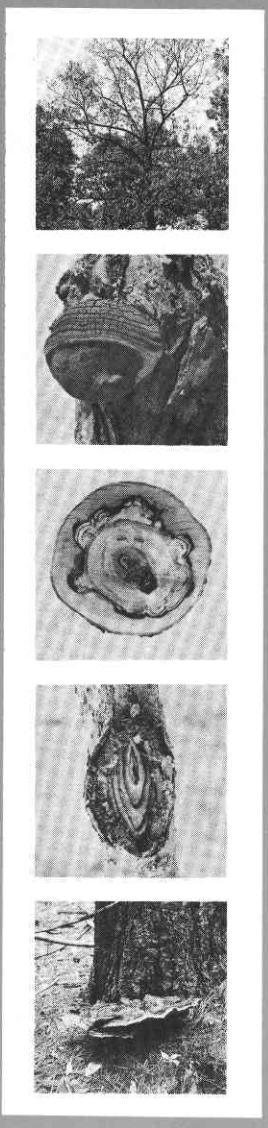

A Survey Of Forest Tree Diseases

In the Northeast — 1957

by Robert A. Zabel
Savel B. Silverborg
Marvin E. Fowler

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A Word of Thanks...

The authors wish to express appreciation to the many forest pathologists, plant pathologists, foresters, and forest research workers throughout the Northeast who freely provided the information summarized here. These survey cooperators, grouped by states, are listed in the Appendix. Special thanks for assistance in field studies are due Mr. Harold Eno of the Forest Disease Laboratory of the Northeastern Forest Experiment Station, at New Haven, Connecticut.

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About The Authors...

ROBERT A. ZABEL *and* SAVEL B. SILVERBORG *are Chairman and Assistant Professor, respectively, in the Department of Forest Botany and Pathology, State University of New York College of Forestry at Syracuse University. In June and July 1957, Dr. Zabel and Dr. Silverborg were employed by the U.S. Forest Service to conduct this forest-disease survey. They worked under the general direction of* MARVIN E. FOWLER, *who is Chief of the Division of Forest Disease Research at the Northeastern Forest Experiment Station, Forest Service, U.S. Department of Agriculture.*

CONTENTS

A Serious Problem

A SERIOUS handicap in planning forestry programs in the Northeast is a lack of basic information about forest diseases and their impact on the forest. Magnitude of disease losses, the relative importance of various diseases, their locations, rates of spread, intensities, and the tree mortality they cause--information on all these factors is basic to the development of a sound forest-disease research program. And we do not have it.

The importance of tree diseases in the future of forestry was emphasized in the Forest Service's recent 700-page appraisal of our forests, TIMBER RESOURCES FOR AMERICA'S FUTURE (2). But precise information is still not available on the magnitude of tree disease losses.

Disease losses are complex: they include tree mortality at all ages, heartrot and other cull conditions, reduction in growth and quality, loss in tree vigor, and deleterious changes in site and stand composition. Some disease losses are slow to develop and difficult to detect. A heartrot fungus that slowly destroys the value of a tree without killing it may be more damaging than a pathogen that kills quickly. A dead or dying tree can often be promptly salvaged, while cull trees too costly to salvage may be left in the woods and continue to occupy prime growing space at the expense of more valuable trees.

For the Timber Resources appraisal, U.S. Forest Service personnel and forest pathologists throughout the country were consulted, and all available factual information was assembled and analyzed. Their estimates of tree disease losses in the Northeast were staggering: the annual impact of diseases on Northeastern forests was said to equal one-half of the annual net growth (2).

This is certainly a challenge for research. The broad aims of forestry research are to obtain an understanding of the many complexities of the forest and to develop principles and practices leading to maximum, continuous, and economic production of forest products and services. Conservation of valuable timber resources and an increase of both

timber yields and quality are important specific goals of forestry research in the Northeast. The Forest Service's Division of Forest Disease Research seeks to reach these goals by developing methods to minimize losses from disease in standing timber and forest products.

In the summer of 1957, an extensive preliminary survey of tree diseases was made by the Northeastern Forest Experiment Station for general planning and appraisal purposes in its region. However, accurate data, of the kind needed to formulate sound management policies and to establish major research needs and priorities in tree-disease control programs, can be accomplished only by an intensive survey, which is at present under consideration for the region. The results of the preliminary survey are summarized in this paper.

A Preliminary Survey

THE main purposes of this initial disease survey were to collect general information and to present in summary form opinions from forest pathologists and other professional foresters on the major regional forest tree diseases, their locations, intensities, rates of spread, control status, and research needs. In addition, the survey was carried out to make foresters and others more aware of regional tree disease problems and also to obtain background information necessary to plan intensified disease-survey procedures.

SURVEY PROCEDURES

Conferences were held and field trips made with various Federal, state, city, and university forest pathologists, plant pathologists, foresters, forest research workers, and others who have major responsibilities in forest-management or tree-disease research. Important local and statewide tree-disease problems were discussed with over 100 specialists in the 12-state Northeastern region. Field examinations were made of all the major diseases reported as well as many of the minor diseases.

INFORMATION LIMITATIONS

The authors strongly emphasize that the survey was extensive in nature and was primarily a compilation of the experiences and opinions of the many participants as to the principal forest tree diseases in their respective areas.

In some cases it was impossible to confirm the identity of diseases reported. (Those minor diseases reported but not actually confirmed by the authors are indicated in table 1 by an asterisk.)

The authors stress the possibility that minor diseases, some as yet unnoticed, may become important in the future. In general, readers are referred to Boyce's (6) and Baxter's (3) textbooks on forest pathology for detailed descriptions of the various diseases, authorities for pathogen names, general information on their field evidences, control, and literature. Additional source material on the important diseases are cited in "Literature References".

Results of Survey

MAJOR FOREST TREE DISEASES

MAJOR diseases are considered to be those that cause heavy losses or present (from their history in other regions) a serious potential threat.

Heartrots and cankers.--Most of the participants contacted reported severe cull due to heartrots on thousands of acres of forest lands, mostly occupied by inferior hardwoods. The present heartrot condition of many forest stands in the Northeast is the cumulative result of "high-grading", repeated burns, logging injuries, frost cracking and ice damage, overmaturity, hurricanes and wind storms, and the sprout origin of large acreages of hardwoods.

Heartrot fungi in their hidden attack on forest trees are not spectacular. Many are not detected until the affected trees are cut. However, cull estimates based on research studies and logging experiences indicate that heartrots are a major regional problem vitally affecting timber production and quality. The heartrot fungi reported and observed to be important are summarized by major types as follows:

Northern hardwoods:

Fomes igniarius, Poria obliqua, Polyporus glomeratus, Fomes connatus, F. applanatus, F. fomentarius, and Ustilina vulgarius.

Oaks:

Polyporus sulphureus, P. hispidus, Fomes robustus, and F. everhartii.

Southern pines:
Fomes pini.

Eastern white pine, spruce, and hemlock:
Fomes pini and Polyporus schweinitzii.

Balsam fir:
Fomes pini, Polyporus balsameus, Corticium galactinum, Poria subacida, and Stereum sanquinolentum.

Several typical heartrot fungi are illustrated in figures 1 and 2. Special references on descriptions of heartrot fungi, their types of decay, and, in some cases, associated cull columns are cited (20, 22, 25, 30).

Estimates of the relative importance and severity of heartrot fungi based on external indicators alone are highly uncertain and speculative. The actual relative importance of the various causal organisms and timber-volume losses will be established in the future primarily by well-designed sampling procedures and cultural identification studies. It should be kept in mind also that, as stand age and species composition change with planting programs and logging, different heartrot flora may become important.

Several canker fungi are of primary importance in Northeastern forests. Nectria canker caused by Nectria galligena was reported on hardwoods throughout the region. It is generally stated to be the most important canker disease on hardwoods in the Northeast, particularly on yellow birch.[1] Nectria magnoliae was indicated to be severe on yellow-poplar in the southern areas of the region. Eutypella canker caused by Eutypella parasitica, observed commonly on sugar maple in the northern areas, was not reported or observed below southern New York. Strumella canker on oaks, caused by Strumella coryneoidea, and elongated narrow cankers caused by Polyporus hispidus were observed and reported commonly on oaks from southern New York and southern areas of the region. Hypoxylon canker caused by Hypoxylon pruinatum appeared to be unusually severe on the several aspen species in the northern area. Several important hardwood cankers are shown in figure 3.

Beech bark disease.--This epidemic disease, which brings about high mortality in American beech, is caused by the woolly beech scale (Cryptococcus fagi) feeding on the bark (fig. 3), and subsequent invasion by Nectria coccinea var. faginata (8). It is reported as the most important forest tree disease problem in Maine, having a severe effect on the industries that use beech wood.

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[1]Common names of trees follow Little, Elbert L., Jr. Check list of native and naturalized trees of the United States (including Alaska). U.S. Dept. Agr., Agr. Handbook 41. 472 pp. 1953

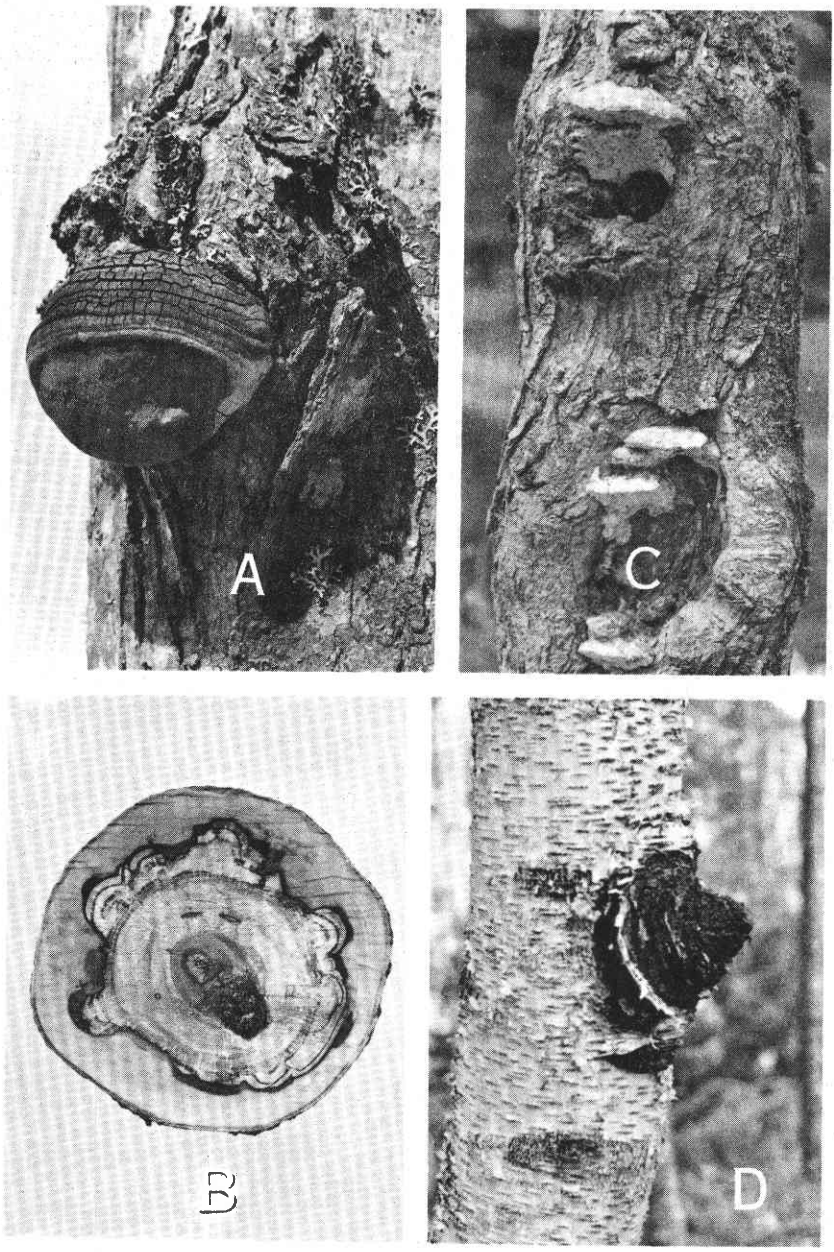

Figure 1.--*Important heartrot fungi occurring on northeastern hardwoods.* A, Fomes igniarius *fruiting body on a live red maple.* B, *typical decay caused by* Fomes igniarius *on beech.* C, Fomes connatus *on live red maple.* D, *sterile conk formed by* Poria obliqua *on paper birch.*

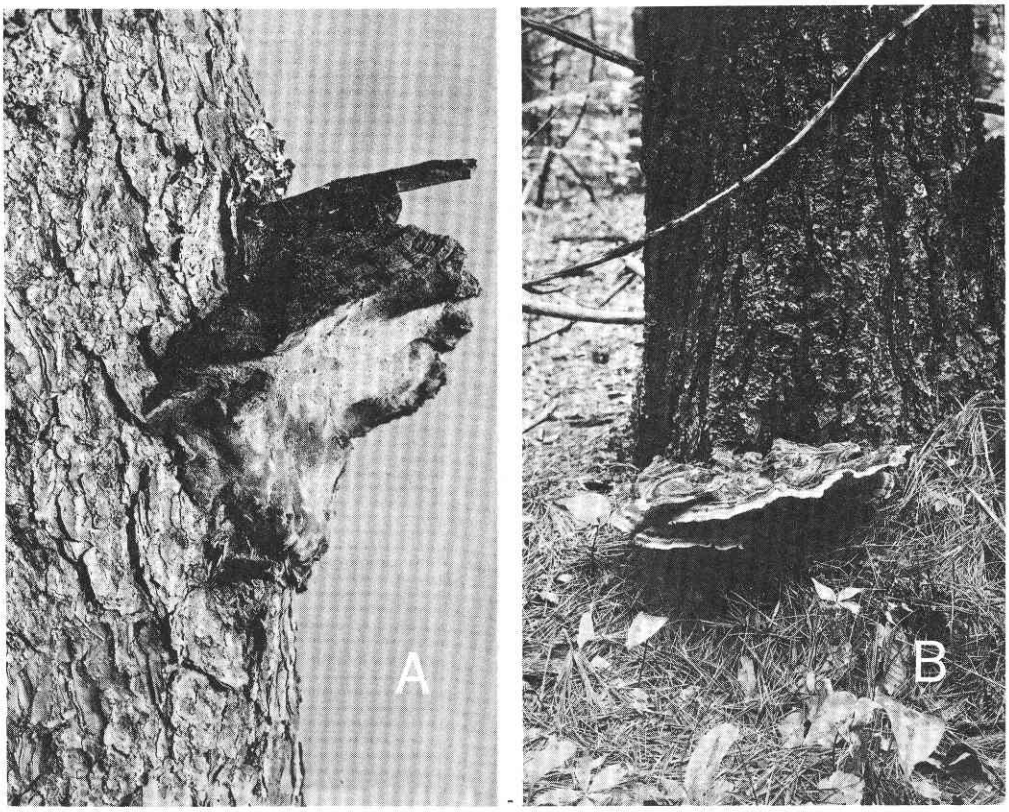

Figure 2.--*Important heartrot fungi occurring on northeastern conifers.* A, Fomes pini *fruiting body on tamarack.* B, Polyporus schweinitzii *at the base of an eastern white pine.*

The disease has been reported in eight counties in the Catskill region of New York. Data from mortality plots in New York reveal alarming death rates--three 1/10-acre plots established in 1950, originally containing 26 trees each, now contain only nine living trees in one plot and five each in the other two plots. Forests surveyed in the Slide Mountain area showed 10 percent of the American beech killed and a high percentage of the remaining trees of all ages infected by both the scale insect and the Nectria fungus. The disease is also present in central and southern Vermont and southern New Hampshire. Effective field controls for the disease are not known. The steady spread of the disease, its high mortality, and the lack of effective controls raise serious doubt as to the future value of American beech in the Northeast.

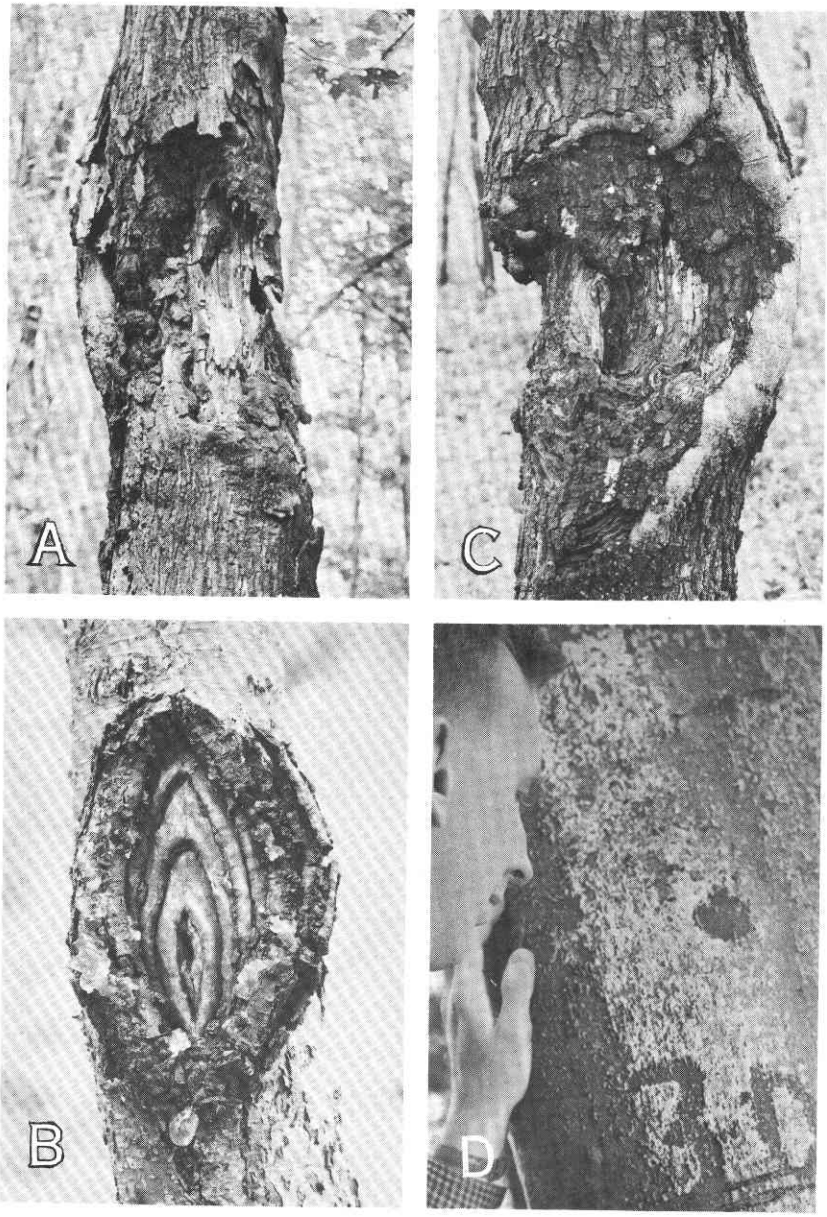

Figure 3.--*Important canker diseases of northeastern hardwoods.* A, Eutypella parasitica *on sugar maple.* B, *Nectria canker on a young black cherry.* C, Strumella coryneoidea *on a red oak.* D, *Early stage of the beech bark disease, showing invasion by the scale insect* Cryptococcus fagi, *which precedes infection by the bark pathogen* Nectria coccinea *var* faginata.

Birch dieback.--This well-known malady is reported in many areas throughout the northern hardwoods region. Intensive research has not yet revealed its cause (13). In the last decade, the disease has spread from the Maritime Provinces of Canada into New England and has killed almost 500 million board feet of sawtimber. In general, reports indicate the disease boundaries have been static during the past few years with some apparent recovery of paper and yellow birch.

White pine blister rust.--This serious disease, caused by the fungus Cronartium ribicola, was described thoroughly by Spaulding (28). It is now present throughout the range of eastern white pine in the Northeast. Usually satisfactory control is reported to be achieved by the present Ribes eradication programs. Ribes eradication, however, was indicated to be only partially effective in controlling the disease in some heavily cutover areas in New York. The disease potential of the blister rust pathogen is evidenced by a rapid 50 percent kill of mature white pine in a 25- to 30-acre tract on a northern New York recreational area where Ribes was not removed.

Diebacks, wilts, and declines.--Collectively, diebacks, wilts, and declines of unknown cause have developed within the past few years in many major tree species. They present a serious and perplexing regional tree-disease problem. Sweetgum is affected by a wilt and dieback throughout much of its range in New Jersey, Delaware, and Maryland. White ash is affected by a dieback throughout most of its northeastern range. A widespread dieback of red oaks, discussed separately, falls into this group. Extensive diebacks and declines were reported in certain areas for American beech, paper and yellow birches, yellow-poplar, boxelder, maples, and elms. The extensive dying and decline of sugar maple was reported and observed over much of its natural range in the Northeast and the disease appeared to be especially severe in southern New York, Vermont, Massachusetts, and New Hampshire. In Vermont, the wilt causing fungus Verticillium sp. was isolated frequently from declining sugar maples, but does not appear to account fully for all of the decline in this species.

A general decline of eastern white pine of unknown cause was observed throughout its range, being particularly serious from Massachusetts to Maine. In this disease, the needles are chlorotic and short; thus, the effects differ from the commonly known needle blight disease in which the current year's needles die from the tips to about half their length. Mortality of balsam fir occurs throughout northern New England and northern New York; it is characterized by the death of an occasional tree in a stand.

The similarity of symptoms in the many species involved and the development of these maladies over extensive

ranges in short periods of time suggest non-pathogenic causes. Several forest pathologists cited regional droughts and changes in water tables as possible causes, with the disease conditions complicated in some cases by the activity of weak pathogens.

Oak dieback.--The unexplained dieback and death of large numbers of red oaks is now a major problem. Disease incidence ranges from occasional trees in stands to a high percentage of trees over large areas. Oak dieback or mortality is concentrated in an area of about 8,000 square miles in north-central Pennsylvania and southwestern New York, and in some 400 square miles in West Virginia where mortality averaged 57 trees per acre. It was generally reported that no significant increase in number of diseased oaks developed in 1957; however, mortality plot data in Pennsylvania showed some continuing tree deaths during the year. In addition, extensive unexplained dying of chestnut oaks and red oaks was reported and observed in southern New York, New Jersey, Pennsylvania, and Maryland. It is not known whether these are one or several different diseases of oaks.

Oak wilt.--This vascular disease, caused by the fungus Ceratocystis fagacearum (fig. 4), concerns foresters primarily because of its potential threat to extensive red oak stands in the region. At present the disease appears to be confined to western Maryland, West Virginia, and south-central Pennsylvania. Diseased trees are few in number; still forest pathologists and entomologists in oak wilt areas report the local spread to be slow but continuous.

Completely effective field control procedures have not been developed to date and frequent "break-overs" or spread from local eradication plots are unexplained. Mechanisms for long-range spread, which are of critical importance in control programs, are not known to date. Research programs emphasizing control and supported by state and Federal agencies are now in progress at the University of West Virginia and Pennsylvania State University. Statewide scouting and control programs for the disease are being made in West Virginia, Pennsylvania, and Maryland.

External symptoms of the disease in white oaks are often obscure or may even be absent. The possible concealment of oak wilt infections in white oaks, in forested areas severely attacked by cicada, or in the extensive oak dieback areas makes it impossible to locate all diseased trees by the usual scouting procedures. This places some question on the actual pathogen range, which is vitally important in effective control programs.

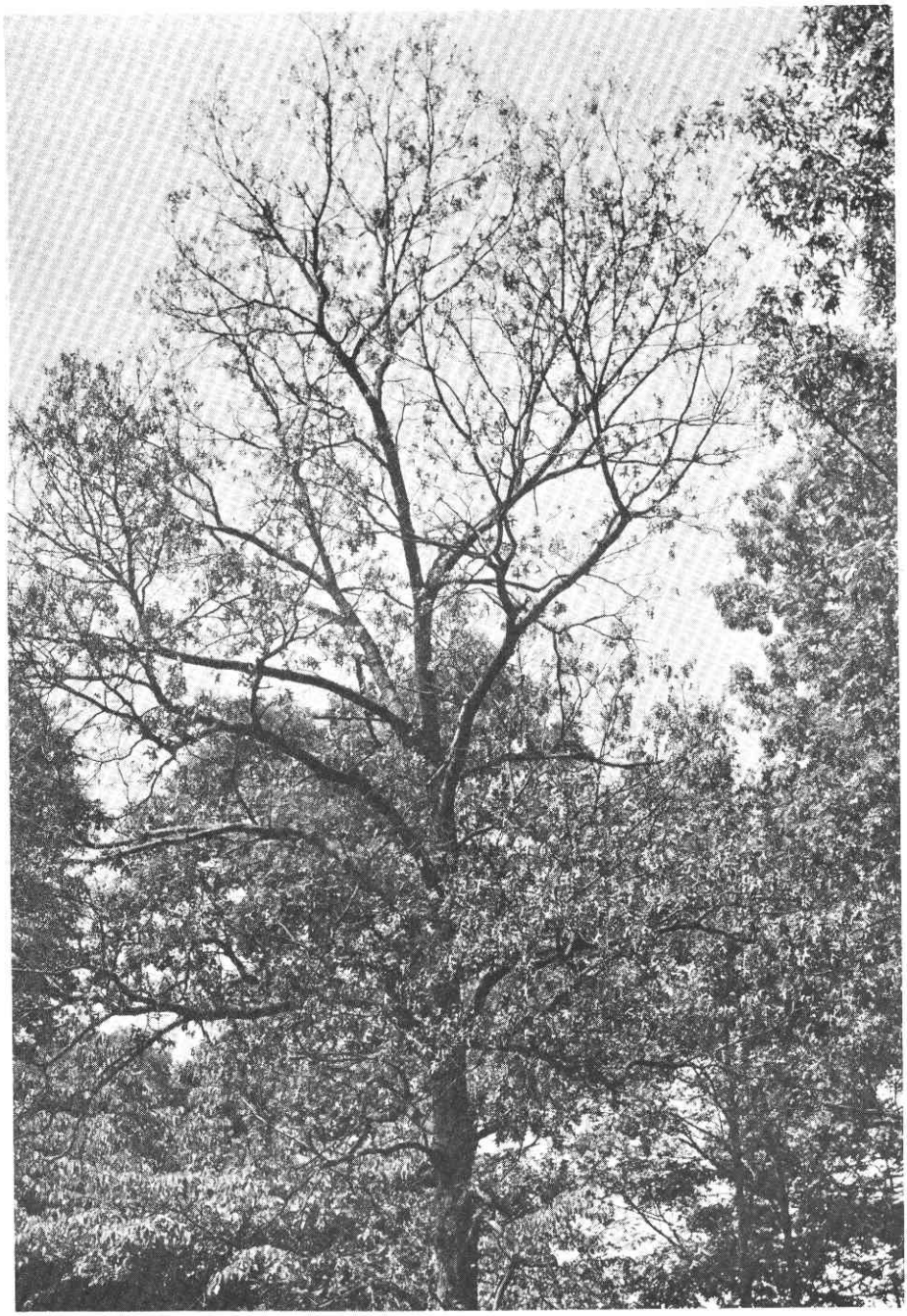

Figure 4.--*A red oak dying of the oak wilt disease,* Ceratocystis fagacearum. *Note the severe defoliation in the upper crown.*

PLANTATION AND NURSERY DISEASES

An impressive number of diseases were reported as locally serious in plantations. Collectively, these diseases appear significant even though at present none are widespread or of major importance.

Fomes annosus.--This root and butt rot fungus was observed killing trees in pine plantations in New Jersey, Delaware, New York, New Hampshire, Massachusetts, Rhode Island, and Connecticut. It was reported to be a serious plantation problem in Rhode Island, Massachusetts, and Connecticut. Since the survey, F. annosus has been reported in an eastern white pine plantation near Mont Alto, Pa. In some areas, infrequent reports of its occurrence may be misleading be-

Figure 5.--*Fruiting bodies of* Fomes annosus, *an important coniferous root and butt rot, on a red pine stump. The fruiting bodies commonly form at the level of the root crown and frequently are hidden by needle litter.*

cause usually sporophores are hidden in the soil and litter at or near the root crown. Typical fruiting bodies and manner of fruiting are shown to aid in field recognition of this potentially important plantation disease (fig. 5). This disease may be more widespread than reported. In three locations where it was previously unknown, Fomes annosus was found causing damage. Extensive European experience and reports from Massachusetts indicate that the disease can be expected to become important after plantations are thinned. This fungus is reported responsible for 90 percent of the decay in conifers in Great Britain (1).

Cytospora kunzei.--This stem and branch canker disease of spruce and occasionally other conifers is widespread and serious in Norway spruce plantations in New York. It is also said to be a problem in plantations in Vermont, Rhode Island, New Hampshire, Massachusetts, and Connecticut. Reports of its behavior in several areas suggest that the pathogen may become inactive and the host tree may form a callus over the cankers after tree growth has been stimulated by heavy stand thinnings.

Rhabdocline pseudotsugae.--This needle-cast disease of Douglas-fir is reported from seven locations in New York, two in Vermont, and several large Christmas tree plantations in Pennsylvania. Observations in New York indicate that this disease may eliminate Douglas-fir as a Christmas tree species unless fungicides are properly applied.

Miscellaneous plantation diseases.--Other diseases reported in plantations were as follows: Tympanis canker caused by Tympanis sp. on red pine planted outside its natural range, red pine malady on poorly drained soils, Adelopus gaumanni needle cast on Douglas-fir in plantations, a canker of unknown cause on balsam fir in Christmas tree plantations, and Cronartium fusiforme in loblolly pine plantations. Many diseases of unknown cause were reported as responsible for minor damage in small areas in plantations.

Principal nursery problems reported were damping-off by soil fungi and killing of seedlings by high soil temperatures.

DISEASES OF SHADE TREES

Dutch elm disease.--This well-known vascular disease, caused by Ceratocystis ulmi, is reported from all states in the region. In many sections of Rhode Island, New Jersey, and Massachusetts it is considered the major tree disease problem. In some areas effective control is obtained by spraying and sanitation programs whereas in others no control is attempted. In some of the oldest infection areas in New Jersey it was the opinion of several pathologists that

the disease was having little if any effect on elms in forest stands.

Verticillium wilt.--This vascular disease of hardwoods (particularly maples and elms), caused by Verticillium spp., is reported generally throughout the region. In New Jersey the Verticillium wilt on elm and maple is considered a major shade tree disease. In Rhode Island it was reported killing as many elms as the Dutch elm pathogen. These observations were based on cultural determinations. In Massachusetts less than 2 percent of cultured wilted elms proved to have Verticillium spp. This reported variation on the relative importance of Verticillium spp. and Ceratocystis ulmi as a vascular disease of elm is puzzling.

Bleeding canker disease.--Phytophthora cactorum was reported to be the most serious shade tree disease of sugar maple in southeastern New Hampshire. This bleeding canker is characterized by oozing of a reddish-brown liquid from bark fissures. It was also cited as a serious problem in Maine, Vermont, and Rhode Island. Bleeding cankers were noted as prevalent on declining sugar maples along roadsides in Vermont.

Canker stain of plane.--This disease of London plane trees, caused by Ceratocystis sp., is present in the metropolitan Philadelphia area where hundreds of plane trees are dead and dying. Research workers report local eradication capable of achieving effective control. The causal fungus is readily carried from tree to tree on pruning tools, saws, axes, and other tools used on infected trees. Tools should be thoroughly sterilized before being used on healthy London plane trees. Public cooperation in control is discouraging and in sections the pathogen is spreading.

Phloem necrosis.--This virulent virus disease of elm is reported from a limited area in western West Virginia.

MINOR DISEASES

Many minor diseases were reported and observed in the region, including quite a few foliage diseases of forest trees and diseases of shade and ornamental trees. It should be emphasized that in certain local areas a specific minor disease may assume considerable importance such as the "shot hole" disease of cherry (Coccomyces lutescens) in reproduction of black cherry in the Allegheny Plateau section of Pennsylvania. The minor diseases are listed in table 1 and classified by general type, hosts, and region.

Table 1.--Minor diseases reported in the disease survey, 1957

Disease (common name)	Pathogen[1]	Hosts[2]	Location by states[3]
		CANKERS	
Ash dieback	Cytophoma pruinosa	White ash	Me., N.H., Vt., Mass., Conn., R.I., N.Y.
Basal canker	———	Eastern white pine	N.Y.
Bleeding canker	Phytophthora cactorum	Sugar maple	N.H., Vt., R.I.
Chestnut blight	Endothia parasitica	American chestnut	N.Y., W. Va.
Dasyscypha canker	Dasyscypha agassizii	Norway spruce	N.Y.
Dasyscypha canker	Dasyscypha sp.	Balsam fir	N.Y.
Dothichiza canker	Dothichiza populea	Lombardy poplar hybrid poplars	N.Y., Md.
Eutypella canker	Eutypella parasitica	Sugar maple	Me., N.H., Vt., Mass., Conn., N.Y., Pa.
Nectria cankers	Nectria galligena	Yellow birch, paper birch, black cherry, sugar maple	Me., N.H., Vt., Mass., Conn., R.I., N.Y., Pa., W. Va.
	N. magnoliae	Yellow-poplar, cucumbertree	W. Va.
Pit canker	Phytophthora sp.	American elm	N.Y., Mass.
Pitch flow	———	Eastern white pine	N.Y., Conn.
Rosy canker	———	London plane[4]	N.J., Pa.
Septoria canker	Septoria [illegible]	[illegible]	[illegible] Md.

Spruce canker	Cytospora kunzei	Norway spruce, red spruce, blue spruce, eastern hemlock, Japanese larch	Me., N.H., Vt., Mass., Conn., N.Y., R.I., Pa.
Strumella canker	Strumella coryneoidea	Oak species	N.Y., Pa., W. Va.
Tympanis canker	Tympanis sp.	Red pine	N.Y.
	FOLIAGE RUSTS OF HARDWOODS & CONIFERS		
Ash rust	Puccinia peridermiospora	Ash species	Mass., N.H., Me.
Cedar apple rust	Gymnosporangium juniperi-virginianae	Eastern red cedar	N.Y., N.J., N.H., Vt., Mass., Conn., Pa.
Pine needle rust	Coleosporium solidaginis	Red pine, Scotch pine, loblolly pine, Virginia pine	N.Y., Me., N.H., Vt., Conn., Mass., R.I., Pa., N.J., Del., Md.
*Poplar rust[5]	Melampsora sp.	Poplar species	Md., N.Y.

[1]Non-infectious diseases and diseases of unknown cause are indicated by a solid line. Scientific names of pathogens are taken from Forest Pathology, a textbook by Dr. J. S. Boyce (6).

[2]Common names of trees are taken from Little, Elbert L., Jr. Check list of native and naturalized trees of the United States (including Alaska). U.S. Dept. Agr., Agr. Handbook 41. 472 pp. 1953.

[3]Listing indicates states where the disease was reported as a common or local problem; the listings should not be interpreted as giving ranges of diseases.

[4]London plane is presumably a hybrid between Platanus occidentalis L., American sycamore, and P. orientalis L., the oriental plane (14).

[5]An asterisk (*) indicates a disease reported but not seen by the authors.

(continued)

Table 1.--(continued)

Disease (common name)	Pathogen[1]	Hosts[2]	Location by states[3]
		STEM RUSTS OF CONIFERS	
Eastern gall rust	Cronartium cerebrum	Pitch pine, Virginia pine	Del., Md., Pa., N.Y.
Southern fusiform rust	Cronartium fusiforme	Loblolly pine	Del.
Stem and branch swellings	Gymnosporangium biseptatum	Atlantic white-cedar	N.J., R.I.
Sweet fern blister rust	Cronartium comptoniae	Scotch pine, loblolly pine	N.Y., N.J.
Witches' broom	Gymnosporangium ellisii	Atlantic white-cedar	N.J.
		VASCULAR DISEASES	
*Dothiorella wilt	Dothiorella ulmi	American elm	Mass.
Verticillium wilt	Verticillium spp.	American elm, sugar maple	Me., N.H., Vt., Mass. Conn., R.I., N.Y.
		VIRUS DISEASE	
*Phloem necrosis	———	American elm	W. Va.
		MISTLETOES	
American mistletoe	Phorandendron flavescens	Oak species	Md.
Dwarf mistletoe	Arceuthobium pusillum	Black spruce, white spruce	Me., N.H.

*Crown gall	Pseudomonas tumefaciens	Willow species	N.Y.
Wetwood	Erwinia nimipressuralis	Elm and maple species	Me., N.H., Vt., Mass., Conn., N.Y., R.I.
MISCELLANEOUS STEM AND BRANCH DISEASES			
Black knot	Dibotryon morbosum	Black cherry	W. Va., Pa., N.Y.
Melanconis dieback	Melanconis juglandis	Butternut	Me., N.H., Vt., Mass., Conn., R.I., N.Y.
Phomopsis galls	Phomopsis sp.	Sugar maple, bitternut hickory	N.Y., W. Va.
OTHER FOLIAGE DISEASE OF CONIFERS			
Adelopus needle cast	Adelopus gäumanni	Douglas-fir	N.Y., Vt., Pa., Conn.
Brown spot needle blight	Scirrhia acicola	Loblolly pine	Del.
Douglas fir needle cast	Rhabdocline pseudotsugae	Douglas-fir	N.Y., Vt., Pa., Conn.
Needle cast	Hypoderma lethale and Lophodermium pinastri	Pitch pine, eastern white pine	Pa., N.Y.
Sooty mold	———	Virginia pine, pitch pine, red pine	Pa., N.Y.
*Tip blight	Rehmiellopsis balsameae	Balsam fir	Mass.
OTHER FOLIAGE DISEASES OF HARDWOODS			
Anthracnose	Gnomonia veneta	American sycamore, oak and maple species	N.Y., Mass., Me., N.H., Vt., Conn., R.I.
Apiosporina witches' broom	Apiosporina collinsii	Serviceberry	N.Y.

(continued)

Table 1.--(continued)

Disease (common name)	Pathogen[1]	Hosts[2]	Location by states[3]
	OTHER FOLIAGE DISEASES OF HARDWOODS (continued)		
Elm leaf spot	Gnomonia ulmea	American elm	N.Y.
*Leaf blister	Taphrina sp.	Oak & poplar species	R.I.
Leaf blotch	Guignardia aesculi	Buckeye species	N.Y.
Leaf spot	Entomosporium thumenii	Hawthorn species	N.Y.
*Phyllosticta leaf spot	Phyllosticta sp.	Red maple	Pa.
Powdery mildew	Species of Erysiphe, Microsphaera, Phyllactinia, Sphaerotheca & Uncinula	Hardwood species	N.Y.
*Shot hole	Coccomyces lutescens	Black cherry	Pa.
Tar spot	Rhytisma acerinum	Maple species	N.J., N.Y.
	ROOT ROTS		
*Damping-off	Cylindrosporium sp.	Conifer species yellow-poplar	Del., W. Va.
*Root rot	Phytophthora sp.	Conifer species	W. Va.
Shoestring root rot	Armillaria mellea	Eastern white pine	N.Y.
	NONINFECTIOUS DISEASES		
Red pine malady	———	Red pine	N.Y.
Needle blight	———	Eastern white pine	N.Y.

Maple scorch	———————	Sugar maple	N.Y., Mass., Vt.
Boxelder dieback	———————	Boxelder	N.J.
Balsam fir mortality	———————	Balsam fir	Me., N.H., Vt., N.Y.
Tumor disease	———————	White spruce	Me., Vt.
Sunscald	———————	Sugar maple	N.Y.
Fluting of red pine	———————	Red pine	N.Y., Mass.
Snow and ice damage	———————	Red pine, eastern white pine	Mass.
Heat injury in seedlings	———————	Conifer species	Me.

[1]Non-infectious diseases and diseases of unknown cause are indicated by a solid line. Scientific names of pathogens are taken from Forest Pathology, a textbook by Dr. J. S. Boyce (6).

[2]Common names of trees are taken from Little, Elbert L., Jr. Check list of native and naturalized trees of the United States (including Alaska). U.S. Dept. Agr., Agr. Handbook 41. 472 pp. 1953.

[3]Listing indicates states where the disease was reported as a common or local problem; the listings should not be interpreted as giving ranges of diseases.

[4]London plane is presumably a hybrid between Platanus occidentalis L., American sycamore, and P. orientalis L., the oriental plane (14).

[5]An asterisk (*) indicates a disease reported but not seen by the authors.

Recommendations

THESE summarized observations and opinions of forest pathologists and foresters reveal that the tree-disease problem in the Northeast is of major proportions. The data presented in this report and the ominous estimates prepared by the Forest Service pathologists in TIMBER RESOURCES FOR AMERICA'S FUTURE indicate the great need for accurate appraisals of current tree-disease damages.

Intensive surveys are necessary to obtain data on the magnitude of the impact of diseases on our forests. Only by these means can accurate estimates of future timber supplies be made, research priorities established, and adequate tree disease control and related research programs be justified. Disease control will greatly increase forest land productivity and the quality of forest products.

Disease survey.--An intensive comprehensive survey is needed in the near future to measure accurately the disease losses caused by heartrots, cankers, other major diseases, and the many minor endemic diseases in the Northeast. Many forest pathologists and foresters believe heartrot and related cull losses are currently our major tree-disease problem, as well as an important regional forestry problem. Quantitative data on disease losses, classified by timber types and major tree species for various regions, are needed if research priorities are to be established and adequate control practices are to be developed.

In this preliminary survey, cruises were made in several major forest types to develop simple field techniques for evaluating disease losses. Transects 1 chain wide and 80 chains long were located randomly in the major types. Diseases and estimates of associated cull or damage were tabulated by species for various d.b.h. classes. This appears to be a simple and satisfactory method for assessing the relative importance of certain diseases. Numerous linear plots, based on sampling statistics, would be required before reliability could be attributed to data obtained. Cultural studies are necessary to determine the accuracy of external evidences of cull and heartrot. Establishment of permanent plots in major types is needed to determine the progress of effects of diseases over extended periods of time.

Research.--Considerable research on tree diseases is in process in the region at Federal, state, and university levels. These research programs should be expanded within a reasonable time to investigate all of the diseases of major importance. In the future, vigorous efforts will have to be

exerted by teams of specialists--pathologists, entomologists, soil scientists, physiologists, ecologists, biochemists, silviculturists, mycologists, statisticians, and others--to solve the many fundamental and field-control problems now known and the new ones that may be recognized from intensive surveys.

The importance of additional fundamental research on tree diseases cannot be overemphasized. Disease problems that need increasing research effort, as suggested by many, are as follows:

- Studies to determine effective silvicultural practices and field controls for minimizing effects of heartrots, Nectria canker on hardwoods, Strumella canker on oaks, sterile conk on birches and beech, black knot on cherry, and others.

- An immediate program designed to determine the present range, rate of spread, mortality, and control methods for the serious beech bark disease.

- Additional research on the oak wilt disease, designed to develop effective local eradication procedures and to determine long-range spread mechanisms.

- Expanded studies on important plantation diseases such as root rot caused by Fomes annosus and canker of conifers caused by Cytospora kunzei.

- Studies to determine causes of extensive unexplained dying of species such as oak, sweetgum, sugar maple, and many others.

Diseases such as oak wilt, oak dieback, beech bark disease, and heartrot complexes may require research coordinated at the Federal level.

Increased effort should be made to further acquaint both foresters and the general public with the nature and seriousness of tree-disease problems. The forestry profession has a right to expect information from forest pathologists on disease control for intensive forest management. It is the responsibility of forest pathologists to facilitate accurate disease-loss appraisals and eventual solution of our many pressing tree-disease problems.

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