Rod Mitchell

Department of Biology
Colorado Women's College
Denver, Colorado 80220

and

Will Moir

Rodeo, New Mexico 88056

Vegetation of the Abbott Creek Research Natural Area, Oregon

Abstract

This study identifies the different forest communities present in Abbott Creek Natural Area, Oregon. It also describes the floristic composition of each community type and comments on the relative relationships of the communities. The five forest community types described are: *Abies magnifica-Abies concolor/Ribes* spp., *Abies concolor-Tsuga heterophylla/Acer circinatum-Taxus brevifolia, Abies concolor/Linnaea borealis, Abies concolor-Pseudotsuga menziesii/Whipplea modesta* and *Pseudotsuga menziesii-Libocedrus decurrens/Arctostaphylos nevadensis.* To accomplish the above objectives 124 reconnaissance and eleven analytical sample plots were taken. These data were analyzed using SIMORD, a two dimensional ordination procedure.

Introduction

This paper gives the results of vegetation classification studies in the Abbott Creek Natural Area located about 29 km (18 mi) west of Crater Lake in southwestern Oregon. Interest in this area stems from a report by H. J. Andrews (1946) who noticed that: "special features of this area . . . are the volume and stands of sugar pine (*Pinus lambertiana*) . . . As characteristic of these stands, this volume is mainly in the large diameter classes, 50 to 60 inches and over, thus presenting a truly optimum stand of Southern Oregon sugar pine." Andrews also stated that reproduction and advanced growth of the sugar pine was of general occurrence in the natural area. When we revisited here some 25 years after Andrews' report, we were impressed by the complexity of forest communities and by the heavy reproduction of white fir (*Abies concolor*) which on most sites appeared to be the climax tree.

The forest communities of the upper drainage basin of the East Fork of Abbott Creek are quite different from those described from other regions of the Western Cascade Province (Franklin and Dyrness, 1969). The forest types in the Abbott Creek area, however, are within the *Abies concolor* and *Abies magnifica shastensis* zones. The only vegetation studies in these zones are those of Whittaker (1960) and Waring (1969) in the Siskiyou Mountains where the community types are quite different. Therefore, the description of habitats, plant communities, and tree successional relationships at Abbott Creek Natural Area contributes to our knowledge of the natural vegetation of the Cascade Range.

We also began these studies for purposes of stratifying the vegetation of this research natural area and initiating a measurement system and baseline documentation within each community type for future comparisons and additional scientific research (Moir, 1972).

Study Area

Abbott Creek Natural Area is located 19 km (12 mi) west of Crater Lake National Park, in the Rogue River National Forest of southern Oregon (Fig. 1). Its boundaries enclose parts of Douglas and Jackson counties, and the total area is 1076 hectares (2660 a).

The western border of the natural area is defined by the main branch of Abbott Creek and is the location of easiest access to major portions of the area. An unmaintained logging road parallels the more southerly half. This road is easily accessible from U.S. Highway 26 via forest road 3047. The northern border is defined by a ridge which divides the Rogue and Umpqua River drainages. The main access to this border is via Abbott Butte fire lookout, which is serviced by forest road 2923, and the remnants of a trail which follows this ridge. The eastern edge of the area follows the Golden Stairs Trail, for the most part, which is accessible at its southern end by forest road 3017, and by forest road 3016 at a more northerly point. The southern border is short, and is accessible from forest road 3047. There are no trails or roads within the area, the major topographic features of which are shown in Figure 2.

Physiography and Geology

Three drainages make up the major portion of the area, with the northernmost containing almost half of the total acreage. The general topography is quite rugged, with much of the area consisting of slopes of 25 percent or more. There are some portions of gentle to almost no relief along the western edge of the area near Abbott Creek, and some benches at high elevations below Abbott Butte. Many of the ridges between and along the borders of drainages contain rock outcroppings with little vegetation.

The highest point in the area is Abbott Butte, elevation 1869 m (6131 ft), lo-

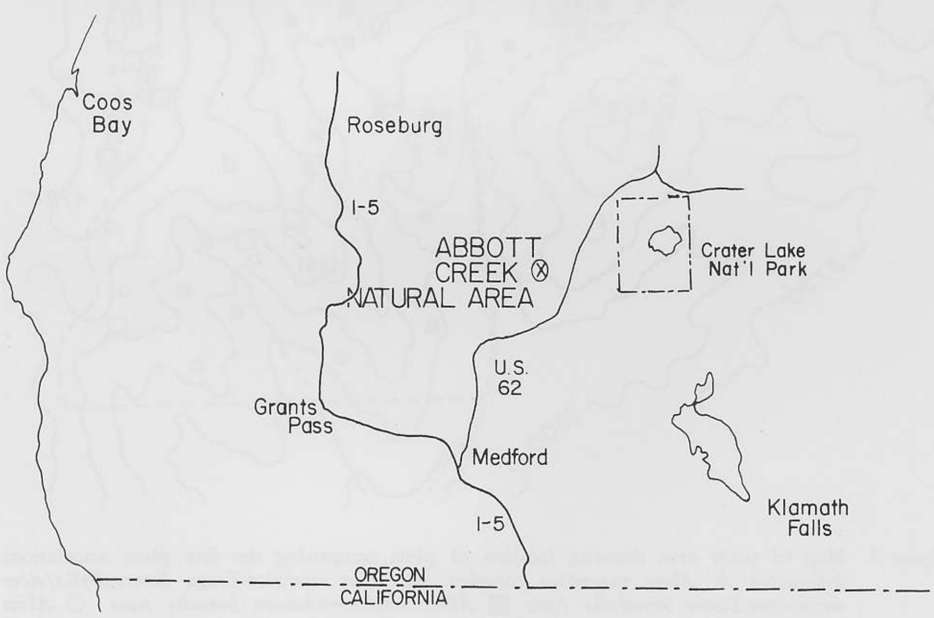

Figure 1. Location of Abbott Creek Natural Area.

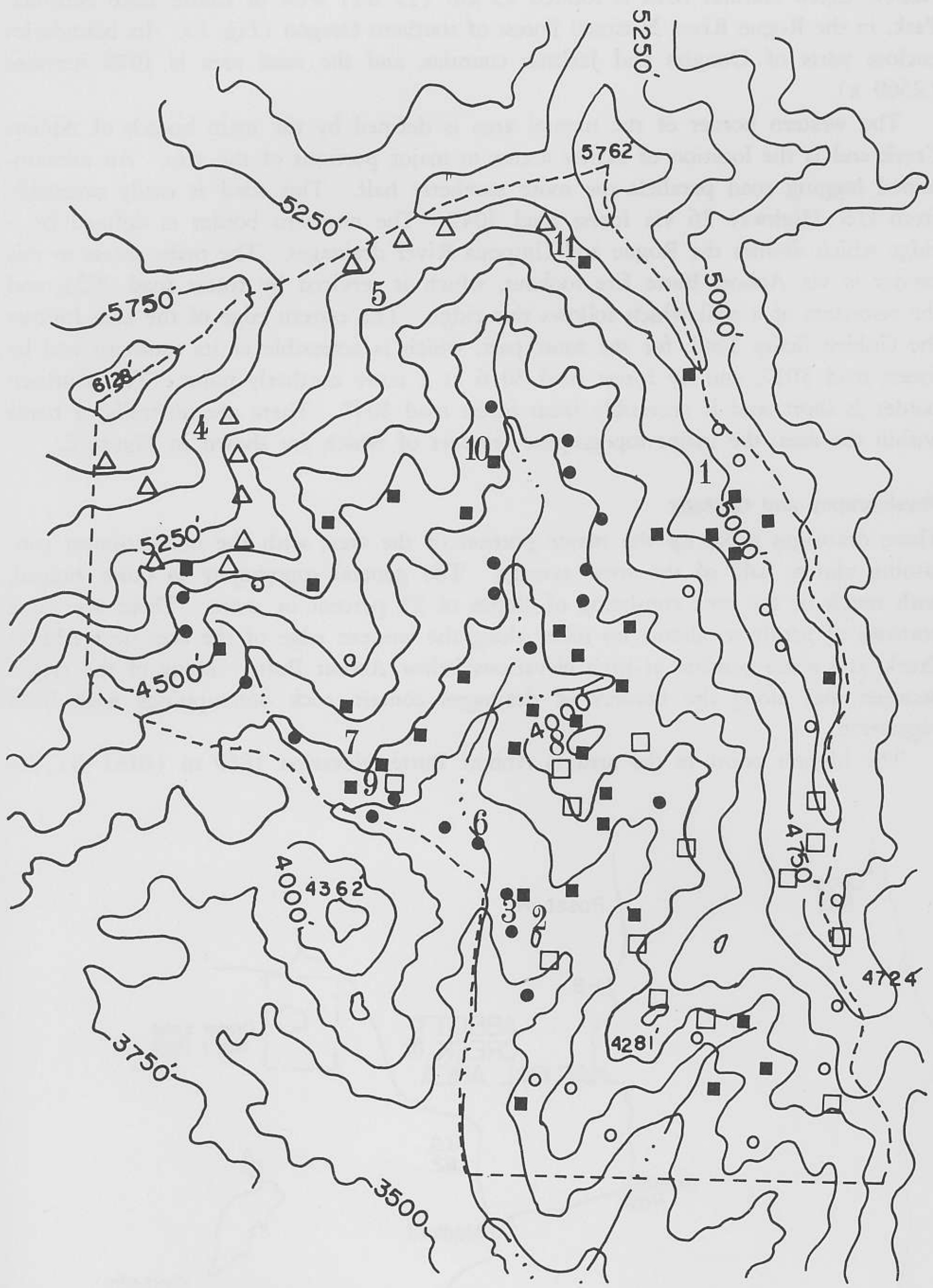

Figure 2. Map of study area showing location of plots comprising the five plant associations designated △ *Abies magnifica* complex. ● *Abies concolor-Tsuga heterophylla/Acer circinatum-Taxus brevifolia* Asso. ■ *Abies concolor-Linnaea borealis* Asso. ○ *Abies concolor-Pseudotsuga menziesii/Whipplea modesta* Asso. □ *Pseudotsuga menziesii-Libocedrus decurrens/Arctostaphylos nevadensis* Asso.

cated in the northwestern corner. The crest of the ridge that parallels the northern border and much of the crest of the ridge paralleling the eastern border are above 1524 m (5000 ft). The southwestern corner is the lowest point, at about 1006 m (3300 ft).

Geologically, the entire area is volcanic in origin. The soil of the natural area is described as belonging to the Freezener-Coyata soil series (Power and Simonson, 1969). Typically these soils are deep and well drained with dark reddish-brown, friable, loam surface layers and clay loam, moderately blocky subsoils. Rock fragments range in abundance from 0 to 30 percent or more by volume. The soils are moderately acid in reaction.

Climate

The climate in the natural area is characterized as "modified maritime." Most of the precipitation is a result of low pressure systems which move eastward across western Oregon from the Pacific Ocean. During the summer, this dominant climatic feature is modified by high pressure systems which shift fronts northward, resulting in clear, dry weather. This phenomenon results in cool, wet winters and warm, dry summers.

Methods

During the summer of 1971 the forest vegetation was sampled by reconnaissance plots (Franklin, Dyrness, and Moir, 1970) and five forest classification units were distinguished (Mitchell, 1972). In the summer of 1972 permanent additional plots were established within each of these types. These plots were 25 x 15 m. All trees within the plots were tallied by species and size class. Understory vegetation was measured by canopy coverage class in each of fifty 2 x 5 dm quadrats systematically placed along two 25 m strips within the plot (Daubenmire, 1968, p. 42 ff, and figs. 13 & 26). All vascular plants in each of the quadrats were measured either in early (June-July) or late (August) summer to insure that each species was observed near its time of maximum foliage. Species not in the quadrats but occurring inside the 25 x 15 m plot were recorded for constance; species of the homogeneous vegetation just outside the plot were recorded for presence.

The plant names (Peck, 1961) of this study are based upon voucher specimens deposited in herbaria at Oregon State University and the U.S. Forest Service at Fort Collins, Colorado.

Permanently marked camera locations were established at each of the 25 x 15 m plots. Here photographs were taken of the existing vegetation within (and sometimes in the vicinity of) the plots.

Data from both reconnaissance and permanent plot samples were analyzed by similarity and ordination procedures, using SIMORD, a reference stand ordination technique (Dick-Peddie and Moir, 1970). We selected reference plots used to define the X and Y axes of the ordination from among the reconnaissance plots that represented, in our judgment, typical and distinctive environments. After several trials of reference plot selection, the resultant ordination distributed the plots in what we considered to be a realistic pattern (Mitchell, 1972, and discussion below). The groupings of the plots on the ordination plane together with synecological and physical site data (*e.g.*, slope, exposure, elevation, landform) not used in ordination were all criteria aiding us in the definition of the major forest types (Franklin, Dyrness, and Moir, 1970; Daubenmire, 1968).

The vegetation of several herbaceous communities along the Golden Stairs Trail was sampled by systematic location of 25 2 x 5 dm quadrats along a line within each homogeneous vegetation type. The vascular plants in each quadrat were estimated by canopy coverage class in the manner similar to the understory vegetation of the forest plots. The 25 m line in each community is permanently marked by stakes at each end. The measurements were taken the third week of June, 1972.

Results

From the analysis of the original reconnaissance data, five forest community types were designated (Table 1) and named according to their major overstory and understory indicators.

When both the reconnaissance and analytical plots (Fig. 2) were subjected to the SIMORD program the two dimensional ordination pattern depicted in Figure 3 resulted. It can be seen that the plots designated as belonging to the same community type tended to group with each other and that the analytical plots chosen to represent each group fell well within the borders of their specific groups.

One factor of great importance to the designation of overstory indicators was their position in the successional sequence of a given community type. To evaluate this factor, the age structure of these overstory species was determined in each plot (Fig. 4). Of the major overstory species evaluated, *Pseudotsuga menziesii* was unique in that a

TABLE 1. Some major characteristics of the forest communities at Abbott Creek. The asterisk indicates distinguishing features.

CLASSIFICATION TYPE	TREE SPECIES Climax	Late Seral	UNDERSTORY VEGETATION Total Cover (PER-CENT)	Evergreen (PER-CENT)	Major Species
Abies magnifica Complex	Abma* (Tsme)	Abco	90-100+	3-10*	*Ribes binominatum* *Achlys triphylla* *Rubus parviflora* *Bromus vulgaris*
Abies concolor-Tsuga heterophylla/Acer circinatum-Taxus brevifolia Association	Abco Tshe	Psme	90-100+	15-70	*Acer circinatum** *Taxus brevifolia** *Vaccinium membran* *Linnaea borealis*
Rhododendron Phase	Abco Tshe	Psme	90-100+	50+	*Rhododendron macrocarpum**
Abies concolor/Linnaea borealis Association	Abco (Tshe)	Psme Lide	60-90*	60*	*Linnaea borealis** *Castanopsis chrysophylla* (shrub)
Whipplea modesta Phase	Abco Lide	Psme	20-75		*Whipplea modesta* *Linnaea borealis*
Abies concolor-Pseudotsuga/Whipplea modesta Association	Abco Lide	Psme	0-20*	0-30	*Whipplea modesta* *Iris chrysophylla*
Pseudotsuga-Libocedrus/Arctostaphylos nevadensis Association	Psme* Lide	Pila	10-40	40-60	*Arctostaphylos nevadensis** *Ceanothus prostatus*
Castanopsis chrysophylla Phase	Psme* Abco*	Lide Pila	30-50	60	*Castanopsis chrysophylla* (tree) *Arctostaphylos nevadensis*

majority of the stands contained old dominant individuals, but no younger individuals. In essence, *Pseudotsuga menziesii* is not reproducing itself in older stands (probably due to its relatively low shade tolerance) and represents a late seral stage species. *Abies concolor* and to a lesser extent *Libocedrus decurrens,* by contrast, were repre-

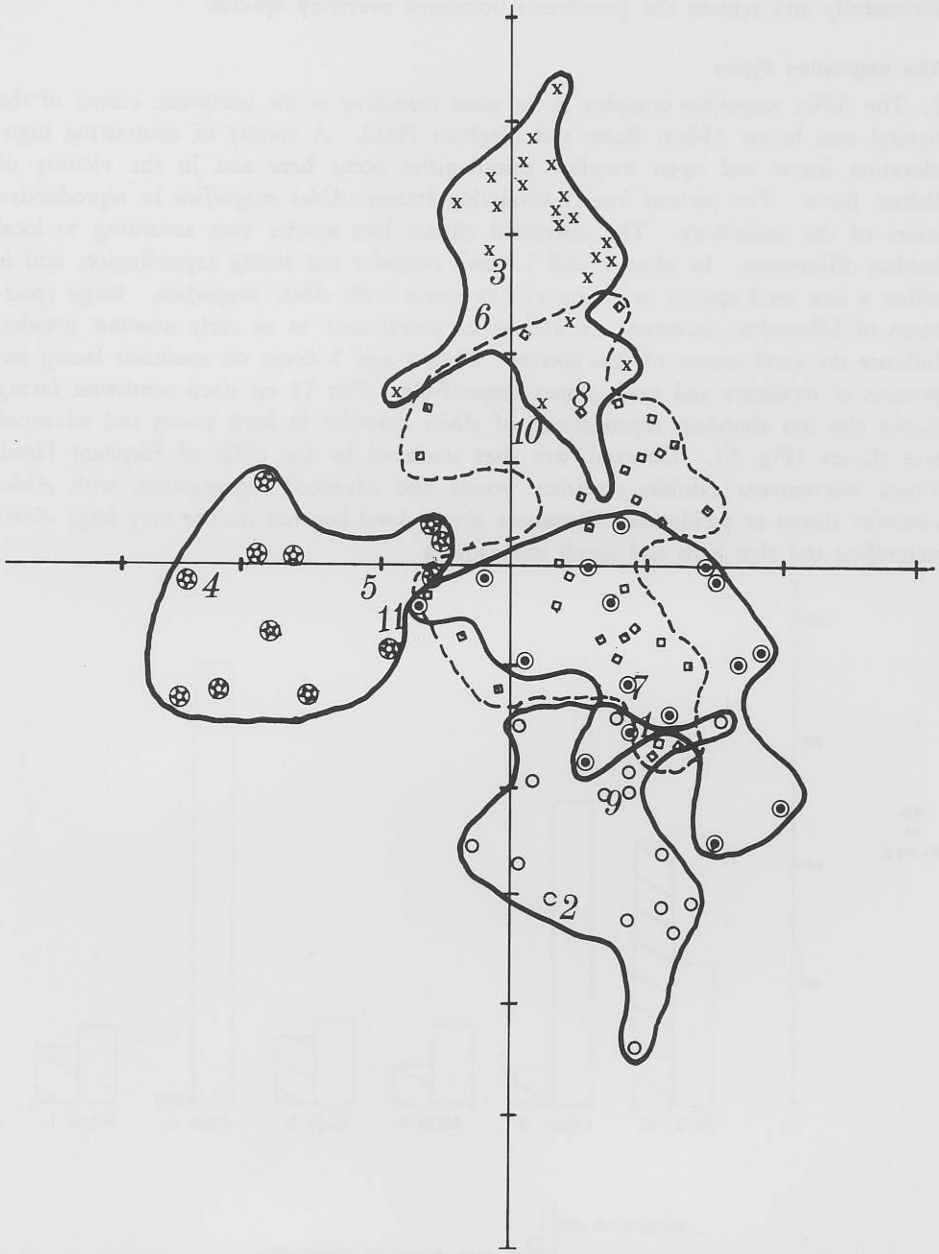

Figure 3. Two dimensional ordination of forest plots of the Abbott Creek Natural Area. *Abies magnifica* complex. X *Abies concolor-Tsuga heterophylla/Acer circinatum-Taxus brevifolia* Asso. □ *Abies concolor-Linnaea borealis* Asso. ⊙ *Abies concolor-Pseudotsuga menziesii/Whipplea modesta* Asso. O *Pseudotsuga menziesii-Libocedrus decurrens/Arctostaphylos nevadensis* Asso.

sented by all age classes in the stands in which they occur, and might be considered dominant climax species. However, a climax situation in an area such as Abbott Creek may not be a real situation. Due to the periodic fires which occur, and the opening of the forest by fallen trees, *Pseudotsuga menziesii* may be able to compete successfully and remain the permanent dominant overstory species.

The Vegetation Types

1. The *Abies magnifica* complex is the most extensive in the northwest corner of the natural area below Abbott Butte and Elephant Head. A variety of contrasting high-elevation forest and open meadow communities occur here and in the vicinity of Falcon Butte. The present forests invariably feature *Abies magnifica* in reproductive strata of the understory. The associated climax tree species vary according to local habitat differences. In plots 4 and 5 *Abies concolor* has strong reproduction, and is either a late seral species or shares climax status with *Abies magnifica.* Large specimens of *Libocedrus decurrens,* as well as its prominence as an early meadow invader, indicate the seral nature of this species. Plots 4 and 5 occur on southeast facing exposures of moderate and steep slopes respectively. Plot 11 on steep southwest facing slopes also has abundant reproduction of *Abies concolor* in both young and advanced size classes (Fig. 5). On cool, wet sites sheltered by the cliffs of Elephant Head, *Tsuga mertensiana* exhibits abundant young and advanced regeneration, with *Abies concolor* absent or accidental. Elsewhere almost level benches feature very large *Abies magnifica* and rich herb and shrub understories.

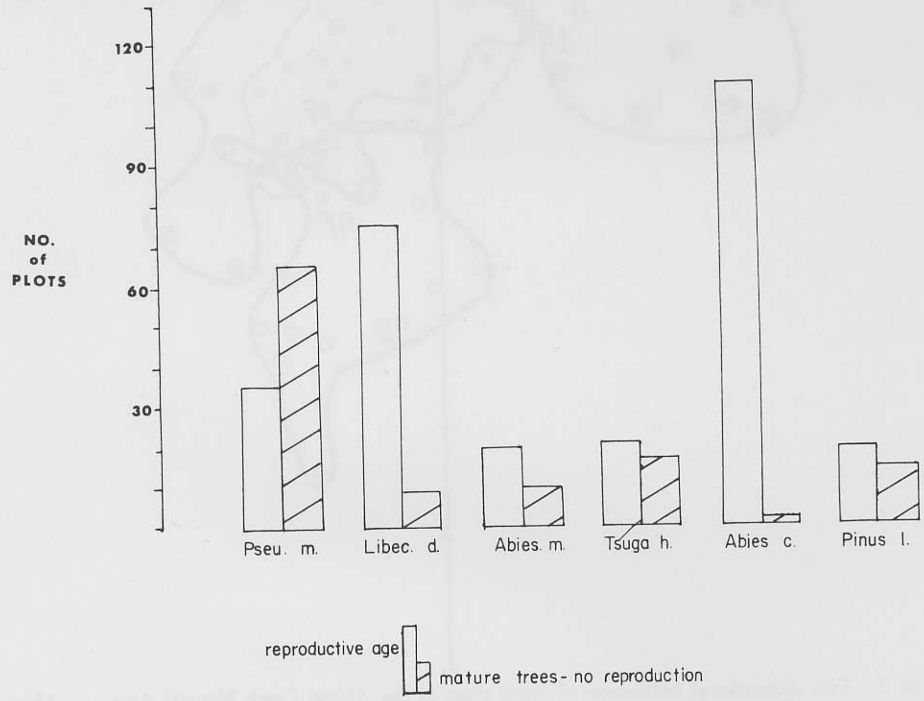

Figure 4. Reproductive and mature age classes of selected tree species.

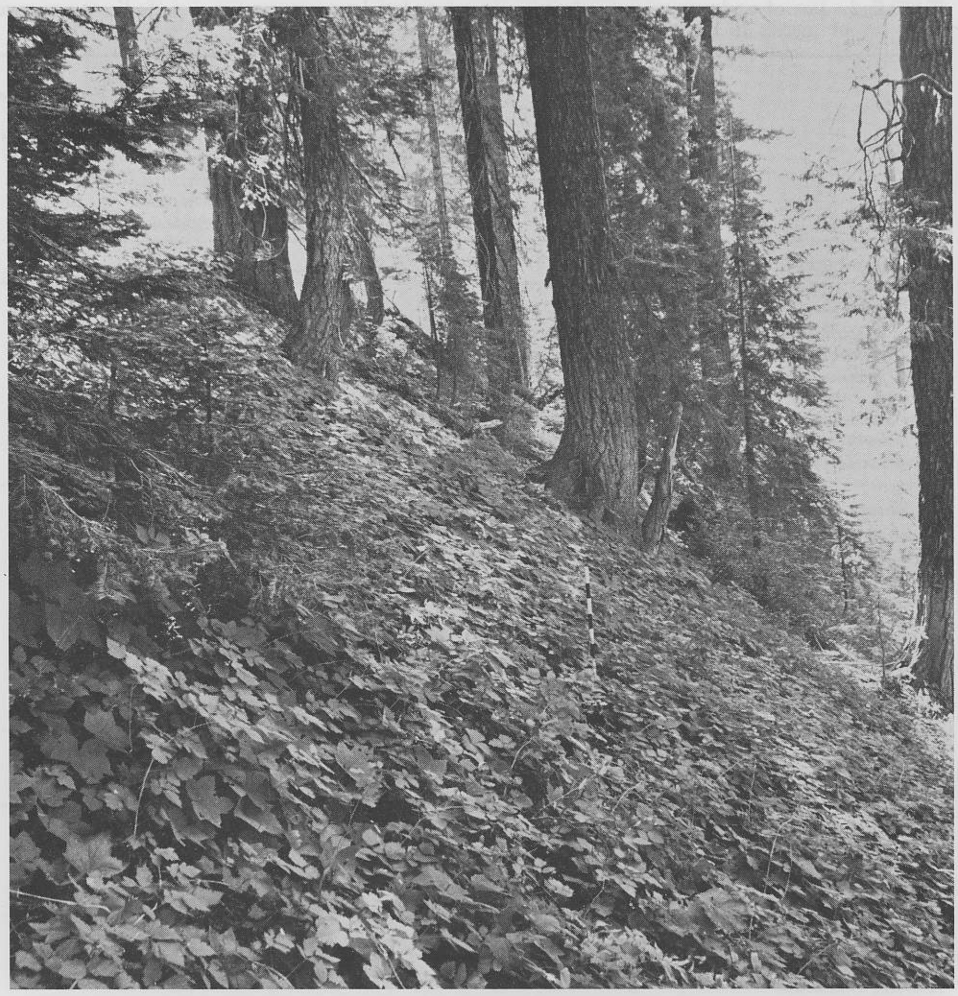

Figure 5. Rich understory vegetation dominated by *Rubus parviflorum* and *Rubus ursinus* in plot 11 of the high elevation *Abies magnifica-Abies concolor/Ribes* spp. complex.

The *Abies magnifica* complex is floristically quite distinct from remaining forest types of Abbott Creek drainage (Table 2). Species such as *Ribes binominatum, Rubus lasiococcus, Erigeron aliceae, Rubus parviflorus, Galium oreganum,* and *Actaea rubra* are generally limited to this high elevation complex; those such as *Adenocaulon bicolor, Osmorhiza chilenses, Montia siberica, Circaea alpina, Vancouveria hexandra, Ribes viscosissimum,* and *Bromus vulgaris* may achieve their greatest cover or density.

In each of the plots of Figure 4 within this complex the total coverage of understory herbs and shrubs is very high, averaging well over 80 percent. *Ribes binominatum, Vicia americana, Smilacina sessilifolia, Galium oreganum,* and *Bromus vulgaris* all have over 8 percent canopy coverage in plot 4. *Adenocaulon bicolor, Achlys triphylla,* and *Vancouveria hexandra* in plot 5 and *Rubus parviflorus, Rubus ursinus, Achlys,* and *Vancouveria* in plot 11 also each have cover values between 7-30 percent. It is noteworthy that the numerous understory species in these plots are mostly decidu-

TABLE 2. List of understory species from permanent plots by percent cover. + Indicate presence of species in the plot at less than one percent cover.

	Abies magnifica Complex			*Abies concolor Tsuga hetero-phylla/Acer circinatum Taxus brevifolia*		*concolor/ Linnaea borealis*		*Abies concolor Pseudo-tsuga/ menziesii/ Whipplea modesta*		*Pseudotsuga menziesii Libocedrus decurrens/ Arctosta-phylos nevadensis*	
Plot Numbers	4	5	11	3	6	8	10	1	7	2	9
Shrubs-Deciduous											
Ribes viscosissimum	3										
Ribes binominatum	16	4	1								
Rosa gymnocarpa	+	2		1	1		+	+	+	+	
Corylus cornuta		3	+		+	+	2		+		
Acer circinatum				14	74						
Vaccinium membranaceum				7	+	6	+				
Symphoricarpos mollis				2	1			+		+	
Shrubs-Evergreen											
Taxus brevifolia				40	4		2				
Berberis nervosa		3		8	+	6		+	2	+	
Pachystima myrsinites				2	2	1	+		+		+
Castanopsis chrysophylla				+	+	8	+		+	1	+
Gaultheria ovatifolia				+		3					
Rubus nivalis							10				
Arctostaphylos nevadensis										15	13
Ceanothus prostratus										10	+
Garrya fremontii								+		2	
Suffrutescent-Deciduous											
Rubus ursinus		4	30	3	3	1	8	+	+		
Suffrutescent-Evergreen											
Linnaea borealis				5	8	12	25				
Chimaphila umbellata	1	+	3	1	2	5	13		1	1	+
Pyrola secunda						+	1				
Forbs											
Rubus parviflorus	+	+	27	+							
Asarum caudatum	2		7				1				
Adenocaulon bicolor	1	17	4		+			1	+		
Montia sibiricia	1	3									
Smilacina sessilifolia	12	1	3	1							
Osmorhiza chilensis	3	4	1		+				+		
Circaea alpina	4	6	2		+				+	+	
Vicia americana	23	5	6	+	+	+		+		1	
Erigeron aliceae	3										
Galium oreganum	9										
Galium trifolium	2	1	2		+		+				
Vancouveria hexandra	1	7	7	1	+		1				
Pteridium aquilinum	7			+			1				
Arenaria macrophylla	3	2	1			+		1	+	1	+
Hieracium albiflorum	2	2	+	+		+	+	+	+	+	+
Trientalis latifolia	+	5	+	+	+	1	2	+	+	1	+
Trillium ovatum	+	1	+	+	+	1	+				
Anemone deltodia		2	1	1	1	+	+				
Dryopteris				2							
Disporum hookeri		+	+	+	+	1	+	+	+		+
Iris chrysophylla		1		+	+		+	+	1		
Clintonia uniflora				+		1	1				
Campanula prenanthoides		+						1			
Syntheris reinformis					1					+	
Whipplea modesta				2	+	4	9	1	6	8	+

ous, and that the evergreen life form is very poorly represented. This suggests that low winter temperatures are more critical than seasonal summer drought in the survival of understory species (*e.g.,* Mooney and Dunn, 1970; Mooney, 1969).

2. Plots 3 and 6 belong to the *Abies concolor-Tsuga heterophylla/Acer circinatum-Taxus brevifolia* association. Stands of this association are almost exclusively located in or near the bottom of major drainages, usually those with permanent streams. The overstory generally contains large *Pseudotsuga menziesii, Pinus lambertiana,* and, less often, *P. monticola.* The presence of all reproductive size classes of *Abies concolor* indicates this to be a climax tree. *Tsuga heterophylla* is the second climax species; its reproductive abundance is especially evident in plot 3, but scattered individuals of young or advanced regeneration are evident nearly throughout this valley bottom habitat.

The tall shrub layer is extensive and well developed. Both *Acer circinatum* and *Taxus brevifolia* may dominate, either singly or in combination (Fig. 6). Other tall shrubs (or low trees) of this understory stratum are *Corylus cornuta, Cornus nuttallii,* and *Castanopsis chrysophylla.* Lower understory strata may have *Vaccinium membranaceum, Pachistima myrsinites, Linnaea borealis, Achlys triphylla,* and *Berberis nervosa* as major species. Evergreens comprise 16-69 percent of the understory (depending mostly on relative proportions of *Acer* and *Taxus*), with nine evergreen species occurring in the two plots.

3. The *Abies concolor/Linnaea borealis* association is represented by plots 8 and 10. These plots occur on mesic lower slopes of northerly or easterly exposure, adjacent to the drainages supporting vegetation of the above association. Stands of the *Abies concolor/Linnaea borealis* association are found on mesic slopes and draws and are very common in the East Fork Abbott Creek drainages. *Abies concolor* is the sole climax tree on most sites (Fig. 7), although occasional *Tsuga heterophylla* are present in draws and *Abies magnifica* is an accidental. *Pseudotsuga menziesii* and *Libocedrus decurrens* contribute to the reproduction in minor quantities on drier or more open forest conditions. The total understory cover of plots 8 and 10 is quite high (59 and 86% respectively) and rich in evergreen constituents. Major species are shrubby *Castanopsis chrysophylla,* and low shrubby or suffrutescent evergreens including *Linnaea borealis, Chimaphila umbellata, Pachistima, myrsinites, Rubus nivalis, Gaultheria ovatifolia,* and *Viola sempervirens.* The well-expressed understory vegetation is a feature of this community; it contrasts with the drier *Abies concolor-Pseudotsuga menziesii/Whipplea modesta* community discussed below. However, a tall shrub stratum of *Acer circinatum, Taxus brevifolia, Cornus nuttallii,* and others is not nearly as continuous and conspicuous as in the *Abies concolor-Tsuga heterophylla/Acer-Taxus* comunity. Nevertheless, several important species are shared between these two community types, including *Vaccinium membranaceum, Linnaea borealis,* and *Tsuga heterophylla.* The *Abies concolor/Linnaea borealis* association also has some floristic similarity to the high-elevation *Abies magnifica* complex, including high canopy coverage of *Achlys triphylla/Trientalis latifolia,* an infrequent *Abies magnifica* in the forest reproduction, and the presence of such species as *Asarum caudatum* and *Pedicularis racemosa* in both types.

On slightly drier sites such as upper draws or easterly or northerly midslopes, the understory vegetation decreases. *Linnaea borealis* or other evergreen species may be subdominant, minor, or absent. Total ground cover may decline to as low as about

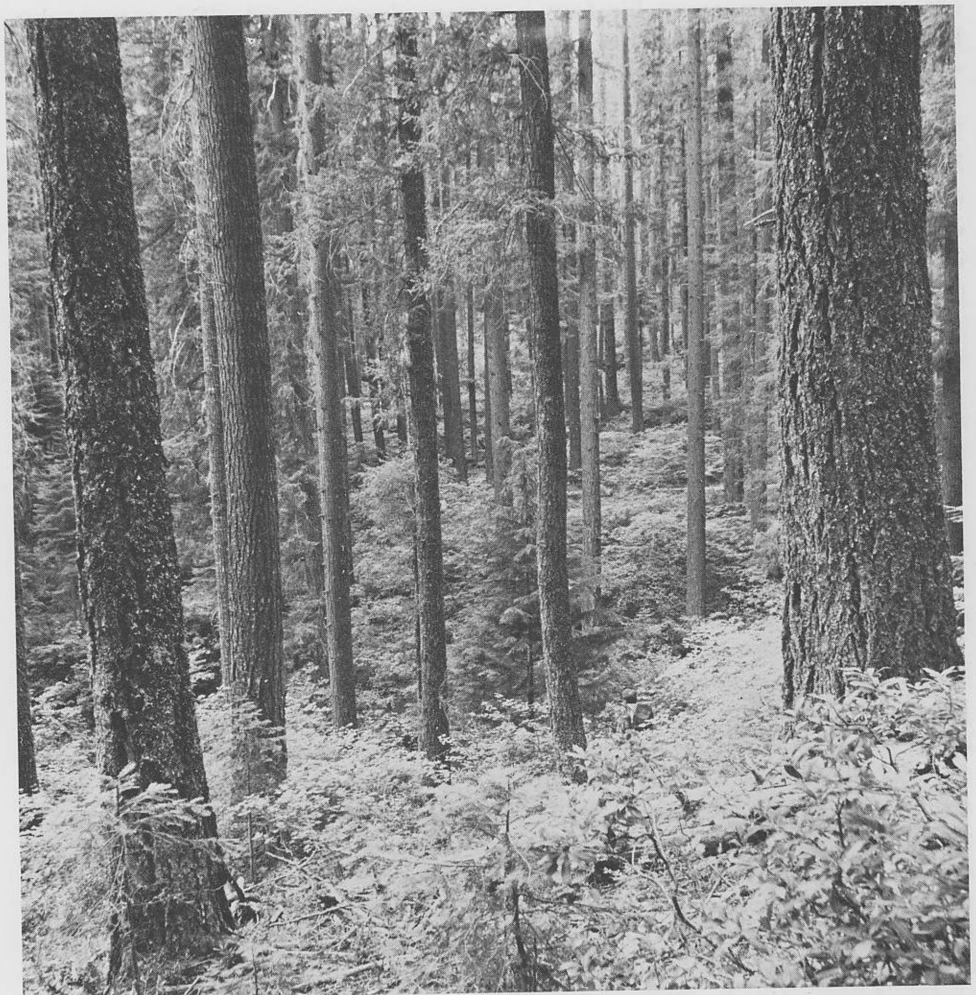

Figure 6. View into plot 6 showing typical *Acer circinatum* dominated tall shrub layer of the *Abies concolor-Tsuga heterophylla/Acer circinatum-Taxus brevifolia* community type.

20 percent. *Abies concolor* continues to be the sole climax tree, for *Tsuga heterophylla* is absent and *Pseudotsuga menziesii* is uncommon in the competing reproduction of *Abies.* We recognize this variation of the *Abies concolor/Linnaea borealis* association as the *Whipplea modesta* phase, for this species often becomes one of the major dominants of the reduced understory flora.

The contribution of evergreen species (about 60% of the understory cover in plots 8 and 10) in many sites of the *Abies concolor/Linnaea borealis* association suggests a higher evergreen understory component than is found on sites of the *Abies magnifica* complex (Mooney and Dunn, 1970; Mooney, 1969).

4. The *Abies concolor-Pseudotsuga menziesii/Whipplea modesta* association is characterized by the presence, often in appreciable numbers, of *Pseudotsuga menziesii* and *Libocedrus decurrens* as persistent late seral or co-climax species. Plots 1 and 7 exhibit all sizes of *Pseudotsuga menziesii* in reproduction (Fig. 8). Another distinc-

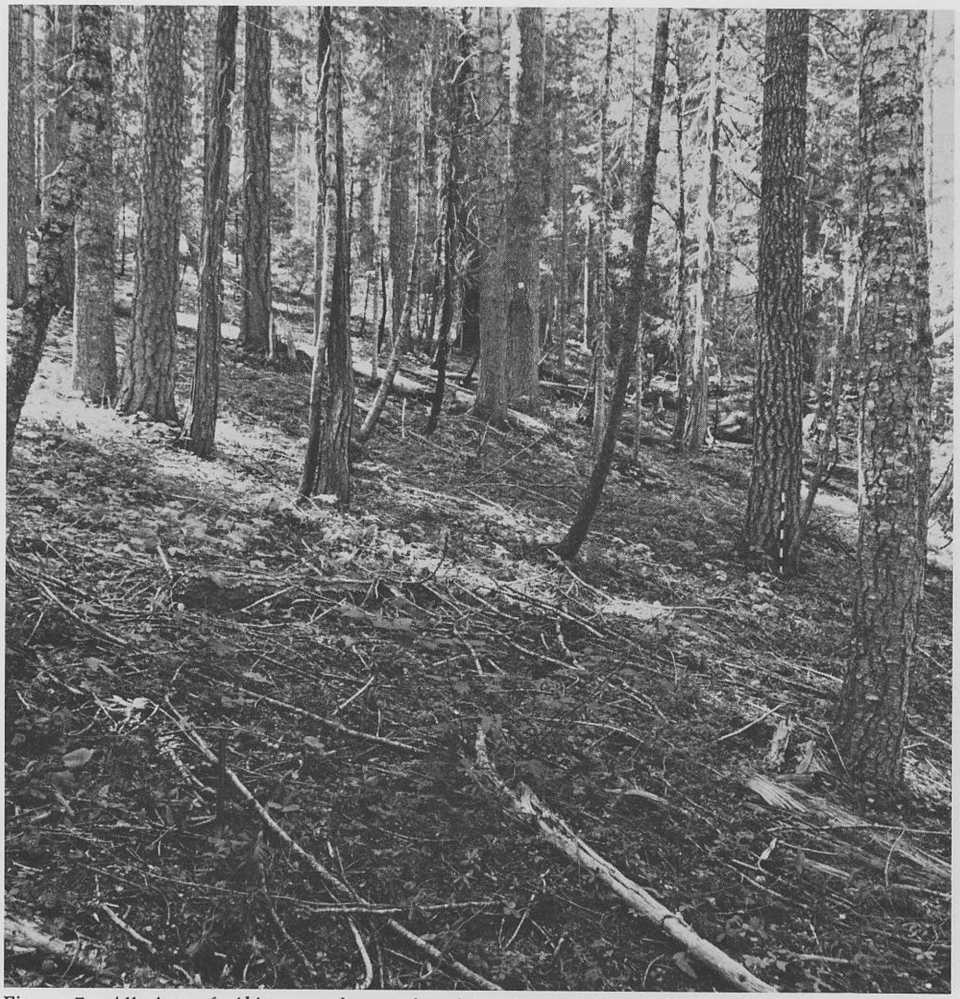

Figure 7. All sizes of *Abies concolor* are found in plot 10 of the *Abies concolor/Linnaea borealis* community type. Ground vegetation here consists of *Linnaea borealis, Chimaphila umbellata, Rubus nivalis, Rubus ursinus,* and *Whipplea modesta.* Note lack of any well-developed tall shrub layer.

tion of this community type is the sparseness of the understory (4 and 11% total cover in respective plots 1 and 7). Shrubs (*Castanopsis chrysophylla, Amelanchier florida, Garrya fremontii,* and others) are only occasional or infrequent; the herb layer, mostly dominated by *Whipplea modesta* or *Iris chrysophylla* in patches, is sporadic and weakly expressed by low density populations. *Linnaea borealis* is absent or minor. The lack of any significant understory cover results from the buildup and accumulation of coniferous litter.

Stands of the *Abies concolor-Pseudotsuga menziesii/Whipplea modesta* community type are found on comparatively dry sites, such as upper or midslopes of south-facing exposures or west-facing slopes near crests and ridges at various elevations. The soils are often shallow and stony, but have moderately developed A1 horizons. The stands often border those of the *Abies concolor/Linnaea borealis* community type in more mesic

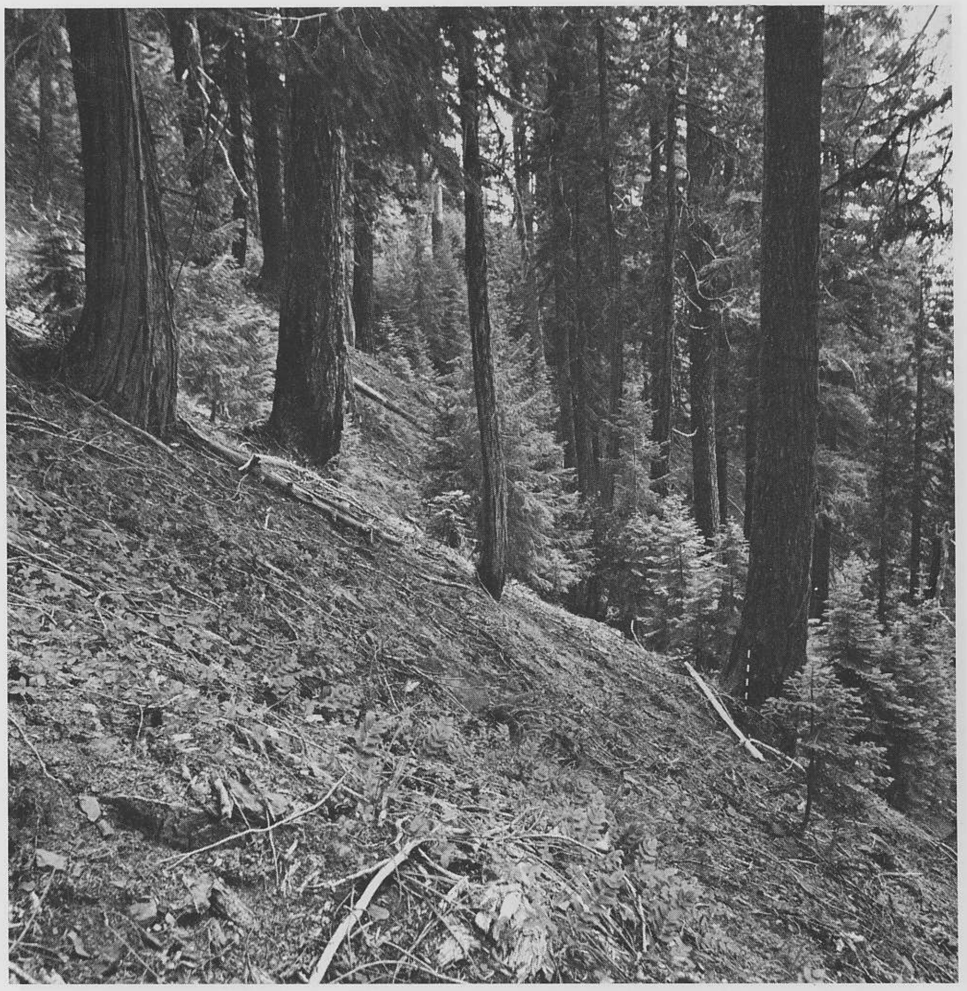

Figure 8. Young regeneration of abundant *Pseudotsuga menziesii* and *Abies concolor* under a canopy of mature *Pseudotsuga menziesii* and *Libocedrus decurrens* in plot 1 on a high elevation, east facing steep slope. The sparse understory exhibits *Whipplea modesta* in patches (*Abies concolor-Pseudotsuga menziesii/Whipplea modesta* community type).

areas and those of the *Pseudotsuga menziesii-Abies concolor/Arctostaphylos nevadensis* or *Pseudotsuga menziesii-Libocedrus decurrens/Arctostaphylos nevadensis* community types in drier sites.

5. The *Pseudotsuga menziesii-Libocedrus decurrens/Arctostaphylos nevadensis* association is represented by plots 2 and 9 located on slabby lithosols near ridge tops. *Abies concolor* is absent or minor; instead, *Pseudotsuga menziesii* and *Libocedrus decurrens* are the edaphic climax species. The forest is open, which may account for the presence here of *Pinus lambertiana* as a late seral species. *Pinus ponderosa* is represented in mature and advanced reproductive size classes. The understory features mats of *Arctostaphylos nevadensis* and *Ceanothus prostratus* which may be quite extensive (Fig. 9). On the surface of rock slabs the crustose lichens, *Lecidea atrobrunnea* and *Rhizocarpon geographicum,* are conspicuous.

Figure 9. View into plot 2. *Arctostaphylos nevadensis* dominates the ground layer and the forest is characteristically open or semi-open.

On somewhat more developed soils, this habitat has more *Abies concolor* reproduction. Also the understory tree stratum includes significant amounts of *Castanopsis chrysophylla* and *Arbutus menziesii.* We recognize this as the *Castanopsis* phase of the *Pseudotsuga menziesii-Libocedrus decurrens/Arctostaphylos nevadensis* association.

This forest habitat is the driest and subjected to the most severe summer drought intensities. Many species (*e.g., Arctostaphylos nevadensis, Ceanothus prostratus, Garrya fremontii*) are evergreen sclerophylls.

The relative position of the different community types on the ordination is significant in that it supports vegetative and topographic observations made in the field. The original or X ordination divides the plots into two groups. The first, which consists of the *Abies magnifica-Abies concolor/Ribes* spp. plots, is associated with the *Abies magnifica* var. *shastensis* zone (Dennis, 1959; Whittaker, 1960; Franklin and Dyrness, 1969). The second group consists of the other four community types described and is associated with the Mixed-Conifer zone (Dennis, 1959; Waring, 1969; Franklin and Dyrness, 1969).

The uniqueness of the *Abies magnifica-Abies concolor/Ribes* spp. community type can be attributed mainly to its location at higher elevations. All of the plots in this group are located above 5000 ft. The high elevation has a snow pack that in many instances has not melted until July. This factor is a major cause for the presence of many species not found in the other community types and absence of other species found in these community types.

The Y axis tends to separate the four community types associated with the Mixed-Conifer zone along a moisture gradient. A similar moisture gradient has been described in other mixed-conifer or montane type forested areas of southwestern Oregon (Waring, 1969; Whittaker, 1960; West, 1966). These gradients have been designated as "topographic moisture gradients," with the more mesic sites being found in ravines and sheltered areas, while the more xeric are found on open southwest-facing slopes. The site locations along the gradient associated with the Y axis have a similar distribution. At many locations it is possible to pass down slope from an *Abies concolor-Pseudotsuga menziesii/Whipplea modesta* or *Pseudotsuga menziesii-Libocedrus decurrens/Arctostaphylos nevadensis* community type into an *Abies concolor/Linnaea borealis* and then an *Abies concolor-Tsuga heterophylla/Acer circinatum-Taxus brevifolia* community type. However, caution must be used in such generalizations. The community types infrequently extend uninterrupted over great expanses of the natural area. This fact, coupled with the rugged topography, would make the assembling of a community type map quite a formidable task.

TABLE 3. Key to the forest communities of the East Fork Abbott Creek Drainage, Abbott Creek Research Natural Area.

1. *Abies magnifica* in reproductive strata . . . 2
1. *Abies magnifica* reproduction absent . . . 3
2. *Tsuga mertensiana* or *Ribes binominatum* present . . . ABMA Complex
2. *Tsuga mertensiana* and *Ribes binominatum* both absent . . . 3
3. *Acer circinatum* and/or *Taxus brevifolia* collectively over 10% cover . . . ABCO-TSHE/ACCI-TABR Association
3. Acci and Tabr both minor or absent . . . 4
4. *Linnaea borealis* over 10% cover . . . ABCO/LIBO Association
4. *Linnaea borealis* less than 10% cover . . . 5
5. *Pseudotsuga menziesii* absent in young regeneration . . . ABCO/LIBO, WHMO Phase
5. *Pseudotsuga* present in young regeneration . . . 6
6. Total understory cover less than 15% and *Whipplea modesta* the most important species . . . ABCO-PSME/WHMO Association
6. Total understory cover often over 15%, with or without *Whipplea modesta* as a major species . . . 7
7. *Arctostaphylos nevadensis* absent or minor . . . ABCO/LIBO, WHMO Phase
7. *Arctostaphylos nevadensis* dominant or codominant . . . 8
8. *Abies concolor* over 2% reproduction; *Arbutus menziesii* often present . . . PSME-LIDE/ARNE, *Castinopsis* Phase
8. *Abies concolor* minor or absent . . . PSME-LIDE, ARNE Association

Conclusions

1. Over most of Abbott Creek Natural Area the forests will eventually be dominated by *Abies concolor*, whose dense reproduction is already apparent. At high elevations *A. magnifica shastensis* may share climax status with *A. concolor* or replace it on cooler, wetter sites. Sugar pine is a late seral species only on drier sites at lower elevations, and under present trends, will become only a minor tree in the area. The forest openings necessary for successful establishment of this and other seral species were probably brought about by fire. The role of fire in natural area management at Ab-

bott Creek needs to be given more attention if the seral forests are to be maintained or reestablished. Natural fire boundaries exist along the high ridge to the east and in the form of mesic forb communities along the divide at the north boundary.

2. The *Abies concolor-Tsuga heterophylla/Acer circinatum-Taxus brevifolia* community has high floristic similarity to several forest types of the western hemlock zone in the western Cascade Range of central Oregon (Dyrness, Franklin, and Moir, 1972; Hawk, 1972). However, the remaining forest types at Abbott Creek Research Natural Area are more similar to California Sierran forests. While these types contain important Cascadian floristic elements, they nevertheless are clearly of the *Abies concolor* and *Abies magnifica shastensis* zones, as described by Franklin and Dyrness (1969). The dominance of such evergreen sclerophyll taxa as *Ceanothus, Arctostaphylos*, or *Garrya* on drier habitats or in seral stands is suggestive of a Mediterranean type climate (mild, wet winters and hot, droughty summers) in the Cascade Range of southern Oregon.

Literature Cited

Andrews, H. J. 1946. Report on Abbott Creek Natural Area. Establishment Report, U.S. For. Serv., Pacific Northwest Forest & Range Experiment Station, Portland, Oregon. 3 pp + map. (Approved by Chief of FS Jan. 2, 1947).

Applegate, E. 1939. Plants of Crater Lake National Park. The American Midland Naturalist 22: 225-314.

Daubenmire, R. 1968. Plant Communities, a Textbook of Plant Synecology. Harper and Row, New York., xi. 300 pp.

Dennis, L. R. J. 1959. A Taxonomic Study of the Vascular Flora of Ashland Peak, Jackson County, Oregon. Oregon State University, M.A. thesis. 144 pp.

Dick-Peddie, W. A., and W. H. Moir. 1970. Vegetation of the Organ Mountains, New Mexico. Colorado State University, Range Science Dept., Science Series No. 4. 18 pp.

Dyrness, C. T., J. F. Franklin, and W. H. Moir. 1972. Forest Communities of the Central Portion of the Western Cascades in Oregon. Review Draft on file at Foresrty Sciences Laboratory, Corvallis, Oregon. 70 pp.

Franklin, J. F. 1971. Abbott Creek Research Natural Area. U.S. For. Serv., Forestry Sciences Laboratory, Corvallis, Oregon.

————, and C. T. Dyrness. 1969. Vegetation of Oregon and Washington. U.S. For. Serv. Res. PNW-80, vi, 216 pp.

————, and ————. 1973. Natural Vegetation of Oregon and Washington. Serv. Res. PNW-80, vi, 216 pp.

————, ————, and W. H. Moir. 1970. A reconnaissance method of forest site classification. Shinrin Richi XII: 1-14 (with Japanese summary).

————, F. C. Hall, C. T. Dyrness, and C. Maser. 1972. Federal Research Natural Areas in Oregon and Washington. U.S. For. Serv.

Hawk, G. M. 1972. Forest Vegetation and Soil of Terrace and Floodplains along the McKenzie River, Oregon. Oregon State University, M.A. thesis.

Mitchell, R. J. 1972. An Analysis of the Vegetation of Abbott Creek Natural Area, Oregon. Oregon State University, Ph.D. thesis.

Moir, W. H. 1972. Natural areas. Sci. 177: 396-400.

Mooney, H. A. 1969. Dark respiration of related evergreen and deciduous mediterranean plants during induced drought. Bull. Torrey Bot. Club. 96(5): 550-555.

————, and E. L. Dunn. 1970. Convergent evolution of mediterranean climate evergreen sclerophyll shrubs. Evol. 24(2): 292-303.

Peck, D. L. and F. G. Wells. 1961. Geologic map of Oregon west of the 121st meridian. (U.S. Geol. Surv. Misc. Geol. Invest. Map, I-325).

Peck, M. E. 1961. A Manual of the Higher Plants of Oregon. Second edition. Binford and Mort, Portland, Oregon. 936 pp.

Power, W. E., and G. H. Simonson. 1969. Oregon Long Range Requirements for Water. General soil map report with irrigable areas—Rogue Drainage Basin. Portland, Oregon (State Water Resources Board, I-15). 4 pp.

United States Department of Commerce. 1961. Weather Bureau. Climatic Summary of the United States Supplement for 1951-1960. Climatography of the United States, No. 86-31.

Waring, R. H. 1969. Forest plants of the eastern Siskiyous: their environmental and vegetational distribution. Northw. Sci. 43: 1-17.

West, N. E. 1960. Matrix cluster analysis of Montane Forest vegetation of the Oregon Cascades. Ecol. 47: 975-980.

Whittaker, R. H. 1960. Vegetation of the Siskiyous Mountains, Oregon and California. Ecol. Monogr. 30: 279-338.

Received December 2, 1974.
Accepted for publication September 25, 1975.