beehive design and single paired trees.

Weisgerber, H. 1975. Possibilities for increasing wood production by short rotation of poplars. Holzzucht. 29(2/4): 29-32.

Weisgerber, H. 1975. Silvicultural behavior of North American poplar (Populus) species and their aptitude for cultivation in Germany. Forst Holzwirt. 30(13): 239-244.

Wertheim, S.J.; Nijse, F. 1975. Report on several windbreak trials. Fruitteelt. 65(44): 1158-1160.

Notes on the relative growth of several species of Alnus, Populus, and Salix and clones of Ulmus X hollandica, assessed from 6- to 10-year-old trials. Alnus cordata was the most promising.

Wyley, K. 1975. Is two-tier poplar tree framing suitable for New Zealand? Farm Forester. 17(4): 99-100.

Zhel'tov, N.M. 1975. Role of root grafts in the differentiation of trees in aspen stands. Referativnyi Zhurnal. 11(56): 166.

Tree differentiation and mortality through natural thinning are intense in young stands of Populus tremula, culminating at 20-25 years old. A clear-felled stand can produce 200,000 suckers/ha which reduce to 500-600 trees/ha at maturity. It is recommended that thinnings should be made so as

to retain the best biogroups and the best trees within these groups for the final crop.

Zsuffa, L. 1975. Some problems of hybrid poplar selection and management in Ontario. *Forestry Chronicle*. 51(6): 240-242.

1976

1976. Chemical weed control in established plantings. In: 1976 Annual report of the PFRA tree nursery. Indian Head, Saskatchewan: Canadian Department of Regional Economic Expansion, Prairie Farm Rehabilitation Administration: 35-36.

Glyphosate at 1.1-3.4 kg/ha was applied as a directed spray in established caragana [*Caragana arborescens*] plantations. The 1.1 kg/ha rate gave good control of bluegrass [*Poa pratensis*] and bromegrass [*Bromus* spp.] but higher rates were required at later stages. Five treatments were evaluated in 1975 in an established poplar [*Populus* spp.] shelterbelt. Glyphosate at 2.5 kg + simazine 3 kg/ha gave good initial and some residual control.

1976. Chemical weed control in established shelterbelts. In: 1975 Annual report of the PFRA tree nursery. Indian Head, Saskatchewan: Canadian Department of Regional Economic Expansion, Prairie Farm Rehabilitation Administration: 46.

Glyphosate at 2.8 kg + simazine 3.4 kg/ha provided fair control of perennial grasses and annual weeds in an established poplar shelterbelt without injuring the poplars. Glyphosate was applied at 1.2-3.4 kg/ha for the control of bluegrass [*Poa pratensis*] and bromegrass [*Bromus* spp.] in an established caragana shelterbelt. The 1.2-kg/ha rate gave good to excellent control when applied in June but poor control with application after the grass had headed in July.

1976. Chemical weed control for new tree plantings. In: 1975 Annual report of the PFRA tree nursery. Indian Head, Saskatchewan: Canadian Department of Regional Economic Expansion, Prairie Farm Rehabilitation Administration: 43-44.

Trifluralin at 2.2 kg/ha and at 1.1 kg + linuron 1.1 kg or + napropamide 4.5 kg or + chloramben 2.2 kg or + lenacil 2.2 kg or + metribuzin 1.1 kg/ha were incorporated before planting 2-year-old seedlings of green ash (*Fraxinus pennsylvanica* var. *lanceolata*) and Siberian elm (*Ulmus pumila*). Glyphosate phytotoxicity to northwest poplar was investigated by spraying the lower branches of rooted 1-year-old plants; the tests showed that glyphosate must not contact the foliage of poplar seedlings.

1976. Chemical weed control for nursery production. In: 1975 Annual report of the PFRA tree nursery. Indian Head, Saskatchewan: Canadian Department of Regional Economic Expansion, Prairie Farm Rehabilitation Administration: 38.

Herbicides are routinely used for the production of caragana (*Caragana arborescens*), poplar, willow [*Salix* spp.], Siberian elm (*Ulmus pumila*), Scots pine (*Pinus sylvestris*), Colorado spruce (*Picea pungens*), and white spruce

(Picea glauca). Amounts used of trifluralin, linuron, paraquat, MCPA, dazomet, and simazine are tabulated.

1976. Field trials. In: 1975 Annual report of the PFRA tree nursery. Indian Head, Saskatchewan: Canadian Department of Regional Economic Expansion, Prairie Farm Rehabilitation Administration: 40-43.

American elm (Ulmus americana) seedlings showed a narrow tolerance of trifluralin at 0.8 kg/ha and Manitoba maple (Acer negundo) seedlings tolerated bentazone at 2.2 kg/ha. Trifluralin at 1.1 and 1.7 kg/ha, incorporated before planting cuttings and chloroxuron 5.6 kg or linuron 2.2 kg/ha after planting had no adverse effects on willow and poplar. Seedlings of white spruce (Picea glauca) and jack pine (Pinus banksiana) were given 9 herbicide treatments before the second growing season. Diphenamid at 4.5 kg/ha was the most acceptable commercially available herbicide. Glyphosate in a 9.4 percent solution, wiped on plants with a roguing glove, gave 80 percent control of sow thistle [Sonchus arvensis] in poplar cuttings.

1976. Fire use section. Proceedings, Tall timbers fire ecology conference 14 and Intermountain Fire Research Council fire and land management symposium; 1974 October 8-10; Missoula, MT. Tallahassee, FL: Tall Timbers Research Station. 644+ p.

1976. Premises and potential of short-rotation forestry in Sweden. Working-meeting premises and potential of short-rotation forestry in Sweden; 1976 October 11-12; Stockholm, Sweden. Stockholm, Sweden: Skogshoegskolan. 96 p.

Papers cover the following subjects: Bogesund Experiment Station, the local climate of the Stockholm area; nutrient requirements of fast-growing Populus and Salix clones; exchange of gasses in soil and the composition of soil atmosphere; vegetative propagation; stand establishment and production systems; land area available; two forest harvesting developments; preliminary energy input-output analysis and a tentative calculus of profitability; potential use of short-rotation wood; wood as a fuel; wood powder as engine fuel; short-rotation hardwood as raw material for pulping; short-rotation wood in paper-making; increased utilization of whole trees - production of protein-vitamin concentrates from leaves; and production of energy from plant material.

1976. Rapport Annuel 1975, Association Foret-Cellulose. Paris, France: AFOCEL. 465 p.

A short introductory section reviews developments in silviculture in France, since 1960, in those fields in which AFOCEL's extension work would have been expected to bring about improvements. The general conclusion is that in the last 15-20 years silviculture has been undergoing a revolution comparable to that in agriculture 20 years earlier. The rest of the report is made up of research papers.

Andresen, J.W. 1976. Urban forestry research systems. In: Stand establishment, treatment and amelioration: Proceedings, Division 1, Forest environment and silviculture: 16th IUFRO world congress; 1976 June 20-July 2; Oslo, Norway. As, Norway: IUFRO: 312-488.

Atrokhin, V.G. 1976. Biotechnological principles of growing 'target forests'. In: Stand establishment, treatment and amelioration: Proceedings, Division 1, Forest environment and silviculture: 16th IUFRO world congress; 1976 June 20-July 2; Oslo, Norway. As, Norway: IUFRO: 481-488.

Betters, D.R. 1976. Guidelines for aspen management. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 105-110.

Cellerino, G.P. 1976. Weed control in newly-planted poplar nurseries in northern Italy. Notiziario sulle Malattie della Pianta. 94-95: 207-224.

Nitrofen (Tok E 25) + propanil (Stam F 34), trifluralin (Treflan) and propyzamide (Kerb) applied to planted Populus spp. cuttings before sprouting were highly efficient in controlling weeds in newly established nurseries. Large scale application in poplar nurseries in northern Italy was more economic than the 2 or 3 manual weedings usually required in the first 3 months, and did not injure the trees.

Chroust, L. 1976. Ecological significance of thinnings in Scots pine stands. In: Stand establishment, treatment and amelioration: Proceedings, Division 1, Forest environment and silviculture: 16th IUFRO world congress; 1976 June 20-July 2; Oslo, Norway. As, Norway: IUFRO: 467-480.

Cifra, J. 1976. The potentialities of growing Populus on inundation areas along the drainage strips. Erdo. 25(10): 461-466.

Curic, R. 1976. Possibility of raising poplars on non-utilized spaces in Bosnia and Herzegovina with special emphasis to the region of Herzegovina. Topola. 20(109/110): 11-14.

Dadykin, V.P.; Samsonova, L.P. 1976. Defoliation as a means of improving survival of woody plants on transplanting. Lesnoi Zhurnal. 1: 18-21.

Describes experiments in which 2-year plants of Acer platanoides, rooted cuttings of Populus nigra var. italica and 3-year plants of Betula verrucosa were planted out in June, a full month later than the latest date normally accepted for planting in the region. Three treatments were compared: (1) transplanting with a latex-based anti-transpirant DMMA-1GP, (2) transplanting with mechanical removal of the leaves, and (3) control. Treatment (1) gave the best results in terms of survival with A. platanoides and B. verrucosa but treatment (2) was best with the poplar.

Davenport, D.C.; Martin, P.E.; Hagan, R.M. 1976. Aerial spraying of phreatophytes with antitranspirant. Water Resources Research. 12(5): 991-996.

To determine whether aerial spraying of a six percent wax-based AT emulsion (Mobileaf) would provide adequate spray coverage and reduce transpiration, multiple passes were made with (1) a fixed wing plane on salt cedar (Tamarix pentandra and T. tetrandra), cottonwood (Populus spp.), and willow (Salix spp.); and (2) a helicopter on salt cedar. Scanning electron microscope photomicrographs showed considerable AT on foliage in the upper canopy and lesser amounts in the lower; the film was detected even at 24 days after spraying. Aerially applied AT increased resistance to leaf water vapor

diffusion by 150 percent during the first few days and by 80 percent thereafter. Transpiration of outer foliage of salt cedar was reduced 50 percent initially and 20 percent after two weeks without phytotoxicity.

Davenport, D.C.; Martin, P.E.; Roberts, E.B.; Hagan, R.M. 1976. Conserving water by antitranspirant treatment of phreatophytes. *Water Resources Research*. 12(5): 985-990.

A wax-based antitranspirant (AT), Mobileaf, was sprayed on leaves of three phreatophytes, salt cedar (Tamarix pentandra and T. tetrandra), cottonwood (Populus spp.), and willow (Salix spp.), as an alternative to eradicating them to conserve water. A 10 percent solution of AT reduced the transpiration rates of container-grown plants by 35-37 percent 1 day after spraying and by 17-56 percent after 4 days. The AT also increased resistance to water vapor diffusion and water potential of leaves.

DeByle, N.V.; Packer, P.E.; Williams, B.D.; Shearer, R.C.; Gordon, F.A.; Beardall, L.E.; Sylvester, V.E.; Norum, R.A.; Stark, N.; Steele, R.; McLeod, B.R. 1976. Fire use section [effects of prescribed burning]. In: Proceedings, Tall timbers fire ecology conference no. 14 and Intermountain fire research council fire and land management symposium; 1974 October 8-10; Missoula, MT. Tallahassee, FL: Tall Timbers Research Station: 446-644.

Dimitri, L. 1976. Possibilities of influencing air quality and exchange of air between forests and urban development areas by silvicultural measures. In: Stand establishment, treatment and amelioration: Proceedings, Division 1, Forest environment and silviculture: 16th IUFRO world congress; 1976 June 20-July 2; Oslo, Norway. As, Norway: IUFRO: 327-338.

Douglass, J.E.; Swank, W.T. 1976. Multiple use in southern Appalachian hardwoods - a 10-year case history. In: Stand establishment, treatment and amelioration: Proceedings, Division 1, Forest environment and silviculture: 16th IUFRO world congress; 1976 June 20-July 2; Oslo, Norway. As, Norway: IUFRO: 425-436.

Eiberle, K. 1976. Forest treatment and hunting. In: Stand establishment, treatment and amelioration: Proceedings, Division 1, Forest environment and silviculture: 16th IUFRO world congress; 1976 June 20-July 2; Oslo, Norway. As, Norway: IUFRO: 437-446.

Fakirov, V. 1976. Effect of growing space on mean height in Poplar plantations. *Gorskostopanska Nauka*. 13(4): 51-63.

Gives results of height measurements in spacing trials in plantations in Bulgaria of Populus 'Regenerata', P. 'I-214', and P. 'Vernirubens' at 14 years, at spacings of 3x3, 4x4, 6x6, and 8x8 m, and also on P. 'Regenerata' at 4, 10, 13, and 20 years at closer spacings, viz. 1.5x1.5, 2.0x2.0, 2.0x2.5, and 2.5x2.5 m. It is concluded that mean stand height cannot be used to characterize site conditions because of the differing patterns of height growth depending on initial density. After the start of differentiation of trees within the plantation, height should be measured only on trees of growth class I, and yield tables should be constructed on the basis of the height of such trees.

Fakirov, V. 1976. Effect tree spacing on the productivity of Populus euroamericana cultivars. *Gorskostopanska Nauka*. 13(1): 22-33.

Gascon, R.J., Jr.; Krinard, R.M. 1976. Biological response of plantation cottonwood to spacing, pruning, thinning. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 385-391.

Georgiev, T. 1976. Normalizing factors in the mechanical uprooting of poplar stumps. *Gorsko Stopanstvo*. 32(9): 19-21.

Ghosh, R.C.; Kaul, O.N. 1976. Effect of standard silvicultural systems on major uses and forest types in India. In: Stand establishment, treatment and amelioration: Proceedings, Division 1, Forest environment and silviculture: 16th IUFRO world congress; 1976 June 20-July 2; Oslo, Norway. As, Norway: IUFRO: 447-462.

Giannini, R.; Piussi, P. 1976. Coppice conversion in Italy. In: Stand establishment, treatment and amelioration: Proceedings, Division 1, Forest environment and silviculture: 16th IUFRO world congress; 1976 June 20-July 2; Oslo, Norway. As, Norway: IUFRO: 388-396.

Gilmore, A.R. 1976. The effects of planting methods on survival of cottonwood seedlings. *Tree Planters' Notes*. 27(1): 11, 20.

Gould, L.K. 1976. Cottonwood for windbreak and shelterbelt plantings. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 10-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 477-481.

Halath, J.; Mlaka, J. 1976. Production conditions and methods in preharvested stands of genetically improved poplars. *Lesn Stud Vysk Ustav Lesn Hospod*. 24: 91 p.

Halupa, L. 1976. Tending of pulpwood poplar stands. Parts II. *Erdogazdasag es Faipar*. 29(1): 6-8.

Pulpwood stands of poplars [Populus x canadensis] have been planted on nearly 45,000 ha in Hungary by government decree over the last 10 years. Yield and tending tables were drawn up for P. 'I-214' and P. 'Robusta' in terms of commonly used spacings. Experiments and practical experience have shown that a single tending operation removing 50 percent of the stems gives the best results in large-scale plantations: this should be done by a combination of geometric thinning (of diagonal rows) and selective thinning.

Heikurainen, L. 1976. Drainage as a means of forest amelioration. In: Stand establishment, treatment and amelioration: Proceedings, Division 1, Forest environment and silviculture: 16th IUFRO world congress; 1976 June 20-July 2; Oslo, Norway. As, Norway: IUFRO: 354-364.

Hessel, D.L. 1976. Applying research information to aspen management decisions--National Forests. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 102-104.

Hoffmann, E.; Jestaedt, M.; Weisgerber, H. 1976. The commercially available black poplar clones: descriptions, growth and resistance characteristics, and recommendations for cultivation. Merkblatt des Forschungsinstituts für Pappelwirtschaft, Hann. Münden. 7:

A summary of essential information, with illustrations of the clones in the nursery and at older stages, and of typical leaves.

Jager, K.; Peeters, J.P. 1976. The use of tree bark as mulch to prevent weed growth in young plantations. Nederlands Bosbouw Tijdschrift. 48(1): 12-14.

Mulching trials with conifer bark in roadside plantations of Populus canescens, and trials with conifer and poplar bark in mixed roadside plantations, in The Netherlands are described. The bark mulches were effective in the first year, but less so in the second year. During the two years of observation of the poplar trial, no significant growth responses to mulching with bark or plastic were observed. Mulching with bark is very expensive and for that reason is not recommended.

Johnson, R.L.; Burkhardt, E.C. 1976. Natural cottonwood stands--past management and implications for plantations. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 20-30.

Joyce, P.M.; Gardiner, J.J. 1976. New trends in the development of afforestation methods. In: Stand establishment, treatment and amelioration: Proceedings, Division 1, Forest environment and silviculture: 16th IUFRO world congress; 1976 June 20-July 2; Oslo, Norway. As, Norway: IUFRO: 365-375.

Kaszakurewicz, A.; White, G. 1976. Planting techniques and establishment of cottonwood plantations: a review. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 370-378.

Kennedy, H.E., Jr.; Henderson, W.H. 1976. Cultivation in cottonwood plantations-practices and equipment. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 379-384.

Kohan, S. 1976. The problem of thinnings in special-purpose poplar plantings. Les (Bratisl). 32(10): 440-445.

Kopecky, F. 1976. New poplar hybrids for cultivation in Hungary. Holzzucht. 30(2/4): 36-37.

Kostylev, A.S. 1976. Growing high-grade aspen from young natural stands. Lesnoe Khozyaistvo. 12: 58-60.

The problem of decay in Populus tremula and ways of growing stands with a high proportion of rot-free wood are discussed. The main sites of decay caused by Phellinus tremulae are the gaps between the stemwood and dead occluded branches. Thinning should remove forked and damaged trees and trees of growth-class III. Dead branches on the residual trees of growth classes I and II should be knocked off to a height of 4-5 m on the stem to accelerate occlusions. The first thinning and the occlusion should take place by age 20 years; the second and final thinning should be done 8-10 years after the first. On plots thinned and dry-pruned, only 4.7 percent of trees were infected by fungal decay, as against 36.9 percent on control plots.

Krinard, R.M. 1976. Growth and branching of young cottonwoods after pruning. Res. Note. SO-208. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 3 p.

Trials of three pruning treatments on Populus deltoides to heights of 9, 13, or 17 feet in either March-April or June-July, were begun during the third year after planting, at two sites in Mississippi and Arkansas. Pruning reduced diameter growth during the year of treatment, but 2 years after treatment diameter increment of most pruned trees did not differ significantly from that of unpruned controls. The incidence of epicormic branching was greater in spring-pruned trees and increased with pruning height. Control trees showed no tendency toward natural pruning. It is recommended that pruning be done in summer, and that no more than one-third of the total height, measured during the dormant season, should be pruned.

Krinard, R.M. 1976. Need early cottonwood pruning to produce high-quality logs. Res. Accompl. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station: 3.

Lesko, G.L.; Soos, J. 1976. Growth response of Wheeler poplar to maintenance techniques in southern Saskatchewan. Inf. Rep. NOR-X-159. Alberta, Canada: Canadian Forest Service, Northern Forest Research Centre. 13 p.

Studies were made between 1968 and 1973 of 5 post-planting maintenance treatments in plantations of Populus X balsamifera cv. Wheeler: (a) paraquat application; (b) shallow cultivation (to 2.5 cm); (c) deep cultivation (to 13-15 cm); (d) high mowing (to 13-15 cm above ground); and (e) cultivation in the first year and subsequent low mowing (to 2.5 cm). The highest mortality resulted from (d), other treatments showed 100 percent survival. Treatment (b) gave greatest height and diameter increments, and good results were obtained from (a), (c), and (e). Treatment (d) was most effective in storing winter moisture.

Loring, T.J. 1976. Applying research information to aspen management decisions--state and private lands. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 111-112.

Lust, N. 1976. The role of forestry in industrialized countries. In: Stand establishment, treatment and amelioration: Proceedings, Division 1, Forest

environment and silviculture: 16th IUFRO world congress; 1976 June 20-July 2; Oslo, Norway. As, Norway: IUFRO: 339-353.

Magnani, G. 1976. Chemical weed control in poplar, eucalypt and conifer nurseries. *Notiziario sulle Malattie delle Piante*. 94-95: 225-230.

Arbonet (phenobenzuron 25 percent plus aminotriazole 50 percent) at 7 kg/ha (applied soon after planting out and before bud break) controlled weeds throughout the growing season in a newly established poplar (*Populus* spp.) nursery on heavy soil. In untreated areas 2 to 3 hand weedings were needed to achieve comparable control. In a 2-year-old nursery, one application of gramoxone (paraquat) controlled competing vegetation throughout the growing season. In a nursery of *Eucalyptus* spp. and conifers, Tok E 25 (nitrofen) at 22 kg/ha applied after irrigation, gave lasting weed control. Herbicide treatments were substantially cheaper than hand weeding.

McKnight, J.S. 1976. Cottonwoods and their future in forestry. In: Thielges, B.A.; Land, S.B., Jr., eds. *Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 482-485.*

Mikhailov, L.E. 1976. Deciduous soft wood growing and utilization - *Populus tremula*, *Betula pendula*, *B. pubescens*, *Alnus glutinosa*, and *A. incana* in the USSR. In: *Stand establishment, treatment and amelioration: Proceedings, Division 1, Forest environment and silviculture: 16th IUFRO world congress; 1976 June 20-July 2; Oslo, Norway. As, Norway: IUFRO: 397-405.*

Randall, W.K.; Kennedy, H.E. 1976. Survival and growth of cottonwood clones after angle planting and base angle treatments. Res. Note S0-220. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 3 p.

Cuttings from 6 Stoneville clones of *Populus deltoides* were planted either vertically or at an angle of 45deg to the soil surface in Mississippi in February 1976. Cuttings planted at 45deg grew roots mainly from the bottom and lower sides. Planting and/or cutting at an angle had generally little effect on 1st-year survival or height increment, but one clone ('Stoneville 124', high-yielding but difficult to root) survived better when cut at 45deg. These planting techniques might be useful for difficult-to-root clones and conditions necessitating deeper roots.

Revell, D.; Deadman, H. 1976. Planted hardwoods and weed competition. In: *Proceedings of the F.R.I. symposium 18: The use of herbicides in forestry in New Zealand; 1975. Rotorua, New Zealand: New Zealand Forest Research Institute: 133-137.*

In trials at Esk forest, the effect of herbicide treatments on the growth of poplar (*Populus* spp.) and eucalypt seedlings was compared with that of applications of fertilizer. The herbicide treatment consisted of paraquat + simazine at 0.83 mlitres + 0.66 g in 200 mlitres of water/poplar seedling applied to a 1-metre radius round the tree, and at 5.5 litres + 4 kg/ha sprayed overall before planting *Eucalyptus regnans* and *E. nitens*. In both crop species best growth increments followed the application of both herbicides and fertilizer; increments were significantly greater from

herbicides alone than from fertilizer alone, particularly in the case of poplars.

Riedacker, A. 1976. How to modify root morphogenesis of some young seedlings and its practical importance. In: Stand establishment, treatment and amelioration: Proceedings, Division 1, Forest environment and silviculture: 16th IUFRO world congress; 1976 June 20-July 2; Oslo, Norway. As, Norway: IUFRO: 376-387.

Robitaille, L.; Roberge, M. 1976. Silvicultural research on broadleaved trees in Quebec. Memoire, Service de la Recherche, Ministere des Terres et Forets, Quebec. 26: 95 p.

Details are given of the aims, results, and publications of 34 research projects, mainly on harvesting systems and fertilizer application; 19 are concerned with northern broadleaves, particularly Betula alleghaniensis and Acer saccharum and 15 with poplars (Populus spp.). The results are reviewed and recommendations are made for future research.

Sachsse, H. 1976. Analysis of branching in a 40-year-old stem of the Populus trichocarpa clone 'Senior'. Mitteilungen, Verein fur Forstliche Standortkunde und Forstpflanzenzuchtung. 25: 39-45.

P. trichocarpa clones, especially 'Senior', have a tendency to epicormic branching which reduces the value of the wood. The internal branching pattern of the stem was examined by sawing through-and-through and by veneer peeling of selected bolts. Results are described including a stem-analysis diagram showing the branching pattern at different heights up to the crown base: branches of diameter greater than 10 mm were seldom found in the shaded, lower stem section, but epicormic and thin branches had been formed in this region. The value of the wood was reduced by a high proportion of unsound (black) knots. It is concluded that silvicultural systems alone cannot prevent epicormic branch formation in P. trichocarpa clones.

Sandberg, L. 1976. Reflections on implementation. Iowa State Journal of Research. 50(3): 293-294.

Schreiner, E.J. 1976. Importance of the poplar in the United States of America within the scope of the increasingly required cultivation in short rotations. Holzzucht. 30(2/4): 18.

Sekawin, M. 1976. Cultivation of poplars for threshold yield sites in Italy. Holzzucht. 30(2/4): 34-36.

Shevkenov, G. 1976. Creation of poplar plantations of valuable varieties in the Yambol forest district. Gorsko Stopanstvo. 32(10): 29-31.

Steneker, G.A. 1976. Guide to the silvicultural management of trembling aspen in the prairie provinces. Inf. Rep. NOR-X-164. Alberta, Canada: Canadian Forest Service, Northern Forest Research Centre. 6 p.

The silvicultural characteristics of Populus tremuloides are outlined and management recommendations are made for harvesting, regeneration, and tending.

Tikhonov, A.S. 1976. D. M. Kravchinskii's thinnings. *Lesnoe Khozyaistvo*. 2: 41-45.

Describes the thinnings carried out by D. M. Kravchinskii from 1897 to 1914 on an area of 1,329 ha in the Leningrad region. The thinnings were in 2-storied hardwood/spruce stands 40-70 years old, in which birch or aspen predominated. The aim was to favor spruce, and the first thinning removed mainly the aspen and the large birch in the immediate vicinity of second-story spruce. Details are given of the spruce stands that formed after these Kravchinskii thinnings, including data on increment and comparisons with yield-table data. The silvicultural effectiveness of these thinnings is assessed, and recommendations are made for the execution of thinnings in similar mixed hardwood/spruce stands.

Tustin, J.R. 1976. Agro-forestry: a multiple land-use production system in New Zealand. In: Stand establishment, treatment and amelioration: Proceedings, Division 1, Forest environment and silviculture: 16th IUFRO world congress; 1976 June 20-July 2; Oslo, Norway. As, Norway: IUFRO: 406-424.

U.S. Department of Agriculture, Forest Service. 1976. Hansen, E.A., ed. Intensive plantation culture: five years research. Gen. Tech. Rep. NC-21. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 117 p.

Van der Meiden, H.A., ed. Handbook of poplar growing. Ed. 4. Arnhem, The Netherlands: Koninklijke Nederlandsche Heide Maatschappij. 304 p.

The new edition has 13 chapters by 9 Dutch specialists on: the genus Populus; quality control of planting stock; growing of planting stock; uses and planting of poplar; increment and yield; financial results; fungal, bacterial, and virus diseases; insect pests; non-parasitic injuries; wood properties; market for wood; uses of wood; and general information.

Van der Poel, A.J. 1976. Forestry and landscape planning. In: Stand establishment, treatment and amelioration: Proceedings, Division 1, Forest environment and silviculture: 16th IUFRO world congress; 1976 June 20-July 2; Oslo, Norway. As, Norway: IUFRO: 463-466.

Vekshegonov, V.Ya. 1976. Shelterbelts on the virgin lands. *Lesnoe Khozyaistvo*. 8: 31-36.

Reviews the development of grain production in the 'virgin lands' developments in Northern Kazakhstan, and discusses the importance of shelterbelts in increasing the yields of grain in this region. The main species used in the shelterbelts are Populus balsamifera and Ulmus pumila var. arborea. Grain yields are better with poplar belts than with elm belts. The optimum distance between belts of poplar is 250 m. Economics are discussed with examples of typical data.

Vidali, E. 1976. Possibilities in the use of marginal land for Poplar planting. *Cellulosa e Carta*. 27(4): 27-29.

Briefly reports the establishment of large-scale trials by the Ente Nazionale per la Cellulosa e per la Carta (ENCC) to determine the economic feasibility of raising poplar plantations on marginal soils in Italy.

Describes the special equipment developed for digging deep holes in such soils. The wood produced, though of low quality, should be suitable for paper pulp.

Von Althen, F.W. 1976. Effects of site preparation and post-planting weed control on the survival and height growth of planted hardwood seedlings. Rep. O-X-248. Sault Ste. Marie, Ontario: Canadian Forest Service, Great Lakes Forest Research Centre. 15 p.

Describes three studies in Ontario to determine the effects of chemical site preparation on individual planting spots, and chemical and mechanical (ploughing, discing, and rototilling, alone or in combination) site preparation in strips, on the survival and height growth of planted hardwood seedlings. Results showed that the survival and height growth of seedlings of Juglans nigra, Fraxinus americana, Tilia americana, and Populus deltoides were significantly improved by site preparation and weed control, but Acer saccharum was not. The applications of herbicides to individual planting spots were the least successful site preparation treatments. Recommendations are given.

Weisgerber, H. 1976. Poplar culture in short rotation, a possibility for increasing wood production. Mitt Schweiz Pappel Arbeitsgem. 27: 9-12.

Werner, H. 1976. Results of 20-year-old trials of Poplar varieties. Mitteilungen, Verein für Forstliche Standortskunde und Forstpflanzenzucht. 25: 8-25.

A report on poplar trials in the Neckar Valley and Schwabische Alb regions of southern Germany, covering three sections of the genus Populus. Results are discussed according to site and soil type. The important varieties from different areas were compared.

White, L.C. 1976. Selection of rotation age and silvicultural regime for longrotation cottonwood. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 402-404.

Zabielski, S. 1976. Poplar cultivation in Poland, the land of the common pine. Holzzucht. 30(2/4): 28-29.

1977

1977. Mixed forestation with poplar and Sophora trees in sandy areas in China. Chung-Kuo Lin Yeh K'o Hsueh. 4: 15-19.

Antonov, E.V. 1977. Effect of shelterbelts on the deposition of snow. Lesnoe Khozyaistvo. 2: 57-59.

An account of studies on the effect of shelterbelts on snow deposits on a large state farm in the Kokchetav region of Kazakhstan (northern steppe zone, annual precipitation approximately 300 mm). The belts are mostly pure, consisting of either Populus balsamifera or Betula verrucosa (B. pendula).

The results indicate that for optimum accumulation and distribution of snow in these conditions, it is best to have 1- or 2-row belts with high wind-permeability, spaced not more than 20 H apart (H being belt height).

Bloomfield, H. 1977. Trees in a hurry. *American Forester*. 83(1): 42-44.

Clayton, N.; Richardson, J. 1977. Hardwood cuttings - field production. In: *International Plant Propagators' Society: combined proceedings*. International Plant Propagators' Society. 27: 64-67.

Production of planting stock from cuttings of Salix, Populus, Sambucus, and other shrubs is discussed.

Cronin, E.H.; Bowns, J.E.; Johnson, A.E. 1977. Herbicides, nitrogen and control of tall larkspur under aspen trees. *Journal of Range Management*. 30(6): 420-422.

Tall larkspur (Delphinium barbeyi) dominates the herbaceous vegetation under quaking aspen (Populus tremuloides) on large areas of mountain summer range in southern Utah. The D. barbeyi plants are more susceptible to single applications of 2,4,5-T at 4 and 8 lb/ac and fenoprop at 8 lb/ac than is reported for the same species growing in the open sub-alpine meadows of central Utah. These herbicide treatments provide a means of manipulating the vegetation for grazing by cattle or cattle and sheep. Nitrogen fertilizer, applied in addition to the herbicides, did not enhance D. barbeyi control or stimulate forage production. High rates of N applied to otherwise untreated plots, did not control tall larkspur and increased forage production only in the first year after application.

Crowther, R.E. 1977. Short-rotation coppice - time for a revival? *Forestry and British Timber*. 6(4): 42-43.

Hardwood 'silage' rotations of 1-5 years at close spacing regenerated by coppice have been reported from Canada and USA. Results of work at Ontario on varieties (clones) of hybrid poplar [Populus X canadensis] are compared with data for poplar clones at Alice Holt Forest, UK. Fast growth leads to early exclusion of weeds, and the total wood production is utilized. Large volumes of wood chips could be produced by growing such selected clones on short rotations. Harvesting, growing costs, land availability, alternative species and marketing prospects are discussed.

Curic, R. 1977. Contribution to the problem of cultivation and increment of poplars in hedgerows in the territory of Bosnia and Herzegovina. *Topola*. 21(113/114): 3-6.

Dadykin, V.P.; Samsonova, L.P. 1977. Effect of film antitranspirants on woody plants. *Soviet Plant Physiology*. 24(3): 464-470.

By employing a film antitranspirant based on butadiene acrylate latex on seedlings and saplings of weeping birch Betula (Betula pendula), small-leaved lime (Tilia cordata), Norway maple (Acer platanoides), and Lombardy poplar (Populus pyramidalis), the period of spring planting could be increased by 2 weeks. The creation of a film of the antitranspirant on the leaves lowers the rate of transpiration by 30-70 percent for a period of 8-12 days; photosynthesis is simultaneously depressed by 30-50 percent for approximately

the same length of time, after which it recovers to attain the control level. Temporary inhibition of photosynthesis affects growth of the plants during the first year. The antitranspirant promotes faster root system growth in transplanted plants.

Davenport, D.C.; Hagan, R.M. 1977. Reducing phreatophyte transpiration. Hydrologic Water Resources of Arizona Southwest. 7: 141-146.

Dickmann, D.; Heiligmann, R.; Gottschalk, K. 1977. Herbicides aid establishment of unrooted poplar cuttings. Tree Planters' Notes. 28(3/4): 10-13.

Linuron, pronamide, or simazine were applied at 2-4 lb/ac to (a) an untilled site which was planted with cuttings of Populus cv. maximowiczii X P. trichocarpa NE 41 after 3 weeks and (b) a tilled site which was planted with P. X euramericana cv. Wisconsin-5, P. deltoides X P. cv. caudina NE 353 and P. deltoides. Simazine gave good weed control. Seedling height (but not survival) was directly related to the degree of weed control. Survival and height growth were greater in (b) than (a): this was partly attributed to poor condition of the planting stock in (a).

Erdo, L. 1977. Experiences and developments in growing pulp-poplar on the state farms. Erdo. 26(9): 402-407.

Esau, R.; Morgan, G.A. 1977. Chemical weed control for rooting of poplar and willow cuttings. Tree Planters' Notes. 28(2): 20-21.

Shoot cuttings of Populus X deltoides 'Northwest' and Salix acutifolia 'Acute' were either set in soil treated with trifluralin or were sprayed with chloroxuron or linuron after setting. Trifluralin did not always give satisfactory weed control and had some phytotoxic effects. Chloroxuron and linuron gave good weed control with no phytotoxic effects. Application of chloroxuron or linuron is recommended.

Faber, P.J. 1977. A growing-space study with Populus 'Dorskamp' in East Flevoland. Populier. 14(2): 31-38.

An experiment was established in 1968, with 1-year rooted cuttings at various spacings from 4x4 to 8x8 m. An assessment was made at age 9, at this time only the earliest of the planned thinnings had been made on the densest plots. The effect of spacing on height growth was small but height/diameter ratios varied from 77 to 59 from the closest to the widest spacing. There were indications that vitality falls off when height is about 3 times spacing.

Fakirov, B.; Iovov, D. 1977. Poplar planting I-262 in the Pazardzhik area. Gorsko Stopanstvo. 33(9): 6-9.

Fakirov, V. 1977. Correlation between canopy density and the root system in very dense plantings of Populus eur. cv. regenerata. Gorskostop Nauka. 14(2): 21-29.

Gacic, Z. 1977. Production trial with poplar plantation in the foreland flood plain of Danube "Pancevacki Rit", Belgrade. Topola 21(113/114): 27-33.

Glinski, R.L. 1975. Regeneration and distribution of sycamore and cottonwood trees along Sonoita Creek, Santa Cruz County, Arizona. Gen. Tech. Rep. RM-43. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 116-123.

Grujic, D. 1977. Planting of poplars in rows. *Gozdar Vestn.* 35(7/8): 318-322.

Hladnik, M. 1977. Poplar plantations--additional forest production. *Gozdar Vestn.* 35(1): 15-18.

Howlett, K.; Gamache, A. 1977. Silvicultural biomass farms, volume II: the biomass potential of short-rotation farms. In: Inman, R.E., ed. *Silvicultural biomass farms, volume 1: summary.* Mitre Tech. Rep. 7347. Springfield, VA: U.S. Department of Commerce, National Technical Information Service. 136 p.

Species selected for silvicultural biomass farms should show rapid juvenile growth, adaptability to site conditions, ease of establishment and regeneration, and freedom from major pests and diseases. Species which meet these criteria include Alnus rubra, Eucalyptus spp., Liquidambar styraciflua, Liriodendron tulipifera, Pinus taeda, Platanus occidentalis, and Populus spp. It is estimated that genetically improved strains and better management techniques could increase annual production.

Ivanyuta, V.M. 1977. The problem of concentrated conversion of secondary forests of industrial importance. *Lesnoi Zhurnal.* 3: 141-143.

The author discusses in general terms the problem of the utilization of the large areas of secondary (derived) forests of birch (Betula alba) and aspen (Populus tremula) that have developed following the clear-felling of primary conifer forests in the European part of the USSR. It is argued that the best method of tackling the problem is by large-scale clear-felling of young, middle-aged and mature broadleaved stands with preservation of any coniferous advance growth and immediate mechanized planting with large conifer planting stock.

James, T.D.W.; Smith, D.W. 1977. Short-term effects of surface fire on the biomass and nutrient standing crop of Populus tremuloides in southern Ontario. *Canadian Journal of Forest Research.* 7(4): 666-679.

Jaro, Z. 1977. Planting poplars on marginal sites. *Erdo.* 26(5): 198-205.

Jestaedt, M. 1977. Planting trials with balsam poplars. *Allgemeine Forst- und Jagdzeitung.* 148(2): 37-43.

Trials were made on 22 sites, most of them not ideal for poplars, in N. and W. Germany, of 49 clones of balsam poplars (including Populus trichocarpa, P. simonii, and P. 'candicans'). On most sites they were compared with clones of black poplars, P. deltoides and/or P. canescens. On 20 sites balsam poplar clones were best, on one coastal marsh P. canescens was best, and on a very good flood plain site black poplars were best.

Kalchev, P. 1977. Soil tillage for poplar planting. *Gorsko Stopanstvo.* 33(11): 18-21.

Kargov, V.A. 1977. Narrow-crowned forms of poplar in field shelterbelts. Lesnoe Khozyaistvo. 9: 67-78.

The need is discussed for fast-growing narrow-crowned species for 2- and 3-row shelterbelts in conditions of irrigated agriculture in the USSR. The crown parameters of a number of hybrid poplars are tabulated, viz. Populus 'Michurinets', P. 'Maxim Gorkii', P. alba x P. bolleana, P. nigra var. italica x 'Canadian poplar', and P. nigra var. italica x P. berolinensis. Of these, the last two hybrids have the most pronounced character of narrow crowns. The crown density in summer and in winter is greatest in P. nigra var. italica x 'Canadian poplar', and lowest in P. 'Michurinets' and P. 'Maxim Gorkii'. On the basis of these findings, optimum plant spacings and distances between the rows are proposed for the various hybrids.

Kluender, R.A. 1977. 'Double O' site-prep/shredder. Tech. Rel. 77-R-33. Washington, DC: American Pulpwood Association. 3 p.

This prototype tractor-mounted, drum-type shredder/mulcher, for breaking down logging slash and brush in site preparation, is able to shred stumps up to 20 inches in diameter and standing trees up to 8 inches in diameter. The machine, which was designed to reduce stumps in cottonwood (Populus deltoides) plantations in the Mississippi delta, and can also cut below soil level to prevent sprouting, was developed and tested by Crown Zellerbach Corp., Bogalusa, Louisiana, and costs \$175,000.

Klyuchnikov, L. Yu. 1977. The degree of thinning of broadleaved species with arboricides. Lesnoi Zhurnal. 5: 24-37.

Investigations were made on the effect of various doses of 2,4-D applied in three different forms, viz. aqueous solution of amine salt, aqueous emulsion of butyl ester, and oily solution of butyl ester, on aspen (Populus tremula), willow (Salix spp.), birch (Betula alba), and alder (Alnus incana). The degree of crown thinning (in percent) was found to be a quadratic function of arboricide dose (in kg/ha). The results indicate that the best treatments for use in young broadleaved/conifer stands in order to release the conifers are doses ensuring 60-70 percent thinning of the broadleaved crowns.

Kolarov, D.; Kalchev, P. 1977. The importance of coppice regeneration in poplar plantations. Gorsko Stopanstvo. 33(12): 12-15.

A plantation of Populus 'I-214' near the Danube in Bulgaria was established in 1966 at a spacing of 6x5 m, but because of prolonged inundation in 1970 it had to be felled. Observations are reported on the growth of the coppice for 6 years, for two variants: (1) with one coppice shoot per stool and (2) with two coppice shoots per stool. Variant (2) was clearly superior, with a standing volume at 6 years of 162.6 m³/ha, as against 84.6 m³/ha for (1).

Korol'kov, V.N. 1977. Progress in practices of poplar growing in nurseries. Lesnoe Khozyaistvo. 3: 76-77.

Lazarevic, M. 1977. Poplar plantations in Belgrade. Topola. 21(113/114): 33-38.

Long, C.; Geyer, W. 1977. Weed control and growth response of selected species in short rotation tree crops for rapid fibre production. In: Proceedings, North Central weed control conference. Weed Abstracts. 28: 1883.

Weed competition during the establishment of cottonwood (Populus spp.) and silver maple (Acer saccharinum) had a significant effect on fiber production. Alachlor at 3 and 5 lb/ac, dichlobenil 8 and 12 lb, oryzalin 3 and 6 lb and oxadiazon 3 and 5 lb applied for weed control immediately after planting were tolerated.

Markovic, J. 1977. State and possibilities of development of forest of soft broadleaved species--poplars and willows in Voivodina. Topola. 21(115/116): 35-44.

Mayer, H. 1977. Silviculture on a sociological-ecological basis. Stuttgart, German Federal Republic: Gustav Fischer Verlag. 483 p.

A comprehensive textbook which comprises the following sections: (A) Survey of the silvicultural situation, (B) Silvicultural assessment of central European tree species, (C) Tending of forests, (D) Forest regeneration, (E) Special silvicultural systems, and (F) The silvicultural outlook.

McCavish, W.J. 1977. The crop tolerance of other broadleaved and conifer species, plus poplar stool beds and cuttings to propyzamide. Res. Inf. Note 23. Farnham, UK: Forestry Commission. 1 p.

Eight species of broadleaves, 8 conifers, and 15 poplars (Populus spp. and hybrids) showed good crop tolerance to propyzamide applied as a 50 percent (w/w) wettable powder at a rate (1.5 kg/ha a.i. or 3 kg/ha product) found to give all-year-round control of grasses in the nursery in southern Britain.

Mohrdiek, O. 1977. Hybrid aspen for marginal forest sites. Forstarchiv. 48(8): 158-163.

The results of progeny tests, initiated in 1953-1967, of 194 Leuce Populus hybrids and clones in W. Germany. Hybrid aspens (P. tremula x P. tremuloides) showed good growth performance, survival, stem quality, and disease resistance. The species P. tremula and P. grandidentata and hybrid P. alba x P. grandidentata were also suitable for cultivation in Germany. Several of the clones and hybrids gave good growth performance on poor soils (podzols, gleys, and waterlogged soils). It is suggested that poplars in general may become increasingly important for timber growing in Germany.

Mueggler, W.F.; Bartos, D.L. 1977. Grindstone Flat and Big Flat exclosures - a 41-year record of changes in clearcut aspen communities. Res. Pap. INT-195. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 17 p.

In trials on Beaver Mountain in S. Utah, a series of exclosures was constructed in 1934 and 75 percent of each exclosure was clearcut of aspen (Populus tremuloides). Aspen reproduction, shrubs, and herbaceous understory were measured in 1937, 1942, 1949, and 1975. Deer browsing prevented aspen regeneration in both uncut stands and small 0.05-ha clearcuts, even though nearby large burned areas regenerated successfully. The size of the clearcut or burned area could be critical. Shrub production was less under deer use and forb production less under cattle use than on protected areas. More aspen

suckers were produced in uncut stands where cattle grazed than in stands protected from grazing. Removal of aspen cover changed the herbaceous composition from forb-dominant to grass-dominant and discouraged conifer invasion.

Perala, D.A. 1977. Manager's handbook for aspen in the North Central States. Gen. Tech. Rep. NC-36. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 30 p.

One of a series of silvicultural manuals noticed elsewhere in FA, dealing with aspen (Populus tremuloides and P. grandidentata). Includes sections on conversion to conifers and landscape management.

Plavsic, S. 1977. Plantations for pulpwood production. Topola. 21(113/114): 20-26.

Poluboiarinov, O.I.; Nekrasova, G.N. 1977. Effect of green pruning on the increment, structure and certain properties of aspen wood. Izv Vyssh Uchebn Zaved Lesnoi Zhurnal. 3: 13-17.

Poissonnier, M. 1977. Herbicides applied to poplar cuttings. Paris, France: AFOCEL: 350-377.

Eight herbicides were tested on cuttings of 4 clones of poplar planted in plots 3x3 m. 'Etazine' (Secbumeton + Simazine), 'Chandor' (trifluraline + linuron), 'Primextra' (metetilachlor + atrazine) and 'Caragarde' (terbuthylazine + terbumeton) were highly effective in eliminating weeds; Kloben C (neburon) Bladex (cyanazine), 'Weedazol' (aminotriazole + ammonium thiocyanate), and 'L50' (linuron) were not. Caragarde was the most persistent. Best results were obtained when herbicide was applied before the cuttings were set out. Damage to poplars was negligible.

Poluboyarinov, O.I.; Nekrasova, G.N. 1977. Effect of pruning aspen on increment, structure, and wood properties. Lesnoi Zhurnal. 3: 13-17.

In 1968, on a plot in an aspen (Populus tremula) stand aged 21 years, 22 trees were dry-pruned (removing dead branches only), 20 were lightly pruned (removing 29 percent of the live crown), and 15 were heavily pruned (removing 42 percent of the live crown). The results indicate that heavy pruning reduces the height and diameter increment of the trees, increases the wood density and fiber length in the pruned zone, and considerably intensifies the process of heartwood formation.

Pryor, L.D. 1977. Silvicultural role and development of cottonwood in Australia. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 134-139.

Information is presented on clones of Populus deltoides in Australia, an interspecific-hybridization technique involving the treatment of the stigma with N-hexane, the production of hybrids involving the semievergreen clone P. nigra 'Persistente' [Persistent] and the selection of P. deltoides clones and Populus hybrids with resistance to Melampsora medusae and M. larici-populina.

Robredo, F. 1977. Poplars silvicultural technology and phytosanitary state. *Agricultura (Madr)*. 46(542): 449-453.

Roksandic, P. 1977. Establishment of poplar and willow plantations in the area of the Osijek forest reserve. *Topola*. 21(115/116): 31-34.

Shetron, S.G.; Carroll, D.A. 1977. Performance of trees and shrubs on metallic mine mill wastes. *Journal of Soil and Water Conservation*. 32(5): 222-225.

Seedlings of more than 30 tree and shrub species were planted in 1970 on stripping dumps, dikes and tailings basins formed by mining operations for Fe and Cu ores in Michigan. Mortality was greatest 2-5 years after planting, and greater on Cu wastes and Fe wastes. Hybrid poplars (Populus spp.), European black alder (Alnus glutinosa) and willows (Salix spp.) showed the best survival and growth 5 years after planting.

Shopov, G. 1977. The problem of poplar plantings in forestry. *Gorsko Stopanstvo*. 33(3): 19-23.

Tubbs, C.H. 1977. Manager's handbook for northern hardwoods in the North Central States. Gen. Tech. Rep. NC-39. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 29 p.

One of the series of silvicultural manuals dealing with northern hardwoods. Major forest types are described and recommendations, techniques, and data, are given for all-aged and even-aged silviculture. Instructions are given for marking of all trees.

Viart, M. 1977. Importance of Populus deltoides to poplar silviculture in France. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 38-43.

The history of introductions of the species into France from before the 18th century until the present day is outlined.

Zasada, J.C.; Densmore, R.A. 1977. Changes in seed viability during storage for selected Alaskan Salicaceae. *Seed Science Technology*. 5(3): 509-518.

1978

1978. Characteristics, nursery practice and planting techniques of Populus euphratica. *Chung-Kuo Lin Yeh K'o Hsueh*. 2: 9-14.

1978. Conversion of osier beds to poplar stands. *Populier*. 15(4): 89-90.

A brief report by a working group on the problems involved. It is easier to convert osier beds (Salix spp.) still in exploitation than abandoned beds. Complete mechanical clearing of stools and burying them under at least 75 cm of soil is estimated to cost about 1,000 fl/ha where osiers have been cut. The merits of small or large plants and setts for different conditions are compared. Control of osier regrowth, weeding, fertilizing, and control of damage by insects and mammals is also briefly covered.

1978. Populus cultivation in brief. Populier. 15(3): 51-54.

Archibold, O.W.; Wilson, M.R. 1978. Spatial pattern and population-dynamics of Populus tremuloides in a Saskatchewan aspen grove. Canadian Field Naturalist. 92(4): 369-374.

Armson, K.A.; Smith, J.H.G. 1978. Case study no. 5: Management of hybrid poplar. Inf. Rep. FMR-X-113. Ottawa, Canada: Forest Management Institute: 5-1--5-27.

Barring, U. 1978. Results of trials in forestry. In: Weeds and weed control: 19th Swedish weed conference; 1978; Uppsala, SE. Uppsala, SE: Sveriges Lantbruksuniversitet: J1-J10.

In continuing trials, the effectiveness of triclopyr in controlling Quercus robur and Populus tremula was confirmed. Selective treatments in conifer plantations can be made in August when Pinus and Picea spp. are resistant to the herbicide; resistance of Pinus contorta appeared to be linked with provenance. The good performance of glyphosate at 1.5 kg/ha under Swedish conditions was confirmed. Results with Krenite [fosamine] at 6 kg a.i./ha or Krenite at 6 kg a.i./ha + Lissapol, a wetter, were very good, particularly against Betula spp.; B. verrucosa [B. pendula] appeared more susceptible than B. pubescens.

Berry, A.B.; Stiell, W.M. 1978. Effect of rotation length on productivity of aspen sucker stands. Forestry Chronicle. 54(5): 265-267.

Bespalova, A.E. 1978. Regeneration of tree and shrub species in protective stands in the semi-desert. Lesnoe Khozyaistvo. 9: 51-54.

The natural regeneration was studied in a stand of Ulmus pumila var. arborea and in mixed plantings of Acer negundo and Fraxinus pennsylvanica in the Kalmyk ASSR. Regeneration was better on meadow-chestnut soils than on light-chestnut soils. It is concluded that A. negundo and F. pennsylvanica produce viable natural regeneration and advance growth, which can often be used as planting stock. For planting of gully and ravine sites, the best species are those which form suckers and layers, and also regenerate well by seed, viz. A. negundo, Robinia pseudoacacia, Populus alba, Elaeagnus angustifolia, and Ribes aureum.

Bonnemann, A. 1978. Studies of the performance and properties of some poplar varieties in short rotation. Holzucht. 32(1/2): 4-10.

Dawson, D.; Zavitkovski, J.; Isebrands, J.G.; Schuster, W.W., eds. 1978. Managing forests for maximum biomass production. In: Proceedings, 2d annual symposium on fuels from biomass; 1978 June 20-22; Troy, NY: 151-167.

The Short-Rotation Intensive Culture System (SRIC) is examined with relation to its potential to increase yields and uses of forest products through more intensive forest management practices. Following a description and a discussion of the advantages of the SRIC system, a summary of test results of a Populus hybrid and jack pine were presented. These studies report yields several times higher than the highest reported yields from natural stands or conventional plantations.

del Prato, O.S. 1978. The poplar. Modern silvicultural techniques. Bologna, Italy: Edagricole. 82 p. Review in Montanaro d'Italia-Montie Boschi. 28(4): 26.

A practical, illustrated handbook for farmers, covering all aspects of poplar growing in Italy.

DenHeyer, J.; Seymour, N. 1978. Aspen and balsam poplar seed collection and storage. Tree Planters' Notes. 29(2): 35.

Dubois, J.M. 1978. Experiments on hornbeam coppice in northeastern France. Paris, France: AFOCEL: 338-405.

A continuation of earlier work reporting effects of thinning and fertilization on 6 coppice stands aged 7-25 years, predominantly of Carpinus betulus. Thinning was by bulldozing or manually clearing 3-m wide bands at various spacings. N or NP fertilization had no effect. It appeared that competition favored stems of marketable size in the thinned plots; controls had a higher proportion of thin stems. The basal area in the thinned plots never caught up with the unthinned plots except where there was a high proportion of birch (Betula alba) or aspen (Populus tremula). The increased value of the stand, and the reduction of the rotation from 35 to 30 years, are profitable using an interest rate of 3 percent, but in general the productivity of these 'hard' species of coppice never justifies large investments.

Einspahr, D.W.; Wyckoff, G. 1978. Growth response of hybrid aspen to intensive forest management. TAPPI. 61(3): 49-52.

The responses were studied of 2 quaking aspen (Populus tremuloides) sucker stands and 2 hybrid aspen (P. alba x grandidentata and P. tremuloides x P. tremula) plantings in northern Wisconsin to fertilization (F) and irrigation (I). Annual increment of young native aspen sucker stands on upland sandy soils can be expected to be increased by 30-35 percent by F, 50-85 percent by I, and 100-150 percent by F+I.

Faber, P.J. 1978. When should narrowly spaced poplar plantations be thinned? Populier. 15(3): 55-60.

Helgerson, O.T.; Gordon, J.C. 1978. Coal-spoil performance of Arnot bristly locust and Crandon hybrid poplar. Iowa State Journal of Research. 52(3): 299-305.

Survival and growth data are tabulated for Robinia fertilis cv. 'Arnot' and Populus alba x grandidentata cv. 'Crandon' after one growing season on severe coal-spoil sites differing in slope, aspect, and pH. Differences are discussed in relation to ability for root growth. Locust survival and root growth were poorer on the more acid spoil.

Holt, D.H.; Murphey, W.K. 1978. Properties of hybrid poplar juvenile wood affected by silvicultural treatments. Wood Science. 10(4): 198-203.

Density, extractives, holocellulose, alpha-cellulose, ash, fiber length and diameter, ray volume, and diameter u.b. were determined for trees of Populus maximowiczii x trichocarpa planted at spacings of 0.12-0.61 m. Diameter u.b. increased with increased distance between trees, but spacing had

no significant effect on the other properties measured. Fiber length increased with increasing age from 2 to 4 years.

Houston, D.W.; Krinard, R.M. 1978. Evaluation of herbicides for cottonwood culture. Proceedings of the Southern Weed Science Society. 31: 196.

Johnson, R.L. 1978. Hardwood culture in the eastern United States. Gen. Tech. Rep. PNW-70. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station: 55-59.

Kalinin, K.K.; Demakov, Yu.P.; Ivanov, A.V. 1978. Natural regeneration of forest on burns. Lesnoe Khozyaistvo. 4: 36-40.

In 1972, forest fires in the Mari ASSR coincided with a good seed year for pine (Pinus sylvestris), the fires being most numerous in late August, when the seeds were ripe in the cones. Data are tabulated on the amounts of pine, birch (Betula alba) and aspen (Populus tremula) regeneration on the various sites. It is concluded that regeneration was adequate in the P. sphagnosum after any type of fire, and in the P. myrtillosum, P. polytrichosum and some of the P. vacciniosum types after ground fires of moderate intensity. The problem of invasion of burns by broadleaved species is emphasized.

Kas'yanov, F.M.; Filippov, M.F.; Zevin, G.N. 1978. Establishing farm shelterbelts in the Kulunda steppe. Lesnoe Khozyaistvo. 6: 40-42.

An account is given of investigations on the effect of three shelterbelts established in 1969-1970 in the Kulunda steppe (Altai region). The belts were made of Populus balsamifera, Betula verrucosa (B. pendula), and Ulmus pumila var. arborea.

Kate-Hzaevoet, A.M. ten. 1978. Evaluating opinion concerning the planting season for Populus. Populier. 15(3): 64-67.

Kohan, S. 1978. On problems of intensive methods of populiculture in the Ulmeto-Fraxinetum carpineum group of forest types. Lesn Cas. 24(1): 3-17.

Kolster, H.W. 1978. Clone mixtures in poplar plantations. Populier. 15(1;2): 3-11; 27-32.

Preliminary results are given for trial plantations established in the Netherlands on contrasting sites from 1965 onwards with two cultivars planted in alternate rows in different spacings. The clones used were Populus 'Robusta', 'Dorskamp', 'Oxford', 'Rochester', etc. Height growth has not been influenced, but the diameter growth of the 2 components of the mixture began to diverge when the height was 8 m or more, the difference increasing with age. Row mixtures of clones are not recommended. It is suggested that the risks of monoclonal plantations would be better limited by establishing smaller plots per clone.

Kostov, K.D. 1978. Forest plantations and artificial forest ecosystems. Gorskostopanska Nauka. 15(4): 44-53.

A distinction is made between (1) plantations where 'cultivation' is dominant throughout the life of the stand, e.g., poplar (Populus) or walnut (Juglans) plantations, and (2) artificial forest ecosystems which although

created by man are nevertheless still subject to the same general laws as natural forests. Genetically uniform material is best for (1), whereas for (2) it is best to retain intra-specific variation.

Kuz'menkov, B.A.; Zastenskii, L.S.; Steshkin, V.V. 1978. Utilization of land devastated by mineral mining operations. *Lesnoe Khozyaistvo*. 3: 48-50.

An account is given of experience since 1968 in Belorussia on the reforestation of land after removal of sand, gravel, and limestone. To date, plantations have been established on 145 ha of reclaimed land, the main species being pine (*Pinus sylvestris*), with some birch (*Betula alba*), and poplar (*Populus* spp.).

LaBonte, G.A.; Nash, R.W. 1978. Cleaning and weeding paper birch - a 24-year case history. *Journal of Forestry*. 76(4): 223-225.

Lapietra, G. 1978. Practical applications of systemic insecticides in 1-year-old poplar nurseries. *Cellulosa e Carta*. 29(6): 25-32.

Results are given of four experiments in 1969-1973 to determine the relative merits of three previously tested systemic granular insecticides (aldicarb, dimethoate, and phorate) and two new products (oxydisulphoton and carbofuran) when applied to the soil in 1-year-old poplar (*Populus* spp.) nurseries in northern Italy. It is concluded that carbofuran, as well as aldicarb, can be recommended for insect control in 1-year-old poplar nurseries.

Nepveu, G.; Keller, R.; Teissierducros, E. 1978. Juvenile selection for wood quality in *Populus nigra* and *Populus euramericana*. *Annales des Sciences Forestieres*. 35(1): 69-92.

Netzer, D.A.; Noste, N.V. 1978. Herbicide trials in intensively cultured *Populus* plantations in northern Wisconsin. Res. Note NC-235. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 4 p.

Okafo, O.A.; Hanover, J.W. 1978. Two-year performance of barerooted and containerized trembling and bigtooth aspen seedlings. *Tree Planters' Notes*. 29(2): 24-28.

Petit, H. 1978. Manual harvesting of coppice poplar. Paris, France: AFOCEL: 331-337.

Manual harvesting short-rotation coppice poplar was carried out by two expert wood cutters. Their productivity was low because, although volume per ha was above average, individual poles were small. It is suggested that such coppice would be suitable for harvesting with a machine that would cut and reduce the whole tree to chips.

Poissonnier, M. 1978. Trials of herbicides applied before planting poplar cuttings. Paris, France: AFOCEL: 108-135.

(Metolachlor + atrazine) and Etazine (sebumeton + simazine) were highly effective, Kloben C (neburon), L 50 (linuron) Bladex 50 (cyanazine), and Weedazol TL (aminotriazole + ammonium thiocyanate) much less so, and on

untreated plots 80 percent of cuttings had died. Best results were obtained with application before planting. Etazine and Chandor had the greatest persistence. These weed killers had no toxic effect on the poplars at the concentrations used.

Russell, T.E. 1978. How to grow yellow-poplars. Ala. Forest Products. 21(4): 28-29.

Smith, D.W.; James, T.D. 1978. Characteristics of prescribed burns and resultant short-term environmental changes in Populus tremuloides woodland in southern Ontario. Canadian Journal of Botany. 56(15): 1782-1791.

In a series of prescribed burns of low intensity and short duration in southern Ontario, wind speed, amount of fuel, and fuel moisture were important controls of fire severity. A heterogenous pattern of burning, related to clumping in the vegetation and to a hummock-hollow microtopography, was perpetuated in the postfire vegetation. Removal of vegetation cover and surface litter, plus surface albedo changes resulted in increased soil temperature 2 months after burning. Soil temperatures were close to those of unburned areas 4 months after the fires. Significant increases in levels of readily available P, K, Ca, and Mg at surface soil depths immediately after burning could have been depleted through uptake by vegetation and microorganisms. Portions of the nutrients were also removed by erosion of fly ash, leaching, and fixation in unavailable form.

Smith, D.W.; James T.D.W. 1978. Changes in the shrub and herb layers of vegetation after prescribed burning in Populus tremuloides woodland in southern Ontario. Canadian Journal of Botany. 56(15): 1792-1797.

Staweko, W. 1978. Effect of different thinning intervals on the productivity of poplar plantations. Prace Instytutu Badawczego Lesnictwa, Poland. 537/541: 55-78.

Two thinning regimes were compared in mixed plantations (predominantly Populus 'Robusta' and P. 'Grandis'): (a) thinnings at 7, 11, and 15 years old and (b) at 10, 13, and 16 years old. Regime (a) produced a volume m.a.i. (o.b.) of 15.95 m³/ha at 20-years-old and (b) produced 14.92 m³/ha.

Tyurin, E.G. 1978. Changes in the composition of young mixed pine stands with age. Lesovedenie. 1: 46-53.

Studies were made of the composition of mixed Pinus sylvestris stands from age 5 to 35 years that had formed by natural regeneration after large-scale clear fellings in pine forests in the central-taiga subzone of the Komi ASSR (N. Russia). The results indicate that pine is a stable community and regenerates on clear-felled areas. Birch (Betula alba) is more vigorous than the pine only in the first 10-15 years. The greatest admixture of birch and aspen (Populus tremula) (averaging 38-48 percent) is observed in stands up to 20 years old in the hylacomiosum group of forest types, and thinnings to favor the pine should be concentrated here.

Wells, J.R. 1978. Tree populations of a mature aspen forest in Cheboygan County, Michigan. Michigan Botanist. 17(2): 73-79.

Williamson, R.K. 1978. Follow-up on trees. *Soil Conservation*. 43(10): 9.

A comparison of 7 tree species, 14 years after planting on surface mined sites near Clarksburg, West Virginia, showed good survival and growth for black locust (*Robinia pseudoacacia*), European black alder (*Alnus glutinosa*), and Virginia pine (*Pinus virginiana*). American sycamore (*Platanus occidentalis*) and Siouland poplar (*Populus* spp.) survived poorly but grew well and were suitable for pulpwood. Red oak (*Quercus rubra*) and baldcypress (*Taxodium distichum*) failed.

Zavitkovski, J. 1978. Biomass farms for energy production: biological considerations. In: Proceedings of the Joint convention of SAF and CIF; 1978 October; St. Louis, MO. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 6 p.

Short-rotation intensive culture (SRIC) has applied agronomic methods to growing trees, especially sycamore and *Populus*. Depending on the initial spacing and rotation length, SRIC sycamore may produce 2.5 to 8.5 mt/ha/yr of stem-branches, and hybrid poplars from 2.9 to 19.1 mt/ha/yr. Net energy yields of SRIC *Populus* 'Tristis No. 1' was estimated at 235 million Btu/ha/yr, equivalent to energy in 43 barrels of oil.

1979

Bowersox, T.W.; Blankenhorn, P.R. 1979. Energy sensitivity and variability analysis of *Populus* hybrid short-rotation plantations in Northeastern United States. Final report to U.S. Department of Energy, Biomass Energy Systems Branch, Contract ET-78-6-01-3070. 108 p.

Production of biomass by corn-like plantations has been demonstrated by a number of researchers. These forest analogs of agronomic cropping systems have the potential to yield substantially more biomass per unit area than traditional forests. Opportunities for increased yields have been suggested for fertilization and irrigation. The objective of this study is to establish and analyze the energy inputs for selected management strategies in order to evaluate the sensitivity and variability of the energy inputs in the net energy analysis, and based on the net energy analysis to recommend a management strategy that minimizes energy inputs while maximizing biomass yield for short-rotation systems of *Populus* species in the northeastern United States.

Henry, J.F. 1979. The silvicultural energy farm in perspective. *Progress of Biomass Conversions*. 1: 215-255.

Silviculture energy farming is an attractive method for increasing the wood-fuel/fiber production to satisfy greater demand for these products. The intensive management of evergreen farms, and their weed control, irrigation, and fertilization are discussed along with the species selection for biomass production (growing sycamore and *Populus* hybrids for energy farming). Economics of silvicultural biomass farms is analyzed on the basis of land acquisition, crop management, and harvesting energy balance for wood production on an energy farm is computed taking into account supervision, irrigation, and fertilizer costs.

Keller, R. 1979. Preliminary results of an experiment on pruning Poplar 'I-214'. *Annales des Sciences Forestieres*. 36(1): 59-92.

Poplars planted in 1962 and 1963 were pruned in 1968 and 1969 respectively to 35-65 percent of total height. Pruning to a high level reduced taper and did not affect height increment; girth and volume increment were reduced, but the improved shape, and hence value, of the stems compensated for this. Possible effects of pruning on wood quality are discussed. To avoid too great a loss of girth increment and excessive costs, it is recommended that pruning should be to 50-55 percent of total height, or a maximum of 10 m.

Kluczynski, B. 1979. Suitability of selected tree and shrub species for the reclamation of ash wastes from power stations. *Arboretum Kornickie*. 24: 217-282.

Trials were made of 50 species on coal ash deposits at two sites in Poland. The most useful species were: Physocarpus intermedius, Rosa rugosa, Spiraea menziesii, S. densiflora, Hippophae rhamnoides, Tamarix gallica, T. tetrandra, Myricaria germanica, Robinia pseudoacacia, Caragana arborescens, Populus alba, Salix acutifolia, and Eleagnus angustifolia, with the last 3 plus Spiraea japonica 'Macrophylla' best under the harshest conditions on the upper slopes of ash piles. NPK, compost, peat, and lupins (Lupinus polyphyllus) + NPK gave best results in fertilizer trials. Chemical analyses showed that N, P, Mn, and sometimes K are absorbed in insufficient quantities in spite of their high concentrations in the ash.

Knauer, P.; vanOoyen, G. 1979. Planning the siting and recultivation of rubbish dumps. *Forstwissenschaftliches Centralblatt*. 98(1): 42-51.

Changes in land-fill disposal methods in W. Germany since 1970 are outlined. Plans for the reclamation of both old and more recent dumps are indicated. The production of toxic gases from the decay of domestic rubbish is a problem in establishing plant cover. Tests on planting trees, e.g., poplars (Populus spp.), directly into the rubbish, without a surface soil covering, have given promising results.

Kolster, K.W.; van der Meiden, H.A. 1979. Wood production on very short rotations: an experimental plantation in Hummelo. *Populier*. 16(1): 3-7.

Trial plantings were made in 1974 with various poplar species and spacings (2x2, 2x2.5, and 2x3 m). Despite initial losses, it was possible to calculate growth data for complete stands, which indicate that high increments are possible.

Kostylev, A.S. 1979. Growing high-grade aspen from young natural stands. *Lesnoe Khozyaistvo*. 12: 58-60.

Zavitkovski, J. 1979. Energy production in irrigated, intensively cultured plantations of Populus 'Tristis #1' and jack pine. *Forest Science*. 25(3): 383-392.

Energy budgets were prepared for irrigated, intensively cultured plantations of Populus 'Tristis No. 1' and jack pine in northern Wisconsin. Energy inputs into biomass production and into material processing amounted to about 20 percent of the total energy at age 10. Energy invested in irrigation brings commensurate energy returns. The available energy from forest biomass,

which is negligible when compared with the total energy consumption in the United States, could be increased by a widespread application of existing agronomic technology.

1980

Allegri, E. 1980. Pruning of poplar. *Annali dell'Istituto Sperimentale per la Selvicoltura, Italy*. 11: 1-23.

Moderate, progressive pruning which maintains a balance between roots and above-ground parts is recommended, applied at the end of winter or beginning of spring. Types of pruning and various pruning systems are discussed.

Alonzo, A.E. 1980. The Salicaceae in the silviculture of Argentina. *Reunion sobre Tecnologia y Aplicacion de Recursos Forestales, La Plata*: 65-71

Barneoud, C. 1980. Short-rotation coppices. *Foret Privee (France)*. 133: 42-46.

The pulp and paper, and particleboard industries do not require large-diameter wood. In France short-rotation cropping trials have been carried out with Eucalyptus species, Populus species, and Sequoia species (mainly S. sempervirens), species which coppice well, and have rapid juvenile growth.

Dawson, D.H.; Zavitkovski, J.; Isebrands, J.G. 1980. Managing forests for maximum biomass production. In: AICHE symposium; 1978 June 4; Philadelphia, PA. AICHE Symposium Series (United States). 76(195): 36-42.

Because conventional forestry practices and research have not led to large increases in yield, studies in Wisconsin to investigate Short-Rotation Intensive Culture (SRIC) systems were initiated in 1970. Studies include spacings, rotations, and culture of Populus hybrids and jack pine. Populus biomass was calculated to yield as much energy as 43 barrels and jack pine 34 barrels of oil per hectare per year.

Fakirov, V. 1980. Amount of foliage in unthinned and thinned poplar plantations. *Gorskostop. Nauka (Bulgaria)*. 17(3): 3-18.

Investigations are reported on the amount of foliage in plantations of Populus 'Regenerata' aged 7, 13, 16, and 22 years, initially established at a spacing of 2x2 m near the Danube in Bulgaria. The measurements were made 3 years after a thinning removing 40-45 percent by volume on some of the plots. The age of maximum foliage formation (8-10 years) coincided with the age of the maximum amount of fine roots and with the culmination of b.a. increment and leaf index, and also with the start of differentiation of tree classes. Accordingly, thinnings in such plantations should not start before age 8-10 years.

Farnham, R.S.; Berguson, W.E.; Levar, T.E.; Sherf, D.B. 1980. Peatland reclamation - the energy crop option. Peat as an energy alternative. In: *Proceedings, IGT symposium on peat as an energy alternative*; 1980 December 1; Arlington, VA. Chicago, IL: Institute of Gas Technology: 635-642.

Peatland research in Minnesota has indicated that a number of vegetable, agronomic, and bioenergy crops are suitable for reclamation of mined peatland

deposits or for production on present surface soils. Potential bioenergy crops include Salix (willow), Alnus (alder), hybrid Populus (poplar), Typha (cattail), Phragmites (rushes), and other wetland species. A recent inventory indicates that Minnesota has seven million hectares of mineral and organic wetlands. This wetland resource includes many large contiguous areas which may be used for renewable bioenergy crop production.

Grinfelde, G. 1980. Dimensions of trees removed during thinning of 20-30 year old stands. *Raksti, Latvijas Lauksaimniecibas Akademija*. 175: 71-80.

Data are given for Betula alba, Populus tremula, Alnus incana, A. glutinosa, Salix capraea, Norway spruce, and Scots pine removed from forests in Latvia.

Tsarev, A.P. 1980. Range of poplars available for the upland conditions of central forest-steppe. *Lesnoe Khozyaistvo*. 6: 27-29.

A review of poplar trials and experience in the central forest-steppe region of the USSR during the 1970s. Data are presented on growth, winter hardiness and drought resistance, and recommendations are made on the choice of poplars for various types of planting.

U.S. Department of Agriculture, Forest Service. 1980. Establishment of Populus energy plantations: Fourth year funding request and 1979-1980 progress reports. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 23 p.

Data were collected on previously established plots of Populus. The following studies will be performed during the quarter ending June, 1981: conduct third stage weed control tests on large plots; determine season and application rates for safe overspraying of trees during herbicide control of weeds; define best planting period for unrooted hardwood cuttings; determine fertilizer and cultural regimes for optimum growth and yields; and determine the necessity and advantages of irrigation on newly established plantations. The plantations were planned to demonstrate the most promising systems and methods, including planting machinery, type of plant material, competition control by cover crops, and plant pest control methods.

Yakushenko, I.K. 1980. Testing poplar varieties in the floodplains of the Dnieper and Pripyat (USSR). *Lesnoe Khozyaistvo*. 6: 21-24.

A summary account is given of experience and results in trials of over 100 species, hybrids, and clones of poplars in 12 official trial areas (totalling 60 hectares), set up in 1961-1963 in Belorussia. Three main groups of poplars are distinguished according to growth rate and suitability for floodplain conditions in Belorussia.

Zubareva, L.M. 1980. Poplar variety testing in the floodplain conditions of the northern Caucasus. *Lesnoe Khozyaistvo*. 6: 24-27.

A summary account is given of poplar trials since 1962 at a number of places in the region. Over 30 different species, varieties, and clones have been tried; some data are tabulated on growth rates of plantations 9 and 10 years old at various sites, and on the cellulose content and fibre length of the wood in 6-year-old trees.

1981

1981. Coppiced trees as energy crops. In: Pearce, M.L.; Chartier, P.; Palz, W., eds. Energy from biomass. Vol. 1. Solar energy R and D in the European Community, Series E. EC Contractor's meeting on energy from biomass; 1981 June 23; Copenhagen, Denmark. Dordrecht, Holland: D. Reidel Publishing Co.: 35-38.

Various difficulties have prevented the establishment of four of the seven proposed experiments, but these will be completed during the winter and spring of 1981-1982. The species considered for planting are: Populus, Salix, Nothofagus, Alnus, and Eucalyptus.

Akinyemiju, Oluyemisi Amos. 1981. Differential effects of simazine and diuron on survival, growth and physiology of Populus clones. Dissertation Abstracts International. 42/02-B: 443.

Field and greenhouse studies were performed to evaluate the differential effects of simazine (2-chloro-4,6-bis(ethylamino) - s - triazine) and diuron (3-(3,4-dichlorophenyl) - 1, 1-dimethyl urea) on survival, growth, and physiology of Populus clones. High doses of each herbicide were toxic to all clones except H 47. Simazine at 2 kg/ha was found adequate for acceptable weed control, survival and biomass yield at the Tree Research Center (TRC) and Dansville. At Manistee, however, simazine was ineffective due to the low pH of the surface soil, but diuron at 2 kg/ha was suitable. Differential physiological and morphological responses to simazine and diuron among clones in greenhouse studies confirmed the varying clonal responses to the herbicides observed in the field.

Baranchugov, E.G.; Strunina, T.F. 1981. Improvement of the conditions of poplar growth during the planting. Lesnoe Khozyaistvo. 4: 33-35.

Burk, Thomas Edward. 1981. Crown architecture of intensively cultured Populus: analysis and modeling. Dissertation Abstracts International. 42/06-B: 2151.

The objective of this research was the development of methodology for characterizing the architecture of rapidly grown hybrid Populus clones. Methods for incorporating an architectural component in physiologically based growth models were studied.

Chatterjee, P.C. 1981. History of poplar trials in Doon valley (India, Populus deltoides, Populus casale). In: Singh, R.V., ed. Symposium proceedings: Silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 5-8.

Davydenko, I.A. 1981. Landscaping plantations of Populus pyramidalis. Lesnoe Khozyaistvo. 10: 46.

Dong, S.L. 1981. The poplar management and culture division in Heilongjiang Province. Journal of North-Eastern Forestry Institute, China. 2: 11-27.

The Province is divided into 3 regions and 16 districts for poplar silviculture based on the climate, soil, and vegetation of the different areas and considering the ecological and economic characteristics of different poplar species.

Fechner, G.H.; Burr, K.E.; Myers, J.F. 1981. Effects of storage, temperature, and moisture stress on seed germination and early seedling development of trembling aspen. *Canadian Journal of Forest Research*. 11(3): 718-722.

Fresh seed from 7 clones of Populus tremuloides, and seed stored at -18degC for 1 to 24 months were germinated. There was no significant effect of storage at any of the water potentials used.

Fotidar, A.N. 1981. Some observations on poplars in Jammu and Kashmir State (Populus, India). In: Singh, R.V., ed. Symposium proceedings: Silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 20-23.

Francis, J.K.; Baker, J.B. 1981. Biomass and nutrient accumulation in a cottonwood plantation - the first four years. Res. Note SO-278. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 4 p.

Height and diameter measurements were made every year in a Populus deltoides plantation established on clay soil in Mississippi in January 1973, and thinned at the end of the third growing season. Height increment was the largest in the first year, diameter increment in the second, and biomass increment in the third. N, P, and possibly Mg were translocated from leaves into bark and other tissue before leaf abscission in the autumn. There was no evidence for translocation of K or Ca. Summer whole-tree harvesting every 3 years would remove nutrients in quantities ranging from 1 kg/ha of P to 16 kg/ha of Ca per rotation. This would be approximately balanced by nutrients added in rainfall.

Grinfelde, G.; Celmillers, J. 1981. Studies of the correlation between dimensions of trees removed during thinning. *Raksti, Latvijas Lauksaimniecibas Akademijs*. 185: 70-76.

Regression equations relating d.b.h. to various dimensions are given for birch, aspen [Populus tremula], Scots pine, Norway spruce, Alnus incana, Alnus glutinosa, and Salix caprea thinnings from mixed stands in Latvia. High linear correlations were found with tree volume and stump diameter in all species, stem length in all but S. caprea and stem volume in all but Norway spruce.

Hansen, E.A. 1981. Root length in young hybrid Populus plantations: its implication for border width of research plots. *Forestry Science*. 27(4): 808-814.

Root length may be important in determining research plot border width. Measurements of hand excavated hybrid Populus roots showed root length increased with tree age up to at least 3 years. It appears that in some studies border width may be considerable and probably increases with tree age. Published data from spacing and yield studies shows tree biomass increases toward the edge of plots, probably as a response to light. This study showed that height and diameter decreased toward the plot edge when an irrigation and fertilization treatment was applied to the plot. These contrasting results in edge effect are discussed in terms of canopy vs. root competition.

Il'in, A.M. 1981. Preliminary regeneration of aspen. *Lesnoe Khozyaistvo*. 11: 18-19.

Il'in, A.M. 1981. State of oak and aspen during combined growing. *Lesnoi Zhurnal*. 4: 123-124.

Il'in, A.M. 1981. Thinning of aspen forests. *Lesovodstvo, Lesnye Kul'tury i Pochvovedenie*. 10: 55-58.

Thinning of young aspen stands at 4-7 years old has become an established practice in Russia on the basis that it reduces the risk of damage by Phellinus igniarius. However, studies of the pattern of attack in Voronezh Province suggest that thinning should start no earlier than 15-17 years old when stems have become naturally clear of branch stubs to a reasonable height. Further sanitary fellings should be made every 2-3 years.

Jamwal, M.S. 1981. Trials to raise poplars in Kathua district of Jammu and Kashmir State. In: Singh, R.V., ed. *Symposium proceedings: Silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 92.*

Joshi, R.C. 1981. Distribution and management of Populus ciliata Wall. in Uttar Pradesh (India). In: Singh, R.V., ed. *Symposium proceedings: Silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 95-97.*

Mattoo, R.K. 1981. Planting technology of poplars. In: Singh, R.V., ed. *Symposium proceedings: Silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 24-28.*

Singh, A. 1981. Poplars under agri-silviculture in Punjab and Haryana. In: Singh, R.V., ed. *Symposium proceedings: Silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 38-40.*

Swatantra, S.D. 1981. Plantation technology of poplars in Ladakh. In: Singh, R.V., ed. *Symposium proceedings: Silviculture, management and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 29-31.*

von Althen, F.W. 1981. Planting studies with hybrid poplars and cottonwood in southwestern Ontario. *Inf. Rep. O-X-332. Canada: Great Lakes Forest Research Centre. 18 p.*

Trials were established in 1977 on a moist sandy loam, using unrooted cuttings of 26 poplar clones, rooted and unrooted cottonwood (Populus deltoides) cuttings, and 2+0 cottonwood seedlings. In general, simazine causes too much damage to the poplar plants in the first year, when it is better to use mechanical weed control.

Yang, R.Y. 1981. Study on the replacement of poplar by pine in windbreaks round fields. *Bulletin, Institute of Forestry and Pedology, Academia Sinica*. 5: 91-96.

Zasada, J.C.; Viereck, L.A.; Foote, M.J.; Parkenson, R.H.; Wolff, J.O.; Lankford, L.A., Jr. 1981. Natural regeneration of Balsam poplar following harvesting in the Susitna Valley, Alaska. *Forestry Chronicle*. 57(2): 57-65.

Regeneration of Populus balsamifera was studied after clear felling with chainsaws in summer and winter, and with tractor-mounted shears in summer, winter, and autumn. Logging with shears in summer and winter produced greatest surface disturbance and poplar regeneration. Regeneration of summer and winter-logged sites was primarily from root suckers; on autumn logged sites regeneration was from buried branches. More than 50 percent of stumps produced sprouts in the first and second year. Seed regeneration occurred only on areas of mineral soil. Revegetation of clear-felled areas by grasses, herbaceous species, alder, and willow was rapid, and production of moose browse was much greater than in unlogged plots.

Zavitkovski, J. 1981. Structure and seasonal distribution of litterfall in young plantations of Populus 'Tristis No. 1'. *Plant and Soil*. 60(3): 409-422.

In relation to stand density and age of 3- to 7-year-old irrigated and fertilized (NPK) stands.

Zheng, S.J. 1981. Poplar cultivation in France and Italy. *Forest Science and Technology*. 3: 30-33.

1982

1982. Stabilizing sand dunes with vegetation. In: Walls, J., ed. *Combating desertification in China*. Nairobi, Kenya: United Nations Environment Programme: 36-42.

In semi-arid regions of China, with an annual rainfall of 150-450 mm, trials have shown that Artemisia sphaerocephala and Hedysarum scoparium are useful for the initial fixing of dunes. Subsequently, A. ordosica will replace A. sphaerocephala. In turn, this will be replaced by Caragana korshinskii and then Ceratoides latens. Finally, communities of Reamuria soongorica and Salsola passerina will complete the process. In arid regions, plants must be drought-resistant, e.g. Haloxylon persicum. Where ground water is available H. ammondendron and Populus euphraticus are suitable; with irrigation, Salix mongolica and Atraphaxis bracteata should be considered.

1982. The transformation of deserts in China: a summary view of the people's experiences in controlling sand. In: Walls, J., ed. *Combating desertification in China*. Nairobi, Kenya: United Nations Environment Programme: 4-29.

Work since 1949 to prevent further spread of desert areas is discussed. Shelterbelts and windbreaks of Populus cupidata, Elaeagnus angustifolia, and other longlived dwarf trees with quick growth and large crowns are planted. Grasses are planted along the desert edge to stabilize moving soil.

Barring, U. 1982. Results of country-wide experiments in forestry. In: *Weeds and weed control: 23d Swedish weed conference; 1982; Uppsala, Sweden*. Uppsala, Sweden: Sveriges Lantbruksuniversitet; 2: 270-276.

Krenite (fosamine 480 g/litre) performed well against aspen (Populus tremula), birch (Betula pubescens and B. verrucosa), and oak (Quercus robur) in a notching experiment when applied at 1 to 2 ml/notch. Sprouting was strongly inhibited in trees treated with Krenite. Krenite also controlled shoots from stumps, provided the stumps as well as the shoots were sprayed. Gufa 94 (2,4-D 300 g + MCPA 200 g a.e./litre) at 3 to 4 litres/ha, applied from the ground or aerially, destroyed the foliage of birch and aspen in the year of treatment but there was some regrowth, in the following year.

Basham, J.T. 1982. Scarification of 3-year-old aspen suckers: 4- and 6-year effects on, and a preliminary forecast of, the internal pathological quality of the survivors. Inf. Rep. O-X-341. Canada: Great Lakes Forest Research Centre. 26 p.

Trembling aspen (Populus tremuloides) suckers that survived scarification treatment in a 3-year-old sucker stand in northern Ontario showed evidence of both height and diameter growth reductions, when sampled 4 and 6 years later. However, observations made 9 years after the event suggested that normal growth had resumed. Wounds caused by scarification machinery were common on both stems and roots, and most were associated with internal stain and rot. Several hymenomycete fungi not usually found in young aspen were isolated from the defective wood associated with both stem and root scarification wounds. Many of these are known to cause serious root, butt, and stem rot in mature aspen. Hence, scarification of 3-year-old aspen carries the risk that the survivors will form crop trees of relatively poor quality with serious, abnormally high incidence of internal stem and root rot.

Erdoş, L. 1982. Poplar plantations in Hungarian agriculture. Sozialistische Forstwirtschaft. 32(10): 314-315.

A brief report on the establishment and utilization of poplar stands, mainly Populus 'Robusta' and P. 'I-214' in rotations averaging 15 years.

Gunzl, L. 1982. Comparative investigation of poplar cultivars cultivated in Austria. Part 1. Silvicultural evaluation of poplar cultivars in Austria with a review of Austrian bottomland forest trees and their utilization possibilities. Holzforschung und Holzverwertung. 34(6): 93-100.

Hahl, J. 1982. Cut-surface treatment in mechanical brush control. In: Weeds and weed control: 23d Swedish weed conference; 1982; Uppsala, Sweden. Uppsala, Sweden: Sveriges Lantbruksuniversitet; 2: 277-289.

Proposed legislation on brush control in forests in Sweden may well ban spraying with herbicides, apart from exceptional cases. A possible alternative is cut surface injection of herbicides when felling trees. The use of glyphosate in a 5-10 percent concentration is effective on species forming stump sprouts but control of suckers in aspen (Populus tremula) requires a higher concentration. Costs are higher than for motor manual cleaning alone because of the extra time requirement and herbicide costs.

Halimi, M.; Gastine, F. 1982. Mechanization and silviculture. Annales de Mecanisation Forestiere, ARMEF/CERMAS, France: 205-263.

Three papers are presented in this section: Influence of the felling method on natural regeneration of a short-rotation poplar coppice, effects of

mechanized felling on coppice regeneration, and mechanized woodcutting in selective thinning.

Hernandez, Leon, M.; Padro, A. 1982. Alternative method in the type of pruning upon planting poplars in irrigated land. *Anales del Instituto Nacional de Investigaciones Agrarias. Serie: Forestal.* 6: 193-205.

Hicks, T.W.; Cooper, D.T. 1982. Glyphosate application with a janitor's dustmop. *Tree Planters' Notes.* 33(3): 15-16.

A simple, gravity-flow applicator is described, which consists of a dustmop mounted on the front of a large-wheeled, self-propelled mower, with the blade disengaged. In field trials, glyphosate applied to grasses between rows in a cottonwood (Populus deltoides) nursery produced negligible damage to tree seedlings.

Ignat'eva, L.A. 1982. Natural regeneration of herbaceous types of fir forests in the plains. *Lesnoe Khozyaistvo.* 6: 23-25.

Investigations were made in Tomsk Province (western Siberia) on the natural regeneration of fir (Abies sibirica) on clear-felled areas 1-5 years after the fellings. The results show that commercial clear fellings in these primary fir forest types cause large-scale succession of broadleaves (Populus tremula and birch) delaying the regeneration of conifers by at least 20-30 years.

Kluczynski, B. 1982. Studies of the suitability of trees and shrubs for the revegetation of siderite mine spoils in the Czestochowa region. *Arboretum Kornickie.* 26: 203-229.

Trials of 27 species over 3 years on the Southern slope of an 8-year-old spoil heap in Dzbow, Poland, showed that the most suitable species are: Elaeagnus angustifolia, Robinia pseudoacacia, Alnus incana, Salix purpurea, S. acutifolia, S. capraea, S. viminalis, Physocarpus intermedius, Crataegus monogyna, Rhus typhina, Populus canescens, Larix decidua, Caragana arborescens, Lonicera tartarica, and Quercus rubra. Fertilizer prescriptions can be developed based on substrate analysis, but site levelling and preparation were found to be more critical in practice.

Kolesnichenko, M.V.; Kryukov, V.V. 1982. Choice of associate species for mixed plantations of Quercus borealis. *Lesnoe Khozyaistvo.* 6: 36-37.

Young red oak plants grown in pots to 1-2 years old were watered with the drainage water from other species of plants (i.e. water containing root exudates and rhizosphere microflora) and simultaneously exposed to the foliage of those species in open-topped chambers. It is concluded that certain species are definite 'activators' while others are definite 'inhibitors'.

Mattson, J.A.; Miyata, E.S. 1982. A time study of planting a short-rotation intensively cultured plantation. Res. Note NC-278. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 4 p.

A study was made of planting a 3 ha site at Rhinelander, Wisconsin, with poplar cuttings on a 1x1 m spacing. Four planting machines, rear-mounted on one tractor, were used. Productivity was 0.52 ha/h, at a planting cost of 97.87 \$/ha (January 1981 prices).

Marinkovic, P.; Zivojinovic, D.; Popov, M.; Markovic, M.; Sigunov, A. 1982. Herbicide application for weed control in intensive poplar cultures in river Tamis region. Topola. 26(133/134): 49-54.

Miyata, E.S.; Steinhilb, H.M.; Sajdak, R.L.; Coffman, M. 1982. Roller chopping for site preparation in Wisconsin: a case study. Res. Pap. NC-223. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 8 p.

Cost and productivity were analysed of roller chopping a 54.4-acre aspen [Populus] stand (on mainly flat ground) logged for pulpwood 6 months earlier and consisting of small aspen stems and sprouts with an average diameter of 3 inches.

Noh, E.R. 1982. A method for evaluating sites suitable to Populus alba x Populus glandulosa F1 clones using path analysis. Res. Rep. 18. Suweon, Korea: The Institute of Forest Genetics: 113-156.

Popovich, S. 1982. Performance of hybrid poplars in Quebec: ten years after planting. Inf. Rep. LAU-X-44. Quebec, Canada: Canadian Forest Service, Laurentian Forest Research Centre. 21 p.

Trials were established during 1963-1974 of 68 clones of hybrid poplar at 53 sites in Quebec. After several years selection, 15 clones at 12 sites were retained for study at 10 years. Three classes of site performance were established based on height growth, diameter, tree health, and survival. Good, average, and poor sites on uncultivated soils produced trees of mean height 13, 10, and 4.5 m respectively. Site preparation and cultivation for 3 years after planting increased height growth and survival.

Roncevic, S.; Ivanisevic, P. 1982. Influence of microrelief and method of planting, on survival of new poplar clones in plantations. Topola. 26(135/136): 29-36.

Schmiedel, H. 1982. Intensive silviculture of aspen. Sozialistische Forstwirtschaft. 32(11): 338-340.

A silvicultural report on Populus tremula grown in 30-40 year rotation (for match stock) in the Grimma, Wermsdorf, and Ziegelroda State Forest Enterprises in E. Germany.

Stawecka, W. 1982. Role of density in accelerated poplar plantations. Prace Instytutu Badawczego Lesnictwa, Poland. 579/583: 49-70.

Studies were made of 15-year-old stands of Populus 'Robusta', P. 'Grandis', P. 'Marilandica', P. 'Serotina', and P. 'Hybrida 194' established at 2.5X2.5, 4X4, 5X5, 4X8, and 5X10 m spacings in the Odra Valley, Poland. An attack of stem canker at 8-years-old reduced diameter growth by 50 percent, with the greatest effects in the 2.5X2.5 and 4X4 m plots. P. 'Serotina' and P. 'Hybrida 194' were most susceptible. It is recommended that plantations on class I sites should be at spacings wider than 5X5 m.

Van Goor, C.P.; Groenhuis, B.; Jacobs, L. 1982. Forestry and forestry research. In: Polders of the world. Vol. 2. Polder aspects; agricultural aspects; socio-economic and physical planning aspects; environmental aspects.

Wageningen, The Netherlands: International Institute for Land Reclamation and Improvement: 392-396.

The planting of forests on the IJsselmeer polders, the choice of species in relation to soil, wood production, and ultimate ecological forest type, the particular role of poplar, and planting schemes are discussed.

Wang, X.C. 1982. Application of herbicides in cutting poplars. Journal of North-Eastern Forestry Institute, China. 3: 135-137.

The application of 'Lasso' [alachlor] and 'Treflan' [trifluralin] to plantations of poplar cuttings achieved over 80 percent weed control and was safe and economical.

White, T.A.; Rolfe, G.L.; Bluhm, D.R. 1982. Effects of herbicides on tolerance of woody biomass species and control of weeds in southern Illinois: 1980 herbicide trials. For. Res. Rep. 82-6. Urbana-Champaign, IL: University of Illinois Agricultural Experiment Station, Department of Forestry. 6 p.

The effects of 36 treatments with 17 herbicides on seedlings or cuttings of 7 fuelwood species in pure or mixed plantings were determined at one site. The species were the 5 used in the previous trial, Alnus glutinosa, and Populus 'NE-41'.

White, T.A.; Rolfe, G.L.; Bluhm, D.R. 1982. The effects of some preemergent herbicides on survival and tolerance of various woody biomass species: 1979 herbicide trials. For. Res. Rep. 82-5. Urbana-Champaign, IL: University of Illinois Agricultural Experiment Station, Department of Forestry. 4 p.

Survival data are reported 5 weeks after applying 13 herbicides to recently planted seedlings of Elaeagnus umbellata, Paulownia tomentosa, Platanus occidentalis, Populus deltoides, and Robinia pseudoacacia at 3 sites in southern Illinois. Results suggested that Paulownia was intolerant of simazine and terbacil + pendimethalin, and Platanus of linuron.

Wooden, A.L.; Locey, C.; Cunningham, G. 1982. Wisconsin woodlands: aspen management. Publ. G3162. Madison, WI: University of Wisconsin, Cooperative Extension Programs. 6 p.

1983

Akinyemiju, O.A.; Dickmann, D.I.; Leavitt, R.A. 1983. Distribution and metabolism of simazine in simazine-tolerant and -intolerant poplar clones. Weed Science. 31(6): 775-778.

Simazine levels in the tolerant clone Populus x euramericana I-45/51 (a section Aigeiros hybrid) and the intolerant clone P. maximowiczii X P. trichocarpa cv. Kingston (a section Tacamahaca hybrid) were still similar 48 hours and 1 week after application. However, the presence of 2-chloro-4-amino-6-ethylamino-1,3,5-triazine (G-28279), a less toxic simazine metabolite, was detected in the tolerant clone after 12 hours and it increased steadily for 1 week after simazine application.

Atamanov, R.S.; Kuznetsova, G.R.; Atamanova, P.P. 1983. The technical parameters of shelterbelts in the steppe zone of the Tuva ASSR. *Lesnoe Khozyaistvo*. 9: 47-48.

Data are given on the growth of Populus balsamifera and Ulmus pumila var. arborea in relation to spacing in shelterbelts in the steppe zone of the Tuva ASSR (S. Siberia). For optimum growth the trees require an individual growing space of at least 14 m². Accordingly it is recommended that shelterbelts should be established with rows 5-7 m apart, and a plant spacing of 2-3 m within the rows; this will increase the life duration of the trees, and make it possible to carry out mechanized cultivation of the stand throughout its life.

Baranchugov, E.G.; Strunina, T.F. 1983. Fast-growing poplar plantations. *Lesnoe Khozyaistvo*. 10: 41-43.

A survey of experience in the Tatar Region of the USSR (north-east forest-steppe zone) on the establishment and management of fast-growing poplar plantations. Data are presented on the performance of 17-year plantations of Populus trichocarpa, P. 'Petrovskii', and P. 'Hybrid No. 85' (P. nigra X P. suaveolens) at various spacings, and also with agricultural crops grown between the rows of 6X6 m, for the first 4 years P. trichocarpa showed the best increment. Growing agricultural crops reduced height and diameter increment of the poplars. Despite this it is concluded that agricultural crops can profitably be grown between the rows for the first 2 years or for longer if the water table is at 1-2 m and competition for moisture is not too great.

Burkhardt, E.C.; King, A.L. 1983. A cottonwood planting punch for 1-year-old, rooted whips. *Tree Planters' Notes*. 34(2): 6-7.

A tractor-mounted hydraulic ram is described, which punches holes 2.5 inches in diameter and 36-44 inches deep in newly cleared areas. Whips are planted by hand from the rear of the tractor. Trial plantings using this method showed that survival was good.

Cheng, S.K.; Wang, S.J.; Liu, Y.R.; Wang, S.; Dou, Z.F. 1983. A study on deep planting technique of poplar. *Scientia Silvae Sinicae*. 19(3): 235-245.

Experiments in Shanxi, Nei Menggu, and Beijing have shown that survival and growth of newly planted trees in water-limited areas can be increased by using this Italian technique. Ground water can be absorbed directly through roots or the ends of sets without the need for irrigation. Sets planted deep in autumn have already rooted before bud opening in the spring. Deep-planted poplars also have higher leaf water potential and content and lower water saturation deficit.

Cram, W.H. 1983. A mechanical planter for hardwood cuttings. *Tree Planters' Notes*. 34(1): 7-9.

A tractor drawn 4-row planter is described for planting Salix and Populus cuttings. The planting mechanism consists of 2 pairs of rubber-faced rollers which are hydraulically driven and push cuttings into a chisel trench. Cuttings are fed by hand into the planting mechanisms.

Crist, J.B.; Mattson, J.A.; Winsauer, S.A. 1983. Effect of severing method and stump height on coppice growth. In: Hansen, E.A., comp. Intensive plantation culture: 12 years research. Gen. Tech. Rep. NC-91. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 58-63.

A study of a Populus 'Tristis No. 1' plantation in Wisconsin, 1, 2, and 3 years after felling.

Crouch, G.L. 1983. Aspen regeneration after commercial clearcutting in southwestern Colorado. *Journal of Forestry*. 81(5): 316-319.

Dalal, S.S.; Trigotra, R.C. 1983. Experiences in poplar cultivation outside forests. *The Indian Forester*. 109(10): 726-736.

Danfield, W.; Martishus, J.; Hansen, E. 1983. Application date affects herbicide tolerance of hybrid poplars. Res. Note NC-301. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 3 p.

Glyphosate alone (Roundup at 1.1 or 2.2 kg/ha a.i.), glyphosate at 2.2 kg/ha a.i. with 2.2 kg/ha a.i. of Lorox [linuron] (a pre-emergent herbicide) applied simultaneously or 1 week later, pronamide [propryzamid] (Kerb) at 1.1 kg/ha a.i., and dichlobenil (Casoron) at 4.5 kg/ha a.i. were applied in October-November 1980 or April-June 1981 to a hybrid Populus plantation in Wisconsin. Herbicides applied between October 20 and May 15 did not significantly injure trees or reduce height growth. Treatments applied earlier or later caused injury and reduced height growth to varying degrees.

Davidson, W.H. 1983. Hybrid poplar sprout clumps: thinning does not improve development. *Journal of Forestry*. 81(10): 662-663.

Coppice shoots from 100 clumps in a plantation in Pennsylvania were thinned (retaining the dominant shoot) in 1978, one season after harvest at age 16 years; 100 clumps were left unthinned. After 3 years, there was no significant difference between thinned and unthinned clumps in number of shoots per clump or in diameter of dominant shoots, although dominant shoots were significantly taller in unthinned clumps.

Dawson, J.O.; Dzialowy, P.J.; Gertner, G.Z.; Hansen, E.A. 1983. Changes in soil nitrogen concentration around Alnus glutinosa in a mixed, short-rotation plantation with hybrid Populus. *Canadian Journal of Forest Research*. 13(4): 572-576.

Soil nitrogen concentration around A. glutinosa stems differed significantly both spatially and with the proportion of hybrid Populus in a 4-year-old mixed plantation near Rhinelander, Wisconsin. Single rows of Alnus bounded by adjacent rows of Populus had the greatest increase and concentration of nitrogen in the top 16 cm of soil. Where Alnus trees had a row of Alnus on either side, the total nitrogen concentration was least. Soil nitrogen accretion and concentration was always highest in the top 4 cm of soil. The results are consistent with speculation that competition-induced stress from shading by Populus or Populus allelochemicals results in early accretion of nitrogen in soil around Alnus intermixed with Populus.

DeWalle, D.R.; Sopper, W.E. 1983. Conjunctive use of soil warming and municipal waste water irrigation to enhance woody biomass production. *Energy in Agriculture*. 2(1): 37-50.

Dickmann, D.I.; Stuart, K.W. 1983. The culture of poplars in eastern North America. 168 p. Available from: Hickory Hollow Associates, Dansville, MI 48819.

Silvical and genetic characteristics, cultural methods, productivity and pest problems are emphasized.

Dilla, L. 1983. Forestry revegetation activities in the Rhineland brown coal-mining district. *Allgemeine Forstzeitschrift*. 48: 1278-1283.

A report based on 65-years experience in an opencast coalmining area west of Cologne. Forestry revegetation goals and methods are discussed during three periods: 1920-1950, characterized by diversified experimentation; 1951-1959, characterized by establishment of large-scale poplar/alder plantings; and the recent past, characterized by establishment of a wide variety of broadleaved and coniferous species on a suitable loess-containing soil mixture, and by conversion of older stands.

D'yakonov, V.I. 1983. Mechanical thinning of leave strips following strip felling of oak stands. *Lesovodstvo i Agrolesomelioratsiya*. 66: 45-49.

Trials were made of a prototype tractor-mounted circular logging saw developed at the author's institute, for thinning leave strips consisting mainly of aspen [*Populus tremula*] and hazel coppice, which serve as a nurse for the main *Quercus robur* crop. The 500 mm diameter saw blade is mounted on a pivoting arm to enable a swinging action so that as the tractor passes alongside the leave strip a sequence of semicircular areas are felled (with approximately 1.5 m between centres). Sawing is at a height of 400 mm, the high stumps helping to keep deer away from the crop trees.

Dzhalilov, K.G. 1983. Poplar plantations in the steppes of Azerbaijan. *Lesnoe Khozyaistvo*. 3: 35-37.

A summary account of experience and trials in the selection of high-yielding and resistant poplars for use in this region. Trials were made on 120 species, hybrids, and varieties, to evaluate rooting of stem cuttings, survival, effect of trimming and cutting, growth rate, and resistance to pests and diseases. Recommendations are made on plantation establishment and early tending.

Evrard, R.; Bary-Lenger, A.; Kimus, J.; Gathy, P. 1983. Choice of plantation spacing in poplar cultivation. Example taken in Belgium on robusta poplars. *Bulletin de la Societe Royale Forestiere de Belgique = Tijdschrift van de Koninklijke Belgische Bosbouwmaatschappij*. 90(5): 271-280.

Fege, Anne Skjaerlund. 1983. Changes in *Populus* carbohydrate reserves during induction of dormancy, cold storage of cuttings, and development of young plants. *Dissertation Abstracts International*. 44/03-B: 662.

Patterns of carbohydrate distribution and utilization in hardwood cuttings were described during the process of collecting, storing, and planting cuttings. At the time of field planting, sugars were found to be higher and

starch content lower in cuttings stored for five to seven months at -20 (degrees) C and -10 (degrees) C, when compared with cuttings stored at -3 (degrees) C and 2 (degrees) C. Concentrations of all sugars and starch were highest in upper shoot positions, but total quantities were greatest in the larger-diameter basal stem positions. Throughout the five weeks of development in a growth chamber, shoots and roots developing from these hardwood cuttings continued to use ¹⁴C-labeled reserves for respiration and growth. Most of the reserves were incorporated into the chloroform, protein, and residue chemical fractions.

Francis, J.K. 1983. Cherrybark and Shumard oaks successfully planted on eroded ridges. Tree Planters' Notes. 34(2): 28-30.

Three poor old-field ridge sites in Mississippi were disced or ditched on the contour in winter 1961 and seedlings of cherrybark and Shumard oaks (Quercus falcata var. pagodifolia and Q. shumardii), yellow poplar, sycamore (Platanus occidentalis) and cottonwood (Populus deltoides) planted in March. Platanus occidentalis and Populus deltoides failed on all sites. Ditching did not affect survival or height growth of oaks.

Goos, J. 1983. Practical experience with poplars along roads and canals in western Netherlands. Populier. 20(2): 44-52.

Suitable planting stock, spacing, thinning, etc.

Groven, I. 1983. Different species of trees for shelterbelts. Tidsskrift for Planteavl. 87(1): 57-68.

In trials with 13 species of deciduous trees and shrubs planted in 1962 in 3 different types of shelterbelt, Quercus petraea, Fraxinus pennsylvanica, Populus tremula X P. tremuloides and to a lesser extent Ulmus minor [U. carpinifolia] were suitable as high shelter, and Sambucus nigra, Lonicera ledebourii, and Prunus serotina were suitable as low shelter.

Hansen, E.; Moore, L.; Netzer, D.; Ostry, M.; Phipps, H.; Zavitkovski, J. 1983. Establishing intensively cultured hybrid poplar plantations for fuel and fiber. Gen. Tech. Rep. NC-78. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 24 p.

A step-by-step procedure is given for establishing commercial plantations, and alternative methods are discussed based on results from 10 years of field research at Rhinelander, Wisconsin.

Heilman, P.; Stettler, R.F. 1983. Phytomass production in young mixed plantations of Alnus rubra and cottonwood in western Washington. Canadian Journal of Microbiology. 29(8): 1007-1013.

The use of red alder in a mixture with 28 clones of cottonwood in close spaced, short-rotation culture was investigated. Early growth was rapid, with red alder averaging 7.2 m and cottonwood mixed with alder averaging 8.2 m in height after 3 years. Dry weight production on mixed plots was generally less than for pure cottonwood. The best cottonwood clone was a hybrid (Populus trichocarpa X P. deltoides). Results indicated severe decline in nitrogenase activity where overtopping and shading of red alder by adjacent cottonwood occurred. Since the highest yielding cottonwood clones are much more productive at this site than the alder used, there would seem to be little

incentive for mixed plantings of these species under the conditions of this experiment.

Heinemann, R.A.; Hennessey, T.C. 1983. Foliar nutrient analysis of cottonwood on a marginal site under various cultural treatments. In: Thielges, B.A., ed. Proceedings, 7th North American forest biology workshop: Physiology and genetics of intensive culture. Lexington, KY: University of Kentucky: 301-304.

Foliar nutrient analysis of samples of known physiological age taken from two levels in the crown of 4-year-old cottonwood (Populus deltoides), grown under various agricultural intercropping treatments, showed upper crown samples consistently ranked higher in nutrient content than those from the lower crown. Foliar nutrient concentrations were of similar magnitude for intercropped (oats or rye-vetch) and clean-tilled treatments.

Janson, L. 1983. Nutrient requirements of Norway spruce and aspen in relation to their coexistence. *Sylvan*. 127(12): 43-49.

Nutrient uptake was measured in 3 seedlings of spruce and 1 of aspen (Populus tremula X P. tremuloides) grown together in Wagner pots. Spruce foliage contained much less N, P, K, Mg, and Zn and more Fe and Mn than aspen. Shoots and roots of spruce contained much more Fe and Mn than aspen, but concentrations of other elements were much closer between species than for foliage. The uptake and accumulation of excess Mn and Fe by spruce and the annual enrichment of soil through aspen leaf fall are considered important factors in their successful coexistence in mixed stands.

Kalchev, P. 1983. Growth of poplar plantations in relation to the method of soil preparation. *Gorskostopanska Nauka*. 20(5): 67-72.

Four different methods were compared for site preparation on felled poplar sites: (1) stumps left in situ, shallow disc harrowing, and planting between the stumps; (2) stumps chipped with the Rotor Levaceppi machine, disc harrowing; (3) stumps chipped with the Rotor Levaceppi, deep plowing and leveling; (4) stumps grubbed out, holes filled in with bulldozer, deep plowing and leveling. One-year plants of Populus cv. Bachelieri were planted and their growth was monitored. The results are tabulated and show little difference between treatments (3) and (4), which were both superior to (2) and especially to (1).

Kang, H. 1983. Founding concepts for tree breeding and research. In: Hansen, E.A., comp. Intensive plantation culture: 12 years research. Gen. Tech. Rep. NC-91. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 149-154.

A report containing 20 papers predominantly on hybrid poplar, presented at the annual review at the end of a 5-year chartered Research and Development Program on the maximum yield of wood and energy from intensively cultured plantations.

Kaul, O.N.; Sharma, D.C.; Tandon, V.N. 1983. Biomass distribution and productivity in a poplar plantation. *Indian Forester*. 109(11): 822-828.

Data are presented on biomass distribution and productivity of an 8-year-old plantation of Populus deltoides 'IC' in Uttar Pradesh, planted for the first 3 years with agriculture crops such as wheat, maize, and oil seeds.

Kaushal, P.S. 1983. Spacing for nursery plants of Populus deltoides cv. 'G-3'. Journal of Tree Sciences. 2(1/2): 97-98.

Data are given on the height and diameter growth of stem cuttings of P. deltoides cv. 'G-3' [P. 'G-3'] planted at different spacings in a nursery trial at the Punjab Agricultural University Campus. Wider spacings gave better growth than narrower spacings, but there were no significant differences between 20X20 and 30X30 and between 40X40 and 50X50 cm spacings. The proportion of good quality stock was also greater at larger spacings. An optimal spacing of 40X40 cm is recommended for this important agroforestry tree.

Kohan, S. 1983. Forest operations in stands of Euramerican poplars. Acta Instituti Forestalis Zvolenensis Vyskumny Ustav Lesneho Hospodarstva. 6: 181-194.

Kozłowska, C. 1983. Health of some balsam poplar cultivars in Poland. Prace Instytutu Badawczego Lesnictwa, Poland. 616/620: 3-25.

Health status was assessed on a numerical scale of 7 cultivars of Populus section Tacamahaca at 32 sites throughout Poland with values of Seljaninov's hydrothermic index of 1.4-2.5. Best health was in the Carpathian and Baltic regions with indices of 2-2.5 and with P. 'Androscoggin' and the P. trichocarpa cultivars '96' and 'Fritzi Pauley'. Careful protection of wounds is necessary in P. trichocarpa because of slow healing.

Krest'yashina, L.V.; Arno, G.I. 1983. Natural regeneration in recreation forests, and ways of improving it. Lesnoe Khozyaistvo. 8: 54-56.

Data are presented on the numbers, height, and condition of natural regeneration of the main tree species (Scots pine, Norway spruce, birch, aspen, alder) in various forest types near Leningrad, subject to various amounts of recreation pressure. The amount and quality of natural regeneration declines sharply with increasing recreational pressure.

Krinard, R.M.; Kennedy, H.E., Jr. 1983. Growth, thinning treatments, and soil properties in a 10-year-old cottonwood plantation on a clay site. Res. Note SO-302. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 4 p.

Sample plots containing 2 of 4 Stoneville clones of Populus deltoides planted in an old field in Mississippi in December 1971 were thinned or left unthinned in March and April 1977. Soil N, P, K, Ca, and Mg contents were greater than after 5 years, but only Ca equaled and Mg exceeded the values in 1971.

Krinard, R.M.; Kennedy, H.E., Jr. 1983. Ten-year growth of five planted hardwood species with mechanical weed control on Sharkey clay soil. Res. Note SO-303. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment station. 4 p.

In trials with 5 hardwood species planted near Stoneville in 1971, disking for weed control gave better tree growth than mowing in the first 5 years. Tree volumes were approximately double. Cultural treatments had no effect on soil moisture but there were small differences in soil properties. Cottonwood (Populus deltoides) showed the highest growth.

Landerink, H. 1983. Poplars for planting on borders of the domanial estate Cromstrijan. *Populier*. 20(2): 58-60.

Meijer, J.P.H. 1983. Poplars along roads and canals in the Dutch landscape. *Populier*. 20(2): 36-43.

Ming, F.F.; Li, C.H.; Shi, Y.X; Zhou, S.Y.; Cheng, L.; Yue, G. 1983. A preliminary report of research on the planting technique of shelter forest in the grasslands in semi-desert areas near the eastern foothills of Helan Mountain. *Ningxia Agricultural Science and Technology (Ningxia Nongye Keji)*. 5: 17-19.

A report of a program carried out at the Grassland Experiment Station, Helan County, Ningxia in 1980. Major shelterbelts were established in planted pastures at intervals of 100-200 m; minor belts ran perpendicular to the major ones at intervals of about 600 m. The tree species used were Cooperative poplar, Xinjiang poplar, Robinia pseudoacacia, Ulmus americana, and Salix cheilophila. The most cold-tolerant species were Cooperative poplar, Pinus sylvestris var. mongolica and P. sinensis [tabulaeformis] and the shrubs Calligonum mongolicum, Hedysarum scoparium, Carogana korshinkii, Amorpha fruticosa and Salix cheilophila. Timely planting, careful site preparation, deep planting of large seedlings, rational irrigation, and intensified improvement were all necessary measures for obtaining good results.

Mohlenbruch, N.; Scheffler, M.L. 1983. Recognized and misunderstood aspects of the use of poplar in revegetation. *Allgemeine Forstzeitschrift*. 48: 1292-1295.

A review of the history of the use of various poplar clones in the Rhineland brown coal-mining district. Early plantings mainly utilized Populus nigra clones, but P. balsamifera clones became more popular later. In current practice, poplar is used mainly as a nurse crop and for soil amelioration and erosion control.

Nas, R.M.W.J. 1983. The choice of poplars in the planning stage. *Populier*. 20(2): 30-35.

Nas, R.M.W.J. 1983. The use of poplars by the highways section of the State Forest Administration. *Populier*. 20(2): 27-29.

Netzer, D.A.; Hansen, E.A. 1983. Controlling weeds in poplars by dormant season glyphosate overspray. In: *Proceedings, North Central weed control conference; Columbus, Ohio*. Ames, IA: Iowa State University: 141-142. Abstract.

Glyphosate or dichlobenil sprayed in poplar plantations in spring or early autumn damaged the trees and stunted growth, but spraying between 20 October and 20 May 1980, during the dormant period, gave good weed control without affecting the trees.

Noh, E.R.; Ahn, J.K.; Kim, Y.M.; Lee, S.B. 1983. Influence of cutting diameter on survival and height growth in Populus nigra X P. maximowiczii F1 clones. *Journal of Korean Forestry Society*. 59: 57-62 .

Initial diameter, survival, and height growth were recorded of cuttings of 8 clones. Survival increased with cutting diameter. Height growth of

cuttings with diameter 13 mm was greater than that of those 13 mm. Daily height growth reached a peak in August and then decreased. There were significant differences among clones in both survival and height growth.

Padro, A. Hernandez Leon, M. 1983. Duality rotation-spacing in poplar plantations: study of a specific case. *Anales del Instituto Nacional de Investigaciones Agrarias. Serie: Forestal.* 7: 83-97.

Perala, D.A. 1983. Shearing restores full productivity to sparse aspen stands. Res. Note NC-296. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 4 p.

Four mature but understocked stands of quaking and bigtooth aspen (Populus tremuloides and P. grandidentata) in Wisconsin were regenerated by 'shearing' trees with a sharp blade mounted on a crawler tractor to produce suckering. It was concluded that the shearing treatment was as effective as complete clearfelling for regenerating aspen.

Putnam, A.R.; DeFrank, J.; Barnes, J.P. 1983. Exploitation of allelopathy for weed control in annual and perennial cropping systems. *Journal of Chemical Ecology.* 9(8): 1001-1010.

A variety of crops, cv. and accessions were evaluated over 6 years for capability to suppress weeds. The most effective regime was to grow cover crops of rye, wheat, sorghum, or barley to a height of 40-50 cm, desiccate the crops by contact herbicides or freezing and allow the residues to remain on the soil surface; up to 95 percent control of weeds was often obtained in the 30- to 60-day period after desiccation. Physical aspects included shading and reduced soil temperature which were similarly achieved using residues of Populus excelsior after glyphosate treatment as a control mulch; chemical aspects included direct release of toxins and production of phytotoxic microbial products.

Schotveld, A. 1983. Road plantings in Flevoland. *Populier.* 20(2): 53-57.
Poplars and willows.

Semizoglu, M.A. 1983. Evaluation of Dibis spacing trial. Rep. No. FAO-FO--DP/IRQ/76/002. 34 p.

Sheikh, M.I. 1983. Effect of cultivation on the growth of poplars. *Pakistan Journal of Forestry.* 33(2): 91.

Two experimental studies are reported. Growing 1-year-old Populus 'I-214' for 4 years with berseem and wheat crops had no effect on height and diameter growth, compared with soil-cultivated controls. In a second study, weeds were allowed to grow in one plot while the second plot was regularly plowed.

Sheikh, M.I.; Raza-ul-Haq. 1983. Depth of irrigation affects volume production in tree species. *Pakistan Journal of Forestry.* 33(1): 25-31.

Plants of 3 species (Salmalia malabarica [Bombax malabaricum], Morus alba, and Eucalyptus camaldulensis) were planted in August 1977 at 2X2 m spacing and on trenches in a compartment of the Chichawatni plantation [NWFP]. Four Populus deltoides clones (72/58, 4/64, 69/55, and 90/60) were planted in a

contiguous area of the Punjab Forest Department in February 1978. Best volume production was by B. malabaricum and least by M. alba.

Sheikh, M.I.; Cheema, A.; Raza-ul-Haq. 1983. Effect of poplars on the yield of wheat at Changa Manga irrigated plantation. *Pakistan Journal of Forestry*. 33(4): 201-207.

Wheat was sown in 1983 in a 1.192-ha plantation of 4-year-old hybrid poplars with average height 15 m, diameter 19 cm, and at a spacing of 5.5X5.5 m the crop was fertilized with urea and canal irrigated. Grazing and wild boar were excluded by fencing. Samples of the crop were taken in 0.5X0.5 m quadrats on all 4 sides of selected trees at distances of 0.75, 1.75, and 2.75 m from the base of the tree. There was no significant difference in any measurement of wheat yield at the 3 distances.

Shi, Q.F. 1983. A summary of trials on intensive cultivation of Populus canadensis and P. pekinica. *Forest Science and Technology (Linze Keji Tongxun)*. 12: 18-20.

A report of trials in the neighborhood of the Chinese Academy of Forest Sciences in 1959-1980. There were 4 experimental areas testing fertilizer application, irrigation, high yield in individual trees and a control area; 2 spacings were used. In each area different tending measures were adopted. Under the same conditions P. canadensis grew more quickly than P. pekinica, had higher resistances to diseases and insects and made a less strict demand on site. A spacing of 3X3 m and a final felling age 10-15 years is suggested.

Singh, R.V.; Virendra Singh. 1983. Germination of Populus ciliata seed as influenced by moisture stress. *Indian Forester*. 109(6): 357-358.

Laboratory tests demonstrated that germination decreased from 73 to 3 percent as moisture stress increased from 0 to -3 atm.

Szczotka, K. 1983. Silvicultural assessment of poplar cultivars using the productivity index as illustrated by selected stands in southern Poland. *Ann. Sclavo (Italy)*. 22: 87-99.

Mensurational data were collected for 7 poplar cultivars growing in stands up to 18 years old at 7 sites. Populus 'Hybrida 275' (NE-42) and P. 'Gelrica' were shown to have the highest value silviculturally and P. 'Marilandica' the lowest, P. 'Hybrida 277' (NE-44), P. 'Robusta', P. 'Grandis', and P. berolinensis were intermediate.

Tauchnitz, E.; Draws, K. 1983. Tree planting in the open landscape. *Sozialistische Forstwirtschaft*. 33(8): 233.

A report on 5-years experience in the Oranienburg State Forest Enterprise (E. Germany) in the use of a patented 'planting plough' that produces furrows 30-60 cm deep and 30-40 cm wide (at bottom) for planting of poplar/willow windbreaks. Work time savings of 150 h/km, and cost savings of 150 M/km were obtained compared with the hole planting method. Survival rates of planting stock averaged 97 percent.

van Broekhuizen, J.T.M. 1983. The poplar trial field at Elst after 50 years. *Nederlands Bosbouw Tijdschrift*. 55(11/12): 380-384.

Data are given on the only surviving trial plantation of a series established in 1933 with 12 commonly used varieties of Populus X canadensis (shown to belong to 6 clones). Volume/ha differed little between clones, except that 'Gelrica' was consistently greater.

Verry, E.S.; Lewis, J.R.; Brooks, K.N. 1983. Aspen clearcutting increases snowmelt and storm flow peaks in north central Minnesota. *Water Resources Bulletin*. 19(1): 59-67.

Clearcutting aspen from the upland portion of an upland peatland watershed in north central Minnesota caused snowmelt peak discharge to increase 11 to 143 percent. Rainfall peak discharge size increased as much as 250 percent during the first two years after clearcutting, then decreased toward precutting levels in subsequent years. Snowmelt volumes did not significantly change. Partial cutting reduced peak snowmelt discharge because melt was desynchronized in cleared and forested parts.

Wang, S.J.; Liu, F.J.; Liu, Y.R.; Wang, S. 1983. Analysis of winter moisture conditions in seedlings of several poplar species and the causes of low survival rate after planting. *Forest Science and Technology (Linze Keji Tongxun)*. 4: 5-9.

Studies on various Euramerican poplars [P. X canadensis] during the winters of 1980-1982 in nurseries at Baoding and Beijing showed that moisture content of P. 'I-69', P. 'I-214', and Populus euramericana cv. Sacrau 79 [P. 'Sacrau 79'] decreased in winter with a high rate of transpiration, and that moisture saturation and water deficit increased sharply. It is concluded that Euramerican poplar seedlings should be kept in a good water regime in winter and that shortening the time of transportation and preventing loss of water from plants could ensure a good survival rate in stand establishment.

Weisgerber, H.; et al. 1983. Growing poplar in northwest Germany. *Holzzucht*. 37(1/2): 1-14, 17-23, 25-30.

A set of 4 papers prepared on the occasion of a meeting in September 1982 of the Association for Non-forest Timber Growing and Poplar Silviculture in northwest Germany.

Zasada, J.C.; van Veldhuizen, R.M.; Norum, R.A.; Teutsch, C.E. 1983. Artificial regeneration of trees and tall shrubs in experimentally burned upland black spruce/feather moss stands in Alaska. *Canadian Journal of Forest Research*. 13(5): 903-913.

Autumn seed-dispersing species, birch (Betula papyrifera), alder (Alnus crispa), and black spruce (Picea mariana), and summer-dispersing species, aspen (Populus tremuloides), balsam poplar (P. balsamifera), feltleaf willow (Salix alaxensis), Scouler willow (S. scouleriana) and Bebb willow (S. bebbiana) were artificially sown on seedbeds created by experimental burning. Germination occurred on moderately and severely burned seedbeds but not on scorched and lightly burned surfaces. Seedling survival occurred almost exclusively on severely burned surfaces.

Zavitkovski, J. 1983. Projected and actual biomass production of 2- to 10-year-old intensively cultured Populus 'Tristis No. 1'. In: Hansen, E.A., comp. Intensive plantation culture: 12 years research. Gen. Tech. Rep. NC-91.

St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 72-76.

Zimmerman, J.H. 1983. The revegetation of a small Yahara Valley prairie fen. *Transaction of the Wisconsin Academy of Sciences, Arts and Letters*. 71(2): 87-102.

Following sewer construction in 1971-1972, revegetation of exposed dredged peat on a 3-ha prairie fen was investigated. After manual removal of an initial massive invasion by Salix spp. and Populus deltoides, full plant cover was restored in 2 seasons and 40 out of the original 71 enduring vascular plant species had returned at reasonable to full frequency. The pioneering woody species were considered as local or temporary dominants in an otherwise sedge/grass-dominated system maintained primarily by consistent groundwater input.

1984

1984. Agroforestry in Minnesota: a status report. In: Berguson, W.E.; Farnham, R.S.; Levar, T.E.; Sherf, D.B.; Fuchsman, C.H.; Spigarelli, S.A., eds. *Proceedings of international symposium on peat utilization*. Bemidji, MN: Bemidji State University: 277-286.

Preliminary data are presented on the suitability of Salix and Populus to agroforestry for energy production on peatlands in Minnesota.

Bartos D.L.; Lester, J.E. 1984. Effects of 2,4-D on a Populus tremuloides community in the western United States - 22 years after treatment. *Great Basin Naturalist*. 44(3): 459-467.

Bulir, P.; Scholz, J.; Suchara, I. 1984. A contribution to the evaluation of windbreaks in the Lednice na Morave areas. *Acta Pruhoniana*. 48: 35-66.

Some 5,800 shelterbelts, covering an area of 12,125 ha, were established by group sowing of several tree species including Juglans nigra, Prunus mahaleb, Gleditsia triacanthos, and Populus spp. in 1950-1952. Soil humus content was always highest in Populus alba and P. tremula belts, suggesting the suitability of poplars as the main species for orchard protection and landscape planting. The shelterbelts were considered to be of practical and aesthetic value.

Du, Y.J. 1984. A preliminary report of planting trail with branches of poplars after being soaked. *Forest Science and Technology (Linze Keji Tongxun)*. 4: 17-18.

A discussion of trials with 2-year-old shoot cuttings and 3-year-old seedlings. Results showed a difference in the survival rate. Cuttings also grew better in d.b.h., basal diameter, height as well as establishing larger root systems. This method is relatively cheap and is especially suitable for rapid establishment of high-yield or shelterbelt stands in dry areas in China.

Erdo, L. 1984. Contemporary aspects of poplar growing on state farms. *Erdo*. 33(11): 509-512.

The annual production of poplar wood in Hungary is 700,000 m³: half of this is grown on state farms and cooperative farms on 30,000 ha of marginal land withdrawn from cultivation.

Feng, D.Q.; Sun, Q.J. 1984. Discussion on the optimum period of planting in Xinjiang with six tree species including Fraxinus americana. Forest Science and Technology (Linye Keji Tongxun). 12: 11-14.

Trees of F. americana, Elaeagnus angustifolia, white willow [Salix alba], Afghan poplar, Xinjiang, and Henan white elms were planted and observed. The growth of new roots and the growth of trees in different growing periods were examined. Results showed that species which start dormancy earlier, with large, vigorous terminal buds and new shoots, could be planted in spring as well as in autumn.

Frison, G. 1984. New method for pruning poplar. Cellulosa e Carta. 35(3): 28-46.

A detailed description is given of a gradual, selective method of pruning, which can be used for trees grown from 1- and 2-year-old saplings of traditional or more recently selected clones. An account is given of branching in poplars and guidelines are given, on the period for pruning, equipment needed, and cutting patterns.

Frochot, H. 1984. Influence of Festuca pratensis on the development of young poplars. Paris, France: COLUMA/EWRS: 307-313.

Young poplars (Populus trichocarpa cv. Fritzi Pauley) were planted in a regular network in a sward of F. pratensis cv. Comtessa. Each tree was surrounded by a circle of bare soil. The soil was a brown eutrophic clay type and the sward was mown once a year. Observations indicated a close correlation between tree growth and the plant-free area. The influence of the grass on poplar height and dry timber weight increased with increasing proximity.

Grodzinski, W.; Weiner, J.; Maycock, P.F., eds. 1984. Forest ecosystems in industrial regions: studies on the cycling of energy, nutrients and pollutants in the Niepolomice Forest in southern Poland. Berlin; Springer. 267 p.

Chapters include: forest functions in industrial regions, stand conformity with site, site formation, selection of trees and shrubs for forest restructuring in industrial regions, and the Niepolomice Forest as an example of a forest affected by industrial stress.

Guo, L. 1984. Afforestation of sandy deserts in Inner Mongolia. Forstarchiv. 55(1): 27-29.

Notes are given on the use and site tolerance (to pH, salt) of the following species: Pinus sylvestris var. mongolica, Pinus tabulaeformis, Populus simonii, Populus euphratica, Elaeagnus angustifolia, Caragana microphylla, and Haloxylon ammodendron.

Hansen, E.A.; Netzer, D.A. 1984. Geese, grass, and trees. Tree Planters' Notes. 35(1): 10-11.

Linuron was applied at 1.6 kg/ha a.i. in May to 4 plots in Wisconsin just before planting unrooted hybrid Populus cuttings. Four other plots were

weeded by goslings from mid-June to mid-August. Tree height, survival, and damage from grazing were recorded in October. Trees in plots weeded by geese were significantly shorter, averaging less than half the height of trees in plots treated with linuron. Survival was also lower: 63 percent in plots with geese; 85 percent in plots treated with linuron.

Hansen, E.; Netzer, D.; Rietveld, W.J. 1984. Site preparation for intensively cultured hybrid poplar plantations. Res. Note NC-320. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 4 p.

The effects of five site preparation methods on survival and total height of 2-year-old hybrid poplars are compared. Fall application of glyphosate followed by plowing and disking was one of the most effective yet operationally simple techniques.

Hansen, E.; Netzer, D.; Rietveld, W.J. 1984. Weed control for establishing intensively cultured hybrid poplar plantations. Res. Note NC-317. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 6 p.

Hardin, E.D. 1984. Variation in seed weight, number per capsule and germination in Populus deltoides Bartr. trees in southeastern Ohio. American Midland Naturalist. 112(1): 29-34.

Hoganson, H.M.; Rose, D.W. 1984. A simulation approach for optimal timber management scheduling. Forest Science. 30(1): 220-238.

A description of a method of simulating the optimal timing of management operations, assuming that future forest output is difficult to predict so that minor violations of output constraints are not critical. It is based on the economic interpretation of the key dual variables of a linear programming formulation of the problem. The schedule developed is tested for feasibility by comparing its forest output to estimates of desired output. Examples are given of harvesting aspen [Populus tremuloides] and red pine [Pinus resinosa].

Johansson, T. 1984. Sheep grazing on reforestation areas. In: Saastamoinen, O., et al., eds. In multiple-use forestry in the Scandinavian countries: Proceedings of the symposium; 1982 September 13-17; Rovaniemi and Saariselka, Finland. Communicationes Instituti Forestalis Fenniae. 120: 109-112.

In grazing trials on reforestation areas in Sweden since 1970, sheep grazed shrubs of aspen (Populus tremula) and rowan (Sorbus aucuparia) successfully, but not birch (Betula pendula, B. pubescens) or alder (Alnus glutinosa, A. incana). Conifer plants were not damaged. Grazing by sheep is regarded as a useful alternative to cleaning by brush saw on forest areas near population centers and lakes.

Kalchev, P. 1984. Effect of soil cultivation on growth and yield of poplar plantations. Gorsko Stopanstvo. 40(2): 28-30.

In Bulgaria, poplar plantations are not usually cultivated after the first 4 years. Details are given of the growth of a Populus 'Bachelieri' plantation, spacing 5X5 m, in which soil cultivation was continued annually up to age 11. The cultivation resulted in improved growth.

Knowe, S.A. 1984. Herbaceous weed control in slash pine and cottonwood plantations. In: Proceedings, Southern weed science society, 37th annual meeting: 214-217.

Studies were conducted in seedlings of Pinus elliottii on a poorly drained P-deficient loam soil in Louisiana and of Populus spp. on a highly fertile alluvial clay loam, subject to flooding, by the Mississippi River.

Kohan, S. 1984. Experiences with cultivation of poplars on unfavorable locations of East Slovakian Lowlands. *Zpravy Lesnickeho Vyzkumu*. 29(2): 6-9.

Kohan, S. 1984. Some results of the intensification of the cultivation of Euramerican poplars on heavy soils of the East-Slovakian lowland. *Lesnický Casopis*. 30(6): 511-526.

Krinard, R.M.; Burkhardt, E.C. 1984. Growth through 13 years of two pruned cottonwood plantations spaced for sawtimber production. *Southern Journal of Applied Forestry*. 8(4): 221-223.

Plantations of Populus deltoides established in Mississippi and Arkansas in 1968 were thinned in the 2nd season. They were pruned in the spring or summer of the 3rd or 4th season. Pruned trees did not differ from unpruned trees in diameter growth and in height.

Lai, J.Z. 1984. Studies on the mechanism of the increase of production of the mixed deciduous plantation in the light serozem belt in the Ningxia Autonomous Region. *Scientia Silvae Sinicae*. 20(2): 205-211.

A comparison was made of the characteristics of mixed locust [Robinia pseudoacacia]/poplar and pure poplar plantations from 1975 to 1983. The mixed plantations showed a 40-80 percent increase in volume per unit area and had fewer insect pests and diseases. Soil analysis indicated improved chemical characteristics and fertility in the mixed plantation.

Larson, R.P. 1984. Using ultra low-volume basal techniques to control brush on rights-of-way. In: Proceedings, Northeastern Weed Science Society. (Suppl.) 38: 27-30.

The effectiveness of applying ultra-low volume basal herbicide/penetrant solution (ULVB) to undesirable brush species was compared with the current practice of applying herbicide to basal frill cuts. Triclopyr-ester undiluted or applied in 50 percent fuel oil or methanol or 20 percent citrus oil and fosamine-ammonium mixed with 50 percent fuel oil or 75 percent methanol were applied by means of back-pack sprayers at rates of 6 gallons/acre in late January. Good control of Betula lenta, B. alleghaniensis, Acer spp., Fraxinus americana, Sassafras albidum, Quercus spp., Populus tremuloides, and Liriodendron tulipifera was given by 25 percent triclopyr ester + 75 percent fuel oil.

Ledin, S.; Rytter, L. 1984. Stand establishment of energy forests. In: Egneus, H.; Ellegard, A., eds. Bioenergy 84. Proceedings of conference; 1984 June 15-21; Goteborg, Sweden. Vol. 2. Biomass resources. Barking, UK: Elsevier Applied Science Publishers: 132-138.

Results are briefly reported from research trials in Sweden on suitable methods of preparing sites for intensive energy forestry. The main material

used so far is Salix spp., with Alnus, Populus, and Betula at a few sites. Mechanical and chemical methods of weed control, the use of cover crops, and planting density experiments are described.

Li, Y.Q.; Yang, S.H.; Xu, Q.Y.; Li, W.Y. 1984. Culture techniques for three clones of poplars of the Aigeiros group. Forest Science and Technology (LinYE Keji Tongxun). 9: 17-19.

The introduction of clones 'I-69/55', 'I-63/51' ['Harvard'] and 'I-72/58' has been successful in the E. plains of China, S. of the Huaihe River especially in the middle and lower reaches of the Changjiang River. Experiments showed that in areas lying between 23deg and 33deg N. with an annual average humidity of 71-82 percent, survival rate of plantations was 97 percent. Intercropping with winter crops during the early years helped to improve the nutrient conditions of the soil. Using stumps for afforestation increased the survival rate and resistance to aridity, and promoted early growth.

Liu, F.J.; Liu, Y.Q.; Wang, S.J.; Zheng, S.K.; Dou, Z.F.; Zang, D.Q.; Sin, Z.Z.; Ma, F. 1984. A study on water metabolism in deeply planted poplars. Ningxia Agricultural Science and Technology (Ningxia Nongye Keji). 6: 8-12, 41.

In the deep planting technique, cuttings with roots cut off are placed in direct contact with groundwater, so that saplings can enjoy a continuous water supply. In 1983, moisture status in Populus 'I-69' and P. 'Robusta' was studied at Juxian County, Shandong Province. It was found that water deficit in branches and leaves of deeply planted poplars was less than in conventional stands. Transpiration rate of trees deeply planted either in spring or in autumn was higher than that of trees in conventional stands. It is recommended that twigs or leaves on the cuttings should in some way be pruned before being planted.

Lowday, J.E. 1984. The effects of cutting and asulam on the frond and rhizome characteristics of bracken (Pteridium aquilinum (L.) (Kuhn). In: Sale, J.S.P., ed. Session 6: Weed control as an aspect of management. Aspects of applied biology 5, weed control and vegetation management in forests and amenity areas. Wellesbourne, Warwick, UK: Association of Applied Biologists, National Vegetable Research Station: 275-281.

Lowday, J.E. 1984. The restoration of heathland vegetation after control of dense bracken by asulam. In: Sale, J.S.P., ed. Session 6: Weed control as an aspect of management. Aspects of applied biology 5, weed control and vegetation management in forests and amenity areas. Wellesbourne, Warwick, UK: Association of Applied Biologists, National Vegetable Research Station: 283-290.

Experiments are also reported on the soil seed population below bracken at Cavenham and Weeting Heaths.

McBride, J.R.; Strahan, J. 1984. Establishment and survival of woody riparian species on gravel bars of an intermittent stream. American Midland Naturalist. 112(2): 235-245.

Factors influencing seedling establishment and survival were studied on gravel bars of lower Dry Creek, Sonoma County, California. Seedling establishment was correlated with sediment texture. Salix spp. established preferentially on areas where surface sediment size was less than 0.2 cm. Populus fremontii established more densely on areas of intermediate and large-sized sediments (0.2-1.0 cm). Seedlings which established in areas protected from the swiftest current were able to withstand the winter flows.

Marrs, R.H. 1984. The use of herbicides for nature conservation. In: Sale, J.S.P., ed. Session 6: Weed control as an aspect of management. Aspects of applied biology 5, weed control and vegetation management in forests and amenity areas. Wellesbourne, Warwick, UK: Association of Applied Biologists, National Vegetable Research Station: 265-274.

With particular reference to screening experiments to select herbicides suitable for bracken and scrub control on heathland.

Meggison, J.R. 1984. Successful establishment of farmland amenity tree planting schemes - the case for increased levels of maintenance. In: Sale, J.S.P., ed. Session 6: Weed control as an aspect of management. Aspects of applied biology 5, weed control and vegetation management in forests and amenity areas. Wellesbourne, Warwick, UK: Association of Applied Biologists, National Vegetable Research Station, : 297-303.

An account, and economic and management analyses are given of schemes in Cambridgeshire in 1979-1983.

Miller, Raymond Oyen. 1984. Woody-biomass production in Michigan: species, genotype, and cultural investigations. Dissertation Abstracts International. 45/08-B: 2385.

A stepwise approach was adopted in 1978 for developing a comprehensive woody-biomass production system for Michigan. The program consisted of four phases: (1) Identification of the most promising biomass species through trial plantings on abandoned agricultural fields and cleared forest stands, (2) Preliminary yield comparisons of several species growing in existing experimental plantations, (3) Species improvement using standard tree improvement techniques, and (4) Development of cultural techniques designed to optimize woody-biomass yield from energy plantations. This dissertation summarizes results of research in each of these areas.

Muhs, H.J. 1984. Fast-growing trees in short rotations - productivity, breeding, ecological, forest policy and agricultural policy aspects. Forstarchiv. 55(5): 171-174.

A discussion on a long-term joint programme being organized in W. Germany to study the possibilities and limits of this kind of intensive silviculture. Some 80 clones or varieties of poplar, aspen, and willow are to be tested at 4 sites. It is suggested that intensive silviculture will be of particular use in areas where agriculture or 'normal' forestry cannot be practiced for economic or environmental reasons.

Myers, C.C.; Buchman, R.G. 1984. Manager's handbook for elm-ash-cottonwood in the North Central States. Gen. Tech. Rep. NC-98. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 11 p.

Presents a key for choosing silvicultural practices for the Ulmus americana/Fraxinus pennsylvanica/Populus deltoides type which is confined to floodplains throughout the North Central States.

Noh, E.R.; Ahn, J.K.; Hyun, S.K. 1984. Growth and adequate sites for the hybrid poplar, Populus nigra X Populus maximowiczii F1 clones in Korea. Res. Rep. 20. Suweon, Korea: The Institute of Forest Genetics: 46-51.

Parfitt, R.I.; Stott, K.G. 1984. Effects of mulch covers and herbicides on the establishment, growth and nutrition of poplar and willow cuttings. In: Sale, J.S.P., ed. Session 6: Weed control as an aspect of management. Aspects of applied biology 5, weed control and vegetation management in forests and amenity areas. Wellesbourne, Warwick, UK: Association of Applied Biologists, National Vegetable Research Station: 305-313.

Poplar and willow cuttings were grown in polyethylene or straw-mulched soil and in weed-free, bare soil conditions. Differences in root and shoot growth, and in mineral nutrition were related to soil moisture and temperatures under these cultural conditions. The effects of partial weed cover on shoot growth and leaf nutrient content were also investigated.

Scott, R.; Marrs, R.H. 1984. Impact of Japanese knotweed and methods of control. In: Sale, J.S.P., ed. Session 6: Weed control as an aspect of management. Aspects of applied biology 5, weed control and vegetation management in forests and amenity areas. Wellesbourne, Warwick, UK: Association of Applied Biologists, National Vegetable Research Station: 291-296.

Reynoutria japonica (Polygonum cuspidatum) on urban sites in the UK.

Shankman, D. 1984. Tree regeneration following fire as evidence of timberline stability in the Colorado Front Range, U.S.A. Arctic and Alpine Research. 16(4): 413-417.

Quantitative data collected on a site severely burned in 1905 showed that tree regeneration is occurring. Picea engelmannii and Pinus flexilis, the dominant species before the fire, became re-established shortly after disturbance. Populus tremuloides was found in the upper and mid-areas of the burn, and Abies lasiocarpa was second to P. engelmannii in frequency. Increasing rates of seedling establishment and survival suggest that complete recovery is possible with no change in the timberline.

Sheikh, M.I.; Raza-Ul-Haq. 1984. Growing space requirements of hybrid poplar. Pakistan Journal of Forestry. 34(1): 19-23.

One-year-old plants of Populus 'I-214' were planted at 7 different spacings on irrigated land at Changa Manga (southeast of Lahore) in February 1976. Soil cultivation was carried out until March 1977. Diameter growth was greatest at spacings of 3.7x3.7 to 4.9x4.9 m, and height growth at 2.4x2.4 to 3.7x3.7 m. Volume growth was greatest at the closest spacing and least at the widest. It is recommended that poplar for wood production for pulp, paper, and chipboard be planted at close spacings and worked on a 5-6 year rotation.

Sheikh, M.I.; Khaliq, A.; Noor, M. 1984. Effect of tree windbreaks on the yield of wheat in the Thal Desert under irrigated conditions. *Pakistan Journal of Forestry*. 34(3): 137-144.

A report of studies at 3 farms, 2 with windbreaks of shisham [*Dalbergia sissoo*], 25 and 3 years old (respectively about 20 and 2 m tall), and 1 with windbreaks of *Populus* 'I-214' (20 m tall) and of shisham. Wheat was grown under irrigated conditions. The economic gain from sale of windbreak wood more than compensated for the grain loss near the windbreaks.

Song, M.L.; Song, Z.Z. 1984. A study on nursery practice with *Populus tomentosa* saplings topped at different intensities. *Forest Science and Technology* (Linze Keji Tongxun). 1: 4-6.

In order to improve the quality of young plants in an area of poor site quality, a study on plant topping [shoot pruning] was performed in 1982, based on trials demonstrating that lighter topping gave better results than cutting stems at full length. In a field nursery of uniform site quality in Hebei Province 10 groups of young plants were topped at intensities of 10-100 percent, with intact plants kept as controls. The best intensity was about 40 percent, which gave an increase in plant height of 77.3 percent compared with 61.4 percent for plants cut at full length, and 54.2 percent for controls.

Souleres, G. 1984. Forest poplars. *Revue Forestiere Francaise*. 36(6): 437-452.

The poplar clones most commonly used in plantations (mainly *Populus* 'I-214' and *P.* 'Robusta') require highly fertile sites. However, other poplars from sections Tacamahaca and Leuce, which are less demanding and can tolerate more competition, can be used on less fertile 'forest' sites. Balsam poplars seem promising, and *P. trichocarpa* clones already play an important part in several European countries. Hybrid balsam poplars are also useful, particularly the interamerican ones, which are more demanding but more productive than the earlier hybrids of Stout and Schreiner. At the same time, technological studies have revealed a considerable clonal effect on wood quality. The European institutes working on poplars are producing many new cultivars, and much research and development needs to be done before they can be made available to poplar growers.

Stawecha, W.; Varga, L. 1984. Comparative poplar trials in Czechoslovakia and Poland. *Sylvan*. 128(9): 1-9.

Results are given from 15-year-old stands of 16 cultivars of *Populus X canadensis* growing on alluvial soils at Ostromecko (Wisla river valley) and Predocin (Odra) in Poland and Gabcikova (Danube) and Selice Bab. (Wag) in Czechoslovakia. Best growth over the range of conditions was with *P.* 'Flachslanden', *P.* 'Eckhof', and *P.* 'Lons' with *P.* 'Dromling', *P.* 'Gelrica', *P.* 'Grandis', and *P.* 'Neupotz' also performing well. Heavy soils gave better growth than light soils. The cultivars *P.* 'Flachslanden', *P.* 'Lons', *P.* 'Virginiana de Frignicourt', *P.* 'Brabantica', and *P.* 'Marilandica' showed most resistance to bark brown spot and *Dothichiza populea*.

Stredicke, R. 1984. Yields from thinning of a 15-year-old poplar stand. *Holzucht*. 38(1-2): 13-14.

A report on yields from first thinning in a mixed stand containing 4 Populus clones established at Xanten (N. Rhine-Westphalia) with 1+2 stock planted at 6X6 m² spacing in 1969.

Sutton, R.F. 1984. Plantation establishment in the boreal forest: glyphosate, hexazinone, and manual weed control. *Forestry Chronicle*. 60(5): 283-287.

Treatments were applied in autumn 1976 or summer 1977 to an area in Ontario clear felled in 1969 that contained (a) Pinus banksiana natural regeneration and (b) post-harvest broadleaved growth (mainly Populus tremuloides); (c) bare rooted 2+2 Picea glauca was planted in June 1978. Results show that (a) was not benefitted by any treatment and (b) was only controlled in the long-term by summer-applied glyphosate.

Tang, P.K. 1984. Approaches to and major plans for establishment of mixed stands in forest areas in Heilongjiang Province. *Forest Science and Technology (Linze Keji Tongxun)*. 3: 10-11.

A discussion recommending good use of naturally regenerated broadleaved woods and the introduction of conifers in line with local conditions. Successful examples of past experience and recent experiments are provided, such as the establishment of mixed stand of naturally regenerated poplar and birch and Pinus koraiensis and also that of naturally regenerated broadleaved weed trees and Picea asperata.

Tuley, G. 1984. Trees in shelters do need to be weeded. In: Sale, J.S.P., ed. Session 6: Weed control as an aspect of management. Aspects of applied biology 5, weed control and vegetation management in forests and amenity areas. Wellesbourne, Warwick, UK: Association of Applied Biologists, National Vegetable Research Station: 315-318.

Tuszynski, M. 1984. Effect of site preparation on the growth and development of forest plantations. *Sylvan*. 128(11): 1-11.

Plantations of Scots pine, larch [Larix decidua], Norway spruce, birch, aspen [Populus tremula], oak and Douglas fir were established in 1968 on various site types in central Poland prepared by (a) complete plowing to depths of 25, 50, or 70 cm or (b) furrowing in strips. Height c.a.i. was greater at first in (a) than (b), especially for deep plowing.

van Mieghem, A.; Schalck, J.; Stevens, M. 1984. Productivity of single stem poplar plantations in Belgium. In: Auclair, D., ed. Proceedings, IUFRO S4.01.00 meeting; 1983 October 3-7; Orleans, France. *Colloques de l'INRA*. 19: 179-188.

Growth was studied over 10 years in Populus 'Unal' and P. 'Beaupre' grown at various spacings.

Varfolomeev, V.E. 1984. Determination of the dates and norms of irrigation of poplar plantations by the transpiration intensity. *Lesnoe Khozyaistvo*. 11: 49-52.

von Strenge, B. 1984. Twenty years experience with poplar in forests in the Neukirchen Forest District. *Allgemeine Forstzeitschrift*. 41: 1032-1034.

A report on poplar silviculture as practiced in this region of Hesse since 1964. Rotations of 40 years are planned for Populus balsamifera and 50-60 years for aspen. Poplars have been used to replace windthrown areas in Norway spruce stands, in gaps and strips in or adjacent to beech stands, in strips for wind protection in young spruce stands, and in groups for protection of beech or oak natural regeneration.

Xia, L.Y.; Wang, F.X. 1984. A preliminary study on planting of poplars with 'three-large-and-one-deep' technique. Forest Science and Technology (Linze Keji Tongxun). 4: 18-22.

'Three-large-and-one-deep' refers to the use of large saplings, large pits, large spacing between rows and deep planting. Though labor consuming and costly, this method produces high yields, shorter rotations, timber of better quality and value and therefore higher economic efficiency, especially in areas where soil conditions are not very good. Pruning of lateral branches, depending on irrigation, size of pits, and planting methods are also discussed.

Xu, X.Z.; Lu, S.X.; Zhao, R.T. 1984. The division of regions for the introduction of southern type poplars. Journal of Nanjing Institute of Forestry. 4: 18-28.

Correlations between climatic factors and the growth of Populus 'I-69/55', P. 'I-72/58', and P. 'I-214' and regression equations were used to identify optimum, favorable, suitable, and unsuitable areas in China for their introduction.

1985

Boon, C.; de Vries, S.M.G.; Bosma, N.J.; Meijer, J.P.H.; van de Knaap, P. 1985. Poplar growing in short rotations. Populier. 22(3): 47-62.

A special number on various aspects of such plantations (qualifying for state subsidies).

Borzini, G. 1985. Aerial application methods for crop protection in agriculture and forestry; results from three years of trials. Informatore Agrario. 41(42): 101-109.

Papers presented at a conference at Turin in 1985 covered the application of fungicides in vineyards in 1982-1984 by helicopter (as compared with tractor application). Disease control was good with aerial application. The addition of an anti-drift compound can reduce the problems occurring when dithiocarbamates are applied aurally.

Boyd, R.J.; Miller, D.L.; Kidd, F.A.; Ritter, C.P. 1985. Herbicides for forest weed control in the inland northwest: a summary of effects on weeds and conifers. Gen. Tech. Rep. INT-195. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 66 p.

Tables show summaries of results of published and unpublished studies on the effectiveness of various herbicide treatments in controlling 34 shrubs and herbaceous species and of the phytotoxic effects of the herbicides on 10 conifers. Data given include chemical formulations, rate of active

ingredient, carrier, adjuvants, total mix application rate and timing of application.

Burykin, A.M. 1985. The reclamation role of forest stands and herbaceous species in an industrial landscape. *Lesnoe Khozyaistvo*. 4: 67-71.

An account of experience in the reclamation of extensive spoil mounds associated with open-cast mining in the region of the Kursk Magnetic Anomaly. Data are presented on soil properties and intensity of erosion processes on plots carrying various tree and/or herbaceous species up to 12 years old. The main species involved are Robinia pseudoacacia, Elaeagnus angustifolia, poplar, birch, etc., and lucerne, natural herbaceous vegetation, or grass/legume sowings.

Busch, H.P.; Kreysa, J. 1985. Production of wood biomass in short rotations for use as an energy source. 1. 2. *Holz-Zentralblatt*. 111(151; 152): 2211-2212; 2225-2226.

An evaluation of intensive poplar silviculture trials at 14 sites in W. Germany, based on 6-year results extrapolated over a 15-year total rotation (with coppicing at intervals of less than or equal to 5 years). Overall, results indicated that fuel plantations on forest sites are uninteresting from the economic point of view, but that plantations established on abandoned agricultural land can be profitable.

Buss, B.; Meyer, W. 1985. High-quality broadleaves in Rhineland-Palatinate. *Holz-Zentralblatt*. 111(5): 54, 56.

A discussion of the distribution, site requirements, and management of poplar, ash, Acer pseudoplatanus, A. platanoides, and Prunus avium, with an evaluation of log market conditions and uses for these timbers. The importance of these species is expected to increase.

Chen, G.H.; Fu, J.G.; Chen, H.B. 1985. Use of glyphosate in forestry practice. *Forest Science and Technology (LinYE Keji Tongxun)*. 3: 29-32.

A discussion covering weed control in forests, on mountains, and to produce firebreaks. For weed control under sensitive trees, such as poplars, it is recommended that spraying is restricted to below the crown. Use with other herbicides is recommended as this is often cheaper and more effective.

DeByle, N.V., ed. 1985. Symposium proceedings: Situation management of two Intermountain species: aspen and coyotes. Vol. 1. Aspen; 1981 April 23-24; Logan, UT. Logan, UT: Utah State University. 99 p.

Eleven papers.

Dou, Z.F. 1985. Effect of stems cut on the survival rate and growth of Populus deltoides Bartr. cv. 'Lux' ex. I'69/55. *Forest Science and Technology (LinYE Keji Tongxun)*. 9: 17-20.

Populus 'I-69/55' has poor drought tolerance. When the conventional planting method is adopted a poor survival rate is obtained. Stems were cut at different heights before planting - at the soil surface, or at a height of 0.5, 1.0, 1.5, or 2.0 m. Yearlings 3-4 m high were planted at a depth of 1 m. Results showed that the survival rate in all the treatments was significantly higher (90 percent) than that of the controls (60.8 percent).

Among the 5 treatments, those cut to 2.0 m gave the best results with high photosynthate production and good early growth. The annual increments in height and collar diameter were 2.65 and 1.65 times those of the controls.

Esterhuyse, C.J. 1985. Site requirements of the most important commercial trees planted in South Africa. *South African Forestry Journal*. 133: 61-66.

Site factors which should be taken into consideration in the selection of species for afforestation are outlined. Pinus patula, P. elliottii, P. radiata, P. taeda, P. pinaster, P. caribaea var. hondurensis, Eucalyptus grandis, E. cloeziana, E. diversicolor, E. fastigata, E. nitens, E. macarthurii [E. macarthurii], Acacia mearnsii, A. melanoxylon, and Populus deltoides are recommended as suitable for commercial afforestation in South Africa.

Francis, J.K. 1985. Roots of plantation cottonwood: their characteristics and properties. Res. Note SO-314. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 6 p.

The root biomass and its distribution and the growth rate of roots of pulpwood-size cottonwood (Populus deltoides) in plantations were estimated by excavation and sampling.

Francis, J.K.; McCracken, F.I. 1985. The decline and mortality of cottonwood clone Stoneville 124 on a clay soil. Res. Note SO-318. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 3 p.

Geyer, W.A.; Naughton, G.G.; Melichar, M.W.; Palz, W.; Coombs, J.; Hall, D.O., eds. 1985. Biomass gains in coppicing trees for energy crops. Proceedings of the International conference on energy from biomass. 3. European Communities energy from biomass conference; 1985 March 25; Venice, Italy. London, UK: Elsevier Applied Science Publishers: 269-273.

Woody biomass is an appealing energy source. When grown under the short-rotation intensive culture (SRIC) system, fuelwood crops are harvested at a relatively young age. Subsequent crops are dependent upon coppice regrowth from established root systems. Use of species/clones that resprout profusely and consistently is crucial to the successful application of this concept. The biomass yields and sprouting longevity observed in the studies indicate that several deciduous tree species and selected Populus clones have potential for successive coppice harvest cuts in short-rotation energy forest plantations.

Hansen, E.A.; Netzer, D.A. 1985. Weed control using herbicides in short-rotation intensively cultured poplar plantations. Res. Pap. NC-260. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 6 p.

Harniss, R.O.; Bartos, D.L. 1985. Survey of aspen stands treated with herbicides in the western United States. Res. Pap. INT-340. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 6 p.

Aspen (Populus tremuloides) stands in the western USA sprayed with 2.2 kg 2,4-D/ha were compared with unsprayed stands. Average number of suckers was higher in sprayed stands and was generally sufficient for stand rejuvenation. More grass species and fewer forb species were found in the understory of sprayed stands. Vegetative cover was greater in sprayed stands, but OM was deeper in unsprayed stands.

Heilman, P.; Stettler, R.F. 1985. Mixed, short rotation culture of red alder and black cottonwood: growth, coppicing, nitrogen fixation, and allelopathy. *Forest Science*. 31(3): 607-616.

Alnus rubra seedlings were grown in a 1:1 mixture at a spacing of 1.2X1.2 m with 28 Populus clones (25 clones of P. trichocarpa, two of P. deltoides X P. trichocarpa, and one P. deltoides X P. nigra) in a study established in W. Washington in March 1979. Nitrogenase activity of alder declined in the 4th season; competition was the most important factor influencing this decline. Soil N content had no effect on fixation. A pot study showed that ground Populus leaf and litter material inhibited the growth of red alder seedlings, although soil collected from Populus plots had no effect. Results indicated that allelopathy is probably a minor factor under field conditions, at most, and that growing mixed stands may, on balance, be beneficial.

Irving, B.D.; Bailey, A.W.; Taylor, B. 1985. A comparison of seedbed preparation methods following clearing of aspen forest. University of Alberta, Agriculture and Forestry Bulletin. (June, special issue): 80.

Mechanical land breaking treatments applied to cleared aspen [Populus spp.] groves for the control of woody suckers were: breaking with 2 passes of a heavy Rome disc and then discing twice with a Kelo farm disc; not broken, disced twice with a Kelo farm disc; or not broken, not disced. The greater the level of seedbed preparation, the greater the control of aspen. It was concluded that the cost of breaking was justified.

Kairyukshtis, L.A.; Yuodval'kis, A.I.; Ionikas, Yu.V.; Barkauskas, A.P. 1985. Thinnings and current increment of stands. *Lesnoe Khozyaistvo*. 11: 32-36.

A review of the possibility of using thinnings to increase current increment and total productivity of stands, with special reference to the optimum degree of thinning in relation to age. Formulae are presented for oak, ash, spruce, birch, and aspen stands. Optimum intensity of thinning is comparatively low, is closely related to stand age, and decreases with increasing age.

Kalchev, P. 1985. Effect of planting density on the technical and economic indices of poplar plantations. *Gorskostop. Nauka (Bulgaria)*. 22(2): 37-44.

Data are presented on wood production, assortment structure, costs, revenue and profitability for plantations of Populus 'I-214' established at various spacings on typical poplar sites in Bulgaria. Volume production was greatest in the densest plantations, but net revenue and profitability increased with decreasing density. The best spacings were 5x5 and 6x6 m.

Kaufmann, M.R. 1985. New silvicultural options for timber and water yield in the Rocky Mountains. In: Proceedings of the Society of American Foresters national convention. Bethesda, MD: The Society of American Foresters: 237-242.

Kellison, R.C. 1985. Increasing forest productivity and value by managing hardwoods on selected sites within the temperate coniferous forest. In: Ballard, R.; Farnum, P.; Ritchie, G.A.; Winjum, J.K., eds. Forest potentials: productivity and value; 1984 August 20-24; Tacoma, WA. Weyerhaeuser Science Symposium. 4: 277-294.

A discussion of stands in the USA. Management of natural stands by removing merchantable timber and controlling residuals was thought to be profitable in the eastern USA but not in the Pacific NW. Plantations were considered successful only when species were matched to site, robust planting stock was used, sites were intensively prepared and competition was controlled. Use of rooted and unrooted cuttings of genetically improved material, and development of herbicides for competition control were thought to be essential. Supplementary nutrients were considered essential on upland soils.

Lapietra, G.; Coaloa, D.; Sampietro, L. 1985. Timber tree rows in the Lombardy Plain. Quaderni di Ricerca, Centro di Sperimentazione Agricola e Forestale/Istituto di Sperimentazione per la Pioppicoltura, Italy. 5: 18 p.

The historical events which caused a gradual restriction of forests to the less fertile lands in the Lombardy Plain and the development of row plantations of poplars for the production of wood and foliage for fodder and litter are briefly reviewed. The present reduction in production is chiefly due to the greater availability of raw materials and of energy sources other than wood.

Li, D.W. 1985. Tentative evaluation of the results in yield increase from shelterbelts with an agricultural effects index. Forest Science and Technology (Linze Keji Tongxun). 2: 14-15.

An agricultural effects index of forest shelterbelts is described, which is based on the relations between resulting yield increases and decreases. Overall, results showed that yield was increased 17 percent by the shelterbelt.

Li, Y.X. 1985. Research on seedling planting depth in poplar plantations. Journal of North-Eastern Forestry College, China. 13(1): 57-61.

Plantations are commonly established using large seedlings in deep widely-spaced holes. Planting depth should be determined on the basis of climate and site conditions.

Malik, P.S. 1985. Experiences in poplar cultivation. Indian Forester. 111(9): 659-666.

An account of various trial plantations in Haryana along roads, canals, and farm boundaries and in the form of block plantations on farms. The trials were mainly with the clone *P. deltoides* G-3 and growth and survival data for the period 1980/1981 to 1984 for different sites are given, along with the main climatic and soil characteristics of the site. Farming of agricultural crops with intensive hoeing, irrigation, and fertilization can be combined usefully but paddy and millets are not desirable associates.

Noh, E.R.; Lee, S.K. 1985. Studies on optimum site selection methods for the new hybrid poplars: *P. alba* X *P. glandulosa* F1 clones, *P. koreana* X *P. nigra*

var. italica F1 clones, and P. nigra X P. maximowiczii F1 clones. Res. Rep. 21. Suweon, Korea: The Institute of Forest Genetics: 37-52

Reighard, G.L.; Howe, G.; Hanover, J.W. 1985. Effects of chemical weed control and seedling planting depth on survival and growth of aspen. Tree Planters' Notes. 36(1): 3-7.

One-year-old seedlings of Populus grandidentata and P. tremuloides were planted in May 1981 on an old field site in Michigan with root collar diameter 3 or 15 cm below the soil surface. Plots were then sprayed with 2.8 kg/ha a.i. of simazine, diuron, or linuron. All 3 herbicides were toxic to the aspens and reduced height, diameter, and survival. Deep planting seedlings to 15 cm reduced simazine injury.

Singh, R.V.; Sharma, K.C.; Singh, Virendra. 1985. Germination of Populus ciliata seed as affected by depth of sowing. Indian Forester. 111(5): 245-249.

Three successive experiments were carried out and it was finally concluded that sowing on the surface is best, and that even the slightest covering of sand has an adverse effect.

Singh, Kamla; Singh, Virendra; Singh, J.P.; Kothari, S.K. 1985. Cultivating medicinal and aromatic plants along agro-forestry. Indian Farmers Digest. 18(9): 34-36.

Herb and essential oil yields of Mentha arvensis, M. piperita, M. citrata [M. piperita var. citrata], M. spicata, Cymbopogon winterianus, C. martinii, and C. flexuosus grown under three tree species, are reported. Results were better under poplar than under Eucalyptus or soobabul.

Stoffel, J.W. 1985. Spatial variation in a young poplar forest. Populier. 22(4): 76-79.

Discusses the use of changes in spacing, thinning patterns, undergrowth, etc. to create variation in young poplar stands, taking into account results of a survey of preferred and rejected forest images.

Torbert, J.L., Jr.; Burger, J.A.; Lien, J.N.; Schoenholtz, S.H. 1985. Results of a tree species trial on a recontoured surface mine in southwestern Virginia. Southern Journal of Applied Forestry. 9(3): 150-153.

Five pines (including Pinus strobus, P. sylvestris, and P. echinata) and 10 broadleaved trees (including Quercus prinus, Q. rubra, Liriodendron tulipifera, Juglans nigra, and Castanea mollissima) were planted in April 1981 on a strip mine site that had been remodelled to its original contours. A systemic herbicide (Roundup) significantly increased the survival of 5 species: Populus deltoides, Platanus occidentalis, Fraxinus [americana], Pinus taeda, and P. virginiana. Among the pines, which outperformed the broadleaves as a group, Pinus taeda and P. virginiana were the fastest growing.

Toth, B. 1985. Guidelines for the practical introduction of new poplar and willow varieties. Erdo. 34(8): 361-364.

A guide to the choice of 11 varieties of poplar and 5 of willow authorized by the state for planting in Hungary. Local site conditions are evaluated by

the growth of the 3 test species Populus 'I-214', P. 'Robusta', and P. 'Marilandica'.

Unteregger, E. 1985. Fuel plantation trials in Styria. *Allgemeine Forstzeitung*. 96(11): 291-293.

A discussion of suitable species, silvicultural methods, timber yields, etc., based on several years of experience in the management of 12-ha experimental plots in Austria.

Wang, C.J.; Zhang, G.X. 1985. Continuous nursery practice with Populus tomentosa saplings buried in soils. *Forest Science and Technology (Linze Keji Tongxun)*. 3: 5-6.

A continuous method is described covering: selection of nursery and bed preparation, sapling selection, time and method for burying saplings in the soil, sapling management in the growing stage, lifting plantlets and management of suckers in the next year.

Wittwer, R.F.; Stringer, J.W. 1985. Biomass production and nutrient accumulation in seedling and coppice hardwood plantations. *Forest Ecology and Management*. 13(3/4): 223-233.

Data are given on the biomass and contents of N, P, K, Ca, Mg, and Mn in foliage, branches, stem bark, and stem wood of 5-year-old seedlings and 5-year-old coppice regrowth following harvesting of the seedlings of Platanus occidentalis, Alnus glutinosa, Betula nigra, Fraxinus pennsylvanica, and a poplar hybrid growing in the Ohio River floodplain, W. Kentucky. A. glutinosa and the hybrid poplar produced most biomass in the seedling stands and A. glutinosa produced most in the coppice stands.

1986

Boudru, M. 1986. *Forests and silviculture: applied silviculture*. Gembloux, Belgium: Les Presses Agronomiques de Gembloux. 244 p.

For major species grown in pure stands, details are given of the biology, regeneration and exploitation methods, artificial regeneration and tending, with particular reference to cultivation in Belgium. Poplar cultivation is covered in detail, with information on systematics, ecology, varieties and cultivars grown in Belgium, vegetative propagation, site requirements, silvicultural systems, and pests and diseases.

Crouch, G.L. 1986. Aspen regeneration in 6- to 10-year-old clearcuts in southwestern Colorado. Res. Note RM-467. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 4 p.

Elmore, C.L. 1986. Weed control in Christmas trees. In: *Proceedings, 38th annual California weed conference*. El Macero, CA. 119-122.

Timing of weed control operations and the use of cultivation, cutting and herbicides for weed control in Christmas trees, Eucalyptus, and Populus spp. are discussed.

Farmer, R.E., Jr.; Reinholt, R.W.; Schnekenburger, F. 1986. Environmental preconditioning and variance in early growth of balsam poplar. *Silvae Genetica*. 35(4): 129-131.

Primary ramets of 16 balsam poplar (Populus balsamifera) clones were either subjected to moisture stress for one growing season or left as unstressed controls. Secondary ramets were taken from these primary ramets, rooted and grown for 80 days. Analysis of variance was used to evaluate variation in growth due to treatment, clones, and primary ramets within treatments. Environmental preconditioning by moisture stress had little effect on growth of secondary ramets. However, there was considerable variation associated with primary ramets within preconditioning treatments.

Gates, D.M.; Weber, J.A. 1986. Interaction of H₂O and nitrogen stresses on trees: Progress report, 1 October 1986 to 30 September 1987. Ann Arbor, MI: Michigan University. Biological Station. 55 p.

A major goal was to establish conditions for seed storage and for growth of plants. Data provided confirmation of the growth responses observed, in that a rate of application one fifth of that recommended by the fertilizer manufacturer proved best. Theoretical studies incorporated energy budget equations, solar geometry, and a mechanistic model of photosynthesis into a program that allows prediction of leaf temperature, transpiration, and photosynthesis for leaves in any orientation at any time of the year at any point on the globe.

Gilchrist, A.N. 1986. Rates of diuron for weed control in poplar and willow beds. In: Proceedings, New Zealand weed and pest control conference. Hastings, New Zealand: New Zealand Weed and Pest Control Society: 99-101.

In trials in a tree nursery on a fine sandy loam at the Soil Conservation Centre, Aokautere, cuttings of Salix matsudana X S. alba cv. Aokautere, Populus spp. X P. euramericana cv. Flevo and S. purpurea cv. Irette were treated with up to 5.6 kg diuron/ha. After 1 growing season there was a very highly significant height response overall, but no significant differences in height response between species. It was concluded that a rate of 2.4 kg/ha would be suitable for nurseries growing the tree species tested.

Goreiko, V.A. 1986. Stabilizing gully slopes with protective stands. *Lesnoe Khozyaistvo*. 5: 46-48.

A review is given of experience from recent planting on staggered terraces, to control erosion in the chernozem gully lands of the Upper Dnieper region. Data are tabulated on the total areas planted annually since 1971, and the areas of the main species (viz. Pinus sylvestris, P. nigra var. caramanica, Quercus robur, Robinia pseudoacacia, Juglans regia, and poplar).

Gurth, P. 1986. Special tasks for silviculture in the southern upper Rhine plain. 1. Revegetation of gravel pits and rubbish dumps. *Holz-Zentralblatt*. 112(64/65): 949-954.

A detailed report on plantations and shelterbelts established mainly in the 1960's and 1970's at 6 sites in the Mullheim region, Baden-Wurtemberg. Survival and growth of several species are reported in various trials. Recommendations are given for site preparation and stand establishment and tending. In particular, loosening of fill before planting is recommended at

all sites; encouragement of aerobic decomposition was found useful at former refuse dumps.

Hansen, E.A. 1986. Planting date affects survival and height growth of hybrid poplar. *The Forestry Chronicle*. 62(3): 164-169.

In studies near Rhinelander, Wisconsin, unrooted cuttings of 2 poplar clones (Populus 'Tristis No. 1' and P. 'NC-9922') were planted throughout the period when soil was frost free during 1979-1982. Cuttings were grown with or without soaking for 6 days before planting, irrigation, and weed control by hand-hoeing. Trees planted in early- to mid-May were taller than those planted earlier. This optimum planting time was not affected by clone, soaking, irrigation, or weed treatment.

Hansen, E.A.; Netzer, D.A.; Woods, R.F. 1986. Tillage superior to no-till for establishing hybrid poplar plantations. *Tree Planters' Notes*. 37(1): 6-10.

Krasny, Marianne Elizabeth. 1986. Establishment of four Salicaceae species on river bars along the Tanana River, Alaska. *Dissertation Abstracts International*. 47/04-B: 1391.

Balsam poplar (Populus balsamifera L.), feltleaf willow (Salix alaxensis (Anderss.) Cov.), and sandbar willow (Salix interior Rowlee) are important colonizing species on river bars of the Tanana River Floodplain in interior Alaska. In contrast to balsam poplar and the willows, trembling aspen (Populus tremuloides Michx.) is largely absent from floodplain sites. It was hypothesized that the mode of regeneration of a species was a key factor in determining its ability to colonize. Differences between the species in (1) the ability to produce adventitious roots in response to flooding, (2) water relations, (3) vegetative phenology, and (4) seedling growth rates were also hypothesized to be important in determining the distribution of the species.

Kr"stanov, K.N.; Fakirov, V.; Belyakov, P.; Ganchev, P.; Tsakov, Kh. 1986. Yield trends in poplar plantations. *Gorskostopanska Nauka*. 23(3): 27-36.

An investigation was made of the performance of Populus 'I-214' and P. 'Robusta' at different spacings on a typical poplar site and on a drained site in Bulgaria. The interactions of clone, site, and spacing were analyzed, and practical recommendations are given.

Libbey, C.R.; Howard, S.W. 1986. Herbicide evaluation in black cottonwood grown for biomass production. *Research Progress Report*. Western Society of Weed Science: 296-297.

Lockaby, B.G. 1986. Nutrient transfer associated with precipitation in plantations of eastern cottonwood. *Forest Ecology and Management*. 17(1): 13-24.

Determinations of pH and annual atmospheric inputs of total N, P, K, Ca, and Mg were made in a 7-year-old plantation located on the floodplain of the Mississippi River near Greenville, MS. Concentration and quantities of P, K, Ca, and Mg in precipitation and throughfall showed pronounced seasonal patterns, generally being greater in summer than winter. The pH of precipitation increased upon contact with the summer canopy; however, the presence of acid precipitation was found in only 8 of the 54 rainfall events

monitored. Quantities of precipitation intercepted by the cottonwood stand exhibited no seasonal differences.

Mezhibovskii, A.M. 1986. Silvicultural peculiarities of old aspen forests with spruce layer in southern taiga. *Lesovedenie*. 6: 81-84.

Mensurational data are presented on aspen stands in the Vologda region, 100-170 years old, with a natural understory of Norway spruce 70-130 years old. Preservation of this understory, plus the viable spruce advance growth is recommended when felling the aspen.

Morley, P.M. 1986. Management and use of aspen poplar in North America. *The Forestry Chronicle*. 62(2): 104-107.

Opitz von Boberfeld, W.; Seemer, H. 1986. Management of grass pasture under double utilization with forest based on the example of Ruraue. *Zeitschrift fur Kulturtechnik und Flurbereinigung*. 27(4): 225-232.

Under double utilization consisting of 30-year-old poplar stands with a grass cover of *Lolium*, the tree canopy reduced photosynthetically active light reaching the grass by more than 50 percent, largely irrespective of the cloud cover. In the spring, the mass of tree foliage impeded development of the first growth of grass. The stand density of the trees had a marked effect on the grass yield as affected by N supply and weather conditions. Competition from the trees also significantly decreased the effectiveness of N fertilizers. Some advantages accrue from the alternative system of interspersing areas of grassland between small wooded zones.

Prikhod'ko, N.N.; Shparik, Yu.S. 1986. Silvicultural characteristics of protection forests in the upper Dnestr basin. *Lesovodstvo i Agrolesomelioratsiya*. 72: 22-26.

Soil and climatic conditions in the area are ideal for high yielding shelterbelts to protect crops and soils and reduce runoff of soluble fertilizer and pesticides. Oak belts achieve site class I-Ia at 35 years old. Planting one of the outside rows with *Populus nigra italica* enables newly planted belts to provide protection much more rapidly.

Prikhod'ko, N.N.; Shparik, Yu.S. 1986. Silvicultural features of protective stands in the upper Dniester basin. *Lesovodstvo i Agrolesomelioratsiya*. 73: 33-36.

Stand characteristics were measured in 12 forest strips 15-50 m wide, 25-35 years old, on collective farms in hilly terrain in Ivano-Frankovsk Province, Ukraine, in order to determine their optimum composition. Recommendations are made for an admixture of up to 20 percent of ash in oak belts, preferably in strips of 2-3 rows separated from the oak by associated species (*Acer platanoides*, possibly *A. pseudoplatanus* and *Tilia cordata*), and for inclusion of *Populus alba* var. *pyramidalis* in at least 1 of the outer rows to accelerate establishment of the protective function.

Santamour, F.S., Jr. 1986. Wound compartmentalization in tree cultivars: addendum. *Journal of Arboriculture*. 12(9): 227-232.

Fourteen cultivars of *Acer*, *Fraxinus*, *Quercus*, and *Tilia* that have been commercially propagated by budding and grafting showed strong walling off of

chisel wounds in the stem. Hybrid poplar clones showed both strong and weak walling off. There was a strong relationship between a strong walling off reaction and the amount of wood discoloration and decay following improper flush pruning of branches.

Siddiqui, K.M.; Sheikh, M.I.; Rehman, S. 1986. Selection trials of Populus ciliata Wall. in Pakistan. Pakistan Journal of Forestry. 36(1): 29-34.

Cuttings and/or seeds were collected from trees on 41 sites and raised in 2 nurseries. After 2 year seedlings produced from seed collected in xeric habitats outperformed those produced from seed collected in mesic habitats, when both were raised under conditions of high rainfall.

Stewart, H.T.L.; Allender, E.; Sandell, P.; Kube, P. 1986. Irrigation of tree plantations with recycled water. 1. Research developments and case studies. Australian Forestry. 49(2): 81-88.

Stiell, W.M.; Berry, A.B. 1986. Productivity of short-rotation aspen stands. Forestry Chronicle. 62(1): 10-15.

Results at age 16 years are reported from the study of the effects of repeated harvesting of suckers of aspen (Populus tremuloides and P. grandidentata) in Ontario. It is concluded that the shortest rotation at which sucker production can be physiologically sustained has not been identified, but is unlikely to be less than 9 or 10 years. Declining yields from short rotations were probably caused by starvation of rootstocks by frequent removal of the photosynthesizing tops. A high incidence of Armillaria mellea probably contributed to the reduced numbers and size of suckers.

Sultani, M.I.; Akhtar Ali; Khan, M.S.; Qureishi, M.A.A. 1986. Water use efficiency of Populus euramericana. Pakistan Journal of Forestry. 36(2): 53-58.

[P. canadensis] shoot cuttings were planted in March 1984 in 12-kg containers with or without rice husk mulch. Entire seedlings were planted in 22-kg containers in July 1984 and the experiment was repeated. The water required to produce 1 g biomass was 358 and 333 g in mulched and unmulched cuttings and 381 and 342 g for mulched and unmulched seedlings, indicating little seasonal difference but that mulched plants were less efficient at using water. The quantities of water evaporated by mulched and unmulched pot surfaces were about 50 and 70 percent less than comparable free water surfaces.

Torreano, S.J.; Frederick, D.J.; Smith, W.H., eds. 1986. Comparison of coppice and seedling biomass production with time and spacing on two sites in North Carolina. In: Biomass energy development: 3d Southern biomass energy research conference; 1985 March 12; Gainesville, FL. New York, NY: Plenum Press. 634 p.

Biomass production and survival for 2-year coppice and 5.5-year seedlings on two sites (Coastal Plain bottomland and Piedmont upland) are presented. The bottomland planting consisted of seven species: green ash (Fraxinus pennsylvanica Marsh.), American sycamore (Platanus occidentalis L.), water-willow oak (Quercus spp.), sweetgum (Liquidambar styraciflua L.), loblolly pine (P. taeda L.), cottonwood (Populus deltoides L.), and European

black alder (Alnus glutinosa L.). The upland site was planted with sweetgum, European black alder, and loblolly pine. Three spacings were used on both sites. After 5.5 growing seasons, the bottomland had greatest biomass production compared to the upland for all species and spacings with the exception of loblolly pine. At the end of the second coppice growing season, coppice survival was less than seedlings on the bottomland while being greater than that of seedlings on the upland.

Wildman, J.A.; Hicks, R.R., Jr.; Pope, P.E., comp. 1986. Direct seeding of aspen on a reclaimed surface mine in West Virginia. In: Proceedings, 4th annual better reclamation with trees conference; 1984 June 7; Owensboro, KY. Indianapolis, IN: Amax Coal Company: 140-151.

Methods of direct seeding aspen on a reclaimed surface mine in Preston County, West Virginia were evaluated using a hierarchical experimental design. In the spring of 1983, seed from bigtooth (Populus grandidentata) and quaking (P. tremuloides) aspens were collected from local sources and hydroseeded in three-meter-diameter plots. Following seeding, the plots were treated with mulch (straw or wood fiber) or were left unmulched. Despite germination rates of 98 percent (quaking aspen) and 76 percent (bigtooth aspen) in the lab there was no evidence of germinated seedlings. The poor results were attributed to an extended drought immediately following the seeding screening period. Aspen seed are notoriously sensitive to seedbed requirements and moisture conditions and have no dormancy period. Inadequate soil moisture results in rapid deterioration of seed reproducing the exacting seedbed conditions required by these species would be cost prohibitive on remote areas such as strip mines, and still would not insure success.

1987

Churchill, H.; Van Laar, A. 1987. Silviculture of poplars. In: Von Gadow, K.; et al., eds. South African forestry handbook. Pretoria, South Africa: The South African Institute of Forestry: 129-137.

Fisher, J.T.; Neumann, R.W. 1987. Cultivation and weed control for aspen seedling establishment in the southern Rocky Mountains. Canadian Journal of Forest Research. 17(1): 47-50.

Four-month-old containerized Populus tremuloides seedlings were planted at high altitude sites in southern and northern New Mexico in May 1982 and July 1983, respectively. Main treatments involved cultivation to a depth of 20 cm in autumn (after applying dalapon) or in spring. Subtreatments included application of dalapon in the autumn without cultivation, application of pre-emergent herbicides linuron, trifluralin, or simazine (2-3 weeks before planting) to plots cultivated in either season, cultivation alone, and no treatment. Results for each treatment are tabulated. In general, pre-emergent herbicides did not significantly improve survival and growth on either site compared with cultivation alone.

Hedin, Robert Stewart. 1987. The consequences of strip mine reclamation: vegetation and economics of reclaimed and unreclaimed sites in West-Central Pennsylvania. Dissertation Abstracts International. 48/03-B: 635.

A survey was conducted of the vegetation on 36 strip mines which varied in reclamation effort and age. Vegetation on sites that had not been resoiled was most influenced by site age and historic liming and fertilization efforts. Barren spoils were significantly associated with low pH values. There was little evidence of active pyrite oxidation, even in barren areas. These results suggest that soil chemistry is currently dominated by aluminum buffering, not pyrite oxidation.

Jilie, Kou; Jinwei, Dong. 1987. Studies on measures improving the survival of poplar plantation. *Journal of Beijing Forestry University*. 9(2): 162-168.

Kr"Stanov, K.N.; Fakirov, V.; Belyakov, P.; Ganchev, P.; Tsakov, K. 1987. Regularities in the growth and increment in height and diameter of poplar plantations. *Gorskostop Nauka*. 24(3): 3-18.

The investigations are conducted on permanent experimental plots along the Danube River Valley on two sites₂ - typical poplar and drained poplar site at growth areas 9, 16, 36, and 64 m² with two clones of Euroamerican poplars - P. 'I-214' and Populus 'Robusta' in a period of observation up to 25 years depending on the density of the plantations.

Milanov, R. 1987. Effect of silvicultural-biological recultivation on certain microbiological indices of dumps from mining activity. *Gorskostopanska Nauka*. 24(1): 41-45.

Investigations were made of the soil micro-organisms on areas after open-cast lignite (brown coal) mining in Bulgaria, planted with ash, Pinus nigra, oak, and poplar, with and without NPK fertilizer. Earthing the plants up, coupled with fertilizer application, had a beneficial effect.

Phelps, J.E.; Isebrands, J.G.; Teclaw, R.M. 1987. Raw material quality of short-rotation, intensively cultured Populus. II. Wood and bark from first-rotation stems and stems grown from coppice. *IAWA Bulletin*. 8(2): 182-186.

Wood and bark properties of 3-year-old first-rotation stems were compared with those of 3-year-old coppiced stems of 3 Populus clones (NC-5236, NC-5377, and NC-5332) grown under short-rotation, intensive culture (SRIC). Trees produced from coppiced stumps were 1.5 to 2.5 times larger than the first-rotation trees. The differences were not considered of any importance from an industrial utilization point of view; the increase in woody biomass from coppiced trees was thought to be of greater significance to industry.

Puttock, G.D.; Smith, C.R. 1987. Evaluation of site preparation with Young's teeth on sites with dense residual poplars. Inf. Rep. O-X-379. Toronto, Ontario, Canada: Canadian Forest Service, Great Lakes Forestry Research Centre: 1-22.

Ranney, J.W.; Wright, L.L.; Layton, P.A.; McNabb, W.A.; Wenzel, C.R.; Curtin, D.T. 1987. Short rotation wood crops program: Annual progress report for 1986. Env. Sci. Div. Pub. No. 2839. Oak Ridge, TN: Oak Ridge National Laboratory: 55 p.

This report describes accomplishments in the Short Rotation Woody Crops Program (SRWCP) for the year ending September 30, 1986. The SRWCP is devoted

to a single objective: improving the productivity, cost efficiency, and fuel quality of wood energy crops as feedstocks for conversion to liquid and gaseous fuels. Production yields from SRWCP research plots and coppice studies are discussed along with new efforts to model growth results and characteristics on a tree and stand basis. Innovative wood energy crop handling techniques are presented as significant cost reduction measures. The conclusion is that new specialized wood energy crops can be feasible with the advances that appear technically possible over the next 10 years.

1988

1988. An alternative to the surplus production of grain: cultivation of fast-growing tree species in a short-rotation system on former agricultural land. *Allgemeine Forstzeitschrift*. 42(45): 1217-1219.

Blankenhorn, P.R.; Bowersox, T.W.; Strauss, C.H.; Stimely, G.L.; Stover, L.R.; Dicola, M.L. 1988. Effects of management strategy and site on selected properties of first rotation Populus hybrid NE-388. *Wood and Fiber Science*. 20(1): 74-81.

Corns, I.G.W. 1988. Ecosystems with potential for aspen management. *The Forestry Chronicle*. 65(1): 16-22.

Guenzl, L. 1988. Tree species diversity as an aim of forest improvement. *Internationaler Holzmarkt*. 79(16): 1-3.

Kidd, R.P.; Koelling, M.R. 1988. Aspen management in Michigan. Ext. Bull. E-1552. East Lansing, MI: Michigan State University, Cooperative Extension Service. 4 p.

Krasny, M.E.; Vogt, K.A.; Zasada, J.C. 1988. Establishment of four Salicaceae species on river bars in interior Alaska. *Holarctic Ecology*. 11(3): 210-219.

Mowrer, H.T. 1988. Is managing aspen density worthwhile? In: Future forests of the mountain west: A stand culture symposium; 1986 September 29-October 3; Missoula, MT. Gen. Tech. Rep. INT-243. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 201-209.

Oh, K.K.; Lee, K.J.; Yim, K.B. 1988. Vegetational management planning of the Namsan nature park in Seoul on the basis of phytosociological characteristics. *Journal of Korean Forestry Society*. 77(1): 1-9.

To analyze phytosociological characteristics of the Mt. Namsan nature park, Seoul, vegetation structure of north-east and south-west slopes, competition capability among species, vegetation structures of afforested species were studied with belt-transect and quadrat methods. A management plan of each vegetational zone was proposed by the results of this study.

Sheikh, M.I. 1988. Management of hybrid poplar for optimum yield of wood. *Pakistan Journal of Forestry*. 38(3): 157-166.

van C. Adkins, R. 1988. Intercropping firewood trees with essential oil plants. Banko Janakari: A Journal of Forestry Information for Nepal. 2(1): 52-55.

SOILS

1975

Akhtyrtsev, B.P.; Sviridova, I.K. 1975. Leaching of some elements from tree crowns, forest litter and soils by rain in the central Russian forest-steppe. *Biologicheskie Nauki*. 7: 123-128.

Tabulates comparative data from chemical analyses of through-fall collected under oak, aspen, and Scots pine forest types in the Voronezh region, showing the amounts of N, Ca, K, Mg, P, and S leached from the crown.

Chernova, N.M.; Novikova, S.I. 1975. Changes in communities of small arthropods and nematodes during leaf-litter breakdown. *Zoologicheskii Zhurnal*. 54(5): 645-656.

Reports results of studies on the breakdown of leaf litter from Quercus robur s.l., Tilia cordata, Betula alba s.l., Populus tremula, and Corylus avellana in a broadleaved forest near Moscow. Differences in the fauna between the litter of different species of tree were not significant.

DeBell, D.S.; Mallonee, E.H.; Alford, L.T. 1975. Effect of nitrogen fertilizer on growth, form, and wood quality of eastern cottonwood. *Forest Research Note* 4. 6 p.

Denev, D. 1975. On the restoration of soil nutrients during the leaf-falling period in young poplar stands. *Gorsko Stopanstvo*. 31(10): 13-17.

Dzekov, S. 1975. One example of the comparative development of the clone of Populus euramericana 'I-214' on the alluvial soil of the Vardar in the valley of Skopje. *Topola*. 18/19(103/106): 117-121.

Frison, G. 1975. Rhythm of nutrient mineral uptake by the poplar (Populus X euramericana) in a nursery. *Cellulosa e Carta*. 26(7/8): 25-43.

Gilmore, A.R.; Arnold, L.E.; Young, R.A. 1975. Fertilization and discing alone will not improve cottonwood survival and growth on degraded soils. *For. Res. Rep.* 75-8. Urbana-Champaign, IL: University of Illinois, Department of Forestry. 2 p.

Populus deltoides seedlings (1+0) were planted in 1964/1965 on a degraded loess-loam site in southern Illinois, treated with combinations of manure (M), limestone (L), and rock phosphate (R) before planting. Fertilizers (N, P, and K at 84, 28, and 69 kg/ha, respectively) were applied on all plots during each of the first 7 growing seasons. It is concluded that discing and fertilizer treatment are insufficient to return the area to its former productive capacity.

Kacar, B.; Ozdemir, O.L. 1975. Estimation of the availability of phosphorus applied by different placement methods to poplar seedlings of various species using a radioactive tracer technique. *Yilligi, Ziraat Fakultesi, Ankara Universitesi*. 24(1-2): 51-66.

One-year-old seedlings of three species of Populus were planted in planting holes in a sandy clay loam calcareous soil low in available P, N, and

organic matter. Ammonium phosphate labelled with P-32 was mixed with soil from the holes, which was then replaced, or the fertilizer was applied to give placement depths of 20, 40, or 60 cm. The results suggest that placement near the roots was the most effective method for newly planted trees. The order of effectiveness may change as the trees grow larger and the root systems increase in extent.

Kinden, D.A.; Brown, M.F. 1975. Electron microscopy of vesicular-arbuscular mycorrhizae of yellow poplar. III. Host-endophyte interactions during arbuscular development. *Canadian Journal of Microbiology*. 21(12): 1930-1939.

Glomus mosseae is considered to be the predominant endophyte in naturally mycorrhizal 1-year-old tree seedlings.

Liani, A. 1975. The neutron moisture probe for detecting soil-moisture variations. *Publicazioni del Centro di Sperimentazione Agricola e Forestale*. 13(1): 67-77.

Describes the use of the Nuclear-Chicago Corporation's Model 5810 neutron moisture probe for making observations of variations in water storage, caused by evapotranspiration, in a 10-year-old Populus 'I-476' plantation from May to December 1971.

Murphey, W.K.; Bowier, J.J. 1975. The response of aspen to irrigation by municipal wastewater. *TAPPI*. 58(5): 128-129.

Parkinson, D.; Louisier, J.D. 1975. Litter decomposition in a cool temperate woodland. In: *Biodegradation et Humification; Rapport du Colloque International 1st*: 75-87.

Prudic, Z. 1975. Effect of European aspen (Populus tremula) on humus and soil conditions of spruce stands in beech-oak and fir-beech stands. *Lesnictvi*. 21(7): 621-626.

Richardson, C.J.; Lund, J.A. 1975. Effects of clear-cutting on nutrient losses in aspen forests on three soil types in Michigan. In: Howell, F.G.; et al, eds. *Mineral cycling in southeastern ecosystems: Proceedings of a symposium; 1974 May 1-3; Augusta, GA. U.S. Energy Research and Development Administration: 673-686.*

Settergren, C.D.; Turner, J.A.; Hansen, W.F. 1975. The use of sewage effluent irrigation techniques at large recreational developments. In: *Forestry issues in urban America: Proceedings, 1974 Society of American Foresters national convention. Washington, DC: Society of American Foresters: 272-282.*

Spray irrigation of effluent from a 3-stage stabilization lagoon system on to old fields on bottomland was tried experimentally in the Bennett Springs State Park, central Missouri, instead of direct discharge of sewage effluent from recreational areas into the R. Niangua. Data are presented on the nutrient content of effluent monthly variation in soil water nitrate, P, K, and Ca and the height and diameter increment of 8 tree species (planted in 1971) during the 1972 growing season. The response to irrigation was very good in Populus deltoides and Platanus occidentalis, good in Taxodium

distichum and Acer saccharinum, fair in Fraxinus pennsylvanica, and poor in Juglans nigra, Pinus sylvestris, and Quercus palustris.

Smirnov, I.A. 1975. Varietal trial of poplars on saline soils. Referativnyi Zhurnal. 11.56.123.

The results are presented of a 5-year trial of many varieties, species, and hybrids. Lists are given of those forms which had the highest growth rate on saline soils and the best resistance to low temperatures.

Van Cleve, K.; Noonan, L.L. 1975. Litter fall and nutrient cycling in the forest floor of birch and aspen stands in interior Alaska. Canadian Journal of Forest Research. 5(4): 626-639.

Whysong, G.L.; Bailey, A.W. 1975. Production and nitrogen content of herbage in a Silverberry community compared to adjacent grassland and forest communities. Canadian Journal of Plant Science. 55(3): 801-808.

Reports measurements in 1972 of the total forage production, nitrogen content of herbage and woody plants, and canopy composition of (a) mixed Populus balsamifera/P. tremuloides stands, (b) E. commutata shrub stands, and (c) moist grassland, on a site exposed 20 years ago by the receding Beaverhill Lake, east of Edmonton, Alberta. Herbage production was similar in (b) and (c) and 63 percent smaller in (a). Roots and suckers of Populus spp. were invading both (b) and (c), depressing herbage production in (c) by 37 percent but not apparently in (b).

Zakhariev, B.; Iliev, S.; Mitev, T. 1975. Growth and wood performance of some European-American Populus clones on riverside soils and dry sites beyond rivers in Bulgaria. Gorskostop Nauka. 12(2): 16-22.

Zaval'ko, F.P. 1975. The effect of mineral fertilizers on the increments of Populus species. Lesovod Agrolesomelior. 42: 64-70.

1976

Baker, J.B.; Broadfoot, W.M. 1976. Soil requirements and site selection for Aigeiros poplar plantations. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 328-343.

Barneoud, C. 1976. Fertilization in poplar culture. Mitt Schweiz Pappel Arbeitsgem. 27: 3-9.

Blackmon, B.G. 1976. Response of Aigeiros poplars to soil amelioration. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 344-358.

Cappaert, I.; Verdonck, O.; de Boodt, M. 1976. A way of valorization of sludge from the waste water treatment of pulp mills. Mededelingen van de Faculteit Landbouwwetenschappen, Rijksuniversiteit Gent. 41(1): 281-285.

Cuttings of Populus trichocarpa showed normal rooting and growth in sludge-treated soils when the plantpit method of cultivation was used. Rooting was abortive in pure sludge.

Carter, A.; Cragg, J.B. 1976. Concentrations and standing crops of calcium, magnesium, potassium and sodium in soil and litter arthropods and their food in an aspen woodland ecosystem in the Rocky Mountains (Canada). Pedobiologia. 16(5): 379-388.

Daamen, W.P. 1976. Spontaneous forest development on man-made soils and abandoned agricultural soils. Uitvoerig Verslag, Rijksinstituut voor Onderzoek in de Bos- en Landschapsbouw "De Dorschkamp". 14(2): 39 p.

Eight areas reclaimed from the sea (two areas under fresh water conditions and six under salt or brackish water conditions), four artificially raised areas (one with peat, one with sand, and two with peat and clay) and 113 abandoned agricultural areas were studied. In reclaimed areas and in relatively large raised areas Salix, Populus, and Betula appear rapidly, but Quercus and Fagus do not occur.

Dimitrov, Kh.; Denev, D.A.; Dimitrova, M. 1976. Determining the optimum proportions of the main nutrient elements for Populus X euramericana cv. 'I-214'. Gorskostopanska Nauka. 13(4): 24-38.

Pot experiments were made to test different doses and combinations of N, P, and K (5 doses of each element, viz. 40, 80, 120, 160, 200, and 240 mg/kg of soil) on alluvial meadow soil. The response to the treatments was assessed by biomass production, height growth, and foliar contents of nutrients.

Dimitrov, Kh.; Dimitrova, M.; Denev, D.; Kolarov, D. 1976. Effect of the supply of nitrogen, phosphorus and potassium in the soil on the growth of saplings of some poplar clones. Gorskostopanska Nauka. 13(3): 24-35.

The six forms studied differed in their reaction to the various types of soil on which they were grown. For example, on light-grey forest soil only Populus trichocarpa had a vigorous growth rate, whereas on saline soil the best growth rate was shown by P. bachelieri and P. deltoides 'ICB7'.

Dochinger, L.S. 1976. Effects of soil applications of acidified solutions on growth and survival of forest tree species. Proceedings of the American Phytopathological Society. 3: 304.

Seedlings (1-year-old) of Acer rubrum, Fraxinus americana, Liquidambar styraciflua, Liriodendron tulipifera, Platanus occidentalis, Populus deltoides, and Ulmus americana, potted in river sand or peat were treated with solutions of pH 3, 5, or 7 applied to the soil. It is concluded that acid precipitation may influence growth and mortality of forest tree seedlings in soils with low buffering capacity.

Frison, G. 1976. Effect of mineral fertilizers on the growth of poplar. Cellulosa e Carta. 27(5): 3-20.

Describes a long-term experiment to determine the effect of NP and NPK fertilizers on the growth of a poplar plantation established in 1969 on land near Mantua previously used for agriculture and rather poor in nutrients. The species used was Populus 'I-214'. Applications were made in 1970, 1972, and 1974 at rates of 160, 200, and 300 kg/ha of N₂, P₂O₅, and K₂O, respectively. The fertilizers had highly significant effects on basal area increment in the years of application but no residual effect except in the year following the first application. Under the conditions studied, the cumulative effects of using mineral fertilizer on both basal area and height increment are significant, but the profitability of the treatment cannot be assessed until the trees are felled.

Frison, G. 1976. Increasing dosages of chicken manure, and growth of poplars in pots. *Cellulosa e Carta*. 27(7/8): 37-44.

Reports the results of a greenhouse experiment in 1975 on the effect of using chicken manure, applied at 0, 5, 10...50 g and at 100 g per pot containing 12 kg of sandy soil poor in N and organic matter, on the height growth and dry-matter content of leaves, shoots and roots of pot-grown cuttings of Populus 'I-214'. Increasing dosages from 0 to 100 g per pot had a significant effect on mean dry weight per plant of leaves, shoots, and lateral roots. It is concluded that, under the greenhouse conditions of the experiment, chicken manure was a quick-acting fertilizer.

Frison, G. 1976. Results of poplar fertilization trials on sandy soils. In: Cottenie, A., ed. *Comptes-Rendus, 4e Colloque International sur le Controle de l'Alimentation des Plantes Cultivees*; 1976 September; Gent, Belgium. Gent, Belgium: Rijksuniversiteit; 2: 377-390.

Three trials with NPK fertilizer applications on sandy soils poor in N and organic matter are reported.

Gilmore, A.R. 1976. Relationship between soil, foliage, stem wood, and growth of planted cottonwoods in Southern Illinois. *Soil Science*. 121(5): 301-306.

Height growth, diameter growth, and wood specific gravity of eastern cottonwood (Populus deltoides Bart.) was determined in relation to soil fertility on a former agronomic experimental area in southern Illinois. Tree growth increased with fertility but wood specific gravity decreased.

Hansen, E.A. 1976. Determining moisture-nutrient requirements for maximum fiber yield. Gen. Tech. Rep. NC-21. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 43-46.

Heinsdorf, D. 1976. Nitrogen fertilizer of poplar and pine on spoil-mound sites. *Beitrage fur die Forstwirtschaft*. 10(4): 219.

Effect of mineral fertilizer on the growth and nutrition of pine plantations on spoil mounds typical of the Niederlausitz region.

Kate-Hazevoet, A.M. ten. 1976. Growing Populus in sandy areas. *Ned Bosbouw Tijdschr*. 48(12): 253-256.

Kate-Hazevoet, A.M. ten. 1976. Poplar growing on artificially raised sites. *Populier*. 13(4): 61-63.

A site in Amsterdam was filled in and levelled with moderately fine calcareous sand. Seventeen treatments were applied. Populus 'Serotina' and Alnus glutinosa were planted, the latter unsuccessfully. Results after 8 years suggest that cultivation to 80 cm is needed to ensure good development. On this test site, clay in particular improved the water regime and increased both tree and weed growth, but it is not considered essential. Sewage sludge caused high initial losses.

Lousier, J.D.; Parkinson, D. 1976. Litter decomposition in a cool temperate deciduous forest. Canadian Journal of Botany. 54(5/6): 419-436.

In an aspen woodland in the Rocky Mountains, the total weight of nutrients returned to the soil by tree leaves in the litter was 116 kg/ha, with N, Ca, and K comprising 89 percent and Mg and P 9.8 percent of the total. The rate of decomposition of leaf litter was slower on northern than on southern slopes.

Migunova, E.S. 1976. The root systems of woody species on saline soils in the South Ukraine. Lesovedenie. 6: 27-36.

Discusses the salt-resistance of a number of tree species in the southern Ukraine, and describes their root systems, as observed by trench excavations. The species considered are Robinia pseudoacacia, Ulmus pinnata-ramosa (U. pumila var. arborea), Gleditsia triacanthos, Fraxinus viridis (F. pennsylvanica), Biota orientalis (Thuja orientalis), Populus alba, P. bolleana (P. alba var. pyramidalis), Tamarix ramosissima, and T. tetrandra.

Naidenova, T.S. 1976. Populus regenerata and soil moisture. Gorsko Smoiansmbo. 31(3): 51-53.

Nakou, G. 1976. The poplar (Populus): a tree very sensitive to the presence of salts. Dasika Chronicle. 18(6): 149-150, 153.

Sheedy, G. 1976. Research and development on poplar in eastern Quebec. VI - Greenhouse fertilizer trials with N, P, K, Mg and Ca using various application methods. Quebec, Canada: Memoire, Service de la Recherche, Ministere des Terres et Forets. 28: 53 p.

NPK at various rates was applied to cuttings of Populus cv. 'Angulata' X P. trichocarpa (B-201-B), P. balsamifera (Q-14-Q), and P. X euramericana (P. X canadensis) (Q-36-Q) by broadcasting, coating the cuttings or application to the base of the cuttings. Various rates of application of Mg and Ca were tested at 2 rates of NPK by surface application. After 3 months, NPK treatments had greater height, diameter, and root growth; 56 kg/ha appeared to be sufficient. Broadcasting was the most effective application method; some coating and basal application treatments had adverse effects on growth and caused bud necrosis, particularly in clone Q-14-Q. Clone Q-36-Q grew best.

Simon, M. 1976. The effect of the groundwater table fluctuation on the growth of 'I-214' poplars. Erdeszeti Kut. 72(2): 5-10.

Switzer, G.L.; Nelson, L.E.; Baker, J.B. 1976. Accumulation and distribution of dry matter and nutrients in Aigeiros poplar plantations. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and

related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 359-369.

Thum, J. 1976. Application of nitrogen fertilizers to the poplar and pine on tipper sites. *Beitrage fur die Forstwirtschaft*. 10(4): 217-218.

A brief report on 3 fertilizer trials in the lignite area South of Leipzig where afforestation is much less general than in Niederlausitz. Calcium ammonium nitrate was applied annually between 1970-1972, at 75-225 kg N/ha, to two rather poor 18-year-old stands of hybrid black poplar (resp. Populus 'Regenerata' and P. 'Robusta') and a better one of Scots pine (Pinus sylvestris) growing on loamy sand soils of quaternary and tertiary deposits. Maximum yield was obtained with a total N dosage of resp. 225 and 150 kg/ha for the poplars and 75 kg/ha for the pine. However, the increased volume increment due to fertilizer over the 3-year period was only small (maximum 1.6 m³ for the poplars, and 2.5 m³ for the pines). It is suggested that 3 applications of N- fertilizer, spread over approximately 6 yr will benefit middle-aged stands of poplar and pine on spoil mounds.

Troth, J.L.; Deneke, F.J.; Brown, L.M. 1976. Upland aspen/birch and black spruce stands and their litter and soil properties in interior Alaska. *Forest Science*. 22(1): 33-44.

Presents data for stand composition and soil properties in (a) three broadleaved stands (Betula papyrifera/Populus tremuloides stands with Picea glauca) and (b) four Picea mariana stands growing on similar parent material in the Yukon-Tanana Uplands. These findings indicate a more rapid return of nutrients to the soil under broadleaved trees than under spruce.

Verry, E.S.; Timmons, D.R. 1976. Elements in leaves of a trembling aspen clone by crown position and season. *Canadian Journal of Forest Research*. 6(3): 436-440.

Concentrations of six major and six minor elements in the leaves were determined for the upper, middle, and lower crown of a 43-year-old stand of Populus tremuloides at 7 sampling dates during the 1971 growing season. One sample tree was felled at each date. Only Ca and K concentrations showed differences related to crown position, being lower in the upper crown than in the rest of the crown. Seasonal changes were shown: NPK decreased with time; Ca and Al increased; and minor elements increased during the season with an intermediate peak. The uniformity of the results showed that the trees formed a single clone. Sampling times for various studies are suggested in relation to such seasonal variations.

Vidali, E.; Vivani, W. 1976. An example of modern Poplar-growing on gravelly soils. *Cellulosa e Carta*. 27(5): 21-27.

Describes and illustrates the successful use in the Po Valley of the technique of establishing Poplar plantations on gravelly soils by deep planting of root-pruned saplings ('impianto profondo a palo').

Wallihan, E.F. 1976. Tissue tests for iron. Bull. 1879. Riverside, CA: University of California, Division of Agricultural Sciences: 32-34.

Leaf analysis data are given for acacia, avocado, black locust, cotton, cottonwood (Populus deltoides), eucalyptus, lemon, maize (Zea mays), orange,

pea, pear, rice, soyabean, sugar beet, sunflower, tomato, tulip tree, and walnut (Juglans nigra). Critical concentrations have not been estimated because of limited data. Recently matured leaves are commonly recommended for sampling. Their thorough washing from contaminants is particularly vital in the case of iron.

Zaval'ko, F.P.; Smol'ianinov, I.I. 1976. Variation of certain chemical and biochemical properties of meadow soils as a result of application of fertilizers in poplar stands. *Lesovod Agrolesomelior.* 46: 58-62.

1977

Badan, R.; Bardet, L.; Jeantet, G. 1977. Thoughts on forest fertilizing. *Foret.* 30(2): 29-33.

It is suggested, with examples from Switzerland, that the profitability of fertilizing is extremely difficult to predict. A lowland trial with 3 poplar clones showed a marked positive but varying response to NPK and negative responses to NK and K; in this case, treatment may be profitable provided that the volume yield of a rotation can be increased by 15 percent with 2 applications. Fertilizing Picea abies was found to be clearly profitable in pole stands, but resulted in reduced increment in a 70-year-old stand on a similar site.

Baker, J.B.; Blackmon, B.G. 1977. Biomass and nutrient accumulation in a cottonwood plantation - the first growing season. *Soil Science Society of America Journal.* 41(3): 632-636.

Data are presented for accumulation and distribution of biomass and nutrients, and for nutrient translocation and cycling, during the first season of growth of Populus deltoides planted on clay soil in western Mississippi.

Barneoud, C. 1977. Maintenance fertilization of poplar. First results. *Annales de Recherches Sylvicoles.* 1976: 467-514.

Trials with young poplar in several regions are reported in detail. NP fertilizer always produced a response but K, Ca, Mg, and Cu were generally ineffective. NP levels of 150-400 g/tree surface-applied to trees less than 35-45 cm in girth were optimum. For larger trees, 80-150 kg NP/ha was sufficient. Ammonium-N was superior to nitrate, while the forms of phosphate were similar in effect. Split application of N or NP had no advantage. Application of 80 kg K/ha was recommended as a means of improving storm and disease resistance. Regression analysis was carried out. Tree girth at application was the most important factor, but soil available K content, CaCO₃ content and clay-loam ratio were also relevant. The economics of fertilization at this stage is discussed.

Blackmon, B.G. 1977. Cottonwood response to nitrogen related to plantation age and site. Res. Note S0-229. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 3 p.

Populus deltoides was planted in 3 consecutive years on alluvial clay and silt loam soils in Mississippi. Ammonium nitrate was applied at 336 and 672 Kg/ha N to 2-, 3-, or 4-year-old plantations thinned in the previous autumn.

A significant response to fertilizer was obtained in only one treatment, viz. on clay at 336 kg/ha in 4-year-old trees. Foliar N concentration was increased from 1.7 to 2.1 percent on clay and from 2.0 to 2.4 percent on silt; it is suggested that N is deficient when less than 2 percent is present in leaves of P. deltoides.

Blackmon, B.G. 1977. Effects of fertilizer nitrogen on tree growth, foliar nitrogen and herbage in eastern cottonwood plantations. Soil Science Society of America Journal. 41(5): 992-995.

N fertilizer was applied at 84-672 kg/ha N (as ammonium nitrate) in two plantations of Populus deltoides (7 and 10 years old) in Mississippi. In fertilized plots, volume increment was more than doubled by the end of the first growing season, but the effect on c.a.i. had disappeared by the end of the third season. Volume increment/plot was greater at higher rates of fertilizer application, but wood increment per unit of applied N was greater at the lowest rate.

Bowersox, T.W.; Ward, W.W. 1977. Soil fertility, growth, and yield of young hybrid poplar plantations in central Pennsylvania. Forest Science. 23(4): 463-469.

Relationships among soil and foliar nutrients and tree height growth or unit weight yields were examined for three Populus hybrids that were planted on an Edom silt loam soil in central Pennsylvania at densities ranging from 0.09 to 0.46 m²/tree.

Brown, R.W.; McDonough, W.T. 1977. Thermocouple psychrometer for in situ leaf water potential determinations. Plant Soil. 48(1): 5-10.

Coyne, P.I.; van Cleve, K. 1977. Fertilizer induced morphological and chemical responses of a quaking aspen stand in interior Alaska. Forest Science. 23(1): 92-102.

Four treatments (control, N, NP, NPK) of a previously established long term factorial fertilization study in an aspen (Populus tremuloides) stand in Alaska were assessed during the 1974 growing season to determine foliage response to added nutrients. Seasonal variation in average canopy specific leaf weight (SLW), leaf chlorophyll, foliar nutrients and non-structural carbohydrates were also studied. Canopy and leaf morphology and foliar nutrient levels responded markedly to applied N; addition of P and K did not greatly alter the response. N doubled canopy leaf area and leaf biomass by increasing leaf numbers rather than leaf size, which was in fact reduced by N alone. A pronounced vertical differentiation in mean leaf area and SLW occurred within fertilized treatments, resulting in a gradation from small leaves of low SLW at the bottom of the canopy to large leaves of higher SLW at the top. Fertilization also increased levels of chlorophyll and foliar nutrients per unit leaf area.

Denev, D.A. 1977. The after-effect of mineral fertilizers in poplar plantations with different soil moisture. Gorskostopanska Nauka. 14(5): 33-41.

Plantations of Populus 'Vernirubens' on drained sites in the Danube region were treated with NPK, NP, PK, and NK, and the effect on growth was determined during the three years after the final application of the fertilizers. On

irrigated plots the response was considerably greater and more prolonged. It is recommended that irrigation should be practiced in conjunction with fertilizer application on drained sites.

Dimitrov, Kh. 1977. Photosynthesis and transpiration productivity of Populus euramericana cv. 'I-214' at different nutrient and soil moisture levels. Gorskostop Nauka. 14(4): 3-11.

Fakirov, V. 1977. Correlation between crown density and the root system in very dense plantations of Populus 'Regenerata'. Gorskostopanska Nauka. 14(2): 21-29.

Measurements were made of the root system of P. 'Regenerata' in plantations 3-20 years old, at a spacing of 2x2 m, on Danube floodplain sites subject to inundation; drained sites on the floodplain; and dry sites away from the river. Density (as measured by crown projection in m²/ha) was found to be related to the length and weight of fine roots, and equations are given showing this relationship for the various soil horizons down to 120 cm. The proportion of fine roots in the upper horizons increased with increasing density utilization of the growing space (soil and air).

Ffolliott, P.F.; Larson, F.R.; Thill, R.E. 1977. Some characteristics of Arizona's mixed conifer forest floor. Res. Note RM-342. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 4 p.

The depth and oven-dry weight of coniferous needles and aspen (Populus tremuloides) leaves in individual forest floor layers were determined in plots in 3 catchment areas and compared with values for the forest floor under Pinus ponderosa forest.

Gladyshev, A.I.; Rodin, L.E. 1977. The structure and distribution of the phytomass in bottomland forest communities of the middle reach of the Amu-Darya. Botanicheskii Zhurnal. 62(1): 3-14.

Tabulated data and histograms describe litter production, the distribution of living and dead roots of Salix songarica, Elaeagnus orientalis, and Populus pruinosa, and the distribution of other organic residues in the soil.

Gragg, J.B.; Carter, A.; Leischner, C.; Peterson, E.B.; Sykes, G.N. 1977. Litter fall and chemical cycling in an aspen woodland ecosystem in the Canadian Rockies. Pedobiologia. 17(6): 428-443.

Litter fall in a predominantly aspen woodland in the Kananaskis Valley of Alberta was studied from 1937 to 1970. Small litter (leaves, twigs, pine needles, aspen, and poplar reproductive parts and detritus) formed 74 percent of the total annual litter fall.

Grigal, D.F.; McColl, J.G. 1977. Litter decomposition following forest fire in northeastern Minnesota. Journal of Applied Ecology. 14(2): 531-538.

Litter bags, containing aspen (Populus tremuloides) or aster leaf litter, were placed in burned and adjacent unburned areas of virgin forest in October 1971, 5 months after a fire, and in October 1972 and October 1973. There was no significant difference in the weight loss of litter bags in burned and unburned areas for bags placed on the same date.

Gyarmatin, Mrs. P.S. 1977. Fertilization of the poplar stands. *Erdo*. 26(5): 205-208.

Harris, M.M.; Jurgensen, M.F. 1977. Development of Salix and Populus mycorrhizae in metallic mine tailings. *Plant and Soil*. 47(2): 509-517.

In 2-year-old willow and poplar planted as cuttings in copper and iron mine tailings the incidence of mycorrhizae was related to tree vigor and to chemical and physical properties of the tailings. No mycorrhizal development occurred on roots of these tree species in the copper tailings; inoculations with natural forest soil extract failed to initiate this symbiosis.

Kovacs-Ligetfalusi, I. 1977. Chemical test of poplar sawdust decayed by Pleurotus ostreatus (Jacq. ex Fr.) Kummer. In: Szegi, J., ed. *Soil biology and conservation of the biosphere*: 287-291.

Krepkii, I.S. 1977. Irrigation regime for amenity stands on chestnut-coloured soils. *Lesnoe Khozyaistvo*. 7: 47-48.

Young stands on heavy clay-loam solonchic chestnut soils in the dry-steppe zone of Kazakhstan were watered so as to maintain the soil moisture at 80, 70, and 60 percent of field capacity. Data are given on the cell-sap concentration and the increment of Ulmus pumila var. arborea and Populus balsamifera in the various treatments. To ensure high increment, the soil moisture content should be at least 60 percent of field capacity for elm and 70 percent for poplar.

Lawrey, J.D. 1977. Soil fungal populations and soil respiration in habitats variously influenced by coal strip-mining. *Environmental Pollution*. 14(3): 195-205.

Soil samples collected from five habitats located in a coal strip-mining reclamation area in Perry County, Ohio generally possessed lower pH and higher levels of trace metals than did soils from habitats not influenced directly by strip-mining. The five habitats studied included: a non-vegetated strip-mined habitat; three vegetated strip-mined habitats, dominated by Pinus resinosa, Robinia pseudoacacia, or Populus grandidentata, and a control habitat dominated by Fagus grandifolia and unaffected by strip-mining.

Loomis, R.M. 1977. Jack pine and aspen forest floors in northeastern Minnesota. Res. Note NC-222. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 3 p.

The weight, depth, and bulk density of the litter (L), humus (H), and fermentation (F) layers were determined for samples from the forest floor of Pinus banksiana and Populus tremuloides stands.

MacLean, D.A.; Ross, W.W. 1977. Nutrient accumulation for postfire jack pine and hardwood succession patterns in New Brunswick. *Canadian Journal of Forest Research*. 7(4): 562-578.

An investigation of long term post-fire nutrient distribution in seven 57-year-old stands of: (a) pure jack pine (Pinus banksiana); (b) mixed broadleaves (including Acer rubrum, Betula papyrifera, Prunus pensylvanica, and Populus tremuloides); in an area of high fire incidence in New Brunswick. A significant proportion of the total above ground nutrient pool was contained

in understory plants, where post-fire accumulation and recycling was rapid. Soil nutrient status was variable.

Mitchell, M.J. 1977. Population dynamics of oribatid mites in an aspen woodland soil. *Pedobiologia*. 17(5): 305-319.

Thum, J.; Fiedler, H.J. 1977. Forestry investigations on the planting value of spoil mounds in the lignite district south of Leipzig. *Archiv fur Naturschutz und Landschaftsforschung*. 17(2): 159-168.

A pot trial with Populus 'Robusta' sets was made on unfertilized samples of 10 different Quaternary and Tertiary geological strata over a 5-month period in 1972. Data are tabulated on total, shoot, root, and 100-leaf dry mass, mortality foliar nutrients, and correlations between dry mass yields and soil chemical characteristics.

Shetron, S.G.; Carroll, D.A. 1977. Performance of trees and shrubs on metallic mine mill wastes. *Journal of Soil and Water Conservation*. 32(5): 222-225.

Hybrid poplars (Populus spp.), European black alder (Alnus glutinosa), and various willows (Salix spp.) proved to be the most suitable species for use on these sites.

Sturhan, D. 1977. First record of the Persian sessile nematode, Cacopaurus pestis Thorne, in Iran. *Nematologia Mediterranea*. 5(1): 125-126.

C. pestis was found in soil from the rooting zone of a Populus nigra tree in Tabriz, Azerbeidjan.

Timmons, D.R.; Verry, E.S.; Burwell, R.E.; Holt, R.F. 1977. Nutrient transport in surface runoff and interflow from an aspen-birch forest. *Journal of Environmental Quality*. 6(2): 188-192.

Nutrients transported in surface runoff and interflow from an undisturbed aspen-birch (Populus tremuloides and Betula papyrifera) forest (6.48 ha) in northern Minnesota were measured for 3 years.

Thum, J. 1977. Factor analysis of soil-plant relations on forested dump sites. *Archiv fur Acker- und Pflanzenbau und Bodenkunde*. 21(5): 435-445.

Factor analysis indicated that variation in height of black poplar (Populus nigra) growing on dumps in the brown coal mining area south of Leipzig was due to 4 separate factors which were an expression of soil properties acting independently (acid factor, nutrient factor, sorption factor, and Ca and Mg or total C).

Traaen, T.S. 1977. Breakdown of organic material. Experiments with 'litterbags'. *Teknisk Notat, Sur Nedboers Virkning pa Skog og Fisk*. 35(77): 14 p.

As part of a study on the effects of acid precipitation, the breakdown of birch (Betula alba) leaves and aspen (Populus tremula) twigs placed in streams in various parts of Norway was followed for 2 years. The acidity of the water was found to be an important factor in the breakdown process.

Tyulin, V.V.; Selezneva, M.A. 1977. Biological cycle of chemical elements in the forest and field on the sod-podzolic soils of the eastern Russian Plain. *Soviet Soil Science*. 9(3): 256-263.

The biological cycle of ash elements and nitrogen was investigated over a 3-year period under natural vegetation and under rye and clover. Comparative data are given on the content of chemical elements in organic residues returned to the soil.

Van den Burg, J. 1977. Growth of the Euramerican poplar and the nitrogen content of soil organic matter. *Populier*. 14(3): 55-58.

Good growth of Euramerican poplar (clones 'Robusta' and 'Gelrica') is obtained if the N content of the soil organic matter (0-25 cm) is 4.0 percent or more. In sandy clay and heavy clay soils the clones act differently.

Van den Burg, J.; Peeters, J.P. 1977. Fertilization and mineral nutrition of hardwoods on young marine soils. *Ned Bosbouw Tijdschr*. 49(9): 253-263.

Van den Burg, J.; Voorburg, J.H. 1977. Animal organic manures in Dutch forestry: application and restrictions. In: Voorburg, J.H., ed. Utilization of manure by land spreading. EUR 5672e. Kirchberg, Luxembourg: Commission of the European Communities: 153-169.

Liquid poultry manure applied to Corsican pine (Pinus nigra) on poor sandy podzols did not increase height growth, and the increased diameter growth was ascribed to the P content and not the N content. Approximately 100 t/ha of pig slurry can be applied to Euramerican 'Robusta' (Populus X canadensis Aggr.) poplar on a humic sandy soil for about 5 years.

Verry, E.S.; Timmons, D.R. 1977. Precipitation nutrients in the open and under two forests in Minnesota. *Canadian Journal of Forest Research*. 7(1): 112-119.

Concentrations of N, P, K, Ca, Mg, and Na were measured in rain and snow in the open and in the throughfall and stemflow under black spruce (Picea mariana) and under aspen (Populus tremuloides) forests in 1971-1973. Concentrations of all nutrients except inorganic N were greater in rain and snow collected from the forests than in precipitation in the open.

Vis, T.; Kolster, H.W. 1977. Observations concerning the growth of some new poplar clones on sand and peat soils. *Populier*. 14(1): 3-14.

Wagner, T.L.; Mattson, W.J.; Witter, J.A. 1977. A survey of soil invertebrates in two aspen forests in northern Minnesota. Gen. Tech. Rep. NC-40. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 23 p.

Invertebrates were sampled (dry funnel extraction, hand sorting of sieved soil and pitfall traps) in July-August in two Populus tremuloides stands. The occurrence of species and seasonal and spatial variations in their abundance are discussed in relation to soil characteristics.

1978

1978. Some results in afforestation on saline-alkali soil as practised by Yangchiayuan Production Brigade, Tientsin. Chung-Kuo Lin Yeh K'o Hsueh. 2: 26-30.

Alban, D.H.; Perala, D.A.; Schlaegel, B.E. 1978. Biomass and nutrient distribution in aspen, pine, and spruce stands on the same soil type in Minnesota. Canadian Journal of Forest Research. 8(3): 290-299.

Atamanov, R.S.; Mozhaev, V.G. 1978. Soil preparation for poplar shelterbelts. Lesnoe Khozyaistvo. 7: 49-52.

Two short papers are presented on various methods of preparing soil for the establishment of poplar shelterbelts. Paper (1) compares several different methods of site preparation for Populus balsamifera in the forest-steppe, steppe, and dry-steppe zones of the Tuva ASSR. Paper (2) compares four depths of ploughing in the Altai region for the establishment of P. balsamifera cuttings.

Baker, J.B. 1978. Nutrient drain associated with hardwood plantation culture. In: Proceedings, 2d symposium on southeastern hardwoods: 48-53.

Potential nutrient loss was estimated for 4-, 12-, and 20-year rotations in whole-tree harvesting of Populus deltoides and for 2-year coppicing of P. deltoides and Platanus occidentalis in Mississippi.

Cooley, J.H. 1978. Survival and early growth of selected trees on waste water application sites. Res. Note NC-231. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 4 p.

Elagin, I.N. 1978. Reaction of pine, birch and aspen to prolonged lowering of the soil temperature. Lesovedenie. 4: 53-59.

Plots on a clear-felled area in Siberia carrying natural regeneration of pine (Pinus sylvestris), birch (Betula pendula), and aspen (Populus tremula) were screened in order to prevent the formation of a snow cover, and so to cause increased cooling of the soil during winter. Measurements were made of air and soil temperature and soil moisture from 1972 to 1975, and the phenology of the natural regeneration was observed. Prolonged low temperatures in the soil affects pine most unfavorably; birch and aspen can adapt to new conditions much more rapidly.

Helgerson, O.T.; Gordon, J.C. 1978. Coal-spoil performance of Arnot bristly locust and Crandon hybrid poplar. Iowa State Journal of Research. 52(3): 299-305.

Survival and growth of Robinia fertilis cv. Arnot and Populus alba X grandidentata cv. Crandon were measured after one growing season on severe coal-spoil sites differing in slope, aspect, and pH. Over all the sites, 60 percent of locusts and 10 percent of poplars survived.

Inman, J.C.; Parker, G.R. 1978. Decomposition and heavy metal dynamics of forest litter in northwestern Indiana. Environmental Pollution. 17(1): 39-51.

The decomposition rate and heavy metal accumulation of litter of three plant species, black oak (Quercus velutina), starry false Solomon's-seal (Smilacina stellata), and quaking aspen (Populus tremuloides) were determined for undisturbed urban and rural ecosystems in northwestern Indiana.

James, T.D.W.; Smith, D.W. 1978. Seasonal changes in the major ash constituents of leaves and some woody components of trembling aspen and red osier dogwood. *Canadian Journal of Botany*. 56(15): 1798-1803.

Concentrations of N, P, K, Ca, and Mg were determined at monthly intervals during the growing season in the leaves, twig bark, and twig wood of Populus tremuloides (trembling aspen) and in the leaves and stems of Cornus stolonifera (red osier dogwood) in southern Ontario. Concentrations of N, P, and K in leaves of both species decreased from May to August. Levels of Mg and Ca increased. Nutrient changes in aspen twigs during May to September, with the exception of Mg, followed the reverse direction to those in leaves, but were very small.

Karabanov, I.A.; Shelukhin, N.V. 1978. Effect of the mineral nutrient regime on the physiological condition and fume resistance of certain woody species. Translation, Fisheries and Environment Canada. (No. 00ENV TR-1458). 18 p.

Liani, A. 1978. N fertilizer trial in a poplar nursery and determination of the removal of minerals. *Cellulosa e Carta*. 29(5): 19-31.

Populus 'I-214' cuttings were planted in a nursery on a sandy-loam soil near Rome with low P, N, and organic-matter contents, a fairly high K content and a pH value of 7.7. Their growth under four different fertilizer treatments and an unfertilized control treatment was compared by analyzing height and d.b.h. measurements. Addition of NH_4NO_3 and urea during the first and second years, respectively, caused a considerable increase in growth; this was still more marked when NPK fertilizer was also applied. No appreciable differences in content of the major elements was found between stem- and branchwood, but bark always had a higher content than wood.

Lousier, J.D.; Parkinson, D. 1978. Chemical element dynamics in decomposing leaf litter. *Canadian Journal of Botany*. 56(21): 2795-2812.

Chemical element change in decomposing aspen (Populus tremuloides) and balsam poplar (P. balsamifera) leaves was followed for 60 months in an aspen woodland site in southwestern Alberta.

MacLean, D.A.; Wein, R.W. 1978. Weight loss and nutrient changes in decomposing litter and forest floor material in New Brunswick forest stands. *Canadian Journal of Botany*. 56(21): 2730-2749.

Weight loss and nutrient (N, P, K, Ca, Mg) changes with decomposition were examined over a 2-year period for a variety of litter types at five forest sites. Litter types included pine needles, leaves of four deciduous species (Acer rubrum, Prunus pensylvanica, Populus tremuloides, and Betula papyrifera), branches of pine and four deciduous species, understory-vegetation, and partially decomposed forest floor material.

Nikolova, T.; Rafailov, G. 1978. Soil conditions and the growth of Populus 'Vernirubens'. *Gorsko Stopanstvo*. 34(12): 25-28.

The growth of *P. Vernirubens* was studied on 5 plots in a plantation on a slope near Ruse, Bulgaria. The depth of soil on the plots ranged from 180 cm at the bottom of the slope to 103 cm at the top. In general the soil moisture, humus content, total N, and pH decreased from the bottom of the slope to the top. Height and diameter growth of the poplar was clearly best on the plot closest but one to the river at the bottom of the slope; the plot at the bottom was next best, and then growth decreased up the slope.

Slyadnev, A.P. 1978. Trial at improving the effectiveness of shelterwood fellings in broadleaf/spruce stands. *Lesnoi Zhurnal*. 1: 10-15.

Permanent plots were established in 1960 in (1) a birch (*Betula alba*)/spruce (*Picea abies*) stand, and (2) an aspen (*Populus tremula*)/spruce stand that had formed after clear fellings. The results are discussed, and show clearly that the application of N fertilizer caused a substantial improvement in the effectiveness of the fellings.

Szodfridt, I. 1978. Poplar cultivation on the sandy marginal sites of the Great Hungarian Plain. *Holzzucht*. 32(1/2): 1-4.

Thum, J. 1978. Humus accumulation on dump soils used for forest production in the lignite region south of Leipzig. *Archiv fur Acker- und Pflanzenbau und Bodenkunde*. 22(10): 615-625.

In the A0 and A1 horizons of soil under poplar stands of medium age (13 to 20 years) on dump sites, 1.3 t of carbon and 60 kg of nitrogen per hectare accumulated each year. Industrial pollution (flue ash, coal dust) accelerated the accumulation of carbon; decomposition of the litter was inhibited by the emissions.

Thum, J. 1978. The potassium supply of the black poplar hybrid 'Robusta' on spoil mounds in the lignite region south of Leipzig. *Beitrage fur die Forstwirtschaft*. 12(1): 11-15.

In 31 sample plots in *Populus* 'Robusta' plantations 14-21 years old, chosen to represent the soil types found on spoil mounds in the area, soil K content was significantly correlated with leaf K content and height growth of poplar. It is considered that K-deficiency is likely to be a limiting factor on tertiary sands and related soils.

Thum, J. 1978. Use of vegetation analysis to determine the success of cultivation measures for soil reclamation. *Beitrage fur die Forstwirtschaft*. 12(3): 140-146.

The effects of three methods of soil improvement were studied on a site planted in autumn 1969 with *Populus* 'Gelrica' on a spoil mound of glacial loamy sand in a brown coal area south of Leipzig, German Democratic Republic, with particular reference to vegetation cover.

Van den Berg, J. 1978. Applicability of animal slurries in poplar plantations. *Populier*. 15(2): 34-38.

Data for a 5-year trial showed that on the basis of the N provided, pig slurry was somewhat more effective than CAN. No signs of N or Cu toxicity were observed. Rates of 30-80 m²/ha/yr are suggested for practical use.

Van den Burg, J. 1978. Sewage sludge in forestry. Mededeling, Rijksinstituut voor Onderzoek in de Bos- en Landschapsbouw 'De Dorschkamp', Wageningen. 172: 8 p.

A review of literature on the application of effluents and sewage sludge in forestry with special reference to Dutch research. Application in conifer stands is not recommended. In planting trials with broadleaves on raised harbor sludge the growth of 5 species, including poplar (Populus spp.) was as good as or better than average. Uptake of heavy metals varied greatly between species (poplar took up Zn and Cd; Quercus robur, Cu; A. glutinosa, Cu and Pb; all species Ni). Mixing sludge with leaf mold is being tried. Recommendations are given on the use of sludge as fertilizer in poplar and willow stands. It is thought likely that planting of broadleaves on soil improved or raised with sewage, or on sewage depots, will prove to be the most promising form of disposal.

Van den Burg, J.; Schoenfeld, P.H. 1978. Poplar cultivation, soil fertility and soil chemical analysis. Populier. 15(4): 75-80.

A review of current knowledge on the chemical site requirements of Euramerican, balsam, and balsam-hybrid poplars (Populus sections Aigeiros and Tacamahaca) with special emphasis on data from soil samples, covering pH, N, P, K, Ca, Mg, trace elements, and salt damage.

Van Cleve, K.; Moore, T.A. 1978. Cumulative effects of nitrogen, phosphorus, and potassium fertilizer additions on soil respiration, pH, and organic matter content. Soil Science Society of America Journal. 42(1): 121-124.

Significant improvements in growth of a 15-year-old stand of Populus tremuloides, in Alaska, have previously been reported after applications of NPK over 2 years. This study assesses the effect of repeated annual applications (1969-1975) on soil characteristics: total applications were 777 kg/ha N (as NH_4NO_3 and KCl) and 385 kg/ha (as treble superphosphate).

1979

Czapowskyj, M.M.; Safford, L.O. 1979. Growth response to fertilizer in a young aspen-birch stand. Res. Note NE-274. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 6 p.

A thinned stand in Maine, established after fire in 1952, was treated with N, P, and N+P, each with or without lime (L) in 1974-1975. Overall, treatments with N and those with L significantly improved both height and volume compared with treatments without N or L. Average volume growth for N-treated plots was increased by nearly 70 percent. Bigtooth aspen (Populus grandidentata) and paper birch (Betula papyrifera) responded more strongly than quaking aspen (P. tremuloides) and red maple (Acer rubrum). P. grandidentata was the only species to respond significantly to P alone (volume growth).

Esu, I.E.; Grigal, D.F. 1979. Productivity of quaking aspen (Populus tremuloides Michx.) as related to soil mapping units in northern Minnesota. Soil Science Society of America Journal. 43(6): 1189-1192.

Garbaye, J. 1979. Soils and productivity of 'I-214' and 'Robusta' poplars grown by traditional methods in the north of the Paris basin. *Annales des Sciences Forestieres*. 36(1): 39-58.

Productivity curves were constructed for the two poplars, related to a productivity index (vol. m.a.i. at 20 years), from measurements in 27 plots of Populus 'I-214' and 40 plots of P. 'Robusta'.

Smith, W.H.; Post, D.M.; Adrian, F.W. 1979. Waste management to maintain or enhance productivity. In: *Proceedings, Impact of intensive harvesting on forest nutrient cycling*: 304-320.

Biomass production by Pinus elliotti treated with garbage compost was nearly three times the biomass produced without treatment. Populus deltoides was far superior to others in both biomass production and nutrient removals. Both parameters depended on rate of irrigation and tree species.

1980

Bialkiewicz, F. 1980. Possible use of municipal sewage effluent in forest plantations. Poland: *Prace Instytutu Badawczego Lesnictwa*. 574: 92 p.

A full account of studies in 1969-1975 with 455 lysimeters of various capacities installed on Scots pine sites with light and medium soils at the Institute's Forest Hydrology Station at Puczniew. Effluent was applied to young saplings of Pinus sylvestris, Salix americana, Larix europaea (L. decidua), Fraxinus excelsior, Populus robusta (P. 'Robusta') and P. gelrica (P. 'Gelrica'). Best overall results were with applications of 50 mm/wk. Sewage effluent significantly increased soil bacterial and actinomycete floras and the rate of cellulose breakdown. Substantial increases in height and diameter growth were found in all 6 species. Older stands also showed large growth increases, together with a large increase in shrub and ground layer vegetation which further improves the extent of effluent purification.

Garbaye, J. 1980. Mineral nutrition and production of 'Robusta' and 'I-214' poplars grown by traditional silviculture in the north of the Paris basin. *Annales des Sciences Forestieres*. 37(2): 159-172.

The relationship between N, P, S, K, Ca, Mg, and Mn contents in soil and leaves and production of Populus 'Robusta' and P. 'I-214' was studied in 66 plantations in N. France, managed without fertilization or tillage. On hill soils, with a permanent water table, CaCO₃ in the top horizon of the soil reduced growth and Mn absorption. When water availability was close to the optimum, N and P were limiting factors.

White, T.A.; Rolfe, G.L. 1980. Differing effects of cadmium on two varieties of cottonwood Populus deltoides Bartr. *Environmental Pollution*. 22(1): 29-38.

Two varieties of Populus deltoides were grown for 14 weeks under greenhouse conditions in soil treated with 5, 25, 100, or 200 μ g Cd/g soil. Following harvest, cadmium concentrations were determined in leaf, stem and root tissue, and leaf, stem and root biomass, height and percent survival of the seedlings were measured.

1981

1981. Use of slow release fertilizers when planting sycamore, yellow poplar and cottonwood seedlings on surface mined land. In: Zimmerman, L.J.; Wittwer, R.F.; Graves, D.H., eds. 1981 Symposium on surface-mining hydrology, sedimentology, and reclamation; 1981 December 7; Lexington, KY. Lexington, KY: University of Kentucky: 477-480.

Eastern cottonwood (Populus deltoides), yellow poplar (Liriodendron tulipifera), and American sycamore (Platanus occidentalis) seedlings (1-0) were planted on a site recently mined for coal by the mountain-top removal method in southeastern Kentucky. Fertilizer treatments were applied near the time of seedling establishment and evaluated for their effect on growth and survival. Fertilizer treatment had no significant effect on survival, total height, or concentrations of N, P, and K in the foliage at the end of the first growing season.

Beller, P. 1981. Combined investigation of tree plantations for waste water disposal at the Szigetvar canning factory. Sopron, Hungary: Erdeszeti es Faipari Egyetem. 1: 34-37.

The factory's annual waste water output of 1 million m³ is discharged to 16 irrigation fields, of total area 144 ha, planted with Populus 'Marilandica'. A new improved method of irrigation was developed and operated since 1977. Over 3 years, soil and groundwater conditions improved and increment increased, becoming less variable between trees.

Ericsson, T.; Lindsjoe, I. 1981. Influence of pH on growth and nutrition of some energy forest tree species. Rep. No. SLU-ESO-TR-11; EFP-TR-11. Sveriges Lantbruksuniversitet, Uppsala, Sweden: Inst. foer Ekologi och Miljoevaard. 12 p.

Root development and plant growth of Alnus incana L., Betula verrucosa Ehrh., Populus trichocarpa Hook., and Salix viminalis L. clone 082, as responses to variations of the substrate pH, was studied in low humified peat. Growth of grey alder and birch was not affected by the substrate pH, 3.8 to 6.7, while the studied poplar and Salix plants reacted negatively at the lowest as well as at the highest pH values. It is concluded that efficient energy forestry with Populus and Salix species on peat lands requires larger amounts of lime compared with grey alder and birch.

Furdyna, L. 1981. Effect of fertilizing with power station ash on the development of Populus 'Hybrida 275' and other tree species. Sylwan. 125(5): 63-70.

Ash from the Halemba power station in Poland was applied by mixing with the top 10 cm of sandy soil (a) in a proportion of 2:1, (b) 1:1, or (c) by introducing a layer of 1:1 mixture at a depth of 60 cm, and seedlings established in 1965 at 1x1 m spacing. P. 'Hybrida 275' showed the best growth after 11 years in (b). Results are also given for seedlings of Betula pendula, Alnus glutinosa, Acer platanoides, Quercus rubra, Robinia pseudoacacia, Tilia platyphyllos, Pinus nigra, and Larix decidua, all of which were improved by application of ash with best results in (b) or (c).

Kennedy, H.E., Jr. 1981. Foliar nutrient concentrations and hardwood growth influenced by cultural treatments. *Plant and Soil*. 63(3): 307-316.

Six hardwood species were planted at a 3x3 m spacing on a slackwater clay soil (Vertic Haplaquept) in western Mississippi and subjected to three cultural treatments for a 4 year period. Cottonwood had the highest nutrient concentrations and sycamore the lowest for most elements tested.

Leech, R.H.; Kim, Y.T. 1981. Foliar analysis and DRIS as a guide to fertilizer amendments in poplar plantations. *Forestry Chronicle*. 57(1): 17-21.

The use of foliar analysis in conjunction with the Diagnostic and Recommendation Integrated System (DRIS) of Beaufils is demonstrated for the poplar clone D38 (*Populus deltoides* Marsh.) to guide fertilizer amendments and monitor subsequent tree growth by use of field and greenhouse standards.

Lu, Q.Q.; et al. 1981. Water and nutrient conditions of soils in western Liaoning Province and their relations to tree growth. *Bulletin, Institute of Forestry and Pedology, Academia Sinica*. 5: 57-78.

Data are given on soil water regimes, nutrient status, and humus content. For *Populus simonii*, growth was best on silt loam meadow soils but could also be grown on moderately 'sod-sandy' soils. Growth of *P. simonii* on weakly 'sod-sandy' soils was completely unsatisfactory because of insufficient water and its replacement by *P. sylvestris* var. *mongolica* is suggested.

Morin, M.D. 1981. Heavy metal concentrations in three-year old trees grown on sludge-amended surface mine spoil. In: Graves, D.H., ed. *Proceedings, 1981 symposium on surface mining hydrology, sedimentology and reclamation*. Lexington, KY: OES Publications, University of Kentucky: 297-306.

Data are reported on the Cd, Cu, Fe, Mn, Ni, and Zn contents of third year leaf, stem and root tissue of silver maple (*Acer saccharinum* L.), green ash (*Fraxinus pennsylvanica* Marsh.), Virginia pine (*Pinus virginiana* Mill.), river birch (*Betula nigra* L.), and eastern cottonwood (*Populus deltoides* Bartr. var. *deltoides*) growing on an abandoned surface mined tract treated with 400-1000 metric tons of digested sewage sludge per hectare.

Ogar, George Eyang. 1981. Effects of spacing and nitrogen-potassium fertilizers on dry matter accumulation and nutrient contents of two-year-old *P. X euramericana* cv. 'I-45/51' and cv. 'Robusta DN17'. *Dissertation Abstracts International*. 42/10-B: 3906.

Seasonal nutrient concentrations and contents and dry matter accumulation for *Populus X euramericana* clone 'Robusta DN17' and *Populus X euramericana* clone 'I-45/51' were studied under field conditions using 2-year-old saplings to obtain some basic information for establishing mini-rotation poplar plantations. Foliar elemental concentrations were not affected by spacing but rather by NK fertilizers which significantly increased NPK concentrations and depressed the concentrations of calcium and magnesium.

Schneider, K.R.; Wittwer, R.F.; Carpenter, S.B. 1981. Trees respond to sewage sludges in reforestation of acid spoil. In: Graves, D.H., ed. *Proceedings, 1981 symposium on surface mining hydrology, sedimentology and reclamation*. Lexington, KY: OES Publications, University of Kentucky: 291-296.

Low and high metal sewage sludges were tested for nutrient and heavy metal effects on early growth of European alder (Alnus glutinosa L.), black locust (Robinia pseudoacacia L.), cottonwood (Populus deltoides Bartr. ex Marsh.), loblolly pine (Pinus taeda L.), and northern red oak (Quercus rubra L.). All species responded favorably to sludge application and no metal toxicity was apparent.

Schmitt, M.D.C.; Czapowskyj, M.M.; Safford, L.O.; Leaf, A.L. 1981. Biomass and elemental uptake in fertilized and unfertilized Betula papyrifera Marsh. and Populus grandidentata Michx. *Plant and Soil*. 60(1): 111-121.

Estimates were made in Maine, USA, of above-ground biomass and contents of N, P, K, Ca, Mg, Mn, Na, Fe, Zn, Al, and Cu. For both species, fertilizer treatment in 1974-1975 increased average above-ground biomass increment by 150 percent and N and P content increment by 300 percent, but reduced uptake of Mn and Zn.

Van Poucke, G. 1981. Advice on reforestation of the sandy soils of the Loire region of France. *Informations Foret*. 4: 283-306.

This region has a summer water deficit attenuated by moderate temperatures. Soils are sandy or calcareous. The most suitable species for planting on sandy soils are various pines and eucalyptus, and poplars on floodplains. On deep soils, Quercus borealis (Q. rubra) and wild cherry (Prunus avium) are recommended, and walnut for calcareous soils.

Van Veen, J.A.; Breteler, H.; Olie, J.J.; Frissel, M.J. 1981. Nitrogen and energy balance of a short-rotation poplar forest system. *Netherlands Journal of Agricultural Science*. 29(3): 163-172.

The energy balance showed that at the present dry matter production the system had a net output of 54 GJ ha⁻¹ year⁻¹. An increase in dry matter production to a maximum of 25 tonnes ha⁻¹ year⁻¹, possible by planting the trees at a higher density, would raise the net energy output to 97 GJ ha⁻¹ year⁻¹, in spite of higher energy inputs associated with fertilizer applications.

1982

Alban, D.H. 1982. Effects of nutrient accumulation by aspen, spruce, and pine on soil properties. *Soil Science Society of America Journal*. 46(4): 853-861.

Nutrient analysis was done for adjacent, 40-year-old stands of pure quaking aspen (Populus tremuloides), white spruce (Picea glauca), red pine (Pinus resinosa), and jack pine (Pinus banksiana) on two soils in Minnesota to determine the effects of tree species on soil properties. On both soils, aspen and spruce stands accumulated more of most nutrients than did pine stands, and these species differences were reflected in the litterfall.

Artamonova, V.S. 1982. Soil algae of the aspen-fir forest of the "Kotorovo" stationary. In: Klevenskaia, I.L., *Otvetstvennyi redaktor*. *Mikrobiologicheskie protsessy v pochvakh Zapadnoi Sibiri*: 161-175.

Brar, H.S.; Katoch, P.C. 1982. Effect of different levels of nitrogen on growth characteristics of Populus deltoides Marsh. In: Khosla, P.K., ed. Improvement of forest biomass: Symposium proceedings. Solan, India: The Indian Society of Tree Scientists: 299-303.

Data for two clones showed that 50 kg N/ha was the most suitable N rate at the nursery stage.

DiLabio, R.N.W.; Rencz, A.N.; Egginton, P.A. 1982. Biogeochemical expression of a classic dispersal train of metalliferous till near Hopetown, Ontario. Canadian Journal of Earth Sciences. 19(12): 2297-2305.

Picea mariana (black spruce), Abies balsamea (balsam fir), Juniperus communis (juniper), Acer saccharum (sugar maple), Populus tremuloides (aspen), grasses, and their till substrate were sampled at a site of zinc mineralization in marble of the Grenville Province of southeastern Ontario.

Frank, J.; Borchgrevink, I. 1982. Soil development under Norway spruce and aspen stands at As. Meldinger fra Norges Landbrukshogskole. 61(19): 30 p.

A soil survey was carried out in an area of 900 m² containing 35-year-old stands of spruce (Picea abies), spruce with aspen (Populus tremula), and aspen with spruce. Chemical and physical properties were analyzed in detail.

Frison, G.; Negro, G.; Bardelli, P. 1982. Research on the water requirements of poplars in the nursery irrigated by sprinklers. Cellulosa e Carta. 33(10): 3-28.

Irrigation trials were carried out in two nurseries of a poplar clone in Italy, using the 'Irrisor' equipment made by Fiat. The soil at (a) Casale Monferrato was sandy, at (b) Orbassano the soil was also sandy. At (a), irrigation significantly increased diameter and height growth and growth of the root system. At (b), irrigation had no significant effect on growth.

Gilman, E.F.; Leone, I.A.; Flower, F.B. 1982. Influence of soil gas contamination on tree root growth. Plant and Soil. 65(1): 3-10.

Rooted-cuttings and saplings of green ash (Fraxinus lanceolata) and hybrid poplar (Populus spp.) were planted on a former municipal refuse landfill and on a nearby nonlandfill control plot. Green ash appeared to avoid the adverse gas environment of the deeper soil layers on the landfill by producing adventitious roots, while hybrid poplar became adapted by redirecting root growth from the deeper soil layers to the soil surface.

Inman, J.C.; McIntosh, M.S.; Foss, J.E.; Wolf, D.C. 1982. Nitrogen and phosphorus movement in compost-amended soils. Journal of Environmental Quality. 11(3): 529-532.

A field study was conducted to investigate the effect of composted sewage sludge on NO₃-N, PO₄-P, and electrical conductivity (EC) levels in soil water collected at three depths. Composted municipal sewage sludge was disked into a Chester silt loam (Typic Hapludult) at rates of 0, 150, and 300 dry tons/ha. White pine (Pinus strobus L.) seedlings and hybrid poplar (Populus generosa Henri) cuttings were grown on the plots.

Insley, H.; Carnell, R. 1982. The influence of depth and type of cover material on tree establishment on a domestic refuse landfill site. *Reclamation and Revegetation Research*. 1(3): 225-232.

Corsican pine, false acacia, common alder, goat willow, and poplar 'Scott Pauley' grown on a domestic refuse landfill survived better when clayey subsoil was used as a cover material rather than composted refuse.

Kerr, S.N.; Sopper, W.E. 1982. Utilization of municipal wastewater and sludge for forest biomass production on marginal and disturbed land. In: Sopper, W.E.; Seaker, E.M.; Bastian, R.K., eds. *Land reclamation and biomass production with municipal wastewater and sludge*. University Park, PA: Pennsylvania State University: 75-87.

The potential for using municipal wastewater irrigation for increasing the woody biomass production of forests is considered. The suitability of wastewater renovated in this way for direct groundwater recharge is discussed in relation to experiments with poplar. The use of treated municipal sludge to ameliorate mined lands is also evaluated.

Kowalkowski, A.; Krol, H. 1982. Soil characteristics in selected poplar plantations. *Prace Instytutu Badawczego Lesnictwa*. 579/583: 3-47.

Detailed morphological, physical, and chemical data are given from 18 experimental poplar plantations throughout Poland on (a) alluvial soils, (b) soils on glacial deposits, (c) loess soils, and (d) soils formed by weathering of Carpathian flysch.

Krause, H.H.; Weetman, G.F.; Koller, E.; Veilleux, J.M. 1982. Interprovincial forest fertilization program. Results of five-year growth remeasurements. Inf. Rep. DPC-X-12. Fredericton, New Brunswick, Canada: Canadian Forestry Service. 106 p.

Results are given for 81 standardized fertilizer trials in New Brunswick, Quebec, Ontario, Manitoba, Alberta, Nova Scotia, and Saskatchewan, using various combinations of nitrogen at 112 or 224 kg/ha and P and K at 112 kg/ha. Significant growth responses were most frequent in P. banksiana stands. Abies balsamea, Picea glauca, P. mariana, P. rubens, and Populus tremuloides also showed good responses at some sites. At most sites, the best responses were obtained with the combined addition of nitrogen, P, and/or K.

Loebel, K.J.; Beauchamp, E.G.; Lowe, S. 1982. Soil modification and plant growth on a calcareous subsoil material treated with a partially composted "sludge-leaf" mixture. *Reclamation and Revegetation Research*. 1(3): 283-293.

The objective of this study was to assess the ameliorative effects of a partially composted sewage sludge-leaf mixture incorporated into a calcareous subsoil road waste. Following an April application of the mixture at 0, 125, and 250 t ha⁻¹, a trefoil-fescue mixture along with three woody species were planted. Significant improvement in woody plant growth occurred only with poplar (Populus x canadensis 'Eugenei'), which had increased shoot growth and larger leaves.

Papadopol, C.S. 1982. Some effects of water supply on the accumulation of poplar biomass and energy budget. In: Zavitkovski, J.; Hansen, E.A., eds.

Proceedings, North American Poplar Council 19th annual meeting. Manhattan, KS: Kansas State University: 84-91.

Yields of four Populus X euramericana clones at age 8 and 3x3 m spacing, subjected to different water supply regimes are reported. The biomass accumulation was strongly influenced by irrigation.

Peeters, W. 1982. Experience with poplar and willow on refuse dumps. *Populier*. 19(2): 23-28.

Willow, poplar, and maple were the best species for old refuse sites. Poplars also did well on more recent deposits provided the structure was porous. On difficult sites a covering layer is required.

Perala, D.A.; Alban, D.H. 1982. Rates of forest floor decomposition and nutrient turnover in aspen, pine, and spruce stands on two soils. Res. Pap. NC-227. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 5 p.

The study sites were located on a very fine sandy loam and loamy fine sand in the Chippewa National Forest. White spruce (Picea glauca), red pine (Pinus resinosa), and jack pine (Pinus banksiana) had been planted in 1933/1934. Trembling aspen (Populus tremuloides) of the same age had developed by suckering on the loam and a rather older planted stand was available on the sand.

Perala, D.A.; Alban, D.H. 1982. Biomass, nutrient distribution and litterfall in Populus, Pinus and Picea stands on two different soils in Minnesota. *Plant and Soil*. 64(2): 177-192.

Particularly large proportions of biomass and nutrients were found in aspen bark and spruce foliage and branches; harvesting entire above-ground trees would remove up to 3 times more nutrients than harvesting the bole alone.

Reily, P.W.; Johnson, W.C. 1982. The effects of altered hydrologic regime on tree growth along the Missouri river in North Dakota. *Canadian Journal of Botany*. 60(11): 2410-2423.

Increment cores of trees were collected to examine the effects of changed hydrological regime on the radial growth of floodplain trees downstream of Garrison Dam. Alterations in seasonal streamflow patterns, near elimination of over-bank flooding and apparent lowering of the water table during the early growing season following completion of the dam in 1953 were implicated in the significant decline in postdam growth of Ulmus americana, Fraxinus pennsylvanica, Acer negundo, and Quercus macrocarpa. Populus deltoides did not show a significant decline in growth.

Roth, P.L.; Weaver, G.T.; Morin, M. 1982. Restoration of a woody ecosystem on a sludge-amended devastated mine site. In: Sopper, W.E.; Seaker, E.M.; Bastian, R.K., eds. Land reclamation and biomass production with municipal wastewater and sludge. University Park, PA: Pennsylvania State University: 368-385.

Anaerobically digested sewage sludge was applied to an abandoned surface-mined tract in southern Illinois. The site is characterized by extensive amounts of pyritic materials leading to barrenness, highly acid

runoff, and the most polluted waterway in Illinois. Third-year leaf, stem, and root tissue of Acer saccharinum, Fraxinus pennsylvanica, Pinus virginiana, Betula nigra, and Populus deltoides var. deltoides were analyzed for concentrations of Cd, Cu, Fe, Mn, Ni, and Zn in mug/g. In general there were poor correlations between spoil extractable amounts and concentrations in component parts of tree species.

Sinclair, R.; Venables, W.M. 1982. An alternative method for analyzing pressure-volume curves produced with the pressure chamber. *Plant, Cell and Environment*. 6(3): 211-217.

An equation is derived relating tissue water potential to relative water content. This equation may be used to fit a single curve to a set of data such as the standard pressure-volume measurements made with a pressure chamber. From such a single curve-fitting operation, estimates of the parameters involved may be found, and this allows calculation of such quantities as bulk modulus of elasticity, osmotic potential at full turgor and at the turgor loss point, pressure potential, and the weight of symplastic water. The method of analysis has several advantages, which are illustrated using pressure chamber data obtained from leaves of Lombardy poplar, Populus nigra L. 'italica'.

Siryk, A.A. 1982. Ways and means of increasing the effectiveness of shelterbelts on irrigated dark chestnut soils in Ukraine. *Lesovodstvo i Agrolesomelioratsiya*. 64: 11-15.

A survey of shelterbelts in the southern steppe showed that current practice of creating belts 6-7 m in height every 650-900 m gives protection to only 25 to 30 percent of the enclosed area. This value is best increased by increasing belt height through automatic irrigation of the belt itself and by choosing appropriate species. Data showed that Populus nigra 'italica' gives most protection followed by Robinia pseudoacacia and Quercus robur.

Sucoff, E. 1982. Water relations of the aspens. *Tech. Bull.* 338. St. Paul, MN: University of Minnesota, Department of Forest Resources. 36 p.

Vail, J.A.; Wittwer, R.F. 1982. Biomass and nutrient accumulation in 10-year-old eastern cottonwood, Virginia pine, and black locust plantations on eastern Kentucky mine spoil. In: Graves, D.H., ed. *Proceedings, 1982 symposium on surface mining, hydrology, sedimentology, and reclamation*. Lexington, KY: University of Kentucky: 237-242.

Eastern cottonwood, Virginia pine, and black locust growing on eastern Kentucky strip mine spoils for 10 years were examined for aboveground biomass and plant nutrient accumulation. Two treatments, tree species grown with grasses and legumes and tree species grown alone were used and nutrient concentrations of N, P, K, Ca, and Mg were determined.

Velasco, F. 1982. Biogeochemical cycle of cations and humification in soils with a riparian vegetation. *Anales de Edafologia y Agrobiologia*. 41(5-6): 815-831.

A comparative study is presented of the content of exchangeable bases and the distribution and structure of humic compounds under Fraxinus, Ulmus, and Populus.

Warnke, Jon Eldon. 1982. Endomycorrhizae of selected forest and shade tree species. Dissertation Abstracts International. 43/04-B: 929.

The roots of Acer nigrum Michx.f., Fraxinus pennsylvanica Marsh., Platanus occidentalis L., Juglans nigra L., and Populus deltoides Bart., growing in lawn and woods, were examined for endomycorrhizae.

Woods, R.F.; Hanover, J.W. 1982. Growth of Imperial Carolina poplar over a range of soil types in lower Michigan. Tree Planters' Notes. 33(2): 8-13.

Hybrid Populus X euramericana Eugenei (P. eugenei) planted on 16 windbreak sites were examined in July 1980, when the trees were aged 1-14 years, and survival, average diameter and height of dominants were recorded. Height growth was best on loamy sand soils, where it reached 2 m/yr on a site treated with paraquat and N and K fertilizer each year.

Zivanov, N. 1982. Variability properties of alluvial soils and their importance for the productivity of poplars. Topola. 26(133/134): 41-48.

1983

Banzhaf, R.; Kranzle, M.; Muhle, H.; Winkler, S. 1983. Effect of leaf leachates on nitrogen mineralization. Verhandlungen der Gesellschaft fur Okologie. 10: 63-70.

Results of incubation studies with Acer pseudoplatanus, Fagus sylvatica, Petasites hybridus, Populus nigra, Salix alba, and Ulmus glabra under controlled conditions showed that leaf leachings influenced nitrogen mineralization. These results and their possible relevance to certain plant communities on alluvial soils are discussed.

Bowersox, T.W.; Blankenhorn, P.R.; Strauss, C.H.; Stover, L.R. 1983. Growth and yield advantages of fertilizers and/or irrigation in dense Populus plantations. In: Thielges, B.A., ed. Proceedings, 7th North American forest biology workshop: Physiology and genetics of intensive culture. Lexington, KY: University of Kentucky: 393-399.

Plantations of a Populus hybrid at one tree per 0.48 m² were established on two dissimilar sites--favorable and unfavorable in inherent nutrients and waterholding capacities. At each site, there were six 0.2 ha replications (three planted in 1980 and three planted in 1981) of four treatments--control, fertilization, irrigation, and fertilization/irrigation.

Brockway, D.G.; Urie, D.H. 1983. Determining sludge fertilization rates for forests from nitrate-N in leachate and groundwater. Journal of Environmental Quality. 12(4): 487-492.

Municipal and papermill wastewater sludges were applied to conifer and hardwood forests growing on sand soils in northwestern Lower Michigan where annual precipitation averages 765 mm/yr, to investigate the impact of sludge on nitrate-N concentrations in soil water and groundwater. The analyses showed anaerobically digested municipal sludge could be applied to a red pine and white pine (Pinus strobus L.) plantation at 16.5 dry Mg/ha (990 kg total N/ha) or less and to aspen sprouts at rates up to 19 dry Mg/ha (1140 kg total N/ha) with the same water quality limits.

Chapin, F.S., III; Tryon, P.R.; van Cleve, K. 1983. Influence of phosphorus on growth and biomass distribution of Alaskan taiga tree seedlings. *Canadian Journal of Forest Research*. 13(6): 1092-1098.

Seedlings of six tree species and one tall shrub were grown in sand culture with low, medium, or high phosphate supplies. Poplar (Populus balsamifera), which had highest growth rate under high phosphate, was most sensitive to reduction in phosphate supply, followed by aspen (Populus tremuloides) and birch (Betula papyrifera), whereas growth of conifers from late successional sites was slow and unaffected by phosphate supply. Growth of alder (Alnus crispa) was high but relatively unaffected by phosphate supply.

Coleman, M.D. 1983. Source variation in water relations of Populus deltoides Bartr. var. deltoides, inoculated with vesicular-arbuscular mycorrhizal fungi. *Forestry Abstracts*. 44(10): 624. [Thesis summary].

Coleman, M.D.; Brandle, J.R.; Lovett, W.R. 1983. Water relations of different mycorrhizal cottonwood clones. In: Thielges, B.A., ed. *Proceedings, 7th North American forest biology workshop: physiology and genetics of intensive culture; 1982 July 26-28; Lexington, KY*. Lexington, KY: University of Kentucky, Department of Forestry: 335-340.

This study was designed to examine the drought resistance of Eastern cottonwood (Populus deltoides Bartr.) clones from Ohio, Missouri, and Nebraska, when such clones were either inoculated with roots infected with mycorrhizal fungi or given sterilized roots as a control.

Dawson, J.O.; Hansen, E.A. 1983. Effects of Alnus glutinosa on hybrid Populus growth and soil nitrogen concentration in a mixed plantation. In: Hansen, E.A., comp. *Intensive plantation culture: 12 years research*. Gen. Tech. Rep. NC-91. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 29-34.

Deol, G.S.; Khosla, P.K. 1983. Provenance-related growth response of Populus ciliata Wall. ex Royle to nitrogen fertilization. *The Indian Forester*. 109(1): 33-40.

Dewar, S.W.; Berglund, E.R. 1983. First-year survival and growth of willow and poplar cuttings on taconite tailings in Minnesota. In: Graves, D.H., ed. *Proceedings, 1983 Symposium on surface mining, hydrology, sedimentology and reclamation*. Lexington, KY: University of Kentucky, OES Publications: 141-147.

The objectives of this research were to evaluate the use of vegetative hardwood cuttings from two local woody plant species, crack willow (Salix fragilis L.) and balsam poplar (Populus balsamifera L.) for establishment and growth on a tailing basin.

Ferda, J.; Mottl, J. 1983. Cultivation of poplar plantations on exploited peat deposits. *Scientia Agriculturae Bohemoslovaca*. 15(1): 51-68.

Data on the effect of improvement measures on the physical and chemical properties of the soil over the period 1965-1979 are presented.

Fortin, J.A.; Chatarpaul, L.; Carlisle, A. 1983. The role of nitrogen fixation in intensive forestry in Canada. Part 2. Research carried out at Laval University in intensive forestry in Canada. Inf. Rep. PI-X-29. Petawawa, CAN: Petawawa National Forestry Institute. 113 p.

Results are reported from the following research projects: the establishment of plots of alder and other tree species to examine effects on yield and soil fertility; nutrient content of alder litter soils in stands of Alnus rugosa; competition between hybrid poplar and black alder (Alnus glutinosa); cycling of nitrogen in alder in the greenhouse; growth and survival of different provenances of Alnus glutinosa; growth of Alnus crispa and Salix on spoil heaps in region LG-2, James Bay, Quebec; allelopathic relationships of alders and poplars; the isolation of superior Frankia strains and their culture, storage and inoculation; and relationships between actinorhizal symbioses, mycorrhizae, and the rhizosphere.

Fox, J.F.; van Cleve, K. 1983. Relationships between cellulose decomposition, Jenny's k, forest-floor nitrogen, and soil temperature in Alaskan taiga forests. Canadian Journal of Forest Research. 13(5): 789-794.

Forest-floor decomposition is compared in 16 stands. These include black spruce (Picea mariana), white spruce (Picea glauca), birch (Betula papyrifera), aspen (Populus tremuloides), and balsam poplar (Populus balsamifera) types, spanning a wide range in decomposition rates, forest-floor microclimates, and litter quality.

Gordon, A.G. 1983. Nutrient cycling dynamics in differing spruce and mixedwood ecosystems in Ontario and the effects of nutrient removals through harvesting. In: Wein, R.W.; Riewe, R.R.; Methven, I.R., eds. Resources and dynamics of the boreal zone. Ottawa, CAN: Association of Canadian Universities for Northern Studies: 97-118.

Nutrient cycling dynamics and productivity of fully-stocked black spruce (Abies balsamea) on two principal landtypes, peat and moist outwash sand, are elucidated and compared with those of two boreal mixedwood ecosystems consisting of white spruce (Picea glauca), white birch (Betula papyrifera), and trembling aspen (Populus tremuloides) of moderate and high productivity.

Goudriaan, J.; de Ruiter, H.E. 1983. Plant growth in response to CO₂ enrichment, at two levels of nitrogen and phosphorus supply. 1. Dry matter, leaf area and development. Netherlands Journal of Agricultural Science. 31(2): 157-169.

The effect on plant growth of doubling the normal aerial CO₂ content was studied in lucerne, faba bean, perennial ryegrass, wheat, maize, poplar, and potato. Because nutrients often limit growth, the effect of CO₂ under N or P shortage was also studied. Doubling CO₂ had the largest effect on DM yield with a good nutrient supply, but with N shortage part of the CO₂ effect was retained even in non-leguminous species.

Guo, X.Z.; Zhao, T.X.; Dou, Z.F.; Guo, M.W. 1983. Preliminary report of study on mycorrhizal fungi of the mixed forests of Populus canadensis and Robinia pseudoacacia. Forest Science and Technology. 7: 10-13.

A mixed stand of the two species at 14-year-olds produced 65 to 95 percent more volume than that of a pure poplar stand at Shunyi County, Beijing. Air

and soil temperatures in the mixed stands were significantly higher than in pure stands. In field trials with Robinia single and double inoculations were carried out with Rhizobium japonica and vesicular-arbuscular endotrophic mycorrhizal fungi. Number of nodules, plant ht, biomass, DM, and P uptake of the trees in the double inoculation treatment were all higher than in singly inoculated or control trees.

Gyarmati-Proszk, S. 1983. Nutrient turnover in fertilized poplar stands. *Erdeszeti Kutatasok*. 74: 27-37.

An experimental plantation of hybrid black poplars (Populus 'Robusta' and P. 'I-214') on a poor sandy site low in CaCO₃ but with a permanent water table in the Danube-Tisza interfluve, Hungary, was fertilized (from the age of 2-3 years old) every 2 years with nitrogen at either 140 or 270 kg/ha, altogether 4 times, and the 140 kg/ha treatment at the first time of application was combined with 70 kg/ha P205 and 80 kg/ha K20. For both poplars, data are tabulated on biomass (DM) and contents of macro- and micro-nutrients, by plant parts, and nutrient turnover in litter.

Hansen, E.A.; Phipps, H.M. 1983. Effect of soil moisture tension and preplant treatments on early growth of hybrid Populus hardwood cuttings. *Canadian Journal of Forest Research*. 13(3): 458-464.

A growth room study indicated that bud opening began sooner as soil moisture tensions decreased up to at least -0.05 bar. Subsequent shoot elongation also increased with decreasing soil moisture tension. Warming at 3degC for 2 weeks and soaking cuttings to the stage of imminent root emergence also accelerated early shoot growth.

Heinonen, T. 1983. A fertilization experiment in a Populus tremula stand. *The Forestry Chronicle*. 17(1): 65-70.

Janson, L.; Gladysz, A. 1983. Content and proportions of nutrient elements in the leaves of two year old seedlings of aspen and its hybrids. *Prace 623. Sekocin, Poland: Prace Instytutu Badawczego Lesnictwa, Poland*. 621/625: 65-84.

Macro- and micronutrient contents of leaves were measured in pot and nursery experiments with P. tremula and several hybrids of P. tremula X P. tremuloides. The ratio of N:P:K in all seedlings was more or less constant at an average 58:3:39 on the basis of milliequivalents of NO₃⁻:H₂PO₄⁻:K⁺, and was apparently unaffected by changing soil fertility, an excess of one element or leaf age.

Kasprzyk, S. 1983. Afforestation of sandy open cast mining spoil as a basis for reclamation of degraded land in Poland. *Las Polski*. 1: 18-20.

A method developed for the reclamation of spoil in the Upper Silesian industrial region is described. A mixture of bentonite and peat with added ammonia water or NPK + microelements is applied at 15 t/ha to improve mineral nutrition and water retention. Best results were with poplars (Populus 'Grandis', P. 'Gelrica', P. 'Hybrid 275' (P. 'NE-42'), and P. 'I-214') and alder. Growth of Quercus rubra, larch, and maple were retarded by the bentonite/peat mixture.

Lawrence, William Thomas, Jr. 1983. Soil temperature effects on carbon exchange in taiga species of interior Alaska. Dissertation Abstracts International. 44/12-B: 3635. (Ph.D. Thesis).

It is hypothesized that changing soil temperature regime exerts a differential effect on the net carbon balance of the species present, leading to the replacement of hardwoods by conifers as growing season soil temperatures decline. This hypothesis was tested in two phases. First, the effect of soil temperature manipulation on hardwood seedling above- and below-ground carbon exchange was investigated in the laboratory. Then a field survey was made of maximum photosynthetic rates of hardwood and conifer species across 17 sites with naturally occurring soil temperature gradients, to test for species-specific responses in carbon exchange at distinct site soil temperatures.

Lawrence, W.T.; Oechel, W.C. 1983. Effects of soil temperature on the carbon exchange of taiga seedlings. 1. Root respiration. Canadian Journal of Forest Research. 13(5): 840-849.

Seedlings of Alnus crispa, Populus balsamifera, P. tremuloides, and Betula papyrifera, species of the taiga of interior Alaska, were grown in sand in a controlled environment room at day/night temperatures of 25 and 20degC, respectively, with a 20-h day length. After establishment, pots containing each species were placed under soil-temperature treatments of 5, 15, and 25degC while maintaining extant air-temperature and light regimes.

Lawrence, W.T.; Oechel, W.C. 1983. Effects of soil temperature on the carbon exchange of taiga seedlings. 2. Photosynthesis, respiration, and conductance. Canadian Journal of Forest Research. 13(5): 850-859.

Potted seedlings of Populus tremuloides, P. balsamifera, Alnus crispa, and Betula papyrifera, species of the taiga of interior Alaska, were placed under soil-temperature treatments of 5, 15, and 25degC with plant tops under a growth-room regime of 20-h day length and day/night air temperature of 25 and 20degC, respectively. Photosynthesis showed a differential soil-temperature effect among the species.

Lemmer, J. 1983. Chemical weed control studies on calcareous sandy soils in the region between the Danube and the Tisza. Kecskemet, Hungary. 149 p. (Thesis).

It was possible to carry out chemical weed control and soil disinfection even on the extremely dry, calcareous sandy soils of the region between the Danube and the Tisza. Doses of 400-500 kg Basamid G [dazomet]/ha or 400-500 kg Di-Trapex/ha are recommended for soil disinfection in sapling stands of acacia and grey poplar.

Li, W.H.; Guo, J.S.; Guo, Y.Q.; Luo, R.Y. 1983. Results of the application of labelled 15N and 32P fertilizers to younglings of slash pine and four clones of hybrid poplars. Journal of Nanjing Technological College of Forest Products. 3: 141-146.

Labelled fertilizer was applied to 1-year-old seedlings of Pinus elliottii and Populus 'I-214', P. 'Harvard' ('I-63/51'), P. 'Lux' ('I-69/55'), and P. 'San Martino' ('I-72/58') in pot and field experiments. The proportion of nitrogen taken up by the seedlings was a little less than that from the soil.

Clones and species differed markedly in P absorbing capacity, highest capacities being in P. 'Harvard' (pot and field), P. 'San Martino' (field), and Pinus elliottii. Soil type also significantly affected P-absorbing capacity.

Li, Y.Q.; Chen, Z.S. 1983. A preliminary study on relationship between soils and growth volume of poplars in alluvial plains of the North China and the middle Yangtze River basin. *Scientia Silvae Sinicae*. 19(1): 1-13.

Data are given on the m.a.i. of 16 poplar clones and 3 other species (Taxodium ascendens, Pterocarya stenoptera, and Catalpa bungei) growing in the 10 soil types found in this region.

Mahendrappa, M.K. 1983. Chemical characteristics of precipitation and hydrogen input in throughfall and stemflow under some eastern Canadian forest stands. *Canadian Journal of Forest Research*. 13(5): 948-955.

At the Acadia Forest Experiment Station in central New Brunswick chemical characteristics of rain samples collected at 5 locations were determined during 1977-1981. Throughfall and stemflow samples from 6 coniferous and 3 broadleaved stands were collected and chemically characterized starting from the early 70's. Throughfall had a higher pH than rain and broadleaved throughfall had a higher pH than the coniferous throughfall. The hydrogen ion load of rain was reduced by all tree species, but there was considerable variation between them in ability to reduce total the hydrogen ions reaching the soil.

McCormick, L.H.; Amendola, F.A. 1983. Soil pH, extractable aluminum and tree growth on acid minesoils. *Communications in Soil Science and Plant Analysis*. 14(3): 249-262.

Paper birch (Betula papyrifera) and hybrid poplar (Populus hybrid) were grown in three acid minesoils amended with different rates and types of lime. Growth of the trees was assessed in relation to soil pH, Ca, Mg, K, P, and Al extractable with 1 N KCl, 0.01 M CaCl₂ and H₂O.

Mital, D.; Sucoff, E. 1983. Predicting soil moisture depletion beneath trembling aspen. *Canadian Journal of Forest Research*. 13(1): 45-52.

Robertson, S.D.; Wittwer, R.F. 1983. The effects of slit-applied fertilizer treatments on growth and survival of sycamore and cottonwood planted on minespoil. In: Graves, D.H., ed. *Proceedings, 1983 Symposium on surface mining, hydrology, sedimentology and reclamation*. Lexington, KY: University of Kentucky, OES Publications: 483-488.

Data from a trial with Populus deltoides and Platanus occidentalis seedlings showed that slit application of slow-release fertilizers can aid growth of seedlings without damaging them.

Schultz, R.C.; Isebrands, J.G.; Kormanik, P.P. 1983. Mycorrhizae of poplars. In: Hansen, E.A., comp. *Intensive plantation culture: 12 years research*. Gen. Tech. Rep. NC-91. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 17-28.

Shoot cuttings of 2 hybrid poplar clones were grown in untreated soils with natural inoculum, in fumigated soils with ecto- or endomycorrhizal fungi

or left untreated. Mycorrhizal infection and biomass growth in stems, leaves, and roots were recorded after one season.

Sergeev, V.K. 1983. Ammonia loss in various litters when urea and ammonium nitrate are applied. OOENV TR-2379. Ontario, Canada: Environment Canada. 6 p.

Shumakov, V.S. 1983. Foliar diagnosis scales for the fertilizer requirement of woody species. *Lesnoe Khozyaistvo*. 12: 14-15.

Details are given of the scales developed in E. Germany by H.G. Krauss and D. Heinsdorf for determining the nutrient requirements of Scots pine and various broadleaved tree species. The scales are for N, P, K, Mg, and Ca.

Singh, T. 1983. A proposed method for preliminary assessment of erosion hazards in west-central Alberta. Inf. Rep. NOR-X-251. Edmonton, Alberta, Canada: Northern Forest Research Centre. 17 p.

Infiltration rates were measured in forest dominated by (a) Pinus contorta var. latifolia, (b) P. glauca/P. mariana/Abies lasiocarpa, and (c) Populus tremuloides, growing on 18 soil types. Erosion potential was classified on a five-point scale. Average infiltration capacity in each forest type suggested low erosion susceptibility for (a), high for (b), and moderate for (c).

Smilde, K.W.; van den Burg, J. 1983. Sewage sludge in forests - potential and problems. Mededeling, Rijksinstituut voor Onderzoek in de Bos- en Landschapsbouw 'De Dorschkamp'. 207: 5 p.

A discussion of research on a limited scale with broadleaved species in pot and field trials with sewage sludge and (calcareous) harbor sludge. Most of the species grew reasonably well and remained healthy. Heavy-metal uptake depended both on concentration in the sludge and preferences of species (poplars and Betula pendula showed particularly high uptake of Zn and Quercus robur of Cu). Sludges differed greatly in composition and properties and changed with time, so that planting advice for areas of sludge deposits can only be given with reservations.

Timmer, V.R.; Savinsky, H.M.; Marek, G.T. 1983. Impact of intensive harvesting on nutrient budgets of boreal forest stands. In: Wein, R.W.; Riewe, R.R.; Methven, I.R., eds. Resources and dynamics of the boreal zone. Ottawa, CAN: Association of Canadian Universities for Northern Studies: 131-147.

The effect of intensive logging systems on future forest productivity was assessed on four contrasting stand conditions in the Nipigon area: a young coniferous (Abies balsamea) stand, a young deciduous (Populus tremuloides - Betula papyrifera) stand, and two 120 year old Picea mariana stands, one established on deep mineral soils, the other on shallow soils restricted by bedrock.

Vakulin, A.A.; Semenov, B.S.; Abramov, B.A. 1983. Stands irrigated with effluents. *Lesnoe Khozyaistvo*. 5: 21-24.

An account of trials in the Volga region of the USSR on the use of effluents from an industrial chemical combine to irrigate young plantations of several broadleaved species on saline solonetz soils. Data are tabulated on the growth of Populus nigra, Ulmus pumila, Robinia pseudoacacia, Acer tataricum, and Fraxinus excelsior with effluent irrigation, and on the

contents of water-soluble salts and several trace-elements in the soil. The results indicate that irrigation with effluent dilutes the soil solution, reduces the salt content in the top 4 m of soil, and causes an accumulation of elements such as Ti, Ba, Mn, Cr, Sr, W, Zr, and Ni. Irrigation with effluent is shown to be economically as well as biologically effective.

Van Cleve, K.; Oliver, L.; Schlentner, R.; Viereck, L.A.; Dyrness, C.T. 1983. Productivity and nutrient cycling in taiga forest ecosystems. *Canadian Journal of Forest Research*. 13(5): 747-766.

Data are presented from the major forest types in interior Alaska (black spruce, *Picea mariana*; white spruce, *P. glauca*; paper birch, *Betula papyrifera*; quaking aspen, *Populus tremuloides*; and balsam poplar, *P. balsamifera*) and examined from the standpoint of the control exerted over them by soil temperature and forest-floor chemistry.

Vasil'eva, N.P. 1983. Natural regeneration of forest on spoil mounds of the Kireev open-cast iron-ore site. OOENV TR-2342. Environment Canada. 13 p. Translated from: *Lesovedenie* (1981). 3: 78-82.

Viereck, L.A.; Dyrness, C.T.; Van Cleve, K.; Foote, M.J. 1983. Vegetation, soils, and forest productivity in selected forest types in interior Alaska. *Canadian Journal of Forest Research*. 13(5): 703-720.

A study of 23 forest stands in the taiga arranged on an environmental gradient from an aspen (*Populus tremuloides*) stand on a dry, steep south-facing bluff, to open black spruce (*Picea mariana*) stands underlain by permafrost on north-facing slopes. A typical soil profile is described for each major forest type. The study supports the hypothesis that black spruce is a nutrient poor, unproductive forest type, and that its low productivity is primarily the result of low soil temperature and high soil moisture.

Williams, T.M.; Gresham, C.A.; Askew, G.R.; Hook, D.D.; Guynn, D.C. 1983. Nitrogen supply for forests intensively managed for fiber and energy in the Atlantic Coastal Plain: a modeling approach. Gen. Tech. Rep. PNW-163. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station: 272-279.

Productivity efficiency (kg/yr/kg N) indicated that if the amount of available land is limited, short rotations of loblolly pine or eastern cottonwood should be emphasized.

Wong, J.Y. 1983. Evaluation of soil strength measurements. NRCC 22881. Ontario, CAN: National Research Council Canada. 47 p.

The results of an evaluation study of the strength of the terrain in 2 hybrid poplar plantation sites in Ontario are presented.

Woods, R.F.; Moore, L.M.; Wilson, L.F.; Ostry, M.E.; Dickmann, D.I. 1983. Performance of 3-year-old hybrid poplar clones on glacial soils in lower Michigan. In: Thielges, B.A., ed. *Proceedings, 7th North American forest biology workshop: physiology and genetics of intensive culture*; 1982 July 26-28; Lexington, KY. Lexington, KY: University of Kentucky, Department of Forestry: 417-422.

Results of 3-year-old hybrid poplar tree performance show a significant decrease in height growth and a significant increase in pest incidence as natural, internal soil drainage is either reduced or approaches excessive.

Xiang, K.F. 1983. Analysis of forest growth and soil in the sea shore safeguarding plantation of north-east region. *Journal of North-Eastern Forestry Institute, China*. 11(1): 72-81.

Data are given for the growth of the main species planted. Robinia pseudoacacia grows best on thick brown forest soil but does not tolerate excessive moisture. It is more salt tolerant than Populus spp. (P. canadensis and P. pekinensis [P. tomentosa]), but these grow better on sandy soil which can be wet but drains well.

Younger, P.D.; Kapustka, L.A. 1983. N₂(C₂H₂)ase activity by Alnus incana spp. Rugosa (betulaceae) in the northern hardwood forest. *American Journal of Botany*. 70(1): 30-39.

Field assays of N₂(C₂H₂)ase activity were performed with intact nodules from a pure alder site (alder) and a mixed alder-aspen site (aspen).

Zaval'ko, F.P. 1983. Effectiveness of mineral fertilizers 8 years after application to a black poplar stand on a meadow chernozem soil. *Lesovodstvo i Agrolesomelioratsiya*. 66: 38-41.

N, P, and NP were applied at rates of 130 kg/ha ammonium nitrate and 70 kg/ha superphosphate to 6-year-old stands of Populus nigra on calcareous sandy loam soils in Poltava Province, Ukraine.

1984

1984. Soils: the foundation of new forests in Ontario: hybrid poplar. *Journal of Forestry*. 82(9): 565.

Carlson, P.J.; Dawson, J.O. 1984. Effects of autumn-olive and black alder leaf mulches on the growth of eastern cottonwood in two soils. For. Res. Rep. 84-1. Urbana-Champaign, IL: University of Illinois, Department of Forestry, Agricultural Experiment Station. 3 p.

Cuttings of Populus deltoides were potted in a loamy prairie soil or in a 2:1:1 sand/peat/soil mixture, mulched with litter from P. deltoides, Alnus glutinosa, or Elaeagnus umbellata. Dry weight of stem and branches was determined after 22 weeks. Results suggest that nitrogen-fixing nurse species would benefit poplar establishment even on fertile prairie soils.

Cote, B.; Camire, C. 1984. Growth, nitrogen accumulation, and symbiotic dinitrogen fixation in pure and mixed plantings of hybrid poplar and black alder. *Plant and Soil*. 78(1/2): 204-220.

Growth and N accumulation were assessed in pure and mixed plantings (2 years old) of hybrid poplar and black alder in southern Quebec. Symbiotic dinitrogen fixation was evaluated by natural ¹⁵N dilution. Growth and N uptake of hybrid poplar increased with decreasing proportion of this species in the mixture, whereas there were no differences among treatments for black alder. The amount of nitrogen accumulated in entire plants of black alder

from symbiotic fixation could be sufficient to balance the N export in harvested stems and branches of short-rotation plantations containing at least 33 percent of alder.

Danielson, R.M. 1984. Ectomycorrhiza formation by the operculate discomycete Sphaerosporella brunnea. *Mycologia*. 76(3): 454-461.

The fungus formed ectomycorrhizas with jack pine (Pinus banksiana) in monaxenic cultures and in open containers and with spruce, larch, and Populus spp. The mycorrhizas were characterized by thin mantles and large diameter hyphal cells with Woronin bodies at the septa. S. brunnea is unusual as a mycorrhizal symbiont due to its taxonomic position, carbonicolous nature, very rapid growth rate, and ease of ascospore germination.

Denev, D. 1984. Effect of fertilizer treatment on the growth of some poplar clones on a typical poplar site. *Gorsko Stopanstvo*. 40(3): 18-22.

Eight poplar clones were established at a spacing of 4x4 m on a Danube floodplain site in Bulgaria in 1971. Some plots were given PK fertilizer treatment plus watering at planting, and further fertilizers (NPK) were applied in the following years. Diameter growth was greater on the fertilized plots, and the best clones were Populus 'I-214', P. 'Weltheimeipappel', and P. 'I-45/51'; the poorest clone was P. 'I-262'. The clone recommended for this site is P. 'I-45/51'.

Dmitrienko, V.K. 1984. Dynamics of the numbers of predacious Coleoptera in woods of the lower reaches of the Angara. *Biologicheskikh Nauk*. 18: 106-112.

Studies were conducted in the Krasnoyarsk territory of the USSR on predatory carabids and staphylinids in the soil in 3 types of forest (pine, fir, and aspen) and in an overgrown area of trees and shrubs. Determinations were made of species composition, distribution in each biotope, dynamics of activity of the abundant species, and their relation to hydrothermic conditions and food sources.

du Cross, E.T.; Jung, G.; Bariteau, M. 1984. Alder-Frankia interaction and alder-poplar association for biomass production. *Plant and Soil*. 78(1/2): 235-243.

In a two-year field trail, inoculation of alder seedlings with Frankia increased the height of Alnus glutinosa at 2 years of age and of A. cordata at 1 and 2 years of age, but had no effect on A. rubra. In a closely spaced field trial, the total volume production of Populus trichocarpa X P. deltoides and Alnus glutinosa grown together in mixed plots was less than production in plots containing poplar alone, indicating that nitrogen fixation by alder did not benefit the associated poplar.

Duvigneaud, P.; Denaeyer, S. 1984. Net primary productivity and mineral cycling in the main forest types and tree plantations in Belgium. Rep. 13. Belgium: Institutionen for Ekologi och Miljovard, Sveriges Lantbruksuniversitet: 357-375.

Concepts of ecosystem, biomass, mineralomass, energy flow, carbon cycle, productivity and mineral cycling are discussed in the first part of this report. The second part synthesizes the results obtained for net primary productivity (NPP) and mineral cycling in the main forest types and tree

plantations studied in southern and central Belgium since 1965. N, P, K, and S absorption and storage in phytomass depend mainly on botanical composition of the stand; the Ca and Mg mineral cycling depends more on soil condition. N absorption and storage in Populus plantations is as high as in ecosystems associated with atmospheric N fixing micro-organisms.

Evers, R.W.; Morse, S.H.; Rogers, D.L. 1984. Soils: the foundation for poplar plantations in Ontario. In: Stone, E.L., ed. Forest soils and treatment impacts: Proceedings, 6th North American forest soils conference; 1983 June; Knoxville, TN. Knoxville, TN: University of Tennessee, Department of Forestry, Wildlife and Fisheries: 29-40.

A discussion of the need for intensive soil surveys and the use of the detailed information in management planning including site preparation, allocation of clonal stock, and tending prescriptions.

Fisher, J.T.; Fancher, G.A. 1984. Effects of soil amendments on aspen seedling production. In: Murphy, P.M., comp. The challenge of producing native plants for the Intermountain area: Proceedings, Intermountain nurseryman's association; 1983 August 8-11; Las Vegas, NV. Gen. Tech. Rep. INT-168. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 66-68.

Populus tremuloides seeds were sown in nursery beds in north central New Mexico, amended with S and peat moss (at 0, 1/4, 1/2, and 3/4 vol./vol.). After 17 weeks, seedlings were harvested, weighed, and leaf area measured. Moss treatment significantly increased height, diameter, leaf number and area, and root and shoot dry weight compared with soil + S alone.

Francis, J.K. 1984. Yield and nutrient removal by whole-tree harvest of a young bottomland hardwood stand. Res. Note SO-305. Atlanta, GA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 4 p.

Sixteen 0.1-acre circular plots were laid out in an 11-year-old mixed stand in Mississippi. Half were harvested in summer (late August) and half in winter (January), trees being felled 2 inches above ground. Data were collected from all trees 4.5 feet tall on species, d.b.h., total height, and green weight. Samples of chipped whole trees and soil collected in August and January were analysed for nutrient content. Soil reserves were high enough to sustain intensive harvests for many 11-year rotations.

Gonzalez Carcedo, S.; Fuente Marco, M.A. 1984. Microbial modulation of soil urease. *Anales de Edafologia y Agrobiologia*. 43(3/4): 479-490.

Studies were made on urease activity, organic matter content (OM) and microorganism populations at 13 sites in Burgos province, Spain, under vegetation cover consisting of trees (Populus alba, pine, or oak), matorral, crops (beetroot, legumes), grapevines, or horticultural plantings.

Harrington, C.A.; DeBell, D.S. 1984. Effects of irrigation, pulp mill sludge, and repeated coppicing on growth and yield of black cottonwood and red alder. *Canadian Journal of Forest Research: Canadian Journal of Chemistry*. 14(6): 844-849.

Growth and yield of black cottonwood (Populus trichocarpa) and red alder (Alnus rubra) on Lady Island, Washington, were measured at 4 successive 2-year coppice harvests. Three amounts of amended pulp mill sludge (450, 225, and 0 t/ha) were applied before planting, and one-half of the plots were irrigated during the 2-year establishment period before the first coppice cycle. Yields of black cottonwood were generally much higher than yields of red alder; annual maximum oven-dry yields were 13.8 t/ha for black cottonwood and 7.1 t/ha for red alder. The species differed in their responses to treatment.

Harris, A.R.; Urie, D.H.; Cooley, J.H. 1984. Sludge fertilization of pine and aspen forests on sand soils in Michigan. In: Stone, E.L., ed. Forest soils and treatment impacts: Proceedings, 6th North American forest soils conference; 1983 June; Knoxville, TN. Knoxville, TN: University of Tennessee, Department of Forestry, Wildlife and Fisheries: 193-206.

Kennedy, H.E., Jr. 1984. Hardwood growth and foliar nutrient concentrations best in clean cultivation treatments. *Forest Ecology and Management*. 8(2): 117-126.

Five hardwood species planted at 3x3 m spacing on a Mississippi River front soil (Aeric Fluvaquents) in western Mississippi were subjected to three cultural treatments. Periodic discing substantially increased height, diameter, and survival of trees through 4 years. Disced plots had significantly lower soil N than mowed and control; Mg was considerably higher in disced than control plots. Cultural treatments did not affect other measured soil nutrient levels. Trees growing on disced plots had significantly higher N and significantly lower P, K, and Mg concentrations than those in control plots. Foliar concentrations of K and Mg in disced and mowed plots were similar. Cultural treatments did not affect foliar Ca concentrations. Sweetgum had the lowest nutrient concentration and cottonwood or green ash the highest for most nutrient elements tested. Other species were intermediate, and no ranking was readily apparent.

Khosla, P.K.; Deol, G.S. 1984. Growth response of male and female clones of Populus ciliata Wall. ex Royle to nitrogen fertilizer. In: Proceedings of the Indian National Science Academy. Part B: Biological Sciences. New Delhi, India: Indian National Science Academy. 50(6): 603-606.

Lemmer, J. 1984. Application of Buviplant-C in growing Populus alba seedlings. *Erdo*. 33(7): 321-323.

Trials of this slow-release fertilizer produced by the Budapest Chemical Works were made on a limy alluvial soil in Hungary at a rate of 120 kg on 0.6 ha. Its available nutrient composition was 22 percent nitrogen, 11 percent P205, 11 percent K20, 4 percent Mg, and trace elements. Regular irrigation increased the fertilizer response. Because this fertilizer is applied only once before sowing, it is more convenient than others in current use.

Lousier, J.D. 1984. Population dynamics and production studies of species of Euglyphidae in an aspen woodland soil. *Pedobiologia*. 26(5): 309-330.

Lousier, J.D. 1984. Population dynamics and production studies of Phryganella acropodia and Diffugiella oviformis in an aspen woodland soil. Pedobiologia. 26(5): 331-347.

McIntosh, M.S.; Foss, J.E.; Wolf, D.C.; Brandt, K.R.; Darmody, R. 1984. Effect of composted municipal sewage sludge on growth and elemental composition on white pine and hybrid poplar. Journal of Environmental Quality. 13(1): 60-62.

A field study was conducted to determine the benefits of land application of composted municipal sewage sludge to white pine (Pinus strobus L.) and hybrid poplar (Populus deltoides spp., P. angulata X P. trichocarpa) growth. White pine seedlings and hybrid poplar cuttings were grown for 3 years on the plots which had been seeded with 'Kentucky 31' tall fescue (Festuca arundinacea Schreb.). White pine growth was not affected by the compost treatments. Poplar growth, however, increased as a result of the compost application. Hybrid poplars grown on the compost-amended soil had higher concentrations of N and K and a lower concentration of Zn in the leaves than the control. No consistent differences in elemental composition of the white pine needles were apparent.

Mital, D.; Sucoff, E. 1984. Predicting soil moisture depletion beneath trembling aspen. Canadian Journal of Forest Research. 13(1): 45-52.

Soil moisture and potential evapotranspiration were monitored in four stands of Populus tremuloides in Minnesota during two growing seasons. Measured soil moisture was compared with soil moisture predicted by four models: THIRSTY, SOGGY, Zahner's, and a simple water budget.

Papamichos, N.; Seilopoulos, D.; Alifragis, D. 1984. Effects of mineral fertilization on growth of poplar ('I-214') plantations. Dasiki Erevna. 5(2): 211-220.

The effects of N, P, and K fertilizations on the growth of young cv. 'I-214' poplar plantations were studied on alluvial soils in the lower part of Aliakmon River. Results show that diameter growth during the first 3 years was significantly increased with fertilization. Relative growth was higher in poorer sites, while absolute growth was higher in better sites. Dry conditions during the growth season affect growth much more in the worst sites.

Pasternak, P.S.; Koptev, V.I.; Lishenko, A.A.; Krivobokova, N.Ya. 1984. Forestry potential of shell-sand soils on Biryuchii Island. Lesovodstvo i Agrolesomelioratsiya. 69: 3-7.

A survey was made of soil conditions, especially water table depth, salt content, and groundwater chemistry, on this island of 7,700 ha in the Sea of Azov, Ukraine, with a terrain of low parallel ridges. Several species have performed well in a park established in 1956-1964, notably Populus deltoides.

Pierpoint, G.; Jones, R.K.; Jeglum, J.K.; Wickware, G.M.; Arnup, R. 1984. Characteristics and management implications of ecosystems with boreal hardwood components in the Great Clay Belt, northern Ontario, Canada. In: Stone, E.L., ed. Forest soils and treatment impacts: Proceedings, 6th North American forest soils conference; 1983 June; Knoxville, TN. Knoxville, TN: University of Tennessee, Department of Forestry, Wildlife and Fisheries: 17-28.

Populus tremuloides, P. balsamifera, and Betula papyrifera form a significant component of the boreal forest within the Clay Belt. The ecosystems with broadleaved species are described and compared in terms of vegetation (trees, shrubs, and herbs) and soil (texture, calcareousness, drainage, pH, profile development, and humus form). Management of these ecosystems is discussed.

Rijmenhams, J. 1984. Distribution of Urtica dioica L. and Rubus fruticosus L. (+ agg.) in relation to edaphic factors in cultivated poplar woods. *Folia Geobotanica et Phytotaxonomica*. 19(1): 83-87.

In field studies in poplar woods in the Winghe valley, Belgium, the distribution of U. dioica and R. fruticosus agg. was assessed using cover/abundance techniques in 210 quadrants.

Running, S.W. 1984. Documentation and preliminary validation of H2OTRANS and DAYTRANS, two models for predicting transpiration and water stress in western coniferous forests. Res. Pap. RM-252. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 45 p.

The models were developed to study flow through coniferous stands in the western USA for hourly and daily timesteps. They incorporate rates of snowmelt, precipitation, canopy interception, and litter and soil evaporation. Simulated soil water depletion compared reasonably well with actual values measured with a neutron probe. A sensitivity analysis of the models is given and ranges of applicability are discussed.

Schonau, A.P.G. 1984. Fertilization of fast-growing broadleaved species. In: Grey, D.C.; Schonau, A.P.G.; Schutz, C.J., eds. Proceedings, IUFRO symposium on site and productivity of fast growing plantations. Pretoria, South Africa: South African Forest Research Institute; 1: 253-268.

The results of field experiments in fertilizer research with the fast-growing broadleaved genera Acacia, Eucalyptus, and Populus are reviewed. It is concluded that for Acacia and Eucalyptus species fertilizing at planting increases timber yields at harvesting but Populus species grown on longer rotations require repeated fertilizer applications.

Sheikh, M.I.; Bangash, S.H. 1984. Response of hybrid poplar to the application of major fertilizer nutrients at Changa Manga. *Pakistan Journal of Forestry*. 34(1): 41-47.

NPK in various combinations was applied to 4-year-old Populus 'I-214' in an irrigated plantation at Changa Manga, SE of Lahore, Pakistan, in 1978. There was no significant difference in height or diameter between any of the treatments or controls. However, nutrient uptake by leaves of treated plants increased significantly during the first vegetative growth period.

Singh, R.V.; Sharma, K.C. 1984. Effect of soil-mix on the growth of Populus ciliata in the nursery. *Indian Journal of Forestry*. 7(2): 102-105.

Cuttings from plants grown in the nursery over one season were planted in tins containing 5 different soil mixes at Shilly and Shillaru nurseries in Himachal Pradesh in 1981. Mixes were pure nursery soil (clay loam in both cases), pure sand, or mixtures of these containing 25, 75, or 50 percent of

nursery soil. Height and diameter were greatest and root:shoot ratio least in the 50:50 soil mixture. Total root volume increased with the proportion of sand up to 50 percent and then stabilized; the volume of fine roots increased with the proportion of sand up to 75 percent; the volume of coarse roots was greatest at 25 and 50 percent sand. It was concluded that the best growth occurred in sandy loam (the 50:50 mix).

van den Burg, J. 1984. Iron and manganese status of poplars and willows. *Populier*. 21(2): 63-72.

A review of the problem in a Netherlands context, tabulating foliar concentrations, deficiency levels, and adequate and very high levels for 9 poplar cultivars and 4 willows.

Varfolomeev, V.E. 1984. Determining the times and amounts of watering for poplar plantations by the transpiration rate. *Lesnoe Khozyaistvo*. 11: 49-52.

Investigations were made in poplar variety trials on furrow-irrigated areas in the Astrakhan Region. The poplars studied were Populus nigra var. 'italica', P. alba var. pyramidalis, P. 'Robusta-236', and P. '48'. Irrigation becomes necessary when soil moisture content falls to 50 percent of field capacity. A graph is presented for calculating the amount of irrigation water required.

Walker, C.; McNabb, H.S., Jr. 1984. Mycorrhizal symbionts associated with hybrid poplars from Iowa, USA. *European Journal of Forest Pathology*. 14(4/5): 282-296.

Seven clones of hybrid poplar, with parents from 4 sections of Populus, were potted in 5 Iowan soils. After 1 year they were sampled for mycorrhizas and endogonaceous spores. Of the 8 species of Endogonaceae recorded, 7 are known to form endomycorrhizas. Two ectomycorrhizal fungi, Cenococcum geophilum and an unidentified species, were noted. There were indications of differences in mycotrophy among the Populus sections.

Wang, D.Y. 1984. Effects of underground water table on planting of poplars in areas around Dongting Lake. *Forest Science and Technology (LinYE Keji Tongxun)*. 12: 15-17.

Trials with Populus 'I-72/58' and 'I-69/55' showed that apart from planting and silvicultural techniques, climate and soil conditions, underground water level was another important factor affecting growth.

1985

Alban, D.H. 1985. Seasonal changes in nutrient concentration and content of aspen suckers in Minnesota. *Forest Science*. 31(3): 785-794.

Cote, B.; Camire, C. 1985. Nitrogen cycling in dense plantings of hybrid poplar and black alder. In: International symposia on Frankia and Actinorhizal plants; 1984 August 5-9; Montmorency Forest, Quebec, Canada. *Plant and Soil*. 87(1): 195-208.

Dawson, J.O.; Gertner, G.Z. 1985. Temporal and spatial changes in soil nitrogen concentration around Alnus glutinosa stressed by interplanted hybrid poplar. In: Dawson, Jeffrey O.; Majerus, Kimberly A., eds. Proceedings, 5th Central hardwood forest conference; 1985 April 15-17; Urbana-Champaign, IL. SAF Publ. 85-05. Urbana-Champaign, IL: University of Illinois, Department of Forestry: 251-256.

Ferm, A. 1985. Early growth and biomass production of some broadleaves grown on sanitary landfill and irrigated with leachate waste water. *Folia Forestalia*, Institutum Forestale Fenniae. 641: 35 p.

Fast growing trees (Salix aquatica, S. viminalis, Populus rasumowskyana, and Betula pendula) were grown on three landfills in southern Finland with different topsoils (gravelly sand moraine, bark humus/sludge, and gravelly sand moraine/coarse sand). Leachate reservoirs from the landfills were used to irrigate the trees. Trees did not survive on the gravelly sand moraine/coarse sand soil because of toxicity of the waste water and compaction of the soil.

Francis, J.K. 1985. Bottomland hardwood fertilization--the stoneville experience. In: 3d Biennial southern silvicultural research conference; 1984 November 7-8; Atlanta, GA. Gen. Tech. Rep. SO-54. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station: 346-350.

Godbout, C.; Fortin, J.A. 1985. Synthesized ectomycorrhizae of aspen: fungal genus level of structural characterization. *Canadian Journal of Botany*. 63(2): 252-262.

The ability of Populus tremuloides to form ectomycorrhizas with identified species of fungi was investigated using a pouch technique. Out of 54 species, all but 3 isolated from sporophore tissue, 29 formed ectomycorrhizas on aspen seedlings. Aspen seems to display little specificity for ectomycorrhizal fungi.

Gorbachev, V.N.; Popova, E.P. 1985. Forest growth properties of the soils of the Yenisei hills. *Lesovedenie*. 2: 3-9.

Investigations were made of the physical and chemical properties of the soddy-podzolic clay-loam soils under four different forest types in the Yenisei hills (Krasnoyarsk region of Siberia), viz. Abies sibirica, 105-125 years old, site class IV, 290 m³/ha; Picea obovata, 137-140 years old, site class III, 310 m³/ha; Larix sibirica, site class I, larch 220-240 and aspen 130-140 years old, 480 m³/ha; and Populus tremula, 140-155 years old, site class II, 470 m³/ha.

Grimstad, S.O. 1985. Soil mixing, liming and fertilization of woody plants and grasses in a polluted industrial area. *Forskning og Forsok i Landbruket*. 36(3): 117-125.

Pollution tolerance was compared in 13 woody species and 4 turf species growing in a heavily polluted area. The species were classified as tolerant (Alnus glutinosa, Fraxinus excelsior, Populus trichocarpa, and Festuca rubra), intermediate (Alnus incana, Picea pungens f. glauca, Agrostis tenuis [capillaris]) or sensitive (Abies concolor, Acer platanoides, Berberis

thunbergii, Betula verrucosa [pendula], Cornus alba cv. Sibirica, Pinus sylvestris, Sorbus aucuparia, Ulmus glabra, Lolium perenne, and Poa pratensis).

Hansen, E.A.; Tolsted, D.N. 1985. Nitrogen sources and fertilizer rates affect growth of hybrid poplar. In: Dawson, Jeffrey O.; Majerus, Kimberly A., eds. Proceedings, 5th Central hardwood forest conference; 1985 April 15-17; Urbana-Champaign, IL. SAF Publ. 85-05. Urbana-Champaign, IL: University of Illinois, Department of Forestry: 71-77.

Hansen-Bristow, K.J.; Wilson, D.M. 1985. Growth responses of lodgepole pine and quaking aspen to sewage effluent application. Proceedings of the Montana Academy of Sciences. 45: 19-25.

Hegg, R.O.; Shearin, A.T.; Handlin, D.L. 1985. Swine lagoon effluent applied to hardwood seedlings. In: Proceedings, 5th International symposium on agricultural wastes: Agricultural waste utilization and management; 1985 December 16-17; Chicago, IL. ASAE Publ. SP 13-85. St. Joseph, MI: American Society of Agricultural Engineers: 249-256.

Pig lagoon effluent was applied to 3 hardwood species: yellow poplar (Liriodendron tulipifera L.), green ash (Fraxinus pennsylvanica Marsh.), and eastern cottonwood (Populus deltoides Bartr. ex Marsh.). Green ash was the best choice for hardwood seedling survival rates. No measurements of growth could be made on cottonwood trees due to a low survival rate, while no significant difference in growth rate was found for the yellow poplar for the different application rates.

Heinsdorf, D. 1985. Mineral fertilizer treatment of Populus 'Androscoggin' on spoil sands at exhausted open-cast soft-coal mining sites in the Cottbus region. Beitrage fur die Forstwirtschaft. 19(1): 34-40.

Studies were made at 2 sites in E. Germany at which P. 'Androscoggin' was given various N/P/K treatments (or NPKCa) beginning in 1976 (age 3 or 5 years), and in 1977 and 1978. Earlier, during site rehabilitation, one site had been given lime treatment and the other lime + P. Foliage analyses indicated deficiencies of N, K, and P. N-treated trees were approximately 1 m greater in height than trees not treated with N, but P, K, and Ca had no significant effect on growth. Suitable spoil soil types in E. Germany are listed; recommended fertilizer treatment is N, combined with amelioration (of acid sites) by the application of lime.

Heslin, K.; Douglas, G. 1985. Mycorrhizae. Res. Rep. 1984, Horticulture. Dublin, Ireland: An Foras Taluntais: 42-43.

Of 18 fungi tested in vitro with Populus trichocarpa x tacamahaca hybrid TT32, 4 Paxillus involutus isolates, 1 of Thelephora terrestris, and 1 of an unnamed fungus formed ectomycorrhizas. Two isolates of Hebeloma crustuliniforme, and 1 of Pisolithus tinctorius formed mantles only on the roots. The presence of ectomycorrhizal fungi increased nutrient levels in poplar hybrids and increased rooting, which contributed to better fitness for planting out.

Heslin, M.C. 1985. Ectomycorrhizae of poplar hybrids in Ireland. *Journal of Life Sciences, Royal Dublin Society*. 5(2): 93-96.

Roots of Populus spp. from 5 locations were examined. The 5 most frequently encountered genera are described and classified as Ac, Cc, Fb, Fg, and Ia following Dominik.

Horak, E.; Nemes, L. 1985. Provision of nutrients to lowland stands of hybrid black poplars. *Erdo*. 34(8): 365-368.

Recommendations are made on fertilizer application to plantations of Populus X canadensis in Hungary before planting, during planting (in the hole in tablet form) and annually thereafter. The annual applications are influenced by soil pH, stickiness, and humus content, and can be in spray form.

Iskra, A.; Hindal, D.F. 1985. Ectomycorrhizal associations of Populus-grandidentata colonizing coal-mine refuse. *Phytopathology*. 75(5): 625-626.

Jepsen, E.A.; Bockheim, J.G. 1985. Acidic deposition influences on biogeochemistry of four forest ecosystems in northwestern Wisconsin. In: Jepsen, E.A.; Bockheim, J.G.; Caldwell, D.E.; Brierley, J.A.; Brierley, C.L., eds. *Planetary ecology: 6th International symposium on environmental biogeochemistry*; 1983 October 10; Santa Fe, NM. New York, NY: Van Nostrand Reinhold Co.: 509-521.

Hydrogen (H), ammonium (NH₄), calcium (CaS), magnesium (MgS), potassium (K), sodium (Na), sulfate (SO₄S), nitrate (NO₃), and bicarbonate (HCO₃) were measured in bulk precipitation, throughfall, stemflow, and in soil solutions at 75 mm and 600 mm from July 1981 to August 1982 in four forest ecosystems in northwestern Wisconsin: Pinus banksiana, Quercus ellipsoidalis-Q. macrocarpa, Betula papyrifera, and Populus tremuloides-P. grandidentata. The dominant cation and anion in precipitation were hydrogen ion and sulfate, respectively. The four ecosystems were able to neutralize acidic deposition during the study period.

Jimenez Ballesta, R.; Lopez Martinez, J.; Lopez Garcia, P.; Ibanez, J.J. 1985. Contribution to the knowledge of the surface peat formations in the Sierras de Guadarrama and Ayllon-pollen analysis. In: *Proceedings, 1st meeting on the Iberian quaternary*; Lisbon, Portugal: Instituto Nacional de Investigacao Cientifica: 213-224.

The results of the pollen analysis of 13 samples taken from different characteristics according to location, humidity, vegetation and development, indicates respect to tree species, a predomination of Pinus spp., with the presence of Quercus, Abies, Picea, Alnus, Betula, Corylus, Fraxinus, Populus, Salix, Ulmus, and Cuprusaceae. The period of formation of the peat deposits studied must correspond to a temperate-humid atmosphere with slight fluctuations.

Jordan, J.E.; Dewar, S.W. 1985. Vegetation characterization of a taconite tailing basin in Minnesota. In: Graves, D.H., ed. *Proceedings, 1985 symposium on surface mining, hydrology, sedimentology, and reclamation*; Lexington, KY: University of Kentucky: 249-254.

The vegetation on 464 ha of a temporarily abandoned taconite tailing basin cell in northeastern Minnesota was investigated. Changes in annual dry matter yield and ground cover and the density of tree growth on the basin were measured. Salix spp. had the highest stocking of any species followed by Populus balsamifera and P. tremuloides.

Kornay, J.; Tihanyi, Z. 1985. Treatment of meat processing sewage on poplar plantations. In: Proceedings, 5th International symposium on agricultural wastes: Agricultural waste utilization and management; 1985 December 16-17; Chicago, IL. ASAE Publ. SP 13-85. St. Joseph, MI: American Society of Agricultural Engineers: 554-559.

The layout of a poplar plantation on sandy soil, which is irrigated by buried pressure pipes carrying waste water from a poultry processing plant, is explained. Significant enrichment in nutrients and trace elements occurred as a result of waste water irrigation. The waste water application is highly efficient and less than half the cost of artificial treatment.

Laing, F.M.; Sendak, P.E.; Aleong, J. 1985. Species trials for biomass production on abandoned farmland. Northern Journal of Applied Forestry. 2(2): 43-47.

Trees of 7 broadleaved species (including green ash (Fraxinus pennsylvanica)), white ash (F. americana), red maple (Acer rubrum), sugar maple, and Chinese elm (Ulmus pumila) and 6 hybrid poplar clones were planted in 1979 at spacings of 0.6x0.6 m or 0.9x0.9 m on four sites in Vermont and given up to three [NPK] fertilizer treatments. After 3 years, fertilizer treatment had increased height, diameter, and stem weight.

Lee, K.J.; Kim, Y.S. 1985. Distribution of ectomycorrhizal fungi in pure stands of eight forest tree species in Korea. Bulletin of the Kwanak Arboretum. 6: 41-47.

Among the 133 species (38 genera) collected 39 species (19 genera) were associated with Pinus densiflora, 25 (12) with P. koraiensis, 9 (7) with larch, 32 (14) with Abies, 29 (13) with oak, 10 (7) with Betula, 21 (11) with Populus, and 16 (11) with chestnut. Amanita, Russula, and Laccaria occurred in all stands while Suillus was associated only with pine.

Lee, K.J.; Koo, C.D. 1985. Enhancement of growth and survival of Populus alba X P. glandulosa cuttings inoculated with ectomycorrhizal fungus, Pisolithus tinctorius under fumigated nursery condition. Journal of Korean Forestry Society. 70: 72-76.

Cuttings were planted in nursery beds which had been fumigated with methyl bromide and then some plots inoculated with P. tinctorius mycelium. Height growth was recorded after one growing season and above-ground biomass determined. Cuttings grown on inoculated plots produced 19 percent greater height and 48 percent greater above-ground dry weight.

Li, Y.C.; Yang, S.H.; Xu, Q.Y. 1985. The suitable sites and soil conditions for the four superior poplars of Aigeros group. Forest Science and Technology. 8: 10-14.

Results of surveys on the introduction of four superior poplars of the Aigeros group in the 1960's indicated that the three southern types of poplar

'I-69', 'I-63', and 'I-72' were quite promising for growing on the East Plains, lat. 23deg-33deg N., and on the Chengdu Plains in Sichuan Province. Appropriate soil conditions are described in detail.

Lodge, Deborah Jean. 1985. The ecology of ecto- and endomycorrhizal fungi associated with Eastern cottonwood roots (competition, drainage, evolution, nutrients, colonization). Dissertation Abstracts International. 46/02-B: 406.

Most plants form mycorrhizae which improve nutrient uptake and water relations. Few plants form both VA-endo- and ectomycorrhizae. Many endo- and ectomycorrhizal plant species colonize flood plains, including Eastern cottonwood (Populus deltoides). One hypothesis is that a plant's ability to associate with both endo- and ectomycorrhizal fungi might increase its probability of forming mycorrhizae in new or disturbed soils. Another hypothesis is that if endo- and ectomycorrhizal fungi are adapted to different conditions, then the plant's ability to form either or both endo- and ectomycorrhizae might facilitate its colonization of flood plains, which typically have heterogeneous soils.

Lomov, S.P.; Medvedev, M.Yu.; Konnov, A.A. 1985. Ecological differences in the development of three biogeocenoses in the Tigrovaya Balka Reserve. Soviet Journal of Ecology. 16(2): 85-90.

The seasonal variation in the m.c. of the soil profile was determined in southern Tajikistan in 1978-1979 in 3 ecosystems on different soil types: sandy desert (shrubland) dominated by Salsola richteri and Haloxylon spp. (with Aristida plumosa); solonchak desert, dominated by sedges with sparse shrub cover--mainly Hellenia (Aellenia auricula) and Zygophyllum gontschani (Z. gontscharovii); and floodplain forest of Populus pruinosa, Elaeagnus angustifolia and reeds. The evolution of the different soil types is discussed.

Love, L.S. 1985. Efficient treatment of high strength food processing wastewater. In: Proceedings, 5th International symposium on agricultural wastes: Agricultural waste utilization and management; 1985 December 16-17; Chicago, IL. ASAE Publ. SP 13-85. St. Joseph, MI: American Society of Agricultural Engineers: 404-410.

Experience of the waste water treatment facility and its use in tree plantations at a Canadian food processing plant are reported. Ten inch poplar cuttings planted in April were 9 feet spindly trees by the following August and after 1 year 16-18 foot tall with a full crown.

Malan'in, A.N. 1985. Effect of groundwater depth on forest growth conditions on sands in the arid zone. Biologicheskie Nauki. 8: 93-101.

Results of field studies in SE European Russia (in 1960-1970) and Kazakhstan (1971-1984) are statistically analyzed. Topography, soil profiles, and stand height were recorded on 100 transects in natural stands and plantations in the steppe, semi-desert and desert zones. Height m.a.i. (Y) was inversely related to the depth to groundwater (X), except in Scots pine plantations on sands with an impervious loamy subsoil, in which Y was related to the depth of the overlying sand layer by a parabolic function with a maximum at 1.5-2 m depth. Y decreased with increasing X according to a

hyperbolic (hollow) or logarithmic curve in pine and aspen (Populus tremula) stands.

McLaughlin, R.A. 1985. Biomass and nitrogen dynamics in an irrigated hybrid poplar plantation. West Lafayette, IN: Purdue University. 115 p. Ph.D. Thesis.

A 3-year study measured the effects of ground cover treatments and nitrogen fertilization on biomass and nitrogen dynamics in an irrigated hybrid poplar (Populus deltoides Bartr. x P. trichocarpa Torr. and Gray, clone NC-9922) plantation in northern Wisconsin.

McLaughlin, R.A.; Pope, P.E.; Hansen, E.A. 1985. Nitrogen fertilization and ground cover in a hybrid poplar plantation: effects on nitrate leaching. *Journal of Environmental Quality*. 14(2): 241-245.

A 3-year study in northern Wisconsin measured the effect of ground cover treatments and N fertilization on tree growth, NO₃--N leaching, and N mineralization in an irrigated hybrid poplar (Populus deltoides X P. trichocarpa) plantation. The tree growth response to N fertilization in bare soil plots was mainly after the second growing season and coincided with a large reduction in NO₃- leaching. High concentrations of NO₃--N in the soil solution suggested that much of the added N may have been lost by leaching. In contrast, a ground cover effectively prevented NO₃- leaching, and fertilizer N significantly increased mineralizable N in plots with a ground cover. After crown closure, decomposing ground cover litter may release enough N for maximum tree uptake, reducing, or eliminating the need to fertilize.

Papadopol, C.S.; Nolan, J.D. 1985. The potential of tree plantation technology in the land treatment of wastewater from food processing industry. In: *Proceedings, 5th International symposium on agricultural wastes: Agricultural waste utilization and management; 1985 December 16-17; Chicago, IL. ASAE Publ. SP 13-85. St. Joseph, MI: American Society of Agricultural Engineers: 411-417.*

The plantation design, growth performance of poplar clones, and operational achievements of a plantation grown on land treated with waste water from a food processing plant, are discussed. The effect of lagoon effluent or anaerobic treatment on performance of the tree plantation is compared for chemical oxygen demand, NH₃, P, and flow in and out.

Richardson, J.A. 1985. Creating a mixed woodland on a pit heap slope. *Vasculum*. 70(3): 17-25.

The establishment of a mixed woodland (alder, birch, pine, poplar, willow, and rowan) on a colliery spoil heap is described.

Richardson, J.L.; Elsner, G.S.; Clambey, G.K.; Arndt, J.L. 1985. Soil organic carbon and pH changes in relation to vegetation types in shelterbelts on fine-textured, carbonate-free, prairie-derived soils. *Soil Survey Horizons*. 26(3): 23-28.

Five shelterbelts, which were planted between 1930 and 1950 and contained green ash (Fraxinus pennsylvanica Marsh.), various poplars (Populus spp.), and a conifer, usually spruce (Picea spp.), were sampled with three pedons in each vegetation group and three pedons in an adjacent field.

Schlentner, R.E.; Van Cleve, K. 1985. Relationships between CO₂ evolution from soil, substrate temperature, and substrate moisture in four mature forest types in interior Alaska. *Canadian Journal of Forest Research*. 15(1): 97-106.

A soda lime technique was used to measure CO₂ evolution at the soil surface in 4 forest types (aspen, Populus tremuloides; paper birch, (Betula papyrifera); black spruce, Picea mariana; and white spruce, (Picea glauca) in interior Alaska.

Sheikh, M.I. 1985. Water requirement for optimum growth of poplars. *Pakistan Journal of Forestry*. 35(3): 119-123.

Cuttings of poplar clones 'I-72/58', 'I-4/64', 'I-69/55', and 'I-90/60' were planted out and irrigated with 0.90, 1.35, or 1.80 m water per season. Diameter and height growth were recorded in October 1983. There was no significant difference in growth in response to water treatment. 'I-69/55' produced the best growth.

Siegel, S.M.; Siegel, B.Z.; Lipp, C.; Kruckeberg, A.; Towers, G.H.N.; Warren, H. 1985. Indicator plant-soil mercury patterns in a mercury-rich mining area of British Columbia. *Water, Air and Soil Pollution*. 25(1): 73-85.

Samples of herbage, soil, water, and air were collected in June-August 1982 at up to 32 locations in central British Columbia and Alberta (within 400 km of Prince George) and analysed using flameless atomic absorption spectrophotometry for Hg content in order to distinguish between anthropogenic and natural sources of Hg contamination. Equisetum arvense, Plantago lanceolata, and Taraxacum officinale proved to be good indicators of soil Hg content, but Aster spp., Matricaria spp., Epilobium spp., Melilotus spp., Populus spp., Cornus spp., and several macrophyte species either showed no differences in plant Hg content in significantly different soils or water or only up to certain concentrations.

Skarie, R.L.; Crane, A.M.; Fairlie, T.E.; et al. 1985. Influence of jack pine and deciduous vegetation on soil chemical and morphological properties. In: *Proceedings of the North Dakota Academy of Science*. 39: 50.

Strong, W.L.; La Roi, G.H. 1985. Root density - soil relationships in selected boreal forests of central Alberta, Canada. *Forest Ecology and Management*. 12(3/4): 233-251.

Soil from pits in stands of Populus tremuloides, Pinus banksiana, and Picea glauca, 19-170 years old on sand or clay loam, was analysed by horizon for nutrients, physical properties, and root densities. Correlation and principal component analysis (PCA) were used to assess the relations between root density and the edaphic variables.

Timmer, V.R. 1985. Response of a hybrid poplar clone to soil acidification and liming. *Canadian Journal of Soil Science*. 65(4): 727-735.

Unrooted hybrid poplar cuttings were grown in a greenhouse at varying soil pH. The soil was a loamy fine sand (pH 5.7) collected from an Ap horizon of a forest tree nursery. The pH was adjusted over a wide range by incorporating different rates of powdered lime or elemental sulfur. Maximum height growth of clone DTAC-32 occurred between pH 6.0 and 7.0, which falls within the general guidelines for producing hardwood nursery stock.

Van Cleve, K.; Harrison, A.F. 1985. Bioassay of forest floor phosphorus supply for plant growth. *Canadian Journal of Forest Research*. 15(1): 156-162.

Forest floor materials from representative examples of each of the major forest types in interior Alaska (Populus tremuloides, Betula papyrifera, Picea glauca from upland and flood plain locations, P. mariana, and Populus balsamifera) were chemically analyzed and bioassayed for nutrient supplying power using potted seedlings of B. papyrifera in which seedling weight and P uptake and, P uptake by root tissue, were measured.

Van den Burg, J.; Schoenfeld, P.H.; van Kreijl, J.L. 1985. Calf slurry in stands of balsam and black balsam poplars in North Brabant. *Populier*. 22(2): 36-41.

In trials with five poplar cultivars planted on low-lying sandy soils 1967-1977 and treated with calf slurry in June 1977 and 1978, growth as evaluated in treatment years and in 1980 was better than in untreated controls and controls treated with calcium ammonium nitrate, provided rooting was not superficial.

Vermes, L. 1985. Results of poplar plantation for wastewater utilization in Hungary. In: Proceedings, 5th International symposium on agricultural wastes: Agricultural waste utilization and management; 1985 December 16-17; Chicago, IL. ASAE Publ. SP 13-85. St. Joseph, MI: American Society of Agricultural Engineers: 398-403.

Waste water from the sewage system of a Hungarian town is treated in a compound settling basin, while food processing wastes are pretreated by sedimentation and grease extraction. The resulting sewage is collected in a storage basin, from which it is pumped through an underground pipeline directly to the furrow system of a poplar plantation, all year round. Results of investigations into the efficiency of the water management, water quality, soil science, hygienic agronomic, dendometric, technical, and economic implications are briefly summarized. The value of the timber reduces the waste water treatment costs.

Woods, Ruth Fortune. 1985. Effect of site on growth of hybrid poplar clones planted on a commercial scale. *Dissertation Abstracts International*. 47/02-B: 453.

Two-, four-, and five-year height growth of Populus hybrids were measured over a full range of USDA Soil Conservation Service natural and altered soil drainage and texture classes on fields planted by Packaging Corporation of America using intensive culture. Substantial soil variability became an important factor on the previously-planted sites. Using the results from the clonal trials and the two tillage system studies, soil/site factors which affected establishment and early growth of hybrid poplar plantings were summarized and outlined in detail, and a practical field guide was formulated for evaluating the potential of agricultural fields for the intensive culture of hybrid poplars.

Yakushenko, I.K. 1985. The soil-transforming influence of poplar stands. *Lesnoe Khozyaistvo*. 12: 52-55.

Investigations were made on four different sites in Belorussia carrying poplar variety trials (one 12 years old, the others 10 years old). Data are

tabulated on the properties of the soils before the establishment of the trials, and after 10-12 years. On these soddy podzolic soils the poplars had caused considerable changes, the soils becoming better structured with a higher humus content, less acid, and with more exchangeable bases and available forms of K and P. The soil-improving effect of the poplars is attributed to the intensive biological cycling of nutrients.

Yu, C.F.; Zhao, K.Z. 1985. Study on the soil animals in Laoye Mountains. *Journal of North-East Forestry University, China*. 13(3): 128-134.

Soil fauna (Annelida, Arthropoda, Gastropoda, and Nematoda) were sampled in April-September 1983 under forests in Heilongjiang. Relations between soil fauna and forest types ('hard' broadleaved, mixed, coniferous, and aspen (Populus tremula var. dauriana)) are tabulated and discussed.

Zambonelli, A. 1985. Factors influencing the mycorrhization of forest trees with Tuber magnatum Pico. 1st contribution. *Micologia Italiana*. 14(2): 5-14.

Two methods of inoculation and 3 sources of T. magnatum were tested in the nursery. Mycorrhizal development in Corylus avellana seedlings and rooted cuttings of Populus alba and Salix alba was best on immersing roots in a spore suspension in water.

1986

Broshchilova, M. 1986. Biological productivity and the cycling of N and certain ash elements in the phytomass of a Populus 'Bachelieri' plantation. *Gorskostopanska Nauka*. 23(2): 59-66.

Data are presented for a plantation 21 years old established at 6x6 m spacing.

Brown, K.; Higginbotham, K.O. 1986. Effects of carbon dioxide enrichment and nitrogen supply on growth of boreal tree seedlings. In: Luxmore, R.J.; Landsberg, J.J.; Kaufmann, M.R., eds. *Coupling of carbon, water and nutrient interactions in woody plant soil systems: Proceedings of a symposium of the International Union of Forestry Research Organizations. Tree Physiology*. 2(1/3): 223-232.

Seedlings of Populus tremuloides and white spruce were grown in controlled environments with ambient or enriched atmospheric CO₂ (350 or 750 microl/litre, respectively) and with nutrient solutions with high, medium, and low N content (15.5, 1.55, and 0.16 mM). Seedlings were harvested, weighed and measured after 10, 30, 40, 50, 60, and 100 days. N supply had pronounced effects on biomass accumulation, height and leaf area of both species. Root weight ratio (RWR) of white spruce was significantly increased with the low-N regime, while RWR of aspen was unaffected by N regime. In spruce, CO₂ enrichment for 100 days significantly increased the leaf and total biomass of seedlings in the high-N regime, RWR of seedlings in medium-N regime and root biomass of seedlings in low-N regime. CO₂ enrichment increased biomass, leaf area, and height of aspen seedlings in all N regimes, but the effects did not persist. Aspen seedlings showed symptoms of mineral shortage during later stages of the study.

Frison, G. 1986. Tests on the treatment of poplar iron chlorosis. *Informatore Agrario*. 42(48): 65-72.

Hassall, M.; Parkinson, D.; Visser, S. 1986. Effects of the collembolan Onychiurus subtenuis on decomposition of Populus tremuloides leaf litter. *Pedobiologia*. 29(3): 209-215.

To investigate the effects that Onychiurus subtenuis has on rates of litter decomposition when it migrates up into the surface litter layers carrying spores from F-layer fungi, laboratory microcosms were designed to monitor microbial metabolism when leaves were incubated with and without Collembola.

Heilman, P.E.; Stettler, R.F. 1986. Nutritional concerns in selection of black cottonwood and hybrid clones for short rotation. *Canadian Journal of Forest Research*. 16(4): 860-863.

Litter production, and concentrations of N in litter and of N, P, and Ca in aboveground tissue were determined in 4-year-old clones of Populus trichocarpa, 2 hybrids of P. trichocarpa x P. deltoides, and P. 'Robusta' in a plantation near Sumner, Washington.

Heslin, M.C.; Douglas, G.C. 1986. Synthesis of poplar mycorrhizas. *Transactions of the British Mycological Society*. 86(1): 117-122.

A technique for production of ectomycorrhizas in Populus under aseptic conditions is described.

Ikeda, T.; Suzaki, T. 1986. Influence of hydraulic conductance of xylem on water status in cuttings. *Canadian Journal of Forest Research*. 16(1): 98-102.

Cuttings were sampled from 1-year-old shoots of Populus carolinensis and Cryptomeria japonica growing in the field at Kyushu University, Japan. The cuttings were placed in tap water in controlled conditions at 25degC and 70 percent RH. In both species, decreases in the base xylem pressure potential of cuttings after planting were clearly related to the decrease in stem water absorption resulting from decreases in hydraulic conductance of xylem. Anatomical studies showed that the increased resistance to water flow was caused by blockage of vessel lumens with tyloses in P. carolinensis and by aspiration of bordered pits in C. japonica.

Khlud, V.Ya.; Elizarov, S.F. 1986. Bioecological features of establishing stands on sandy-shelly soils. *Lesnoe Khozyaistvo*. 2: 67-69.

Studies were made on several sites on spits along the shore of the Sea of Azov, to determine the success of various plantations established on soils consisting of sand and sea-shell deposits. Some Canadian poplar plantations exhibit 100 percent survival, while others are total failures.

Kienzler, M.; Alban, D.H.; Perala, D.A. 1986. Soil invertebrate and microbial populations under three tree species on the same soil type. Res. Note NC-337. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 4 p.

The surface mineral soil beneath an aspen stand contained about 10 times as many bacteria (Corynebacteria, Mycobacteria, and Nocardia) and 30 to 50

percent more fungi (*Trichoderma*, *Aspergillus*, *Cephalosporium*, and *Fusarium*) than did soil beneath two conifer stands.

Kim, Y.T.; Leech, R.H. 1986. The potential use of DRIS in fertilizing hybrid poplar. *Communications in Soil Science and Plant Analysis*. 17(4): 429-438.

Beaufils' Diagnosis and Recommendation Integrated System (DRIS) was used to diagnose nutrient balance through foliar analysis on hybrid poplar (*Populus X euramericana*) clone 'I-45/51'.

Mahendrappa, M.K. 1986. Abilities of organic horizons under some eastern Canadian forest stands to alter the acidity of rainwater. *Canadian Journal of Forest Research*. 16(1): 18-22.

Precipitation data were collected for 13 years from 6 coniferous (*Picea rubens*, *P. glauca*, *Pinus resinosa*, *P. strobus*, *Abies balsamea*, and *Larix laricina*) and 3 broadleaved (*Acer saccharum*, *Betula papyrifera*, and *Populus tremuloides*) stands at Acadia Forest Experiment Station, central New Brunswick.

Maynard, D.G.; Germida, J.J.; Addison, P.A. 1986. The effect of elemental sulfur on certain chemical and biological properties of surface organic horizons of a forest soil. *Canadian Journal of Forest Research*. 16(5): 1050-1054.

Surface organic horizon (LFH) samples were collected in 1982-1983 at sites 50, 250, and 750 m from an elemental S block in *Pinus contorta*/*Populus tremuloides* forest in Alberta.

Min, E.S.; Lee, S.W. 1986. Influence of soil bulk density on growth and root development of *Populus alba* X *P. glandulosa*. *Journal of Korean Forestry Society*. 66: 45-53.

Soil profiles and root distributions were examined in a stand in Chungnam, Korea Republic. Bulk density and porosity changed on average from 1.17 g/cm³ and 52.65 percent respectively at the bottom of a slope to 1.43 g/cm³ and 41.20 percent at the top. Soil bulk density also increased significantly with depth. Tree height, d.b.h., total biomass and foliage, branch, stem wood and bark, and root dry weight decreased as bulk density increased. Trees showed shallow root systems, chiefly distributed in the A1 horizon - critical bulk density was 1.40 g/cm³.

Raizada, A.; Srivastava, M.M. 1986. Litter production in a *Populus deltoides* Marsh. plantation. *Forest Ecology and Management*. 15(3): 215-218.

In a 13-year-old plantation at Dehra Dun, India, maximum litter fall occurred in October (1931 kg/ha) and a second peak was observed in May (440.7 kg/ha). Leaf litter accounted for 92.6 percent of the total litter production.

Safford, L.O.; Czapowskyj, M.M. 1986. Fertilizer stimulates growth and mortality in a young *Populus-Betula* stand: 10-year results. *Canadian Journal of Forest Research*. 16(4): 807-813.

Following a uniform thinning, a young stand of *Populus grandidentata*, *P. tremuloides*, *Betula papyrifera*, and *Acer rubrum* (in Maine) was treated with N, P, and N+P, each with and without lime (L). The stand responded strongly to

fertilizer treatments for the entire 10-year period. Primary growth response was to N, but L and P also stimulated growth rate.

Shitkei, Yu. 1986. Effect of fertilizers on growth of poplars and the quality of underground waters. *Gorskostopanska Nauka*. 23(2): 93-96.

A note is given on investigations over 13 years in plantations of Populus 'I-214' in Hungary. When heavy doses of fertilizer are used on soils of low adsorption and high conducting capacity, with a high water table, the underground water is polluted, but this gradually disappears in the following 3-6 months.

Son, D.S.; Shin, J.B. 1986. Soil moisture content affecting rooting of cutting and height growth of Populus alba x P. glandulosa and parents. *Journal of Korean Forestry Society*. 66: 74-78.

Cuttings of P. alba, P. alba x P. glandulosa, P. glandulosa and P. davidiana (P. tremula var. davidiana) were grown in pots irrigated every 1, 3, 6, 9, or 15 days (soil m.c. 21.3, 19.7, 18.3, 16.7, and 14.3 percent; water potentials -0.0404, -0.050, -0.055, -0.070, and -0.100 bar, respectively) and height growth and rooting (percent) recorded.

Stewart, H.T.L.; Salmon, G.R. 1986. Irrigation of tree plantations with recycled water. 2. Some economic analyses. *Australian Forestry*. 49(2): 89-96.

Analyses of the economics of irrigating tree plantations with effluent are presented for 3 Australian case studies: radiata pine grown for saw logs, poplar grown for peeler logs, and Eucalyptus grandis grown for firewood. The profitability of each case study was examined for both flood irrigation and fixed-sprinkler irrigation. Radiata pine and poplar are shown to be more profitable than sheep grazing on irrigated pastures, which in turn is considerably more profitable than E. grandis.

Stewart, H.T.L.; Allender, E.; Sandell, P.; Kube, P. 1986. Irrigation of tree plantations with recycled water. 1. Research developments and case studies. *Australian Forestry*. 49(2): 81-88.

Three case studies are described, which demonstrate how effluent can successfully be recycled by irrigating tree plantations: a 30-ha plantation of Populus spp., a plantation of Eucalyptus grandis and E. camaldulensis, and a plantation of E. camaldulensis.

Tsanov, Ts.I.; Broshchilova, M.; Denev, D.A. 1986. Growth and productivity of fertilized and non-fertilized seedlings from some poplar clones at optimum soil moisture. *Gorskostopanska Nauka*. 23(6): 26-34.

Pot experiments were made with 7 clones of hybrid black poplar ('I-214', 'Agathe', 'I-39/61', 'MC', 'I-37/61', 'CB-7', and 'BL') in alluvial meadow soil, with and without NPK fertilizer. Fertilizer treatment prolonged the growing period by 19-45 days, increased the total phytomass by 33.6-99.7 percent, reduced the difference between clones in the amount of phytomass, and increased the proportion of the stem in the total phytomass. Populus 'Agathe' gave the best height growth and total phytomass production.

Van Cleve, K.; Heal, O.W.; Roberts, D. 1986. Bioassay of forest floor nitrogen supply for plant growth. *Canadian Journal of Forest Research*. 16(6): 1320-1326.

Potential N supply in the floor of 6 major forest types in interior Alaska was determined from biomass production and net uptake of nitrogen by Betula papyrifera seedlings in pots containing standardized mixtures of quartz sand and forest floor organic matter. Seedling yield and N uptake were least with black spruce and flood plain white spruce forest floors and greatest with B. papyrifera floor. Values were intermediate for floors from upland white spruce, Populus tremuloides and P. balsamifera. Total N extracted from floor samples during 130 days' incubation followed similar trends. Relations between N supply and forest floor organic matter quality are discussed and supply of P and N are compared.

1987

Amiro, B.D.; Wuschke, E.E. 1987. Evapotranspiration from a boreal forest drainage basin using an energy balance/eddy correlation technique. *Boundary-Layer Meteorology*. 38(1/2): 125-139.

Meteorological techniques were used to monitor evapotranspiration (ET) at two sites in a boreal forest drainage basin located in southeastern Manitoba, Canada. An energy balance method was used in which net radiation (RN) and ground heat flux (G) were measured directly. Measurements at an open bare rock site indicated that G could be a substantial fraction of the daily RN at some locations, but over longer time periods, it was a small fraction and, therefore, was ignored.

Bird, G.A.; Rachar, D.B.; Chatarpaul, L. 1987. Increased skeletonization of leaf litter under snow following timber harvest. *Ecology*. 68(1): 221-223.

Skeletonization of Populus leaves was greater in both whole-tree and conventionally harvested plots than on an uncut plot.

Bryant, J.P.; Clausen, T.P.; Reichardt, P.B.; McCarthy, M.C.; Werner, R.A. 1987. Effect of nitrogen fertilization upon the secondary chemistry and nutritional value of quaking aspen leaves for the large aspen tortrix. *Oecologia*. 73(4): 513-517.

Cote, B.; Camire, C. 1987. Tree growth and nutrient cycling in dense plantings of hybrid poplar and black alder. *Canadian Journal of Forest Research*. 17(6): 516-523.

The cycling of N, P, K, Ca, and Mg was quantified during the third growing season in plantings of black alder (Alnus glutinosa (L.) Gaertn.) and hybrid poplar cv. Roxbury (Populus nigra L. X Populus trichocarpa Torr. and Gray).

Coxson, D.S.; Parkinson, D. 1987. Winter respiratory activity in aspen woodland forest floor litter and soils. *Soil Biology and Biochemistry*. 19(1): 49-59.

Hendrickson, O.Q.; Burgess, D.M.; Chatarpaul, L. 1987. Biomass and nutrients in Great Lakes - St. Lawrence forest species: implications for whole tree and conventional harvest. *Canadian Journal of Forest Research*. 17(3): 210-218.

In studies in a mixed conifer/broadleaved stand at Petawawa National Forestry Institute, Ontario, plots were established from which all aboveground parts of woody plants 1.3 m tall were removed (whole-tree harvest) or on which stems 9 cm d.b.h. were left standing and crowns were left on site after felling larger trees (conventional harvest). Dry weight of living and dead material, and nutrient contents were determined for Pinus strobus, P. resinosa, Picea glauca, Abies balsamea, Populus tremuloides, Betula papyrifera, and Acer rubrum. Whole-tree harvesting on these nutrient-poor sites may lead to establishment of stands of Populus spp. of low productivity.

Johnson, J.A.; Gallagher, T.; Naylor, L.M. 1987. Sludge proves effective as fertilizer. *BioCycle*. 28(7): 33-35.

Liu, Jichang; Mei, Aihua; Gu, Jianca. 1987. The effect of ammonium sulfate on microbes and biochemical capacity in nursery soil cultured with poplar rooted cuttings. *Journal of Beijing Forestry University*. 9(3): 270-278.

Makarov, M.I. 1987. Influence of industrial pollution on the phosphorus content in humic acids of sod-podzol soils. *Moscow University Soil Science Bulletin*. 42(2): 31-36.

Maynard, D.G.; Kalra, Y.P.; Radford, F.G. 1987. Extraction and determination of sulfur in organic horizons of forest soils. *Soil Science Society of America Journal*. 51(3): 801-806.

Eight extractants (H₂O, 0.01 M CaCl₂, 0.01 M KCl, 0.01 M LiCl, 0.003 M NH₄OAc, 0.003 and 0.01 M NH₄Cl, and 500 mg P L⁻¹ as Ca(H₂PO₄)₂·H₂O) were evaluated for the extraction and determination of SO₄-S and total extractable S in surface organic horizons of five forest soils. The 0.01 M NH₄Cl extractant was found to be the most consistent extractant. The precision ranged from 3.7 to 8.9 percent for the IC analyses excluding the aspen (Populus tremuloides) sample and from 1.9 to 8.4 percent for the ICP-AES analyses. Poor precision in the SO₄-S determination of the aspen organic horizon was due to the elution of an unidentified peak adjacent to the S peak.

McLaughlin, R.A.; Hansen, E.A.; Pope, P.E. 1987. Biomass and nitrogen dynamics in an irrigated hybrid poplar plantation. *Forest Ecology and Management*. 18(3): 169-188.

A 3-year study measured the effects of ground cover treatments and N fertilization on biomass and nitrogen dynamics in an irrigated Populus 'NC-9922' plantation in northern Wisconsin, USA. Trees in bare-soil plots responded to fertilization primarily in the third growing season, but total biomass of 3-year-old trees was not increased by annual fertilization. In plots with a ground cover, fertilization increased tree growth but cover crop treatment had no effect.

Miller, A.C. 1987. Site and fertilizer requirements of intensive hybrid poplar culture on Prince Edward Island. *Forestry Abstracts*. 48(4): 247-248.

Nelson, L.E.; Switzer, G.L.; Lockaby, B.G. 1987. Nutrition of Populus deltoides plantations during maximum production. Forest Ecology and Management. 20(1-2): 25-41.

Richardson, J.A.; Evans, M.E. 1987. Establishing trees and shrubs on magnesian limestone waste. Journal of Environmental Management. 24(2): 157-167.

Lists are presented of trees and shrubs found in natural and semi-natural woodlands on the magnesian limestone tract in County Durham, UK, and colonizing waste heaps of quarry workings. Alnus glutinosa, A. incana, Betula pendula, Crataegus monogyna, Fraxinus excelsior, Populus alba, and Salix caprea were likely to be successful with only some slight amelioration of the substrate.

Schutz, C.J.; de Villiers, J.M. 1987. Foliar diagnosis and fertiliser prescription in forestry - the DRIS system and its potential. South African Forestry Journal. 141: 6-12.

Problems associated with current foliar diagnosis techniques are reviewed. Many of these problems have been overcome in agricultural crops by use of the Diagnosis and Recommendation Integrated System (DRIS). The advantages of DRIS over the critical levels approach are described by means of examples in agricultural crops. In forestry, DRIS has been tested on a small-scale, investigative basis only. Studies on Pinus radiata, P. patula, Populus deltoides, and Eucalyptus saligna are reviewed.

Weetman, G.F.; Krause, H.H.; Koller, E.; Veilleux, J.M. 1987. Interprovincial forest fertilization trials: 5- and 10-year results. Forestry Chronicle. 63(3): 184-192.

An overview of published results and results in press of 81 trials with NPK fertilizers established from 1969 and 1972 in unmanaged stands of Pinus banksiana, Picea mariana, Picea rubens, Picea glauca, Abies balsamea, and Populus tremuloides in Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, and Alberta.

1988

David, M.B.; Grigal, D.F.; Ohmann, L.F.; Gertner, G.Z. 1988. Sulfur, carbon, and nitrogen relationships in forest soils across the northern Great Lakes States as affected by atmospheric deposition and vegetation. Canadian Journal of Forest Research. 18(11): 1386-1391.

Gale, M.R.; Grigal, D.E. 1988. Performance of a soil productivity index model used to predict site quality and stand production. In: Ek, Alan R.; Shifley, Stephen R.; Burk, Thomas E., eds. Forest growth modelling and prediction; 1987 August 23-27; Minneapolis, MN. Gen. Tech. Rep. NC-120. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 1: 403-410.

Lahdesmaki, P.; Piispanen, R. 1988. Degradation products and the hydrolytic enzyme activities in the soil humification processes. Soil Biology and Biochemistry. 20(3): 287-292.

Ruark, G.A.; Bockheim, J.G. 1988. Digital image analysis applied to soil profiles for estimating tree root biomass. *Soil Science*. 146(2): 119-123.

Taylor, B.R.; Parkinson, D. 1988. Annual differences in quality of leaf litter of aspen affecting rates of decomposition. *Canadian Journal of Botany*. 66(10): 1940-1947.

Taylor, B.R.; Parkinson, D. 1988. Aspen and pine leaf litter decomposition in laboratory microcosms. I. Linear versus exponential models of decay. *Canadian Journal of Botany*. 66(10): 1960-1965.

Taylor, B.R.; Parkinson, D. 1988. Aspen and pine leaf litter decomposition in laboratory microcosms. II. Interactions of temperature and moisture level. *Canadian Journal of Botany*. 66(10): 1966-1973.

Taylor, B.R.; Parkinson, D. 1988. Patterns of water absorption and leaching in pine and aspen leaf litter. *Soil Biology and Biochemistry*. 20(2): 257-258.

Taylor, B.R.; Parkinson, D. 1988. Respiration and mass loss rates of aspen and pine leaf litter decomposing in laboratory microcosms. *Canadian Journal of Botany*. 66(10): 1948-1959.

Watters, R.J.; Price, A.G. 1988. The influence of stemflow from standing dead trees on the fluxes of some ions in a mixed deciduous forest. *Canadian Journal of Forest Research*. 18(11): 1490-1493.

UTILIZATION

1975

Neilson, R.W. 1975. Poplar utilization: a problem analysis. VP-X-149 Canada Forestry Service, Environment Canada. 65 p.

Oreskovic, M. 1975. Utilization and conversion of poplar wood. Topola. 19(107/108): 28-33.

Stem, E.G.; Wallin, W.B. 1975. Design of aspen pallet deckboard-stringer joints. Forest Products Journal. 25(2): 51-54.

Stern, E.G.; Wallin, W.B. 1975. Aspen pallets with 2 1/4", 2 1/2", and 2 3/4"-wide stringers and aspen pallets with oak stringers and leading-edge deckboards. Bull. 135. Blacksburg, VA: Virginia Polytechnic Institute and State University. Wood Research and Wood Construction Laboratory. 30 p.

Szalay, L. 1975. Industrial utilization of Salix alba. Faipar. 25(9): 282-286.

Recent trials in Hungary have shown that the wood is suitable for a wide range of uses owing to its low density (0.426 g/cm³ air dry) and good workability. The wood properties are compared with those of poplars.

1976

Auchter, R.J. 1976. Trends and prospects for use in fiber products. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 54-58.

Baker, A.J. 1976. Aspen wood and bark in animal feeds. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 75.

Brodbeck, C. 1976. Curtain of poplars for protection of noise. Mitt Schweiz Pappel Arbeitsgem. 27: 1-2.

Csekunov, P. 1976. The utilization of home-grown hybrid Poplars, taking into account the possibilities of composite board manufacture. Budapest, Hungary: Faip. Kutato Intezet: 109-141.

On the basis of trials in Hungary and test results according to DIN and Hungarian standards, it is recommended that the primary use of poplar wood should be for plywood. Results are summarized in detail.

Fullinwider, J.A. 1976. Colorado steers and aspen bark. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 76-83.

Geimer, R.L. 1976. "Agricultural" poplars as a raw material for structural particleboard. Gen. Tech. Rep. NC-21. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 115-117.

Giordano, E. 1976. Industrial support to poplar culture in Italy. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 456-459.

Giordano, E.; Avanzo, E.; Rossi Marcelli, A. 1976. Full utilization of Poplar: first observations on a plantation of Populus X euramericana [P. X canadensis] 'I-467'. *Cellulosa e Carta*. 27(4): 23-26.

The distribution of woody biomass was studied in a plantation of P. 'I-476' near Rome. The percent distribution in different parts of the tree proved to be nearly the same 8 and 14 years after planting. The present utilization of branches is equivalent to 10-15 percent of the stem biomass. Thus, the unused woody biomass (branches, stump and roots) amounts to ca. 60-65 percent of that of the stem. On this basis, only 5.7 million t of the poplar wood actually produced in Italy in 1973 were used, leaving >3 million t unused. Recovery of this waste material would be very beneficial and should not be difficult, since the underground biomass is concentrated around the stump in an area $2 \times 2 \text{ m}^2$.

Hadnagy, J.; Nyars, J. 1976. The latest research results on the utilization of particle boards in the building industry. Budapest, Hungary: Faip. Kutato Intezet: 161-189.

A wide range of test results is tabulated for locally made boards of beech (Fagus sylvatica) and poplar (Populus X canadensis).

Harsanyi, I. 1976. Utilization of poplar wood in the manufacture of wooden houses. Budapest, Hungary: Faip. Kutato Intezet: 95-104.

The possibility was investigated of substituting home-grown light hardwoods in building components of the ERDERT range of wooden houses (16-41 m^2 ground area) built in Hungary, hitherto almost entirely of softwood. It was found that 30-50 percent of the original softwood could be substituted by poplar with an average cost saving in material of over 15 percent (increasing with the size of the house).

Hernadi, S.; Lengyel, P. 1976. Utilization of short fibers in the Hungarian paper industry - research and practical experiences. *Tappi*. 59(10): 82-85.

Various Hungarian hardwoods are compared in relation to NSSC and kraft pulping; best results were obtained with Populus spp. Some problems of papermaking from hardwood pulps are discussed.

Johnsson, H. 1976. Production potential of the hybrid aspen in southern Sweden. *Holzzucht*. 30(2/4): 19-22.

Kamstra, L.D.; Singh, M.; Embry, L.B.; Peterson, L. 1976. Aspen material as a feed ingredient in ruminant rations. In: 20th Annual Cattle Feed Day of the South Dakota Agricultural Experiment Station. [Sioux Falls, SD]: South Dakota State University, Department of Animal Science: 34-44.

Lapinska, I.; Surewicz, W. 1976. Optimization of management of hardwood resources in the pulp and paper industry. *Przeglad Papierniczy*. 32(11): 405-410.

Utilization of hardwoods by the Polish paper industry has increased 5-fold in the past 15 years to comprise 14 percent of the total pulpwood; they constitute 20 percent of the forest resource. A programme has been developed to increase further the utilization of hardwoods and to include new species, e.g. oak, alder, and hornbeam. Data are given on morphological, chemical, and pulping characteristics of beech (Fagus sylvatica), birch (Betula alba), poplar (Populus spp.) oak (Quercus spp.), hornbeam (Carpinus betulus) and black alder (Alnus glutinosa).

Loennberg, B. 1976. Short rotation hardwood species as whole-tree raw material for pulp and paper. 3. Chemical pulping. Pap. Puu (Finland). 58(3): 113-124.

Sulphate pulps from whole-tree leafless samples of 3- to 5-year-old, 10- to 15-year-old and 20- to 25-year-old Populus tremula, Alnus incana, Salix caprea, and Betula pubescens, and 9-year-old Populus tremula X P. tremuloides required more alkali and gave lower yields than barked materials. Soda/oxygen pulps were not satisfactory. It is thought that 25 percent of young whole-tree hardwood chops would be acceptable in a furnish of normal birch chips.

Loennberg, B. 1976. Short-rotation hardwood species as whole-tree raw material for pulp and paper. 4. Effect of bark upon chemical pulping. Pap. Puu (Finland). 58(4a): 181-197.

Data are tabulated and discussed from pulping, beating, and washing experiments on pulps including various proportions of the bark and leaves of 4 species: aspen (Populus tremula), sallow (Salix caprea), white birch (Betula pubescens) and grey alder (Alnus incana).

Lowery, D.P. 1976. Potential utilization of aspen in the Rocky Mountains. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 95-97.

Porter, L.D. 1976. Applying aspen research to industry. Gen. Tech. Rep. RM-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 113.

Stephens, E.P. 1976. Populus in perspective (wood as a source of energy, developing the forest as an alternative source of energy). In: Thielges, B.A., Land, S.B., Jr., eds. Proceedings, Symposium on eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 1-5.

Touzet, G. 1976. Creation, mobilization, and utilization of new raw materials for the pulp industry. ATIP Revue. 30(4): 123-129.

The use of tropical woods, the intensification of silvicultural practices, the extension of forested areas, the recovery of logging wastes, and the cultivation of fast-growing tree species (Eucalyptus and Populus) are examined in a French and a European context as ways for overcoming the developing shortage of pulpwood.

Wengert, E.M. 1976. Research advances in aspen utilization for pulp. Gen. Tech. Rep. RM-29, Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 68.

Wittmann, G.; Pluzsik, A. 1976. New results of the application of glulam load-bearing structures in Hungary. Budapest, Hungary: Faip. Kutato Intezet: 61-70.

Recent experimental buildings with wide-span arches are briefly described, viz. a warehouse (single-span) and a covered swimming pool (with supporting columns), showing the successful use of home-grown hardwoods available in large quantities (hybrid poplar and Robinia).

Zavitkovski, J.; Isebrands, J.G.; Dawson, D.H. 1976. Productivity and utilization potential of short-rotation Populus in the Lake States. In: Thielges, B.A.; Land, S.B., Jr., eds. Proceedings, Symposium on Eastern cottonwood and related species; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 392-401.

1977

Anderson, H.W.; Zsuffa, L. 1977. Farming hybrid poplar for food and fibre: an exploratory study of the seasonal above-ground biomass. Forest Research Report. Ontario, Canada: Ministry of Natural Resources. Vol. 103.

Stools of 5 Populus clones were established in 1972 in a nursery near Orono, Ontario. The entire living sprout growth of one stool of each clone was harvested at 2-week intervals between July 2 and October 8 to determine the oven-dry biomass of the tissue components and their nitrogen, protein, and amino acid content.

Dickson, R.E.; Larson, P.R. 1977. Muka from Populus leaves: a high-energy feed supplement for livestock. In: TAPPI Forest Biology, wood chemistry conference: 95-99.

Hernadi, S.; Lengyel, P. 1977. Utilization of short-fibred materials in the Hungarian paper industry: experimental investigations and their industrial evaluation. Papiripar. 21(1): 1-7.

Kamstra, L.D.; Singh, M.; Sharps, J. 1977. Utilization of aspen trees as a ruminant feed component. In: 21st Annual Cattle Feed Day of the South Dakota Agricultural Experiment Station. [Sioux Falls, SD]: South Dakota State University, Department of Animal Science: 28-36.

Karaim, B.W. 1977. Energy and chemicals from wood in Alberta. In: Proceedings, Forest and field fuels symposium; 1977 October 12; Winnipeg, Canada. Canada: XV.1-XV.9.

The Alberta research program on obtaining energy and chemicals from its large standing resource of unutilized aspen (Populus tremuloides) is briefly outlined. The specific objectives and the funding by the Canadian government are summarized.

Lehtonen, I. 1977. Wood as a fuel; a literature study. *Folia Forestalia*. 283: 16 p.

McGovern, J.N.; Zehner, C.E.; Boyle, J.B. 1977. Investigation of bark residues for livestock bedding. *Forest Products Journal*. 27(7): 29-34.

Samples of hardwood and softwood residues (sawdust, shavings, etc.) were collected from 40 midwestern producers and consumers. Data are tabulated on the moisture content, bulk densities and uses of the samples. Trials were also made on (a) bulk storage of aspen (*Populus tremuloides*/*P. grandidentata*) bark, (b) further mechanical processing of aspen bark, (c) suitability of the materials for bedding livestock, and (d) manurial value of aspen bark for maize grown in pots.

Moeltner, H. 1977. Waferboard and strandboard in Canada. *Holz-Zentralblatt*. 103(57): 103-105.

The strength properties and economic aspects of these types of (3-ply) particleboard, which are successfully competing with plywood in building construction in North America, are compared with those of plywood. The raw material is mainly aspen (*Populus tremuloides*) which is plentiful and under-utilized.

Park, K. 1977. Prairie cattle are happily munching shredded aspen. *British Columbia Lumberman*. 61(10): 32.

A new feedstuff, developed by Stake Technology, Ottawa, and now on trial at the University of Manitoba, is produced by shredding and heating whole aspen trees (*Populus* spp.). Steam from wood moisture breaks down some of the cellulose, and the finished product (as pellets or bundles) is said to be approximately 50 percent digestible.

Wells, C.G.; Jorgensen, J.R.; Dickson, R.E.; et al. 1977. Biochemistry and tree physiology. In: Proceedings, TAPPI conference papers: Forest biology, wood chemistry conference; 1977 June 20-22; Madison, WI. TAPPI Press. 38 p.

Zhukova, V.M. Zhigalkin, A.M.; Zolotokrylin, A.N. 1977. The energetics of the production process in the aspen forests of the area around Moscow. *Biull Moskovsk O-va Ispyt Prir Otd Biol*. 82(6): 54-62.

1978

Drew, A.P.; Bazzaz, F.A. 1978. The versatile eastern cottonwood (*Populus deltoides*). *Illinois Research*. 20(1): 18-19.

Kolarov, D. 1978. Present state and prospects of growing *Populus* and using its wood. *Gorsko Stopanstvo*. 34(6): 9-14.

Kolster, H.W. 1978. The sale of poplar and willow plants from 1973 to 1977. *Populier*. 15(4): 84-88.

Plant sales and planting programmes in The Netherlands as a whole, and in the IJsselmeer Polders, are analyzed by species, cultivar and age of plants. The polder programme showed an increase in the use of 'new' cultivars and

1-year-old plants. The planting of willow (Salix spp.) is on the increase, but that of poplar (Populus spp.) continues to decline.

McLain, T.E.; Stern, E.G. 1978. Withdrawal resistance of pallet nails and staples in five western woods. Bull. 155. Blacksburg, VA: Virginia Polytechnic Institute and State University. 11 p.

The delayed withdrawal resistance was examined for pointless, helically-threaded hardened-steel pallet nails with umbrella heads and plastic coated pallet staples in shocks of Populus fremontii, Quercus lobata, Q. kelloggii, Q. garryana, and Pseudotsuga menziesii.

Prevosto, M. 1978. The importance of poplar as a basic essential for industrial purposes in Italy. Cellulosa e Carta. 29(6): 3-11.

An address given to the 'Afforestation for industry' conference, Turin, 1978. The author gives statistical data on the present demand for, and output of, poplar (Populus spp.) wood in Italy, describes the present distribution of the country's poplar plantations and the methods of establishment and silviculture in use, compares the relatively low return obtainable from investment in poplar growing with the profit obtainable from agricultural crops, and suggests remedies that should provide an incentive for the expansion of poplar growing in Italy.

Riscuta, S. 1978. Research on the obtainment of forage yeast from hydrolised materials originating from poplar wood hydrolysis in the autoclav. Rev Padurilor Ind Lemnului Celul Hirtie Ind Lemnului. 29(2): 74-82.

Stonkus, A.I. 1978. Utilization of large low-grade wood. Lesnaya Promyshlennost'. 8: 18.

A description is given of a mechanized flow-line for the conversion of large low-grade aspen (Populus tremula) logs in Lithuania.

1979

1979. Major outlet for poplar. Forestry and British Timber. 8(5): 24-25.

A UK company is using rotary-cut poplar (Populus spp.) veneer for making folding vegetable crates.

Davidson, W.H. 1979. Hybrid poplar pulpwood and lumber from a reclaimed strip-mine. Res. Note NE-282. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 2 p.

Hybrid poplars were planted on a 6x6 foot spacing adjacent to 1-2 rows of white spruce or Scots pine on strip mine spoils in Pennsylvania. Poplar yield was 90 tons of pulpwood and 9400 board feet of lumber, equivalent to a m.a.i. of approximately 2 cords/acre.

Isebrands J.G.; Sturos, J.A.; Crist, J.B. 1979. Integrated utilization of biomass - case study of short-rotation intensively cultured Populus raw material. TAPPI. 62(7): 67-70.

Noack, D. 1979. Properties and range of uses for the timber of fast-growing tree species. *Forst- und Holzwirt.* 34(6): 112, 114-120.

Special attention is given to the properties and utilization of Douglas fir (*Pseudotsuga menziesii*) and poplar (*Populus* spp. and hybrids).

1980

Istrate, V.; Bularca, M. 1980. The utilization of poplar wood in the manufacture of wood fibreboards. *Industria Lemnului.* 31(1): 2-5.

1981

Khan, A.R. 1981. Poplars as raw material for fruit box industry. In: Singh, R.V., ed. Symposium proceedings: Silviculture, management, and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 151-153.

Khan, A.; Kachroo, P. 1981. Utilization of poplars. In: Singh, R.V., ed. Symposium proceedings: Silviculture, management, and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 157-159.

Misra, Y.P. 1981. Utilization of *Populus ciliata* for artificial limbs manufacture. In: Singh, R.V., ed. Symposium proceedings: Silviculture, management, and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 160-162.

Negi, S.S. 1981. Poplars as feed for animals. In: Singh, R.V., ed. Symposium proceedings: Silviculture, management, and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 167-169.

Raina, V. 1981. Prospects of planting poplar *Populus ciliata* in fir zone Himachal Pradesh (India). In: Singh, R.V., ed. Symposium proceedings: Silviculture, management, and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 32-34.

Rose, D.W.; Walker, B.A.; Ferguson, K.; Lothner, D.C. 1981. A comparison of the energy efficiency of intensive and extensive hybrid poplar production systems. In: Klass, D.L.; Emert, G.H., eds. Proceedings, Fuels from biomass and wastes. Ann Arbor, MI: Ann Arbor Science Publishers: 53-70.

Seth, C.M. 1981. Scope of poplar cultivation in Jammu (*Populus*, India). In: Singh, R.V., ed. Symposium proceedings: Silviculture, management, and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 93-94.

Sethi, C.M. 1981. Perspective planning for poplar cultivation in Punjab (India, *Populus*). In: Singh, R.V., ed. Symposium proceedings: Silviculture,

management, and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 9-11.

Shukla, N.K. 1981. Poplar wood for packing cases. In: Singh, R.V., ed. Symposium proceedings: Silviculture, management, and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 154-156.

Thangam, E.S. 1981. Poplar in Arunachal Pradesh (India, Populus). In: Singh, R.V., ed. Symposium proceedings: Silviculture, management, and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 17-19.

Tondon, J.C. 1981. Poplar wood utilization by match industry in India offers a big potential. In: Singh, R.V., ed. Symposium proceedings: Silviculture, management, and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 170-179.

Warty, P.W.; Ghosh, S. 1981. Hybrid poplars in Assam--some observations (Populus, India). In: Singh, R.V., ed. Symposium proceedings: Silviculture, management, and utilization of poplars; 1979 October 15-18; Srinagar. Delhi, India: Controller of Publications: 180-181.

Zhurova, O.N. 1981. Poplars, a promising culture along Kura River and irrigation canals. Doklady - Akademiia Nauk Azerbaidzhanskoi SSR. 37(10): 61-64.

1982

Benea, V.I.; Milea, I. 1982. Phytomass production for energy by fast growing forest tree species in specialized plantations. Silvicultura si Exploatarea Padurilor. 97(2): 76-80.

Bykov, V.A.; Korol'kov, I.I.; Levanova, V.P.; Boiko, V.I.; Livanova, R.P. 1982. Experience in the production of feed yeast from aspen sawdust and chips. Hydrolysis and Wood Chemistry USSR. 8: 16-20.

Fay, M. 1982. The use of bark in the fibreboard industry. Faipar. 32(7): 197-205.

Data are presented on the bark thickness and bark content (on a volume and DM basis) of Populus X canadensis, P. canescens, and Salix alba used in fiberboard production, in relation to tree diameter on two different sites. Bark thickness is also influenced by disease and injuries.

Frankos, N.H.; Gouin, F.; Sikora, L.J. 1982. Using woodchips of specific species in composting. BioCycle. 23(3): 38-40.

Tests with woodchips (hybrid poplar, tulip tree, sycamore, Paulownia, Ailanthus, and a woodchip mixture) as the bulking material for the preparation of sewage sludge composts showed none of the woodchips tested degraded to the point where screening of the final product could be eliminated.

Hathaway, R.L. 1982. New and potential horticulture shelter species. New Zealand Agricultural Science. 16(1): 15-18.

Mathur, H.N.; Singh, R.P.; Sharma, K.C. 1982. Populus ciliata--a promising tree species for soil conservation in hilly areas. The Indian Forester. 108(9): 599-604.

Pluzsik, A. 1982. Manufacture of packing cases for machinery and suitable materials for this purpose. Faipar. 32(11): 347-348.

Heavy industrial packaging uses wood as its raw material almost exclusively. Poplar is proposed for bottom covers and for other components in which allowance can be made for its tendency to warping and deformation. Robinia can be used for thin strips. Fiberboard and particleboard can be nailed on to ribs made of lumber.

Zoller, V. 1982. Analysis of the utilization of softwood lumber. Faipar. 32(3): 83-86.

The consumption of softwood lumber (SL) in Hungary since 1950 is analyzed. Only 16 percent of SL is now used in containers, owing to the availability of poplar wood and the prohibition of SL in boxes for horticultural produce.

1983

Abe, F.; Unrinin, G.; Endo, M.; Kigure, M.; Sugiura, G. 1983. Manufacture of charcoal from fast-grown trees and burning gasifying characteristics of charcoal produced. I. A consideration of the specific gravity of air-dried woods for carbonization. Journal of the Japan Wood Research Society. 29(1): 82-95.

Trials were conducted in the carbonization of fast-grown trees of Eucalyptus, Populus, Betula, Robinia, Acacia, and Quercus spp. in a batch-type concrete-block charcoal kiln.

Chlebek, A.; Jarabac, M. 1983. Growth and use of poplar-trees of selected cultivars in riparian stands. Lesnictvi - Ceskoslovenska Akademia Zemedelska, Ustav Vedeckotechnickych Informacia pro Zemedelstvi. 29(7): 551-562.

Chum, H.L.; Johnson, D.; Posey, F.; Ratcliff, M.; Black, S. 1983. Biomass electrochemistry (in relation to fuel production from biomass sources, Populus tremuloides lignin, carboxylic acids, waste stream upgrading). In: 3d Annual solar and biomass workshop; 1983 April 26-28; Atlanta, GA. Washington DC: U.S. Department of Agriculture, Forest Service: 325-328.

Costantini, F.; Panella, F. 1983. Use of leaves of shrubs in feeding the goose and potential use of its excrement as fertilizer. Avicoltura. 52(10): 31-36.

In tests of leaves from 17 shrub species the most appetizing to adult geese were, in order, Medicago arborea, Prunus domestica, Morus alba, Vitis spp., Ulmus campestris, Ostrya carpinifolia, Populus nigra, Tilia cordata, and Acer campestre.

Dennington, V.N.; Chadwick, M.J.; Chase, D.S. 1983. Energy cropping on derelict and waste land. *Journal of Environmental Management*. 16(3): 241-260.

The productivity of Alnus glutinosa, A. incana, Salix caprea, Betula pendula, Populus canadensis, Larix leptolepis, Pinus sylvestris, and P. contorta was investigated on colliery spoil, railway land, pulverized fuel ash, sand and gravel workings, land degraded by atmospheric pollution, and land contaminated by heavy metals in England and Wales.

Dulloo, J.N. 1983. Poplars for economic development. *The Indian Forester*. 109(10): 717-725.

Galgoczi, G.; Toth, S. 1983. Material-saving dimensioning of wooden upholsterer's frameworks for single couches. *Faipar*. 33(10): 307-313.

Upholsterer's frameworks account for 39 percent of the softwood used in furniture factories in Hungary. Structures are discussed that require a smaller cross-sectional area of lumber. Other possibilities are: end-jointing and partial substitution of poplar or Robinia.

Korotaev, E.I.; Klimenko, M.I. 1983. Utilization of light hardwood. Moscow, USSR: *Lesnaya Promyshlennost'*. 128 p.

Discusses the resources of light hardwoods (mainly birch and aspen (Populus tremula)) in the USSR, the technology of their sawmilling and utilization in building or in the manufacture of consumer goods, and economic aspects.

Milosavljevic, I. 1983. Possibilities for using poplar wood in the industrial production of glulam beams for house construction. *Zbornik Radova, Gradevinskog Fakulteta u Beogradu*. 43-50.

An investigation into the mechanical properties of Populus euramericana (P. canadensis) glulam beams of up to 15 m span showed that they compared favourably with Abies alba beams for house construction.

Ruskin, F.R., ed. 1983. Firewood crops. Shrub and tree species for energy production. Vol. 2. Washington, DC: National Academy of Sciences. 92 p.

Each species is described and illustrated and its distribution, use as firewood, yield, other uses, environmental requirements, establishment, pests and diseases, and limitations are briefly discussed.

1984

1984. Production of liquids from biomass by continuous flash pyrolysis. In: Scott, D.S.; Piskorz, J.; Egneus, H.; Ellegaard, A., eds. *Proceedings of Bioenergy 84*. Vol. 3. Biomass conversion; 1984 June 15; Goeteborg, Sweden. Barking, England: Elsevier Applied Science Publishers: 15-22.

Data are presented on the yields and physical and chemical characters of pyrolysis oils produced from various types of biomass feed during laboratory and larger scale tests. Yields of organic liquids of 65 percent were routinely obtained from poplar, yields from straw were lower. The oils were

suitable for use as low-grade fuel. A preliminary economic analysis is given of a plant processing 1,000 dry t/day of waste wood.

Blankenhorn, P.R.; Bowersox, T.W.; Strauss, C.H.; Stimely, G.L.; Hornicsar, C.A.; DiCola, M.L. 1984. The characterization of hybrid poplar as a potential feedstock for fermentation to ethanol. In: Proceedings, Technical Association of the Pulp and Paper Industry, 1984 research and development conference; 1984 September 30-October 3; Appleton, WI. Atlanta, GA: TAPPI Press: 43-49.

Brandels, L.; Hansson, L. 1984. Short-rotation forestry in Sweden--Energy R&D programme and potential fuel market. In: Perttu, K.L., ed. Energy forestry aspects in general: ecology and management of forest biomass production systems. Lantbruksuniversitet. 15: 513-517.

Chmielewski, W. 1984. New directions for intensifying woody biomass production and possibilities for its utilization. Sylwan. 128(8): 23-32.

Foreign and Polish literature and data on short rotation forestry are reviewed and the potential in Poland assessed. Poplar and willow plantations could yield up to 30 t/ha DM annually for use in board, pulp, and chemical manufacture or as a fuel.

Dziegielewski, S.; Adanowicz, J. 1984. Design of cross-sectional profiles for selected furniture parts. Holztechnologie. 25(3): 135-137.

The strength of timber (Scots pine, Norway spruce, silver fir, poplar) elements, machined for use in upholstery frames, was studied in static bending load tests.

Farsang, P.; Gerencser, K. 1984. Possible use of poplar wood in window manufacture. Faipar. 34(6): 169-175.

Experiments were made with Populus 'Robusta' in Hungary. Window components were joined by tapered tenon finger joints.

Galgoczi, G.; Toth, S. 1984. Materials-saving design of solid timber frames for couches. Holztechnologie. 25(6): 298-300.

Deflection under constant load is reported of solid timber (Robinia, poplar, or pine) couch frames. Results confirm the validity of a theoretical model.

Huber, H.; Maeglin, R.R.; Bozaan, D. 1984. Commercial evaluation of SDR - using aspen for door parts. Forest Products Journal. 34(11/12): 35-39.

The SDR process has been shown to reduce warp in studs and is studied here as a method suitable for manufacturing door parts. In a commercial-scale test, comparing conventional practices with SDR, the SDR process reduced crook and bow and, with high-temperature drying, it also reduced twist in boards used for making door stiles and rails.

Hughes, M.; Gertjejansen, R. 1984. Spruce budworm killed balsam fir as a raw material for flakeboard and waferboard. Forest Products Journal. 34(2): 42-46.

Li, D.W. 1984. Investigation on utilizing the fallen leaves from forest belts of Populus nigra var. italica as winter fodder for sheep. Forest Science and Technology (Linze Kejitongxun). 6: 20-21.

Shelterbelts in Fengzheng County (Nei Menggu) established to protect farmland and improve the environment, also provide large amounts of fodder for sheep. The nutritive content of fallen poplar leaves and herbage were found to be similar. However, forest litter is very important for the circulation of nutrients in the soil. The use of fallen leaves as fodder achieves short-term economic efficiency but restricts this circulation and will decrease soil fertility in time, reducing tree growth. Fertilizer application is recommended.

Mottl, J. 1984. Growth of poplars in the air polluted region of the Ore Mountains and their use in greening up the country side. Zpravy Lesnickeho Vyzkumu. 29(1): 1-4.

Neenan, M.; Lyons, G.; Palz, W., eds. 1984. Production of energy from short rotation forestry. Brussels, Belgium: Commission of the European Communities: 45-47.

Dry matter yields of 12-18 t/ha annum were obtained from Populus trichocarpa and one of its hybrids is best, while Salix aquatica gigantea is the most promising on very wet peatland. Results show that short rotation forestry fuel can be produced at about US \$110 per ton oil equivalent.

Nelson, N.D.; Sturos, J.A.; Fritschel, P.R.; Satter, L.D. 1984. Ruminant feedstuff from the commercial foliage of hybrid poplars grown under intensive culture. Forest Products Journal. 34(4): 37-44.

The 'commercial foliage' (primarily leaves and twigs) of hybrid poplars was separated from the whole-tree chips with (a) a foliage separator attached to a whole-tree harvester, or with (b) a vacuum airlift segregation process. With (a), the commercial foliage had a high wood and bark content which had only marginally acceptable digestibility for ruminants. The foliage produced with (b) was high in leaf content, comparable to forage legumes in protein content, and of high 'in situ' digestibility, i.e., in dacron bag trials. It is considered suitable as a low-cost protein supplement in feed formulations.

Simionescu, C.I.; Aly, H.I.M.; Toma, C.; Rozmarin, G. 1984. Possibilities of utilizing juvenile poplar wood in the paper and hydrolysis industries. (1.) Biometrical data and chemical composition. Cellulose Chemistry and Technology. 18(1): 55-62.

The microscopic structure and chemical composition of juvenile wood (1-8 years) from Populus deltoides and P. euramericana (P. canadensis) and the suitability of using such wood in the pulp and paper industry were studied. Taking into account the biometrical, chemical, and analytical results, binary correlating equations were calculated between poplar age and the parameters investigated.

Sperbeck, J. 1984. Growing Minnesota's next energy crop. Minnesota Science. 39(1): 13-14.

Viart, M. 1984. Poplars in China: possibilities and recommendations. *Unasyuva*. 36(3): 28-29.

Yu, E.K.C.; Deschatelets, L.; Levitin, N.; Saddler, J.N. 1984. Production of 2,3-butanediol from HF-hydrolyzed aspen wood. *Biotechnology Letters*. 6(9): 611-614.

Yung, A.W.; Moslemi, A.A. 1984. Korean lignocellulosics and Portland cement as a structural material. *Wood Science and Technology (Mogjae-Gonghak)*. 12(4): 36-46.

The effects on inhibitory index were determined of hot-water extraction and the addition of hardening accelerators to lignocellulose/cement mixtures made from 6 Korean reforestation species and 2 agricultural waste products. With hot-water extraction, rice husk, *P. koraiensis*, *Larix leptolepis*, and *Abies holophylla* were reclassified as suitable under limited conditions. Combining hot-water extraction with the addition of calcium chloride or magnesium chloride as accelerators rendered *Populus alba-glandulosa*, *L. leptolepis*, and *P. rigida* highly-suitable.

Zsuffa, L.; Morgan, D. 1984. *Populus* and *Salix* biomass for energy: a survey of International Poplar Commission countries. *Unasyuva*. 36(3): 31-33.

1985

Bailey, A.W.; Irving, B.D. 1985. Forage production and use in clear and break vs. spray and burn in the aspen parkland. In: 64th Annual feeders' day report; 1985 June; Alberta, Canada. *Agriculture and Forestry Bulletin*. Special issue: 75-77.

Lonergan, S.C.; Cocklin, C. 1985. Multi-objective optimization model for renewable energy resource management. *Resource Management Optim.* 3(3): 261-279.

In Ontario, Canada, extensive research has been devoted to the development of forest energy plantations providing energy in the form of heat, electricity, or methanol. Goals for the establishment of such plantations relate to economic efficiency, environmental quality, regional employment, and income generation and net energy gains. Allocation of land and other resources for biomass production and energy conversion in order to satisfy these goals is discussed in relation to the use of a linear, multi-objective goal programming model to assess resource options for the forest energy project using hybrid poplar (*Populus X canadensis*) in Ontario.

Mehrling, P.; Reimert, R. 1985. Fuel- and synthesis gas from biomass via gasification in the circulating fluid bed. In: Palz, W.; Coombs, J.; Hall, D.O., eds. *Energy from biomass: 3d E.C. conference; 1985 March 25-29; Venice, Italy*. London, UK: Elsevier Applied Science Publishers: 905-909.

A report of trial runs of a pilot plant using beech, pine, poplar or spruce wood particles (up to 70 mm). The economics of fuel gas and methanol production using this method are briefly outlined.

Neenan, M. 1985. Short rotation forestry for energy production. In: Palz, W.; Coombs, J.; Hall, D.O., eds. Energy from biomass: 3d E.C. conference; 1985 March 25-29; Venice, Italy. London, UK: Elsevier Applied Science Publishers: 278-282.

A report of trials established in the Irish Republic in 1977 and 1982. On soils of low, but not the lowest, fertility, the most promising genera were Salix, Populus, and Alnus, producing annual yields of up to 18 t/ha on a 3- or 4-year cycle.

Nikolov, S.; Panaiotov, P. 1985. Possibilities of using modified wood in building on livestock farms. Nauchni Trudove, Mekhanichna Tekhnologiya na D"rvesinata, Vissh Lesotekhnicheski Institut, Sofiya, Bulgaria. 29: 13-18.

Samples of natural wood of alder, willow, poplar, and pine, and also samples impregnated with polyester resin, were exposed to aqueous solutions of ammonia (0, 5, 10, 15, 20, and 25 percent concentrations). The modified wood was much stronger than the natural wood in wet conditions, and considerably more resistant to the effect of the ammonia solutions.

Pearce, M.L. 1985. Coppiced trees as energy crops. In: Palz, W.; Coombs, J.; Hall, D.O., eds. Energy from biomass: 3d E.C. conference; 1985 March 25-29; Venice, Italy. London, UK: Elsevier Applied Science Publishers: 292-295.

Early results are given of a series of trials with Populus 'Rap', Salix 'AG', and Eucalyptus archerii in South Britain.

San Miguel, A.; Gonzalez, A.F. 1985. Possibilities of using poplars as fodder in Spain. Anales del Instituto Nacional de Investigaciones Agrarias, Forestal. 9: 75-86.

The possibility of using the leaves, bark and wood of Populus spp. as animal fodder was investigated. The nutritive value of leaves was high and similar to that of Medicago sativa. Poplar bark and wood were suitable for use as a roughage component in feeds. In long rotation poplar groves the trees can be pruned in summer without affecting timber production, yielding approximately 0.5 t DM of leaves and 0.75 t DM of branches/ha annually. Short rotation intensively cultured poplars can be used for livestock feeding in rotations of less than or equal to 1 year, with 10,000-20,000 plants/ha producing 15-20 t DM/ha.

Shukla, K.S.; Shah, R.S.; Bagga, J.K. 1985. Suitability of Populus ciliata (poplar) for hardboards. Indian Forester. 111(4): 225-229.

Hardboard was made on a laboratory scale from residue from veneer logs from Himachal Pradesh.

Tebo, P.W.; Marler, R.L. 1985. Design and operation of a commercial SRIC hybrid poplar energy plantation for boiler fuel. In: Klass, Donald L., chair. Energy from biomass and waste 9; 1985 January 28-February 1; Lake Beuna Vista, FL. Chicago, IL: Institute of Gas Technology: 283-312.

Torzewski, B.; Lipinska, J. 1985. Chemical composition of forest foliage from some tree species. Przegląd Papierniczy. 41(11): 354-355.

Abies alba, Picea abies, Betula papyrifera, Populus tremula, Alnus glutinosa, and Quercus robur were analyzed for crude fiber, total protein,

crude fat, non-nitrogenous extractives, reducing sugars, carotene, and ash. Results show that needles and leaves of these species are a valuable source of nutrients, with high contents of crude fiber and proteins. The proteins contain nearly all essential amino acids. Logging residues would be suitable for processing into animal feed.

Walterne-Illes, V. 1985. Use of forest byproducts for feeding of game. *Erdeszeti es Faipari Tudomanyos Kozlemanyek*. 2: 239-242.

Foliage of hornbeam, oak, and hybrid poplar but not ash, lime, and Turkey oak were suitable for ensiling. Foliage of broadleaved trees collected between 15 May and 15 June should be stored in conical stacks 4-5 m high with the base of the stack a dry brushwood layer of 30 cm. The crown branches, stumps, and root suckers of tree species readily consumed by game are suitable.

Wengert, E.M.; Donnelly, D.M.; Markstrom, D.C.; Worth, H.E. 1985. Wood utilization. Gen. Tech. Rep. RM-119. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 169-180.

Winistorfer, Paul Michael. 1985. Raw material characterization and properties of structural flakeboard from coppice grown hybrid poplar. Dissertation Abstracts International. 46/05-B: 1405.

Tree growth variables and properties of the wood and bark were evaluated for 3-year-old coppice grown hybrid poplar. Three clones (NE-5323, NE-5326, and NE-5377) from a Populus X euramericana cross were studied. This material was then used for the manufacture of 40 lb/ft ('3) homogeneous flakeboards in an attempt to evaluate the effects of the raw material quality on properties of flakeboard.

1986

Ahuja, M.R.; Muhs, H.-J. 1986. Biomass production in forest plantations used as raw material for industry and energy. Rep. No. BMFT--FB-T-86-073. Bonn, Federal Republic of Germany: Bundesministerium fuer Forschung und Technologie. 38 p.

Baertsche, S.R.; Yokoyama, M.T.; Hanover, J.W. 1986. Short rotation, hardwood tree biomass as potential ruminant feed - chemical composition, nylon bag ruminal degradation and ensiling of selected species. *Journal of Animal Science*. 63(6): 2028-2043.

Chemical composition, nylon bag ruminal degradation, and the ensiling characteristics of the biomass of 10 short rotation, intensively-cultured hardwood tree species were estimated to evaluate their potential feeding value for cattle. Species examined included ailanthus (Ailanthus altissima), aspen (Populus tremuloides), black alder (Alnus glutinosa), black locust (Robinia pseudoacacia), birch (Betula papyrifera), elm (Ulmus americana), green ash (Fraxinus pennsylvanica), honeylocust (Gleditsia triacanthos), poplar (Populus deltoides), and willow (Salix nigra). Based on the data, short rotation,

intensively-cultured hardwood tree biomass seems to have a feeding value for cattle.

Calve, L.R.; Shields, J.A.; Gravel, M.C. 1986. Maximizing aspen poplar residue utilization for waferboard production. *Forest Products Journal*. 36(5): 39-45.

Waferboards were manufactured from aspen poplar (Populus tremuloides) trees of 20, 70, 150, and 360 mm butt diameter, with or without bark, branches, and unmerchantable boles. Using total trees utilizes 85 percent of the above-ground biomass compared with 68 percent for merchantable boles. Reductions in physical properties were minimized by manufacturing 3-layer waferboards having high quality flakes in the surface layers and lower-quality total tree material in the central core.

Geles, I.S. 1986. Bark as fuel. *Bumazhnaya Promyshlennost'*. 4: 21-22.

An analysis was made of the heat of combustion, moisture content, and content of C, H, S, volatile substances, and ash of the inner and outer bark of trees indigenous to Siberia, viz. spruce, pine, larch, aspen, and birch. Results suggest that only the outer bark should be used as fuel.

Klimentov, A.S.; Kostenko, L.D.; Dikun, P.P.; Khudolei, V.V.; Pliss, G.B. 1986. A study of wood decomposed by radiation. 6. Comparison of the benzo[a]pyrene content and the mutagenic activity of substances formed during the exposure of lignified raw materials to gamma radiation and accelerated electrons. *Khimiya Drevesiny*. 2: 45-48, 124.

Irradiation of Scots pine sawdust, aspen (Populus tremula) sawdust or peat at doses up to 2.7 MGr had no mutagenic effect as judged by the Salmonella assay 2 months later. Slight increases in the benzopyrene content were found in some samples; these increases were within the limits found naturally in plants. Results suggest that irradiated woody materials can be safely used as fodder.

Kolster, H.W. 1986. Balsam poplars: suitable or unsuitable for clogs? *Populier*. 23(2): 32-33.

Following a complaint about a consignment used for making souvenir clogs, analysis suggested that wood from young balsam poplars (mainly P. 'Androscoggin' but also some Populus nigra X P. deltoides cultivars) especially if slow-growing, may be unsuitable chiefly because of epicormic knots.

Mathison, G.W.; Milligan, L.P. 1986. Evaluation of aspen as a feedstuff for ruminants. *Agriculture and Forestry Bulletin, University of Alberta*. 9(1): 25.

The digestibility and voluntary intake of diets containing high percentage of ground, whole aspen trees were measured for sheep and cattle. It was concluded that the feeding value of unprocessed aspen in ruminant diets is less than 75 percent of the feeding value of straw due to low potential digestibility, low rate of degradation in the rumen and low voluntary consumption by cattle and sheep.

Mathison, G.W.; Milligan, L.P.; Weisenburger, R.D. 1986. Ruminant feed evaluation unit: evaluation of aspen as a feedstuff for cattle. *Agriculture and Forestry Bulletin, Special Issue*: 53-55.

An experiment was undertaken to examine the nutritive value of ground whole aspen trees given with hay or in an aspen-barley grain silage mixture to cattle and sheep. It is concluded that unprocessed ground aspen has limited potential as a ruminant feedstuff; particularly for sheep.

Myers, G.C.; Crist, J.B. 1986. Feasibility of manufacturing hardboard from short-rotation intensively cultured Populus. Forest Products Journal. 36(1): 37-44.

Medium- and high-density hardboards were manufactured by wet and dry processes from: (a) wood chips of short-rotation intensive culture (SRIC) Populus 'Tristis No. 1', (b) material identical to (a) that had been improved by vacuum airlift segregation (VAS) to remove fines and bark, and (c) wood chips of Populus tremuloides (control).

Roshchin, V.I.; Poverinova, O.Yu.; Polovnikova, I.N.; Kurnygina, V.T. 1986. Group composition of extractives in aspen leaves and shoots. Khimiya Drevesiny. 4: 106-109, 128.

Large amounts of broadleaved foliage are produced by summer tending fellings in European Russia. Foliage of Populus tremula from Leningrad Province was analyzed with a view to processing into fodder. Ethanol-soluble extractives were a major constituent.

Shukla, K.S.; Sharma, Y.K.; Chandra, R. 1986. Harvesting young Populus deltoides plants for hardboard manufacture. Journal of the Timber Development Association of India. 32(4): 32-37.

Stems of 1- and 2-year-old P. deltoides were analysed for moisture content and percentages of bark and wood prior to chipping and manufacture into hardboard. Both age groups were suitable for hardboard but board properties were better for boards made from 2-year-old plants, which had a lower percentage of bark than 1-year-old plants (21 vs. 30 percent).

1987

Neenan, M; Grassi, G.; Zibetta, H., eds. 1987. Production of energy from short rotation forestry: Energy from biomass. 1. Proceedings, 1st contractors' meeting; 1986 April 29; Brussels, Belgium. Barking, England: Elsevier Applied Science Publishers Ltd.: 41-45.

Ranney, J.W.; Wright, L.L.; Layton, P.A. 1987. Genetic improvement of energy crops. Journal of Forestry. 85(9): 26-28.

1988

Giordano, G. 1988. Poplar wood, a valuable raw material of the board industries: utilization and properties. Holz- und Moebelindustrie. 23(12): 1230.

WILDLIFE

1975

Telfer, E.S.; Scotter, G.W. 1975. Potential for game ranching in boreal aspen forests of western Canada. *Journal of Range Management*. 28(3): 172-180.

1976

Gordon, F.A. 1976. Spring burning in an aspen-conifer stand for maintenance of moose habitat, West Boulder River, Montana. In: Komarek, E.V.; Fischer, W.C., chair. Proceedings, Tall Timbers fire ecology conference and Intermountain fire research council fire and land management symposium: 1974 October 8-10; Missoula, MT. 14: 501-538.

Following a prescribed burn in spring 1972 of a moose winter range area in S. central Montana, aspen stands increased due to sprouting from roots from a few hundred/ac prior to burning to >25000/ac after burning. Two years after burning aspen was at a height that could be utilized. Following the winter of 1973-1974, heaviest use by moose of aspen and shrubs was adjacent to unburned control areas where cover was quite dense.

Hagvar, S.; Soerensen, O.J. 1976. We can do something for hole-nesters. *Norsk Skogbruk*. 22(9): 3-6.

It is suggested that hole-nesting birds such as woodpeckers can be favored, in the interests of forest hygiene, by leaving broadleaved trees, especially aspen (Populus tremula) standing when conifer crops are felled.

Hale, J.B.; Gregg, L.E. 1976. Woodcock use of clearcut aspen areas in Wisconsin. *Wildlife Society Bulletin*. 4(3): 111-115.

Clear-felled areas in aspen (mainly Populus tremuloides) forests were very attractive to woodcock (Philohela minor) for feeding and night roosting.

Joyal, R. 1976. Winter foods of moose in La Verendrye Park, Quebec: an evaluation of two browse survey methods. *Canadian Journal of Zoology*. 54(10): 1765-1770.

The winter foods of moose (Alces alces) were studied in 3 winter yards in representative mixed forests of western Quebec. Moose preferred willows and trembling aspen (Populus tremuloides), which showed the highest availability:utilization ratio.

Patton, D.R. 1976. Timber harvesting increases deer and elk use of a mixed conifer forest. Res. Note RM-329. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 3 p.

A 'use index', based on faecal pellet counts, was calculated for Odocoileus hemionus and Cervus canadensis in a mixed conifer forest in Arizona for the period 1969-1975. Compared to an adjacent control area, harvesting resulted in an increase in the use index for both deer and elk. Two years after harvesting, herbage production was increased by 50 lb/acre as compared

to 1969, and P. tremuloides, an important source of food, was increased by about 300 stems/acre.

Snyder, J.D.; Janke, R.A. 1976. Impact of moose browsing on boreal-type forests of Isle Royal National Park. *American Midland Naturalist*. 95(1): 79-92.

Describes a study for the long-term effects of browsing by Alces alces on the vegetational succession of a forest stand in which an overstory of pioneer species had been established before the moose arrived in the area. Dominant tree species included Abies balsamea, Betula papyrifera, Picea glauca, Populus tremuloides, Acer saccharum, Betula alleghaniensis, and Picea mariana. Effects attributed to 60 years' browsing were: reduced density of trees, increased b.a., reduced height of the shrub layer, increased ground vegetation cover and increased number of windfalls.

Wesley, D.E.; Perkins, C.J.; Sullivan, A.D. 1976. Preliminary observations of cottonwood plantations as wildlife habitat. In: Thielges, B.A.; Land, S.B., Jr., eds. *Proceedings, Symposium on eastern cottonwood and related species*; 1976 September 18-October 2; Greenville, MS. Baton Rouge, LA: Louisiana State University: 460-476.

Wolff, J.O. 1976. Utilization of hardwood browse by moose on the Tanana flood plain of interior Alaska. Res. Note PNW-267. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 7 p.

Measurements of shrub and tree density, pellet group counts, and estimations of the availability and utilization of broadleaf browse by moose (Alces alces) were made during winter 1974-1975 in (a) an 8-year-old stand and (b) a 15-year-old stand of early successional broadleaves. Populus balsamifera was more heavily browsed in (a) where there were more small branches within reach than in (b).

1977

Armstrong, D.M. 1977. Ecological distribution of small mammals in the Upper Williams Fork Basin, Grand County, Colorado. *Southwestern Naturalist*. 22(3): 289-304.

The distribution of 9 small mammal species was studied in relation to vegetation type along transects at altitude 2590-3475 m. Habitat physiognomy seemed to be more important to the animals than the species composition of the overstory.

Crete, M. 1977. The importance of harvesting for winter habitat of moose in southeastern Quebec. *Canadian Journal of Forest Research*. 7(2): 241-257.

Areas in (a) Mont-Tremblant Provincial Park and (b) Pontiac County were studied by aerial photography and ground surveys. The abundance of browsable stems was the most important habitat component influencing the use of stands by moose. Stands of shade-intolerant hardwoods (including Betula papyrifera and Populus tremuloides) that had been logged were used more frequently than unlogged stands in (b), whereas the reverse occurred in (a), possibly because

less abundant regeneration of the feeding stratum and greater snowfall occurred in area (a). Logging practices that provide suitable moose habitat are suggested for the main forest types.

Johnson, R.R.; Haight, L.T.; Simpson, J.M. 1977. Endangered species versus endangered habitats: a concept. Gen. Tech. Rep. RM-43. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 68-79.

Lavie, P. 1977. The relationship between propolis, poplar buds and castoreum. In: Proceedings, 25th International Apicultural Congress; Grenoble. Bucharest, Romania: Apimondia Publishing House: 229-233.

Analyses of propolis, and of poplar buds from which it is chiefly collected, showed the presence in both of five compounds: chrysene, tectochrysene, galangine, isalpinine and pinocembrine. In tests on 10 strains of bacteria, propolis and poplar bud extracts had similar antibiotic effects. The beaver (Castor fiber) feeds on poplar or willow bark, twigs and buds and produces castoreum, a glandular secretion used for marking territory. The antibiotic effect of castoreum was very similar to that of propolis and poplar buds.

Maxson, S.J. 1977. Spring home range and habitat use by female ruffed grouse. Journal of Wildlife Management. 42(1): 61-71.

Studies were made on 15 female ruffed grouse (Bonasa umbellus), monitored by automatic radio-tracking system, before and during laying and during and after incubation of eggs. During incubation the hens fed almost exclusively on trembling aspen (Populus tremuloides).

Oldemeyer, J.L.; Franzmann, A.W.; Brundage, A.L.; Arneson, P.D.; Flynn, A. 1977. Browse quality and the Kenai moose population. Journal of Wildlife Management. 41(3): 533-542.

In trials in 1973-1974 digestibility (in vitro DM disappearance) and levels of CF, CP and minerals were determined in herbage eaten by moose (Alces alces) in the NW Kenai Peninsula, Alaska. Alnus spp. and Salix spp. were ranked as the best summer browse and V. vitis-idaea as the worst. In winter P. tremuloides and V. vitis-idaea were the best and B. papyrifera the worst browse species. As the different species provide different nutrients, sufficient quantities of all 5 species could meet the needs of moose better than any single species.

Padaiga, V. 1977. Clear fellings and fodder resources for game. Lesnoe Khozyaistvo. 3: 79-82.

Sample plots were established in Lithuania to determine the amounts and chemical composition of winter fodder available for game (elk, red deer, hares, and roe deer) on clear-felled areas at various periods after felling in broadleaved and mixed spruce/broadleaved stands. Studies of the distribution of droppings of elk, red deer and roe deer in winter showed that the animals tended to concentrate in areas where aspen (Populus tremula) was felled.

Patton, D.R.; Jones, J.R. 1977. Managing aspen for wildlife in the Southwest. Gen. Tech. Rep. RM-37. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 7 p.

Reynolds, J.W.; Krohn, W.B.; Jordan, G.A. 1977. Earthworm populations as related to woodcock habitat usage in central Maine. In: Proceedings, 6th Woodcock symposium: 135-146.

Numbers and biomass of lumbricid earthworms were directly and significantly related to the intensity of cover usage by radio-marked American woodcock (Philohela minor) in 2 old fields (abandoned 20-30 years) surrounded by forest of various types. Earthworm populations were highest in covers providing preferred leaf litter, especially of alder (Alnus spp.) or aspen (Populus [sect. Leuce]), and moderately moist. It is concluded that in order to sustain the greatest densities of earthworm and hens of woodcock, management of second-growth broadleaves is more efficient than improvement of coniferous or mixed forest habitats.

Slough, B.G.; Sadleir, R.M.F.S. 1977. A land capability classification system for beaver. Canadian Journal of Zoology. 55(8): 1324-1335.

Beaver colony site density was sampled on 136 lakes (about 1830 shoreline km) and 45 stream sections (145 stream km) in the northern interior of British Columbia. Beaver habitat factors were quantified and then related to beaver colony site density by multiple regression analysis. Conservation of existing aspen (Populus tremuloides) stands, common throughout the beaver's range, is considered the most powerful management tool for maintaining or enhancing present beaver land capability.

Stocker, M.; Gilbert, F.F.; Smith, D.W. 1977. Vegetation and deer habitat relations in southern Ontario: classification of habitat types. Journal of Applied Ecology. 14(2): 419-432.

A functional habitat classification was derived using the parametric land classification approach. Construction of a habitat map was based on photoecological techniques, vegetation sampling and analysis. It was concluded that the classification scheme presented provides a useful framework for habitat evaluation related to wildlife populations, and in this respect would be considered a useful wildlife management tool.

Walski, T.W.; Mautz, W.W. 1977. Nutritional evaluation of three winter browse species of snowshoe hares. Journal of Wildlife Management. 41(1): 144-147.

Ability to digest and metabolize three important winter browse species: quacking aspen (Populus tremuloides), white cedar (Thuja occidentalis) and red maple (Acer rubrum), was evaluated in 12 snowshoe hares (Lepus americanus). Digestible energy (DE) ranged from 18 percent of gross energy for maple to 42 percent for aspen. Metabolizable energy (ME) was from 17 percent for maple to 25 percent for aspen.

1978

Braathe, P. 1978. Damage by elk browsing must be taken seriously. Will our forests contain less pine in future? Norsk Skogbruk. 24(4): 12-13, 27.

In trials in which insufficient regeneration of Picea abies was supplemented by pine, elk damage was so severe that this method had to be abandoned. Pine is also heavily attacked in natural mixed stands (pine and spruce) and in pure stands. In mixed broadleaf and conifer regeneration elk browse particularly heavily on aspen (Populus tremula) and maple (Acer spp.). It is suggested that by judicious cleaning of regeneration areas with glyphosate the food supply for elk might be greatly reduced thereby reducing the present intolerably high population density.

Edwards, W.R.N. 1978. Effect of salicin content on palatability of Populus foliage to opossum. New Zealand Journal of Science. 21(1): 103-106.

For 50 clones of Populus there was a significant relation between salicin concentration in foliage and the palatability of foliage to captive opossums (Trichosurus vulpecula). Opossums ate less of the foliage with more salicin. There may be seasonal and other effects on palatability. Poplar trees are used to control erosion in New Zealand and are damaged or killed by browsing opossums.

Hendriks, J.L.J. 1978. Poplars and nature conservation. Populier. 15(1): 16-20.

From the ecological point of view, poplar (Populus spp.) plantations on former forest sites on alluvial soils in The Netherlands may have long-term effects on the composition of the flora. On former agricultural land they have little effect botanically but may provide interesting biotopes for birds. Plantations on recently drained land are only a first stage in the development of a well-structured forest community.

Parker, G.R.; Morton, L.D. 1978. The estimation of winter forage and its use by moose on clearcuts in northcentral Newfoundland. Journal of Range Management. 31(4): 300-304.

An estimation of the effects of clear felling on browsing by moose (Alces alces americana) in 14 logged areas of various size and age in Abies balsamea/Picea mariana forest. Regression models were developed for estimating browse dry weight for individual species (including Populus tremuloides and Acer rubrum). Maximum browse production occurred 8 years after felling. The greatest use of winter browse was on clear-felled areas of 40-50 ha.

Rusch, D.A.; Reeder, W.G. 1978. Population ecology of Alberta red squirrels. Ecology. 59(2): 400-420.

Temporal and spatial variations in population structure and density of Tamiasciurus hudsonicus were investigated, after live trapping and tagging, in three habitats near Rochester, Alberta. Between 1966 and 1969, the squirrels were most abundant in mixed spruce (Picea mariana/P. alba [P. glauca]) stands, less abundant in jack pine (Pinus banksiana) and least abundant in aspen (Populus tremuloides) stands.

1981

Fraser, James Dempsey. 1981. The breeding biology and status of the bald eagle on the Chippewa National Forest. Dissertation Abstracts International. 42/01-B: 8.

Bald eagles (Haliaeetus leucocephalus) were studied on the Chippewa National Forest in north central Minnesota from 1974 to 1978 to investigate breeding biology, reproductive parameters, the effect of human activities on reproduction, and the population's status. Nests were in super-dominant trees: 10 percent in Populus spp., 30 percent in Pinus resinosa, and 59 percent in P. strobus.

Priedytis, A.; Tauginas, J. 1981. Feeding effectiveness of granules, made from summer cutting waste of aspen, in the winter ration of roe deer. Nauk Litovskoi SSR. Seria V. 3: 149-158.

Rabe, Dale Leslie. 1981. Habitat and energetic relationships of American woodcock in Michigan. Dissertation Abstracts International. 42/12-B: 4633.

During the springs of 1978 and 1979, 23 aspen (Populus tremuloides) community habitat complexes were censused for singing males and intensively searched with a pointing dog to locate nests, broods, and solitary birds.

1983

Althoff, Donald Paul. 1983. Daytime home range, habitat selection, and microenvironments used by cottontail rabbits in central Pennsylvania. Dissertation Abstracts International. 45/01-B: 9.

Daytime use of space and resources by cottontail rabbits (Sylvilagus floridanus) was documented in central Pennsylvania from December 1978 through November 1980. Home range, habitat selection, and microenvironments were studied to explore the relative influence of environmental factors on the behavior of rabbits. Tartarian honeysuckle (Lonicera tatarcia), multiflora rose (Rose multiflora), aspen (Populus spp.), and gray dogwood (Cornus racemosa) in the shrub layer and aspen, black cherry (Prunus serotina), and white pine (Pinus strobus) in the tree layer were the most common species near rabbit bedsites regardless of aspen.

Bencze, L. 1983. The role of forests in meeting the food requirement of the red deer population. Erdeszeti es Faipari Tudomanyos Kozlemenyek. 2: 199-204.

A populus alba stand at 40-50 years old provides 15 t of bark and 3 t of branch ends on 1 ha which, in the case of 50 percent exploitation, would be sufficient to feed 8-10 deer for 100 days.

Kossak, S. 1983. Winter foddering of roe deer. Prace Instytutu Badawczego Lesnictwa, Poland. 616/620: 93-108.

Studies were made of feeding by 14 roe deer (Capreolus capreolus) in an enclosure in Bialowieza ancient forest, Poland, and a programme of winter foddering is suggested. Fodder should be given regularly at fixed hours during permanent snow cover and consist of 400 g acorns or oats per head per

day, 500 g of hay, and 600 g of dried young shoots, especially Populus tremula, Salix capraea, Sorbus aucuparia, and Rubus idaeus.

Rice, J.; Ohmart, R.D.; Anderson, B.W. 1983. Habitat selection attributes of an avian community: a discriminant analysis investigation. *Ecological Monographs*. 53(3): 263-290.

Studies were made in 72 transects representing all riparian habitat types in the lower Colorado River Valley. Aspects examined include the importance of individual habitat attributes, e.g. foliage height diversity, proportions of Prosopis glandulosa, P. pubescens, Tamarix chinensis, Populus fremontii, and Salix gooddingii and foliage density characteristics, and ecological attributes of the birds.

Verch, R.L. 1983. Some implications of Populus intensive culture on nongame birds. In: Hansen, E.A., Comp. In intensive plantation culture: 12 years research. Gen. Tech. Rep. NC-91. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 110-114.

1984

LaBau, V.J.; Fox, P.M. 1984. Use of timberlands by moose in the Yakutat area of costal Alaska. In: LaBau, V.J., ed. Proceedings, Society of American Foresters regional technical conference: Inventorying forest and other vegetation of the high latitude and high altitude regions; 1984 July 23-26; Fairbanks, AK. Bethesda, MD: Society of American Foresters: 249-256.

Netzer, D.A. 1984. Hybrid poplar plantations outgrow deer browsing effects. Res. Note NC-325. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 3 p.

Brief reports are given of studies to evaluate the preference of Odocoileus virginianus for 13 poplar clones and to determine the effects of browsing on tree height and subsequent growth in plantations west of Rhinelander, Wisconsin. It is concluded that well-established plantations will grow above the research of deer during the second year.

Tyurnin, B.N. 1984. Factors determining numbers of the river beaver (Castor fiber) in the European North. *Soviet Journal of Ecology*. 14(6): 337-344.

Widespread logging in the southern part of the USSR has improved the habitat for beaver by creating stands of aspen (Populus tremula) and birch along waterways. The ecology and natural enemies of the beaver in the USSR are reviewed.

1985

DeByle, N.V. 1985. Managing wildlife habitat with fire in the aspen ecosystem. In: Lotan, J.E.; Brown, J.K. comps. Fire's effects on wildlife habitat: symposium proceedings. Gen. Tech. Rep. INT-186. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 73-82.

A brief review is given of the role of fire in habitat management for 6 wildlife species. Current research to develop fire prescriptions for the P. tremuloides community is outlined.

Gullion, G.W. 1985. Aspen management, an opportunity for maximum integration of wood fiber and wildlife benefits. In: Transactions of the 50th North American wildlife and natural resources conference. Washington, DC: Wildlife Management Institute: 249-261.

Kheruvimov, V.D. 1985. Some characteristics of the winter diet of moose. Soviet Journal of Ecology. 15(3): 137-142.

The rumen contents of 11 moose were analysed during a period of steadily decreasing air temperature in December in a forest in Tambov Province, Russia. Scots pine predominated in the diet, increasing to 100 percent at low temperature (-17degC), while birch accounted for the remainder and formed at least 22 percent of the diet of pregnant cows; aspen (Populus tremula) was browsed only in relatively mild weather (above -4deg).

McGinley, M.A.; Whitham T.G. 1985. Central place foraging by beavers (Castor canadensis) - a test of foraging predictions and the impact of selective feeding on the growth form of cottonwoods. Oecologia. 66(4): 558-562.

Reynolds. R.T.; Linkhart, B.D.; Jeanson, J.J. 1985. Characteristics of snags and trees containing cavities in a Colorado conifer forest. Res. Note RM-455. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 6 p.

Seip, D.R.; Bunnell, F.L. 1985. Foraging behaviour and food habits of Stone's sheep. Canadian Journal of Zoology. 63(7): 1638-1646.

Studies on the foraging behaviour of Stone's sheep (Ovis dalli stonei) in different seasons and on burnt and unburnt rangeland showed that in summer sheep selected plant species which were no higher in protein or lower in acid detergent fibre than avoided species, but lacked physical and chemical deterrents present in avoided plants. Graminoids including Carex spp., Elymus innovatus, Festuca spp., and Poa spp. were selected in preference to forbs (Achillea, Artemisia, Astragalus, Oxytropis and Dryas spp., and Lupinus archticus), browse (conifers, Salix, Populus and Vaccinium spp.), lichens and mosses. The greatest single contribution of a species to the sheeps' diet was achieved by Poa spp. (49.4 percent) in February on subalpine burnt meadows.

Stauffer, D.F.; Peterson, S.R. 1985. Seasonal micro-habitat relationships of ruffed grouse in southeastern Idaho. Journal of Wildlife Management. 49(3): 605-610.

Urness, P.J. 1985. Wildlife-aspen interrelationships. In: Proceedings of the Society of American Foresters national convention. Bethesda, MD: Society of American Foresters: 112-115.

1986

Fielder, P.C.; Starkey, R.G. 1986. Bald eagle perch-sites in eastern Washington. Northwest Science. 60(3): 186-190.

During winter 1982-1983 and 1983-1984, Haliaeetus leucocephalus favored ponderosa pines, snags, and cottonwoods where they were available. It is recommended that riparian areas should be managed to preserve such perches.

Gutzwiller, K.J.; Anderson, S.H. 1986. Trees used simultaneously and sequentially by breeding cavity-nesting birds. Great Basin Naturalist. 46(2): 358-360.

Structural and floristic attributes are given of 14 nest trees (7 Populus sargentii, 1 P. angustifolia, 1 Salix amygaloides, and 5 unknown species) used simultaneously by 2 or 3 bird species, sequentially from year to year by the same species or sequentially within a single breeding season along rivers in southeastern Wyoming. The data can be used by managers for improving species richness and density of cavity-nesting birds in western riparian cottonwood communities.

Joyal, R.; Bourque, C. 1986. Variations, as a result of the advance of winter, in choice of habitat and diet by three groups of moose in an agro-forest environment. Canadian Journal of Zoology. 64(7): 1475-1481.

Three distinct groups of moose (Alces alces) were followed for one winter in settlement areas of northwestern Quebec to investigate changes in their choice of diet and habitat during winter. No trend was found in the diet during the winter, except that trembling aspen (Populus tremuloides) was most heavily used by the 3 groups in March.

Parris, Robert Warren. 1986. Forest vegetation, earthworm (Lumbricidae), and woodcock (Scolopax minor) relationships. Dissertation Abstracts International. 47/12-B: 4720.

The relationships among forest types, earthworm communities, and woodcock (Scolopax minor) diurnal habitat selection were examined in Oswego County, New York from 1982 to 1984. Stands composed of mull-forming overstory vegetation (alder (Alnus rugosa), apple (Malus spp.), arrowwood (viburnum dentatum), dogwood (Cornus stolonifera), aspen (Populus spp.), ash (Fraxinus spp.), and fire cherry (Prunus pensylvanica)) had the highest worm densities (30 to 220 worms/m²) composed primarily of Lumbricus terrestris and Aporrectodea caliginosa. The overall relationships among forest types, earthworms, and woodcock were that overstory vegetation (mull-forming species) influenced worm abundance which in conjunction with the stand's structure influenced woodcock diurnal use of the stand.

Patton, D.R.; Vahle, J.R. 1986. Cache and nest characteristics of the red squirrel in an Arizona mixed-conifer forest. Western Journal of Applied Forestry. 1(2): 48-51.

A survey was made of Tamiasciurus hudsonicus food and cover requirements in 18 ten-acre stands in the White Mountains, Arizona. Each of the seven coniferous species in the area supported nests, but none were found in Populus tremuloides, the only deciduous species in the area.

Renecker, L.A.; Hudson, R.J. 1986. Seasonal foraging rates of free-ranging moose. *Journal of Wildlife Management*. 50(1): 143-147.

Foraging rates of free-ranging moose (Alces alces) in aspen (Populus spp.) boreal habitats were evaluated in summer, autumn, and winter. Consumption rates (g/min) increased asymptotically with biomass of potential forage, but both maximum rates and slopes varied seasonally. Maximum rates appeared to be related to forage quality since values declined from 23 g/min in July to 11 g/min in January.

Verch, R.L. 1986. Nongame breeding bird activity in an intensively cultured Populus plantation. Res. Note NC-336. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 6 p.

An account is given of bird activity each year from the time of establishment to 6 years later in a 30-acre plantation in northern Wisconsin. Results indicated that breeding bird usage followed a pattern expected in secondary succession for the area.

1987

Canon, S.K.; Urness, P.J.; DeByle, N.V. 1987. Habitat selection, foraging behavior, and dietary nutrition of elk in burned aspen forest. *Journal of Range Management*. 40(5): 433-438.

Jenkins, K.J.; Wright, R.G. 1987. Simulating succession of riparian spruce forests and white-tailed deer carrying capacity in northwestern Montana. *Western Journal of Applied Forestry*. 2(3): 80-83.

Rates of succession were determined during 1945-1980 in 6 floodplain plant communities along the North Fork of the Flathead River, Montana. A succession model was developed to forecast the long-term effects of land-use change on the carrying capacity of Odocoileus virginianus winter range. The areas occupied by mature spruce (Picea engelmannii X P. glauca) and spruce/Populus trichocarpa forests were relatively constant during this period. Successional modelling showed the effects of 2 timber harvesting strategies (removing 1 percent of mature spruce alone or with spruce/P. trichocarpa annually for 100 years) on deer populations. The simulated populations declined during harvesting, but recovered with the cessation of harvesting after 100 years. The decline was less severe when only mature spruce was harvested.

Hunter, W.C.; Anderson, B.W.; Ohmart, R.D. 1987. Avian community structure changes in a mature floodplain forest after extensive flooding. *Journal of Wildlife Management*. 51(2): 495-502.

Probst, J.R.; Rakstad, D.S. 1987. Small mammal communities in three aspen stand-age classes. *The Canadian Field-Naturalist*. 101(3): 362-368.

Scott, V.E.; Crouch, G.L. 1987. Response of breeding birds to commercial clearcutting of aspen in southwestern Colorado. Res. Note RM-475. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 5 p.

Sedgwick, J.A.; Knopf, F.L. 1987. Breeding bird response to cattle grazing of a cottonwood bottomland. *Journal of Wildlife Management*. 51(1): 230-237.

1988

Scott, V.E.; Crouch, G.L. 1988. Summer birds and mammals of aspen-conifer forests in west-central Colorado. Res. Pap. RM-280. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 6 p.

