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Forest Habitat Types of Northern Idaho: A Second Approximation

**Stephen V. Cooper
Kenneth E. Neiman
David W. Roberts**

PREFACE TO REVISED EDITION

The true test of a habitat type classification and the manual that explains it can only be performed through actual use by a variety of field personnel. Following two seasons of field use, revising and updating this manual seemed warranted. This revised edition of "Forest Habitat Types of Northern Idaho: A Second Approximation" corrects errors in the first edition, clarifies information presented in text and tables, and adds new information such as a list of incidental communities. No major changes have been made to the classification or the keys in an attempt to maintain continuity with the first printing. A few minor changes in the canopy coverage value required for delineation of a habitat type phase have been introduced. We hope these changes are beneficial to understanding of all users.

Appendix I is new and contains a list of incidental and rare habitat types and plant communities that may be encountered in northern Idaho. Recognition of many of these was included in the first edition, referencing the reader to classification publications for adjoining areas where the type is more fully described. The new list contains additional communities that may later be incorporated into habitat type descriptions. Before this can be done, additional field sampling, data anaylsis, and correlation with data from adjoining area classifications are needed.

Appendix J contains map locations for important habitat types and phases of sampled stands. Map locations do not include all possible locations where a particular habitat type or phase may occur in northern Idaho.

Intermountain Research Station
324 25th Street
Ogden, UT 84401

RESEARCH SUMMARY

A land classification system based upon potentially climax natural vegetation has been developed for the forests of northern Idaho. The system is based on reconnaissance and detailed sampling of approximately 1,100 stands. The habitat type concept of Daubenmire is used to construct a hierarchical taxonomic classification of forest sites. A total of eight climax series, 46 habitat types, and 60 additional phases of habitat types are defined. A dichotomous key, based on indicator species used in development of the classification, is provided for field identification of the syntaxonomic units.

In addition to site (forest environments) classification, descriptions of mature plant communities are provided, accompanied by tables to portray the distribution of important species. Potential timber productivity and climatic characteristics are also provided for the habitat types and phases. Preliminary implications for natural resource management are included based on field observations and published information.

ACKNOWLEDGMENTS

We thank the Northern Region of the Forest Service, U.S. Department of Agriculture, for its financial support, administered through a cooperative agreement with the Intermountain Research Station and the Montana Conservation and Experiment Station (University of Montana). Robert D. Pfister (University of Montana) and Charles A. Wellner (Intermountain Station, retired) initiated, secured funding, and provided major guidance to this project; for their efforts we are sincerely appreciative. Wellner was especially helpful in sharing his unparalleled knowledge of Idaho's forests and appropriate sampling locations.

Many people have assisted this effort, but foremost among them were our field assistants and computer technicians Brian Steele, Mike Sweet, and Patricia Patterson. Those generously donating vegetation data were Dr. James Habeck (University of Montana); Rex Crawford and Frederic Johnson (University of Idaho); Stephen F. Arno and Robert Steele (Intermountain Station); Rexford and Jean Daubenmire (Washington State University, retired).

Those contributing their knowledge in the fields of soils and geology (primarily through parent material identification) were Ken Fry (Lolo National Forest); Gary Ford, Jerry Niehoff, and Lewis Monk (Idaho Panhandle National Forests); and Neil Peterson, Charles Weisell, and Don Larson (Soil Conservation Service, Moscow, ID).

Identification and verification of difficult plant specimens were provided by Peter Stickney (Intermountain Station) and Douglass Henderson (University of Idaho).

Providing technical commentary were Robert Pfister (University of Montana); Stephen Arno and Robert Steele (Intermountain Station); William Stewart, Wendel Hann, and John R. "Bob" Naumann (Northern Region); Frederic Johnson (University of Idaho); and David Gruenhagen (Idaho Department of Lands). Many land managers, both public and private, assisted in field sampling and provided suggestions during the classification's development.

THE AUTHORS

STEPHEN V. COOPER, research forester with the University of Montana when this study was initiated, was assigned major responsibility for the conduct of this study. He has coauthored a number of habitat type classifications for the Central and Northern Rocky Mountains and was primary author and analyst of the *Abies grandis, Abies lasiocarpa,* and *Tsuga mertensiana* series in this manual. He holds B.S. (Union College, Schenectady, NY) and M.S. (State University of New York, Albany) degrees in biology and a Ph.D. in botany from Washington State University, Pullman.

KENNETH E. NEIMAN, forest ecologist with the Clearwater National Forest detailed to the Intermountain Research Station, Moscow, was principal coinvestigator for this study. He has previously developed community classifications with the U.S. Forest Service Pacific Northwest Region Ecology Program in south central Oregon. He was the primary analyst and author of the *Thuja plicata, Tsuga heterophylla, Pseudotsuga menziesii, Pinus ponderosa,* and *Pinus contorta* series. He earned B.S. (range management) and M.S. (forest and range management) degrees from Washington State University and a Ph.D. in forest ecology from the University of Idaho, Moscow.

DAVID W. ROBERTS, currently with the Department of Forestry and Outdoor Recreation, Utah State University, Logan, initiated the field sampling and authored our data analysis computer programs. He received B.S. and M.S. degrees (forestry) from the University of Montana and a Ph.D. (plant ecology) from the University of Wisconsin, Madison.

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INTRODUCTION

Northern Idaho's forest vegetation presents a complex array in composition and structure. To facilitate effective management of these lands, a classification is needed to reduce the diversity to a reasonable number of units. Natural classifications, in contrast to technical classifications of specific applicability such as timber types or cover types, are based on natural relationships and have a broad application, serving a multiplicity of management needs. Natural classifications such as habitat types (Daubenmire and Daubenmire 1968) reflect ecological patterns and thus accommodate the greatest number of applications.

The implementation of habitat type (h.t.) or similar approaches (based on plant associations) to forest site classification has steadily progressed (since Daubenmire's [1952] pioneering effort), with the publication of more than 30 such classifications in the Western United States (Pfister 1981). This approach has proven useful in forest management and research (Hall 1980; Layser 1974; Pfister 1980). Its widespread use recognizes the need to emphasize management of ecosystems rather than individual resources. It answers the need among specialists for a common medium to guide communication, management decisions, and research.

The Daubenmires' (1968) classification of forest h.t.'s in eastern Washington and northern Idaho has proven eminently useful, serving as a model for subsequent classifications. Nevertheless, studies for contiguous areas (Montana, Pfister and others 1977; central Idaho, Steele and others 1981) revealed that the Daubenmires' original h.t. classification could be refined to better reflect the full range and diversity of forest environments. The considerable amplification in the number of h.t.'s delineated in the Nez Perce National Forest preliminary classification (Steele and others 1976), an area addressed by the Daubenmires' (1968) original study, indicated the need for more intensive sampling on the remainder of the Daubenmires' core area. The studies of Henderson and Peter (1981) and Hemstrom and others (1982) in coastal forest types similar to those of northern Idaho have shown that intensive sampling (both in the number of plots per unit area and quantity of site data recorded) results in classifications having greater management utility and less ambiguity in application (since fewer environments are left uncategorized). They sampled at approximately one plot per section, whereas the Daubenmires' (1968) sampled at one plot per 200 sections (one plot per 500 sections on the Nez Perce National Forest). Personnel on National Forests and in research units have sometimes found that the Daubenmires' (1968) classification was too general a treatment for the ecological diversity encountered or that the site simply did not fit the key or description. This is not to fault Daubenmires' work. Rather, the "state of the art" in habitat typing has advanced to where foresters, including some initially resistant to the concept of a classification with 22 units, now want an even more detailed classification.

Study Objectives and Scope

Rather than extrapolate from classifications of adjacent areas or work with data-deficient, local, informally revised classifications, a decision was made to refine the Daubenmires' classification. To this end a cooperative study was initiated in 1980 between the Northern Region USDA Forest Service and the Intermountain Research Station. Objectives of this study were to:

1. Develop a refined classification of habitat types for forested lands of northern Idaho based on potential climax vegetation (plant associations).
2. Describe the general site characteristics, topography, microclimate, and soils for each habitat type.
3. Describe the vegetational composition of mature and old-growth stands of each type.
4. Provide observations on successional development, estimates of potential timber productivity, and general biological observations potentially useful for management.

This classification pertains to that portion of Idaho from the Salmon River north to the United States-Canada border (fig. 1). This area encompasses approximately 12.2 million acres (4.9 million ha), of which 6.4 million acres (2.6 million ha) occur on National Forest lands (Nez Perce, 2.2 million acres [0.9 million ha]; Clearwater, 1.7 million acres [0.7 million ha]; St. Joe, 0.9 million acres [0.4 million ha]; Coeur d'Alene, 0.7 million acres [0.3 million ha]; and Kaniksu, 0.9 million acres [0.4 million ha]). Most sampling was conducted on National Forest lands. Flood plains and riparian stringers dominated by broad-leaved trees were not sampled or classified. *Populus tremuloides*-dominated stands in the core area were considered to be short-lived seral stages; hence, no potential climax series (see Synecological Perspective and Terminology section) is recognized for this species.

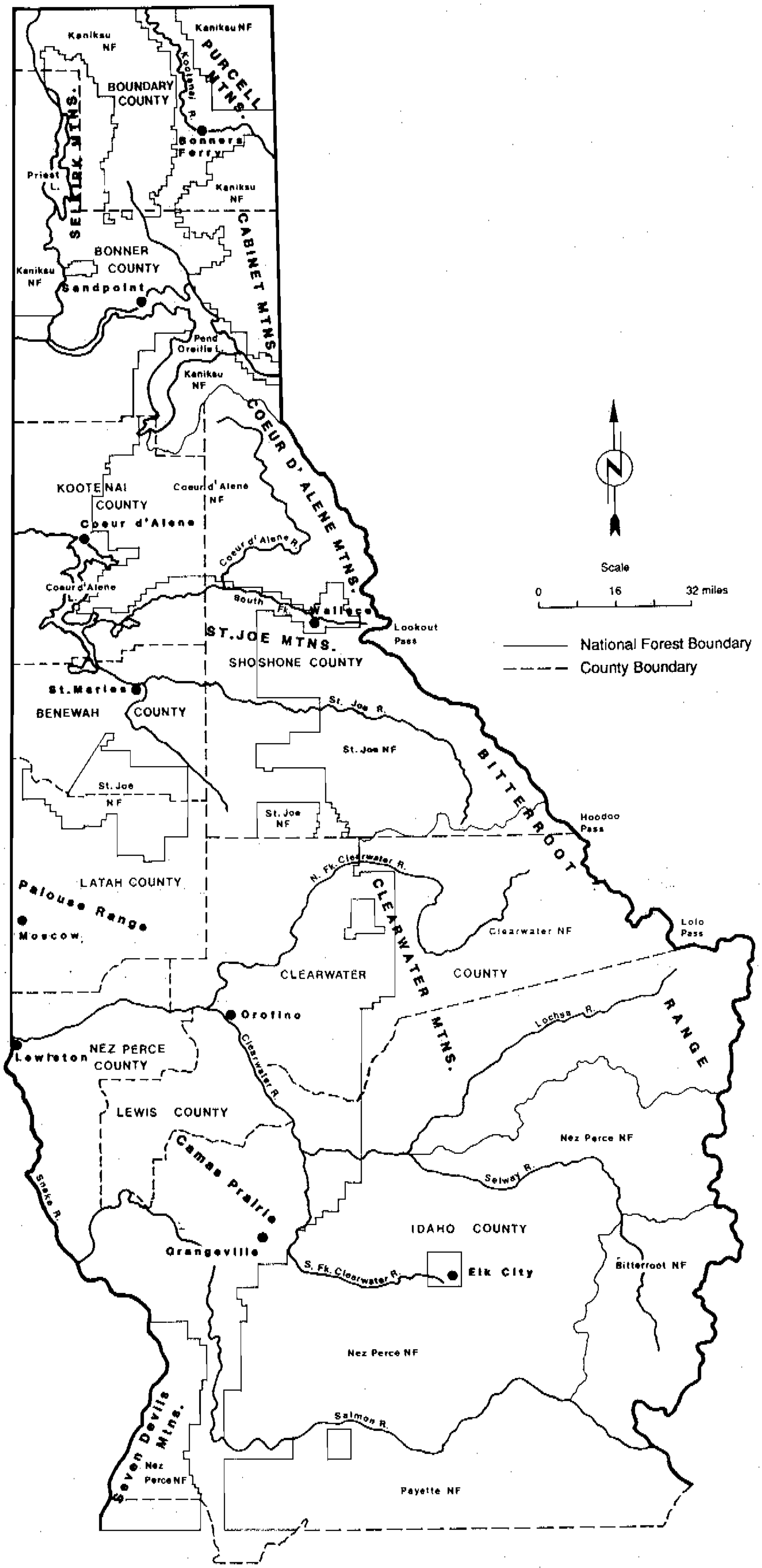

Figure 1—Northern Idaho study area indicating geopolitical units and selected physiographic features.

METHODS

Field Methods

Our goal was to efficiently sample the complete environmental spectrum of Idaho's coniferous forests north of the Salmon River for which we could locate mature and old-growth forests. These goals precluded the use of random and systematic sampling and much reduced the intensity at which broad valley bottoms (largely privately held) were sampled. Mueller-Dombois and Ellenberg (1974) have termed an approach similar to ours "subjective, but without preconceived bias." Plots were not chosen with regard to their position in any classification, extant or envisioned, or by applicability to specific management considerations. This philosophy was adhered to at the three major steps of locating plots: (1) selecting road transects, (2) choosing stands, (3) situating the macroplot within the stand.

Road transects were chosen that traversed as wide a range in environmental conditions as possible in a given area while simultaneously satisfying stand successional stage and nondisturbance criteria. On a given elevational transect, plots were generally spaced 300 to 400 ft (90 to 120 m) vertically, and areas were chosen that offered maximum contrast in a minimum distance; for example, contrasting north and south slopes or toe-slope versus ridgeline. Transect sampling offers indispensible insights into forest community patterns that can be incorporated into h.t. descriptions.

For locating plots within stands the determining factor was homogeneity of the overstory (distribution by species and size classes), understory (distribution by species evaluated in terms of coverage), and site parameters. The plot center was relocated if ecotones, microsites, or recent disturbance were detected. Recognition of ecotones is the single most subjective criteria; it demands field experience and familiarity with the ecological responses of the species present.

In the course of our work, we switched from a 375-m^2 (4,032-ft^2, ≅ 0.09-acre) circular or rectangular plot to a circular 500-m^2 (5,379-ft^2, ≅ 0.12-acre) plot; the larger plot size helped reduce bias detected in preferentially locating plots in high-basal-area stands. A complete inventory for trees taller than 4.5 ft (1.37 m) was made, tallying species by 2-inch (5-cm) diameter classes on the 500-m^2 (≅ 0.12acre) plot. Reproductive success for tree species was sampled by recording trees between 0.5 and 4.5 ft (0.15 and 1.37 m) in height on a 50- or 100-ft^2 (4.6- or 9.3-m^2) circular plot at the center of the macroplot.

We visually estimated cover of all vascular plant species, using Daubenmire's (1959) eight cover classes (+ = present in stand but not in plot, T = 0 to <1 percent cover, 1 = 1 to <5 percent, 2 = ≥5 to <25 percent, 3 = ≥25 to <50 percent, 4 = ≥50 to <75 percent, 5 = ≥75 to <95 percent, 6 = ≥95 to 100 percent). Although the coverages were estimated for the entire macroplot, the accuracy of this method approaches or exceeds that of the 50 small (20- by 8-inch [50- by 20-cm]) quadrats per macroplot originally specified by Daubenmire (1959), and it more than doubles the number of stands sampled per day. Cover class values are used directly in association tables, ordinations, and other objective data analysis routines.

To estimate site potential, three to five (or more where variability warranted) dominant or codominant trees per species were measured for height, age, and diameter at breast height (d.b.h.) (see Timber Productivity section for tree selection criteria). Occasionally, as on the more moist sites in the *Thuja plicata* series (high percentage of trees with root rot), or on overstocked sites (stagnated), and in near-climax stands (stagnation, root and butt rot, crown damage) there were no suitable site trees. Maximum heights only were determined for some old-growth stands.

Near plot center, a soil pit was hand-excavated to a control depth of 40 inches (approximately 1 m) or to bedrock and the profile described according to prescriptions of the Soil Survey Manual (Soil Survey Staff 1981). Samples of each horizon and the parent material were saved and air dried for laboratory analysis. Litter, fermentation, and humus layers were measured at three randomly chosen locations on the plot.

Site factors measured included elevation, slope aspect and inclination, position on slope, microrelief, and landform; location coordinates (township, range, section) and road mileage to relocatable site were also recorded. Observations were made regarding insects and tree pathogens, animal use, fire history, extent of the stand, its position relative to surrounding vegetation types and environmental conditions, and, when available, seral communities developing on similar sites. The rationale for employing these field procedures is detailed by Pfister and Arno (1980).

One field team in a very abbreviated 1980 field season sampled 96 stands on the Kaniksu and Coeur d'Alene National Forests. During the summers of 1981 through 1984, two field crews sampled a total of 620 stands from the whole study area, including the Nez Perce National Forest, which R. Steele and S. Arno had previously sampled (106 stands) in preparation of a preliminary h.t. classification (Steele and others 1976). Whenever possible, plots from preceding studies were incorporated into our data base, including 226 collected by James Habeck (University of Montana) on the Selway-Bitterroot Wilderness, 86 from Daubenmire and Daubenmire's (1968) Idaho locations, several mature forest plots donated by S. Arno from a succession study, 42 from R. Steele's study (1971) on the lower North Fork Clearwater River, and 51 from R. Crawford and F. Johnson (University of Idaho) in an area east and south of Grangeville. All plots from the Palouse Ranger District have been included as part of the Clearwater National Forest data. The combined data set represents a sampling intensity of one plot per 18 sections (11,500 acres [4,700 ha]).

Nearly all the cited investigators used the same plot size (375 m^2), techniques, and cover classes for estimating vegetative cover; their studies differed only in intensity of soil description and measurement of site index. Thus, for constructing the classification, all plots were of nearly equal utility; but for formulating management implications, estimating productivity, and ascertaining the relationship of h.t.'s to one another and environmental gradients, the set of useful plot data was heterogeneous and much reduced.

Office Procedures

Soil parent materials were determined by professional geologists Carol Hammond (Intermountain Research Station, Moscow, ID) and Ken Fry (Lolo National Forest, Missoula, MT). Textural class determinations and training of our staff was provided by soil scientists Richard Kline (Northern Region, Missoula), Maynard Fosberg (University of Idaho, Moscow), and Neil Peterson (Soil Conservation Service, Moscow). Air-dried samples from each horizon were weighed, sieved at 0.08 inch (2 mm), and reweighed for determination of gravel content (percentage by weight). The soil separate was analyzed for dry and wet color, texture, consistency, and saturated-paste pH.

Data analysis and development of our classification follow the procedures and rationale detailed by Pfister and Arno (1980); the following section is a condensation thereof, with our exceptions to their approach noted. One of our major considerations was that the resulting classification should be a refinement of a previous, well-accepted work in forest classification by Daubenmire and Daubenmire (1968). The classification should also mesh with classifications produced for contiguous areas—central Idaho (Steele and others 1981) and Montana (Pfister and others 1977)—which had been habitat typed according to the approach we have subscribed to in this publication. We follow their ecological classification where their interpretations agree with northern Idaho data.

We assumed that the tree series (potential climax) should be provisionally accepted as delineated in previous studies cited above. Therefore, we stratified our stands into the indicated tree series; within each series, plots were grouped into possible associations by their similarities in vegetal composition (by species, constancy, and coverage) and correspondence to classifications from contiguous areas. In order to group those stands with the greatest overall similarity, synthesis tables (Mueller-Dombois and Ellenberg 1974) were generated by computer and rearranged numerous times.

Printing of elevation, slope, aspect, etc., and geographic location as stand headers on synthesis tables facilitated the comparison of site factors by stand groupings in the quest for a close correspondence between environmental-geographic patterns and taxonomic units.

Mathematical ordinations based on index of similarity (Bray and Curtis 1957) were applied to each series as a graphical comparison of stand composition and relative placement on apparent environmental gradients. These ordinations were used in evaluating the subjective stand groupings and the merits of given species as indicators. Ordinations also provided insight for interpreting vegetation-environment relationships.

Vegetal characteristics for the habitat types and phases were identified and described, and a dichotomous key was then designed for their identification. The key was tested using each sample stand. We then revised the key to accommodate essentially all stands. Terminology for naming the types and wording of the key was adjusted where warranted to reflect the correspondence between this and other existing classifications. Development of the key in this manner resulted in species canopy coverage values used for site classification that often do not reflect average conditions discussed in the h.t. narratives or constancy-coverage tables (Appendix C). When consistent vegetal differences within a habitat type were correlated with relatively minor environmental dissimilarities, a phase level was designated to categorize this variability (see Syntaxonomic Perspective and Terminology section for definitions). A tentative key was developed for field testing the summers of 1982 and 1983, and user responses were requested and incorporated where appropriate.

The geographic distribution, relative importance, distribution in relation to key site factors and other h.t.'s, characteristic vegetal features, and phase descriptions and their distinctions are described for each habitat type. The obvious management implications, those that generally follow from considering a habitat type's environmental and vegetational characteristics (including productivity) are addressed. This classification serves as a repository of information useful for generating "site specific" management guidelines—in short, an information storage and retrieval system.

Taxonomic Considerations

In the course of sampling, several hundred voucher specimens were collected. The better collections were deposited in the herbaria of the Intermountain Research Station at Missoula, and the University of Idaho, Moscow. Difficult specimens were verified or identified by P. Stickney (USDA Forest Service, Intermountain Station, Missoula, MT) or D. Henderson (University of Idaho, Botany Department). Nomenclature follows Hitchcock and Cronquist (1973).

A continually vexing problem is discriminating between *Vaccinium globulare* and *V. membranaceum*. Stickney (n.d.) in Montana, and Steele and others (1981) in central Idaho have found most material best conforms to *V. globulare*. But Steele and others (1981) cited their northernmost areas as supporting populations with intermediate characteristics. We have found insufficient flowering material to ascertain for our area the relative proportions of the two taxa in observed populations, but based on leaf morphology most material appears to agree with *V. globulare*. Therefore, we have used *V. globulare* to designate these populations (species) in the h.t. classification.

Vaccinium myrtillus was noted to intergrade with *V. scoparium* and to a lesser extent with *V. globulare* in the northernmost portion of the study area. Virtually all of this material was treated as *V. scoparium* because of its broom-like branching habit, small leaf size, and occupancy of habitats similar to those characterized elsewhere by *V. scoparium*.

Arnica cordifolia and *A. latifolia* are a confusing pair, but *A. cordifolia* usually occupies warmer, drier sites and has leaves of a deep, intense green, with distinct petioles and the pairs progressively reduced from the basal pair upward. *Arnica latifolia* occurs at higher elevations and has lighter, lettuce-green leaves, of which the middle pair on flowering stems is sessile and larger than those above or below. Confident separation of the two taxa is possible only by examination of mature achenes.

At the upper elevational limits of *Tsuga heterophylla*, some of its characteristics, particularly branching habit and leaf arrangements, intergrade with those of *T. mertensiana* (even where *T. mertensiana* is not present at higher elevations!). The two *Tsuga* species are most easily separated on the basis of ovulate cone size; those of *T. mertensiana* are generally longer than 1 inch (≥2.5 cm), while those of *T. heterophylla* are 1 inch or less (≥2.5 cm).

SYNECOLOGICAL PERSPECTIVE AND TERMINOLOGY

Habitat Type: Definition and Interpretation

Daubenmire (1968a) defined habitat type as all those land areas potentially capable of supporting similar plant communities at climax. Although this "climax" is theoretical and seldom develops (because of recurring disturbance), the trend toward climax can be identified rather readily in the field from an examination of stand structure. Thus h.t.'s are based on potential climax vegetation. The climax plant community, because it is the relatively stable concluding stage of plant succession and in dynamic equilibrium with its macroclimate, is the most meaningful index of the environmental factors affecting vegetation. A habitat type represents a relatively narrow span of the environmental spectrum. The vast majority of land area included in any one h.t. is recovering from disturbance and thus occupied by seral plant communities; however, the ultimate product of vegetative succession anywhere within the habitat type will always be similar climax communities. Thus the habitat type system is to some (Pfister and Arno 1980; Steele and others 1981) a site or land classification system that employs the plant community (projected to its potential climax state) as an integrated bioassay of environmental factors as they affect species reproduction and competitive effects. Others (Hall 1980; Mueller-Dombois 1964) specify that to function as a site or land classification system, habitat types should be more narrowly defined; they include landscape features, productivity, and other management-oriented variables in habitat type definitions.

Habitat types are logically named for the potential climax community type or plant association (Daubenmire and Daubenmire 1968); for example *Abies lasiocarpa / Xerophyllum tenax.* The classification's series level is denoted by the first portion of the name identifying the potential climax tree species, usually the most shade-tolerant tree adapted to the site. The second part of the name refers to a dominant or indicator undergrowth species of the plant association. Presence of a third species name designates the phase level, such as *Abies lasiocarpa / Xerophyllum tenax-Luzula hitchcockii* (see Habitat Type Classification section for an explanation of h.t. abbreviations). Phases represent a difference in vegetation dominance in a third layer, a broad transition between two adjacent habitat types, or minor floristic variation within an h.t. These differences are more specifically referred to as facies, sub-associations, and variants by Crawford and Johnson (1985).

Three misconceptions stemming from the use of plant association names are that: (1) an abundance of climax vegetation is present in the current landscape; (2) we should manage the resource to promote climax vegetation; and (3) to apply this classification system requires climax vegetation. The converse is actually the case in the first two instances: (1) A very high percentage of our forested landscape reflects some degree of disturbance, resulting in the preponderance of seral stages. (2) Management strategies usually favor seral species, regardless of the h.t. Regarding the third misconception, comparing the relative reproductive success of the present tree species with known successional patterns and scrutinizing the current undergrowth vegetation generally permit habitat type identification. Largely as a consequence of their temporally compressed life histories, succession appears to be more rapid for the undergrowth species than for the tree layer. The undergrowth becomes compositionally relatively stable concurrent with tree canopy closure. Where stands have been severely disturbed, are in very early seral stages, or have closed canopies, with depauperate understory vegetation, comparison of the stand with adjacent stands of later seral stages having comparable site factors permits confident h.t. identification.

Attributes of habitat type classifications useful to land and resource managers are: (1) they provide a permanent and ecologically based system of land stratification referenced to vegetation potential (Daubenmire 1976); (2) they furnish a vegetational classification system for mature to near-climax forest communities; (3) they serve as a system in which succession modeling, the next logical area of investigation for increasing management effectiveness, can proceed; and (4) from units of land within the same type can be expected generally similar successional responses to management treatments or natural perturbations.

Habitat Type Versus Continuum Philosophy

Plant community ecologists have for many years heatedly debated the interpretation of plant community organization. Numerous "schools" and philosophies have originated, but the debate can be generalized to two opposing views: (1) typal community advocates maintain that plant succession leads to relatively distinct climax vegetation types and these types repeat, insofar as floristic vagaries permit, across the landscape (Daubenmire 1966); (2) continuum advocates contend that at climax, vegetation, like climate, varies continuously over the landscape (Cottam and McIntosh 1966; Vogl 1966; Whitaker 1967). While ecologists still debate this question, more pertinent questions for land managers are "what constitutes a type?" and "what criteria should be used for establishing types?" (Hall 1980).

Some Synecological Relationships

We have subscribed to the terminology and polyclimax concepts of Tansley (1935) when describing the relationship of a habitat type to environmental variables. Climax communities are classified and named according to the predominant factor responsible for determining their character. Thus a **climatic climax** characterizes "normal" topography and soils and is not dependent upon fire or animal disturbance to maintain its character; it reflects the prevailing macroclimate of an area. An **edaphic climax** is indicated where peculiarities of the soil are sufficiently influential to produce a vegetation type differing from the climatic climax. **Topographic climaxes** are characterized by distinctive microclimates produced by aspect effects, peculiarities of air drainage, or precipitation redistribution. **Topoedaphic climaxes** reflect the combined effects of soils and topography, causing a shift away from the prevailing climatic climax.

Some habitat types occur exclusively as one type of climax, but most can occur in any polyclimax category due to factor compensation. Factor compensation is responsible, for instance, for the *Pseudotsuga menziesii / Physocarpus malvaceus* h.t. shifting from warm, dry, south-facing slopes in northern Idaho to generally steep north slopes east of the Continental Divide in Montana. Where this h.t. occurs in the western part of its range, precipitation is relatively high; in the lower precipitation eastern part of its range, it occurs on north aspects where sufficient environmental moisture is retained. Factor compensation also explains why, within a localized area, a given type will gradually shift from, say, steep north-facing slopes at low elevations to warmer southerly aspects with increasing elevation. As Steele and others (1981) have noted, climatic climaxes are scarce in Idaho; vegetation distribution is strongly determined by topographic features (slope aspect, inclination, and position) or edaphic features such as layers of volcanic ash and glacial drift.

Factor compensation, combined with the natural variability of biological systems (either at the organismal or community level), explain why individual habitat types occur over what may appear to be a broad range of environments. Individual stands may exhibit some modal (average, commonly observed) characteristics and some attributes transitional to other types, especially where major climatic, edaphic, or topographic types grade from one to another. The natural temporal and spatial variation inherent in vegetation and environment dictates that a classification system address transitional types. The two extreme solutions to partitioning variation in vegetation are (1) a relatively simple system with broadly defined types and narrow ecotones and (2) narrowly defined types with either unclassified broad ecotones or numerous types. We have written the keys in specific terms that allow for only narrow ecotones between h.t.'s and facilitate field identification; with this approach more of the land is identifiable to habitat type for practical resource management. Written type descriptions emphasize the modal conditions with extremes of the type noted. Our intention was to achieve a balance among numbers of classified units application to field conditions, and natural variation within types.

Habitat types have geographic distributions and variation that follow regional patterns of floristics, climate, and topography. They occupy various soils and topographic positions near their distributional centers, but near their limits of distribution they are more confined to particular topographic positions and substrates. The areal extent of an h.t. thus varies geographically, although the relative position in vegetation-soil sequences remains constant.

A type occupying a broad area between two other types in one geographic area may be recognizable as only a narrow ecotonal situation in other geographic areas. Our h.t. descriptions attempt to generalize about a type's area of occurrence, but because our travels were limited to a small percentage of the total area represented by the classification, the presence of a particular type in a given area will not have been noted—**do not** depend on cited areas of occurrence as an objective criterion of whether you have correctly keyed a particular stand.

Scale of mapping and type of management action will influence how these transitional areas (ecotones) are interpreted and displayed. Ecotones and "hybrid" stands may cause some frustration, but can be mapped as intergrades ("a mixture of h.t. A and h.t. B"), referenced to adjacent or ecologically similar types, and managed accordingly.

PHYSICAL SETTING

Climate and Microclimate

The dominant climatic influence in northern Idaho is the prevailing westerlies which carry maritime air masses from the northern Pacific Ocean across the Northern Rockies during the winter and spring, and continue eastward but in increasingly modified form. This "inland maritime" regime occurs from British Columbia's Selkirk Range, southward 150 to 200 mi (250 to 330 km) to the northern Clearwater National Forest, its intensity gradationally decreasing north to south across the study area. A gradient of decreasing maritime influence also exists from west to east because successive mountain ridges bring about the depletion of moisture within the air masses (they also buffer the intensity of Pacific storm systems in summer). Concomitant with this climatic pattern are gradients in the flora composition and vegetation types of this region (Daubenmire and Daubenmire 1968). During winter and spring, the "inland maritime" regime is characterized by precipitation occurring as prolonged gentle rains, deep snow accumulations at higher elevations, with abundant cloudiness, fog, and high humidity. Winter temperatures are 15 to 25 °F (8 to 14 °C) warmer than continental or East Coast locations of comparable latitude, except during chinook periods, when locations east of the Continental Divide reach 50 to 60 °F (10 to 16 °C). Temperatures on the east side of the Northern Rocky Mountains are much more extreme at both ends of the scale. The mild, moderate winters are in part responsible for the productive forests of northern Idaho (Franklin and Waring 1980).

Summers (specifically July and August) are very dry (usually <1 inch [2.5 cm] precipitation per month; see appendix E) as a consequence of West Coast subtropical high pressure system shifting northward in late June causing the prevailing westerlies to carry dry subsiding air across northern Idaho (Ross and Savage 1967). Most summer precipitation is associated with convectional storms; however, there are occasional "dry" thunderstorms, which constitute a severe fire hazard when coupled with dry fuels.

Elevation is a major influence on climate and consequently on vegetation patterns. The lowest elevations on the western periphery are the warmest, driest locations within the core area; they are on the steppe-forest ecotone;(see appendix E, Grangeville). The shifts from one forest type to another are controlled at lower elevations primarily by moisture, and at upper elevations principally by temperature (Daubenmire 1956). Except for a few of the highest peaks, the highest elevations of northern Idaho are not above climatic timberlines and support only traces of alpine tundra communities (Layser 1980).

Generally, precipitation increases with elevation but temperature decreases. If these were the only factors governing local vegetation distribution, we would expect vegetation zones to be serial and parallel, arranged by elevation. But such zonation is patently not the pattern in rugged mountainous terrain. Daubenmire (1980) has provided a dramatic, didactic illustration (fig. 2) of how topographic features may produce distinct meso-microclimates and complicated vegetation patterns. In figure 2, two zonal patterns are delineated. Studying only the fully exposed south-slope interfluves (area between adjacent streams flowing in the same direction), one can identify an east-west series of vegetational (elevational) zones that are decidedly tilted, with ends toward the steppe (west) occurring at relatively high elevations. This pattern is explained by assuming that the lower temperatures of increasing elevations compensate for the decreased precipitation as one nears the semiarid steppe.

Oriented somewhat perpendicularly to the relatively horizontal system of the other vegetation types, the islands of relatively mesophytic (moist) *Thuja plicata* / *Clintonia uniflora* h.t. that occur in the deep valleys of the south slope constitute a second system of zones. Because these draws are deeply incised and south-facing, sunlight reaches the valley bottoms only at midday and the valley-dependent vegetation is relatively mesophytic. Starting at the ridge's western extremity, the vegetation of the spindle-shaped islands becomes increasingly more diverse, more mesophytic, and more extensive to the east. The most mesophytic types (some more mesophytic at the eastern extreme and bottoms than conveyed in diagram) are located deepest in the valley, the center of a concentric pattern.

In ascending the drainages from the steppe, one encounters progressively more mesophytic vegetation types, but somewhat above the elevational middle the order is reversed. The drought-mitigating effect of lowering air temperatures cannot compensate for the combined effects of increasing exposure and insolation coupled with the blow-over effect on precipitation (Daubenmire 1980, 1981).

Where the main ridge crest dips and projects a lateral spur immediately to the west, strips of the mesophytic types extend up to and across the crest, becoming continuous with a comparable mesophytic forest on the north face. Valley systems change from islandlike to peninsulalike with increasing distance from the range's west end. The island effect is due to protection from desiccating winds; the peninsula, to increasing orographically stimulated precipitation.

From *Thuja* forests to steppe, every locally important vegetation type can be found between 3,300 and 4,900 ft (1,000 and 1,500 m) on this south slope of the Palouse Range. This vegetation mosaic, not atypical for mountainous terrain, could be made considerably more complex if a substrate discontinuity were superimposed on the existing environmental variation.

Physiography and Geology

Northern Idaho is included in two geological provinces. The major portion of the area is within the Northern Rocky Mountains Province; the western fringe is within the Columbia Intermontane Province (Thornbury 1965). The Columbia Intermontane Province extends from just

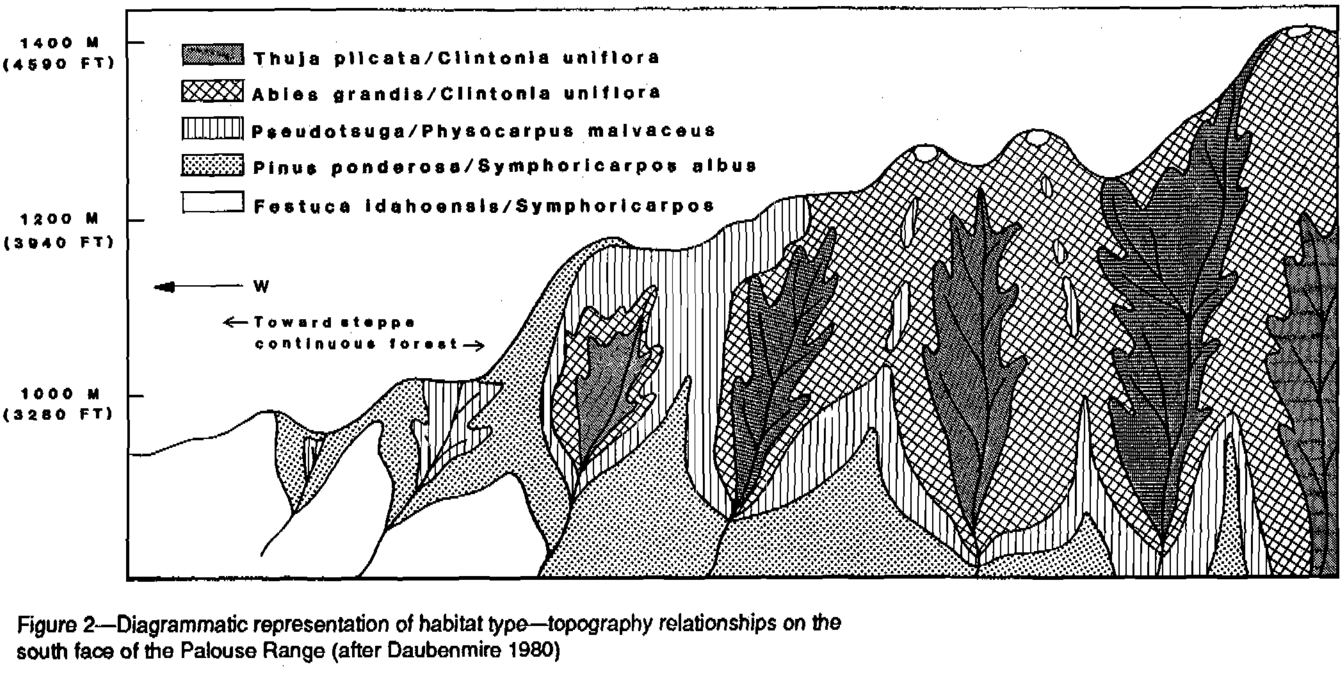

Figure 2—Diagrammatic representation of habitat type—topography relationships on the south face of the Palouse Range (after Daubenmire 1980)

southwest of Coeur d'Alene southward toward Boise. Along this front it interfingers with the Northern Rocky Mountains Province.

The Columbia Intermontane Province is underlain by Columbia River basalts, but these basalts are not generally exposed, nor do they constitute the dominant weathering material for soil formation because of a thick (to 40 ft [12 m]) wind-deposited mantle of loess. This loesal material has a maximum thickness to the north (Palouse Hills Section). It also extends into the Northern Rockies where the greatest accumulations are found on lee slopes (northeast exposures) mixed with volcanic ash; and to the south and east of Grangeville it grades to a thin covering. Soils derived from basalt-loess constitute very productive substrates for tree growth; but this area, excepting overly steep slopes or shallow soils, has been largely cleared and put into cropland.

The most extensive exposure of weathered basalt and greatest vertical relief (1,500 to 9,000 ft [460 to 2,745 m]) are exhibited in the Seven Devils Mountains area (Wallowa-Seven Devils Section), and Hells Canyon, which forms the western border of the study area (fig. 1). A great variety of rock types are exposed in this relief, but the soils are generally shallow and despite the dominance of a weak "inland maritime" climatic regime range communities are prevalent on warm exposures at low to midelevations.

The Northern Rocky Mountains Province includes four mountain groups with a great diversity of geology, structure, and topography. Two of these groups occur in the core area. The Central Idaho Range (Thornbury 1965) extending from north of the Snake River Plains to Lake Pend Oreille is such a broad, undifferentiated mass, so lacking lineation that the term "range" is only loosely applied. Only the Bitterroot Range on the eastern margin forms a linear northwest-southeast trending chain of high peaks (a few exceeding 9,000 ft [2,745 m]). The boundaries between the mountain "ranges" of central Idaho (including Clearwater, Coeur d'Alene, and Bitterroot in our area) are poorly defined. The relative lithologic homogeneity imposed by both the Precambrian Belt Supergroup metasediments and Idaho Batholith granitics (quartz monzonites and granodiorites) is reflected in the sprawling mountains, dendritic drainages, narrow V-shaped valleys, scant topographical lineation, and accordant ridges.

Border Zone rocks—Belt Series metasediments altered by batholith intrusion—occurring north and west of the Idaho Batholith, primarily on the northern Nez Perce and Clearwater NF's, are well weathered and produce deep, massively unstable soils. Granitic-derived soils prevalent on the Nez Perce NF are generally thin and highly erodable (Arnold 1975).

Tertiary and quaternary glacial drift is extensive in the Elk City Basin and occurs sporadically to the north, where large deposits are again present in the Coeur d'Alene-Rathdrum Prairie vicinity.

Extending north from the Clark Fork drainage of the Columbia River and west from the Front Range in Montana to the Selkirk Mountains on the Idaho-Washington border are a number of linear northwest-to-southeast trending, imbricately thrust-faulted ranges, where the surface exposures are primarily Belt Supergroup argillites and quartzites (fig. 1). These ranges (few in northern Idaho exceed 7,000 ft [2,140 m]), and associated valleys were twice overridden by the continental glacier. The preglacial loess was scoured away leaving a coarse and less fertile substrate on the uplands and U-shaped valleys floored with glacial drift. The Purcell Trench, stretching from Coeur d'Alene into Canada, is the largest example (in our area) of a broad-floored basin associated with the glacial erosion-deposition of a major intermontane ice lobe (Thornbury 1965); the Purcell Trench also has major lacustrine deposits from glacial Lake Kootenai. The mosaic pattern in the particle size composition of these deposits (especially where mixed with volcanic ash eroded from the highlands) produces a corresponding complex of plant communities.

Postglacial time has seen the deposition of eolian materials, especially volcanic ash (predominantly Mount Mazama [Nimlos and Zuring 1982]), which has been concentrated (locally exceeding a meter in depth) on north to northeast exposures. The differential deposition of these materials, combined with precipitation redistribution to northerly exposures by prevailing southwest winds, further accentuates the contrast in north-south slope plant communities.

SUCCESSIONAL STATUS

Fire History

Recognition and documentation of the importance of natural (lightning-caused) fires for the perpetuation of natural forest ecosystems and landscape diversity in the Northern Rocky Mountains is steadily accumulating (Arno 1980; Habeck and Mutch 1973; Romme 1982; Wellner 1970a). Incidence of fire in these ecosystems is practically a certainty within 400 to 500 years from stand initiation (Daubenmire and Daubenmire 1968), but natural fire-free intervals are considerably shorter. The studies of Barrett and Arno (1982) emphasize the extensive impact that burning (planned or otherwise) by Native Americans has had on maintaining stand structure and composition. Other human-caused fires were set by prospectors to expose mineral outcrops (Space 1964) and by settlers for range improvement.

Virtually every stand we sampled had some indication of past fire: even-aged size-class structure of seral species, charred material on the ground, burned-out stumps and snags, charcoal in the soil profile, and fire-scarred boles (usually the exception—evidence indicated a high proportion of stand-replacing fires). Where fire evidence was not immediately obvious, soil probing could almost invariably produce charcoal traces. Only unproductive, high-elevation sites or wet sites occasionally lacked fire evidence.

Thus it is not surprising that the most abundant tree species in northern Idaho are seral ones adapted to a landscape periodically disturbed by fire. Mature *Larix occidentalis, Pinus ponderosa,* and *Pseudotsuga menziesii* have thick, corky, fire-resistant bark. The previously cited species and *Pinus monticola* have light and/or winged seed, or as is the case with *Pinus contorta,* serotinous cones, adaptations for early arrival on burned sites. Their growth patterns are characterized by rapid initial height growth favoring them over their shade-tolerant competitors. Even-aged stand structure that results following extensive stand-replacing fires (for example, 1910 burns) is circumstantial evidence that a considerable amount of viable seed survives these catastrophic fires. The distances from the nearest seed wall to the center of burned areas virtually preclude effective seed dispersal.

Arno's (1980) recent synopsis of fire history in the Northern Rockies and other publications (Arno 1976; Davis and others 1980; Wellner 1970a) indicate that the fire-free interval ("fire-return interval" in other studies) can be related to climax tree series and habitat type. On a local scale, incidence of fire (predominantly surface fire) decreases with decreasing moisture stress, from mean fire-free intervals of 6 years on *Pinus ponderosa-Pseudotsuga menziesii / bunchgrass* types to 40+ years on subalpine h.t.'s (Arno and Petersen 1983).

Surface fires also occur in the *Thuja-Tsuga* forests of northern Idaho, but with much-reduced frequency compared to northwestern Montana or the Nez Perce NF, where reconnaissance data show 40 to 80 percent of the stands in *Thuja* h.t.'s experience ground fire. Studies on small subunits (150 to 300 acres [60 to 120 ha]) of the Priest Lake Ranger District, Kaniksu NF (Arno and Davis 1980) indicate only one or two significant fires per century can be expected on upland *Thuja-Tsuga* h.t.'s. Wet-site *Thuja-Tsuga* subunits experience only very limited lightning-strike spot fires; average stand-replacing fire intervals may exceed 500 years. The *Abies lasiocarpa* h.t.'s associated with the *Tsuga-Thuja* zone have much longer fire-free intervals (to 250+ years) and reduced burn sizes (<10 acres [4 ha] [Arno and Davis 1980] compared to ABLA series h.t.'s on the Lolo and Bitterroot NF's [beyond the *Tsuga-Thuja* zone] [Arno and Petersen 1983; Davis and others 1980]). Arno and Davis (1980) have speculated on management implications associated with the types and frequencies of fire as they interact with h.t.'s, seral species, and site properties on *Thuja-Tsuga* zone forests.

The high productivities of *Thuja-Tsuga* forests reflect their mesic environments; however, every few years an extreme summer drought occurs. Drought, combined with drying winds, vastly increases the probability of large, stand-replacing fires. The destructive 56,000-acre (22,700-ha) Sundance Fire (Kaniksu NF) of 1967 (Anderson 1968) was the most recent example of the massive crown fires that collectively have burned millions of acres. Other extensive fires occurred in 1934, 1926, 1919, 1889, and most notably 1910 (990,000 acres [400,000 ha] burned on the Clearwater and Nez Perce NF's alone [Barrows 1952]). The U.S. Forest Service Northern Region (R-1) experiences about three times as many lightning fires as the Intermountain Region (R-4), and the western zone (R-1, west of Continental Divide) records six times as many lightning fires as the eastern zone (Barrows 1952). The Clearwater and Nez Perce NF's are clearly the regional focus of lightning fires, both in terms of the average number of fires per million acres (114 and 67, respectively, computed on the period 1931-45) and average annual acreage burned per million acres (5,670 and 7,580, respectively). The average acreage burned per million acres for these forests is two to 10 times greater than on contiguous forest lands.

Wellner (1970a) describes how the accumulation of dead, fallen fuels from previous fires may set the stage for massive and successive fires, the eventual outcome being retarded establishment of forest because of seed source elimination and long-persisting shrub and forb fields (dominated by *Salix scouleriana, Amelanchier alnifolia, Ceanothus* spp., *Acer glabrum, Prunus* spp., *Physocarpus malvaceus, Holodiscus discolor, Pteridium aquilinum,* and *Rudbeckia occidentalis*). On the Clearwater NF (centered on Cook Mountain area) we find the most extensive reburns and shrubfields in the Northern Rockies. Barrett (1982) has speculated on the combination of factors responsible for these conflagrations: (1) less summer rainfall than northward in the panhandle, yet still enough moisture for rapid fuel buildup; (2) local topography favoring the drying influence of prevailing westerlies on mid and upper slope forests; (3) high lightning frequency.

Succession modeling (Arno and others 1985) in four extensive habitat types of western Montana (important h.t.'s also in northern Idaho) has documented that the intensity of burn, along with preburn vegetational composition and h.t., are important variables in predicting response to wildfire. The results of Arno and others (1985) have important implications about managing for particular species through specific treatments. In many cases, successional responses to combinations of logging and site preparation will mimic the vegetational responses to wildfire. Fire history studies in combination with succession modeling of vegetation, fuels, and flammability have great potential for ecological understanding of the natural role of wildfire, how fire may be best managed, and the use of prescribed fire as a tool (prescription) to achieve land management objectives. (See Logging History section for additional citations regarding succession models.)

Logging History

Centers of mining activity were the first areas to be heavily logged. Timber was used for construction, mine supports, and fuel for stamp mills and smelters. Cutting for ties was extensive along railroad lines. Early in the century the most fertile and accessible valleys and adjacent gentle slopes were cleared for agriculture, and upslope stands were used for fuel and building materials. Loggers soon gained access to more remote stands of valuable timber and floated huge log-booms to downstream mills on the major watercourses of the area. Records of these early activities are preserved in springboard cuts on large rot-resistant *Thuja plicata* stumps. Some areas with these relicts have produced a second cutting and are well on their way to a third.

The biggest spur to increased harvesting was the booming wartime (World War II) and postwar economy. For instance, on the Clearwater NF the largest cut prior to 1946 was 18.0 million board ft (MM bd ft), but the annual cut jumped to 116.3 MM bd ft by 1959, and since has dropped below 100 MM bd ft only once; similar increases in harvested volume occurred on other forests in the region. With continued pressure to harvest old-growth stands and the introduction of aerial logging techniques making stands accessible where harvesting was once deemed impractical, it appeared that only the most remote (or unproductive) stands would remain undisturbed. But the Research Natural Areas (RNA) program is preserving primarily old-growth areas representative of formerly extensive types. Also, National Forests are setting aside a certain percentage of their remaining old-growth stands, recognizing that certain wildlife species are dependent upon this structural state.

Succession models have also been constructed with various cutting practices and site treatments constituting the disturbance types (a major prediction variable). Some models are data intensive, geographically restricted, and treat all lifeforms (for example Arno and others 1985 in western Montana). Others are deterministic, of broad geographic application, but emphasize the response of tree and shrub parameters (Laurson 1984; Moeur 1985; Scharosch 1984). Moeur's (1985) model, COVER, an extension of version 5.0 of the Stand Prognosis Model (Wykoff and others 1982) incorporates the databases of Laurson (1984), Scharosch (1984), and Ferguson and others (1986) making the model applicable to the Inland Northwest and Northern Rocky Mountains.

THE HABITAT TYPE CLASSIFICATION

We have defined 46 forest habitat types and 60 phases for northern Idaho. This number represents almost a fivefold increase over the Daubenmires' 22 taxonomic units and is a more detailed representation of the environmental diversity of the study area. To conserve space, the term habitat type is abbreviated h.t. (h.t.'s plural) as are the h.t. names. The first two letters of the genus and species epitaph are combined and capitalized for the appropriate overstory (series level) and undergrowth species (habitat type and phase levels) to generate the abbreviation of each taxonomic unit; for example *Abies lasiocarpa / Clintonia uniflora* becomes ABLA/CLUN. For convenient reference the complete classification by scientific, abbreviated, and common names is listed in table 1. To avoid confusion common names are not used in the text. Foresters and biologists have readily adopted the scientific name abbreviations for accurate and concise referencing in both written and verbal communication.

The classification follows the order:

1. Key to the habitat types (fig. 3). **A careful reading of the instructions and definitions used in the key is essential.** Identification proceeds from climax series, to habitat type, and finally to phase (where indicated). These steps should not be circumvented. A field guide to common forest plants of northern Idaho is specifically designed to aid in indicator species identification (Patterson and others 1985).
2. Series description. Some h.t. characteristics are summarized at the series level, avoiding repetition at the h.t. level.
3. Habitat type description. The h.t. is characterized in terms of extent, environmental variables, geographic range, vegetation, phases, soils, productivity, and management implications. All designations regarding slope aspect proceed in a clockwise direction from north.
    a. The order of series and h.t. identification tends to follow a moisture gradient, from wettest to driest.
    b. When considering lower elevation environments, progressing through the key leads generally to drier h.t.'s; at upper elevations, progressing through the key leads to increasingly colder h.t.'s.
    c. Species with the greatest importance as indicators (or narrowest ecological amplitude) tend to appear first in the key.
    d. Species canopy coverage values used in the key for site classifiction reflect **minimum** coverage values for the h.t. or phase. Coverage values described in the h.t. or phase narratives are generally one or two coverage classes greater and reflect the conceptualized "average stand." Coverage values presented in the constancy/coverage tables (Appendix C) were derived from intensive plot sampling data and may differ somewhat from both the key and narrative values.
    e. When types from different geographic areas are merged into one key, this order may deviate. Not all series or types occur in any one region, as is revealed in a comparison of figures 4 and 5 showing generalized series-level zonations for northernmost Idaho and the Nez Perce NF (southern portion of northern Idaho). In northernmost Idaho the *Tsuga heterophylla* series is extensive, whereas only the exceptionally dry (excessively drained soils) sites are capable of supporting *Pinus ponderosa* or *Pseudotsuga menziesii* series. Conversely, on the Nez Perce NF the *T. heterophylla* series is nonexistent and the *P. menziesii*, and *Abies grandis* series occur extensively.

Table 1—Forest habitat types (h.t.'s), community types (c.t.'s), and phases by series for northern Idaho. Do not use this table as a substitute for the key or the narratives that follow. The required species, cover values, and proper order do not appear in this table.

ADP code[1]	Abbreviation	Scientific name	Common name
502	TSHE	***TSUGA HETEROPHYLLA*** **SERIES**	
565	TSHE/GYDR	*T. heterophylla/Gymnocarpium dryopteris* h.t.	western hemlock/oak-fern
575	TSHE/ASCA	*T. heterophylla/Asarum caudatum* h.t.	western hemlock/wild ginger
576	-ARNU	-*Aralia nudicaulis* phase	-wild sarsaparilla
577	-MEFE	-*Menziesia ferruginea* phase	-menziesia
578	-ASCA	-*Asarum caudatum* phase	-wild ginger
570	TSHE/CLUN	*T. heterophylla/Clintonia uniflora* h.t.	western hemlock/queencup beadlily
572	-ARNU	-*Aralia nudicaulis* phase	-wild sarsaparilla
573	-MEFE	-*Menziesia ferruginea* phase	-menziesia
574	-XETE	-*Xerophyllum tenax* phase	-beargrass
571	-CLUN	-*Clintonia uniflora* phase	-queencup beadlily
579	TSHE/MEFE[2]	*T. heterophylla/Menziesia ferruginea* h.t.	western hemlock/menziesia
501	THPL	***THUJA PLICATA*** **SERIES**	
550	THPL/OPHO	*T. plicata/Oplopanax horridum* h.t.	western redcedar/devil's club
540	THPL/ATFI	*T. plicata/Athyrium filix-femina* h.t.	western redcedar/lady-fern
541	-ADPE	-*Adiantum pedatum* phase	-maidenhair fern
542	-ATFI	-*Athyrium filix-femina* phase	-lady-fern
560	THPL/ADPE	*T. plicata/Adiantum pedatum* h.t.	western redcedar/maidenhair fern
555	THPL/GYDR	*T. plicata/Gymnocarpium dryopteris* h.t.	western redcedar/oak-fern
545	THPL/ASCA	*T. plicata/Asarum caudatum* h.t.	western redcedar/wild ginger
547	-MEFE	-*Menziesia ferruginea* phase	-menziesia
548	-TABR	-*Taxus brevifolia* phase	-Pacific yew
546	-ASCA	-*Asarum caudatum* phase	-wild ginger
530	THPL/CLUN	*T. plicata/Clintonia uniflora* h.t.	western redcedar/queencup beadlily
533	-MEFE	-*Menziesia ferruginea* phase	-menziesia
535	-TABR	-*Taxus brevifolia* phase	-Pacific yew
534	-XETE	-*Xerophyllum tenax* phase	-beargrass
531	-CLUN	-*Clintonia uniflora* phase	-queencup beadlily
701	TSME	***TSUGA MERTENSIANA*** **SERIES**	
675	TSME/STAM	*T. mertensiana/Streptopus amplexifolius* h.t.	mountain hemlock/twisted-stalk
676	-LUHI	-*Luzula hitchcockii* phase	-smooth woodrush
677	-MEFE	-*Menziesia ferruginea* phase	-menziesia
685	TSME/CLUN	*T. mertensiana/Clintonia uniflora* h.t.	mountain hemlock/queencup beadlily
686	-MEFE	-*Menziesia ferruginea* phase	-menziesia
687	-XETE	-*Xerophyllum tenax* phase	-beargrass
680	TSME/MEFE	*T. mertensiana/Menziesia ferruginea* h.t.	mountain hemlock/menziesia
681	-LUHI	-*Luzula hitchcockii* phase	-smooth woodrush
682	-XETE	-*Xerophyllum tenax* phase	-beargrass
710	TSME/XETE	*T. mertensiana/Xerophyllum tenax* h.t.	mountain hemlock/beargrass
711	-LUHI	-*Luzula hitchcockii* phase	-smooth woodrush
713	-VASC	-*Vaccinium scoparium* phase	-grouse whortleberry
712	-VAGL	-*Vaccinium globulare* phase	-blue huckleberry
840	TSME/LUHI[2]	*T. mertensiana/Luzula hitchcockii* h.t.	mountain hemlock/smooth woodrush
600	ABLA	***ABIES LASIOCARPA*** **SERIES**	
650	ABLA/CACA	*A. lasiocarpa/Calamagrostis canadensis* h.t.	subalpine fir/bluejoint
655	-LEGL	-*Ledum glandulosum* phase	-Labrador-tea
654	-VACA[2]	-*Vaccinium caespitosum* phase	-dwarf huckleberry
652	-LICA[2]	-*Ligusticum canbyi* phase	-Canby's ligusticum
651	-CACA	-*Calamagrostis canadensis* phase	-bluejoint
635	ABLA/STAM	*A. lasiocarpa/Streptopus amplexifolius* h.t.	subalpine fir/twisted-stalk
636	-MEFE	-*Menziesia ferruginea* phase	-menziesia
637	-LICA	-*Ligusticum canbyi* phase	-Canby's ligusticum
620	ABLA/CLUN	*A. lasiocarpa/Clintonia uniflora* h.t.	subalpine fir/queencup beadlily
625	-MEFE	-*Menziesia ferruginea* phase	-menziesia
624	-XETE	-*Xerophyllum tenax* phase	-beargrass
621	-CLUN[2]	-*Clintonia uniflora* phase	-queencup beadlily
670	ABLA/MEFE	*A. lasiocarpa/Menziesia ferruginea* h.t.	subalpine fir/menziesia
672	-LUHI	-*Luzula hitchcockii* phase	-smooth woodrush
674	-VASC	-*Vaccinium scoparium* phase	-grouse whortleberry
671	-COOC[2]	-*Coptis occidentalis* phase	-western goldthread
673	-XETE	-*Xerophyllum tenax* phase	-beargrass
640	ABLA/VACA[2]	*A. lasiocarpa/Vaccinium caespitosum* h.t.	subalpine fir/dwarf huckleberry

(con.)

Table 1 (Con.)

ADP code[1]	Abbreviation	Scientific name	Common name
690	ABLA/XETE	*A. lasiocarpa/Xerophyllum tenax* h.t.	subalpine fir/beargrass
694	-LUHI	*-Luzula hitchcockii* phase	-smooth woodrush
692	-VASC	*-Vaccinium scoparium* phase	-grouse whortleberry
693	-COOC	*-Coptis occidentalis* phase	-western goldthread
691	-VAGL	*-Vaccinium globulare* phase	-blue huckleberry
720	ABLA/VAGL[2]	*A. lasiocarpa/Vaccinium globulare* h.t.	subalpine fir/blue huckleberry
750	ABLA/CARU[2]	*A. lasiocarpa/Calamagrostis rubescens* h.t.	subalpine fir/pinegrass
730	ABLA/VASC[2]	*A. lasiocarpa/Vaccinium scoparium* h.t.	subalpine fir/grouse whortleberry
830	ABLA/LUHI[2]	*A. lasiocarpa/Luzula hitchcockii* h.t.	subalpine fir/smooth woodrush
860	LALY-ABLA[2]	*Larix lyallii-Abies lasiocarpa* communities	alpine larch-subalpine fir
850	PIAL-ABLA[2]	*Pinus albicaulis-Abies lasiocarpa* communities	whitebark pine-subalpine fir
500	ABGR	***ABIES GRANDIS*** **SERIES**	
529	ABGR/SETR[2]	*A. grandis/Senecio triangularis* h.t.	grand fir/arrowleaf groundsel
516	ABGR/ASCA	*A. grandis/Asarum caudatum* h.t.	grand fir/wild ginger
518	-MEFE	*-Menziesia ferruginea* phase	-menziesia
519	-TABR	*-Taxus brevifolia* phase	-Pacific yew
517	-ASCA	*-Asarum caudatum* phase	-wild ginger
520	ABGR/CLUN	*A. grandis/Clintonia uniflora* h.t.	grand fir/queencup beadlily
525	-MEFE	*-Menziesia ferruginea* phase	-menziesia
526	-TABR	*-Taxus brevifolia* phase	-Pacific yew
523	-XETE	*-Xerophyllum tenax* phase	-beargrass
524	-PHMA	*-Physocarpus malvaceus* phase	-ninebark
521	-CLUN	*-Clintonia uniflora* phase	-queencup beadlily
590	ABGR/LIBO	*A. grandis/Linnaea borealis* h.t.	grand fir/twinflower
592	-XETE	*-Xerophyllum tenax* phase	-beargrass
591	-LIBO	*-Linnaea borealis* phase	-twinflower
510	ABGR/XETE	*A. grandis/Xerophyllum tenax* h.t.	grand fir/beargrass
511	-COOC	*-Coptis occidentalis* phase	-western goldthread
512	-VAGL	*-Vaccinium globulare* phase	-blue huckleberry
515	ABGR/VAGL[2]	*A. grandis/Vaccinium globulare* h.t.	grand fir/blue huckleberry
506	ABGR/PHMA	*A. grandis/Physocarpus malvaceus* h.t.	grand fir/ninebark
507	-COOC	*-Coptis occidentalis* phase	-western goldthread
508	-PHMA	*-Physocarpus malvaceus* phase	-ninebark
505	ABGR/SPBE	*A. grandis/Spiraea betulifolia* h.t.	grand fir/white spiraea
200	PSME	***PSEUDOTSUGA MENZIESII*** **SERIES**	
260	PSME/PHMA	*P. menziesii/Physocarpus malvaceus* h.t.	Douglas-fir/ninebark
263	-SMST	*-Smilacina stellata* phase	-starry Solomon-plume
261	-PHMA	*-Physocarpus malvaceus* phase	-ninebark
250	PSME/VACA	*P. menziesii/Vaccinium caespitosum* h.t.	Douglas-fir/dwarf huckleberry
280	PSME/VAGL[2]	*P. menziesii/Vaccinium globulare* h.t.	Douglas-fir/blue huckleberry
310	PSME/SYAL[2]	*P. menziesii/Symphoricarpos albus* h.t.	Douglas-fir/common snowberry
340	PSME/SPBE[2]	*P. menziesii/Spiraea betulifolia* h.t.	Douglas-fir/white spiraea
320	PSME/CARU	*P. menziesii/Calamagrostis rubescens* h.t.	Douglas-fir/pinegrass
322	-ARUV	*-Arctostaphylos uva-ursi* phase	-kinnikinnick
323	-CARU	*-Calamagrostis rubescens* phase	-pinegrass
330	PSME/CAGE[2]	*P. menziesii/Carex geyeri* h.t.	Douglas-fir/elk sedge
220	PSME/FEID[2]	*P. menziesii/Festuca idahoensis* h.t.	Douglas-fir/Idaho fescue
210	PSME/AGSP[2]	*P. menziesii/Agropyron spicatum* h.t.	Douglas-fir/bluebunch wheatgrass
900	PICO	***PINUS CONTORTA*** **SERIES**	
920	PICO/VACA[2]	*P. contorta/Vaccinium caespitosum* c.t.	lodgepole pine/dwarf huckleberry
925	PICO/XETE[2]	*P. contorta/Xerophyllum tenax* c.t.	lodgepole pine/beargrass
940	PICO/VASC[2]	*P. contorta/Vaccinium scoparium* h.t.	lodgepole pine/grouse whortleberry
100	PIPO	***PINUS PONDEROSA*** **SERIES**	
190	PIPO/PHMA	*P. ponderosa/Physocarpus malvaceus* h.t.	ponderosa pine/ninebark
170	PIPO/SYAL	*P. ponderosa/Symphoricarpos albus* h.t.	ponderosa pine/common snowberry
140	PIPO/FEID[2]	*P. ponderosa/Festuca idahoensis* h.t.	ponderosa pine/Idaho fescue
130	PIPO/AGSP[2]	*P. ponderosa/Agropyron spicatum* h.t.	ponderosa pine/bluebunch wheatgrass

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[1] Automatic data processing code for National Forest System use.

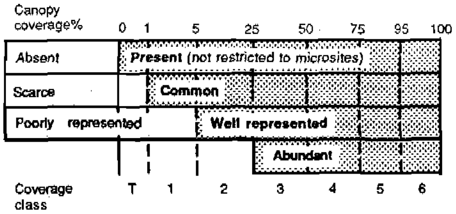
[2] Incidental habitat type, phase, or community type in northern Idaho; eliminated from some other tables and appendixes.

READ THESE INSTRUCTIONS BEFORE USING KEYS!

1. **NOTE**: The key is **NOT** the classification! Validate your selection by comparing the site with the written type description and constancy-coverage tables (appendix C). Species canopy coverage values used in the key for site classification reflect minimum cover values not average values for sampled stands. Refer to the northern Idaho field guide (Patterson and others 1985) that is specifically designed to aid in identification of forest h.t. indicator species.
2. This key is most appropriately applied to stands that are at least at a pole-mature, closed canopy successional stage. If a severely disturbed community or early seral conditions are encountered, habitat type is best determined by extrapolating from the nearest relatively undisturbed, mature stand with similar site conditions (slope, aspect, elevation, and soils).
3. The plot being classified must be representative of the stand as a whole. If not, and you are not constrained by other considerations, relocate the plot. Plant ecologists consider environmental and/or vegetation homogeneity as primary requisites for plot selection. Stand examination procedures (for example, those employed by the Northern Region, Forest Service) require a systematic plot location within sometimes environmentally heterogeneous stands. If plot relocation is not an acceptable procedure, record the predominant habitat type for the site being classified and note inclusions of other h.t.'s.
4. Accurately identify and record canopy coverages for **all** indicator species using field form (appendix G). Canopy coverage terms for use in the key and written descriptions are diagramed below:

   Depauperate: unusually sparse undergrowth conditions resulting from dense shading or thick duff require the adjustment of canopy coverage values in the key to the next lower class (for instance, "well represented" becomes "common"), or extrapolation from the nearest nondepauperate condition occurring on a comparable site.

   "Present" as applied to trees or large shrubs requires at least 10 individuals per acre (25/ha), well scattered through the stand, not restricted to microsites. "Present" as applied to low *shrubs and herbaceous plants requires scattered individuals* throughout the stand, usually 5 or more individuals or clumps per ⅒ acre (125/ha), not occurring on microsites. Microsites are small areas that are atypical for the stand, such as windthrow pockets, micro-drainage ways, seeps, well-rotted logs, or excessively rocky areas.
5. Using the SERIES KEY, identify the potential climax tree species. "Successfully reproducing" is considered to be 10 trees per acre (25 trees/ha). NOTE: Extensive, repeated burns have eliminated climax tree seed sources for several square miles in numerous areas; *in the most severe cases extensive shrubfields* (lacking even seral tree species) have developed. If a site has 10 or more stumps (snags per acre) (25/ha) of a species more shade tolerant than the current tree populations, classify the site to the series indicated by the remnant trees. Where expansive shrubfields have developed, a *regional model relating series/habitat type—phase* occurrence to site parameters is the most practicable solution. NOTE: **not all shrubfield conditions should be extrapolated to a forested h.t.** Recent findings regarding a long-recognized problem condition, long-persisting, intractable to reforestation shrubfields and bracken fern (*Pteridium aquilinum*) glades occurring in a mosaic with forest communities, have resulted in a modification of previous versions of our classification. (See Series Level Key, couplet 1.)
6. Within the selected series key, determine habitat type by literally following the key. **All** conditions stipulated for each couplet must be satisfied to make the correct choice. The first set of conditions satisfied by site characteristics should generally supply the correct classification. As stipulated in Instruction 1, validate your determination by checking the written description and constancy-coverage tables. Several habitat types in the key are not described in the text; references are provided.
7. PHASE determination is achieved by matching the first appropriate phase description to the stand conditions. Validate your determination per Instruction 1.
8. Always follow the key to the finest level in the hierarchy. Knowledge of phase can be as, or sometimes more, important than habitat type when developing management prescriptions.
9. Some percentage of stands will not key to a defined habitat type or phase. These plots should be coded to the lowest level identifiable in hierarchy and annotated accordingly. Data accumulated on "no fit" conditions will serve for future refinements of the classification. Appendix I lists incidental plant communities that may occur in northern Idaho. Additional field work is needed to sample these communities and describe a habitat type.



KEY TO SERIES LEVEL: NORTHERN IDAHO REFINEMENT—REVISED 1990

1. Habitats where the canopy dominant is *Alnus sinuata* or *Pteridium aquilinum;* no indication of successful tree reproduction or that past tree density was greater than 10 per acre (25/ha), though scattered *Picea engelmannii* (seedling-saplings) may be present; 2

1. Not as above; sites capable of supporting forest even if savanna-like or currently dominated by shrubfields 3

   2. *Alnus sinuata* dominated shrub/low tree layer; undergrowth is depauperate (five or fewer herbaceous species present) and *Montia cordifolia* well represented (5%) .... *Alnus sinuata/Montia cordifolia* h.t.

   2. Not as above .... see OTHER VEGETATION TYPES (p. 83) or Appendix I

3. Habitats with unstable broken rock substrate usually on steep slopes (>30 degrees); sparse, poorly developed, and spatially variable undergrowth .... SCREE (p. 83)

3. Habitats with stable substrates and some soil development; undergrowth well developed and spatially somewhat uniform 4

   4. *Tsuga heterophylla* present and reproducing successfully .... TSUGA HETEROPHYLLA SERIES (item A)

   4. *T. heterophylla* absent or if present not reproducing successfully 5

5. *Thuja plicata* present and reproducing successfully, though success may be considerably less than competing species and often episodic or missing .... THUJA PLICATA SERIES (item B)

Figure 3—Key to climax series, habitat types, and phases.

5. *T. plicata* absent or not as above 6

6. *Tsuga mertensiana* present and reproducing successfully .... TSUGA MERTENSIANA SERIES (item C)
6. *T. mertensiana* absent, or, if present, not reproducing successfully 7

7. *Abies lasiocarpa* present and reproducing more successfully than *Abies grandis* (or other tree species) .... ABIES LASIOCARPA SERIES (item D)
7. Not as above or *A. grandis* reproduction greater than that of *A. lasiocarpa* 8

8. *Abies grandis* or *Taxus brevifolia* present and reproducing successfully .... ABIES GRANDIS SERIES (item E)
8. *A. grandis* and *T. brevifolia* absent or not reproducing successfully 9

9. *Pseudotsuga menziesii* present and reproducing successfully, though perhaps episodically .... PSEUDOTSUGA MENZIESII SERIES (item F)
9. *P. menziesii* absent or not reproducing successfully 10

10. Virtually pure stands of *Pinus contorta* that may or may not be self-reproducing, and little evidence as to climax tree species .... PINUS CONTORTA SERIES (item G)
10. *Pinus ponderosa* present and reproducing, perhaps episodically .... PINUS PONDEROSA SERIES (item H)

A. *Tsuga heterophylla* Series; Key to Habitat Types

1. *Oplopanax horridum* well represented (≥5%) .... THPL/OPLOPANAX HORRIDUM h.t.[1] (p. 27)
1. *O. horridum* poorly represented (<5%) 2

2. *Athyrium filix-femina* well represented (≥5%) or common (≥1%) if in combination with *Senecio triangularis, Trautvetteria caroliniensis, Streptopus amplexifolius,* and/or *Gymnocarpium dryopteris* .... THPL/ATHYRIUM FILIX-FEMINA h.t.[1] (p. 28)
   a. *Adiantum pedatum* well represented (≥5%) .... -ADIANTUM PEDATUM phase
   b. *A. pedatum* poorly represented (<5%) .... -A. FILIX-FEMINA phase
2. *A. filix-femina* poorly represented (<5%) or not as above 3

3. *Adiantum pedatum* well represented (≥5%) .... THPL/ADIANTUM PEDATUM h.t.[1] (p. 29)
3. *A. pedatum* poorly represented (<5%) 4

4. *Gymnocarpium dryopteris* common (≥1%) .... TSHE/GYMNOCARPIUM DRYOPTERIS h.t. (p. 20)
4. *G. dryopteris* scarce (<1%) 5

5. *Asarum caudatum* present or *Viola glabella* common (≥1%), neither restricted to microsites .... TSHE/ASARUM CAUDATUM h.t. (p. 21)
   a. *Aralia nudicaulis* present, not restricted to microsites .... -ARALIA NUDICAULIS phase
   b. *A. nudicaulis* absent, *Menziesia ferruginea* well represented (≥5%) .... -MENZIESIA FERRUGINEA phase
   c. Not as above .... -ASARUM CAUDATUM phase
5. *A. caudatum* absent and *V. glabella* scarce (<1%) 6

6. *Clintonia uniflora* or *Tiarella trifoliata* present, not restricted to microsites .... TSHE/CLINTONIA UNIFLORA h.t. (p. 23)
   a. *Aralia nudicaulis* present, not restricted to microsites .... -ARALIA NUDICAULIS phase
   b. *A. nudicaulis* absent, *Menziesia ferruginea* well represented (≥5%) .... -MENZIESIA FERRUGINEA phase
   c. Not as above, *Xerophyllum tenax* well represented (≥5%) .... -XEROPHYLLUM TENAX phase
   d. Not as above .... -CLINTONIA UNIFLORA phase
6. *C. uniflora* and *T. trifoliata* absent 7

7. *Menziesia ferruginea* and/or *Xerophyllum tenax* well represented (≥5%), and/or fewer than 12 undergrowth species present .... TSHE/MENZIESIA FERRUGINEA h.t. (p. 26)
7. Not as above, then
   a. Reevaluate choice of *Tsuga heterophylla* as appropriate series, and
   b. Note that closed canopy of mid- to late successional stages may have exceedingly depauperate undergrowth; in which case, examine the nearest stand with similar site variables, but a canopy structure permitting undergrowth development, and reenter key
   c. After exhausting the above approaches .... TSHE SERIES (p. 19 or Appendix I)

[1] See *Thuja plicata* Series narrative for discussion of *Tsuga heterophylla*-dominated stands in these THPL h.t.'s.

B. *Thuja plicata* Series; Key to Habitat Types

1. *Oplopanax horridum* well represented (≥5%) .... THPL/OPLOPANAX HORRIDUM h.t. (p. 27)
1. *O. horridum* poorly represented (<5%) 2

2. *Athyrium filix-femina* well represented (≥5%) or common (≥1%) if in combination with *Senecio triangularis, Trautvetteria caroliniensis, Streptopus amplexifolius,* and/or *Gymnocarpium dryopteris* .... THPL/ATHYRIUM FILIX-FEMINA h.t. (p. 28)
   a. *Adiantum pedatum* well represented (≥5%) .... -ADIANTUM PEDATUM phase
   b. *A. pedatum* poorly represented (<5%) .... -A. FILIX-FEMINA phase
2. *A. filix-femina* poorly represented (<5%) or not as above 3

3. *Adiantum pedatum* well represented (≥5%) .... THPL/ADIANTUM PEDATUM h.t. (p. 29)
3. *A. pedatum* poorly represented (<5%) 4

4. *Gymnocarpium dryopteris* common (≥1%) .... THPL/GYMNOCARPIUM DRYOPTERIS h.t. (p. 31)
4. *G. dryopteris* scarce (<1%) 5

5. *Asarum caudatum* present, not restricted to microsites or *Viola glabella* common (≥1%) .... THPL/ASARUM CAUDATUM h.t. (p. 32)
   a. *Menziesia ferruginea* well represented (≥5%) .... -MENZIESIA FERRUGINEA phase
   b. *M. ferruginea* poorly represented (<5%), *Taxus brevifolia* well represented (≥5%) .... -TAXUS BREVIFOLIA phase
   c. Not as above, *T. brevifolia* poorly represented (<5%) .... -ASARUM CAUDATUM phase
5. *A. caudatum* absent or restricted to microsites and *V. glabella* scarce (<1%) 6

Figure 3—(con.)

6. *Clintonia uniflora, Tiarella trifoliata,* or *Coptis occidentalis* present, not restricted to microsites .... THPL/CLINTONIA UNIFLORA h.t. (p. 34)
    a. *Menziesia ferruginea* well represented (≥5%) .... -MENZIESIA FERRUGINEA phase
    b. *M. ferruginea* poorly represented (<5%), *Taxus brevifolia* well represented (≥5%) .... -TAXUS BREVIFOLIA phase
    c. *T. brevifolia* poorly represented (<5%), *Xerophyllum tenax* well represented (≥5%) .... -XEROPHYLLUM TENAX phase
    d. Not as above .... -CLINTONIA UNIFLORA phase
6. *C. uniflora, T. trifoliata,* and *C. occidentalis* absent, then,
    a. Reevaluate choice of *Thuja plicata* as appropriate series, and
    b. Note that closed canopy successional stages may have exceedingly depauperate undergrowths; in these cases, examine the closest stand with similar site variables but having a canopy structure permitting undergrowth development and reenter key;
    c. A small percentage of THPL sites, usually on edaphically atypical sites, appear incapable of supporting the mesic undergrowth species enumerated above; exhausting the above choices designate stand as .... THPL SERIES (p. 26 or Appendix I)

C. *Tsuga mertensiana* Series; Key to Habitat Types

1. Sites supporting a variable combination of the following species, their single or combined coverages common (≥1%), *Streptopus amplexifolius, Senecio triangularis, Trautvetteria caroliniensis, Ligusticum canbyi, Mitella breweri,* or *M. pentandra* .... TSME/STREPTOPUS AMPLEXIFOLIUS h.t. (p. 37)
    a. *Luzula hitchcockii* or *Phyllodoce empetriformis* or their combined coverages common (≥1%) .... -LUZULA HITCHCOCKII phase
    b. Not as above .... -MENZIESIA FERRUGINEA phase
1. Not as above 2

2. *Clintonia uniflora* or *Tiarella trifoliata* present and not restricted to microsites, or *Coptis occidentalis* common (≥1%) .... TSME/CLINTONIA UNIFLORA h.t. (p. 38)
    a. *Menziesia ferruginea* well represented (≥5%) .... -MENZIESIA FERRUGINEA phase
    b. *M. ferruginea* poorly represented, *Xerophyllum tenax* common (≥1%) .... -XEROPHYLLUM TENAX phase
    c. *X. tenax* scarce (<1%) .... /C. UNIFLORA h.t. (p. 38)
2. *C. uniflora* and *T. trifoliata* absent, *C. occidentalis* scarce (<1%) 3

3. *Menziesia ferruginea* well represented (≥5%) .... TSME/MENZIESIA FERRUGINEA h.t. (p. 40)
    a. *Luzula hitchcockii* or *Phyllodoce empetriformis* or their combined coverages common (≥1%) .... -LUZULA HITCHCOCKII phase
    b. Not as above, *Xerophyllum tenax* common (≥1%) .... -XEROPHYLLUM TENAX phase
    c. *X. tenax* scarce (<1%) .... /M. FERRUGINEA h.t. (p. 40)
3. *M. ferruginea* poorly represented (<5%) 4

4. *Xerophyllum tenax* common (≥1%) .... TSME/XEROPHYLLUM TENAX h.t. (p. 43)
    a. *Luzula hitchcockii* or *Phyllodoce empetriformis* or their combined coverages common (≥1%) .... -LUZULA HITCHCOCKII phase
    b. Not as above, *Vaccinium scoparium* (*V. myrtillus*) well represented (≥5%) .... -VACCINIUM SCOPARIUM phase
    c. Not as above, *V. scoparium* (*V. myrtillus*) poorly represented (<5%) .... -VACCINIUM GLOBULARE phase
4. *X. tenax* scarce (<1%) 5

5. *Luzula hitchcockii* common (≥1%) .... TSME/LUZULA HITCHCOCKII h.t. (p. 44)
5. *L. hitchcockii* scarce (<1%) .... TSME SERIES (p. 36)

D. *Abies lasiocarpa* Series; Key to Habitat Types

1. *Calamagrostis canadensis* or *Ledum glandulosum* well represented (≥5%) .... ABLA/CALAMAGROSTIS CANADENSIS h.t. (p. 46)
    a. *Ledum glandulosum* well represented (≥5%) .... -LEDUM GLANDULOSUM phase
    b. Not as above, *Vaccinium caespitosum* common (≥1%) .... -VACCINIUM CAESPITOSUM phase
    c. Not as above, *Ligusticum canbyi* or *Trautvetteria caroliniensis* common (≥1%) .... -LIGUSTICUM CANBYI phase
    d. Not as above, *C. canadensis* undergrowth dominant .... -CALAMAGROSTIS CANADENSIS phase
1. *C. canadensis* and *L. glandulosum* poorly represented (<5%) 2

2. *Streptopus amplexifolius, Senecio triangularis, Ligusticum canbyi, Mitella breweri, M. pentandra, Gymnocarpium dryopteris,* or *Trautvetteria caroliniensis* singly, or in combination of two or more, common (≥1%) .... ABLA/STREPTOPUS AMPLEXIFOLIUS h.t. (p. 48)
    a. *Menziesia ferruginea* well represented (≥5%) .... -MENZIESIA FERRUGINEA phase
    b. *M. ferruginea* poorly represented (<5%) .... -LIGUSTICUM CANBYI phase
2. Not as above 3

3. *Clintonia uniflora* present, not restricted to microsites .... ABLA/CLINTONIA UNIFLORA h.t. (p. 50)
    a. *Menziesia ferruginea* or *Rhododendron albiflorum* well represented (≥5%) .... -MENZIESIA FERRUGINEA phase
    b. *M. ferruginea* and *R. albiflorum* poorly represented (<5%), *Xerophyllum tenax* common (≥1%) .... -XEROPHYLLUM TENAX phase
    c. *X. tenax* scarce (<1%) .... -CLINTONIA UNIFLORA phase
3. *C. uniflora* absent or restricted to microsites 4

4. *Menziesia ferruginea* or *Rhododendron albiflorum* well represented (≥5%) .... ABLA/MENZIESIA FERRUGINEA h.t. (p. 52)
    a. *Luzula hitchcockii* common (≥1%) .... -LUZULA HITCHCOCKII phase
    b. *L. hitchcockii* scarce (<1%), *Vaccinium scoparium* (*V. myrtillus*) common (≥1%) .... -VACCINIUM SCOPARIUM phase
    c. Not as above, *Coptis occidentalis* common (≥1%) .... -COPTIS OCCIDENTALIS phase
    d. *C. occidentalis* scarce (<1%), *Xerophyllum tenax* common (≥1%) .... -XEROPHYLLUM TENAX phase
    e. *X. tenax* scarce (<1%) .... /M. FERRUGINEA h.t. (p. 52)
4. *M. ferruginea* and *R. albiflorum* poorly represented (<5%) 5

Figure 3—(con.)

5. *Vaccinium caespitosum* common (≥1%) .... ABLA/VACCINIUM CAESPITOSUM h.t. (p. 54)
5. *V. caespitosum* scarce (<1%) 6

6. *Xerophyllum tenax* common (≥1%) .... ABLA/XEROPHYLLUM TENAX h.t. (p. 55)
a. *Luzula hitchcockii* common (≥1%) .... -LUZULA HITCHCOCKII phase
b. *L. hitchcockii* scarce (<1%), *Vaccinium scoparium* (*V. myrtillus*) well represented (≥5%) .... -VACCINIUM SCOPARIUM phase
c. Not as above, *Coptis occidentalis* present, not restricted to microsites .... -COPTIS OCCIDENTALIS phase
d. Not as above, *Vaccinium globulare* common (≥1%) .... -VACCINIUM GLOBULARE phase
e. Not as above .... /X. TENAX h.t. (p. 55)
6. *X. tenax* scarce (<1%) 7

7. *Luzula hitchcockii* common (≥1%) .... ABLA/LUZULA HITCHCOCKII h.t. (p. 57)
7. *L. hitchcockii* scarce (<1%) 8

8. *Vaccinium globulare* well represented (≥5%) .... ABLA/VACCINIUM GLOBULARE h.t. (see Pfister and others (1977))
8. *V. globulare* poorly represented (<5%) 9

9. *Vaccinium scoparium* (*V. myrtillus*) well represented (≥5%) .... ABLA/VACCINIUM SCOPARIUM h.t. (p. 57)
9. *V. scoparium* (*V. myrtillus*) poorly represented (<5%) 10

10. *Calamagrostis rubescens* well represented (≥5%) .... ABLA/CALAMAGROSTIS RUBESCENS h.t. (see Pfister and others (1977))
10. *C. rubescens* poorly represented (<5%) 11

11. *Larix lyallii* present .... LARIX LYALLII-ABIES LASIOCARPA communities (p. 58)
11. *L. lyallii* absent, *Pinus albicaulis* well represented (≥5%) .... PINUS ALBICAULIS-ABIES LASIOCARPA communities (p. 58)

E. *Abies grandis* Series; Key to Habitat Types

1. Sites supporting any of the following wet-site species well represented (≥5%) or a variable combination of at least two species, whose single or combined coverages are common (≥1%), *Senecio triangularis, Streptopus amplexifolius, Ligusticum canbyi, Trautvetteria caroliniensis*, or *Athyrium filix-femina* .... ABGR/SENECIO TRIANGULARIS h.t. (p. 60)
1. Not as above, not characterized by combination of wet-site species cited above 2

2. *Asarum caudatum* present, not restricted to microsites .... ABGR/ASARUM CAUDATUM h.t. (p. 61)
a. *Menziesia ferruginea* well represented (≥5%) .... -MENZIESIA FERRUGINEA phase
b. *M. ferruginea* poorly represented (<5%), *Taxus brevifolia* well represented (≥5%) .... -TAXUS BREVIFOLIA phase
c. Not as above, *T. brevifolia* poorly represented (<5%) .... -ASARUM CAUDATUM phase
2. *A. caudatum* absent or restricted to microsites 3

3. *Clintonia uniflora* or *Tiarella trifoliata* present, not restricted to microsites .... ABGR/CLINTONIA UNIFLORA h.t. (p. 63)
a. *Menziesia ferruginea* well represented (≥5%) .... -MENZIESIA FERRUGINEA phase
b. *M. ferruginea* poorly represented (<5%), *Taxus brevifolia* well represented (≥5%) .... -TAXUS BREVIFOLIA phase
c. Not as above, *Xerophyllum tenax* common (≥1%) .... -XEROPHYLLUM TENAX phase
d. *X. tenax* scarce (<1%): *Physocarpus malvaceus* or *Holodiscus discolor* well represented (≥5%) .... -PHYSOCARPUS MALVACEUS phase
e. Not as above, *P. malvaceus* and *H. discolor* poorly represented (<5%) .... -CLINTONIA UNIFLORA phase
3. *C. uniflora* and *T. trifoliata* absent; or restricted to microsites 4

4. *Linnaea borealis* common (≥1%) .... ABGR/LINNAEA BOREALIS h.t. (p. 68)
a. *Xerophyllum tenax* common (≥1%) .... -XEROPHYLLUM TENAX phase
b. *X. tenax* scarce(<1%) .... -LINNAEA BOREALIS phase
4. *L. borealis* scarce (<1%) 5

5. *Xerophyllum tenax* well represented (≥5%) .... ABGR/XEROPHYLLUM TENAX h.t. (p. 69)
a. *Coptis occidentalis* common (≥1%) .... -COPTIS OCCIDENTALIS phase
b. *C. occidentalis* scarce (<1%), *Vaccinium globulare* common (≥1%) .... - VACCINIUM GLOBULARE phase
c. *Vaccinium globulare* scarce (<1%) .... /X. TENAX h.t. (p. 69)
5. *X. tenax* poorly represented (<5%) 6

6. *Vaccinium gobulare* well represented (≥5%) .... ABGR/VACCINIUM GLOBULARE h.t. (p. 71)
6. *V. globulare* poorly represented (<5%) 7

7. *Physocarpus malvaceus* or *Holodiscus discolor* or their combined coverages well represented (≥5%) .... ABGR/PHYSOCARPUS MALVACEUS h.t. (p. 71)
a. *Coptis occidentalis* common (≥1%) .... -COPTIS OCCIDENTALIS phase
b. *C. occidentalis* scarce (<1%) .... -PHYSOCARPUS MALVACEUS phase
7. *P. malvaceus* and *H. discolor* or their combined coverage poorly represented (<5%) 8

8. *Spiraea betulifolia* or *Symphoricarpos albus* well represented (≥5%) .... ABGR/SPIRAEA BETULIFOLIA h.t. (p. 72)
8. *S. betulifolia* and *S. albus* poorly represented (<5%) .... ABGR SERIES (p. 59 or Appendix I)

F. *Pseudotsuga menziesii* Series; Key to Habitat Types

1. *Physocarpus malvaceus, Holodiscus discolor* or their combined coverages well represented (≥5%) .... PSME/PHYSOCARPUS MALVACEUS h.t. (p. 73)
a. *Disporum hookeri* or *Smilacina stellata* present; or *Larix occidentalis* or *Galium triflorum* common (≥1%) .... -SMILACINA STELLATA phase
b. Not as above .... -PHYSOCARPUS MALVACEUS phase
1. *P. malvaceus* and *H. discolor* singly or combined coverages, poorly represented (<5%) 2

Figure 3—(con.)

2. *Vaccinium caespitosum* present, not restricted to microsites; *Arctostaphylos uva-ursi* common (≥1%) ... PSME/VACCINIUM CAESPITOSUM h.t. (p. 75)
2. *V. caespitosum* absent and/or *A. uva-ursi* scarce (<1%) ... 3

3. *Xerophyllum tenax* or *Vaccinium globulare* well represented (≥5%) ... PSME/VACCINIUM GLOBULARE h.t. (p. 75)
3. *X. tenax or V. globulare* poorly represented (<5%) ... 4

4. *Symphoricarpos albus* well represented (≥5%) ... PSME/SYMPHORICARPOS ALBUS h.t. (p. 75)
4. *S. albus* poorly represented (<5%) ... 5

5. *Spiraea betulifolia* well represented (≥5%) ... PSME/SPIRAEA BETULIFOLIA h.t. (p. 76)
5. *S. betulifolia* poorly represented (<5%) ... 6

6. *Calamagrostis rubescens* singly or in combination with *Arctostaphylos uva-ursi* well represented (≥5%) ... PSME/CALAMAGROSTIS RUBESCENS h.t. (p. 76)
   a. *A. uva-ursi* present, not restricted to microsites ... -ARCTOSTAPHYLOS UVA-URSI phase
   b. *A. uva-ursi* absent ... -CALAMAGROSTIS RUBESCENS phase
6. *C. rubescens* and *A. uva-ursi*, singly or combined, poorly represented (<5%) ... 7

7. *Carex gereyi* well represented (≥5%) ... PSME/CAREX GEYERI h.t. (p. 76)
7. *C. gereyi* poorly represented (<5%) ... 8

8. *Festuca idahoensis* well represented (≥5%) ... PSME/FESTUCA IDAHOENSIS h.t. (p. 76)
8. *F. idahoensis* poorly represented (<5%) ... 9

9. *Agropyron spicatum* well represented (≥5%) ... PSME/AGROPYRON SPICATUM h.t. (p. 77)
9. *A. spicatum* poorly represented (<5%) ... PSME SERIES (p. 72 or Appendix I)

G. *Pinus contorta* Series; Key to Habitat and Community Types

For identification of plant communities in which tree species other than *Pinus contorta* are a minor component; *P. contorta* need not appear to be self-reproducing. See indicated h.t. key for phase level identifiication.

1. *Calamagrostis canadensis* or *Ledum glandulosum* well represented (≥5%) ... ABLA/CALAMAGROSTIS CANADENSIS h.t. (p. 46)
1. *C. canadensis* or *L. glandulosum* poorly represented (<5%) ... 2

2. *Streptopus amplexifolius, Senecio triangularis, Ligusticum canbyi, Mitella pentandra, Gymnocarpium dryopteris,* or *Trautvetteria caroliniensis,* singly or in combinations, common (≥1%) ... ABLA/STREPTOPUS AMPLEXIFOLIUS h.t. (p. 37)
2. The above cited species, singly or in combinations, scarce (<1%) ... 3

3. *Asarum caudatum, Clintonia uniflora, Tiarella trifoliata,* or *Coptis occidentalis* present, or *Linnaea borealis* common (≥1%) ... See a.- e.
   a. Within *Tsuga heterophylla* zone[1] ... TSHE/ASARUM CAUDATUM or CLINTONIA UNIFLORA h.t.'s (pages 21, 23, 32, 34)
   b. Within *Thuja plicata* zone ... THPL/as above
   c. Within *Abies grandis* zone ... ABGR/as above, or LINNAEA BOREALIS h.t. (pages 61, 63, 68)
   d. Within *Tsuga mertensiana* zone ... TSME/CLINTONIA UNIFLORA h.t. (p. 38)
   e. Within *Abies lasiocarpa* zone ... ABLA/CLINTONIA UNIFLORA h.t. (p. 50)
3. *A. caudatum, C. uniflora, T. trifoliata,* or *C. occldentalis* absent; or *L. borealis* scarce (<1%) ... 4

4. *Xerophyllum tenax* common (≥1%), or *Menziesia ferruginea* well represented (≥5%) ... See a.- e.
   a. Within the *T. heterophylla* zone ... TSHE/MENZIESIA FERRUGINEA h.t. (p. 26)
   b. Within the *T. mertensiana* zone ... TSME/XEROPHYLLUM TENAX or MENZIESIA FERRUGINEA h.t.'s (p. 43 & 40)
   c. Within the *A. grandis* zone ... ABGR/XEROPHYLLUM TENAX h.t. (p. 69)
   d. Within the *A. lasiocarpa* zone ... See (1)
      (1) *M. ferruginea* well represented (≥5%) ... ABLA/MENZIESIA FERRUGINEA h.t. (p. 52)
      (1) *M. ferruginea* poorly represented (<5%) ... See (2)
      (2) *A. lasiocarpa* or *Picea engelmannii* regeneration, if present, not severely stunted, *Vaccinium globulare* well represented (≥5%), soils[2] deeper than 12 inches (30 cm) ... ABLA/XEROPHYLLUM TENAX h.t. (p. 55)
      (2) *A. lasiocarpa* and *P. engelmannii* regeneration, if present, severely stunted, *V. globulare* poorly represented (<5%), *V. scoparium* well represented (≥5%) and soils[2] shallower than 12 inches (30 cm) and very well drained ... PICO/VACCINIUM SCOPARIUM h.t. (p. 79)
   e. *Pinus contorta* the only reproducing tree species for extensive areas ... See (1)
      (1) *Vaccinium caespitosum* common (≥1%) ... PICO/VACCINIUM CAESPITOSUM c.t. (p. 79)
      (1) *V. caespitosum* scarce (<1%) ... See (2)
      (2) *Vaccinium globulare* well represented (≥5%), soils[2] deeper than 12 inches (30 cm) ... PICO/XEROPHYLLUM TENAX c.t. (p. 79)
      (2) *V. globulare* poorly represented (<5%), soils[2] shallower than 12 inches (30 cm) ... PICO/VACCINIUM SCOPARIUM h.t. (p. 79)
4. *X. tenax* scarce (<1%) or *M. ferruginea* poorly represented (<5%) ... 5

5. Within the *Abies grandis* zone ... ABGR SERIES, couplet 4
5. Not within the *A. grandis* zone, but rather *A. lasiocarpa* zone ... 6

Figure 3—(con.)

6. *Abies lasiocarpa* or *Picea engelmannii* regeneration, if present, not severely stunted, *Vaccinium globulare* or *Calamagrostis rubescens* well represented (≥5%), and soils[2] deeper than 12 inches (30 cm) .... ABLA SERIES, couplet 8
6. *A. lasiocarpa* and *P. engelmannii* regeneration, if present, severely stunted, *V. globulare* and *C. rubescens* poorly represented (<5%); soils[2] shallower than 12 inches (30 cm) and well drained .... See lead 4.e. above

[1] Zone = area potentially occupied by a given climax tree species on locally normal soils and topography, and no evidence that tree's presence is dependent on recurrent disturbance.

[2] Soil depths = the depth from top of mineral soil surface (A and B horizons) to the top of weathered parent material (C horizon) or bedrock (R horizon), whichever is least. Depth should be sampled on an average topographic position for the site, and more than once if questions remain.

H. *Pinus ponderosa* Series; Key to Habitat Types

1. *Physocarpus malvaceus* or *Holodiscus discolor* or their combined coverages well represented (≥5%) .... PIPO/PHYSOCARPUS MALVACEUS h.t. (p. 87)
1. *P. malvaceus* and *H. discolor* poorly represented (<5%) 2

    2. *Symphoricarpos albus* or *Berberis repens* or their combined coverages well represented (≥5%) .... PIPO/SYMPHORICARPOS ALBUS h.t. (p. 81)
    2. *S. albus* and *B. repens* poorly represented (<5%) 3

3. *Festuca idahoensis* well represented (≥5%) .... PIPO/FESTUCA IDAHOENSIS h.t. (p. 82)
3. *F. idahoensis* poorly represented (<5%) 4

    4. *Agropyron spicatum* well represented (≥5%) .... PIPO/AGROPYRON SPICATUM h.t. (p. 83)
    4. *A. spicatum* poorly represented (<5%) .... PIPO SERIES (p. 80)

Figure 3—(con.)

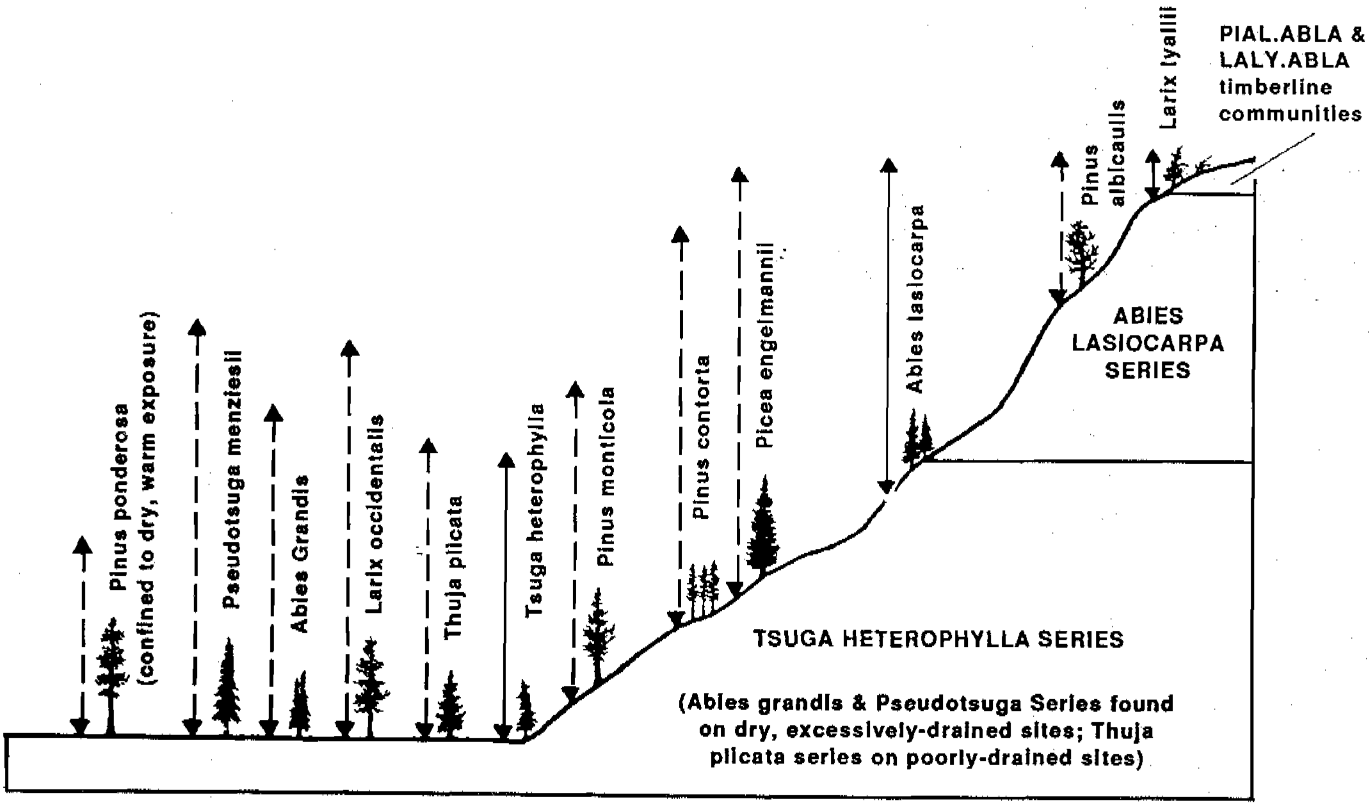


Figure 4—Generalized distribution of forest tree species in northernmost Idaho.

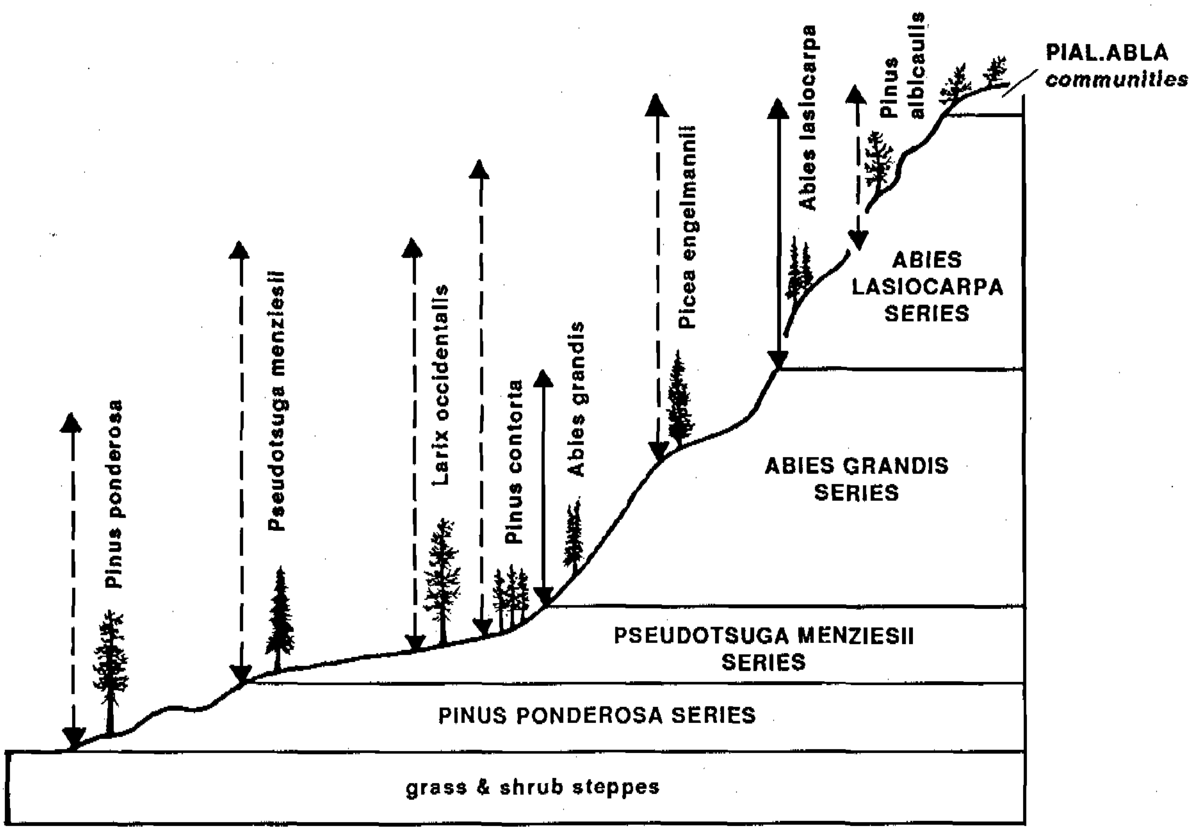


Figure 5—Generalized distribution of forest tree species on the west-central portion of the Nez Perce NF.

Tsuga heterophylla (TSHE) Series

Distribution—Of the climax tree species occurring in northern Idaho, *Tsuga heterophylla* is the most shade tolerant, least frost hardy, and has been ranked second to *T. mertensiana* for intolerance to drought and second to *Pseudotsuga menziesii* for intolerance to excess moisture (Minore 1979). Due to its restricted ecologic amplitude, plant communities dominated by *Tsuga* occupy the moist, moderate temperature sites within the maritime-influenced climatic zone of the Northern Rocky Mountains. Nevertheless, communities occur extensively, the Idaho Panhandle National Forests (St. Joe, Coeur d'Alene, and Kaniksu) being their center of importance. Their southern extension abruptly ends at the North Fork Clearwater River drainage. The easternmost limit of this series is the McDonald Lake drainage in Glacier National Park (Habeck 1968), while westward it extends (considering only interior populations) to the Columbia River drainage in northeastern Washington (Daubenmire and Daubenmire 1968; Williams and Lillybridge 1984).

Tsuga heterophylla can be found as the climax-dominant tree from 2,500 to 5,500 ft (760 to 1,680 m) in elevation, its occurrence increasing in elevation along a north-to-south transect. It occurs in areas having greater than 30 inches (76 cm) mean annual precipitation and greater than 8 inches (20 cm) average warm-season precipitation (Ross and Savage 1967). It can dominate sites of all exposures, landform, and position except wet bottomlands where it is replaced by or codominant with *Thuja plicata*. At the lower elevational boundary of this series, *Tsuga* is replaced by *Thuja* on both wetter and drier sites. *Thuja*, compared to *Tsuga*, appears to be more tolerant of short drought periods in the summer and excessive soil moisture, while also being better adapted to warmer temperatures (Minore 1979). At the upper elevational limits, *T. heterophylla* is replaced by either *T. mertensiana* or *Abies lasiocarpa;* this shift in species dominance appears to be a function of low summer temperature (Daubenmire and Daubenmire 1968), but is probably also related to mean annual and mean summer precipitation.

Vegetation—All endemic tree species except *Pinus ponderosa*, *Larix lyallii*, *Pinus albicaulis*, and *Tsuga mertensiana* act as major seral species within this series. Some of these species are very long-lived and codominate sites for extended periods of time. Daubenmire and Daubenmire (1968) mention relict *Pinus monticola* 450 years of age in *Tsuga* stands. Areas on the Priest Lake Ranger District currently support *Thuja* as a codominant, with estimated stand ages in excess of 2,000 years (Parker 1979). This long-term, late seral condition has led to formal classifications of *Thuja-Tsuga* types and widespread common usage of the name "cedar-hemlock forest." Because of the exceptionally long duration of these successional stages and the lack of data showing a true *Tsuga* dominance on excessively wet areas (sites with well-represented coverages of *Oplopanax horridum, Athyrium filix-femina,* and/or *Adiantum pedatum),* these sites have been placed in the *Thuja* series. Only sites potentially dominated by *Tsuga,* the better drained upland environments, are described in this section.

The undergrowth in this series is characterized by species with an affinity for the Pacific Maritime climatic regime. All *Tsuga* sites support members of what Daubenmire (1952) termed the *Pachistima myrsinites* union. Daubenmire and Daubenmire (1968) stated "analysis of the data representing 19 old virgin stands. . . reveals no significant floristic gradients." Our much larger data set, 152 stands, including 11 of the Daubenmires' original stands, shows species compositional groups indicative of significant differences relating to site productivities and response to management. The understory vegetation has four major communities corresponding to a moisture gradient, the wettest group being those already discussed as members of the *Tsuga-Thuja* complex (OPHO, ATFI, and ADPE). The driest group we have classified as the *Clintonia uniflora* h.t., roughly equivalent to the Daubenmires' *Pachistima* h.t. Two intermediate groups characterized by the presence of *Asarum caudatum* and *Gymnocarpium dryopteris* occupy a transition regime of increasing moisture.

Old-growth stands of this series have an open and occasionally almost parklike nature, with 75 to 95 percent canopy closure, large-diameter (30- to 50-inch [76- to 127-cm] d.b.h.) trees, and two-storied to multistoried stand structure. Early to midseral stands are quite the opposite. Canopy closure is complete to the extent that very little light reaches the forest floor. Occupancy of the site by trees can exclude all but the most shade tolerant of understory species, creating very sparse shrub and herbaceous layers. Classification of sites such as these will require inspection of adjacent more open stands having similar environmental characteristics (slope, aspect, soils, landform, etc.).

Productivity/Management—The *Tsuga heterophylla* and *Thuja plicata* series occupy the most productive habitats in northern Idaho. Comparing the two, we find the following tree species to have slightly higher site indexes when growing in the *Tsuga* zone: *Abies grandis, A. lasiocarpa, Larix occidentalis, P. contorta, P. monticola, T. heterophylla.* Within this series natural regeneration 20 years following various silvicultural treatments is usually significant in quantity (Boyd 1969). Any disturbance in existing stands can result in tremendous *Tsuga* regeneration (Graham 1982). *Abies grandis, P. monticola,* and *T. heterophylla* are the major components of these naturally regenerated sites. Some attempts at *Pinus ponderosa* plantations in this series have been failures (Daubenmire 1961). Use of *P. ponderosa* in a planting mixture should be successful on the warmest, driest sites of this series; there are tentative indications though that the seed source should come from the *Tsuga* series (Rehfeldt 1983).

Natural regeneration should be successful if adequate seed is available. Ferguson and others (1986) have developed a regeneration model as a submodel to Stage's (1973) Prognosis Model; their model uses the silvical characteristics of Northern Rocky Mountain conifer species and site data stratified by habitat type and treatment to predict regeneration success.

Tsuga heterophylla/Gymnocarpium dryopteris h.t. (TSHE/GYDR; western hemlock/oak fern)

Distribution—TSHE/GYDR is widespread in the Coeur d'Alene NF and northward, but is also found sporadically as far south as Moscow. It occurs at elevations ranging from 2,500 to 4,500 ft (760 to 1,370 m) on moderate slopes or benches on the lower third of slopes. This h.t. is generally not found on southerly aspects.

Vegetation—*Tsuga* dominates the site in late seral to climax stages. This is the wettest h.t. in the *Tsuga* series. *Thuja* was found as a mid to late-seral species in half of our stands; it persists with much reduced numbers in climax stands. *Abies grandis, Pinus monticola,* and *Picea engelmannii* are the other major seral species, with *Larix occidentalis* and *Abies lasiocarpa* represented by scattered individuals in many mature stands.

The undergrowth is characterized by a rich mixture of shrubs and forbs requiring moderate temperatures and abundant moisture. In addition to *Gymnocarpium dryopteris* being common, many sites support *Clintonia uniflora, Coptis occidentalis, Asarum caudatum, Disporum hookeri, Smilacina stellata, Tiarella trifoliata, Trillium ovatum,* and *Viola orbiculata,* with most sites also supporting a low coverage of *Athyrium filix-femina* (fig. 6). *Lonicera utahensis, Pachistima myrsinites,* and *Linnaea borealis* are common shrub species in this h.t., with *Menziesia ferruginea, Vaccinium globulare,* and *Taxus brevifolia* often present in low amounts.

Soils—Parent materials are mostly ash over quartzite, but also include siltite, metasediments, and glacial till. Textures are predominantly loams or sandy loams, with 30 to 50 percent gravel. Total soil depth ranges between 15 and 28 inches (40 and 70 cm), and pH ranges between 4.9 and 6.0. Bare soil and rock usually do not occur on these sites. Average litter depth is 2 inches (5 cm).

Productivity/Management—High site indexes and basal areas indicate high timber productivity. *Abies grandis, L. occidentalis, T. plicata,* and *P. engelmannii* achieve some of their highest site indexes in this h.t. (appendix F). *Pinus monticola* does well here, but better growth is achieved on slightly drier sites. Short-rotation, even-aged management of *L. occidentalis, P. engelmannii,* and/or *P. monticola* is currently the preferred management regime. The soils remain moist throughout the year; logging operations should be scheduled such that desirable soil characteristics are not unduly modified. Mature stands within this type have a high percentage of the trees with extensive heartrot (for example, *Echinodontium tinctorum, Fomes pini,* and *Polyporus tomentosus).* Windthrow and root rot pockets give the mature stand a rather open character. Forage production for big game is good during early seral stages, poor during the closed canopy mid- to late-seral stages, and fair in mature stands.

Other Studies—This h.t. has not been previously described. TSHE/GYDR is equivalent to the wettest sites described as the *Tsuga / Pachistima myrsinites* h.t. by Daubenmire and Daubenmire (1968); five of their sample plots in northern Idaho are used in this data set. Pfister and others (1977) describe an environment similar to this h.t. as a portion of THPL/CLUN-ARNU in northwestern Montana.

Figure 6—*Tsuga heterophylla/Gymnocarpium dryopteris* h.t. on a toeslope, covelike position (3,200 ft [975 m]) just east of the Magee Work Center, Coeur d'Alene NF. A 90-year-old stand dominated by *T. heterophylla* with a mix of seral tree species. Abundant coverage of *G. dryopteris* is obscured by the rank growth of larger herbs including *Trautvetteria caroliniensis, Tiarella trifoliata, Smilacina stellata, Coptis occidentalis,* and scattered *Athyrium filix-femina.*

Tsuga heterophylla/Asarum caudatum h.t. (TSHE/ASCA; western hemlock/wild ginger)

Distribution—TSHE/ASCA is a broadly distributed h.t. that increases in occurrence from the St. Joe NF northward to the Canadian border. If temperature and soil moisture are adequate, TSHE/ASCA can occupy any landform or slope position at elevations ranging from 2,200 to 5,000 ft (670 to 1,520 m). Two of the phases delineated are related to distinctive topographic, aspect, and elevational factors. At the dry extreme of this h.t., it merges with TSHE/CLUN and occasionally THPL/CLUN, while on more moist sites it grades to TSHE/GYDR or one of the *Tsuga-Thuja* codominant fern h.t.'s. In an ordination of h.t.'s of northern Idaho based on a multidimensional environmental gradient of precipitation, temperature, soil moisture, and numerous other site factors, TSHE/ASCA is the most centrally located h.t. along any of the gradients.

Vegetation—All conifer species of northern Idaho, except *Larix lyallii, Pinus albicaulis,* and *Tsuga mertensiana,* can occur in this h.t. The dominant successional species are *Abies grandis, Larix occidentalis, Thuja plicata, Pinus monticola,* and *Pseudotsuga menziesii. Thuja plicata* is often a minor component in climax (old-growth) stands. *Pinus contorta* locally constitutes an important seral species forming nearly pure stands. Early to midsuccessional stands often have seven or eight conifer species represented. The shrub and herbaceous layers are just as diverse, with an average of eight shrub species and 15 to 20 herbaceous species present on all but the most closed-canopy late successional stands. The presence of *Asarum caudatum* throughout the stand is diagnostic of the h.t. High constancy of *Clintonia uniflora, Coptis occidentalis, Disporum hookeri, Adenocaulon bicolor,* and *Tiarella trifoliata* is also characteristic of this type. The shrub species *Linnaea borealis, Lonicera utahensis, Pachistima myrsinites, Rosa gymnocarpa,* and *Vaccinium globulare* also exhibit high constancy in TSHE/ASCA.

Aralia nudicaulis (ARNU) phase—The ARNU phase is found on sites north of the Coeur d'Alene River. It generally occurs below 3,000 ft (910 m), on bottomlands, toeslopes, or the first bench above a wet bottom. This is the warmest, most moist phase of the TSHE/ASCA h.t.

The ARNU phase is characterized by the presence of *Aralia nudicaulis* throughout the stand (fig. 7). *Athyrium filix-femina* and *Gymnocarpium dryopteris* are usually present, but generally not exceeding trace amounts. In addition to the understory species listed above as common to this h.t., this phase shows increased constancy for *Acer glabrum*, *Chimaphila umbellata*, and *Goodyera oblongifolia*, and a reduced occurrence of *Coptis occidentalis*. *Thuja plicata* is the major seral species, often remaining as a climax codominant due to the mosaic of wet microsites that abound in these stands. Adjacent upslope h.t.'s are generally TSHE/ASCA-ASCA, and downslope on wetter sites, TSHE/GYDR or THPL/ATFI.

Menziesia ferruginea (MEFE) phase—The MEFE phase occurs throughout the range of TSHE/ASCA at elevations above 3,500 ft (1,070 m) and generally on northwest to northeast aspects. This phase occupies the cold, moist portion of TSHE/ASCA. With a shift to drier, more southerly aspects, *M. ferruginea* decreases in coverage and *Xerophyllum tenax* increases. Major seral trees in the MEFE phase are *Abies lasiocarpa* and *Picea engelmannii*. In addition to the characteristically dominant *M. ferruginea* and *Vaccinium globulare* shrub layer, *Arnica latifolia* and *X. tenax* are common herbaceous species.

Asarum caudatum (ASCA) phase—The ASCA phase is commonly distributed from the St. Joe NF to the south end of Priest Lake (occurring only sporadically northward), at elevations between 2,200 and 4,500 ft (670 and 1,370 m). It occurs on all aspects, landforms, and slopes but is more prevalent on warm exposures. Major seral trees are *Abies grandis*, *Larix occidentalis*, *Pinus monticola*, and *Pseudotsuga menziesii*, with *Thuja plicata* often being a late seral codominant. The shrub and herbaceous layers are rich in species as described above for the h.t. The ASCA phase of TSHE/ASCA usually is located adjacent to TSHE/CLUN-CLUN or THPL/ASCA h.t. on drier sites, and grades into TSHE/GYDR or TSHE/ASCA-ARNU on more moist sites.

Soils—Parent materials are quartzite, sandstone, siltite, and metasediments, with an ash cap or mantle of mixed loess and volcanic material. The predominant textural classes are loam to silty-loam and occasionally clay-loam. Gravel content ranges from 30 to 60 percent in the ARNU and MEFE phases, only 10 percent being normal for the ASCA phase. Total soil depth ranges between 12 and 26 inches (30 and 65 cm), and average pH varies widely, from 4.5 to 6.7. Bare soil and rock usually do not occur; litter depth averages 1.5 inches (4 cm).

Figure 7—*Tsuga heterophylla/Asarum caudatum* h.t.-*Aralia nudicaulis* phase on a stream terrace (2,500 ft [760 m]) above Lightning Creek, north of Clark Fork, ID. Dominated by even-aged *Betula papyrifera*, *Larix occidentalis*, and *Pseudotsuga menziesii*, the stand is decidedly uneven-aged due to the continuous ingrowth of *Thuja plicata*, *Abies grandis*, and comparatively recently, *T. heterophylla*. Seventeen shrub species are present, none in more than trace amounts. The rich herbaceous layer is dominated by *Smilacina stellata*, *A. caudatum*, *Adenocaulon bicolor*, and *A. nudicaulis* (noted in left foreground by its distinctive horizontally oriented leaflets).

Productivity/Management—Of the extensively occurring h.t.'s in northern Idaho, TSHE/ASCA is the most productive (appendix F). Excellent height growth is achieved by *P. menziesii, L. occidentalis, P. monticola,* and *A. grandis* on this h.t. Any natural or artificial regeneration treatment should be successful; the main problem is the potential for overstocked stands. Shelterwood or selection treatments will favor regeneration of *A. grandis, T. plicata, T. heterophylla, P. engelmannii,* and/or *A. lasiocarpa.*

Inherent high productivity of these sites can lead to heavy shrub competition, particularly if shrub establishment is allowed to precede tree regeneration by a year or two. Seasonally wet soils in the ARNU phase are subject to compaction during most of the year. Large herbivores and rodents may do extensive damage during early stages of regeneration. Stands with high coverages of shrubs, particularly *Taxus brevifolia* and *Vaccinium globulare,* may provide significant moose, elk, and grizzly bear habitat.

Other Studies—This h.t. has not been previously described. TSHE/ASCA was included as a portion of the *Tsuga / Pachistima myrsinites* h.t. of Daubenmire and Daubenmire (1968). In northern Idaho this type appears to be restricted to the central portion of the Inland Pacific Maritime climatic influence; however, analogous communities undoubtedly occur west of the Cascades in Oregon and Washington.

Tsuga heterophylla/Clintonia uniflora h.t. (TSHE/CLUN; western hemlock/queencup beadlily)

Distribution—Of the *Tsuga* h.t.'s in northern Idaho, TSHE/CLUN is the most widely distributed. It can be found from the Canadian border to the North Fork Clearwater River drainage. Its elevational range is from 2,500 to 5,200 ft (760 to 1,580 m), with all aspects, slopes, and landforms being represented. TSHE/CLUN is the driest environment capable of supporting *Tsuga.* Slightly drier sites constitute THPL/CLUN, ABGR/CLUN, or ABLA/CLUN h.t.'s, while on more moist sites TSHE/CLUN may merge with TSHE/ASCA or THPL/ASCA h.t.'s.

Vegetation—Seral species that may dominate early successional stages are *Pseudotsuga menziesii, Larix occidentalis, Pinus monticola,* and *Pinus contorta.* Species found as codominants in mid- to late-seral stands and occasional individuals in old-growth stands are *Abies grandis, Abies lasiocarpa, Picea engelmannii,* and *Thuja plicata.* In successional stands of the *Tsuga* series, great care must be taken when determining the most tolerant, successfully reproducing tree species, because nearly all northern Idaho species, including *Pinus ponderosa,* may be present.

TSHE/CLUN shrub and herbaceous layers are species rich. Most sites have a high coverage of *Lonicera utahensis, Pachistima myrsinites, Rosa gymnocarpa, Linnaea borealis,* and *Vaccinium globulare. Clintonia uniflora* and *Tiarella trifoliata* are diagnostic for the h.t. and are joined by other high-constancy herbs such as *Disporum hookeri, Goodyera oblongifolia, Smilacina stellata,* and *Viola orbiculata.*

Mid- to late-seral stands of the TSHE/CLUN h.t. usually have extremely dense overstory canopies. This leads to a much-reduced light and moisture regime on the forest floor. Consequently, the herbaceous layer is sparse, sometimes to the apparent exclusion of any undergrowth vegetation. This condition will persist until the stand is opened by either natural or human-caused disturbance. Determination of h.t. for these stands requires careful investigation of what little understory vegetation may be present, and examining adjacent more open stands, or root rot pocket openings.

Aralia nudicaulis (ARNU) phase—The ARNU phase is found north of Coeur d'Alene, its major occurrence in northern Idaho being centered north and west of the Purcell Trench. It is restricted to elevations below 3,400 ft (1,040 m), flat to moderate slopes, and generally to toe-slopes, lower side slopes, or benches above a wet bottom area. This is the warmest, and generally most moist phase of the TSHE/CLUN h.t.

The ARNU phase is characterized by the presence of *Aralia nudicaulis* scattered throughout the stand. Other commonly associated species besides *C. uniflora* and *Tiarella trifoliata* are *Cornus canadensis, L. borealis,* and *R. gymnocarpa. Thuja plicata* and *A. grandis* are the major seral trees in this phase. While some sites are too wet for other species to assume more than a subordinate role, *P. monticola, L. occidentalis,* and *Pseudotsuga* are capable of seral dominance and excellent growth where drainage is adequate. Some stands of this phase have been observed that appear relatively dry and barely able to support the above-listed moist site species.

Menziesia ferruginea (MEFE) phase—The MEFE phase is generally found between 4,300 and 5,000 ft (1,310 and 1,520 m) elevation with occasional occurrences on cold-air drainage slopes down to 3,000 ft (910 m). It normally occupies moderate to steep slopes with northwest exposures. This phase represents the cold, moist environments of the TSHE/CLUN h.t. Important seral dominants are *P. menziesii, A. grandis, L. occidentalis, P. monticola,* and *P. contorta.* In addition to these species, mature stands can also have a major component of *T. plicata, P. engelmannii,* and *A. lasiocarpa.* The understory vegetation is dominated by a shrub cover of *M. ferruginea* with *V. globulare, L. utahensis,* and/or *P. myrsinites* (fig. 8). The herbaceous layer may have high coverages of *Xerophyllum tenax, Arnica latifolia,* or *L. borealis,* along with *C. uniflora, Coptis occidentalis, S. stellata,* and *T. trifoliata.*

Xerophyllum tenax (XETE) phase—The XETE phase is found north of Coeur d'Alene at elevations ranging between 3,300 and 4,700 ft (1,000 and 1,433 m). This phase occurs on southeast to west aspects, flat to moderate slopes, and may be found on any landform or position. This is the driest of the higher elevation TSHE/CLUN phases. Major early seral tree species are *P. menziesii, L. occidentalis, P. contorta,* and *P. monticola.* Late seral and mature stands normally contain *A. grandis* and *T. plicata.* Although *Picea* and *A. lasiocarpa* are occasionally present, these sites are generally unfavorable for both. The understory is characterized by coverage of *Xerophyllum* in excess of 5 percent, with *V. globulare* often being abundant (fig. 9). *Clintonia uniflora* or *Coptis occidentalis* has at least sparse occurrence in all stands.

Clintonia uniflora (CLUN) phase—The CLUN phase is the driest, warmest phase of the TSHE/CLUN h.t. This

Figure 8—*Tsuga heterophylla/Clintonia uniflora* h.t.-*Menziesia ferruginea* phase on steep east-facing midslope (4,700 ft [1,430 m]) above Canuck Creek, Bonners Ferry Ranger District. The overstory is comprised of *T. heterophylla, Picea engelmannii, Abies lasiocarpa, Pinus monticola,* and *P. contorta.* The dense tall shrub layer is dominated by *M. ferruginea, Rhododendron albiflorum,* and *Alnus sinuata. Arnica latifolia* is the predominant forb with *C. uniflora* and *Tiarella trifoliata* common.

Figure 9—*Tsuga heterophylla/Clintonia uniflora h.t.-Xerophyllum tenax* phase on an old stream terrace (2,800 ft [850 m]) above East Fork Creek north of Clark Fork, ID. The overstory of this late-seral stage is dominated by *T. heterophylla.* The stand is unusual in that *Thuja* is outreproducing *T. heterophylla* and the moss coverage forms a nearly continuous carpet; this latter feature may account for the depauperate undergrowth in this rather open stand.

phase can be found throughout the range of the *Tsuga* series on elevations ranging from 2,500 to 5,000 ft (760 to 1,520 m) and on all slopes, aspects, and landforms except wet bottoms. Early seral stands are usually dominated by *P. menziesii, L. occidentalis,* and/or *P. monticola.* Prior to site dominance by the climax species, these stands may have *A. grandis, A. lasiocarpa,* and/or *T. plicata* as late seral codominants. The CLUN phase is characterized by the absence of more water-demanding species and is generally less species rich, with lower herbaceous coverages than associated phases. This phase has a low but consistent cover of *V. globulare, L. utahensis, P. myrsinites,* and/or *L. borealis* (fig. 10). These species increase in cover on toeslopes and lower gradient slopes, an indication of slightly more mesic conditions, usually grading into the TSHE/ASCA h.t.

Soils—Parent materials are mainly quartzite, siltite, sandstone, and metasediments with an ash cap, but gneiss, schist, gabbro, and loess are also found. Textures are slightly heavier than TSHE/GYDR and TSHE/ASCA soils, the predominant textural classes being silty-loam to silty clay-loam. The ARNU, MEFE, and XETE phases have 30 to 60 percent gravel, while the CLUN phase tends to have less than 10 percent gravel in its horizons. Average pH varies from 4.8 to 6.8. Total soil depths average between 12 and 26 inches (30 and 65 cm). Bare soil and rock usually do not occur on these sites. Average litter depth is 1.5 inches (4cm).

Productivity/Management—Timber productivity is high to very high in the TSHE/CLUN h.t. (appendix F). Excellent height growth can be realized from *P. menziesii, L. occidentalis, A. grandis,* or *P. monticola.* The highest site indexes for *Pseudotsuga* are found on the CLUN phase: the best height growth for *Larix* is on the ARNU phase, and all species have appreciably reduced height growth on the XETE phase (appendix F).

Seedtree or very open shelterwood treatments on south east to west slopes should result in good natural regeneration of *P. menziesii, L. occidentalis, A. grandis,* and *P. monticola.* On all other aspects, if an adequate seed source is present, clearcutting following seedfall should lead to abundant natural regeneration of these same species and even *T. heterophylla* (Boyd 1969). If the seed source is inadequate, planting in either of these aspect-dependent situations should prove successful. Shelterwood and selection treatments may be utilized if the desired regeneration species are *A. grandis, T. heterophylla, T. plicata, P. engelmannii,* or *A. lasiocarpa.* Stands with tall shrub components, particularly *Taxus brevifolia* and *V. globulare,* are important as moose, elk, and grizzly bear habitat.

Figure 10—*Tsuga heterophylla/Clintonia uniflora* h.t.-*Clintonia uniflora* phase on a midslope bench formation (3,750 ft [1,140 m]) northwest of the Sylvanite Ranger Station, Kootenai NF, MT. The center foreground, featuring a canopy gap occupied by *C. uniflora,* trailing *Rubus pedatus* and *Linnaea borealis,* and abundant moss, contrasts with the background where the depauperate undergrowth is typical of the closed canopy portion of this dense stand (basal area of 460 ft²/acre [105 m²/ha]). Note *T. heterophylla* reproduction is confined to decaying logs.

Other Studies—The TSHE/CLUN h.t. is a subdivision of Daubenmire and Daubenmire's (1968) original *Tsuga/Pachistima myrsinites* h.t. Our ARNU and CLUN phases are essentially equivalent to syntaxa recognized by Pfister and others (1977) for northwestern Montana, Bell (1965) for southeastern British Columbia, and Lillybridge and Williams (1984) for the Colville NF. Our MEFE and XETE phases considerably overlap, both environmentally and compositionally, with the TSHE/*Rhododendron albiflorum* and TSHE/XETE associations of Lillybridge and Williams (1984). The several phases of our TSHE/CLUN h.t. are necessary to partition the broad environmental amplitude denoted by *C. uniflora* or *T. trifoliata* alone.

Tsuga heterophylla/Menziesia ferruginea h.t. (TSHE/MEFE; western hemlock/menziesia)

Distribution—TSHE/MEFE appears to be an incidental h.t. in northern Idaho, occurring above 5,000 ft (1,525 m) elevation in the Selkirk Range east of Priest Lake. The combination of environmental factors that restrict its occurrence to this location is unknown; we speculate this h.t. may be more extensive than our limited sample indicates. TSHE/MEFE tends to occupy sites warmer (gentle southfacing slopes and ridgetops) than those generally associated with *Menziesia ferruginea.*

Vegetation—*Abies lasiocarpa* and *Picea engelmannii* codominate with *Tsuga heterophylla* on seral stands of this h.t. Near-climax stands observed were almost pure *T. heterophylla,* with a very species-poor undergrowth consisting of *M. ferruginea, Xerophyllum tenax,* and *Vaccinium globulare* and scarcely more than trace amounts of *Pyrola secunda, Goodyera oblongifolia, Chimaphila umbellata,* and *Viola orbiculata.* TSHE/MEFE is floristically similar to TSME/MEFE-XETE, replacing *Tsuga mertensiana* by *T. heterophylla.* Further investigation may show this h.t. to be a slowly developing climax type on many acres currently supporting seral *A. lasiocarpa* and *P. engelmannii* communities.

Productivity/Management—We assume, lacking productivity data, that this h.t. approximates the timber productivity of ABLA/MEFE-XETE or TSME/MEFE-XETE. Management considerations should correspond to those of the two foregoing h.t.'s. The low species diversity in both overstory and undergrowth may indicate a nonproductive site having serious regeneration problems.

Other Studies—This h.t. has not been previously described, but colder environments of the TSHE/*Rhododendron albiflorum* association of Lillybridge and Williams (1984) for the Colville NF have a comparable species composition.

Thuja plicata (THPL) Series

Distribution—In northern Idaho, *Thuja plicata* ranks second only to *Tsuga heterophylla* in its restrictive environmental requirements. *Thuja* can withstand both higher and lower temperatures, short periods of summer drought, and excess soil moisture better than *Tsuga.* Thus at the lower elevational transition of *T. heterophylla* h.t.'s, sites are usually dominated by *T. plicata*; and at the southern geographic limit of *Tsuga* (North Fork Clearwater River drainage) there is a transition to *Thuja* on upper-elevation moist sites. *Thuja* commonly occurs as far south as the Selway River drainage. An essentially direct relationship exists between the areal extent of THPL h.t.'s in northern Idaho and the western white pine type (Haig and others 1941).

The Daubenmires (1968) found codominance of *Thuja* and *Tsuga* to be typical of most wet sites, with no floristic differentiation evident in the undergrowth on sites that might eventually be dominated by one or the other of these tree species. On sites with high water tables or hummocky bottomlands within the *Tsuga* zone, we also found this to be the case. Only two stands, in almost one hundred samples of these wet environments, exhibited monospecific dominance by *T. heterophylla.* The apparent lack of *Tsuga* dominance may be an artifact of there being no stands at or near climax in our data base. This condition is so predominant throughout northern Idaho that we have, like the Daubenmires, combined *Thuja*- and *Tsuga*dominated wet-site stands into the *Thuja* series.

In northern Idaho between the Selway River drainage and the Canadian border, *T. plicata* h.t.'s can be found on any aspect or slope and at elevations ranging from 1,500 to 5,500 ft (455 to 1,675 m). Although it occurs on all landforms, *Thuja* grows best on toeslopes and bottomlands—areas with high soil moisture. *Thuja* occurs as scattered populations in eastern Washington (Daubenmire and Daubenmire 1968; Lillybridge and Williams 1984) and is well distributed along the northwestern border of Montana (Pfister and others 1977; Arno 1979).

Vegetation—In this series *Thuja plicata* is the climax dominant species; on very moist to wet sites *Tsuga heterophylla* may be a climax codominant. The presence of *Thuja* reproduction and all-age stand structure is not necessary for classification to this series. Extremes of temperature and soil moisture differences probably determine climax tree species on these sites. These factors seem to be particularly effective from germination to canopy closure. *Thuja* is a prolific seed producer and readily establishes regeneration on exposed mineral soil (Minore 1983). Due to the longevity of *Thuja* (500 to 1,000 years in northern Idaho), regeneration only needs to occur sporadically to maintain site dominance. Vegetative reproduction (layering) occurs in mature stands (Parker 1979), where reproduction of *Thuja* is often sparse, absent, or occasionally surpassed by less shade-tolerant species. Utilization by big game, snowshoe hares, and livestock is reported to remove significant amounts of *Thuja* reproduction (Tisdale 1960; Packee 1975; Habeck 1978; Mahoney 1981). Major seral tree species within the *Thuja plicata* series are *Pseudotsuga menziesii, Abies grandis,* and *Pinus monticola,* with *Picea engelmannii* on colder, wetter sites, and *Larix occidentalis* on drier sites. *Pinus ponderosa,* which is seldom important in this series, is conspicuously absent on wet sites, as is *Pseudotsuga.* Once an overstory canopy is developed, the understory climatic conditions of *Thuja* and *Tsuga* communities appear to be very similar. *Clintonia uniflora, Coptis occidentalis, Smilacina stellata, Disporum hookeri, Galium triflorum,* and *Viola orbiculata* are found on nearly every site within this series. Stratification of THPL habitat types is based on soil moisture and varying intensity of maritime climatic influence, the dry to wet gradient being expressed by a change from *C. uniflora* h.t., to *Asarum caudatum* h.t., to *Gymnocarpium dryopteris* h.t., to *Adiantum pedatum* h.t., to *Athyrium filix-femina* h.t., to *Oplopanax horridum* h.t., respectively.

Productivity/Management—Although all tree species of northern Idaho except *Larix lyallii* can be found in at least minor amounts within the *T. plicata* zone, only *A. grandis, L. occidentalis, P. engelmannii, P. monticola, P. contorta, P. menziesii,* and *T. plicata* are capable of maintaining viable populations and high productivity on these sites. Within the mature stands sampled in northern Idaho, *P. engelmannii, P. monticola, Pseudotsuga,* and *Thuja* have their highest site indexes in this zone and are the major species on naturally regenerated sites. Competition for soil moisture and heavy browsing by snowshoe hares are found to be significant mortality factors in *Thuja* plantations (Mahoney 1981). Attempts at *P. ponderosa* plantations using offsite seed sources on sites apparently representing the cooler, more moist habitats of this series have been failures (Daubenmire 1961). Rehfeldt (1980) found for southern Idaho, and is finding in a current study for northern Idaho, considerable genetic diversity among and within *P. ponderosa* populations. The presence of relict *P. ponderosa* in the drier h.t.'s of the *Thuja* series indicates that plantings with local seed source progeny could be successful. A regeneration model (Ferguson and others 1986), based on silvical characteristics of Northern Rocky Mountain coniferous species and site data stratified by habitat type and treatment, has been developed as a submodel of the Stand Prognosis Model (Stage 1973).

Fire—Fire has been a major disturbance factor in the drier h.t.'s of the *Thuja* series. All stands sampled within the CLUN, ASCA, GYDR, and *Adiantum pedatum* h.t.'s had either fire-scarred trees or significant amounts of charcoal in the upper soil horizons. The wetter h.t.'s, *Oplopanax horridum* and *Athyrium filix-femina,* had little evidence of past fire, other than sporadic, cool, ground fires.

Other Studies—In the Northern Rocky Mountains, plant associations of the *Thuja* series have been described by Daubenmire (1952), Daubenmire and Daubenmire (1968), Pfister and others (1977), Steele (1971), Steele and others (1976), and Utzig and others (1983).

Thuja plicata/Oplopanax horridum h.t. (THPL/OPHO; western redcedar/devil's club)

Distribution—THPL/OPHO is found in small patches from the North Fork Clearwater River to the Canadian border. *Oplopanax is* normally found in bottoms having high water tables and cold-air drainage. It occurs at elevations ranging from 1,500 to 4,900 ft (460 to 1,495 m). This h.t. is generally associated with low gradient slopes on any aspect; landforms tend to be lower benches, valleys, and lower stream terraces. In the northwest portion of Boundary County, the THPL/OPHO h.t. occurs in mosaics with THPL/ATFI, THPL/CLUN-MEFE, and/or TSHE/CLUN-MEFE on steep, subirrigated, north-facing slopes.

Vegetation—*Oplopanax horridum,* a large, rhizomatous shrub with stout prickles, is the diagnostic species of this h.t., ranging from scattered individuals (at least 5 percent canopy coverage) to dense, impenetrable canopies. In addition to *Asarum caudatum, Clintonia uniflora, Tiarella trifoliata, Trillium ovatum,* and *Disporum hookeri,* these sites have high coverages of *Athyrium filix-femina, Circaea alpina, Gymnocarpium dryopteris, Senecio triangularis, Viola glabella,* and *Streptopus amplexifolius* (fig. 11). A warm, moist variant of this h.t. occurs on the north end of Dworshak Reservoir and up the North Fork Clearwater River to Isabella Creek in a coastal disjunct area (Steele 1971). *Thuja* and *Tsuga heterophylla,* either alone or as codominants, are the major seral and climax tree species on these sites. *Picea engelmannii* and *Abies grandis* occur sporadically as seral species on colder or higher elevation sites and warmer, lower elevation sites, respectively. Microsites with better drained soils occasionally support *Pinus monticola.*

Soils—Parent materials are quartzite and alluvial mixtures of metasediments, siltite, ash, and mica schist. Textures are fairly coarse, ranging from gravelly loamy sands to sandy loams, with gravel content of 40 to 50 percent in most horizons. The pH ranges from 4.5 to 6.0. Bare soil and rock usually do not occur on these sites. Average litter depth is 2 inches (5 cm).

Productivity/Management—The THPL/OPHO h.t. is a highly productive site for *Thuja, Tsuga heterophylla,* and *Picea* (appendix F). Site index is difficult to measure accurately due to the high percentage of suppressed and overmature trees present in natural stands. *Picea* and *Thuja* are the species best suited for toeslopes and bottomlands. These two species, along with *Pinus monticola* on drier microsites, can be used to regenerate hillside mosaics. In all cases, though, great care must be exercised in logging these sites because water tables are near the surface. Bottomland or riparian sites should not be disturbed other than to salvage high-value trees or to remove high-risk trees. Salvage logging should not remove all dead and down logs because downed woody material serves as a seedbed for *Thuja* and *Tsuga* regeneration (Parker 1979). Hillside sites should also receive silvicultural treatments conducive to minimal soil disturbance. Natural regeneration by *Thuja* and *Tsuga* should be sufficient to revegetate sites; interplanting of *Picea* throughout the stand and *P. monticola* on drier microsites should be successful for establishing mixed-species stands. Major disturbance of this h.t. can result in total site occupancy by tall shrubs *(Acer glabrum, Alnus,* and *O. horridum).*

This h.t. has high value as wildlife habitat, offering high quantities of food, cover, and water. An unidentified wild ungulate, presumably elk, utilizes *Oplopanax* leaves and flower heads in late summer and fall, leaving some stands with only old, woody *Oplopanax* stems. Domestic livestock do not appear to use this h.t. to any extent.

Other Studies—This is the same h.t. as originally described by Daubenmire and Daubenmire (1968). It also corresponds to that described for Montana (Pfister and others 1977) and is comparable to interior British Columbia associations described by Bell (1965) and Utzig and others (1983).

Figure 11—*Thuja plicata/Oplopanax horridum* h.t. on a gently sloping north aspect (4,900 ft [1,495 m]) on the west side of Silver Mountain, Bonners Ferry Ranger District. Overstory is dominated by *T. plicata* and *Tsuga heterophylla* from 300 to 500 years in age. Undergrowth is dominated by patches of *O. horridum* interspersed with high coverages of ferns. Despite the sloping ground the water table is high; the characteristic gravelly soil is saturated to the surface throughout the growing season.

Thuja plicata/Athyrium filix-femina h.t. (THPL/ATFI; western redcedar/lady fern)

Distribution—The THPL/ATFI h.t. occurs commonly throughout the central and southern range of *Thuja*, with scattered locations north of Coeur d'Alene. Elevations range from 1,500 to 4,700 ft (460 to 1,430 m), slopes are less than 20 degrees, and all aspects other than southerly are represented. It occupies stream terraces, toe-slopes, and lower slope positions. This h.t. is slightly warmer than THPL/OPHO.

Vegetation—These sites are consistently very species rich. *Athyrium filix-femina*, with a coverage of generally 5 percent or more and a stature generally in excess of 3 ft (1 m), is diagnostic of this h.t. Species with high constancy are *Adenocaulon bicolor, Asarum caudatum, Clintonia uniflora, Coptis occidentalis,* and *Tiarella trifoliata*. When *A. filix-femina* coverage is below 5 percent, the type is distinguished by the presence of *Senecio triangularis, Trautvetteria caroliniensis, Streptopus amplexifolius,* and/or *Gymnocarpium dryopteris* as well as other moist site species such as *Circaea alpina, Viola glabella, Aconitum columbianum,* or *Mertensia paniculata* (fig. 12). Incidental individuals or small patches of *Oplopanax horridum* may be found in this type, but they are restricted to microsites. Some sites have a high coverage of *Taxus brevifolia, Acer glabrum,* or *Alnus sinuata,* while other sites with better soil drainage support nearly pure stands of *Tsuga heterophylla,* indicating possibly a TSHE/ATFI h.t. *Tsuga* dominance does not occur on enough acres in northern Idaho to warrant delineating these communites from THPL/ATFI at this time.

Adiantum pedatum (ADPE) phase—The ADPE phase is found from the St. Joe River south to the Selway River or extreme northern Idaho. Elevations for this phase range from 1,500 to 3,700 ft (460 to 1,130 m); aspects vary from north to east. *Thuja plicata* and *Abies grandis* are the major tree species on these sites. *Adiantum pedatum* cover greater than 5 percent is diagnostic of this phase. This phase represents the warm, nutrient-rich portion of the THPL/ATFI h.t.

Athyrium filix-femina (ATFI) phase—The ATFI phase represents the modal condition for this h.t. Elevations generally range from 2,500 to 4,600 ft (760 to 1,400 m) on gentle slopes, with aspects from northwest to east. The major tree species are again *T. plicata* and *A. grandis*, but we also find seral *Pseudotsuga menziesii, Pinus monticola, Abies lasiocarpa,* and *Picea engelmannii* in this phase on suitable sites.

Figure 12—*Thuja plicata/Athyrium fllix-femina* h.t.-*A. fllix-femina* phase on a gently sloping terrace (4,200 ft [1,280 m]) occurring north of Grass Mountain on the Bonners Ferry Ranger District. The stand is dominated by *T. plicata, Tsuga heterophylla*, and *Picea engelmannii; Abies lasiocarpa is* scattered. *Athyrium filix-femina* (considerably shorter than the 6-ft (2-m) heights attainable in this habitat type), *Dryopteris austriaca, Gymnocarpium dryopteris, Menziesia ferruginea* (in background), and *Rubus pedatus* dominate the undergrowth. Common herbaceous species are *Streptopus amplexifolius, Trautvetteria caroliniensis, Veratrum viride, Viola glabella*, and *Tiarella trifoliata.*

Soils—Parent materials are mainly quartzite, sandstone, and granitic, with some sites having metasediments, biotite, shale, and riverine or glacial alluvium. Textures are loamy sands to silt-loams, normally high in gravel content and very permeable. Soil pH ranges from 5.0 to 6.0; total soil depths range from 16 to 32 inches (40 to 80 cm). Bare soil and rock are usually not found on these sites; average litter depth is 2 inches (5 cm).

Productivity/Management—The THPL/ATFI h.t. is highly productive, the ADPE phase being slightly more productive than the ATFI phase (appendix F). Because this habitat type occurs on riparian terraces and adjacent toe-slope sites and on wet, highly compactible soils, disruptive logging practices are not recommended. Salvage logging should be limited to preserve downed woody material as a seedbed for *Thuja* and *Tsuga* regeneration (Parker 1979). These sites, particularly those with *T. brevifolia,* have extremely high value as big-game habitat throughout the year. Isolated old-growth stands have added value as recreational and botanical-interest areas.

Other Studies—Our THPL/ATFI h.t. is equivalent to that described by Daubenmire and Daubenmire (1968), Steele (1971), and Steele and others (1976). The ADPE phase we have described is equivalent to the ATFI phase of the THPL/ADPE h.t. of Steele and others (1976) and encompasses most of THPL/*Dryopteris* spp. h.t. described by Steele (1971).

Thuja plicata/Adiantum pedatum h.t. (THPL/ADPE; western redcedar/maidenhair fern)

Distribution—The distribution of the THPL/ADPE h.t. is restricted by the limited geographic occurrence of *Adiantum pedatum,* which in northern Idaho is found almost exclusively between the St. Joe and Selway Rivers. A few sites outside this area are known, but they are all small populations on microsites. Elevations for this h.t. are generally restricted to sites below 3,000 ft (910 m), although in the Selway River drainage examples of this h.t. occur as high as 4,700 ft (1,430 m). It is found on slopes ranging from 0 to 40 degrees and on all aspects except south. THPL/ADPE is normally located on moist mid to lower slopes and toe-slopes with good cold-air drainage, in a position slightly drier and upslope from THPL/ATFI.

Vegetation—Well-represented (≥5 percent) canopy cover of *A. pedatum* and much reduced coverages of wet-site species

Figure 13—*Thuja plicata/Adiantum pedatum* h.t. on a northeast aspect of moderate slope (2,300 ft [700 m]) along Nylon Creek north of Dworshak Reservoir. The overstory is dominated by *T. plicata* with scattered *Abies grandis, Pseudotsuga menziesii,* and *Pinus monticola* still present as seral remnants. The diverse undergrowth is dominated by *A. pedatum* and *Polystichum munitum* with 15 shrub and 30 herbaceous species present in varying amounts.

(Trauvetteria caroliniensis, Senecio triangularis, and *Gymnocarpium dryopteris)* indicators of the THPL/ATFI h.t. characterize this h.t. (fig. 13). *Thuja plicata* is the major climax tree species; however, an occasional site will have enough *Tsuga heterophylla* regeneration to indicate that *Tsuga* may eventually dominate. *Abies grandis* is the most abundant seral species in older natural stands; reduced amounts of *Larix occidentalis, Pseudotsuga menziesii,* and *Pinus monticola* will also occur.

Stands found along the North Fork Clearwater River and the upper end of Dworshak Reservoir are much richer in species than the THPL/ADPE h.t. in general. This diversity is due to a long-persisting locally intensified expression of maritime environment, which has fostered disjunct, relict populations of coastal plant species (Steele 1971).

Soils—Parent materials are mainly metasediments, granitics, or mica schist, with occasional ash deposits, sandstone, and basalt. Textures range from loams to clay-loams, with small amounts of gravel. The pH values normally range from 5.1 to 6.3. Bare soil and rock do not usually occur; litter cover averages 1.5 inches (4 cm) in depth.

Productivity/Management—Site indexes are generally very high in this h.t. (appendix F). Both the small acreages and their close proximity to streams and riparian zones reduce the silvicultural options for this h.t. Salvage on these sites should be limited because downed woody material serves as a seedbed for *Thuja* and *Tsuga* regeneration. Disturbance to seasonally wet soils may lead to soil compaction or mass wasting. Big game may heavily use these sites, particularly during winter and spring.

Other Studies—The THPL/ADPE h.t. was originally described by Steele (1971) and Steele and others (1976). Sites that Steele classified as the ATFI phase of this h.t. we classified as belonging to the THPL/ATFI h.t., ADPE phase. Though similar, a THPL/ADPE association described by Bailey (1966) for the Oregon coast appears to be a different h.t.

Thuja plicata/Gymnocarpium dryopteris h.t. (THPL/GYDR; western redcedar/oak fern)

Distribution—Known locations of this h.t. for northern Idaho occur between the St. Joe and Selway River drainages. North of the St. Joe River, this h.t. is generally replaced by the TSHE/GYDR h.t. Elevations range from 3,200 to 4,500 ft (975 to 1,370 m). Slopes range from moderate to fairly steep (8 to 35 degrees), with mid to lower slope positions on predominantly west to northeast aspects. The THPL/GYDR h.t. is located on a moisture gradient between THPL/ATFI on the wet portion and THPL/ASCA on the drier sites.

Vegetation—This is the driest of northern Idaho plant associations characterized by a fern species, 1 percent or greater coverage of *Gymnocarpium* being diagnostic. *Athyrium filix-femina, Dryopteris* spp., and/or *Adiantum pedatum* may be present, but are either rare and of low stature, or occur on moist microsites. *Abies grandis* and *Picea engelmannii* are the major late-seral tree species with *Pseudotsuga menziesii* and *Pinus monticola* occurring occasionally.

Excepting mature stands of THPL/OPHO (and certain of its seral variations), these are the wettest closed-canopy *Thuja plicata* sites that support appreciable shrub coverages. Shrub species with high constancy for this h.t. are *Acer glabrum, Lonicera utahensis, Rosa gymnocarpa, Linnaea borealis, Rubus parviflorus, Taxus brevifolia, Menziesia ferruginea,* and *Vaccinium globulare.* Commonly occurring forbs throughout this h.t. are *Asarum caudatum, Clintonia uniflora, Coptis occidentalis, Disporum hookeri, Smilacina stellata,* and *Tiarella trifoliata* (fig. 14).

Soils—Parent materials are mainly quartzite, sandstone, and schist, often mixed or overlain with volcanic ash. Textures range from gravelly loam to silty clay loam and pH values range from 5.4 to 6.4. Bare soil and rock are usually absent; litter depth averages 3 inches (8 cm).

Productivity/Management—The THPL/GYDR h.t. is highly productive for *A. grandis* and *P. engelmannii* and moderately productive for *P. monticola, P. menziesii,* and *T. plicata* (appendix F). Any of the above species with the proper silvicultural treatment should do well on these sites. Because of the richness and high growth rates of shrub species in this h.t., tree regeneration should be scheduled immediately following logging. Shrub and forb invasion can significantly impact reforestation through direct competition and/or attraction of large and small herbivores. Other major management considerations should be the proximity of these sites to riparian zones and potential compaction of seasonally saturated soils. Stands in this h.t. that have a high coverage of *T. brevifolia* may have high local value as moose winter habitat.

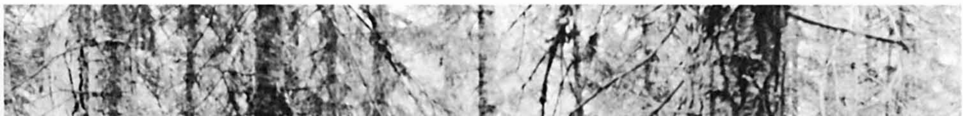


Figure 14—*Thuja plicata/Gymnocarpium dryopteris* h.t. on a stream terrace bench (3,500 ft [1,070 m]) near Powell Campground on the Clearwater NF. The stand is multiple-aged evidenced by the presence of fire-scarred *Larix occidentalis* veterans, a population of even-aged mature *Abies grandis,* and vigorous saplings and seedlings of *T. plicata* and *Picea.* The characteristically diverse and dominant herbaceous layer has over 30 species; foremost in coverage are *G. dryopteris, Coptis occidentalis, Clintonia uniflora, Disporum hookeri,* and *Cornus canadensis.*

Other Studies—This h.t. has not been previously described. These sites would have been classified as *Thuja-Pachistima* by Daubenmire and Daubenmire (1968). Steele and others (1976) included GYDR as a minor phase of their THPL/ASCA h.t. on the Nez Perce NF.

Thuja plicata/Asarum caudatum h.t. (THPL/ASCA; western redcedar/wild ginger)

Distribution—The THPL/ASCA h.t. occurs commonly throughout the range of *Thuja plicata* in northern Idaho, from drainages in the Selway-Bitterroot Wilderness to the Canadian border. The normal elevational range is from 2,200 to 5,200 ft (670 to 1,590 m). It can be found on all aspects, landforms, and positions, with moderate slopes (8 to 25 degrees) predominating. THPL/ASCA occupies the warm, moist portion of the *Thuja* series, between the THPL/CLUN and THPL/GYDR h.t.'s.

Vegetation—A species-rich herbaceous layer is characteristic of this h.t., with the presence of *Asarum caudatum* scattered throughout the stand being diagnostic. When common (≥1 percent), *Viola glabella is* an equivalent indicator of this h.t. *Pteridium aquilinum* and *Polystichum munitum* commonly occur, with coverages to 5 percent (coverage much higher on open, disturbed sites); other fern species have not been recorded in greater than trace amounts. Other common forbs are *Clintonia uniflora, Coptis occidentalis, Disporum hookeri, Smilacina stellata,* and *Tiarella trifoliata.* The tree layer in seral stages often has *Pseudotsuga menziesii, Abies grandis, Larix occidentalis,* and *Pinus monticola,* with *Abies lasiocarpa* and *Picea engelmannii* present on colder sites.

Menziesia ferruginea (MEFE) phase—A shrub layer 3 to 6 ft (1 to 2 m) tall, having *M. ferruginea* well represented (≥5 percent), is diagnostic of this phase. *Vaccinium globulare, Lonicera utahensis, Rubus parviflora,* and *Acer glabrum* are commonly associated shrub species. This phase normally occurs above 4,000 ft (1,220 m) elevation on predominantly northerly aspects, on the coldest sites within the THPL/ASCA h.t.

Taxus brevifolia (TABR) phase—*Taxus brevifolia* as a dominant tall shrub or low tree layer, with canopy coverage of 5 percent or more, is diagnostic of this phase (fig. 15). This phase occurs from the St. Joe NF to northern portions of the Nez Perce NF on all slopes and landforms, but it is most prevalent on north and east aspects. The TABR phase occurs on the most moist, cool sites of the h.t., generally at elevations between 3,000 and 5,000 ft (910 to 1,525 m).

Figure 15—*Thuja plicata/Asarum caudatum h.t.-Taxus brevifolia* phase on a west-facing gentle backslope (4,700 ft [1,430 m]) on the Lower Fishhook Research Natural Area, St. Joe NF. Despite a very dense canopy of veteran (>300 years old) fire-scarred *T. plicata* and *Larix occidentalis, Taxus brevifolia* coverage is still abundant; *Menziesia ferruginea* and *Vaccinium globulare* coverages are much higher in canopy gaps. Though reduced in coverage the herbaceous component is moderately diverse and not depauperate (compare fig. 9).

Asarum caudatum (ASCA) phase—ASCA is the most common phase of THPL/ASCA, occurring on the warmest, driest sites within the h.t (fig. 16). The ASCA phase occurs over a wide range in aspect, slope, and position; however it tends to occur preferentially on northerly aspects at low elevations and on warmer southerly aspects at its upper elevational limits. The major seral tree species are *P. menziesii, A. grandis,* and *P. monticola. Aralia nudicaulis* is an occasional component of this phase, indicating potential for an ARNU phase as is found for THPL/CLUN in Montana (Pfister and others 1977). In northern Idaho, the ARNU phase occurs so sporadically that we have included it within the ASCA phase.

Soils—Parent materials are mainly granitic, quartzite, siltite, and sandstone, with some mixed loess and generally an ash cap or a loess-volcanic ash mix in the upper horizons. Textures are predominantly loams to silt-loams, with gravel contents of 5 to 30 percent. The TABR phase tends to have finer textured, more moist upper horizons than the other phases of this h.t. Soil pH ranges from 5.6 to 6.5; total depth ranges from 8 to 43 inches (20 to 110 cm), and average litter depth is 2 inches (5 cm).

Productivity/Management—THPL/ASCA is highly productive for timber. *Pseudotsuga menziesii* and *A. grandis* attain some of their highest site indexes on the ASCA and TABR phases, with significant reductions occurring for all species on the colder MEFE phase (appendix F). Selection and shelterwood cuts will favor *T. plicata* and *A. grandis* regeneration. *Pseudotsuga, L. occidentalis, Pinus monticola,* and *Pinus ponderosa* (ASCA phase only) should regenerate successfully from seedtree or artificial plantation treatments following overstory removal. Due to high productivity, these sites are susceptible to heavy shrub competition and damage from large herbivores and rodents during early stages of stand regeneration. A second precaution pertains to the potential for site degradation following stand entry on seasonally wet soils.

Old-growth stands of the TABR phase have high potential as late fall and winter moose habitat (Pierce 1983), particularly where this community replaces ABGR/ASCA-TABR in the areas north of the west-central Nez Perce NF.

Other Studies—THPL/ASCA describes a portion of the *Thuja-Pachistima* h.t. of Daubenmire and Daubenmire (1968), and has been partially described by Steele and others (1976) for the northern Nez Perce NF. East of the Cascade Range this h.t. appears to be restricted to the Pacific Maritime-influenced climatic zone of northern Idaho and northeastern Washington. Lillybridge and Williams (1984) have designated a THPL/ARNU association, the drier stands of which are floristically-environmentally very similar to our THPL/ASCA-ASCA.

Figure 16—*Thuja plicata/Asarum caudatum* h.t.-*Asarum caudatum* phase on a moderately sloping northwest aspect (4,600 ft [1,400 m]) on Moscow Mountain, Palouse Ranger District. The stand is pure old-growth *T. plicata* with no saplings or seedlings present. The shrub component is very reduced. Low forbs constitute the majority of the undergrowth with *Actaea rubra, Adenocaulon bicolor, Coptis occidentalis, Asarum caudatum,* and *Tiarella trifoliata* being most prevalent.

Thuja plicata/Clintonia uniflora h.t. (THPL/CLUN; western redcedar/queencup beadlily)

Distribution—The THPL/CLUN h.t. is the most common h.t. within the *Thuja plicata* series. It occurs throughout the range of *T. plicata* in northern Idaho, from drainages in the Selway-Bitterroot Wilderness to the Canadian border. The normal elevational range is between 2,200 and 4,800 ft (670 to 1,460 m), but it has been found as low as 1,500 ft (450 m) and as high as 5,500 ft (1,680 m). THPL/CLUN has a tendency to occur on the warmer southeast to northwest aspects, but does occur on all aspects. It is usually located on side slopes with moderate gradients (10 to 30 degrees). This h.t. represents the driest end of the environmental gradient in which *T. plicata* is the self-reproducing climax dominant species.

Vegetation—Self-sustaining populations of *T. plicata* and an understory containing *Clintonia uniflora, Coptis occidentalis,* or *Tiarella trifoliata* with very scarce representation of wet-site forbs or ferns are diagnostic of this h.t. *Asarum caudatum* and *Viola glabella,* if present, only occur on isolated moist microsites within the stand.

Menziesia ferruginea (MEFE) phase—This phase is characterized by dominance of midshrubs 3 ft (1 m tall)—*Menziesia ferruginea, Vaccinium globulare, Pachistima myrsinites,* and *Lonicera utahensis,* and on the coldest, wettest (or disturbed) sites, *Alnus sinuata.* Predominant seral tree species are *Pseudotsuga menziesii, Abies grandis, Larix occidentalis,* and *Picea engelmannii* (fig. 17). This phase normally occurs above 4,000 ft (1,220 m) elevation on northwest to east aspects, the cold, moist end of the environmental gradient encompassed by the THPL/CLUN h.t.

Taxus brevifolia (TABR) phase—The TABR phase is a minor component of the THPL/CLUN h.t., but very important as wildlife habitat. *Taxus* is well represented (≥5 percent) in the tall shrub to low tree layer on all aspects, slopes, and landforms and at elevations generally between 3,000 and 5,000 ft (915 and 1,525 m). Predominant seral tree species are *P. menziesii, A. grandis,* and *P. engelmannii; T. plicata* is capable of rapid postdisturbance colonization of these sites. This phase is centered on the Clearwater NF but may occur from the southern Coeur d'Alene NF to northern Nez Perce NF. The TABR phase represents the most moderate sites within THPL/CLUN but is slightly cooler and possibly drier than the TABR phase of THPL/ASCA.

Xerophyllum tenax (XETE) phase—The XETE phase is a minor component of the THPL/CLUN h.t. currently known

Figure 17—*Thuja plicata/Clintonia uniflora* h.t.-*Menziesia ferruginea* phase on a gentle north-facing slope approaching ridgetop (4,100 ft [1,250 m]) on Austin Ridge, Pierce Ranger District. This midseral stand is dominated by *Abies grandis* with abundant *T. plicata* regeneration in the understory. The undergrowth is very species rich (>40 species) with the shrub layer comprised primarily of *M. ferruginea* and *Vaccinium globulare. Xerophyllum tenax* dominates the herbaceous layer where *C. uniflora, Coptis occidentalis,* and *Cornus canadensis* are well represented.

only from the St. Joe drainage south to the Selway-Bitterroot Wilderness, but may occur elsewhere. Elevations range from 3,300 to 4,600 ft (1,010 to 1,400 m), with all aspects and slopes represented. This phase is characterized by a coverage of 5 percent or more of *Xerophyllum tenax* and a much reduced coverage of species characteristic of warm, moist environments, such as *C. uniflora, Disporum hookeri,* and *Galium triflorum.* Seral tree species in this phase are mostly *A. grandis* and *P. engelmannii,* with lesser amounts of *P. menziesii, Pinus monticola,* and *L. occidentalis.* The XETE phase represents the cold, dry environments within THPL/CLUN.

Clintonia uniflora (CLUN) phase—This is the most common phase of the THPL/CLUN h.t. occurring on the warmest, driest sites of the type. *Clintonia uniflora, Coptis occidentalis,* or *T. trifoliata* is always present, with very sparse or no representation of species diagnostic of the other three phases (fig. 18). The CLUN phase spans the elevational range for THPL/CLUN, occurring on all slopes and positions, with a tendency to occupy the warmer, drier, southeast to northwest aspects. Major seral tree species are *Pseudotsuga, A. grandis,* and *L. occidentalis. Pinus monticola* and *Pinus ponderosa* should do well on these sites. *Aralia nudicaulis* is an occasional component of this phase, indicating potential for an ARNU phase of this h.t. as is found in Montana (Pfister and others 1977); this species occurs so inconsistently in northern Idaho that we have included these communities within the CLUN phase of the THPL/CLUN h.t.

Soils—Parent materials are mostly granitic, quartzite, siltite, and sandstone, with some loess and ash caps. Textures are predominantly loams to silt-loams, with a gravel content of 5 to 35 percent. In the XETE phase the upper soil horizons are well to excessively drained. Soil pH ranges mostly between 5.6 and 6.6. Total soil depths are quite variable, ranging from 8 to 32 inches (20 to 80 cm). Bare soil and rock usually do not occur on these sites. Average litter depth is 2 inches (5 cm).

Productivity/Management—The THPL/CLUN h.t. is generally highly productive for timber. *Abies grandis* site indexes are nearly as high as in THPL/ASCA h.t., while *P. menziesii* and *L. occidentalis* have only slightly lower indexes than those measured on TSHE h.t.'s (appendix F). A significant reduction in site index occurs on the MEFE and XETE phases. The site index for *P. monticola* does not appear to be greatly affected by differing phases of THPL/CLUN, but its height growth appears to be significantly reduced from that measured on TSHE h.t.'s.

Selection and shelterwood cuts will favor *T. plicata* and *A. grandis* regeneration. *Pinus monticola, P. ponderosa* (CLUN phase only), *L. occidentalis,* and *P. menziesii*

Figure 18—*Thuja plicata/Clintonia uniflora* h.t.-*C. uniflora* phase on a gentle east-facing slope (2,800 ft [850 m]) south of Bovill, Palouse Ranger District, Clearwater NF. Midseral stand codominated by *T. plicata* and *Abies grandis.* Undergrowth species diversity is high. *Vaccinium globulare* and *Linnaea borealis* dominate the shrub and subshrub layers, respectively. *Cornus canadensis, Coptis occidentalis, C. uniflora,* and *Smilacina stellata* are the dominant herbaceous species.

should regenerate successfully from seedtree treatments or artificial plantations following overstory removal. Old-growth stands of the TABR and MEFE phases, respectively, have potentially high value as late-fall/winter and summer big game habitat, especially for moose (Pierce 1983).

Other Studies—This h.t. describes the driest environments of Daubenmire and Daubemire's (1968) *Thuja-Pachistima* h.t. The Montana THPL/CLUN h.t. and phases (Pfister and others 1977) coincide very well with those of northern Idaho, except that the *Aralia nudicaulis* phase in Montana occurs only sporadically in *T. plicata* stands in northern Idaho and appears to be seral to TSHE/CLUN-ARNU. Steele and others' (1976) THPL/CLUN h.t. for the Nez Perce NF corresponds directly to our THPL/CLUN various phases. Lillybridge and Williams (1984) recognize a THPL/CLUN association which largely corresponds to our CLUN phase of THPL/CLUN. Their THPL/VACCI association is environmentally transitional between our XETE and CLUN phases of THPL/CLUN.

Tsuga mertensiana (TSME) Series

Distribution—The *Tsuga mertensiana* series has not been previously recognized in Idaho or Montana, having been encompassed within the *Abies lasiocarpa* series (Daubenmire and Daubenmire 1968; Pfister and others 1977). Our study has identified significant acreages where *T. mertensiana* is potentially the climax dominant, making its recognition worthwhile at a higher taxonomic level. The geographic distribution of *T. mertensiana* appears related to a strong maritime influence (Daubenmire and Daubenmire 1968; Habeck 1967), but it enigmatically occurs as discontinuous tracts within the subalpine zone occupied by *Abies lasiocarpa* and appears to be absent on the Kaniksu and most of the Kootenai NF's, where the inland-maritime influence ostensibly is strongest. Even where the TSME series is extensive it may be locally absent without an obvious environmental explanation.

The southern limit of the TSME series is the southern portion of the Middle Fork Clearwater River drainage. Scattered stands or individual trees of *T. mertensiana* have been found as far south as the White Sand Creek drainage of the Lochsa River. It extends northward as a rather continuous zone above 4,800 to 5,100 ft (1,460 to 1,555 m) in the Bitterroot, Clearwater, and Coeur d'Alene ranges to just south of the Clark Fork River drainage. The area just north of the Clark Fork River and west through the Purcell Trench represents the southernmost extension of continental glaciation in northern Idaho.

The series is encountered again in the Canadian Rockies, approximately 40 mi (66 km) north of the border (Arno and Hammerly 1984, pp. 223-226). Little (1971) shows limited acreages in the vicinity of Upper Priest Lake and Smith Peak (Kaniksu NF), but neither the authors nor the Daubenmires (1968) found these stands.

The current distribution of *T. mertensiana* in northern Idaho can be interpreted as a consequence of past glacial activity. Like the Canadian Rockies the mountains of northernmost Idaho were extensively glaciated but, unlike the valley locations of the Canadian Rockies, those of northern Idaho did not constitute refugia from which *T. mertensiana* was able to expand directly upslope following glacial recession. If *T. mertensiana* was not able, for whatever reasons, to keep pace with the glaciers' northward movement in the time of post-Pleistocene warming and drying (Mehringer 1985), then subsequent movement from more southerly refugia across intervening lowlands might have been rendered a physical improbability.

Along the border between the St. Joe and Clearwater NF's the *Tsuga mertensiana* series is replaced at lower elevations by the *T. heterophylla* series to the north and by the *Thuja plicata* series to the south. TSME types appear to grade to ABLA types over a broad environmental range within the TSME zone. The ABLA series sites do not appear environmentally different, but *T. mertensiana* may have a higher moisture requirement critical to establishment stages than do *A. lasiocarpa* or *Picea*. Alternatively, the explanation may be found in historical factors, specifically the vagaries of local fire histories and climate. *Tsuga mertensiana,* with its seed sources destroyed over large acreages, is simply slow to reforest sites where *A. lasiocarpa* has successfully established. (See McCune and Allen [1985] for possible explanations of why similar sites may fail to support similar, relatively stable forests.) Though uncommon, *T. mertensiana* may occur in frost pockets more than 2,000 ft (610 m) below its normal range. Consult the taxonomy section regarding apparent *T. mertensiana* x *T. heterophylla* intergrades.

Vegetation—As others (Daubenmire and Daubenmire 1968; Pfister and others 1977) have noted, the salient (and only aboveground) characteristic that distinguishes the *T. mertensiana* from the *A. lasiocarpa* series is the presence of *T. mertensiana,* reproducing successfully to become at least a climax codominant with the less shade-tolerant *A. lasiocarpa*. *Picea engelmannii* is the major seral species in more moderate environments, followed by, in decreasing order of importance, *Pinus contorta, Larix occidentalis, Pinus monticola,* and *Pseudotsuga menziesii.* The decreased seral importance of *P. contorta* in the TSME series, as opposed to similar environments in the ABLA series, may reflect greater stand ages in our data or possibly a stronger maritime climatic influence. Eighty percent of the stands in our data set were 120 years or older, a relatively old age for seral *P. contorta* stands in northern Idaho. Much of the Idaho-Montana Divide between Lolo Pass and Thompson Pass was severely burned between 1889 and 1919. The results in the TSME zone were vast acreages of seral stands (generally too young to sample, *P. contorta* the dominant and occasionally only tree species) and treeless areas. *Abies grandis* occurs sporadically as a minor seral or coclimax component on the warmest exposures. *Pinus albicaulis* is a seral component on upper subalpine and timberline habitats. (See ABLA series, Vegetation section for definition of terms relating to subalpine and timberline habitats.)

The undergrowth is dominated by *Menziesia ferruginea* on cold-moist exposures. *Vaccinium globulare* is well represented on all but the most severe sites. *Xerophyllum tenax* is well represented throughout the series—an indication that TSME sites are not as harsh (less windy, greater protective snowpack, and increased maritime influence) as the most stressful ones in the ABLA series. The most moderate sites support a relatively lush moist-site forb layer. Disturbance species other than *Epilobium angustifolium* are not extensive. The usual postdisturbance response is a delayed coverage increase of onsite species; however, *V. globulare* coverages may drop markedly and proportionately to the severity of disturbance on warm-dry exposures.

Productivity/Management—Lower elevation sites within the series have the highest timber potentials. In comparison with similar h.t.'s of adjacent areas and in absolute terms, the northern Idaho types show greater seral importance for *Picea* and *P. monticola* and reduced importance for *Pseudotsuga* and *P. contorta*. The reduced *P. contorta* and *L. occidentalis* importance may be spurious; where found, their growth potential was high. Site indexes for all species are remarkably similar to those of the ABLA series (appendix F).

Loss to heartrot, particularly *Echinodontium tinctorium*, is high in older stands (>100 years). Much of the old-growth *T. mertensiana* was cull, especially on moist or upper elevation sites.

Upper subalpine sites within the series have generally low timber potential and limited silvicultural opportunities; they are best suited to recreation, wildlife, and snowpack management.

Tsuga mertensiana/Streptopus amplexifolius h.t. (TSME/STAM; mountain hemlock/twisted stalk)

Distribution—This is a minor h.t. sampled only on the St. Joe and northern Clearwater NF's. TSME/STAM denotes the wettest sites in the series. It ranges from 5,000 to nearly 6,000 ft (1,525 to 1,830 m). Its occurrence is associated with seasonally saturated soils usually found on toe-slope positions and as riparian stringers (in tracts of less than 1 acre (0.4 ha)).

Vegetation—*Abies lasiocarpa* and *Picea* are often coclimax species with *Tsuga mertensiana;* all three species can rapidly recolonize these sites following disturbance. On lower elevation sites *Larix occidentalis, Pinus contorta,* and *P. monticola* may be well-represented seral components. Undergrowth vegetation strongly resembling that of ABLA/STAM is characterized by a variable assemblage of wet-site forbs (for example, in order of decreasing constancy, *Senecio triangularis, Ligusticum canbyi, Trautvetteria caroliniensis, Mitella breweri,* and *Veratrum viride). Menziesia ferruginea* and *Vaccinium globulare* create a dense shrub layer where tree canopy coverages are reduced.

Luzula hitchcockii (LUHI) phase—The LUHI phase represents high-elevation sites (>5,600 ft [1,710 m]), where snowpacks are deep and persistent. Sites are dominated by a variable composition of *T. mertensiana, A. lasiocarpa,* and *Picea,* all of which appear capable of maintaining populations in these open stands. The herbaceous layer, usually dominated by *Luzula hitchcockii, is* considerably less diverse and has less forb coverage than the MEFE phase. Adjacent sites with better drained soils support TSME/XETE or TSME/MEFE. Based on a limited sample and reconnaissance information, these sites are unfavorable for seral trees; only *P. contorta, P. monticola,* and *P. albicaulis* occur sporadically. Some areas have recently experienced heavy *P. albicaulis* mortality, possibly due to white pine blister rust *(Cronartium ribicola).* Extensive "ghost forests" typified by weathered large diameter snags of *P. albicaulis* are most likely remnants of the 1911-42 mountain pine beetle *(Dendroctonus ponderosae* Hopkins) outbreak (Ciesla and Furniss 1975).

Menziesia ferruginea (MEFE) phase—This phase represents lower elevation (<5,600 ft [1,710 m]) sites within the type. Though northerly slopes predominate, they experience earlier snowpack melt-off than those of the LUHI phase. TSME/STAM-MEFE usually grades to TSME/ CLUN-MEFE or TSME/MEFE on better drained positions. Seral trees are apparently more common in this phase than the LUHI phase. *Pinus contorta* and *L. occidentalis* are the most important seral trees but are often absent or poorly represented because these sites can regenerate directly to the climax species or are excessively wet for *L. occidentalis* (fig. 19). Undergrowth composition follows the h.t. description.

Soils—Small sample size does not permit extensive characterization; preliminary results show rooting depths (to 27.5 inches [70 cm]) are relatively deep for the series and gravel content is high (average 30 percent), even in the upper profile (appendix D). The dominant factor, however, is a water table that influences the upper profile for at least a portion of the growing season.

Productivity/Management—Based on very limited data, site index values appear to be moderate to high (MEFE phase only), comparable to those of ABLA/STAM (appendix F). In terms of site index, *Picea is* the most productive species. Water tables, which rise following overstory removal, restrict timber management options. Where *Picea* has been selectively cut, the result has been pure *Abies-Tsuga* stands, with canopy gaps usually filled by dense undergrowth or climax tree reproduction.

Other Studies—Similar types have not been recognized for contiguous areas, but ecologically comparable units have been described for the Washington Cascades as *TSME / Streptopus roseus* (Henderson and Peter 1981), and southwestern British Columbia as *Tsugeto-Abieteto-Streptopetum* (Brooke 1965); both types are floristically much richer than that described here.

Figure 19—*Tsuga mertensiana/Streptopus amplexifolius* h.t.-*Menziesia ferruginea* phase on the Lewis and Clark Trail near Saddle Camp with a gentle easterly exposure (4,970 ft [1,515 m]). Characteristic for the h.t., the species other than *Picea, T. mertensiana*, and *Abies lasiocarpa* have not occupied this site since stand initiation. The typically robust shrub layer *(M. ferruginea* reaching 11 ft [3.5 m] and *Vaccinium globulare* taller than 5 ft [1.5 m]) obscures the rich undergrowth in which *Clintonia uniflora, Senecio triangularis, Arnica latifolia*, and *Trautvetteria caroliniensis* share dominance.

Tsuga mertensiana/Clintonia uniflora h.t. (TSME/CLUN; mountain hemlock/queencup beadlily)

Distribution—TSME/CLUN occupies relatively warm and moist sites within the *Tsuga mertensiana* series. It is extensive on the St. Joe, Coeur d'Alene, and northern Clearwater NF's. It occurs mainly between 4,800 and 5,700 ft (1,460 and 1,740 m) on all exposures. It was noted as low as 3,300 ft (1,010 m) with mature *Thuja plicata* or *Tsuga heterophylla* scattered in the stands, indicating communities transitional to THPL or TSHE/CLUN-MEFE. It normally grades to these types at its lower elevational limits on cold exposures. At its upper limits it grades to TSME/XETE or TSME/MEFE.

Vegetation—A wide variety of seral trees are adapted to these sites—the most important being *Picea engelmannii* and *Abies lasiocarpa;* both, but especially *Picea*, may persist as old-growth or minor climax components. Other sporadically occurring seral species are, in order of decreasing importance, *Pinus monticola, Larix occidentalis, Pinus contorta*, and *Pseudotsuga menziesii.*

A moderately rich forb assemblage sets this type apart from others in the TSME series; of those indicative of the h.t.—*Clintonia uniflora, Tiarella trifoliata*, and *Coptis occidentalis*—only *Coptis* is consistently well represented. *Vaccinium globulare* dominates the midshrub layer; *Xerophyllum tenax*, the forb layer. *Anemone piperi, Goodyera oblongifolia, Pyrola secunda, Trillium ovatum*, and *Viola orbiculata* are highly constant for the h.t.

Menziesia ferruginea (MEFE) phase—The MEFE phase occurs on west- through east-facing slopes, being most prevalent on cold, north-facing slopes from 4,700 to 5,700 ft (1,430 to 1,740 m). It moves far downslope along cold-air drainages and is transitional to TSME/MEFE on colder, possibly drier sites and TSME/CLUN-XETE or TSHE/CLUN-MEFE on warmer sites. *Picea* and *T. mertensiana* rapidly reforest these sites, with the early seral success of *P. monticola* and *L. occidentalis* much reduced by comparison. *Menziesia ferruginea* is abundant in the tall shrub (to 10 ft [3 m]) layer; *Vaccinium globulare* dominates a subordinate shrub layer. *Arnica latifolia* and *X. tenax* are the dominant herbs in a sometimes diverse assemblage (fig. 20).

Figure 20—*Tsuga mertensiana/Clintonia uniflora* h.t.-*Menziesia ferruginea* phase on a moderately steep north-facing slope (5,150 ft [1,570 m]) on Sheep Mountain Range, Clearwater NF. Widely spaced, large *Picea engelmannii* and *Tsuga mertensiana* create an open aspect typical of old-growth conditions. The undergrowth, dominated by *M. ferruginea* and *Vaccinium globulare*, is diverse with over 30 herbaceous species represented.

Xerophyllum tenax (XETE) phase—The XETE phase constitutes the relatively warm, moist portion of the h.t., occurring predominantly on southerly slopes and occasionally benchlands. The observed elevational range was 4,750 to 5,600 ft (1,450 to 1,710 m). It grades to TSME/ XETE on drier, colder exposures, to TSME/CLUN-MEFE on colder sites, or to the THPL and TSHE series on warmer sites. *Picea* is the most important seral species and may persist as a coclimax dominant. Limited samples permit only a crude ranking of the other seral species; apparently *Pseudotsuga* is more successful here than elsewhere in the series, followed by *P. contorta, P. monticola,* and *Larix.* Undergrowth composition corresponds to the h.t. description (fig. 21).

Soils—Parent materials are predominantly granitics and quartzite but include other noncalcareous sedimentary rocks (appendix D); the upper horizons are all strongly ash influenced to a depth of at least 14 inches (35 cm) (average 17 inches [44 cm]). Restrictive layers have not been noted, and exposed soil and rock are negligible. Surface soils are, without exception, fine textured, ranging from loams to silty clay loams; subsurface soils are also dominated by loams and gravel content increases markedly only in the lower B and C horizons (to an average of 20 percent). Effective rooting depths average 19 inches (49 cm), the deepest within the series. Both surface and subsurface horizons are mostly moderately acidic (surface pH averages 5.8, 4.9 to 6.3; subsurface 5.7, 5.2 to 6.0). Insufficient data exist to distinguish phase differences (between MEFE and XETE), though the XETE phase does trend to shallower rooting depths.

Productivity/Management—Based on limited site index data TSME/CLUN appears to be the most productive of the TSME series h.t.'s, similar on a species-by-species comparison with ABLA/CLUN for northern Idaho (appendix F) or western Montana (Pfister and others 1977). Given that seral tree species are often minor components of mature stands as well as on clearcuts, silvicultural prescriptions should address strategies for the establishment of more rapidly growing intolerant species. Other implications and prescriptions follow those for the corresponding phases of ABLA/CLUN.

Other Studies—This type has not been previously described, but data sets of Daubenmire and Daubenmire (1968) and Pfister and others (1977) contain a small percentage of stands fitting this h.t. In the Cascades and Olympic Mountains where maritime climatic regimes prevail, Hemstrom and others (1982) and Henderson and Peter (1981) have described TSME types, portions of which are vegetatively very similar to TSME/CLUN.

Figure 21—*Tsuga mertensiana/Clintonia uniflora* h.t.-*Xerophyllum tenax* phase just east of Mullan Pass, ID, on a gentle south-facing slope (4,780 ft [1,460 m]). The infamous 1910 Burn devastated this area. *Abies lasiocarpa* and *T. mertensiana* are just entering the sapling size class under the 60- to 65-year-old canopy dominated by *Pinus contorta* and *Larix occidentalis*. *Vaccinium globulare* and *X. tenax* dominate the undergrowth in which *Pachistima myrsinites* and *Calamagrostis rubescens* are well represented and typical of early to midseral conditions.

Tsuga mertensiana/Menziesia ferruginea h.t. (TSME/MEFE; mountain hemlock/menziesia)

Distribution—This h.t. is important on the St. Joe, Coeur d'Alene, and northern portion of the Clearwater NF's. TSME/MEFE typifies sites colder than TSME/CLUN, which it merges with below; it is found between 5,100 and 6,100 ft (1,550 and 1,860 m), characteristically on the highest northerly slopes and protected portions of ridgeline benches. It grades to TSME/XETE and ABLA/XETE on warmer, drier exposures and to TSME/CLUN on warmer exposures.

Vegetation—The relative climatic severity of these upper subalpine sites is reflected in a reduced importance of seral *Pseudotsuga menziesii, Pinus monticola,* and *Larix occidentalis. Pinus contorta* and *Picea engelmannii* are inexplicably poorly represented compared to their representation in ABLA/MEFE, possibly as an artifact of small sample size and older stands, or because *Abies lasiocarpa* and *T. mertensiana* rapidly restock these sites following disturbance (Fiedler 1980).

A tall, dense *Menziesia* layer dominates the undergrowth, and *Xerophyllum tenax* is well represented in the forb layer, which is notably depauperate compared to more moderate subalpine h.t.'s. Of other species present, only *Vaccinium globulare* and *V. scoparium* exceed 50 percent constancy, and their coverage is phase dependent.

Luzula hitchcockii (LUHI) phase—This phase is not common, being present on only the highest elevations, generally above 5,700 ft (1,740 m) on north-facing slopes to ridgetop benchlands. Here snowpacks persist well into the growing season. *Abies lasiocarpa* and *Tsuga mertensiana* are usually codominant, and *Picea, P. contorta,* and *L. occidentalis* are sporadically distributed seral species. Common coverages of *Luzula hitchcockii* or *Phyllodoce empetriformis* are diagnostic for the phase and under the characteristically open canopy structure they often become abundant (fig. 22). Species diversity and the size and importance of *V. globulare* are generally much less than within the XETE phase, whereas *V. scoparium* and *Rhododendron albiflorum* increase in importance.

Figure 22—*Tsuga mertensiana/Menziesia ferruginea* h.t.-*Luzula hitchcockii* phase on a moderately steep north-facing slope (6,010 ft [1,830 m]) near a ridgecrest above Papoose Saddle on the Clearwater NF. Stand is still in early phenological state in this mid-July photo showing the dominant *M. ferruginea* just leafing out; snow patches have just melted off the *L. hitchcockii* patches near the meter pole. Dominants in the overstory and understory are, respectively, *Abies lasiocarpa* and *T. mertensiana*.

Xerophyllum tenax (XETE) phase—XETE is the common phase within the type, occurring from 5,100 to 5,800 ft (1,550 to 1,770 m) primarily on northerly exposures. It grades to TSME/MEFE-LUHI or TSME/XETE-VASC at higher elevations, TSME/CLUN-MEFE at lower elevations, or TSME/XETE or ABLA/XETE on warmer exposures. Tree distribution follows the h.t. description. Undergrowth is distinguished by greater forb diversity and constancy than that of the LUHI phase; consistently present are *Goodyera oblongifolia, Viola orbiculata,* and *Pyrola secunda. Vaccinium globulare* is abundant in more open stands (fig. 23).

Soils—Soils were developed primarily from quartzite, granitics, and gneiss, with all profiles having a moderate ash influence to about 10 inches (25 cm) (appendix D). Rooting depth in the LUHI phase averaged only 13 inches (33 cm) and is expected to be deeper in the XETE phase. In both phases, surface horizons are dominantly nongravelly whereas subsoils usually contain a high percentage of gravel. The nongravel fractions are loams to silty clay loams. No restrictive layers were found, but rooting depths usually dramatically decrease where rock content increases. Surface soils in the LUHI phase are extremely acidic (average 4.2, range of 4.0 to 5.2), whereas subsoil horizons are mostly strongly acidic (5.5, 5.0 to 5.9); the XETE phase averages more than one pH unit higher than LUHI for surface soils and one-half unit higher for the subsurface.

Figure 23—*Tsuga mertensiana/Menziesia ferruginea* h.t.-*Xerophyllum tenax* phase in the vicinity of Little Joe Pass, ID, on a gentle northwest slope at relatively high elevation (6,180 ft [1,885 m]) for the phase. Overstory dominance in the 140-year-old stand is shared among *Picea engelmannii, Abies lasiocarpa,* and *T. mertensiana* with no indication intolerant tree species have occupied the site since stand initiation. Presence of *Vaccinium scoparium* and *Luzula hitchcockii* and low stature of *Vaccinium globulare* indicate this site is tending toward harsh conditions for the type.

Productivity/Management—Analysis of limited site index data suggests that productivity decreases along the gradient of increasing site severity, from moderate to high in the XETE phase to low to moderate in the LUHI phase (appendix F). Management considerations should correspond to those of the comparable ABLA series h.t.'s. Especially noteworthy is the relative lack of seral tree species in both mature stands and following clearcutting (with various postharvest treatments).

Other Studies—Daubenmire and Daubenmire (1968) first described this h.t. for northern Idaho; it was confirmed for extreme western Montana by Pfister and others (1977) and Habeck (1967). Pfister and others (1977) defined TSME/MEFE more narrowly, including stands with *L. hitchcockii* present in TSME/LUHI-MEFE. We saw little indication that these stands were approaching a timberline condition typical of TSME/LUHI-MEFE, although they are frequently quite open, with shrub-dominated parks between tree clumps.

Tsuga mertensiana/Xerophyllum tenax h.t. (TSME/XETE; mountain hemlock/beargrass)

Distribution—TSME/XETE is an important type on the St. Joe and Coeur d'Alene NF's and the Clearwater NF north of the Clearwater and Lochsa Rivers. It occurs from 5,100 to 6,350 ft (1,550 to 1,940 m) on upper slopes and ridgelines, with all but northern aspects represented. It grades to TSME/MEFE on cooler or more protected sites and to TSME/CLUN-XETE on warmer sites.

Vegetation—The tree layer of these sites is usually dominated in all successional stages by *Tsuga mertensiana* and *Abies lasiocarpa*. Seral species, especially *Pinus contorta* and *Picea engelmannii*, are seemingly less successful here than in the comparable type in Montana or in ABLA/XETE. *Pinus albicaulis* may be locally important as a long-lived seral component. Undergrowth is very similar to ABLA/XETE; *Xerophyllum tenax is* dominant and other components vary by phase.

Luzula hitchcockii (LUHI) phase—This phase occupies cold, relatively high-elevation (6,000 to 6,350 ft [1,830 to 1,940 m]) sites, which because of their position in the landscape or low slope angles, accumulate deep, late-persisting snowpacks. *Luzula hitchcockii* and *Phyllodoce empetriformis* are indicative of these conditions (and the phase) (fig. 24). *Picea*, on protected sites, and *P. contorta* and *Larix occidentalis* are minor seral species. *Vaccinium scoparium* exhibits increased coverages relative to other types and phases in the series, whereas *Vaccinium globulare* occurs sporadically and generally is not a shrub layer dominant.

Vaccinium scoparium (VASC) phase—The VASC phase denotes upper elevations (5,700 to 6,500 ft [1,750 to 1,980 m]) and environmentally stressful conditions within TSME/XETE. It usually occurs on the upper third of southerly facing slopes. *Pinus contorta* dominates seral stands and *Pinus monticola, L. occidentalis,* and *Pseudotsuga menziesii* are represented on the more protected sites. *Pinus albicaulis* is a minor seral component at higher elevations. Stands are characteristically open (tree canopy coverages generally not exceeding 80 percent) which favors the development of dense patches of *V. scoparium* interspersed with clumps of *X. tenax* and *Carex geyeri*. With high tree canopy coverages, *V. scoparium is* markedly reduced in cover, and in extreme cases canopy gaps must be examined to reveal potential of the site to support *V. scoparium*. The undergrowth is notably depauperate, averaging only eight species per plot.

Vaccinium globulare (VAGL) phase—The VAGL phase occurs from 5,100 to 6,000 ft (1,550 to 1,830 m), predominantly on southern exposures. It grades to TSME/CLUN-XETE below and to TSME/XETE-LUHI or XETE-VASC above. *Larix occidentalis, P. monticola, P. contorta, Pseudotsuga,* and *Picea* were noted in reconnaissance to be locally important seral species; our sample plots reflect a

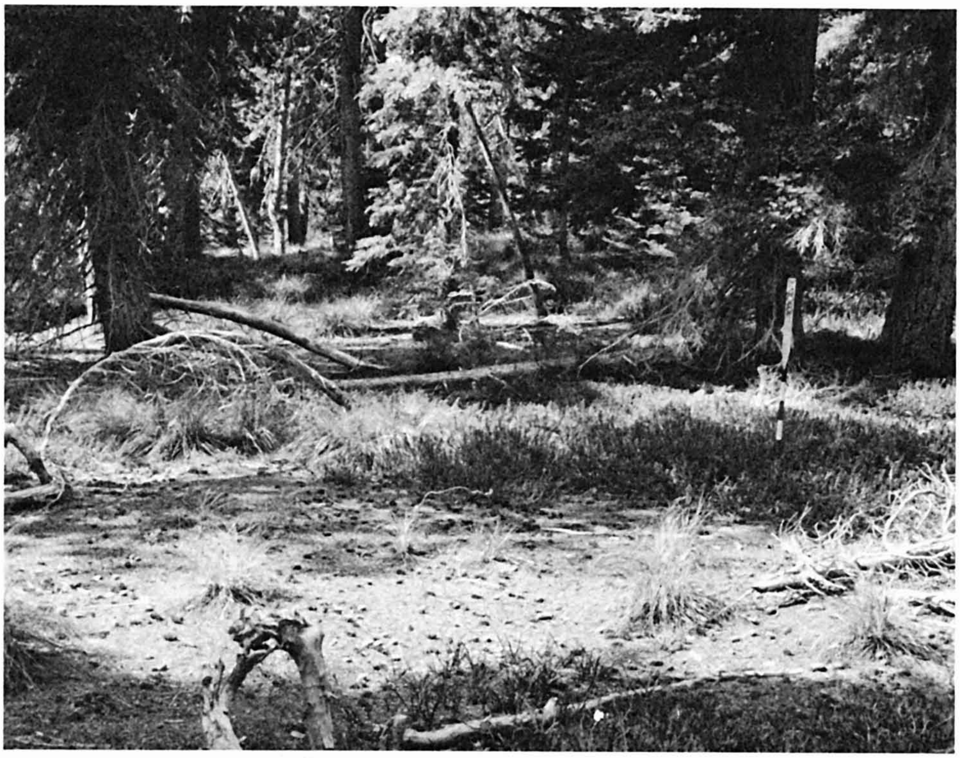


Figure 24—*Tsuga mertensiana/Xerophyllum tenax* h.t.-*Luzula hitchcockii* phase on a high ridgecrest (6,480 ft [1,975 m]) along the Lewis and Clark Trail east of Indian Post Office, Clearwater NF. All aged *Abies lasiocarpa* and *T. mertensiana* dominate the site, with *Pinus contorta* remnants scattered. *Phyllodoce empetriformis* and *L. hitchcockii* form a mosaic of dense patches; the open ground denotes areas of late-persisting snowpack.

notable scarcity of these species. Species diversity in all layers is higher here than in the LUHI phase, but not nearly that of TSME/CLUN-XETE. *Vaccinium globulare* dominates the shrub layer in which *Sorbus scopulina* and *V. scoparium* are highly constant but low in coverage. *Calamagrostis rubescens* and *C. geyeri* are capable of dominating early seral stages and persisting in abundance in open, mature (80 years plus) stands.

Soils—Parent materials consisted of metamorphosed granitic and sedimentary rocks (appendix D). Ash and loess influenced all profiles to a variable degree. Restrictive layers were not encountered; exposed soil and rock, generally not exceeding 5 percent coverage, occurred in over 75 percent of the stands. Soil textures are predominantly loams and silt loams; however, coarser soils are found more frequently in this than other TSME h.t.'s. Rooting depth varies by phase, VASC and LUHI averaging 14 inches (36 cm) and VAGL 18 inches (46 cm). Gravel content averages 17 percent in the upper profile and increases greatly with increasing depth, usually with a 20 to 50 percent increase from the B horizons to the B/C or C horizons, at a depth that corresponds approximately to the depth of rooting. In all phases soil reactions of the upper profile are strongly to very strongly acidic, decreasing to mostly moderately to slightly acidic with increasing depth.

Productivity/Management—Based on limited data, TSME/XETE site indexes differ according to phase; XETE-VAGL timber productivity appears comparable to that of ABLA/XETE-VAGL (appendix F). The more limiting environments of VASC and LUHI phases register lower site index values, comparable to those of ABLA/XETE-VASC or ABLA/XETE-LUHI (appendix F). The reduced importance of typical seral species (*P. contorta* and *L. occidentalis*) is notable and could have significant silvicultural implications. This observation must be further evaluated over a greater area and for younger stands. The results of Fiedler's (1980) study may be cautiously extrapolated to this type (see ABLA/XETE); among the salient points is the need for scarification to achieve rapid reforestation by seral species. High coverages of *C. rubescens* and *C. geyeri*, which may result following overstory removal, retard seedling establishment.

Other Studies—Daubenmire and Daubenmire (1968) first described this type, without phase distinctions. Pfister and others (1977) also recognized this h.t., but any stands containing *Luzula hitchcockii* were placed in TSME/LUHI-VASC. Plant associations very similar to TSME/XETE have been described for relatively dry subalpine sites in the Cascade Range (Hemstrom and others 1982; Henderson and Peter 1981).

Tsuga mertensiana/Luzula hitchcockii h.t. (TSME/LUHI; mountain hemlock/smooth woodrush)

Distribution/Vegetation—TSME/LUHI is an incidental type found as small patches at the uppermost elevations and denoting the most severe environments within the TSME series. It generally occurs on lee slope positions where snowpack is deep and late persisting, as indicated by the nearly monospecific dominance of *Luzula hitchcockii*. Clusters of wind- and snowpack-deformed *Tsuga mertensiana* and *Abies lasiocarpa* codominate. The density of *Pinus albicaulis* snags shows it can be an important seral tree depending on the vicissitudes of stand development. The generally small diameter of the dead trees and complete demise of whole stands point to white pine blister rust (*Cronartium ribicola*) as the responsible agent. The possibility of mortality due to mountain pine beetle (*Dendroctonus ponderosae* Hopkins) can be evaluated by examining debarked boles for the outlines of vertical egg galleries etched into the sapwood (Ciesla and Furniss 1975).

Productivity/Management—No data exist here, but the similarity to ABLA/LUHI in site factors and vegetation argues that these sites hold marginal timber-producing potential. Because these sites often border mountain grasslands and herb-dominated meadows, they are of value as wildlife cover. Generally low productivity, inaccessibility, and fragility of these sites suggest minimal disturbance.

Other Studies—Pfister and others (1977) described TSME/LUHI from the Montana-Idaho border area, but their h.t. corresponds to VASC and LUHI phases within our TSME/MEFE and TSME/XETE h.t.'s. Neither Pfister and others (1977) nor Daubenmire and Daubenmire (1968) described TSME series sites as severe as described herein.

Abies lasiocarpa (ABLA) Series

Distribution—The *Abies lasiocarpa* series occurs as a broad subalpine zone on all National Forests in northern Idaho, but the series is greatly reduced in occurrence from the northern portion of the Middle Fork Clearwater River drainage to the southern portion of the Coeur d'Alene NF, where it is displaced by the *Tsuga mertensiana* series. On the southern Clearwater and Nez Perce NF's, the lower limits of the ABLA series considerably overlap the upper limits of the *Abies grandis*, or occasionally the *Pseudotsuga menziesii* series.

Field separation of the *A. grandis* and *A. lasiocarpa* series is made difficult by this distributional overlap. These series are distinguished on the basis of relative reproductive success, projecting the more numerous species to climax dominance. Consequently, either species may occur as a seral or climax component of the opposing series. In younger seral stands or where relative reproductive success is equivalent or difficult to ascertain, we have favored *A. lasiocarpa* in the key; most evidence (Minore 1979) indicates *A. lasiocarpa* to be more shade tolerant. *Abies lasiocarpa* presence in the *A. grandis* series is indicative of somewhat colder and less productive environments. If a choice of series appears completely arbitrary, a more conservative approach would be to select the *A. lasiocarpa* series.

Northward, the ABLA series merges downslope with the *Thuja plicata* or *Tsuga heterophylla* series. The ecotone from the ABLA series to any of the above-mentioned series indicates low temperatures and shortened growing seasons critical to reproduction and establishment (Daubenmire 1956).

The areal extent of the ABLA series in northern Idaho, especially when contrasted to Montana or central Idaho, is limited due to a scarcity of high elevations and a climate more moderate than Montana or central Idaho.

Habitat types of the ABLA series extend to the alpine timberline, where on the highest peaks they are bordered by small tundralike herb communities, extensive grassy balds, or heaths dominated by the ericaceous subshrubs *Cassiope mertensiana* and *Phyllodoce empetriformis*. At mid- to upper-elevations of the ABLA series, dry, grassy parks or balds of southerly exposures, and moist meadows of northerly slopes, are caused by a combination of wind redistribution of snow from southerly to northerly aspects, shallow, rocky soils, and bedrock fractured so as to permit water percolation beyond tree rooting depths (Root and Habeck 1972). The dry, grassy parks are dominated by variable combinations of *Festuca idahoensis, Agropyron spicatum, Festuca viridula,* and *Arenaria capillaris,* whereas the late-melt areas ("snow glade" community type) (Billings 1969) support alpine herbs such as *Carex nigricans, Carex tolmiei, Deschampsia atropurpurea, Deschampsia cespitosa, Sibbaldia procumbens,* etc. (Daubenmire and Daubenmire 1968; Daubenmire 1981).

Pfister and others (1977), following Löve (1970), have delineated three elevational-ecological subdivisions of the ABLA series that reflect increasing climatic severity: (1) Lower subalpine forest h.t.'s are those sufficiently warm to support *Pseudotsuga, Larix occidentalis,* or *Pinus monticola. Picea is* the major seral species on moist to wet h.t.'s. In northern Idaho, this category is compressed to 600 to 1,000 vertical ft (180 to 305 m) on the Kaniksu and Coeur d'Alene NF's but expands to cover from 1,000 to 2,000 vertical ft (305 to 610 m) on the Nez Perce NF. (2) Upper subalpine forest h.t.'s are those above the climatic limits of *Pseudotsuga, L. occidentalis,* and *P. monticola.* These sites usually support *Luzula hitchcockii* in the undergrowth, and *Pinus albicaulis* is a common, sometimes persistent, seral tree. *Abies lasiocarpa* growth is slow, often taking 200+ years to reach full height of only 50 to 70 ft (15 to 22 m). *Picea engelmannii* is a major, persistent, seral component on all sites, whereas *Pinus contorta* is a short-lived, major seral species characteristic of drier, warmer sites. This middle zone is of limited vertical extent, usually less than 500 ft (150 m) on the Kaniksu NF and 800 ft (245 m) on the Nez Perce NF. (3) Timberline habitat types constitute the transition between continuous forest (tree line) and alpine, tundralike conditions. The uppermost portion of this zone is krummholz ("scrub line") (Arno 1966). This zone is conveniently indicated by the stunting of *A. lasiocarpa* and *Picea,* their mature heights generally not exceeding, respectively, 50 and 65 ft (15 and 20 m). Only *P. albicaulis, P. engelmannii, A. lasiocarpa,* and *Larix lyallii* are capable of establishing here, beyond the climatic limits of *P. contorta, Pseudotsuga, A. grandis,* and even *Menziesia ferruginea.* These sites are apparently of very limited extent in northern Idaho. Three groups of timberline communities are recognized: PIAL-ABLA, ABLA-LALY, and ABLA/LUHI. In Montana, these habitats are primarily temperature controlled (macroclimate), whereas in northern Idaho, drying winds, heavy snow accumulations, or excessive subsurface rockiness may result in the same community response.

Vegetation—*Picea engelmannii is* the major seral species on moist-cool sites. It is progressively reduced in importance on colder and/or drier sites where the importance of *A. lasiocarpa* and seral *P. contorta is* concomitantly increased. *Pinus contorta* tends to be quickly replaced on productive sites but is more persistent on upper subalpine sites. *Pinus ponderosa* is notably rare in the series. *Pseudotsuga* is best represented on lower subalpine types, developing significant coverages on warmer slopes with free drainage. *Larix occidentalis* and *P. monticola* are generally less important than other seral species, but given the proper circumstances, can produce nearly pure, long-persisting, even-aged stands.

Undergrowth varies from graminoid-dominated (open parklike sites) to dense tall shrubs; and from lush forbs (wet sites) to a depauperate herbaceous component (dry sites). Species diversity is progressively reduced from lower to upper subalpine to timberline h.t.'s. Because few species are adapted to sites with a short growing season and low temperatures, revegetation and recovery proceed slowly following disturbance. Except for *Pteridium aquilinum, Calamagrostis rubescens, Epilobium angustifolium, Rudbeckia occidentalis,* and *Alnus sinuata,* which may increase markedly following fire or logging, indicators of disturbance are uncommon. For central Idaho, Steele and others (1981) cite *Polygonum phytolaccaefolium, Spraguea umbellata,* high coverages of *Penstemon attenuatus* and *Potentilla glandulosa,* and, on wet sites, *Veratrum viride* as indicators of disturbance, principally grazing. Within northern Idaho the same disturbance patterns have been noted only on the southwestern Nez Perce NF, especially in the Seven Devils Range.

Fire—Nearly pure stands of fire-generated *P. contorta* occupy extensive areas on all northern Idaho forests but are most common in the southern portion of the study area. Locally, *L. occidentalis* occurs in a similar pattern of pure, even-aged stands on old burns. Stand-replacing wildfires have burned vast expanses and, coupled with subsequent burns, have locally nearly eliminated the seed sources of climax species and delayed succession to intolerant conifers. Another, more common result of stand-replacing wildfire is monospecific stands which are frequently overstocked and potential centers for disease and insect epidemics. In the wetter portions of the ABLA series, fires are infrequent (fire-free intervals of 100 years or longer) and usually stand-replacing (Arno 1980). Harvesting can produce a mosaic of smaller, even-aged stands or stands of varied ages and will thus reduce the potential for natural epidemics through removal of fuels and breeding environments.

Productivity/Management—Lower subalpine sites have the greatest timber potential followed by the upper subalpine and lastly the noncommercial timberline environments (appendix F). These upper elevation sites are better suited for management that emphasizes recreation, wildlife, and watershed values.

Pinus contorta, Picea, L. occidentalis, and *P. monticola* are productive and can be successfully regenerated in the lower subalpine zone. *Picea* is susceptible to windthrow on partial cuts, especially where water tables are high. *Pseudotsuga is* moderately to highly productive, and the highest probability of successful silvicultural manipulation occurs on lower subalpine sites. The notable lack of success with planted *P. ponderosa* in the ABLA series corresponds to the observation that it rarely occurs naturally within the series.

Pertinent studies of silvicultural manipulation and secondary succession include Roe and DeJarnette (1965), Boyd and Deitschman (1969), Basile and Jensen (1971), Alexander (1973), Fiedler (1980, 1982), Arno and Simmerman (1982), and McCaughey and Schmidt (1982).

Abies lasiocarpa/Calamagrostis canadensis h.t. (ABLA/CACA; subalpine fir/bluejoint)

Distribution—ABLA/CACA is a minor type in northern Idaho, found mostly south of the Middle Fork of the Clearwater River drainage; its presence only in the south of the study area may be attributable to a stronger continental climatic regime (see Other Studies section). ABLA/CACA occurs at lower to middle elevations of the subalpine zone (5,100 to 7,100 ft [1,555 to 2,165 m]) but may extend to 7,500 ft (2,290 m); small frost pocket locations were noted as low as 3,900 ft (1,190 m). It occupies stream terraces, adjacent to *Carex*- and *Juncus*-dominated wet meadows (and *Salix* spp.- and *Ledum glandulosum*-dominated swamps), toe-slopes with seeps, and sites with perched water tables—in general, poorly drained, seasonally saturated sites. Because of the distinctive site conditions, ABLA/CACA is mostly confined to small areas. It borders a broad variety of h.t.'s, from ABLA/XETE-VASC to ABGR/CLUN-CLUN.

Vegetation—The saturated soils and cool microclimate limit conifer establishment to a few species. *Pinus contorta* and *Picea engelmannii* are the major seral species, with *Picea* persisting as a climax codominant with *Abies lasiocarpa*. *Larix occidentalis* and *Pseudotsuga menziesii* occur rarely, only on better drained microsites. The h.t. has been partitioned into floristically distinct phases, but no definitive correlation between the phases and specific environmental conditions has been established.

Ledum glandulosum (LEGL) phase—Its presence in frost pockets and higher elevations of the h.t., as well as its reduced species richness and dominance of cold-site shrubs *L. glandulosum* and *Vaccinium scoparium*, indicate that the LEGL phase occupies the coldest sites within the ABLA/CACA h.t. The sparse coverages of *Calamagrostis canadensis* and abundance of *Xerophyllum tenax*, which is intolerant of long-persisting saturated conditions, associate these sites with the better drained portion of the h.t. Tree species' roles coincide with the h.t. description.

Vaccinium caespitosum (VACA) phase—This is a minor phase found only on the Nez Perce and southern Clearwater NF's. It occurs in frost pockets that develop in lower elevation (4,900 to 5,800 ft [1,495 to 1,770 m]) valleys or upland benches. Coarse-textured glacial outwash or stratified alluvium characterize the substrates. Adjacent, upslope positions support ABLA or ABGR series h.t.'s, usually ABGR/CLUN-XETE or ABLA/XETE. *Pinus contorta* is a persistent seral dominant; *Picea* and *A. lasiocarpa* may be slow to reinvade following disturbance. *Vaccinium caespitosum* in common coverages (≥1 percent) is diagnostic. The VACA phase often supports high coverages of *C. canadensis* and scattered *Ligusticum canbyi* and *Senecio triangularis* (fig. 25).

Ligusticum canbyi (LICA) phase—Occurrence in the low to middle subalpine zone (5,100 to 6,600 ft [1,555 to 2,010 m]), higher species richness, high constancy of wet-site herbs *Ligusticum canbyi, Trautvetteria caroliniensis, C. canadensis, Aconitum columbianum,* and *S. triangularis,* and a poorly represented shrub layer characterize the LICA phase (fig. 26). These qualities indicate that this is a more moderate phase, a possible consequence of a stronger maritime influence than received by the h.t. in general. *Picea* and *Abies lasiocarpa* codominate all successional stages; *P. contorta* shows only limited success on these sites.

Calamagrostis canadensis (CACA) phase—This is an incidental phase unrepresented by sampling and noted in reconnaissance as riparian stringers too small to sample. This is the common phase elsewhere in the Northern Rocky Mountains, in central Idaho it is characteristic of low to middle elevations of the h.t., occurring south and east of the LICA phase, and in Montana it is represented at high elevations. *Calamagrostis canadensis* forms a sward that obscures the forb layer. Other phase characteristics correspond to those of the h.t. level description.

Soils—All soils are developed on granitic parent materials (appendix D); only one plot contained ash. Most soils are well-drained silt loams with an average rock content of 20 percent in the surface horizon, increasing to 35 percent in subsurface horizons. Only one profile had a restrictive layer, but some test excavations indicate restrictive clay pans may be a feature distinguishing this type, particularly ABLA/CACA-VACA, from associated h.t.'s with better drainage (usually ABLA/XETE-VASC). Exposed rock and soil were not noted. Surface soils are strongly to moderately acidic (pH 5.1 to 5.6); acidity decreases slightly with increasing depth (pH 5.4 to 5.9).

Productivity/Management—Timber productivity data are meager, causing us to draw on the results of Steele and others (1981). We concur with their observations that the LICA phase is the most productive (appendix F) and LEGL is the least, and that *Picea* has the highest site index values, with *P. contorta* the most easily regenerated species. Steele and others (1981) note that partial cutting leaves the remaining trees susceptible to windthrow. As a consequence of rising water tables following overstory removal, *Carex* spp. and *C. canadensis* increase to compete with tree seedlings.

Harvesting, site preparation, and grazing of these sites should be postponed until late summer because wet soils are easily churned and compacted. Considerable forage and access to water attract livestock. These sites offer important food and cover for moose, elk, deer, bear, and Franklin's grouse (Steele and others 1981). Seral stages can support *Salix* spp. and abundant *Carex* spp.

Other Studies—ABLA/CACA has been described for Montana (three phases, Pfister and others 1977), central Idaho (four phases, Steele and others 1981), and the east slope of the Canadian Rockies (Ogilvie 1962); the type extends south and east into northwestern Wyoming (Steele

Figure 25—*Abies lasiocarpa/Calamagrostis canadensis* h.t.-*Vaccinium caespitosum* phase on a toeslope position (5,680 ft [1,730 m]) above Muleshoe Creek, Powell Ranger District. *Pinus contorta* dominates the overstory with *A. lasiocarpa* reproducing well. The low shrub layer is dominated by *V. caespitosum* and *V. scoparium*. *Xerophyllum tenax* and *C. canadensis* are the only important herbaceous components.

Figure 26—*Abies lasiocarpalCalamagtostis canadensis* h.t.-*Ligusticum canbyi* phase on a stream terrace bordering Colt Creek (5,720 ft [1,740 m]), Powell Ranger District. At a stand age of 200 plus years *Pinus contorta* is present only as long dead snags; *Picea engelmannii* dominates the canopy and understory. *Ledum glandulosum* and four species of *Vaccinium* constitute a scattered shrub layer that is obscured by the rich herb layer dominated by *Cornus canadensis, Senecio triangularis,* and *Dodecatheon jeffreyi*.

and others 1983) and Utah's Uinta Range (Mauk and Henderson 1984; Youngblood and Mauk 1985). The above citations of occurrence, coupled with the knowledge that this h.t. is unreported for eastern Washington and northernmost Idaho, is circumstantial evidence connecting it with a continental climatic regime.

Abies lasiocarpa/Streptopus amplexifolius h.t. (ABLA/STAM; subalpine fir/twisted stalk)

Distribution—ABLA/STAM is a minor h.t., confined to slopes with seeps and subirrigated alluvial terraces of the subalpine zone; however, on areas with compacted till it may be locally extensive. Observed elevations in the north range from 3,300 ft (1,010 m) in some frosty bottoms, to 5,900 ft (1,800 m); and in the south, from 4,100 to 6,800 ft (1,250 to 2,075 m). A narrow ecotone generally exists between ABLA/STAM and neighboring habitat types from the Clearwater River southward, but to the north the ecotones become increasingly broader; in all cases the type is characterized by the presence of a seasonally high water table.

Vegetation—Characteristic features common to the physiognomically dissimilar phases are the dominance of *Picea engelmannii* and *Abies lasiocarpa* at all successional stages and a variable combination of the following moist- to wet-site species (in order of decreasing constancy): *Senecio triangularis, Streptopus amplexifolius, Trautvetteria caroliniensis, Veratrum viride, Ligusticum canbyi, Mitella breweri, Athyrium filix-femina,* and *Dodecatheon jeffreyi.* Low *Xerophyllum tenax* constancy and coverage further confirms the poor drainage of these sites.

Menziesia ferruginea (MEFE) phase—This phase, which occurs from the Clearwater NF to the Canadian border, on all but the highest subalpine elevations (from 4,400 ft [1,340 m]), is characterized by an open canopy structure dominated at all successional stages by *Picea* and *A. lasiocarpa.* Seral trees are limited to the sporadic occurrence of *Pinus monticola, Pinus contorta, Pseudotsuga menziesii, Larix occidentalis,* and *Abies grandis* on lower elevation sites. The undergrowth supports a variable assemblage of the above-listed forbs, and is dominated by a dense shrub layer of *Menziesia ferruginea* and *Vaccinium globulare* (fig. 27). On the Kaniksu NF, in areas with deep snowpacks, *Rhododendron albiflorum* adds to the shrub-dominated aspect in at least half the stands. Adjacent drier sites frequently support ABLA/CLUN-MEFE or ABLA/MEFE .

Figure 27—*Abies lasiocarpa/Streptopus amplexifolius h.t.-Menziesia ferruginea* phase on a slightly inclined bench in the Canuck Pass-American Mountain, ID, vicinity (5,650 ft [1,720 m]). This view emphasizes the typically open canopy dominated by *Picea engelmannii* and *A. lasiocarpa.* The undergrowth is dominated by a very dense cover of *M. ferruginea* and *Rhododendron albiflorum* beneath which occurs a diverse assemblage of wet-site species.

Ligusticum canbyi (LICA) phase—This phase is common on the Nez Perce and Clearwater NF's, with declining representation to the north. The sampled elevation range was 4,250 to 6,750 ft (1,295 to 2,060 m), but outliers were noted in cold valleys as low as 3,300 ft (1,010 m). Lacking the shrub coverage typical of STAM-MEFE, these sites support a more closed canopy of *A. lasiocarpa* and *Picea* and a forb-dominated undergrowth (fig. 28). Seral tree species apparently are even more limited here than in the MEFE phase; *Pseudotsuga* and *P. contorta* occupy the better drained microsites.

Soils—Parent materials are dominated by alluvium, especially in the LICA phase, and include granitics, sandstone, quartzite, and mica schist (appendix D). Restrictive layers, primarily clay pans and compacted glacial till, are found on virtually all the LICA and half of the MEFE sites. Most of the MEFE sites have a deep (13 inches [33 cm] average) ash cap, whereas ash influences were limited in the LICA phase. Though gravel content varies widely, low content (<5 percent) prevails in both the surface and lower horizons on benches, stream terraces, and toe-slope positions; across both phases and all soil depths gravel content averages only 16 percent. The range in surface and subsurface soil textures is narrow, loam to silty clay loam. Effective rooting depths are relatively shallow (average of 14 inches [36 cm]), reflecting the presence of high water tables and saturated soils. Soil reaction (pH) for surface and subsurface horizons is strongly to moderately acidic.

Productivity/Management—Timber potential varies from moderate, where cold-air drainage is impeded and soils are saturated throughout the year, to very high on sites with better drainage; on these better drained sites *Picea* has the highest site index values (appendix F). Caution should be exercised in timber management; clearcutting will negate the high probability of windthrow associated with partial cutting, but the resulting rise in water tables may produce herb-dominated meadows that reforest very slowly. Light selection cutting may avoid these pitfalls, but heavy equipment use should be delayed until the late summer. Roads, trails, or other site development should be avoided. Cole (1983) showed trails crossing this h.t. to be in much poorer condition than those trail portions located in h.t.'s with higher drainage rates.

The abundant forage found in the LICA phase and adjacent watercourses attracts livestock; soils on these sites are easily churned, destroying undergrowth and tree seedlings. Elk use of lower elevations within the MEFE phase is moderate to high for cover and forage. Mountain caribou use old-growth stands as part of their winter range because the lower branches are festooned with lichens, an important part of their nutrition (Edwards and others 1960; Edwards and Ritcey 1960).

Figure 28—*Abies lasiocarpa/Streptopus amplexifolius* h.t.-*Ligusticum canbyi* phase on a terrace adjacent to Beaver Creek (3,780 ft [1,150 m]) on the St. Joe NF. The frosty bottomland position accounts for the dominance of uneven-aged *Picea engelmannii* and *A. lasiocarpa* and exclusion of *Thuja* from a site surrounded by the THPL series. The undergrowth, dominated by *Athyrium filix-femina, Gymnocarpium dryopteris, Trautvetteria caroliniensis,* and *L. canbyi,* is typically associated with the THPL/ATFI h.t.

Other Studies—The forb-dominated phases of this type are documented to the south and east of the study area: Uinta Mountains of Utah (Mauk and Henderson 1984; Youngblood and Mauk 1985), Teton and Absaroka Mountains of Wyoming (Steele and others 1983), central Idaho (Steele and others 1981), and in Montana (Pfister and others 1977) as ABLA/CACA-GATR and portions of ABLA/GATR. In northeastern Washington Lillybridge and Williams (1984) have sampled numerous stands (scattered among three associations, ABLA/COCA [*Cornus canadensis*], ABLA/LIBO [*Linnaea borealis*], and ABLA/RHAL [*Rhododendron albiflorum*]) that would key to and match the description for either phase of our ABLA/STAM h.t. In southern Alberta, Ogilvie (1962) has documented an h.t., ABLA-PIEN/Tiarella trifoliata-MEFE, closely corresponding to our MEFE phase.

Abies lasiocarpa/Clintonia uniflora h.t. (ABLA/CLUN; subalpine fir/queencup beadlily)

Distribution—ABLA/CLUN is a major subalpine h.t., increasing in extent from the Kaniksu to the Nez Perce NF; its continuity is broken on the southern Coeur d'Alene, St. Joe, and northern Clearwater NF's, replaced by the TSME/CLUN h.t. on similar sites. It ranges from 4,600 to 5,600 ft (1,400 to 1,710 m) in the north and from 5,000 to 5,900 ft (1,525 to 1,800 m) in the south. The XETE phase occupies higher elevations and warmer slopes, while the MEFE phase occurs at lower elevations on north-facing slopes. The warm extreme of ABLA/CLUN grades to TSHE/CLUN in the north, to THPL/CLUN on the Clearwater and northern Nez Perce NF's, and to ABGR/CLUN on the southern Nez Perce NF. Its cold-dry extreme borders on ABLA/MEFE and ABLA/XETE throughout the study area.

Vegetation—*Pseudotsuga menziesii, Picea engelmannii, Pinus contorta,* and *Larix occidentalis* are important seral species; their success is related to phase and locality. In late seral stands *Picea* is a major component, with *Abies grandis* commonly persisting as a minor climax component. Copious advance regeneration of *Abies lasiocarpa* is common, even in young stands.

The undergrowth is a variable mixture of forbs and shrubs, richer in species number and generally higher in coverages than other ABLA h.t.'s. The presence of *Clintonia uniflora* is indicative of this h.t.; other mesic forbs of high constancy are *Tiarella trifoliata, Coptis occidentalis, Trillium ovatum, Goodyera oblongifolia,* and *Bromus vulgaris. Thalictrum occidentale* and *Xerophyllum tenax* also have high constancy. Of the shrub component, *Vaccinium globulare, Menziesia ferruginea,* and *Lonicera utahensis* have high constancy, but only the first two attain abundant coverages.

Menziesia ferruginea (MEFE) phase—This phase is characteristic of moist, cold, northerly slopes and frost pockets, and grades to ABLA/MEFE on still colder and possibly drier (better drained) sites. *Abies lasiocarpa* and *Picea* codominate late seral stands and are also important early in the sere, followed in order of importance by *P. contorta* and *Pseudotsuga.* The low importance of *P. contorta* reflects the old age (average = 180 years) of sampled stands; reconnaissance of younger stands (<100 years) indicated *P. contorta to* be the major seral tree. For reasons not evident, *L. occidentalis* and *Pinus monticola* are insignificant compared to their representation in the same phase in Montana. The lush undergrowth is dominated by *M. ferruginea, V. globulare,* and *X. tenax* (fig. 29). *Alnus sinuata* and *Sorbus scopulina* may increase markedly following disturbance and delay or prevent full stocking.

Xerophyllum tenax (XETE) phase—This phase, characterized by the generally high cover of *Xerophyllum* and *V. globulare,* is indicative of the warm, relatively dry environments within the type. It is found predominantly on south- and west-facing slopes. At lower elevations it grades to ABGR/CLUN-XETE or THPL/CLUN, and above, or on drier sites, to ABLA/XETE.

Seral tree species, more abundant in this phase than ABLA/CLUN-MEFE, are, in order of decreasing importance, *Pseudotsuga, L. occidentalis, P. contorta,* and *P. monticola. Picea* does not attain the late seral dominance here that it does in the other phases. The relatively high constancy and coverage of *A. grandis* reflect the relatively warm site conditions of this phase.

Clintonia uniflora (CLUN) phase—This is a minor phase, especially compared to its prominence in Montana. Its small areal extent in northern Idaho is explained by the fact that moderate environments, of which it is typical, are occupied by more competitive (shade-tolerant) tree species. The CLUN phase is characterized by the absence or poor representation of *Menziesia* and *Xerophyllum* and a corresponding increase in forb coverages in all but closed-canopy seral stages.

Soils—Parent materials are dominated by granitics, quartzites, and mica schists (appendix D). Surface soils are generally dominated by an ash cap (andic diagnostic horizon) averaging over 12 inches (30 cm) in depth (ranging from 3 to 24 inches [8 to 60 cm] thick). Surface horizon textures are primarily loams to silt loams; subsurface textures are highly variable. Rock content averages 17 percent in the surface horizons and does not increase appreciably with depth. The MEFE phase has slightly deeper rooting depths than the XETE phase, 23 inches (58 cm) (14 to 43 inches [35 to 110 cm]) versus 18 inches (45 cm) (11 to 21 inches [28 to 53 cm]). Restrictive layers are found only in the XETE phase. Surface soil pH ranges from strongly acidic to neutral; acidity decreases slightly with increasing depth.

Productivity/Management—Timber potentials are generally high for all seral species, ABLA/CLUN being the most productive sites in terms of site index and basal area of all subalpine h.t.'s (appendix F). Based on limited site index data, the three phases appear equally productive, though natural understocking commonly occurs on the MEFE phase. *Pseudotsuga* and *Larix* readily establish here and exhibit high growth rates. Vast acreages, however, support an overstory of only *Pinus contorta* (with *A. lasiocarpa* and *Picea* as understory) because of their fire history coupled with poor *Pseudotsuga* and *Larix* cone crops. *Picea* is the highest site index species on all phases, but regeneration may be considerably delayed and in lesser

Figure 29—*Abies lasiocarpa/Clintonia uniflora h.t.-Menziesia ferruginea* phase on a steep northeast-facing slope (5,450 ft [1,660 m]) in the Horse Creek headwaters vicinity, Nez Perce NF. The canopy *of A. lasiocarpa, A. grandis,* and *Picea engelmannii* is typically open, however the shrub cover is unusually sparse. The undergrowth is very rich and dominated by *Arnica latifolia, Synthyris platycarpa, C. uniflora,* and *Coptis occidentalis.*

amounts than *P. contorta* or *Pseudotsuga.* The diversity of seral species and high productivity of this h.t. permits the greatest range of silvicultural options for subalpine sites. Partial cutting will accelerate *A. lasiocarpa,* and to a lesser degree *Picea,* dominance.

Fiedler's (1980) studies on the ABLA/CLUN h.t. in western Montana have established that the probability of immediate natural stocking following clearcutting is high, 70 to 80 percent, and does not improve significantly over the following 10 years. Probability of stocking is higher with site scarification than with burning for approximately 12 years following treatment. Undergrowth coverages above 10 to 15 percent are correlated with significantly reduced stocking probability; in 12 years at 100 percent undergrowth coverage (no site preparation), only 60 percent stocking is achieved. The MEFE phase usually requires more intensive site preparation because of possible shrubfield development.

Seral shrubs can produce considerable summer browse for elk and deer; the lower elevation sites within the MEFE phase constitute a portion of moose winter range on the Nez Perce NF. Along the Canadian border ABLA/CLUN is one of the major h.t.'s, serving as critical winter range for woodland caribou (Edwards and Ritcey 1960; Edwards and others 1960). The lush forage produced in openings and early seral stages attracts livestock.

Watershed values are high because of heavy snowpack and high precipitation, typical across most of the subalpine zone (appendix E).

Other Studies—ABLA/CLUN represents the major portion of what Daubenmire and Daubenmire (1968) described as ABLA/*Pachistima myrsinites* and includes the moist portion of their ABLA/MEFE and ABLA/XETE h.t.'s. The type is very extensive and environmentally diverse in northwestern Montana beyond the range of *Tsuga* and *Thuja* (Pfister and others 1977) and extends north into Alberta (as ABLA-PICEA/TITR-MEFE) (Ogilvie 1962) and British Columbia (Utzig and others 1983; Wali and Krajina 1973), south to central Idaho (Steele and others 1981), and west to northeastern Washington (as portions of the ABLA/COCA, ABLA/LIBO, ABLA/VACCI [*Vaccinium* spp.] and ABLA/RHAL associations) and east slope of the Cascades and Okanogan Highlands (Lillybridge and Williams 1984; Williams and Lillybridge 1983). The majority of stands sampled by Lillybridge and Williams (1984) appear to floristically resemble our CLUN phase of ABLA/CLUN, which occurs infrequently in northern Idaho.

Abies lasiocarpa/Menziesia ferruginea h.t. (ABLA/MEFE; subalpine fir/menziesia)

Distribution—ABLA/MEFE is a common h.t. on the Nez Perce and Clearwater NF's, its areal extent dwindling to the north, but nowhere in northern Idaho does it attain the abundance displayed in western Montana (Pfister and others 1977). On the Kaniksu NF it ranges from 4,900 to 6,500 ft (1,495 to 1,980 m) but can occur as much as 1,000 ft (305 m) lower in frost pockets. It ranges from 5,100 to 7,300 ft (1,555 to 2,225 m) on the Nez Perce NF. At lower elevations ABLA/MEFE is confined to predominantly steep, sheltered, northerly aspects. With increasing elevation it may move onto sheltered westerly or easterly slopes or even ridgetops. It gives way below on more moist, moderate sites to ABLA/CLUN-MEFE, with which it is easily confused in the field, and grades to ABLA/ XETE on warmer exposures.

Vegetation—Common to all phases is the clear dominance of *Abies lasiocarpa,* followed in importance by *Picea engelmannii,* which persists as massive old-growth trees. Seral *Pinus contorta* is short-lived, dying out almost completely in 160 years. Though *P. contorta* is capable of establishing in nearly pure, even-aged stands, it is poorly represented over considerable acreages where long (>200 years) fire-free intervals have prevented maintenance of a seed source. Other seral tree species are distributed according to phase.

The characteristic tall shrub layer is dominated by a dense growth of *Menziesia ferruginea* (6 to 8 ft [1.8 to 2.4 m], extremes 3 to 10 ft [0.9 to 3.0 m]), and commonly joined by *Rhododendron albiflorum* on higher elevations of the Kaniksu and Coeur d'Alene NF's. On the northernmost portions of the Kaniksu NF, reconnaissance of the highest elevations revealed stands with the tall shrub layer composed of only *R. albiflorum;* these sites occur above the limits of *M. ferruginea* and *Vaccinium globulare* and presumably indicate cold-wet conditions that are described in the Canadian (Utzig and others 1983) and coastal literature (Hemstrom and others 1982). *Vaccinium globulare* is abundant in all phases, but its size parallels the severity of the site and even approaches dwarf shrub status. The herb layer, depauperate by comparison to that of the ABLA/CLUN-MEFE h.t., is strongly dominated by *Xerophyllum tenax; Goodyera oblongifolia* and *Viola orbiculata,* in trace amounts, are the only forbs approaching 50 percent constancy.

Luzula hitchcockii (LUHI) phase—The LUHI phase is found at the highest elevations of the type (up to 6,500 ft [1,980 m] in the north and 7,300 ft [2,225 m] in the south) where it is bordered by ABLA/XETE-LUHI on warmer aspects and ABLA/LUHI on exposed areas. Typically these sites are steep northerly aspects, immediately downslope from ridgelines. This phase is indicative of cold, relatively harsh sites where the snowpack may persist long into the growing season. Supporting this interpretation is the high constancy of seral *Pinus albicaulis,* low species diversity of the undergrowth, and high coverages of the diagnostic species *L. hitchcockii.* Where tree canopy coverages are low, *Luzula hitchcockii* and *Vaccinium scoparium* may form a dense undergrowth; on some sites *L. hitchcockii* occurs only in the lee of mature tree atolls (fig. 30).

Vaccinium scoparium (VASC) phase—On the gradient of increasing site severity, from ABLA/MEFE-COOC to MEFE-LUHI, the VASC phase typifies intermediate sites. This phase is most common in the southeastern part of northern Idaho and generally is found above 6,000 ft (1,830 m) and near ridgelines. Though these tend to be microclimatically severe sites, they experience earlier snowpack melt-off than the LUHI phase. *Pinus contorta* is the most important seral tree species, followed by *Picea* and *P. albicaulis. Abies lasiocarpa* can rapidly reforest these sites, sometimes to the near exclusion of seral species. Undergrowth follows the type description with the addition of a low shrub layer of *V. scoparium.*

Coptis occidentalis (COOC) phase—This phase, indicated by common coverages of *Coptis,* represents the most moderate sites within the type, those transitional to ABLA/CLUN-MEFE and ABGR/CLUN-MEFE. Species diversity and forb coverage and constancy, especially for *Pyrola asarifolia, Trillium ovatum,* and *G. oblongifolia,* are the highest within the type. The moderate nature of these sites is reflected in the increased seral importance of *Pseudotsuga menziesii* and *Larix occidentalis,* which still considerably trail *Picea* in abundance and timber potentials.

Xerophyllum tenax (XETE) phase—This is the common phase at lower elevations of the subalpine zone (to 6,900 ft [2,100 m] on the Nez Perce NF, and 6,000 ft [1,830 m] on the Kaniksu NF). *Larix occidentalis, Pseudotsuga,* and *Pinus monticola* are minor seral components; other features follow the type description.

Soils—Within ABLA/MEFE, four phases are recognized; compared below are two phases for which we possess limited soils information, the most moderate phase, COOC, and the most environmentally stressed phase, LUHI. Parent materials are exclusively granitics and mica schists. Ash layers are present on most sites; depths of those on the COOC phase averaged 15 inches (38 cm) and on the LUHI phase only 7 inches (18 cm). No restrictive layers are found in either phase. Surface soil textures are consistently silt loams in the COOC phase and more variable in the LUHI phase. The two phases show notable differences in gravel content. COOC surface soils are nearly devoid of gravel, and content increased an average of only 5 percent to the subsoil depths. In contrast, LUHI soils are gravelly in the surface portion (30 percent average) and content increases markedly with depth, to an average of 60 percent. LUHI also exhibits higher soil acidity than COOC in both the surface (pH 4.7 versus 5.8) and subsurface (pH 5.3 versus 5.8) horizons.

Productivity/Management—Based on limited data it appears there is a distinction between phases for timber potentials (appendix F), the COOC phase having the highest site index values. *Picea* has the highest site index and is the most important species (basal area) on all phases, although absolute values of site index range upward to high only on the XETE and COOC phases; on the VASC and LUHI phases the 50-year site index for *Picea* does not exceed 58 to 60. *Pinus contorta* exhibits moderate site index values on the XETE and VASC phases and reduced potential on the more severe LUHI phase.

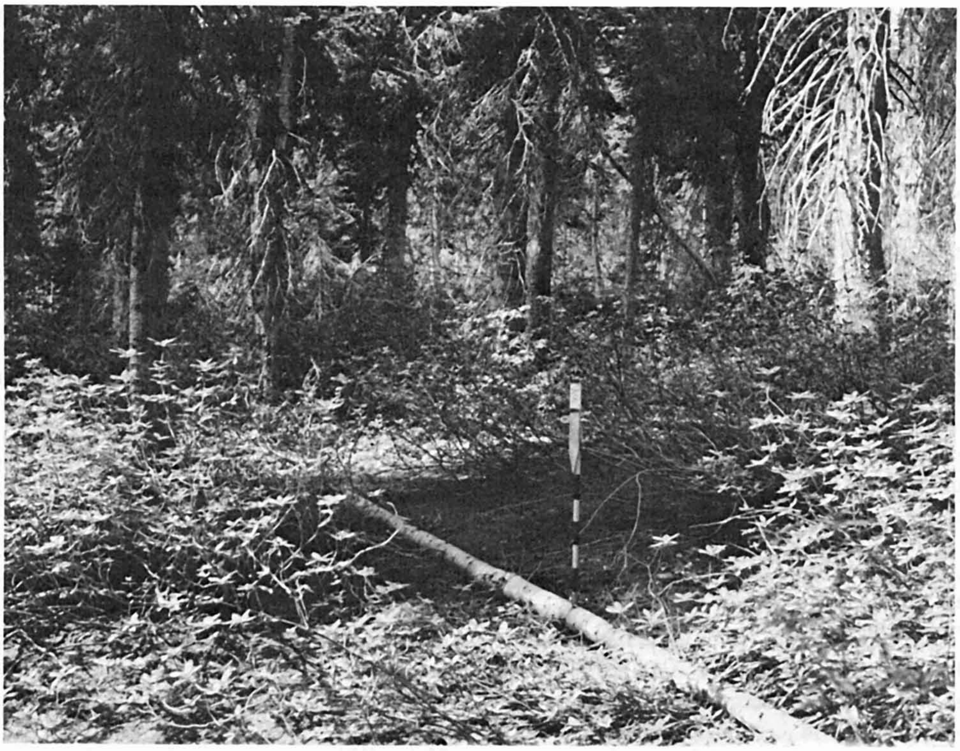


Figure 30—*Abies lasiocarpa/Menziesia ferruginea* h.t.-*Luzula hitchcockii* phase on a bench (6,180 ft [1,885 m]) east of Saddle Lake, Kaniksu NF. The tree canopy is comprised of nearly pure, uneven-aged *A. lasiocarpa*. The dominant shrub, *Rhododendron albiflorum*, is relatively short, barely 3 ft (1 m) on this harsh site. *Luzula hitchcockii* and *Arnica latifolia* are the only undergrowth species present in more than trace amounts.

Roe and DeJarnette (1965) state that the best *Picea* growth is attained on clearcuts, but that ample regeneration is achieved only in partially shaded openings of scarified sites. Fiedler (1982) has shown for ABLA/MEFE (no phase designated) in western Montana: (1) High relative importance of *Picea* (followed closely by *A. lasiocarpa* and distantly by *P. contorta*) extends to the earliest seral stages following clearcutting. (2) Total undergrowth coverage exceeding 50 percent (contributed by increased *Menziesia, Vaccinium* spp., and *Alnus sinuata*) is correlated with retardation of natural regeneration by up to 60 percent of possible stocking for at least 12 years. (3) Considerably higher (by 10 to 30 percent) probabilities of natural stocking follow scarification, as opposed to burning (however, slopes too steep for scarification dictate burning during the few times when fuels are dry). (4) ABLA/ MEFE displays a high probability for natural stocking, considering 82 percent stocking results 7 to 10 years following cutting, regardless of treatment. (5) The success rate of planted regeneration (the most frequently employed strategy) is relatively high (75 percent), and 35 percent of these planting attempts achieved a super-abundant stocking because natural regeneration was adequate. Silvicultural recommendations of Boyd and Deitschman (1969) may also apply here.

The harsher environments and lower productivity of the VASC and LUHI phases suggest silvicultural prescriptions should consider minimal site disturbance. The consistently deep snowpack will tend to increase in clearcuts, in some cases promoting a *Luzula* sward and/or *Menziesia*- and *Alnus*-dominated shrubfields that can appreciably retard reforestation. Partial cuttings will expose these high-elevation, fragile sites, risking heavy blowdown in *Picea* and promoting dominance by *A. lasiocarpa*. Livestock grazing has little potential, but big game, especially elk and moose, use these areas in summer for cover and browse. Along the northern border of the Kaniksu NF, mature stands of ABLA/MEFE serve as critical winter range for mountain caribou, their principal forage being epidendric lichens encrusting older trees (Edwards and others 1960). Watershed values are high.

Other Studies—Daubenmire and Daubenmire (1968) first described ABLA/MEFE in northern Idaho and did not partition the variability into phases, as was done in Montana by Pfister and others (1977), and in central Idaho by Steele and others (1981). Virtually the same environments as we describe (LUHI, VASC, XETE phases only) are described for northeastern Washington as the modal portions of the ABLA/RHAL *(Rhododendron albiflorum)* association of Lillybridge and Williams (1984). The most distant described regional extensions of this type appear to be southwestern Alberta (Ogilvie 1962), southeastern British Columbia (Utzig and others 1983), and northwestern Wyoming (Steele and others 1983).

Abies lasiocarpa/Vaccinium caespitosum h.t. (ABLA/VACA; subalpine fir/dwarf huckleberry)

Distribution/Vegetation—ABLA/VACA is an incidental h.t. described from reconnaissance data on the southern and western Nez Perce NF. It is consistently found on gently rolling to flat terrain at lower to midelevations (5,200 to 6,700 ft [1,585 to 2,040 m]), usually valleys where cold air may be impounded. These sites typically are mantled with coarse-textured glacial drift, predominantly outwash. Daubenmire (1980) documents the regional importance of cold-air drainage and topographic situations producing frost pockets and their characteristic vegetation.

Sites are dominated by persistent, but seral, *Pinus contorta. Picea engelmannii* and *Abies lasiocarpa* are slow to recolonize and characteristically have slow growth and poor form. Other coniferous species are usually lacking. *Vaccinium caespitosum is* diagnostic for the type, occurring as a discontinuous layer with *Calamagrostis rubescens* and *Carex geyeri* and joined by *Vaccinium scoparium* on more severe sites. The few forbs present are obscured by the subshrub and graminoid layer (fig. 31).

Productivity/Management—Based on data from contiguous areas, timber productivity ranges from low to moderate, with *P. contorta* the only species well suited for management (Pfister and others 1977; Steele and others 1981). These populations have predominantly nonserotinous cones, accounting for the high rate of seedling establishment in the absence of disturbance. Gentle terrain and stable soils should favor intensive silviculture. However, the frost pocket microclimate argues otherwise; data assessing response to treatment are wanting.

Livestock find moderate forage, provided by *C. rubescens* and *C. geyeri,* and favorable terrain. Proximity to moist meadows suits these sites for summer and fall elk and deer use as cover.

Other Studies—This type is best represented beyond the influence of the inland maritime climatic regime, ranging from Alberta (Ogilvie 1962, as portions of the *Picea-Abies / Calamagrostis* h.t.) through eastern Montana (Pfister and others 1977) to central Idaho (Steele and others 1981) and northern Utah (Henderson and others 1976). For northeastern Washington Lillybridge and Williams (1984) describe an ABLA/VACCI association for which *V. caespitosum* is ostensibly the diagnostic species. Habitats described for their association are very similar to those of our ABLA/VACA h.t., but floristic composition of their stands reveals a wider range of environments.

Figure 31—*Abies lasiocarpa/Vaccinium caespitosum* h.t. on a gentle toeslope associated with frost-pocket conditions (5,320 ft [1,620 m]) on Red River Ranger District, Nez Perce NF. This midseral stand is dominated by *Pinus contorta* in the overstory, with *V. caespitosum* and *V. scoparium* forming a low shrub layer; *Xerophyllum* is the only forb of importance.

Abies lasiocarpa/Xerophyllum tenax h.t. (ABLA/XETE; subalpine fir/beargrass)

Distribution—ABLA/XETE is an abundant h.t. on the Nez Perce and southern Clearwater NF's, decreasing in importance to the north. It is strongly associated with steep, warm exposures with well-drained soils but also occurs on benchlands. Observed elevational range was 5,100 to 6,200 ft (1,550 to 1,890 m) in the north and 5,300 to 7,600 ft (1,615 to 2,320 m) on the Nez Perce NF. It usually grades to ABLA/MEFE phases on colder sites and to ABLA/CLUN-XETE on moderated environments.

Vegetation—*Abies lasiocarpa* is usually well represented even in early seral stands and increases in importance to dominate these sites as in no other subalpine zone h.t.; conversely, *Picea engelmannii* occurs only sporadically. Seral tree occurrence and growth vary by phase.

Generally abundant *X. tenax* and *Vaccinium globulare* (on all but the coldest sites) are the only undergrowth species with high constancy in all phases.

Luzula hitchcockii (LUHI) phase—The LUHI phase delineates the highest elevations (5,700 to 7,600 ft [1,740 to 2,320 m]) or areas where snowpacks remain well into the growing season. The severity of these sites is reflected by: (1) the much lower coverage constancy and diminutive form (12 to 20 inches [30 to 50 cm]) of *V. globulare,* (2) the depauperate forb layer, (3) the occurrence of *Luzula hitchcockii* and/or *Phyllodoce empetriformis* and/or high coverage of *Vaccinium scoparium,* (4) the absence of *Pseudotsuga menziesii,* and (5) the waning of *Pinus contorta*'s seral importance and increase in that of *Pinus albicaulis.*

Vaccinium scoparium (VASC) phase—The VASC phase occurs predominantly on the Clearwater and Nez Perce NF's. Though ranging from 5,200 to 6,900 ft (1,585 to 2,105 m), it defines predominantly upper elevation sites (>5,900 ft [1,800 m]), frost pocket conditions, or relatively severe, windswept, near-ridgeline positions. The undergrowth may be quite dense with a layer of *V. scoparium* surrounding clumps of *Xerophyllum* over which *V. globulare* is superimposed (fig. 32). Excepting *X. tenax,* the forb layer is sparse; only *Viola orbiculata* is even moderately constant. *Pinus contorta* is the major seral species followed distantly by, in order of decreasing importance, *Picea, Pseudotsuga,* and *P. albicaulis.*

Coptis occidentalis (COOC) phase—Recognized by the common coverage of *Coptis,* the COOC phase is indicative of the most moderate sites within the type, those transitional to ABLA/CLUN-XETE, ABGR/CLUN-XETE, and ABGR/XETE. It was found only on the Clearwater and Nez Perce NF's. It commonly occurs between 5,200 and 5,900 ft (1,585 and 1,800 m) (extremes to 6,400 ft [1,950 m]) and predominantly on east- and west-facing aspects. The moderated conditions of this phase are reflected in relatively high constancy and coverage for *Abies grandis, Picea,* and *Pseudotsuga; P. contorta* is still the major seral tree. Higher constancy for *Viola orbiculata, Anemone piperi,* and *Goodyera oblongifolia,* and generally greater undergrowth diversity, distinguish this phase (fig. 33).

Vaccinium globulare (VAGL) phase—This phase occurs at lower elevations of the h.t. (<6,400 ft [1,950 m]) and represents modal conditions within the type. It supports a variety of seral tree species, of which only *P. contorta, Pseudotsuga,* and *Larix occidentalis* are important. *Pinus monticola* may be locally significant from the Clark Fork River drainage northward. *Calamagrostis rubescens* and *Carex geyeri* have high constancy and are locally abundant in this phase. The VAGL phase grades to ABLA/MEFE-XETE on northerly, sheltered positions and ABLA/XETE-VASC on colder, drier sites.

Soils—Parent materials included, in decreasing frequency of occurrence, granitics, gneiss, mica schist, and rhyolite (appendix D). Only one restrictive layer was found in 30 profiles. The ash cap influence is strong (averaging 14 inches [35 cm] in depth) in all phases but LUHI, where it is conspicuously reduced. Surface horizons in COOC and VAGL phases are exclusively silt loams and loams, whereas for VASC and LUHI the textural range is much greater; soil textures increase in coarseness with increasing depth. Surface soil gravel content averages about 15 percent for COOC, XETE, and VASC with LUHI averaging approximately double this value; subsurface soil gravel content increases with depth and averages about twice that of the surface soil for all phases. Rooting depth averages 16, 20, 21, and 13 inches (41, 50, 53, and 33 cm) for COOC, VAGL, VASC, and LUHI phases, respectively. In accordance with expectations of increasing precipitation and hence increased leaching, the surface soil pH decreases along the gradient COOC (5.9), VAGL (5.8), VASC (5.6), LUHI (5.2); subsoil pH values are slightly higher but approximate the surface soil gradient.

Productivity/Management—Site index data are sketchy but indicate a steady decline by phase from moderate to high in VAGL and COOC, low to moderate in VASC, and low in LUHI (appendix F). The VAGL and COOC phases offer the most opportunity for mixed species management; in order of decreasing potential they are *P. contorta, Pseudotsuga, Picea,* and *L. occidentalis.*

Fiedler (1980) has shown that following clearcutting on the VAGL phase in northwestern Montana (1) undergrowth has a dramatic, inverse correlation with tree stocking at tree coverages greater than 25 percent; (2) scarification is preferable to burning in achieving regeneration the first 9 to 10 years following cutting—the "no treatment" alternative following cutting is least successful; and (3) *A. lasiocarpa* seedlings constituted 40 percent of natural regeneration in 12 years, followed distantly by *Pseudotsuga* (18 percent) and, in order of decreasing amounts, *P. contorta, Picea,* and *L. occidentalis. Abies lasiocarpa,* though relatively prolific in regeneration, has slow initial growth, with seedlings concentrated in the lower crown class. Planting of these sites in areas with an abundant seed source seems unwarranted. Some of these results can be extrapolated to the VASC phase.

Timber management for VASC and LUHI phases should concentrate on *P. contorta* and *Picea.* These are severe sites. The creation of forest openings through patch clearcutting can cause increased snow deposition and retarded reforestation. Partial cutting leaves *Picea* susceptible to windthrow, while advance regeneration of *Abies lasiocarpa* may be released to dominate the stand.

Livestock grazing potential is low in all phases. Evidence of light to moderate use by elk and deer is present in the

Figure 32—*Abies lasiocarpa/Xerophyllum tenax* h.t.-*Vaccinium scoparium* phase on a gently sloping ridge shoulder (6,520 ft [1,990 m]) east of Dixie Guard Station, Nez Perce NF. Even-aged *Pinus contorta* dominates the overstory, with *A. lasiocarpa* and *Picea* scattered in the understory. A low mat (8 inches [20 cm]) of *V. scoparium* is interspersed with clumps of *X. tenax*.

Figure 33—*Abies lasiocarpa/Xerophyllum tenax* h.t.-*Coptis occidentalis* phase on a gentle east-facing slope (6,000 ft [1,830 m]) north of Dixie Summit, Nez Perce NF. *Pseudotsuga* dominates this multiple-aged stand (180 years old) and is currently reproducing in greater numbers than *A. lasiocarpa*. Undergrowth is dominated by *Vaccinium globulare*, *Spiraea betulifolia*, and *X. tenax*.

VAGL phase in early and midsummer, with herds moving through all phases by late summer-early fall. *Xerophyllum* flowering heads were consistently cropped in some areas and individual *V. globulare* plants were hedged to less than 1 ft (30 cm) in height. Mainly bears and grouse feed on the huckleberry crop.

Watershed management opportunities are greatest in the VASC and LUHI phases; in general, moderate to high precipitation occurs here, with high rates of evapotranspiration and runoff characteristic of these generally warm exposures.

Other Studies—Daubenmire and Daubenmire (1968) first described the ABLA/XETE h.t. for northern Idaho, combining all phases recognized here. Lillybridge and Williams (1984) recognize an ABLA/XETE association which is restricted to east of the Pend Oreille River in Washington. For Montana, Pfister and others (1977) recognize VASC and VAGL phases similar to ours, but they assign stands containing *L. hitchcockii* to ABLA/LUHI. We follow Steele and others' (1981) classification for central Idaho; there they discount the indicator value of *L. hitchcockii* because it extends to relatively lower elevations of the subalpine zone than in Montana. Ogilvie (1962) for southeastern Alberta and Cooper (1975) for northwestern Wyoming describe known outliers of the type.

Abies lasiocarpa/Vaccinium scoparium h.t. (ABLA/VASC; subalpine fir/grouse whortleberry)

Distribution—As Daubenmire and Daubenmire (1968) noted, ABLA/VASC is poorly represented where the inland maritime climatic influence is strongest. Thus it was noted in reconnaissance as an incidental type found only at the periphery of the study area, the Seven Devils Mountains, and southern Nez Perce NF. In eastern Washington Lillybridge and Williams (1984) identified ABLA/VASC as a minor type and in northwestern Montana the h.t. was not found (Pfister and others 1977). It was not observed below 6,200 ft (1,890 m) and showed no aspect preference. Of the three phases noted for central Idaho and Montana, only the VASC phase (characteristic of the most severe environments) was identified in northern Idaho.

Vegetation—*Picea engelmannii* and *Abies lasiocarpa* are slow to reestablish on these harsh sites that are dominated in seral stages by mostly nonserotinous *Pinus contorta. Pinus contorta* readily reproduces, even before the breakup of the densely stocked stands. *Pinus albicaulis* may be a significant seral component at the highest elevations. The undergrowth is dominated by a low layer of *Vaccinium scoparium;* the herbaceous layer is rather depauperate, with only *Arnica* spp., *Lupinus* spp., *Carex geyeri,* and *Carex rossii* normally present.

Productivity/Management—See Steele and others (1981) and Pfister and others (1977) for detailed management considerations. Reconnaissance observations suggest *P. contorta* is the only suitable timber species, regenerating easily in unshaded clearings, but having poor height growth.

Other Studies—ABLA/VASC is one of the most wide-ranging, areally extensive subalpine h.t.'s in the Interior West, having varying degrees of compositional differences, from British Columbia and Alberta (Illingsworth and Arlidge 1960; Ogilvie 1962) south to Arizona and New Mexico (Moir and Ludwig 1979).

Abies lasiocarpa/Luzula hitchcockii h.t. (ABLA/LUHI; subalpine fir/smooth woodrush)

Distribution—ABLA/LUHI is a minor h.t. in northern Idaho, confined to the highest and harshest sites where snowpacks remain late into summer. It was found as low as 6,000 ft (1,830 m) on the Kaniksu NF but ranges to 8,000 ft (2,440 m) on the Nez Perce NF.

Vegetation—Trees tend to occur in clusters. The multiple-stemmed condition of *Pinus albicaulis,* the major seral species, may result from germination of unharvested avian (Lanner 1980) or rodent seed caches. *Picea* and *Abies lasiocarpa* are well represented to abundant on all but the youngest seral stages. ABLA/LUHI sites occur above the limits of *Pseudotsuga, Larix occidentalis,* and *Pinus monticola* and are marginal for *Pinus contorta* establishment.

The undergrowth is species-poor and coverages vary considerably. *Luzula hitchcockii* sometimes occurs as a dense sward with *Vaccinium scoparium* and *Phyllodoce empetriformis* superimposed. *Valeriana sitchensis* and *Arnica latifolia* are characteristic of the more moist sites (fig. 34).

Soils—Because all samples with soils information were collected on the eastern portions of the Nez Perce NF where the Idaho batholith predominates, granitics were the only parent materials represented (appendix D). Very limited data show soil textures, rock content, and rooting depth to vary widely; no restrictive layers were found. Generally there is little exposed soil, but exposed rock may be considerable. Surface horizons are very acidic (pH 4.2 to 4.8), with values increasing with depth (lower profile pH 5.1 to 5.3).

Productivity/Management—Timber potentials are low (appendix F). Seral tree regeneration may be difficult to achieve due to heavy snowpack, competition from a sward of *Luzula,* and advance regeneration of *Abies lasiocarpa* (frequently vegetatively layering).

These are fragile sites due to their harsh environments. Apparently only the Seven Devils area has been subjected to the degrading forces of intensive sheep trailing cited by Steele and others (1981) as extensive in central Idaho. Key management concerns include watershed protection and maintenance of "high country" esthetics for recreation.

ABLA/LUHI provides summer and fall cover and forage for elk, deer, mountain goats, bighorn sheep, and bears.

Other Studies—In central Idaho, where there is much more high-elevation country capable of supporting ABLA/LUHI, Steele and others (1981) have recognized LUHI and VASC phases; Pfister and others (1977) in Montana have defined a broader LUHI h.t. by emphasizing the mere presence of *Luzula hitchcockii.* We often noted *L. hitchcockii* occurring far downslope, distant from an upper subalpine environment, and thus did not accord the same indicator significance as in Montana environments.

Figure 34—*Abies lasiocarpa/Luzula hitchcockii* h.t. on a gentle west-facing slope near Heaven's Gate Lookout, ID (8,150 ft [2,485 m]), Nez Perce NF. Except where erosion pockets occur, *L. hitchcockii* approaches sward-like conditions under an open canopy *of A. lasiocarpa* and *Pinus albicaulis.* Minor amounts of *Lupinus, Penstemon, Phlox,* and *Polemonium* species also occur.

Larix lyallii-Abies lasiocarpa communities (LALY-ABLA; alpine larch-subalpine fir)

Distribution/Vegetation—Occurring at the outer fringe of the maritime mountain climates on cold exposures with limited soil development, LALY-ABLA communities have been classified only for Montana timberlines (Pfister and others 1977) west of the Continental Divide. According to the distribution map of Arno and Habeck (1972), this complex occurs along the highest peaks of the Bitterroot Mountains (Idaho-Montana border) and northward as isolated occurrences at Roman Nose and Northwest Peak on the Kaniksu NF, making it a very incidental type. Although we have not sampled this type, we have used the plural designation to indicate the possibility of diverse types. See Pfister and others (1977) and Arno and Habeck (1972) for community descriptions and management implications.

Generally the overstory is dominated by *Larix lyallii* and varying amounts of *Abies lasiocarpa, Pinus albicaulis,* and *Picea engelmannii.* The undergrowth varies, with *Vaccinium scoparium* and *Luzula hitchcockii* usually present and often dominant.

Pinus albicaulis-Abies lasiocarpa communities (PIAL-ABLA; whitebark pine-subalpine fir)

Distribution—PIAL-ABLA communities constitute a mosaic of timberline sites, reduced to insignificant acreages in northern Idaho compared to surrounding regions with extensive high-elevation areas. The plural designation denotes variation in undergrowth composition. Individual h.t.'s are not described for want of adequate data and the lack of need to meet broad-based management applications.

Vegetation—*Abies lasiocarpa, Pinus albicaulis,* and *Picea engelmannii* occur in varying proportions, often as groveland clusters; with increasing elevation, the spacing between groves increases as does crown deformation due to the effects of wind and snowpack. *Abies* and *Picea* are stunted (<55 to 60 ft [16 to 18 m]), may approach a shrublike form, and reproduce principally by layering of lower branches.

Usually a notable undergrowth difference exists between (1) windward and dry sites dominated by grasses, *Juncus parryi,* and scattered forbs; and (2) lee slopes and moist sites (heavy snowpack), characterized by *Arnica latifolia, Vaccinium scoparium, Luzula hitchcockii,* and north of the Nez Perce NF by the heath plants *Phyllodoce empetriformis* and *Cassiope mertensiana.*

Steele and others (1981) have noted for central Idaho that excessive sheep use is reflected in contour ribbons composed of *Juncus parryi,* and in the case of severe degradation and erosion, by dominance of *Polygonum phytolaccaefolium.*

Productivity/Management—Timber potential is very low because of slow growth rates, low basal areas, and poor bole form. Watershed potential is apparently high, as is esthetic appeal. The fragile nature and slow vegetational recovery time of these sites dictates dispersed, low-impact recreation.

Other Studies—This vegetation complex was originally described by Daubenmire and Daubenmire (1968). Pfister and others (1977) in Montana, and Steele and others (1981) in central Idaho, have extended the known area of this complex of types.

Abies grandis (ABGR) Series

Distribution—The inland maritime climate and its moderating effects, with which the distribution of *Abies grandis* is correlated, is sufficiently strong to support *A. grandis* throughout the study area. *Abies grandis is* the indicated climax species beyond the geographical and ecological limits of the more shade-tolerant and moisture-dependent *Thuja plicata* and *Tsuga heterophylla* (Minore 1979). The *A. grandis* series area of importance is confined to the Nez Perce and southernmost Clearwater NF's. Further north the series is restricted, relative to the area occupied by the *Thuja* and *Tsuga heterophylla* series, occurring on relatively warm exposures and excessively drained substrates. The *A. grandis* series grades to the *Pseudotsuga menziesii* series on drier, warmer sites and to the *Abies lasiocarpa* series on cooler sites. The elevational range of the *A. grandis* series is greatest in the southern portion of the Clearwater River drainage, from <1,500 to 6,300 ft (460 to 1,920 m). To the north 250 mi (416 km) in northern Boundary County, *A. grandis* as a series is relegated to specific edaphic or topographic conditions; as a species, it ranges from valley floors (1,800 ft [550 m]) to approximately 5,100 ft (1,555 m).

See Distribution section of ABLA series for a discussion of the separation of the *A. grandis* from the *A. lasiocarpa* series.

Vegetation/Fire—Steele and others (1981) note the ABGR series to be floristically the most diverse of all central Idaho series; whereas in northern Idaho it shares this distinction with the *T. plicata* series (absent in central Idaho). The relatively moderate climate is associated with high species diversity. Both climate and flora are transitional, respectively, between Pacific maritime and continental, and between Central Rocky Mountain and Northern Rocky Mountain. Ostensibly, there is greater environmental diversity (three h.t.'s) for the series at its eastern limits in Montana (Pfister and others 1977) and southern limits in central Idaho (six h.t.'s, Steele and others 1981) when compared to the Daubenmires' (1968) one h.t., ABGR/*Pachistima myrsinites,* in northern Idaho. This disparity is explained by the Daubenmires' limited data set (10 stands) that underrepresented environmental diversity for northern Idaho and resulted in lumping of distinct environments where data were inadequate to assess the variability represented. Our more intensive sampling for the series (270 stands) led to partitioning of the environmental spectrum into 15 taxonomic units, a number more in accord with the diversity expected from a tree series' geographic center of importance (Cooper and Pfister 1984).

The ABGR series supports no unique undergrowth species assemblages; rather, its composition bears an affinity to the undergrowths of the *A. lasiocarpa, Pseudotsuga, T. plicata,* and *T. heterophylla* series. A diverse high-coverage shrub component *(Acer glabrum, Ceanothus* spp., *Amelanchier alnifolia, Rubus parviflorus, Holodiscus discolor,* and *Symphoricarpos albus)* may be present on early successional stages with their coverages generally decreasing with age (increasing tree canopy coverage), even on the warmest exposures. Forb species range from those characteristic of saturated soils (for example, *Senecio triangularis* and *Athyriumfilix-femina)* to those typical of steppe sites (for example, *Balsamorhiza sagittata).*

On moist sites, *A. grandis* is a major recolonizer and canopy dominant even following severe site disturbances. However, because of slower initial establishment and growth it usually forms a subordinate layer to seral trees. *Pseudotsuga,* which also has slower initial growth than its common seral associates, is the major seral species on nearly all *A. grandis* h.t.'s. The predominance of *Pseudotsuga* in our data, however, may be a bias introduced by sampling older stands. Distribution of other seral species is differentiated by region and h.t., but their relative abundance may be more a consequence of stand history and age than site characteristics (Antos and Habeck 1981; Cattelino and others 1979). Mixtures of *Picea engelmannii* and *Pinus contorta* generally occur on colder h.t.'s, whereas *Pinus ponderosa* is prevalent only on the warmer types and phases. *Larix occidentalis* can be a major component where fire has been a significant influence, but overall its occurrence is notably sporadic relative to its distribution in northwestern Montana (Pfister and others 1977). It is virtually absent from whole drainages where the local climate seems favorable. *Pinus monticola* occurs scattered on the Clearwater NF and northward; it is seldom a stand dominant.

Multiple-pathway successional models developed by Antos and Habeck (1981) for Montana's Swan Valley, more general ones by Kessel and Fischer (1981) and Cattelino and others (1979), and a seral stages classification for the ABGR/VAGL h.t. (Steele and Geier-Hayes 1982) indicate that a wide variety of seral communities can develop on a given ABGR h.t., depending on an interaction of initial composition, seed source, type and degree of disturbance, and time since stand initiation. According to the Antos and Habeck (1981) model, a local scarcity of *L. occidentalis* (cited above) may result from fires recurring at intervals shorter than required for *L. occidentalis* to develop its highly fire-resistant bark. The implications of the short life expectancy (120 to 160 years) and rapid canopy breakup of *P. contorta* stands are several: (1) mixed stands (*P. contorta-L. occidentalis)* that burn prior to significant *P. contorta* mortality will be replaced by stands with a higher proportion of *P. contorta;* (2) heavy fuel beds are produced, increasing the probability of intense fires and resulting in the dominance of *P. contorta,* especially toward the center of large burns; (3) repeated fires at intervals of less than 100 to 150 years favor *P. contorta* but significantly longer intervals (>160 years) tend to eliminate this species and favor *L. occidentalis, Pseudotsuga,* and *A. grandis.*

On the Nez Perce and Clearwater NF's, periodic fires have been a major influence and have resulted in site domination by *P. ponderosa* and *Pseudotsuga* on warm, dry sites and *P. contorta* on colder sites. Throughout northern

Idaho, *A. grandis* h.t.'s have registered repeated underburns that maintained open, seral-species forests prior to 1900 (Arno 1980). Extremely high coverages of *Pteridium aquilinum* and *Poa pratensis* can be produced, respectively, by burning and heavy livestock use. Most disturbed areas, depending on the rate of tree canopy development and degree of livestock use, return to native species dominance. Some sites, despite the cessation of disturbance, show negligible recolonization by native species, or at least a continued dominance of *P. pratensis, P. aquilinum,* and/or *Rudbeckia occidentalis.*

The best documented succession studies in this series are: (1) Zamora's (1982) regarding broadcast-burned clearcuts and wildfire on the Nez Perce NF, ABGR/PAMY h.t. (corresponding to our CLUN-CLUN, CLUN-XETE, ASCA-ASCA h.t.'s), which spans a 190-year sequence, and (2) that of Steele and Geier-Hayes (1982) of the ABGR/VAGL h.t. in central Idaho. Antos and Habeck (1981) also discuss undergrowth changes following burning on logged sites and stand-replacing fires (ABGR/CLUN and THPL/CLUN h.t.'s). All studies indicate that major changes in undergrowth composition coincide with "tree canopy closure" (Antos and Habeck 1981) or development of "a distinct overstory stratum" (Zamora 1982). This point marks the beginning of the "stagnation stage" of Daubenmire and Daubenmire (1968); shade-intolerant species are eliminated, the shrub stage terminates (in nonshrubby h.t.'s), and changes in undergrowth species are of relative abundance, not loss or displacement. These changes are a function of overstory structure (mostly canopy coverage). Time elapsed until a distinct overstory develops is primarily a function of the rapidity of tree regeneration following disturbance. Antos and Shearer (1980) and Stickney (1982) also discuss plant succession in this series with attention to management implications.

Productivity/Management—Site indexes range from moderate to very high (appendix F), with values from the more moist sites being comparable to those of the THPL series. The diversity of seral trees and their generally high growth rates combine to offer diverse silvicultural opportunities. Site indexes for *A. grandis* are highest on relatively warm, moist sites; here its height growth rate occasionally exceeds those of the seral species. *Pinus ponderosa is* generally the fastest growing tree but is currently important on only the warmest sites, partly because of fire suppression and advancing succession. *Pseudotsuga* is moderately to highly productive in this series and occurs on all but sites having saturated soils. *Picea engelmannii* and *P. contorta* are adapted to wet and cold sites.

Ferguson and Adams (1980) have proposed some silvicultural strategies that follow from their model of *A. grandis* response (height growth) after overstory removal. Their model indicates that, in addition to physical site variables, habitat type is an important response predictor. Generally, *A. grandis* on ABGR series sites is not suitable for release unless certain mitigating conditions are met. A regeneration model applicable to the ABGR series that is based on silvical characteristics of Northern Rocky Mountain tree species, site data, and stratified by habitat type and treatment, has been developed as a submodel of the Prognosis Model (Ferguson and others 1986; Stage 1973).

Reforestation of h.t.'s on which succession favors shrubfields, *Rudbeckia occidentalis* or *Pteridium* glades, or *Calamagrostis rubescens* swards may require thorough site preparation and planting. Early successional stages of some types can produce high-quality browse for elk and deer, with lower elevations and south slopes often being used as winter range. Much of this series in the Palouse and Joseph Plains area, where soils are deep, has been converted to farms and pastures.

Trunk rots, primarily *Echinodontium tinctorium* (Indian paint fungus), may be rampant in *Abies* on moist sites (areas of heavy mortality noted as "heartrot" centers), but are of decreasing incidence on drier sites (Frederick and Partridge 1977). The intrinsically high rates of *E. tinctorium* infestation and increase due to the reactivation of dormant infections by mechanical injury (logging) are major factors arguing against uneven-aged management of *A. grandis* on moist sites (Antos and Shearer 1980). *Poria weirii* and *Armillaria mellea* are the primary root-rot pathogens in the series. Preliminary indications (McDonald 1983) are that the rate and severity of *Armillaria* infestations are associated with groups of like h.t.'s; the more moist, moderate temperature groups are most severely affected.

Abies grandis/Senecio triangularis h.t. (ABGR/SETR; grand fir/arrowleaf groundsel)

Distribution—ABGR/SETR is a minor h.t., occurring on bottomlands and toe-slopes with high water tables at low to middle elevations (2,600 to 4,600 ft [790 to 1,400 m]) of the *Abies grandis* zone. These sites are beyond the geographic range of *Thuja plicata* and at or below the lower elevational limits of *Abies lasiocarpa.* Adjacent slopes or better drained conditions usually support ABGR/ASCA-ASCA or ABGR/CLUN-CLUN.

Vegetation—*Picea engelmannii* and *A. grandis* are the major colonizing species, but *A. grandis* demonstrates the greater reproductive capacity under heavy shading. In mature stands Ferguson (1985) has noted *A. grandis* and *P. engelmannii* regenerating only on rotting logs and stumps. *Abies lasiocarpa* may occur as a minor climax species at upper elevations or in frost pocket locations. Drier edges of the h.t. support small amounts of *Pseudotsuga menziesii* and *Larix occidentalis.*

The undergrowth is characterized by a diverse assemblage of moist-site forbs, of which *Athyrium filix-femina, Trautvetteria caroliniensis,* and *Senecio triangularis* exhibit the highest constancy and coverage.

Productivity/Management—Based on limited data, site indexes for *A. grandis* and *Picea* appear high. As with all high-water-table sites, extreme caution should be exercised in site manipulation. These sites are easily degraded through any disturbance; susceptibility to windthrow may be unusually high. Cutover stands are colonized by *Alnus sinuata, Pteridium aquilinum,* and/or *Rudbeckia occidentalis,* making regeneration difficult.

Other Studies—Steele and others (1976) have described this type as *ABGR/Athyrium filix-femina* on the Nez Perce NF. Also using *Athryium* as a diagnostic species, Pfister and others (1977) found this type in canyon bottoms of Montana's Bitterroot Range (denoting it *ABGR*/CLUN-*Aralia nudicaulis*).

Abies grandis/Asarum caudatum h.t. (ABGR/ASCA; grand fir/wild ginger)

Distribution—ABGR/ASCA is a major h.t. south of the distribution of *Thuja plicata,* reaching its greatest extent on the drainages of the Clearwater River. It occupies all terrain from lower to upper elevations (2,200 to 5,950 ft [670 to 1,815 m]) of the ABGR zone. Some phase distinctions are noted with regard to its topographic, aspect, and elevational distribution. ABGR/ASCA is indicative of environments warmer and more moist than ABGR/CLUN, usually protected exposures or covelike situations. The original data set (Steele and others 1976) from which this type was identified has been considerably augmented, and the originally defined type and phases have been confirmed. On warm but drier sites it merges with ABGR/CLUN h.t.'s; on colder, drier sites it grades to ABGR/XETE or ABLA/CLUN h.t.'s.

Vegetation—Seral tree success is differentiated by phase; only *Pseudotsuga menziesii* is moderately important across all phases. Following disturbance, ABGR/ASCA sites are frequently recolonized by *Abies grandis,* leading to the somewhat atypical case of even-aged stands dominated by a climax species. In mature stands on the Selway Ranger District, Ferguson (1985) has noted that regeneration of *A. grandis* and *Picea engelmannii* is confined to rotting logs and fractured stumps; *Taxus brevifolia* was able to regenerate on the soil surface. The moderate environments of these sites are reflected in high species richness and undergrowth coverages, especially in the forb layer where *Clintonia uniflora, Tiarella trifoliata, Viola glabella,* and *Smilacina stellata* are characteristically present. Only *Asarum caudatum* is diagnostic for the type. Other forbs, *Coptis occidentalis, Disporum hookeri, Polystichum munitum,* or *Synthyris platycarpa,* may occasionally dominate this layer. *Acer glabrum* and *Rosa gymnocarpa* are the only shrubs with high constancy; their coverage declines with increasing stand age and canopy cover. With the exception of one phase, *Xerophyllum tenax* is notably unimportant.

Menziesia ferruginea (MEFE) phase—This phase occurs on the coolest, upper elevation (>4,400 ft [1,340 m]) sites within the h.t., usually confined to steep northwest- through east-facing slopes or benchlands. It grades to ABGR/CLUN-MEFE on drier, less moderate sites and to ABGR/ASCA-TABR or -ASCA phases on warmer sites. A layer of *M. ferruginea* dominates a tall shrub stratum, which may include abundant *T. brevifolia* and *Vaccinium globulare.* Within ABGR/ASCA these sites have the greatest potential for supporting a diversity of seral trees—*Picea engelmannii* and *Pseudotsuga* are the major seral dominants—but *Pinus contorta, Pinus monticola,* and *Larix occidentalis* also occur. *Abies lasiocarpa* can be a minor coclimax dominant.

Taxus brevifolia (TABR) phase—To date, this phase has been found exclusively on the Nez Perce NF, concentrated in the western portion of the South Fork Clearwater River drainage. It ranges in elevation from 4,000 to 5,600 ft (1,220 to 1,710 m) and occupies a variety of topographic positions, but is most prevalent on moderate to steep slopes with warm, often protected exposures and ridgetop benches. These sites differ environmentally from those of ABGR/ASCA-ASCA or ABGR/CLUN-CLUN by occurring principally at higher elevations, where they grade to ABGR/CLUN-XETE on more exposed or warmer, drier sites. Employing discriminant analysis, Crawford (1983) has shown thinner A horizons and shallower depth to the BC horizon for his TABR/ASCA h.t. (our ABGR/ASCA-TABR) as contrasted with the ABGR/ASCA h.t. Whether these soil differences are the cause of vegetation patterns or, conversely, register vegetation effects is a moot point.

The very shade-tolerant *T. brevifolia* dominates a tall shrub-small tree layer, becoming so dense in patches that shrubs of lesser stature, herbs, and tree seedlings (except *Taxus)* are virtually eliminated. Generally, *A. grandis* dominates the overstory. *Picea* is the most common of the weakly represented seral trees. Hypothetically, given at least several hundred years with no disturbance, these sites could succeed to monospecific *Taxus* dominance (Crawford and Johnson 1984). Acknowledging that this successional consequence is possible, though improbable, owing to high fire-return frequencies on the Nez Perce NF and windthrow, we have recognized most sites with the potential for developing high coverages of *Taxus* as TABR phases. Nevertheless, some sites supporting high *Taxus* coverages occur in other types and phases (for example, ABGR/ASCA-MEFE, ABGR/CLUN-MEFE, and ABGR/SETR).

Asarum caudatum (ASCA) phase—Description of this, the most moderate phase, generally follows that of the h.t. It ranges from 2,100 to 5,400 ft (640 to 1,645 m) but occurs predominantly below 4,800 ft (1,465 m). It occupies gentle to steep slopes of all aspects, with warmer exposures more frequently represented. It is bordered at lower elevations by the THPL series and on drier or colder sites by other ABGR/ASCA phases or ABGR/CLUN-XETE, -PHMA, or -CLUN phases. Coverages of forbs and warm-site shrubs, such as *Symphoricarpos albus, Holodiscus discolor,* and *Physocarpus malvaceus,* are increased relative to those found on the other phases and persist late into the sere (fig. 35). *Abies grandis* and *Pseudotsuga* generally codominate seral stages. The seral importance of *Picea* is reduced in this phase, while that of *P. monticola, P. ponderosa,* and *L. occidentalis* is increased.

Soils—Parent materials vary, but granitics and metasediments are best represented. Upper horizons of virtually all profiles are influenced by volcanic ash (appendix D). Only traces of exposed soil or rock are found, and gravel content generally did not exceed 30 percent (average 15 percent in upper horizons). Soil textures are primarily silt loams and silty clay loams. About half of the ASCA phase profiles possess a restrictive layer, caused by increases in clay content or a compacted horizon; sites not having this layer are well drained. The effective rooting depth ranges widely, from 9 to 31 inches (22 to 80 cm) averaging 20 inches (50 cm). Throughout the profile soil pH ranges from slightly acid (6.0) to neutral (7.1), averaging 6.3.

Productivity/Management—Site indexes for all species across all phases are high to very high. *Pseudotsuga* and *P. ponderosa* are most successful and fastest growing on lower elevations and warmer exposures within the type (usually the ASCA phase), whereas *Picea* establishes and grows most rapidly on colder sites (MEFE phase) (appendix F). Though most stands appear to be highly productive, early site domination by shade-tolerant, tall shrubs

Figure 35—*Abies grandis/Asarum caudatum* h.t.-*Asarum caudatum* phase on a moderate southerly slope (3,800 ft [1,160 m]) south of Mush Saddle in the Clearwater Mountains. Even-aged 80-year-old *Pseudotsuga* dominates the canopy with *A. grandis* slowly establishing in the understory. Undergrowth is dominated by forbs with *Disporum hookeri, A. caudatum, Smilacina stellata,* and *Coptis occidentalis* well represented. The scattered shrub layer is typical of later successional stages (canopy closure) within this phase.

(*Menziesia* and *Taxus*) apparently reduces stocking levels (and productivity) throughout the life of the stand. Removal or reduction of the tall shrub layer may be necessary to establish seral conifers. Partial cutting practices can result in the dominance of *A. grandis*; in fact, conditions within the type are so favorable to *A. grandis* that it often regenerates on clearcuts in greater numbers than seral associates and its rate of initial height growth can equal that of seral species.

The TABR and portions of the MEFE phase constitute important winter range for moose (Pierce 1983); they both may also receive appreciable summer and fall use. Silvicultural strategies seeking to maintain *Taxus* stands should consider that it is: (1) extremely shade tolerant but can adjust to the high light intensities following canopy removal; (2) capable of regeneration by sprouting and layering following overstory removal, though its primary dispersal mechanism is animals; and (3) extremely sensitive to fire and sun scalding and, to a much lesser degree, to mechanical damage (Crawford 1983). Overstory removal, especially in the ASCA phase, promotes a dense layer of forbs and shrubs that provides considerable large herbivore forage. ASCA phase sites also constitute that portion of the h.t. with the greatest winter range potential for herbivores other than moose.

Much of this h.t. covers those portions of the Clearwater and Nez Perce NF's where succession on cutover areas leads to dominance by *Alnus sinuata, Pteridium aquilinum,* and/or *Rudbeckia occidentalis;* these communities are both long-persisting and intractable to tree regeneration. Pocket gophers (*Thomomys* spp.) are a major influence in this complex of community types (Neiman and others 1985).

Other Studies—Several of the stands in the Daubenmires' (1968) ABGR/*Pachistima myrsinites* h.t. and at least one stand of ABGR/CLUN of Lillybridge and Williams (1984) ABGR correspond to the ASCA phase of ABGR/ASCA. This h.t. and phases were first described for the Nez Perce NF by Steele and others (1976), and this location and those on the Clearwater NF encompass its reported extent. Crawford and Johnson (1984) have conducted an intensive analysis of *T. brevifolia* dominated stands on the Nez Perce NF and recommend an alternative syntaxonomy, emphasizing the climax status of *T. brevifolia,* for environments we recognize as the ABGR/ASCA h.t.; they conclude alternative syntaxonomies may coexist and that each may have specific information and unique implications for land managers.

Abies grandis/Clintonia uniflora h.t. (ABGR/CLUN; grand fir/queencup beadlily)

Distribution—ABGR/CLUN is a broadly distributed major h.t. that increases in importance from the Kaniksu NF southward to the Nez Perce NF. South of the Middle Fork Clearwater River drainage it is the dominant midmontane h.t. In its northern range it occurs on relatively dry exposures; adjacent moist sites belong to the *Tsuga heterophylla* or *Thuja plicata* series, CLUN h.t.'s. In the southern part of its range, where the greatest phase diversity is found, it occupies all exposures on relatively moist sites from 2,000 to 6,100 ft (610 to 1,860 m). Phases are associated with unique combinations of site attributes.

Vegetation—*Abies grandis,* in addition to being the climax dominant, is a major and the most consistent dominant of seral stages, even following clearcutting or severe wildfire. Seral tree success is related to region and phase; only *Pseudotsuga menziesii* is consistently important in all phases.

Undergrowth is characterized by the presence of *Clintonia uniflora* and a variable assemblage of moist-site herbs, including *Smilacina stellata, Galium triflorum, Coptis occidentalis, Bromus vulgaris, Disporum hookeri,* and *Adenocaulon bicolor.* The only shrubs consistently present in all phases, generally with higher coverages in early seral stands, are *Rubus parviflorus, Rosa gymnocarpa, Lonicera utahensis, Vaccinium globulare,* and *Linnaea borealis,* a subshrub.

Menziesia ferruginea (MEFE) phase—The MEFE phase is indicative of the coldest sites within the type, grading to ABGR/CLUN-XETE and ABGR/CLUN-CLUN on warmer sites and ABLA/CLUN-MEFE on colder sites. It ranges between 4,200 and 6,200 ft (1,280 and 1,890 m) elevation, generally confined to cool northerly exposures, but in cold-air drainages it may extend more than 1,000 ft (305 m) below the usual phase limits. *Picea engelmannii, Pinus contorta,* and *Larix occidentalis* are more, and *Pseudotsuga* less abundant than in other phases of the h.t. *Abies lasiocarpa* is commonly present. The shrub layer is dominated by *M. ferruginea* and *V. globulare,* and the forb layer by *Arnica latifolia, C. occidentalis,* and *Xerophyllum tenax,* or even *Viola orbiculata* (fig. 36). On the Nez Perce NF, *Taxus brevifolia* may be an important, sometimes dominant, component of the tall shrub layer.

Taxus brevifolia (TABR) phase—This phase is found on the Nez Perce NF, concentrated primarily in the western portion of the South Fork Clearwater River drainage. It ranges from 3,400 to 5,800 ft (1,035 to 1,770 m) and occupies moderate to steep slopes with warm, though often protected, exposures. These sites differ environmentally from ABGR/CLUN-CLUN sites by occurring principally at higher elevations; 80 percent of ABGR/CLUN-TABR stands were found between 5,000 and 5,600 ft (1,525 and 1,710 m) whereas 80 percent of ABGR/CLUN-CLUN stands occurred between 3,000 and 5,200 ft (915 and 1,585 m). Abiotic site conditions are also quite similar to those of ABGR/CLUN-XETE. Steele and others (1976) hypothesized that an unknown soil condition may explain the difference between the stands wherein *Taxus* is abundant (and characteristic for the phase), and surrounding vegetation (fig. 37). Crawford (1983) could not demonstrate statistically significant differences in abiotic variables (including soil conditions) between TABR/CLUN (our ABGR/CLUN-TABR) and ABGR/CLUN (all other phases) though his ABGR/CLUN-TABR sites tend to have thicker A horizons and greater potential solar insolation loads.

Abies grandis dominated the overstory in all observed successional stages, with *Picea, Pseudotsuga,* and *L. occidentalis* relatively equally represented as minor seral species. Only in the densest *Taxus* patches is forb coverage and species richness reduced; even under less than the highest density conditions, conifer seedlings (other than those of the extremely shade-tolerant *Taxus)* may be totally eliminated. *Coptis occidentalis, V. orbiculata,* or *A. latifolia* may dominate the forb layer. *Linnaea borealis* is well represented as a subshrub. Crawford (1983) proposed a *T. brevifolia* series for these sites; we have not incorporated the *Taxus* series into this classification, largely for practical considerations (see discussion of ABGR/ASCA-TABR h.t.).

Xerophyllum tenax (XETE) phase—Found from the Kaniksu to the Nez Perce NF, the XETE phase is most prevalent on the eastern portion of the Clearwater and Nez Perce NF's. These sites are environmentally intermediate between warmer CLUN phases and the colder and drier ABGR/XETE h.t., or comparable h.t.'s in the ABLA series. More than 75 percent of the stands occurred on southeast- through west-facing slopes, and 90 percent were found between 4,000 and 5,750 ft (1,220 and 1,750 m), with extremes to 3,350 and 6,000 ft (1,020 and 1,830 m). *Pseudotsuga* is the major seral dominant. *Larix occidentalis, Picea, P. contorta,* and *P. monticola* may be present, but in amounts generally much reduced relative to *Pseudotsuga. Pinus ponderosa* may occur as scattered individuals. Undergrowth differs from other CLUN phases by the dominance of *Xerophyllum* in a forb layer of reduced cover and species diversity (fig. 38). *Vaccinium globulare* dominates the shrub layer.

Physocarpus malvaceus (PHMA) phase—This phase occupies the warmest, driest portion of the h.t. It is found from the Kaniksu NF southward on well-drained sites between 2,200 and 4,800 ft (670 and 1,460 m). Ranging from east- to west-facing slopes, it predominates on exposed south-facing slopes. The PHMA phase borders on several series and h.t.'s but was most noted grading to THPL/CLUN-CLUN, ABGR/XETE, or ABGR/CLUN-CLUN on more moist sites, or ABGR/PHMA on drier sites. Following major disturbance, *Pseudotsuga* is the leading seral conifer, with *A. grandis* sometimes slow to reestablish. *Picea* and *A. lasiocarpa* are notably absent. *Larix* and *P. contorta* are sporadically represented, and *P. ponderosa* is more abundant than in other phases. Undergrowth is dominated by the shrubs characteristic of the phase—*Physocarpus malvaceus* and *Holodiscus discolor*—with high coverages, especially in early seral stages, of *Acer glabrum, Amelanchier alnifolia, Rosa gymnocarpa, Symphoricarpos albus,* and *Rubus parviflorus* (fig. 39). Despite the high shrub coverages, herb coverages and diversity are not notably reduced from modal h.t. conditions; however, *Tiarella trifoliata* is conspicuously absent.

Figure 36—*Abies grandis/Clintonia uniflora* h.t.-*Menziesia ferruginea* phase on a moderate northwest slope (4,340 ft [1,325 m]) west of the Red River Ranger Station. The shrub layer is dominated by *M. ferruginea*, *Vaccinium globulare*, and *V. scoparium*. Herbaceous layer canopy cover is greater than normal due to significant canopy reduction through *Pinus contorta* mortality in this 120-year-old stand currently dominated by *Pseudotsuga*.

Figure 37—*Abies grandis/Clintonia uniflora* h.t.-*Taxus brevifolia* phase on a gentle south aspect (4,850 ft [1,480 m]) on the Horse Creek Research Natural Area north of Elk City, ID. In this 100-year-old stand *T. brevifolia* is just attaining a tree size stature, the largest being 6 inches d.b.h. (15 cm) and 25 to 30 ft (7 to 9 m) tall. *Xerophyllum tenax* dominates the undergrowth with relatively high coverage considering the two superimposed tree layers.

Figure 38—*Abies grandis/Clintonia uniflora* h.t.-*Xerophyllum tenax* phase on a moderately steep southeastern exposure (4,280 ft [1,305 m]) just south of Elk City, ID. Typical for this phase, the overstory is dominated by even-aged *Pseudotsuga* and *Pinus contorta; Abies grandis* is establishing slowly, mostly in gaps created by *P. contorta* mortality. *Xerophyllum tenax* is so dense that overlapping tussocks give the impression of a grassy sward.

Figure 39—*Abies grandis/Clintonia uniflora* h.t.-*Physocarpus malvaceus* phase on a gentle southwest exposure (3,210 ft [975 m]) just south of the Pend Oreille River; stand has experienced at least two underburns since establishment following stand-replacing wildfire. *Pseudotsuga, Pinus ponderosa,* and *Larix* characterize the overstory with the undergrowth of *Abies grandis* slowly establishing in canopy gaps. The undergrowth is dominated by a tall shrub layer (including *Physocarpus malvaceus, Holodiscus discolor,* and *Acer glabrum*); of the 20 herbaceous species, none exceed 1 percent coverage.

Clintonia uniflora (CLUN) phase—This phase predominates on the Nez Perce and Clearwater NF's, but occurs sporadically as far north as the Kaniksu NF. The observed elevational range was 2,200 to 5,350 ft (670 to 1,630 m); 75 percent of the stands were located below 4,000 ft (1,220 m). This phase represents modal environments within the h.t.; they are transitional (considering core area only) between the warmer-more moist ABGR/ASCA-ASCA and TABR phases, the cooler MEFE phase, and the cooler, drier XETE phase. In the northern portion of its range, the CLUN phase occurs on warm exposures or excessively drained sites; south in its range it is found more broadly distributed on benches, stream terraces, and toe-slope to midslope positions, usually of low to moderate slope, and all but northerly exposures.

Pseudotsuga and *A. grandis,* together or singly, dominate seral stages. Other seral species—*P. ponderosa, P. contorta, P. monticola, Larix,* and *Picea*—are weakly represented, especially considering the moderate site conditions and their importance in this phase in contiguous studies (Pfister and others 1977; Steele and others 1981). *Abies grandis* approaches monospecific dominance within approximately 250 to 300 years following stand initiation. Undergrowth composition generally follows the type description. *Vaccinium globulare* increases in importance on cooler exposures, and *L. borealis* is common throughout this phase, being best represented on benches and warmer toe-slopes. *Coptis occidentalis, S. stellata,* and *C. uniflora* dominate the forb layer (fig. 40).

Soils—The following description considers the modal CLUN-CLUN phase with exceptions noted by phase. Parent materials vary widely and include limestone, a relatively rare substrate in northern Idaho (appendix D). Ash-influenced soils are relatively rare in the CLUN phase, but ash is prevalent in about one-third of the plots in other phases (lack of ash in our CLUN-phase sites may result from a biased sample, primarily Nez Perce NF plots). Soil textures are predominantly loams, silt-loams, and clays, but range to loamy sands. Gravel content of surface horizons ranges from zero to 60 percent, averaging between 15 and 20 percent for all phases but MEFE, which has a value of less than 5 percent. MEFE phase gravel content increases sharply with increasing depth. Clay pans developing at depths greater than 20 inches (50 cm) constitute restrictive layers on about one-third of the XETE phase. Effective rooting depth varies widely, from 7 to 31 inches (18 to 80 cm), averaging 16 inches (40 cm), the relatively deep average rooting depth (24 inches [60 cm]) of the MEFE phase may be related to low gravel content. Surface and subsurface soil pH ranges, respectively, from 5.6 to 6.5 (average 6.0) and 5.5 to 6.2 (average 5.9); soils of the TABR phase appear to be more basic (pH values to 7.2).

Figure 40—*Abies grandis/Clintonia uniflora* h.t.-*Clintonia uniflora* phase on a bench (3,280 ft [1,000 m]) north of Orofino, ID. The undergrowth is dominated by a rich forb layer (predominantly *Coptis occidentalis, Smilacina stellata, Cornus canadensis,* and *C. uniflora*). Following clearcutting nearly 100 years ago *Abies grandis* and *Pseudotsuga* (and fewer numbers of *Pinus monticola* and *P. contorta*) established and are now between 120 and 150 ft (36 and 46 m) in height.

Productivity/Management—Timber productivity and species suitability for management are related to phase; however, the type in general is highly productive (appendix F) and affords a wide latitude in silvicultural prescriptions. On a portion of this h.t. Daubenmire (1961) found *P. ponderosa* height growth was rapid for 50 to 60 years. After approximately age 60, though, growth tapered off, resulting in higher site index values for *P. ponderosa* growing on PSME/PHMA and PIPO/PHMA h.t.'s (at index age of 100 years).

Site indexes for the ABGR/CLUN phases floristically comparable to ABGR/ASCA phases show a trend of reduced values for all species jointly represented (appendix F). The warmer ABGR/CLUN phases, PHMA, CLUN, and even XETE, on the basis of limited data, appear to be prime sites for *P. ponderosa. Abies grandis, Pseudotsuga,* and *P. contorta* are easily regenerated on clearcuts, with their response varying according to phase. The moderate nature of these sites should be favorable for *Larix,* but insufficient data exist to evaluate its potential. Many of the sites sampled for site index were beyond the geographic concentration of *P. monticola,* accounting for its being underrepresented in appendix F. Most ABGR/CLUN sites, except those of the PHMA phase, appear, on the basis of vegetative composition and site parameters, capable of supporting good *P. monticola* growth.

The TABR phase, for which meager data exist, is floristically and environmentally most similar to ABGR/ASCA-TABR and may respond similarly to management. Overstory removal in both h.t.'s results in a marked seral shrub and forb increase and burning may result in a sward of *Pteridium aquilinum.* Reduction of the *Taxus* layer will be necessary to achieve stocking with seral conifers. Regarding *Taxus* Crawford (1983) indicated that:
(1) mortality following overstory removal is due, not to solarization, but to mechanical injury from logging,
(2) tractor piling of slash could cause severe losses, and
(3) it is extremely intolerant of fire and any attempt at slash disposal and site preparation through broadcast burning would cause its virtual elimination. *Taxus* response to manipulation is an important consideration because it is a very significant component of moose winter forage (Pierce 1983). Its high coverages in the west-central Nez Perce NF are considered responsible for concomitantly high moose populations. Uneven-aged management may be the most feasible approach to preserving *Taxus* and harvesting timber, but will probably result in the dominance of *A. grandis,* the value of which is severely reduced by a high incidence of Indian paint fungus (*Echinodontium tinctorium*) and root rot.

Little is known concerning the MEFE phase, but it seems to produce *Picea* and *P. contorta* of high site index. Partial cutting, especially in the MEFE and PHMA phases, may result in a lack of tree regeneration under an increased shrub cover. Clearcutting and stand-replacing wildfire in these two phases can result in dramatic increases in shrub coverages; therefore immediate planting would seem advisable where reforestation is a prime management objective.

All phases produce abundant elk and deer forage, especially in earlier successional stages. Low-elevation phases with southerly aspects, principally CLUN and PHMA, are utilized as elk and deer winter range. Browse production can be enhanced by broadcast burning of slash following clearcutting or seedtree cuts. The warmer phases of this h.t. potentially support *Pteridium* glades, which constitute a loss in browse production and a long-persisting impediment to tree regeneration. Under these conditions, site preparation may be limited to mechanical scarification; if steep slopes dictate burning then planting should immediately follow site disturbance. Consult the management section of ABGR/ASCA concerning the impact of regeneration and site preparation techniques on *Taxus*. Livestock find little forage on stocked sites, whereas early successional stages may constitute productive transitional range. Kingery (1983) indicates that livestock use of these sites during early regeneration stages may be detrimental to planted stock.

Zamora (1982) and Pyke and Zamora (1982) discuss some important management implications regarding succession within the Daubenmires' (1968) ABGR/*Pachistima myrsinites* h.t. (Zamora's plots correspond mainly to our CLUN-CLUN and CLUN-XETE phases). They show an inverse, nearly linear relationship between tree canopy and undergrowth coverages. But the most intense effects of tree-undergrowth interaction do not occur until at least 25 years following cutting. This interval may be considerably extended because it is a function of the rate of post-disturbance tree establishment. Until trees seed in, become established, and overgrow the shrub layer, there is little effect of trees on shrubs. Broadcast-burned clearcuts attain maximum shrub and forb productivities (2,320 to 2,680 lb/acre [2,600 to 3,000 kg/ha]), within 13 to 17 years following disturbance (Zamora 1982).

Other Studies—All the stands in the Daubenmires' (1968) ABGR/PAMY h.t. correspond to phases of our ABGR/CLUN and ABGR/ASCA h.t.'s, predominantly CLUN-CLUN and ASCA-ASCA. ABGR/CLUN (including several of the same phases described herein) has been described for northwestern Montana (Pfister and others 1977), central Idaho (Steele and others 1981), the Nez Perce NF (Steele and others 1976), and northeastern Washington (Lillybridge and Williams 1984).

Abies grandis/Linnaea borealis h.t. (ABGR/LIBO; grand fir/twinflower)

Distribution—ABGR/LIBO is a minor h.t. sampled on the Nez Perce NF, in the Purcell Trench and also observed on the southern Clearwater NF. It is more extensive in central Idaho (Steele and others 1981), where three phases are distinguished. ABGR/LIBO is found on lower to middle elevations of the *Abies grandis* series, ranging from 2,200 to 5,300 ft (670 to 1,615 m) on protected and gentle slopes and benches. As noted by Pfister and others (1977), this type replaces ABGR/CLUN to the east and south of the zone most influenced by the Inland Maritime climatic regime.

Vegetation—All stands sampled were a mix of seral tree species. *Pseudotsuga menziesii* and *Pinus ponderosa* were most abundant, followed by *Pinus contorta* and *Picea engelmannii*. *Larix occidentalis* is a minor seral component, but with a favorable stand history it is capable of site dominance.

Linnaea borealis is common to abundant and *Calamagrostis rubescens* usually forms a scattered layer. Some stands support a diverse forb assemblage, but generally sparse coverages and lack of mesic-site species is the pattern. Other vegetation features vary according to phase.

Xerophyllum tenax (XETE) phase—The XETE phase is found at higher elevations (>4,900 ft [1,490 m]), usually on southerly aspects, where it grades to the drier ABGR/XETE h.t. The undergrowth is dominated by *X. tenax* over which is superimposed a layer of *Vaccinium globulare*. *Pinus contorta* and *Pseudotsuga* are the primary seral species.

Linnaea borealis (LIBO) phase—The LIBO phase is found most frequently on benchlands or gentle topography. In the northern portion of its range, this phase is associated with coarse outwash materials whereas adjacent sites on finer textured soils usually support TSHE or THPL series habitat types. *Pinus ponderosa* is increased in importance and *Picea* decreased relative to the XETE phase. The undergrowth is likely to be dominated by *C. rubescens* in earlier successional stages, but crown closure limits its cover in more mature stands.

Soils—Very limited data indicate slightly acidic, gravelly depositional soils with shallow ash horizons (appendix D). Only trace amounts of exposed soil and rock are found. Effective rooting depth varies between 8 and 18 inches (21 and 45 cm).

Productivity/Management—Site index data are extremely limited, even from adjacent areas; hypothetically, productivity should be moderate to high (Steele and others 1981), somewhat less than on ABGR/CLUN or ABGR/ASCA h.t.'s. Site indexes on the more moderate LIBO phase are assumed to be higher than on the XETE phase. Opportunity for mixed stand establishment following fire or clearcutting appears good.

Although the usually gentle terrain may attract livestock, it is primarily the early seral stages that provide forage. Browse potential is greater, too, for big game early in the sere (Steele and others 1981).

Other Studies—ABGR/LIBO (XETE and LIBO phases) has been identified by Pfister and others (1977) in western Montana; however, its centers of importance are probably northeastern Oregon (Hall 1973) and west-central Idaho (Steele and others 1981). Some stands within the ABGR/VACA association (Lillybridge and Williams 1984) are environmentally and floristically similar to our ABGR/LIBO-LIBO.

Abies grandis/Xerophyllum tenax h.t. (ABGR/XETE; grand fir/beargrass)

Distribution—ABGR/XETE occurs mainly on the eastern Nez Perce and southeastern Clearwater NF's and extends into contiguous portions of Montana and central Idaho. It is very sporadically distributed as far north as the southern Kaniksu NF. Indicative of the cool-dry limits of the *Abies grandis* series, it therefore is usually found between ABGR/LIBO and *Abies lasiocarpa* series h.t.'s and may grade to ABGR/CLUN-MEFE or ABLA/MEFE on colder, more moist exposures. ABGR/XETE occurs from 4,200 to 6,500 ft (1,280 to 1,980 m), predominantly on east- to west-facing slopes.

Vegetation—*Pseudotsuga menziesii* and *Pinus contorta* are the most important seral species. *Pinus ponderosa, Picea engelmannii,* and *Larix occidentalis,* in decreasing order of importance, occur in mixed-species stands. *Abies grandis* is occasionally slow to reestablish, reflecting relatively dry and frosty conditions within the type.

Xerophyllum tenax and *Vaccinium globulare* dominate the undergrowth, with other undergrowth characteristics determined by phase.

Coptis occidentalis (COOC) phase—The COOC phase represents more moderate conditions within the h.t., often bordering ABGR/CLUN-XETE or less frequently ABGR/LIBO. *Pseudotsuga* is the primary seral tree species, with lesser amounts of *L. occidentalis* and *P. contorta* also present. The forb layer, usually dominated by *C. occidentalis,* and in which *Anemone piperi, Goodyera oblongifolia, Viola orbiculata,* and *Thalictrum occidentale* are highly constant, is richer than that of VAGL phase (fig. 41).

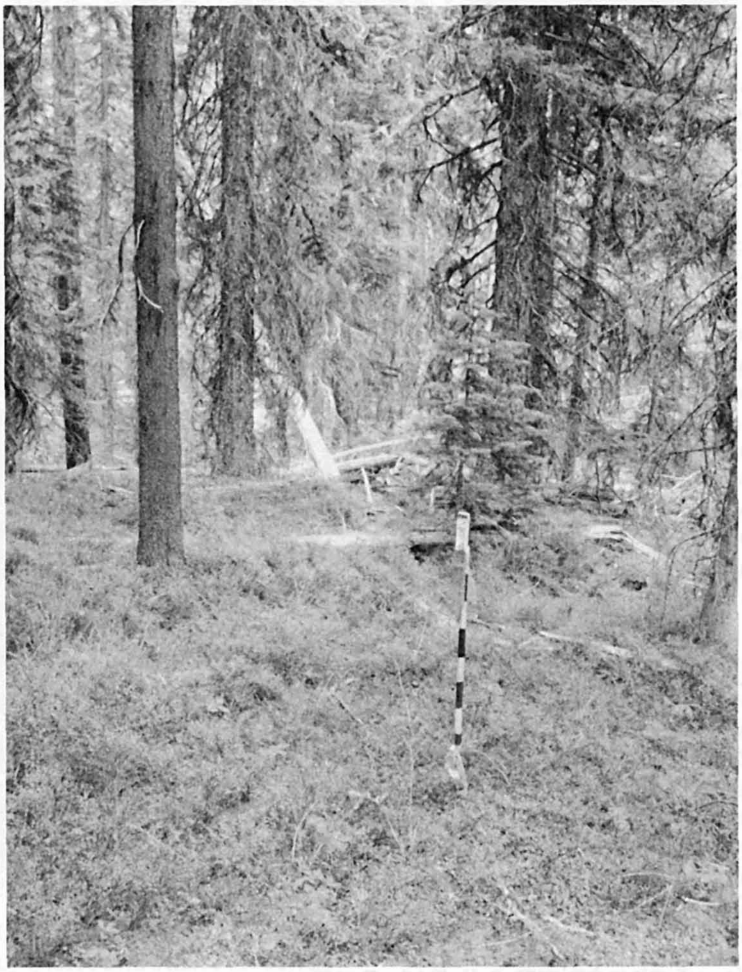


Figure 41—*Abies grandis/Xerophyllum tenax* h.t.-*Coptis occidentalis* phase on a midelevation (4,820 ft [1,470 m]) bench south of Fish Creek Meadow Campground on the Nez Perce NF. *Abies grandis, A. lasiocarpa,* and *Picea engelmannii* share overstory dominance in the 170-year-old stand. *Vaccinium globulare* is the scattered midsize dominant shrub superimposed on a dense layer of *V. scoparium,* which obscures a diverse forb layer dominated by *Anemone piperi.*

Vaccinium globulare (VAGL) phase—The VAGL phase characterizes colder, drier, more exposed sites within the h.t.; the most extreme sites are indicated by *Vaccinium scoparium* (fig. 42). Warmer sites or those in early seral stages may support a sward of *Calamagrostis rubescens.* Seral tree importance follows the h.t. description, except for *P. contorta,* which increases relative to its COOC phase representation.

Soils—Because all plots with soil pits occurred on the Nez Perce and southern Clearwater NF's, the parent materials are nearly exclusively granitics and gneiss; quartzite and shale are also represented (appendix D). Surface soils are mainly fine textured (loams and silt loams averaging 15 percent gravel) over coarser subsurface soils (sandy loams and sands averaging 20 percent gravel). No restrictive layers were found, and ash deposits were found only in the moist COOC phase. Surface and subsurface pH values are moderately to slightly acidic, averaging 6.2.

Productivity/Management—Site index values range from moderate to high for *Pseudotsuga;* other seral trees have a comparable range (appendix F). Given adequate seed sources, mixed species stands should naturally regenerate following clearcutting with site preparation. Planting *L. occidentalis* where historic factors (for example, catastrophic fires) may have eliminated it, or in areas beyond its **apparent** geographic limits (portions of the Nez Perce NF) seems warranted on a test basis.

Figure 42—*Abies grandis/Xerophyllum tenax* h.t.-*Vaccinium globulare* phase on a ridgetop bench (5,240 ft [1,595 m]) east of the Red River Ranger Station. Even-aged 100-year-old *Pinus contorta* dominates the site with *A. grandis* slowly reestablishing. Though *X. tenax* dominates the undergrowth, high coverages (>50 percent in this stand) of *Vaccinium scoparium* accompanying scattered *V. globulare* are indicative of a colder microclimate for the phase as found primarily on the Nez Perce NF.

In Montana, on the ecologically comparable but colder, less mesophytic ABLA/XETE-VAGL h.t., Arno and others (1985) have modeled tree and undergrowth succession for treatments of varying intensities. Their results generally explain the disturbance response of northern Idaho's ABGR/XETE and ABLA/XETE h.t.'s. Salient points of their study are: (1) If slash or site receive no treatment or are broadcast burned full stocking requires >15 years; following wildfire or site scarification regeneration time is half that of untreated stands. (2) Extreme scarification is the treatment most likely to produce "doghair" *P. contorta* stands. (3) *P. contorta* dominates following all treatments. (4) *Pseudotsuga* usually becomes a mature forest stage codominant 100 to 125 years after disturbance (the ubiquity of *P. contorta* is reduced in the ABGR/XETE type) and the overstory dominant following *P. contorta*'s demise. (5) Planting is generally either superfluous or unsuccessful.

These sites are used spring through fall by elk and deer; in some stands *Xerophyllum* flowering heads are totally consumed and *V. globulare* is heavily hedged. *Vaccinium globulare* in adjacent stands may be virtually untouched, possibly an indication of palatability differences or simply a result of proximity to established game trails. Livestock use was not observed in mature stands and potential for such is low. Arno and Simmerman (1982) have found heavy use by cattle on scarified clearcuts produces a persistent, weedy flora in place of native species.

Other Studies—ABGR/XETE was described by Pfister and others (1977) in Montana (only western portions of the Bitterroot and Lolo NF's), by Steele and others (1976) for the Nez Perce NF, and by Steele and others (1981) as an incidental central Idaho h.t.

Abies grandis/Vaccinium globulare h.t. (ABGR/VAGL; grand fir/blue huckleberry)

Distribution/Vegetation—This is an incidental h.t. for northern Idaho, noted in reconnaissance only in the Seven Devils Mountains; the considerable importance of this h.t. in central Idaho is emphasized by its selection for successional modeling (Steele and Geier-Hayes 1982). ABGR/VAGL characterizes the cool extremes of the ABGR series beyond the distributional limits of *Xerophyllum tenax*. *Pinus contorta, Pseudotsuga menziesii,* and *Picea engelmannii* are the predominant seral trees.

Productivity/Management—Site indexes are generally high (Steele and others 1981) with *Picea* and *Pseudotsuga* having the highest values. Seral stands provide important cover and forage for elk and white-tailed deer.

Other Studies—The ABGR/VAGL h.t. was originally described for central Idaho by Steele and others (1981). In Oregon's Blue Mountains, portions of Hall's (1973) white fir-big huckleberry community type (c.t.) are similar to ABGR/VAGL.

Abies grandis/Physocarpus malvaceus h.t. (ABGR/PHMA; grand fir/ninebark)

Distribution—This is a relatively minor but broadly distributed type, occurring throughout northern Idaho. Its observed elevational range was from 2,200 ft (670 m) on the Kaniksu NF to 4,600 ft (1,400 m) on the Nez Perce NF, with most stands occurring from 2,400 to 4,300 ft (730 to 1,310 m). One of the driest ABGR h.t.'s, ABGR/PHMA occurs almost exclusively on southeast through west slopes except at lowest elevations. On drier slopes it merges with PSME/PHMA and on more moist or cooler exposures with ABGR/XETE, ABGR/CLUN-PHMA, ABGR/CLUN-XETE, or ABGR/SPBE.

Vegetation—Even in older stands (100 to 200 years), *A. grandis* may not be well represented because these sites are near its environmental limits as well as those of *Pinus contorta, Larix occidentalis,* and *Pinus monticola.* Further reducing *Abies* representation on these types of sites is a past history of frequent underburning (Hall 1977). *Pseudotsuga menziesii* and *Pinus ponderosa,* in that order, are the important and long-persisting seral species.

Undergrowth is dominated by a variable combination of the characteristic tall shrubs *Physocarpus malvaceus, Holodiscus discolor,* and *Acer glabrum.* Other shrubs with high constancies and coverages (that decline with increasing stand age and tree cover) are *Symphoricarpos albus, Amelanchier alnifolia,* and *Berberis repens.* Forbs present with high constancy are *Smilacina stellata, Osmorhiza chilensis, Galium triflorum, Anemone piperi, Adenocaulon bicolor,* and *Bromus vulgaris. Calamagrostis rubescens* is often well represented and may dominate the herb layer of early seral stands.

Coptis occidentalis (COOC) phase—The COOC phase occupies moister and cooler sites within the h.t. and is more prevalent on the Nez Perce and Clearwater NF's. Common (≥1 percent) canopy coverages of *C. occidentalis* are diagnostic. The diversity and coverage of forbs is higher than in the PHMA phase; notable among mesic site forbs are *S. stellata, Disporum hookeri,* and *Polystichum munitum. Pseudotsuga* is apparently the major seral species. The unexpected lack of other seral tree species in this, the more moist of the two phases, probably reflects the small sample size (6 plots versus 20 for the PHMA phase) and PHMA-COOC's restricted geographic representation, at or beyond the limits of *P. monticola* and *L. occidentalis.*

Physocarpus malvaceus (PHMA) phase—This phase is associated with the drier, lower elevation limits of the type—those environments transitional to the PSME series. *Calamagrostis rubescens* and *Carex geyeri* may constitute a dominant herb layer in young or open stands, but the high shrub (and tree) cover that develops in later seral and mature stands effectively reduces the graminoid component. High-constancy forbs that are also occasionally well represented include *G. triflorum, A. bicolor, Osmorhiza chilensis,* and *Smilacina racemosa.*

Soils—Granite and mica schist dominate the parent materials that included rhyolite, quartzite, argillites, and basalts (appendix D). Ash layers are uncommon though some profiles were loess influenced. Most soils are fine textured, with loams and silt loams predominating. Gravel content is highly variable but most values ranged from 25 to 55 percent; surface rock and bare soil occur in trace amounts. Somewhat less than half of the PHMA phase plots exhibit a restrictive layer usually associated with the rockiness of glacial till or clay pan development in basalts. Effective rooting depth averages 19 inches (48 cm), ranging from 10 to 28 inches (25 to 70 cm). Surface soil pH values spanned a relatively narrow range (6.1 to 7.1, average 6.4) while subsurface pH ranged widely (4.8 to 7.2).

Productivity/Management—Site indexes (appendix F) range from moderate to very high for all seral and climax species, but stand compositions indicate that *Pseudotsuga,* and especially *P. ponderosa,* should be favored for reforestation. Overstory removal will permit shrubs to develop a dense, long-persisting layer that competes with establishing tree seedlings. Burning the site will often result in site occupancy by *Ceanothus* spp. or *Pteridium aquilinum.*

For elk and deer, ABGR/PHMA constitutes important winter range and thermal and yearlong hiding cover, especially in earlier seral stages. Livestock use of these sites is usually nil, except in early seral stages; use at this time can produce heavy *Poa pratensis* coverages as described by Daubenmire and Daubenmire (1968) for PSME/PHMA.

Other Studies—ABGR/PHMA, or a nearly identical taxon, has been described in northeastern Washington (as ABGR/*Holodiscus discolor* association) by Lillybridge and Williams (1984). ABGR/PHMA is similar in vegetative composition and management considerations to the PHMA phase of ABGR/*Acer glabrum* described by Steele and others (1981) for central Idaho, but does not occupy the cool exposures they describe.

Abies grandis/Spiraea betulifolia h.t. (ABGR/SPBE; grand fir/white spiraea)

Distribution/Vegetation—ABGR/SPBE is a minor type representing the warm, dry extremes of the ABGR series. Only in central Idaho and the southwestern Nez Perce NF do individual stands constitute appreciable acreages on benchlands and steep south- to west-facing slopes, otherwise it occurs as a fringe on more moist ABGR/PHMA and ABGR/CLUN h.t.'s. During reconnaissance we found it occurs as far north as the Kaniksu NF and at elevations from 2,800 to 5,200 ft (850 to 1,585 m), but undoubtedly it extends to the lower elevational limits of the ABGR series (<1,600 ft [<485 m]).

Abies grandis is slow to reestablish on these sites, almost all of which have been maintained in seral *Pseudotsuga menziesii* and *Pinus ponderosa* through recurrent underburning. *Pinus contorta* may be an important seral tree on the exceptional benchland occurrence of the type. *Spiraea betulifolia, Symphoricarpos albus,* and *Rosa gymnocarpa* dominate the low shrub layer; *Calamagrostis rubescens* increases with disturbance and may also form a discontinuous layer in mature stands. More moist sites within the type support *Smilacina stellata, Galium triflorum,* and *Disporum hookeri.*

Soils—Very limited data indicate moderately deep (18 to 26 inches [45 to 65 cm]), effective rooting on these well-drained, moderately gravelly (20 percent average), and slightly acid soils (appendix D). Ash cap depths are highly variable, from a trace to 24 inches (60 cm).

Productivity/Management—Extrapolating from the central Idaho classification (Steele and others 1981) and limited data from this study (appendix F), timber productivity should range from moderate to high. Site indexes tentatively appear higher for *P. ponderosa* than associated species; however, Steele and others (1981) observed *A. grandis* to have exceptionally good growth on these sites under optimum stocking. Site preparation to attain adequate stocking is indicated where *Calamagrostis* sod is present.

Generally, steep terrain and low forage productivity should discourage livestock use; however, these sites may have substantially greater potential for wild ungulate use.

Other Studies—The description of Steele and others (1981) indicates central Idaho (western portion) to be the center of importance for the type; in Oregon's Blue Mountains, the "mixed conifer-pinegrass c.t." of Hall (1973) is quite similar in vegetation and habitat.

Pseudotsuga menziesii (PSME) Series

Distribution—Throughout northern Idaho, *Pseudotsuga menziesii* exhibits a very broad environmental amplitude. Rehfeldt (1978) reports two ecotypes for northern Idaho: one from cool environments mostly above 5,000 ft (1,525 m) elevation, and the other from warmer environments at lower elevations. Plant associations dominated by this species are very limited in far northern Idaho, becoming more extensive and important to the east (Pfister and others 1977), south (Steele and others 1981, 1983), and west (Lillybridge and Williams 1984; Hall 1973). *Pseudotsuga*-dominated associations range from 2,000 to 6,400 ft (610 to 1,950 m) elevation in northern Idaho, with the majority located between 2,500 and 3,700 ft (760 and 1,130 m). All aspects, slopes, and landforms are represented, but our data show a tendency for this series to occupy the warm-dry, moderately steep, south-southwest aspects at midslope of minor ridges.

Vegetation—In northern Idaho, *P. menziesii* occurs as the climax dominant in a narrow environmental zone between *Pinus ponderosa* on drier sites and *Abies grandis* on more moist sites. As a seral species, *Pseudotsuga* is found in all series except *P. ponderosa.* The predominant seral tree species of the *Pseudotsuga* series is *P. ponderosa.* Successional stages on more moist sites within this series may be dominated by *Larix occidentalis* or *Pinus contorta.* Isolated individual *A. grandis* may be scattered within the more moist environments of this series, but investigation of their distribution usually shows them to be associated with microsites. Understory vegetation varies from savannalike, bunchgrass-dominated forest to grassy-sward-dominated open forest to dense tall shrubs and closed canopy forest.

Fire—A vast majority of the stands sampled in this series show signs of past fire; probably all stands have been subjected to cool underburns. Fire intervals averaged 7 to 25 years prior to 1900 (Arno 1980). Very few stands sampled have an age greater than 150 years, possibly indicating a cyclic period for conflagration at that rate. If fires were both frequent and hot enough to remove *P. menziesii* and adjacent seed sources, burned sites within this series may appear to be *P. ponderosa* climax. Other sites may have experienced cool surface fires at 7- to 8-year intervals with no subsequent stand replacement occurring for long periods.

Productivity/Management—Productivity for this series varies from low to moderate and is reflected in the undergrowth composition, which ranges from bunchgrass to shrub dominance. As in the *P. ponderosa* series, bunchgrass-dominated *Pseudotsuga* associations are susceptible to severe infestation by dwarf mistletoe (*Arceuthobium* spp.). Silvicultural treatments must take this into consideration, along with the damage that can result from western budworm (*Choristoneura occidentalis*) and Douglas-fir beetle (*Dendroctonus pseudotsugae*) infestations. In stands relatively free of insect and disease infestations, and where *Pseudotsuga* is the desired regeneration species, a selection or shelterwood treatment is recommended; partial shade for seedlings is often necessary on these relatively harsh sites. For sanitation of a stand or to favor *P. ponderosa* or *L. occidentalis* regeneration, a clearcut with thorough site preparation and planting of desired species should be used.

The PSME series is the driest environment in which *Armillaria mellea* (laminated root rots) damage conifers and may prove to be the driest sites on which *Armillaria* can occur (McDonald 1983). Initial results indicate *Armillaria* to be restricted to the moistest environments within this series, with major occurrence and damage in the ABGR, THPL, and TSHE series.

As in the *P. ponderosa* series, light year-round use of shrubs by deer should be beneficial for tree growth (Kosco and Bartolome 1983). Three to 5 years following plantation establishment, light controlled grazing by domestic livestock has been shown to aid timber productivity by reducing herbaceous and woody species competition (Currie and others 1978; Wheeler and others 1980). Initial results from a study currently being conducted in PSME/PHMA and wetter h.t.'s indicate no damage to plantation seedlings in PSME/PHMA from light to moderate livestock grazing the same year as planting (Kingery 1983). Some damage to seedlings does appear to become a problem when similar livestock use is allowed in the *Abies grandis* or *Thuja plicata* series.

Pseudotsuga menziesii/Physocarpus malvaceus h.t. (PSME/PHMA; Douglas-fir/ninebark)

Distribution—PSME/PHMA is the most widely occurring *Pseudotsuga menziesii* h.t. in northern Idaho. On the dry side, this h.t. is normally adjacent to PSME/SYAL, PIPO/SYAL, or PIPO/PHMA and on the moist side adjacent to ABGR/PHMA or PHMA phase of ABGR/CLUN. PSME/PHMA generally occurs on southeast to west aspects of low to moderate slopes at elevations between 2,000 and 3,700 ft (600 to 1,130 m), but is not restricted to these environments.

Vegetation—*Pinus ponderosa* is the major seral tree species in this h.t.; some sites, mostly from the Clearwater NF north, are capable of supporting *Larix occidentalis*. Physiognomy of the overstory is relatively closed forest, with canopy cover ranging from 70 percent to over 100 percent. The understory shrub layer is dominated by *Physocarpus malvaceus* and/or *Holodiscus discolor*, which singly or combined generally have a canopy coverage of 25 percent to much greater than 100 percent. Other commonly found shrubs in this h.t. are *Amelanchier alnifolia, Philadelphus lewisii, Rosa gymnocarpa, Spiraea betulifolia,* and *Symphoricarpos albus.* The PSME/PHMA h.t. has increased coverage of *Arenaria macrophylla, Arnica cordifolia, Fragaria* spp., and *Bromus vulgaris* compared to other h.t.'s in this series. Shrub and herbaceous species composition remains relatively constant for all phases.

Smilacina stellata (SMST) phase—The SMST phase occurs throughout the range of this h.t. and represents the most moist environment on which *P. menziesii* is the climax dominant. *Larix occidentalis* and *P. ponderosa* maintain codominance on some of these sites into late seral stages. Diagnostic characteristics of the phase are the presence of *Smilacina stellata* or *Disporum hookeri* or common coverages (≥1 percent) for *Galium triflorum,* or ≥10 trees per acre of *L. occidentalis* well scattered through the stand. This phase has an increased constancy and coverage of mesophytic species (*Osmorhiza chilensis, Thalictrum occidentale, Arenaria macrophylla,* and *Anemone piperi*) compared to the drier PHMA phase (fig. 43). *Carex geyeri* and *Calamagrostis rubescens* may form a sod in seral stands, but their coverage is usually significantly reduced under mature canopies.

Physocarpus malvaceus (PHMA) phase—This phase represents drier and warmer sites of PSME/PHMA and occurs throughout northern Idaho, generally along the westernmost forested portion. *Pinus ponderosa* is the major seral species; *L. occidentalis* is never more than an accidental in this phase. Characteristics diagnostic of the PHMA phase are the lack of or very reduced coverage of species diagnostic in the SMST phase. High coverages of *C. geyeri* and/or *C. rubescens* may dominate the understory on some sites (fig. 44), but the predominant undergrowth composition is moderate to tall shrubs and dry-site forbs.

Soils—Soil parent materials are mainly basalt and quartzite for the SMST phase, with granitics, loess, and volcanic ash also occurring on PHMA phase sites (appendix D). Textures are generally silt-loam to silty clay-loam in the SMST phase, with a broader textural range, gravelly sandy loam to clay-loam, in the PHMA phase. Total depths vary from 8 to 39 inches (20 to 100 cm), with SMST sites tending to have deeper soils. For all phases, pH ranges between 5.5 and 6.6. Bare soil seldom occurs and rock occasionally has up to 25 percent exposure. Litter depth averages 2 inches (5 cm).

Productivity/Management—Productivity for this h.t. is moderate, with the SMST phase having higher site indexes and total basal area than the PHMA phase (appendix F). The two highly competitive graminoids, *C. geyeri* and *C. rubescens,* may cause reduced tree growth in either phase. Sites having a thick moss cushion over basalt talus are essentially unsuitable for intensive management due to unworkable soils.

Reforestation problems can be significant on this h.t.; for central Idaho, Steele and Geier-Hayes (1983) found contour trenching followed by planting to be the only consistently successful technique. With site preparation that effectively controls early site dominance by shrubs and the highly competitive graminoids, all even-aged silvicultural techniques show promise for regenerating highly productive stands of *P. ponderosa.* Uneven-aged techniques should give satisfactory results if *P. menziesii*

Figure 43—*Pseudotsuga menziesii/Physocarpus malvaceus* h.t.-*Smilacina stellata* phase on a gentle northwest-facing ridge shoulder (3,000 ft [915 m]) north of Moscow, ID. *Pinus ponderosa* and *P. menziesii* codominate the overstory. The tall shrub layer towering over the meter pole is dominated by *P. malvaceus* and *Holodiscus discolor* (its white pyramidal inflorescence reflecting the sun). *Symphoricarpos albus* and *Spiraea betulifolia* form a dense lower shrub layer that obscures the rich forb layer.

Figure 44—*Pseudotsuga menziesii/Physocarpus malvaceus* h.t.-*P. malvaceus* phase on a moderately steep south-facing slope (3,080 ft [940 m]) with coarse-textured soils on Snow Creek west of Bonners Ferry, ID. *Pinus ponderosa, P. contorta,* and *Pseudotsuga* codominate the overstory. Note that *P. malvaceus* and *Holodiscus discolor,* while dominating the shrub layer, have much reduced coverage and robustness relative to that shown in figure 43. *Calamagrostis rubescens* (foreground) forms a dense sward; no other herb is present in more than trace amounts.

is the preferred species. On the SMST phase, *L. occidentalis* should be considered a potential component for increasing the species mix.

The drier, less-productive PHMA-phase sites within PSME/PHMA may have significant dwarf mistletoe (*Arceuthobium*) infestations. PSME/PHMA-SMST appears to be the driest environment (across all series) on which *Armillaria mellea* root rots damage conifer species (McDonald 1983). Potential for regeneration failure following site disturbance exists due to *Armillaria* inoculum sources remaining onsite.

This h.t. can receive light to moderate seasonal use by cattle without significant damage to advance reproduction or planted stock (Currie and others 1978; Wheeler and others 1980). Significant damage can occur from excessive use as shaded resting areas adjacent to sites having greater forage production. In mature stands wildlife use this h.t. primarily for cover; forage production for elk is low as is palatability of browse species for deer. Seral stages of this h.t. can be very productive for both food and cover requirements of big game.

Other Studies—This h.t. has been described by many other investigators. Daubenmire and Daubenmire (1968) included our two phases in their PSME/PHMA h.t. Hall (1973), Cooper (1975), Pfister and others (1977), Steele and others (1976, 1981, 1983), and Lillybridge and Williams (1984) all describe quite similar plant associations. Successional trends of PSME/PHMA following different disturbances have been described by Cholewa and Johnson (1983) for northern Idaho, Steele and Geier-Hayes (1983) for central Idaho, and Arno and others (1985) for western Montana.

Pseudotsuga menziesii/Vaccinium caespitosum h.t. (PSME/VACA; Douglas-fir/dwarf huckleberry)

Distribution—This h.t. occupies cold (frost pocket) sites within the *Pseudotsuga menziesii* series. It occurs from 2,300 to 4,500 ft (700 to 1,370 m) elevation on low to moderate slopes and all aspects. Its distribution correlates well with soils having well-drained to excessively drained surface horizons, such as found in the glacial tills and outwash material of the Purcell Trench.

Vegetation—*Pinus ponderosa* and *P. contorta* are the seral conifers sometimes dominating these sites for long periods of time. The presence of *Vaccinium caespitosum* with at least common coverage (≥1 percent) of *Arctostaphylos uva-ursi* is diagnostic of this h.t. Generally low coverage of *Spiraea betulifolia, Fragaria* spp., and *Calamagrostis rubescens* also characterizes this h.t. On an environmental gradient, PSME/VACA is slightly colder and more moist than PSME/CARU-ARUV. Yet the occurrence of bunchgrasses, such as *Agropyron spicatum, Festuca idahoensis,* and *F. scabrella* indicate these sites to be drier and perhaps warmer than the PSME/VACA h.t. described by Pfister and others (1977) or Steele and others (1981).

Productivity/Management—Timber productivity should be moderate for *P. ponderosa, P. contorta,* and *P. menziesii* (appendix F). Expect regeneration on mineral soil to be successful, except in frost pocket locations in the Purcell Trench, where a cover crop of *P. contorta* may be required to moderate the microenvironment for seedlings of the other two species. PSME/VACA sites have low forage potential for livestock, and moderate to high potential as winter habitat for deer, elk, and occasionally moose.

Other Studies—Pfister and others (1977) describe PSME/VACA as a major h.t. in Montana; Steele and others (1981) and Ogilvie (1962) list it as incidental in central Idaho and Alberta, respectively. As mentioned, in northern Idaho PSME/VACA appears to be slightly warmer and drier than its description in the above geographic areas. A major portion of PSME/VACCI described by Lillybridge and Williams (1984) for the Colville NF appears quite similar to PSME/VACA as described for northern Idaho.

Pseudotsuga menziesii/Vaccinium globulare h.t. (PSME/VAGL; Douglas-fir/blue huckleberry)

Distribution—This is an incidental h.t. in northern Idaho, occurring mostly on the far eastern edge of the Red River Ranger District of the Nez Perce NF. It tends to occur on south to west aspects above 5,000 ft (1,525 m) elevation. It is much more prevalent in Montana and eastern Idaho, though never a very important h.t. in the Northern Rocky Mountains.

Vegetation—*Xerophyllum tenax* and *Calamagrostis rubescens* are consistently well represented; *Vaccinium globulare* ranges from missing to abundant. Other common shrub and herbaceous associates are *Berberis repens, Spiraea betulifolia,* and *Goodyera oblongifolia.*

Productivity/Management—Extrapolating from Montana data, timber productivity of these sites is expected to be low to moderate. *Pinus ponderosa* and *P. contorta* are the common seral tree species and should regenerate on mineral soils. This h.t. can produce significant forage and cover for big game, and berry crops for bears, grouse, and humans.

Other Studies—Pfister and others (1977) describe this as a major h.t. in southwestern Montana; our samples seem to best fit the XETE phase of their PSME/VAGL h.t. Cooper (1975) and Steele and others (1981, 1983) describe this minor h.t. in central and eastern Idaho and western Wyoming.

Pseudotsuga menziesii/Symphoricarpos albus h.t. (PSME/SYAL; Douglas-fir/common snowberry)

Distribution—This is an incidental h.t. in northern Idaho, with most occurrences located north of Orofino. Reconnaissance revealed this h.t. occurs as small, usually highly disturbed stands in areas bordering on, or within, the Palouse Prairie. This h.t. is well represented in central Idaho, Montana, and Wyoming. In northern Idaho, PSME/SYAL occurs on warm, dry, low to middle elevation slopes and benches.

Vegetation—*Pinus ponderosa* is the major seral tree species and often codominates with *Pseudotsuga menziesii* in mature stands. Shrub species, normally low in total coverage, are usually represented by *Symphoricarpos albus, Spiraea betulifolia, Amelanchier alnifolia, Rosa* *gymnocarpa*, and *Berberis repens*. The herbaceous layer tends to be rather sparse, with most stands having less than 25 percent total coverage of *Agropyron spicatum, Calamagrostis rubescens, Carex geyeri*, and associated herbs.

Productivity/Management—Timber productivity, extrapolating from western Montana data, is expected to be low to moderate; however, based on limited data for northern Idaho, this h.t. appears to be considerably more productive (appendix F). *Pinus ponderosa* should regenerate and grow well, whereas *P. menziesii* may prove difficult to regenerate on all but the most moist sites. *Calamagrostis rubescens* sod may develop following disturbance, causing further regeneration difficulty. Forage and browse production on this h.t. is relatively low.

Other Studies—Daubenmire and Daubenmire (1968) originally described this type from stands in eastern Washington. Pfister and others (1977), Steele and others (1981), Hall (1973), and Lillybridge and Williams (1984) describe similar plant associations, but most of these appear to be drier and less productive.

Pseudotsuga menziesii/Spiraea betulifolia h.t. (PSME/SPBE; Douglas-fir/white spiraea)

Distribution—This is an incidental h.t. in northern Idaho; all sampled locations are in the Selway-Bitterroot Wilderness. It usually occupies dry southerly exposures at mid to upper elevations.

Vegetation—These are open stands, with codominance of *Pseudotsuga menziesii* and *Pinus ponderosa*. The understory is characterized by a dominance of *Spiraea betulifolia* in the low shrub layer and *Agropyron spicatum* in the herbaceous layer.

Productivity/Management—Timber productivity of these sites is expected to be low to moderate. *Pinus ponderosa* should be the preferred species due to ease of regeneration and higher yields, compared to *P. menziesii*. Use of this h.t. by livestock and wildlife can be high.

Other Studies—The modal description for this h.t. comes from central Idaho (Steele and others 1981) where it commonly occurs. Adjacent areas have also recognized this h.t. (Pfister and others 1977; Steele and others 1983).

Pseudotsuga menziesii/Calamagrostis rubescens h.t. (PSME/CARU; Douglas-fir/pinegrass)

Distribution—This incidental h.t. for northern Idaho has two phases that tend to occupy spatially (and environmentally) disjunct sites. The moderate- to high-elevation CARU phase generally occurs on steep south-facing slopes above 4,500 ft (1,370 m), while the lower elevation ARUV phase occurs on low to moderate slopes, all aspects, and on glacial drift in and adjacent to the Purcell Trench at elevations of 2,300 to 4,500 ft (700 to 1,370 m). This h.t. occurs in significant amounts outside of northern Idaho (see Other Studies below).

Vegetation—*Pseudotsuga menziesii* is the major species in near-climax stands, with very old seral remnants of *Pinus ponderosa* or *Larix occidentalis* occasionally codominant. *Pinus contorta* is often an early, and occasionally long-persisting, seral dominant. Understory vegetation is generally dominated by a sward of *Calamagrostis rubescens*, with other shrub and forb species being less than abundant (<25 percent coverage). The two phases of this h.t. are identified by *Arctostaphylos uva-ursi*'s presence (ARUV phase) (fig. 45) or absence (CARU phase); also distinctive is the 100 percent constancy and well-represented coverages of *Carex geyeri* in the CARU phase and virtual absence in ARUV.

Productivity/Management—Site index values are generally moderate due primarily to the cold environment and excessively drained soils. *Pinus ponderosa* on the ARUV phase shows the best growth potential within the h.t. With the exception of sites supporting high densities of the very palatable bunchgrass *Festuca scabrella*, mature stands produce little forage for wild and domestic ungulates. Early and midseral conditions, however, should produce a tall shrub component useful as browse and cover.

Other Studies—In the Northern Rocky Mountains, PSME/CARU appears to be the most widely distributed PSME series h.t. In-depth descriptions of the type as it occurs in areas adjacent to northern Idaho can be referenced in Ogilvie (1962), Brayshaw (1965), Daubenmire and Daubenmire (1968), McLean (1970), Stringer and LaRoi (1970), Hall (1973), Cooper (1975), Pfister and others (1977), Steele and others (1981, 1983), and Lillybridge and Williams (1984). Steele and Geier-Hayes (1984) detail successional patterns and management implications for this h.t. in central Idaho.

Pseudotsuga menziesii/Carex geyeri h.t. (PSME/CAGE; Douglas-fir/elk sedge)

Distribution—This h.t. is incidental in northern Idaho, occurring in minor amounts on the Nez Perce NF. It occupies dry, generally south aspects at mid to upper elevations.

Vegetation—*Pinus ponderosa* and *Pseudotsuga menziesii* normally codominate on these open, parklike stands. The undergrowth is dominated by graminoids *Carex geyeri, Agropyron spicatum*, and *Festuca idahoensis*.

Productivity/Management—Productivity should be low to moderate, with *P. ponderosa* the most productive and easily regenerated species. Forage production for livestock and elk is site-dependent and variable.

Other Studies—This is a major h.t. in central Idaho and is thoroughly described by Steele and others (1981). In western Montana, however, this is a minor, slightly different h.t. becoming more abundant east of the Continental Divide (Pfister and others 1977). Hall (1973) describes a similar plant community in eastern Oregon.

Pseudotsuga menziesii/Festuca idahoensis h.t. (PSME/FEID; Douglas-fir/Idaho fescue)

Distribution—This is an incidental h.t. in northern Idaho, occurring in only minor amounts on the Nez Perce NF. It is normally located at lower timberline on north and

Figure 45—*Pseudotsuga menziesii/Calamagrostis rubescens* h.t.-*Arctostaphylos uva-ursi* phase on a coarse-textured soil lacking an ash cap and developed from glacial drift in the Hoodoo Lake vicinity of the Purcell Trench (2,290 ft [700 m]). *Pinus ponderosa* dominates the overstory of this multiple-aged stand in which *Pseudotsuga* is slowly regenerating. The dominant herb is rhizomatous *C. rubescens* and the conspicuous bunchgrass is *Festuca scabrella;* only *A. uva-ursi* among the other undergrowth species is more than poorly represented.

east aspects, being replaced by the drier PIPO/FEID h.t. on south and west aspects. The PSME/FEID h.t. is much more common in central Idaho and west-central Montana.

Vegetation—*Pinus ponderosa* usually codominates with *Pseudotsuga menziesii.* This condition differs from Montana, where *P. ponderosa* is unrepresented in the PSME/ FEID h.t. The undergrowth has few characteristic shrubs and forbs. *Festuca idahoensis* and *Agropyron spicatum* generally codominate the herb layer, but only the well-represented coverage of *F. idahoensis* is diagnostic for the h.t.

Productivity/Management—Timber productivity of PSME/FEID is expected to be low to very low due to both poor height growth and low stockability. Low regeneration success is a further silvicultural consideration. In good range condition this h.t. is relatively productive (800 lb/acre [896 kg/ha] [McLean and others 1971]) for livestock forage in early summer and wildlife habitat during winter months.

Other Studies—This h.t. has been described in British Columbia (McLean 1970), Montana (Pfister and others 1977), and central Idaho (Steele and others 1981); central Idaho's PIPO phase of PSME/FEID seems to best fit our sites.

Pseudotsuga menziesii/Agropyron spicatum h.t. (PSME/AGSP; Douglas-fir/bluebunch wheatgrass)

Distribution—PSME/AGSP is an incidental h.t. in northern Idaho; its occurrence appears to be limited to the Salmon River drainage and possibly lower portions of the Clearwater River drainage. It is best developed in southern portions of central Idaho and central Montana. It occupies steep south to west aspects below 3,000 ft (910 m) and either borders on PIPO/AGSP or constitutes the lower timberline ecotone transitional to bunchgrass steppe vegetation. At its cool, moist extremes, PSME/AGSP grades to PSME/FEID, PSME/SPBE, or PSME/SYAL.

Vegetation—Widely spaced *Pseudotsuga menziesii* and *Pinus ponderosa* are overstory codominants, with generally sparse undergrowth vegetation. Rhizomatous or caespitose *Agropyron spicatum* dominates the grass cover; *Festuca idahoensis* is often a minor component. Other high-constancy herbs are *Achillea millefolium, Balsamorhiza sagittata,* and *Pteridium aquilinum.* The presence of *Pteridium* is indicative of past disturbance by fire and grazing.

Productivity/Management—Timber productivity of PSME/AGSP is expected to be low due to both height growth far below the PSME series average and low stockability; poor regeneration success is a further silvicultural problem. Forage production is generally low (5-year average of 400 lb/acre [448 kg/ha]) (McLean and others 1971); the less steep sites are used for livestock grazing only in the spring. In some areas PSME/AGSP does serve as winter and spring habitat for big game and occasionally wild turkey.

Other Studies—Similar descriptions of PSME/AGSP exist for British Columbia (McLean 1970), Montana (Pfister and others 1977), central Idaho (Steele and others 1981), eastern Washington (Daubenmire and Daubenmire 1968; Lillybridge and Williams 1984), and northeastern Oregon (Hall 1973).

Pinus contorta (PICO) Series

Distribution/Vegetation—The PICO series, a minor one in northern Idaho and apparently confined to the Nez Perce and Clearwater NF's, is characterized by essentially pure stands of *Pinus contorta* in which there is no clear indication that another tree species is potentially climax. Areas of nearly exclusive *P. contorta* dominance can be traced to several factors (Pfister and others 1977), listed in order of their decreasing influence in northern Idaho: (1) sites where frequent, widespread, stand-replacing wildfire has eliminated seed sources of shade-tolerant competitors (PICO seral); (2) sites where tolerant competitors are removed through frequent light ground fires (PICO seral); (3) sites with excessively dense stands that competitively exclude regeneration of shade-tolerant competitors (PICO seral); and (4) sites that are intrinsically unsuitable for regeneration and establishment of other conifers (PICO climax).

Pfister and Daubenmire (1975) indicate that *P. contorta* occupies a climax dominant position on sites having particular topoedaphic features, but cite no examples for the Northern Rocky Mountains. On portions of the Nez Perce NF and possibly other locations in northern Idaho, one *P. contorta* community (PICO/VASC) does occupy sites that appear to be unsuited for the regeneration and establishment of other conifer species, and thus we have recognized this condition as a habitat type. Shallow, moisture-deficient soils appear to be the controlling environmental factor for this edaphic climax. It is hypothesized that these conditions are a result of either (or both) (1) major wildfires and subsequent surface soil erosion, or (2) chance distribution of volcanic ash, found well-mixed with soils of other sites, that missed being deposited on or was eroded from these sites. These conditions are associated with reduced soil fertility and increased moisture stress.

Sites where *P. contorta* is self-perpetuating are typically well-drained to excessively drained uplands with gentle topography (Moir 1969; Despain 1983). They are similar environmentally to the colder portions of the *Pseudotsuga menziesii* series and drier portions of the *Abies* spp. series. The PICO series is extensive in eastern Montana (Pfister and others 1977) and central Idaho (Steele and others 1981) where *P. contorta* functions primarily as a seral conifer. PICO community succession in northern Idaho within the ABGR, ABLA, THPL, TSHE, or TSME zones will normally proceed to site dominance by one of these climax species. The rate of succession on these sites is inversely proportional to the size, frequency, and intensity of disturbance. Areas of *P. contorta* seral dominance should classify, through the presence of mesic undergrowth associations, to one of the above-cited series. Two PICO c.t.'s have been delineated; field identification and management of these long-term *P. contorta*-dominated sites is facilitated by recognizing them as distinct seral types.

Note that not all *P. contorta*-dominated stands belong in this series. Where dense, stagnated stands have prevented or reduced the regeneration of competitors, observation of nearby stands having very similar site characteristics, particularly soil depths and parent materials, and an adequate seed source should allow one to determine the successional status and climax species for these sites.

Ecology/Fire—Some special ecological conditions, most of which occur on a very limited basis in northern Idaho, favor *P. contorta*. It is well adapted to cold-air drainage (Heuser 1969), fluctuating water tables (Tarrant 1953), soils at both ends of the spectrum of drainage conditions (Stephens 1966), and soils that develop on locally unique parent materials (Youngberg and Dahms 1970; Pfister and others 1977; Despain 1973, 1983). On the southern portion of the Nez Perce NF, coarse granitic (lacking ash cap) and glacial detritus substrates, coupled with severe microclimates of high elevations, seem capable of producing environments sufficiently unique to favor *P. contorta* to the virtual exclusion of its competitors.

Most of the nearly pure *P. contorta* populations of northern Idaho appear to have resulted from postfire succession as evidenced by even-aged stand structure and omnipresence of abundant soil charcoal. However, as in stands of central Idaho where *P. contorta* appears to be self-perpetuating (Steele and others 1981), those of northern Idaho have nonserotinous cones, sparse undergrowth, widely spaced trees, and light fuels. All these conditions are atypical for ecosystems where fire is a significant evolutionary factor and point to unique substrate conditions as the controlling factor in distribution of climax *P. contorta*.

Productivity/Management—Timber productivity is expected to be low to moderate. *Pinus contorta* is the obvious choice for management; some lower elevation sites (<6,200 ft [1,890 m]) may support unthrifty *Pseudotsuga*.

The gentle terrain provides easy access and opportunity for recreation. These sites receive light to moderate use by elk and deer during the summer and fall.

Other Studies—Many studies (Moir 1969; Pfister and Daubenmire 1975; Pfister and others 1977; Steele and others 1981, 1983; Despain 1983) have recognized *P. contorta* c.t.'s or h.t.'s and associated their distribution with environmental conditions, particularly gentle terrain coupled with edaphic factors that are inimical to the regeneration of other conifers.

Pinus contorta/Vaccinium caespitosum c.t. (PICO/VACA; lodgepole pine/dwarf huckleberry)

Distribution/Vegetation—PICO/VACA c.t. is locally represented in the higher valley floors of the Nez Perce NF, especially in the Red River Valley and Dixie vicinity. It occurs at mid to lower elevations of the *Abies lasiocarpa* zone on gentle or undulating topography, where cold-air ponding creates frost pockets; usually these are positions of glacial drift deposition and coarse textured soils.

Vaccinium caespitosum forms a patchy dwarfed shrub layer often accompanied by *Calamagrostis rubescens*. Regeneration of climax tree species is so sporadic that relating these sites to the ABLA series or the cold portion of the PSME series is problematic.

Productivity/Management—Stands of PICO/VACA are best managed as ABLA/VACA (see Pfister and others 1977; Steele and others 1981), with *P. contorta* the only suitable timber species. Timber productivity appears to be midway between PICO/VASC h.t. and ABLA series h.t.'s.

Other Studies—This c.t. has been described by Pfister and others (1977) and Steele and others (1981).

Pinus contorta/Xerophyllum tenax c.t. (PICO/XETE; lodgepole pine/beargrass)

Distribution/Vegetation—PICO/XETE is an incidental type; it has been observed only on the Nez Perce NF at mid to upper elevations of the *Abies lasiocarpa* zone. Soils of these sites are thin, granitic, and generally lack an ash layer. These sites can be distinguished from PICO/VASC sites by having soils generally deeper than 16 inches (40 cm) and an average litter depth of 2 inches (5 cm).

Vaccinium scoparium or *V. globulare* dominates the undergrowth. *Xerophyllum tenax* tussocks are widely spaced and other forbs (*Arnica* spp., *Lupinus* spp.) are sparse. The highest elevation sites support *Luzula hitchcockii* and *Pinus albicaulis*, and are transitional to ABLA/XETE-LUHI and ABLA/LUHI h.t.'s. In most cases this c.t. represents a long-persisting seral stage of ABLA/XETE or, more infrequently, ABGR/XETE.

Productivity/Management—For timber production, stands of PICO/XETE c.t. can be managed as the ABLA/XETE h.t. (colder phases), with *P. contorta* the most favored species.

Other Studies—This c.t. has been previously described by Steele and others (1976) for portions of the Nez Perce NF. A similarly named but richer c.t. was described by Volland (1976) for TSME and ABLA sites of central Oregon.

Pinus contorta/Vaccinium scoparium h.t. (PICO/VASC; lodgepole pine/grouse whortleberry)

Distribution/Vegetation—PICO/VASC is the only *Pinus contorta*-dominated community recognized as climax (h.t.) in northern Idaho. It is an incidental h.t. occurring mainly in southern and eastern portions of the Nez Perce NF at mid to upper elevations of the *Abies lasiocarpa* zone. Excessively drained shallow soils are especially characteristic of these sites. Elevations range from 5,000 to 6,000 ft (1,520 to 1,830 m); aspects from southeast to west.

In both the overstory and understory *P. contorta* is virtually the only tree species represented. Individuals in the overstory exhibit poor height growth; none had site index values exceeding 42. Individuals in the understory are severely stunted and are normally the same age as the stand dominants. What few shade-tolerant tree species are present in the understory are extremely stunted, not merely suppressed, and appear incapable of responding to release following thinning or overstory removal. Regeneration of all tree species following initial stand establishment is essentially nonexistent; self-perpetuation of *P. contorta* is sporadic, favored by mortality-created canopy gaps.

The undergrowth is dominated by a layer of *Vaccinium scoparium;* other shrubs are very sparse. *Xerophyllum tenax, Chimaphila umbellata, Calamagrostis rubescens,* and *Carex concinnoides*, all with low coverages, are the only consistently represented herbaceous species (fig. 46). Very seldom do more than 12 species occur in a 1/10-acre (0.04-ha) plot.

Soils—The soils are highly diagnostic for this h.t. They are exceptionally shallow, with depth to parent material usually less than 8 inches (20 cm) and not exceeding 12 inches (30 cm), and always excessively welldrained. Parent materials are granitic or mica schist, and the coarser fragments are predominantly quartz. Textural classes range from coarse sandy loam to loam, while pH ranges from 5.8 to 6.1. No ash caps were found, but minor amounts of ash are mixed in the upper horizons. Average litter depth is 0.5 inch (1.5 cm).

Productivity/Management—*Pinus contorta* is the only timber species adapted to this h.t. Productivity is very low; natural 100-year-old stands produce trees averaging 60 ft (18 m) in height and 8 to 11 inches (20 to 28 cm) d.b.h. (average site index of 36). Regeneration problems may result on highly disturbed sites.

Other Studies—A climax *P. contorta* h.t. has not previously been described for northern Idaho. A PICO/VASC h.t. was recognized by Hoffman and Alexander (1976, 1980) in Wyoming's Big Horn Mountains and Colorado's Routt NF (as PICO/*Shepherdia canadensis*). Various studies have described PICO/VASC as a c.t. generally seral to ABLA/VASC (Hall 1973; Moir 1969; Pfister and others 1977; Steele and others 1981, 1983; Volland 1976).

Figure 46—*Pinus contorta/Vaccinium scoparium* h.t. on a moderate southeast-facing slope (5,650 ft [1,720 m]) along Whitewater Ranch Road, Nez Perce NF. *Pinus contorta* is the only successfully reproducing tree; very stunted *Abies lasiocarpa* occur as accidentals. The species-poor undergrowth is dominated by *V. scoparium* and *Calamagrostis rubescens*, with *Xerophyllum tenax* present as scattered clumps. Soils are shallow (<12 inches [30 cm]).

Pinus ponderosa (PIPO) Series

Distribution—Pure stands of *Pinus ponderosa* are a minor component of the forested vegetation in northern Idaho. It is the climax dominant overstory species on the western edge of northern Idaho's driest forested zone at elevations generally below 4,000 ft (1,220 m). In the loessal soils of the Palouse region of northern Idaho, many of the currently *P. ponderosa*-dominated stands are actually seral to *Pseudotsuga menziesii;* therefore sites must be classified with special care. Eastward along the major river drainages between Moscow and Riggins, *P. ponderosa* occupies a narrow environmental strip between steppe vegetation and more mesic *Pseudotsuga menziesii* forests. It occurs in a broad range of canopy densities, from closed forest to very open savanna. The ability to rapidly elongate the root system in an environment of high moisture deficiency is the primary competitive advantage *P. ponderosa* has with respect to other tree species of this region (Daubenmire 1968b). This series occurs on all aspects, slopes, and landforms at elevations ranging from 1,000 ft (300 m) to as high as 5,000 ft (1,520 m). Like Daubenmire and Daubenmire (1968), we had difficulty finding relatively undisturbed plant communities representative of this series to sample.

Vegetation—*Pinus ponderosa* is the only tree species capable of growing in this dry environment. *Pinus ponderosa* associations can be segregated into two groups: a shrub- and forb-rich group and a drier bunchgrass-dominated group. The shrub-dominated undergrowth is very similar to that of the *Physocarpus malvaceus* and *Symphoricarpos albus* h.t.'s of the *P. menziesii* series. The graminoid-dominated sites have understory associations quite similar to the *Agropyron-Festuca* association of Daubenmire (1970) and the *Festuca-Agropyron* association of Tisdale (1979).

Fire—Fire has had varying effects within this series. Prior to 1900, all sites probably experienced cool underburns at 5- to 20-year intervals (Arno 1980). On most sites these fires simply reduced the litter and duff accumulations. On some of the more moist sites, *P. menziesii* regeneration was periodically removed, but with aggressive fire control these "fire climax" *Pinus* sites are succeeding to *Pseudotsuga* site dominance. These sites must be classified with care because although *Pseudotsuga* is the indicated climax, it may never have dominated the site and developed soils characteristic of *Pseudotsuga* h.t.'s.

Productivity/Management—The *P. ponderosa* series is generally the least productive forest land of northern Idaho. On grass-dominated sites, productivity is very low and tree regeneration is very scarce and sporadic. Wildlife and livestock grazing is often the major use of these lands. Shrub-dominated sites are much more productive due not only to increased site index, but also to the site's ability to produce greater basal area (that is, higher stocking rates). Daubenmire (1961) found widespread *Arceuthobium campylopodum* (dwarf mistletoe) infection of trees on bunchgrass-dominated sites but virtually no parasitization of trees on shrub-dominated sites. Steele and others (1981) found infestation in 15 percent of all stands in central Idaho, while Pfister and others (1977) found none in Montana. Silvicultural controls for mistletoe have been outlined by Barrett (1979).

All silvicultural regeneration techniques have been utilized for *P. ponderosa*. Site preparation to reduce competition for soil moisture is recommended on most sites. Sites with shallow soils should not be greatly disturbed because any soil loss may irreparably degrade the site. It may therefore be prudent to forgo harvesting sites with less than 24 inches (61 cm) total soil depth. Due to the infrequent concurrent combination of a good seed crop, adequate site preparation, and a cool, moist spring, natural regeneration should not be extensively relied upon (Barrett 1979; Foiles and Curtis 1973; Harrington and Kelsey 1979; Wellner 1970b). A seed-tree treatment, when coupled with interplanting, may be the most realistic approach, accepting that a prolonged regeneration period is expected.

Light year-round use of shrubs by deer should be beneficial for tree growth (Kosco and Bartolome 1983). Three to 5 years following plantation establishment, light controlled grazing by domestic livestock should aid timber productivity by reducing herbaceous and woody competition (Currie and others 1978; Wheeler and others 1980).

Pinus ponderosa/Physocarpus malvaceus h.t. (PIPO/PHMA; ponderosa pine/ninebark)

Distribution—PIPO/PHMA is very limited in northern Idaho. It has been found only on northwest to northeast aspects of moderate slopes, bordering PIPO/SYAL of hotter, drier southerly exposures and grading to PSME/PHMA on slightly more moist sites. The PIPO/PHMA h.t. is generally found at elevations below 3,000 ft (910 m).

Vegetation—Two shrub layers are characteristic of this h.t. The lower layer, up to 3 ft (1 m) tall, is composed of *Symphoricarpos albus, Spiraea betulifolia, Berberis repens,* and *Rosa* spp. The tall layer, up to 6 ft (2 m), is dominated by *Physocarpus malvaceus* and/or *Holodiscus discolor,* with other commonly found shrubs being *Ceanothus sanguineus, Philadelphus lewisii, Prunus virginiana,* and *Amelanchier alnifolia.* The herbaceous layer has high constancy for *Galium boreale, Arenaria macrophylla, Osmorhiza chilensis, Erythronium grandiflorum, Fragaria* spp., *Bromus vulgaris, Calamagrostis rubescens,* and *Carex geyeri.* This understory composition is very similar to that found in the PSME/PHMA-PHMA phase.

Soils—Soil parent material is mainly loess, with volcanic ash mixed in the upper horizons. Textures range from silt to silty clay-loam. Total depth ranges between 24 and 32 inches (60 and 80 cm), and pH ranges from 5.8 to 6.6. Bare soil and rock usually do not occur on these deep soil sites. Litter depth averages 1.5 inches (4 cm) and totally covers surface on undisturbed sites.

Productivity/Management—Although timber productivity is low, PIPO/PHMA is still the most productive h.t. within the series (appendix F). Proper stocking levels and control of highly competitive shrub species are important silvicultural considerations in this h.t. Because total site occupancy by native shrubs typically follows disturbance, planting immediately following logging and site preparation is recommended.

Other Studies—This h.t. was originally described by Daubenmire and Daubenmire (1968) for eastern Washington and northern Idaho. Steele and others list PIPO/ PHMA as being an incidental h.t. on the Nez Perce NF (1976) and in central Idaho (1981).

Pinus ponderosa/Symphoricarpos albus h.t. (PIPO/SYAL; ponderosa pine/common snowberry)

Distribution—The PIPO/SYAL h.t. occurs sporadically from Coeur d'Alene south along the western forested edge of northern Idaho. It constitutes a narrow strip between the *Festuca idahoensis-Symphoricarpos albus* h.t. (Daubenmire 1970) on drier sites and PIPO/PHMA or PSME/SYAL on more moist sites. Most locations are below 3,500 ft (1,070 m) elevation on moderately steep terrain and on warm, dry southeast to northwest aspects.

Vegetation—Low shrubs dominate this h.t.; *Symphoricarpos albus, Spiraea betulifolia, Berberis repens,* and *Rosa* spp. have the greatest constancy. Some of these sites may also have *Crataegus douglasii, Prunus emarginata, P. virginiana, Amelanchier alnifolia,* and/or *Rhamnus purshiana* as a tall shrub layer. The herbaceous undergrowth of this h.t. is usually sparse and lacking in species diversity, although disturbed sites of this h.t. often have rampant populations of exotic herbs. Daubenmire and Daubenmire (1968) note the presence of *C. douglasii* on relatively moist sites and along river terraces within this h.t. In our area this appears to be a response to past disturbance, or occurs on sites transitional to the steppe community, *Crataegus-Symphoricarpos* (Daubenmire 1970).

Soils—Soil parent materials are typical of the westernmost portion of the study area being mainly loess, basalts, metasediments, and some volcanic ash. Textures are fairly heavy, being silt-loam to silty clay-loam. Total depth ranges from 15 to 35 inches (40 to 90 cm). Bare soil and rock usually do not occur on undisturbed sites. Litter depths average 2 inches (5 cm).

Productivity/Management—Timber productivity in naturally occurring stands of this h.t. is low, but could be improved by means of appropriate stocking levels and control of highly competitive understory vegetation. Although natural regeneration in this h.t. is often successful, once site preparation costs are incurred, early spring planting should be considered so as to ensure prompt site occupancy by tree seedlings.

Other Studies—This h.t. was originally described by Daubenmire and Daubenmire (1968) from sites mostly located in eastern Washington. Steele and others (1976, 1981) describe this h.t. for west-central Idaho, Pfister and others (1977) describe a similar type for Montana, and Johnson and Simone (1986) describe a more productive association for northeastern Oregon.

Pinus ponderosa/Festuca idahoensis h.t. (PIPO/FEID; ponderosa pine/Idaho fescue)

Distribution—PIPO/FEID occurs in minor amounts along the western edge of our forested zone from Coeur d'Alene south. It is most prevalent along the Clearwater, Snake, and Salmon River drainages on sites slightly more moist than in the PIPO/AGSP h.t., but drier than the PIPO/SYAL h.t. It occurs on gentle to steep slopes of east, south, and west aspects. At the northern end of its range in Idaho, PIPO/FEID does not occur above 2,500 ft (760 m) elevation, whereas Steele and others (1981) found it at 5,800 ft (1,770 m) in the Salmon Uplands.

Vegetation—This type has an open, parklike appearance because of the low natural stocking capacity. *Festuca idahoensis* is the dominant grass species, usually found in conjunction with lesser amounts of *Agropyron spicatum* (fig. 47). This h.t. has a richer component of both perennial and annual forbs than is found in the PIPO/AGSP h.t., with increases particularly in coverage of *Balsamorhiza sagittata, Achillea millefolium,* and *Eriogonum heracleoides.*

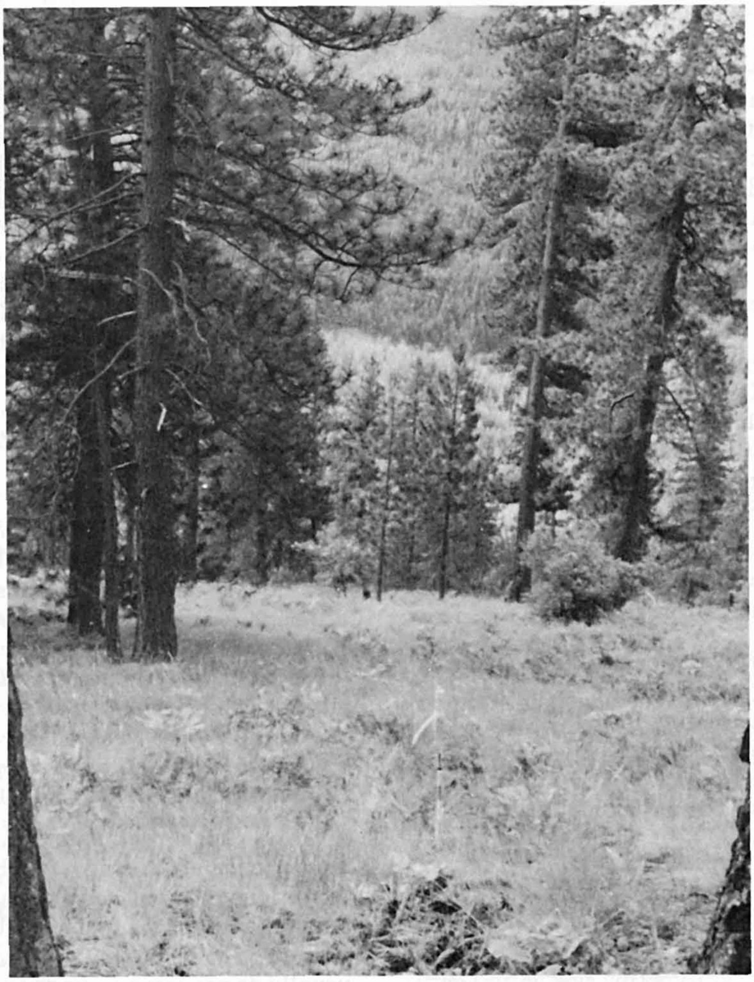


Figure 47—*Pinus ponderosa/Festuca idahoensis* h.t. on a *steep* south-facing slope with shallow and gravelly soils, in the Dudley Peak vicinity, Coeur d'Alene NF. Overstory of *P. ponderosa* is uneven-aged. *Agropyron spicatum* and *F. idahoensis* are abundant and *Balsamorhiza sagittata* is the only important forb.

Productivity/Management—Timber productivity of this h.t. is low due to both poor individual tree growth and low site stockability. Tree regeneration will be almost as difficult as on the PIPO/AGSP h.t.; both natural and artificial regeneration will have a generally low probability of success. Forage production for domestic and wild ungulates on this h.t. is greater than on PIPO/AGSP; in southern British Columbia McLean and others (1970) measured 700 lb/acre (784 kg/ha) whereas in northeastern Oregon mean herbage production was 360 lb/acre (404 kg/ha) (Hall 1973). Overgrazing and harsh logging treatments can significantly damage soils and thus site productivity.

Other Studies—Daubenmire (1952) originally described this h.t. as a portion of PIPO/AGSP h.t., but later (Daubenmire and Daubenmire 1968) split the two h.t.'s. Our h.t. is similar to the *Pinus ponderosa-Festuca idahoensis* h.t. of McLean (1970), the FEID phase of PIPO/FEID h.t. of Pfister and others (1977), PIPO/FEID h.t. of Steele and others (1981), and ponderosa pine-fescue of Hall (1973) and Johnson and Simone (1986).

Pinus ponderosa/Agropyron spicatum h.t. (PIPO/AGSP; ponderosa pine/bluebunch wheatgrass)

Distribution—PIPO/AGSP occurs primarily on steep, south-facing slopes overlooking the Snake and Salmon Rivers. As Daubenmire and Daubenmire (1968) originally identified this h.t. in Spokane County, WA, some examples for northern Idaho may occur on coarse-textured glacial drift to the west of Coeur d'Alene. The Daubenmires also mention its occurrence in the Clearwater River drainage. It appears to be limited to elevations less than 4,000 ft (1,220 m) on hot, dry slopes.

Vegetation—A sparse overstory of only *Pinus ponderosa* characterizes the tree layer of this h.t. The bunchgrass or rhizomatous form of *Agropyron spicatum* is the only conspicuous understory species. *Achillea millefolium* and *Balsamorhiza sagittata* are the only consistently present perennials; most other herbaceous species are small, early flowering annuals.

Productivity/Management—This h.t. has very low timber productivity due to both poor individual tree growth and low site stockability. Regeneration of trees, whether naturally or artificially, will have low probability of success; natural site potential will allow only a low basal area stocking level (appendix F). The major resource of these sites is often forage for wild and domestic ungulates. McLean and others (1970) indicate forage production to average 400 lb/acre (448 kg/ha) for the very similar PSME/AGSP association and Hall (1973) found 430 lb/acre (516 kg/ha) for the PIPO/AGSP c.t. Relatively high amounts of forage are available for cattle and elk; browse production for deer and sheep is essentially zero. Season and amount of use by livestock should be regulated if these sites serve as elk winter range.

Other Studies—The PIPO/AGSP h.t. has been described in nearly the same form in several adjacent areas. It was originally described by Daubenmire (1952) and Daubenmire and Daubenmire (1968), and later listed by Steele and others (1981) in central Idaho, and Pfister and others (1977) in Montana. For the northern Blue Mountains Hall (1973) described a ponderosa pine/wheatgrass c.t. without shrubs that appears comparable to our PIPO/AGSP h.t., as did Johnson and Simone (1986). McLean (1970) identified a *Pinus ponderosa-Agropyron spicatum* h.t. for southeastern British Columbia that appears to be slightly drier than that found in northern Idaho.

OTHER VEGETATION TYPES

This classification treats the vast majority of forested environments in northern Idaho. Communities where recurring disturbance is part of the natural environment—for example, avalanche chutes or flood plains—have not been classified but could be included in future work at the community-type level, as is being done with wetlands for the Northern Region, USDA Forest Service (Pierce 1986).

Forested Scree Communities (SCREE)

Slopes dominated by loose fragmented rock are termed talus, scree, or rock fans (debris). Although these excessively drained sites are often treeless in other locales, the high precipitation regime of northern Idaho is frequently sufficient for these sites to support trees, shrubs, and drought-tolerant herbs. Ecologically, these stands may approach a dynamic equilibrium with their perpetually shifting substrate.

The environment of these sites is spatially heterogeneous, owing to differential sorting of rock fragments, variation in the rate of debris movement, and subsurface drainage patterns. Scree sites are characterized by steep (>30 degrees), unstable slopes (hence frequent, natural interruption of normal successional patterns), usually with warm, dry exposures. These sites occur most abundantly along the slopes of deeply incised drainages. Forested scree slopes have widely spaced trees (low stockability and productivity), are difficult to regenerate, and have a shrub layer of variable density and composition. Occasionally the undergrowth may be forb-dominated, with half-shrub *Penstemon* spp. being a conspicuous component. Typically, these sites support tree species adapted to conditions of limited soil moisture; that is, *Pinus ponderosa, P. contorta,* and *Pseudotsuga menziesii. Thuja plicata, Abies lasiocarpa, A. grandis,* and even *Tsuga heterophylla* occur under the most favorable moisture conditions, where they are able to tap subsurface water.

We have followed the approach of Pfister and others (1977) and recognized a generalized forested scree condition (abbreviated SCREE) because of the high degree of intrasite and intersite variability and the dominant topoedaphic influence. SCREE is distinguished at the series level to prevent users from trying to identify these sites at an h.t. level. The hazards and limited opportunities associated with these sites preclude intensive management; only natural or low-impact uses such as for wildlife, watershed, and recreation are appropriate.

Flood Plain and Riparian Communities

Flood plains are formed on some of the shallow-gradient portions of major drainages of northern Idaho; these conditions are especially notable along the lower St. Joe and Kootenai Rivers. Here, flood plains and riparian stringers are subject to fluctuations in stream actvity that periodically alter substrate depths and composition, and water table levels. Community analysis is often complicated by the added disturbance of livestock use. These recurring interruptions to successional processes pose unique challenges in applying the potential climax concept. Despite these perturbations, relatively stable plant communities can develop and are recognizable at the community-type level (Pierce 1986; Tuhey 1981).

Overstory dominants occur in varying proportions of *Populus* spp. (mostly *trichocarpa), Betula* spp., *Salix* spp., *Alnus* spp., and *Crataegus* spp., with various conifer species being weakly represented. The undergrowth is usually lush and patterned by small-scale topoedaphic effects.

Alnus sinuata Communities

Pure stands of *Alnus sinuata* and mosaics of *A. sinuata* with conifers and other shrub species occur throughout northern Idaho. Successional status of these communities varies from early pioneer secondary succession stages following site disturbance by wildfire, avalanche, or massive soil slumping, to long-lived midseral and climax communities on sites having high water tables, seasonally high soil moisture resulting from late-melting snowpacks, or stabilized talus slopes.

Alnus mosaics occur in all series but tend to be more extensive and a management problem in *Abies grandis, Abies lasiocarpa, Tsuga heterophylla,* and *Tsuga mertensiana* series. The density of the partially prostrate, springy stems impedes travel of both humans and livestock, generally restricting use of these stands to wildlife. The only tree species regularly associated with pure *Alnus* stands is *Picea engelmannii,* which seldom develops beyond the seedling or small sapling stage.

Shrub species associated with these communities are *Acer glabrum, Ribes lacustre, Salix* spp., *Sambucus* spp., *Sorbus* spp., and *Menziesia ferruginea.* Herbaceous species are usually shade tolerant and moisture requiring such as: *Asarum caudatum, Athyrium filix-femina, Circaea alpina, Clintonia uniflora, Dryopteris austriaca, Montia cordifolia, Montia sibirica, Pteridium aquilinum, Senecio triangularis, Trautvetteria caroliniensis, Valeriana sitchensis,* and *Veratrum viride.*

Soils developing under nearly pure *Alnus* stands tend to be moist to wet, relatively deep, and normally have a 12- to 24-inch deep (30- to 61-cm), dark colored, base-leached, diagnostic upper horizon (umbric epipedon), very high in organic carbon and low pH values (relatively poor nutrient source). Nevertheless, soil properties can vary widely under pure *A. sinuata,* including soils with light-colored diagnostic upper horizon(s) (ochric epipedons) and ones that are seasonally dry throughout the upper 60 inches (1.5 m). Efforts to link the presence of these communities to various site factors, including parent materials, have thus far not borne results.

In northern Idaho attempts to convert pure *A. sinuata* stands to coniferous forest have generally been failures. On drier sites an *A. sinuata*-conifer mosaic has responded favorably to low-acreage clearcuts and uneven-aged management. But wet sites have produced highly competitive pure stands of *Alnus* and other species. Shrub competition, and damage by pocket gopher and varying hares are major management considerations in all the *A. sinuata* community types. Research on the feasibility and effective techniques to convert these communities is needed before further conifer regeneration is attempted.

Small disjunct populations of *Alnus rubra* occur scattered throughout northern Idaho (Johnson 1968; Steele 1971). These are generally restricted to very moist, warm sites below 2,500 ft (760 m). These sites are often located on major slump zones and therefore indicate a potential for periodic disturbance.

Alnus sinuata/Montia cordifolia h.t. (ALSI/MOCO; Sitka alder/miner's lettuce)

Distribution—ALSI/MOCO is a relatively minor h.t. found throughout northern Idaho, occurring most frequently on the Selway Ranger District, Nez Perce NF, and the Lochsa and Powell Ranger Districts, Clearwater NF. It has been found at elevations ranging from 3,500 ft (1,070 m) to over 5,000 ft (1,520 m), on aspects generally northwest to east. Slopes vary from gentle to moderate. The h.t. of adjacent drier (upslope) positions is frequently ABGR/ASCA, THPL/ASCA, or TSHE/ASCA; where ALSI/MOCO occurs on sites with a high soil moisture status it grades to ABGR/SETR or THPL/ATFI on yet wetter sites. Further sampling and analysis is needed before this h.t. can be accurately placed on an environmental gradient.

Vegetation—*Alnus sinuata,* with a constancy of 100 percent and average cover of 92 percent, forms a dense upper canopy, virtually the only shrub/tree present. Occasional *Picea engelmannii* seedlings establish, but appear to never develop beyond the sapling size class. Small islands of conifers do establish and grow exceptionally well inside some *Alnus* stands, but further investigation shows these are actually islands of different soil conditions in an otherwise homogeneous habitat.

Understory vegetation in many stands is limited to *Montia cordifolia* alone, having a constancy of 100 percent and cover of 90 percent. Other species which occur in much reduced amounts are *Asarum caudatum, Circaea alpina, Montia sibirica, Senecio triangularis, Veratrum viride,* and the ferns *Athyrium filix-femina* and *Pteridium aquilinum.* Generally, a depauperate flora, the presence of only six to eight species, in addition to *A. sinuata* and *M. cordifolia,* is indicative of an ecotone to the previously mentioned "conifer-island" soil condition.

Soils—Parent materials vary from volcanic ash to highly weathered granites to glacial till of metasedimentary origin. Soils generally exceed 40 inches (1 m) in depth and often dry throughout the rooting zone by late July and August. Soil family classification is usually a Typic or Andic Cryumbrept or Andic Cryochrept. Textures tend to be coarse sands to sandy loams, and structure is usually single grain to weak granular. The pH varies from 4 to 5.5 and is generally 1.0 pH unit lower than that of adjacent conifer-occupied sites (see Other Studies section regarding successional status/genesis of these sites).

Productivity/Management—We know of no successful management attempt to establish conifers on these sites. Silvicultural treatments on *Alnus*-dominated sites should only be performed where it can be ascertained that *Alnus* is not the indicated overstory climax species. The highly productive "conifer-islands" intermixed with this type should receive immediate regeneration treatment following overstory removal. Among other problems within this h.t. are high population densities of pocket gophers and hares. ALSI/ MOCO sites produce abundant browse and thermal and hiding cover for wildlife.

Other Studies—This h.t. has not been previously described. All communities wherein *A. sinuata* is virtually the sole upper canopy dominant have heretofore been considered secondary successional stages of conifer-dominated h.t.'s. However, the stands analyzed in the study indicate that *Alnus sinuata* has long been the canopy dominant, perhaps for a period of time sufficient to develop a soil horizonation different from adjacent conifer-dominated sites. At least two alternative hypotheses can be advanced to explain this *A. sinuata* site dominance: (1) Site properties (ostensibly those of the soil) are inherently unfavorable to conifer establishment; initial site differences are possibly accentuated by continued *A. sinuata* dominance. (2) Chance phenomena in stand development have resulted in *A. sinuata* site dominance which in turn has generated site modification favoring the continued dominance of *A. sinuata*. We speculate, seeing no evidence to the contrary, that *A. sinuata* will continue to occupy these sites to the virtual exclusion of conifers and thus consider them examples of long-term stable or climax vegetation (recognized at h.t. level). Although research is needed, this also appears to be the situation on certain *Pteridium aquilinum*-dominated sites.

CHARACTERIZATION AND DISTRIBUTION OF HABITAT TYPES

Climate

Appendix E shows, via Walter (1973), diagrams arranged by series, climatic patterns representative of various habitat types. Most of the cited weather stations have long-term records. The habitat type indicated for each station is an estimation of the local climatic climax. Some caution should be exercised in applying climatic records to vegetation data; one must ascertain that the vegetation in the proximity of the station expresses the potential climatic climax and not an edaphic or topoedaphic condition. In rugged, mountainous terrain, particularly in the intermountain valleys where the great majority of weather stations are located, and the low-lying land may be blanketed with glacial drift, determination of climatic climax is not practicable.

Soils

Our soils data vary in completeness. Some researchers contributed much vegetation data but had not recorded information on soils; others had recorded characteristics of only the upper 4 to 8 inches (10 to 20 cm) of the mineral soil; whereas the authors described soil profiles to control depth or to an impermeable layer on every sample plot (totaling more than 600 plots). Preliminary results for characteristics of the upper horizon(s) and other important factors (for example, effective rooting depth) are presented in appendix D (for syntaxa with three or more samples) and as a paragraph following most habitat type descriptions.

Previous soil sampling strategies for the Northern Region and Intermountain Region have been designed to simply characterize the surface soil for each h.t. rather than investigate detailed soil-vegetation relationships. Our intention in acquiring complete profile descriptions is to build a data base for future soil-vegetation-site productivity research and to correlate our studies with those of Northern Region soil scientists. Based even on our limited data, some habitat types appear strongly controlled by edaphic or topoedaphic factors and express a narrow range in soil values; other h.t.'s are found on a wide range of soil conditions. The most salient associations between h.t.'s and soil conditions occur on sites with seasonally or permanently high water tables (THPL/OPHO, THPL/ATFI, ABLA/STAM, ABLA/CACA); these sites have less gravel (except THPL/OPHO), finer textures, higher pH, and deeper litter accumulations than upslope, well-drained sites. Neiman (1986) identified four soil physical characteristics that appear to be highly useful for differentiating between the extremely similar ABGR/CLUN, ABGR/ASCA, THPL/CLUN, THPL/ASCA, TSHE/CLUN, and TSHE/ASCA h.t.'s. His study indicates that data stratification into narrowly defined parent material groups within a restricted geographic area is a requisite to meaningful analysis.

The influence of parent material on vegetation patterns, which is so evident in Montana (east of the Continental Divide [Pfister and others 1977]) and northwestern Wyoming and adjacent Idaho (Steele and others 1983), is not manifested in obvious ways under the Inland Maritime climatic regime of northern Idaho. Of the commonly occurring parent material groups, the most strongly contrasted pair in terms of their influence on vegetation in Montana, calcareous versus noncalcareous, are rarely represented in northern Idaho owing to a lack of calcareous substrates (<1 percent of plots). Valley locations and loess-derived soils are underrepresented in the dataset because these lands are largely both privately held and deforested. Due to the extensive level of this study, insufficient representation within contrasting parent materials precludes demonstrating significant contrasts in terms of vegetation response.

The soil moisture regime and depletion rate studies of McMinn (1952) and Daubenmire (1968b) have demonstrated that these rates differ significantly and predictably among types, but these differences are not necessarily demonstrable by conventionally inventoried soil properties (for soil classification, USDA 1975). The often-advanced hypothesis that vegetation types (h.t.'s) are predictable from a standard set of soil characteristics was discredited in northern Idaho by the Daubenmires (1968). Even on a local scale (Priest River Experimental Forest), Daubenmire (1973) demonstrated poor correlation between habitat types and soils at even the Order level of soil classification.

This result is not unexpected because (1) soil classification systems are not designed to reflect primarily those properties influencing vegetation development; (2) vegetation response to climatic fluctuation is relatively rapid, whereas development of equilibrium in soil properties requires a relatively long time; (3) many factors, of which soil characteristics are only one, influence vegetational development, and through factor compensation species are able to grow on a wide range of substrates (soils); and (4) a rather coarse vegetation classification containing large within-type variation was used. Thus, one must exercise caution when attempting to "shortcut" inventories of either vegetative potentials or soils through a process of assumed correlations; relationships must be objectively and adequately tested and cautiously extrapolated. The results of Neiman (1986) indicate that with adequate data and proper stratification, certain of the physical soil characteristics can be correlated with identifiable vegetation patterns.

Vegetation

Species Occurrence

Appendix B is an interpretation, based on both field samples and personal experience, of where (h.t. and phase) tree species occur. Appendix B provides a synopsis for selecting and managing tree species in accordance with their successional role in, and adaptation to, specific habitats.

For 112 "important" species, those with high constancy or indicator significance, appendix C lists the constancy and average coverage (for plots in which the species occurs) for each h.t. and phase. Insight into the classification structure can be gained through study of this table; it also serves as a summary of the composition of sample stands and a basis for evaluating a species' ecological amplitude and abundance in late successional stages.

Examples of questions that might be posed and answered using these appendixes are: What is the relative importance of *Pinus ponderosa* in the *Thuja plicata* series? Referencing appendix B opposite the THPL series under column 1, note that *P. ponderosa* is weakly represented as a seral or accidental species. What tree species occur within ABGR/ASCA-TABR h.t.? What are their successional roles? How abundant are they? Here again we could use appendix B to answer the first two parts. But appendix C is better suited to answering questions regarding abundance, recalling however that these are figures for mature to near climax communities. If you were provided planting stock of *Acer glabrum* and *Prunus virginiana* for big game habitat improvement, in what h.t.'s and phases would you plant? Scanning appendix C across all series for these species shows *A. glabrum* to have a broader amplitude than *P. virginiana,* occurring in TSHE, THPL, and even ABLA, as well as on the warmer ABGR and PSME series. *Prunus virginiana* is confined to warmer, drier portions of ABGR, as well as PSME and PIPO; nowhere is it an important species in later successional stages.

Timber Productivity

Timber productivity is one of the key management concerns for which data were accumulated during the study. Our data base for estimating productivity by habitat type is much reduced compared to that for characterizing the vegetational composition because (1) near-climax stands frequently have no suitable site trees; and (2) we have borrowed many plots from studies interested primarily in vegetation classification, in which they did not record associated productivity features.

All site trees were relatively free-growing, of dominant and codominant crown classes. We have expanded the number of trees sampled, from one per species per plot, as done in previous regional studies (Steele and others 1981, 1983; Pfister and others 1977), to three to five (or more) trees per species per plot to better represent the within stand variation. Preliminary indications from work in western Montana for four major seral species are that a one-tree sample will be within ±9 to 10 site index units (50-year base) of the true mean 90 percent of the time; five tree samples will be within ±3 to 5 site index units of the true mean 90 percent of the time (Fiedler 1983).

We adhered to the criteria of Pfister and others (1977) for recognizing suppressed trees by increment core analysis, rejecting those with 10 or more years of suppression. Preliminary onsite counting of tree rings, examination of their pattern, and tree height computation enabled us to recognize and delete from the data set those trees whose radial growth reflected a questionable or atypical height growth rate. Some sites with high incidence of root rot or Indian paint rot *(Echinodontium tinctorium)* required coring of 10 to 12 trees of one species to attain an acceptable three- to five-tree sample. For any mature stand the probability is high that all site trees have incurred some degree of growth reduction caused by insects, disease, or short-term climatic phenomena (drought years of late 1930's are readily detectable). Though such damage can be detected by ring width measurements (Carlson and McCaughey 1982) for determining the frequency and severity of past pest population eruptions, these measurements are not currently applicable for assessing the degree to which tree height or stand productivity has been reduced. It is also possible that some habitat types are more subject to higher incidences or greater degrees of growth reduction. We mention these factors as a cautionary note to uncritical acceptance or comparison of the timber productivity of various habitat types.

Each species requires a specific algorithm for computing its site index. Most site index computations require total age and height to utilize the curves; the age to breast height (4.5 ft [1.4 m]), which varies with stand history and h.t., must be estimated or measured. For species not having a specific site curve, a curve from a species hypothesized to have a similar growth curve is substituted. Table 2 summarizes the criteria used to determine total age and the source of site index curves; some of our curve selections differ from those employed in previous regional classifications for the reasons outlined below. See Steele and Cooper (1986) for a compilation of applicable site curves.

Table 2—Criteria and sources for determining site index

Species	Estimated years to reach breast height	Source of site curve and area for which derived
ABLA	*[1]	Used *Picea engelmannii* curves
ABGR	*	Stage (1959); northern Idaho, eastern Washington
LAOC	5	Schmidt and others (1976); western Montana, northern Idaho
PIEN	*	Alexander (1967); Colorado and Wyoming
PIAL	*	Used *Picea engelmannii* curves
PICO	5	Brickell (1970); northern Idaho, eastern Washington, western Montana
PIMO	5	Haig (1932); northern Idaho
PIPO	10	Brickell (1970); northern Idaho, eastern Washington, western Montana
PSME	*	Monserud (1984); northern Idaho, northwestern Montana
THPL	8	Used *Tsuga heterophylla* curves
TSHE	8	Barnes (1962); western Oregon, Washington, Alaska, and British Columbia
TSME	*	Used *Picea engelmannii* curves

[1] * Indicates breast height age used to enter curves.

Pseudotsuga menziesii site indexes were determined using Monserud's (1984a) curves, which are derived from stem analysis of stands throughout our study area and based on breast-height age.

For *Picea engelmannii* we employed Clendenen's (1977) 50-year age base modifications of Alexander's (1967) curves. These curves are not very different from Brickell's (1970) and have the advantage of being based on breast-height age and have yield data associated with them (Alexander and others 1975). We also used Clendenen (1977) for *Abies lasiocarpa* and *Tsuga mertensiana,* reasoning that all three have similar ecological roles in subalpine ecosystems and may possess similar growth curve form.

We used Barnes' (1962) curves derived for coastal *Tsuga heterophylla* for both inland populations of *T. heterophylla* and *Thuja plicata,* based on the similarity of their growth forms and ecological roles.

The site index data (50-year base age) and basal areas have been summarized by species within types and phases (appendix F).

We have computed an average site index whenever values exist for three or more stands; for five or more values a 90 percent confidence interval (CI) for estimating the true population mean was computed. The population sampled for site index (S.I.) is a species as it occurs on a given h.t. (or phase). An example for interpretation: average S.I. = 50, CI = ±10 (90 percent), n = 15, means that if one were to take 15 S.I. readings (sample 15 stands for a given species and h.t.), then 90 percent of the time the true S.I. mean for that species on the specified h.t. will lie between 40 and 60. The CI narrows with both increased sample size and decreased variability.

For many of the same reasons that considerable vegetational variation occurs within a given h.t., so, too, do we expect variability in productivity estimates, within and between species, within types. Even though all species are related to a 50-year age base, the difference in estimates based on actual breast-height age versus adjusted total age means the species' S.I. values are not strictly comparable. On less productive h.t.'s the time to reach breast height may be as much as two to five times greater than that on more productive sites. The shortcomings outlined by Daubenmire (1961) in using anamorphic site index curves are still with us and cast a degree of doubt on using index values for comparative purposes; Monserud (1984b, 1985) is yet more critical of anamorphic curves and the whole site index concept, from outmoded curve construction techniques to erroneous assumptions made in predicting volume productivity.

Pfister and others (1977) have noted productivity differences between eastside and westside (of Continental Divide) stands for a given h.t. We recognize the desirability of regionally stratifying our site index data, but our data are presently insufficient for this approach. Preliminary indications are that h.t. productivities for the study area tend to be higher than for comparable types of contiguous areas to the south or east. The most appropriate, meaningful stratification could be made by individual forests or divisions thereof, drawing upon their inventory data.

Previous regional h.t. publications have presented net yield capabilities (in ft^3/acre/year [m^3/ha/year]) by h.t. as being more meaningful than S.I. as estimates of site productivity. Brickell (1970) states "yield capability, as used by Forest Survey, is defined as mean annual increment of growing stock attainable in fully stocked natural stands at the age of culmination of mean annual increment." We agree that yield capability is a more meaningful comparison, but only when some estimate of confidence can be placed on the values. The curves presented by Pfister and others (1977) for relating S.I. to yield capability by species have relatively low R^2 and unspecified standard error of estimate values. Given the relatively low or uncertain confidence to be placed in these curves, the fact that these curves do not apply to S.I. values greater than 80 (commonly exceeded in northern Idaho), and the misuse to which the values generated have been applied, we feel it is best to refrain from their presentation at this time; again this is an area for which individual National Forests (or other agencies) could profitably generate their own conversions. Research is sorely needed to develop the relationships between site variables, h.t., species site index, basal area stockability, and productivity.

Geographic and Zonal Distribution of Habitat Types

With changing environments, individual species occur in a predictable sequence; h.t.'s also exhibit predictable patterns in local areas. On a larger scale, the sequence of h.t.'s will vary through additions or deletions, but their relative positions will remain constant. For example, *Abies grandis* h.t.'s occur in warmer and drier environments than *A. lasiocarpa* h.t.'s, but in certain north Idaho localities the *Thuja plicata* series may occur between the two *Abies* series.

Schematic diagrams (figs. 48-52) depict the relative positions of h.t.'s and phases for several environmentally and floristically different areas of northern Idaho. The diagrams are not literally accurate due to the impossibility of depicting a three-dimensional landscape or multidimensional environment in two dimensions. In an actual mountain slope transect near one of the localities depicted in figures 48-52, the number of h.t.'s might be reduced or, conversely, expanded to include h.t.'s typical of topoedaphic peculiarities not portrayed on these diagrams.

As outlined in individual descriptions, most h.t.'s are found within certain areas of northern Idaho; their quantitative occurrence by National Forest, as reflected in sample numbers, is presented in appendix A. Lack of sample plots of a specific h.t. or phase for a given area implies that it is of minor importance, but not necessarily entirely absent.

Figures 48-52—Schematic representation of key tree and undergrowth species encountered along an increasing elevational gradient (temperature decreasing, precipitation increasing, left to right). Horizontal bars indicate the approximate ecological amplitude of species along the gradient; crosshatching indicates where trees are climax species (designating series) or where the undergrowth species serve as indicators of a particular h.t. or phase (see narrative for details).

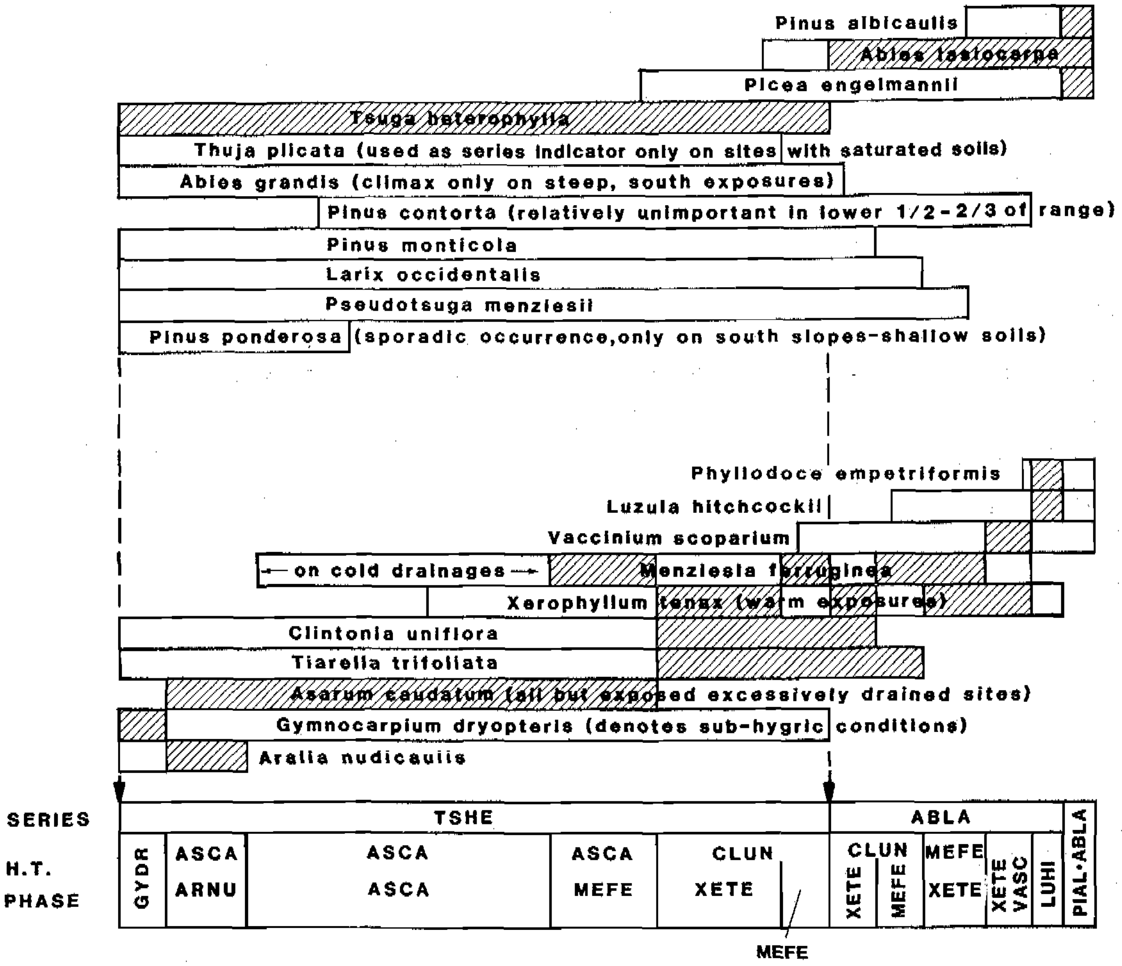


Figure 48—Schematic representation of the distribution of forest h.t.'s with environmental gradients in the vicinity of Bonners Ferry, ID.

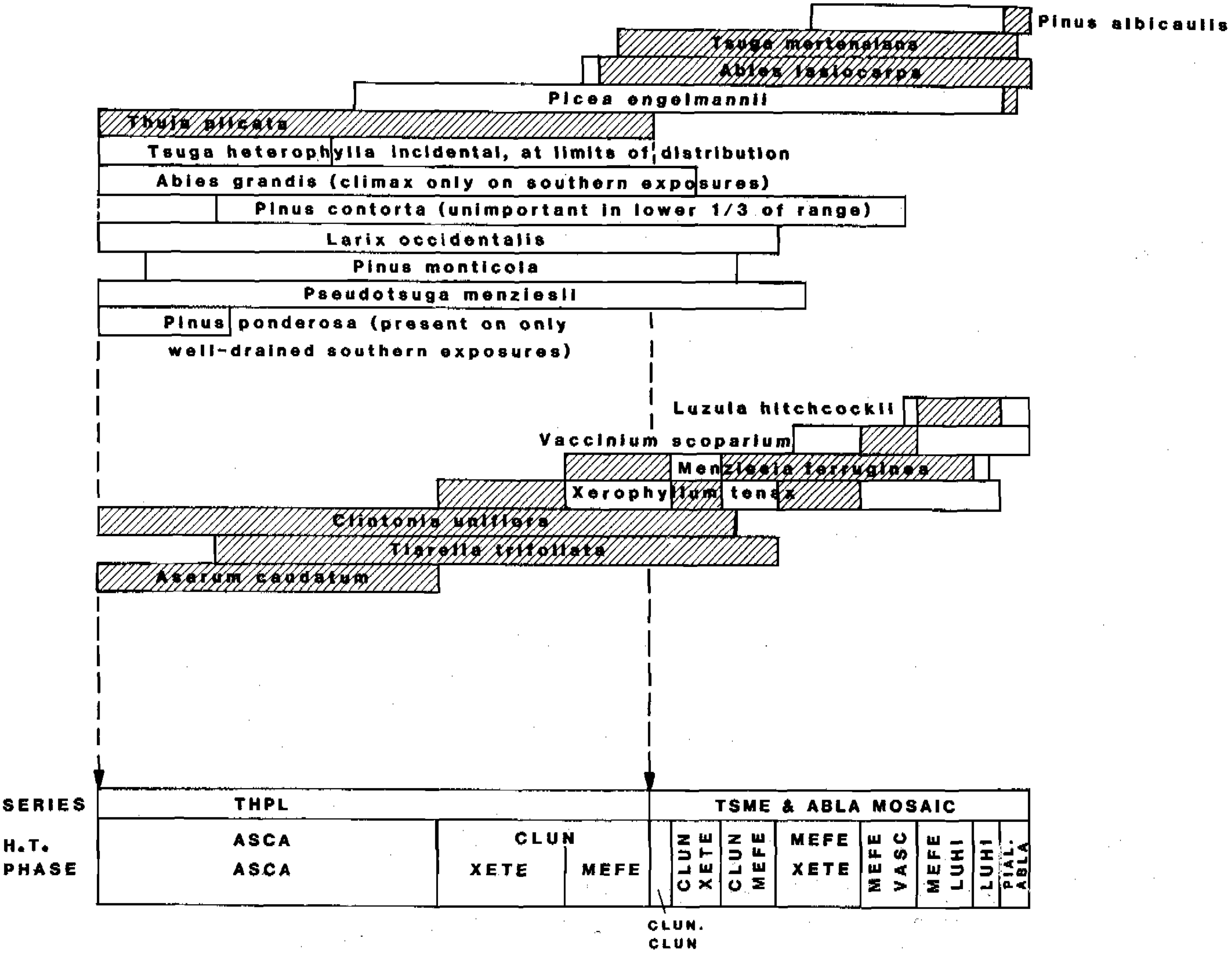


Figure 49—Schematic representation of forest h.t. distribution with environmental gradients in the vicinity of the Aquarius Research Natural Area, Clearwater NF.

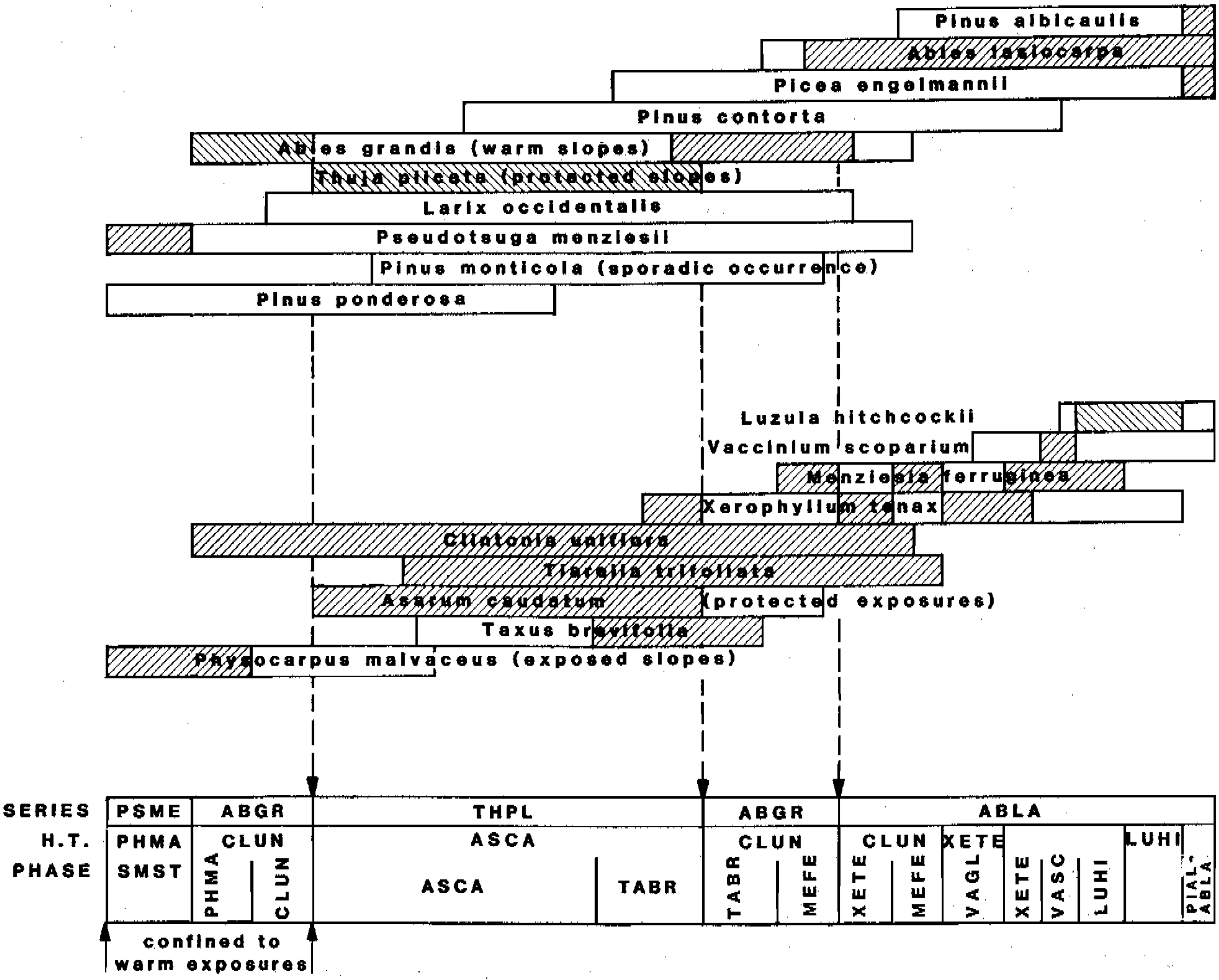


Figure 50—Schematic representation of forest h.t. distribution with environmental gradients in the vicinity of Fenn Ranger Station, Nez Perce NF.

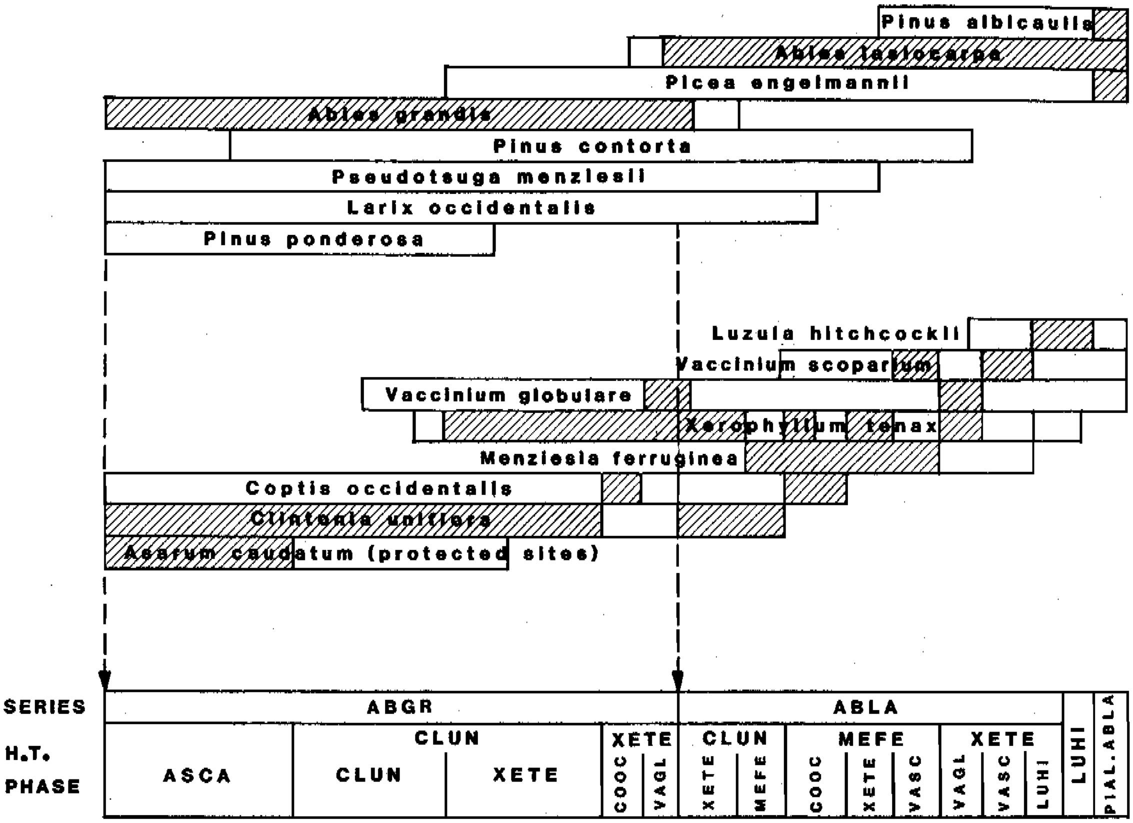


Figure 51—Schematic representation of forest h.t. distribution with environmental gradients in the vicinity of Elk City, ID.

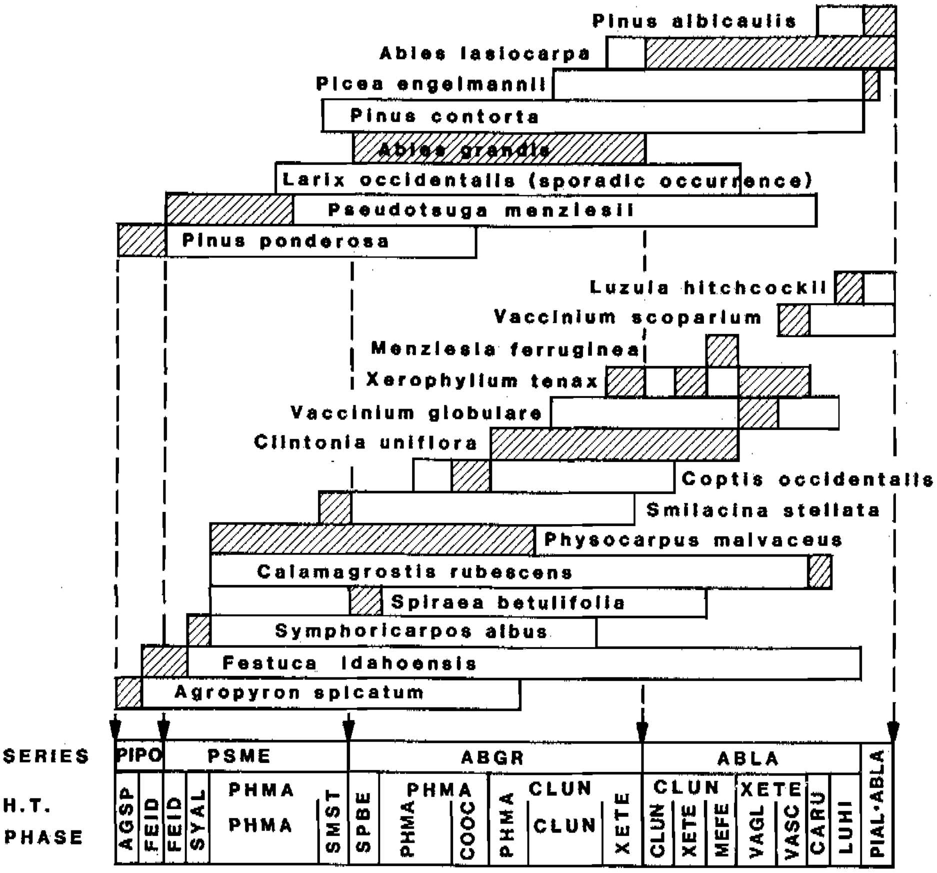


Figure 52—Schematic representation of forest h.t. distribution with environmental gradients in the vicinity of Seven Devils Mountains, Nez Perce NF.

Relationship to Previous Habitat Type Classifications in Idaho and Contiguous Areas

Our initial goal in producing this classification was to refine the pioneering work of Daubenmire and Daubenmire (1968) for northern Idaho. Since the Daubenmires' (1968) publication, classifications in areas contiguous to northern Idaho (Montana, Pfister and others 1977; central Idaho, Steele and others 1981) have served as successive approximations in understanding the vegetation distribution and ecology of this region. Our classification represents both a refinement of our predecessors' classifications and a tailoring of them to meet the ecological conditions peculiar to northern Idaho. Figure 53 illustrates how the variation encompassed in the series, h.t.'s, and phases of preceding classifications corresponds to our classification.

USE OF THE CLASSIFICATION

Our objectives in developing this classification have been to:

1. Provide a natural stratification of forested lands in terms of plant associations.
2. Correlate environmental site variables with plant associations, and, where appropriate, with individual species.
3. Provide a means of predicting both site quality and response following disturbance.
4. Provide baseline data set for the development of successional plant community classification for northern Idaho.

Use of Habitat Types

Habitat typing is most useful as a land stratification system—delineating land areas with approximately equivalent environments or biotic potential—a tool for: (1) reducing site-to-site variation within research and administrative studies; (2) cataloging field observations and intuitive evaluations; (3) modeling site response/secondary succession to various management decisions. In summary, habitat type classifications are basically information storage and retrieval systems, a foundation for basing predictions. Potential values of habitat types in resource management have been outlined by Layser (1974), Volland (1974), Daubenmire (1976), Pfister (1976), and Pfister and others (1977).

Some of the current and potential uses for habitat types include:

1. Communication: providing a common framework for site recognition and interdisciplinary activities.
2. Timber management: assessing site and species response to silvicultural prescriptions, species selection for planting, cutting, and regeneration, and assessing relative timber productivity.
3. Range and wildlife management: assessing relative forage and browse production for wild and domestic ungulates, and comparing potential wildlife habitat values.
4. Watershed management: estimating relative precipitation, evapotranspiration, and moisture-holding capacities, recognizing areas of heavy snowpack, high water tables, or high potential for surface erosion or mass wasting.
5. Recreation: assessing suitability for various types of recreational use, site impacts due to recreational use, and esthetic recovery rates following stand disturbances.
6. Forest protection: evaluating fuel buildup, fuel management and the natural role of fire (frequency and intensity of burns), assessing susceptibility to forest pests, diseases, and soil erosion.
7. Natural area preservation: ensuring that a complete environmental spectrum is represented in research natural areas.
8. Research: stratification tool for designing studies, analyzing results, modeling responses, and extrapolating study results to related sites. For instance, habitat type is a most important predictor variable in both the Prognosis and Regeneration Establishment Models.

Some management implications are discussed in the descriptions of the habitat types in this report. Appendix data can provide additional implications through interpretation by ecosystems-oriented specialists. Field personnel can also document personal observations to help expand our knowledge of vegetational responses on specific habitat types.

One caution, however, is that habitat types are **not** a panacea for all decision-making or site response interpretations. Habitat types **will** complement information on soils, recreation, hydrology, and wildlife, and will aid development of intensive land management.

	R.&J. DAUBENMIRE E.WASH.,N. IDAHO	NO. IDAHO FINAL, 1987	NO. IDAHO PRELIM.DRAFT	NEZPERCE N.F.	MONTANA H.TS.
	▨	SCREE	▨	▨	SCREE
PIFL SERIES	▨	▨	▨	▨	PIFL SERIES
PIPO SERIES	PIPO/STCO	▨	▨	▨	▨
	▨				PIPO/ANDR
	PIPO/AGSP	PIPO/AGSP	PIPO/AGSP	PIPO/AGSP	PIPO/AGSP
	PIPO/FEID	PIPO/FEID	PIPO/FEID	PIPO/FEID	PIPO/FEID •FEID •FESC
	PIPO/PUTR	▨	▨	▨	PIPO/PUTR•AGSP •FEID
	PIPO/SYAL	PIPO/SYAL	PIPO/SYAL	PIPO/SYAL	PIPO/SYAL•SYAL •BERE
		▨	▨	▨	PIPO/PRVI •PRVI •SHCA
	PIPO/PHMA	PIPO/PHMA	PIPO/PHMA	PIPO/PHMA	▨
PSME SERIES	▨	▨	▨	▨	PSME/SYOR
		PSME/AGSP	PSME/AGSP		PSME/AGSP
		PSME/FEID	PSME/FEID	PSME/FEID	PSME/FEID
		▨	▨	▨	PSME/FESC
	PSME/SYAL	PSME/SYAL	PSME/SYAL	PSME/SYAL	PSME/SYAL•AGSP •SYAL •CARU
		PSME/SPBE	PSME/SPBE	PSME/SPBE	PSME/SPBE
	PSME/PHMA	PSME/PHMA •PHMA •SMST	•CARU PSME/PHMA•CAGE •PHMA	•CARU PSME/PHMA •PHMA	PSME/PHMA•CARU •PHMA
	▨	▨	▨	▨	•SYAL PSME/LIBO •CARU •VAGL
		PSME/VAGL	PSME/VAGL		•ARUV PSME/VAGL•VAGL •XETE
	•ARUV PSME/CARU •CARU	•ARUV PSME/CARU •CAGE	•ARUV PSME/CARU •CARU	PSME/CARU	•AGSP •PIPO PSME/CARU•ARUV •CARU
	▨	PSME/CAGE	PSME/CAGE	PSME/CAGE	PSME/CAGE
		PSME/VACA	PSME/VACA	PSME/VACA	PSME/VACA
		▨	▨	▨	PSME/ARUV
					PSME/JUCO
					PSME/ARCO
PICEA SERIES	▨	▨	▨	▨	PICEA SERIES : 7 H.TS.
ABGR SERIES	▨	ABGR/SPBE	▨	ABGR/SPBE	▨
		ABGR/PHMA•COOC •PHMA	ABGR/PHMA	ABGR/ACGL	
		ABGR/XETE•COOC •VAGL	ABGR/XETE	ABGR/XETE	ABGR/XETE
		ABGR/VAGL	ABGR/VAGL	ABGR/VAGL	▨
		ABGR/LIBO •XETE •LIBO	ABGR/LIBO	ABGR/~~LIBO~~ •XETE •LIBO	ABGR/LIBO •XETE •LIBO
		ABGR/PHMA•COOC	ABGR/COOC•COOC •PHMA	ABGR/COOC	▨
	ABGR/PAMY	•PHMA •XETE ABGR/CLUN•CLUN •TABR •MEFE	•PHMA •CLUN ABGR•CLUN•XETE •ASCA •TABR •MEFE	ABGR/CLUN•CLUN •XETE	•CLUN ABGR/CLUN•XETE •ARNU
	▨	•ASCA ABGR/ASCA•TABR •MEFE		•ASCA ABGR/ASCA•TABR •MEFE	
		ABGR/SETR	ABGR/SETR	ABGR/ATFI	▨

Figure 53—Correspondence of the second-approximation northern Idaho h.t. classification to existing classifications of the same and contiguous areas.

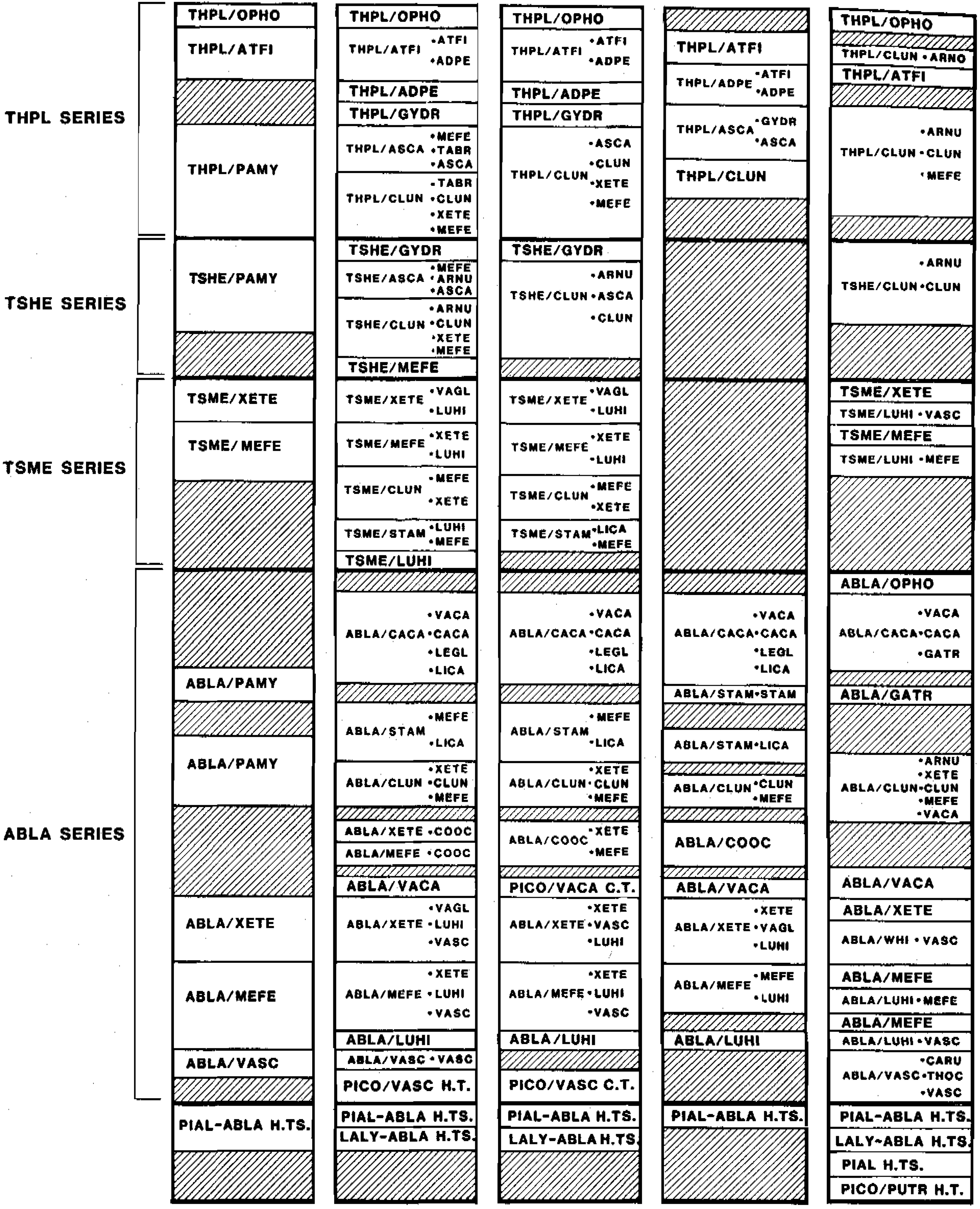


Figure 53 Con.

Mapping

Habitat type maps have become an important management tool in the Northern Region of the Forest Service (Deitschman 1973; Stage and Alley 1973; Daubenmire 1973). Maps provide a permanent record of habitat type distribution on the landscape and a basis for acreage estimates for land-use planning. Habitat type maps do **not** provide a substitute for maps of existing vegetation. Proper planning and silvicultural prescriptions require knowledge of both the **present** and **potential** vegetation.

Maps may be created at different scales and degrees of accuracy, depending on one's objectives. Wherever it is even remotely practical, all habitat type mapping should be done at the phase level. As our classification is hierarchical in nature, agglomerative procedures can be used to create more inclusive mapping units for use at project, district, forest, or regional level. For research studies and project planning, maps should be accurate and detailed; each **phase** of a habitat type should be delineated. The map scale should range from 4 to 8 inches per mile (10 to 20 cm per 1.6 km). At a broader level of planning (district or forest), map scale may decrease (loss of detail) and all necessary information included at the habitat type level. Map scale in this case ranges from 0.5 to 4 inches per mile (0.8 to 6 cm per 1.0 km). Still broader levels of mapping may be desirable for regional needs (zone, state, or region). These may employ scales of 0.25 to 0.5 inch per mile (0.4 to 0.8 cm per 1.0 km), and may depict only habitat type groups or dominant tree series. These should be synthesized from large-scale habitat type maps whenever possible.

At scales of 4 to 8 inches per mile (10 to 20 cm per 1.6 km), the habitat types and phases should be the mapping units, accepting inclusions (up to 15 percent) of other types too restricted in acreage to separate. In complex terrain and at smaller scales special mapping units may be developed. Such mapping unit complexes must be defined for each area being mapped, as in most cases they will be unique to that area and that mapping project's objectives. The amount and relative positions of habitat types and phases within a complex must be documented as management interpretations of a mapping unit are tied to these taxonomic units—series, habitat type, and phase. The amount and location of field reconnaissance should also be specified on the map or in a report for users of the map.

Selection of a mapping approach and scale should be based on the following: (1) anticipated use of the map, (2) accuracy level required, (3) availability of trained personnel, and (4) amount of time and resources available to achieve the specified accuracy level. The map, like the habitat type classification itself, is only an approximation based on the experience and judgment of personnel doing the interpretations. Maps should be considered dynamic tools, undergoing updating and correcting, changing in a direction of ever-increasing accuracy with use.

Grouping

The classification system in this guide was developed to be both natural and hierarchical. Because of this it can be used at various levels of differentiation for many purposes. We recommend collecting and recording of field data (vegetation or stand inventories) always be detailed enough for determination of habitat type and phase. A standard format such as the checklist/field form in appendix G is suggested. It is highly desirable to include a complete plant list with cover estimates. This allows reinterpretation of questionable data as well as transfer to future or past habitat type manuals. Developing plant lists at each site also increases the likelihood of locating sensitive plants, adds to our knowledge of plant distribution, and enhances the individual's perception of the complexity of plant communities. Data collected at this level of resolution enhance their current and future value and make possible more specific, detailed applications to research and resource management.

In a given area, a reduced percentage of the regionally recognized forest habitat types and phases will occur. Some h.t.'s will be so minor in extent that once their presence is documented they may not enter into broadscale forest management planning. On the other hand, they indicate specialized habitats which reflect diversity and often harbor sensitive plants. Certain rare habitat types may seriously constrain land use on a site specific basis. This leaves relatively few habitat types to be identified and mapped. After identification and mapping to phase level, regrouping into similar categories can facilitate resource planning at various levels. There are many permutations that can be delineated based on ecological characteristics of h.t.'s. For example, groupings of potential problem sites for *Armillaria mellea* (McDonald 1983) may differ from groupings for predicting forest growth and yield (Wykoff and others 1982).

Where implications for management are similar, it may be desirable to consider an entire tree series, such as the *Pseudotsuga menziesii* or *Abies grandis* series, as one group. Recording at the phase level allows one to collapse similar groups, whereas if phases are not recorded, later splits or regroupings of the data will be impossible. Any document using habitat types and/or phases which have been grouped should include a complete description of the relative amounts of each habitat type and phase contained therein. An explanation of why the particular grouping was created is also an invaluable aid to map interpretation.

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APPENDIX A: DISTRIBUTION OF SAMPLE STANDS BY SERIES, HABITAT TYPE, AND PHASE WITHIN NATIONAL FORESTS OF NORTHERN IDAHO (PLOTS NOT ACTUALLY ON NATIONAL FOREST LAND ARE REFERENCED TO THE NEAREST NATIONAL FOREST) AND CONTIGUOUS LANDS

K = Kaniksu National Forest
CDA = Coeur d'Alene National Forest
STJ = St. Joe National Forest
CW = Clearwater National Forest
NP = Nez Perce National Forest
KOO = Kootenai National Forest
B = Bitterroot National Forest
EWA = Eastern Washington

	National Forest vicinity								
Habitat type-Phase	**K**	**CDA**	**STJ**	**CW**	**NP**	**KOO**	**B**	**EWA**	**Total**
***Tsuga heterophylla* (TSHE) Series**									
TSHE/GYDR	12	7	4	.	.	1	.	.	24
/ASCA-ARNU	5	2	.	.	.	.	.	.	7
/ASCA-MEFE	1	2	.	.	.	.	.	.	3
/ASCA-ASCA	5	27	6	1	.	.	.	.	39
/CLUN-MEFE	4	1	2	1	.	1	.	.	9
/CLUN-ARNU	11	.	.	.	.	3	.	.	14
/CLUN-XETE	6	7	.	.	.	2	.	.	15
/CLUN-CLUN	22	12	.	2	.	2	.	.	38
/MEFE	3	.	.	.	.	.	.	.	3
									152
***Thuja plicata* (THPL) Series**									
THPL/OPHO	10	2	7	.	.	.	.	.	19
/ATFI-ADPE	.	.	1	8	5	.	.	.	14
/ATFI-ATFI	3	.	7	14	9	1	.	.	34
/ADPE	.	.	3	15	12	.	.	.	30
/GYDR	.	.	6	3	3	.	.	.	12
/ASCA-MEFE	.	.	5	2	.	.	.	.	7
/ASCA-TABR	.	.	1	2	5	.	.	.	8
/ASCA-ASCA	2	1	8	16	21	.	.	.	48
/CLUN-MEFE	.	.	4	5	2	.	.	.	11
/CLUN-TABR	.	.	.	.	8	.	.	.	8
/CLUN-XETE	1	.	1	2	5	.	.	.	9
/CLUN-CLUN	5	3	5	16	17	.	1	.	47
									247
***Tsuga mertensiana* (TSME) Series**									
TSME/STAM-LUHI	.	.	3	1	.	.	.	.	4
/STAM-MEFE	.	1	2	1	.	.	.	.	4
/CLUN-MEFE	.	3	7	13	.	.	.	.	23
/CLUN-XETE	.	.	5	1	.	.	1	1	8
/MEFE-LUHI	.	2	2	8	.	.	1	.	14
/MEFE-XETE	.	.	8	6	.	.	1	.	13
/XETE-LUHI	.	.	8	3	.	.	.	.	11
/XETE-VASC	.	.	7	4	.	.	1	.	12
/XETE-VAGL	.	1	7	4	.	.	3	.	15
									104
***Abies lasiocarpa* (ABLA) Series**									
ABLA/CACA-LEGL	.	.	.	3	6	.	.	.	9
/CACA-LICA	.	.	.	.	.	.	.	.	0
/CACA-VACA	.	.	.	2	2	.	.	.	4
/CACA-CACA	.	.	.	2	4	.	.	.	6
/STAM-MEFE	6	.	.	5	5	1	.	.	17
/STAM-LICA	1	1	1	1	10	.	.	.	14
/CLUN-MEFE	1	1	.	6	9	.	.	.	17
/CLUN-XETE	4	1	2	4	6	1	.	.	18
/CLUN-CLUN	1	.	.	1	1	.	.	.	3
/MEFE-LUHI	5	.	.	1	2	.	.	.	8
/MEFE-VASC	.	.	.	3	8	.	.	.	11
/MEFE-COOC	.	.	1	2	7	.	.	.	10
/MEFE-XETE	2	1	1	.	2	.	.	.	6
/VACA[1]	.	.	.	.	+	.	.	.	+
/XETE-LUHI	3	.	.	3	10	.	2	.	18

(con.)

APPENDIX A (Con.)

Habitat type-Phase	National Forest vicinity								
	K	CDA	STJ	CW	NP	KOO	B	EWA	Total
/XETE-VASC	.	.	.	5	13	.	2	.	20
/XETE-COOC	.	.	.	3	13	.	.	.	16
/XETE-VAGL	3	.	2	5	6	.	.	.	16
/LUHI	1	.	.	.	5	.	.	.	6
/VAGL	.	.	.	.	2	.	.	.	2
/CARU	.	.	.	.	1	.	.	.	1
LALY-ABLA communities[1]	+	.	.	+	+	.	+	.	+
PIAL-ABLA communities[1]	.	.	.	+	+	+	+		+
									202
***Abies grandis* (ABGR) Series**									
ABGR/SETR	.	.	.	.	9	.	.	.	9
/ASCA-MEFE	.	.	.	1	11	.	.	.	12
/ASCA-TABR	.	.	.	1	20	.	.	.	21
/ASCA-ASCA	1	4	4	10	13	.	.	.	32
/CLUN-MEFE	.	.	.	3	14	.	.	.	17
/CLUN-TABR	.	.	.	.	11	.	.	.	11
/CLUN-XETE	2	4	3	4	25	.	.	.	38
/CLUN-PHMA	5	3	4	4	5	.	.	.	21
/CLUN-CLUN	1	3	1	7	14	.	1	.	27
/LIBO-LIBO	.	1	.	1	9	.	.	.	11
/LIBO-XETE	.	.	1	1	5	.	.	.	7
/XETE-COOC	.	.	.	2	13	.	.	.	15
/XETE-VAGL	1	.	1	2	11	.	1	.	16
/VAGL[1]	.	.	.	.	+	.	.	.	+
/PHMA-COOC	.	.	.	1	6	.	.	.	7
/PHMA-PHMA	2	7	3	3	3	.	.	.	18
/SPBE	.	1	1	2	4	.	.	.	8
									270
***Pseudotsuga menziesii* (PSME) Series**									
PSME/PHMA-SMST	4	2	1	8	6	.	.	1	22
/PHMA-PHMA	7	2	1	7	13	.	.	5	35
/VACA	2	.	.	.	2	.	.	.	4
/VAGL	.	.	.	.	.	.	1	.	1
/SYAL	.	.	.	.	.	3	.	4	7
/SPBE	.	.	.	.	4	.	.	3	7
/CARU-ARUV	5	.	.	.	1	.	.	3	9
/CARU-CARU	1	.	.	.	1	.	3	.	5
/CAGE	.	.	.	.	1	.	.	.	1
/FEID	.	.	.	.	2	.	.	.	2
/AGSP	.	.	.	.	3	.	.	.	3
									96
***Pinus ponderosa* (PIPO) Series**									
PIPO/PHMA	.	.	.	4	.	.	.	3	7
/SYAL	.	2	.	3	3	.	.	6	14
/FEID	.	1	.	.	10	.	.	2	13
/AGSP	.	.	.	.	8	.	.	.	8
									42
***Pinus contorta* (PICO) Series**									
PICO/VACA	.	.	.	.	3	.	.	.	3
/XETE	.	.	.	.	2	.	.	.	2
/VASC	.	.	.	.	7	.	.	.	7
									12

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[1] No sampled stands recorded for northern Idaho, reconnaissance observations or hypothesized occurrence recorded as +.

APPENDIX B: OCCURRENCE AND ROLES OF TREE SPECIES BY HABITAT TYPE AS INTERPRETED FROM STAND DATA AND RECONNAISSANCE OBSERVATIONS

C = Major climax species
c = Minor climax species
S = Major seral species
s = Minor seral species
a = accidental
( ) = occurring only locally
? = Status in question or conflicts with published results for same h.t. (or phase)

Series/Habitat type-Phase	PIPO	PSME	PICO	LAOC	ABGR	PIMO	PIEN	THPL	TSHE	ABLA	TSME	PIAL
***Tsuga heterophylla* (TSHE) Series**												
TSHE/GYDR	a	(s)	.	(S)	s	S	(s)	c	C	a	.	.
/ASCA-ARNU	a	(s)	a	(s)	S	s	.	C	C	.	.	.
/ASCA-MEFE	.	S	s	s	s	S	(S)	c	C	s	.	.
/ASCA-ASCA	a	S	a	s	S	S	(s)	c	C	.	.	.
/CLUN-MEFE	.	S	(S)	(S)	S	S	(s)	S	C	(S)	a	.
/CLUN-ARNU	a	S	(s)	S	S/(c)	(s)	a	(c)	C	.	.	.
/CLUN-XETE	a	S	(S)	(S)	S/(c)	S	S	s	C	s	a	.
/CLUN-CLUN	a	S	(s)	(S)	S/(c)	(S)	(S)	S	C	(s)	.	.
/MEFE	.	.	s	s	.	?/(s)	S	a	C	S	(c)	.
***Thuja plicata* (THPL) Series**												
THPL /OPHO	.	a	.	a	(s)	s	(S)	C	(C)	a	.	.
/ATFI-ADPE	.	a	.	a	S	(s)	(s)	C	(C)	.	.	.
/ATFI-ATFI	.	(s)	.	a	S	(s)	S	C	(C)	(s)	.	.
/ADPE	.	s	.	(s)	S	(s)	a	C	(C)	.	.	.
/GYDR	.	(s)	a	(s)	S	s	s	C	a	a	.	.
/ASCA-MEFE	.	S	(S)	S	S	S	S	C	.	s	a	.
/ASCA-TABR	.	s	(s)	(S)	S	s	s	C	.	.	.	.
/ASCA-ASCA	(s)	S	a	(s)	S	s	s	C	.	a	a	.
/CLUN-MEFE	a	S	(S)	s	S	s	S	C	.	s	s	.
/CLUN-TABR	.	(s)	(s)	.	S	(s)	S	C	.	a	.	.
/CLUN-XETE	a	S	a	S	S	(s)	S	C	.	s	s	.
/CLUN-CLUN	(s)	S	(s)	S	S	(s)	(s)	C	.	s	a	.
***Tsuga mertensiana* (TSME) Series**												
TSME/STAM-LUHI	.	.	(s)	a	.	(s)	s	.	.	c	C	s
/STAM-MEFE	.	s	s	s	.	(s)	S	.	.	c	C	.
/CLUN-MEFE	.	s	(S)	s	(s)	s	S	.	.	S/c	C	a
/CLUN-XETE	.	S	S	S	(s)	s	S	.	.	S/(c)	C	.
/MEFE-LUHI	.	.	s	.	.	(s)	S	.	.	c	C	s
/MEFE-XETE	.	(s)	S	(S)	a	s	S	.	.	S/(c)	C	(s)
/XETE-LUHI	.	.	s	a	.	.	s	.	.	c	C	s
/XETE-VAGL	.	s	(S)	(s)	a	s	s	.	.	c	C	(S)
/LUHI	.	.	s	.	.	.	S	.	.	s	C	?/(s)
***Abies lasiocarpa* (ABLA) Series**												
ABLA /CACA-LEGL	.	a	S	(s)	a	.	S/(c)	.	.	C	.	(s)
/CACA-LICA	.	.	s	.	.	.	S/(c)	.	.	C	.	.
/CACA-VACA	.	.	S	.	.	.	s	.	.	C	.	.
/CACA-CACA	.	s	S	.	.	.	S/(c)	.	.	C	.	(s)
/STAM-MEFE	.	s	s	(s)	s	s	S/(c)	a	.	C	.	.
/STAM-LICA	.	s	S	(s)	s	?	S/(c)	.	.	C	.	.
/CLUN-MEFE	.	(S)	s	(s)	(S)	(s)	S/(c)	.	.	C	a	.
/CLUN-XETE	.	S	S	S	S	(S)	S/(c)	.	.	C	a	.
/CLUN-CLUN	.	s	S	S	S	?	S/(c)	.	a	C	.	.
/MEFE-LUHI	.	.	s	?	.	a	S/(c)	.	.	C	.	s
/MEFE-VASC	.	(s)	S	?	s	.	S/(c)	.	.	C	a	s
/MEFE-COOC	.	s	S	s	s	(s)	S/(c)	.	.	C	a	.
/MEFE-XETE	.	s	(S)	?	a	(s)	S/(c)	a	a	C	a	.
/VACA	.	s	S	.	a	.	s	.	.	C	.	.
/XETE-LUHI	.	.	S	.	.	.	c	.	.	C	.	S
/XETE-VASC	.	(s)	S	?	(s)	.	c	.	.	C	a	s
/XETE-COOC	.	S	S	s	S	(s)	S/(c)	.	.	C	.	a
/XETE-VAGL	.	S	S	(s)	(s)	(s)	s/(c)	.	.	C	a	(S)
/LUHI	.	.	a	.	.	.	c	.	.	C	.	S
/VAGL	.	S	S	s	.	.	S/(c)	.	.	C	.	(s)
/CARU	.	S	S	.	a	.	.	.	.	C	.	(s)
LALY-ABLA communities[1]	.	.	.	.	.	.	(c)	.	.	C	.	(C)
PIAL-ABLA communities[1]	.	.	.	.	.	.	(C)	.	.	C	.	C

(con.)

APPENDIX B (Con.)

Series/Habitat type-Phase	PIPO	PSME	PICO	LAOC	ABGR	PIMO	PIEN	THPL	TSHE	ABLA	TSME	PIAL
***Abies grandis* (ABGR) Series**												
ABGR/SETR	.	s	s	(s)	C	(s)	S	.	.	(c)	.	.
/ASCA-MEFE	a	S	s	(s)	C	(s)	S	.	.	(c)	.	.
/ASCA-TABR	.	s	.	(s)	C	(s)	S	a	.	(c)	.	.
/ASCA-ASCA	s	S	s	s	C	s	(s)	a	.	a	.	.
/CLUN-MEFE	a	S	S	(S)	C	s	S	.	.	(c)	.	.
/CLUN-TABR	.	S	(s)	s	C	(s)	S	.	.	(c)	.	.
/CLUN-XETE	s	S	S	S	C	s	s	.	.	(c)	.	.
/CLUN-CLUN	s	S	s	s	C	s	(s)	a	.	a	.	.
/CLUN-PHMA	S	S	s	s	C	s	.	a	.	a	.	.
/LIBO-LIBO	S	S	S	s	C	(s)	s	.	.	(c)	.	.
/LIBO-XETE	(S)	S	S	S	C	(s)	S	.	.	(c)	.	.
/XETE-COOC	(S)	S	S	(s)	C	.	s	.	.	c	.	.
/XETE-VAGL	s	S	S	(s)	C	(s)	s	.	.	c	.	.
/VAGL	(s)	S	S	(s)	C	.	s	.	.	(c)	.	.
/PHMA-COOC	s	S	(s)	(s)	C	(s)	.	.	.	.	.	.
/PHMA-PHMA	S	S	(s)	(S)	C	a	.	.	.	.	.	.
/SPBE	S	S	(s)	(s)	C	(s)	a	.	.	.	.	.
***Pseudotsuga menziesii* (PSME) Series**												
PSME/PHMA-SMST	S	C	s	S	a	.	.	.	.	.	.	.
/PHMA-PHMA	S	C	(s)	a	a	.	.	.	.	.	.	.
/VACA	S	C	S	s	.	.	.	.	.	.	.	.
/VAGL	(s)	C	S	(s)	a	.	.	.	.	.	.	.
/SYAL	S	C	(s)	(s)	.	.	.	.	.	.	.	.
/SPBE	S	C	(s)	.	.	.	.	.	.	.	.	.
/CARU-ARUV	S	C	S	(S)	.	.	.	.	.	.	.	.
/CARU-CARU	(s)	C	s	.	.	.	.	.	.	.	.	.
/CAGE	c	C	s	.	.	.	.	.	.	.	.	.
/FEID	S(c)	C	.	.	.	.	.	.	.	.	.	.
/AGSP	S(c)	C	.	.	.	.	.	.	.	.	.	.
***Pinus ponderosa* (PIPO) Series**												
PIPO/PHMA	C	a	.	.	.	.	.	.	.	.	.	.
/SYAL	C	a	.	.	.	.	.	.	.	.	.	.
/FEID	C	a	.	.	.	.	.	.	.	.	.	.
/AGSP	C	.	.	.	.	.	.	.	.	.	.	.
***Pinus contorta* (PICO) Series**												
PICO/VACA	.	s	S	.	s	.	s	.	.	C	.	.
/XETE	.	s	S	(s)	s	(s)	s	.	.	C	.	(s)
/VASC	.	.	C	.	a	.	a	.	.	a	.	.

[1] No recorded data from northern Idaho, values from Pfister and others (1977).

APPENDIX C: CONSTANCY AND AVERAGE COVERAGE (PERCENT) OF IMPORTANT PLANTS IN NORTHERN IDAHO FOREST HABITAT TYPES AND PHASES

ADP abbrev.	Scientific name	Common name
	Tree Species	
1 ABGR	*Abies grandis*	grand fir
2 ABLA	*Abies lasiocarpa*	subalpine fir
3 BEPA	*Betula papyrifera*	paper birch
6 LAOC	*Larix occidentalis*	western larch
7 PIEN	*Picea engelmannii*	Engelmann spruce
9 PIAL	*Pinus albicaulis*	whitebark pine
10 PICO	*Pinus contorta*	lodgepole pine
12 PIMO	*Pinus monticola*	western white pine
13 PIPO	*Pinus ponderosa*	ponderosa pine
16 PSME	*Pseudotsuga menziesii*	Douglas-fir
17 THPL	*Thuja plicata*	western redcedar
18 TSHE	*Tsuga heterophylla*	western hemlock
19 TSME	*Tsuga mertensiana*	mountain hemlock
	Shrub Species	
102 ACGL	*Acer glabrum*	Rocky Mountain maple
104 ALSI	*Alnus sinuata*	Sitka alder
105 AMAL	*Amelanchier alnifolia*	serviceberry
110 CRDO	*Crataegus douglasii*	black hawthorn
111 HODI	*Holodiscus discolor*	ocean-spray
113 LEGL	*Ledum glandulosum*	Labrador tea
115 LOUT	*Lonicera utahensis*	Utah honeysuckle
116 MEFE	*Menziesia ferruginea*	fool's huckleberry
117 OPHO	*Oplopanax horridum*	devil's club
118 PAMY	*Pachistima myrsinites*	pachistima
119 PHLE	*Philadelphus lewisii*	syringa
122 PHMA	*Physocarpus malvaceus*	ninebark
124 PRVI	*Prunus virginiana*	common chokecherry
127 RHAL	*Rhododendron albiflorum*	white rhododendron
130 RILA	*Ribes lacustre*	prickly currant
133 ROGY	*Rosa gymnocarpa*	baldhip rose
161 RONU	*Rosa nutkana*	Nootka rose
134 ROWO	*Rosa woodsii*	pearhip rose
136 RUPA	*Rubus parviflorus*	western thimbleberry
137 SASC	*Salix scouleriana*	Scouler willow
142 SPBE	*Spiraea betulifolia*	white spiraea
143 SYAL	*Symphoricarpos albus*	common snowberry
144 TABR	*Taxus brevifolia*	Pacific yew
146 VAGL	*Vaccinium globulare*	blue huckleberry
	Dwarf Shrubs and Low Woody Plants	
201 ARUV	*Arctostaphylos uva-ursi*	bearberry
203 BERE	*Berberis repens*	creeping Oregon grape
205 GAHU	*Gaultheria humifusa*	western wintergreen
206 LIBO	*Linnaea borealis*	twinflower
219 PHEM	*Phyllodoce empetriformis*	red mountain-heather
218 SADO	*Satureja douglasii*	yerba buena
145 VACA	*Vaccinium caespitosum*	dwarf huckleberry
147 VAMY	*Vaccinium myrtillus*	dwarf bilberry
148 VASC	*Vaccinium scoparium*	grouse whortleberry
	Ferns and Allied Taxa	
260 ADPE	*Adiantum pedatum*	maidenhair fern
251 ATFI	*Athyrium filix-femina*	ladyfern
255 GYDR	*Gymnocarpium dryopteris*	oak-fern
258 POMU	*Polystichum munitum*	western swordfern
259 PTAQ	*Pteridium aquilinum*	bracken fern

(con.)

APPENDIX C (Con.)

ADP abbrev.	Scientific name	Common name
	Graminoids	
301 AGSP	*Agropyron spicatum*	bluebunch wheatgrass
304 BRVU	*Bromus vulgaris*	Columbia brome
305 CACA	*Calamagrostis canadensis*	bluejoint reedgrass
307 CARU	*Calamagrostis rubescens*	pinegrass
309 CAGE	*Carex geyeri*	elk sedge
311 CARO	*Carex rossii*	Ross sedge
317 FEID	*Festuca idahoensis*	Idaho fescue
325 LUHI	*Luzula hitchcockii*	smooth woodrush
	Perennial Forbs	
401 ACMI	*Achillea millefolium*	common yarrow
402 ACRU	*Actaea rubra*	baneberry
403 ADBI	*Adenocaulon bicolor*	trail-plant
407 ANPI	*Anemone piperi*	windflower
418 ARNU	*Aralia nudicaulis*	wild sarsaparilla
420 ARMA	*Arenaria macrophylla*	bigleaf sandwort
421 ARCO	*Arnica cordifolia*	heartleaf arnica
422 ARLA	*Arnica latifolia*	mountain arnica
564 ASCA	*Asarum caudatum*	wild ginger
426 ASCO	*Aster conspicuus*	showy aster
431 BASA	*Balsamorhiza sagittata*	arrowleaf balsamroot
442 CHUM	*Chimaphila umbellata*	prince's pine
445 CIAL	*Circaea alpina*	alpine circaea
447 CLUN	*Clintonia uniflora*	queencup beadlily
449 COOC	*Coptis occidentalis*	western goldthread
452 COCA	*Cornus canadensis*	bunchberry dogwood
454 DIHO	*Disporum hookeri*	Hooker fairy-bell
455 DITR	*Disporum trachycarpum*	wartberry fairy-bell
458 DOJE	*Dodecatheon jeffreyi*	Jeffrey's shooting star
465 FRVE	*Fragaria vesca*	woods strawberry
467 FRAG	*Fragaria* species	strawberries
466 FRVI	*Fragaria virginiana*	strawberry
471 GATR	*Galium triflorum*	northern bedstraw
476 GOOB	*Goodyera oblongifolia*	rattlesnake-plantain
482 HECY	*Heuchera cylindrica*	roundleaf alumroot
489 LICA	*Ligusticum canbyi*	Canby's licorice-root
800 LIVE	*Ligusticum verticillatum*	licorice-root
647 MEPA	*Mertensia paniculata*	tall bluebells
501 MIBR	*Mitella breweri*	Brewer's mitrewort
649 MIPE	*Mitella pentandra*	alpine mitrewort
502 MIST	*Mitella stauropetala*	side-flowered mitrewort
505 OSCH	*Osmorhiza chilensis*	mountain sweet-cicely
507 PEBR	*Pedicularis bracteosa*	bracted lousewort
508 PECO	*Pedicularis contorta*	coiled-beak lousewort
509 PERA	*Pedicularis racemosa*	leafy lousewort
519 POPU	*Polemonium pulcherrimum*	Jacob's ladder
526 PYAS	*Pyrola asarifolia*	common pink wintergreen
529 PYSE	*Pyrola secunda*	one-sided wintergreen
539 SETR	*Senecio triangularis*	arrowleaf groundsel
542 SMRA	*Smilacina racemosa*	false Solomon's seal
543 SMST	*Smilacina stellata*	starry Solomon seal
546 STAM	*Streptopus amplexifolius*	twisted-stalk
810 SYPL	*Synthyris platycarpa*	evergreen synthyris
547 THOC	*Thalictrum occidentale*	western meadowrue
548 TITR	*Tiarella trifoliata*	coolwort foamflower
563 TRCA	*Trautvetteria caroliniensis*	false bugbane
560 TROV	*Trillium ovatum*	white trillium
551 VASI	*Valeriana sitchensis*	Sitka valerian
552 VEVI	*Veratrum viride*	American false hellebore
554 VIAD	*Viola adunca*	hook violet
556 VIGL	*Viola glabella*	pioneer violet
557 VIOR	*Viola orbiculata*	round-leaved violet
558 XETE	*Xerophyllum tenax*	beargrass

APPENDIX C (Con.)

SERIES	TSHE	TSHE	TSHE	TSHE	TSHE	TSHE	TSHE	TSHE	TSHE
H.T.	GYDR	ASCA	ASCA	ASCA	CLUN	CLUN	CLUN	CLUN	MEFE
PHASE		ARNU	MEFE	ASCA	ARNU	MEFE	XETE	CLUN	
NO. OF PLOTS	N= 24	N= 7	N= 3	N= 39	N= 14	N= 9	N= 15	N= 38	N= 3
TREE SPECIES									
1 ABGR	5(14)	9(52)	7(T)	9(49)	7(19)	6(47)	7(21)	7(20)	-( )
2 ABLA	2(5)	-( )	10(13)	1(T)	-( )	4(50)	5(17)	2(27)	10(46)
3 BEPA	1(T)	4(13)	-( )	+(3)	2(7)	-( )	-( )	1(18)	-( )
6 LAOC	3(12)	4(5)	7(2)	5(8)	6(25)	4(34)	7(19)	6(19)	7(19)
7 PIEN	3(6)	-( )	10(6)	2(1)	3(5)	6(18)	3(15)	3(21)	3(3)
9 PIAL	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
10 PICO	-( )	1(T)	-( )	2(1)	3(5)	4(11)	5(13)	2(3)	3(15)
12 PIMO	7(8)	7(3)	7(8)	6(10)	8(10)	8(5)	7(11)	6(9)	-( )
13 PIPO	-( )	-( )	-( )	1(7)	-( )	-( )	1(T)	1(T)	-( )
16 PSME	2(3)	4(10)	3(15)	5(21)	5(35)	8(17)	5(23)	5(28)	-( )
17 THPL	6(48)	10(45)	-( )	5(36)	9(49)	8(17)	7(33)	9(37)	-( )
18 TSHE	9(72)	10(54)	10(73)	10(36)	9(35)	9(17)	10(38)	10(53)	10(62)
19 TSME	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	-( )
SHRUB SPECIES									
102 ACGL	6(5)	9(1)	3(T)	5(3)	4(5)	3(6)	4(14)	3(T)	-( )
104 ALSI	+(3)	4(5)	7(3)	1(T)	1(T)	6(8)	1(8)	+(T)	-( )
105 AMAL	3(T)	6(T)	-( )	5(T)	5(T)	2(T)	3(T)	4(T)	-( )
110 CRDO	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
111 HODI	-( )	1(T)	-( )	2(2)	4(T)	-( )	2(T)	1(T)	-( )
113 LEGL	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
115 LOUT	8(2)	9(T)	10(1)	7(T)	6(T)	10(3)	9(2)	9(1)	7(T)
116 MEFE	6(3)	1(T)	10(27)	2(1)	3(T)	10(30)	7(2)	4(T)	10(53)
117 OPHO	3(1)	6(1)	-( )	2(T)	1(T)	-( )	1(T)	+(T)	-( )
118 PAMY	7(5)	7(8)	10(7)	7(4)	6(7)	6(18)	9(14)	7(5)	-( )
119 PHLE	-( )	1(T)	-( )	1(2)	-( )	-( )	-( )	-( )	-( )
122 PHMA	-( )	1(3)	-( )	2(6)	1(T)	1(T)	-( )	1(T)	-( )
124 PRVI	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
127 RHAL	+(T)	-( )	-( )	-( )	-( )	3(6)	-( )	1(T)	3(38)
130 RILA	1(T)	-( )	-( )	1(T)	-( )	2(T)	-( )	1(T)	-( )
133 ROGY	7(2)	10(T)	-( )	8(2)	10(1)	3(1)	6(3)	5(T)	-( )
161 RONU	-( )	1(T)	-( )	+(T)	-( )	1(T)	-( )	+(3)	-( )
134 ROWO	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
136 RUPA	5(2)	4(T)	7(T)	5(3)	6(T)	4(1)	4(1)	3(2)	-( )
137 SASC	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	-( )
142 SPBE	+(T)	3(T)	-( )	3(T)	4(6)	3(1)	5(1)	3(1)	-( )
143 SYAL	1(T)	6(T)	3(T)	5(6)	3(T)	1(T)	1(T)	1(T)	-( )
144 TABR	5(15)	3(T)	7(T)	2(1)	1(15)	1(T)	2(22)	2(4)	-( )
146 VAGL	9(7)	7(9)	10(19)	7(2)	8(8)	10(28)	10(25)	9(7)	10(18)
LOW WOODY PLANTS AND DWARF SHRUBS									
201 ARUV	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	+(T)	-( )
203 BERE	+(T)	1(T)	-( )	3(1)	4(4)	-( )	1(2)	2(T)	-( )
205 GAHU	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
206 LIBO	8(11)	9(14)	3(15)	8(14)	10(17)	4(27)	8(5)	8(14)	-( )
219 PHEM	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
218 SADO	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
145 VACA	1(T)	-( )	-( )	-( )	1(T)	-( )	-( )	+(T)	-( )
147 VAMY	+(T)	-( )	3(T)	+(3)	1(T)	1(15)	-( )	+(T)	3(T)
148 VASC	+(T)	-( )	-( )	-( )	-( )	1(63)	-( )	1(2)	-( )
FERNS AND ALLIED TAXA									
260 ADPE	-( )	-( )	-( )	-( )	-( )	-( )	-( )	+(T)	-( )
251 ATFI	6(2)	6(T)	3(T)	4(T)	2(T)	-( )	3(T)	2(T)	-( )
255 GYDR	10(25)	6(T)	3(T)	3(T)	4(T)	3(T)	2(T)	3(T)	-( )
258 POMU	2(1)	4(1)	3(T)	4(1)	1(T)	2(T)	1(T)	2(T)	-( )
259 PTAQ	3(1)	1(T)	-( )	4(1)	2(5)	3(1)	3(T)	2(5)	-( )
GRAMINOIDS									
301 AGSP	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
304 BRVU	6(2)	6(T)	7(2)	9(T)	4(T)	7(T)	5(T)	4(T)	-( )
305 CACA	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	+(T)	-( )
307 CARU	-( )	-( )	-( )	1(T)	2(2)	2(2)	1(T)	1(5)	-( )
309 CAGE	-( )	-( )	-( )	1(T)	-( )	2(2)	-( )	+(T)	-( )
311 CARO	-( )	-( )	-( )	1(T)	2(T)	-( )	-( )	-( )	-( )
317 FEID	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	-( )
325 LUHI	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	7(T)

(con.)

APPENDIX C (Con.)

SERIES	TSHE	TSHE	TSHE	TSHE	TSHE	TSHE	TSHE	TSHE	TSHE
H.T.	GYDR	ASCA	ASCA	ASCA	CLUN	CLUN	CLUN	CLUN	MEFE
PHASE		ARNU	MEFE	ASCA	ARNU	MEFE	XETE	CLUN	
NO. OF PLOTS	N= 24	N= 7	N= 3	N= 39	N= 14	N= 9	N= 15	N= 38	N= 3
PERENNIAL FORBS									
401 ACMI	-( )	-( )	-( )	-( )	-( )	-( )	-( )	+(T)	-( )
402 ACRU	3(T)	4(T)	-( )	3(T)	-( )	-( )	-( )	-( )	-( )
403 ADBI	5(T)	10(3)	7(T)	9(1)	5(T)	2(T)	3(T)	3(T)	-( )
407 ANPI	3(1)	4(T)	-( )	5(T)	-( )	6(T)	1(T)	1(T)	-( )
418 ARNU	1(10)	10(3)	-( )	1(T)	10(7)	-( )	-( )	+(T)	-( )
420 ARMA	-( )	-( )	-( )	1(T)	-( )	-( )	1(T)	1(T)	-( )
421 ARCO	1(22)	-( )	-( )	-( )	1(T)	-( )	-( )	+(T)	-( )
422 ARLA	+(T)	3(T)	10(34)	2(T)	-( )	6(29)	3(21)	1(18)	-( )
564 ASCA	5(2)	10(8)	10(T)	9(4)	-( )	-( )	-( )	-( )	-( )
426 ASCO	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )
431 BASA	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
442 CHUM	4(T)	10(1)	3(T)	7(T)	8(T)	4(1)	7(T)	8(2)	-( )
445 CIAL	+(T)	-( )	-( )	1(1)	-( )	-( )	-( )	-( )	-( )
447 CLUN	10(6)	10(5)	10(2)	10(2)	10(6)	10(4)	10(1)	10(2)	3(T)
449 COOC	5(28)	3(8)	7(15)	9(16)	3(14)	4(15)	4(9)	4(9)	-( )
452 COCA	3(8)	3(2)	-( )	2(2)	5(5)	4(8)	1(T)	2(6)	-( )
454 DIHO	9(4)	10(3)	3(T)	8(2)	6(3)	4(T)	5(T)	5(T)	-( )
455 DITR	-( )	-( )	-( )	1(T)	2(T)	-( )	1(T)	1(T)	-( )
458 DOJE	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
465 FRVE	-( )	1(T)	-( )	2(2)	1(T)	-( )	1(T)	1(T)	-( )
467 FRAG	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
466 FRVI	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	-( )
471 GATR	4(1)	4(T)	7(T)	7(1)	6(T)	7(T)	1(T)	2(T)	-( )
476 GOOB	7(T)	9(T)	7(T)	5(T)	6(T)	6(1)	7(T)	7(T)	7(T)
482 HECY	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	+(T)	-( )
489 LICA	+(T)	1(T)	3(T)	+(T)	-( )	1(T)	-( )	+(T)	-( )
800 LIVE	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
647 MEPA	+(T)	-( )	-( )	+(T)	-( )	1(T)	-( )	-( )	-( )
501 MIBR	-( )	-( )	3(T)	-( )	-( )	-( )	-( )	-( )	-( )
649 MIPE	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
502 MIST	2(1)	-( )	3(T)	2(T)	1(T)	2(T)	1(2)	2(T)	-( )
505 OSCH	5(T)	7(T)	10(T)	7(T)	4(T)	4(T)	3(T)	2(T)	-( )
507 PEBR	+(T)	-( )	-( )	+(T)	-( )	3(T)	1(T)	-( )	-( )
508 PECO	+(T)	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	-( )
509 PERA	+(T)	-( )	-( )	+(T)	-( )	1(T)	1(T)	-( )	-( )
519 POPU	+(T)	-( )	3(T)	+(T)	-( )	-( )	1(T)	+(T)	-( )
526 PYAS	6(T)	4(T)	3(T)	3(T)	3(T)	6(2)	7(T)	6(T)	7(2)
529 PYSE	5(T)	6(T)	3(T)	5(T)	5(T)	7(3)	7(T)	6(T)	10(T)
539 SETR	1(1)	3(T)	-( )	+(T)	-( )	-( )	-( )	-( )	-( )
542 SMRA	1(T)	-( )	3(T)	2(T)	1(T)	3(T)	1(T)	1(T)	-( )
543 SMST	10(3)	10(3)	10(1)	10(4)	9(1)	3(14)	7(T)	5(T)	-( )
546 STAM	4(T)	1(T)	-( )	1(T)	-( )	2(T)	1(T)	1(T)	-( )
810 SYPL	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
547 THOC	2(T)	1(T)	10(T)	4(T)	4(T)	6(1)	4(T)	1(T)	-( )
548 TITR	9(9)	9(4)	10(5)	9(7)	4(4)	10(7)	7(2)	7(3)	-( )
563 TRCA	2(4)	1(T)	-( )	+(T)	1(T)	1(T)	-( )	-( )	-( )
560 TROV	9(T)	6(T)	10(T)	7(T)	4(T)	4(T)	5(T)	5(T)	-( )
551 VASI	+(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
552 VEVI	1(T)	1(T)	-( )	1(T)	-( )	-( )	-( )	1(T)	-( )
554 VIAD	-( )	1(T)	-( )	2(T)	-( )	-( )	-( )	+(T)	-( )
556 VIGL	3(1)	1(T)	-( )	2(T)	1(T)	-( )	-( )	+(T)	-( )
557 VIOR	8(1)	9(1)	7(T)	6(T)	8(T)	10(2)	8(T)	9(T)	3(T)
558 XETE	3(T)	-( )	10(5)	2(T)	-( )	7(16)	10(30)	4(T)	10(70)

CODE TO CONSTANCY VALUES

+ = 0-5%	2 = 15-25%	4 = 35-45%	6 = 55-65%	8 = 75-85%	10 = 95-100%
1 = 5-15%	3 = 25-35%	5 = 45-55%	7 = 65-75%	9 = 85-95%	

(Average percent canopy coverage, on plots where the species occurred)

(con.)

APPENDIX C (Con.)

SERIES H.T. PHASE	THPL OPHO	THPL ATFI ATFI	THPL ATFI ADPE	THPL ADPE	THPL GYDR	THPL ASCA MEFE	THPL ASCA TABR	THPL ASCA ASCA	THPL CLUN MEFE	THPL CLUN TABR	THPL CLUN XETE	THPL CLUN CLUN
NO. OF PLOTS	N= 19	N= 34	N= 14	N= 30	N= 12	N= 7	N= 8	N= 48	N= 11	N= 8	N= 9	N= 47
TREE SPECIES												
1 ABGR	3(4)	6(25)	8(12)	8(26)	9(41)	10(27)	10(28)	10(46)	9(34)	10(47)	9(31)	9(49)
2 ABLA	1(2)	2(20)	-( )	-( )	2(6)	6(5)	-( )	1(8)	5(2)	1(T)	3(25)	1(T)
3 BEPA	-( )	+(3)	-( )	1(T)	-( )	-( )	-( )	1(17)	-( )	-( )	-( )	1(12)
6 LAOC	1(T)	1(1)	-( )	2(10)	2(2)	9(25)	4(14)	3(4)	7(8)	-( )	6(22)	4(16)
7 PIEN	2(18)	6(13)	2(2)	+(T)	7(9)	9(29)	5(2)	4(3)	9(23)	9(9)	8(7)	2(4)
9 PIAL	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
10 PICO	-( )	-( )	-( )	+(T)	1(T)	3(20)	1(3)	+(19)	4(30)	1(T)	3(18)	2(8)
12 PIMO	4(3)	3(4)	2(2)	3(7)	4(4)	6(T)	5(5)	3(5)	5(10)	2(T)	4(T)	4(7)
13 PIPO	-( )	+(T)	-( )	+(T)	-( )	-( )	-( )	1(5)	2(2)	-( )	-( )	2(8)
16 PSME	-( )	1(15)	2(T)	3(12)	2(5)	9(20)	2(3)	6(23)	7(16)	6(4)	8(13)	8(21)
17 THPL	9(59)	9(65)	10(60)	10(60)	10(75)	10(33)	10(73)	10(50)	9(29)	10(53)	10(31)	10(43)
18 TSHE	6(51)	2(38)	2(20)	3(20)	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	1(3)
19 TSME	-( )	+(T)	-( )	-( )	-( )	1(T)	-( )	1(1)	5(2)	-( )	2(8)	-( )
SHRUB SPECIES												
102 ACGL	6(1)	5(4)	7(2)	6(2)	8(5)	7(7)	6(3)	8(4)	3(1)	1(T)	1(T)	6(8)
104 ALSI	1(T)	2(14)	-( )	+(T)	2(T)	4(2)	-( )	1(T)	5(11)	-( )	2(9)	1(6)
105 AMAL	1(T)	2(T)	3(4)	4(T)	5(T)	1(T)	6(1)	6(T)	3(2)	4(T)	3(T)	6(T)
110 CRDO	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	+(T)	-( )	-( )	-( )	+(T)
111 HODI	-( )	+(T)	2(1)	2(T)	-( )	-( )	-( )	2(2)	-( )	-( )	-( )	3(1)
113 LEGL	-( )	+(T)	-( )	-( )	-( )	-( )	-( )	-( )	1(15)	-( )	-( )	-( )
115 LOUT	5(T)	4(T)	4(T)	7(T)	8(1)	9(3)	7(3)	7(1)	8(3)	9(4)	8(1)	7(T)
116 MEFE	2(10)	5(5)	2(T)	2(T)	7(8)	10(20)	5(T)	3(1)	10(40)	6(2)	7(2)	2(3)
117 OPHO	10(39)	1(T)	5(2)	2(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
118 PAMY	3(T)	1(T)	1(T)	-( )	5(2)	6(23)	7(T)	3(3)	5(17)	2(9)	4(10)	4(7)
119 PHLE	-( )	+(3)	2(T)	1(T)	-( )	-( )	-( )	2(3)	-( )	-( )	-( )	2(4)
122 PHMA	-( )	+(T)	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	1(12)
124 PRVI	-( )	-( )	-( )	+(T)	-( )	-( )	-( )	+(T)	-( )	-( )	-( )	+(T)
127 RHAL	1(T)	+(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
130 RILA	2(2)	4(2)	2(T)	+(T)	5(T)	6(T)	-( )	1(T)	4(T)	-( )	2(8)	1(T)
133 ROGY	3(T)	4(1)	7(T)	7(T)	7(T)	3(T)	5(1)	8(2)	6(2)	7(1)	6(2)	9(4)
161 RONU	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
134 ROWO	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	-( )
136 RUPA	4(1)	6(2)	5(T)	7(1)	8(2)	9(4)	4(T)	6(3)	7(3)	4(T)	6(4)	6(4)
137 SASC	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	2(9)	-( )	-( )	+(3)
142 SPBE	-( )	1(4)	-( )	2(T)	2(T)	3(T)	-( )	4(1)	3(1)	4(T)	3(5)	5(3)
143 SYAL	2(T)	4(5)	7(T)	5(2)	2(2)	-( )	4(T)	6(3)	2(T)	-( )	2(T)	6(5)
144 TABR	5(8)	4(15)	5(6)	5(6)	5(34)	4(T)	10(18)	3(1)	3(18)	10(37)	4(2)	2(1)
146 VAGL	5(7)	6(3)	4(1)	7(T)	9(13)	10(16)	7(2)	7(3)	10(39)	9(12)	10(25)	6(7)
LOW WOODY PLANTS AND DWARF SHRUBS												
201 ARUV	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
203 BERE	-( )	-( )	1(T)	+(T)	1(T)	-( )	-( )	1(3)	2(T)	1(T)	3(T)	4(2)
205 GAHU	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
206 LIBO	2(2)	4(5)	5(7)	8(15)	8(4)	4(1)	6(14)	7(13)	8(9)	9(21)	7(8)	9(15)
219 PHEM	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
218 SADO	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	+(T)	-( )	-( )	-( )	+(T)
145 VACA	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(2)
147 VAMY	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	+(T)
148 VASC	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
FERNS AND ALLIED TAXA												
260 ADPE	4(6)	3(1)	10(32)	10(23)	4(T)	1(T)	1(T)	2(T)	-( )	-( )	-( )	1(T)
251 ATFI	9(25)	10(45)	10(13)	5(2)	5(1)	6(1)	5(T)	2(T)	3(T)	2(T)	-( )	+(T)
255 GYDR	10(41)	6(20)	10(13)	5(4)	10(19)	4(T)	4(T)	1(T)	3(T)	1(T)	-( )	+(T)
258 POMU	4(2)	3(2)	8(3)	9(13)	7(3)	4(1)	7(T)	5(1)	5(T)	2(T)	-( )	4(2)
259 PTAQ	1(2)	4(2)	4(4)	4(1)	1(T)	3(2)	2(T)	4(2)	1(T)	1(T)	2(T)	4(2)
GRAMINOIDS												
301 AGSP	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
304 BRVU	7(1)	7(T)	7(1)	8(1)	7(T)	10(T)	7(T)	7(3)	5(T)	1(T)	3(1)	6(T)
305 CACA	1(T)	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
307 CARU	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	2(T)	-( )	1(15)	1(3)
309 CAGE	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	1(1)
311 CARO	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	+(T)	-( )	-( )	-( )	-( )
317 FEID	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
325 LUHI	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )

(con.)

APPENDIX C (Con.)

SERIES H.T. PHASE	THPL OPHO	THPL ATFI ATFI	THPL ATFI ADPE	THPL ADPE	THPL GYDR	THPL ASCA MEFE	THPL ASCA TABR	THPL ASCA ASCA	THPL CLUN MEFE	THPL CLUN TABR	THPL CLUN XETE	THPL CLUN CLUN
NO. OF PLOTS	N= 19	N= 34	N= 14	N= 30	N= 12	N= 7	N= 8	N= 48	N= 11	N= 8	N= 9	N= 47
PERENNIAL FORBS												
401 ACMI	-( )	-( )	-( )	-( )	-( )	-( )	-( )	+(T)	-( )	-( )	-( )	+(T)
402 ACRU	6(T)	7(3)	5(T)	4(T)	3(T)	3(T)	1(T)	3(5)	1(T)	-( )	1(T)	1(T)
403 ADBI	8(T)	8(6)	9(5)	10(6)	6(T)	4(1)	9(5)	8(4)	2(T)	4(T)	2(T)	6(2)
407 ANPI	5(1)	6(2)	8(1)	8(2)	8(1)	10(T)	10(1)	8(2)	9(1)	9(2)	9(T)	7(T)
418 ARNU	1(3)	+(3)	-( )	-( )	-( )	-( )	-( )	+(33)	-( )	-( )	-( )	+(T)
420 ARMA	-( )	1(T)	2(T)	3(1)	-( )	-( )	4(T)	2(1)	1(T)	-( )	2(T)	1(T)
421 ARCO	-( )	1(T)	1(T)	1(2)	2(19)	3(8)	2(T)	1(2)	2(33)	2(2)	1(3)	2(15)
422 ARLA	-( )	1(2)	-( )	1(T)	4(14)	7(17)	2(8)	2(5)	5(22)	1(15)	7(22)	1(4)
564 ASCA	7(8)	9(11)	10(8)	9(8)	8(3)	10(3)	10(7)	10(4)	-( )	1(T)	-( )	2(T)
426 ASCO	-( )	-( )	-( )	+(T)	-( )	-( )	-( )	+(T)	-( )	1(T)	1(T)	+(T)
431 BASA	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
442 CHUM	-( )	1(4)	-( )	2(T)	5(3)	4(T)	6(2)	6(1)	7(3)	10(12)	8(1)	6(5)
445 CIAL	6(3)	6(10)	9(22)	5(18)	1(T)	-( )	-( )	1(7)	-( )	-( )	-( )	-( )
447 CLUN	10(6)	9(6)	10(7)	10(5)	10(4)	10(7)	10(7)	10(6)	10(6)	10(16)	10(8)	9(6)
449 COOC	4(6)	8(18)	10(7)	10(15)	10(28)	10(11)	10(21)	9(22)	10(13)	10(32)	9(20)	9(18)
452 COCA	3(2)	4(6)	9(5)	8(3)	2(10)	4(T)	4(23)	5(7)	4(2)	6(4)	3(5)	4(6)
454 DIHO	9(4)	8(9)	8(4)	7(7)	9(3)	9(T)	7(3)	7(6)	4(T)	2(T)	1(T)	6(4)
455 DITR	-( )	-( )	1(38)	1(13)	1(T)	-( )	-( )	1(21)	-( )	-( )	-( )	1(3)
458 DOJE	-( )	+(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
465 FRVE	-( )	+(T)	-( )	1(T)	1(3)	-( )	-( )	2(T)	4(T)	-( )	-( )	2(T)
467 FRAG	1(T)	+(T)	2(T)	1(1)	-( )	-( )	-( )	1(1)	-( )	-( )	1(T)	1(1)
466 FRVI	-( )	1(T)	2(3)	1(T)	1(T)	-( )	-( )	2(5)	-( )	-( )	-( )	1(1)
471 GATR	7(2)	9(3)	10(5)	10(2)	9(T)	10(T)	7(3)	7(1)	6(T)	1(T)	3(T)	6(1)
476 GOOB	5(T)	5(T)	4(T)	8(T)	7(T)	7(T)	10(T)	8(T)	7(1)	6(1)	10(T)	7(T)
482 HECY	-( )	-( )	-( )	-( )	-( )	-( )	-( )	+(T)	-( )	-( )	-( )	-( )
489 LICA	-( )	1(3)	-( )	-( )	1(T)	-( )	-( )	+(T)	-( )	-( )	-( )	-( )
800 LIVE	-( )	+(T)	-( )	1(T)	-( )	-( )	-( )	+(T)	1(T)	-( )	1(T)	1(1)
647 MEPA	1(T)	3(1)	2(1)	-( )	2(T)	1(T)	-( )	-( )	-( )	-( )	-( )	-( )
501 MIBR	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
649 MIPE	1(19)	2(12)	2(3)	1(T)	-( )	-( )	1(T)	+(T)	-( )	-( )	-( )	-( )
502 MIST	1(3)	2(T)	2(2)	3(T)	3(T)	3(T)	2(2)	3(T)	3(T)	1(T)	3(1)	3(T)
505 OSCH	8(T)	7(T)	8(2)	7(1)	3(T)	4(T)	4(T)	5(T)	3(T)	2(T)	3(T)	6(T)
507 PEBR	1(T)	1(T)	-( )	-( )	-( )	-( )	-( )	+(T)	2(T)	-( )	1(T)	-( )
508 PECO	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	+(T)
509 PERA	-( )	+(T)	-( )	-( )	1(T)	3(T)	1(T)	2(2)	2(T)	6(T)	6(1)	2(T)
519 POPU	-( )	-( )	-( )	-( )	-( )	-( )	-( )	+(T)	-( )	-( )	-( )	-( )
526 PYAS	1(T)	1(T)	2(T)	1(T)	6(T)	4(T)	5(T)	3(T)	7(T)	5(2)	7(T)	3(T)
529 PYSE	1(T)	1(T)	-( )	1(T)	5(T)	4(T)	7(1)	5(1)	7(T)	6(4)	6(T)	4(T)
539 SETR	4(3)	6(3)	8(8)	2(T)	4(T)	6(T)	1(T)	1(T)	-( )	-( )	2(2)	-( )
542 SMRA	1(T)	1(T)	2(T)	1(T)	2(T)	6(T)	5(T)	3(T)	2(T)	1(T)	1(T)	1(1)
543 SMST	8(3)	9(7)	9(8)	9(5)	9(4)	10(6)	10(8)	9(5)	8(1)	7(4)	6(4)	9(4)
546 STAM	8(1)	6(2)	6(T)	4(T)	3(T)	3(T)	-( )	1(T)	1(T)	2(T)	-( )	+(T)
810 SYPL	-( )	-( )	1(T)	1(T)	1(3)	-( )	4(5)	1(2)	-( )	1(T)	-( )	1(T)
547 THOC	2(T)	5(T)	2(2)	4(2)	4(1)	10(T)	2(T)	7(1)	4(T)	4(T)	3(2)	5(T)
548 TITR	9(17)	10(15)	10(5)	9(5)	10(4)	9(3)	10(4)	8(3)	9(T)	9(2)	6(1)	4(2)
563 TRCA	4(3)	5(7)	7(15)	2(T)	2(T)	1(T)	2(T)	1(3)	1(T)	1(T)	1(T)	-( )
560 TROV	9(T)	9(2)	8(T)	8(T)	9(T)	9(T)	10(2)	7(T)	6(T)	9(1)	7(1)	7(T)
551 VASI	-( )	1(T)	-( )	-( )	-( )	1(T)	-( )	+(T)	-( )	-( )	2(T)	-( )
552 VEVI	3(3)	5(T)	2(T)	1(T)	2(T)	3(T)	2(T)	1(T)	-( )	2(T)	1(T)	+(T)
554 VIAD	-( )	-( )	-( )	+(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	+(T)
556 VIGL	7(3)	5(6)	8(2)	3(2)	1(T)	3(T)	4(1)	2(T)	-( )	-( )	-( )	1(T)
557 VIOR	7(4)	6(4)	8(3)	9(2)	6(1)	7(1)	10(2)	8(2)	9(T)	9(1)	9(T)	7(2)
558 XETE	1(T)	+(T)	-( )	+(T)	2(T)	6(T)	5(T)	3(2)	7(9)	10(12)	10(12)	2(2)

CODE TO CONSTANCY VALUES

+ = 0-5%
1 = 5-15%
2 = 15-25%
3 = 25-35%
4 = 35-45%
5 = 45-55%
6 = 55-65%
7 = 65-75%
8 = 75-85%
9 = 85-95%
10 = 95-100%

(Average percent canopy coverage, on plots where the species occurred)

(con.)

APPENDIX C (Con.)

SERIES	TSME	TSME	TSME	TSME	TSME	TSME	TSME	TSME	TSME	ABLA	ABLA	ABLA
H.T.	STAM	STAM	CLUN	CLUN	MEFE	MEFE	XETE	XETE	XETE	CACA	CACA	CACA
PHASE	MEFE	LUHI	MEFE	XETE	XETE	LUHI	VAGL	VASC	LUHI	LEGL	VACA	LICA
NO. OF PLOTS	N= 4	N= 4	N= 23	N= 8	N= 15	N= 13	N= 15	N= 12	N= 11	N= 9	N= 4	N= 6
TREE SPECIES												
1 ABGR	-( )	-( )	3(24)	1(15)	1(T)	-( )	1(T)	2(T)	-( )	3(T)	7(T)	-( )
2 ABLA	10(44)	10(51)	10(24)	7(13)	10(41)	10(33)	10(22)	10(29)	10(33)	10(29)	10(5)	10(23)
3 BEPA	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
6 LAOC	5(3)	-( )	6(4)	7(16)	1(15)	1(19)	5(11)	2(1)	-( )	3(T)	-( )	-( )
7 PIEN	10(44)	2(63)	10(28)	9(16)	7(28)	6(22)	7(3)	9(7)	5(7)	10(28)	10(8)	10(23)
9 PIAL	-( )	-( )	+(3)	-( )	1(3)	4(T)	2(18)	4(2)	5(4)	2(T)	-( )	2(T)
10 PICO	-( )	-( )	4(23)	7(32)	5(20)	5(17)	7(34)	9(45)	4(14)	9(21)	10(50)	7(12)
12 PIMO	5(9)	-( )	6(6)	6(7)	3(4)	1(2)	5(6)	2(2)	1(T)	1(T)	-( )	-( )
13 PIPO	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )
16 PSME	5(15)	-( )	6(8)	7(8)	1(8)	-( )	5(16)	3(14)	-( )	4(T)	-( )	3(19)
17 THPL	-( )	-( )	2(T)	1(T)	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )
18 TSHE	-( )	-( )	+(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
19 TSME	10(14)	10(65)	10(32)	10(21)	10(37)	10(49)	10(30)	10(29)	10(56)	-( )	-( )	-( )
SHRUB SPECIES												
102 ACGL	-( )	-( )	2(5)	1(15)	-( )	-( )	1(2)	-( )	-( )	-( )	-( )	-( )
104 ALSI	5(8)	2(38)	5(8)	1(T)	1(T)	-( )	1(T)	-( )	-( )	2(15)	-( )	7(11)
105 AMAL	-( )	-( )	1(T)	2(2)	-( )	-( )	1(T)	-( )	-( )	-( )	2(T)	3(8)
110 CRDO	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
111 HODI	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
113 LEGL	2(T)	-( )	-( )	-( )	1(9)	1(T)	-( )	-( )	-( )	10(44)	10(17)	3(2)
115 LOUT	7(1)	5(8)	7(3)	9(4)	4(3)	1(T)	3(2)	1(T)	3(5)	3(T)	2(3)	5(T)
116 MEFE	10(61)	10(44)	10(54)	4(2)	10(53)	10(54)	4(T)	2(2)	2(T)	6(33)	-( )	5(13)
117 OPHO	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
118 PAMY	-( )	-( )	2(3)	5(5)	1(2)	-( )	2(7)	-( )	-( )	-( )	-( )	-( )
119 PHLE	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
122 PHMA	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
124 PRVI	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
127 RHAL	-( )	-( )	+(T)	-( )	1(3)	2(18)	-( )	-( )	-( )	-( )	-( )	-( )
130 RILA	2(T)	2(T)	3(3)	2(T)	1(T)	-( )	1(T)	-( )	-( )	1(3)	-( )	5(T)
133 ROCY	-( )	-( )	2(2)	2(2)	-( )	-( )	1(3)	-( )	-( )	1(T)	-( )	-( )
161 RONU	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
134 ROWO	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
136 RUPA	2(3)	-( )	3(T)	2(8)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
137 SASC	-( )	-( )	1(2)	1(3)	1(T)	1(T)	1(T)	1(T)	-( )	-( )	-( )	-( )
142 SPBE	2(3)	-( )	1(1)	2(3)	-( )	-( )	3(1)	2(T)	-( )	2(T)	-( )	2(T)
143 SYAL	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	3(T)
144 TABR	-( )	-( )	+(T)	-( )	1(19)	-( )	-( )	-( )	-( )	-( )	-( )	2(3)
146 VAGL	10(33)	10(21)	10(31)	9(46)	8(35)	8(29)	10(47)	10(34)	8(17)	6(22)	2(T)	7(10)
LOW WOODY PLANTS AND DWARF SHRUBS												
201 ARUV	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
203 BERE	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
205 GAHU	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	9(3)	5(T)	-( )
206 LIBO	-( )	-( )	+(T)	1(15)	-( )	-( )	-( )	-( )	-( )	2(9)	5(T)	5(1)
219 PHEM	-( )	2(15)	+(T)	-( )	2(T)	4(10)	-( )	2(T)	6(23)	-( )	-( )	-( )
218 SADO	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
145 VACA	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	10(30)	3(T)
147 VAMY	-( )	-( )	+(T)	-( )	-( )	1(15)	-( )	-( )	1(15)	-( )	-( )	2(T)
148 VASC	-( )	7(2)	1(T)	2(T)	7(16)	9(15)	5(1)	10(29)	9(25)	10(27)	10(20)	8(3)
FERNS AND ALLIED TAXA												
260 ADPE	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
251 ATFI	5(T)	2(3)	2(T)	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	3(2)
255 GYDR	5(T)	-( )	1(8)	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )
258 POMU	2(T)	-( )	1(T)	1(T)	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )
259 PTAQ	-( )	-( )	2(1)	4(6)	1(T)	2(T)	1(2)	-( )	-( )	-( )	-( )	2(3)
GRAMINOIDS												
301 AGSP	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
304 BRVU	5(T)	2(T)	6(T)	5(1)	-( )	1(T)	1(T)	-( )	-( )	2(T)	-( )	3(T)
305 CACA	-( )	5(8)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	3(1)	10(13)	10(27)
307 CARU	-( )	-( )	+(3)	4(6)	1(T)	1(15)	3(10)	2(1)	-( )	3(T)	2(T)	-( )
309 CAGE	-( )	2(T)	2(T)	5(1)	2(1)	4(T)	4(10)	7(1)	5(4)	2(T)	2(T)	2(T)
311 CARO	-( )	-( )	+(T)	1(T)	1(T)	1(T)	1(T)	4(1)	2(T)	-( )	-( )	2(T)
317 FEID	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
325 LUHI	7(T)	10(24)	1(T)	-( )	3(T)	9(10)	2(T)	4(T)	8(17)	-( )	-( )	2(T)

(con.)

APPENDIX C (Con.)

SERIES H.T. PHASE	TSME STAM MEFE	TSME STAM LUHI	TSME CLUN MEFE	TSME CLUN XETE	TSME MEFE XETE	TSME MEFE LUHI	TSME XETE VAGL	TSME XETE VASC	TSME XETE LUHI	ABLA CACA LEGL	ABLA CACA VACA	ABLA CACA LICA
NO. OF PLOTS	N= 4	N= 4	N= 23	N= 8	N= 15	N= 13	N= 15	N= 12	N= 11	N= 9	N= 4	N= 6
PERENNIAL FORBS												
401 ACMI	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	5(T)	-( )
402 ACRU	2(T)	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
403 ADBI	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )
407 ANPI	5(T)	2(T)	7(T)	9(T)	1(T)	1(T)	1(T)	1(T)	1(3)	6(T)	5(T)	3(T)
418 ARNU	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
420 ARMA	2(T)	-( )	+(T)	1(T)	-( )	1(T)	-( )	-( )	-( )	1(T)	-( )	2(3)
421 ARCO	-( )	-( )	+(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
422 ARLA	10(21)	7(11)	6(24)	5(10)	4(12)	4(10)	1(2)	-( )	5(T)	4(14)	-( )	5(2)
564 ASCA	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	2(T)
426 ASCO	-( )	-( )	+(T)	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
431 BASA	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
442 CHUM	-( )	-( )	4(1)	7(T)	3(T)	1(T)	6(T)	4(2)	1(T)	3(T)	5(T)	-( )
445 CIAL	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
447 CLUN	10(9)	-( )	9(3)	9(3)	1(T)	1(T)	1(T)	-( )	-( )	2(T)	5(T)	5(5)
449 COOC	7(2)	-( )	5(11)	4(7)	1(T)	-( )	1(T)	-( )	-( )	7(6)	5(2)	5(T)
452 COCA	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	2(3)
454 DIHO	-( )	-( )	1(T)	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	2(T)
455 DITR	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
458 DOJE	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	4(5)	-( )	7(1)
465 FRVE	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	2(T)	3(T)
467 FRAG	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
466 FRVI	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	2(T)	5(T)	2(T)
471 GATR	5(T)	-( )	4(T)	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	2(T)	5(T)
476 GOOB	5(T)	2(T)	7(T)	5(1)	5(T)	3(T)	5(T)	2(T)	2(T)	3(T)	-( )	-( )
482 HECY	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
489 LICA	-( )	5(3)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	2(2)	7(2)	5(18)
800 LIVE	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	2(T)
647 MEPA	2(T)	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	2(T)	2(T)
501 MIBR	7(T)	5(2)	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )
649 MIPE	-( )	5(8)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	2(T)	5(T)	3(T)
502 MIST	-( )	-( )	2(T)	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )
505 OSCH	-( )	-( )	1(T)	4(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
507 PEBR	2(T)	2(T)	3(T)	1(T)	2(T)	4(T)	3(T)	3(T)	2(T)	-( )	2(T)	-( )
508 PECO	2(T)	2(T)	1(2)	-( )	1(T)	1(T)	2(T)	2(3)	2(2)	-( )	-( )	-( )
509 PERA	-( )	-( )	3(T)	1(T)	2(T)	2(T)	3(T)	2(T)	1(3)	2(T)	-( )	3(T)
519 POPU	-( )	10(1)	1(T)	-( )	1(2)	4(T)	1(T)	-( )	2(2)	-( )	7(T)	-( )
526 PYAS	5(2)	-( )	5(T)	5(1)	4(T)	1(T)	3(T)	2(T)	-( )	3(1)	5(T)	-( )
529 PYSE	2(T)	2(T)	7(1)	10(T)	5(1)	2(1)	5(T)	3(T)	2(2)	3(1)	-( )	2(T)
539 SETR	7(2)	5(T)	2(T)	1(T)	-( )	1(T)	1(T)	-( )	1(T)	3(5)	7(T)	8(4)
542 SMRA	-( )	-( )	+(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
543 SMST	5(2)	-( )	4(T)	6(2)	-( )	-( )	1(T)	-( )	-( )	-( )	2(T)	5(1)
546 STAM	5(T)	2(T)	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	1(3)	2(T)	5(T)
810 SYPL	-( )	-( )	1(5)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
547 THOC	5(T)	-( )	4(T)	2(2)	1(T)	-( )	1(T)	-( )	-( )	3(T)	2(15)	7(1)
548 TITR	10(5)	2(T)	5(1)	2(T)	1(T)	-( )	1(T)	-( )	-( )	2(T)	2(T)	2(T)
563 TRCA	2(T)	2(38)	-( )	-( )	-( )	1(T)	1(T)	-( )	-( )	1(15)	2(T)	8(4)
560 TROV	10(T)	5(T)	7(T)	5(T)	1(T)	-( )	2(T)	-( )	-( )	4(T)	7(T)	7(T)
551 VASI	2(T)	2(T)	1(T)	-( )	1(T)	1(T)	-( )	-( )	1(T)	2(T)	5(8)	2(T)
552 VEVI	5(T)	5(3)	1(T)	-( )	-( )	4(T)	-( )	-( )	1(T)	2(T)	-( )	5(2)
554 VIAD	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
556 VIGL	10(2)	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	5(T)
557 VIOR	7(1)	2(3)	9(T)	10(3)	5(1)	3(T)	4(T)	2(T)	3(1)	8(1)	7(6)	2(T)
558 XETE	7(2)	7(T)	8(26)	10(46)	10(34)	10(29)	10(61)	10(50)	10(51)	8(18)	7(15)	7(10)

CODE TO CONSTANCY VALUES

+ = 0-5%	2 = 15-25%	4 = 35-45%	6 = 55-65%	8 = 75-85%	10 = 95-100%
1 = 5-15%	3 = 25-35%	5 = 45-55%	7 = 65-75%	9 = 85-95%	

(Average percent canopy coverage, on plots where the species occurred)

(con.)

APPENDIX C (Con.)

	ABLA STAM MEFE	ABLA STAM LICA	ABLA CLUN MEFE	ABLA CLUN XETE	ABLA CLUN CLUN	ABLA MEFE LUHI	ABLA MEFE VASC	ABLA MEFE COOC	ABLA MEFE XETE	ABLA XETE LUHI	ABLA XETE VASC	ABLA XETE COOC	ABLA XETE VAGL	ABLA LUHI
NO. OF PLOTS	N= 17	N= 14	N= 17	N= 18	N= 3	N= 8	N= 11	N= 10	N= 6	N= 18	N= 20	N= 16	N= 16	N= 6
TREE SPECIES														
1 ABGR	2(30)	4(14)	4(21)	5(23)	7(20)	-( )	4(4)	3(2)	2(T)	-( )	2(3)	7(11)	2(14)	-( )
2 ABLA	10(60)	10(26)	10(40)	9(45)	10(54)	10(72)	9(82)	10(35)	10(60)	10(52)	10(30)	10(33)	10(37)	10(48)
3 BEPA	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
6 LAOC	1(2)	1(3)	1(8)	5(23)	7(19)	-( )	-( )	1(38)	-( )	-( )	-( )	2(5)	2(4)	-( )
7 PIEN	9(44)	10(45)	10(36)	8(12)	10(54)	9(21)	8(12)	10(24)	8(17)	7(4)	7(8)	9(19)	6(5)	5(18)
9 PIAL	-( )	-( )	-( )	-( )	-( )	6(1)	5(T)	-( )	-( )	10(19)	3(4)	1(T)	3(14)	10(30)
10 PICO	2(3)	4(17)	4(7)	3(28)	7(26)	2(8)	8(10)	7(9)	3(33)	7(23)	9(57)	10(33)	7(38)	-( )
12 PIMO	1(8)	-( )	2(1)	3(25)	-( )	1(T)	-( )	1(T)	2(15)	-( )	-( )	1(T)	2(8)	-( )
13 PIPO	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	-( )
16 PSME	2(10)	2(10)	4(21)	8(20)	7(8)	-( )	3(2)	6(7)	2(T)	-( )	3(3)	7(18)	7(24)	-( )
17 THPL	1(T)	1(T)	1(T)	2(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
18 TSHE	-( )	1(T)	-( )	2(1)	3(T)	-( )	-( )	-( )	2(T)	-( )	-( )	-( )	-( )	-( )
19 TSME	1(T)	-( )	-( )	1(T)	-( )	-( )	-( )	1(T)	2(T)	-( )	-( )	-( )	1(T)	-( )
SHRUB SPECIES														
102 ACGL	3(4)	1(2)	2(1)	4(5)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(3)	-( )
104 ALSI	4(5)	4(1)	4(22)	3(4)	10(1)	1(T)	1(63)	3(T)	2(3)	-( )	2(T)	4(10)	-( )	-( )
105 AMAL	1(T)	1(T)	3(T)	4(1)	7(2)	1(T)	-( )	1(T)	-( )	-( )	-( )	1(T)	3(T)	-( )
110 CRDO	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
111 HODI	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
113 LEGL	1(3)	1(2)	1(3)	-( )	-( )	-( )	-( )	4(1)	2(T)	1(T)	1(T)	1(T)	-( )	-( )
115 LOUT	5(5)	5(T)	8(1)	9(2)	7(T)	5(4)	4(1)	5(T)	2(15)	4(2)	2(T)	7(T)	5(T)	2(T)
116 MEFE	10(47)	7(2)	10(48)	6(1)	7(2)	9(48)	9(58)	10(36)	10(55)	2(1)	2(1)	4(T)	1(2)	2(3)
117 CPHO	1(2)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
118 PAMY	1(2)	1(T)	1(T)	5(4)	3(T)	-( )	-( )	1(3)	2(3)	-( )	-( )	1(T)	2(7)	-( )
119 PHLE	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
122 PHMA	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
124 PRVI	-( )	-( )	-( )	-( )	3(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
127 RHAL	4(12)	-( )	-( )	1(T)	-( )	7(22)	-( )	-( )	3(32)	-( )	-( )	-( )	-( )	-( )
130 RILA	8(1)	5(3)	6(2)	3(T)	3(T)	-( )	-( )	2(T)	-( )	1(T)	-( )	1(T)	-( )	-( )
133 ROGY	1(T)	-( )	1(T)	5(3)	7(T)	-( )	-( )	2(T)	-( )	-( )	1(T)	2(1)	1(2)	-( )
161 RONU	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
134 ROWO	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
136 RUPA	4(3)	3(2)	2(T)	6(2)	7(8)	-( )	1(T)	1(T)	-( )	-( )	-( )	-( )	-( )	-( )
137 SASC	-( )	1(T)	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	1(T)	1(2)	1(T)	1(T)	-( )
142 SPBE	-( )	1(3)	1(T)	5(1)	3(T)	-( )	-( )	1(T)	-( )	-( )	4(1)	5(3)	6(1)	-( )
143 SYAL	1(T)	4(2)	1(T)	1(T)	3(15)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
144 TABR	1(2)	1(3)	1(8)	1(38)	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	-( )
146 VAGL	10(18)	9(8)	10(24)	10(42)	10(25)	9(26)	9(20)	10(36)	10(36)	7(16)	6(25)	9(52)	10(45)	3(9)
LOW WOODY PLANTS AND DWARF SHRUBS														
201 ARUV	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	2(1)	-( )	1(T)	-( )
203 BERE	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	1(T)	-( )
205 GAHU	1(T)	1(T)	1(T)	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	+(T)	1(2)	-( )	-( )
206 LIBO	1(T)	4(4)	2(7)	1(33)	7(19)	-( )	-( )	4(10)	-( )	-( )	1(1)	6(12)	1(T)	-( )
219 PHEM	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	-( )
218 SADO	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
145 VACA	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(3)	1(18)	1(3)	1(15)	-( )
147 VAMY	1(T)	-( )	-( )	1(T)	-( )	2(2)	-( )	-( )	-( )	1(19)	-( )	1(T)	-( )	-( )
148 VASC	1(2)	4(13)	5(9)	1(3)	3(T)	7(12)	9(11)	7(13)	5(T)	8(49)	10(50)	7(25)	6(1)	5(18)
FERNS AND ALLIED TAXA														
260 ADPE	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
251 ATFI	5(5)	4(15)	-( )	-( )	3(T)	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	-( )
255 GYDR	2(41)	1(8)	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
258 POMU	1(T)	1(T)	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	-( )
259 PTAQ	2(1)	-( )	1(T)	3(2)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
GRAMINOIDS														
301 AGSP	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	-( )
304 BRVU	5(2)	8(T)	7(T)	7(2)	7(T)	-( )	-( )	3(T)	-( )	1(T)	+(T)	2(1)	1(2)	-( )
305 CACA	1(3)	1(15)	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	+(T)	1(T)	-( )	-( )
307 CARU	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	3(T)	-( )	-( )	5(5)	4(1)	5(12)	-( )
309 CAGE	-( )	-( )	-( )	4(1)	-( )	-( )	2(T)	-( )	-( )	3(1)	4(4)	2(1)	6(11)	-( )
311 CARO	1(T)	1(T)	1(T)	2(1)	-( )	1(T)	1(T)	-( )	-( )	1(T)	1(T)	1(T)	2(T)	2(T)
317 FEID	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	+(T)	-( )	-( )	-( )
325 LUHI	5(T)	1(2)	1(T)	-( )	-( )	10(6)	4(T)	1(T)	5(T)	10(11)	1(T)	-( )	1(T)	10(54)

(con.)

APPENDIX C (Con.)

	ABLA STAM MEFE	ABLA STAM LICA	ABLA CLUN MEFE	ABLA CLUN XETE	ABLA CLUN CLUN	ABLA MEFE LUHI	ABLA MEFE VASC	ABLA MEFE COOC	ABLA MEFE XETE	ABLA XETE LUHI	ABLA XETE VASC	ABLA XETE COOC	ABLA XETE VAGL	ABLA LUHI
NO. OF PLOTS	N= 17	N= 14	N= 17	N= 18	N= 3	N= 8	N= 11	N= 10	N= 6	N= 18	N= 20	N= 16	N= 16	N= 6
PERENNIAL FORBS														
401 ACMI	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	1(T)	3(T)
402 ACRU	3(5)	5(T)	1(T)	2(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	-( )
403 ADBI	1(T)	-( )	-( )	3(T)	3(T)	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )
407 ANPI	4(5)	4(T)	8(2)	7(2)	7(T)	-( )	6(T)	10(T)	3(2)	-( )	6(T)	9(T)	4(T)	-( )
418 ARNU	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
420 ARMA	2(6)	2(T)	2(1)	4(T)	3(3)	-( )	1(T)	1(T)	-( )	-( )	+(T)	4(T)	1(T)	-( )
421 ARCO	1(8)	-( )	1(15)	-( )	-( )	-( )	1(T)	2(T)	2(T)	-( )	1(T)	2(5)	-( )	-( )
422 ARLA	6(21)	8(10)	7(33)	3(27)	3(85)	2(8)	4(1)	5(19)	3(T)	4(3)	3(T)	2(8)	3(T)	5(5)
564 ASCA	3(2)	3(2)	1(T)	2(1)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
426 ASCO	-( )	-( )	-( )	2(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	-( )
431 BASA	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
442 CHUM	2(1)	1(T)	5(T)	6(1)	7(2)	4(T)	4(T)	9(T)	2(T)	1(T)	5(2)	10(T)	6(1)	-( )
445 CIAL	1(T)	1(2)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
447 CLUN	8(9)	6(3)	9(6)	9(8)	10(1)	-( )	-( )	4(T)	-( )	-( )	-( )	1(T)	1(T)	-( )
449 COOC	4(9)	6(14)	5(11)	5(7)	7(9)	-( )	-( )	10(7)	2(T)	-( )	1(2)	10(4)	1(T)	-( )
452 COCA	1(3)	1(8)	1(8)	-( )	3(15)	-( )	-( )	3(3)	-( )	-( )	-( )	1(T)	-( )	-( )
454 DIHO	2(1)	1(T)	1(T)	2(13)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
455 DITR	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
458 DOJE	1(T)	3(4)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
465 FRVE	1(T)	3(T)	-( )	2(1)	-( )	-( )	-( )	3(T)	-( )	-( )	1(T)	-( )	-( )	-( )
467 FRAG	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
466 FRVI	1(T)	-( )	1(T)	1(2)	3(T)	-( )	-( )	1(T)	-( )	-( )	1(2)	1(T)	1(T)	-( )
471 GATR	5(1)	6(3)	5(T)	6(T)	7(T)	-( )	-( )	1(T)	-( )	-( )	-( )	1(T)	1(T)	-( )
476 GOOB	7(T)	1(T)	10(T)	7(T)	10(T)	2(T)	6(T)	8(1)	5(T)	1(T)	4(T)	6(T)	4(T)	3(T)
482 HECY	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
489 LICA	4(2)	5(3)	1(T)	-( )	-( )	-( )	-( )	1(T)	-( )	1(T)	-( )	-( )	-( )	-( )
800 LIVE	1(2)	1(T)	1(T)	2(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	-( )
647 MEPA	1(T)	1(3)	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
501 MIBR	2(2)	1(8)	-( )	-( )	-( )	-( )	-( )	-( )	2(T)	-( )	-( )	-( )	-( )	2(T)
649 MIPE	4(2)	2(1)	1(T)	-( )	-( )	2(T)	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	-( )
502 MIST	2(2)	1(T)	2(T)	6(T)	3(T)	1(T)	-( )	1(T)	-( )	-( )	-( )	1(8)	1(T)	-( )
505 OSCH	5(1)	5(T)	4(T)	5(1)	7(T)	-( )	-( )	-( )	-( )	1(T)	-( )	1(T)	1(T)	-( )
507 PEBR	5(T)	1(T)	2(T)	1(T)	-( )	2(T)	5(2)	1(T)	-( )	1(T)	+(T)	-( )	2(T)	-( )
508 PECO	1(T)	1(T)	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	1(T)	+(T)	-( )	-( )	3(2)
509 PERA	3(1)	2(T)	7(T)	5(T)	3(T)	2(T)	5(T)	7(T)	2(3)	1(2)	3(T)	6(T)	1(T)	2(T)
519 POPU	2(T)	4(2)	2(1)	1(T)	3(T)	-( )	1(T)	1(T)	-( )	1(T)	+(T)	1(T)	1(T)	5(T)
526 PYAS	1(T)	1(T)	4(T)	3(T)	7(2)	-( )	-( )	8(T)	2(T)	-( )	1(T)	1(T)	-( )	-( )
529 PYSE	6(1)	4(T)	7(1)	6(T)	7(2)	4(T)	4(1)	7(T)	8(T)	1(T)	2(T)	6(T)	3(T)	-( )
539 SETR	6(5)	9(6)	1(T)	-( )	-( )	1(T)	-( )	1(T)	-( )	1(T)	+(T)	-( )	-( )	-( )
542 SMRA	1(T)	-( )	1(T)	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
543 SMST	5(3)	6(1)	4(T)	7(2)	10(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	-( )
546 STAM	5(T)	4(T)	-( )	-( )	3(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
810 SYPL	1(T)	1(26)	1(9)	2(2)	-( )	-( )	1(T)	-( )	-( )	-( )	+(T)	-( )	-( )	-( )
547 THOC	7(4)	6(2)	8(1)	8(1)	10(5)	-( )	-( )	2(T)	-( )	-( )	+(T)	1(T)	3(T)	-( )
548 TITR	7(17)	7(8)	5(8)	4(T)	7(2)	-( )	-( )	2(T)	-( )	1(T)	-( )	1(T)	1(T)	-( )
563 TRCA	4(7)	5(19)	-( )	-( )	3(T)	1(T)	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	2(T)
560 TROV	6(2)	7(T)	9(T)	7(T)	3(T)	1(T)	1(T)	6(T)	-( )	1(T)	-( )	3(T)	2(T)	2(T)
551 VASI	4(3)	4(T)	3(T)	3(2)	-( )	1(T)	2(T)	1(T)	-( )	2(T)	+(T)	1(T)	1(T)	3(9)
552 VEVI	5(3)	5(2)	2(1)	1(T)	-( )	1(T)	-( )	1(T)	3(T)	2(T)	+(T)	-( )	-( )	2(T)
554 VIAD	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
556 VIGL	2(1)	4(11)	1(T)	1(T)	3(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
557 VIOR	8(4)	4(2)	8(3)	8(2)	10(T)	2(T)	7(T)	10(T)	7(T)	1(T)	6(T)	9(2)	4(T)	2(3)
558 XETE	6(13)	7(5)	10 (23)	10 (41)	-( )	10(36)	9(34)	10(21)	8(48)	10(59)	10(36)	10(32)	10(51)	5(T)

CODE TO CONSTANCY VALUES

+ = 0-5%	2 = 15-25%	4 = 35-45%	6 = 55-65%	8 = 75-85%	10 = 95-100%
1 = 5-15%	3 = 25-35%	5 = 45-55%	7 = 65-75%	9 = 85-95%	

(Average percent canopy coverage, on plots where the species occurred)

(con.)

APPENDIX C (Con.)

SERIES	ABGR	ABGR	ABGR	ABGR	ABGR	ABGR	ABGR	ABGR	ABGR	ABGR	ABGR	ABGR	ABGR
H.T.	SETR	ASCA	ASCA	ASCA	CLUN	CLUN	CLUN	CLUN	CLUN	LIBO	LIBO	XETE	XETE
PHASE		MEFE	TABR	ASCA	MEFE	TABR	XETE	PHMA	CLUN	LIBO	XETE	COOC	VAGL
NO. OF PLOTS	N= 9	N= 12	N= 21	N= 32	N= 17	N= 11	N= 38	N= 21	N= 27	N= 11	N= 7	N= 15	N= 16
TREE SPECIES													
1 ABGR	9(26)	10(46)	10(43)	10(45)	10(43)	10(33)	10(42)	10(30)	10(62)	10(40)	10(39)	10(50)	10(25)
2 ABLA	3(2)	2(11)	1(5)	1(2)	4(3)	3(2)	3(2)	+(3)	1(1)	2(19)	4(6)	5(3)	6(5)
3 BEPA	-( )	-( )	-( )	+(15)	-( )	-( )	-( )	+(3)	-( )	-( )	-( )	-( )	-( )
6 LAOC	3(6)	2(2)	3(3)	4(5)	4(9)	3(3)	4(18)	3(21)	3(7)	3(2)	6(10)	4(14)	2(8)
7 PIEN	8(11)	8(13)	8(7)	2(12)	8(7)	5(8)	6(6)	-( )	2(6)	5(6)	6(11)	3(11)	2(5)
9 PIAL	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
10 PICO	-( )	2(15)	-( )	1(23)	5(18)	1(3)	6(17)	3(4)	3(21)	5(15)	9(43)	6(17)	9(38)
12 PIMO	-( )	1(3)	-( )	2(7)	1(3)	-( )	2(5)	4(3)	3(7)	1(T)	1(T)	-( )	1(1)
13 PIPO	-( )	2(T)	-( )	2(11)	1(T)	-( )	3(3)	7(15)	4(6)	6(14)	4(14)	3(17)	4(12)
16 PSME	2(8)	5(21)	4(8)	9(40)	6(11)	7(8)	9(28)	10(49)	9(26)	8(31)	9(38)	10(23)	9(18)
17 THPL	-( )	1(T)	+(T)	2(T)	1(3)	-( )	1(2)	-( )	1(2)	-( )	-( )	1(T)	-( )
18 TSHE	-( )	-( )	-( )	1(T)	-( )	-( )	1(T)	-( )	1(T)	-( )	-( )	-( )	-( )
19 TSME	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(1)
SHRUB SPECIES													
102 ACGL	8(8)	9(12)	9(11)	9(6)	2(11)	5(7)	4(4)	9(8)	6(7)	5(2)	1(3)	3(T)	1(2)
104 ALSI	1(3)	3(4)	-( )	+(T)	2(2)	-( )	2(3)	+(T)	1(T)	-( )	1(T)	1(8)	2(1)
105 AMAL	4(6)	7(2)	4(1)	6(2)	5(3)	4(2)	7(2)	9(3)	9(2)	6(T)	7(2)	4(7)	6(1)
110 CRDO	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	+(T)	1(T)	-( )	-( )	-( )
111 HODI	-( )	-( )	-( )	5(1)	1(T)	1(3)	1(2)	8(14)	4(2)	3(1)	3(9)	2(1)	1(1)
113 LEGL	1(3)	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
115 LOUT	8(2)	8(2)	6(T)	7(1)	6(4)	10(T)	7(1)	3(T)	6(2)	6(T)	7(4)	5(2)	2(1)
116 MEFE	8(14)	10(23)	6(2)	1(2)	10(23)	3(2)	3(2)	-( )	1(T)	1(T)	4(1)	3(2)	1(1)
117 OPHO	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
118 PAMY	3(T)	4(T)	2(T)	4(7)	4(10)	2(2)	4(12)	4(9)	2(12)	-( )	4(5)	2(T)	2(4)
119 PHLE	-( )	-( )	-( )	1(T)	-( )	1(3)	-( )	2(5)	1(6)	1(T)	-( )	-( )	-( )
122 PHMA	-( )	2(T)	-( )	4(7)	1(T)	-( )	1(6)	8(21)	3(3)	2(T)	3(9)	3(10)	1(T)
124 PRVI	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	+(T)	1(T)	-( )	-( )	-( )
127 RHAL	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
130 RILA	7(2)	6(T)	3(T)	2(T)	1(2)	4(1)	1(T)	-( )	2(6)	1(T)	1(T)	1(T)	1(T)
133 ROGY	6(2)	8(2)	6(1)	9(4)	8(3)	8(2)	9(2)	10(7)	10(5)	9(3)	7(3)	9(1)	7(2)
161 RONU	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	-( )
134 ROWO	-( )	-( )	-( )	-( )	-( )	-( )	-( )	+(15)	-( )	-( )	-( )	-( )	-( )
136 RUPA	6(1)	7(T)	3(T)	7(6)	3(T)	3(T)	5(6)	7(7)	6(10)	4(T)	4(T)	6(1)	2(T)
137 SASC	1(3)	-( )	-( )	1(T)	1(T)	-( )	1(1)	-( )	-( )	-( )	-( )	1(T)	2(1)
142 SPBE	2(T)	1(T)	2(T)	5(T)	2(1)	3(T)	7(4)	8(5)	6(8)	5(T)	7(4)	7(7)	8(2)
143 SYAL	2(T)	3(2)	5(T)	8(6)	2(1)	3(T)	3(2)	10(17)	8(5)	7(10)	1(T)	3(5)	1(1)
144 TABR	7(32)	7(32)	10(56)	1(T)	6(28)	10(72)	2(2)	-( )	3(5)	1(T)	1(3)	1(T)	1(1)
146 VAGL	8(22)	10(12)	8(4)	6(9)	10(17)	9(5)	10(28)	5(3)	7(10)	5(1)	9(43)	10(29)	10(37)
LOW WOODY PLANTS AND DWARF SHRUBS													
201 ARUV	-( )	-( )	-( )	+(T)	1(T)	-( )	1(T)	+(3)	1(6)	3(T)	-( )	-( )	2(5)
203 BERE	-( )	1(T)	-( )	2(1)	2(T)	1(3)	5(T)	8(7)	5(2)	6(4)	4(T)	3(4)	6(1)
205 GAHU	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
206 LIBO	2(9)	7(8)	7(11)	4(13)	9(16)	10(8)	8(13)	7(6)	9(26)	10(11)	10(10)	5(T)	3(T)
219 PHEM	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
218 SADO	-( )	-( )	-( )	-( )	1(T)	-( )	+(T)	+(T)	+(T)	1(15)	-( )	-( )	-( )
145 VACA	-( )	-( )	-( )	-( )	-( )	-( )	+(T)	-( )	1(15)	3(5)	-( )	-( )	-( )
147 VAMY	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
148 VASC	-( )	-( )	-( )	-( )	3(6)	-( )	2(10)	-( )	1(15)	1(T)	3(T)	-( )	5(28)
FERNS AND ALLIED TAXA													
260 ADPE	-( )	-( )	-( )	1(1)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
251 ATFI	6(13)	2(T)	3(1)	2(T)	2(T)	-( )	-( )	-( )	1(T)	1(T)	-( )	-( )	-( )
255 GYDR	-( )	-( )	-( )	+(T)	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
258 POMU	2(T)	3(1)	3(1)	3(8)	4(T)	2(8)	1(T)	3(T)	4(T)	-( )	-( )	1(T)	-( )
259 PTAQ	4(5)	1(T)	3(T)	5(1)	-( )	1(T)	4(4)	5(2)	2(3)	-( )	1(T)	3(T)	3(1)
GRAMINOIDS													
301 AGSP	-( )	-( )	-( )	-( )	-( )	-( )	+(3)	-( )	+(T)	-( )	-( )	-( )	1(T)
304 BRVU	10(3)	9(4)	8(T)	9(3)	7(1)	5(T)	7(1)	7(2)	7(2)	6(3)	4(T)	3(2)	2(T)
305 CACA	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
307 CARU	-( )	-( )	-( )	2(7)	2(5)	-( )	4(18)	7(13)	3(17)	6(6)	7(3)	3(5)	7(14)
309 CAGE	2(T)	1(T)	-( )	2(1)	2(T)	1(T)	2(T)	3(1)	2(2)	4(1)	-( )	3(T)	4(1)
311 CARO	6(1)	3(T)	2(T)	1(1)	2(6)	3(T)	2(T)	-( )	+(T)	-( )	1(T)	1(T)	1(T)
317 FEID	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
325 LUHI	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	-( )

(con.)

APPENDIX C (Con.)

SERIES H.T. PHASE	ABGR SETR	ABGR ASCA MEFE	ABGR ASCA TABR	ABGR ASCA ASCA	ABGR CLUN MEFE	ABGR CLUN TABR	ABGR CLUN XETE	ABGR CLUN PHMA	ABGR CLUN CLUN	ABGR LIBO LIBO	ABGR LIBO XETE	ABGR XETE COOC	ABGR XETE VAGL
NO. OF PLOTS	N= 9	N= 12	N= 21	N= 32	N= 17	N= 11	N= 38	N= 21	N= 27	N= 11	N= 7	N= 15	N= 16
PERENNIAL FORBS													
401 ACMI	-( )	-( )	-( )	+(T)	-( )	-( )	1(T)	1(T)	1(T)	3(T)	-( )	1(T)	-( )
402 ACRU	9(4)	6(T)	5(5)	2(7)	1(T)	-( )	1(T)	+(3)	1(1)	-( )	-( )	-( )	-( )
403 ADBI	6(4)	2(5)	6(2)	8(3)	1(T)	4(T)	3(T)	7(2)	8(4)	5(4)	1(3)	2(1)	-( )
407 ANPI	9(4)	9(1)	10(2)	8(1)	9(2)	10(2)	9(1)	7(T)	8(2)	9(T)	10(T)	9(T)	6(1)
418 ARNU	-( )	-( )	-( )	-( )	-( )	-( )	-( )	+(T)	-( )	-( )	-( )	-( )	-( )
420 ARMA	8(2)	6(15)	4(T)	6(3)	2(1)	3(1)	4(T)	5(1)	5(2)	4(1)	4(T)	5(T)	5(1)
421 ARCO	1(15)	2(26)	+(T)	1(T)	1(T)	1(T)	1(1)	3(9)	5(7)	5(T)	1(T)	5(30)	1(38)
422 ARLA	-( )	3(32)	3(27)	2(32)	3(24)	-( )	4(14)	1(1)	1(6)	-( )	3(20)	1(2)	2(1)
564 ASCA	9(13)	10(5)	10(5)	10(3)	-( )	-( )	1(T)	1(T)	+(T)	-( )	-( )	-( )	-( )
426 ASCO	-( )	-( )	1(1)	2(T)	1(T)	-( )	2(T)	5(T)	1(T)	1(T)	3(T)	1(T)	1(T)
431 BASA	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
442 CHUM	2(2)	6(T)	5(T)	5(1)	9(4)	10(2)	9(2)	3(1)	7(T)	8(3)	10(2)	9(T)	10(2)
445 CIAL	7(24)	2(T)	+(T)	2(1)	-( )	1(T)	-( )	+(T)	1(T)	1(T)	-( )	1(T)	-( )
447 CLUN	10(10)	10(5)	10(7)	10(3)	8(3)	9(7)	9(2)	10(4)	10(3)	-( )	-( )	1(T)	-( )
449 COOC	10(14)	9(11)	10(13)	8(10)	10(13)	10(12)	9(14)	6(3)	9(16)	7(5)	10(7)	10(13)	5(T)
452 COCA	-( )	3(5)	4(2)	2(3)	5(10)	4(8)	4(7)	1(T)	3(7)	1(T)	-( )	1(T)	1(8)
454 DIHO	1(15)	2(1)	2(T)	7(8)	1(2)	-( )	1(T)	7(1)	4(5)	-( )	-( )	-( )	-( )
455 DITR	1(T)	-( )	+(T)	2(T)	-( )	-( )	1(19)	2(T)	3(T)	3(T)	1(T)	-( )	-( )
458 DOJE	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
465 FRVE	-( )	2(T)	1(1)	6(T)	2(1)	1(T)	5(1)	7(1)	3(T)	7(T)	4(T)	5(T)	4(1)
467 FRAG	2(T)	-( )	+(T)	1(1)	-( )	2(2)	+(T)	-( )	2(T)	-( )	-( )	-( )	-( )
466 FRVI	2(2)	1(T)	+(3)	-( )	1(T)	2(T)	1(2)	3(T)	2(3)	2(T)	-( )	1(T)	1(1)
471 GATR	10(2)	7(T)	5(T)	9(1)	4(T)	5(T)	6(T)	9(1)	7(2)	5(T)	1(T)	1(T)	1(1)
476 GOOB	4(T)	9(T)	7(T)	4(T)	7(T)	10(T)	7(T)	3(T)	6(T)	5(1)	6(T)	9(T)	5(1)
482 HECY	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	+(T)	1(T)	-( )	-( )	-( )
489 LICA	-( )	-( )	-( )	-( )	-( )	-( )	+(T)	-( )	-( )	-( )	-( )	-( )	-( )
800 LIVE	-( )	1(T)	-( )	1(T)	2(T)	-( )	2(1)	1(3)	+(3)	-( )	-( )	1(T)	-( )
647 MEPA	3(2)	-( )	+(T)	+(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
501 MIBR	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
649 MIPE	1(T)	-( )	-( )	-( )	-( )	-( )	+(T)	-( )	-( )	-( )	-( )	-( )	-( )
502 MIST	7(3)	5(T)	6(T)	5(T)	4(1)	5(1)	2(T)	4(T)	6(T)	5(T)	1(T)	2(T)	1(1)
505 OSCH	10(3)	8(T)	8(T)	8(T)	5(T)	6(T)	6(T)	7(T)	8(2)	6(T)	3(T)	4(T)	2(1)
507 PEBR	-( )	-( )	-( )	1(T)	1(T)	-( )	2(T)	-( )	1(T)	-( )	-( )	-( )	1(3)
508 PECO	-( )	1(T)	-( )	-( )	-( )	-( )	+(T)	-( )	-( )	-( )	-( )	-( )	-( )
509 PERA	-( )	2(T)	1(T)	+(T)	5(T)	2(8)	4(T)	-( )	3(T)	3(T)	4(T)	7(T)	4(1)
519 POPU	3(7)	2(1)	2(1)	2(1)	2(T)	1(T)	1(T)	-( )	-( )	-( )	-( )	1(T)	1(1)
526 PYAS	-( )	2(T)	2(1)	2(T)	6(2)	4(1)	3(1)	+(T)	1(T)	1(T)	3(T)	2(1)	2(1)
529 PYSE	1(T)	5(T)	4(T)	3(T)	5(1)	5(1)	5(T)	2(T)	3(1)	4(T)	4(T)	5(T)	4(T)
539 SETR	8(2)	1(T)	1(T)	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
542 SMRA	-( )	-( )	1(T)	3(T)	2(T)	-( )	2(T)	7(T)	3(1)	2(T)	1(T)	4(T)	1(1)
543 SMST	9(9)	8(2)	10(4)	10(4)	4(T)	6(T)	6(1)	9(6)	10(7)	6(T)	1(T)	4(T)	1(3)
546 STAM	1(T)	-( )	+(T)	+(T)	-( )	-( )	+(T)	-( )	+(T)	-( )	-( )	-( )	-( )
810 SYPL	6(4)	3(2)	3(T)	1(T)	1(T)	-( )	1(1)	-( )	+(T)	-( )	-( )	-( )	-( )
547 THOC	10(6)	7(2)	8(2)	8(2)	6(T)	5(2)	5(T)	7(T)	5(3)	5(T)	6(1)	6(3)	1(8)
548 TITR	7(7)	7(3)	10(2)	4(1)	6(T)	6(2)	2(4)	-( )	4(3)	-( )	-( )	-( )	-( )
563 TRCA	1(38)	-( )	-( )	+(T)	-( )	-( )	+(T)	-( )	+(T)	-( )	-( )	-( )	-( )
560 TROV	10(2)	10(T)	10(T)	6(T)	9(T)	8(1)	5(T)	3(T)	6(1)	5(T)	1(T)	6(T)	2(T)
551 VASI	6(7)	-( )	1(T)	1(T)	-( )	-( )	1(T)	-( )	1(T)	1(T)	-( )	1(T)	1(T)
552 VEVI	1(T)	2(T)	+(T)	1(2)	1(T)	1(T)	-( )	+(T)	1(T)	-( )	-( )	-( )	1( )
554 VIAD	-( )	-( )	+(T)	1(T)	-( )	-( )	1(T)	2(T)	1(T)	2(T)	-( )	1(T)	1( )
556 VIGL	9(7)	5(T)	5(2)	2(1)	1(T)	-( )	+(T)	-( )	1(T)	-( )	-( )	-( )	1( )
557 VIOR	7(11)	10(3)	10(2)	7(1)	9(4)	10(5)	8(2)	3(T)	7(1)	6(3)	9(T)	7(3)	6(T)
558 XETE	4(2)	9(13)	6(3)	4(T)	9(19)	8(16)	10(21)	1(T)	2(2)	5(2)	9(28)	10(21)	10(40)

CODE TO CONSTANCY VALUES

+ = 0-5%	2 = 15-25%	4 = 35-45%	6 = 55-65%	8 = 75-85%	10 = 95-100%
1 = 5-15%	3 = 25-35%	5 = 45-55%	7 = 65-75%	9 = 85-95%	

(Average percent canopy coverage, on plots where the species occurred)

(con.)

APPENDIX C (Con.)

SERIES H.T. PHASE	ABGR PHMA COOC	ABGR PHMA PHMA	ABGR SPBE	PSME PHMA SMST	PSME PHMA PHMA	PSME VACA	PSME SYAL	PSME SPBE	PSME CARU ARUV	PSME CARU CARU	PSME FEID	PSME AGSP
NO. OF PLOTS	N= 7	N= 18	N= 8	N= 22	N= 35	N= 4	N= 7	N= 7	N= 9	N= 5	N= 2	N= 3
TREE SPECIES												
1 ABGR	10(23)	9(24)	10(26)	1(T)	2(T)	2(T)	1(T)	3(2)	-( )	-( )	-( )	3(T)
2 ABLA	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	4(T)	-( )	-( )
3 BEPA	-( )	-( )	-( )	+(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
6 LAOC	-( )	2(19)	1(T)	2(10)	1(1)	2(T)	1(3)	-( )	4(8)	-( )	-( )	-( )
7 PIEN	-( )	-( )	2(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
9 PIAL	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
10 PICO	1(T)	3(16)	2(50)	-( )	1(1)	10(27)	1(15)	1(15)	7(14)	4(T)	5(T)	-( )
12 PIMO	-( )	3(3)	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
13 PIPO	3(9)	6(20)	6(14)	9(24)	8(28)	10(12)	10(35)	7(22)	4(62)	-( )	10(32)	10(38)
16 PSME	10(59)	9(53)	10(31)	10(73)	10(51)	10(29)	10(57)	10(40)	9(42)	10(54)	10(20)	10(15)
17 THPL	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
18 TSHE	-( )	1(T)	-( )	+(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
19 TSME	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
SHRUB SPECIES												
102 ACGL	10(9)	7(8)	6(3)	5(6)	4(6)	-( )	1(3)	-( )	1(T)	4(T)	-( )	-( )
104 ALSI	-( )	-( )	-( )	+(T)	1(8)	-( )	-( )	-( )	1(T)	-( )	-( )	-( )
105 AMAL	9(3)	7(5)	9(3)	8(4)	7(5)	5(2)	9(5)	9(4)	2(T)	6(T)	5(T)	7(2)
110 CRDO	-( )	-( )	1(T)	-( )	-( )	-( )	1(T)	1(T)	-( )	-( )	-( )	3(T)
111 HODI	9(9)	8(17)	7(1)	9(15)	7(22)	2(T)	1(3)	-( )	1(T)	-( )	5(T)	3(3)
113 LEGL	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
115 LOUT	4(T)	3(1)	5(4)	1(1)	2(T)	-( )	-( )	-( )	1(3)	4(2)	-( )	3(T)
116 MEFE	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
117 OPHO	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
118 PAMY	-( )	4(17)	1(38)	1(T)	1(1)	5(32)	1(T)	-( )	3(6)	2(T)	-( )	-( )
119 PHLE	4(6)	2(7)	1(38)	3(8)	1(13)	-( )	1(T)	1(T)	-( )	-( )	-( )	3(T)
122 PHMA	9(16)	9(34)	5(1)	10(33)	9(34)	-( )	1(T)	1(3)	1(T)	2(3)	-( )	-( )
124 PRVI	-( )	-( )	1(T)	2(5)	2(T)	-( )	4(T)	4(5)	-( )	-( )	5(T)	3(T)
127 RHAL	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
130 RILA	-( )	1(T)	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
133 ROGY	9(1)	9(8)	9(3)	8(5)	5(3)	5(T)	4(T)	4(1)	2(T)	2(3)	-( )	3(15)
161 RONU	-( )	1(T)	-( )	1(2)	+(3)	-( )	-( )	-( )	1(T)	-( )	-( )	-( )
134 ROWO	-( )	1(T)	-( )	-( )	1(T)	2(T)	-( )	-( )	-( )	-( )	-( )	-( )
136 RUPA	6(1)	4(1)	5(T)	3(T)	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )
137 SASC	-( )	1(2)	2(8)	1(6)	1(1)	-( )	-( )	-( )	-( )	-( )	-( )	-( )
142 SPBE	7(1)	7(3)	10(2)	9(7)	8(5)	7(T)	10(9)	10(18)	6(4)	10(2)	10(T)	3(T)
143 SYAL	9(14)	8(16)	7(16)	10(19)	9(16)	5(19)	10(23)	7(3)	4(1)	6(1)	10(2)	3(3)
144 TABR	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
146 VAGL	1(T)	4(3)	5(1)	-( )	1(2)	2(T)	-( )	-( )	2(T)	-( )	-( )	-( )
LOW WOODY PLANTS AND DWARF SHRUBS												
201 ARUV	-( )	-( )	-( )	-( )	1(T)	10(35)	-( )	-( )	9(5)	-( )	5(3)	-( )
203 BERE	3(19)	6(4)	6(2)	6(T)	5(4)	10(4)	4(7)	1(T)	4(1)	8(2)	5(T)	-( )
205 GAHU	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
206 LIBO	-( )	1(T)	2(T)	-( )	-( )	2(T)	-( )	-( )	1(3)	-( )	-( )	-( )
219 PHEM	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
218 SADO	-( )	2(T)	4(T)	1(19)	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	3(15)
145 VACA	-( )	-( )	-( )	-( )	-( )	10(1)	-( )	-( )	2(T)	-( )	-( )	-( )
147 VAMY	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	-( )
148 VASC	-( )	-( )	-( )	-( )	-( )	5(T)	-( )	-( )	1(15)	-( )	-( )	-( )
FERNS AND ALLIED TAXA												
260 ADPE	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
251 ATFI	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
255 GYDR	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
258 POMU	7(8)	1(T)	1(T)	2(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
259 PTAQ	3(T)	2(1)	1(3)	1(T)	1(2)	-( )	1(T)	4(1)	1(T)	-( )	5(T)	10(30)
GRAMINOIDS												
301 AGSP	-( )	1(T)	-( )	1(T)	3(14)	2(15)	6(14)	7(31)	1(T)	4(2)	10(26)	10(15)
304 BRVU	9(T)	7(T)	4(1)	7(7)	3(2)	-( )	3(9)	-( )	-( )	-( )	-( )	-( )
305 CACA	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
307 CARU	3(2)	8(12)	6(13)	6(15)	7(32)	10(17)	6(5)	6(1)	9(54)	10(51)	5(3)	3(3)
309 CAGE	1(T)	3(T)	4(5)	5(17)	4(16)	5(9)	6(20)	3(9)	1(T)	10(19)	10(T)	3(T)
311 CARO	-( )	-( )	2(T)	1(T)	1(1)	2(T)	1(T)	3(T)	-( )	-( )	5(T)	3(3)
317 FEID	-( )	-( )	-( )	-( )	1(2)	2(T)	3(2)	4(6)	4(T)	-( )	10(26)	7(3)
325 LUHI	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )

(con.)

APPENDIX C (Con.)

SERIES	ABGR	ABGR	ABGR	PSME	PSME	PSME	PSME	PSME	PSME	PSME	PSME	PSME
H.T.	PHMA	PHMA	SPBE	PHMA	PHMA	VACA	SYAL	SPBE	CARU	CARU	FEID	AGSP
PHASE	COOC	PHMA		SMST	PHMA				ARUV	CARU		
NO. OF PLOTS	N= 7	N= 18	N= 8	N= 22	N= 35	N= 4	N= 7	N= 7	N= 9	N= 5	N= 2	N= 3
PERENNIAL FORBS												
401 ACMI	-( )	2(T)	4(T)	1(T)	5(1)	7(T)	3(2)	4(2)	7(T)	8(1)	10(T)	10(1)
402 ACRU	-( )	1(T)	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
403 ADBI	7(4)	7(2)	6(1)	6(2)	2(T)	-( )	-( )	-( )	-( )	-( )	5(T)	3(3)
407 ANPI	7(2)	8(T)	7(4)	5(2)	3(T)	5(T)	1(T)	-( )	-( )	2(3)	-( )	-( )
418 ARNU	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
420 ARMA	6(1)	3(4)	5(4)	6(8)	4(4)	5(T)	3(8)	-( )	-( )	2(T)	-( )	-( )
421 ARCO	1(3)	3(19)	5(4)	8(14)	5(12)	-( )	4(19)	1(3)	4(5)	10(6)	-( )	-( )
422 ARLA	3(2)	1(T)	-( )	-( )	+(T)	-( )	-( )	-( )	-( )	2(3)	-( )	-( )
564 ASCA	-( )	-( )	-( )	+(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
426 ASCO	-( )	4(T)	5(T)	5(1)	4(1)	-( )	-( )	-( )	-( )	4(T)	-( )	-( )
431 BASA	-( )	-( )	-( )	+(T)	2(3)	-( )	1(3)	4(26)	1(T)	2(T)	5(T)	10(18)
442 CHUM	1(T)	3(T)	5(T)	+(T)	1(T)	2(T)	-( )	-( )	3(1)	2(T)	-( )	-( )
445 CIAL	1(T)	2(T)	-( )	2(11)	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )
447 CLUN	1(T)	1(T)	-( )	+(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
449 COOC	10(21)	2(T)	4(T)	+(T)	1(2)	-( )	-( )	-( )	-( )	2(T)	-( )	-( )
452 COCA	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
454 DIHO	6(14)	4(T)	2(T)	6(3)	+(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )
455 DITR	3(8)	3(T)	1(T)	4(T)	3(T)	-( )	-( )	-( )	1(T)	2(T)	-( )	-( )
458 DOJE	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
465 FRVE	6(T)	7(5)	4(T)	6(6)	5(3)	5(2)	1(T)	-( )	4(T)	2(3)	5(T)	3(3)
467 FRAG	-( )	-( )	1(15)	2(2)	2(5)	-( )	4(2)	4(T)	3(5)	6(T)	-( )	-( )
466 FRVI	-( )	1(T)	2(T)	1(T)	2(1)	5(T)	1(T)	1(T)	-( )	-( )	5(T)	7(2)
471 GATR	10(3)	7(3)	6(3)	9(3)	3(T)	-( )	1(T)	1(T)	-( )	-( )	-( )	-( )
476 GOOB	4(1)	4(T)	4(T)	4(T)	3(T)	-( )	-( )	3(T)	2(T)	4(T)	-( )	-( )
482 HECY	1(T)	1(T)	1(T)	1(T)	2(T)	5(2)	3(T)	1(T)	6(1)	8(T)	-( )	-( )
489 LICA	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
800 LIVE	7(2)	1(T)	2(T)	1(8)	1(5)	-( )	1(15)	1(38)	-( )	-( )	-( )	-( )
647 MEPA	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
501 MIBR	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
649 MIPE	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
502 MIST	3(2)	3(2)	5(1)	5(2)	2(T)	2(T)	-( )	-( )	1(T)	2(T)	-( )	-( )
505 OSCH	4(T)	7(T)	6(T)	9(1)	3(1)	-( )	3(T)	-( )	-( )	4(T)	-( )	-( )
507 PEBR	-( )	-( )	1(T)	-( )	+(T)	-( )	-( )	-( )	1(T)	2(T)	-( )	-( )
508 PECO	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
509 PERA	1(T)	-( )	2(T)	+(T)	+(T)	-( )	-( )	-( )	-( )	2(T)	-( )	-( )
519 POPU	-( )	-( )	-( )	+(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
526 PYAS	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
529 PYSE	1(T)	1(T)	2(T)	+(T)	-( )	-( )	-( )	-( )	2(T)	2(T)	-( )	-( )
539 SETR	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
542 SMRA	1(T)	7(T)	5(T)	9(4)	6(2)	-( )	6(T)	4(1)	3(1)	8(T)	-( )	-( )
543 SMST	7(4)	7(2)	5(T)	6(3)	2(T)	-( )	-( )	-( )	-( )	2(T)	-( )	-( )
546 STAM	-( )	-( )	-( )	+(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
810 SYPL	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
547 THOC	6(T)	6(T)	2(T)	5(4)	4(4)	-( )	-( )	-( )	2(T)	6(1)	-( )	-( )
548 TITR	-( )	-( )	-( )	+(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
563 TRCA	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
560 TROV	4(T)	2(T)	2(T)	2(1)	1(T)	-( )	1(T)	-( )	-( )	-( )	-( )	-( )
551 VASI	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
552 VEVI	-( )	-( )	-( )	1(T)	+(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )
554 VIAD	1(T)	2(T)	2(2)	2(1)	3(T)	-( )	1(T)	-( )	1(T)	2(T)	-( )	3(T)
556 VIGL	1(T)	-( )	-( )	-( )	+(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )
557 VIOR	-( )	1(T)	1(T)	+(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
558 XETE	-( )	1(2)	2(T)	-( )	1(19)	5(3)	-( )	-( )	1(T)	2(15)	-( )	-( )

CODE TO CONSTANCY VALUES

+ = 0-5%	2 = 15-25%	4 = 35-45%	6 = 55-65%	8 = 75-85%	10 = 95-100%
1 = 5-15%	3 = 25-35%	5 = 45-55%	7 = 65-75%	9 = 85-95%	

(Average percent canopy coverage, on plots where the species occurred)

(con.)

APPENDIX C (Con.)

SERIES H.T. PHASE	PIPO PHMA	PIPO SYAL	PIPO FEID	PIPO AGSP	PICO VASC	PICO VACA	PICO XETE
NO. OF PLOTS	N= 7	N= 14	N= 13	N= 8	N= 7	N= 3	N= 2
TREE SPECIES							
1 ABGR	-( )	-( )	-( )	-( )	1(T)	3(T)	5(T)
2 ABLA	-( )	-( )	-( )	-( )	7(T)	10(T)	10(T)
3 BEPA	-( )	-( )	-( )	-( )	-( )	-( )	-( )
6 LAOC	-( )	-( )	-( )	-( )	-( )	-( )	-( )
7 PIEN	-( )	-( )	-( )	-( )	3(T)	3(T)	10(T)
9 PIAL	-( )	-( )	-( )	-( )	-( )	-( )	-( )
10 PICO	-( )	-( )	-( )	-( )	10(66)	10(74)	10(80)
12 PIMO	-( )	-( )	-( )	-( )	-( )	-( )	-( )
13 PIPO	10(65)	10(52)	10(50)	10(23)	-( )	-( )	-( )
16 PSME	-( )	1(T)	1(T)	1(T)	1(T)	3(T)	5(T)
17 THPL	-( )	-( )	-( )	-( )	-( )	-( )	-( )
18 TSHE	-( )	-( )	-( )	-( )	-( )	-( )	-( )
19 TSME	-( )	-( )	-( )	-( )	-( )	-( )	-( )
SHRUB SPECIES							
102 ACGL	1(T)	-( )	-( )	-( )	-( )	-( )	-( )
104 ALSI	-( )	-( )	-( )	-( )	3(T)	-( )	5(3)
105 AMAL	10(4)	9(6)	4(T)	1(T)	-( )	3(T)	-( )
110 CRDO	9(1)	6(12)	-( )	-( )	-( )	-( )	-( )
111 HODI	9(15)	1(2)	1(T)	-( )	-( )	-( )	-( )
113 LEGL	-( )	-( )	-( )	-( )	1(T)	-( )	-( )
115 LOUT	-( )	-( )	-( )	-( )	1(T)	3(T)	-( )
116 MEFE	-( )	-( )	-( )	-( )	-( )	-( )	5(T)
117 OPHO	-( )	-( )	-( )	-( )	-( )	-( )	-( )
118 PAMY	-( )	-( )	-( )	-( )	-( )	-( )	-( )
119 PHLE	1(15)	2(2)	-( )	1(T)	-( )	-( )	-( )
122 PHMA	10(65)	1(T)	1(T)	1(T)	-( )	-( )	-( )
124 PRVI	6(8)	6(2)	1(T)	1(T)	-( )	-( )	-( )
127 RHAL	-( )	-( )	-( )	-( )	-( )	-( )	-( )
130 RILA	-( )	-( )	-( )	-( )	-( )	-( )	-( )
133 ROGY	-( )	1(T)	2(T)	1(T)	-( )	3(T)	-( )
161 RONU	-( )	1(T)	-( )	-( )	-( )	-( )	-( )
134 ROWO	10(4)	7(8)	-( )	1(T)	-( )	-( )	-( )
136 RUPA	1(T)	-( )	-( )	-( )	-( )	-( )	-( )
137 SASC	-( )	-( )	-( )	1(T)	4(T)	-( )	-( )
142 SPBE	10(10)	6(19)	2(1)	1(T)	9(T)	10(T)	5(T)
143 SYAL	10(32)	9(36)	2(T)	2(T)	-( )	3(T)	-( )
144 TABR	-( )	-( )	-( )	-( )	-( )	-( )	-( )
146 VAGL	-( )	-( )	-( )	-( )	4(2)	3(T)	10(50)
LOW WOODY PLANTS AND DWARF SHRUBS							
201 ARUV	-( )	-( )	-( )	-( )	4(1)	10(T)	-( )
203 BERE	6(3)	4(15)	-( )	1(T)	-( )	-( )	-( )
205 GAHU	-( )	-( )	-( )	-( )	-( )	-( )	-( )
206 LIBO	-( )	-( )	-( )	-( )	-( )	3(T)	-( )
219 PHEM	-( )	-( )	-( )	-( )	-( )	-( )	-( )
218 SADO	-( )	-( )	-( )	-( )	-( )	-( )	-( )
145 VACA	4(T)	1(3)	-( )	-( )	3(2)	10(38)	-( )
147 VAMY	-( )	-( )	-( )	-( )	-( )	-( )	-( )
148 VASC	-( )	-( )	-( )	-( )	10(55)	10(46)	5(3)
FERNS AND ALLIED TAXA							
260 ADPE	-( )	-( )	-( )	-( )	-( )	-( )	-( )
251 ATFI	-( )	-( )	-( )	-( )	-( )	-( )	-( )
255 GYDR	-( )	-( )	-( )	-( )	-( )	-( )	-( )
258 POMU	3(T)	1(T)	-( )	-( )	-( )	-( )	-( )
259 PTAQ	-( )	1(T)	2(2)	-( )	-( )	-( )	-( )
GRAMINOIDS							
301 AGSP	3(3)	6(6)	7(13)	10(47)	-( )	-( )	-( )
304 BRVU	7(3)	1(T)	-( )	-( )	-( )	-( )	-( )
305 CACA	-( )	-( )	-( )	-( )	-( )	-( )	-( )
307 CARU	9(6)	4(10)	2(6)	1(T)	10(10)	10(19)	10(19)
309 CAGE	6(15)	1(20)	2(6)	1(T)	-( )	3(T)	5(T)
311 CARO	1(3)	2(2)	2(T)	-( )	1(T)	-( )	-( )
317 FEID	-( )	1(T)	10(61)	2(2)	-( )	-( )	-( )
325 LUHI	-( )	-( )	-( )	-( )	-( )	-( )	-( )

(con.)

APPENDIX C (Con.)

SERIES H.T. PHASE	PIPO PHMA	PIPO SYAL	PIPO FEID	PIPO AGSP	PICO VASC	PICO VACA	PICO XETE
NO. OF PLOTS	N= 7	N= 14	N= 13	N= 8	N= 7	N= 3	N= 2
PERENNIAL FORBS							
401 ACMI	7(2)	7(T)	9(1)	7(1)	-( )	10(T)	-( )
402 ACRU	-( )	-( )	-( )	-( )	-( )	-( )	-( )
403 ADBI	-( )	-( )	-( )	-( )	-( )	-( )	-( )
407 ANPI	1(T)	-( )	-( )	-( )	4(T)	10(T)	5(T)
418 ARNU	-( )	-( )	-( )	-( )	-( )	-( )	-( )
420 ARMA	4(7)	1(T)	1(T)	-( )	-( )	3(T)	5(T)
421 ARCO	1(3)	-( )	1(T)	1(T)	-( )	3(T)	-( )
422 ARLA	-( )	-( )	-( )	-( )	-( )	-( )	5(15)
564 ASCA	-( )	-( )	-( )	-( )	-( )	-( )	-( )
426 ASCO	1(3)	-( )	-( )	-( )	-( )	-( )	-( )
431 BASA	-( )	4(7)	9(5)	9(3)	-( )	-( )	-( )
442 CHUM	1(T)	-( )	-( )	-( )	7(T)	7(2)	10(T)
445 CIAL	3(T)	-( )	-( )	-( )	-( )	-( )	-( )
447 CLUN	-( )	-( )	-( )	-( )	-( )	-( )	-( )
449 COOC	-( )	-( )	-( )	-( )	-( )	-( )	5(T)
452 COCA	-( )	-( )	-( )	-( )	-( )	-( )	-( )
454 DIHO	-( )	-( )	-( )	-( )	-( )	-( )	-( )
455 DITR	-( )	-( )	-( )	-( )	-( )	-( )	-( )
458 DOJE	-( )	-( )	-( )	-( )	-( )	-( )	-( )
465 FRVE	-( )	3(T)	1(T)	1(T)	-( )	-( )	-( )
467 FRAG	9(2)	2(T)	2(2)	-( )	-( )	-( )	-( )
466 FRVI	-( )	-( )	-( )	-( )	1(T)	7(2)	-( )
471 GATR	1(T)	1(T)	1(T)	-( )	-( )	-( )	-( )
476 GOOB	-( )	-( )	-( )	-( )	-( )	-( )	5(T)
482 HECY	6(T)	3(2)	-( )	1(T)	-( )	-( )	-( )
489 LICA	-( )	-( )	-( )	-( )	-( )	-( )	-( )
800 LIVE	-( )	-( )	-( )	-( )	-( )	-( )	-( )
647 MEPA	-( )	-( )	-( )	-( )	-( )	-( )	-( )
501 MIBR	-( )	-( )	-( )	-( )	-( )	-( )	-( )
649 MIPE	-( )	-( )	-( )	-( )	-( )	-( )	-( )
502 MIST	-( )	1(T)	-( )	-( )	-( )	-( )	-( )
505 OSCH	7(3)	1(2)	-( )	-( )	-( )	-( )	-( )
507 PEBR	-( )	-( )	-( )	-( )	-( )	-( )	-( )
508 PECO	-( )	-( )	-( )	-( )	-( )	-( )	-( )
509 PERA	-( )	-( )	-( )	-( )	-( )	3(T)	-( )
519 POPU	-( )	-( )	-( )	-( )	-( )	-( )	-( )
526 PYAS	-( )	-( )	-( )	-( )	-( )	-( )	-( )
529 PYSE	-( )	-( )	-( )	-( )	-( )	3(T)	5(T)
539 SETR	-( )	-( )	-( )	-( )	-( )	-( )	-( )
542 SMRA	1(T)	1(T)	-( )	-( )	-( )	-( )	-( )
543 SMST	-( )	1(T)	-( )	-( )	-( )	-( )	-( )
546 STAM	-( )	-( )	-( )	-( )	-( )	-( )	-( )
810 SYPL	-( )	-( )	-( )	-( )	-( )	-( )	-( )
547 THOC	4(11)	-( )	-( )	-( )	-( )	3(T)	-( )
548 TITR	-( )	-( )	-( )	-( )	-( )	-( )	-( )
563 TRCA	-( )	-( )	-( )	-( )	-( )	-( )	-( )
560 TROV	-( )	-( )	-( )	-( )	-( )	-( )	-( )
551 VASI	-( )	-( )	-( )	-( )	-( )	-( )	-( )
552 VEVI	-( )	-( )	-( )	-( )	-( )	-( )	-( )
554 VIAD	6(T)	1(T)	-( )	-( )	-( )	3(T)	-( )
556 VIGL	-( )	-( )	-( )	-( )	-( )	-( )	-( )
557 VIOR	-( )	-( )	-( )	-( )	-( )	7(T)	10(T)
558 XETE	-( )	-( )	-( )	-( )	9(7)	10(6)	10(26)

CODE TO CONSTANCY VALUES

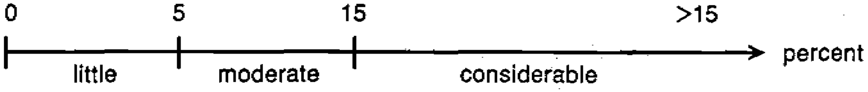
+ = 0-5% 2 = 15-25% 4 = 35-45% 6 = 55-65% 8 = 75-85% 10 = 95-100%
1 = 5-15% 3 = 25-35% 5 = 45-55% 7 = 65-75% 9 = 85-95%

(Average percent canopy coverage, on plots where the species occurred)

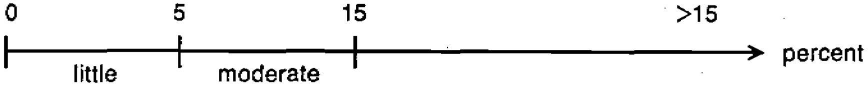
APPENDIX D: SUBSTRATE FEATURES OF NORTHERN IDAHO HABITAT TYPES

The following table presents soils data by habitat type and phase in format similar to that for vegetative data (appendix C). Coarse-fragment rock types are expressed as a percentage of the stands in which a given rock type was the apparent residual parent material. Note that ash and loess content, which constitute at least a fraction of the parent material in a substantial portion of the plots, are noted only in the h.t. soils section narrative because their contribution could not be unambiguously ascertained. Textural classes are also shown as a percentage of stands having a given soil texture. Mean values ($\bar{x}$) are presented for all other data categories. "Upper profile" and "lower profile" are arbitrarily defined respectively as (1) that profile portion including any A horizon or the uppermost horizon if an A horizon is not present and (2) that root-containing portion of the profile above the C or R horizons and below the "upper profile"; both terms may express an average of more than one horizon. The terminology diagramed below and used in the narratives is based primarily on USDA Soil Conservation Service (1975) definitions, with some modifications.

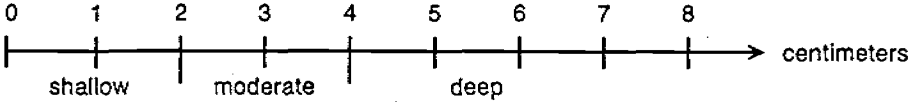
Surface Rock Exposed (includes cobbles, stones, and fixed rock; material >3 inches [7.6 cm] diameter)



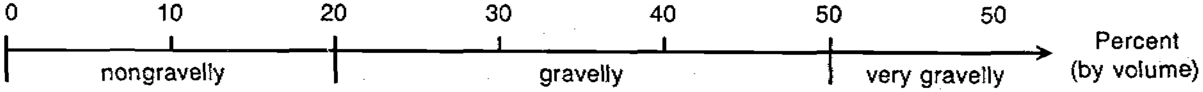
Bare Soil Exposed (includes soil and gravel; material <3 inches [7.6 cm])



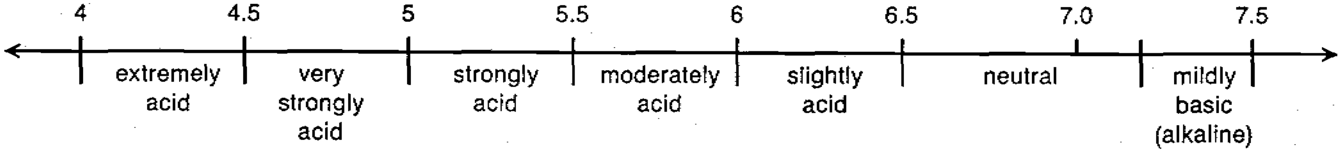
Duff Depth



Gravel Content



Reaction (pH units)



(con.)

APPENDIX D (Con.)

Soil characteristics	*Tsuga heterophylla* series							*Thuja plicata* series										
	GYDR h.t.	ASCA h.t.			CLUN			OPHO	ATFI		ADPE	GYDR	ASCA			CLUN		
		ARNU phase	MEFE phase	ASCA phase	ARNU phase	MEFE phase	CLUN phase		ATFI	ADPE			MEFE	TABR	ASCA	MEFE	XETE	CLUN
	n=6	n=4	n=3	n=15	n=6	n=4	n=16	n=4	n=6	n=2	n=4	n=4	n=5	n=2	n=11	n=3	n=3	n=6
	COARSE FRAGMENT ROCK TYPES (percent of stands)																	
SEDIMENTARY																		
Calcareous	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Noncalcareous	50	—	67	13	—	—	19	—	33	—	25	25	—	—	9	—	33	17
METAMORPHIC																		
Argillite	—	—	—	—	—	—	—	—	—	—	—	—	—	100	27	33	—	—
Quartzite	17	—	33	27	—	50	25	—	50	—	—	75	60	—	18	67	67	50
Gneiss & schist & phyllite	—	—	—	—	—	—	—	—	—	—	75	—	40	—	18	—	—	33
Miscellaneous	—	—	—	—	—	—	—	—	—	—	—	—	—	—	9	—	—	—
IGNEOUS																		
Basalt & andesite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dacite, trachyte, & latite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Rhyolite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other volcanics	—	—	—	7	—	25	—	—	—	—	—	—	—	—	9	—	—	—
Quartz monzonite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Granitics (undifferentiated)	—	—	—	13	—	25	25	—	16	—	—	—	—	—	—	—	—	—
Miscellaneous	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
MIXED (e.g., alluvium, glacial till)	33	100	—	40	100	—	31	100	—	100	—	—	—	—	9	—	—	—
	SUBSTRATE CHARACTERISTICS																	
EFFECTIVE ROOTING DEPTH (x̄ in cm)	56	35	42	38	56	55	45	31	34	100	62	45	46	56	50	41	43	61
EXPOSED ROCK (x̄ in %)	0	<1	<1	<1	0	<1	<1	0	0	0	0	<1	0	0	0	<1	<1	0
EXPOSED SOIL (x̄ in %)	0	0	<1	<1	0	0	<1	0	0	0	<1	0	0	0	0	0	<1	0
DUFF DEPTH (x̄ in cm)	5.6	3.0	5.0	4.0	4.4	4.3	5.6	4.0	5.4	4.8	4.2	8.1	4.5	5.3	5.2	5.1	5.1	4.7
GRAVEL CONTENT UPPER PROFILE (x̄ in %)	8	32	5	20	2	24	15	16	10	5	5	25	13	3	20	22	15	11
GRAVEL CONTENT LOWER PROFILE (x̄ in %)	8	40	55	41	14	44	24	40	25	5	5	43	31	7	25	50	35	12
REACTION UPPER PROFILE (x̄ pH)	6.0	5.4	5.4	6.1	6.0	5.9	5.6	5.7	5.7	6.4	6.5	6.2	6.1	6.4	6.4	5.7	6.1	6.5
REACTION LOWER PROFILE (x̄ pH)	6.1	5.8	5.7	6.0	6.3	5.7	6.1	5.7	5.6	6.6	6.1	6.3	6.2	6.2	6.4	5.9	5.8	6.3
TEXTURE CLASS (upper profile, % occurrence)																		
Sand & loamy sand	—	—	—	—	—	—	—	—	33	—	25	—	—	—	9	—	—	—
Sandy loam	—	25	—	—	—	—	—	25	—	—	—	—	—	—	—	—	—	17
Loam	17	25	—	13	—	—	—	25	—	—	—	—	—	50	18	—	—	17
Silt loam & silt	67	50	100	67	60	100	—	50	16	100	75	75	40	50	64	67	100	33
Silty clay loam & clay loam	17	—	—	20	40	—	25	—	50	—	—	25	60	—	9	33	—	33

(con.)

APPENDIX D (Con.)

Soil characteristics	*Tsuga mertensiana* series								*Abies lasiocarpa* series													
	STAM	CLUN		MEFE		XETE			CACA		STAM		CLUN		MEFE		VACA	XETE				LUHI
	MEFE	MEFE	XETE	XETE	LUHI	XETE	VASC	LUHI	LEGL	VACA	MEFE	LICA	MEFE	XETE	COOC	LUHI		COOC	VAGL	VASC	LUHI	
	n=3	n=10	n=4	n=4	n=9	n=7	n=13	n=7	n=4	n=2	n=9	n=8	n=6	n=6	n=4	n=4	n=4	n=7	n=4	n=10	n=7	n=3
COARSE FRAGMENT ROCK TYPES (percent of stands)																						
SEDIMENTARY																						
Calcareous	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Noncalcareous	—	10	—	—	22	—	—	—	—	—	—	38	—	—	—	—	—	—	—	—	—	—
METAMORPHIC																						
Argillite	33	20	—	—	—	29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Quartzite	—	30	75	—	22	43	31	43	—	—	11	—	17	33	—	—	—	14	25	—	—	—
Gneiss & schist & phyllite	33	—	—	50 25	22	—	23	14	—	—	—	25	17	17	25	—	25	28	25	—	28	—
Miscellaneous	33	10	25	—	—	14	8	—	—	—	—	—	—	—	—	—	—	—	—	10	14	—
IGNEOUS																						
Basalt & andesite	—	—	—	—	—	—	—	—	—	—	—	—	—	17	—	—	—	—	—	—	—	—
Dacite, trachyte, & latite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Rhyolite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other volcanics	—	—	—	—	—	—	—	—	—	—	—	12	—	—	—	—	—	—	—	—	—	—
Quartz monzonite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Granitics (undifferentiated)	—	30	—	50	33	14	38	43	100	50	66	12	67	17	75	100	50	57	50	80	57	100
Miscellaneous	—	—	—	—	—	—	—	—	—	—	—	—	—	17	—	—	—	—	—	10	—	—
MIXED (e.g., alluvium, glacial till)	—	—	—	—	—	—	—	—	—	50	33	12	—	—	—	—	25	—	—	—	—	—
SUBSTRATE CHARACTERISTICS																						
EFFECTIVE ROOTING DEPTH (x̄ in cm)	55	49	38	—	33	46	39	37	37	57	36	39	57	45	46	38	41	41	50	48	33	32
EXPOSED ROCK (x̄ in %)	0	1	<1	<1	1	1	2	1	<1	<1	<1	<1	0	<1	<1	6	<1	<1	<1	1	1	<1
EXPOSED SOIL (x̄ in %)	<1	<1	<1	0	<1	<1	2	<1	0	0	0	<1	0	0	1	0	0	<1	0	2	2	<1
DUFF DEPTH (x̄ in cm)	2.6	3.0	2.7	2.9	2.7	2.2	2.2	2.3	2.2	2.5	3.7	3.3	3.4	2.8	3.2	1.1	3.2	2.3	2.1	1.7	1.7	1.8
GRAVEL CONTENT UPPER PROFILE (x̄ in %)	30	10	21	15	15	23	12	22	13	15	16	14	21	16	—	30	12	19	14	13	25	22
GRAVEL CONTENT LOWER PROFILE (x̄ in %)	47	17	32	22	20	34	23	32	30	27	27	17	28	22	—	60	30	34	44	24	33	30
REACTION UPPER PROFILE (x̄ pH)	5.2	5.7	5.4	5.2	4.5	5.1	5.0	5.1	5.2	4.9	5.0	5.4	5.9	5.8	5.5	4.6	5.9	5.9	5.8	5.6	5.0	4.5
REACTION LOWER PROFILE (x̄ pH)	5.5	5.6	5.4	6.0	5.4	5.7	5.6	5.6	5.7	5.6	5.5	5.6	5.9	5.6	5.8	5.3	6.1	5.9	5.9	5.7	5.7	5.2
TEXTURE CLASS (upper profile, % occurrence)																						
Sand & loamy sand	33	—	—	—	—	—	8	14	—	—	11	—	—	—	—	—	—	43	25	20	28	—
Sandy loam	—	—	—	—	—	—	8	—	50	—	—	12	17	17	25	—	25	14	—	10	—	—
Loam	—	20	25	50	27	43	—	—	25	50	22	12	17	17	—	—	75	—	25	30	14	66
Silt loam & silt	67	70	50	50	54	57	58	57	—	50	67	63	50	50	75	100	—	14	50	40	57	33
Silty clay loam & clay loam	—	10	25	—	18	—	25	29	25	—	—	12	17	17	—	—	—	28	—	—	—	—

(con.)

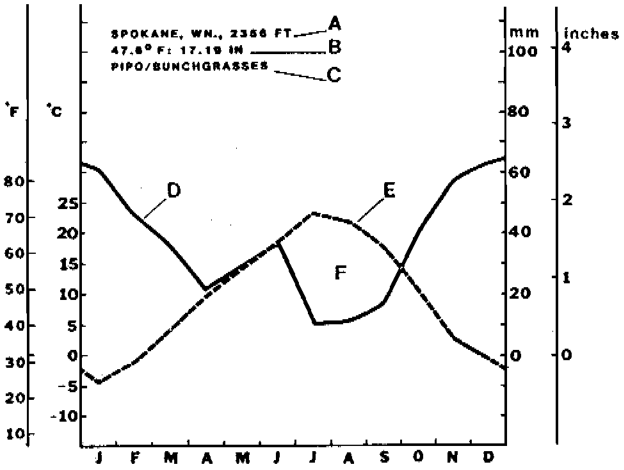
APPENDIX D (Con.)

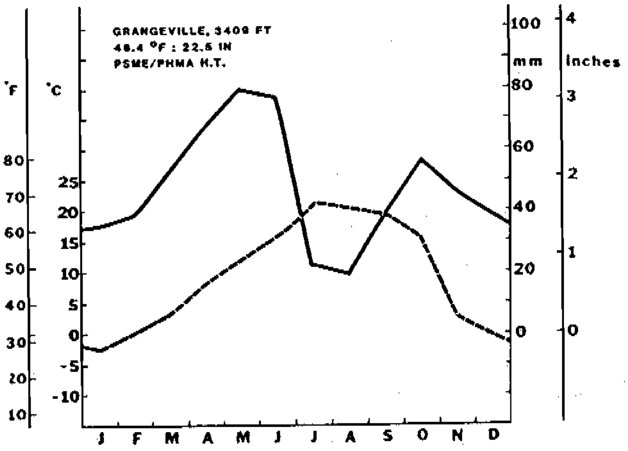
Soil characteristics	*Abies grandis* series															*Pseudotsuga menziesii* series			
	ASCA			CLUN					LIBO		XETE		PHMA		SPBE	PHMA		VACA	CARU
	MEFE	TABR	ASCA	MEFE	TABR	XETE	PHMA	CLUN	XETE	LIBO	COOC	VAGL	COOC	PHMA		SMST	PHMA		
	n=4	n=3	n=13	n=3	n=2	n=16	n=12	n=7	n=4	n=3	n=3	n=10	n=2	n=10	n=3	n=6	n=10	n=2	n=3
	COARSE FRAGMENT ROCK TYPES (percent of stands)																		
SEDIMENTARY																			
Calcareous	—	—	—	—	—	—	—	14	—	—	—	—	—	—	—	—	10	—	—
Noncalcareous	—	—	8	—	—	6	—	—	—	33	—	—	—	—	50	—	—	—	—
METAMORPHIC																			
Argillite	—	—	15	—	—	—	8	14	—	—	—	—	—	11	—	—	—	—	33
Quartzite	50	—	15	—	—	31	16	29	25	—	33	20	—	22	—	33	20	—	33
Gneiss & schist & phyllite	—	66	8	33	—	25	25	14	—	—	—	—	—	—	—	—	10	—	—
Miscellaneous	—	—	31	—	—	—	—	—	—	—	—	10	—	—	—	—	—	—	—
IGNEOUS																			
Basalt & andesite	—	—	8	33	—	—	8	—	—	—	33	10	—	33	—	50	—	—	—
Dacite, trachyte, & latite	—	—	—	—	—	—	16	—	—	—	—	—	—	—	—	—	—	—	—
Rhyolite	—	—	—	—	—	—	8	—	—	—	—	—	—	11	—	—	—	—	—
Other volcanics	50	—	—	—	—	6	—	—	—	—	—	—	—	—	—	—	—	—	—
Quartz monzonite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Granitics (undifferentiated)	—	33	8	33	100	31	8	29	75	—	33	40	100	22	50	17	60	—	—
Miscellaneous	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
MIXED (e.g., alluvium, glacial till)	—	—	8	—	—	—	8	—	—	67	—	20	—	—	—	—	—	100	33
	SUBSTRATE CHARACTERISTICS																		
EFFECTIVE ROOTING DEPTH (x̄ in cm)	67	66	50	60	70	52	44	40	45	51	52	44	36	48	52	38	54	75	37
EXPOSED ROCK (x̄ in %)	0	0	<1	0	0	<1	<1	<1	<1	<1	<1	<1	2	<1	<1	<1	<1	<1	1
EXPOSED SOIL (x̄ in %)	0	0	<1	0	0	<1	<1	<1	<1	0	<1	<1	<1	<1	<1	1	1	<1	<1
DUFF DEPTH (x̄ in cm)	5.5	5.3	4.6	4.7	5.1	4.2	4.1	4.3	3.6	4.6	4.3	3.2	4.2	3.5	2.5	4.2	3.4	2.0	3.1
GRAVEL CONTENT UPPER PROFILE (x̄ in %)	14	1	14	5	5	18	17	20	28	20	35	15	35	25	20	10	32	5	33
GRAVEL CONTENT LOWER PROFILE (x̄ in %)	24	3	19	5	15	30	25	32	40	42	30	35	45	30	25	17	37	15	50
REACTION UPPER PROFILE (x̄ pH)	5.6	6.5	6.4	6.2	7.0	6.1	6.3	6.0	5.9	6.6	6.4	6.1	6.7	6.4	6.1	6.6	6.5	5.9	6.0
REACTION LOWER PROFILE (x̄ pH)	6.0	6.1	6.1	6.1	6.9	6.1	6.1	5.9	5.9	6.8	6.0	6.0	6.7	6.1	6.3	6.2	6.5	6.1	5.7
TEXTURE CLASS (upper profile, % occurrence)																			
Sand & loamy sand	25	—	8	—	—	30	33	14	—	—	33	—	—	—	—	—	20	50	—
Sandy loam	25	—	8	—	—	—	—	29	25	—	—	—	50	10	—	17	20	—	—
Loam	25	33	8	33	50	8	8	29	50	—	—	22	—	20	33	—	10	—	—
Silt loam & silt	25	66	61	66	50	38	33	—	25	33	—	77	—	60	66	50	30	50	33
Silty clay loam & clay loam	—	—	16	—	—	23	25	29	—	67	67	11	50	10	—	33	20	—	66

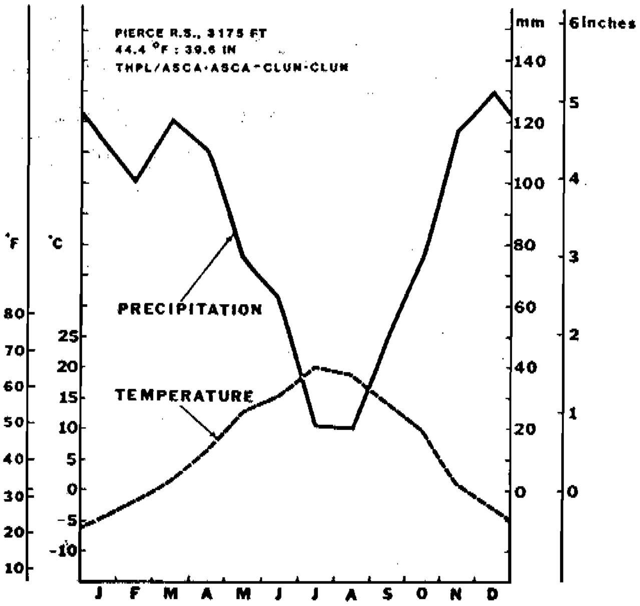
APPENDIX E: CLIMATE DIAGRAMS (WALTER 1973) FOR WEATHER STATIONS WITHIN OR PROXIMAL TO SELECTED NORTHERN IDAHO HABITAT TYPES; ORDER OF PRESENTATION IS FROM STATIONS OF WARM-DRY ENVIRONMENTS TO THOSE OF COLD-MOIST ENVIRONMENTS

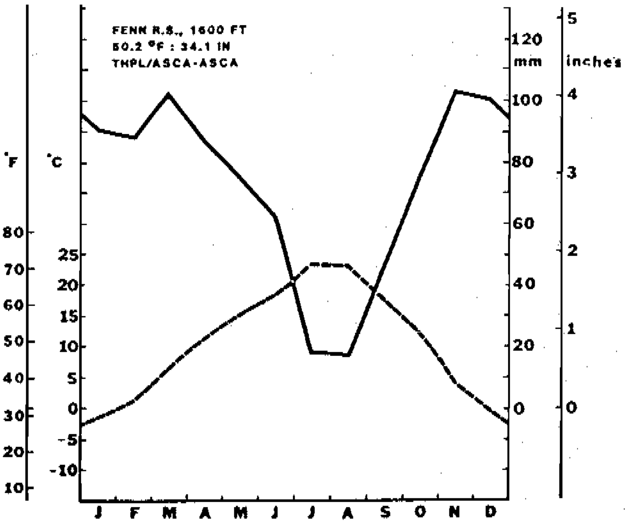
KEY TO WALTER-TYPE CLIMATE DIAGRAMS

A. Station locations, elevation (feet)
B. Mean annual temperature & precipitation
C. Series/Habitat Type • Phase
D. Annual march of precipitation
E. Annual march of temperature
F. Area where temperature curve exceeds the precipitation curve represents hypothetical period of drought (when scaled 20 mm precipitation per 10°C)
G. Following diagrams arranged by series, from warm-dry to cold-wet environments.

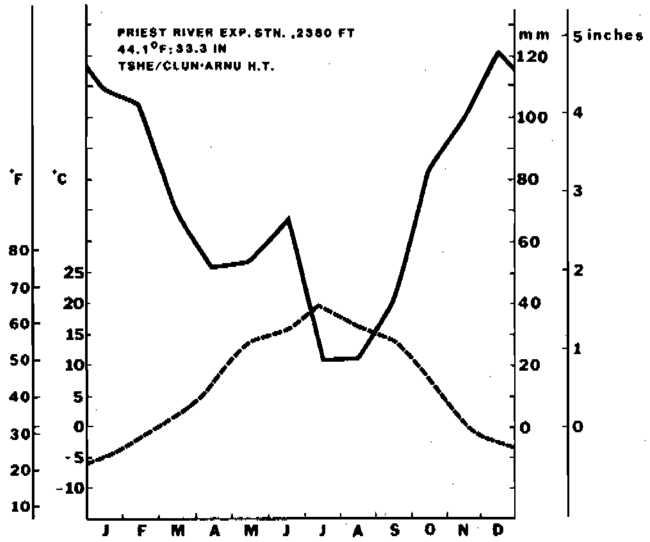


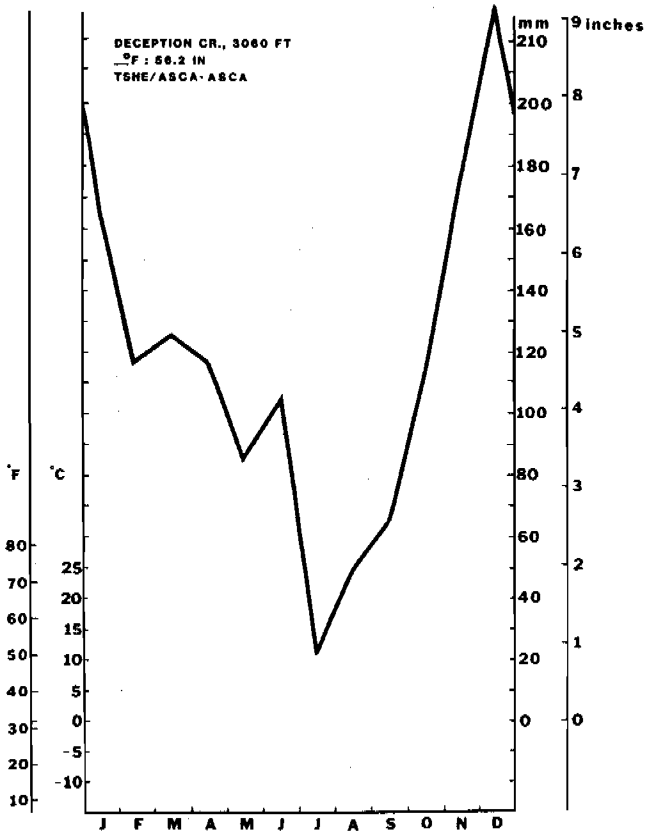






(con.)


PRIEST RIVER EXP. STN. ,2380 FT
44.1°F; 33.3 IN
TSHE/CLUN·ARNU H.T.
°F
°C
80
70
60
50
40
30
20
10
25
20
15
10
5
0
-5
-10
mm
120
100
80
60
40
20
0
5 inches
4
3
2
1
0
J F M A M J J A S O N D


DECEPTION CR., 3060 FT
__°F : 56.2 IN
TSHE/ASCA·ASCA
°F
°C
80
70
60
50
40
30
20
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25
20
15
10
5
0
-5
-10
mm
210
200
180
160
140
120
100
80
60
40
20
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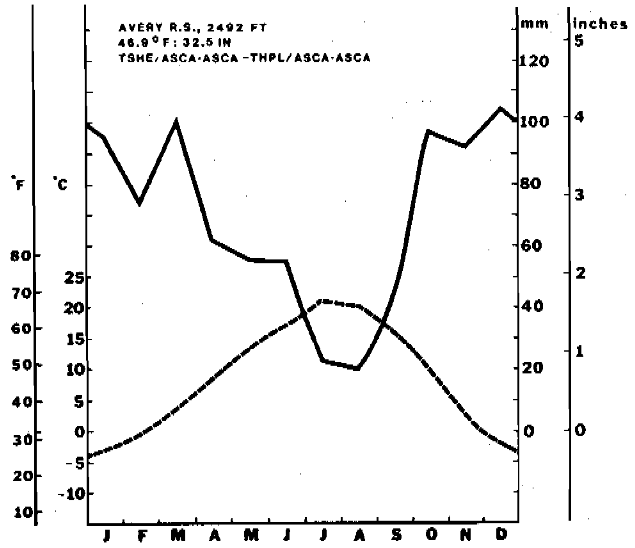
9 inches
8
7
6
5
4
3
2
1
0
J F M A M J J A S O N D


AVERY R.S., 2492 FT
46.9°F : 32.5 IN
TSHE/ASCA·ASCA -THPL/ASCA·ASCA
°F
°C
80
70
60
50
40
30
20
10
25
20
15
10
5
0
-5
-10
mm
120
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inches
5
4
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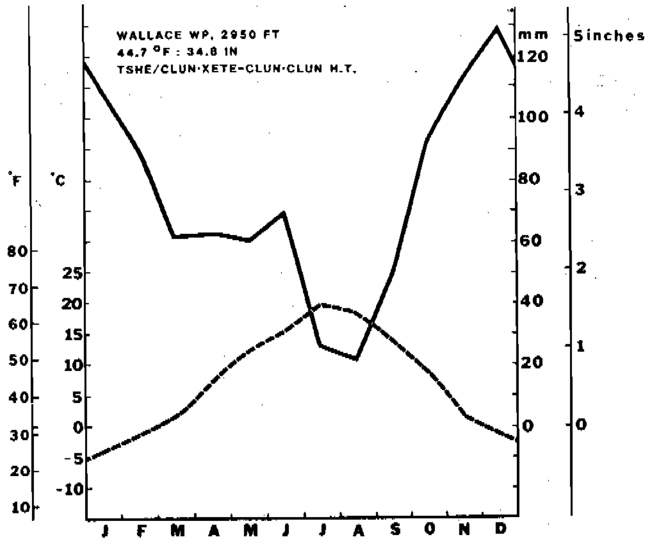
2
1
0
J F M A M J J A S O N D


WALLACE WP, 2950 FT
44.7 °F : 34.8 IN
TSHE/CLUN·XETE-CLUN·CLUN H.T.
°F
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80
70
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20
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15
10
5
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mm
120
100
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5 inches
4
3
2
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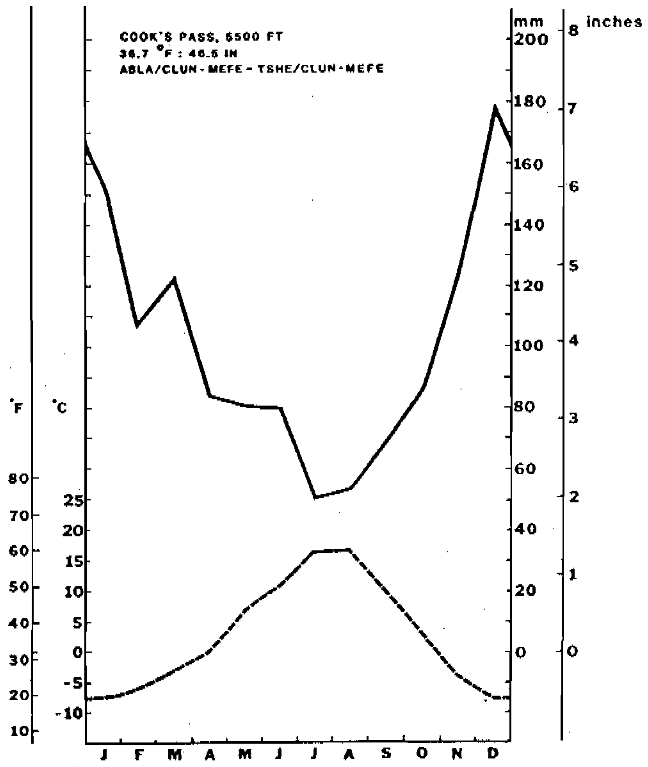
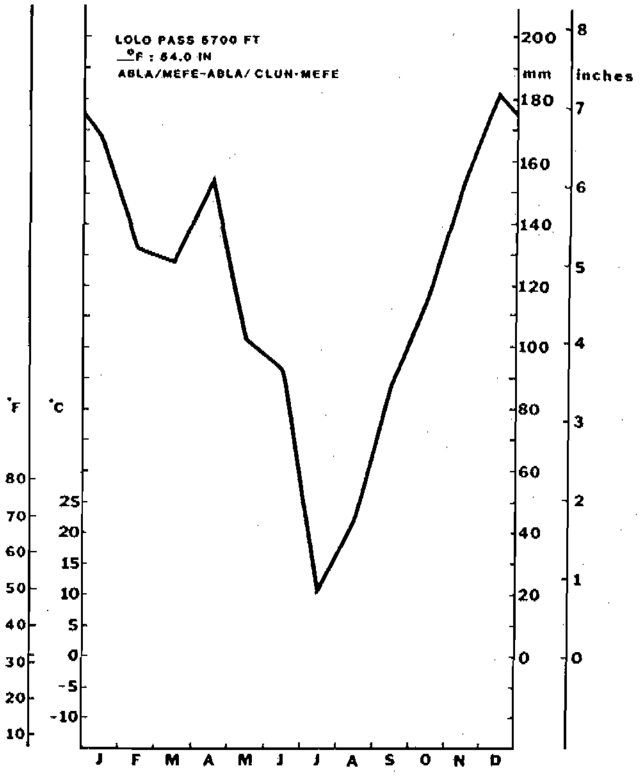
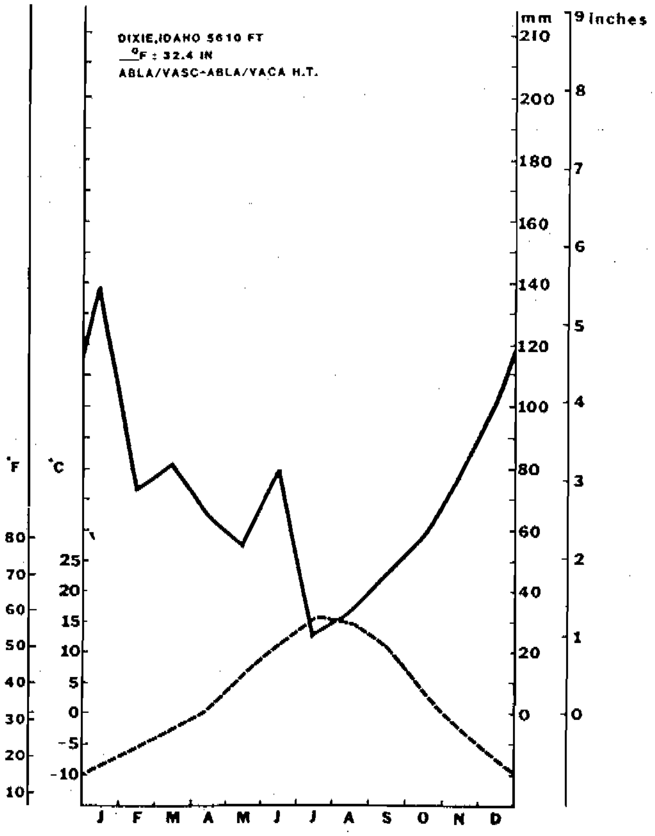
J F M A M J J A S O N D

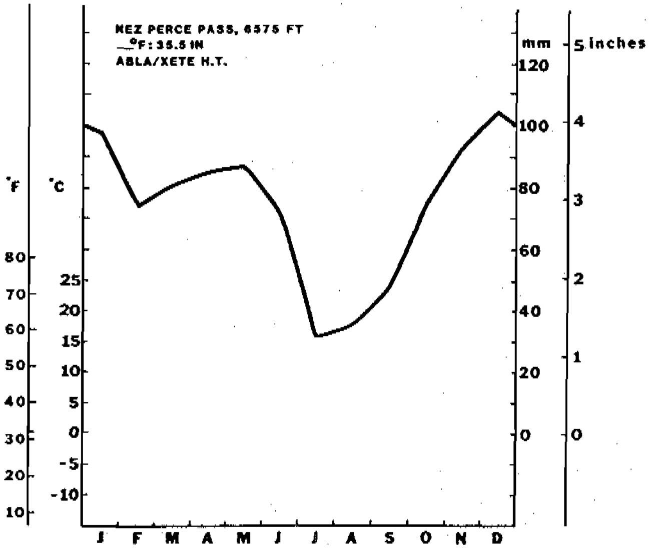
(con.)

APPENDIX E (Con.)









APPENDIX F: MEAN BASAL AREA (FT²/ACRE) AND SITE INDEXES (50-YEAR INDEX AGE) FOR NORTHERN IDAHO, BY SERIES/HABITAT TYPE-PHASE (MEANS SHOWN WHERE THE NUMBER OF STANDS, n ≥3; CONFIDENCE LIMITS [95 PERCENT] GIVEN FOR ESTIMATING THE MEAN IF n ≥5; A ? INDICATES LACK OF DATA FOR POTENTIALLY IMPORTANT SPECIES)[1]

Series/habitat type-phase	Basal area	PIPO	PSME	PICO	LAOC	ABGR	PIMO	THPL	PIEN	ABLA	TSME
TSHE/GYDR	230 ± 49	.	.	.	75 ± ?	?	70 ± ?	68 ± 7	77 ± ?	.	.
/ASCA -ARNU	225 ± 67	?	?	?	?	66 ± ?	?	?	.	.	.
/ASCA-MEFE	194 ± 24	.	?	?	?	?	?	?	?	?	.
/ASCA -ASCA	236 ± 26	?	79 ± 11	.	74 ± 7	62 ± 6	77 ± 9	62 ± ?	.	.	.
/ASCA-_____	220 ± 18	.	80 ± 10	?	75 ± 6	75 ± 5	77 ± 10	63 ± 10	?	.	.
/CLUN-MEFE	191 ± 52	.	?	?	70 ± ?	?	?	?	82 ± ?	.	.
/CLUN-ARNU	196 ± 33	.	?	.	74 ± 10	?	?	64 ± ?	.	.	.
/CLUN-XETE	201 ± 36	.	63 ± 9	59 ± 4	63 ± 4	?	57 ± 5	?	?	?	?
/CLUN-CLUN	233 ± 28	?	75 ± 12	?	74 ± 9	77 ± ?	74 ± 20	63 ± ?	78 ± ?	?	.
/CLUN-_____	208 ± 21	.	69 ± 8	62 ± 7	69 ± 4	80 ± ?	67 ± 12	63 ± 6	75 ± 9	?	.
/MEFE	156 ± ?	.	?	?	.	?	?	?	?	?	?
TSHE Series (wt. ave.)	.	?	71 ± 5	62 ± 4	72 ± 3	75 ± 6	70 ± 6	64 ± 3	78 ± 5	?	?
THPL/OPHO	455 ± 84	.	.	.	.	.	?	?	?	.	.
/ATFI-ADPE	.	.	?	.	.	?	.	?	.	.	.
/ATFI-ATFI	.	.	?	?	.	62 ± 12	68 ± ?	65 ± 18	82 ± 7	.	.
/ATFI-_____	365 ± 116	.	71 ± ?	?	.	62 ± 12	68 ± ?	65 ± 18	82 ± 7	.	.
/ADPE	260 ± 93	.	89 ± 9	.	80 ± ?	77 ± 9	82 ± ?	?	.	.	.
/GYDR	293 ± 151	.	.	?	?	60 ± ?	?	60 ± ?	?	.	.
/ASCA -MEFE	209 ± 69	.	65 ± ?	68 ± ?	68 ± ?	?	?	?	71 ± ?	.	.
/ASCA -TABR	529 ± ?	.	?	?	?	?	?	?	?	.	.
/ASCA -ASCA	284 ± 54	?	76 ± 13	?	77 ± 12	?	?	58 ± 5	74 ± ?	.	.
/ASCA-_____	302 ± 45	.	76 ± 9	68 ± ?	74 ± 9	63 ± 9	?	58 ± 5	73 ± 11	.	.
/CLUN-MEFE	205 ± 48	.	66 ± 4	67 ± 10	69 ± 4	59 ± 15	74 ± ?	54 ± ?	74 ± 7	80 ± ?	.
/CLUN-TABR	?	.	?	?	?	?	?	?	?	.	.
/CLUN-XETE	184 ± 45	?	60 ± ?	?	62 ± ?	?	?	?	?	.	.
/CLUN-CLUN	225 ± 28	?	78 ± 8	65 ± ?	71±6	60 ± 10	72 ± ?	62 ± 13	?	.	.
/CLUN-_____	216 ± ?	73 ± ?	74 ± 5	65 ± 5	71±3	63 ± 7	74 ± 10	63 ± 10	.	.	.
THPL Series (wt. ave.)	.	73 ± ?	74 ± 4	67 ± 5	70 ± 3	65 ± 5	75 ± 6	63 ± 5	79 ± 4	81 ± 12	.
TSME/STAM-LUHI	235 ± ?	.	.	?	.	.	.	.	60 ± ?	47 ± ?	42 ± ?
/STAM-MEFE	128 ± ?	.	?	?	68 ± ?	.	?	.	78 ± 4	68 ± ?	53± ?
/STAM-_____	.	.	.	.	.	.	.	.	.	.	.
/CLUN-MEFE	198 ± 31	.	.	60 ± ?	58 ± 11	?	54 ± ?	.	65 ± 6	61±6	56 ± 10
/CLUN-XETE	175 ± 37	.	?	60 ± ?	63 ± ?	?	56 ± 18	.	69 ± ?	?	?
/CLUN-_____	.	.	.	.	.	.	.	.	.	.	.
/MEFE-LUHI	?	.	?	52 ± 8	58 ± ?	.	?	.	47 ± ?	49 ± ?	42 ± 8
/MEFE-XETE	?	.	?	54 ± 10	?	.	.	.	60 ± ?	50 ± 7	44 ± ?
/MEFE-_____	—	.	.	.	.	.	.	.	.	.	.
/XETE-LUHI	240 ± ?	.	.	36 ± ?	.	.	.	.	49 ± ?	41 ± ?	33 ± 4
/XETE-VAGL	184 ± 52	?	50 ± 9	53 ± 4	60 ± 4	?	58 ± ?	.	61 ± 11	47 ± ?	48 ± 5
/XETE-VASC	174 ± 36	.	54 ± ?	43 ± 3	57 ± ?	?	51 ± ?	.	49 ± 12	46 ± 10	44 ± 6
/XETE-_____	.	.	.	?	.	.	.	.	?	?	?
TSME Series (wt. ave.)	.	?	58 ± 5	52 ± 3	58 ± 4	?	57 ± 7	.	62 ± 4	53 ± 4	43 ± 4
ABLA/CACA-LEGL	?	.	.	57 ± ?	.	.	.	.	?	?	.
/CACA-LICA	?	.	?	?	.	.	.	.	?	?	.
/CACA-VACA	?	.	?	?	.	.	.	.	?	?	.
/CACA-CACA	?	.	.	?	.	.	.	.	?	?	.
/CACA-_____	126 ± 26	.	?	57 ± 7	.	.	.	.	?	?	.
/STAM-MEFE	210 ± 34	.	.	?	.	.	.	.	69 ± 6	70 ± ?	.
/STAM-LICA	219 ± 54	.	?	64 ± ?	?	.	.	.	77 ± 7	68 ± ?	.
/STAM-_____	.	.	61 ± ?	63 ± ?	?	.	.	.	72 ± 4	69 ± 5	.
/CLUN-MEFE	171 ± 43	.	60 ± ?	?	?	.	?	.	68 ± 8	60 ± ?	.
/CLUN-XETE	183 ± 27	.	60 ± 12	56 ± ?	62 ± ?	.	?	.	70 ± 12	?	.
/CLUN-CLUN	187 ± ?	.	60 ± ?	66 ± ?	66 ± ?	55 ± ?	?	.	81 ± ?	?	.
/CLUN-_____	.	.	60 ± 8	59 ± 9	64 ± 11	56 ± ?	?	.	69 ± 6	63 ± 12	.
/MEFE-LUHI	217 ± 56	.	.	40 ± 3	.	.	.	.	38 ± ?	?	.
/MEFE-VASC	?	.	.	47 ± ?	.	.	.	.	?	?	.

(con.)

APPENDIX F (Con.)

Series/habitat type-phase	Basal area	PIPO	PSME	PICO	LAOC	ABGR	PIMO	THPL	PIEN	ABLA	TSME
/MEFE-COOC	123 ± 24	.	?	57 ± ?	54 ± ?	.	?	.	61 ± ?	?	.
/MEFE-XETE	190 ± ?	.	?	55 ± 4	?	.	.	.	?	?	.
/MEFE-_____	.	.	?	54 ± ?	54 ± ?	.	?	.	49 ± 9	?	.
/VACA	?	.	?	?	?	.	.	.	?	?	.
/XETE-LUHI	129 ± 31	.	.	40 ± 7	.	.	.	.	43 ± ?	33 ± ?	.
/XETE -VASC	101 ± 17	.	.	46 ± 5	?	.	.	.	56 ± ?	?	.
/XETE -COOC	166 ± 32	.	46 ± 10	53 ± 5	?	.	?	.	58 ± 10	55 ± 16	.
/XETE-VAGL	139 ± 34	.	46 ± ?	56 ± 3	?	.	.	.	?	?	.
/XETE- _____	.	.	46± 6	48 ± 3	?	.	?	.	56 ± 7	43 ± 10	.
/LUHI	126 ± 74	.	.	24 ± ?	.	.	.	.	?	?	.
/VAGL	?	.	?	?	?	.	.	.	?	?	.
/CARU	?	.	?	?	.	.	.	.	.	?	.
ABLA Series (wt. ave.)	.	.	54 ± 5	51 ± 3	61 ± 6	50 ± 10	53 ± ?	.	64 ± 3	56 ± 7	.
ABGR/SETR	.	.	.	.	?	?	?	.	?	?	?
/ASCA -MEFE	232 ± ?	.	66 ± ?	67 ± ?	?	?	.	.	73 ± ?	.	.
/ASCA -TABR	192 ± 74	.	78 ± ?	.	?	67 ± ?	?	.	79 ± ?	.	.
/ASCA -ASCA	212 ± 20	?	78 ± 6	.	72 ± ?	69 ± 11	69 ± ?	.	75 ± ?	.	.
/ASCA-_____	.	78 ± ?	76 ± 5	67 ± ?	72 ± ?	68 ± 9	68 ± ?	.	76 ± 8	.	.
/CLUN-MEFE	170 ± 37	.	60 ± 11	62 ± ?	68 ± ?	56 ± ?	?	.	75 ± 9	.	.
/CLUN -TABR	187 ± ?	.	?	.	?	?	?	.	?	.	.
/CLUN-XETE	200 ± 24	?	64 ± 3	63 ± 5	66 ± 3	60 ± 10	?	.	76 ± ?	.	.
/CLUN-PHMA	181 ± 19	83 ± 10	70 ± 4	?	71 ± 10	55 ± ?	?	.	.	.	.
/CLUN-CLUN	215 ± 30	84 ± ?	72 ± 9	65 ± ?	72 ± ?	63 ± 11	72 ± ?	.	?	.	.
/CLUN-_____	.	81 ± 8	67 ± 3	63 ± 3	68 ± 2	57 ± 6	65 ± 12	.	74 ± 8	.	.
/LIBO-LIBO	122 ± ?	?	66 ± ?	56 ± ?	?	?	?	.	.	.	.
/LIBO-XETE	173 ± 20	?	?	55 ± ?	63 ± ?	60 ± ?	?	.	?	.	.
/LIBO-_____	.	64 ± ?	62 ± 12	55 ± 4	65 ± 12	60 ± ?	?	.	?	.	.
/XETE-COOC	254 ± ?	77 ± ?	65 ± ?	55 ± ?	62 ± ?	?	.	.	?	.	.
/XETE-VAGL	161 ± 28	69 ± ?	64 ± 5	59 ± 4	65 ± 11	50 ± ?	.	.	63 ± ?	.	.
/XETE-_____	.	73 ± 9	63 ± 5	58 ± 4	64 ± 5	50 ± 14	?	.	70 ± 10	.	.
/VAGL	?	.	?	?	?	.	.	.	?	?	.
/PHMA-COOC	220 ± ?	?	78 ± ?	?	?	?	.	.	.	.	.
/PHMA-PHMA	208 ± 36	86 ± 18	72 ± 6	?	?	57 ± ?	.	.	.	.	.
/PHMA-_____	.	84 ± 15	73 ± 5	?	?	57 ± ?	.	.	.	.	.
/SPBE	167 ± ?	?	56 ± ?	?	.	?	.	.	.	.	.
ABGR Series (wt. ave.)	.	78 ± 5	69 ± 4	60 ± 4	67 ± 4	62 ± 6	65 ± ?	.	74 ± 5	.	.
PSME/PHMA-SMST	196 ± 32	75 ± 6	71 ± 5	?	74 ± ?	.	.	.	.	.	.
/PHMA-PHMA	167 ± 23	69 ± 6	65 ± 5	.	.	.	.	.	.	.	.
/VACA	?	?	?	60 ± ?	?	.	.	.	.	.	.
/VAGL	?	?	?	?	?	.	.	.	.	.	.
/SYAL	?	62 ± ?	64 ± ?	?	.	.	.	.	.	.	.
/SPBE	?	?	?	?	.	.	.	.	.	.	.
/CARU-ARUV	127 ± 48	71 ± 10	65 ± ?	?	?	.	.	.	.	.	.
/CARU-CARU	162 ± ?	?	?	?	?	.	.	.	.	.	.
/CARU-_____	.	71 ± 8	65 ± ?	?	?	.	.	.	.	.	.
/CAGE	?	?	?	?	?	.	.	.	.	.	.
/FEID	139 ± ?	64 ± ?	65 ± ?	.	.	.	.	.	.	.	.
/AGSP	?	.	.	.	.	.	.	.	.	.	.
PSME Series (wt. ave.)	.	69 ± ?	67 ± ?	59 ± ?	67 ± ?	.	.	.	.	.	.
PIPO/PHMA	?	63 ± 6	.	.	.	.	.	.	.	.	.
/SYAL	145 ± ?	59 ± 5	.	.	.	.	.	.	.	.	.
/FEID	125 ± ?	?	.	.	.	.	.	.	.	.	.
/AGSP	88 ± ?	44 ± 4	.	.	.	.	.	.	.	.	.
PIPO Series (wt. ave.)	.	60 ± 3	.	.	.	.	.	.	.	.	.
PICO/VASC	?	.	.	?	.	.	.	.	.	.	.

[1] Data were insufficient to calculate site indices for TSHE and PIAL.

APPENDIX G: NORTHERN IDAHO HABITAT TYPE FIELD FORM

NAME ____________________ **DATE** ____________

LANDFORM:
1-Major ridge, exposed
2-Major ridge, protected
3-Minor ridge, protected
4-Plateau
5-Terrace, not flooded
6-Stream or flooded terrace
7-Valley slope
8-Valley bottom
9-Canyon floor
10-Basin, >1/4 mi. dia.
11-Basin, <1/4 mi. dia.

CANOPY COVERAGE CLASS:
T = Rare to <1%
1 = 1 to <5%
2 = 5 to <25%
3 = 25 to <50%
4 = 50 to <75%
5 = 75 to <95%
6 = 95 to 100%

CONFIGURATION:
Horiz./Vert.
1-Convex
2-Flat
3-Concave
4-Undulating

POSITION:
1-Top
2-Upper 1/3
3-Mid 1/3
4-Lower 1/3
5-Bottom

Plot No.				
Location				
T., R., S.				
Elevation				
Aspect				
Slope	%	%	%	%
Landform				
Position				
Configuration H/V	/	/	/	/
Stand structure				
Stand Age Meas.				
Est.				
Remarks:				

Note: Rate trees (>4" d.b.h.) and regen. (<4" d.b.h.)
Stand structure: even-aged, 2-aged, uneven-aged

TREES Scientific name	**Abbrev.**	**Common name**	**Canopy coverage class**			
1. *Abies grandis*	ABGR	grand fir	/	/	/	/
2. *Abies lasiocarpa*	ABLA2	subalpine fir	/	/	/	/
3. *Betula papyrifera*	BEPA	paper birch	/	/	/	/
4. *Larix lyallii*	LALY	alpine larch	/	/	/	/
5. *Larix occidentalis*	LAOC	western larch	/	/	/	/
6. *Picea engelmannii*	PIEN	Engelmann spruce				
7. *Pinus albicaulis*	PIAL	whitebark pine	/	/	/	/
8. *Pinus contorta*	PICO	lodgepole pine	/	/	/	/
9. *Pinus monticola*	PIMO	western white pine	/	/	/	/
10. *Pinus ponderosa*	PIPO	ponderosa pine	/	/	/	/
11. *Populus tremuloides*	POTR	quaking aspen	/	/	/	/
12. *Pseudotsuga menziesii*	PSME	Douglas-fir	/	/	/	/
13. *Thuja plicata*	THPL	western redcedar	/	/	/	/
14. *Tsuga heterophylla*	TSHE	western hemlock	/	/	/	/
15. *Tsuga mertensiana*	TSME	mountain hemlock	/	/	/	/
SHRUBS AND SUBSHRUBS						
1. *Acer glabrum*	ACGL	Rocky Mountain maple				
2. *Arctostaphylos uva-ursi*	ARUV	bearberry				
3. *Berberis repens*	BERE	Oregon-grape				
4. *Gaultheria humifusa*	GAHU	western wintergreen				
5. *Holodiscus discolor*	HODI	ocean-spray				
6. *Ledum glandulosum*	LEGL	Labrador-tea				
7. *Linnaea borealis*	LIBO2	twinflower				
8. *Menziesia ferruginea*	MEFE	fool's huckleberry				
9. *Oplopanax horridum*	OPHO	devil's club				
10. *Phyllodoce empetriformis*	PHEM	red mountain-heath				
11. *Physocarpus malvaceus*	PHMA	ninebark				
12. *Rhododendron albiflorum*	RHAL	white rhododendron				
13. *Ribes lacustre*	RILA	prickly currant				
14. *Rosa gymnocarpa*	ROGY	baldhip rose				
15. *Spiraea betulifolia*	SPBE	shiny-leaf spiraea				
16. *Symphoricarpos albus*	SYAL	common snowberry				
17. *Taxus brevifolia*	TABR	Pacific yew				
18. *Vaccinium caespitosum*	VACA	dwarf huckleberry				
19. *Vaccinium globulare*	VAGL	blue huckleberry				
20. *Vaccinium scoparium*	VASC	grouse whortleberry				
FERNS						
1. *Adiantum pedatum*	ADPE	maidenhair fern				
2. *Athyrium filix-femina*	ATFI	lady-fern				
3. *Gymnocarpium dryopteris*	GYDR	oak-fern				
FORBS						
1. *Aralia nudicaulis*	ARNU3	wild sarsaparilla				
2. *Asarum caudatum*	ASCA3	wild ginger				
3. *Clintonia uniflora*	CLUN	queencup beadlily				
4. *Coptis occidentalis*	COOC2	western goldthread				
5. *Cornus canadensis*	COCA	bunchberry dogwood				
6. *Disporum hookeri*	DIHO	Hooker fairybells				
7. *Dodecatheon jeffreyi*	DOJE	Jeffrey's shooting star				
8. *Galium triflorum*	GATR	sweetscented bedstraw				
9. *Goodyera oblongifolia*	GOOB	rattlesnake-plantain				
10. *Ligusticum canbyi*	LICA2	Canby's licorice-root				
11. *Mitella breweri*	MIBR	Brewer's mitrewort				
12. *Mitella pentandra*	MIPE	alpine mitrewort				
13. *Senecio triangularis*	SETR	arrowleaf groundsel				
14. *Smilacina stellata*	SMST	starry Solomon-plume				
15. *Streptopus amplexifolius*	STAM	twisted-stalk				
16. *Thalictrum occidentale*	THOC	western meadowrue				
17. *Tiarella trifoliata*	TITR	coolwort foamflower				
18. *Trautvetteria caroliniensis*	TRCA3	false bugbane				
19. *Viola glabella*	VIGL	pioneer violet				
20. *Viola orbiculata*	VIOR2	round-leaved violet				
21. *Xerophyllum tenax*	XETE	beargrass				
GRAMINOIDS						
1. *Agropyron spicatum*	AGSP	bluebunch wheatgrass				
2. *Calamagrostis canadensis*	CACA	bluejoint reedgrass				
3. *Calamagrostis rubescens*	CARU	pinegrass				
4. *Carex geyeri*	CAGE	elk sedge				
5. *Festuca idahoensis*	FEID	Idaho fescue				
6. *Luzula hitchcockii*	LUHI	smooth woodrush				

SERIES				
HABITAT TYPE				
PHASE				
ADP#				

APPENDIX H: GLOSSARY

The following terms are defined **as used in this report.** The definitions should reduce misunderstanding resulting from the various interpretations of these terms according to the specialty of the user. Primary references include Hanson (1962), Ford-Robertson (1971), and Daubenmire (1968a).

Abundant. When relating to species coverages in the h.t. key and written h.t. descriptions, any species with 25 percent or greater canopy coverage.

Accidental. A species found rarely, or at most occasionally, as scattered in a given habitat.

Amplitude, ecological. The range in environmental and community conditions (competition) within which a plant species is capable of establishing and growing (similar to term "niche breadth" of animal ecology).

Association. An abstract climax plant community type (after Daubenmire 1968a) in which all component stands are comprised of the same vegetational layers with limited variability in species composition and in habitat conditions.

Basal area. The cross-sectional area of a tree trunk measured at breast height (4.5 ft [1.4 m]) above the ground; summed for all trees on a given stand or type and expressed on a per-acre basis.

Bench, benchland. An area of flat or gently sloping terrain (<15 percent slope).

Browse. (Noun) Shrubby forage consumed especially by large animals; (Verb) To eat shrubby foliage.

Caespitose. Growing in clumps or tufts, as in bunchgrasses.

Canopy coverage. The area covered when an imaginary polygon is circumscribed about a plant's foliage and projected to a horizontal plane and expressed as a percentage of the sampling unit (Daubenmire 1968a). The collective canopy coverage of all individuals of a species on a plot or stand is expressed as a percentage of the total area or as a coverage class (see key to habitat types).

Classification. The arrangement of entities according to similarities and differences in their properties.

Climax community. The culminating stage in plant (forest) succession for a given habitat, that develops and perpetuates itself in the absence of disturbance, natural or otherwise.

Climax species. A species that is self-perpetuating in the absence of disturbance, with no evidence of replacement by other species.

Climax, types of... in relation to environment (Polyclimax Concept of Tansley 1935).

- **Climatic climax.** The climax plant community that develops on normal (zonal) sites with well-drained, medium-textured soils, and flat to gently sloping topography.
- **Edaphic climax.** A deviation in climax community caused by abnormal soils (or parent materials).
- **Topographic climax.** A deviation from the climatic climax due to an unusual microclimate caused by topographic influences.
- **Topoedaphic climax.** Combinations of edaphic and topographic conditions that deflect climax from the characteristic community developing under the prevailing macroclimate. (Example: *Pseudotsuga menziesii* stands occupying thin-soiled, rocky, south-facing slopes surrounded by more mesic forest types.)

Common. When relating to plant coverage in the h.t. key and narratives, any species with 1 percent or greater canopy coverage.

Community (plant community). An assemblage of plants occurring in a defined area but denoting no particular ecological status or successional stage.

Constancy. The percentage of stands in a habitat type containing a given species. (Appendix C expresses constancy by class: 1 = 5 to 15 percent, 2 = 16 to 25, etc.)

d.b.h. (diameter at breast height). Tree trunk diameter at 4.5 ft (1.4 m) above the ground.

Depauperate. Describes a sparse undergrowth coverage; this condition is caused (in northern Idaho) by dense forest canopies and often accompanied by a deep duff layer.

Disjunct. A small (usually) portion of a population that is geographically separated from the main population.

Ecosystem. Any community of organisms and its environment that forms an interacting system; size and boundaries of the system are arbitrarily stipulated.

Ecotone. The boundary or transition zone between adjacent plant communities; it often separates different habitat types.

Ecotype. A portion of a species population that is adapted to a particular habitat and not necessarily phenotypically distinguishable from the remainder of the population.

Edaphic. Referring to soil.

Endemic. Confined to a particular geographic area.

Episodic. Occurring irregularly, generally with long periods of time between events.

Forb. An herbaceous plant that is not a graminoid.

Frequency. The percentage of subsampling units in a single sample stand that contains a given species; though generally a measure of the uniformity of distribution of a species in a stand, its value is dependent on the size and shape of the subsample plots.

Graminoid. All grasses (Gramineae) and grasslike plants, including sedges (*Carex* spp.) and rushes (*Juncus* and *Luzula* spp.).

Habitat type. All land areas potentially capable of producing similar plant communities (associations) at climax.

Grove, groveland. Referring to physiognomy (gross appearance) of vegetation that is similar to savanna except that plants of the tallest stratum (trees) occur as small clusters (groves); groves encompassed within a vegetation matrix of lower stature lifeforms constitute a groveland.

Indicator plant. A plant whose presence or coverage is indicative of certain environmental conditions. H.t. classifications employ plants with relatively narrow ecological amplitudes to denote the presence of a given series, habitat type, or phase.

Mesophytic. Vegetation adapted to grow under conditions of medium moisture regimes.

Park, parkland. Referring to physiognomy (gross appearance) of vegetation; the reciprocal of grove or groveland; a patch of low vegetation (park) or patches of low vegetation distributed over a rather continuous forest (parkland).

Phase. A subdivision of habitat type representing minor differences in climax or mature vegetation that may reflect environmental differences or floristic and/or historic peculiarities within the h.t. (see Crawford and Johnson 1984).

Phenotype. The physical appearance or measurable attributes of an individual or a group distinguished by possession of similar attributes—in contrast to "genotype," which is a measure of genetic constitution or similarities.

Physiognomy. Apparent characteristics: outward features or appearance of a community.

Physiography. The study and description of landforms, particularly their genesis.

Poorly represented. When relating to plant coverage in the h.t. key or written descriptions, any species with less than 5 percent canopy coverage.

Present. "Present" as applied to trees or large shrubs requires at least 10 individuals per acre (25/ha) well scattered through the stand, not restricted to microsites. "Present" as applied to low shrubs and herbaceous plants requires scattered individuals throughout the stand, usually 5 individuals or clumps per 1/10 acre (125/ha), not occurring on microsites. Microsites are small areas that are atypical for the stand, such as windthrow pockets, micro-drainageways, seeps, well-rotted logs, or excessively rocky areas.

Rhizomatous. Having a horizontal stem, generally under the soil surface.

Rich. Having many diverse species, as in "species rich."

Riparian. Vegetation bordering water courses, lakes, swamps, or marshes.

Scarce. When referring to plant coverage in the h.t. key or written descriptions, any species that is absent or has less than 1 percent coverage.

Scree slope. Any slope covered with loose rock fragments, including the accumulation of rock at a cliff or slope base (talus) as well as loose, unstable material lying on slopes without cliffs.

Seral. A species or community that is replaced (at least in part) by another species or community as succession occurs.

Sere. A step or stage in the series of successional processes.

Series. A group of habitat types having the same potential climax tree species.

Site index. An indicator of forest productivity as referenced by the height attained by a given tree species at a designated base age (usually 50 or 100 years, total or breast height age).

Stand. A plant community that is relatively uniform in composition (undergrowth and canopy species), structure (diameter or age distribution), and habitat conditions (does not correspond to Northern Region, Timber Management Division concept of stand; see instructions to users of key section).

Steppe. Grass and forb dominated vegetation community, occurring in climates too dry for zonal soils to support self-regenerating trees.

Stockability factor. An estimate of the stocking potential on a given site; for example, a factor of 0.8 indicates the site is capable of supporting only 80 percent of normal stocking as indicated in yield tables or basal area on site index regressions.

Stocking. A general term for the number of trees or basal area per acre relative to some desirable number or basal area for best growth and management.

Succession. A term for changes in the biota (plant communities) of a given area relative to some previous state, usually changes toward some hypothetical dynamic equilibrium point, climax.

Terrace, stream. A relatively flat, horizontal or gently inclined surface, of depositional or erosional origin, bounded by steeper ascending and descending slopes on either side.

Undergrowth. Collectively, those plants shrub-sized and less growing under a forest canopy.

Understory. In a forest stand that portion of the trees below the overstory, including seedlings, saplings, and suppressed trees.

Union. A vegetation layer consisting of one or more species having similar environmental amplitudes within a limited geographic area; presence of union is indicative of particular environmental conditions.

Well represented. When relating to plant coverages in the h.t. key or descriptions, any species having a 5 percent or greater coverage.

Yield capability. The mean annual increment attainable in a fully stocked natural stand at the age of culmination of mean annual increment, expressed in volume per acre per year. (See a forest mensuration text for the distinction between "mean annual increment" and growth in a specific year, or period of years, termed "periodic annual increment.")

APPENDIX I: INCIDENTAL AND RARE HABITAT TYPES AND PLANT COMMUNITIES THAT ARE KNOWN OR SUSPECTED TO OCCUR IN NORTHERN IDAHO

Before assigning one of the community names to a site, be sure the vegetation does not fit any of the existing habitat type descriptions. Additional field work is needed to sample and describe these communities, leading to a formal habitat type designation.

Abbreviation	**Scientific name**
TSHE/ADPE	*Tsuga heterophylla/Adiantum pedatum*
TSHE/CLUN-TABR	*Tsuga heterophylla/Clintonia uniflora-Taxus brevifolia* phase
TSHE/XETE	*Tsuga heterophylla/Xerophyllum tenax*
TSHE/ATFI	*Tsuga heterophylla/Athyrium filix-femina*
TSHE/OPHO	*Tsuga heterophylla/Oplopanax horridum*
THPL/LYAM	*Thuja plicata/Lysichitum americanum*
THPL/EQUI	*Thuja plicata/Equisetum* spp.
THPL/CLUN-PHMA	*Thuja plicata/Clintonia uniflora-Physocarpus malvaceus* phase
THPL/COOC	*Thuja plicata/Coptis occidentalis*
THPL/PHMA	*Thuja plicata/Physocarpus malvaceus*
THPL/DRSP	*Thuja plicata/Dryopteris* spp.
TSME/LUHI[1]	*Tsuga mertensiana/Luzula hitchcockii*
ABLA/CABI	*Abies lasiocarpa/Caltha biflora*
ABLA/OPHO	*Abies lasiocarpa/Oplopanax horridum*
ABLA/CACA-CACA[1]	*Abies lasiocarpa/Calamagrostis canadensis*-CACA phase
ABLA/COOC-COOC	*Abies lasiocarpa/Coptis occidentalis*-COOC phase
ABLA/RHAL	*Abies lasiocarpa/Rhododendron albiflorum*
ABLA/VACA[1]	*Abies lasiocarpa/Vaccinium caespitosum*
ABLA/XETE-XETE	*Abies lasiocarpa/Xerophyllum tenax*-XETE phase
ABLA/VAGL[1]	*Abies lasiocarpa/Vaccinium globulare*
ABLA/CARU[1]	*Abies lasiocarpa/Calamagrostis rubescens*
ABLA/VASC[1]	*Abies lasiocarpa/Vaccinium scoparium*
LALY-ABLA[1]	*Larix lyalli-Abies lasiocarpa* communities
PIAL-ABLA	*Pinus albicaulis-Abies lasiocarpa* communities
ABGR/ADPE	*Abies grandis/Adiantum pedatum*
ABGR/ACGL-PHMA	*Abies grandis/Acer glabrum-Physocarpus malvaceus* phase
ABGR/VAGL[1]	*Abies grandis/Vaccinium globulare*
ABGR/COOC	*Abies grandis/Coptis occidentalis*
PSME/VAGL[1]	*Pseudotsuga menziesii/Vaccinium globulare*
PSME/FESC	*Pseudotsuga menziesii/Festuca scabrella*
PSME/CAGE[1]	*Pseudotsuga menziesii/Carex geyeri*
PSME/FEID[1]	*Pseudotsuga menziesii/Festuca idahoensis*
PSME/AGSP[1]	*Pseudotsuga menziesii/Agropyron spicatum*
PIPO/PHMA-CRDO	*Pinus ponderosa/Physocarpus malvaceus-Crataegus douglasii* phase
PIEN/EQUI	*Picea engelmannii/Equisetum* spp.
ALIN	*Alnus incana* communities
PTAQ	*Pteridium aquilinum* communities

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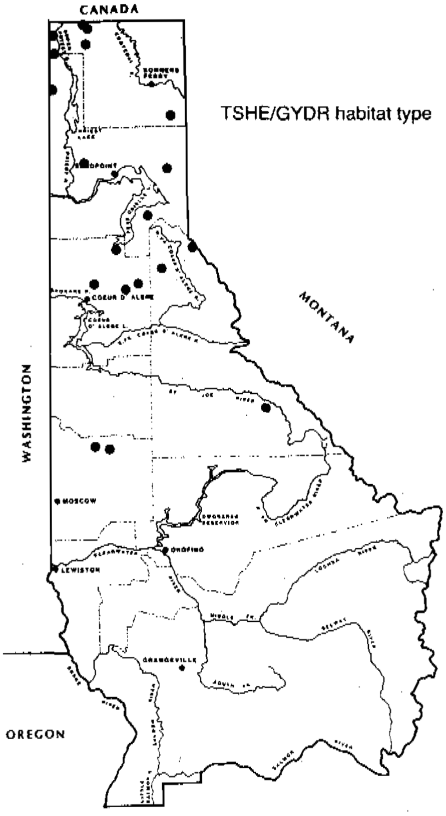
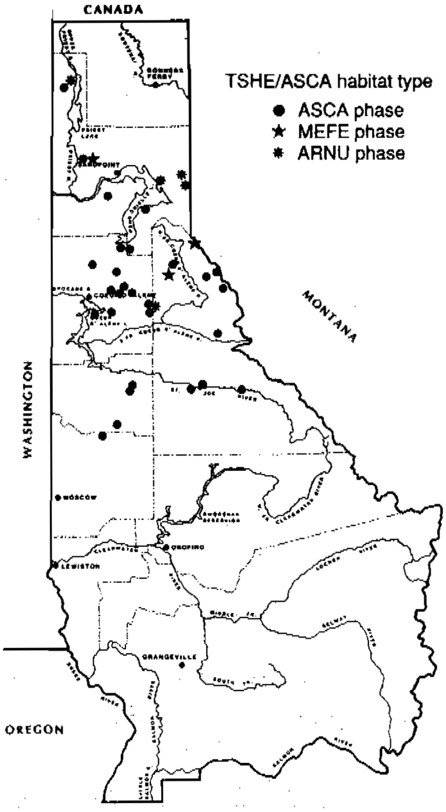
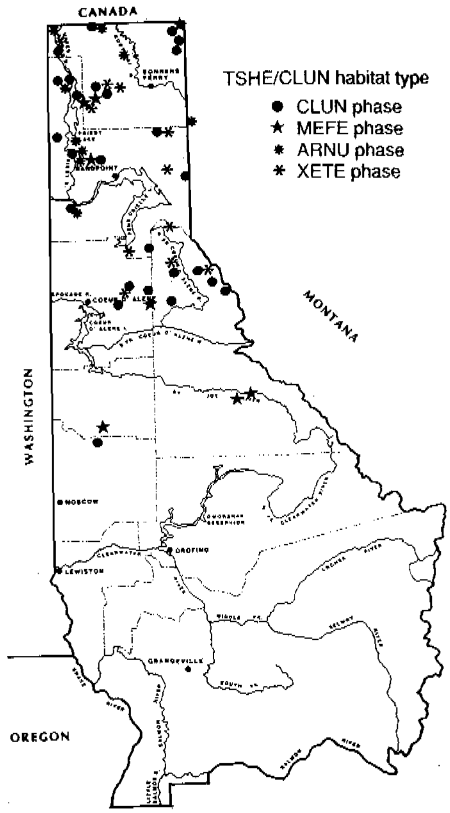
[1] Descriptions are included in this manual but more samples are needed to improve the description in the text and the constancy/coverage values.

APPENDIX J: LOCATION MAPS OF STANDS SAMPLED SINCE 1980 FOR MAJOR HABITAT TYPES AND PHASES

Caution: map locations do not include all possible locations in which a particular habitat type or phase may occur in northern Idaho. If the user finds an example of a habitat type in a much different locale, depend on thoughtful use of the key, coupled with the narrative description and the constancy/coverage tables.



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✱ ARNU phase
* XETE phase
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SANDPOINT
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WASHINGTON
MONTANA
MOSCOW
DWORSHAK RESERVOIR
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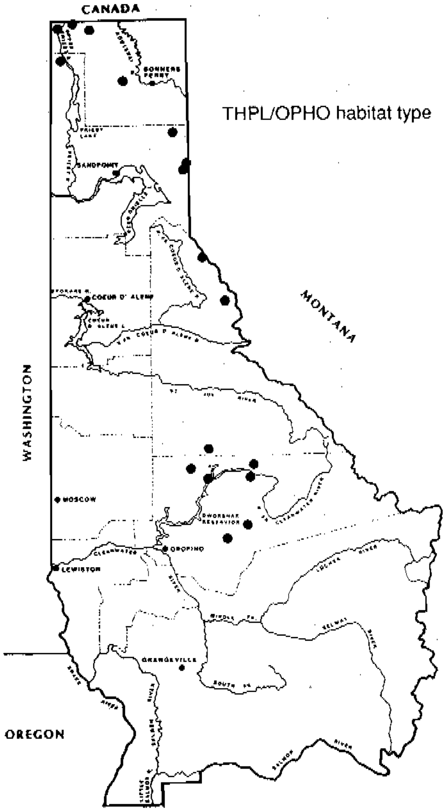
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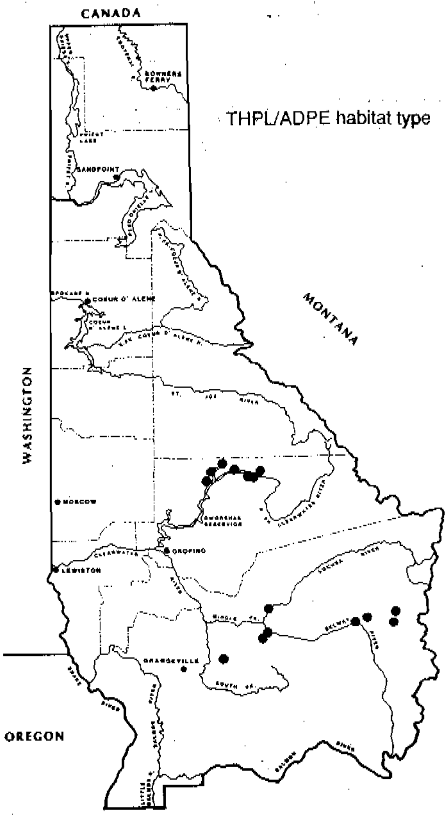
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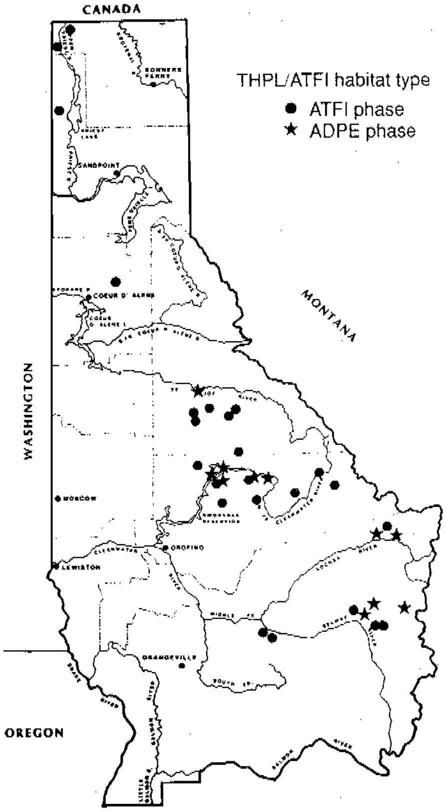
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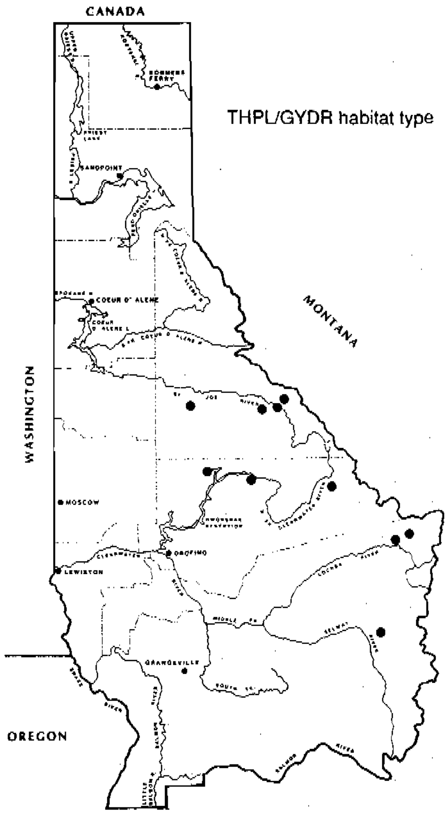
GRANGEVILLE
OREGON

APPENDIX J (Con.)



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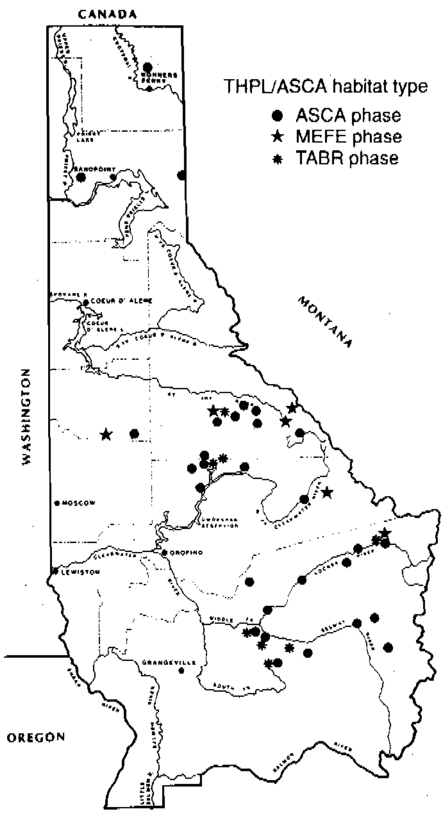

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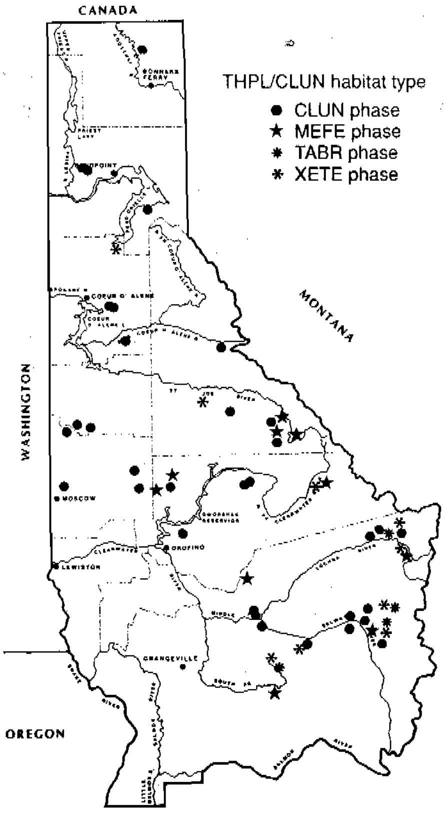
- ✱ TABR phase



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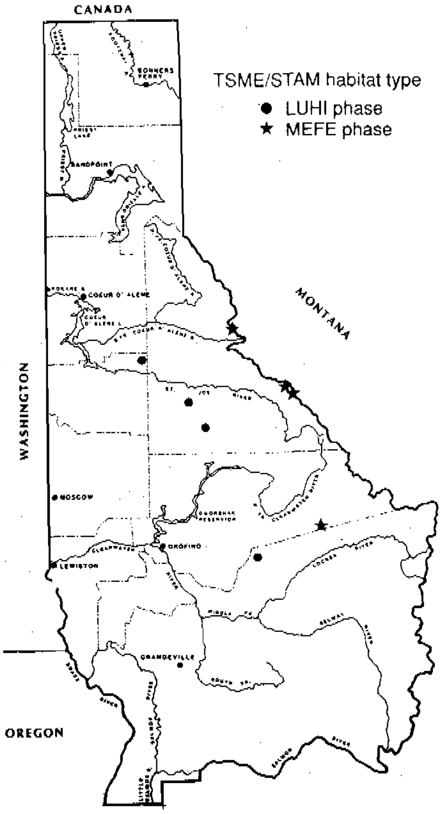
- ✱ XETE phase



TSME/STAM habitat type

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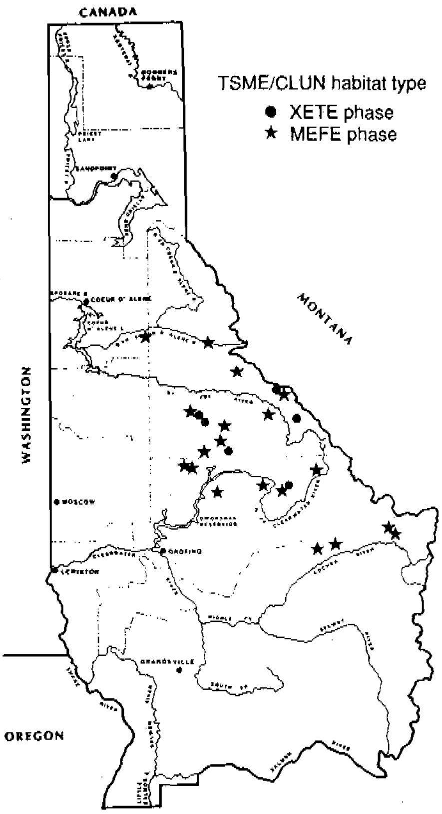
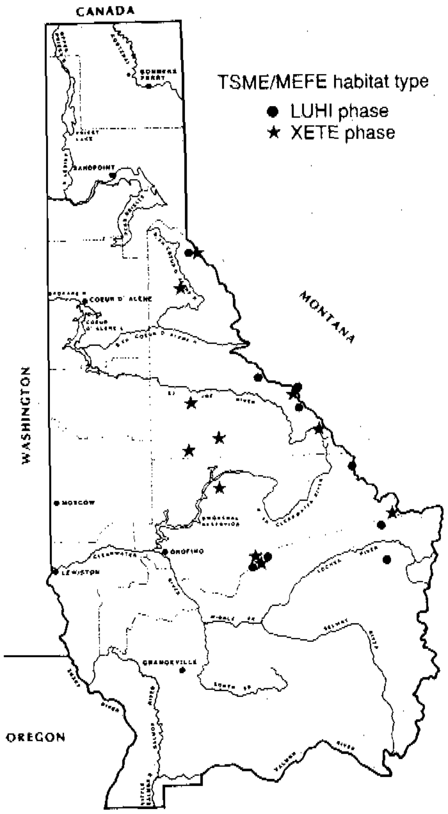
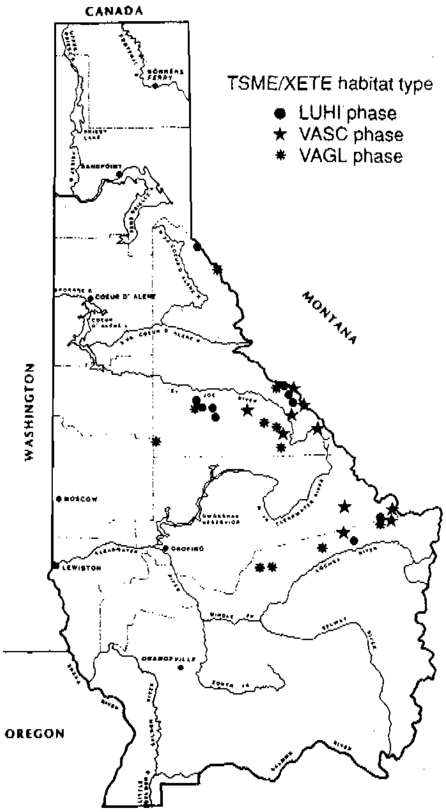
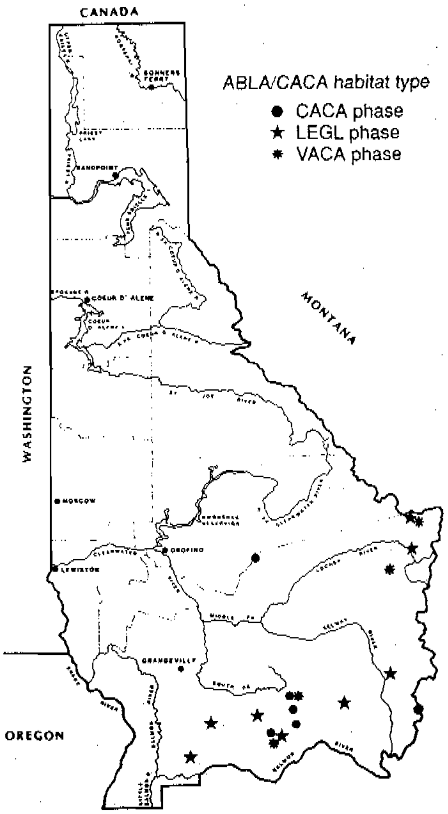
APPENDIX J (Con.)









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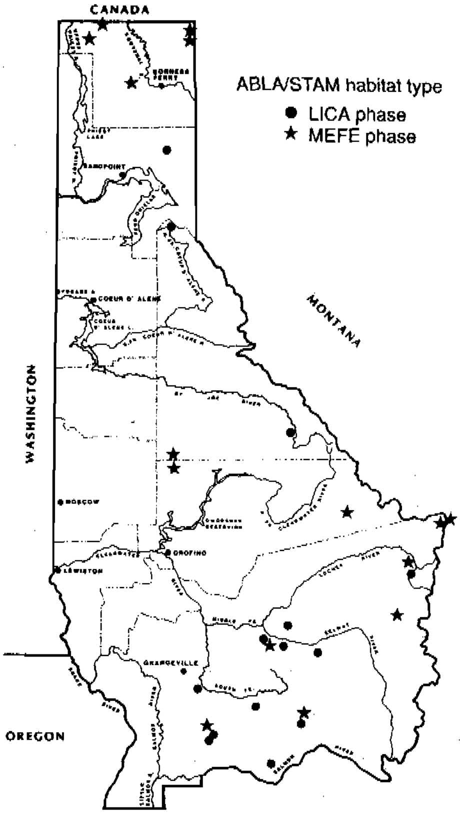

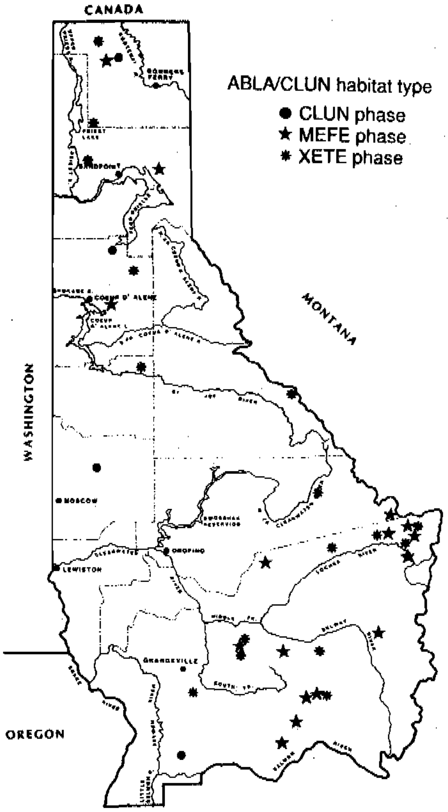

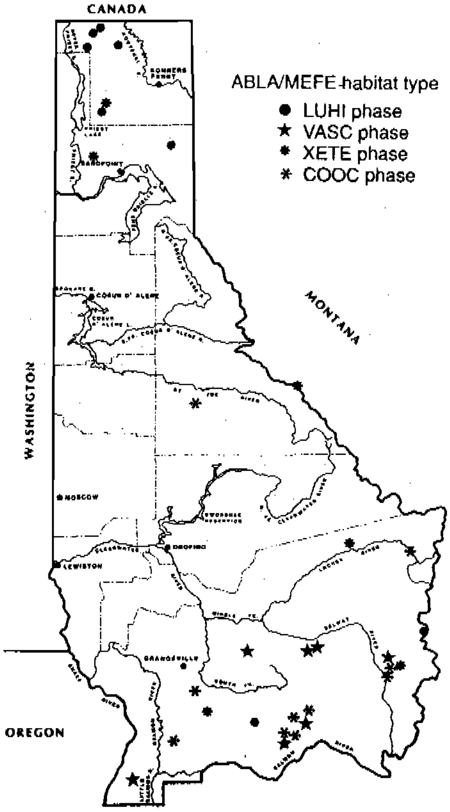

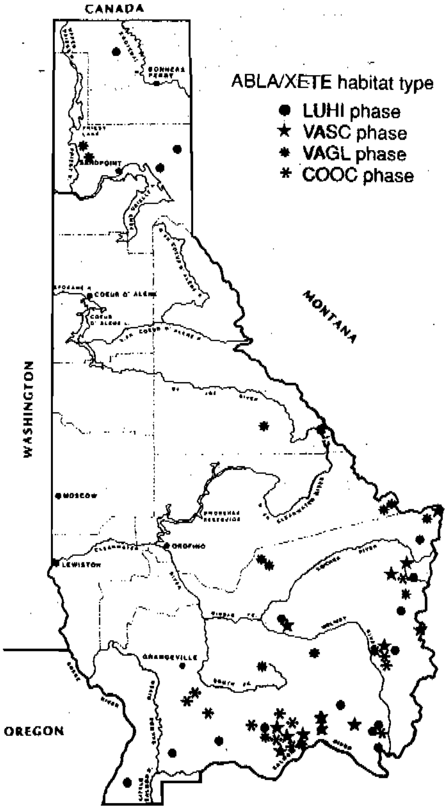

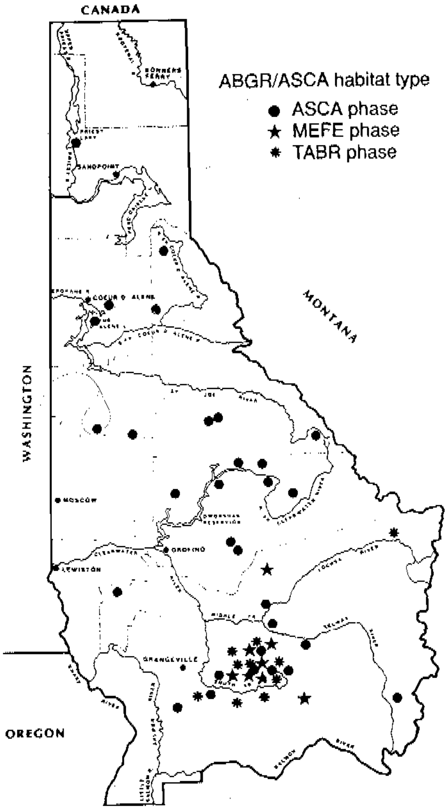
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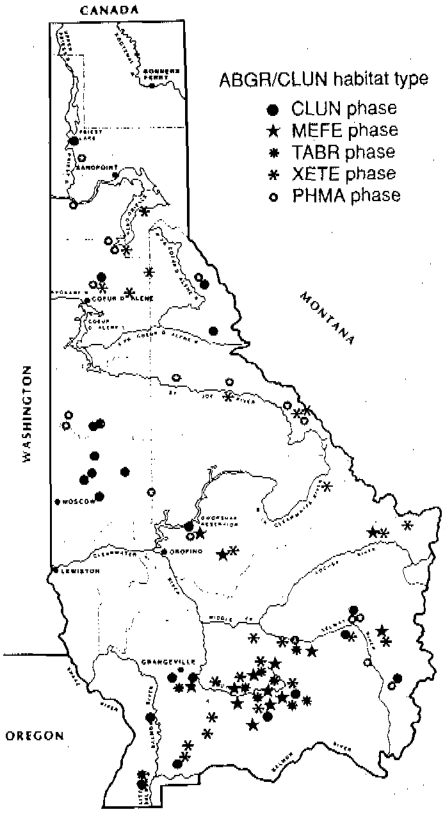
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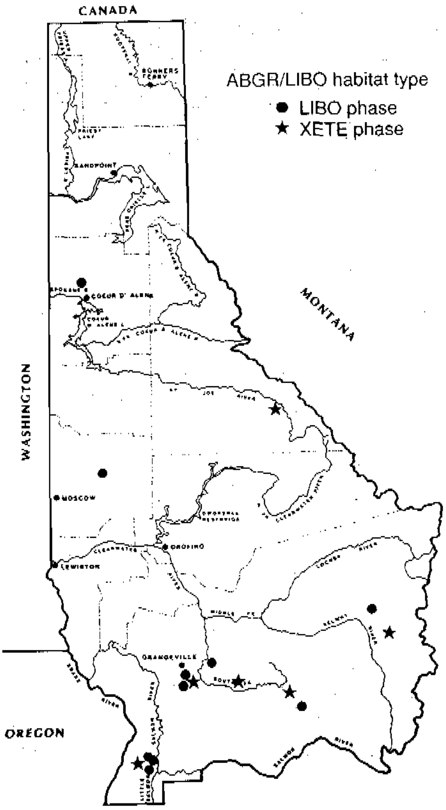
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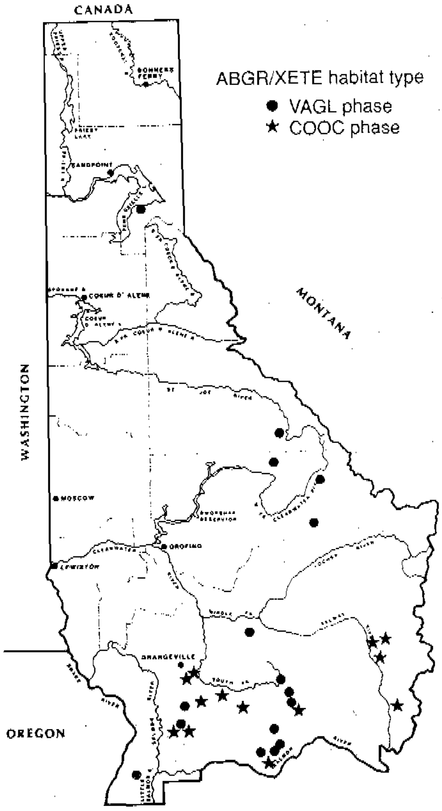
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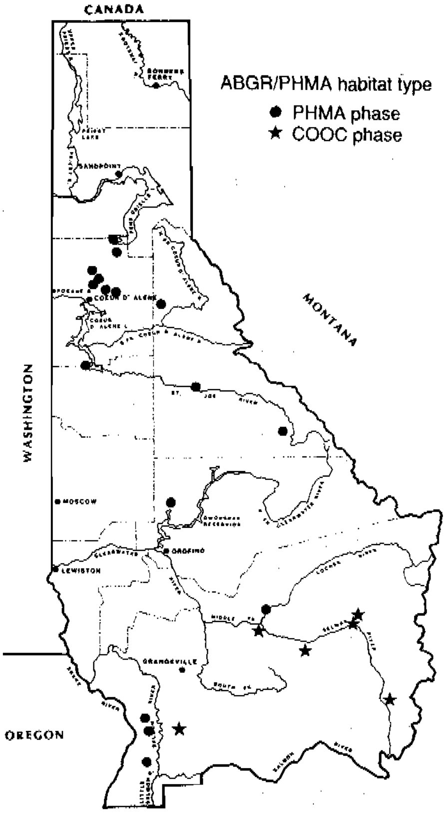
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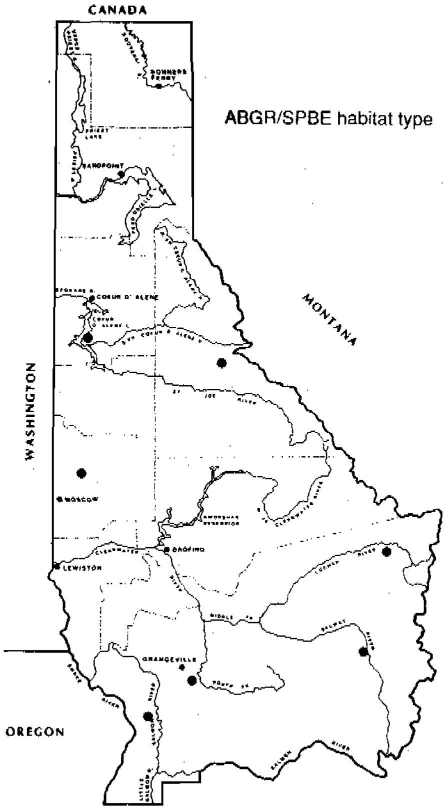
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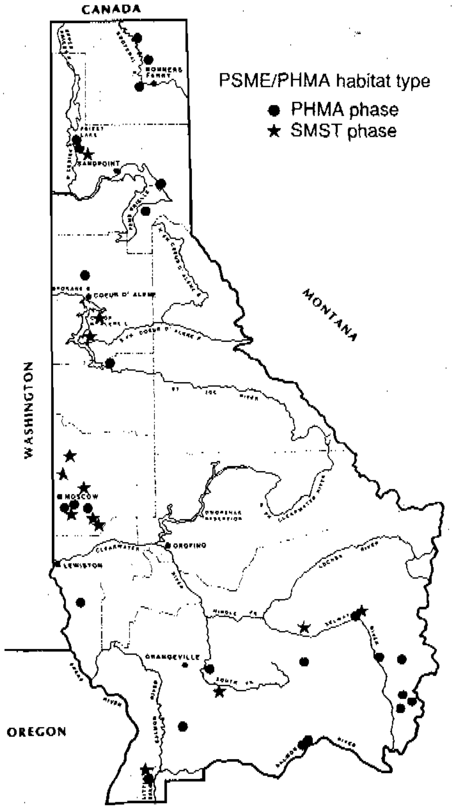
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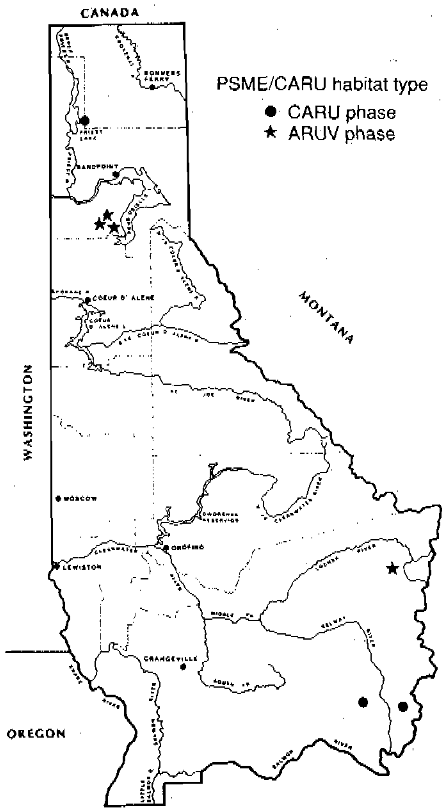
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★U.S. GOVERNMENT PRINTING OFFICE: 1991-573-041/21027

Cooper, Stephen V.; Neiman, Kenneth E.; Roberts, David W. Rev. 1991. Forest habitat types ot northern Idaho: a second approximation. Gen. Tech. Rep. INT-236. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 143 p.

The addition of more than 900 plots to the Daubenmire's original 181-plot database has resulted in a refinement of their potential natural vegetation-based land classification for northern Idaho. A diagnostic, indicator species-based key is provided for field identification of the eight climax series, 46 habitat types, and 60 phases. Recognized syntaxa are described by occurrence, environment, vegetation, and management implications.

KEYWORDS: northern Idaho, habitat types, forest communities, plant associations, hierarchical classification

INTERMOUNTAIN RESEARCH STATION

The Intermountain Research Station provides scientific knowledge and technology to improve management, protection, and use of the forests and rangelands of the Intermountain West. Research is designed to meet the needs of National Forest managers, Federal and State agencies, industry, academic institutions, public and private organizations, and individuals. Results of research are made available through publications, symposia, workshops, training sessions, and personal contacts.

The Intermountain Research Station territory includes Montana, Idaho, Utah, Nevada, and western Wyoming. Eighty-five percent of the lands in the Station area, about 231 million acres, are classified as forest or rangeland. They include grasslands, deserts, shrublands, alpine areas, and forests. They provide fiber for forest industries, minerals and fossil fuels for energy and industrial development, water for domestic and industrial consumption, forage for livestock and wildlife, and recreation opportunities for millions of visitors.

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