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U.S. Forest Service
United States Department of Agriculture
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ACKNOWLEDGMENTS

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RESEARCH SUMMARY

A habitat type classification is presented for the coniferous forests of northern Utah and adjacent areas of Idaho and Wyoming. The classification and descriptions are based on data from about 1,100 sample stands covering 6 years of reconnaissance sampling. The habitat type concept, a hierarchical system of land classification, is based on potential natural vegetation of forest sites. A total of 8 climaxes series, 36 habitat types, and 24 phases of habitat types were identified. A diagnostic key is provided for field identification of the habitat types based on the indicator species used in the development of the classification. In addition to a site classification, mature coniferous forest communities are described and tables provided to portray ecotinal distributions of all species. Potential productivity, timber, physical site characteristics, climatic characteristics, and surface soil characteristics are also described for each type. Preliminary implications affecting natural resource management and general successional dynamics for both trees and undergrowth species are discussed.
INTRODUCTION

Forest vegetation, and the sites that support it, are complex entities in themselves. Vegetation also reflects, however, the physical environment under which it has developed and will develop in the immediate future. Thus, some system of resource classification is fundamental to sound, intelligent management of both the forest vegetation and other site resources.

Pilster and others (1977) have briefly reviewed some of the classification systems that have been employed. They state that forest managers and researchers usually find special classifications inadequate for general use. For example, a cover-type classification often encompasses gey variability in forest conditions and, in addition, provides little information on the distribution of species of prime importance. A "physical" classification, on the other hand, has little relationship to forest vegetation, even though the environment substantially in the forest.

The need for an integrated classification system is clear. And as these authors have further noted, such a system must also provide a basis for improving communications, management interpretations, and research applications.

The habitat type approach to forest site classification is such a system. Developed by Rixford Daubenspeck (1963) for forests of northern Idaho and adjacent Washington, with subsequent modification (Daubenspeck and Daubenspeck 1969), it has proven to be useful for management and research applications (Leyser 1974; Pilster 1976). Thus, in 1971, the habitat type classification system was selected for development and application by the State of Montana (Pilster and others 1977). As a part of a program to expand such classifications throughout the western North America, the Forest Service initiated the development of the classification for Utah.

The classification the Utah Forests and Range Experiment Station and the Intermountain Region of the Forest Service, U.S. Department of Agriculture. This report constitutes the preliminary results of this classification

OBJECTIVES AND SCOPE

As a part of a broad regional classification program, the objectives of the northern Utah study correspond to those outlined by Pilster and others (1977):

1. Development of a classification for conifer-dominated forest lands based on potential vegetation.

2. Description of the general geographic, physiographic, climatic, and edaphic features of the type.

3. Description of the mature forest communities (state seral) as well as the potential climax communities (associational characteristics) of each type.

4. Presentation of information on successional development, timber productivity potential, and other biological observations of importance to forest land managers.

To provide a continuity between the classifications of specific areas, our terminology corresponds largely to that of Steele and others (1980). Reference to the glossary included in that publication as appendix G (p. 137-139) is encouraged. Also, their format of organization and presentation has been followed.

The area of study includes the forested lands of northern Utah and adjacent Idaho (fig. 1). As such, the classification encompasses parts of five National Forests, as well as private and public lands. Some land supporting certain plant communities were not included. Exposedly excluded were riparian sites dominated by Populus angustifolia, Betula occidentalis, Acer negundo, or Salix; various woodlands such as Acer grandidentatum, Quercus gambeli, Juniperus osteosperma, J. scopulorum, Pinus edulis, or P. monophylla; and Pseudotsuga taxocides lands of uncertain successional status. This classification therefore includes the forested lands that are potentially capable of supporting at least a 25 percent canopy cover of conifers, excluding woodland species.
**METHODS**

Plot Sampling

Mature to near-climax stands were sampled with temporary plots in an attempt to represent the full range of environmental conditions and late successional stages for forested sites throughout northern Utah and adjacent Idaho. Sampling was conducted over three summers. The methodology of the study essentially followed that of Pfister and others (1977), as recently discussed in further detail by Pfister and Abrams (1980).

Stands were selected for sampling by first inspecting forest conditions along a traveled transect usually a road or trail, generally following an elevational gradient. The identification of potential stands was based on the overstory, understory, substrate, and environmental characteristics, and also the relationships to both adjacent stands and the study area as a whole. Plots were then objectively located in the most representative and homogeneous parts of the most mature stands of the area. Ecotones, exceptionally dense clumps, openings, rock outcrops, and seeps were purposefully avoided. Reclassified stands were also avoided, but this was not always possible because of the invasive e that has occurred throughout much of the study area. The use of random or systematic systems for stand selection was rejected. Such methods are inefficient, generating many stands that either are not mature, which is necessary for classifying habitat types, or that represent ecotone conditions. Random selection systems also tend to oversample abundant communities and undersample scarcer ones.

Three distinct types of plots were used for sampling: survey plots, reconnaissance plots, and "detail research" or "Daubennim" (after Henderson and West 1977). All data were recorded on specially designed cards. In addition, extensive photography was employed, which proved to be valuable during data analysis. Survey plots were circular. During 1975, a 375-m² plot (about one-tenth acre) was used, with a centered 50-m² subplot for tree regeneration. After 1975, a 500-m² plot (about eight-eighths acre) and 100-m² subplot were adopted in order to provide a better representation of overstory conditions. In exceptionally dense stands of Pinus contorta, however, a 250-m² plot (50-m² subplot) was substituted to reduce data collection time.

The less intensive reconnaissance plot was chiefly used in 1977 for verifying the classification and for supplementing sample. Reconnaissance plots were similar to the survey plots, except that plot boundaries encompassing about the same area were estimated, not measured, and less data were collected. One investigator can lay out and collect the data on a reconnaissance plot in about 20 minutes, versus 45 minutes to 2 hours for the survey plot, or 2 to 4 hours for the detailed research plot (Henderson 1979).

The detailed research plot was employed to provide both training and recurrant calibration of cover estimates. This plot was derived from Daubennim (1909; see also Daubennim and Daubennim 1968). The cover of each upgrowth species was estimated indepen-
Notes were made on stand and fire history and the relationship of the sample stand to adjacent stands as well as on wildlife use, forest diseases and pests, and general management implications.

During the summer of 1975, a total of 445 plots were sampled in the Wasatch, Caribou, and Sawtooth National Forests of northwestern and adjacent Idaho (fig. 1). This was done by three-person teams. In 1975, 256 plots were sampled in the Uinta Mountains, Utah, and Wyoming by two two-person teams. This work covered the Ashley and Wasatch National Forests and an adjacent section of the Uinta National Forest. During the summer of 1977, 292 reconnaissance plots were sampled throughout northern Utah by these individuals for classification verification or for supplemental sampling where data were scant. In addition, about 10 survey plots in 1975, 25 plots in 1986, and 11 plots in 1981 were taken in the latter purpose.

In 1975 and 1977, the higher forested mountain ranges of the Green River, Bear River, and Madison Basins included the Deep Creek Range and Oquirrh, Rattlesnake, and Stansbury Mountains of Utah; and the Black Pine Range, another Wasatch Range including the Albion Mountain of Idaho. Sampling was generally more intensive in the more northern mountain ranges where accessibility was better. All of these areas, except the Deep Creek Range, are represented in the data by 47 plots. In addition, 84 plots sampled by Pfister (1972) in northern Utah were used for verification and then incorporated into the dataset. Thus, the classification has been developed from about 1,182 plots. The distribution of plots was present in National Forest and State or geographic region in appendix A.

Office Procedures

The development of this habitat type classification follows in general the data analysis procedures discussed in detail by Pfister and Pfister (1980). The classification was developed through a series of successive approximations and revisions, and its general chronological development is outlined as follows:

1. Subjective first groupings were made following each field season (1975 and 1977). These were based on habitat types reported from adjacent studies (see above) and from observations made during sampling. Possible new habitat types were briefly described.

2. Following the identification of voucher collections, all data were prepared for computer processing. Computer programs were developed by the senior author for specific analyses throughout the course of the study.

3. Synthesis tables (found in tabular format and as a listing of land types between adjacent types—for example, ABLA-BEE h.t., RM1-2 h.t.) were prepared. These tables were used for convenience throughout this report; these are shown in table 1.1. A phase may also represent a different of similarity matrices were computer generated for particular difficult groups of stands. Initially, "Severance's k-1 index (Dusch-Peddie and Moir 1970) and, later, the Bray-Curtis index (Mueller-Dombois and Ellenberg 1974) were used, with the specific percentages of cover as attributes. Cluster analysis dendrograms were also created from the similarity matrices through the use of the general purpose program, CLUSTER (Marshall and Romsburg 1977), along with UPGMA clustering linkage (Unweighted Pair Group Method. Both of these analyses provided general insights for the problem areas.

<table>
<thead>
<tr>
<th>Table 1—Northern Utah forest habitat types</th>
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<tr>
<td>Abbreviation</td>
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| PFJULECE h.t. | Pinus flexilis/Cercocarpus ledifolius h.t. | | |}
| PFJUREBE h.t. | Pinus flexilis/Barberia repens h.t. | | |}
| PIPORAGE h.t. | Pinus ponderosa/Carex geyeri h.t. | | |}
| PITFOOE h.t. | Pinus ponderosa/Paxtoniidae h.t. | | |}
| ARPA phase | -Acrothamnus petulue phase | | |}
| ARTR phase | -Ampelopsis tridentata phase | | |}
| FEID phase | -Festuca idahoensis phase | | |}
| PEMEIPEMA h.t. | Pseudotsuga menziesii/Ptychosporus maculatus h.t. | | |}
| PAMY phase | -Pachystima myrtalis phase | | |}
| PEMPSA h.t. | Pseudotsuga menziesii/S. t. maculatus h.t. | | |}
| PEMCOCH h.t. | Pseudotsuga menziesii/Camphorita chilensis h.t. | | |}
| PEMSCARU h.t. | Pseudotsuga menziesii/Camphorita rubescens h.t. | | |}
| PEMCELE h.t. | Pseudotsuga menziesii/Cercocarpus ledifolius h.t. | | |}
| PEMCABE h.t. | Pseudotsuga menziesii/Berberis repens h.t. | | |}
| -CAGE phase | -Carex geyeri phase | | |}
| -JUCO phase | -Juncus communis phase | | |}
| -SYR phase | -Symonachina oreyophos phase | | |}
| -BERE phase | -Berberis repens phase | | |}
| PEMSTORS h.t. | Pseudotsuga menziesii/Symonachina oreyophos h.t. | | |}
| PEMGUN h.t. | Picea pungens/Apogynon spicatum h.t. | | |}
| PIPUGAS h.t. | Picea pungens/Barberia repens h.t. | | |}
| PIPUBER h.t. | Picea engelmannii/Symonachina oreyophos h.t. | | |}
| ABCCOPHMA h.t. | Abies concolor/Physocarpus maculatus h.t. | | |}
| ABCECOH h.t. | Abies concolor/Schizocarpus cristatus h.t. | | |}
| ABCEBRE h.t. | Abies concolor/Barberia repens h.t. | | |}
| -SYR phase | -Symonachina oreyophos phase | | |}
| -BERE phase | -Berberis repens phase | | |}
| PNIEGAR h.t. | Picea engelmannii/Equisetum arvense h.t. | | |}
| PENICALE h.t. | Picea engelmannii/Caltha leptosepala h.t. | | |}
| PENIVACA h.t. | Picea engelmannii/Vaccinium caespitosum h.t. | | |}
| PENIAVAC h.t. | Picea engelmannii/Vaccinium scoparium h.t. | | |}

| In other cases, a phase may distinguish geographic sub- | divisions of types that have wide distributions—for | example, PSEMEICOL h.t., PAMY phase. | | |}
| divisions of types that have wide distributions—for | example, PSEMEICOL h.t., PAMY phase. | | |}
| examples provided general insights for the problem areas. | | | |
13. This classification provides the foundations for developing "sensitive" considerations useful for management or for future research. For example, consider the appraisal of timber productivity, which immediately follows. An understanding of the environmental and vegetative features of each habitat type can help the user answer many pressing management questions. Some of the more obvious relationships have been stressed in the descriptions. Undoubtedly more will become known as the system is used.

Timber Productivity

Timber productivity is one of the key management considerations for which data were collected in the northern Utah study. Quantitative measures of productivity followed those of Pfister and others (1977).

For each plot, one dominant or codominant tree of each species was selected for age and height measurement, wherever possible. Trees were rejected for further analysis if increment curves exhibited diameter-growth suppression or if height growth was less than 7 feet per year. The trees used, then, represent the productivity of relatively free-growing trees existing at any given stand.

Pfister and others (1977) outlined the special procedures and considerations for determining site index from age-height data. For curves based on total age, the number of years to reach breast height must be determined. Species for which site index curves are not available require the use of a substitute curve. In addition, each curve has a range of basic age-height data from which it was derived. Trees having values not included in these ranges were rejected for site index analysis. Criteria used to determine total age and the sources of site index and yield capability curves are summarized in table 2.

Lynches's (1968) Picea pondersiana curve was used to determine Pseudotsuga site index rather than Bracken's (1969) curve because the latter does not have yield capability relationship.

Although we had to determine total age (introducing a possible error), the Picea pondersiana curve was used to determine Abies concolor and Picea flexilis site index. This use also facilitated a direct comparison with Pseudotsuga, which is the most common associate of these species. Alexander's (1967) Picea engelmanni curve also appeared to reflect rather reasonably Abies concolor site index, but it poorly represented Picea flexilis.

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The site index data (base age 50 years) have been summarized by species within habitat type (appendices E-1 and E-5). Because there were marked occurrence and apparent regional differences in productivity for some habitat types, all timber productivity data were tabulated separately for the northwest Oregon region and the Utitata Mountains. The mean site index was calculated whenever three or more values were available, with five or more values, a 95 percent confidence interval for estimating the true population mean was calculated. The procedure was used for sum- mation basic areas of sample stands.

Site index alone can be used to compare differences in site productivity. A more useful assessment, however, is that of net estimated yield capability (cubic-foot produc- tion). Pilscher and others (1977) further explain yield capability.

Until man-made stand tables are mature, the best approach is to use natural- stand yield tables for assessing yield capa- bility. This approach is used in this report. Yield capability as used by Forest Survey, is defined as mean annual increment of growing stock attaining fully stocked stands at the age of culmination of mean annual increment.

The computer program was developed for the graphic and statistical analysis of the yield capability estimates. The procedures employed were essentially those of Pilscher and others (1977): 1. Yield capability was estimated for each site tree according to the criteria set forth in table 2. These estimates were then divided within each category habitat type or phase, by region, for a visual display of data distribution.

2. Mean yield capability based on all site trees in each category was calculated. Cutoffs were established to within approximately 90 percent of the collection of data. Values were combined and new means and cutoffs were determined.

3. For habitat types (or phases) where stock- ability appeared to limit productivity, a stockability factor was used. The cutoffs for plots in these categories were compared to Meyer's (1930) basal area data for western Oregon, with habitat type as the basis (Nimrod and Boisjoly 1973). From these calculations and additional observations, an average mean stock- ability value for each region was assigned to each habitat type.

4. Yield capability and mean index are presented in appendix E-2. These estimates were used to determine a regional average yield capacity. The yields were then divided within each category habitat type or phase, by region, for a visual display of data distribution.

The curves used to determine yield capability from site index are presented in figure 2; sources of the relationships are discussed in table 2. All yield capability values (cubic feet/acre/year) are based on all trees 0.5 inches d.b.h.

The site index (y-axis) in figure 2 can be evaluated to determine within which range the site falls. The lines representing the yield curves are labeled with the yield class at the 100- and 150-year age classes. The yield formula is determined for each site tree, and the resultant plot is compared to the yield curve. If the site tree falls outside the area of the yield curve, the yield is assumed to be significantly below the potential level.

In some cases in figure 2, the yield curve is dashed. This indicates that the number of observations is too low for a reliable yield curve.

The yield capability data are presented in table 3. The data are presented for each habitat type or phase, by region, for a visual display of data distribution.

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SYNECOLOGICAL PERSPECTIVE AND TERMINOLOGY

The following two sections of discussion are quoted directly from Pfenker and others (1977, p. 9-11).

Definition and Explanation of Habitat Type

All plant communities potentially capable of producing similar plant communities at climax may be classified as the same habitat type (Dudenskii 1966). The climax plant community, because it is the end result of plant succession, reflects the most meaningful integration of the environmental factors affecting vegetation. Thus, each habitat type represents a relatively narrow segment of environmental variation and delineates a certain potential for climax vegetation. Each habitat type supports a variety of disturbance-induced, or serial, plant communities, but the vegetative succession following a disturbance produces similar plant communities at climax throughout the type.

The climax plant community, or association, provides a logical name for the habitat type—for example, Pseudostachys menziesii/Calamagrostis ramosa. The first part of this name is based on the climax tree species, which is usually the most shade-tolerant tree species adjacent to the climax. The second level of classification is the series and it encompasses all habitats in a certain division at climax. The second part of the habitat type name is based on the dominant or characteristic undergrowth species in the climax community type.

Unlike taxonomic synonyms to name habitat types does not imply that we have an abundance of climax vegetation in the present landscape, but that the vegetation in the landscape reflects some form of disturbance and variation that relates to a position towards climax. Nor do climax community type names imply that management for climax vegetation in the future is an effective tool for protecting the environment. Some habitats do develop on deep loamy soils of gently undulating relief; an edaphic climax could form from the climatic climax due to extreme soil conditions such as coarse texture or poor drainage; and a topographic climax is a combination of compensating effects of topography on microclimate. The topographic climax is a convenient way to designate deviation from a climatic climax due to combined effects of edaphic and topographic factors. Some habitat types have a definite direction, but the majority often occur in two or more of the above categories in response to interaction of environmental factors.

Habitat Types Versus Continuum Philosophy

A vigorous debate has been carried on for many years by ecologists over comparison by considering the relative reproductive success of the tree species present with known successional trees. The use of only existing undergrowth vegetation. Successional trends towards climax communities—i.e., phytosociologists. Although several philosophers have contributed to the interpretation plant communities, two of them are often the center of debate: (1) the advocates of the continuum type versus climax and (2) the continuum type versus climax and are repeated over the landscape where environmental conditions are similar; and (3) the continuum advocates argue that even at climax, vegetation, life types and community classification must remain the same as the Wastach, a range that is similar to those in the Great Basin (Cronquist and others 1972). As Cottam (1930) stated, "the Uinta Mountains represent Utah's only claim to a typical Northern Rocky Mountain Flora." This is reflected prominently in the associations of vegetation in each respective area and therefore, their prevalent habitat types.

Because of these differences, the Uinta Mountains are largely treated throughout the discussion as a separate region of the study area, advocates may be regarded habitat type classifications as an attempt to draw fine lines at intervals along a complex vegetational continuum. Collier and others (1973) presented the contrasting philosophies and advocated an intermediate viewpoint.

While this debate may be of interest academically, it need not concern natural resources and students who need a logical, organized classification with which to work. We have proceeded under the philosophy that if a "continuum" does exist, then we would subdivide it into classes. Our primary objective has remained to develop a logical classification that reflects the natural processes involved.

The physical setting

The physiography of the study area is generally characterized by several high, discontinuous mountain ranges and a narrow belt of lowlands through which the Wasatch Mountains run. The Wasatch Mountains consist mostly of Precambrian schist and gneiss. The southermost portion of the Wastach Mountains is the study area and that area is geographically the Wasatch Range. In this area, the mountain ranges are Precambrian quartzite and argillite, and various Paleozoic and Mesozoic sedimentary rocks (both carbonate and non-carbonate).

Additional, the study area includes the Little Cottonwood Canyon. The Wasatch conglomeration is widespread from the Utah-Ideas border toward the Great Basin to the Wastach Ranges to the northeast of Salt Lake City. Terrain is generally gentle to rolling uplands. This formation is comprised of sand and gravel and is of early Tertiary deposition (Williams 1946). It has been mapped by Stiles, Stiles, and Johnson (1967) and the map is the Northen region.

The complex vegetational communities of the study area are primarily represented by the Wasatch and the Sangre de Cristo mountains. The southeastern portion of the study area, the Uinta Mountains, is geographically the Wasatch Range. The Uinta Mountains are geographically the Wasatch Range. The Uinta Mountains represent Utah's only claim to a typical Northern Rocky Mountain Flora. This is reflected prominently in the associations of vegetation in each respective area and therefore, their prevalent habitat types.

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The topography of the Uinta Mountains, then, is largely determined by mountainous and forested features. In addition, that of the more western and central areas has also been shaped by the extensive glacial action. Extensive glacial activity has sculpted several glaciers extending well into the surrounding basins. Those of the south slope cut very deep canyon systems, whereas those of the north slope (the Uinta-Madison) have cut only shallow or imperceptible ones in this respect. Throughout, the higher elevations are characterized by cirques such as the scalloped crest, and large, deep-crested basins. Additionally, extensive interbasin, plateaulike surfaces remain in most areas. The largely restricted to the southwestern and southeastern Uinta are characterized by deep V-shaped cirques topographically similar to that of the Wasatch Range.

Contrasting plant communities often develop at the contact of calcareous and noncalcareous substrates throughout northern Utah and adjacent Idaho. Various situations have become apparent in the course of study, including: calcareous series and habitat types. Many instances are quite similar to those which have been described by others (1971), central Idaho through western Wyoming (Steels and others 1981, 1980), and north-central Wyoming (Hoffman and Alexander 1976). Pelton and others (1977, p. 12) have also listed several, more local studies of such communities in and around Montana. But the Uinta Mountains in general and for Picea contorta and Pseudotsuga menziesii there in particular, Duspratt's (1970) study of the vegetation near Recapture, Wyo., is especially significant in this respect.

The Wasatch conglomerate is not directly affected on plant communities because the surface of this formation occurs well within the temperature range of Pseudotsuga, yet Pseudotsuga is not widely associated with this substrate. Instead, persistent Pseudotsuga tremuloides communities of fire origin as well as various nonforest communities dominate these sites. Whether this pattern represents an idiosyncrasy of Pseudotsuga to the soils or is related to moisture patterns is not apparent. On the other hand, some of the most productive sites for Picea engelmannii are associated with the highest elevations in the Uinta Mountains. Although only a few of these stations are situated within the forested zone, the others allow for general correlations within northern Utah.

Temperature is influenced most strongly by elevation. Generally for Utah, mean annual temperature decreases about 2 °F (1.1 °C) for each 1,000 feet (305 m) increase in altitude, and decreases approximately 1.5° to 2.0 °F (0.8° to 1.1 °C) for each 1° increase in latitude (Brown 1960). Temperature and microclimate, however, can be greatly modulated by slope exposure or cold air drainage or fog. Two additional influences on temperature are locally produced by the area. One is wind chill, temperature inversions, ranging from 500 to 1,500 feet (150 to 450 m) in depth, develop in surrounding valleys as a result of downslope drainage and valley accumulation. Thus, temperatures of lower mountain slopes situated above the inversion layers can average between 8° and 18° F (0° and -8° C) higher than valley bottoms (Wilson and others 1975). Second, both the Great Salt Lake and Provo Lake have a mediating effect on the temperatures of nearby mountains (Brown 1960); these lakes also lower air temperatures by increasing the moisture content of the western storm systems. This high mountainous area has special significance within the study area. Abies concolor has its northernmost Rocky Mountain location near Logan, Utah. As Abies concolor is a temperate species, the study of its distribution is significant to that of the Wasatch Range area.

The second pattern is associated with moisture-laden air flowing in from the Pacific Ocean from the Gulf of Mexico during the spring and summer months. This pattern usually penetrates only to the southern Uinta Mountains. These areas are irregularly developed. For example, mean precipitation for the period of May to August is significantly higher for the Utah sections than for the Wasatch Range stations (appendix D-2). The occurrence of Pines ponderosa within its temperature limits could reflect the distribution of this early growing season rainfall through the lower eastern Uintas to the northeastern area. Farther west, the high crest creates a rain shadow condition in local areas of the north-central slopes. There, Picea contorta is frequently the indicated climax. Both of these vegetation patterns are discussed in more detail under each respective mountain range.

Wind patterns also significantly influence vegetation. Wind-speed usually varies with elevation and local topography, with upper slopes and ridgtops being most windy. Wind-speed averages 15 to 20 miles per hour (24 to 32 km/h) at higher elevations, and about half as much at lower elevations. (Winds up to 90 miles per hour (145 km/h) accompany cold fronts, intense thunderstorms, and other conditions.) Although only a few of the stations are situated within the forested zone, the others allow for general correlations within northern Utah. Wind patterns also significantly influence vegetation.
The entire classification is listed in table 1 for convenient reference. Only scientific names are used in the text to prevent the confusion that might result from common names. All species of the genera included in table 1, under each habitat type description heading, and in the checklist, appendix F. Frequent reference to type names requires the use of abbreviations: all follow a standard four-letter code, which consists of the first two letters of the genus and the first two letters of the species. Initially this code may be confusing, but it is easily mastered.

The classification is presented in the following order:

1. Key to the habitat types (fig. 3).—The first step in the correct identification of the habitat type is to become familiar with the instructions for the use of the key. The identification of the potential climax series, the habitat type, and finally the phase follows.

2. Series description.—This provides a general overview for each series and the habitat types. It usually includes a discussion of characteristics common to most of the habitat types within the series.

3. Habitat type description.—This information summarizes the geographic range, environmental features, vegetation, phases, and general management implications.

The series are discussed in an order that generally corresponds to an increasing moisture gradient and an increasing altitudinal gradient. Of course, not all series are encountered in any given location of the study area. The westernmost Uinta Mountains are the most diverse in this respect.

Under each series habitat types are presented in the order of their position in the key. Typically, the position of an indicator species in the key also reflects its relative ecological amplitude—species appearing first tend to have more restricted requirements and are on more moist sites than those appearing later. The order of habitat types usually reflects the relative extent of the type across the landscape, except that most of the last few types listed are minor in occurrence. Until the user gains experience with the classification, the identification of particularly awkward sites can be aided by this knowledge of indicator amplitude and of the relative dryness of a site.

The extent of the habitat types is indicated by relative terms. "Incidental" types occur as isolated extensions of types that reportedly are more common in other areas, such as ABLA; STAM. "Local," or "minor," habitat types are either prevalent in specific locations within the study area (for example, ABLA; CARU) or widespread in occurrence but do not occupy extensive areas throughout a region or the entire study area (ABLA; CACU). "Major" habitat types are both widely distributed and extensive (PINEBE, ABLA; BERE, and APLA; VASC).

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

READ THESE INSTRUCTIONS FIRST!

1. Use this key for stands with a mature tree canopy that are not severely disturbed by grazing, logging, forest fire, etc. of the stand is severely disturbed or in an early successional stage, the habitat type can best be determined by extrapolating from the nearest mature stand occupying a similar site. (The first phase description that fits the stand is the correct one.)

2. Accurately identify and record canopy coverages for all indicator species (appendix F). Canopy coverage is the nearest percentage of cover, from 1 to 10 percent and the nearest 5 percent thereafter. If a species is present with a 0.5 percent cover and is not obviously restricted to typical microsites, record a "T" for trace.

3. Check plot data in the field to verify that the plot is representative of the stand as a whole. If not, take another plot.

4. Identify the correct potential climax tree species in the Series key. (Generally, a tree species is considered reproducing successfully if 10 or more individuals per acre [25 per hectare] occupy or will occupy the site.)

5. Within the appropriate series, key to HABITAT TYPE by following the key literally. Determine the phase by matching the stand conditions with the phase descriptions for the type. (The first phase description that fits the stand is the correct one.)

6. If you have difficulty deciding between types, refer to constancy and coverage data (appendix C: 1) and the habitat type descriptions.

7. In stands where growth is obviously degenerated (unsusurably sparse) because of dense shading or litter accumulations, reduce the critical key coverage levels from 1 percent to "present" and 5 percent to 1 percent.

8. Remember, the key is NOT the classification! Validate the determination made using the key by checking the written description.

Key to Climax Series

(DO NOT PROCEED UNTIL YOU HAVE READ THE INSTRUCTIONS!)

1. Abies lasiocarpa present and reproducing successfully .......................... Abies lasiocarpa Series (item H)

2. Abies lasiocarpa not the indicated species ........................................... 2

3. Abies concolor present and reproducing successfully .......................... Abies concolor Series (item E)

4. Abies concolor not the indicated climax ............................................. 3

5. Picea engelmannii present and reproducing successfully ....................... Picea engelmannii Series (item F)

6. Picea engelmannii not the indicated climax ......................................... 4

7. Picea pungens present and reproducing successfully .......................... Picea pungens Series (item D)

8. Picea pungens not the indicated climax ............................................. 5

9. Pinus flexilis a successfully reproducing dominant, often sharing that status with Pseudotsuga ................................................................. Pinus flexilis Series (item A)

10. Pinus flexilis absent or clearly rare .................................................. 6

11. Pseudotsuga menziesii present and usually reproducing successfully .......... Pseudotsuga menziesii Series (item C)

12. Pseudotsuga menziesii not the indicated climax .................................. 7

13. Pinus ponderosa present and reproducing successfully ....................... Pinus ponderosa Series (item B)

14. Pinus ponderosa not the indicated climax .......................................... 8

15. Pure Pinus contorta stands with little evidence as to potential climax .... Pinus contorta Series (item G)

16. Pinus contorta absent. Populus tremuloides present ............................. Populus tremuloides Series (Unclassified)

(CON.)
**Figure 2.** (con.)

<table>
<thead>
<tr>
<th>A. Key to Pine flexilis Habitat Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <em>Cercocarpus ledifolius</em> at least 5% cover (and persistent)</td>
</tr>
<tr>
<td>2. <em>C. ledifolius</em> less than 5% cover or clearly seral</td>
</tr>
<tr>
<td>3. <em>Berberis repens</em> at least 1% cover</td>
</tr>
<tr>
<td>4. <em>B. repens</em> less than 1% cover; <em>Leucopost</em> kingi present</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B. Key to Pine ponderosa Habitat Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <em>Carex cliveri</em> at least 5% cover</td>
</tr>
<tr>
<td>2. Not as above; <em>Festuca idahoensis</em> or <em>P. owina</em> present</td>
</tr>
<tr>
<td>a. <em>Arctostaphylos patula</em> at least 5% cover</td>
</tr>
<tr>
<td>b. <em>Artemisia tridentata</em> at least 5% cover</td>
</tr>
<tr>
<td>c. Not as above</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C. Key to Pseudotsuga menziesii Habitat Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <em>Physocarpus malvaceus</em> at least 5% cover</td>
</tr>
<tr>
<td>2. <em>P. malvaceus</em> less than 5% cover</td>
</tr>
<tr>
<td>3. <em>Acer glabrum</em> at least 5% cover</td>
</tr>
<tr>
<td>4. <em>A. glabrum</em> less than 5% cover</td>
</tr>
<tr>
<td>5. <em>Osmorhiza chilensis</em> or <em>O. depauperata</em> at least 5% cover either separately or collectively</td>
</tr>
<tr>
<td>6. <em>O. chilensis</em> or <em>O. depauperata</em> less than 5% cover</td>
</tr>
<tr>
<td>7. <em>Calamagrostis rubescens</em> at least 5% cover</td>
</tr>
<tr>
<td>8. <em>C. rubescens</em> less than 5% cover</td>
</tr>
<tr>
<td>9. <em>Cercocarpus ledifolius</em> at least 5% cover</td>
</tr>
<tr>
<td>10. <em>C. ledifolius</em> less than 5% cover</td>
</tr>
<tr>
<td>11. <em>Berberis repens</em> or <em>Pachistima myrsinites</em> at least 1% cover</td>
</tr>
<tr>
<td>a. <em>Carex cliveri</em> at least 5% cover</td>
</tr>
<tr>
<td>b. <em>Juniperus communis</em> at least 5% cover</td>
</tr>
<tr>
<td>c. <em>Symphoricarpus oreophilus</em> at least 5% cover and <em>Leucopost</em> kingi usually present, stands isolated or never achieving closed canopies</td>
</tr>
<tr>
<td>d. Not as above</td>
</tr>
<tr>
<td>12. <em>B. repens</em> and <em>P. myrsinites</em> less than 1% cover; <em>Symphoricarpus oreophilus</em> present (and usually greater than 9% cover)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>D. Key to Picea engelmannii Habitat Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <em>E. arvense</em> at least 5% cover</td>
</tr>
<tr>
<td>2. <em>E. arvense</em> less than 5% cover</td>
</tr>
<tr>
<td>5. <em>A. clematitis</em> at least 5% cover</td>
</tr>
<tr>
<td>6. <em>A. clematitis</em> less than 5% cover; <em>Berberis</em> repens or <em>Juniperus communis</em> present</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>E. Key to Abies concolor Habitat Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <em>Physocarpus malvaceus</em> at least 10% cover</td>
</tr>
<tr>
<td>2. <em>P. malvaceus</em> less than 10% cover</td>
</tr>
<tr>
<td>3. <em>Osmorhiza chilensis</em> at least 10% cover (or riparian tree species present)</td>
</tr>
<tr>
<td>4. Not as above; <em>Berberis</em> repens or <em>Pachistima myrsinites</em> present</td>
</tr>
<tr>
<td>a. <em>Symphoricarpus oreophilus</em> at least 5% cover or stands isolated or never achieving closed canopy</td>
</tr>
<tr>
<td>b. Not as above</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>F. Key to Picea engelmannii Habitat Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <em>E. arvense</em> at least 5% cover</td>
</tr>
<tr>
<td>2. <em>E. arvense</em> less than 5% cover</td>
</tr>
<tr>
<td>5. <em>A. clematitis</em> at least 5% cover</td>
</tr>
<tr>
<td>6. <em>A. clematitis</em> less than 5% cover; <em>Berberis</em> repens or <em>Juniperus communis</em> present</td>
</tr>
<tr>
<td>4. <em>Vaccinium caespitulosum</em> at least 1% cover</td>
</tr>
<tr>
<td>5. <em>V. caespitulosum</em> less than 1% cover</td>
</tr>
<tr>
<td>6. <em>Vaccinium scoparium</em> at least 5% cover</td>
</tr>
<tr>
<td>7. <em>V. scoparium</em> less than 5% cover</td>
</tr>
<tr>
<td>8. <em>Ribes montigenum</em> present</td>
</tr>
<tr>
<td>9. <em>R. montigenum</em> absent; <em>Juniperus communis</em> the major undergrowth species</td>
</tr>
</tbody>
</table>
G. Key to Pinus contorta Communities

1. Calamagrostis canadensis at least 5% cover
2. C. canadensis less than 5% cover
3. Vaccinium caespitosum at least 1% cover
4. V. caespitosum less than 1% cover
5. Vaccinium scoparium at least 5% cover
6. V. scoparium less than 5% cover
7. Calamagrostis rubescens at least 5% cover
8. C. rubescens less than 5% cover
9. Stands of the south-central Uintas; Juniperus communis (or Arctostaphylos pumila) the dominant undergrowth
10. Not as above
11. Arctostaphylos uva-ursi at least 1% cover
12. A. uva-ursi less than 1% cover
13. Berberis repens or Pachistima myrsinites present
14. B. repens and P. myrsinites absent

H. Key to Abies lasiocarpa Habitat Types

1. E. arvense at least 5% cover
2. E. arvense less than 5% cover
3. Calamagrostis canadensis at least 5% cover
4. C. canadensis less than 5% cover
5. Streptopus amplexifolius or Senecio triangulatus at least 5% cover either separately or collectively
6. Not as above
7. Caltha leptosepalia at least 1% cover
8. C. leptosepalia less than 1% cover
9. Actaea rubra at least 5% cover
10. A. rubra less than 5% cover
11. Physocarpus malvaceus at least 5% cover
12. P. malvaceus less than 5% cover
13. Acer glabrum or Sorbus scopulina at least 5% cover either separately or collectively
14. Not as above
15. Vaccinium caespitosum at least 1% cover
16. V. caespitosum less than 1% cover (con.)

Figure 3.—(con.)

9. Vaccinium globulare at least 5% cover
10. V. globulare less than 5% cover
11. Vaccinium scoparium at least 5% cover
12. V. scoparium less than 5% cover
13. Calamagrostis rubescens at least 5% cover
14. C. rubescens less than 5% cover
15. Pedicularis racemosa at least 1% cover and Ribes montigenum or Pinus flexilis absent
16. Not as above
17. Berberis repens or Pachistima myrsinites present
18. Not as above
19. Ribes montigenum present
20. Not as above
21. Osmorhiza chilensis or O. depauperata at least 1% cover either separately or collectively
22. Not as above; Juniperus communis the major Undergrowth species
23. Abies lasiocarpa/Vaccinium globulare h.t. (p. 43)
24. Abies lasiocarpa/Vaccinium scoparium h.t. (p. 44)
25. Arnica latifolia at least 1% cover
26. Carex guyeri at least 5% cover
27. Not as above
28. Vaccinium scoparium phase
29. Arctostaphylos pumila phase
30. Carex guyeri phase
31. Ribes montigenum phase
32. Pseudotsuga menziesii phase
33. Not as above
34. Pseudotsuga menziesii phase
35. Pedicularis racemosa phase
36. Not as above
37. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
38. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
39. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
40. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
41. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
42. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
43. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
44. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
45. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
46. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
47. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
48. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
49. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
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51. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
52. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
53. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
54. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
55. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
56. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
57. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
58. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
59. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
60. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
61. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
62. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
63. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
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66. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
67. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
68. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
69. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
70. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
71. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
72. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
73. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
74. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
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80. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
81. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
82. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
83. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
84. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
85. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
86. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
87. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
88. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
89. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
90. Abies lasiocarpa/Pedicularis racemosa h.t. (p. 46)
**Piusa flexilis Series**

**Distribution.** This series has a limited distribution in northwestern Utah and adjacent Idaho, occurring principally in the Wasatch Range. Stands are found on all aspects but normally occupy south to west-facing slopes or ridgtops of about 7,000 feet (2,135 m) in elevation. These exposures represent some of the most adverse environments for trees anywhere in the intermountain west. Octeopus and upper Pseudotsuga menziesii zones. In this respect, the *Piusa flexilis* series represents a topographic or edaphic climax.

- **In northwestern Utah.** Stands of this series do not usually have *Piusa flexilis* as the only tree species present; more often *Pseudotsuga* is a climax associate. Normally *Piusa flexilis* is a successfully reproducing dominant with no indication of being replaced at climax. Stands have trees that occur either singly or in scattered groups. Recent evidence indicates that *Piusa flexilis* extends to at least the southern limits of the wasatch Front in scattered bands of abandoned seed caches of the Clark's nutcracker (Laman and Vander Wall 1980).

- **In eastern Wasatch.** The principal species include *Sempervirens occidentalis*, *Picea engelmannii*, and *Juniperus scopulorum*, species which are also commonly representative of adjacent, drier forest communities (Room 1964). In addition, where *Cercocarpus leucodermis* is persistent, understory is often impenetrably dense. Adjacent, more moderate exposures are the PSEMECLE or PSEMEBE h.t.'s. Salt Mountain. This series occurs on calcareous and shale- and quartzite-fragmental substrates, which are often considered as the assemblage D. Soils are correspondingly shallow and graveled, and surface textures range from sandy loam to clayey. Loose surface rock and bare soil are also typically present. Erosion of fine particles is usually evident. Litter accumulation is often intermittent and shallow; litter depth for the series averages 0.6 inches (1.6 cm).

Exposure is dry, relatively warm, and with heavy diurnal and seasonal temperature fluctuations. *Piusa flexilis* is a species that represents the extreme limits of its distribution. In addition to the adverse conditions, the series extends southward into the desert, and the species occurs on high, gravelly sands that are subject to extreme diurnal and seasonal temperature fluctuations. The species is predominantly a calcicole and occurs on limestone substrates.

**Comandra pallida, Erica arnoldii, Agropyron scoparium.** A. trachycaulus, Leucopus kingii, and *Stipa leucotricha*.

- **Soils.** - Soils are described for the series. The stands in the eastern Wasatch are, in general, considerably less than those for Pseudotsuga. A deviation in the site-index analysis should be noted. For this habitat type only, average site index represents values obtained mainly from old-growth trees (computed at 200 years ago). These estimates appear to be reasonable because other stand trees in the same stand meeting the age criterion have values slightly below those of the old-growth trees.

**Other studies.** - *Piusa flexilis* habitat type have been described in Montana by Petersen and others (1977); central Idaho by Steele and others (1981); eastern Idaho and western Wyoming by Steele and others (1981); and southeastern Wyoming by Wising and Alexander (1975).

**Variations in *Piusa flexilis* habitat types have been described in the Bighorn Mountains of Wyoming (Despain 1973), New Mexico, Colorado and southeastern Wyoming (Pest 1978); and Utah (Elison 198; 10: Petersen 1977; Renen 1964).**

**The *Piusa flexilis-Leucopus kingii* h.t. (Hesperochilus h.t.) described by Steele and others (1983).**

**The *Piusa flexilis-Leucopus kingii* h.t. (Hesperochilus h.t.) described by Steele and others (1983).**

**The *Piusa flexilis-Leucopus kingii* h.t. (Hesperochilus h.t.) described by Steele and others (1983).**

**PINUS FLEXILIS/CERCOCARPUS LEDIFOLIUS H.T./PSEMECLE LIMBER PINEWRECKLE MIXED**

Distribution. - This habitat type occurs mainly in the northern Wasatch Range. The most common exposures are south-facing upper ridges and rock walls between about 7,000 and 8,700 feet (2,135 and 2,650 m) elevation.

Vegetation. - *Piusa flexilis* is the indicated climax, usually with *Pseudotsuga* as a climax associate. Normally, old-growth stands are open (fig. 4).
lower southern areas. Most surface soils are sandy loams or loams. Exposed surface rock is greater in the south, but most habitat type is soil is absent throughout. Litter depth is fairly uniform.

No weather stations exist within the series. Data from Flaming Gorge, however, located below the series in a Pinus-Juniperus woodland community, are presented in appendix D-2.

Fire History. — Fires were undoubtedly frequent in the past. Large P. ponderosa are resistant to surface fires, but fire will kill or damage seedlings and smaller trees. Destryctive crown fires sometimes occur in dense stands of young trees. Thus, fire locally shifts stands and, conversely, stand structure can influence significantly burning patterns and intensity.

Fire effects do not long persist in undergrowth that is principally herbaceous. But where chaparral-like vegetation occurs, as in the Plipofied h., ARPA phases, fire can alter local composition and structure for some time. Different shrub species react differently to fire. For instance, ectotypes of Purshia tridentata may be killed outright by light surface fires. But usually burned easily. Arctostaphylos regenerates readily following a fire and may also resprout from rooting crown, as it does in parts of Oregon (Franklin and Dymond 1973). Frequent fires, then, would tend to result in the development of a dense, shrubby undergrowth that would persist under conditions less than maximum overstory density.

Productivity-management. — Timber productivity ranges from very low to low (appendix D). This is largely because of stockability limitations. PIPOCAGE is generally the most productive habitat type of the series.

Opportunities for timber management are generally good for the more moderate sites. Throughout the P. ponderosa series, however, relatively large competion from undergrowth vegetation as well as relatively unfavorable soil physical and chemical traits will retard seedling establishment; this is further compounded by infrequent seed production. But when all factors are favorable, especially during cool wet springs, P. ponderosa readily regenerates. As Weller and Ryker (1973) suggest, the multitude of advantage that undergrowth vegetation in the series usually provide several viable strategies for natural regeneration: methods include selection, seedling, and small clearcut. Some site preparation might be necessary for all. Also, artificial regeneration may be successful on the better sites.

Where sites are less brushy, this series provides good forage for domestic livestock. Deer use for browse and as cover is moderate.

Other studies. — Various Push ponderosa habitat types have been described from the Northern Rocky Mountains (Durant 1908; Hoffman and Alexander 1976; McLean 1970; Pflister and others 1971; Stotts and others 1973; Waring and Alexander 1975). In addition, Franklin and Dymond (1973) have summarized the P. ponderosa communities of the Northern United States, many of which have P. ponderosa as the indicated climax.

| Table 3. — Distribution of the PIPOCAGE h. and phases of the PlipoFied h. in different geographic areas of the Uinta Mountains |
| --- | --- | --- | --- |
| Habitat type | Northernmost | South-central |
| Elevation range | Exposure | Elevation range | Exposure |
| Feet (m) | Feet (m) |
| PIPOCAGE | 7,200-8,300 | NW-SE | 8,500-9,900 | W-SE |
| PIPOFED-ARPA | None | None | | |
| PIPOFED-ARTR | 7,500-8,700 | W-NE | 8,300 | SE |
| PIPOFED-FEID | 7,100-8,400 | NW-SE | 8,200-8,600 | E-S-W |

Figure 8. Pinus ponderosa/Festuca idaho- nica h. on the eastern and north of the Uinta Mountains (7,930 feet [2,460 m] elevation). Ashley National Forest. The undergrowth consists of an abundance of F. idahoensis and annuals scattered Artemisia tridentata and Purshia tridentata.

mediately above Artemisia/granoid communities, which are common to this area. Overall, densities tend to be more weedy than those of the FEID phase. Pinus ponderosa occurs in groups as or scattered indi- viduals. Juniperus scopulorum is a local, minor shrub species. Canopies are more closed wherever P. contorta and Populus occur as important components. Undergrowth is variable, but generally shrubby and characterized by Artemisia tridentata/cambria. This species has its greatest abundance in this phase, as does Festuca idahoensis on the western and northern edges of the series. Symphyotrichum are usually present in addition to the typical species. Festuca idahoensis (FEID) phase. — This phase is common in both areas of the Uinta Mountains. In the northeast it is locally extensive above 7,800 feet (235 m) elevation, occupying meadows and

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slopes that generally have more easily exploitable than the drier ARB phases. Most often adjacent forest sites support shrub/bunchgrass communities.

Sulphur-cauliflower and Populus are local, minor seral associates in this area. Undergrowth varies from moderately dense in cover to desapure. It is dominated locally by the species of Pissoria and Pue FERris are the most common; the other types are usually sparse. The ARB phase is occasionally present with Pissoria pondersa and is commonest at moderately close than those of the other phases. Undergrowth tends to be more brushy than those of the ARB phases; typically, Pue fendleri is the dominant member of this type of vegetation.

Sulfur—Sampled stands primarily have sandstone or quartzite bedrock, and are covered by a variety of brushy rock types. The northern stands are associated with glacial outwash, ground moraine, alluvium, and residual bedrock, whereas the northeastern stands are found on residual bedrock. Soils over the talus slopes are sandy loam to loamy, and gravelly and typically present in considerable amounts. Surface rock varies in amount, ranging from absent to very considerable; the southwestern stands have very rocky. Little or no bare soil is present in the type. Litter depth is smallest in the southwestern stands, where it averages 1.5 inches (0.9 cm) for both ARB and FEID phases.

Productivity—Timber productivity is low to very low because of site limitations, regeneration difficulties, and brush competition hazards resulting from overstory manipulation are varied. Usually only the most productive or protected sites in the FEID phase offer fair timber management opportunities.

Uses are light to moderate. Overstory manipulation appears to increase use, particularly where brush development is severe. Sheep and cattle utilize this forest type for browse. PEEF is one of the most important forest habitat types in the Uinta Mountains for livestock.

Other studies—PIPE-FeID b1. is similar to the FEID phase of the demonstration forest group (Clarke and others 1977). Eastern Washington, northern Idaho (Duschensive and Duschensive 1969), central Idaho (Steere and others 1969), and Colorado (Dudley 1971). However, described a seris Pissoria ponderosa/Antsophyly petra/ Festsia Idahoensis community that occupies northwestern New Mexico and southern Oregon. The ARB and ARD phases should be considered regional variants that are not closely related to PIPE/FED of the Rocky Mountains.

Pseudotsuga menziesii Series

Distribution—Throughout most of the新三世合 Utah and adjacent Idaho. Pseudotsuga is the indicated climax of low to moderate elevations. This broad elevational belt ranges from below 500 feet (150 m) to about 8,000 feet (2,400 m), and locally up to about 8,800 feet (2,600 m). In general, the lower exposures are more protected, overly canyon slopes. Some of these low elevations reflect lower treelines, if woodland species are excluded. Pseudotsuga grows on seemingly unproductive or westernly exposures at the higher elevations.

Nearby warmer or drier exposures at low to moderate elevations are occupied by Acer grandidentatum or occasionally Juniperus woodslands. Shrub-dominated communities of taly variations are briefly noted under this species.

Fire history—In the northern west region, all the mountains have a second-growth history. All the stands are probably from the 18th century. Evidently, most conspicuous herbaceous species; others that occur throughout the type include Cystopteris fragilis, Fragaria virginiana, Symphyotrichum neomarisci, and, locally, Carex gerardi. Ground moss is occasionally notable, and Oscolaella chairs is frequently abundant on slope sides reflecting greater moisture and deeper soil material.

Figure 6 Pseudotsuga menziesii/Physocarpus malvacei H. (PIPE/PHC) in the subalpine forest types of the Rocky Mountains. The subalpine forest is the most important forest type in this region. These forests are often found in the subalpine forest types of the Rocky Mountains.

Adapted warming exposures contain Acer grandidentatum and Artemisia tridentata shrub communities. Cooler or more rocky sites are often the PIPE-SHE-EU phase.
Sols—Stands in northern Utah and adjacent Idaho north of generally occur on very stony colluvium. Parent materials are calcareous or quartziferous substrates (Ippendel 11). Soil surface texture varies from sandy loam to clayey. Considerable amounts of coarse fragments are often present in the profile. Some stands have a great amount of surface rock but exposed soil is generally absent. The latter averages 23.2 inches (53.5 cm) in depth, with an observed maximum of 7.8 (122 cm).

Productivity management. Timber productivity is low to moderate in Ippendel 11. Although productivity may be moderate, timber management opportunities are very limited because of the typical steepness of slopes and difficult hard-cored stumps. Central control associated with overstory manipulation. Shelterwood techniques are often the most reliable regeneration strategy.

This habitat type is an important part of the winter range in this area. In addition, many sites have considerable aesthetic and watershed cover values. Domestic livestock use is minimal.

Other studies. The PSEME/PHMA habitat occurs throughout Cache and Summit counties. It has been described from eastern Washington, northern Idaho (Eustad and Dauvergne 1970; Pfeiffer and others 1977), central Idaho (Steles and others 1983), Hoffman and Alexander (1976) and Moe and Ludwig (1979) have described the type within western Wyoming and northern Oregon.

Steels and others (1983) have broadly classified this habitat type in southern Idaho and western Wyoming as the PAMY phase to geographically differentiate it from the PSEME/PHMA habitat of central Idaho.

PSEUDOSUGA MENZIESII/ACER GLABRUM H.T. (PTEME/AGC D) DOUGLAS-FIR/MOUNTAIN MAPLE

Idahoanization. PSEME/AGC is a relatively cool and moist habitat type in this series. It occurs locally throughout southwestern Utah and adjacent Idaho at 3,800 to 7,500 feet (1177 to 2286 m) and sporadically in the Uinta Mountains above 7,700 feet (2306 m). It is generally associated with the cold air drainage features common to middle and lower slopes, such as ravines or stream bottoms. These slopes are usually very steep and north to northeast-facing.

Adjacent habitat types include the relatively warmer PSEME/OSCH and PSEME/PHMA h.t.'s or the drier PSEME/REH h.t. and bordering sites are most often ARA/AGC or ARA/ACU h.t.'s.

Vegetation. Pseudotsuga is the indicated climax and most often is the subdominant species of the stand. Many minor serial species occur locally Ippendel 11 of which Paperaceae is most common.

Undergrowth generally has several canopy components (fig. 7). The prominent high-shrub layer typically includes Acer rubrum, Abies balsamea, Alnus incana, Alnus rubra, Salix discolor, and some of the minor serial species. Undergrowth vegetation is diverse in those common species are Arctostaphylos, Oxycoccus spp., and Salix discolor.

PSEUDOSUGA MENZIESII/OXYCCUS CHILENSIS H.T. (PSEME/OSCH DOUGLAS-FIR/MOUNTAIN SWEETGUM)

Distribution. This relatively warm, moist habitat type occurs locally in southwestern Utah and adjacent Idaho, but principally in the northern Wasatch Range (fig. 8). It usually occupies moderate to steep slopes to middle to lower.

Sols—These stands are associated with mixed calcareous or quartziferous substrates (Ippendel 11). Soil surface textures range from sandy loam to clayey. Considerable amounts of coarse fragments are often present in the profile. Some stands have a great amount of surface rock but exposed soil is generally absent. The latter averages 23.2 inches (53.5 cm) in depth, with an observed maximum of 7.8 (122 cm).

Productivity management. Timber productivity is low to high Ippendel 11. This habitat type includes some of the highest values observed in the series, although the average site index is slightly lower than that of the PSEME/PHMA and PSEME/OSCH h.t.'s. Management opportunities for timber, however, are generally restricted in northern Utah by steepness of slope and limited extent of the habitat type. Where opportunities exist, the shelterwood method should provide some control over subsequent brush development. Scarrification may also be necessary where relatively undisturbed stands are present.

Use of this habitat type by domestic livestock is very low. Deer use is moderate to heavy.

Other studies. We consider this habitat type to correspond to the PAMY phase as described by Steles and others (1983) for the PSEME/AGC h.t. of easternTYPE of the Ippendel 11.

PSEUDOSUGA MENZIESII/ACER GLABRUM SUBSPECIES H.T. (PSEME/ACGU DOUGLAS-FIR/MOUNTAIN MAPLE)

Distribution. We sampled this habitat type on a steep cold-shrub exposure at 6,440 feet (1952 m) elevation in the extreme northeastern extension of the Wasatch Range near Malad, Idaho. Isolated occurrences are to be expected in northeastern Washington and the westernmost Utah where it represents the southwesternmost extent of the habitat type. The PSEME/ACGU h.t. is also probably absent because Abies lasiocarpa is the most probable indicated climax of sites having a dense Calamagrostis advena understory.

The PSEME/ACGU h.t. in southeastern Idaho and adjacent Wyoming is recognized as the PAMY phase and is described in detail by Steles and others (1983).

Vegetation. Pseudotsuga is the indicated climax. Acer grandidentatum and Populus tremuloides are locally major serial associates. Picea engelmanni is occasionally a minor associate in this type.

Undergrowth is diverse. Common species include the following: Nyssa sylvatica var. sylvatica, Salix discolor, and Pyrola umbrosa. Sites that receive regular livestock use normally have an abundance of woody species. Interestingly, Circa pallescens was only encountered in the PSEME/ACGU h.t. in the Wasatch Range.

Acer, Prunus, and other shrub communities occupy nearby winter and dr s sites. Drift forested sites, typically uplands, are normally the PSEME/BERE h.t.

Sols—This habitat type occurs almost exclusively on colluvium. Various parent materials are represented Ippendel 11. Subsurface coarse fragments are usually present, and soil surface textures range from loamy to clayey. Surface rock is generally absent. Bare soil is occasionally present. The average litter depth of the habitat type is 2.4 inches (6.2 cm).

Productivity management. Timber productivity is moderate to high Ippendel 11. This type has the highest well-sampled site index, productivity, and basal area increment and development of the northern Utah Pseudotsuga, but site index values are quite variable. The plants reflect the overall moderate environment of the type and in particular the moistness of the colluvial soils. Opportunities for intensive management, however, are limited because of the scarcity of the habitat type.

Agriculture. The method of the Pseudotsuga regeneration patterns observed in mature stands. Also, this method provides some additional site protection from potential hardwood and brush development. In this series, pocket gopher activity appears to be greatest in this habitat type, probably because of the typical harshness of hardwood vegetation and conducive soil factors, as well as the close proximity of meadow areas. Best deer may be this habitat type for cover and limited forage.

Other studies. This type has also been described in central Utah (Boyer and others 1981), and eastern Idaho (Steels and others 1983).
Berberis repens (BERE) phase.—This is the commonest phase in the southern Utah and adjacent Idaho elevations. The habitat type range from 5,400 to 7,700 feet (1 646 to 2486 m), but most sites occur at these lower elevations. The BERE phase is well developed, but it may also be found in association with Juniperus scopulorum. Undergrowth is variable. Sites with the lower elevations have many species in common with the PSEME/PRIMA h.t. Higher sites are normally more diverse than those of the other phases.

Pseudosequoia is usually only the tree present, but some lichen species may grow on it. The soil is generally not too well developed, ranging from moderate to very steep. Exposures are common and climates are normally more moderate than those of the other phases.

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Pseudosequoia is usually the only tree present, but some lichen species may grow on it. The soil is generally not too well developed, ranging from moderate to very steep. Exposures are common and climates are normally more moderate than those of the other phases.
Productivity-management. Timber productivity is low to moderate in the temperate zones. Pine puschins is the most productive species but it is present in small areas. Extensively grazed sites and pastures are the principal management species. Ponderosa pine and lodgepole pine are moderate and livestock use is locally important where adjacent forage is also available. This series also provides watershed protection.

Other studies. Pine puschins has been observed to be associated with the southern Rocky Mountains, from Utah (Kerr and Henderson 1977) to Idaho (Pilster 1972). Arizona and New Mexico are also considered as potential sites (Peet 1977) for Puschins puschins West of eastern Wyoming (Steele and others 1983).

PIECA PENNUSAERBERIES REPENS H.T.
(PUSCHINS PUSCHINS)

Distribution. This series has been observed in the northeastern USA to northwestern Montana. Puschins puschins is restricted to the northern Rocky Mountains. This series occurs in the western United States. In general, it is found in the western United States between the elevations of 8,000 feet (2,440 m) and 10,000 feet (3,048 m). This series is generally found in the higher elevations of the mountains.

Other studies. This series has been observed in the western United States to northern Canada. Puschins puschins is found in the western United States between the elevations of 8,000 feet (2,440 m) and 10,000 feet (3,048 m). This series is generally found in the higher elevations of the mountains.

Abies canescens series

Distribution. This series occurs in the western United States to northern Canada. Abies canescens is a commonly observed species in the western United States. This series is generally found in the higher elevations of the mountains.
Timber management is generally limited, however, largely because other values are paramount. Timber guidelines are similar overall to those which are discussed for the other conifers. In the case of Abies concolor, it is usually accompanied best through shelterwoods.

The species provides a multitude of non timber benefits: deer habitat, watershed protection, and a diverse range of recreational opportunities.

Other studies—Various Abies concolor habitats have been discussed for Oregon by Frankline and Dynneson (1978), who provide a summary of many studies, and for New Mexico and Colorado by Poet (1978).

Abies concolor habitat's have been described from central and southern Utah (Pilster 1972), and Arizona and New Mexico (Moir and Ludwig 1973). Abies concolor/Acer glabrum and Abies concolor/Cercocarpus ledifolius are unsampled habitat types that are expected to be common in the Wasatch Range and that possibly occur in the study area near Salt Lake City.

**Abies concolor/Physocarpus malvaceus H.T. (ABSCOPHMA; WHITE FIF/NINEBEAR)**

**Distribution**—This habitat type is common in the southern Wasatch Range and Stansbury Mountains. It occupies relatively warm sites that most closely resemble those of the Physocarpus/HMA hpt. Slopes range from moderate to very steep.

**Vegetation**—Abies concolor is the indicated climax. This is typical of the southern Wasatch Range by typically Physocarpus. Species which occur throughout the type are Amelanchier alnifolia, Physocarpus malvaceus, and Prunus virginiana. In some cases C. sitchensis is locally abundant. The presence of barberry species varies (Appendix C), as does that of seral overstory associates (Appendix B).

Physocarpus is usually a major seral associate, and stands with a very heavy understory of Acer and Quercus are represent but they are persistent in the largest canopy openings only. In addition to the typical species, undergrowth includes Symphoricarpos orbiculatus, Mirtillo stauronotus, and Salix lasiandra as the most important species in this community. Nearby drier forested sites are typically the ABLA/BEERI hpt. Cooler, more moist exposures at higher elevations are the ALBA/ACEL, ALBA/PHIBA, or ABLA/ACGIL hpt.

The soils of our sample stands are derived primarily from shale quartzite (Appendix D). In general, soils are gravely with surface texture loamy to clayey. Surface rocks are usually seen to an depth average 0.6 cm.

**Productivity—**In general, timber productivity is high. This type is important for deer, especially as winter range. Watershed protection and aesthetics are also important.

Other studies—This habitat has not been previously mentioned.

**Abies concolor/osmorhiza chilensis H.T. (ABSCOSCH; WHITE FIF/MOUNTAIN SWEETROSE)**

**Distribution**—This minor, moist habitat type occurs throughout the geographical extent of the series, with the exception of the Uinta Mountains. The type is fairly similar to the PSEMEOSCH hpt. Exposures are northerly, steep to very steep lower and mid slopes. Sites otherwise are protected and principally occupy streambeds or benches. Elevations are between about 2,400 and 1,600 feet (745 m) above sea level.

**Vegetation**—Abies concolor is the indicated climax. Normally Pseudotsuga is a major seral associate, and Pumila angustifolia and Abies neogena are associated with streamside species.

**Undergrowth**—Undergrowth is usually sparse. Common shrubs include Amelanchier alnifolia, Pachistandra satureoides, Prunus virginiana, and, when the drier ABSCOPHMA hpt. is prominent, minor elements dominate. Monospermous Osmorhiza is usually the most notable herbaceous species (Appendix C).

**Soils**—The soils of our study area arise from a variety of substrates (Appendix D). Surface textures are variable, ranging from loamy to clayey, stony, or gravelly soils but relatively moist. Considerable surface rock but little bare soil is typically present. Litter depth averages 1.8 inches (4.6 cm).

**Productivity—**Timber productivity is high to very high, which is typical of the type upon which it grows. Timber management opportunities, however, are restricted because of the limited extent and nature of the sites. In this respect, the parameters of water quality is usually a paramount concern.

**Other studies**—This habitat type has not been mentioned previously.

**Abies concolor/berberis repens H.T.**

**Distribution**—This habitat type, with two recognized phases, occurs throughout the geographical extent of the series. Elevations range from about 5,700 feet (1735 m) to over 8,000 feet (2,400 m). Exposures are north-facing or otherwise protected, and surfaces are gentle to extremely steep. The habitat type is similar in most all respects to the PSEME/BERE hpt. Undergrowth includes Amelarchis glutinosa, Pachistandra satureoides, and sometimes C. sitchensis. It is locally abundant. The presence of barberry species varies (Appendix C), as does that of seral overstory associates (Appendix B).

**Vegetation**—Abies concolor is the indicated climax. Seral associates vary in occurrence by phase.

Undergrowth is typically breckland (fig. 11). Common species include the joint indicators Berberis and Pachistandra satureoides, as well as Symphoricarpos orbiculatus. Thicker than the average depth average 1.3 inches (3.3 cm). The species of Osmorhiza chilensis are the most significant, because the type of Physocarpus malvaceus are also present. Other more moist habitat types include ABSCOSCH and the cooler ABSCO/BERE. Warmer and drier site most frequently support woodland or non forest communities: also the PSEME/BERE hpt. is occasionally adjacent.

**Productivity—**Timber productivity is very good, with stocking limitations in the SYRO phase, and low in the BERRE phase (Appendix E). Very local timber management opportunities exist where other use considerations are not predominant. Shelterwoods best reflect observed patterns of regeneration. Moderate density occurs throughout the type.

**Other studies**—The ABOC/BEER hpt. has been briefly described from central Utah by Pilster (1972).

**Picea engelmannii Series**

**Distribution**—This series occurs most commonly throughout the more central and eastern Uinta Mountains. It occurs on most of the higher sites in the Salt Lake City area of the Wasatch Range as well as in the westernmost Uintas. Although most all sites occur within the geographical range of Abies lasiocarpa, the series is either too cold or too dry for Abies. In general, all associated species and elevations range from about 9,000 feet (2,745 m) to over 11,000 feet (3,350 m) in timberline.

**Vegetation—**Historically, Picea engelmannii is often very long-lived, frequently attaining ages of greater than 400 years. Fire is an important perturbation: although more frequent at lower elevations, its effect may be more severe at higher elevations where establishment of fir can be quite prolonged. Very wet sites often have Abies lasiocarpa represented as a climax associate. Several old-growth structural trends are encountered on drier sites. These old-growth stands vary from a rather diverse assemblage of moist-site species to undergrowth dominated by cold-site species, especially Vaccinium.

Below about 10,000 feet (3,050 m) elevation, Picea engelmannii is usually a major seral associate. Piceas, however, can be quite persistent. Where it is present, Piceas usually occur as scattered individuals, and subalpine Piceas reproduce sporadically, particularly reflecting the droughty seedling conditions. Papules occur commonly and frequently an additional seral associate at lower elevations.

Old-growth stands occurring sites above the occurrence of Piceas are comprised of largely all-aged Piceas. Stands vary from fairly continuous to isolated groups of trees, or copses, that are surrounded by meadow communities. Within this series, the stems vary in most similar to those of the TRSF phase of the ABLA/RIMO hpt.

Pilster (1972) recognized a Picea engelmannii/Ribes montigenum hpt., which occurs above the cold limits (ca. 3200 m) of Abies lasiocarpa in southern Utah. One old-growth PIFEN/RIMO community was sampled in the near 10,000 feet (3,050 m) elevation. Although Abies was not represented in the stand, it was nearby on the same substrate, and the site appeared to be sufficiently warm for this species. This stand was placed in the ABLA/RIMO hpt. TRSF phase. Also, several mature stands of Picea engelmannii/Ribes montigenum were sampled in the southern-central Uintas. These appeared to have occupied the FRM/CO hpt. and were placed in that group. It is expected that similar correspondences will occur for other stands of similar species. Probably the most distinctive stands of the northern region will also represent the Abies lasiocarpa series, with the possible exception of the Deep Creek Range where a major PIFEN/RIMO hpt. appears to be present and where A. lasiocarpa was not encountered.
Soils.—Soils are derived predominantly from quartzitic materials (appendix D). Most are gravely and typically sandy to very finely drained sandy loams to very clayey for the moistest sites. Exposed rock ranges from absent or only slight to considerable, it is most common on slopes and at high elevations. Bare soil is normally absent. Litter accumulation is somewhat greater than that of the comparable Abies lasiocarpa h.s.

Productivity management.—Timber productivity is generally low throughout the series (appendix E). The adverse regeneration conditions of high-elevation sites within the series have been discussed in Reo and others (1970). Where environmental factors and growth rates are acceptable, small clearcuts for Picea contorta appear to be the best natural regeneration strategy guidelines for this species are discussed under the P. contorta series, Management section. If Picea is desired, partial cutting and mineral soil usage is usually necessary.

The most important values of the series are summer elk habitat (Wimm 1976), watershed cover, and wilderness considerations. Use by sheep for shaded bedding is most extensive at the higher elevations where open growing areas are found.

Other studies.—Various, mostly dissimilar Picea engelmannii h.s. have been described from Montana (Pfister and others 1977) and central Idaho (Steble and others 1981). In general, these occupy very cool sites between the Abies lasiocarpa and Pseudotsuga menziesii series. The P. engelmannii series of western Wyoming (Steele and others 1983) as well as the Big Horn Mountains, Wyo. (Hoffman and Alexander 1976), is more similar to that of northern Utah. In addition, one habitat type has been described from northern New Mexico (Moir and Llwyd 1979) and, as noted, from southern Utah (Pfister 1972).

PICEA ENGELMANNII EQUSETUM ARVENSE H.T. (PIENCE-PAO; ENGELMANN SPRUCE/COMMON HORSETAIL)

Distribution.—This minor habitat type occurs in the central Wasatch Range of the Salt Lake City, and in isolated locations in the Uinta Mountains. Elevations are near 9,000 feet (2,754 m). The P. engelmannii h.t. normally occurs on cold preserve terraces that are relatively cool for the area but warm for the series (fig. 12).

Vegetation.—Picea engelmannii is the indicated climax. Picea contorta is a minor seral associate in the Uinta Mountains. Nawa is a climax associate, however, we concur with Pfister and others (1977) and Steele and others (1983) in the placement of such sites in the Picea engelmannii series in that Picea appears to have a greater competitive advantage under these very wet environments. Although Picea engelmannii was considered as a climax dominant under such conditions, it can be expected to occur in northern Utah. When present, such sites should be placed in the P. engelmannii h.t. for management considerations.

Undergrowth is normally characterized by abundant Equisetum arvense and a variable assortment of moist-site forbs, such as Aconitum columbianum, Pyrola asarifolia, Stellaria edelweissii, Senecio triangularis, species of Carex including C. dissecta, and Salix. In addition, the Uinta Mountains Colchicaceous community is characteristically present. Epigaea repens, Pyrola secunda, Silene stellata, Bromus ciliatus, Elymus glaucus, and species of Listera, Aricia, and Geranium commonly occupy drier microsites. Bistorta vivipara, Caltha palustris, and other species are nearby.

In northeastern Utah, the ABLA/CACA.E.T. ElM0 phase, is often found upland of the PIENCE-PAO h.t. in the Uinta Mountains, the ABLA/CACA.E.T. is sometimes proximate. Similarly the ABLA/VASC or ABLA/VASC.E.T. are found on better drained sites. Adjacent, wetter sites everywhere normally support Salix-Carex communities which usually contain an Equisetum component.

Soils.—The substrates of our stands are predominantly alluvium of variable composition, but chiefly granite or quartzitic alluvium. Surface soils are normally very moist and locally range in texture from sandy loam to mucky-clay. Gravel occurrence is equally variable. Surface rock is sometimes present but bare soil is usually absent. Litter depth averages 2.5 inches (6.5 cm).

Productivity management.—Timber productivity is low in the Uinta Mountains and moderate in the Wasatch Range (appendix E). Sites are extremely fragile. Thus the principal use of the type is as streamside cover or wildlife habitat.

Other studies.—The P. engelmannii h.t. has been described from Montana (Pfister and others 1977), central Idaho (Steele and others 1981), and eastern Idaho, western Wyoming (Steele and others 1983).

PICEA ENGELMANNICALTHA LEPHITEPALEA H.T. (PIENCE-PAO; ENGELMANN SPRUCE/WHITEBARK PINE)

Distribution.—This is a local habitat type occurring principally in the southern and western Uinta Mountains. The elevation range is low and to cold, often with anomalously high water tables. Elevations range from near 10,000 feet (3,050 m) to over 10,000 feet (3,050 m). Vegetation in this type is the indicated climax. Picea contorta is locally a major seral associate. Although Abies lasiocarpa is sometimes present, individual trees are normally stunted and only occupy drier microsites.

Undergrowth is predominantly herbaceous. In addition to the indicator Calamagrostis, other common moist- or cold-site species are Armeria spp., Pedicularis (breviceps, F. greenlandica, Polygonum bimucronatum, Potentilla spp., Silphium procumbens, Trifolium spp., Carex atrata, C. scoparia, Deschampsia caespitosa, Lasana spicata, Phlox alpina, and occasionally Veronica arvensis, Festuca ovina, and Poa alpina. Species commonly found on drier microsites include Antennaria microphylla, Erigeron peregrinus, Danthonia intermedia, Poa nutans, and Trisetum spicatum. The only common shrubs are Vaccinium scoparium and V. scoporum; these also reflect the proximate, drier PIENCE-PAO, PIENCE-VASC, and ABLA/VASC h.t.'s.

Soils.—Our stands have quartzite or Duschene sandstone substrates (appendix D). Surface soils are moist and stony to very stony and local gravel. Subsurface clay-dominated horizons are also usually present. Some surface rock, but little or no bare soil, is present. Litter averages 1.3 inches (3.3 cm) deep.

Productivity management.—Timber productivity is low and growth rates are poor (appendix E). For the most part, overstory manipulation usually results in raised water table levels and an enhancement of invasion and frost heaving, which impedes regeneration. Cattle use is local and particularly intensive near recent stand openings or very grievous areas.

Other studies.—Steele and others (1983) described this habitat type for western Wyoming.

PICEA ENGELMANNIVACCINIUM CALTHA H.T. (PIENCE-PAO; ENGELMANN SPRUCE/WHITEBARK PINE/BLUEBERRY)

Distribution.—The PIENCE-PAO h.t. occurs throughout the Uinta Mountains. Elevations are between 9,000 feet and 11,100 feet (2,755 and 3,385 m) and occasionally as low as 9,350 feet (2,855 m) at northerly exposures. The ABLA/VASC h.t. extends as sites are dominated by cold air drainage or accumulation. In the Wasatch Range terrain includes such features as basins, benches, ridge slopes, and plateaus.

Vegetation.—Picea engelmannii is the indicated climax. Below 10,000 feet (3,050 m) Picea contorta is usually a major seral associate. Sometimes it is persistent. Populus tremuloides is locally an important seral component at lower elevations.

Vaccinium scoparium characters a rather diverse undergrowth (fig. 13). At higher elevations, several other color species are prominent, e.g., Vaccinium pygmaeum, Polygonum bimucronatum, Potentilla spp., Silphium procumbens, Trifolium spp., Deschampsia caespitosa, and a variety of alpine and particularly near timberline, Geum rupestre, Carex albo-nitida, and Carex scoparia. Occurring throughout the type are Juniperus communis, Ribes montigenum, Achillea millefolium, Antennaria spp., Arnica cordifolia. Ephedra distachya, Erigeron parviflorus, Fragaria virginiana, Sedum lanceolatum, Carex rupestris, Poa serotina, and Trisetum spicatum. In addition, Vaccinium scoparium is often abundant, reflecting the warmer, proximate PIENCE-VASC h.t. Normally, a variety of non-forest communities are adjacent at higher elevations (which are described by Lewis 1970).
PIECA ENGELMANNII VACCINIUM SCOPARIUM H.T. PIEN-VAEC ENGELMANN SPRUCE/COURSE

Distribution. - This habit type is common throughout the central and eastern Uinta Mountains. Elevations range from 2,900 m to 3,925 m to 11,200 feet (415 m to 3,925 m at timberline. Exposures are typically south facing. The PIEN-VAEC h.t. occupies a variety of gentle to moderately steep terrain that encompasses drainage bottom slopes and ridges as well as broad, shallow, sideplateau surfaces.

Vegetation. — Picea engelmannii is the indicated climax. Picea contorta, which is often persistent, is a major seral associate below 10,000 feet (3,925 m elevation). Undergrowth usually consists of a striking cover of Vaccinium scoparium. Common species include Juniperus communis as well as small amounts of Artemisia tridentata, Arctostaphylos uva-ursi, Potentilla spp., Carex rossii, Pinnus and Pseudotsuga taxifolia. All are commonly present except for Pseudotsuga, which is uncommon and confined to the ABLA/RIMO h.t. (THFE phase), and the ABLA/VASC h.t. (ARLA phase). In the above instances, it appears that Picea is a long-lived dominant that some authors consider coolman. The relative inability of Picea to establish on its own, as demonstrated by large, charred stumps and from Bird (1964), and succession to cooler dominance probably would have been fairly rapid. This is an area of major changes and topographic changes. Populus are clearly severe stages of A. lasiocarpa h.t.

Productivity management. — Within the series, timber productivity is highest in the mesic, middlevalley habitat types of northeastern Utah and adjacent Idaho. Upper-moderate to high yield capability occurs in parts of the ABLA/ACRU, ABLA/PESA, the PSME and BERE phases of the ABLA/BERE, and the THFE phase of this series (compare E. Bales). Major area development is also good in these types. With the exception of the ABLA/ACRU h.t., either Picea engelmannii or Ablas lasiocarpa is the fastest growing species, as measured by average sample site index. Elsewhere, productivity ranges from low to moderate, and P. engelmannii or P. contorta is the most productive species. In some instances, such as the ABLA/ACRU h.t., marginal growth ranges from the Populus normans indicate the need to reduce overall coniferous productivity.

The northern U.S.T.R.D. timber management opportunities on the more gentle portions of the above types, as with the ABLA/ACRU and ABLA/PSME, are good, and include most of the old-growth stands of this region. In the Uinta Maira, similar opportunities are good, but less so. populus normans indicate the need to reduce overall coniferous productivity.
autological studies relating to the natural regeneration of these species. Piola contorta is normally the oldest species to regenerate; by far the most obvious means. Because its cone base is largely nonresinous throughout north- ern Utah, all pitch or strip clearcuts are generally best. The trees of these species are best regenerated under conditions of partial shade. Various authors’ investigations reflect the majority of observed stand patterns, particularly for Pseudotsuga. These also serve to suppress subsequent Populus development. Populus, however, may be especially desirable for wildlife forage (Putnam and Jones 1977) or as a “nurse” cover for conifer establishment, especially when diseased-old-growth necessitates clearcutting. Selection methods are sometimes possible for P. engelmannii. Smaller patch or strip clearcuts are feasible for all of these species but usually on more protected en-vironments only; even so, all species are not always successful. Bow and others (1970) discussed the various factors that are potentially troublesome with clearcutting and the number of other levels. These include seedling mortality from direct inoculation, moisture stress, frost heaving, cold injury, and damage by vertebrates. The development of competition from Carex rossii appears to be especially critical in larger clearcuts.

Shade-tolerant species are the hosts for several diseases, most of which are only local problems and, in general, only occur in vigorous growth. The most con- spicuous of these are brown rusts (Stemella) in an alter- native growth form. Conifer regeneration is severe in a stand, clearcutting may be the only available regeneration strategy. Root rots (primarily Fomes annosus) and stem decay fungi are very important because of mortality and merchantability losses. The Abies lasiocarpa series provides significant non-timber benefits throughout northern Utah. Economic con- siderations are very important because of the fairly intensive management, of these species, such as skiing in the Wasatch Range and wilderness values in the higher Uinta Mountains. Watershed protection values are high, and both recreational opportunities and water management are often major considerations. Stand species provide summer and winter forage for big game and domestic livestock on the more gentle sites. Additional- ly, the series is habitat for a multitude of other wildlife if managed with others 1979; Deschamp and others 1979; Wims 1976).

ABIES LASIOCARPA C. KALAMAYOSISTI CANADENSIS R. D. ALBACA/SCABRIFOLIAE E. P. ALBACA/SCABRIFOLIAE DISTRIBUTION. —This habitat type is locally common in the coniferous stands of the Uinta Basin in Utah and Idaho, and is described by Putnam and others (1983). It is relatively low in elevation and is most closely associated with the ponderosa pine type. It is characterized by a stand of Abies lasiocarpa and Pinus contorta. Undergrowth is usually brassy, with a lush herbaceous component. Shrubs include Amelanchier alnifolia, Parthenocissus quinquefolia, and Symphoricarpos oreophilus. Undergrowth is very sparse, with only a few species. The dominant species are Amelanchier alnifolia, Parthenocissus quinquefolia, and Symphoricarpos oreophilus. Vegetation is very sparse, with only a few species. The dominant species are Amelanchier alnifolia, Parthenocissus quinquefolia, and Symphoricarpos oreophilus. Vegetation is very sparse, with only a few species. The dominant species are Amelanchier alnifolia, Parthenocissus quinquefolia, and Symphoricarpos oreophilus. Vegetation is very sparse, with only a few species. The dominant species are Amelanchier alnifolia, Parthenocissus quinquefolia, and Symphoricarpos oreophilus. Vegetation is very sparse, with only a few species. The dominant species are Amelanchier alnifolia, Parthenocissus quinquefolia, and Symphoricarpos oreophilus. Vegetation is very sparse, with only a few species. The dominant species are Amelanchier alnifolia, Parthenocissus quinquefolia, and Symphoricarpos oreophilus.
Normaly Vaccinium vagum is represented with subsp. rufinerve. In BALEA/VAG/L is seen A. vagum. In especcialy undepressa uner or at lower elevations, however, this species occurs mainly as isolated stems. Nevertheless, in many of these instances its presence generally reflects an ecological niche similar to such sites. Therefore, this species should be considered as an A. vagum h. s.

Our stands have soil parent materials that are either wholly quartzite or predominantly quartzite-rich. Surface soils range from sandy loams to clay loams but are usually non-textured. Gravel content and surface rock are often considerable but bare soil is normally absent. Average litter depth is 1.3 inches (3.2 cm).

Productivity-management. - Timber productivity is low (appendix I). Seeding growth is poor and reflects the exceptionally frosty environment. Because of this, Pinus conspurica is the species for management, and is the easiest to regenerate.

Wildlife and livestock use is local; sites adjacent to moderate use are covered.

Other studies. - In Montana, the A. vagum h. s. has been described by Pflister and others (1977). Kerr and Goodwin (1979) described an A. vagum h. s. from central Utah that is overall similar to our stands containing Betula and Picea glauca. A. vagum h. s., which occur in the indicated climate. Most most stands are dominated by Pinus engelmanni, with Picea engelmanni or Pseudotsuga as an additional seral component. In appearance, being of fire origin. A. vagum develops rather slowly on some sites.

Undergrowth is characterized by abundant cover of Vaccinium for which the northern Utah stands is unique in the southwestern United States. However, Vaccinium species are the usually the most abundant herbs; others include Arctostaphylos, Cornus, Actaea, Erythroxylum, and Vaccinium. All of these species reflect warmer, more xeric habitat types.
scoparium. Some sites in the Uinta Mountains may correspond to this phase. The other phase, *Pachistima myrsinoides*, serves as a geographical distinction from the VAGL phase of central Idaho (Steele and others 1981).

**ABIES LASIOCARPAPA/VACCINIUM SCOPARIUM H.T. (ABLA-VASC: SUBALPINE FIR/ROSE HEBBERRY)**

**Distribution.** The ABLA-VASC h.t. occurs throughout most of the Uinta Mountains. Elevations range from about 9,000 feet (2,745 m) to just below 11,000 feet (3,355 m) near treeline. The relatively cool to cold exposures are variable in moisture; these conditions are reflected by the three recognized phases. In general, the type encompasses the extensive plateaulike surfaces and basin and ridge slopes which so characterize the central massif. ABLA-VASC is the most ubiquitous habitat type of the upper Uptas, but it is relatively uncommon in the north-central area. There, it normally occupies only the most moderate sites within the rain shadow area, being largely replaced by the PIEN-VASC h.t. on cooler exposures and the PICO-VASC h.t. on warmer exposures.

The ABLA-VASC h.t. was not found in northwestern Utah. In Idaho, it was sampled from only a few isolated locations in the Wasatch Range (Copenhagen Basin). There, exposures were gentle, northeasterly slopes near 8,500 feet (2,590 m) elevation, with quartzite substrates.

**Vegetation.** *Abies lasiocarpa* is the indicated climax. Two extreme overstory conditions are commonly encountered with old-growth stands. Whenever *Picea engelmannii* is initially a major seral component, it tends to dominate the overall old-growth aspect, with an often dense *Abies* understory of layered stems. Such conditions are especially evident at the higher, timberline extent of the VASC phase, or the more moist portions of the ARLA phase. Elsewhere in the Uptas, *Pinus contorta* is the primary seral associate. On particularly warm-dry sites, *Pinus* can be the dominant aspect of old-growth stands; sometimes shade-tolerant species such as *Picea* have only poor representation and a slow rate of placement. *Populus tremuloides* is nominally represented at lower elevations.

A sweeping high carpet of *V. scoparium* typifies the undergrowth (fig. 15). Small amounts of *Achillea millefolium*, *Epilobium angustifolium*, *Hieracium spp.*, *Carex rosii*, *Poa nervosa*, *Trisetum spicatum*, and the conspicuous *Arnica cordifolia* are represented throughout the type. *Vaccinium vacidens* and either *Pachistima myrsinoides* or *Berberis repens* are often present also, reflecting their presence in adjacent habitat types.

*Arnica latifolia* (ARLA) phace. — This phase, typically the moistest, is chiefly absent from the southern Uinta Mountains. Elevations range from 9,000 feet (2,745 m) to near 10,600 feet (3,230 m). Exposures are northwest- to northeast-facing, moderate Lower slopes or occasionally undulate surfaces. Sites otherwise are very protected.

Normally *P. engelmannii* is the dominant component of late seral stands. Undergrowth is generally dominated by *V. scoparium*. In addition to the typical species and an often abundant cover of *A. latifolia*, other common herbs include *Hieracium gracilis*, *Pedicularis racemosa*, *Pyrola secunda*, and species of *Erigeron* and *Osmorhiza*. Also, *Carex geyeri* is occasionally present on the warmer exposures. The presence of *Ribes montigenum* sometimes reflects the adjacent, drier RIMO phase of the ABLA-BERE h.t.

*Carex geyeri* (CAGE) phase. — The CAGE phase occurs in the western and occasionally in the eastern areas. Relatively warm and dry, it typically occupies gentle, northeasterly to southerly slopes that are typically well drained. Elevations are between 8,700 and 10,100 feet (2,650 and 3,080 m).

Principal seral associates are *P. contorta* and, to a lesser extent, *Carex* component. In addition to the typical species, *Juniperus communis*, *Hieracium* and *Juniperus communis*, *Hieracium albiniflorum*, *Osmorhiza* spp., *Pedicularis racemosa*, *Pyrola secunda*, *Stellaria jamesiana*, and *Elymus glaucescens* are commonly represented. *Calamagrostis rubescens* is also sometimes abundant in the eastern area. Most warmer exposures are the CAGE phase of the ABLA-BERE h.t., whereas cooler sites are generally the VASC phase.

*Vaccinium scoparium* (VASC) phase. — This phase occurs throughout the Uinta Mountains and often forms the moderately moist timberline forests. Exposures, elevations, and undergrowth characteristics are typical of the type, although the average coverage of *V. scoparium* is somewhat less than that of the other phases. Seral associates are *P. contorta* and *P. engelmannii*, the former being absent from the highest elevations and the latter from the lowest elevations of the phase. Undergrowth often includes *Ribes montigenum* and *Juniperus communis*. These species commonly reflect proximate habitat types: at the higher elevations the more exposed, drier TRSP phase of the ABLA-RIMO h.t.; and at the lower elevations in the southern area, the much warmer and drier ABLA-JUCO h.t. Elsewhere, the ABLA-BERE h.t. occupies the warmer exposures.
Soda—Our stands are almost exclusively dominated with quartz-fractionated-dominated substrates in Soda. These are derived primarily from quartz, although some feldspar and mica and clay minerals are also encountered. In general, substrates are relatively thin and parched, but surface soils contain considerable gravel. Surface soils range from 1 to 2 days. Exposed rock varies from almost to very considered, while soil is usually absent. The average litter depth ranges from 0.7 inches (1.9 cm) in the CAVE phase to 1.3 inches (3.3 cm) in the ARLA phase.

Productivity—Timber productivity is low to moderate (Appalachian T). While the VASC and ABLA phases include the highest measured values, the CAGE phase has the highest average productivity. Opportunities for timber management are generally good although not especially extensive. PVA stands are managed as prime timber species when present. Pseudotsuga presents additional management potential under certain circumstances. Regeneration by small clear-cutting, or clear-cut with planting, is usually adequate for PVA. But partial shade should enhance Pseudotsuga regeneration. In addition, site preparation measures may be necessary because of the rhizomatous nature of Calamagrostis and Carex geyeri.

Wildlife and livestock use is light to moderate. Other studies—The ABLA/CAVE h.t. has been described from Montana (Pfister and others 1971), central Idaho (Steele and others 1981), and eastern Idaho—western Wyoming (Steele and others 1983). Northern Utah is apparently the southernmost extent of the habitable range. Steele and others (1983) have recognized two phases: the Pseudotsuga myrtifolia phase, where Pseudotsuga and Carex are more common, and the C. rubescens phase, which has PVA contours as the major seral stages. Both phases are probably present in northern Utah even though not formally described.

Pseudotsuga menziesii (PSME) phase—Although this relatively warm and dry phase occurs throughout the range of the type, it is most common in southeastern Idaho. PSME is delineated by the presence or potential presence of Pseudotsuga as evidenced by the occurrence of the local environmental range of Pseudotsuga, including its upland-mountain locations. PSME soils typically occur on higher-elevation exposures of intermediate slopes. Typically, elevations are between 6,800 feet (2,070 m) and 8,600 feet (2,620 m) and exposures are generally northwesterly. Where sites are protected, the phase is encountered at elevations as low as 5,000 feet (1,520 m) or more and only locally and spottily exposed. The predominant terrain is moderate to steep, middle and upper slopes. In addition to the other sere associates, Pseudotsuga is normally a major component of stand stands. It often persists as fairly massive individuals in old-growth stands, but it only occasionally establishes in the larger canopy openings. Subsequent development is similar to that of the ABLA/BERE h.t. PSME phase, although it normally progresses more rapidly, particularly through a Pseudotsuga sere.

Undergrowth is more shrubby in this phase. In addition to Pseudotsuga, Acer rubrum, Betula occidentalis, Amelanchier alnifoila, Betula papyrifera, Cercocarpus betulis, and Quercus gambelii are generally present.

Figure 18. Abies lasiocarpa/Pseudotsuga racemosa h.t. is a prominent in the Wasatch Range. This stand occurs on a moderate southwestern exposure at an elevation of 7,200 feet (2,194 m). P. racemosa, Symphoricarpos oreophilus, and Thalictrum fendleri dominate the understory.
Symphoricarpos and Rosa species as additional indicators for the habitat type. We found that the presence of either Berberis or Puschkinia is adequate in northern Utah. However, the ranges of only these two species have also been reduced. Potentilla and Pissalia have been selected as additional indicators for the TRSP phase. The TRSP phase is characterized by the presence of these species.

Pissalia contorta, Pseudotsuga menziesii, and Populus tremuloides are also present in the TRSP phase, indicating a more humid climate. These species prefer mesic conditions and are often found in areas with a high precipitation. The TRSP phase is characterized by the presence of these species, indicating a more humid climate.

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corresponds to our ABLA/RE B.E. hist. and to a lesser extent our ABLA/RE B.A. hist.

The ABLA/RE B.E. OSC is represented by a much narrower concept than that which was originally described in Henderson and others (1929). The cooler or drier portions of their type are presently classified in our ABLA/RE, ABLA/BERE, or ABLA/RE B.R. hist. s.

ABIES LASIOCARPUS JUNIPERUS COMMON HIST.

Distribution—The ABLA/RE B.E. is found only in the southernmost Uinta Mountains, roughly between the Duchesne and Whiterocks Rivers, where it is fairly common. Relatively warm and dry, it embraces moderate to very steep ridge and canyon slopes as well as gentle upland surfaces. Elevations are between about 7,800 and 10,500 feet (2,378 and 3,200 m). These sites are typically the most droughty of the Abies lasiocarpa series.

Vegetation—Abies lasiocarpa is usually the indicated climax. Picea engelmannii, Pinus contorta, and locally Pseudotsuga menziesii. Populus tremuloides in occasionally a minor serial associate. Species are relatively open, and replacement progresses rather slowly.

Dense to scattered Juniperus accretes a rather scant undergrowth, which reflects greatly the dryness of sites. Of the herbs having the highest constancy, Lysimachia argentea usually has the greatest abundance. Other relatively inconspicuous members include Astrantia microphylla, Arctostaphylos cordifolia, Epilobium angustifolium, Solidago spp., Tanacetum amareum, and Varia nana. These are all found in the understory of the Abies lasiocarpa series. Lithospermum carolinianum is present on excessively dry surfaces where this fire is a common phenomenon. Minor amounts of Vaccinium retrorsum or V. scoparium are sometimes present on wet sites.

Soils—The soils of our stands are derived predominantly from the fluvial sandstone of the Duchesne formation, and often consist of the uppermost units of the Upper Crandall formation. These grey, medium sands are occasionally quite deep. In general, surfaces tend to be moderately to considerlable amounts, but there is very little exposed litter. Litter averages 1.1 inches (2.9 cm) in depth.

Other studies.—An ABLA/RE B.E. has been described from Montana and Idaho (Pfister and others 1977). However, as noted for some other eastern and western Wyoming described by Steele and others (1930).

Pinus contorta Series

Distribution.—The lands that comprise this series support essentially pure stands and are often judged to be so by the investigator through an examination of nearby, more open or older stands occupying similar sites.

Soils.—Soils are derived almost exclusively from quartzite and some other bedrock materials (B. D.) In general, they vary from shallow, when over fractured quartzite bedrock, to rather deep, when associated with various depositional features or certain geologic surface formations. With the exception of some especially moist, clayey soils that occur most notably with the PICOACCA c.c., soils are typically gravely and well-drained and have little tendency to form surface textures. Many are very dry. The amount of exposed rock varies, but bare soil is generally absent. Litter usually averages about 1.2 inches (3.0 cm) in depth.

Productivity/Management.—Although timber productivity is high for the series as a whole, environmental conditions are good. The values shown in appendix E may be low because the stands are not correctly expressed for an extensive crown competition. Pinus contorta is almost invariable the only cultivar having management possibilities. With the exception of the more serice sites where shelterwood techniques are perhaps more applicable. Pinus usually regenerates well with clearingcut and minimal mineral soil preparation (Tackie 1960). In fact, overstocked conditions often occur. Planting, while feasible, ordinarily is not necessary. General silvicultural guidelines have been discussed by Lottan (1975a) and by Albrecht and others (1963). Considered windbreak hazard, an often critical concern in the Uintas. These three other eastern or semi-eastern stands having observed conditions, and various pest problems. These concerns are present throughout the series.

Too much regeneration is especially undesirable because of excessive densities. Pinus is particularly susceptible to early suppression of heights and diameter growth. This is perhaps a greater problem with the "better" stands, which are generally those associated with seasonally moist soil conditions associated with the presence of an angulate horizon (personal communication with Dennis Austin, Utah Division of Wildlife). One problem that has been introduced is the integration of distribution relationships, the presence of dwarf mistletoe which was included as part of our plot examination in the southeastern part of the state. The occurrence of sites of elevations of between 8,000 and 10,000 feet (2,438 and 3,048 m.), these are infrequent and the stand. This was the case and the stands are associated with seasonally moist soil conditions associated with the presence of an angulate horizon (personal communication with Dennis Austin, Utah Division of Wildlife). One problem that has been introduced is the integration of distribution relationships, the presence of dwarf mistletoe which was included as part of our plot examination in the southeastern part of the state. The occurrence of sites of elevations of between 8,000 and 10,000 feet (2,438 and 3,048 m.), these are infrequent and the stand. This was the case and the stands are associated with seasonally moist soil conditions association.
however. The most significant mammal pests are pocket gophers and porcupines; the latter are especially harmful in the areas managed in the Wanapum (Daniel) and Burnet (1959).

Notable values of the Picea contorta series are:

- Occurrence by various wildlife species has been studied locally by Collins and others (1978), Dechamp and others (1978), and others. The effect of management activities on water yield and quality is an important consideration throughout the region. These values are associated with sites where overgrowths are prominent.

Other studies—Various, often similar Picea contorta community types have been described from Montana (Pilster and others 1977), central Idaho (Steely and others 1981), and eastern Idaho, western Wyoming (Cooper 1975, Steely and others 1983).

Pilster and Deshmukh (1975) listed the current references to plant communities in the northwestern United States which refer to P. contorta as climax. Several specific situations are particularly noteworthy. Cooper (1975) and Pilster and others (1977) recognized a Picea Firma zone in northern Montana. In central Idaho, a Picea contorta Fescue Dekker (t.h. has been described by Steely and others (1981). Hoffman and Alexander (1970) and Reel (1976) recognized a total of three PICEA habitat types in Wyoming. Also, Moir (1960) discussed a zone in the Colorado Front Range where P. contorta is either a prolonged seral or climax species. This zone is similar in several respects to the zone recognized by the Unita Mountains, as is the climax zone of the Bighorn Mountains, Wyoming (Despain 1975).

**PINUS CONTORTA-CALAMAGROSTIS CANADENSIS-CYTISUS Picea/CALAMAGROSTIS PINE/Lodgepole PINE/BLUE-JOINT REEDGRASS**

Distribution—This community type occurs locally in the northern Unita Mountains, reared through the southeastern areas. Elevations range from about 8,900 feet to 6,000 feet (2,600 to 1,800 m). Most sites occur on gentile slopes in relatively cool and generally dry. Usually, surface soils are seasonally moist. This type apparently results from local drainage-hydrological conditions such as an aridic horizon.

Vegetation—*Pinus contorta* is occasionally a minor species or a replacement species in the past when fire occurred. Only two were older than 150 years of age. Stochastic, scattered reproduction of other conifers is common in these stands. For our sample sites, then, it appears that *Abies lasiocarpa* is sometimes present in the stands, and that *Pinus contorta* is a persistent seral species. *Picea engelmanni* is locally present as a minor associate. Sites and their distribution are scattered in the region. *Picea engelmanni* is scattered in the region. It is the major species in various patches. This species is considered as *Picea contorta* in the western slopes of the northern Idaho and eastern Oregon. It is often absent in the southern areas of the same state, and some burned but otherwise similar Abies stand the other stand was entirely *Picea* in composition. Three younger stands also had similar representation of these shade-tolerant conifers.

In the establishment model for the higher elevations, these conditions suggest that most *Pinus* and probably most *Abies* becomes established with *Picea*, probably latterly the rather prolonged period of stand establishment. Once the stand develops an extensive, shallow root system and duff further accumulates, however, the seedbed becomes too dry and cold for successful establishment of *Picea* or *Abies*. Limiting amounts of critical mineral nutrients may also impede establishment. From a management standpoint, then, these stands are probably best considered a *Picea contorta* climax, with other conifers occurring as accidentals. For the Unitas, both of the above factors are probably more significant than the presence of predominantly frequent, natural surface fires in curtailing *Picea* and *Abies* regeneration.

Of the nine remaining younger stands, four pure *Picea* stands occupied very dry sites at about 9,100 feet (2,750 m) elevation. These sites most probably represented a *PICEA* h. r. regardless of stand ages. Stunted *Abies* stands, on the other hand, were from 3,900 feet (1,200 m) elevation of which four were over 150 years old and two were over 200 years old. Five of these six stands also had very widely spaced coniferous regeneration of about the same age, and some stunted but otherwise similar Abies stand the other stand was entirely *Picea* in composition. Three younger stands also had similar representation of these shade-tolerant conifers.

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Other studies—Hoffman and Alexander (1976) recognize a PICO/ARUV community from the Bighorn Mountains, Wyo. This type is similar in many respects to the dry extensive of our stands designated as a P. contorta climax. The PICO/ARUV c.t. has been described from Montana (Pfister and others 1979), central Idaho (Shepherd and others 1981), and northeastern Idaho, western Wyoming (Shepherd and others 1983). In Montana, Idaho, Utah, and Wyoming, this community type occupies the ABLA/ARUV h.t. although these authors recognize certain drought conditions where P. contorta may be climax.

PINCUS CONTORTAJUNIPERUS COMMUNITIES C.T. (PICO/ARUV, LODGEPOLE PINE/COMMON JUNIPER) DISTRIBUTION—The PICO/ARUV c.t. occurs only in the south-central Uinta Mountains. There, it is found primarily between the Whitney Creek and eastern Duchense River drainages. This community type most all southerly, moderately steep to very steep ridge and canyon slopes where the soil is coarse, usually between 8,400 and 10,000 feet (2,560 m to 3,050 m). These exposures are warm and soils are extremely well drained, being some of the driest within that area.

Vegetation—This community type occurs within the normal altitudinal distribution of Abies lasiocarpa or Pseudotsuga menziesii; the ABLA/ARUV or PSME/BERE h.t. are usually nearby on the more protected expositions of the ridge tops and spurs. These Juniperus, however, appears to be exceptionally slow.

Undergrowth also exhibits the influence of fire. In addition to Juniperus, several shrubs are locally present, such as Arctostaphylus patula, Amelanchier uniflora, Rosa spp., and Salix discolor. The herbaceous component is typically xerophytic. The most frequently encountered species include Aster dilatatus, Elymus angustifolius, Bromus ciliatus, Carex rossii, and species of Festuca and Poa.

Pachistima myriostis and occasionally Pachistima myriostis are encountered in the understory, which sometimes appears to be a patch of the PICO/ARUV c.t. With the exception of a few instances, however, the undergrowth and typical vegetation are similar to that of the ABLA/ARUV h.t.—a type where these two species are apparently absent.

Abies lasiocarpa, Pseudotsuga menziesii, and Juniperus communis, Avena annua var., Avena cordifolia, Artemisia tridentata, Epilobium angustifolium, Bromus ciliatus, Carex rossii, and species of Festuca and Poa are dominant.

Abies lasiocarpa and Pseudotsuga menziesii are normal in occurrence to the moistest microsites.

Patches of Abies lasiocarpa and occasionally Pachistima myriostis are encountered in the understory, which sometimes appears to be a patch of the PICO/ARUV c.t. With the exception of a few instances, however, the undergrowth and typical vegetation are similar to that of the ABLA/ARUV h.t.—a type where these two species are apparently absent.

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Abies lasiocarpa and Pseudotsuga menziesii are normal in occurrence to the moistest microsites.
APPENDIX A. NUMBER OF SAMPLE STANDS BY HABITAT TYPE OR PHASE AND NATIONAL FOREST VICINITY IN NORTHERN UTAH AND ADJACENT IDAHO AND WYOMING

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<thead>
<tr>
<th>Habitat type, phase</th>
<th>SI</th>
<th>C</th>
<th>SU</th>
<th>WW</th>
<th>U</th>
<th>WE</th>
<th>A</th>
<th>Total</th>
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<td>Picea flexilis series</td>
<td>PIF/CHE</td>
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<tr>
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<td>PSME/OGCH</td>
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<td></td>
<td>PSME/SYOR</td>
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<td>17</td>
<td>2</td>
<td>9</td>
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<td>1</td>
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<td>/BERE, SYOR</td>
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<td>/BERE, BERE</td>
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<td></td>
<td>Picea engelmanii series</td>
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<td>2</td>
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<td></td>
<td>PIP/UBERE</td>
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<td></td>
<td>Abies concolor series</td>
<td>ABC/PHMA</td>
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<td>ABC/ACUL</td>
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<td>/BERE, BERE</td>
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<td></td>
<td>ABC/CARU</td>
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APPENDIX C-1. CONCONSTANCY AND AVERAGE CANOPY COVER (THE LATTER IN PARENTHESES) OF IMPORTANT PLANTS IN NORTHERN UTAH CONIFEROUS FOREST HABITAT TYPES AND PHASES (SEE BELOW FOR CODES)

<table>
<thead>
<tr>
<th>Phase</th>
<th>PINE</th>
<th>BIRCH</th>
<th>ROCKY MOUNTAIN PINON</th>
<th>WHITE SPRUCE</th>
<th>BALSAM PINE</th>
<th>ASPEN</th>
<th>BOREAL</th>
<th>SHORE</th>
<th>TALL SHORE</th>
<th>CLIFF</th>
<th>CRAG</th>
<th>CRAG</th>
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Note: Codes: PINE = Picea; BIRCH = Betula; ROCKY MOUNTAIN PINON = Pinus flexilis; WHITE SPRUCE = Picea glauca; BALSAM PINE = Pinus resinosa; ASPEN = Populus; BOREAL = Abies lasiocarpa; SHORE = Populus tremuloides; TALL SHORE = Populus balsamifera; CRAG = Salix; CRAG = Salix; CRAG = Salix; CRAG = Salix; CRAG = Salix; CRAG = Salix; CRAG = Salix; CRAG = Salix.
| Series | Title | Abb | Units
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### APPENDIX D-1. GENERAL LANDFORM AND SOIL CHARACTERISTICS (upper 20 cm) OF NORTHERN UTAH HABITAT TYPES AND PHASES

<table>
<thead>
<tr>
<th>Soil Group</th>
<th>Percentage of Ground Surface</th>
<th>Percentage of Upper Soil</th>
<th>Percentage of Course Fringe Presence</th>
<th>Percentage of Residual Surface</th>
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#### SEDIMENTARY
- **Lithosol**:
  - Course Fringe Presence
  - Residual Surface
- **Tuffosol**:
  - Course Fringe Presence
  - Residual Surface
- **Tuffosol sand**:
  - Course Fringe Presence
  - Residual Surface
- **Lithosol**:
  - Course Fringe Presence
  - Residual Surface

#### DEPOSITIONAL
- **Coarse-Grained Till**:
  - Course Fringe Presence
  - Residual Surface
- **Silty Tills**:
  - Course Fringe Presence
  - Residual Surface
- **Silty-Gravelly Till**:
  - Course Fringe Presence
  - Residual Surface
- **Silt**:
  - Course Fringe Presence
  - Residual Surface

#### WATER FLOWED
- **Soil**:
  - Course Fringe Presence
  - Residual Surface
- **Soil**:
  - Course Fringe Presence
  - Residual Surface

#### SURFACE COMPOSITION
- **Course Fringe Presence**:
  - Lithosol
  - Tuffosol
  - Tuffosol sand
  - Lithosol
- **Residual Surface**:
  - Lithosol
  - Tuffosol
  - Tuffosol sand
  - Lithosol

#### SURFACE COMPOSITION (com.)

<table>
<thead>
<tr>
<th>Soil Group</th>
<th>Course Fringe Presence</th>
<th>Residual Surface</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lithosol</strong>:</td>
<td>- Course Fringe Presence</td>
<td>- Residual Surface</td>
</tr>
<tr>
<td><strong>Tuffosol</strong>:</td>
<td>- Course Fringe Presence</td>
<td>- Residual Surface</td>
</tr>
<tr>
<td><strong>Tuffosol sand</strong>:</td>
<td>- Course Fringe Presence</td>
<td>- Residual Surface</td>
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<tr>
<td><strong>Lithosol</strong>:</td>
<td>- Course Fringe Presence</td>
<td>- Residual Surface</td>
</tr>
</tbody>
</table>

#### RESIDUAL SURFACE
- **Lithosol**:
  - Course Fringe Presence
  - Residual Surface
- **Tuffosol**:
  - Course Fringe Presence
  - Residual Surface
- **Tuffosol sand**:
  - Course Fringe Presence
  - Residual Surface
- **Lithosol**:
  - Course Fringe Presence
  - Residual Surface

#### DEPOSITIONAL SURFACE
- **Coarse-Grained Till**:
  - Course Fringe Presence
  - Residual Surface
- **Silty Tills**:
  - Course Fringe Presence
  - Residual Surface
- **Silty-Gravelly Till**:
  - Course Fringe Presence
  - Residual Surface
- **Silt**:
  - Course Fringe Presence
  - Residual Surface

#### WATER FLOWED SURFACE
- **Soil**:
  - Course Fringe Presence
  - Residual Surface
- **Soil**:
  - Course Fringe Presence
  - Residual Surface

#### SURFACE COMPOSITION SURFACE
- **Course Fringe Presence**:
  - Lithosol
  - Tuffosol
  - Tuffosol sand
  - Lithosol
- **Residual Surface**:
  - Lithosol
  - Tuffosol
  - Tuffosol sand
  - Lithosol

#### SURFACE COMPOSITION SURFACE (com.)

<table>
<thead>
<tr>
<th>Soil Group</th>
<th>Course Fringe Presence</th>
<th>Residual Surface</th>
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<tbody>
<tr>
<td><strong>Lithosol</strong>:</td>
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<tr>
<td><strong>Tuffosol</strong>:</td>
<td>- Course Fringe Presence</td>
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<tr>
<td><strong>Tuffosol sand</strong>:</td>
<td>- Course Fringe Presence</td>
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<tr>
<td><strong>Lithosol</strong>:</td>
<td>- Course Fringe Presence</td>
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</table>

#### RESIDUAL SURFACE SURFACE
- **Lithosol**:
  - Course Fringe Presence
  - Residual Surface
- **Tuffosol**:
  - Course Fringe Presence
  - Residual Surface
- **Tuffosol sand**:
  - Course Fringe Presence
  - Residual Surface
- **Lithosol**:
  - Course Fringe Presence
  - Residual Surface

#### DEPOSITIONAL SURFACE SURFACE
- **Coarse-Grained Till**:
  - Course Fringe Presence
  - Residual Surface
- **Silty Tills**:
  - Course Fringe Presence
  - Residual Surface
- **Silty-Gravelly Till**:
  - Course Fringe Presence
  - Residual Surface
- **Silt**:
  - Course Fringe Presence
  - Residual Surface

#### WATER FLOWED SURFACE SURFACE
- **Soil**:
  - Course Fringe Presence
  - Residual Surface
- **Soil**:
  - Course Fringe Presence
  - Residual Surface

#### SURFACE COMPOSITION SURFACE SURFACE (com.)

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<th>Soil Group</th>
<th>Course Fringe Presence</th>
<th>Residual Surface</th>
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<tbody>
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<td><strong>Lithosol</strong>:</td>
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<tr>
<td><strong>Tuffosol</strong>:</td>
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<td><strong>Tuffosol sand</strong>:</td>
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<tr>
<td><strong>Lithosol</strong>:</td>
<td>- Course Fringe Presence</td>
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#### RESIDUAL SURFACE SURFACE SURFACE
- **Lithosol**:
  - Course Fringe Presence
  - Residual Surface
- **Tuffosol**:
  - Course Fringe Presence
  - Residual Surface
- **Tuffosol sand**:
  - Course Fringe Presence
  - Residual Surface
- **Lithosol**:
  - Course Fringe Presence
  - Residual Surface

#### DEPOSITIONAL SURFACE SURFACE SURFACE
- **Coarse-Grained Till**:
  - Course Fringe Presence
  - Residual Surface
- **Silty Tills**:
  - Course Fringe Presence
  - Residual Surface
- **Silty-Gravelly Till**:
  - Course Fringe Presence
  - Residual Surface
- **Silt**:
  - Course Fringe Presence
  - Residual Surface

#### WATER FLOWED SURFACE SURFACE SURFACE
- **Soil**:
  - Course Fringe Presence
  - Residual Surface
- **Soil**:
  - Course Fringe Presence
  - Residual Surface
# APPENDIX D-4 CLIMATIC PARAMETERS FOR STATIONS WITHIN OR PROXIMATE TO HABITAT TYPES OF SERIES IN NORTHERN UTAH (FROM U.S. WEATHER SERVICE RECORDS UNLESS NOTED)

(- = APPROXIMATELY; ND = NO DATA)

<table>
<thead>
<tr>
<th>Geographical location and station</th>
<th>Estimated habitat type</th>
<th>Elevations</th>
<th>Relative abundance</th>
<th>Mean monthly temperature °F (°C)</th>
<th>Average number of days with frost</th>
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<td>NORTHERN WASATCH</td>
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<tr>
<td>Utah State University</td>
<td>below PSRE series</td>
<td>72-73</td>
<td>49</td>
<td>6.5</td>
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<tr>
<td>College Forest</td>
<td>ABLA-LPRA-PERA</td>
<td>59/10</td>
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<td>Commack Wash</td>
<td>below ASCO series</td>
<td>80-97</td>
<td>5-1</td>
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<td>Elkhorn A.S.</td>
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<td>Moon Lake</td>
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# APPENDIX E-1. MEAN BASAL AREAS AND 50-YEAR SITE INDEXES (IN FEET) FOR NORTHERN UTAH SAMPLE STAND DATA BY HABITAT TYPE

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<tr>
<th>Habitat type</th>
<th>Boreal pine</th>
<th>PPL</th>
<th>PSRE</th>
<th>ASCO</th>
<th>PRO</th>
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A land classification system based upon potential natural vegetation is presented for the coniferous forests of northern Utah. The classification and descriptions are based on reconnaissance data from over 1,000 stands. A total of 8 climax series and 36 habitat types are described. A diagnostic key, utilizing conspicuous indicator species, provides for field identification of the types.

KEYWORDS: forest vegetation, Utah, habitat types, plant communities, forest ecology, forest management, classification

The Intermountain Station, headquartered in Ogden, Utah, is one of eight regional experiment stations charged with providing scientific knowledge to help resource managers meet human needs and protect forest and range ecosystems. The Intermountain Station includes the States of Montana, Idaho, Utah, Nevada, and western Wyoming. About 231 million acres, or 85 percent, of the land area in the Station territory are classified as forest and rangeland. These lands include grasslands, deserts, shrublands, alpine areas, and well-stocked forests. They supply fiber for forest industries; minerals for energy and industrial development; and water for domestic and industrial consumption. They also provide recreation opportunities for millions of visitors each year.

Field programs and research work units of the Station are maintained in:

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Bozeman, Montana (in cooperation with Montana State University)

Logan, Utah (in cooperation with Utah State University)

Missoula, Montana (in cooperation with the University of Montana)

Moscow, Idaho (in cooperation with the University of Idaho)

Provo, Utah (in cooperation with Brigham Young University)

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