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Pacific Northwest Region

Forested Plant Associations of the Oregon East Cascades

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By
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The cover photo of Mt. Jefferson at the head of the Metolius River was taken by John Hutmacher.

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This work builds largely on the sampling, concepts and foundations laid by previous potential vegetation classifications completed in the 1960-1980's in Central Oregon. Without the pioneering efforts of Fred Hall, Lenny Volland, and Bill Hopkins, this effort would not have been possible. In addition, the surrounding classifications developed by Frank Marsh and Rich Helliwell (Warm Springs), Chris Topik and Nancy Diaz (Mt. Hood), Miles Hemstrom and Sheila Logan (Willamette), Cindy McCain and Nancy Diaz (Northwest Oregon Cascades) and Tom Atzet, Diane White, Lisa McCrimmon, and Pat Martinez (Southwest Oregon) were very influential and helped solidify concepts for many of the types found in this product.

All errors or omissions are the sole responsibility of the author.

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Introduction

In the early to mid 1990's the Deschutes National Forest systematically mapped plant associations across the Forest using the Plant Associations of Central Oregon Pumice Zone classification (Volland 1985). During this mapping process, several areas were identified that did not key well using Volland's classification. Specifically, the horn of the Metolius and Mt. Jefferson Wilderness on Sisters District, the south end of Bend District and the Willamette Pass/Odell Lake area of the Crescent District had many areas which did not fit the keys. Most of the sites that did not key well were "Mixed Conifer", Shasta Red Fir, or Mountain Hemlock series sites. Mixed Conifer sites were defined by Volland (1985) as forests of Douglas-fir, Sugar Pine, Ponderosa Pine, Incense Cedar and White Fir in various combinations.

Volland's sampling and subsequent classification did not include the High Cascade Wilderness areas around Diamond Peak, the Three Sisters, Mt. Washington, or Mt. Jefferson (Note: Sampling occurred in the Mt. Jefferson Wilderness, but the data was not included in the Pumice Zone Classification). The southern portion of Bend District and the western portion Crescent District also had very few sample sites.

Rather than extrapolate from classifications of adjacent areas, a decision was made to refine Volland's classification. In 1997-1998, 275 additional reconnaissance (recon) plots were established by Susan Geer and Caroline Lindstedt under Bill Hopkin's guidance to supplement Volland's original dataset. Plot data included species composition data and environmental information. Each plot location was documented with a Global Positioning System (GPS) receiver. More intensive data (tree height, age, diameter growth, basal area) was collected on 67 of these recon plots to determine SI, GBA, and yield (ft3/acre/year) by tree species.

An initial draft classification based on a dataset that combined Volland's original data and the new plot data from 1997 and 1998 was completed in 2000 and 2001 by Bill Hopkins. Hopkins retired in December of 2001. In February 2002, this author was given the task of reviewing comments on the draft and finalizing a new classification.

After reviewing comments received and understanding the dataset, additional ecology plot data from adjoining areas were added to supplement the dataset in types with few samples, especially in the

Mountain Hemlock, Silver Fir, and Western Hemlock series. The additional data allowed a comprehensive look at potential vegetation in forested ecosystems for the entire eastside of the Cascade Mountain Range in Oregon. Other data used in the classification to improve soils, productivity, and distribution data include 650 plots from an ecological unit inventory on the Winema NF (Dorr et al. 2005) and 2751 inventory plots from the Current Vegetation Survey (Max et al. 1996) .

The ecological inventory plots consist of a 1/10th acre circular plot with canopy cover estimates for all plant species co-located with a complete soil pedon description. The Current Vegetation Survey (CVS) plots consist of 1 hectare circular plots with 5 nested ½ acre subplots (stake positions). A complete description of the CVS plot design and data collected at each plot is described in Field Procedures for the Current Vegetation Survey (USDA 2002). This document is available at the following website: http://www.fs.fed.us/r6/survey/document.htm.

The CVS plots were primarily used to supplement the tree productivity, management implications including disease susceptibility, and type distribution data. Unlike the Region 6 ecology plots and the ecological inventory plots which are "subjectively sampled without preconceived bias" (Mueller-Dombois and Ellenburg 1974), the CVS plots are sampled on a systematic grid 1.7 miles apart on all USFS lands outside designated wilderness, and on a 3.4 mile grid inside wilderness areas.

The additional data allowed a comprehensive look at potential vegetation for forested ecosystems along the eastside of the Cascade Mountain Range in Oregon. The total dataset used in this version of the classification is summarized in Table 1-1.

The distribution of sample plots is displayed in Figure 1-1. The area included in the classification consists of forested lands east of the Cascade crest between the Columbia River and the California border. These occur from Mt. Hood to the Deschutes River in the north and from Mt. McLoughlin to the east side of the Warner Mountains along the California border. Although western juniper is an important component in portions of the Ponderosa Pine Series, juniper woodlands are not specifically addressed in this work due to the paucity of sample plots where western juniper is the indicated overstory climax dominant in the dataset.

Physical Setting

The Oregon East Cascades analysis area is made up of portions of 3 physiographic provinces: Sierra-Cascade Mountains, Columbia-Snake Plateau, and Basin & Range. Physiographic provinces are broad-scale subdivisions based on terrain texture, rock type, and geologic structure and history. Each of these provinces are divided into smaller classification units called sections.

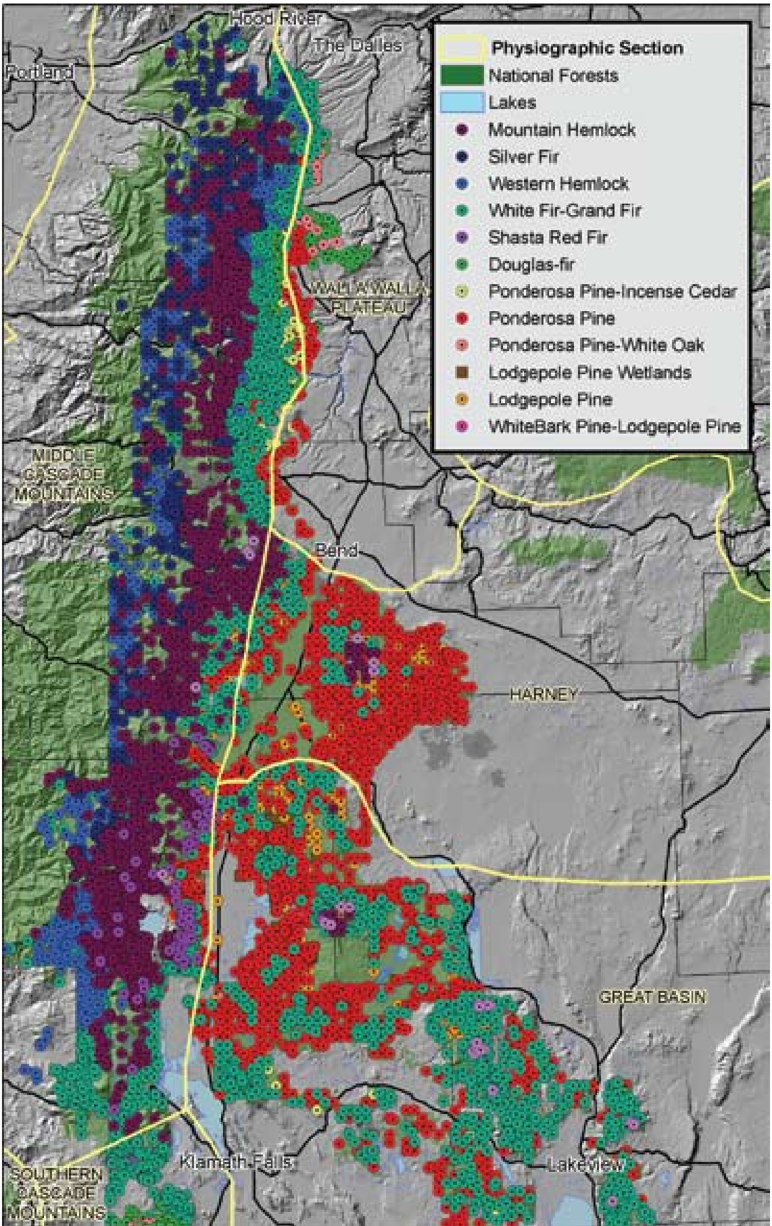
The Sierra Nevada—Cascade Mountain Province consists of narrow (50 to 60 miles wide) mountains trending north-south for a distance of almost 1000 miles. The Cascade Mountains make up the northern

Table 1-1. Datasets used in development of the Oregon East Cascades Classification.

Investigator(s)	Locations	# of Plots
Atzet, Martinez, White, and others	Crater Lake NP	302
Atzet, Martinez, White, and others	Rogue River NF	593
Atzet, Martinez, White, and others	Umpqua NF	299
Atzet, Martinez, White, and others	Klamath Falls RA BLM	215
Diaz, Topik, and others	Mt. Hood NF	189
Dorr and others	Winema NF	650
Geer and Lindstedt	Deschutes NF	275
Hall	3 Sisters Wilderness	95
Hopkins	Fremont NF	378
Hopkins	Winema NF	109
Marsh, Helliwell, and others	Warm Springs IR	822
McCain, Kertis, and others	Deschutes NF	83
McCain, Kertis, and others	Willamette NF	473
Simon and Volland	Mt. Jefferson Wilderness	221
Volland	Deschutes NF	425
Volland	Winema NF	386
Volland	Fremont NF	45
Volland	Crater Lake NP	27
Total		**5589**

CVS Plots	# of Plots
Deschutes NF	572
Fremont NF	451
Mt. Hood NF	367
Rogue River NF	146
Umpqua NF	246
Willamette NF	567
Winema NF	403
Total	**2752**

Figure 1-1. Distribution of sample plots used in the Oregon East Cascades classification with Physiographic Sections.



portion of the province. They extend over a distance of 650 miles from Lassen Peak (northern California) to Meager Mountain (southwestern British Columbia).

The Cascade Mountains include 12 major strato-volcanoes; Mount Shasta (14,030 feet), Mount Adams (12,190 feet), and Mount Rainier (14,274 feet) exceed 12,000 feet in elevation. The only rivers to breach the Cascades are the Fraser, Columbia, Klamath, and Pit, and all flow westward. The Columbia and Klamath Rivers bracket the north and south boundaries of the analysis area.

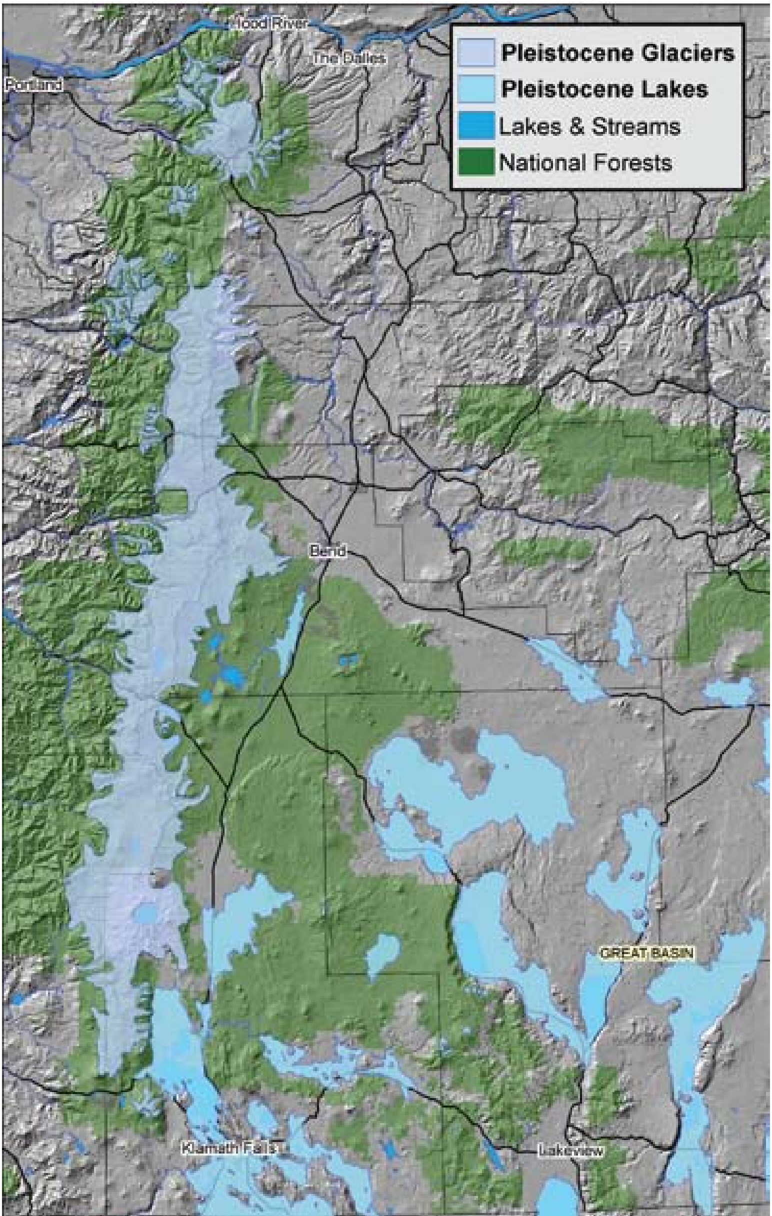
Three sections are recognized within the Cascade Mountains. The portion of the Oregon East Cascades analysis area within the Sierra-Cascades province is predominantly within the Middle Cascades section. A small portion of the Southern Cascades enters the analysis area near the California border south of Mt. McLoughlin.

The **Middle Cascades Section** is an uplift of middle Tertiary lavas dominated by Quaternary volcanic cones. The east side is higher, overlooking the Columbia Plateau; the crest is marked by the High Cascades as defined by Franklin and Dyrness (1973). The major volcanoes within the Middle Cascades section are: Mt. McLoughlin, Mt. Mazama (Crater Lake), Diamond Peak, The Three Sisters, Mt. Jefferson and Mt. Hood. Crater Lake was formed after the eruption of the high volcanic cone of Mount Mazama, which occurred during the late Pleistocene (approximately 6800 years ago). The cone subsequently collapsed and filled with water. An ice cap formed at elevations above 5600 feet during the Pleistocene, and some glaciers still persist today on the higher peaks. The extent of the ice cap during the Suttle Lake glacial maximum is displayed in Figure 1-2.

Eruptions from the volcanoes in the section have occurred throughout recent geologic times and have occurred as recently as 1300 years ago within the analysis area. The eruptive products from these events have significant influence on the vegetation. Recent basalt flows in the McKenzie – Santiam Pass area, Parkdale, and Newberry Crater have little or no soil development and meager development of vegetation. Primary succession has not progressed very far on these surfaces.

These sites are warmer and usually drier due to the lack of water holding capacity than the areas immediately around them. The expressed vegetation reflects these warmer and drier conditions. Depending

Figure 1-2. Pleistocene Glaciation and Pleistocene Lakes in Central Oregon approximately 18,000 years before present.



on the age of the individual flow and on average precipitation, trees occupy some sites. Other sites may only be vegetated where additional sediments have been deposited in cracks and crevices in the basalt by wind and water.

Tephra (air-fall ash and pumice) from more explosive volcanic events coats large areas of the Oregon East Cascades analysis area. The most recent (within the last 7,000 years) ash/pumice deposits are displayed in Figure 1-3. Only the tephra deposits that have been previously mapped are displayed in Figure 1-3. Other deposits, less than 50,000 years old, are known from the area (Three Sisters, Newberry and Shasta). However, their extents and depths have not been systematically documented yet. Additional deposits correlated with the Rhyolite, Dacite and Andesite flows in Table 1-2 are likely to be located in the future.

In general these deposits are excessively drained and cooler than adjacent residual soil sites. The depth of the ash/pumice deposit is important in regulating the patterns of vegetation. Water often perches on the top of the buried soil layer. The extent of the soil drainage on these sites dramatically reduces the cover of herbaceous vegetation.

Sites with greater than 2 feet of ash/pumice deposited over the original soil surface may allow water to recede too far from the surface for many herbaceous species to reach the water table with their root systems. Woody species that can reach the available moisture are favored. Herbaceous layers on deep pumice therefore appear much drier than the mean precipitation would otherwise indicate.

On sites with less than 2 feet of ash, the herbaceous layer generally can reach the water table and the effect is less visible. In fact, the ash in these situations may act like a mulch and reduce evaporation losses which can increase the effective moisture available to the understory.

The **Columbia-Snake River Plateau Province** occupies the northern end of the basin between the Sierra-Cascade and Rocky Mountains. It is a series of semiarid plateaus of rolling, mostly laminar, basaltic lava flows. The lava plains of the Columbia basin are among the most extensive volcanic outpourings in the world. Much of the surface is covered by loess. Along with the extensive basalts, huge amounts of sand, gravel, and clay occur in alluvial fans and washes. Average elevation is about 3000 feet. The plateau is deeply dissected by the

Figure 1-3. Recent volcanic deposits in central Oregon.

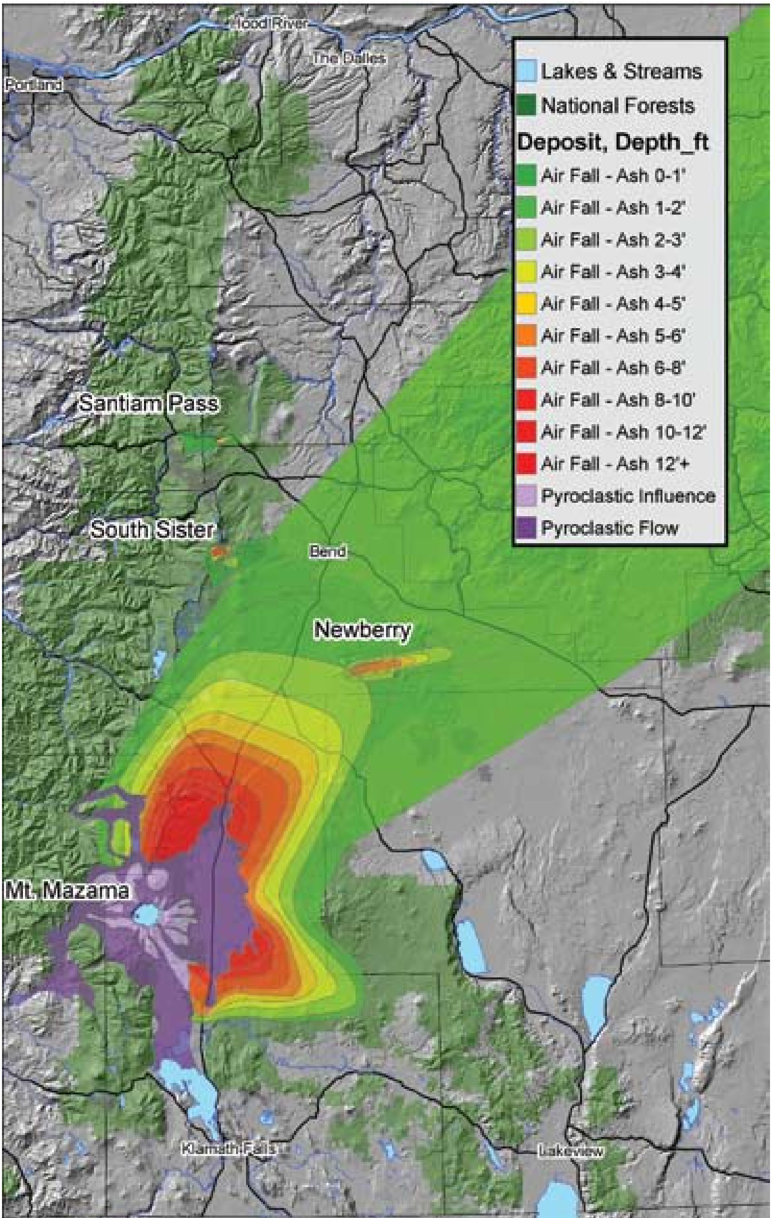


Table 1-2. Geologic timeline of volcanic and glacial events affecting the East Cascades of Oregon within the last 150,000 years.

Material Type	Location	Source	Age in Years
Air-Fall Ash/ Pumice	Crater Rock	Mt. Hood	210
	Hotlum	Shasta	220
		Shasta	750
		Shasta	800
	Blue Lake	Santiam Pass	1500
	Newberry Pumice	Newberry Crater	1500
	Devil's Hill	South Sister	1970
	Rock Mesa	South Sister	2150
	East Lake	Newberry Crater	2200
	Santiam Junction	Little Nash Crater	2750
	Llao Rock	Crater Lake	7000
	East Lake Tephra	Newberry Crater	7300
	Mazama Caldera	Crater Lake	7600
	East Rim	Newberry Crater	11000
	Wono Tephra	Newberry Crater	27300
	Summer Lake G Tephra	Newberry Crater	27800
	Paulina Creek Tephra	Newberry Crater	52500
	Ice Quarry Tephra	Newberry Crater	63700
	Jefferson Pumice	Jefferson	70000
Basalt and Basaltic Flows	Belknap	McKenzie Pass	1300
	Collier Cone	Santiam Pass	1500
	Four in One Cone	McKenzie Pass	1900
	Lost Lake	McKenzie Pass	1900
	Little Nash Crater	Santiam Pass	2750
	South Belknap	McKenzie Pass	2750
	Clear Lake Flow	Sand Mountain	2850
	Little Belknap	McKenzie Pass	3000
	Fish Lake Flow	Nash Crater	4250
	Bear Butte	Jefferson	6500
	Egan Cone	Bachelor	7000
	Lava Butte	Newberry	7000
	Black Butte	Shasta	9500
		Medicine Lake	11000
	Summit Cone	Bachelor	12500
	Prospect Peak	Lassen	15000
	Subglacial Buttes	Lassen	20000
	Hat Creek Flow	Lassen	29000
	Kings Creek	Lassen	35000
	Middle Sister Cone	Middle Sister	37700
Pyroclastic Flows	Paulina Lake Ash Flow	Newberry	1250
	Mazama Climatic Eruption	Crater Lake	7600

Table 1-2. Geologic timeline of volcanic and glacial events affecting the East Cascades of Oregon within the last 150,000 years.

Material Type	Location	Source	Age in Years
Rhyolite-Dacite-Andesite Flows	Hotlum	Shasta	150
	Little Glass Mountain	Medicine Lake	900
	Chaos Crags	Lassen	1100
	Glass Mountain	Medicine Lake	1100
	Hotlum Cone	Shasta	8000
	Shastina	Shasta	9600
	Chambers Lakes Dome	Middle Sister	14400
	SW Flank TS 233	Middle Sister	16800
	Misery Ridge	Shasta	17500
	Lane Plateau	Middle Sister	21400
	East Side	Middle Sister	23300
	Lewis Glacier	South Sister	24000
	West Side	Middle Sister	24500
	SW Flank TS 224	Middle Sister	25000
	South-Middle Saddle	Middle Sister	26000
	Lassen Peak	Lassen	27000
	South Sister Cone	South Sister	27000
	North Slope	South Sister	32800
	Chambers Lakes	Middle Sister	36100
	Carver Lake	South Sister	36800
	Obsidian Cliffs	Middle Sister	37800
	Moraine Lake	South Sister	38200
	Sunflower Flat	Lassen	41000
	Crescent Crater	Lassen	42000
	Krummholz Dome	Lassen	43000
	Black Hump	Middle Sister	45100
	Mesa Creek	South Sister	47400
	Clark Glacier	South Sister	50500
	Sargent's Ridge	Shasta	150000
Glacial Events	**Local Event Names**	**Correlated Events**	**Age in Years**
Glacial Advances	Little Ice Age		150
	Late Neo-Glacial		1500
	Early Neo-Glacial		4000
	Canyon Creek Drift	Fraser, Pinedale	11500
	Pluvial Lake High Stands		16000
	Suttle Lake Drift	Fraser, Pinedale	20000
	Jack Creek Drift	Hayden, Bull Lake	140000

Columbia and Snake rivers. Substrates exposed in gorges are mostly igneous with lowest walls of granite and schist. Several sections are recognized. Portions of two sections, the Harney Lake Section (roughly equivalent to the High Lava Plains as defined by Franklin and Dryness 1973) and the Walla Walla Section (Columbia Basin as defined by Franklin and Dryness 1973) occur within the Oregon East Cascades analysis area.

The **Harney Lake Section** is a volcanic plain at the southwestern corner of the province with little local relief except at centers of volcanism, where cones rarely exceed 200 feet above adjacent floors. During the late Pleistocene (10,000-120,000 years ago) many of the basins were filled with fresh water lakes. Although the local lake basins within the analysis area are now dry, remnant lakes still occur in the section today. Harney (alkaline) and Malheur (fresh) lakes occur east of the analysis area included in this classification. Recent basalt flows from vents associated with Newberry Crater dammed the Deschutes River near Benham Falls and drainages in the Millican Valley near Horse Butte to create Holocene (within the last 10,000 years) and Pleistocene lakes. These Holocene lakes have since emptied, as water cut through. The Millican Valley drainages are currently dry with no perennial streams.

The **Walla Walla Plateau Section** is underlain by basalts and is covered by lake sediments and loess. The eastern side has gently rolling relief and canyons to 2000 feet deep. The Deschutes and John Day Rivers rivers cut deep gorges in the western portion of the section within the analysis area. Areas south of Madras have Mazama ash deposits which overlay recent basalt flows from Newberry Crater and sediments of John Day and Clarno age. Juniper communities are more developed in areas with ash deposits than in areas with no ash influence. Western juniper shrub-steppe communities dominate areas with less than 12” annual precipitation with scattered ponderosa pine or less commonly Douglas-fir communities found in areas with more moisture.

The **Basin and Range Province** is bounded to the north by the lava flows of the Columbia Plateau and extends south into Mexico between the Sierra Nevada--Cascades Mountains and the Rockies. Relief from basin floor to adjacent mountain tops ranges between 3000 to 4500 feet. The province is characterized by broad, level desert basins and narrower, elongate, isolated, parallel mountain ranges trending north to south. Many basins lack external drainage. These basins filled with lakes during wetter (Pleistocene) climate cycles. This topography originated by block faulting in the Oligocene (23.8-33.7 million years ago), accompanied by extension of the crust underneath the North American Plate. Paleozoic formations predominate within the Province; they consist of limestone, siltstone, shale, and sandstone. However, bedrock within the Oregon East Cascades analysis area is generally Pliocene to recent (less than 5.3 million years old) igneous rocks of volcanic origin, not the sedimentary rocks that are typical throughout most of the Basin and Range Province. The province is geologically very diverse, and several sections are recognized. Only the Great Basin Section occurs within the Oregon East Cascades analysis area.

The **Great Basin Section** occurs north of the Mojave Desert and is delimited on the west by the Garlock Fault. Centered on Nevada, it has topography typical of the Basin and Range Province: isolated mountain chains oriented north to south, with broad, intermontane basins. John C. Frémont gave the area the name “Great Basin.” Only the northwestern most part of this section enters the area. The portions in the Klamath River drainage (Williamson, Sycan, and Sprague Rivers), have external drainage. The eastern parts of Oregon East Cascades analysis area drain into enclosed basins, many which have remnants of larger Pleistocene lakes. Summer Lake, Abert Lake, and Goose Lakes are local examples of these remnant lakes. Vegetation in the lake basins is typically dominated by non-forest communities. Soils associated with the old lake beds may be saline and support shadscale and greasewood plant communities.

Climate

The Cascade Mountains form an effective barrier to marine air masses from the Pacific Ocean. The marine air masses mix with the continental air masses over the Oregon East Cascade analysis area. Pacific air masses moderate the temperatures (warmer in winter and cooler in summer) of the more continental air masses east of the mountains. The Columbia Gorge to the north and the Klamath River Canyon in the south provide lower elevation pathways for the marine air to penetrate to the eastside of the Cascade Mountains. The major mountain passes also funnel marine influenced air through the Cascades and areas adjacent to the passes have climates more typical of westside locations.

As the marine air rises over the Cascades, it releases much of its moisture and the air becomes much drier. The eastside of the Oregon Cascade Mountains have some of the steepest moisture gradients in the world. Mean annual precipitation ranges from 120+" on the Three Sisters, Mt. Jefferson, and Mt. Hood to less than 8" in the vicinity of Redmond. Near the Three Sisters a 100-110" precipitation difference occurs over less than 15 miles. Mean annual precipitation derived from the Oregon Climate Service's PRISM dataset is displayed in Figure 1-4.

Mean annual temperature ranges from approximately 32°F on higher mountain peaks to about 52°F at low elevations along the Columbia, Deschutes, and Klamath Rivers. Mean annual temperature derived from the Oregon Climate Service's PRISM dataset is displayed in Figure 1-5.

Potential vegetation communities are strongly correlated with combinations of moisture and temperature. Figure 1-6 displays the mean annual temperature-precipitation by series and sub-series for forested communities on the east side of the Cascade Mountains in Oregon.

Methods

The multiple datasets were combined into a single master database. Species names were checked to ensure that taxonomy changes through time were resolved and to ensure that the same species was not named more than one name throughout the dataset. Taxonomy follows *Flora of the Pacific Northwest* (Hitchcock and Cronquist 1973) unless specifically noted. A list of latin names, common names, and crosswalk to PLANTS database names is provided in Appendix A.

Plant association names use Region 6 four-letter plant codes. The ecoclass codes adhere to <u>Pacific Northwest ecoclass codes for seral and potential natural communities</u> (Hall 1998). Following the ecoclass codes is a second plant association name, using PLANTS Database codes.

Figure 1-4. Mean Annual Precipitation in inches.

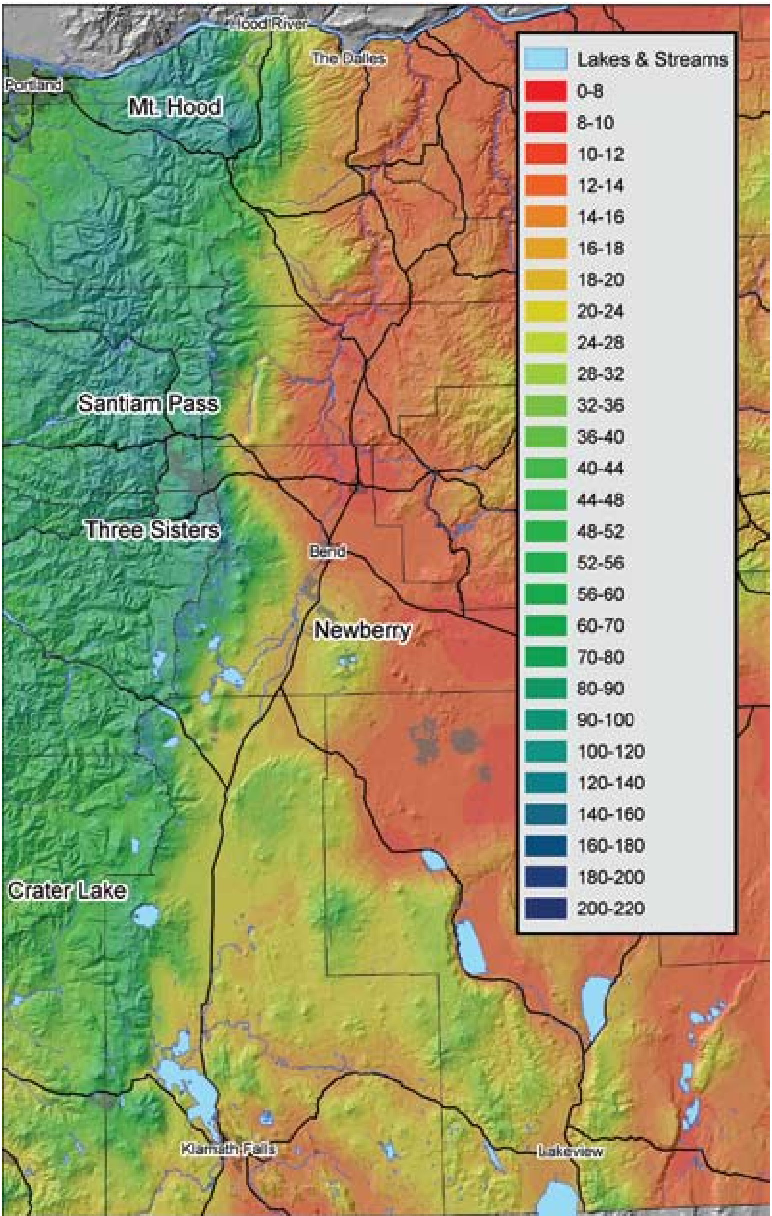


Figure 1-5. Mean Annual Temperature in °F.

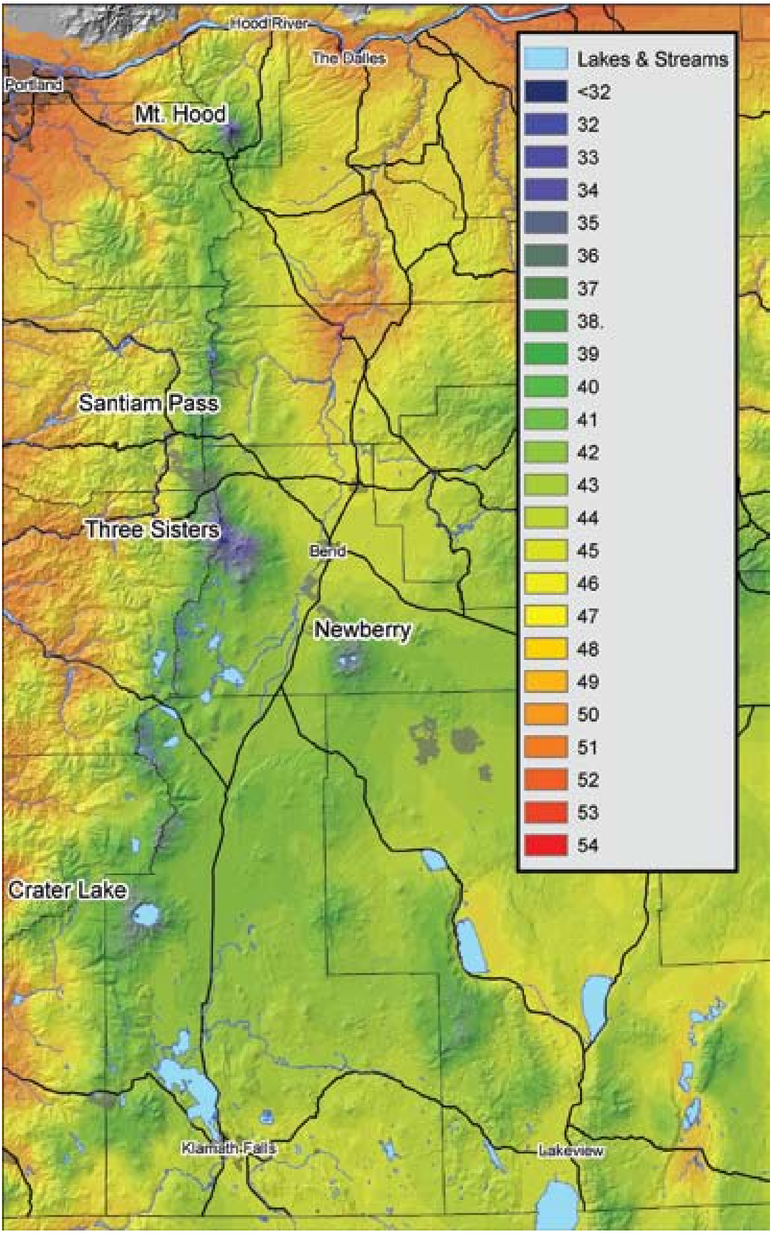
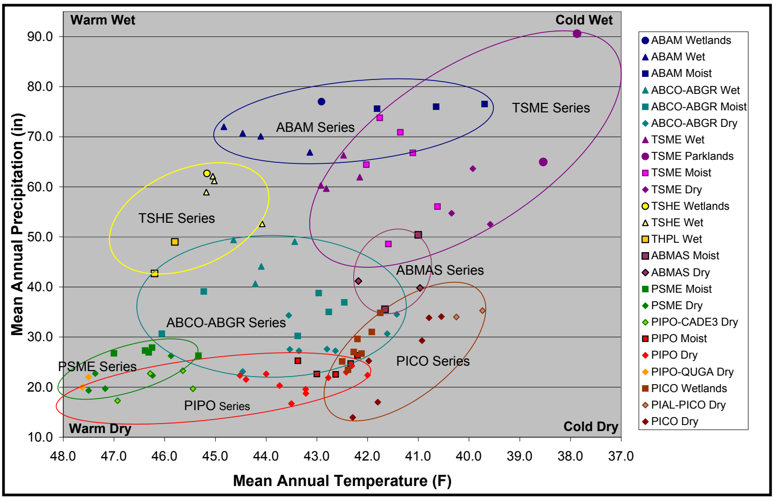
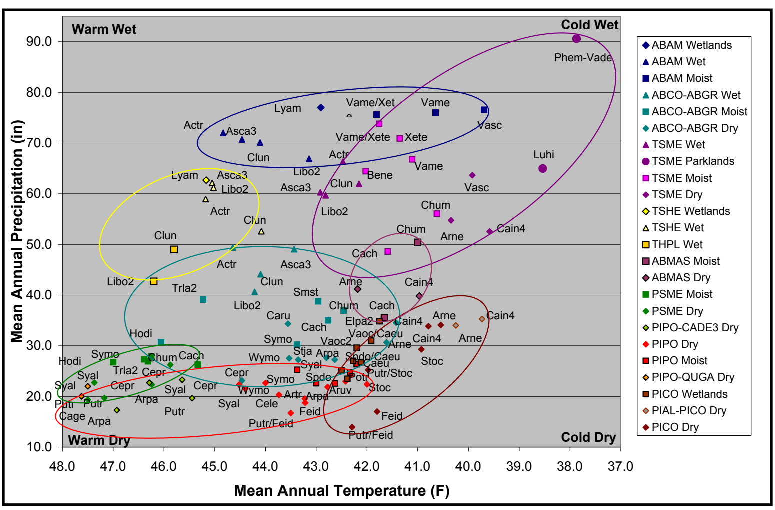


Figure 1-6. Average Moisture-Temperature Relationships for Forested Communities in the East Cascades of Oregon by Series, Sub-Series, and Association.





Plot location data was checked against original plot maps for the Volland, Hopkins, and Hall datasets. All other datasets used the locations provided with the datasets. A Geographic Information System (GIS) layer was then created from the location data to analyze spatial patterns.

Species composition data was analyzed using PC-ORD version 4.36. Programs used in data analysis included non-metric multidimensional scaling (NMS), hierarchical cluster analysis (CA), Bray-Curtis ordination (BC), two-way indicator species analysis (TWINSPAN, Hill 1979) and synthesis tables (Mueller-Dombois and Ellenberg 1974). Synthesis tables and NMS were used most. NMS analyses used the Sørensen (Bray-Curtis) distance measure. NMS similarity was assessed using 5 dimensions. CA analyses also used a Sørensen distance measure and used a flexible beta linkage method with β =-.25.

Initial groups were segregated using climax tree species. Secondary subdivisions were made within each tree series by identifying shrubs and herbs which, by their presence or dominance, suggested meaningful vegetation patterns. These floristic units were examined for consistency in environmental characteristics and productivity estimates. If the floristic pattern appeared related to consistent environmental and productivity characteristics, then the type (association or community type) was described. Indicator species affinity to moisture and temperature was determined in 2 ways.

1. BC and NMS were used to help select the key indicator species and to test hypothesis on relative species moisture-temperature relationships using the PRISM climate datasets for precipitation and temperature inputs.
2. PRISM dataset values of temperature and precipitation were assigned to each plot based on plot location, and frequency distributions of temperature and precipitation for each indicator species were then developed.

The frequency distributions of mean annual precipitation and temperature were then compared between species, and the indicator species were ordered from most moisture to least moisture and from warmest temperature to coolest temperature. Floristic units defined by the indicator species associated with the most moisture were then given precedence in the keys. On sites that were not recently disturbed, the indicator species present above its threshold value in the keys and with the greatest affinity to moisture, were assumed to indicate the effective moisture regime on an individual site.

The Ecology dataset sampled site trees selected specifically for determining site index (SI). Data for SI that came from the CVS dataset used site tree and dominant or co-dominant Growth Sample Tree (see CVS methods). SI for each tree species by plant association was calculated using the SI curves displayed in Table 1-3. Each SI function is a separate Visual Basic routine that calculates SI_{100} from the equations in the source publications. The Visual Basic routines were originally developed by the Forest Service Management Center in Ft. Collins, Colorado and augmented by the Pacific Northwest Inventory and Analysis unit in Portland, Oregon.

Growth Basal Area (GBA) was developed by Hall (1987,1989) as an index of stand stockability (ie the proportion of a given area capable of holding and growing trees). Stockability is directly affected by inter-tree competition. GBA uses tree diameter growth as an indirect measure of inter-tree competition. GBA was developed in essentially pure single species even-aged stands.

Table 1-3. Site Index Curve Sources.

Species Code	SI Function	Site Index Source
ABAM	ABAM2	Hoyer and Herman 1989
ABCO	qPSME13	Curtis, Herman and Demars 1974
ABGR	qPSME13	Curtis, Herman and Demars 1974
ABLA2	PIEN3	Clendennen 1977, Alexander 1967
ABMAS	zABPR2	DeMars, Herman and Bell 1970
ABPR	ABPR1	Herman, Curtis and DeMars 1974
CADE3	PIPO3	Barrett 1978
LAOC	qPSME13	Curtis, Herman and Demars 1974
PICO	zPICO2	Dahms 1975
PILA	PIPO3	Barrett 1978
PIMO	PIMO3	Curtis et al. 1990
PIPO	PIPO3	Barrett 1978
PSME	qPSME13	Curtis, Herman and Demars 1974
TSHE	qPSME13	Curtis, Herman and Demars 1974
TSME	zTSME	Means et al. 1988

Fred Hall's assumptions:

1. Stand density is a major factor affecting rate of diameter growth in stands without serious insect and or disease impacts.
2. Diameter growth rates reflect competition. A given rate of growth indicates a somewhat universal degree of competition for most tree species.
3. Rates of diameter growth reflect competition independent of crown closure.

Hall used a diameter growth rate of 1.0"/decade (10/20^{ths} of an inch radial growth) as a reference point to compare stockability between stands. Radial growth was used as a surrogate for diameter growth in Hall's original work, because he did not have repeat diameter measurements on individual trees. Instead, diameter growth was estimated from the last 10 years radial growth measured from an increment core.

Hall (1983) and Hopkins (1986) found that 2nd order polynomial and exponential equations both described the BA/Acre – Diameter growth relationship reasonably well. They chose the polynomial equation over the exponential equation, because they felt it was easily transformed to a linear form and statistical tests for significant differences between species were simplified.

Hall (1989) recommended use of the GBA concept in stands that meet the following criteria.

1. Predominantly even-aged.
2. Single species, two species, or at most three species dominated stands (% BA of each species in the stand is greater than 20%).
3. Greater than 20 years old.
4. Dominant trees > 5" dbh.
5. Diameter growth is decreasing or stagnated (competition effects are evident).

The first 2 criteria are difficult to meet within the East Cascades analysis area especially in unmanaged stands. Since a rigorous application of Hall's criteria would disqualify a high percentage of the tree data available, the first 2 criteria were relaxed and multi-species, multi-aged stands were included in the analysis.

Total basal area (BA)-diameter growth relationships were derived from the plots using nonlinear regression algorithms in SPSS-Windows, version 13. Both 2nd order polynomial ($Y = a + bX + cX^2$) and exponential ($Y = ae^{bX}$) curves were fit. Exponential curves were used instead of polynomial curves, because the fit (R^2) of the exponential curve was slightly better than the fit of the polynomial curve in most cases. The curve form consistently followed the relationship of BA/Acre to diameter growth portrayed by Hall (1987, 1989).

An exponential curve was fit for each tree species by plant association group (PAG). Growth basal area (GBA) was calculated based on 1" diameter growth per decade (10/20^{ths} radial growth) and adjusted for age using methods in Hall (1989). The GBA calculations utilized the raw site tree data from the United States Forest Service Region 6 (R6) ecology plot data set where it was available. Additional tree data from CVS plots supplemented the R6 ecology dataset.

Diameter growth rates for CVS data are based on average diameter change between measurements plus 1 standard deviation (s.d.) of diameter change by species by stake position. The average diameter + 1 s.d. convention was used to reduce the impact of outliers in diameter growth rates while still focusing on the better growth rates within the stake position. Total BA was calculated independently at each stake position based on the sum BA of all live or recently dead trees >3" of all species on the stake position.

Yield Capability (ft^3/acre/year) was derived using an empirical formula (ft^3/acre/year = SI base 100 * GBA * K) where K =0.0046. The K constant is used for conversion purposes only and not interpreted as a relationship between stand culmination and GBA as described by Hall (1989). The purpose of presenting these indices is to allow comparison of productivity between plant associations.

How to use the series key:

Many people will go straight to the series chapters to begin keying out plant associations, however, it would be prudent to take some time to consider in which series you are really standing. If you are keying a site where there is disturbance, and cannot go to an adjacent area with minimal disturbance, you should consider carefully how the disturbance influenced the area.

White fir/grand fir zones may be particularly difficult to identify if the disturbance history of the site is unknown. Past fire or harvest history may have reduced the occurrence of the white fir/grand fir in the local area. Regeneration of white fir/grand fir may be sparse, but if it is present and not restricted to microsites you are probably standing in an area where white fir-grand fir will return.

The series key that follows takes into account both understory regeneration and the overstory tree canopy. For example, if the overstory is Douglas-fir and white fir/grand fir, but the understory regeneration is western hemlock, you should refer to the western hemlock chapter.

Key to Potential Vegetation Series:

1a	Mountain Hemlock ≥ 10% cover.	TSME series
1b	Mountain Hemlock < 10% cover.	2a.
2a	Pacific Silver Fir ≥ 10% cover.	ABAM series
2b	Pacific Silver Fir < 10% cover	3a.
3a	Western Hemlock ≥ 10% cover	TSHE series
3b	Western Hemlock < 10% cover	4a.
4a	Western Red Cedar ≥ 10% cover.	TSHE series
4b	Western Red Cedar < 10% cover	5a.
5a	White fir or Grand Fir ≥ 10% cover.	ABCO-ABGR series
5b	White fir or Grand Fir < 10% cover.	6a
6a	Shasta Red Fir ≥ 10% cover	ABMAS series
6b	Shasta Red Fir < 10% cover	7a.
7a	Douglas-fir ≥ 10% cover	PSME series
7b	Douglas-fir < 10% cover.	8a.
8a	Ponderosa Pine ≥ 10% cover.	PIPO series
8b	Ponderosa Pine < 10% cover.	9a
9a	Whitebark Pine ≥ 10% cover.	PICO series
9b	Whitebark Pine < 10% cover	10a
10a	Lodgepole Pine ≥ 10% cover	PICO series
10b	Lodgepole Pine (< 10%)cover	11a
11a	Western Juniper ≥ 10% cover	JUOC series
11b	Western Juniper < 10% cover	Non- Forest communities

Mountain Hemlock Series

MOUNTAIN HEMLOCK SERIES

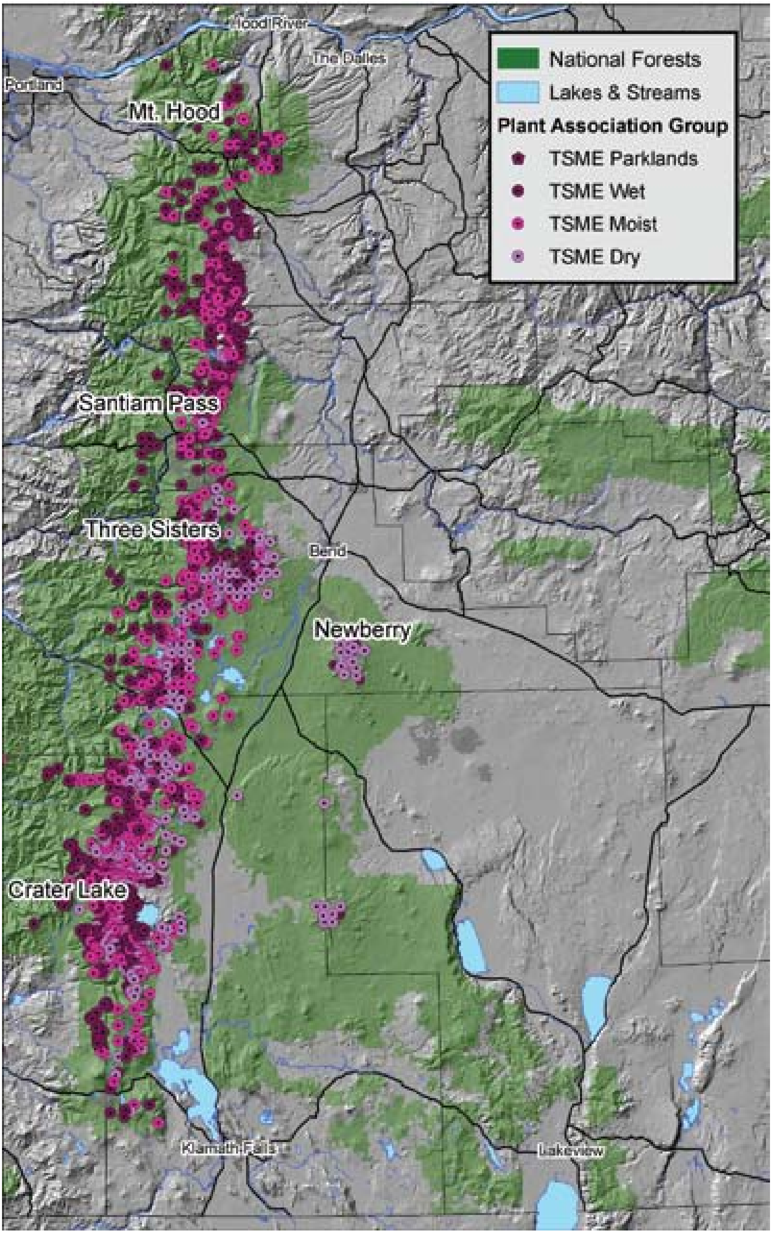
TSME
Tsuga mertensiana
mountain hemlock
Total Plots 1596

Distribution and Environment— Mountain hemlock is widely distributed in the Pacific Northwest in cold, maritime climates. It is the major upper timberline tree species along the Oregon and Washington Cascade Crest. It is also found east of the Cascades in central and southern Oregon on Newberry Crater, Walker, Bald, and Yamsey Mountains. Its presence indicates cold, snowy habitats where snow accumulations of several feet or more during winter are normal. These snowpacks persist well into June or early July, resulting in a relatively short growing season. Mountain hemlock is most resistant to physical snow damage. In the Oregon Cascades, mean elevation for TSME series plots is 5,450 feet, mean annual precipitation averages 63" and mean annual temperature averages 41° F. In general, mean elevations for the series rise from Mt. Hood in the north to Mt. McLoughlin in the south.

A few outlying stands also occur in northeastern Oregon away from the Cascades. In the Rocky Mountains of northern Idaho and Montana, mountain hemlock stands can be quite extensive but are also limited to very snowy areas with a maritime or modified maritime climate. Mountain hemlock is considered the climax species when canopy cover is predicted to be 10% or more in stable stands (300+ years). Mountain hemlock and Pacific silver fir broadly overlap in their ecological distribution in the Oregon Cascades, so that distinguishing between the two series can be difficult. In most stands within the Mountain Hemlock Series, when Pacific silver fir is present, it will likely never be excluded, and is essentially a co-dominant even in climax and near-climax stands. Only on the harshest mountain hemlock sites is Pacific silver fir absent or nearly so. As noted above, predicted or actual canopy cover that exceeds 10% in older stands is the convention for placing stands within the Mountain Hemlock Series in this guide.

At the highest elevations, the Mountain Hemlock Series usually grades quickly into subalpine parkland. However, subalpine fir or whitebark pine associations can be found at the upper fringe of the series on some sites. The controlling mechanisms of the ecotone between forest (tree island) and non-forest are complex and still only poorly understood. Snowpack depth and duration, and excess or insufficient soil moisture during the growing season, are some of the primary operating factors.

Figure 2-1. Map of TSME Series PAG Distribution—



At lower elevations, the Mountain Hemlock Series grades into the Pacific Silver Fir Series in a complex fashion on sites with high maritime influences, as noted above, or it grades into the White Fir-Grand Fir or Shasta Red Fir Series in sites with more continental influence or that are excessively drained. At its driest fringe, the Mountain Hemlock Series grades into the Subalpine Fir or Whitebark Pine Series. Similar sites further east in the Blue Mountains or central Idaho areas usually support the Subalpine Fir Series

Vegetation— Mountain hemlock is present in the overstory of most stands, and averages over 25% cover. Pacific silver fir is shade tolerant, present in about 35% of the plots, and is often dominant where present. Subalpine fir, Shasta red fir, whitebark pine, and occasionally lodgepole pine are the only seral species within the higher elevation (often parkland) areas of the series. The more moderate, closed areas within the series support an abundance of other seral trees, including western hemlock, western red cedar, subalpine fir, Douglas-fir, western larch and western white pine. Douglas-fir is present in only about 25% of the stands. Only stands at the upper elevational limits of the series consist of nearly pure canopies of mountain hemlock, with crowns heavily festooned by lichens. These stands often have a uniform size-class structure, giving the false impression of an even-aged stand. Reproduction can be sparse. Undergrowth varies from dense herbaceous or shrub layers to depauperate conditions characterized by a few scattered plants and deep litter. Dense shrub layers, including such species as Pacific rhododendron, and golden chinquapin are characteristic of more mesic habitats within the series, while beargrass, smooth woodrush, grouse whortleberry, or big huckleberry are more typical in the colder and often excessively drained areas.

Fifteen associations are defined for the TSME Series on the east slope of the Cascades in Oregon. The plant associations within the TSME Series have been further grouped into plant association groups (PAGs) which reflect temperature-precipitation zones (Figure 2-2). The TSME Wet PAG consists of TSME/ASCA3, TSME/CLUN, TSME/ACTR and TSME/LIBO2. The TSME Parklands PAG consists of TSME/LUHI and TSME/PHEM-VADE. The TSME Moist PAG consists of TSME/BENE, TSME/VAME, TSME/VAME/XETE, TSME/CACH, TSME/XETE, and TSME/CHUM. The TSME Dry PAG consists of TSME/VASC, TSME/ARNE, and TSME/CAIN4. Species diversity and site productivity decline as the plant associations change from warm to cold and wet to dry within the series.

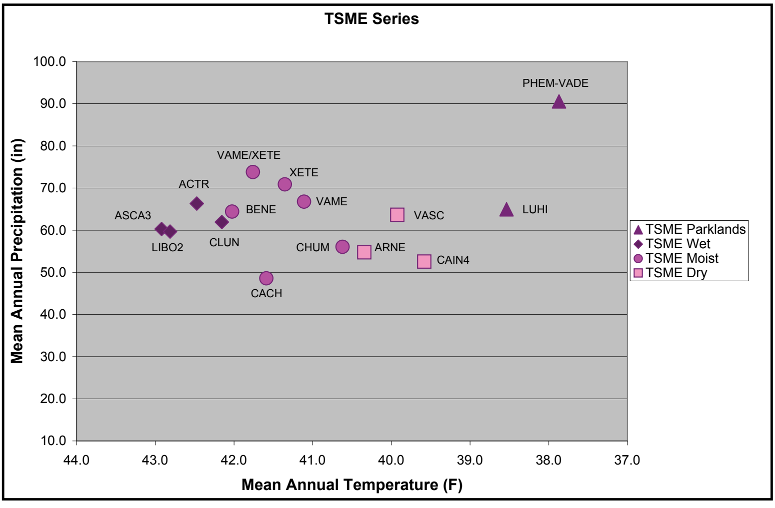
TSME Wet PAG plant associations typically have herb-rich understory vegetation. These types represent the warmest, wettest and most productive sites in the TSME Series. The shrub layer is variable; the most common species is VAME. Diverse shrub layers frequently form after disturbance. Douglas-fir is often a significant component of overstory canopies and is a primary early seral conifer.

The TSME Parklands PAG represents the coldest environments that support forested vegetation in the Oregon Cascades. Plant associations in the TSME Parklands are often adjacent to subalpine meadows and form either a forest-meadow mosaic or the upper boundary of closed forest. These associations are generally too cold for Douglas-fir and white fir-grand fir.

The TSME Moist PAG represents the middle moderate environments within the TSME Series. Warmer portions of the plant association group support Douglas-fir.

The TSME Dry PAG represents cold dry environments. Although average precipitation on these sites is relatively high, effective moisture is much lower than corresponding TSME Moist or TSME Wet plant

Figure 2-2. Temperature – Precipitation Relationships for Plant Associations and Plant Association Groups within the TSME Series.



associations. Plant associations in this group are extremely species poor. These associations are generally too cold for Douglas-fir and white fir-grand fir. Lodgepole pine is the dominant early seral conifer in the TSME Dry PAG. Shasta red fir is an important species south of Lookout Mountain on the Deschutes National Forest.

Fire— Tree ages are generally old; 30-40% of sampled stands have trees >200 years old, suggesting that fire frequency is generally low. Wind and snow loads may be more important disturbance agents than fire. Ridgetop and upper-slope locations favor lightning strikes, but a combination of late melting snowpacks and the high likelihood of moisture from storms means conditions are rarely dry enough to favor extensive fires. Fire occurrence depends largely on regional drought.

Regional drought is associated with the interactions between the El Nino Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO); recent studies indicate the Atlantic Multidecadal Oscillation may also be important. These climate drivers tend to create regional droughts on a 30-40 year period, producing fire episodes that affect different parts of the entire Cascade Range, depending on storm tracks in a given year or period of years. The Columbia River Gorge also modifies climate patterns as far south as 45° latitude, affecting the presence of typical westside and eastside species and fire return intervals. Thus conditions tend to be drier and fire return intervals tend to be shorter south of 45° latitude than north of this latitude.

Usually fires started by lightning within the Mountain Hemlock zone will burn briefly and extinguish. Sometimes fires establish in the duff and burn small areas over extended periods via smoldering spread. Mountain hemlock has thin bark (Fischer and Bradley 1987), so it is easily killed by low intensity fire. However the patchy nature of fuels within this type tends to limit fire size and create mosaics. In the absence of perimeter mapping shortly after an individual fire, the collection of patches can be mistaken for separate fires.

Simon (1991) reported fire return intervals averaged 168 years in Mountain Hemlock Series sites on the east side of the Mt. Jefferson Wilderness. Most of the sites included in Simon's study area correspond to plant associations within the TSME Moist and TSME Dry PAGs. Booth (1991) reported a return interval of 611 years on a site west of the Cascade Crest. Booth's estimate indicates that wetter sites within the TSME series may have much longer fire return interval than 168 years. Sites in the TSME Wet PAG may have return intervals well over 200 years. Long return intervals and the typically patchy nature of the fires correspond to a Fire Regime IV (infrequent, stand replacement fire) in the TSME Moist and TSME Dry PAGs or Fire Regime V (very infrequent, stand replacement) in the TSME Wet PAG.

Productivity and Management— Many sites in the series are poorly suited for intensive timber management. Short growing seasons and heavy snowpacks are the major limitations. Productivity estimates for mountain hemlock are difficult to obtain. Site trees are difficult to find. Most trees show extended periods of suppressed growth when younger, or have some form of top damage. Site index values (base 100) for Pacific silver fir and mountain hemlock ranged from 46-107 and from 42-70, respectively. TSME/ASCA3, TSME/CLUN, and TSME/ACTR appear to be the most productive sites and TSME/PHEM-VADE and TSME/LUHI the least productive (Table 2-1). Pacific silver fir becomes more successful on lower elevation (warmer) sites and is an indicator of higher timber productivity for all tree species. The Mountain Hemlock Series is cold and wet with lingering snow.

Key Insects and Diseases: Balsam woolly adelgid (ABLA2), mountain pine beetle (PICO, PIMO, PIAL), rust red stringy rot, white pine blister rust, Douglas-fir dwarf mistletoe, laminated root rot, Armillaria and annosus root diseases.

Secondary Insects and Diseases: Western spruce budworm, Douglas-fir tussock moth, fir engraver, spruce beetle (PIEN), larch casebearer (LAOC), mountain hemlock dwarf mistletoe, western gall rust, and Schweinitzii butt rot.

Important Effects: Laminated root rot is the most important disease in these systems creating openings in the hemlock canopy for early seral lodgepole pine to regenerate. Dickman and Cook (1989) describe Mountain hemlock forests cycling from lodgepole pine, readily killed by mountain pine beetle, to late successional mountain hemlock and true fir which are short lived due to laminated root rot. Annosus root and butt rot causes substantial amounts of decay and stem breakage in older true fir and hemlock, and is common in wounded trees in highly managed areas. Incidence has been found to be 72% in wounded noble fir on the Warm Springs Indian Reservation (WSIR)(Sullivan et al. 2001).

Table 2-1. Site Index (SI standard error), Growth Basal Area (GB A standard error), Yield Capability ($Ft^{3)}$ by Species and Plant Association Group within the TSME Series

PAG	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
TSME Parklands							
ABAM	55	5	9	320	23	39	81
ABLA2	32	10	3	247	31	20	36
PIAL				268	20	8	
PICO	60	3	4	205	5	36	56
TSME	44	2	75	359	7	392	73
TSME Dry							
ABAM	57	4	30	259	7	143	68
ABCO-ABGR	68	6	3	153	10	40	48
ABLA2	59	3	14	221	14	33	60
ABMAS	75	3	46	426	12	259	147
PIAL	45	6	6	143	6	97	30
PICO	59	1	187	143	2	791	39
PIMO	71	3	34	183	7	81	60
TSME	48	1	229	315	3	1642	70
TSME Moist							
ABAM	63	2	73	262	4	603	75
ABCO-ABGR	87	3	64	241	9	169	96
ABLA2	49	4	13	221	8	107	50
ABMAS	89	3	108	333	7	351	136
ABPR	65	10	6	278	14	57	83
PICO	65	2	96	179	3	656	53
PIEN	50	16	3	298	33	11	68
PIMO	81	4	35	200	8	109	75
PSME	82	3	60	255	8	192	96
TSHE	68	3	20	263	9	86	82
TSME	55	1	252	264	2	2110	68
TSME Wet							
ABAM	78	2	91	339	4	598	122
ABCO-ABGR	96	3	96	336	9	217	149
ABLA2	61	6	11	259	8	114	73
ABMAS	95	2	152	348	8	238	153
ABPR	107	6	20	365	7	343	180
CADE3	105	5	4	493	63	9	239
PICO	73	2	47	165	4	361	56
PIEN	84	3	31	292	11	145	112
PIMO	104	4	48	287	12	99	138
PSME	96	2	157	350	3	1299	154
THPL	86	10	7	363	23	36	143
TSHE	94	3	46	353	5	452	153
TSME	64	1	206	295	3	1145	87

Bark beetles are most important in lodgepole pine, but slightly less dramatic than in lower-elevation stands of that species. When lodgepole pine stands reach about 100 years of age, they become particularly vulnerable to infestation by the mountain pine beetle. Outbreaks can last for several years and most of the larger trees in the stand are typically killed.

White pine blister rust in western white pine and whitebark pine is the most detrimental disease to retaining these five-needle pines in the stand. It is a major killer of regenerating five-needle pines and makes reestablishment of wild populations on high-hazard sites difficult. White pine blister rust can significantly weaken larger, older trees, making them vulnerable to bark beetle attack and reproductively extinct. Blister rust combined with mountain pine beetle significantly alters stand structure and composition on sites where five-needle pines have major ecological roles and are detrimental to retaining whitebark pine on these sites. White pine blister rust is found on all plant associations throughout the TSME series, although, infection levels maybe higher and retaining five needle pines on parklands and wet sites may be unfeasible.

Rust red stringy rot is common in true fir and hemlock stands, typically suppressed in the understory for long periods of time before eventually releasing. Rust red stringy rot manifests itself when the trees are older and is considered to be the most significant heart rot organism. Losses of 25-50% or more of the gross volume have been recorded. The disease frequently causes stem breakage.

Western gall rust occurs frequently on the Confederated Tribes of Warm Springs Indian Reservation as noted by Marsh et al. (1987). Dwarf mistletoe in PICO occurs locally, however, is less important than in the PICO series.

Wildlife Management— Wildlife habitats do not precisely match plant associations or even plant series, therefore Appendix C in this guide is provided. Please see page C-8 for a discussion on Mountain Hemlock.

Relationships to other Classifications— The Mountain Hemlock Series has been described by numerous authors up and down the Cascades, in northern Idaho and Montana, and in the Wallowa Mountains of northeastern Oregon, either as a unique type or occasionally in the Pacific Silver Fir Series. Some of these authors include: Daubenmire and Daubenmire 1968; Pfister et al. 1977; Hemstrom et al. 1982; Brockway et al. 1983; Williams and Lillybridge 1983; Logan et al. 1987; Johnson and Simon 1987; Franklin et al. 1988; John et al. 1988; Henderson et al. 1992; Cooper et al. 1987; Atzet et al. 1996: Diaz et al. 1997; McCain and Diaz 2002. A variety of plant associations have been described, with perhaps the common link being that the Mountain Hemlock Series requires cold sites with moist-maritime or modified-maritime climatic regimes.

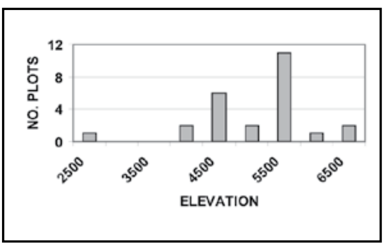
Key to the Plant Associations of the Mountain Hemlock Series:

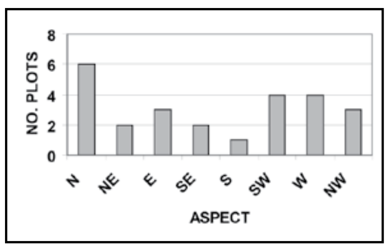
1a	*Asarum caudatum* or *Athyrium felix-femina* (>1%)	TSME/ASCA3
1b	Not as above	2a
2a	*Clintonia uniflora* (>1%) and not restricted to microsites	TSME/CLUN
2b	Not as above	3a
3a	*Achlys triphylla* (>1%) and not restricted to microsites	TSME/ACTR
3b	Not as above	4a
4a	*Linnaea borealis* (>1%) and not restricted to microsites	TSME/LIBO2
4b	Not as above	5a
5a	*Phyllodoce empetriformius* or *Vaccinium deliciosum* (>5%)	TSME/PHEM-VADE
5b	Not as above	6a
6a	*Luzula hitchcockii* (>1%) and not restricted to microsites	TSME/LUHI
6b	Not as above	7a
7a	*Berberis nervosa* (>1%) and not restricted to microsites	TSME/BENE
7b	Not as above	8a
8a	*Vaccinium membranaceum* (>5%) and *Xerophyllum tenax* (>5%)	TSME/VAME/XETE
	Xerophyllum tenax <5%)	TSME/VAME
8b	Not as above	9a
9a	*Castanopsis chrysophylla* (>5%)	TSME/CACH
9b	Not as above	10a
10a	*Xerophyllum tenax* (>5%)	TSME/XETE
10b	Not as above	11a
11a	*Chimaphila umbellata* (>1%) and not restricted to microsites	TSME/CHUM
11b	Not as above	12b
12a	*Vaccinium scoparium* (>5%)	TSME/VASC
12b	Not as above	13a
13a	*Arctostaphylos nevadensis* (>5%)	TSME/ARNE
13b	Not as above	14a
14a	*Carex inops* (>1%) and not restricted to microsites	TSME/CAIN4
14b	Not as above	return to start of key and relax cover %.

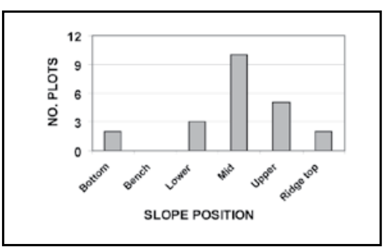
TSME/ASCA3 — TSME Wet

CMF311 (TSME/ASCA2)
Tsuga mertensiana/Asarum caudatum
mountain hemlock/wild ginger
Plots 25

Distribution and Environment— This association represents the warmest wet TSME association. It often grades into TSHE/ASCA3 or ABAM/ASCA3 associations on adjacent warmer slopes or aspects. Cooler positions often have TSME/CLUN, TSME/VAME, or TSME/VAME/XETE associations. TSME/ASCA3 is often associated with fertile soils that are somewhat poorly drained, or that accumulate moisture. TSME/ASCA3 has been observed as far south as Willamette Pass on the eastside of the Cascade Crest. Mean annual precipitation is about 60" and mean annual temperature is approximately 43˚F. Average elevation is 4852 feet (range 2300-6230 feet). Average slope is 35% (range 2-75%). Most plots were found on a north or west aspect.

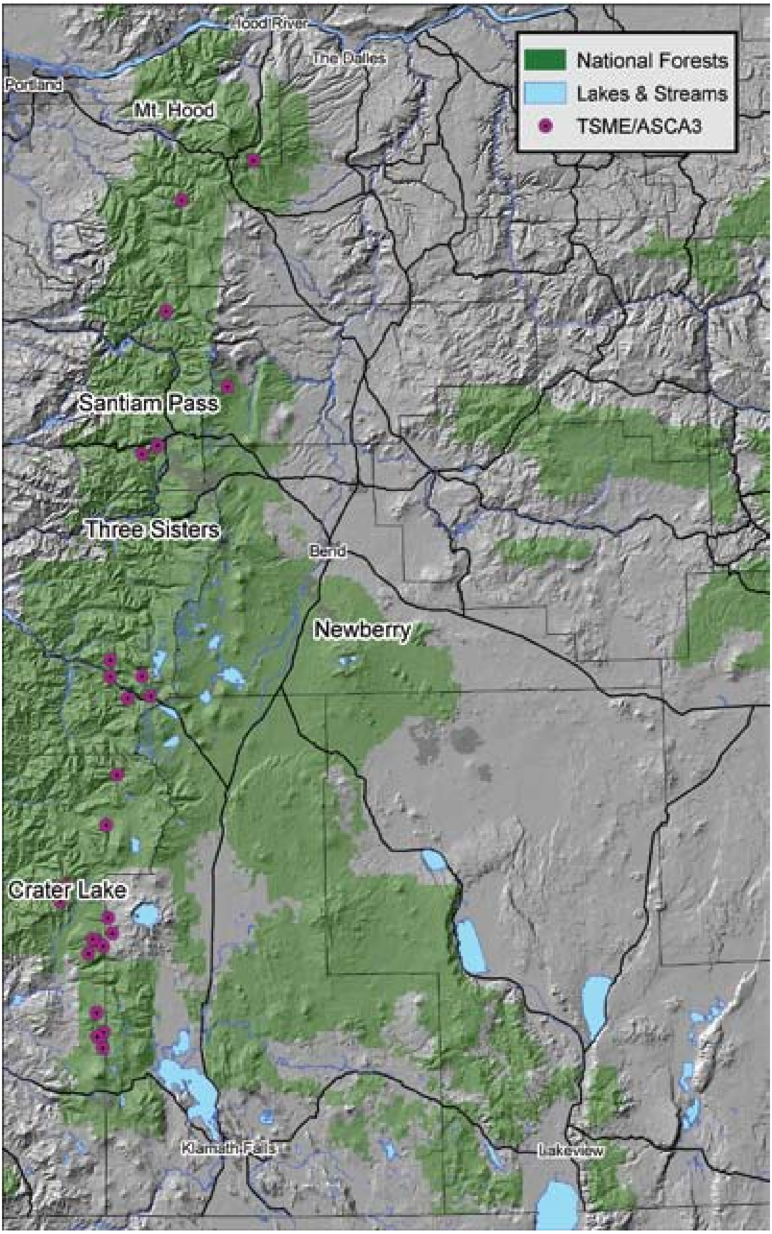






Mean Precip	60.3"	47-115"
Mean Temp	42.9°F	39-48°F

Figure 2-3. Map of TSME/ASCA3 Plot Distribution—



Vegetation— TSME/ASCA3 is the most diverse plant association of the Mountain Hemlock Series. PSME or ABMAS are often important overstory species. ABAM and/or TSHE may be co-climax species in this type where they occur. Diverse shrub layers occur on TSME/ASCA3 sites following disturbance of tree layers. Higher shrub cover values may indicate past disturbance. TSME/ASCA3 sites are herbaceously rich.

Code	Species Latin name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABAM	*Abies amabilis*	24	28	14.4	18.1
ABCO	*Abies concolor*	36	40	18.1	21.6
ABMAS	*Abies magnifica shastensis*	48	44	21.7	12.0
PSME	*Pseudotsuga menziesii*	80	52	26.4	9.3
TABR	*Taxus brevifolia*	4	32	5.2	4.8
TSME	*Tsuga mertensiana*	48	92	18.4	10.3
Shrubs					
AMAL	*Amelanchier alnifolia*	32%		2.3	
BENE	*Berberis nervosa*	64%		3.5	
CACH	*Castanopsis chrysophylla*	32%		2.5	
CHUM	*Chimaphila umbellata*	76%		3.1	
HODI	*Holodiscus discolor*	24%		1.1	
PAMY	*Pachistima myrsinites*	52%		1.6	
ROGY	*Rosa gymnocarpa*	48%		1.8	
VAME	*Vaccinium membranaceum*	64%		14.8	
Herbaceous					
ACTR	*Achlys triphylla*	60%		7.4	
ADBI	*Adenocaulon bicolor*	32%		1.6	
ASCA3	*Asarum caudatum*	100%		4.4	
CLUN	*Clintonia uniflora*	80%		1.5	
DIHO	*Disporum hookeri*	28%		1.6	
FRVE	*Fragaria vesca*	28%		2.1	
GOOB	*Goodyera oblongifolia*	48%		1.0	
HIAL	*Hieracium albertinum*	44%		1.3	
LIBO2	*Linnaea borealis*	56%		10.1	
OSCH	*Osmorhiza chilensis*	36%		1.6	
POMU	*Polystichum munitum*	36%		0.8	
PYPI	*Pyrola picta*	40%		0.9	
PYSE	*Pyrola secunda*	60%		2.1	
SMRA	*Smilacina racemosa*	28%		0.5	
SMST	*Smilacina stellata*	64%		1.6	
TITR	*Tiarella trifoliata*	44%		0.9	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management— TSME/ASCA3 represents the most productive sites for timber, shrub, and herb biomass within the TSME series.

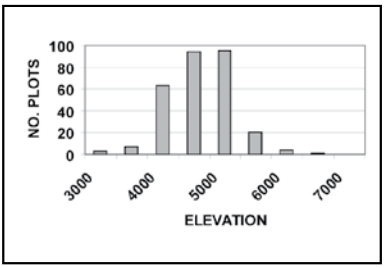
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
TSME/ASCA3							
ABAM	103	5	8	294	12	37	139
ABCO-ABGR	103	8	13	300	31	13	142
ABMAS	97	4	26	315	25	26	141
ABPR	115	8	12	361	11	86	191
PSME	105	6	21	374	10	179	181
TSHE	111	4	10	330	19	41	168
TSME	59	5	17	270	17	50	73

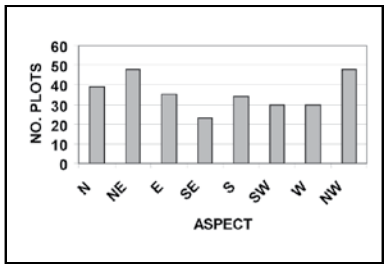
Relationships to Other Classifications— The TSME/ASCA3 association has not been previously described. TSHE/ASCA3 types have been described in northern Idaho (Cooper et al. 1987) and Central Washington (Lillybridge et al. 1995). Shrub and herbaceous layers appear similar to these classifications, however, the TSME/ASCA3 sites described here all have greater than 10% cover of TSME and average 28% TSME cover which likely indicates cooler temperature regimes than the analogous TSHE types described elsewhere.

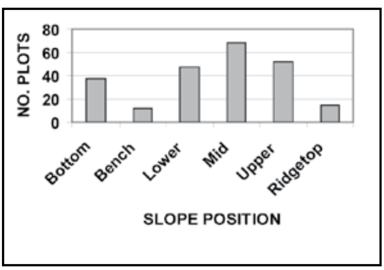
TSME/CLUN **TSME Wet**

CMF211 (TSME/CLUN2)
Tsuga mertensiana/Clintonia uniflora
Mountain hemlock/queencup beadlily
Plots 302

Distribution and Environment— TSME/CLUN is a widespread association that occurs on both sides of the Cascade Crest. TSME/CLUN is very common north of Santiam Pass on the east side of the Cascades. It is typically found on lower to mid slopes. Many TSME/CLUN sites are sub-irrigated. Average elevation is 4848 feet (range 3200-6541feet). Average slope is 19% (range 0-76%). Plot aspect varied.

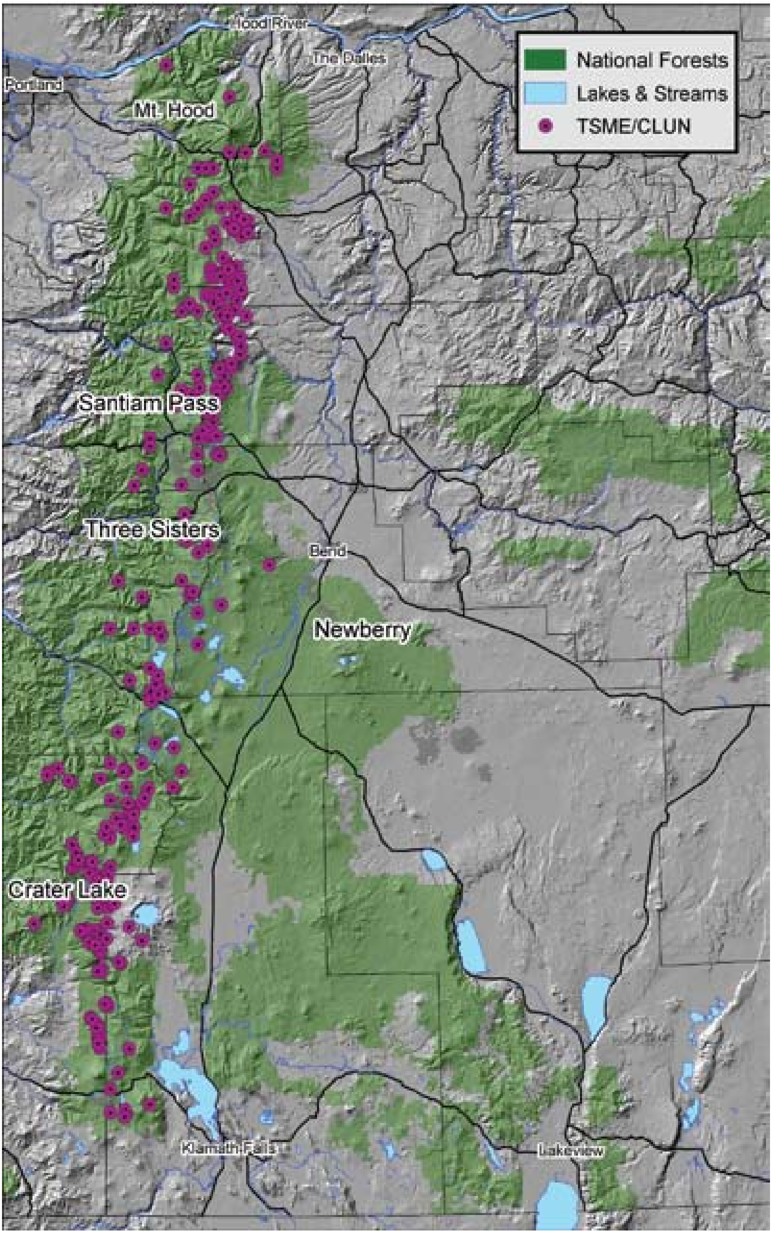






Mean Precip	61.9”	31-119”
Mean Temp	42.2°F	37-48°F

Figure 2-4. Map of TSME/CLUN Plot Distribution—



Vegetation— PSME or ABMAS (south of Lookout Mountain, Deschutes NF) often are important overstory species. ABAM and/or occasionally TSHE may be co-climax species in this type where they occur. Diverse shrub layers may occur on TSME/CLUN sites following disturbance of the tree layers. Higher shrub cover values may indicate past disturbance.

Code	Species Latin name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABAM	*Abies amabilis*	46	51	21.3	13.8
ABCO	*Abies concolor*	24	36	16.7	12.5
ABMAS	*Abies magnifica shastensis*	34	30	25.1	9.6
PICO	*Pinus contorta*	30	18	12.5	4.0
PIMO	*Pinus monticola*	41	39	5.1	2.0
PSME	*Pseudotsuga menziesii*	62	31	21.9	4.1
TSHE	*Tsuga heterophylla*	25	30	23.1	9.4
TSME	*Tsuga mertensiana*	79	89	18.6	10.0
Shrubs					
BENE	*Berberis nervosa*	40%		4.7	
CACH	*Castanopsis chrysophylla*	32%		4.8	
CHUM	*Chimaphila umbellata*	79%		4.4	
PAMY	*Pachistima myrsinites*	46%		4.3	
ROGY	*Rosa gymnocarpa*	41%		1.4	
VAME	*Vaccinium membranaceum*	82%		16.1	
Herbaceous					
ACTR	*Achlys triphylla*	50%		5.3	
CLUN	*Clintonia uniflora*	100%		2.2	
GOOB	*Goodyera oblongifolia*	39%		0.9	
HIAL	*Hieracium albertinum*	31%		0.8	
LIBO2	*Linnaea borealis*	49%		6.3	
PYPI	*Pyrola picta*	28%		0.8	
PYSE	*Pyrola secunda*	75%		1.6	
SMST	*Smilacina stellata*	33%		1.6	
XETE	*Xerophyllum tenax*	44%		13.6	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
TSME/CLUN							
ABAM	77	3	69	342	5	450	122
ABCO-ABGR	93	3	67	343	10	156	147
ABLA2	61	5	9	294	12	55	83
ABMAS	98	2	111	382	10	159	172
ABPR	101	3	4	362	10	193	168
PICO	76	2	42	168	4	315	58
PIEN	81	4	24	265	10	123	99
PIMO	103	4	35	332	15	58	157
PSME	98	2	85	361	4	719	162
TSHE	91	4	26	354	6	261	149
TSME	66	1	158	300	4	834	91

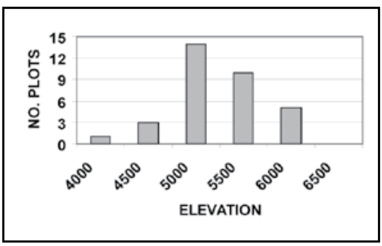
Relationships to Other Classifications— TSME/CLUN and TSME/CLUN/XETE types have previously been described in North Idaho (Cooper et al. 1987). McCain and Diaz (2002) described TSME/VAME/CLUN and TSME/VAME/XETE types which have many plots that would key to TSME/CLUN in this classification. Atzet et al. (1996) describe ABAM-TSME/VAME/ACTR, and TSME-ABMAS/VAME/CLUN which are closely related types and may key in part to TSME/CLUN in this classification.

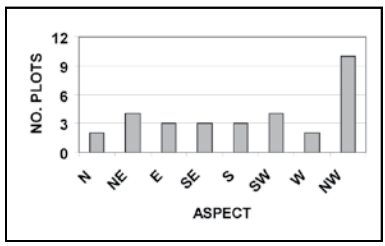
TSME/CLUN sites appear cooler and drier (better drained or lower total precipitation) than TSME/ASCA3 sites described in this guide.

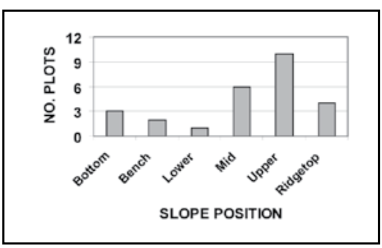
TSME/ACTR — TSME Wet

CMF221 (TSME/ACTR)
Tsuga mertensiana/Achlys triphylla
mountain hemlock/vanilla leaf
Plots 38

Distribution and Environment— TSME/ACTR occurs predominantly west of the Cascade Crest in Oregon. East slope observations occur on the Warm Springs Indian Reservation and the eastside of the Mt. Hood National Forest. Sites are typically mid to upper slopes positions on northerly aspects. Average elevation is 4995 feet (range 4000-5955 feet). Average slope is 26% (1-85%). Warmer slope positions are usually TSHE Wet PAG or ABAM Wet PAG associations west of the Crest and north of the Metolius River on the east slope. Farther south, TSME/ACTR is transitional to ABCO-ABGR associations on warmer sites or TSME Moist or TSME Dry associations on cooler and/or better drained sites.

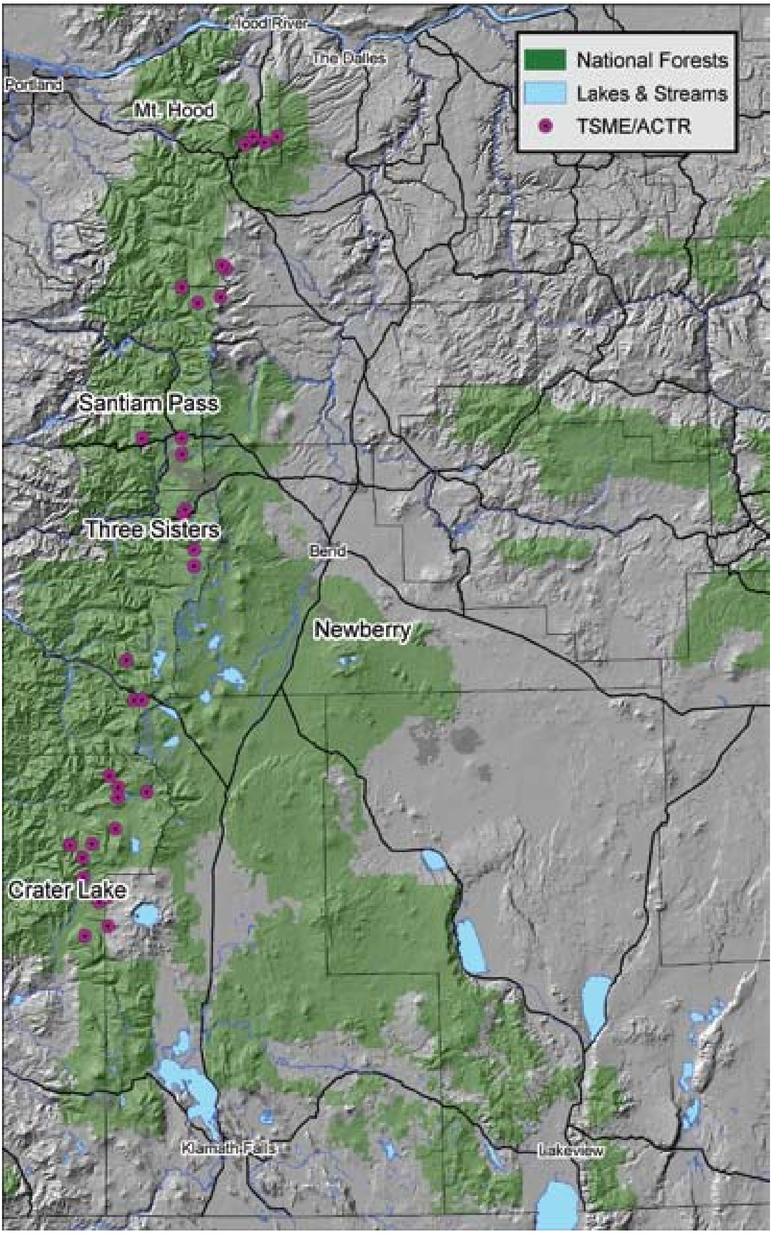






Mean Precip.	66.3”	(44-105”)
Mean Temp.	42.5°F	(40-47°F)

Figure 2-5. Map of TSME/ACTR Plot Distribution–



Vegetation— PSME or ABMAS (south of Lookout Mountain, Deschutes NF) often are important overstory species. ABAM and/or occasionally TSHE may be co-climax species in this type where they occur. Diverse shrub layers may occur on TSME/ACTR sites following disturbance of the tree layers. Higher shrub cover values may indicate past disturbance.

Code	Species Latin name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABAM	*Abies amabilis*	47	53	13.0	8.8
ABCO	*Abies concolor*	26	39	17.0	23.6
ABLA2	*Abies lasiocarpa*	24	32	14	4.0
ABMAS	*Abies magnifica shastensis*	34	34	23.8	11.9
ABPR	*Abies procera*	29	16	14.6	6.3
PIMO	*Pinus monticola*	37	26	6.0	1.6
PSME	*Pseudotsuga menziesii*	71	42	27.1	4.8
TSME	*Tsuga mertensiana*	76	87	15.0	9.6
Shrubs					
BENE	*Berberis nervosa*	53%		3.3	
CACH	*Castanopsis chrysophylla*	29%		8.3	
CHUM	*Chimaphila umbellata*	87%		8.3	
PAMY	*Pachistima myrsinites*	55%		1.1	
RHMA	*Rhododendron macrophyllum*	26%		30.6	
ROGY	*Rosa gymnocarpa*	39%		0.9	
RUUR	*Rubus ursinus*	26%		3.7	
VAME	*Vaccinium membranaceum*	76%		11.9	
Herbaceous					
ACTR	*Achlys triphylla*	100%		3.3	
FRVE	*Fragaria vesca*	29%		1.0	
GOOB	*Goodyera oblongifolia*	37%		0.7	
HIAL	*Hieracium albertinum*	29%		0.8	
LIBO2	*Linnaea borealis*	45%		3.6	
PYPI	*Pyrola picta*	39%		0.9	
PYSE	*Pyrola secunda*	66%		2.1	
SMST	*Smilacina stellata*	26%		1.0	
XETE	*Xerophyllum tenax*	37%		14.9	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

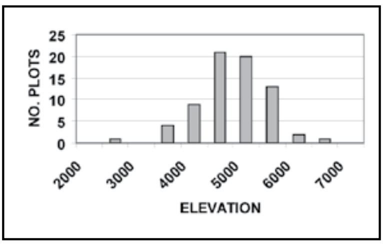
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
TSME/ACTR							
ABAM	89	6	2	396	24	41	161
ABCO-ABGR	125	12	9	310	40	18	178
PSME	91	7	17	338	15	74	141
TSME	67	3	9	270	12	73	84

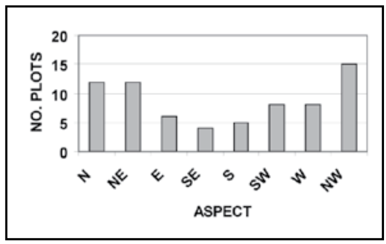
Relationships to Other Classifications— TSME/ACTR is similar to the ABAM-TSME/VAME/ACTR association and may include some sites that would key to the TSME-ABMAS/VAME/CHUM association described by Atzet et al. 1996 for southwest Oregon. Similar types in northwest Oregon include drier and warmer portions of TSME/VAME/CLUN and wetter portions of the TSME/RHMA associations described by Diaz et al. 1997 and by McCain and Diaz 2002. TSME/ACTR is cooler and better drained than TSME/ASCA3 and warmer than TSME/CLUN.

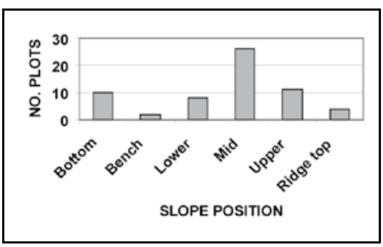
TSME/LIBO2 — TSME Wet

CMF231 (TSME/LIBO3)
Tsuga mertensiana/Linnaea borealis
mountain hemlock/twinflower
Plots 75

Distribution and Environment— TSME/LIBO2 sites are more common east of the Cascade Crest. TSME/LIBO2 is often found adjacent to ABCO-ABGR Wet plant associations east of the Crest and ABAM Wet or TSHE Wet plant associations west of the Cascade Crest. Average elevation is 4502 feet (range 2400-6259 feet). Average slope is 18% (1-50%). Most plots were found on a northwestern aspect, with notably few plots in the southeast aspect.

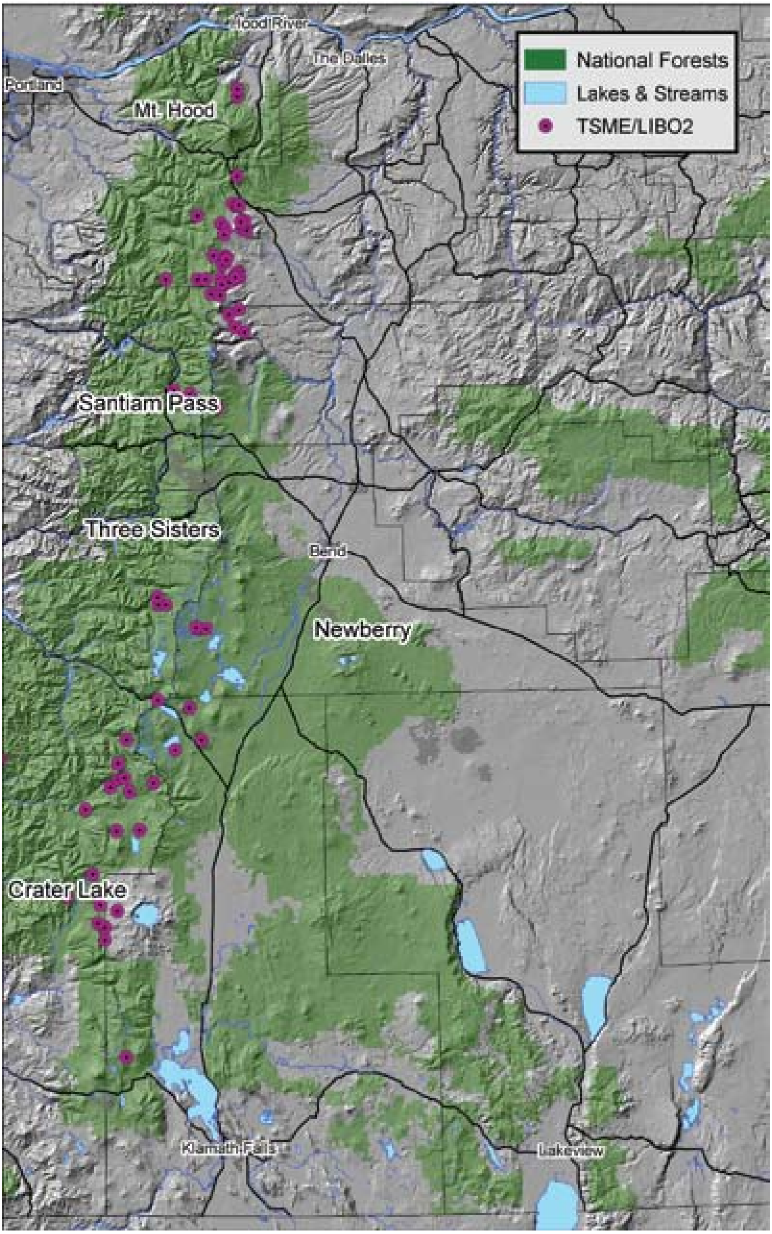






Mean Precip.	59.7”	29-85”
Mean Temp.	42.8°F	39-52°F

Figure 2-6. Map of TSME/LIBO2 Plot Distribution—



Vegetation— PSME, ABMAS (south of Lookout Mountain, Deschutes NF), or ABPR (north of the Metolius River) often are important overstory species. ABAM and/or TSHE may be co-climax species in this type where they occur. Diverse shrub layers occur on TSME/LIBO2 sites following disturbance of the tree layers. Higher shrub cover values may indicate past disturbance. Herbaceous layers are more depauperate than other TSME Wet plant associations.

Code	Species Latin name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABAM	*Abies amabilis*	43	53	11.2	14.3
ABPR	*Abies procera*	43	31	12.8	4.3
PICO	*Pinus contorta*	55	37	10.5	2.9
PIMO	*Pinus monticola*	68	64	5.0	3.1
PSME	*Pseudotsuga menziesii*	87	48	23.0	6.3
TSHE	*Tsuga heterophylla*	36	41	29.4	8.3
TSME	*Tsuga mertensiana*	81	96	20.6	9.0
Shrubs					
ARNE	*Arctostaphylos nevadensis*	48%		6.6	
BENE	*Berberis nervosa*	51%		3.4	
CACH	*Castanopsis chrysophylla*	57%		6.2	
CHUM	*Chimaphila umbellata*	92%		3.8	
PAMY	*Pachistima myrsinites*	43%		2.6	
ROGY	*Rosa gymnocarpa*	25%		0.8	
VAME	*Vaccinium membranaceum*	81%		7.6	
VASC	*Vaccinium scoparium*	31%		5.3	
Herbaceous					
GOOB	*Goodyera oblongifolia*	32%		0.9	
LIBO2	*Linnaea borealis*	100%		2.8	
PYPI	*Pyrola picta*	29%		1.0	
PYSE	*Pyrola secunda*	53%		1.4	
XETE	*Xerophyllum tenax*	63%		10.7	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

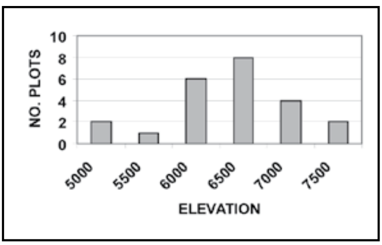
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
TSME/LIBO2							
ABAM	68	5	11	293	12	48	92
ABCO-ABGR	79	6	7	327	23	30	119
ABMAS	75	7	12	244	7	50	84
ABPR	90	10	4	384	15	63	157
PIMO	98	8	10	206	15	36	92
PSME	87	4	34	318	6	327	128
TSHE	85	4	10	373	9	125	145
TSME	58	4	15	282	8	154	76

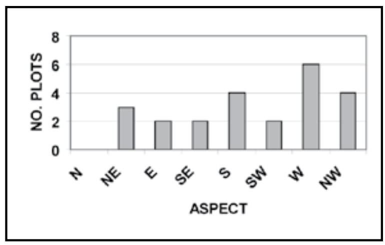
Relationships to Other Classifications— The wetter portions of TSME/XETE plant association described by Marsh et al. (1987) would key to TSME/LIBO2 in this classification.

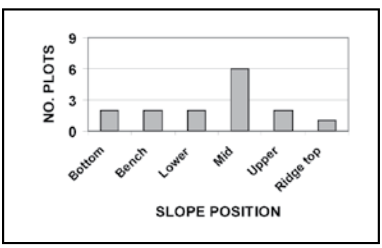
TSME/PHEM-VADE TSME Parkland

CMS313 (TSME/PHEM-VADE)
Tsuga mertensiana/Phyllodoce empetriformis-Vaccinium deliciosum
mountain hemlock/pink mountain heath-Cascade bilberry
Plots 23

Distribution and Environment— Sample plots in this plant association are located in cold moist sites usually in the transition zone between continuous forest and subalpine meadow. East slope occurrences are known from the vicinity of the Three Sisters and Mt. Jefferson. Average elevation is 5505 feet (range 4118-6810 feet). Average slope is 25% (range 0-90%). Many plot aspects were north facing.

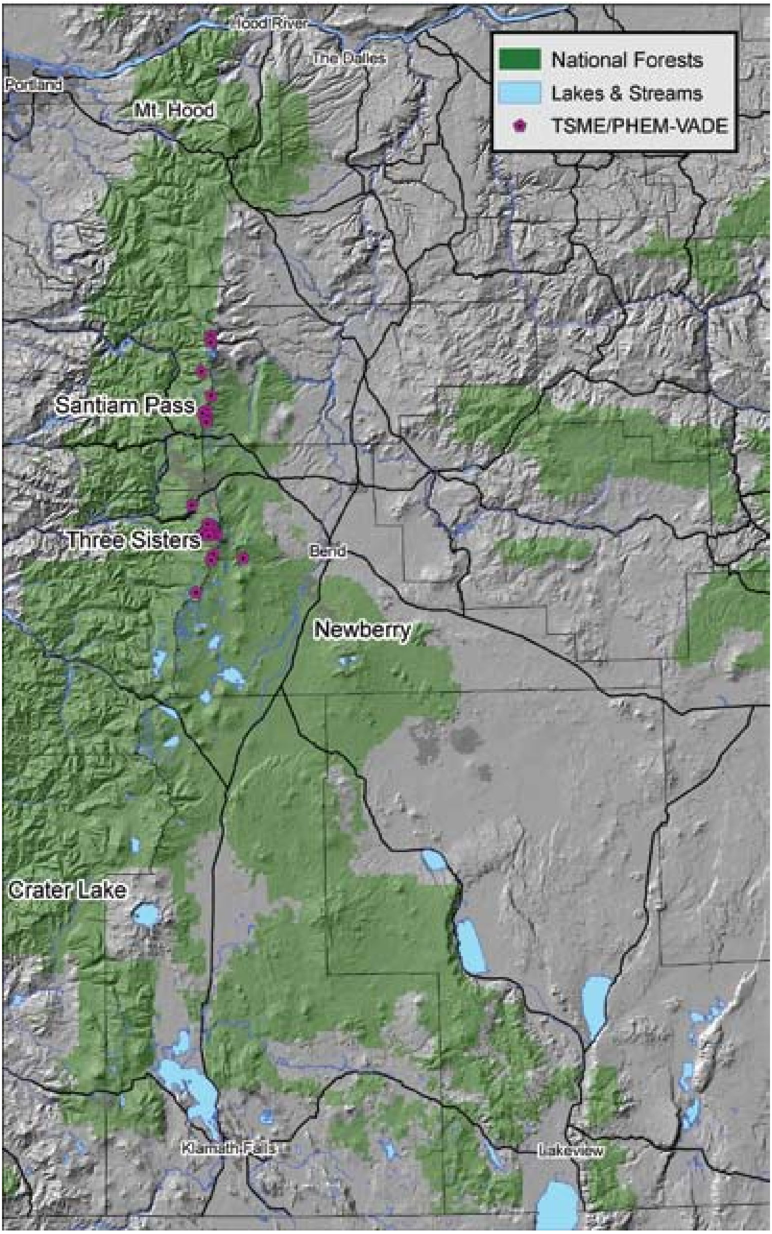






Mean Precip.	90.6”	71-105”
Mean Temp.	37.9°F	34-42°F

Figure 2-8. Map of TSME/PHEM-VADE Plot Distribution—



Vegetation— The overstory is dominated by TSME with ABAM or ABLA2 commonly present. The shrub layer is well developed. TSME/PHEM-VADE is a species-poor plant association. This association is generally too cold for PSME and ABCO-ABGR. Lodgepole pine and whitebark pine are the primary early seral conifers. Only partridgefoot (LUPE) and Hitchcock's woodrush (LUHI) have constancy values > 30% in the herbaceous layer.

Code	Species Latin name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABAM	*Abies amabilis*	26	35	14.5	10.8
ABLA2	*Abies lasiocarpa*	26	35	4.3	3.1
TSME	*Tsuga mertensiana*	74	83	32.3	4.0
Shrubs					
PHEM	*Phyllodoce empetriformis*	65%		9.0	
VADE	*Vaccinium deliciosum*	48%		9.2	
VAME	*Vaccinium membranaceum*	39%		15.3	
VASC	*Vaccinium scoparium*	48%		9.6	
Herbaceous					
LUPE	*Luetkea pectinata*	57%		3.7	
Graminoids					
LUHI	*Luzula hitchcockii*	35%		1.5	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

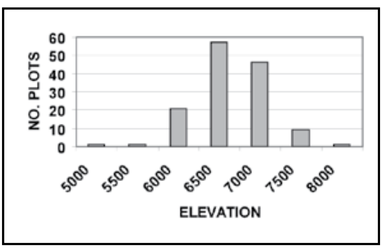
Data for this plant association is not available at this time. Productivity for this type will be similar to TSME/PHEM-VADE as described in NWO by McCain and Diaz (2002).

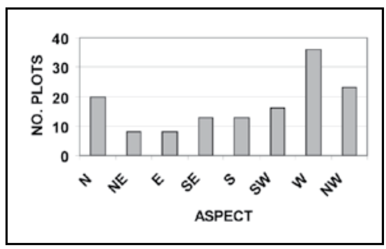
Relationships to Other Classifications— TSME/PHEM-VADE has been previously described in western Washington Cascades (Henderson et al. 1992 and Diaz et al. 1997), central Washington (Lillybridge et al. 1995), and northwest Oregon Cascades (McCain and Diaz 2002).

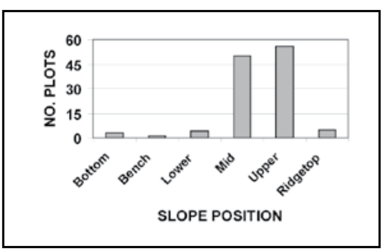
TSME/LUHI — TSME Parkland

CMG221 (TSME/LUGL2)
Tsuga mertensiana/Luzula hitchcockii
mountain hemlock/smooth woodrush
Plots 138

Distribution and Environment— TSME/LUHI is a common high elevation association. Sample plots occur from Sky Lakes Wilderness in the southern Oregon Cascades to Barlow Pass in the northern Oregon Cascades. Sample plots are especially common in the vicinity of Crater Lake and the Three Sisters. It occurs predominantly on west and north slopes at mid to upper slope positions. The type is often in areas where wind deposits snow from more exposed sites nearby. Average elevation is 6391feet (4780-7550 feet). Average slope is 18% (range 1-65%). Most plots were found on a western to northwestern aspect. The TSME/LUHI association grades into the TSME/PHEM-VADE type on more moist sites and into TSME/VASC, TSME/ARNE, or TSME/CAIN4 on drier sites.

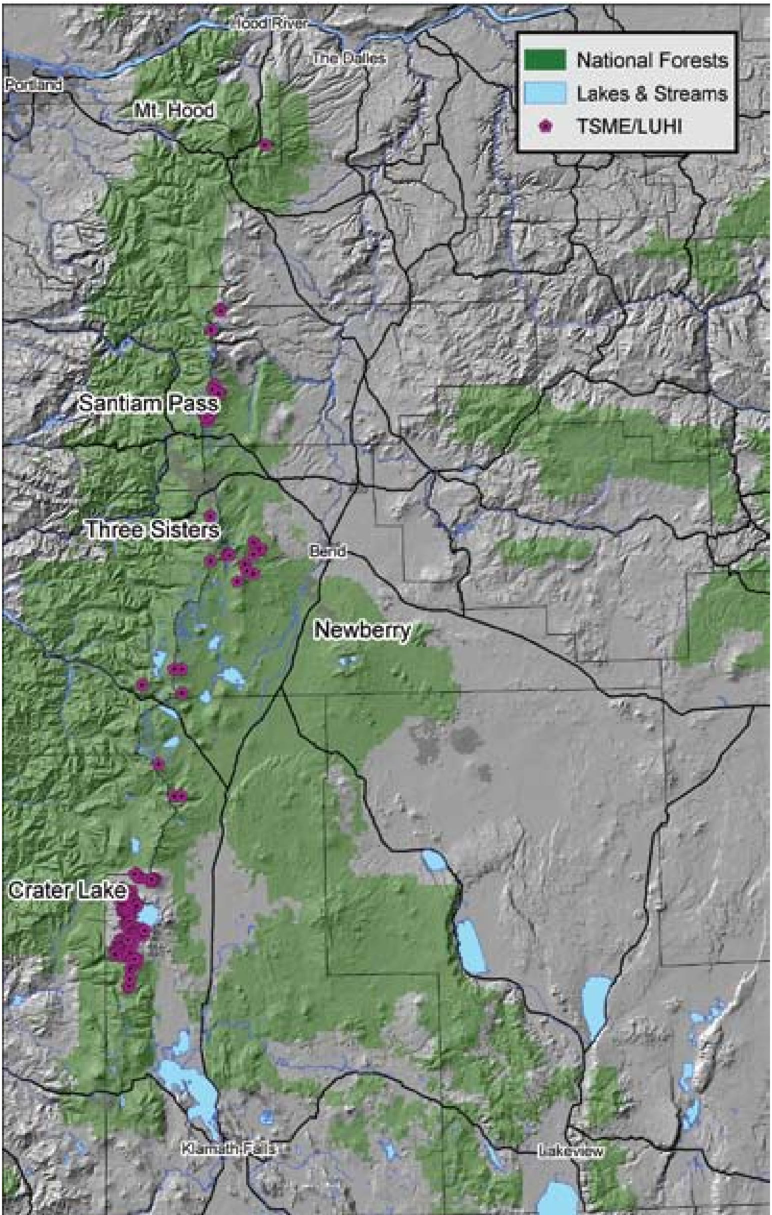






Mean Precip.	64.9”	41-105”
Mean Temp.	38.5°F	35-44°F

Figure 2-7. Map of TSME/LUHI Plot Distribution—



Vegetation— TSME/LUHI is a species-poor plant association. This association is generally too cold for PSME and ABCO-ABGR. Lodgepole pine is the primary early seral conifer. South of Lookout and Cultus Mountains on the Deschutes National Forest, Shasta red fir may be a significant species especially in the overstory tree layer. Only grouse whortleberry, sidebells pyrola, long-stolon sedge, and Hitchcock's woodrush have constancy values > 30% in the shrub and herbaceous layers. Long-stolon sedge and Hitchcock's woodrush dominate the herbaceous layer and locally grouse whortleberry may have significant cover values.

Code	Species Latin name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABLA2	*Abies lasiocarpa*	16	25	5.2	4.1
ABMAS	*Abies magnifica shastensis*	32	51	19.7	5.5
PICO	*Pinus contorta*	26	27	7.5	2.3
TSME	*Tsuga mertensiana*	93	96	42.4	12.8
Shrubs					
VASC	*Vaccinium scoparium*	34%		11.8	
Herbaceous					
PYSE	*Pyrola secunda*	40%		1.2	
Graminoids					
CAIN4	*Carex inops*	38%		3.1	
LUHI	*Luzula hitchcockii*	100%		14.7	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

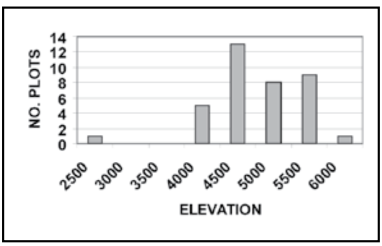
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
TSME/LUHI							
ABAM	55	5	9	320	23	39	81
TSME	45	2	68	359	7	392	75

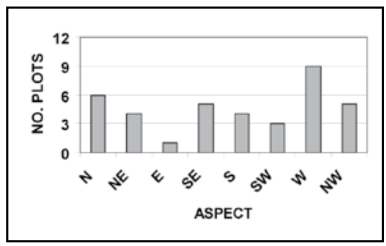
Relationships to Other Classifications— TSME/LUHI plant associations have been previously described in northern Idaho (Cooper et al. 1987), western Montana (Pfister et al. 1977), central Washington (Lillybridge et al. 1995), southwest Washington (Diaz et al. 1997), northwest Oregon (Logan et al. 1987, McCain and Diaz 2002).

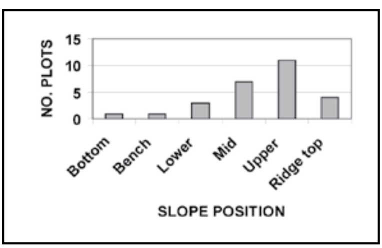
TSME/BENE — TSME Moist

CMF321 (TSME/MANE2)
Tsuga mertensiana/Berberis nervosa
mountain hemlock/Cascade Oregongrape
Plots 41

Distribution and Environment— TSME/BENE occurs in warmer well-drained sites in higher precipitation zones within the TSME Series. TSME/BENE is common on the Warm Springs Indian Reservation. It is known from the east slope of the Cascades as far south as Elk Lake on the Deschutes NF. Average elevation is 4529 feet (range 2400-5836 feet). Average slope is 22% (3-60%). Plot aspects varied. Adjacent warmer sites are generally ABAM or TSHE plant associations.

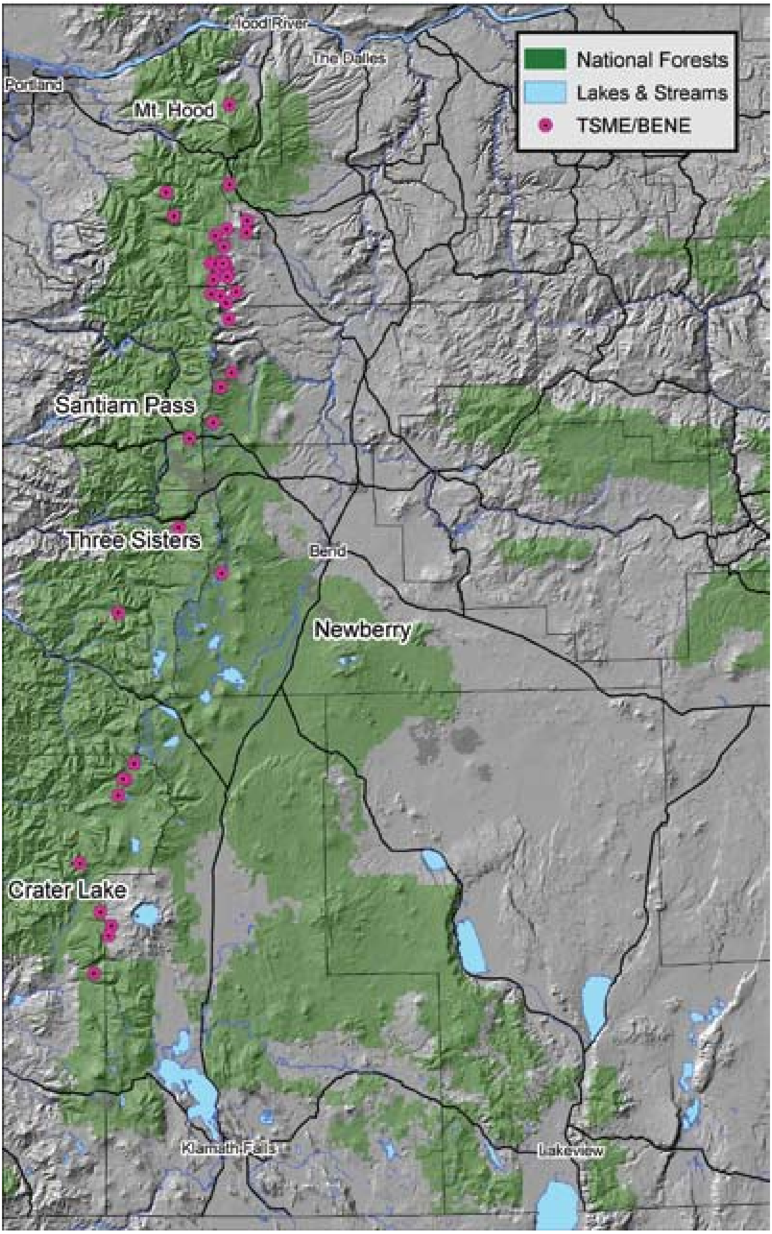






Mean Precip.	64.4”	39-105”
Mean Temp.	42.0°F	39-47°F

Figure 2-9. Map of TSME/BENE Plot Distribution—



Vegetation— Overstory tree layers are usually a mixture of silver fir, noble fir, lodgepole pine, Douglas-fir, western hemlock, and mountain hemlock. Conifer regeneration is typically dominated by silver fir and mountain hemlock. Late seral shrub layers are dominated by thinleaf huckleberry (VAME), Cascade Oregongrape (BENE), and common prince's pine (CHUM). Disturbance will favor greenleaf manzanita (ARPA), golden chinquapin (CACH), and Pacific rhododendron (RHMA). Herb layers are species poor and mesic species such as SMST, OSCH, DIHO, and GOOB are usually absent. Beargrass (XETE) is the most common herbaceous species.

Code	Species Latin name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABAM	*Abies amabilis*	41	51	11.6	7.3
ABPR	*Abies procera*	44	49	11.0	1.6
PICO	*Pinus contorta*	49	39	15.9	3.5
PIMO	*Pinus monticola*	66	61	4.6	2.2
PSME	*Pseudotsuga menziesii*	78	39	14.2	7.7
TSHE	*Tsuga heterophylla*	37	44	19.9	7.0
TSME	*Tsuga mertensiana*	83	100	26.5	6.6
Shrubs					
ARNE	*Arctostaphylos nevadensis*	34%		6.5	
BENE	*Berberis nervosa*	100%		1.7	
CACH	*Castanopsis chrysophylla*	59%		4.9	
CHUM	*Chimaphila umbellata*	80%		1.7	
PAMY	*Pachistima myrsinites*	51%		2.4	
RHMA	*Rhododendron macrophyllum*	39%		36.9	
VAME	*Vaccinium membranaceum*	80%		7.0	
VASC	*Vaccinium scoparium*	27%		13.0	
Herbaceous					
GOOB	*Goodyera oblongifolia*	29%		0.8	
PYPI	*Pyrola picta*	46%		1.0	
PYSE	*Pyrola secunda*	29%		1.0	
XETE	*Xerophyllum tenax*	63%		8.6	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
TSME/BENE							
ABAM	82	9	7	335	20	35	127
ABCO-ABGR	113	8	6	267	9	32	138
ABMAS	66	8	9	214	13	9	64
PICO	70	4	6	200	4	98	64
PIMO	99	6	7	245	24	8	111
PSME	61	4	8	292	18	44	82
TSHE	66	3	8	265	12	31	80
TSME	65	6	8	321	17	56	96

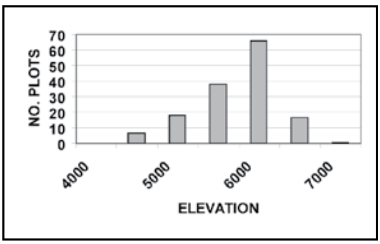
Relationships to Other Classifications— The TSME/BENE plant association has not been previously described. This plant association is closely related to warmer portions of the TSME/XETE plant association described for the Warm Springs Indian Reservation (Marsh et al. 1987), and portions of TSME/RHMA plant association described for the northwest Oregon Cascades (Diaz et al. 1997, McCain and Diaz 2002). It may also represent a cooler-drier version of the ABAM/BENE and ABAM/RHMA/BENE described for the northwest Oregon Cascades (McCain and Diaz 2002).

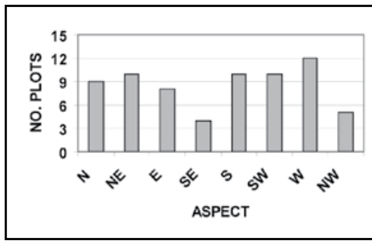
TSME/VAME

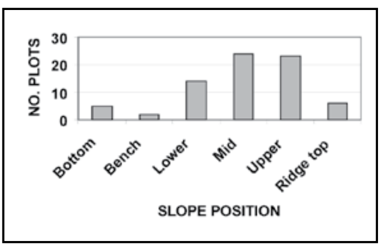
TSME Moist

CMS232 (TSME/VAME)
Tsuga mertensiana/Vaccinium membranaceum
mountain hemlock/thinleaf huckleberry
Plots 156

Distribution and Environment— TSME/VAME is usually found on lower to mid slopes. This widespread type is found from Mt. Hood south to the Sky Lakes Wilderness. Average elevation is 5540 feet (range 3586-6674 feet). Average slope is 23% (1-93%). Plot aspects varied.

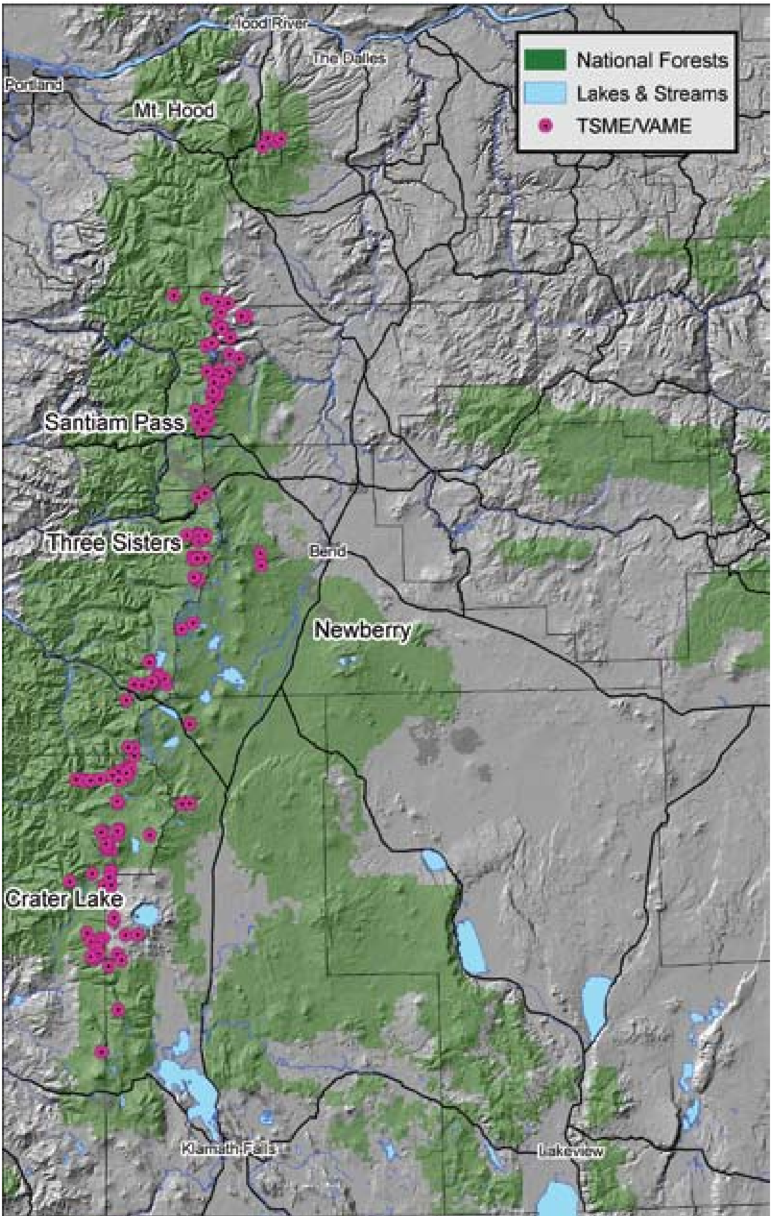






Mean Precip.	66.8”	31-97”
Mean Temp.	41.8°F	36-46°F

Figure 2-10. Map of TSME/VAME Plot Distribution—



Vegetation— TSME/VAME is a relatively species-poor association, only 9-10 species are typically found on an individual plot. Sites are apparently too cold for consistent occurrence of PSME or ABCO-ABGR. ABAM is a co-climax species where it occurs. PICO may occur on disturbed sites, but is not common.

Code	Species Latin name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABAM	*Abies amabilis*	47	59	22.7	13.6
ABLA2	*Abies lasiocarpa*	21	27	7.3	5.2
ABMAS	*Abies magnifica shastensis*	31	29	31.1	11.3
PIMO	*Pinus monticola*	26	29	6.0	2.3
TSME	*Tsuga mertensiana*	85	84	28.1	12.5
Shrubs					
CHUM	*Chimaphila umbellata*	38%		4.2	
VAME	*Vaccinium membranaceum*	100%		17.4	
VASC	*Vaccinium scoparium*	49%		12.5	
Herbaceous					
PYSE	*Pyrola secunda*	46%		1.8	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
TSME/VAME							
ABAM	56	2	27	269	6	180	69
ABMAS	90	4	25	325	27	27	134
PICO	71	8	7	236	40	7	77
PSME	73	8	8	257	24	25	87
TSME	53	2	66	268	4	409	65

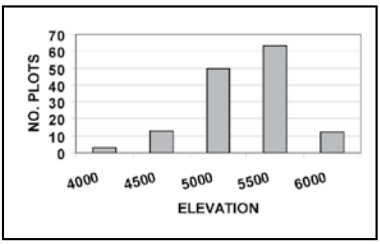
Relationships to Other Classifications— The TSME/VAME plant association has been previously described in central Washington (Lillybridge et al. 1995) and northeastern Oregon (Johnson and Simon 1987). The version of the type described here is defined more narrowly than the Wenatchee version and represents a drier variant. It lacks the Clintonia, Linnaea, and Chamaecyparis described by Lillybridge (1995).

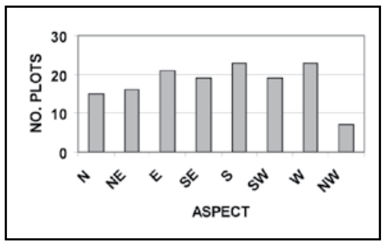
The TSME/VAME plant association is closely related to, but drier and cooler and less diverse than, the TSME/XETE and TSME/VAME/XETE associations.

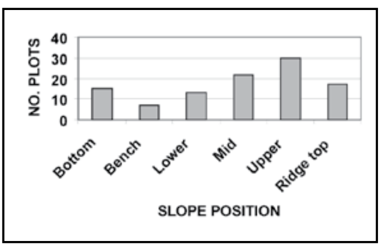
TSME/VAME/XETE — TSME Moist

CMS216 (TSME/VAME/XETE)
Tsuga mertensiana/Vaccinium membranaceum/Xerophyllum tenax
mountain hemlock/thinleaf huckleberry/common beargrass
Plots152

Distribution and Environment— Average elevation is 5027 feet (range 3600-6000 feet). Average slope is 16% (range 0-60%). Plots appear uniformly throughout all aspects except for notably few in the northwest aspect.

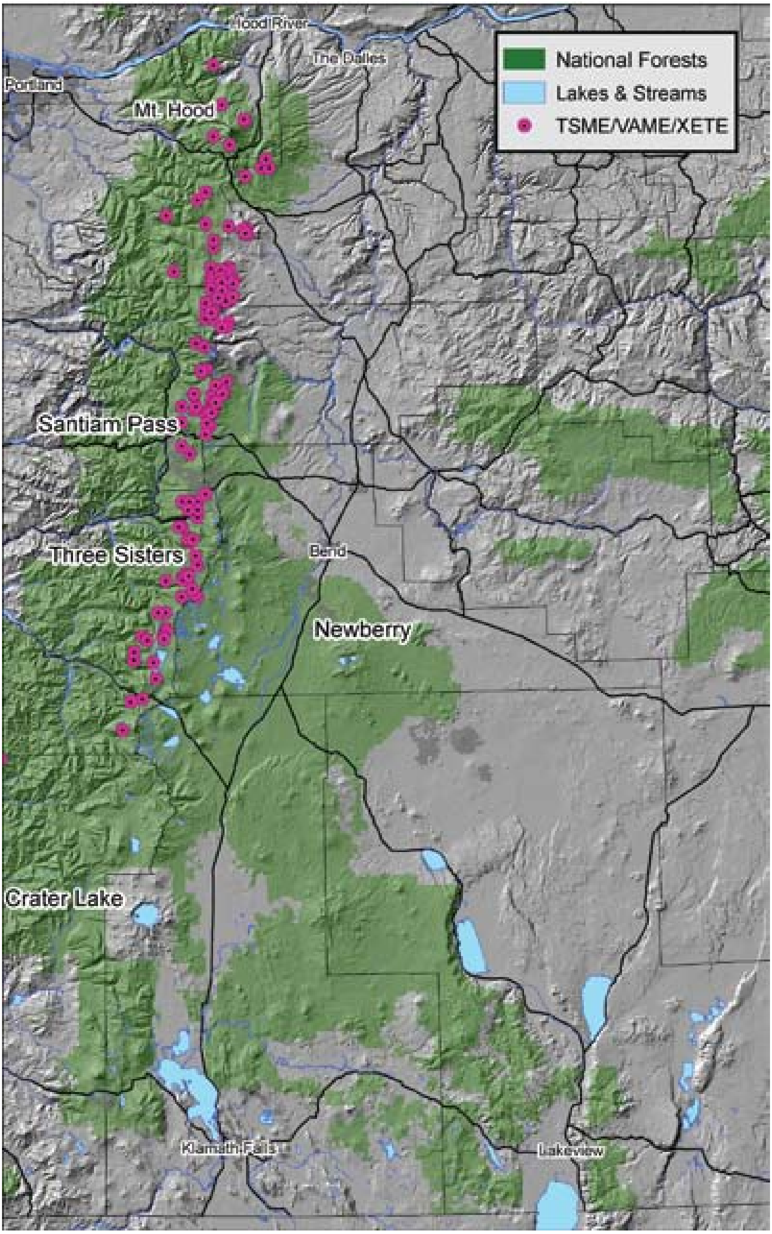






Mean Precip.	74.0”	43-117”
Mean Temp.	41.6°F	37-46°F

Figure 2-11. Map of TSME/VAME/XETE Plot Distribution—



Vegetation— TSME/VAME/XETE is a relatively species-poor association, only 13-14 species are typically found on an individual plot. ABAM is a co-climax species where it occurs. PICO may attain significant cover after disturbance and is the main early seral species in the tree layer. Sites are apparently too cold for ABCO-ABGR. Occurrence of ABCO-ABGR and PSME indicate warmer sites within the type and may be transitional to the ABCO-ABGR Series.

Code	Species Latin name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABAM	*Abies amabilis*	64	74	20.3	13.1
ABLA2	*Abies lasiocarpa*	38	43	6.6	5.4
ABPR	*Abies procera*	31	26	7.9	3.3
PICO	*Pinus contorta*	58	42	15.3	2.9
PIMO	*Pinus monticola*	49	45	3.9	2.4
PSME	*Pseudotsuga menziesii*	34	19	8.5	4.0
TSME	*Tsuga mertensiana*	95	86	30.3	8.1
Shrubs					
ARNE	*Arctostaphylos nevadensis*	31%		5.4	
CHUM	*Chimaphila umbellata*	56%		1.0	
VAME	*Vaccinium membranaceum*	100%		14.5	
VASC	*Vaccinium scoparium*	47%		13.4	
Herbaceous					
PYSE	*Pyrola secunda*	35%		1.2	
XETE	*Xerophyllum tenax*	100%		16.7	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
TSME/VAME/XETE							
ABAM	66	4	35	265	5	326	81
ABCO-ABGR	71	9	3	178	3	3	58
ABLA2	48	10	4	187	16	21	42
LAOC	73	13	3	323	27	9	109
PICO	61	3	17	178	7	172	50
PSME	81	3	18	256	14	72	95
TSHE	70	5	9	249	10	52	81
TSME	57	2	92	258	3	898	68

Relationships to Other Classifications— The TSME/VAME/XETE plant association has been previously described in northwest Oregon and southwest Washington (Hemstrom et al. 1982, McCain and Diaz 2002, Diaz et al. 1997).

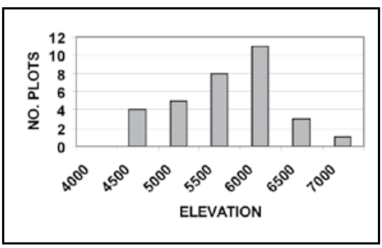
Similar associations have been described for the Warm Springs Indian Reservation (TSME/XETE, Marsh et al. 1987), eastside of the Washington Cascades (TSME/XETE-VAMY, Lillybridge et al. 1995), northern Idaho (TSME/XETE-VAGL, Cooper et al. 1987), and western Montana (TSME/XETE-VAGL, Pfister et al. 1977).

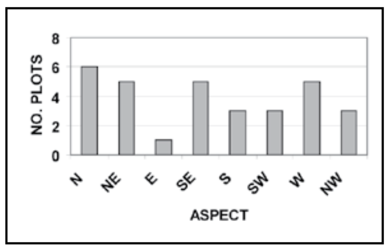
TSME/CACH

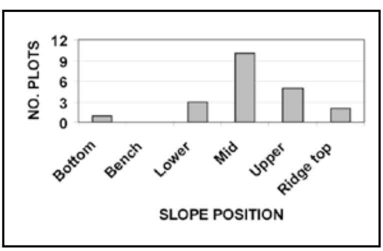
TSME Moist

CMS841 (TSME/CHCH7)
Tsuga mertensiana/Castanopsis chrysophylla
mountain hemlock/golden chinquapin
Plots 34

Distribution and Environment— TSME/CACH sample plots are common east of the Cascade Crest. They are found from the southern Klamath District on the Winema NF to the southern Deschutes NF with scattered locations north to Mt. Jefferson. TSME/CACH plant associations represent the warmest and lowest precipitation zones within the TSME Series. Adjacent warmer sites usually support ABMAS or ABCO-ABGR plant associations. Average elevation is 5365 feet (range 4066-6711 feet). Average slope is 27% (range 2-82%). Plot aspects varied, with notably few plots on east aspects.

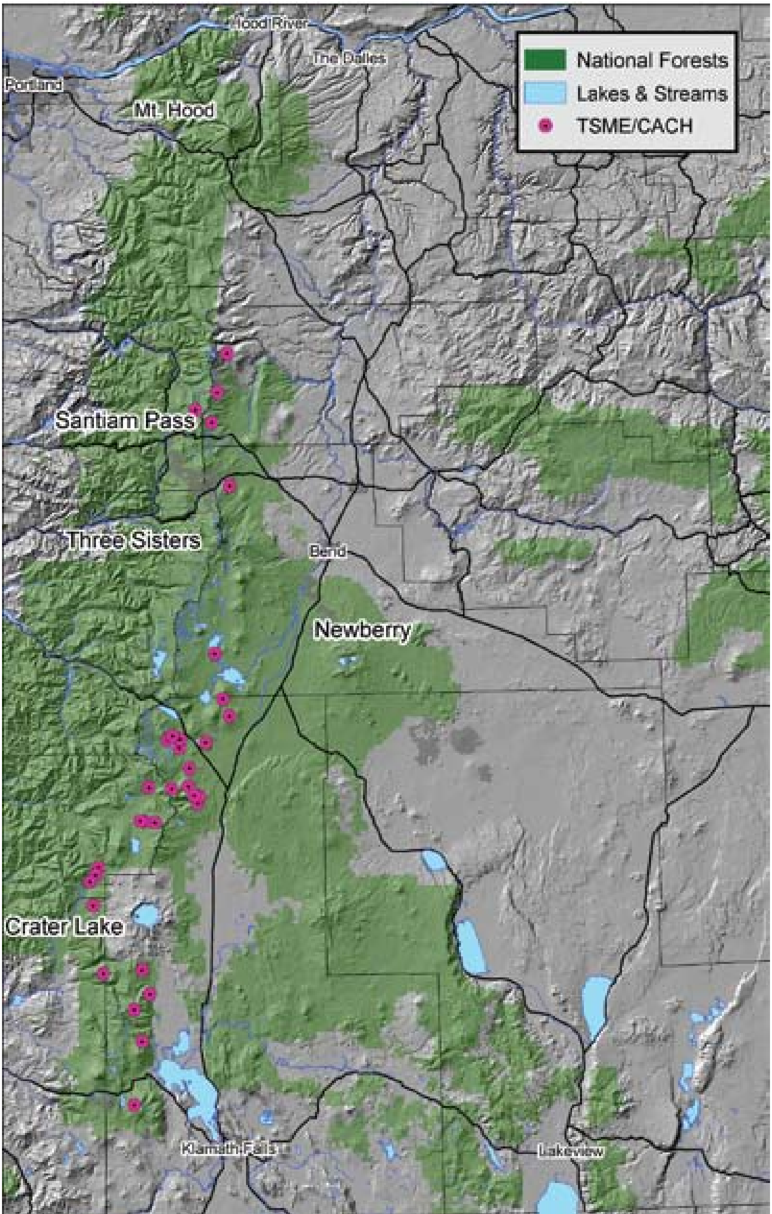






Mean Precip.	48.6”	31-83”
Mean Temp.	41.6°F	40-43°F

Figure 2-12. Map of TSME/CACH Plot Distribution—



Vegetation— Overstory tree layers are usually a mixture of white fir-grand fir, Shasta red fir, lodgepole pine, Douglas-fir, and mountain hemlock. Conifer regeneration is typically dominated by white fir-grand fir. Shrub layers are dominated by chinquapin (CACH), pinemat manzanita (ARNE), and greenleaf manzanita (ARPA). Constancy of ARNE is higher than the similar ABCO-ABGR/CACH association. Disturbance will favor greenleaf manzanita and snowbrush ceanothus. Herb layers are species poor and mesic species such as SMST, OSCH, DIHO, and GOOB are usually absent.

Code	Species Latin name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABCO	*Abies concolor*	44	53	18.1	18.2
ABMAS	*Abies magnifica shastensis*	68	74	19.6	9.5
PICO	*Pinus contorta*	50	50	10.6	4.4
PIMO	*Pinus monticola*	50	74	5.3	2.1
PIPO	*Pinus ponderosa*	32	12	3.7	1.5
PSME	*Pseudotsuga menziesii*	53	47	25.9	5.5
TSME	*Tsuga mertensiana*	62	88	9.2	7.4
Shrubs					
ARNE	*Arctostaphylos nevadensis*	79		9.7	
ARPA	*Arctostaphylos patula*	50		2.6	
CACH	*Castanopsis chrysophylla*	100		9.7	
CHUM	*Chimaphila umbellata*	68		5.3	
PAMY	*Pachistima myrsinites*	29		10.3	
VASC	*Vaccinium scoparium*	35		11.4	
Herbaceous					
PYSE	*Pyrola secunda*	53		1.0	
Graminoids					
CAIN4	*Carex inops*	56		0.9	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
TSME/CACH							
ABCO-ABGR	74	5	17	265	21	38	90
ABMAS	75	5	34	247	9	127	85
PIMO	79	15	6	199	16	23	72
PSME	81	5	17	206	10	43	77
TSME	52	5	13	210	8	62	50

Relationships to Other Classifications— The TSME/CACH plant association occupies the warmest – driest TSME Series sites on the eastside of the Oregon Cascades. It has not been previously described.

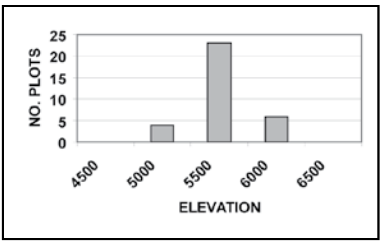
It contains warmer and wetter portions of the TSME-PICO/ARNE plant association described for the Warm Springs Indian Reservation (Marsh et al. 1987).

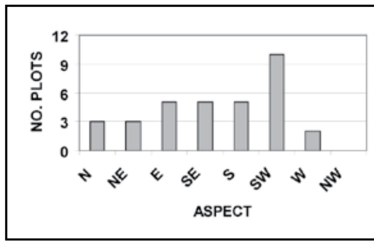
TSME/XETE

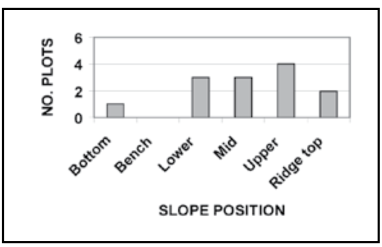
TSME Moist

CMF141 (TSME/XETE)
Tsuga mertensiana/Xerophyllum tenax
mountain hemlock/common beargrass
Plots 34

Distribution and Environment—TSME/XETE is a common plant association on the Sisters Ranger District of the Deschutes National Forest. It is occasionally found south to Willamette Pass. TSME/XETE is closely related to TSME/VAME/XETE and TSME/VAME. Average elevation is 5279 feet (range 4800-5920 feet). Average slope is 20% (range 2-60%). Most plots were found on a southern to southwestern aspect, with a notable absence of plots in the northwestern aspect.

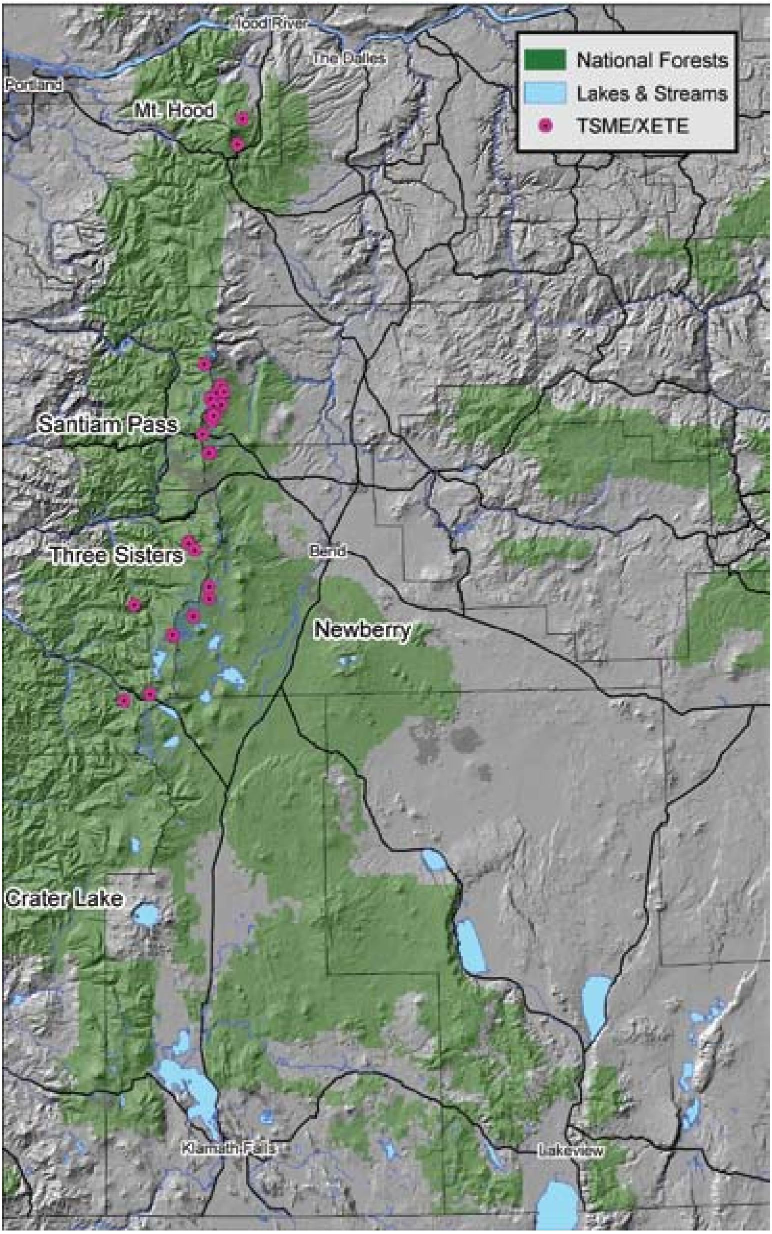






Mean Precip.	70.9”	51-117”
Mean Temp.	41.4°F	38-46°F

Figure 2-13. Map of TSME/XETE Plot Distribution—



Vegetation— Overstory tree layers occur as various mixtures of mountain hemlock, silver fir and subalpine fir. Mountain hemlock and silver fir (where it occurs) are the primary overstory dominants in late seral stands. Subalpine fir is a shorter-lived shade tolerant species that is eventually out-competed by mountain hemlock on these sites. Lodgepole pine can dominate sites after stand replacement fire. Lodgepole pine may be locally important within laminated root rot pockets. Understory vegetation is species poor. Depauperate understories are common under stands of TSME, ABAM, and ABLA2 with high canopy closure. Pinemat manzanita and beargrass are the only common understory species.

Code	Species Latin name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABAM	*Abies amabilis*	21	29	19.4	11.7
ABLA2	*Abies lasiocarpa*	65	62	12.0	11.7
PICO	*Pinus contorta*	68	38	25.9	3.5
TSME	*Tsuga mertensiana*	79	74	18.2	7.1
Shrubs					
ARNE	*Arctostaphylos nevadensis*	26		11.1	
Herbaceous					
XETE	*Xerophyllum tenax*	100		21.4	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
TSME/XETE							
ABLA2				271	31	15	79
PICO	76	3	18	197	33	14	69
TSME	70	5	12	318	18	46	103

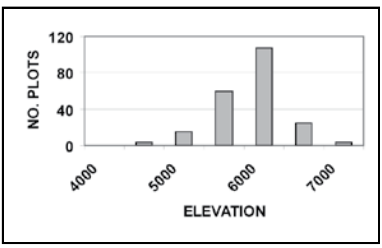
Relationships to Other Classifications— Similar associations have been described for the Warm Springs Indian Reservation (TSME/XETE, Marsh et al. 1987), eastside of the Washington Cascades (TSME/XETE-VAMY, Lillybridge et al. 1995), northern Idaho (TSME/XETE-VASC, Cooper et al. 1987), and western Montana (TSME/XETE-VASC, Pfister et al. 1977).

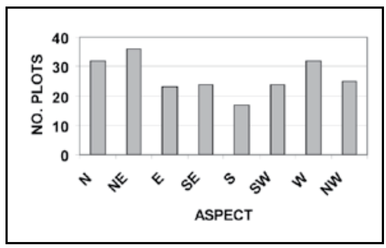
The TSME/VAME/XETE plant association has been previously described in northwest Oregon and southwest Washington (Hemstrom et al. 1982, McCain and Diaz 2002, Diaz et al. 1997).

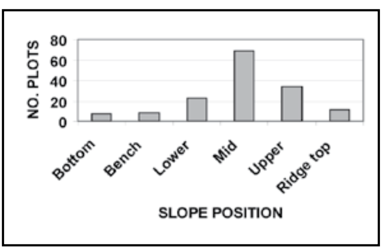
TSME/CHUM — TSME Moist

CMF331 (TSME/CHUM)
Tsuga mertensiana/Chimaphila umbellata
mountain hemlock/common prince's pine
Plots 236

Distribution and Environment— TSME/CHUM is predominantly a central and southern Oregon Cascade plant association. TSME/CHUM is essentially absent from deep Mazama pumice/ash deposits. This plant association occurs from Mt. Jefferson to the Mountain Lakes Wilderness on the Winema NF. North of Willamette Pass; it occurs predominantly east of the Cascade Crest. Average elevation is 5595 feet (range 4337-6740 feet). Average slope is 14% (range 0-80%). Plot aspect varied.

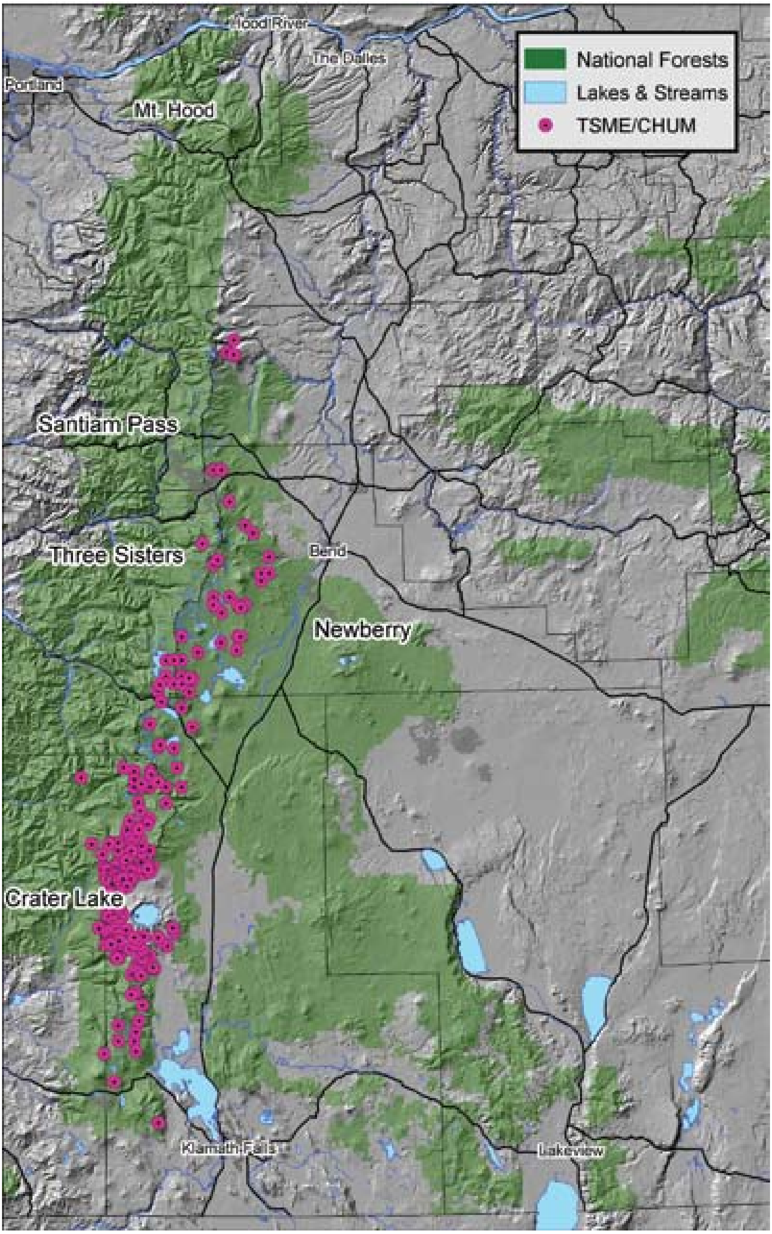






Mean Precip.	56.1”	31-89”
Mean Temp.	40.6°F	37-45°F

Figure 2-14. Map of TSME/CHUM Plot Distribution—



Vegetation—Mountain hemlock and Shasta red fir (south of Lookout Mountain on the Deschutes National Forest) are the primary overstory dominants in mid to late seral stands. Lodgepole pine can dominate sites after stand replacement fire. Western white pine and lodgepole pine may be locally important within laminated root rot pockets. Understory vegetation is species poor. Depauperate understories are common under stands of TSME, ABMAS, and ABCO-ABGR with high canopy closure.

Code	Species Latin name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABCO	*Abies concolor*	15	28	13.8	7.5
ABMAS	*Abies magnifica shastensis*	64	70	28.6	11.9
PICO	*Pinus contorta*	51	49	12.2	6.3
PIMO	*Pinus monticola*	42	54	5.0	2.1
TSME	*Tsuga mertensiana*	71	97	24.5	14.3
Shrubs					
ARNE	*Arctostaphylos nevadensis*	48%		4.4	
CHUM	*Chimaphila umbellata*	100%		2.5	
VASC	*Vaccinium scoparium*	47%		13.6	
Herbaceous					
PYSE	*Pyrola secunda*	60%		1.1	
Graminoids					
CAIN4	*Carex inops*	42%		1.6	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

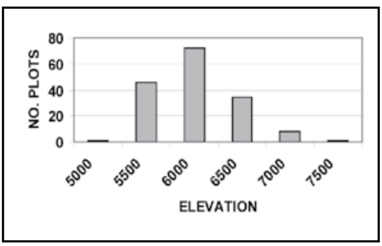
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
TSME/CHUM							
ABCO-ABGR	90	4	38	226	12	96	93
ABMAS	106	4	40	398	8	188	194
PICO	62	3	42	169	3	337	48
PIMO	77	4	13	172	14	38	61
PIPO	89	4	15	223	8	45	91
PSME	112	4	9	297	29	8	154
TSME	54	2	61	268	4	639	66

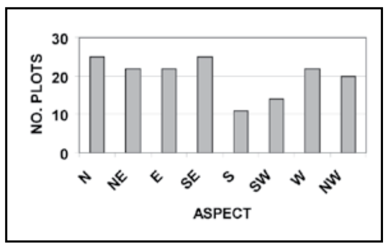
Relationships to Other Classifications— A TSME/CHUM plant association has not been previously described for the Pacific Northwest. The Southwest Oregon Ecology program (Atzet et al. 1996) has defined several associations with TSME as an important overstory species and CHUM as an important understory associate. TSME/ARNE/CHUM, TSME/VASC/CHUM, and ABMAS-TSME/ARNE/CHUM all have plots that may key to TSME/CHUM in this classification. The TSME/CHUM association as defined here has more effective moisture and is warmer than TSME/VASC or TSME/ARNE plots that do not have CHUM. Atzet et al. (1996) also describe TSME-ABMAS/VAME/CHUM which may have a few plots that key to TSME/CHUM here. TSME/CHUM as defined in this guide is likely slightly drier and cooler than TSME-ABMAS/VAME/CHUM.

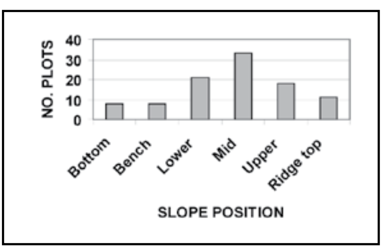
TSME/VASC — TSME Dry

CMS111 (TSME/VASC)
Tsuga mertensiana/Vaccinium scoparium
mountain hemlock/grouse whortleberry
Plots 173

Distribution and Environment— TSME/VASC plant associations are found on cold, very well drained sites. TSME/VASC is one of three plant associations in the TSME Series to occur east of the Cascade Mountains proper. TSME/VASC is more common east of the Crest than west of the crest. It is found from Sky Lakes Wilderness to Mt. Jefferson on both sides of the crest and on Newberry Crater. Average elevation is 5775 feet (range 4957-7200 feet). Average slope is 11% (range 0-70%). Plots appear uniformly throughout all aspects except for notably few in the southern aspect.

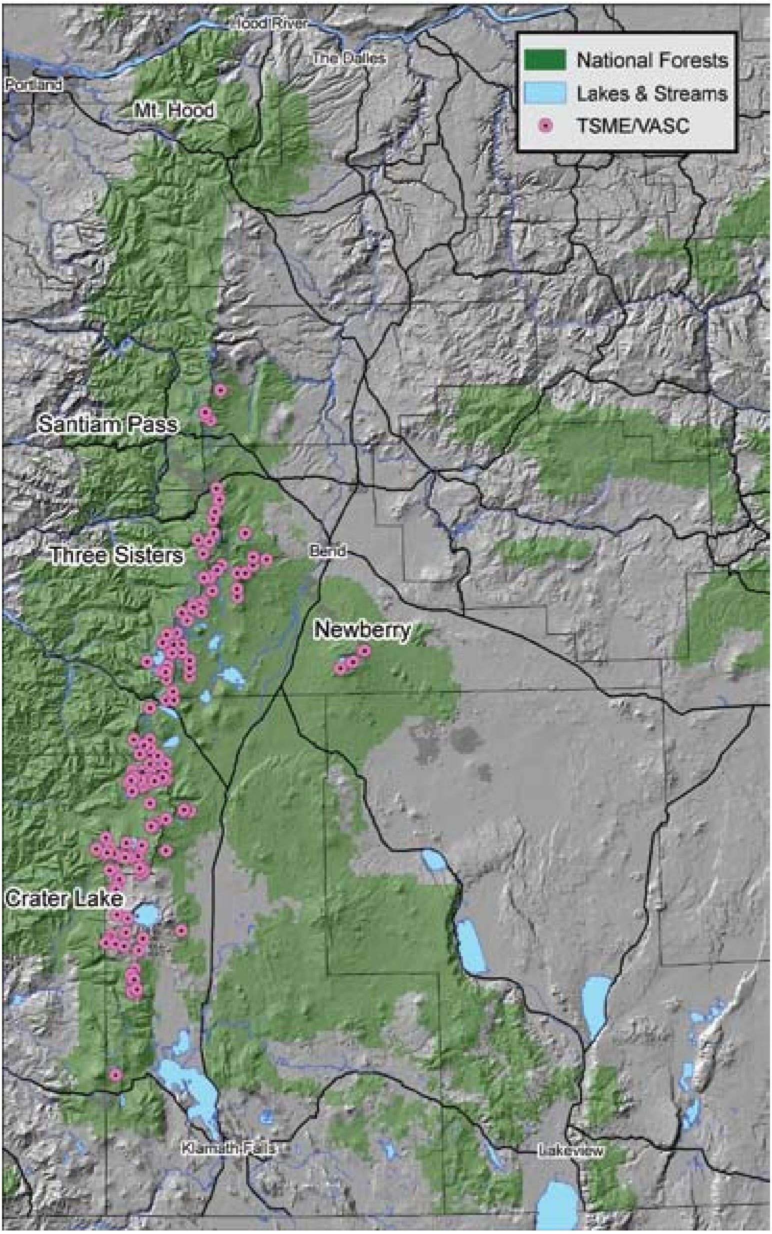






Mean Precip.	63.6”	23-109”
Mean Temp.	39.9°F	35-44°F

Figure 2-15. Map of TSME/VASC Plot Distribution—



Vegetation— TSME/VASC is a species-poor association. Lodgepole is the primary seral conifer. Silver fir is a co-climax species where it occurs. Shasta red fir may be an important seral species south of Lookout Mountain on the Deschutes National Forest. Lodgepole and white pines may be locally important in laminated root rot pockets. Understory vegetation is sparse; only ARNE, CAIN4, and VASC have constancies >25% and only VASC has average cover over 10%.

Code	Species Latin name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABAM	*Abies amabilis*	15	27	21.3	9.7
ABMAS	*Abies magnifica shastensis*	19	29	17.2	4.5
PICO	*Pinus contorta*	53	51	14.1	6.0
PIMO	*Pinus monticola*	30	39	4.7	1.6
TSME	*Tsuga mertensiana*	84	89	31.9	12.3
Shrubs					
ARNE	*Arctostaphylos nevadensis*	25%		3.9	
VASC	*Vaccinium scoparium*	100%		16.4	
Graminoids					
CAIN4	*Carex inops*	35%		1.0	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
TSME/VASC							
ABAM	52	4	27	254	7	140	65
ABLA2	61	4	8	208	20	16	58
PICO	63	2	74	137	4	168	40
PIMO	77	4	22	218	14	27	77
TSME	48	1	160	312	3	877	70

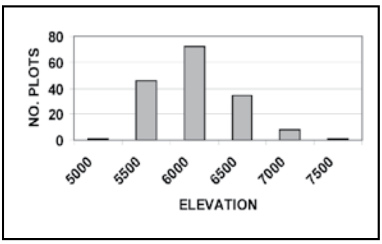
Relationships to Other Classifications— TSME/VASC plant associations have been widely described throughout the Pacific Northwest in areas that contain mountain hemlock. Pfister et al. (1977) and Cooper et al. (1987) both describe a TSME/XETE/VASC which has more effective moisture. In Washington, Franklin and Dyrness (1973) and Diaz et al. (1997) have described TSME/VASC associations in southwestern Washington. Lillybridge et al. (1995) describes a TSME/LUHI/VASC. All the Washington associations appear moister and more productive than the TSME/VASC described here. In Oregon, Hopkins (1979), Volland (1985), Johnson and Simon (1987), Hemstrom et al. (1982) and McCain and Diaz (2002) all describe a TSME/VASC association. The TSME/VASC associations described for the Wallowa Mountains, (Johnson and Simon 1987), southern Oregon (Hopkins 1979) and central Oregon (Volland 1985) fit this type reasonably well. The TSME/VASC associations described for northwestern Oregon (Hemstrom et al. 1982, McCain and Diaz 2002) may have a few plots that would key well here, however they appear to have more effective moisture and are more closely related to the southwest Washington types described by Franklin and Dyrness (1973) and Diaz et al. (1997).

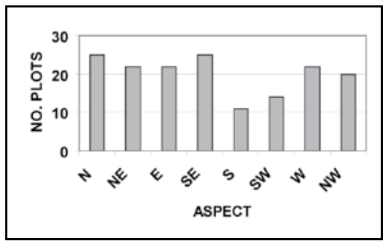
TSME/ARNE

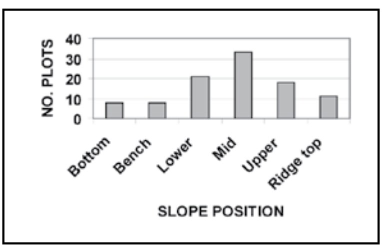
TSME Dry

CMS117 (TSME/ARNE)
Tsuga mertensiana/Arctostaphylos nevadensis
mountain hemlock/pinemat manzanita
Plots 91

Distribution and Environment— TSME/ARNE is found in cold, extremely well-drained sites. Average elevation is 5784 feet (range 3792-7100 feet). Average slope is 18% (range 0-75%). Most plots were found on a southern to eastern aspect, with notably few in the northwest aspect. Slope positions are typically mid- to upper-slopes.

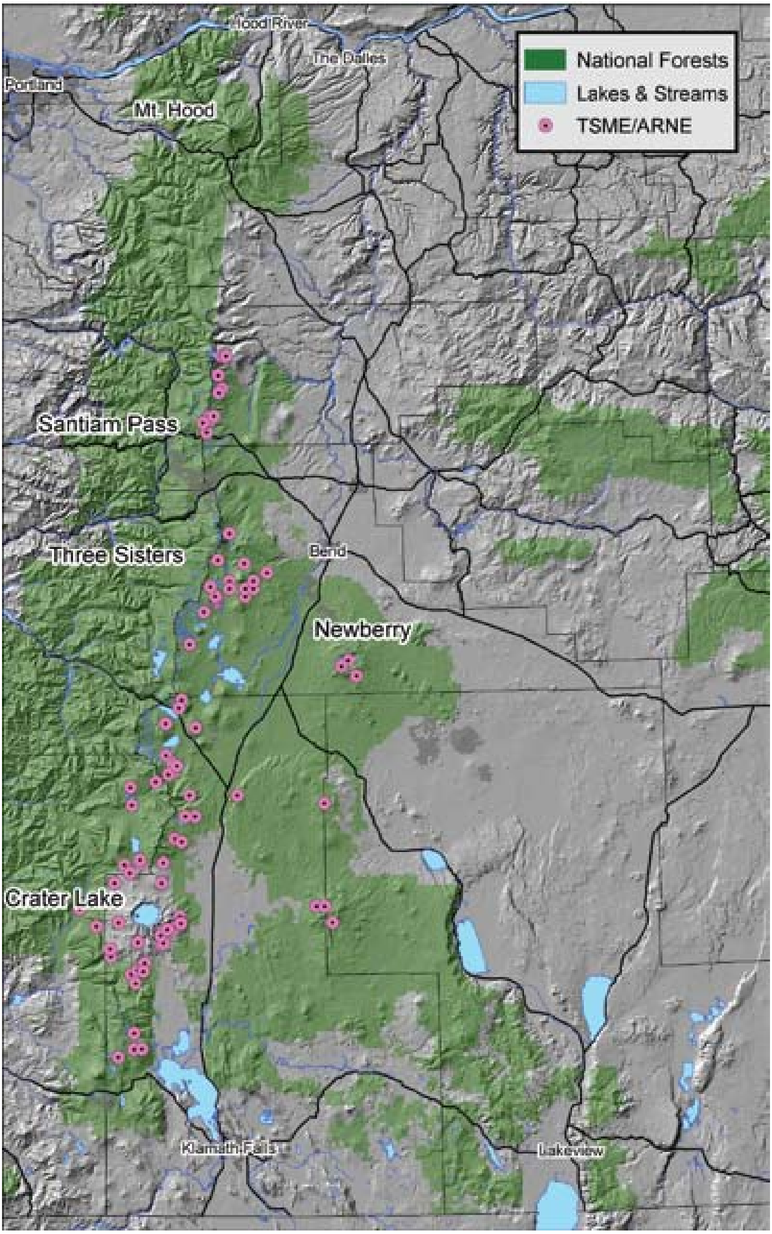






Mean Precip	54.7”	25-89”
Mean Temp.	40.3°F	35-44°F

Figure 2-16. Map of TSME/ARNE Plot Distribution—



Vegetation— Mountain hemlock and Shasta red fir (south of Lookout Mountain on the Deschutes National Forest) are the primary overstory dominants in mid to late seral stands. Lodgepole pine can dominate sites after stand replacement fire. Western white pine and lodgepole pine may be locally important within laminated root rot pockets. Pinemat manzanita dominates a species poor understory.

Code	Species Latin name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABMAS	*Abies magnifica shastensis*	44	45	23.1	5.6
PICO	*Pinus contorta*	73	70	14.3	10.1
PIMO	*Pinus monticola*	56	57	5.1	2.3
TSME	*Tsuga mertensiana*	77	76	14.3	6.6
Shrubs					
ARNE	*Arctostaphylos nevadensis*	100%		8.6	
ARPA	*Arctostaphylos patula*	37%		3.1	
Graminoids					
CAIN4	*Carex inops*	49%		3.7	
CARO	*Carex rossii*	32%		0.4	
STOC	*Stipa occidentalis*	26%		0.5	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

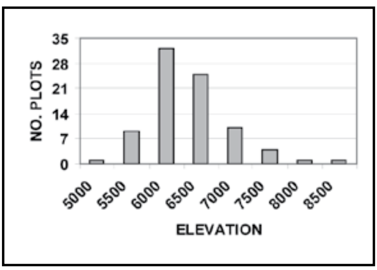
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
TSME/ARNE							
ABCO-ABGR	68	6	3	153	10	40	48
ABMAS	75	4	31	295	13	108	102
PICO	54	3	38	122	4	261	31
PIMO	60	6	12	165	8	50	46
TSME	46	2	25	216	5	217	46

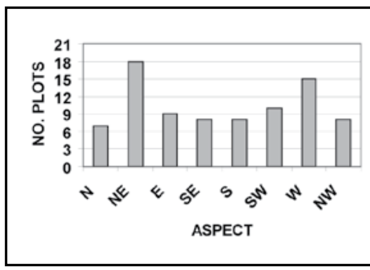
Relationships to Other Classifications— TSME/ARNE has been previously described in the northwest Oregon Cascades (McCain and Diaz 2002). The TSME/ARNE type described for northwest Oregon is generally moister than conditions described here. Much of the TSME-PICO/ARNE described for the Warm Springs Indian Reservation (Marsh et al. 1987) fits this type. Cooler portions of the Mixed Conifer / Manzanita association described by Volland (1985) also are included in this plant association. In southern Oregon, Hopkins (1979b) described a ABMAS-TSME/ARNE/CAIN4 association and Atzet et al. (1996) described TSME/ARNE/CHUM which fit this type in part. Drier portions of both associations that have >1% prince's pine (CHUM) will key here.

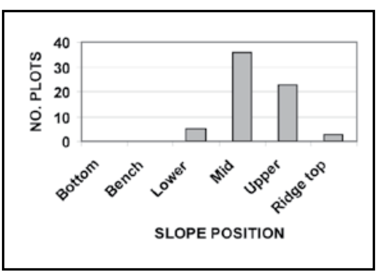
TSME/CAIN4 TSME Dry

CMG341 (TSME/CAIN9)
Tsuga mertensiana/Carex inops
mountain hemlock/long-stolon sedge
Plots 91s

Distribution and Environment— TSME/CAIN4 is a high elevation central and southern Oregon Cascades plant association with excessive drainage. TSME/CAIN4 is primarily found in or adjacent to the Three Sisters Wilderness, Crater Lake National Park in the Cascades proper and Newberry Crater and Yamsey Mountain east of the Cascade Mountains. Typically TSME/CAIN4 occurs on mid to upper slope positions. Average elevation is 6108 feet (range 5000-8100 feet). Average slope is 11% (range 0-58%). Plot aspects varied. Northeast to west aspects are most common.

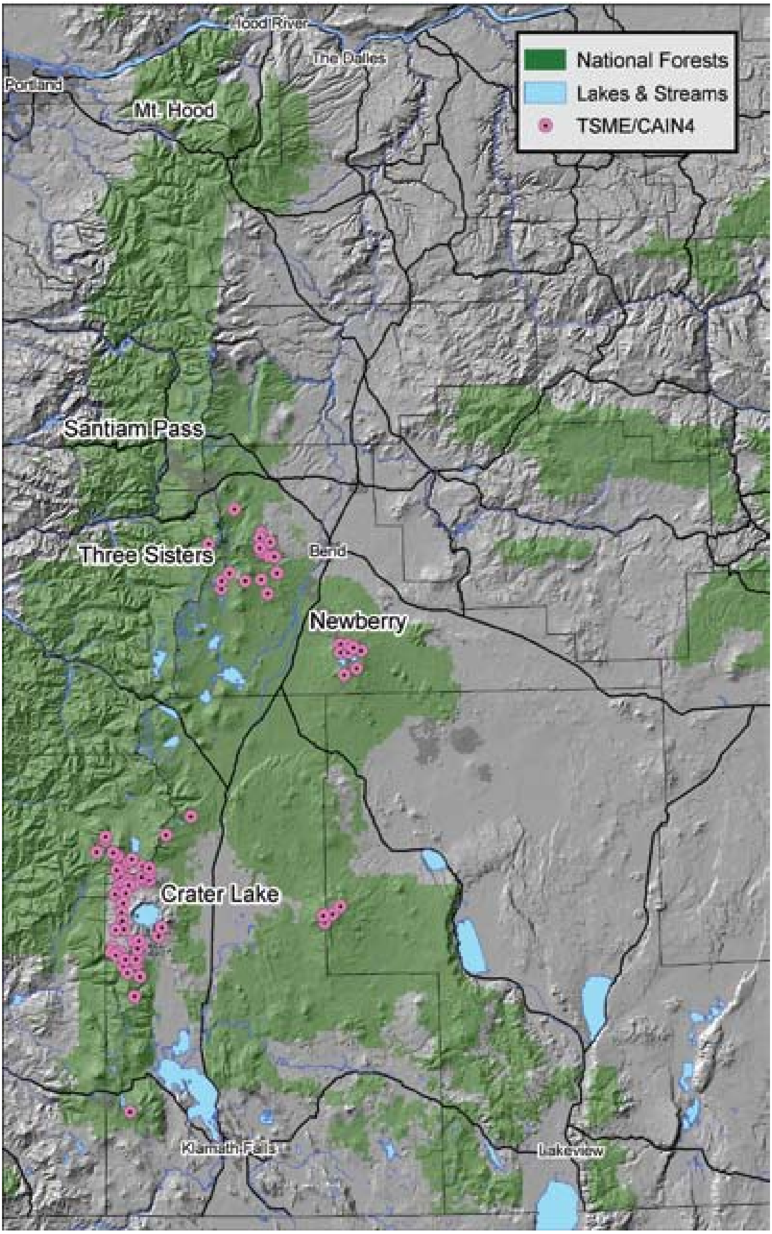






Mean Precip.	52.5”	27-93”
Mean Temp.	39.6°F	36-44°F

Figure 2-17. Map of TSME/CAIN4 Plot Distribution—



Vegetation— Only mountain hemlock, Shasta red fir, and lodgepole pine have constancies >20%. Lodgepole pine is the most important shade intolerant conifer. Environments in the TSME/CAIN4 plant association appear too cold and perhaps too dry for Douglas-fir, white fir-grand fir, and ponderosa pine. Colder portions of the association may have as much as 10% cover of whitebark pine. Wetter portions of the association may have minor amounts of western white pine. Understory vegetation is sparse, shrubs are almost non-existent and herbaceous plants have low cover (<10%).

Code	Species Latin name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABMAS	*Abies magnifica shastensis*	44	58	23.3	6.6
PICO	*Pinus contorta*	70	69	21.2	14.1
TSME	*Tsuga mertensiana*	69	97	26.7	10.2
Graminoids					
CAIN4	*Carex inops*	78%		4.0	
CAREX	*Carex spp.*	23%		4.6	
STOC	*Stipa occidentalis*	24%		1.0	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
TSME/CAIN4							
PICO	57	2	57	146	4	201	39
TSME	51	8	9	290	7	241	68

Relationships to Other Classifications— The TSME/CAIN4 plant association has not been described before. Hopkins (1979b) described a ABMAS-TSME/ARNE/CAIN4 association for the Klamath Ranger District that is closely related. TSME/CAIN4 is colder and somewhat drier (more excessively drained) than the ABMAS-TSME/ARNE/CAIN4 defined by Hopkins.

Silver Fir Series

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SILVER FIR SERIES

ABAM
Abies amabilis
Pacific silver fir
Total Plots 588

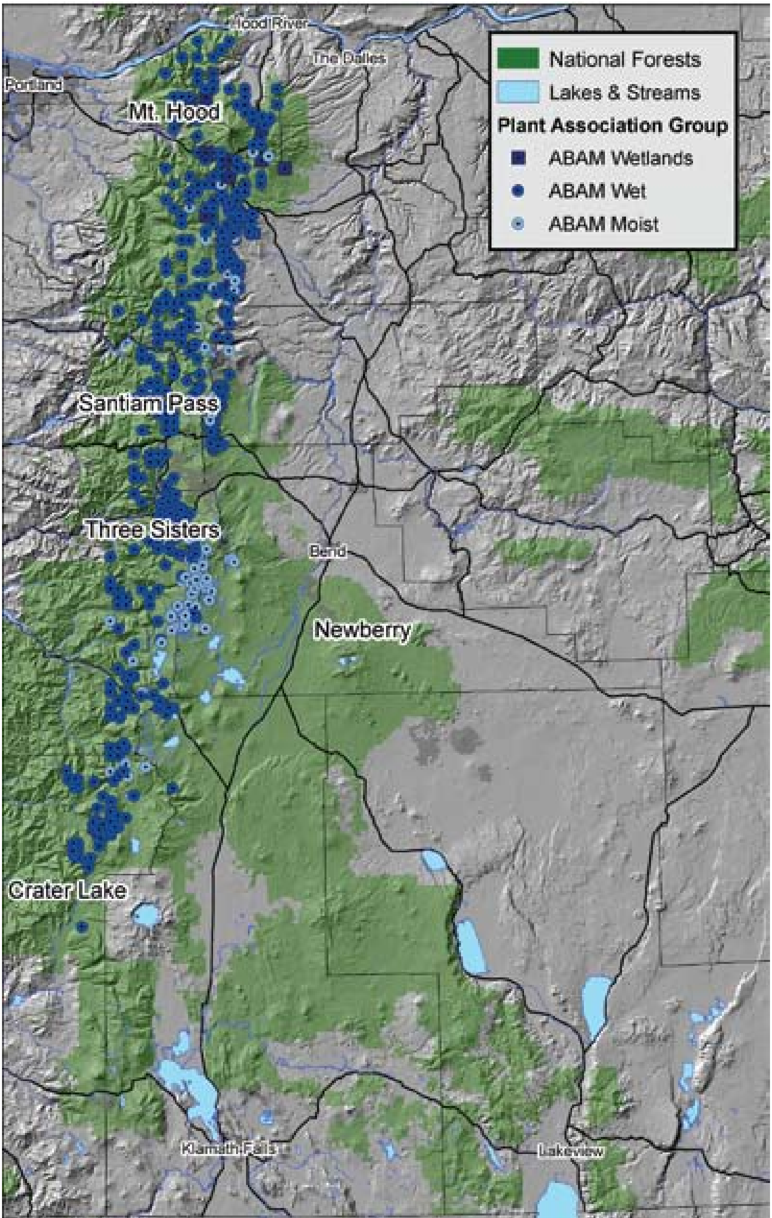
Distribution and Environment— Pacific silver fir is one of the most shade-tolerant and environmentally restricted conifers on the east slope of the Oregon Cascades. East of the Cascade Crest, it is found only in areas of strong maritime climatic influence, usually within a few miles of the Crest. The series is found on sites that rarely, if ever, experience soil drought. Snowpacks are high and temperatures are cool to cold, but sites rarely experience intense, long-lasting cold temperatures below 0°F. Mean annual precipitation averages 72" and mean annual temperature averages 43°F for plot locations in the Silver Fir Series.

Pacific silver fir is more abundant and widespread on suitable sites west of the Cascade Crest than it is on the eastern slopes. Mountain hemlock is an accidental species in the series. The Pacific Silver Fir Series includes all forest stands potentially dominated at climax by silver fir, unless mountain hemlock has the potential to have over 10% cover. In the Oregon Cascades, mountain hemlock and Pacific silver fir broadly overlap in their ecological distribution as far south as the Rogue-Umpqua divide on the west slope and Little Deschutes Canyon on the east slope, so distinguishing between the two Series can be difficult. If mountain hemlock can maintain at least 10% cover in later successional stands, those sites are considered part of the Mountain Hemlock Series.

Pacific silver fir climax sites are more moderate than those in the Mountain Hemlock Series. Most sites are over 4000 feet, but stands of Pacific silver fir may follow cold air down valley bottoms to as low as 2200 feet. The Series is normally bounded, on cooler sites with deeper snowpacks, by the Mountain Hemlock Series. Warmer, less snowy sites support the Western Hemlock Series or the White Fir-Grand Fir Series.

Vegetation— Because of its superior shade tolerance, Pacific silver fir is often the most abundant species in the tree regeneration layer in mixed species stands. Some Pacific silver firs less than 10 feet tall are often 50 or more years old. Pacific silver fir can persist in the understory for years and then respond to canopy openings from windfall or the death of taller trees. Very old Pacific silver fir stands (>300 years) are rare on the east slope of the Oregon Cascades because of fire and other forms of disturbance, including wind, avalanches, and disease. Only 15% of sampled ABAM trees are greater than 200 years old. The largest Pacific silver firs in the sample stands are often more than 100 years younger than associated western hemlocks and Douglas-firs. Pacific silver fir dominates the regeneration layers on these sites but is more prone to diseases than western hemlock and Douglas-fir.

Figure 3-1. Map of ABAM Series PAG Distribution—



Common tree species in the Pacific Silver Fir Series include western hemlock, western red cedar, subalpine fir, Douglas-fir, western larch, western white pine, noble fir, Shasta red fir, lodgepole pine, and Engelmann spruce. The seral role of each species varies from association to association. For example, western hemlock is more important on warmer sites (ABAM/ASCA3 and ABAM/ACTR) and noble fir and western larch are only components of some associations north of Santiam Pass. On warm deforested sites, Pacific silver fir may require establishment of a tree canopy by another species, such as western hemlock, western white pine, white fir-grand fir or Douglas-fir, before it can successfully establish. As forest canopies develop after disturbance, the interior of the stands becomes cooler, and Pacific silver fir gains a competitive advantage over the equally shade tolerant western hemlock.

Mature stands characteristically have two or more tree canopy layers, with species such as Douglas-fir, noble fir, and western larch forming a tall, emergent canopy above a layer made up of more shade-tolerant and slower-growing species such as Pacific silver fir, western hemlock, and white fir-grand fir.

The shrub and herb layers are floristically rich and varied, but heavily shaded stands are characterized by very low understory plant cover (depauperate). Very dense canopies, deep litter layers and low light levels at the forest floor all appear to reduce the number and amounts of shrubs and herbs. In very dense stands with very low cover of understory species, inspection of adjacent, more open stands or use of relative cover may be needed to identify the type.

The plant associations have been further grouped into plant association groups (PAGs) which reflect effective temperature-precipitation zones. ABAM Wetlands consists of ABAM/LYAM; ABAM Wet consists of ABAM/ASCA3, ABAM/CLUN, ABAM/ACTR, and ABAM/LIBO2; ABAM Moist consists of ABAM/VAME/XETE, ABAM/VAME, and ABAM/VASC. Species diversity and site productivity decline as the plant associations change from warm to cold and wet to moist within the series.

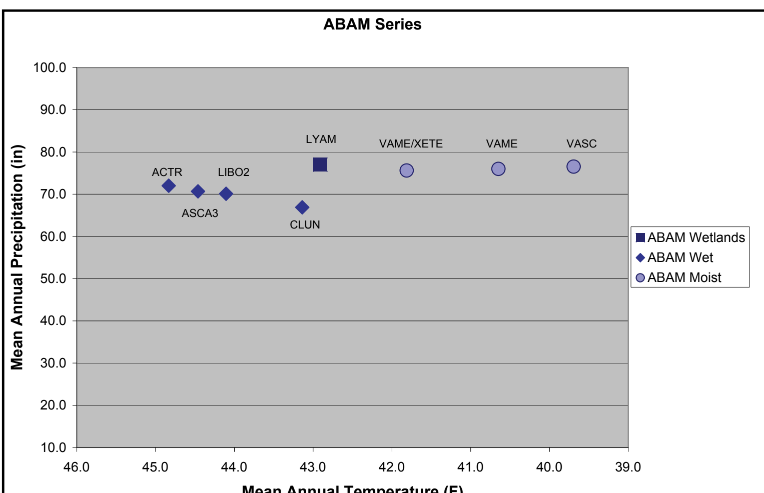
The ABAM Wetlands PAG (ABAM/LYAM) represents the wettest environments that support forested vegetation in the Oregon Cascades. ABAM/LYAM associations are often adjacent to riparian areas or other wet, poorly-drained sites.

ABAM Wet PAG plant associations typically have herb-rich understory vegetation. These types represent warm-moderate environments and the most productive sites in the ABAM Series. The shrub layer is variable; the most common species is VAME. Diverse shrub layers often form after disturbance. Douglas-fir is often a significant component of overstory canopies and is a primary early seral conifer.

The ABAM Moist PAG represents cold, dry environments within the ABAM Series. Although mean annual precipitation is equal to or greater than the ABAM Wet or ABAM Wetlands PAGs, effective moisture is considerably less in these types due to excessive soil drainage. Plant associations in this group are extremely species poor. The only herbaceous species with high cover is XETE. These associations are generally too cold for Douglas-fir and white fir-grand fir.

Fire— In spite of the cool, wet climate characteristic of the series, fire has played a major role in the development of all sample stands. Tree age samples indicate that fire return intervals are normally less than 200 years on all but the wettest sites (ABAM Wetlands). Simon (1991) reported fire return intervals averaging <138 years for silver fir sites in the Mt. Jefferson Wilderness. The increase in fire frequency within the

Figure 3-2. Temperature – Precipitation Relationships for Plant Associations and Plant Association Groups within the ABAM Series.



ABAM Series on the eastside of the Cascade Mountains compared to sites west of the Cascade Crest may be due to the spatial distribution of the Series and it's adjacency to ABCO-ABGR Series sites.

Fire exclusion is believed to have had little or no impact on fire occurrence or successional dynamics in the Pacific silver fir zone. Prolonged regional drought in combination with fuel loadings are the main drivers of fire occurrence in this higher elevation zone. Regional drought is associated with the interactions between the El Nino Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO); recent studies indicate that the Atlantic Multidecadal Oscillation may also be important. These climate drivers tend to create regional droughts on a 30-40 year period, producing fire episodes that affect different parts of the entire Cascade Range, depending on storm tracks in a given year or period of years. The Columbia River Gorge also modifies climate patterns as far south as 45º latitude, affecting the presence of typical westside and eastside species and fire return intervals. Thus conditions tend to be drier and fire return intervals tend to be shorter south of 45º latitude than north of this latitude. Regardless, fires are usually stand-replacing with greater than 75% mortality in the overstory, placing this group in Fire Regime IV or Fire Regime V.

Stands believed to be most prone to ignition tend to be characterized by two or more tree canopy layers and high surface fuel loadings. Often an insect or disease outbreak actually creates the initial mortality, opening the stand and creating overall drier conditions (increased winds at the surface, higher surface fuel temperatures and lower surface relative humidity), increasing fuel loadings and promoting the development of extensive ladder fuels. Fire exclusion may have reduced the incidence of smaller fires that would have also interacted with insects and disease to increase overall ignitability based on evidence in the northern Rockies. However, the higher elevations of the Cascades tend to be warmer and wetter than the northern Rockies, so the role of smaller fires is not as well understood.

Productivity and Management— Site index (SI), growth basal area (GBA), and yield capability (Ft^3) summaries by species and plant association group are displayed in Table 3-1.

Sites are very productive. Cool average annual temperatures and heavy snowpacks are the main limitations to tree growth. Site index values for

Pacific silver fir ranged from 60 to 113 (base 100). The most productive sites appear to be ABAM/LYAM, ABAM/ASCA3, and ABAM/CLUN; while the least productive are ABAM/VAME/XETE, ABAM/VAME, and ABAM/VASC (Appendix C). Note that basal areas approach or exceed 400 sq. ft/acre on most sites. Douglas-fir is not well suited to the colder associations such as ABAM/VASC, ABAM/VAME, and ABAM/VAME/XETE. Although ponderosa pine occasionally occurs (<5% constancy) on Pacific silver fir sites, the species is not suited to the environmental conditions representative of the Pacific Silver Fir Series.

Dense shrubfields often typify early successional stages after logging, fire, or other disturbance within the series, especially on ABAM/CLUN and ABAM/LIBO2 sites. Although the development of shrubfields may initially appear detrimental to conifer establishment and early growth, the ecologic role of the shrub-dominated stage of succession may have benefits over longer time frames. Shrubs provide shade for conifers and add organic matter to the soil; and species such as *Ceanothus*, alders, and red elderberry fix nitrogen. Further, many shrubs provide important forage and cover for insectivorous wildlife, which also influence stand health and vigor. Common shrubfield species include vine maple, Douglas maple, Scouler willow, pachistima, big huckleberry, golden chinquipin, Sitka alder, and snowbrush ceanothus.

Shrub size and twig production often peak between 10 and 15 years after disturbance. Shade from residual trees can inhibit shrubfield development. Therefore, seed tree and shelterwood treatments should have significantly less shrub development than clearcuts. Late summer and fall broadcast burning in clearcuts leads to the greatest shrub development, due to increased snowbrush ceanothus cover.

Ceanothus seeds have both seed coat scarification and cold-wet seed stratification requirements for optimum germination. These are met by most fall and late summer burns. Spring burns usually do not provide the necessary cold-wet stratification, so *Ceanothus* germination is greatly reduced. Spring burning favors species that sprout from root crowns or buried roots like golden chinquipin.

<u>*Key Insects and Diseases:*</u> Silver fir beetle, Douglas-fir beetle, fir engraver, laminated root rot, white pine blister rust, rust red stringy rot, Douglas-fir and hemlock dwarf mistletoe.

Table 3-1. Site Index (SI standard error), Growth Basal Area (GB A standard error), Yield Capability ($Ft^{3)}$ by Species and Plant Association Group within the ABAM Series

PAG	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
ABAM Moist							
ABAM	57	3	58	231	11	135	60
PICO	66	4	14	105	3	37	32
PSME	90	7	11	234	12	87	96
TSHE	84	9	10	216	8	90	83
ABAM Wet							
ABAM	90	2	128	340	5	840	140
ABCO-ABGR	114	3	71	318	7	347	167
ABMAS	115	5	19	419	24	20	221
ABPR	113	5	30	451	8	503	235
PICO	81	5	9	186	5	182	69
PIEN	115	5	6	296	11	58	156
PIMO	118	6	10	272	30	29	147
PSME	107	1	280	354	3	2980	174
TSHE	94	2	161	355	4	1288	153
ABAM Wetlands							
ABAM	97	4	42	361	7	383	161
ABCO-ABGR	126		1	378	29	20	219
ABPR	136	8	8	420	19	70	262
PSME	113	6	33	367	6	441	190
THPL	81	5	14	344	17	120	129
TSHE	102	3	44	400	6	418	187

<u>Secondary Diseases:</u> Mountain pine beetle (PICO, PIMO), western spruce budworm (ABAM), Armillaria root disease, red ring rot, Schweinitzii root and butt rot.

Important effects: The silver fir beetle has been known to reach outbreak levels in the past in mature silver fir stands. The mountain pine beetle could be an important mortality agent on lodgepole and western white pines once these hosts are fairly large. Stands with a Douglas-fir component could be affected by western spruce budworm, but outbreaks would not likely originate in this series.

Root disease was recorded on 23% of the CVS plots in ABAM series with 15%, 28%, and 21% for the ABAM moist, ABAM wet, and ABAM wetlands PAGS respectively. Laminated root rot is the most damaging agent in these systems and occurs throughout the associations of the pacific silver fir series. Laminated root rot can prevent Douglas-fir, western hemlock, and true fir species in reaching full maturity in areas with root disease. Western white pine, western larch (north of Santiam pass), and lodgepole pine are the most resistant species and should be favored in laminated root rot openings. On the western slope of the Cascades, Douglas-fir bark beetles under endemic populations are almost exclusively found in root disease infected Douglas-fir. Armillaria root disease becomes common and laminated root rot much less common in ABAM/CLUN on the Sisters RD. The drier plant associations have a high occurrence of Armillaria root disease that essentially replaces laminated root rot in some areas. Annosus is a major butt decay organism of older true fir and hemlock that have reached their pathological rotation.

White pine blister rust frequency was noted on 18% of CVS plots with 5 needle pines in the ABAM series. This is lower than expected frequency and may be due to reduced amounts of host (white pines) following the initial wave of infection in the early to mid 1900's. However, environmental conditions in the series are conducive for infection especially for younger trees. Use of disease resistant stock and lower crown pruning are important management strategies to keep western white pine present in many of these stands and should be selectively used based on site risk rating systems.

Dwarf mistletoe was present on 28% of the CVS plots within the ABAM Series. Douglas-fir is commonly infected by dwarf mistletoe on the eastern slope of the Cascade crest and is not common west of the crest. Douglas-fir dwarf mistletoe creates large brooms that provide important nesting and hiding habitat for some birds and small mammals. However, it can prevent smaller trees from attaining large tree stature. Thinning fully stocked infected stands releases latent infections, resulting in broom development and associated vigor and growth impacts 15 or 20 years later. Hemlock dwarf mistletoe is frequent in its host across the series.

Indian paint fungus occurs across the entire moisture gradient in true fir and hemlock. It is the primary stem decay organism of these species and is common in older stands, especially in trees that were long-suppressed and/or wounded.

Wildlife Management— Because wildlife habitats do not precisely match plant associations or even plant series, Appendix C in this guide is provided. Please see page C-8 for a discussion on Pacific silver fir.

Relationships to Other Classifications— The Pacific Silver Fir Series has been described by numerous authors up and down the Cascades. Some of these authors are: Hemstrom et al. 1982; Brockway et al. 1983; Williams and Lillybridge 1983; Logan et al. 1987; Franklin et al. 1988; John et al. 1988; Henderson et al. 1992; Atzet et al. 1996. Sometimes they included some mountain hemlock zone types. The distinction between the Mountain Hemlock and Pacific Silver Fir Series has not been consistent between authors. In this classification, sites with the ability to support 10% cover of mountain hemlock (in mature stands) are included in the Mountain Hemlock Series.

Key to Plant Associations of the Silver Fir Series:

1a *Lystichitum americanum* (>1%) not restricted to microsites . . . . ABAM/LYAM
1b Not as above 2a

2a *Asarum caudatum* or *Athyrium felix-femina* (>1%) ABAM/ASCA3
2b Not as above 3a

3a *Clintonia uniflora* (>1%) and not restricted to microsites . . . . . . .ABAM/CLUN
3b Not as above 4a

4a *Achlys triphylla* (>1%) and not restricted to microsites . . . . .ABAM/ACTR
4b Not as above 5a

5a *Linneaa borealis* (>1%) and not restricted to microsites ABAM/LIBO2
5b Not as above 6a

6a *Vaccinium membranaceum* or *Xerophyllum tenax* (>5%) ABAM/VAME/XETE
6b Not as above 7a

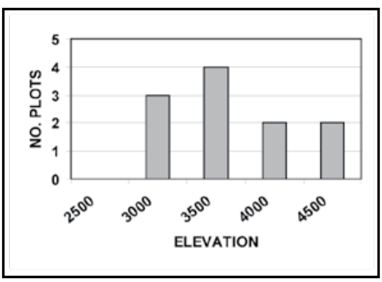
7a *Vaccinium membranaceum* (<5%) . . . . ABAM/VAME
7b Not as above 8a

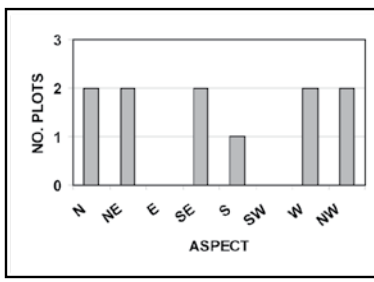
8a *Vaccinium scoparium* (>5%) . . . . .ABAM/VASC
8b Not as above . . . . .return to the start of the key and relax cover %.

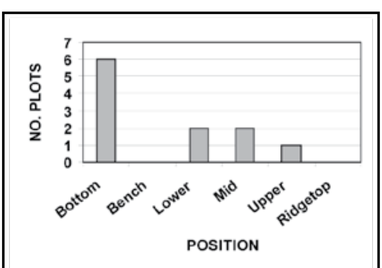
ABAM/LYAM — ABAM Wetlands

CFM112 (ABAM/LYAM3)
Abies amabilis/Lysichitum americanum
Pacific silver fir/American skunkcabbage
Plots 11

Distribution and Environment— ABAM/LYAM is a rare type in the northern Oregon Cascades. Plot data east of the Cascade Crest for the association are sparse. Plot locations east of the Crest are known from the Warm Springs Indian Reservation and the Mt. Hood National Forest. This association is observed as far south as Bear Valley Creek and near Willamette Pass on the Deschutes National Forest. These southern locations have not been sampled to date. ABAM/LYAM occurs on sub-irrigated sites at low to middle elevations. These are poorly drained sites usually with standing water at the soil surface most of the growing season. Adjacent sites with better drainage are often ABAM/ASCA3 or ABAM/CLUN, and warmer sites grade into the TSHE Series. Slope position is typically lower slope to broad stream bottoms. Mean annual precipitation for the series is 77” and mean annual temperature is approximately 43°F. Average elevation is 3259 feet (range 2700-4055 feet). Average slope is 14% (5-25%). Plot aspects varied.

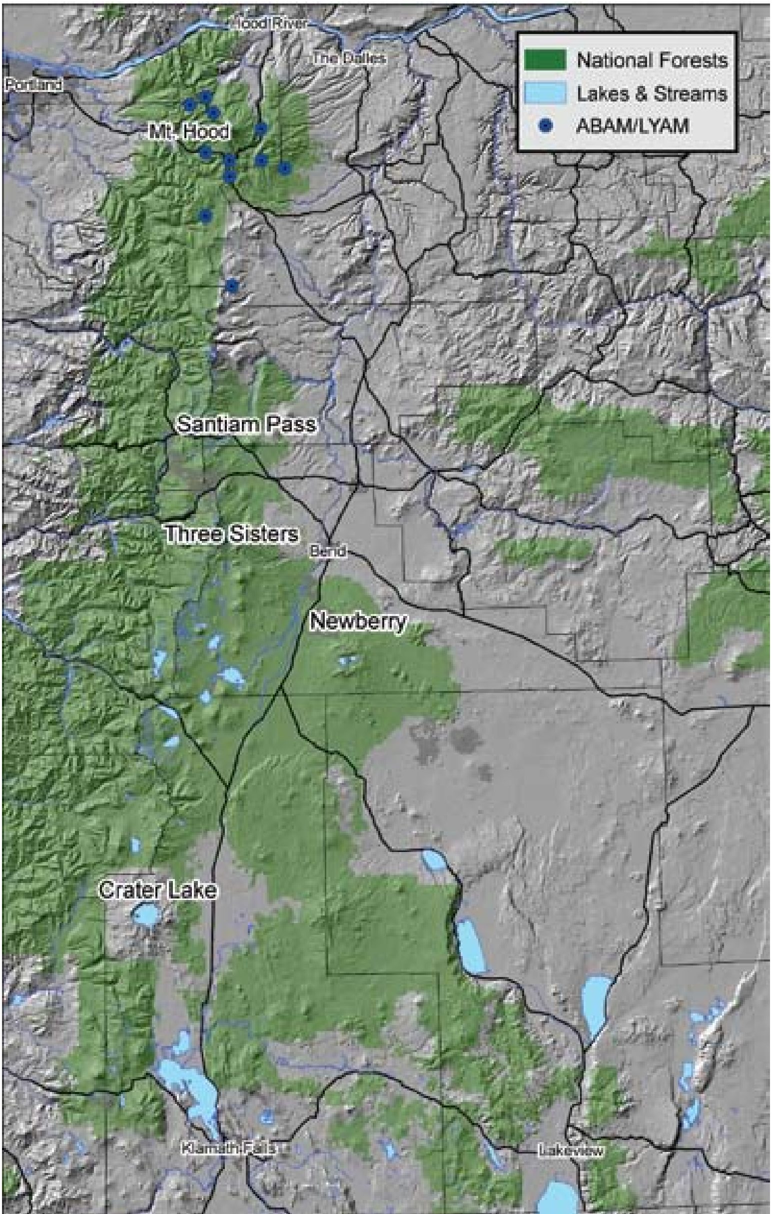






Mean Precip.	77.0”	33-115”
Mean Temp.	42.9°F	41-47°F

Figure 3-3. Map of ABAM/LYAM Plot Distribution—



Vegetation— ABAM/LYAM is the most diverse plant association of the Silver Fir Series. The tree layer is dominated by western hemlock and western red cedar with lesser amounts of Douglas-fir and Pacific silver fir. Understories are varied with some components of drier silver fir sites.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABAM	*Abies amabilis*	100	73	16.4	8.0
PIEN	*Picea engelmannii*	45	36	9.4	3.3
PIMO	*Pinus monticola*	18	36	3.4	1.0
PSME	*Pseudotsuga menziesii*	91	64	15.6	6.7
TABR	*Taxus brevifolia*	18	36	4.0	8.1
THPL	*Thuja plicata*	82	73	30.6	11.5
TSHE	*Tsuga heterophylla*	91	100	38.8	14.4
Shrubs					
ACCI	*Acer circinatum*	64%		20.4	
AMAL	*Amelanchier alnifolia*	36%		0.6	
BENE	*Berberis nervosa*	64%		1.6	
CHUM	*Chimaphila umbellata*	64%		0.4	
OPHO	*Oplopanax horridus*	45%		15.5	
RHMA	*Rhododendron macrophyllum*	45%		9.2	
RILA	*Ribes lacustre*	45%		0.7	
ROGY	*Rosa gymnocarpa*	64%		0.7	
RUPA	*Rubus parviflorus*	55%		0.4	
RUUR	*Rubus ursinus*	64%		0.8	
VAAL	*Vaccinium alaskaense*	64%		17.0	
VAME	*Vaccinium membranaceum*	45%		2.2	
Herbaceous					
ACTR	*Achlys triphylla*	100%		0.8	
ADBI	*Adenocaulon bicolor*	36%		2.3	
ASCA3	*Asarum caudatum*	45%		1.6	
ATFI	*Athyrium filix-femina*	64%		2.7	
CLUN	*Clintonia uniflora*	100%		0.7	
COCA	*Cornus canadensis*	91%		2.1	
GOOB	*Goodyera oblongifolia*	45%		0.3	
HIAL	*Hieracium albiflorum*	36%		0.1	
LIBO2	*Linnaea borealis*	82%		2.6	
LYAM	*Lysichitum americanum*	100%		5.5	
POMU	*Polystichum munitum*	45%		0.6	
PYSE	*Pyrola secunda*	82%		0.4	
SMRA	*Smilacina racemosa*	55%		0.1	
SMST	*Smilacina stellata*	100%		1.3	
TIUN	*Tiarella unifoliata*	82%		0.9	
XETE	*Xerophyllum tenax*	36%		1.6	

* Species with a constancy of 30% or greater are shown here.

Productivity and Management— ABAM/LYAM sites are moderately to highly productive.

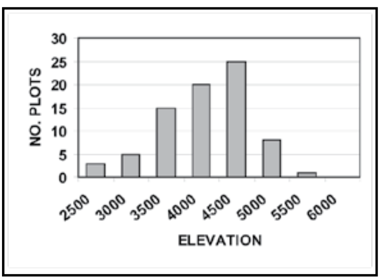
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
ABAM/LYAM							
ABAM	92	7	5	480	308	27	204
ABCO-ABGR	126		1	380	49	9	220
TSHE	92	6	5	413	20	69	174

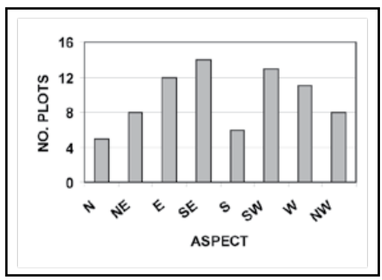
Relationships to Other Classifications— ABAM/LYAM has been described in northwestern Washington (Henderson et al. 1989). The concept of the northwest Washington type is similar. However, there are some floristic differences. Henderson's ABAM/LYAM type has significant cover of salal, oval-leaf huckleberry, fool's huckleberry, and cutleaf goldthread. These species are not represented in the plot data in northern Oregon.

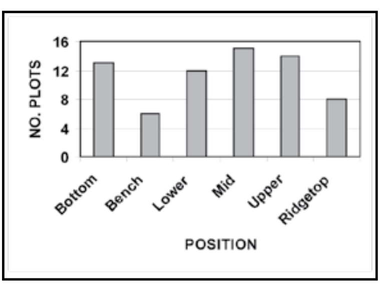
ABAM/ASCA3 — ABAM Wet

CFF121 (ABAM/ASCA2)
Abies amabilis/Asarum caudatum
Pacific silver fir/wild ginger
Plots 91

Distribution and Environment— ABAM/ASCA3 represents warm sites within the ABAM Series with high effective moisture. Adjacent warmer sites are generally either TSHE Wet or TSHE Wetlands plant associations, cooler sites grade into ABAM/CLUN or TSME Wet plant associations. Typical sites are somewhat poorly drained or accumulate sub-surface moisture. Sites with even less drainage grade into ABAM/LYAM east of the Cascade Crest and into ABAM/OPHO or ABAM/LYAM west of the Crest. Average elevation is 4269 feet (range 2600-5520 feet). Average slope is 30% (range 3-90%). Plot aspects varied.

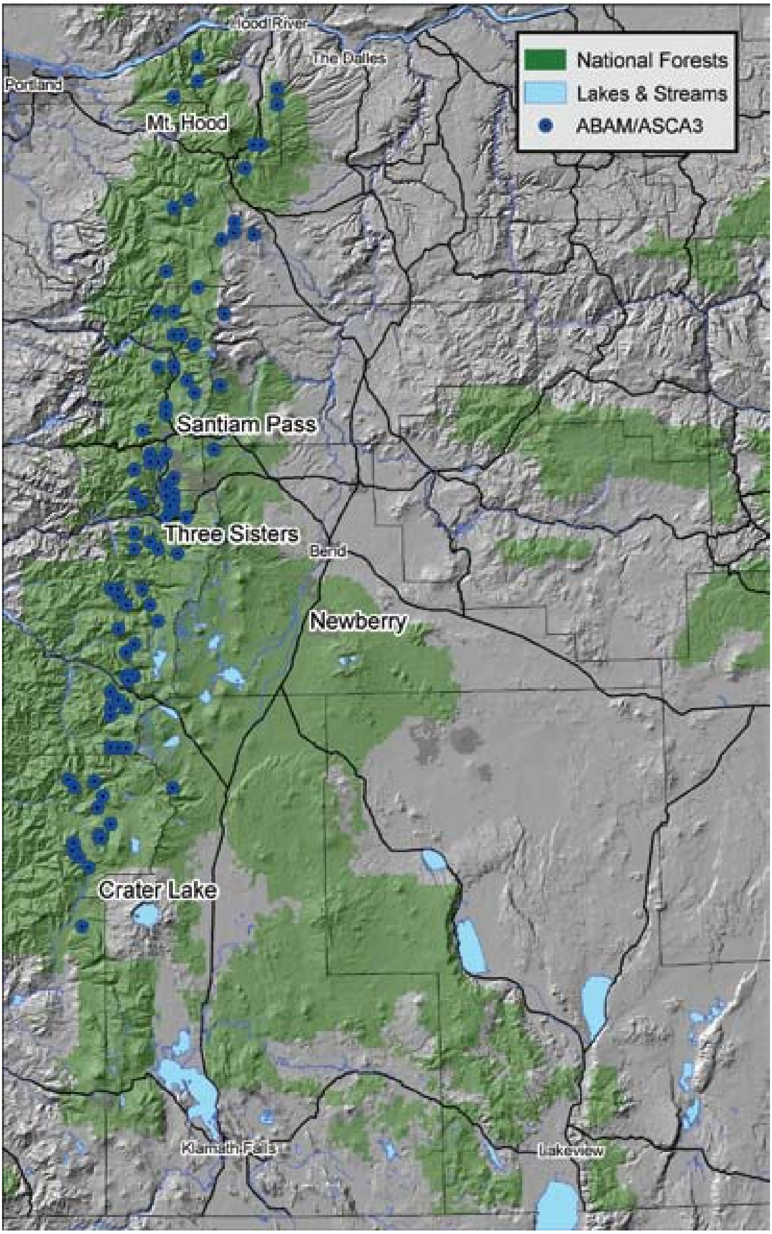






Mean Precip.	70.7”	45-113”
Mean Temp.	44.5°F	40-48°F

Figure 3-4. Map of ABAM/ASCA3 Plot Distribution—



Vegetation— ABAM/ASCA3 is the second most diverse plant association of the Silver Fir Series. PSME or ABPR often are important overstory species. TSHE may be a co-climax species in this type where it occurs. TSME is only a minor or accidental species in this type. Increased amounts of TSME indicate transition to the TSME Series. Diverse shrub layers occur on ABAM/ASCA3 sites following disturbance of the tree layers. Higher shrub cover values may indicate past disturbance. ABAM/ASCA3 sites are herb rich.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABAM	*Abies amabilis*	73	93	15.3	9.1
ABGR	*Abies grandis*	36	33	14.7	4.6
ABPR	*Abies procera*	43	26	16.6	3.5
PSME	*Pseudotsuga menziesii*	95	45	39.8	7.1
TSHE	*Tsuga heterophylla*	64	74	26.8	9.5
TSME	*Tsuga mertensiana*	24	30	4.7	2.2
Shrubs					
ACCI	*Acer circinatum*	60%		14.3	
BENE	*Berberis nervosa*	79%		5.5	
CHUM	*Chimaphila umbellata*	87%		3.0	
RHMA	*Rhododendron macrophyllum*	41%		9.9	
ROGY	*Rosa gymnocarpa*	78%		0.9	
RUUR	*Rubus ursinus*	34%		1.4	
SYMO	*Symphoricarpos mollis*	48%		1.5	
VAME	*Vaccinium membranaceum*	77%		4.2	
Herbaceous					
ACTR	*Achlys triphylla*	89%		7.8	
ADBI	*Adenocaulon bicolor*	30%		1.6	
ASCA3	*Asarum caudatum*	100%		1.6	
CLUN	*Clintonia uniflora*	82%		2.6	
COCA	*Cornus canadensis*	60%		3.2	
LIBO2	*Linnaea borealis*	63%		5.4	
POMU	*Polystichum munitum*	54%		1.0	
PTAQ	*Pteridium aquilinum*	31%		5.5	
PYSE	*Pyrola secunda*	31%		1.5	
SMST	*Smilacina stellata*	85%		3.8	
TITR	*Tiarella trifoliata*	53%		2.0	
XETE	*Xerophyllum tenax*	31%		2.3	

* Species with a constancy of 30% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
ABAM/ASCA3							
ABAM	104	4	33	350	15	138	168
ABCO-ABGR	116	6	32	326	11	142	173
ABMAS	120	10	8	464	53	8	255
ABPR	125	6	17	438	13	189	252
PIEN	112		1	270	14	20	139
PIMO	129	38	2	259	87	4	154
PSME	107	3	104	449	5	953	222
TSHE	95	3	51	388	11	231	169
TSME	83	13	4	368	31	17	141

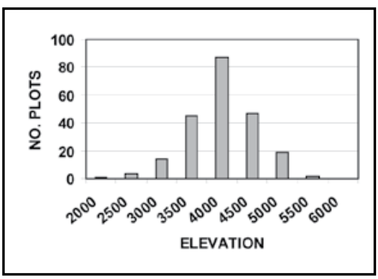
Relationships to Other Classifications— ABAM/ASCA3 has not been previously described in the Pacific Northwest. Hall (1998) recognized a ABAM/ANOR-ASCA3-Pyrola type from resource inventory plots which may be similar. TSHE/ASCA3 a closely related type without ABAM has been described for central Washington (Lillybridge et al. 1995) and northern Idaho (Cooper et al. 1987). In southwest Oregon Atzet et al. (1996) described ABAM-TSME/VAME/ACTR, ABAM/TSHE/VAME/ ACTR, and ABAM-TSHE/ROGY/ ACTR which include some plots that would key to ABAM/ASCA3. In northwest Oregon, wetter portions of the ABAM-ABGR/SMST, ABAM/ TIUN, and ABAM/VAME/CLUN would key to ABAM/ASCA3.

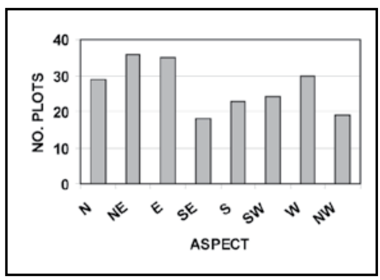
ABAM/CLUN

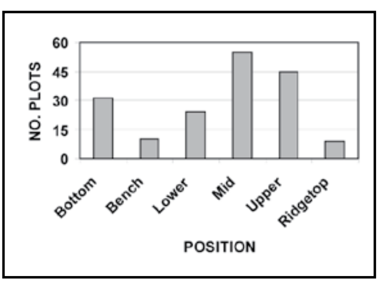
ABAM Wet

CFF142 (ABAM/CLUN2)
Abies amabilis/Clintonia uniflora
Pacific silver fir/queencup beadlily
Plots 233

Distribution and Environment— ABAM/CLUN is the most common association in the ABAM Series. It occurs from the Rogue-Umpqua divide to Mt. Hood. East of the Cascade Crest, ABAM/CLUN is common from Mt. Hood south to Santiam Pass with scattered observations as far south as Diamond Peak. Mid to upper slope positions are typical west of the crest. East of the crest, ABAM/CLUN is usually located on lower slope or bottom slope positions. Mean annual precipitation is about 67” and mean annual temperature is approximately 43°F. Average elevation is 4242 feet (range 2400-5510 feet). Average slope is 19% (range 0-68%). Plot aspect varied.

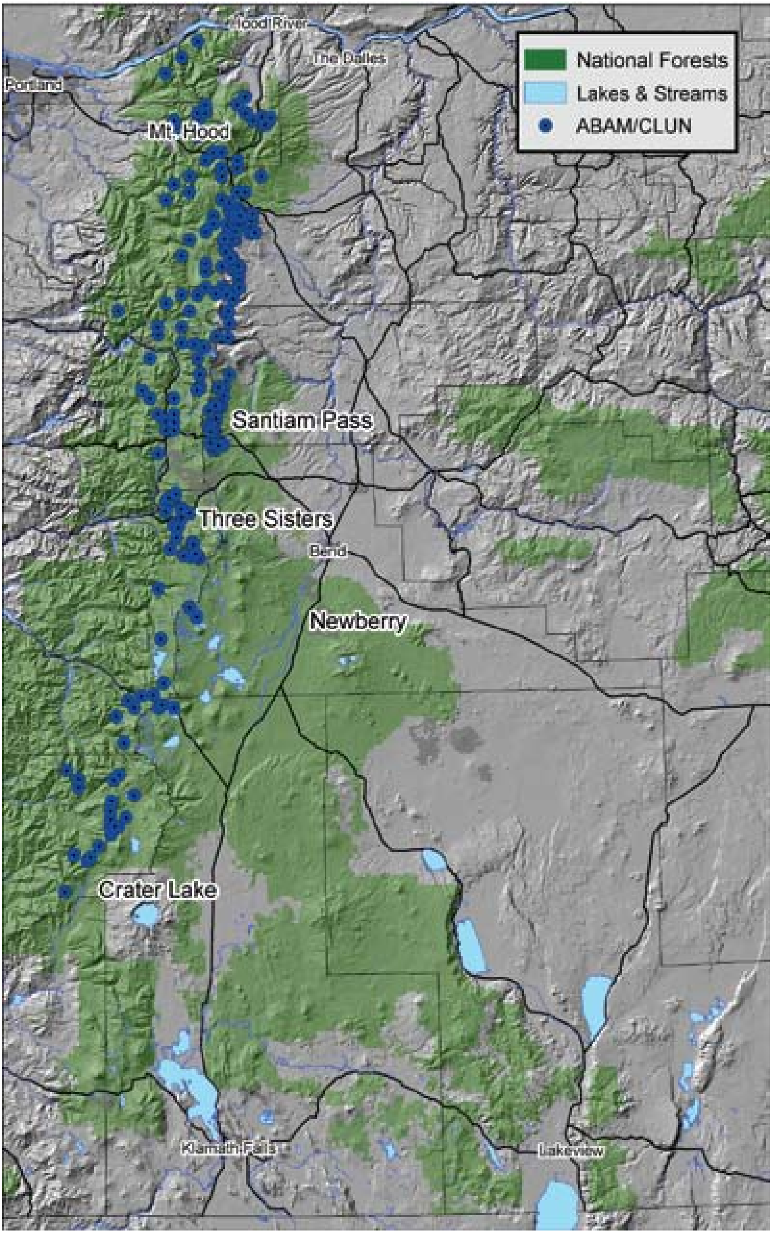






Mean Precip.	66.9”	31-125”
Mean Temp.	43.1°F	39-48°F

Figure 3-5. Map of ABAM/CLUN Plot Distribution—



Vegetation— ABAM/CLUN is an herb-rich association. PSME, ABPR, or ABMAS (south of Willamette Pass) often are important overstory species. TSHE may be a co-climax species in this type where it occurs. TSME is only a minor or accidental species in this type. Increased amounts of TSME indicate transition to the TSME Series. Diverse shrub layers occur on ABAM/CLUN sites following disturbance of the tree layers. VAME, BENE, and CHUM are the shrubs with highest constancy in mid to late seral stands. Higher shrub cover values may indicate past disturbance.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABAM	*Abies amabilis*	83	89	20.5	10.6
ABPR	*Abies procera*	32	15	17.2	2.2
PIMO	*Pinus monticola*	31	23	4.4	1.2
PSME	*Pseudotsuga menziesii*	79	24	27.2	5.4
TSHE	*Tsuga heterophylla*	61	63	35.4	9.4
TSME	*Tsuga mertensiana*	35	33	3.7	2.2
Shrubs					
ACCI	*Acer circinatum*	33%		10.8	
BENE	*Berberis nervosa*	64%		4.5	
CACH	*Castanopsis chrysophylla*	34%		3.6	
CHUM	*Chimaphila umbellata*	79%		2.9	
PAMY	*Pachistima myrsinites*	41%		2.1	
ROGY	*Rosa gymnocarpa*	58%		1.2	
RUUR	*Rubus ursinus*	37%		1.3	
VAME	*Vaccinium membranaceum*	88%		6.9	
Herbaceous					
ACTR	*Achlys triphylla*	67%		3.2	
CLUN	*Clintonia uniflora*	100%		2.9	
COCA	*Cornus canadensis*	43%		4.2	
GOOB	*Goodyera oblongifolia*	48%		1.0	
LIBO2	*Linnaea borealis*	65%		4.1	
PTAQ	*Pteridium aquilinum*	30%		4.5	
PYPI	*Pyrola picta*	31%		0.8	
PYSE	*Pyrola secunda*	61%		1.5	
SMST	*Smilacina stellata*	55%		2.3	
XETE	*Xerophyllum tenax*	50%		8.3	

* Species with a constancy of 30% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
ABAM/CLUN							
ABAM	87	3	65	378	6	483	151
ABCO-ABGR	114	5	25	314	9	131	165
ABLA2	83	9	2	332	46	3	126
ABMAS	111	6	11	389	15	12	199
ABPR	102	5	9	503	11	224	236
PICO	81	5	6	167	6	72	62
PIEN	124	4	3	312	20	25	178
PIMO	114	3	5	277	34	15	145
PSME	113	2	94	344	5	879	178
THPL	66	3	4	445	15	70	135
TSHE	90	2	45	396	5	523	164
TSME	84	11	6	250	28	18	97

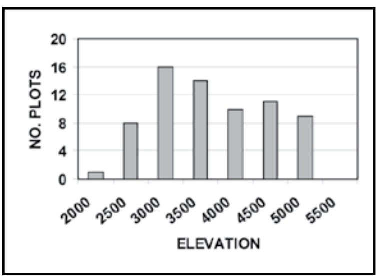
Relationships to Other Classifications— ABAM/CLUN has been described for the Warm Springs Indian Reservation (Marsh et al. 1991) and for the H.J. Andrews Experimental Forest (Dyrness et al. 1974) in the western Cascades of Oregon. The Warm Springs classification is very similar. Only the coldest plots in the Warm Springs ABAM/CLUN association (those with >10% cover of TSME) would not key to this type.

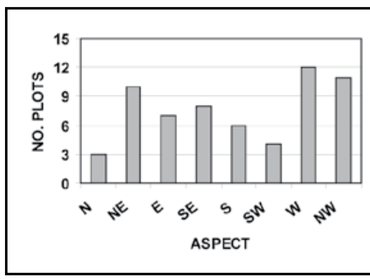
In northwest Oregon, ABAM/VAME/CLUN, ABAM/VAME/XETE, and ABAM/TIUN (McCain and Diaz 2002, Hemstrom et al. 1986) are similar associations that have plots that would key to ABAM/CLUN. Brockaway et al. (1983) described an ABAM/ACTR-CLUN association for southwest Washington which is also very similar and may have plots that key to ABAM/CLUN in this classification.

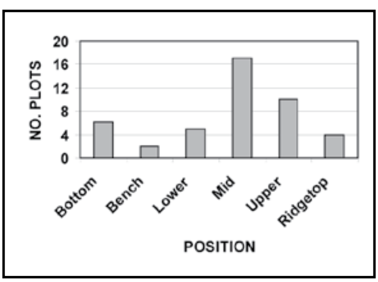
ABAM/ACTR **ABAM Wet**

CFF252 (ABAM/ACTR)
Abies amabilis/Achlys triphylla
Pacific silver fir/vanilla leaf
Plots 69

Distribution and Environment— ABAM/ACTR occurs predominantly west of the Cascade Crest. East slope locations are known from Warm Springs Indian Reservation north to the east side of Mt. Hood. Scattered locations are known as far south as Willamette Pass. ABAM/ACTR is warmer and occurs in slightly higher precipitation zones than ABAM/CLUN. However, sites have greater soil drainage than ABAM/CLUN sites. Average elevation is 3777 feet (range 2200-5000 feet). Average slope is 35% (range 4-86%). Plot aspects varied.

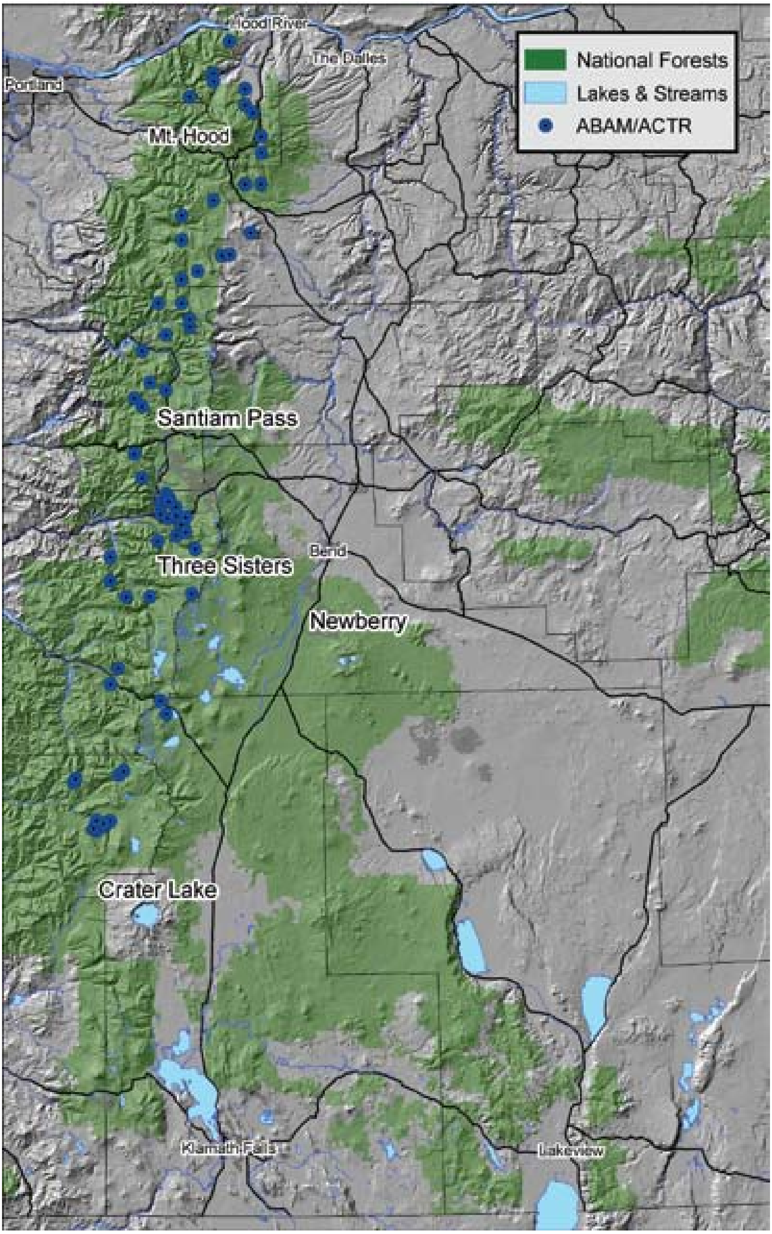






Mean Precip.	72.0”	41-117”
Mean Temp.	44.8°F	41-49°F

Figure 3-6. Map of ABAM/ACTR Plot Distribution—



Vegetation— ABAM/ACTR is a herb-rich association. PSME and TSHE are important overstory species. TSHE may be a co-climax species in this type where it occurs. Diverse shrub layers occur on ABAM/ACTR sites following disturbance of the tree layers. ACCI, CACH, RHMA, and CEVE may increase substantially after fire. VAME, BENE, and CHUM are the shrubs with highest constancy in mid to late seral stands. Higher shrub cover values may indicate past disturbance.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABAM	*Abies amabilis*	67	91	15.5	11.7
PSME	*Pseudotsuga menziesii*	90	41	37.0	11.2
TABR	*Taxus brevifolia*	6	29	5.1	6.6
THPL	*Thuja plicata*	23	29	17.4	7.1
TSHE	*Tsuga heterophylla*	74	78	31.3	12.6
Shrubs					
ACCI	*Acer circinatum*	49%		8.0	
BENE	*Berberis nervosa*	81%		7.9	
CACH	*Castanopsis chrysophylla*	52%		4.9	
CHUM	*Chimaphila umbellata*	90%		2.7	
PAMY	*Pachistima myrsinites*	39%		1.7	
RHMA	*Rhododendron macrophyllum*	43%		20.1	
ROGY	*Rosa gymnocarpa*	61%		1.3	
RUUR	*Rubus ursinus*	38%		2.3	
SYMO	*Symphoricarpos mollis*	33%		3.2	
VAME	*Vaccinium membranaceum*	74%		4.6	
Herbaceous					
ACTR	*Achlys triphylla*	100%		2.0	
COCA	*Cornus canadensis*	43%		5.3	
GOOB	*Goodyera oblongifolia*	39%		0.7	
LIBO2	*Linnaea borealis*	81%		6.6	
POMU	*Polystichum munitum*	33%		1.6	
XETE	*Xerophyllum tenax*	51%		9.5	

* Species with a constancy of 30% or greater are shown here.

Productivity and Management—

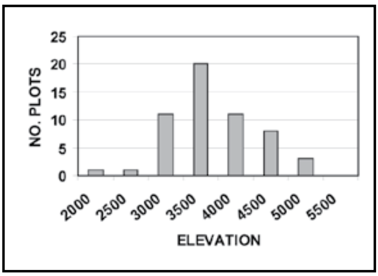
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
ABAM/ACTR							
ABAM	87	9	8	287	10	144	114
ABCO-ABGR	117	7	9	310	18	72	167
ABPR	92	9	2	370	21	77	157
PIMO	120	5	2	411	207	3	226
PSME	106	6	27	335	6	447	163
THPL	87	7	2	414	20	58	165
TSHE	97	5	24	333	9	213	149

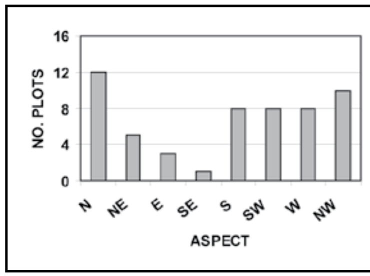
Relationships to Other Classifications— ABAM/ACTR has been described for northwest Oregon (Dyrness et al. 1974), central Washington (Lillybridge et al. 1995), and northwest Washington (Henderson et al. 1992). The ABAM/ACTR association described by Lillybridge is slightly wetter. Most of their plots would key to ABAM/CLUN in this classification.

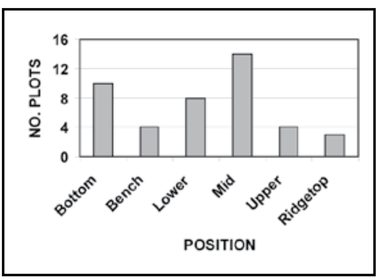
ABAM/LIBO2 — ABAM Wet

CFF511 (ABAM/LIBO3)
Abies amabilis/Linnaea borealis
Pacific silver fir/twinflower
Plots 62

Distribution and Environment— Average elevation is 3890 feet (range 2400-5200 feet). Average slope is 21% (range 0-90%). Most plots were found on a north to northwest aspect, with notably few plots in the southeast aspect.

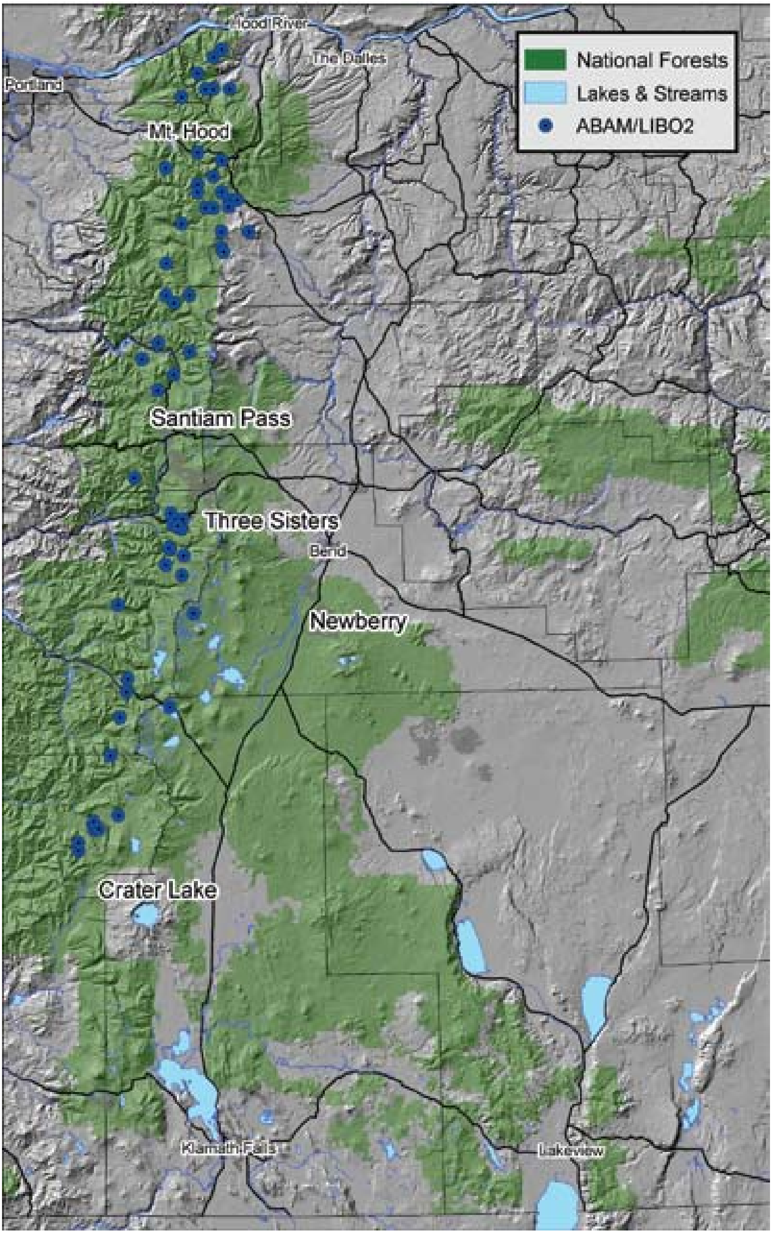






Mean Precip.	71.0”	41-111”
Mean Temp.	44.1°F	41-48°F

Figure 3-7. Map of ABAM/LIBO2 Plot Distribution—



Vegetation— ABAM/LIBO2 is a herb-rich association. PSME and TSHE are important overstory species. TSHE may be a co-climax species in this type where it occurs. Diverse shrub layers occur on ABAM/ACTR sites following disturbance of the tree layers. CACH, RHMA, and CEVE may increase substantially after fire. VAME, BENE, and CHUM are the shrubs with highest constancy in mid to late seral stands. Higher shrub cover values may indicate past disturbance.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABAM	*Abies amabilis*	68	90	10.8	6.1
PIMO	*Pinus monticola*	26	44	4.2	0.9
PSME	*Pseudotsuga menziesii*	81	55	36.8	6.3
TSHE	*Tsuga heterophylla*	84	89	29.4	11.6
Shrubs					
BENE	*Berberis nervosa*	76%		4.6	
CACH	*Castanopsis chrysophylla*	53%		5.3	
CHUM	*Chimaphila umbellata*	87%		2.3	
PAMY	*Pachistima myrsinites*	50%		1.7	
RHMA	*Rhododendron macrophyllum*	66%		36.7	
RUUR	*Rubus ursinus*	44%		1.3	
VAME	*Vaccinium membranaceum*	79%		2.9	
Herbaceous					
COCA	*Cornus canadensis*	37%		3.6	
GOOB	*Goodyera oblongifolia*	32%		0.8	
HIAL	*Hieracium albiflorum*	31%		0.4	
LIBO2	*Linnaea borealis*	100%		3.8	
XETE	*Xerophyllum tenax*	63%		9.9	

* Species with a constancy of 30% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
ABAM/LIBO2							
ABAM	88	7	9	189	11	59	76
ABCO-ABGR	92	12	5	320	42	2	136
PSME	97	3	41	251	4	657	112
TSHE	95	3	36	279	7	301	120

Relationships to Other Classifications— ABAM/LIBO2 has not been previously described. Hall (1998) recognized an ABAM/LIBO2 type from resource inventory plots. ABAM/LIBO2 is closely related to the TSHE/LIBO3 described for northwest Oregon by McCain and Diaz (2002). The northwest Oregon TSHE/LIBO3 is warmer and has slightly greater effective moisture (> 2% cover of ACTR, high cover of LIBO2) than ABAM/ LIBO2 as described here.

ABAM/VAME/XETE — ABAM Moist

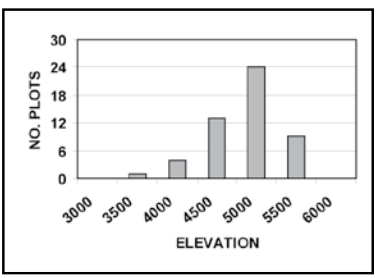
CFS251 (ABAM/VAME/XETE)

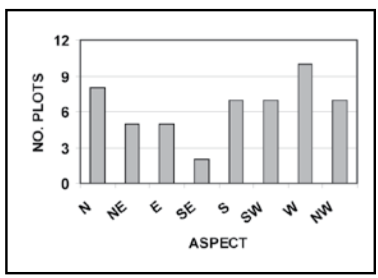
Abies amabilis/Vaccinium membanaceum/Xerophyllum tenax

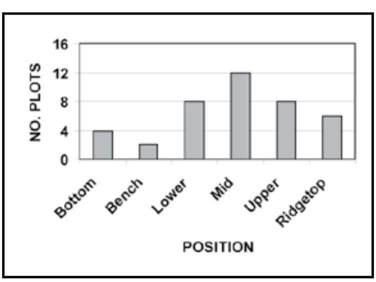
Pacific silver fir/thinleaf huckleberry/common beargrass

Plots 52

Distribution and Environment— ABAM/VAME/XETE is a central and north Oregon Cascades plant association. It occurs from the Waldo Lake area in the south to Barlow Pass. Cooler, excessively well-drained sites grade into ABAM/VAME, ABAM/VASC, or TSME/VAME/XETE and TSME/XETE associations if more TSME is present. ABAM/VAME/XETE occurs in cold high precipitation areas. Sites are extremely well drained and have considerably less effective moisture than ABAM Wet plant associations. However, these sites are apparently warmer and have more effective moisture than ABAM/VAME or ABAM/VASC sites. Average elevation is 5054 feet (range 3810-5820 feet). Average slope is 16% (range 1-53%). Most plots were found on a western aspect, with notably few of plots in the southeast aspect. Slope positions are typically mid to upper slopes or ridgetops. These slope positions drain cold air more effectively than the closely related ABAM/VAME association and may contribute to warmer effective temperatures.

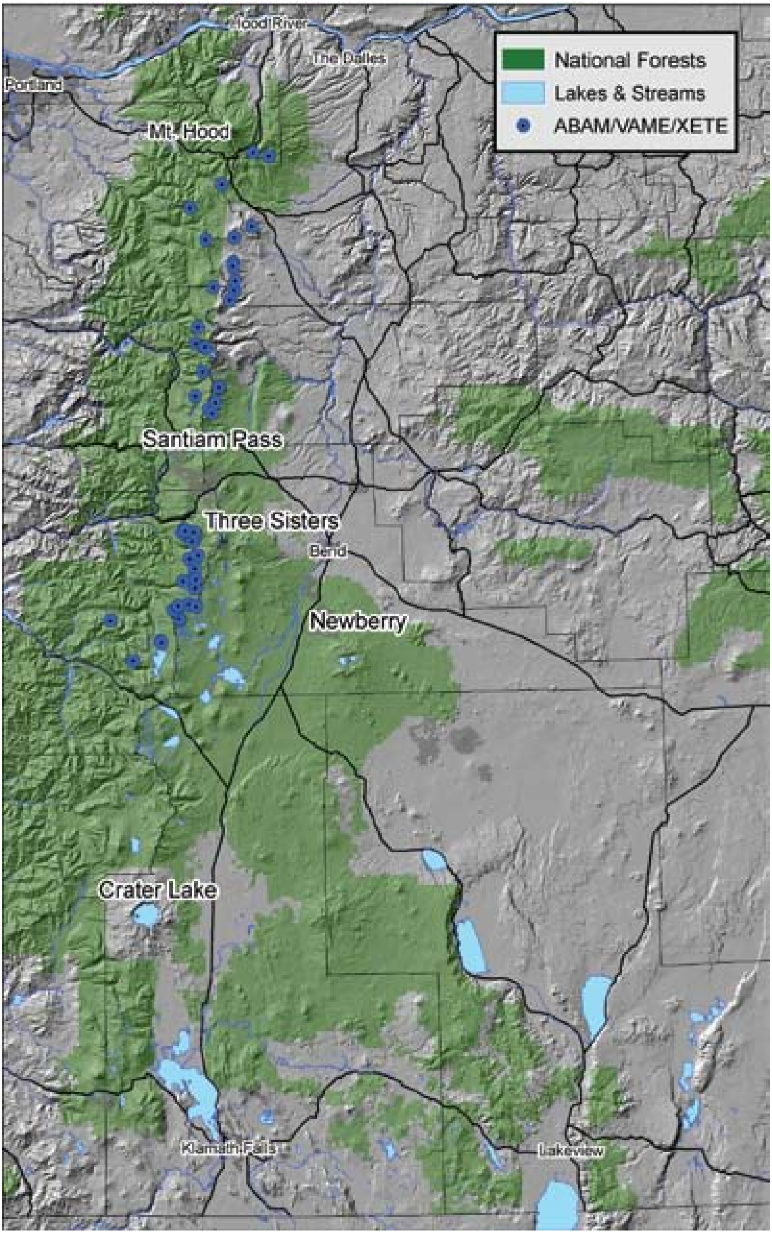






Mean Precip.	75.6”	49-95”
Mean Temp.	41.8°F	39-47°F

Figure 3-8. Map of ABAM/VAME/XETE Plot Distribution—



Vegetation— ABAM/VAME/XETE is a relatively species-poor association, only 13-14 species are typically found on an individual plot. Sites are apparently too cold for PSME or ABCO-ABGR. Increasing cover of TSME indicates a transition to the TSME Series. PICO may occur after sites are disturbed, but is not common. Constancy of PICO in mid seral or later stands is higher than ABAM/VAME (20-25%). PICO may attain significant cover (15-20%) when it occurs. Occurrence of moist site species such as CHUM and PAMY indicate higher effective site moisture than ABAM/VAME.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABAM	*Abies amabilis*	77	65	23.6	9.2
PICO	*Pinus contorta*	27	17	19.3	2.1
PIMO	*Pinus monticola*	19	33	4.1	0.5
TSME	*Tsuga mertensiana*	48	62	4.2	1.3
Shrubs					
CHUM	*Chimaphila umbellata*	35%		1.1	
PAMY	*Pachistima myrsinites*	25%		1.4	
VAME	*Vaccinium membranaceum*	100%		14.2	
VASC	*Vaccinium scoparium*	51%		7.3	
Herbaceous					
PYSE	*Pyrola secunda*	35%		1.0	
XETE	*Xerophyllum tenax*	100%		15.9	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

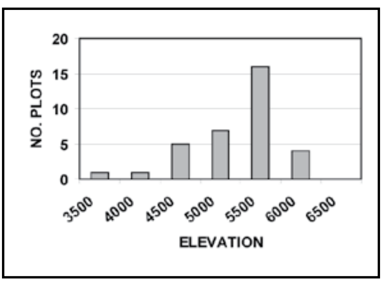
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
ABAM/VAME/XETE							
ABAM	36	2	4	166	12	42	28
PICO	74		1	105	3	37	36
TSHE	58	3	4	216	16	39	57
TSME	37	3	2	119	28	8	20

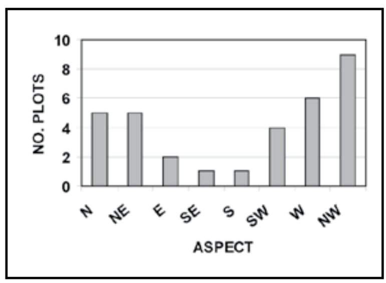
Relationships to Other Classifications— ABAM/VAME/XETE has been described for northwest Oregon (McCain and Diaz 2002) and for northwest Washington (Henderson et al. 1989, 1992). However, all of these previously described types are warmer, have greater effective moisture, and greater species diversity than the ABAM/VAME/XETE type described here.

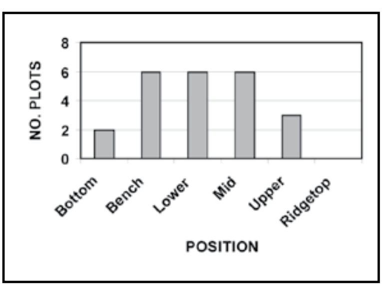
ABAM/VAME — ABAM Moist

CFS270 (ABAM/VAME)
Abies amabilis/Vaccinium membanaceum
Pacific silver fir/thinleaf huckleberry
Plot 34

Distribution and Environment— ABAM/VAME is a central Oregon Cascades plant association. It occurs from Mt. Wilson on the Warm Springs Indian Reservation south to Windigo Pass. Cooler excessively well-drained sites grade into ABAM/VASC or TSME/VAME associations. ABAM/VAME occurs in cold, high precipitation areas. Mean annual precipitation is 76” and mean annual temperature is between 40-41°F. Sites are extremely well drained and have considerably less effective moisture than ABAM Wet plant associations. Average elevation is 5434 feet (range 3600-6140 feet). Average slope is 21% (range 1-65%). Most plots were found on a north to western aspect, with notably few of plots in the south to southeast aspect. Slope positions are typically mid to lower slopes or benches and are likely influenced by cold air drainage.

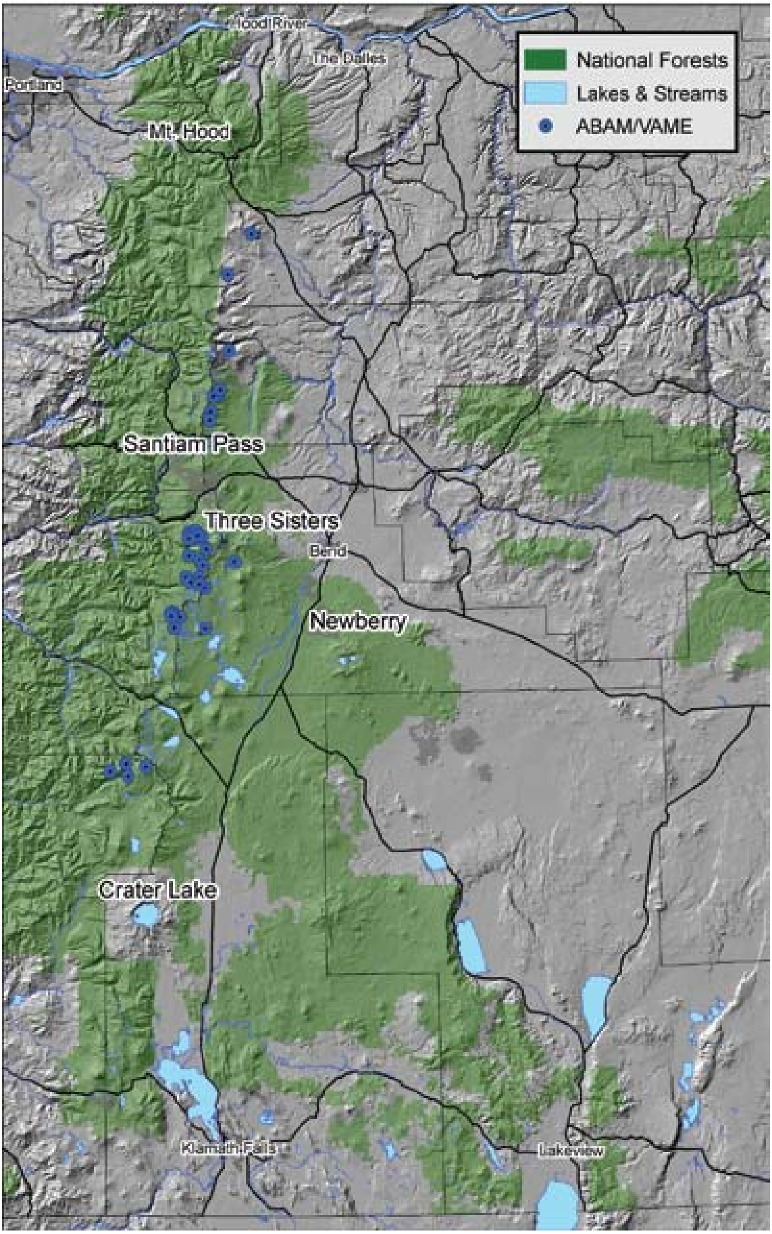






Mean Precip.	76.0”	51-95”
Mean Temp.	40.6°F	36-45°F

Figure 3-9. Map of ABAM/VAME Plot Distribution—



Vegetation— ABAM/VAME is a relatively species-poor association, only 9-10 species are typically found on an individual plot. Sites are apparently too cold for PSME or ABCO-ABGR. Increasing cover of TSME indicates a transition to the TSME Series. PICO may occur after sites are disturbed, but is not common. Constancy of PICO is 10-15%, but PICO may attain significant cover (15-20%) when it occurs.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABAM	*Abies amabilis*	88	53	18.7	11.2
PIMO	*Pinus monticola*	21	15	6.2	2.2
TSME	*Tsuga mertensiana*	32	47	4.9	1.5
Shrubs					
PAMY	*Pachistima myrsinites*	24%		1.3	
VAME	*Vaccinium membranaceum*	100%		18.3	
VASC	*Vaccinium scoparium*	50%		10.9	
Herbaceous					
PYSE	*Pyrola secunda*	35%		0.6	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management— No data is available for this plant association. Productivity is expected to be similar or slightly less productive than ABAM/VAME/XETE.

Relationships to Other Classifications— ABAM/VAME has been described for northwest Washington (Henderson et al. 1992). A similar type, ABAM/VAME/CLUN, has been described for northwest Oregon (McCain and Diaz 2002). Lillybridge et al. (1995) also describe a ABAM/VAME/CLUN and a ABAM/VAME/PYSE which is somewhat drier. However, all of these previously described types are warmer, have greater effective moisture, and greater species diversity than the ABAM/VAME type described here.

ABAM/VASC

ABAM Moist

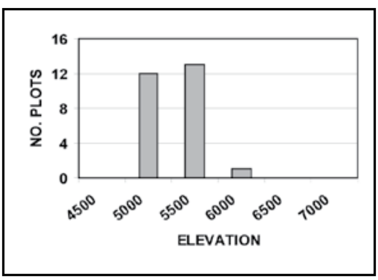
CFS410 (ABAM/VASC)

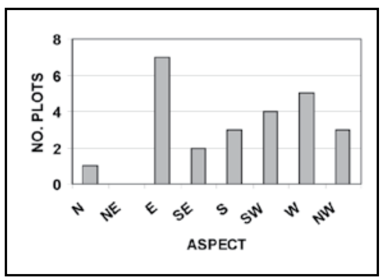
Abies amabilis/Vaccinium scoparium

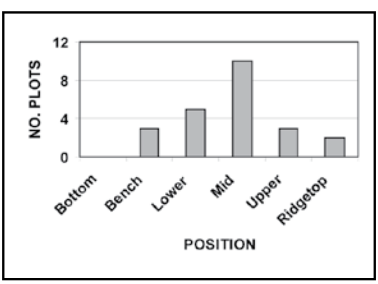
Pacific silver fir/grouse whortleberry

Plots 26

Distribution and Environment— ABAM/VASC is a central Oregon Cascade association. Plot locations occur from the Three Sisters south to Willamette Pass. ABAM/VASC is a transitional type to the TSME Series. Sites are cold and snow packs linger until well into July. Growing seasons are short and mean temperatures are < 40°F. Average precipitation is high (76.5”), but sites are extremely well drained resulting in much lower effective moisture. Average elevation is 5558 feet (range 5200-6199 feet). Average slope is 11% (range 0-30%). Plot aspects varied, although notably few plots were found on a north to northeast aspect. Slope positions are typically mid to lower slopes or benches. These positions, in combination with the gentle slopes, increase local cold air drainage effects.

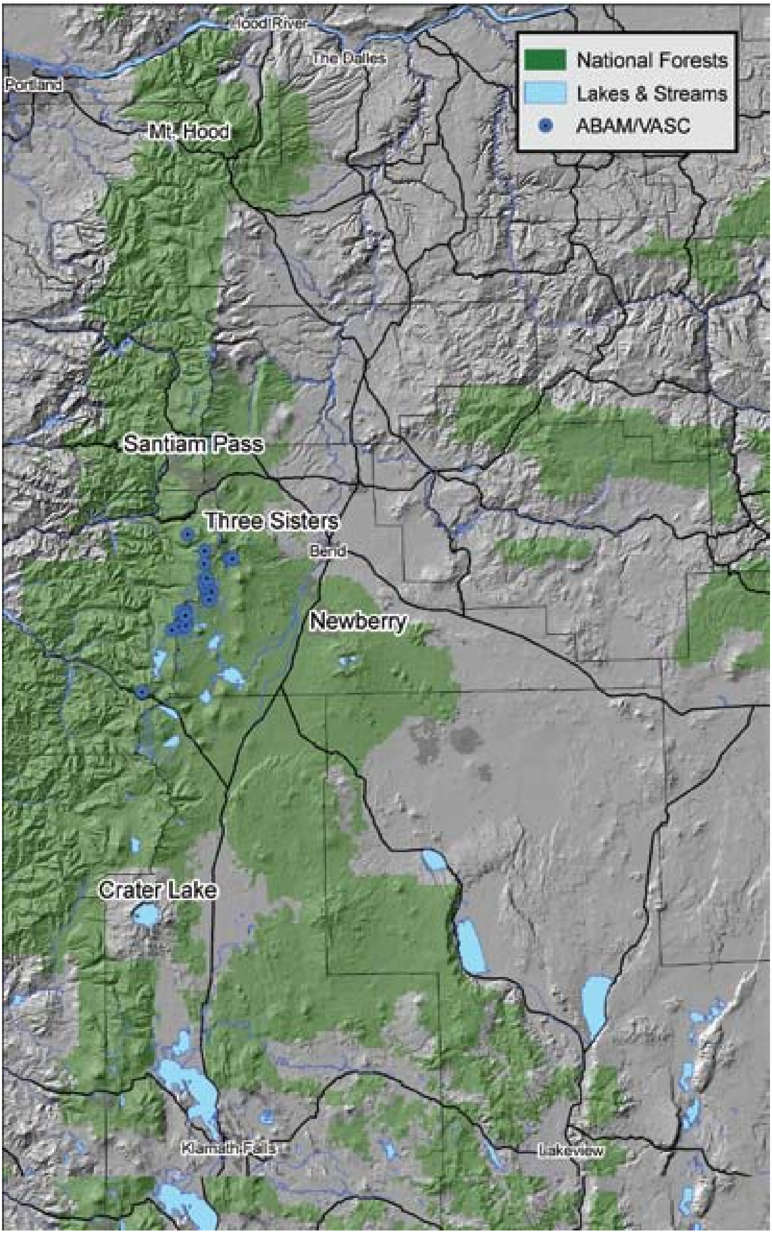






Mean Precip.	76.5”	67-91”
Mean Temp.	39.7°F	36-45°F

Figure 3-10. Map of ABAM/VASC Plot Distribution—



Vegetation— ABAM/VASC is a relatively species-poor association, only 5-6 species are typically found on an individual plot. Sites are apparently too cold for PSME or ABCO-ABGR. Increasing cover of TSME indicates a transition to the TSME Series. PICO cover and constancy are extremely low. Only 2 plots had PICO occurrence; and maximum cover of PICO is 3%. Low incidence of PICO may indicate that fire is extremely rare in this type.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABAM	*Abies amabilis*	100	12	13.8	15.5
PIMO	*Pinus monticola*	23	23	3.2	0.1
TSME	*Tsuga mertensiana*	31	42	2.5	0.2
Shrubs					
ARNE	*Arctostaphylos nevadensis*	23%		2.0	
VAME	*Vaccinium membranaceum*	31%		0.1	
VASC	*Vaccinium scoparium*	100%		21.5	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
ABAM/VASC							
ABAM	76	8	4	219	8	78	77
PIMO	69		1	226	54	2	72

Relationships to Other Classifications— ABAM/VASC has not been previously described in the Pacific Northwest. Hall (1998) identified an ABAM/VASC community from resource inventory data. ABAM/VASC is closely related to TSME/VASC, but occurs in higher precipitation zones that are excessively drained.

Western Hemlock Series

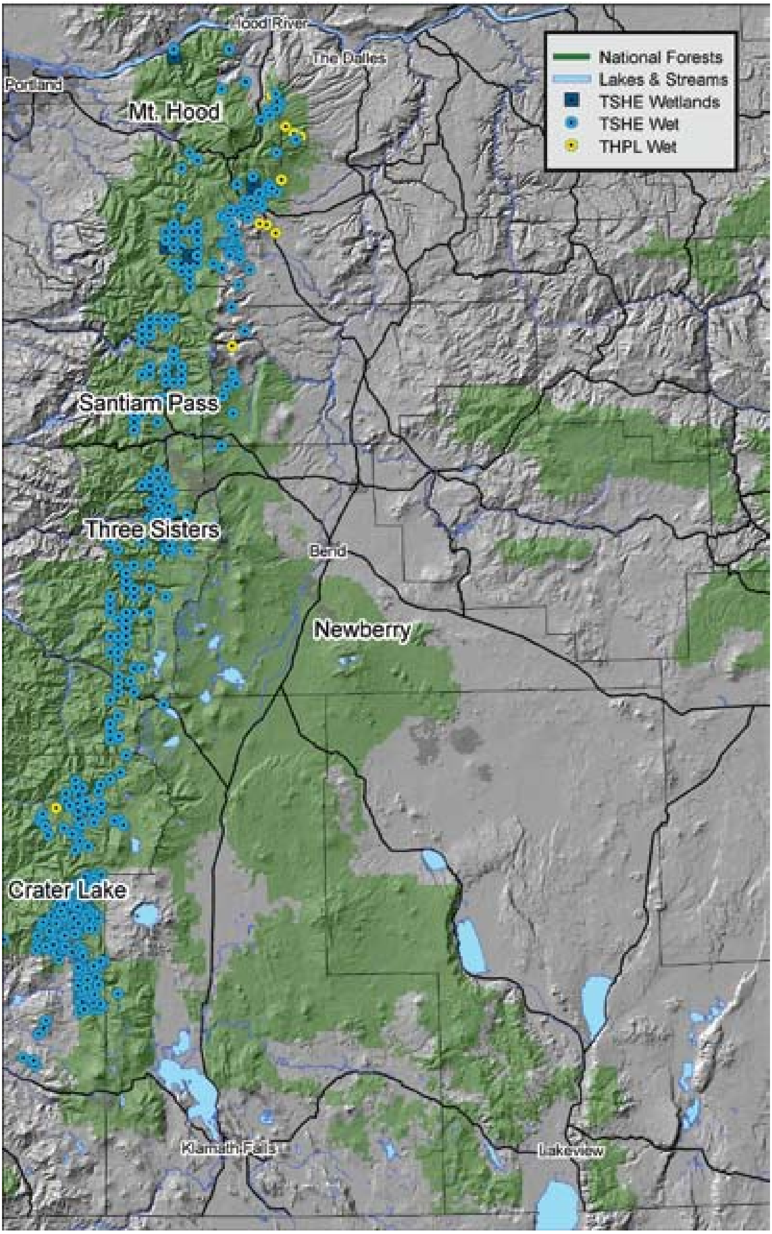
WESTERN HEMLOCK SERIES

TSHE
Tsuga heterophylla
western hemlock
Total Plots 549

Distribution and Environment— Western hemlock, like Pacific Silver Fir, is one of the more shade tolerant and environmentally restricted conifers on the east slope of the Cascades in Oregon. The best development of the series is in areas with the strongest maritime climatic influence and where Pacific silver fir and mountain hemlock are absent. On the east side of the Cascades Mountains the series is most extensive on the Warm Springs Indian Reservation and the Mt. Hood National Forest. There are considerable intergradations between the Western Hemlock, Pacific Silver Fir and White Fir-Grand Fir Series. White fir-grand fir will occupy drier sites, while Pacific silver fir prefers cooler, more maritime environments. South of the Metolius River the distribution of the series becomes discontinuous and is rare south of Santiam Pass on the east side of the Cascade crest. Small amounts of the Western Hemlock Series occur as far south as Cache Mountain and Willamette Pass on the Deschutes National Forest.

Elevations range from just under 2000’ to over 5000’, although over 80% of all stands fall below 4000’. Western hemlock can be found at elevations approaching 6000’, though it is not the climax dominant tree on those sites. Soils tend to be deep, of mixed material, and often with volcanic ash in the surface horizons. On colder sites, the series is normally bounded by the Pacific Silver Fir Series, and on warmer, slightly drier sites, by the Grand Fir Series. Western red cedar and western hemlock are co-dominant on very wet sites. Western red cedar tolerates warm temperatures and both wetter and drier conditions better than western hemlock (Minore 1979). Including wet Western red cedar sites in the Western Hemlock Series follows the convention of Daubenmire and Daubenmire (1968) and Lillybridge et al. (1995). Western red cedar does not usually form upland climax stands on the east slopes of the Cascade Range, as it often does in the northern Rocky Mountains.

Figure 4-1. Map of TSHE Series Plot Distribution by PAG —



Vegetation— Because of its superior shade tolerance, western hemlock is considered the climax dominant on sites too warm for Pacific silver fir and mountain hemlock wherever there is sufficient evidence to indicate its success. On cool sites that support Pacific silver fir or mountain hemlock, western hemlock functions as a long-lived, shade-tolerant seral species. Pacific silver fir and mountain hemlock both tolerate cooler temperatures and deeper snowpacks better than western hemlock. Mid seral stands (100-200 years old) often have abundant, vigorous grand fir under a canopy of long-lived seral species such as larch or western white pine. Grand fir may be nearly the same age as the larch and pine, but slow early growth keeps it a minor component of stands, until its superior shade tolerance and vigorous later growth allow it to increase in prominence. Ponderosa pine is typically found only on the warmest sites.

These plant associations have been further grouped into plant association groups (PAGs) which reflect temperature-precipitation zones. The TSHE Wetlands PAG consists of TSHE/LYAM. The TSHE Wet PAG consists of TSHE/ASCA3, TSHE/CLUN, TSHE/ACTR, and TSHE/LIBO2. The THPL Wet PAG consists of THPL/CLUN and THPL/LIBO2. As the effective moisture in the plant associations decreases, the species diversity declines.

The TSHE Wetlands PAG (TSHE/LYAM) represents the wettest environments within the TSHE Series. TSHE/LYAM associations are often adjacent to riparian areas or other wet, sub-irrigated sites.

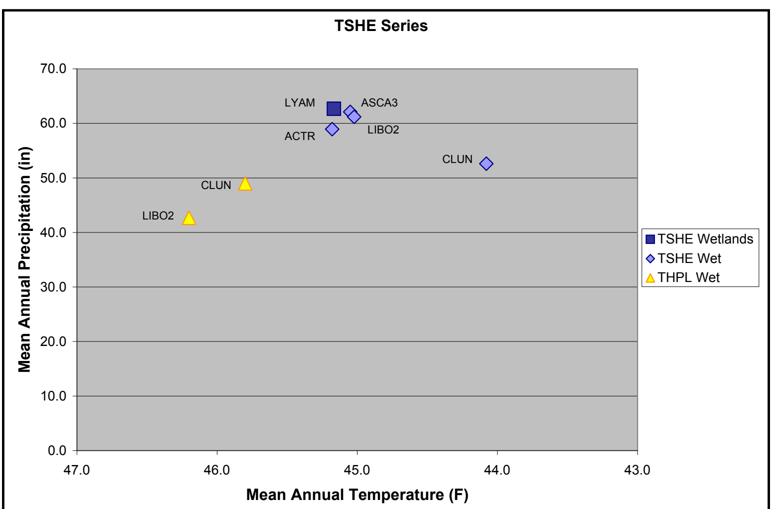
TSHE Wet PAG plant associations typically have rich, herbaceous understory vegetation. These types represent warm-moderate environments and the most productive sites in the TSHE Series. The shrub layer is variable; the most common species is VAME. Diverse shrub layers often form following disturbance. Douglas-fir is a significant component of overstory canopies and is a primary early seral conifer.

The THPL Wet PAG represents warm, dry environments within the TSHE Series. Sites on the east side of the Cascade Crest north of McKenzie Pass, apparently beyond the warmer ecological limits of western hemlock that support western red cedar, are grouped into this PAG. The data, however, are inadequate to describe a stand-alone Western Red Cedar Series at this time. Consequently, in areas where western red cedar is present and western hemlock is absent, the sites are placed within the Western Hemlock Series.

Although commonly associated with western hemlock, western red cedar influences soil development and associated herbs and shrubs much differently. Mineral soil next to cedar trees in a mixed species stand has higher extractable calcium, base saturation, pH, and nitrification potential than does soil next to neighboring hemlocks (Turner and Franz 1986). Turner and Franz also note that shrubs and herbs under cedars are greater in terms of both numbers of species and size of individuals than shrubs and herbs under hemlocks.

Disturbance types, timing, and intensity, combined with species composition prior to disturbance, are important modifiers of secondary succession within the series. Nearly any tree species may be important during early seral stages in the warmer areas of this series. After fire removes the humus layer, quaking aspen, black cottonwood, or even red alder (in areas with strong maritime climate influence), can form extensive stands. In spite of the complexity of possible successional paths, some general patterns exist and are as follows:

Figure 4-2. Temperature – Precipitation Relationships for Plant Associations and Plant Association Groups within the TSHE Series



Dense shrubfields often typify early successional stages after logging, fire, or other disturbance within the series, especially on TSHE/CLUN and TSHE/LIBO2 sites. Although the development of shrubfields may initially appear detrimental to conifer establishment and early growth, the ecologic role of the shrub-dominated stage of succession may also have benefits over time. Shrubs provide shade for conifers; add organic matter to the soil; and species such as *Ceanothus*, alders, and red elderberry fix nitrogen. Further, many shrubs provide important forage and cover for insect eating wildlife species such as birds and bats. Presence of these species influence stand health and vigor. Common shrub field species include vine maple, Douglas maple, Scouler willow, pachistima, big huckleberry, golden chinquapin, Sitka alder, and snowbrush ceanothus.

Shrub size and twig production often peak between 10 and 15 years following disturbance. Shade from residual trees can inhibit shrub field development. Therefore, seed tree and shelterwood treatments should have significantly less shrub development than clearcuts. Late summer and fall broadcast burning in clearcuts leads to the greatest shrub development due to increased snowbrush ceanothus cover.

Ceanothus seeds have both seed coat scarification and cold-wet seed stratification requirements for optimum germination. These are met by most fall and late summer burns. Spring burns usually do not provide the necessary cold-wet stratification, so *Ceanothus* germination is greatly reduced. Spring burning favors species that sprout from root crowns or buried roots like golden chinquapin (see Appendix D).

Fire— Less than 15% of the 138 plots with tree age data collected exceeded 200 years in age. Most stands were between 100 and 200 years old, suggesting a typical fire interval for the series of perhaps 100-200 years. Associations in the dry end of the type with ladder fuels would tend to burn more often and with higher intensity. Agee (1994) suggests that low to moderate severity fire may occur every 50 to 100 years, while the stand-replacement interval might be 150 to 500 years. However, Agee's dataset has few samples from Oregon east of the Cascade Crest and return intervals for this series remain poorly understood on the east slope in Oregon.

Western hemlock stands east of the Cascade crest are often intermixed with Pacific silver fir or white fir/grand fir stands. When in a silver fir setting they will be associated with its long fire return interval (Fire

Regime IV and V). When in the drier setting of white fir/grand fir, they will feature a mixed severity and frequency of return (Fire Regime III), as in Agee 1994. Halverson et al. (1986) did not mention fire as a consideration in their classification of western hemlock on the Mt. Hood National Forest, including areas east of the Cascade crest.

North of Mt. Jefferson where contiguous western hemlock sites are widespread or associated with Pacific silver fir sites, fire intervals will tend to be long and fires severe. Lodgepole pine can gain dominance on some sites, especially in areas with poor cold air drainage. Sites with lodgepole pine may have increased fire frequency. Lodgepole pine stands tend to be drier, due to the more open crown structures. The open crowns allow higher wind speeds, higher surface and fuel temperatures and lower relative humidity than the denser canopies of western hemlock and western red cedar. Generally, when the fire interval is less than 200 years and lodgepole was in the original stand, intensive fires favor lodgepole pine. However, even though few stands exceed 200 years breast-height age, the data record few stands where lodgepole pine is the dominant tree in the Western Hemlock Series. Longer intervals between stand replacement events favor western larch or western white pine. Less intense fires favor larch, white pine, and Douglas-fir. Fires are variable in intensity and effect on individuals and stands. The pattern in the Rockies that may apply here tends to be "(1) complete stand replacement, (2) partially killed overstory (resistant species surviving), (3) underburning with little overstory mortality, and (4) unburned forest" (Arno and Davis 1980). Stands on steep mid-slopes may occur in "thermal belts" that are more predisposed to stand replacement. Such sites are warmer, drier, and more wind-exposed than are stands on sheltered slopes and slope positions (Arno and Davis 1980). The result is a complex vegetation mosaic of the nature described for the White fir-Grand fir Series

After harvest, shrub competition with tree seedlings can be significant, particularly if vine maple or golden chinquapin were present in the pre-harvest stand. Snowbrush ceanothus, after sprouting from seed, also has the ability to form dense shrubfields on many Western Hemlock Series sites. The amount of *Ceanothus* competition can be difficult to predict unless the plant is evident in the undisturbed stand, because of its ability to store seed in the soil for long time periods (> 300 years).

Productivity and Management— The Western Hemlock Series is highly productive, as indicated by high basal areas and high site index

Table 3-1 – Site Index (SI standard error), Growth Basal Area (GB A standard error), Yield Capability (Ft^{3}) by Species and Plant Association Group within the TSHE Series

PAG	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
THPL Wet							
ABCO-ABGR	100	27	4	162	11	22	75
LAOC				87	27	6	
PIEN				220	9	4	
PIPO	76		1	84	9	5	29
PSME	108	7	7	159	17	38	79
TSHE Wet							
ABCO-ABGR	126	2	155	308	6	346	178
ABMAS	127	5	9	406	20	11	238
ABPR	120	12	2	393	19	47	217
ACMA				236	53	6	
ALRU				201	22	10	
CADE3	99	3	50	331	10	84	151
LAOC				311	31	12	
PICO	70	21	2	191	21	21	62
PIEN	93	6	3	319	35	19	136
PILA	127	3	55	374	11	65	218
PIMO	123	4	31	284	15	53	160
PIPO	138	5	7	293	26	17	186
PSME	128	1	553	365	2	3383	215
THPL	85	7	14	376	16	110	147
TSHE	104	2	158	338	6	578	161
TSHE Wetlands							
ABCO-ABGR				393		1	
ABPR				572	53	3	
ACMA				320	94	2	
ALRU				307	63	8	
LAOC	111		1	347	54	7	177
PIEN	86	4	4	323	29	15	127
PSME	128	10	18	443	6	360	261
THPL	91	14	2	426	17	49	178
TSHE	115	5	21	459	12	155	243

values (Table 3-1). However, most seral tree species exhibit better growth than western hemlock on Western Hemlock Series sites. This is true in most series: the climax dominant tree does not grow as rapidly as some seral tree species. Intense frost is not typically a problem in this series because sites where western hemlock is climax are inherently mild. On the other hand, cutting practices can create frost pockets in some situations if cold air drainage is impeded. Regeneration harvests in the TSHE/LYAM, and to a lesser extent in the TSHE/ASCA3 associations, can raise the water table, possibly creating a swamp.

Key Insects and Diseases: Douglas-fir beetle, fir engraver, laminated root rot, annosus, and Armillaria root diseases, white pine blister rust, rust red stringy rot, western larch dwarf mistletoe.

Secondary Insects and Diseases: Hemlock looper, Douglas-fir dwarf mistletoe, western hemlock dwarf mistletoe, Schweinitzii root and butt rot, needle diseases and needle blights of western larch.

Important Effects: Root diseases were present on 29, 32, and 8% of the inventory plots in the TSHE wetlands, wet, and moist PAGS respectively. Of the root diseases laminated root rot is the most common and damaging. Laminated root rot is especially common in early and mid seral stands dominated by Douglas-fir and grand fir and on the western slope of the Cascades. Annosus and laminated root rot are more common in mature hemlock where substantial amounts of decay and stem breakage is common. Annosus and armillaria root diseases are more common in the TSHE/CLUN association of plots that occur on the eastern slope of the Cascades.

White pine blister rust, an exotic disease, is common throughout the range of the TSHE series on all five needle pines. In this series the result of the disease is a significant reduction in the abundance of western white pine.

Rust red stringy rot is considered to be the most significant heart rot of true firs and hemlocks. It frequently causes stem breakage and leads to large amounts of volume loss. Douglas-fir dwarf mistletoe is only present on the eastern slope of the Cascades.

The fir engraver maybe found on true fir hosts when they are weakened by root disease. Douglas-fir can be infested by the Douglas-fir beetle after wind events or other disturbances. The western hemlock looper defoliates western hemlock and can be a significant mortality agent in stands greater than 80 years old. Damage is typically greater in coastal forests than in the Cascades. The larch case bearer may occasionally defoliate western larch, but long-term damage appears to be minimal.

Wildlife Management— Because wildlife habitats do not precisely match plant associations or even plant series, Appendix C in this guide is provided. Please see page C-9 for a discussion on Western Hemlock.

Relationships to Other Classifications— Numerous authors have described the Western Hemlock Series in the Cascades, northeastern Washington, northern Idaho, and Montana. Some of these are: Daubenmire and Daubenmire 1968; Pfister et al. 1977; Topik et al. 1988; John et al. 1988; Halverson et al. 1986; Williams et al. 1990; and Henderson et al. 1992. A variety of plant associations have been described. The common attribute of all TSHE plant associations is that they are strongly limited to areas with a maritime climate.

Key to the Plant Associations of the Western Hemlock Series:

1a *Tsuga heterophylla* (>1%) 2a
1b *Tsuga heterophylla* (<1%) and *Thuja plicata* common (>1%) 8a

2a *Lysichitum americanum* (>1%) and not restricted to microsites . . . .TSHE/LYAM
2b Not as above 3a

3a *Asarum caudatum* or *Athyrium filix-femina* (>1%). TSHE/ASCA3
3b Not as above 4a

4a *Clintonia uniflora* (>1%) and not restricted to microsites. . . . . TSHE/CLUN
4b Not as above 5a

5a *Achlys triphylla* (>1%) and not restricted to microsites . . . . TSHE/ACTR
5b Not as above 6a

6a *Linnaea borealis* (>1%) and not restricted to microsites TSHE/LIBO2
6b Not as above 7a

7a *Clintonia uniflora* (>1%) and not restricted to microsites. . . . . .THPL/CLUN
7b Not as above 9a

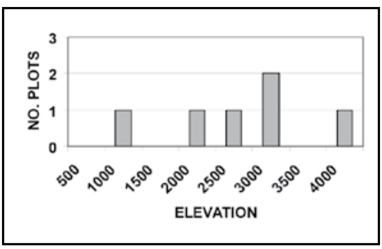
8a *Linnaea borealis* (>1%) and not restricted to microsites THPL/LIBO2
8b Not as above . . . . return to start of the key and relax cover.

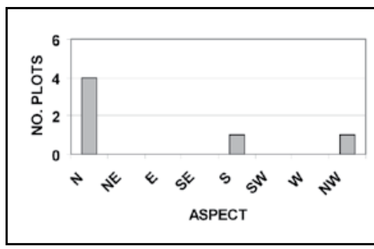
TSHE/LYAM

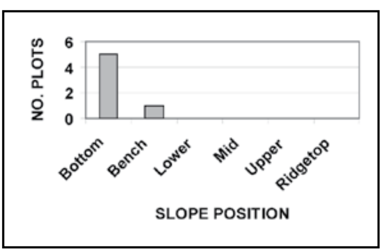
TSHE Wetlands

CHM121 (TSHE/LYAM3)
Tsuga heterophylla/Lysichitum americanum
western hemlock/skunk cabbage
Plots 6

Distribution and Environment— TSHE/LYAM is a rare type in the northern Oregon Cascades. Plot data east of the Cascade Crest for the association is sparse. Plot locations east of the Crest are known from the Warm Springs Indian Reservation and the Mt. Hood National Forest. TSHE/LYAM occurs on sub-irrigated sites at low to middle elevations. These are poorly drained sites, usually with standing water at the soil surface during most of the growing season. Adjacent sites with better drainage are often TSHE/ASCA3 or TSHE/CLUN and cooler sites grade into the ABAM series. Slope positions are typically wet benches or broad stream bottoms. Average elevation is 2385' (range 900-3700'). Average slope is 4% (range 0-11%). Most plot aspects are north to northwest.

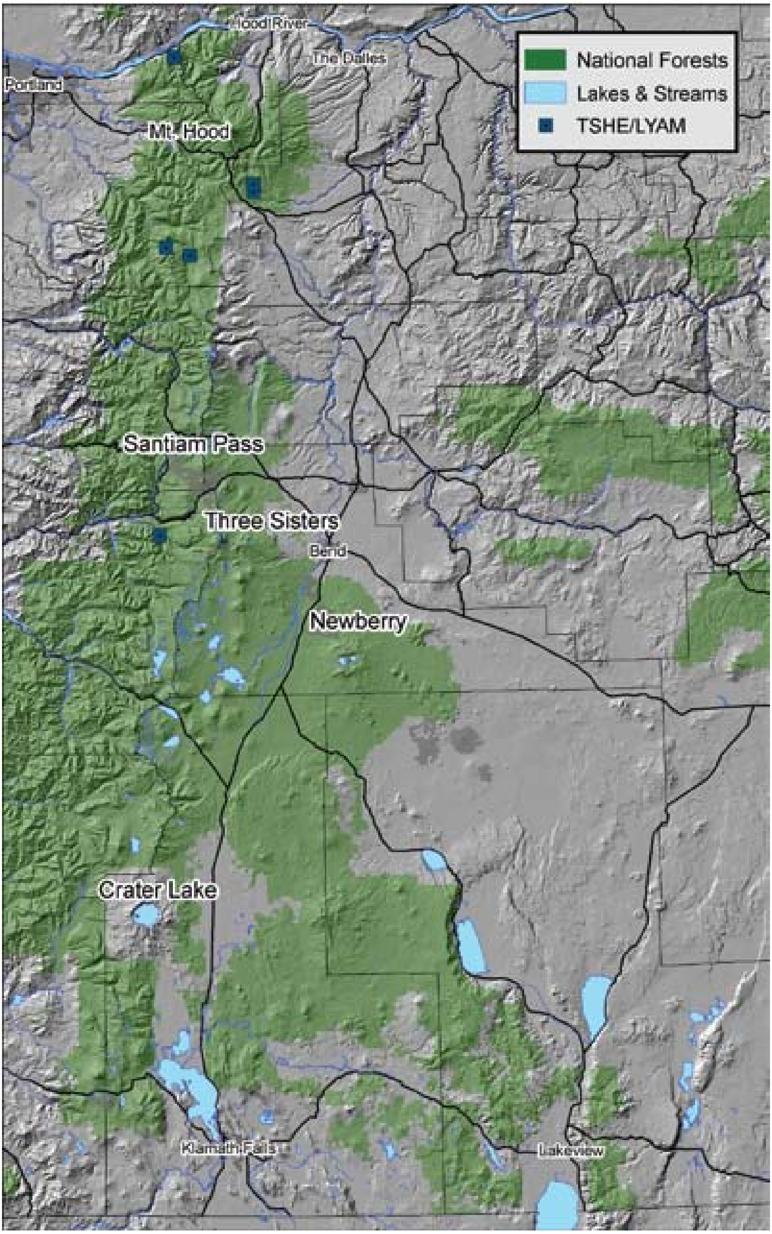






Mean Precip.	62.7"	39-95"
Mean Temp.	45.2°F	44-48°F

Figure 4-3. Map of TSHE/LYAM Plot Distribution—



Vegetation— TSHE/LYAM is a species-rich plant association within the Western Hemlock Series. The tree layer is dominated by Douglas-fir, western hemlock, and western red cedar, with lesser amounts of grand fir. Red alder is an important successional tree species. Understories vary with some components of drier western hemlock sites. ACCI and RHMA increase dramatically after disturbance on these sites, if the water table does not rise after the disturbance. TSHE/LYAM is rich in moisture-loving herbaceous species. Characteristic herbaceous species are LYAM, ATFI, COCA, POMU, ASCA3, CLUN, ACTR, and LIBO2.

Code	Species Latin Name	% Const		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABGR	*Abies grandis*	67	33	4.2	1.4
ALRU	*Alnus rubra*	50	17	13.1	6.4
PSME	*Pseudotsuga menziesii*	83	50	43.1	2.2
TABR	*Taxus brevifolia*	-	50	-	1.2
THPL	*Thuja plicata*	100	83	33.4	21.7
TSHE	*Tsuga heterophylla*	100	100	30.2	12.5
Shrubs					
ACCI	*Acer circinatum*	83%		17.7	
BENE	*Berberis nervosa*	83%		1.9	
CHUM	*Chimaphila umbellata*	50%		0.5	
RHMA	*Rhododendron macrophyllum*	50%		7.4	
ROGY	*Rosa gymnocarpa*	50%		0.4	
RUPA	*Rubus parviflorus*	50%		1.7	
RUUR	*Rubus ursinus*	67%		0.3	
SYAL	*Symphoricarpos albus*	50%		0.7	
Herbaceous					
ACTR	*Achlys triphylla*	50%		1.1	
ADBI	*Adenocaulon bicolor*	67%		0.3	
ATFI	*Athyrium filix-femina*	67%		4.5	
COCA	*Cornus canadensis*	83%		3.0	
LIBO2	*Linnaea borealis*	67%		4.6	
LYAM	*Lysichitum americanum*	100%		1.2	
POMU	*Polystichum munitum*	67%		3.2	
PTAQ	*Pteridium aquilinum*	50%		0.6	
PYSE	*Pyrola secunda*	67%		0.3	
SMST	*Smilacina stellata*	67%		0.8	
TITR	*Tiarella trifoliata*	50%		1.1	

* Species with a constancy of 35% or greater are shown here.

Productivity and Management—

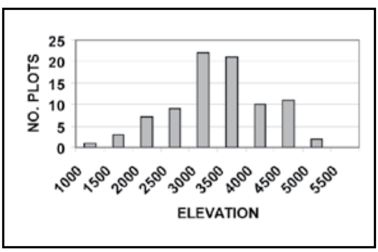
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
TSHE/LYAM							
PIEN	86	4	4	323	28	15	127
PSME	152	16	7	396	9	133	277
TSHE	123	12	7	371	17	29	210

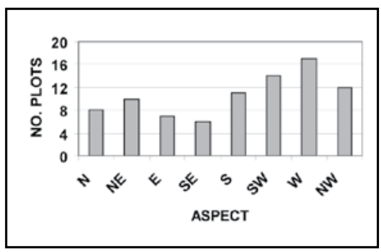
Relationships to Other Classifications— TSHE/LYAM has been previously described for northwest Washington (Henderson et al. 1989, 1992), southwest Washington (Topik et al. 1986), central Washington (Lillybridge et al. 1995), and northwest Oregon (Halverson et al. 1986, McCain and Diaz 2002). These types are very similar to the TSHE/LYAM described here.

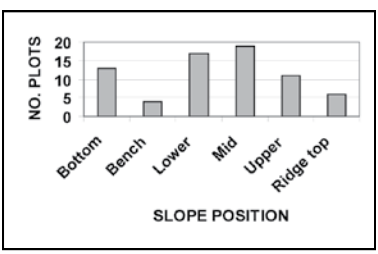
TSHE/ASCA3 — TSHE Wet

CHF313 (TSHE/ASCA2)
Tsuga heterophylla/Asarum caudatum
western hemlock/wild ginger
Plots 99

Distribution and Environment— TSHE/ASCA3 represents warm, wet sites within the TSHE series with high effective moisture. Adjacent drier sites are generally TSHE/CLUN, TSHE/ACTR, or TSHE/LIBO2 plant associations. Cooler sites grade into ABAM/CLUN associations. Typical sites are somewhat poorly drained or accumulate sub-surface moisture. Sites with even less drainage grade into TSHE/LYAM east of the Cascade Crest and into TSHE/OPHO or TSHE/LYAM west of the Crest. Average elevation is 3507' (range 1100-5422'). Average slope is 24% (range 2-110%). Many plots are found on western aspects. Slope positions are typically mid to lower slopes and alluvial bottom lands.

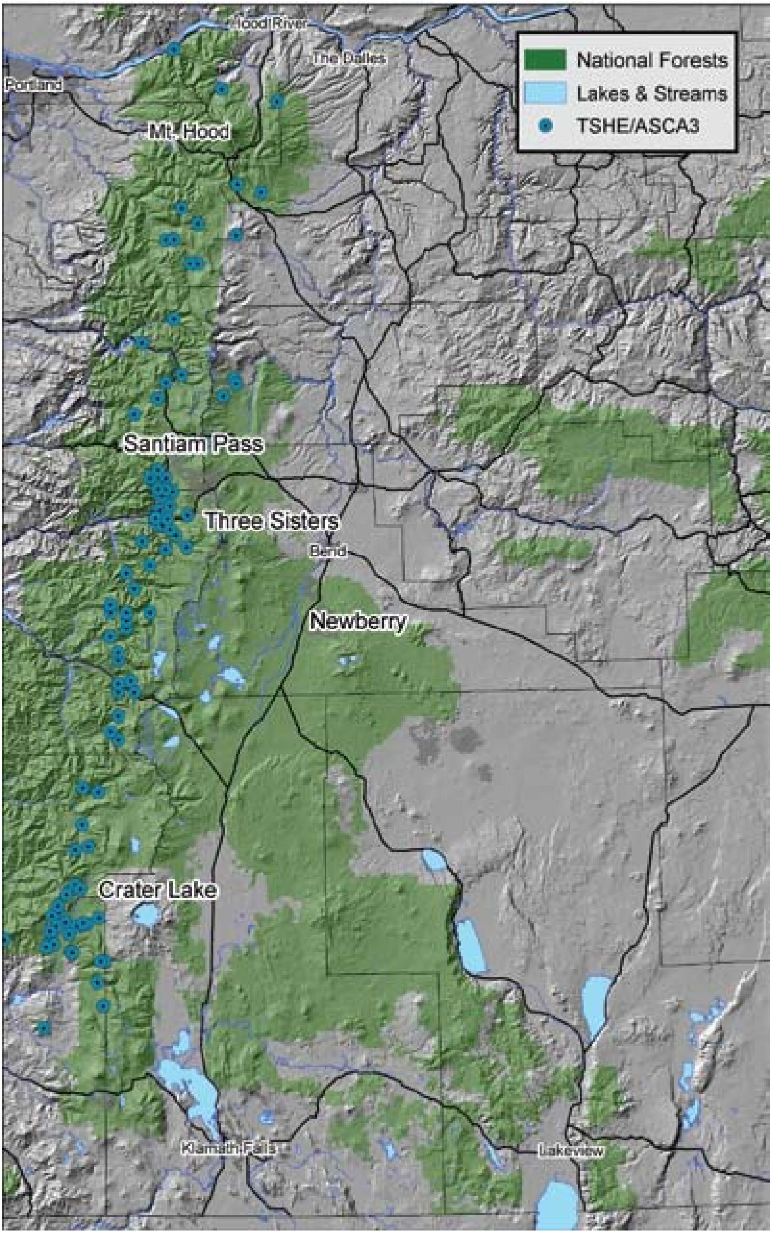






Mean Precip.	62.1"	31-89"
Mean Temp.	45.1°F	40-50°F

Figure 4-4. Map of TSHE/ASCA3 Plot Distribution—



Vegetation— TSHE/ASCA3 is a species-rich plant association of the Western Hemlock Series. ATFI is an alternate indicator species in the herb layer. PSME and TSHE usually dominate the overstory tree layer. Diverse shrub layers occur on TSHE/ASCA3 sites. ACCI, BENE, CHUM, and ROGY are the most common shrub species. Higher cover values of ACCI, RHMA, and CEVE may indicate past disturbance. TSHE/ASCA3 sites are herb rich. Increased amounts of ABAM, VAME, or XETE indicate cooler temperatures and a transition to the ABAM series.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABCO	*Abies concolor*	23	33	19.1	17.2
ABGR	*Abies grandis*	18	33	10.9	2.7
CADE3	*Calocedrus decurrens*	21	35	6.0	3.4
PSME	*Pseudotsuga menziesii*	96	73	47.4	7.4
TABR	*Taxus brevifolia*	12	49	8.5	3.9
THPL	*Thuja plicata*	30	30	19.3	9.6
TSHE	*Tsuga heterophylla*	66	93	24.3	12.3
Shrubs					
ACCI	*Acer circinatum*	68%		21.1	
BENE	*Berberis nervosa*	87%		11.2	
CACH	*Castanopsis chrysophylla*	39%		5.5	
CHUM	*Chimaphila umbellata*	80%		3.6	
COCO2	*Corylus cornuta*	46%		3.9	
PAMY	*Pachistima myrsinites*	30%		1.7	
RHMA	*Rhododendron macrophyllum*	32%		10.5	
ROGY	*Rosa gymnocarpa*	79%		1.4	
RUUR	*Rubus ursinus*	55%		2.3	
SYMO	*Symphoricarpos mollis*	61%		3.9	
VAME	*Vaccinium membranaceum*	39%		1.5	
Herbaceous					
ACTR	*Achlys triphylla*	76%		9.3	
ADBI	*Adenocaulon bicolor*	44%		1.6	
ASCA3	*Asarum caudatum*	97%		2.5	
CLUN	*Clintonia uniflora*	53%		2.8	
COCA	*Cornus canadensis*	32%		5.6	
GOOB	*Goodyera oblongifolia*	45%		0.9	
LIBO2	*Linnaea borealis*	84%		5.4	
SMST	*Smilacina stellata*	69%		4.1	
TITR	*Tiarella trifoliata*	40%		3.1	
TRLA2	*Trientalis latifolia*	45%		1.7	
POMU	*Polystichum munitum*	56%		2.9	
PTAQ	*Pteridium aquilinum*	40%		6.3	

* Species with a constancy of 30% or greater are shown here.

Productivity and Management—

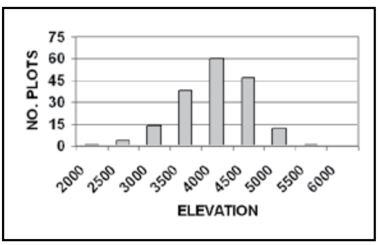
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
TSHE/ASCA3							
ABCO-ABGR	131	4	38	367	11	64	211
ABMAS	128	8	5	361	21	5	212
ABPR	120	12	2	430	18	37	237
CADE3	105	4	12	302	20	20	146
PSME	137	3	134	406	5	994	256
TSHE	109	4	30	369	16	100	186

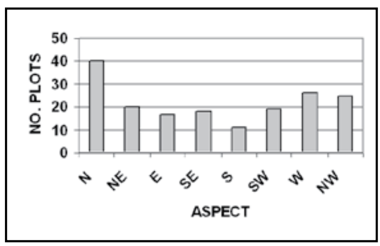
Relationships to Other Classifications— TSHE/ASCA3 has been previously described for central Washington (Lillybridge et al. 1995) and northern Idaho (Cooper et al. 1987). These types are very similar to the TSHE/ASCA3 described here minus ACCI, RHMA, and CADE3 for northern Idaho and minus RHMA and CADE3 for central Washington. Northern Idaho and central Washington are beyond the known range of these species.

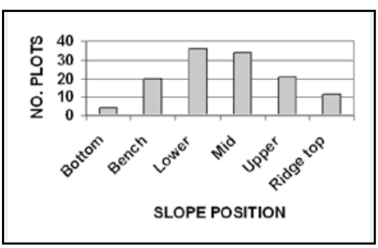
TSHE/CLUN — TSHE Wet

CHF311 (TSHE/CLUN2)
Tsuga heterophylla/Clintonia uniflora
western hemlock/queencup beadlily
Plots 190

Distribution and Environment— TSHE/CLUN is a widespread association. It is found on the eastside of the Cascade Crest from Cache Mountain near Santiam Pass north through the Warm Springs Indian Reservation to the eastside of Mt. Hood. Many sites accumulate subsurface moisture, but in general have better drainage than TSHE/ASCA3 association sites. Average elevation is 3714’ (range 1880-5137’). Average slope is 21% (range 0-90%). Many plots are found on a northern aspect. Slope positions are typically mid to lower slopes or benches.

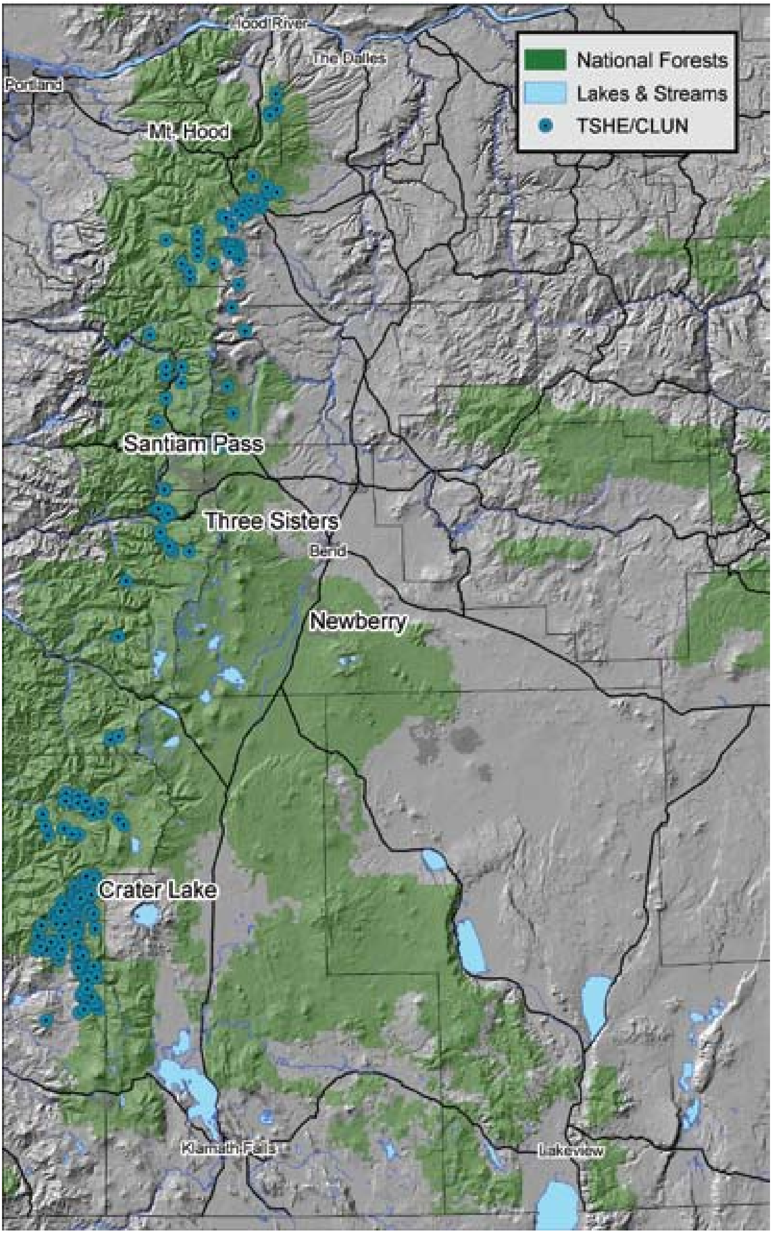






Mean Precip.	52.6”	21-91”
Mean Temp.	44.1°F	40-50°F

Figure 4-5. Map of TSHE/CLUN Plot Distribution—



Vegetation— TSHE/CLUN is an herb-rich association. PSME, ABCO, or ABGR (north of Metolius River) often are important overstory species. TSME and ABAM are only minor or accidental species in this type. Increased amounts of ABAM indicate transition to the ABAM series. Diverse shrub layers occur on TSHE/CLUN sites following disturbance of the tree layers. BENE, CHUM, ROGY, RUUR, and CACH are the shrubs with highest constancy in mid to late seral stands. Higher cover values of ACCI, CACH, or RHMA may indicate past disturbance.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABCO	*Abies concolor*	31	56	18.1	13.8
PIMO	*Pinus monticola*	36	34	5.3	1.5
PSME	*Pseudotsuga menziesii*	96	65	36.8	5.4
TSHE	*Tsuga heterophylla*	72	95	21.3	18.9
Shrubs					
ACCI	*Acer circinatum*	44%		15.5	
BENE	*Berberis nervosa*	94%		11.8	
CACH	*Castanopsis chrysophylla*	72%		6.1	
CHUM	*Chimaphila umbellata*	93%		3.9	
COCO2	*Corylus cornuta*	42%		3.6	
PAMY	*Pachistima myrsinites*	72%		1.9	
ROGY	*Rosa gymnocarpa*	82%		1.4	
RUUR	*Rubus ursinus*	76%		2.1	
SYMO	*Symphoricarpos mollis*	59%		2.2	
VAME	*Vaccinium membranaceum*	68%		3.3	
Herbaceous					
ACTR	*Achlys triphylla*	82%		5.6	
ADBI	*Adenocaulon bicolor*	38%		1.3	
CLUN	*Clintonia uniflora*	100%		1.5	
DIHO	*Disporum hookeri*	34%		0.9	
FRVE	*Fragaria vesca*	40%		1.2	
GOOB	*Goodyera oblongifolia*	67%		0.9	
HIAL	*Hieracium albiflorum*	41%		0.8	
LIBO2	*Linnaea borealis*	96%		8.2	
PTAQ	*Pteridium aquilinum*	36%		2.0	
PYPI	*Pyrola picta*	40%		0.9	
PYSE	*Pyrola secunda*	51%		1.0	
SMST	*Smilacina stellata*	48%		2.1	
TRLA2	*Trientalis latifolia*	58%		1.3	

* Species with a constancy of 30% or greater are shown here.

Productivity and Management—

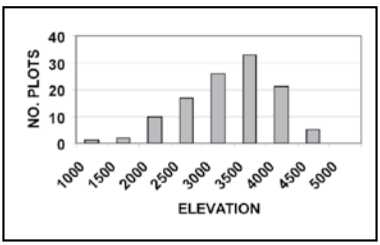
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
TSHE/CLUN							
ABCO-ABGR	122	4	69	295	10	162	165
CADE3	89	8	12	289	20	14	118
PILA	113	4	23	367	17	30	191
PIMO	119	4	19	316	20	30	173
PIPO	139	7	4	288	42	8	184
PSME	121	2	196	349	5	680	194
THPL	93	12	7	347	38	16	148
TSHE	100	3	71	295	9	134	136

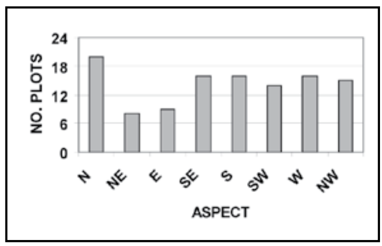
Relationships to Other Classifications—TSHE/CLUN is a widely described type in the Pacific Northwest. It has been described for western Montana (Pfister et al. 1977), northern Idaho (Cooper et al. 1987), and northeastern Washington (Zamora 1983, Williams et al. 1995). A similar TSHE-ABGR/CLUN has been described for northwest Oregon and southwest Washington (Topik et al. 1986, Halverson et al. 1986).

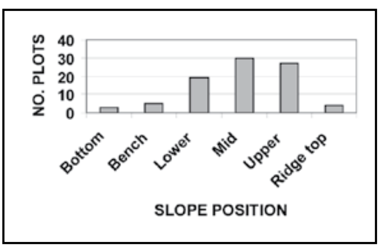
TSHE/ACTR — TSHE Wet

CHF221 (TSHE/ACTR)
Tsuga heterophylla/Achlys triphylla
western hemlock/vanilla leaf
Plots 122

Distribution and Environment— TSHE/ACTR associations have a limited distribution east of the Cascade Crest. Sampled sites are located from Mill Creek on the Warm Springs Indian Reservation, north through the Bear Springs, Barlow, and Hood River Ranger Districts on the Mt. Hood National Forest. Mean precipitation and mean annual temperature are slightly higher than TSHE/CLUN associations; however, TSHE/ACTR associations favor sites with less topographic moisture. This is reflected in an affinity for mid to upper slope positions.

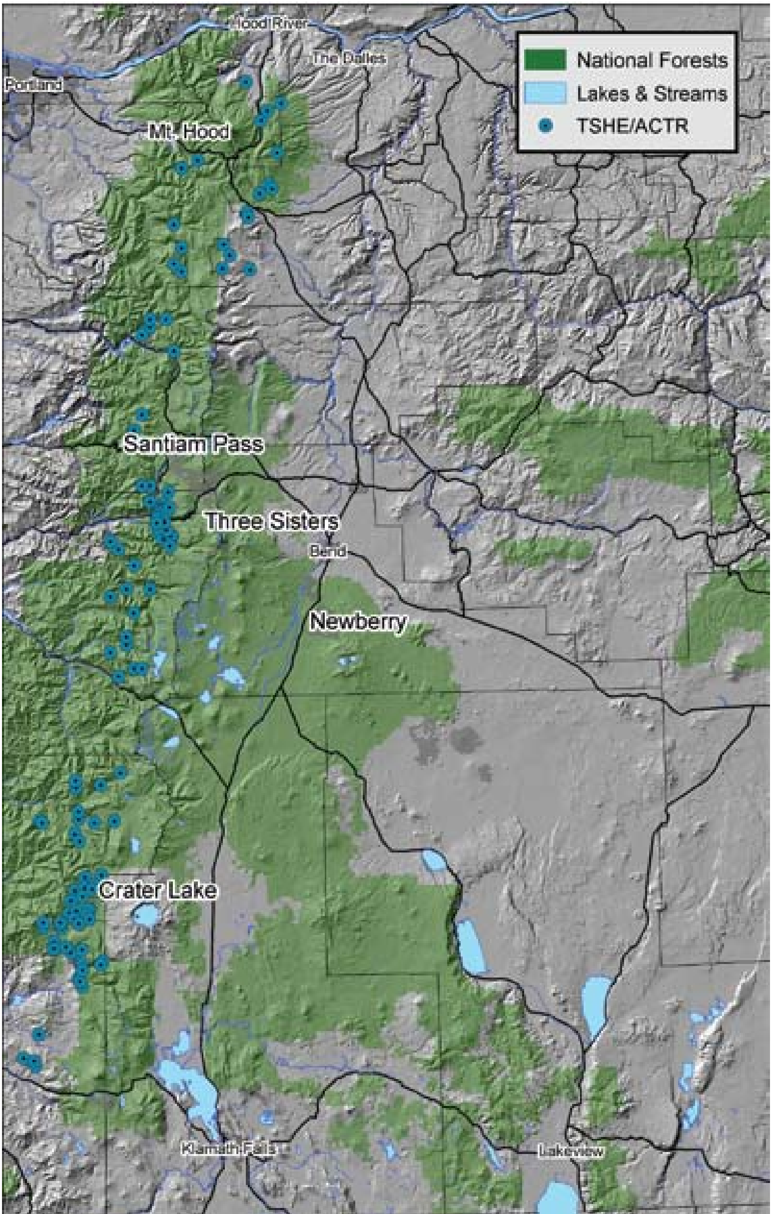






Mean Precip.	59.0”	33-93”
Mean Temp.	45.2°F	40-50°F

Figure 4-6. Map of TSHE/ACTR Plot Distribution—



Vegetation— TSHE/ACTR is an herb-rich association. PSME, ABCO, or ABGR (north of Metolius River) often are important overstory species. TSME and ABAM are only minor or accidental species in this type. Increased amounts of ABAM indicate transition to the ABAM series. Diverse shrub layers occur on TSHE/CLUN sites following disturbance of the tree layers. BENE, CHUM, ROGY, RUUR, and CACH are the shrubs with highest constancy in mid to late seral stands. Higher cover values of ACCI, CACH, RHMA, or PTAQ may indicate past disturbance.

Code	Species Latin Name	% Constancy		% Cover	
Tree		**Over**	**Regen**	**Over**	**Regen**
ABCO	*Abies concolor*	28	43	13.8	17.4
CADE3	*Calocedrus decurrens*	25	33	8.7	4.6
CONU	*Cornus nuttallii*	6	30	6.7	3.7
PSME	*Pseudotsuga menziesii*	96	66	49.6	7.1
TABR	*Taxus brevifolia*	6	40	6.2	4.0
TSHE	*Tsuga heterophylla*	59	98	21.0	9.8
Shrubs					
ACCI	*Acer circinatum*	57%		14.1	
BENE	*Berberis nervosa*	96%		15.0	
CACH	*Castanopsis chrysophylla*	66%		5.6	
CHUM	*Chimaphila umbellata*	84%		3.8	
COCO2	*Corylus cornuta*	45%		4.2	
GASH	*Gaultheria shallon*	30%		18.0	
PAMY	*Pachistima myrsinites*	37%		1.6	
RHMA	*Rhododendron macrophyllum*	35%		12.7	
ROGY	*Rosa gymnocarpa*	74%		1.1	
RUUR	*Rubus ursinus*	61%		2.5	
SYMO	*Symphoricarpos mollis*	48%		3.4	
VAME	*Vaccinium membranaceum*	52%		2.1	
Herbaceous					
ACTR	*Achlys triphylla*	100%		4.6	
ADBI	*Adenocaulon bicolor*	33%		1.0	
FRVE	*Fragaria vesca*	30%		1.5	
GOOB	*Goodyera oblongifolia*	49%		0.9	
HIAL	*Hieracium albiflorum*	43%		0.8	
LIBO2	*Linnaea borealis*	85%		7.1	
SMST	*Smilacina stellata*	30%		0.8	
TRLA2	*Trientalis latifolia*	52%		1.6	
POMU	*Polystichum munitum*	55%		2.5	
PTAQ	*Pteridium aquilinum*	43%		3.5	

* Species with a constancy of 30% or greater are shown here.

Productivity and Management—

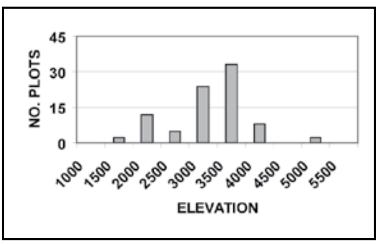
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
TSHE/ACTR							
ABCO-ABGR	123	5	32	305	12	93	172
CADE3	102	3	26	368	12	43	172
PILA	138	4	29	391	14	31	248
PIMO	128	14	5	270	28	7	159
PSME	127	2	149	370	4	878	215
TSHE	105	3	36	377	9	135	182

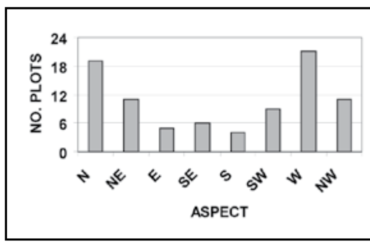
Relationships to Other Classifications— TSHE/ACTR is a widely described type in the Pacific Northwest. TSHE/ACTR has been previously described for northwest Washington (Henderson et al. 1989), southwest Washington (Topik et al. 1986), central Washington (Lillybridge et al. 1995), and northwest Oregon (Halverson et al. 1986, McCain and Diaz 2002). These types are very similar to the TSHE/ACTR described here.

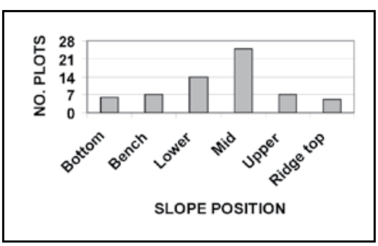
TSHE/LIBO2 — TSHE Wet

CHF321 (TSHE/LIBO3)
Tsuga heterophylla/Linnaea borealis
western hemlock/twinflower
Plots 90

Distribution and Environment— TSHE/LIBO2 is a widespread association. It is found on the eastside of the Cascade Crest from Jefferson Creek north through the Warm Springs Indian Reservation to the eastside of Mt. Hood. Adjacent warmer and drier sites are typically ABCO-ABGR Series sites. Average elevation is 3343' (range 1760-5080'). Average slope is 20% (range 0-80%). Many plots were found on northwestern aspects. Mean precipitation and mean annual temperature are slightly higher than TSHE/CLUN associations, however TSHE/LIBO2 associations favor sites with less topographic moisture. This is reflected in a strong affinity for mid-slope positions.

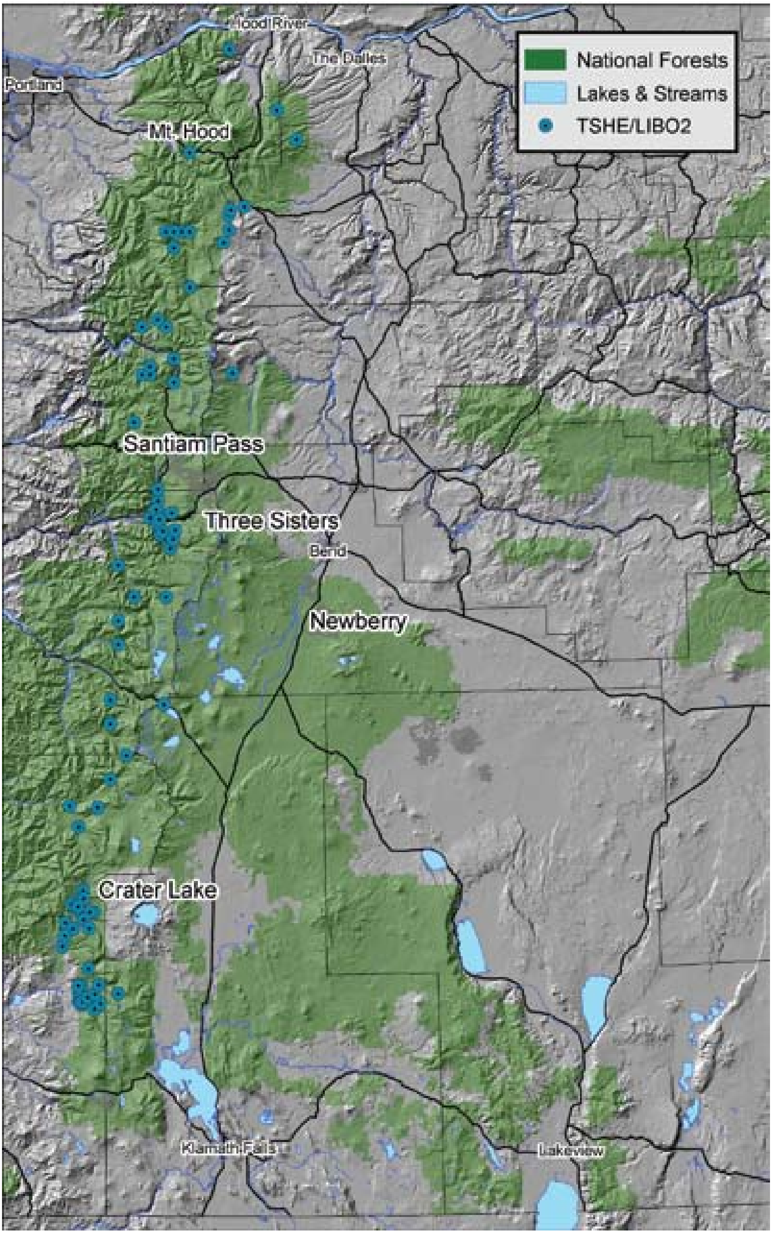






Mean Precip.	61.2"	37-97"
Mean Temp.	45.2°F	44-48°F

Figure 4-7. Map of TSHE/LIBO2 Plot Distribution—



Vegetation— TSHE/LIBO2 is less herb-rich than TSHE/CLUN or TSHE/ACTR associations. PSME, ABCO, or ABGR (north of Metolius River) often are important overstory species. TSME and ABAM are only minor or accidental species in this type. Increased amounts of ABAM indicate transition to the ABAM series. Diverse shrub layers occur on TSHE/LIBO2 sites following disturbance of the tree layers. BENE, CHUM, ROGY, RUUR, and CACH are the shrubs with highest constancy in mid to late seral stands. Higher cover values of ACCI, CACH, RHMA, or PTAQ may indicate past disturbance.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABCO	*Abies concolor*	26	36	14.8	9.8
PSME	*Pseudotsuga menziesii*	87	63	40.2	8.3
TABR	*Taxus brevifolia*	6	30	8.0	1.3
THPL	*Thuja plicata*	26	30	20.4	7.3
TSHE	*Tsuga heterophylla*	62	96	26.6	13.1
Shrubs					
ACCI	*Acer circinatum*	49%		13.6	
BENE	*Berberis nervosa*	93%		9.5	
CACH	*Castanopsis chrysophylla*	53%		4.2	
CHUM	*Chimaphila umbellata*	78%		3.2	
GASH	*Gaultheria shallon*	38%		14.7	
PAMY	*Pachistima myrsinites*	47%		0.9	
RHMA	*Rhododendron macrophyllum*	39%		15.6	
ROGY	*Rosa gymnocarpa*	46%		0.7	
RUUR	*Rubus ursinus*	60%		1.3	
SYMO	*Symphoricarpos mollis*	32%		5.8	
VAME	*Vaccinium membranaceum*	49%		1.1	
Herbaceous					
GOOB	*Goodyera oblongifolia*	43%		0.7	
LIBO2	*Linnaea borealis*	100%		3.5	
POMU	*Polystichum munitum*	31%		1.0	
PTAQ	*Pteridium aquilinum*	33%		1.7	
PYPI	*Pyrola picta*	30%		0.7	
TRLA2	*Trientalis latifolia*	33%		1.4	

* Species with a constancy of 30% or greater are shown here.

Productivity and Management—

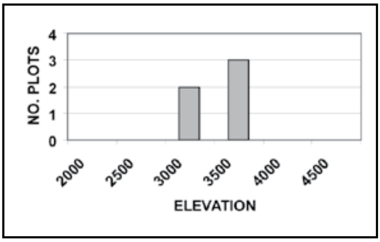
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
TSHE/LIBO2							
ABCO-ABGR	136	5	16	262	24	27	164
PSME	127	4	54	294	6	547	172
TSHE	106	6	15	278	14	147	136

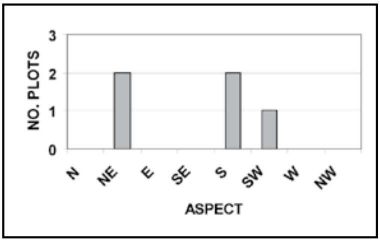
Relationships to Other Classifications— TSHE/LIBO2 and TSHE/RHMA/LIBO2 associations have been previously described for the central Oregon Cascades (Hemstrom et al. 1986, McCain and Diaz 2002). Plots from both types Hemstrom described would key to TSHE/LIBO2 here.

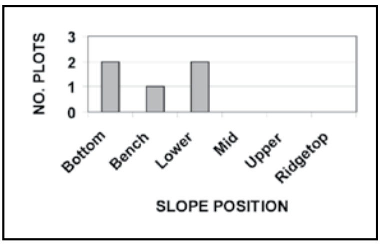
THPL/CLUN **THPL Moist**

CCF221 (THPL/CLUN2)
Thuja plicata/Clintonia uniflora
western red cedar/queencup beadlily
Plots 5

Distribution and Environment— THPL/CLUN is a north Oregon Cascade association. Sample plots come from the eastside of the Mt. Hood National Forest and the Warm Spring Indian Reservation. The association has been observed south to the Metolius Basin. Average elevation is 3576' (range 3100-3855'). Average slope is 21% (range 8-50%). There are too few plot aspects to see a pattern. Slope positions strongly favor lower slopes, wet benches, and alluvial bottomlands.

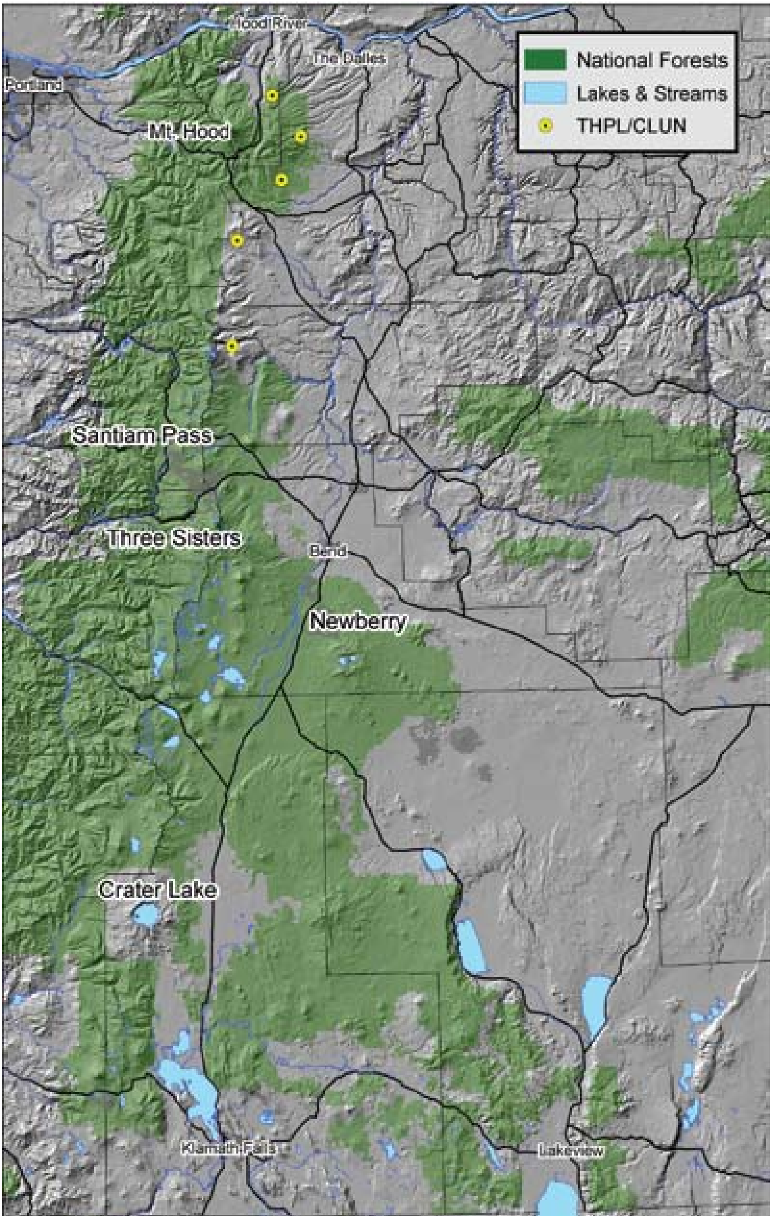






Mean Precip.	49.0"	31-67"
Mean Temp.	45.8°F	44-47°F

Figure 4-8. Map of THPL/CLUN Plot Distribution—



Vegetation—

Code	Species Latin Name	% Constancy*		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABGR	*Abies grandis*	100	100	33.7	6.5
LAOC	*Larix occidentalis*	40	-	2.0	-
PIEN	*Picea engelmannii*	20	40	1.0	1.0
PIMO	*Pinus monticola*	60	20	2.0	2.0
PIPO	*Pinus ponderosa*	80	-	6.3	-
PSME	*Pseudotsuga menziesii*	100	40	21.6	1.0
THPL	*Thuja plicata*	80	60	4.0	2.7
Shrubs					
ACGL	*Acer glabrum*	60%		3.9	
AMAL	*Amelanchier alnifolia*	80%		1.3	
BENE	*Berberis nervosa*	80%		2.3	
CHME	*Chimaphila menziesii*	80%		1.0	
CHUM	*Chimaphila umbellata*	100%		2.7	
HODI	*Holodiscus discolor*	60%		1.2	
PAMY	*Pachistima myrsinites*	80%		1.3	
RILA	*Ribes lacustre*	60%		0.7	
ROGY	*Rosa gymnocarpa*	100%		2.3	
RUPA	*Rubus parviflorus*	60%		0.7	
RUUR	*Rubus ursinus*	40%		2.5	
SYAL	*Symphoricarpos albus*	40%		0.9	
SYMO	*Symphoricarpos mollis*	100%		2.0	
Herbaceous					
ACTR	*Achlys triphylla*	80%		2.0	
ADBI	*Adenocaulon bicolor*	40%		1.5	
ARMA3	*Arenaria macrophylla*	80%		0.8	
CLUN	*Clintonia uniflora*	100%		2.6	
DIHO	*Disporum hookeri*	40%		0.6	
FRVE	*Fragaria vesca*	100%		1.6	
GOOB	*Goodyera oblongifolia*	100%		1.0	
LIBO2	*Linnaea borealis*	100%		6.5	
OSCH	*Osmorhiza chilensis*	60%		1.0	
PTAQ	*Pteridium aquilinum*	60%		1.0	
PYPI	*Pyrola picta*	60%		1.7	
PYSE	*Pyrola secunda*	100%		0.9	
SMST	*Smilacina stellata*	60%		1.0	
TIUN	*Tiarella unifoliata*	40%		1.0	
TRLA2	*Trientalis latifolia*	100%		2.6	
Graminoids					
FEOC	*Festuca occidentalis*	40%		0.6	

* Species with a constancy of 30% or greater are shown in table.

THPL/CLUN is an herb-rich association. PSME or ABGR often are important overstory species. Diverse shrub layers occur on THPL/CLUN sites following disturbance of the tree layers. Higher cover values of ACGL, CACH, or RHMA may indicate past disturbance.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
THPL/CLUN							
ABCO-ABGR	106	63	2	164	22	7	80
PSME				121	13	10	

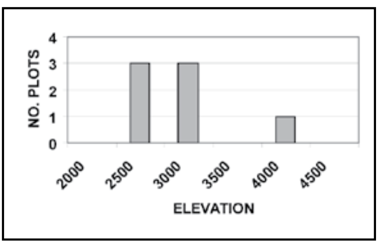
Relationships to Other Classifications—THPL/CLUN has been previously described for northeast Washington (Williams et al. 1990, Zamora 1983), northern Idaho (Cooper et al. 1987), and western Montana (Pfister et al. 1977). These types are similar in concept, but typically have much higher cover values of THPL than the type as described here.

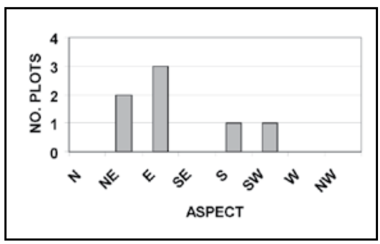
Similar associations, (THPL/ACTR, TSHE-ABGR/CLUN) described for the eastside of Mt. Hood and southwest Washington (Topik et al. 1988, Topik 1989, Diaz et al. 1996) have plots that may key to THPL/CLUN here.

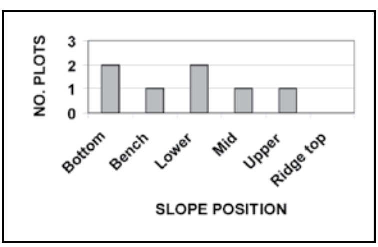
THPL/LIBO2 — THPL Moist

CCF211 (THPL/LIBO3)
Thuja plicata/Linnaea borealis
western red cedar/twinflower
Plots 7

Distribution and Environment— THPL/LIBO2 is predominantly a north Oregon Cascade association. Sample plots come from the eastside of the Mt. Hood National Forest and the Warm Springs Indian Reservation. Two isolated occurrences come from the Willamette and Umpqua National Forests. These outliers may belong to an analogous TSHE/LIBO2 type. The association has been observed south to the Metolius Basin although no sample plots have been installed in these southern locations. Average elevation is 3176’ (range 2600-4100’). Average slope is 19% (range 1-45%). There are too few plot aspects to see a pattern. Slope positions are slightly more variable than THPL/CLUN, but still indicate affinities to lower slopes, benches, and bottomlands.

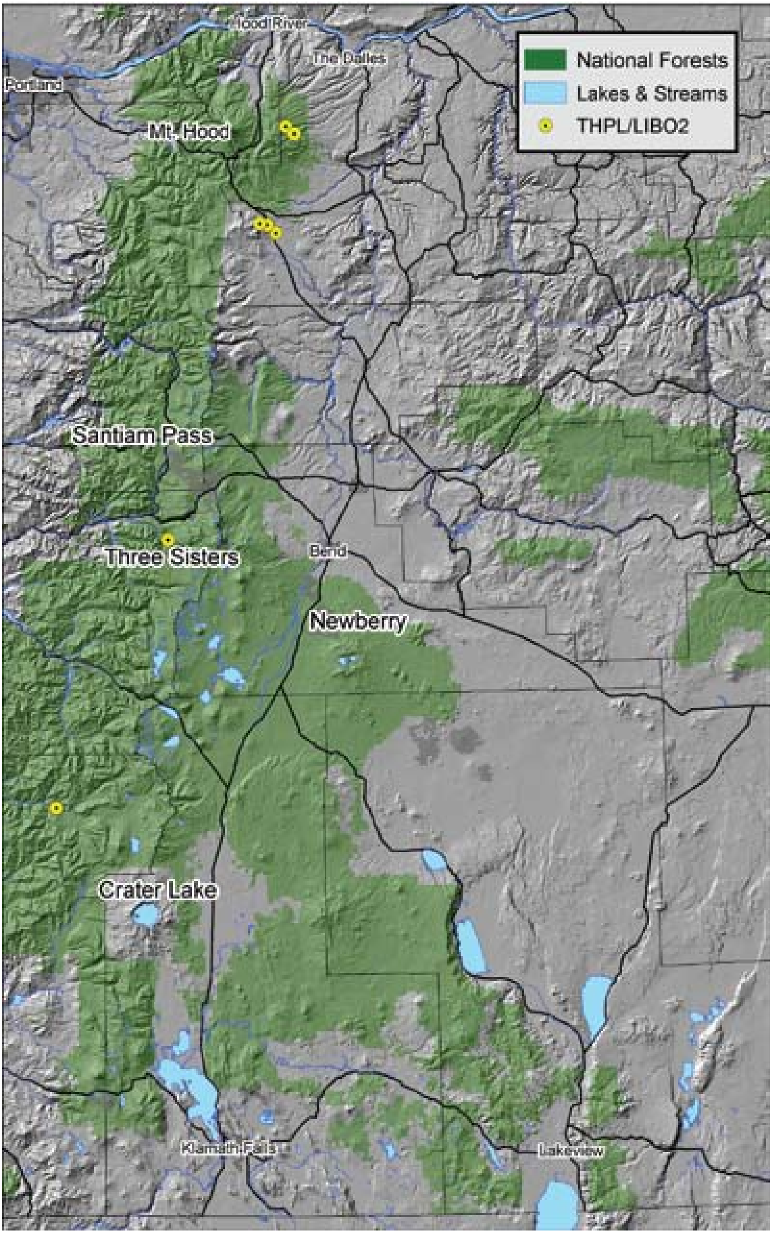






Mean Precip.	42.7”	23-75”
Mean Temp.	46.6°F	44-50°F

Figure 4-9. Map of THPL/LIBO2 Plot Distribution—



Vegetation— THPL/LIBO2 is an herb-rich association, but is less rich than THPL/CLUN. PSME or ABGR often are important overstory species. Diverse shrub layers occur on THPL/LIBO2 sites following disturbance of the tree layers. Higher cover values of ACCI, ACGL, ARPA, CEVE, CACH, or RHMA may indicate past disturbance.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABGR	*Abies grandis*	57	57	24.8	9.5
LAOC	*Larix occidentalis*	43	-	2.3	-
PIPO	*Pinus ponderosa*	57	14	9.0	1.0
PSME	*Pseudotsuga menziesii*	86	43	36.3	1.0
THPL	*Thuja plicata*	86	57	19.7	5.0
Shrubs					
ACCI	*Acer circinatum*	71%		10.4	
ACGL	*Acer glabrum*	43%		1.7	
BENE	*Berberis nervosa*	71%		4.4	
CACH	*Castanopsis chrysophylla*	43%		1.3	
CHME	*Chimaphila menziesii*	71%		0.8	
CHUM	*Chimaphila umbellata*	86%		2.2	
COCO2	*Corylus cornuta*	43%		1.7	
PAMY	*Pachistima myrsinites*	43%		2.3	
ROGY	*Rosa gymnocarpa*	86%		2.2	
RUUR	*Rubus ursinus*	43%		1.0	
SYAL	*Symphoricarpos albus*	57%		2.3	
SYMO	*Symphoricarpos mollis*	57%		1.3	
Herbaceous					
ACTR	*Achlys triphylla*	43%		1.4	
FRVE	*Fragaria vesca*	43%		2.3	
GOOB	*Goodyera oblongifolia*	43%		1.0	
LIBO2	*Linnaea borealis*	100%		5.0	
POMU	*Polystichum munitum*	43%		0.7	
PYSE	*Pyrola secunda*	43%		1.7	
SMRA	*Smilacina racemosa*	43%		1.0	
SMST	*Smilacina stellata*	43%		1.0	
TRLA2	*Trientalis latifolia*	86%		3.3	
Graminoids					
FEOC	*Festuca occidentalis*	60%		1.0	

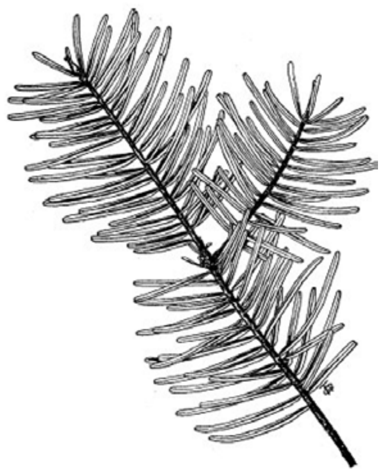
* Species with a constancy of 30% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
THPL/LIBO2							
ABCO-ABGR				118	7	5	
PIPO				81	11	4	28
PSME	82	6	2	94	5	16	35

Relationships to Other Classifications— THPL/LIBO2 has not been previously described in the Pacific Northwest. A similar type, THPL-ABGR/ACTR, has been described on the eastside of the Mt. Hood National Forest which would have a few plots key here.

White Fir – Grand Fir Series



WHITE FIR – GRAND FIR SERIES

ABCO-ABGR
Abies concolor-Abies grandis
white fir – grand fir
Total plots 2071

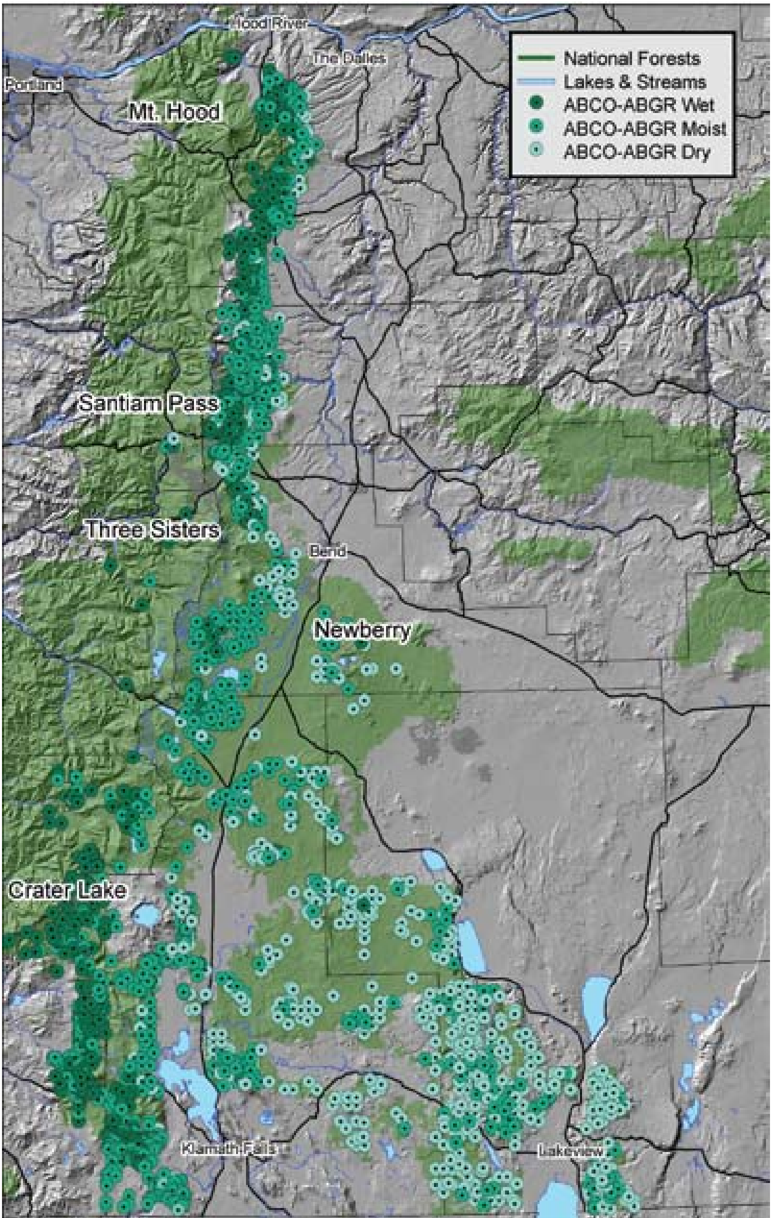
Distribution and Environment— In the eastern Oregon Cascades, grand fir reaches its southern limit as an important forest species in the Metolius drainage. South of there, grand fir hybridizes with white fir. The zone of hybridization continues south to Klamath Falls, Oregon, and extends west to the Siskiyou Mountains and east through the Blue Mountains to central Idaho (Steinhoff 1978). In the eastern Blue Mountains and central Idaho the hybrids were determined to have more characteristics of grand fir than white fir and are usually recognized (named) as grand fir (Daniels 1969).

In central Oregon, the affinities to one of the parent species or the other are less clear. Individual trees and groups of trees within stands may exhibit more characteristics from either species, or such a mix of characteristics from both species, that naming the population for either species is problematic. Names applied to individuals from these mixed populations have varied through time and by investigator. Usually, all trees were designated either white fir or grand fir on a site, no matter what the mix of characteristics on an individual tree might otherwise indicate. White fir appears to have slightly greater amplitude in moisture requirements (tolerates somewhat drier conditions) and also appears to have slightly earlier development of fire resistant bark. However, overall the two species appear to have similar successional relationships with their associated species. Due to the inconsistencies in naming by investigators, all of the species records for white fir and grand fir were lumped in this analysis and have been grouped into a single series.

South and east of Klamath Falls, populations of mid-elevation true firs more readily fit typical white fir descriptions. The distribution of white fir continues south through the Modoc Plateau, Southern Cascades into Northern California, and through mid-elevations of the Sierra Nevada Range south to southern California.

This distribution suggests that the White Fir-Grand Fir Series has an affinity for modified maritime climates and does not tolerate dry, extended cold temperatures well, though it tolerates drier conditions than do western hemlock or western red cedar, which share a similar

Figure 5-1. Map of ABCO-ABGR Series Plot Distribution by PAG—



geographical distribution across Oregon and Washington. White fir-grand fir is an important forest species complex in central Oregon and climax white fir-grand fir stands are a major component of the east slope Cascade forests. In addition, it is a major seral species in the Western Hemlock Series, and a seral species in some of the warmer types in the Pacific Silver Fir and Mountain Hemlock Series as well. It is virtually absent from the Douglas-fir, Ponderosa Pine, Lodgepole Pine, and Western Juniper Series because they are too hot and dry. The extremely cold and harsh conditions of Whitebark Pine Series also exclude white fir and/or grand fir.

Vegetation— Douglas-fir or ponderosa pine, or both, dominate the overstory canopy of most stands in the series. White fir or grand fir often occur as co-dominants, especially in the moister associations and community types, but is less often found as a dominant. Western larch and lodgepole pine are seral species found in some habitats. Western white pine is a significant component only in wetter and cooler types. Western white pine was probably more important in the White Fir-Grand Fir Series before white pine blister rust was introduced into the area.

Those series most commonly confused with the White Fir-Grand Fir Series in early to mid-seral stands are the Douglas-fir, Shasta Red Fir, Silver Fir, and Western Hemlock Series. These species typically bound the grand fir zone and consequently can cause identification difficulties in the transition areas. It is not uncommon to debate the "true" series on some sites. Undergrowth in mature forest stands varies from a dense shrub layer difficult to penetrate, to grass and sedge-dominated swards. No undergrowth species occur across all types in the series and none are confined to this series. Understory species are typically restricted in their distribution within the series to 1 or 2 PAGs. Important factors governing species patterns include water availability, temperature, parent material, and past disturbances, including grazing, logging, and fire.

A number of understory species are common to this series and almost never found in the drier Douglas-fir, Ponderosa Pine or Oak Series. Generally, stands containing starry solomonplume, queencup beadlily, Hooker fairybells, vine maple, Cascade Oregongrape, twinflower, or vanilla leaf are able to support a series more moist than Douglas-fir, ponderosa or lodgepole pine. The presence of species such as dwarf bramble or skunkleaf polemonium indicates more moist, maritime, or cooler series such as Western Hemlock, Pacific Silver Fir, Subalpine Fir or Mountain Hemlock Series.

On many sites, dense shrubfields typify early successional stages after logging, fires, and other disturbances. Perturbation types, timing and intensity, combined with species composition prior to disturbance, are important modifiers of secondary succession. In spite of the complexity of possible successional paths, some general patterns exist. Fall broadcast burns tend to favor development of redstem and snowbrush ceanothus, with vine maple, chinquapin, greenleaf manzanita and Scouler willow more favored by spring burns. Fall burns meet the scarification and cold wet stratification needs of ceanothus, while spring burns normally do not provide sufficient cold-wet seed stratification for maximum germination. If ceanothus was common on the site prior to burning, it may resprout vigorously. However, even if little ceanothus is evident, seed viability may exceed 300 years. Spring burning favors species that resprout from root crowns but whose seeds are not stored for long periods of time in the soil.

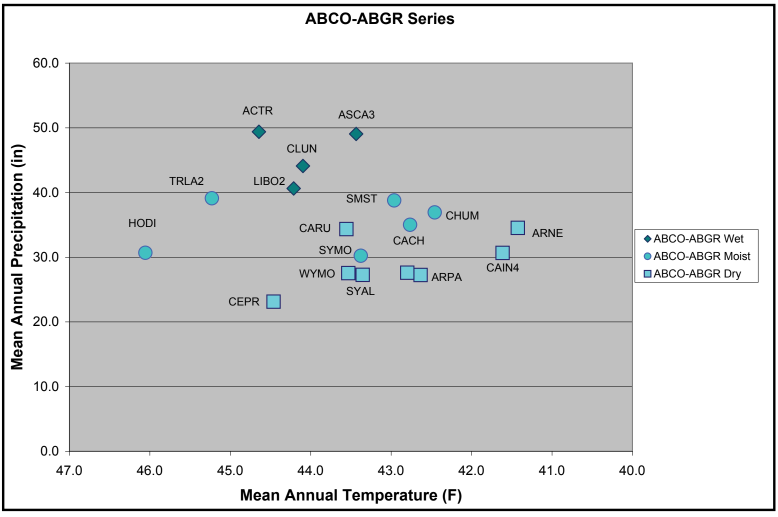
The ABCO-ABGR Series plant associations have been further grouped into plant association groups (PAGs) which reflect effective temperature-precipitation zones. ABCO-ABGR Wet consists of ABCO-ABGR/ASCA3, ABCO-ABGR/CLUN, ABCO-ABGR/ACTR, and ABCO-ABGR/LIBO2. ABCO-ABGR Moist consists of ABCO-ABGR/TRLA2, ABCO-ABGR/CACH, ABCO-ABGR/SMST, ABCO-ABGR/SYMO, ABCO-ABGR/CHUM, and ABCO-ABGR/HODI. ABCO-ABGR Dry consists of ABCO-ABGR/SYAL, ABCO-ABGR/CARU, ABCO-ABGR/ARNE, ABCO-ABGR/CAIN4, ABCO-ABGR/CEPR, ABCO-ABGR/WYMO, ABCO-ABGR/ARPA, and ABCO-ABGR/STJA. Species diversity declines as the plant associations change from warm to cold and wet to dry within the series.

ABCO-ABGR Wet PAG plant associations typically have herb-rich understory vegetation. These types represent the wettest and most productive sites in the ABCO-ABGR Series. The shrub layer is variable; the most common species in mid-late seral stands are BENE, CACH, CHUM, ROGY, RUUR, and SYMO. Diverse shrub layers often form after disturbance. Douglas-fir is typically a significant component of overstory canopies and is a primary early seral conifer. These sites are often transitional to TSHE, ABAM, or TSME series.

The ABCO-ABGR Moist PAG represents the middle moderate environments within the ABCO-ABGR series. Douglas-fir is an important component of these types outside the deep ash/pumice deposits of the Mazama ash plume. Diverse shrub layers often form after disturbance. Typical species are ARPA, CACH, CEVE, HODI, ROGY, SYAL, and SYMO. Colder sites transition to Shasta red fir (south of Lookout Mountain on the Deschutes National Forest) or to Mountain Hemlock Series. Many sites have high precipitation but are well drained especially within the Mazama ash/pumice deposits.

The ABCO-ABGR Dry PAG represents warm (SYAL, CARU, CEPR, WYMO, ARPA) or cold dry (ARNE and CAIN4 associations) environments. Although average precipitation on some of these sites is relatively high, effective moisture is much lower than corresponding ABCO-ABGR Moist plant associations due to excessively drained soils. Plant associations in this group are extremely species poor. These associations are generally too cold or have too frequent a disturbance interval to support high constancy or coverage of Douglas-fir. Colder portions of this PAG (ARNE and CAIN4 associations) may have

Figure 5-2. Temperature – Precipitation Relationships for Plant Associations and Plant Association Groups within the ABCO-ABGR Series .



lodgepole pine as the dominant early seral conifer and may support Shasta red fir south of Lookout Mountain on the Deschutes National Forest.

Fire— The white fir-grand fir series occupies a relatively wide elevation band, encompassing two fire regimes. This series covers extensive areas east of the Cascade crest. Agee (1994) considered this zone to occupy an intermediate landscape position between lower elevation and subalpine forests.

The ABCO-ABGR Dry plant association group is associated with a historically very frequent, low-intensity fire regime (Fire Regime I) with a return interval of 9-25 years (Bork 1985). Under the historical regime, frequent burning and self-thinning created typical stand densities of 15-50 stems per acre. Evidence from the Klamath-Siskiyou Mountains suggests that the most common fire type was a low severity underburn. Occasional patches of stand-replacing fire were not uncommon, but these patches tended to be small, akin to group torching and short crowning runs of only a few minutes duration, and generally were not of a size that would indicate placement into a mixed severity fire regime. Stand replacement fires occurred on average about once every 100-200 years (Agee 1993), usually driven by regional drought. White fir or grand fir was present in unburned areas, but generally was much less common and abundant than today. Douglas-fir, ponderosa pine and western larch (north of McKenzie Pass) were the most common tree dominants, being resistant to fires after they have matured enough to develop the characteristic thick, corky, insulating bark typical of the species. Because grand fir and white fir are less fire resistant than ponderosa pine or Douglas-fir, fire would tend to remove it from stands (Agee 1993).

The ABCO-ABGR Moist group is believed to experience somewhat longer average fire return intervals and a greater incidence of stand-replacement patches. The resulting complex makes it difficult to determine if the moist plant association group belongs in fire regime I or fire regime III, tending to exhibit characteristics of both. The moister sites in this PAG will more approximate a mixed severity fire regime (Fire Regime III), with historic fire return intervals of 40-100 years (Agee 1993). Historically, therefore, this portion of the ABCO-ABGR series took the form of a landscape mosaic rather than the more even, park-like nature of drier ponderosa pine. Patches of white fir and grand fir tended to be larger and occur more frequently across the landscape and both species tended to be somewhat more common as a stand component intermixed with earlier seral species as compared to the dry PAG group in this series.

The wet end of the series (ABCO-ABGR Wet PAG) falls more obviously into fire regime III with still longer fire return intervals and a greater incidence of stand-replacing patches. Collectively, the transitional nature of white fir-grand fir series resulted in a very complex mosaic of species, patch sizes, stand structures, and stand ages and a naturally fragmented landscape.

Fire exclusion has significantly altered stand dynamics in the dry and moist groups of this series. The proportional representation of white fir and grand fir has increased dramatically along with surface fuel loadings and ladder fuel extent. Removal of the small and medium sized fires with their stand-replacing patches and high proportion of edge has increased landscape homogeneity and increased the probability of very large fires with a reduced post-fire mosaic of unburned, lightly burned and moderately burned patches. Understory vegetation has likely been altered as well, although, this aspect of the forest is not well studied or understood at the landscape scale.

It is less clear how or whether fire exclusion has significantly altered the ABCO-ABGR Wet PAG. In very moist white fir-grand fir sites, conditions were conducive to less frequent fires of higher intensity, usually resulting in a greater proportion of stand replacement. After high-intensity fires, throughout the White Fir-Grand Fir Series, seral trees such as ponderosa pine, Douglas-fir, western larch, or lodgepole pine are the first to regenerate and claim the open sites. Lodgepole pine can form dense stands in these instances if present in the previous stand.

Productivity and Management— Tree productivity is generally good in this series. As effective moisture increases within the series, tree productivity also increases. The plant association groups defined within the series capture major changes in historic disturbance regimes and also reflect differences in site productivity. Site index (SI), growth basal area (GBA), and yield capability (Ft^3) summaries by species and plant association group are displayed in Table 5-1.

ABCO-ABGR Dry plant associations historically experienced frequent low-severity disturbances (fire regime 1 and fire regime 3a). Site productivity in this PAG is the lowest within the series. Ponderosa pine and lodgepole pine (cooler sites only) are the best species to feature in managed stands.

ABCO-ABGR Moist plant associations typically had very mixed severity disturbance regimes on a longer interval (fire regime 3b). Site productivity in this PAG is 10-15% greater than the ABCO-ABGR Dry PAG. Choices of species to feature in managed stands in the ABCO-ABGR Moist PAG are more varied than in the ABCO-ABGR Dry associations. Douglas-fir and western larch, where present, ponderosa pine, and sugar pine should all be successful species on these sites.

ABCO-ABGR Wet plant associations historically experienced the longest disturbance intervals and the greatest percentage of stand replacement disturbances within the series. Average site productivity is 10-20% greater than in the ABCO-ABGR Moist PAG and 20-35% greater than ABCO-ABGR Dry sites. Species to feature in managed stands in the ABCO-ABGR Wet PAG are more varied than in the ABCO-ABGR Dry or ABCO-ABGR Moist associations. Douglas-fir, ponderosa pine, or western larch, where present, should all be successful on these sites. Sugar pine and western white pine are very productive on these sites, but may be more susceptible to blister-rust than in the drier PAGs.

Because white fir-grand fir stands are often departed from historic proportions on the landscape due to fire exclusion, and many of these areas are in the wildland-urban interface, they are often good candidates for thinning. The dense understories and ladder fuels typical in this series require thinning and clearing of slash before using prescribed burning. Thinning from below, free thinning, and reserve tree shelterwoods methods are the most useful for reducing crown fires (Oester et al. 2002). Selection thinning and approaches that maintain multiple canopy layers usually will not reduce the risk of crown fires (Graham et al. 1999). Prescribed burning can be thought of as a maintenance treatment applied on a routine basis, once proper stand density has been achieved.

Other resource concerns, such as habitat for the northern spotted owl, will complicate fuels treatments planning. Stands within moister portions of this series commonly serve as some of the most productive spotted owl habitats on the east slope of the Cascades. Large amounts of dead and down material and multiple structural layers (often the

Table 5-1 Site Index (SI standard error), Growth Basal Area (GB A standard error), Yield Capability (Ft$^{3)}$ by Species and Plant Association Group within theABCO-ABGR Series

PAG	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
ABCO-ABGR Dry							
ABCO-ABGR	80	1	379	244	3	2678	89
ABMAS	84	7	9	334	10	187	129
CADE3	55	5	11	152	6	168	39
PICO	62	1	255	149	2	1854	42
PILA	83	4	23	167	8	122	64
PIPO	82	1	678	164	1	3433	62
PSME	98	4	30	205	9	126	93
ABCO-ABGR Moist							
ABCO-ABGR	99	1	531	231	2	2306	105
ABMAS	95	3	56	289	9	220	127
CADE3	94	2	7	274	18	42	118
PICO	69	2	120	128	3	616	41
PILA	106	5	29	183	6	189	89
PIPO	95	1	615	178	2	1934	78
PSME	115	1	383	247	3	1230	130
ABCO-ABGR Wet							
ABCO-ABGR	121	2	282	283	4	811	158
ABMAS	119	5	26	314	22	51	172
CADE3	108	3	30	314	22	58	157
PICO	84	5	14	133	4	165	51
PIEN	106	5	19	276	14	34	134
PILA	130	5	12	344	30	16	205
PIPO	105	2	124	215	5	288	104
PSME	131	1	341	298	4	1144	179

result of lack of natural fire) provide habitat suitable to meet the owl's requirements. Stands within the series also tend to be relatively warm and therefore important fawning and forage areas in the spring for large ungulates. Areas with high shrub cover are useful for deer and elk, providing both forage and cover.

Mature and late seral stands are not normally well suited to domestic livestock grazing, due to low amounts of palatable forage produced in mature stands. Only ABCO-ABGR/CARU and ABCO-ABGR/SYAL associations provide enough forage in late seral stages. However, early seral stages may provide high quantities of forage and consequently serve as excellent transitional range in most of the series.

Key Insects and Diseases: Western spruce budworm (PSME, ABCO), Douglas-fir tussock moth (PSME, ABCO), fir engraver, western pine beetle, mountain pine beetle, rust red stringy rot, white pine blister rust, laminated root rot, and Armillaria and annosus root diseases, dwarf mistletoe in Douglas-fir, ponderosa pine, and western larch, dwarf mistletoe in white and grand fir and associated decay fungi.

Secondary Insects and Diseases: pine engraver (PIPO), Douglas-fir beetle, dwarf comandra blister rust, needle diseases and blights of western larch.

Important Effects: Both the Douglas-fir tussock moth and western spruce budworm currently have much more available habitat than they did in the past, and their damage has become more severe than it was historically. The tussock moth is on a 9-10 year outbreak cycle with each outbreak lasting only three years, while budworm cycles are unpredictable in both occurrence and duration. The Douglas-fir tussock moth tends to have its most dramatic effects in low to mid-elevation late seral stands that were traditionally fire-climax ponderosa pine (Hessburg et al. 1994). Stands affected by the budworm are often on considerably moister sites than those favoring the tussock moth. Budworm outbreaks can persist for many years as host trees are repeatedly defoliated year after year. Complex forests with several ages of trees and a high percentage of host trees are most heavily damaged by the budworm. Common effects from the spruce budworm include tree mortality in smaller host trees and top-kill in larger trees. Fir engravers are normally associated with trees infected by root pathogens, but during drought periods can be found wherever the true fir host occurs. Tree mortality caused by the fir engraver is most extreme where rainfall is between 20 and 25” per year, and decreases with increasing available moisture. In such settings, long-term management of a white fir component is not recommended. Defoliator outbreaks are often followed by elevated fir engraver populations. The western pine beetle is most important as a mortality agent of older low-vigor ponderosa pines, especially those growing under dense conditions. Dense stands of second-growth ponderosa pine can also be affected. Mountain pine beetle is common in dense second-growth stands of ponderosa pine, especially on the driest sites, where trees are killed in groups. The pine engraver is commonly found in pine slash but rarely kills trees.

Root diseases are the most important disease in the ABCO-ABGR series and are present on 36% of plots in this type. Armillaria root disease is the most prevalent. It can be locally severe creating large openings where highly susceptible species (white and grand fir) never attain large size. Annosus root disease is also common in the ABCO-ABGR series with incidence increasing on the Warm Springs Indian Reservation (WSIR). Both Armillaria and annosus have increased in severity in stands where intensive management has occurred. The late successional true fir species are the most susceptible species to all root diseases. Annosus root disease (s-type) incidence increases with an increase in number of harvest entries (Schmitt et al. 1984), however, in plantations effects are minimal 25 years after harvest (Filip et al. 2006). Laminated root rot occurs in scattered pockets on the ABCO-ABGR moist associations especially in the northern end of this series on the WSIR (Marsh et al. 1987) and Mt. Hood National Forest and west of Crater Lake NP.

Dwarf mistletoe was present on 35% of the CVS plots in the ABCO-ABGR series. Dwarf mistletoe is most damaging on Douglas-fir, western larch, and ponderosa pine. Growth loss is high when trees are severely infected and can often lead to mortality. Impacts are greatest in single-species host stands and in stands with infected overstories above susceptible understories (Goheen and Willhite 2006). Young stands that are heavily infected will not develop into large tree dominated forests.

White pine blister rust, an exotic disease, is common in these systems on all five needle pines. It is more common on the ABCO-AGBR wet and moist PAGs, and relatively rare on the dry PAG. Indian paint fungus is considered to be the most significant cause of heart rot in true fir species and frequently causes stem breakage. Comandra blister rust is found throughout the range of ponderosa pine and is most common on Sisters RD, typically in the ABCO/ABGR and PSME series. Infection is rare, but an infection period is thought to have occurred in the 1930s (Filip 1977).

Wildlife Management— Because wildlife habitats do not precisely match plant associations or even plant series, Appendix C in this guide is provided. Please see page C-9 for a discussion on white fir/grand fir.

Relationships to Other Classifications— A Grand Fir Series has been described by numerous authors. A partial list of the areas and workers includes the Cascades (Topik et al 1988; Topik 1989, McCain and Diaz 2002); eastern Washington and Oregon (Daubenmire and Daubenmire 1968; Hall 1973; Clausnitzer and Zamora 1987; John et al 1988; Williams et al 1990; Johnson and Clausnitzer 1992); northern Idaho (Cooper et al 1987); central Idaho (Steele et al 1981, and Montana (Pfister et al 1977). A White Fir Series has been defined for southwest Oregon (Atzet et al 1996) and Northeast California (Smith 1994, 2003). A variety of plant associations have been described, from quite xeric to quite moist. Typically, grand fir or white fir is the climax tree in areas too dry for more shade tolerant trees like western hemlock

Key to Plant Associations of the Grand Fir & White Fir Series–

1a *Asarum caudatum* or *Athyrium filix-femina* >1% ABCO-ABGR/ASCA3
1b Not as above 2a

2a *Clintonia uniflora* (>1%) and not restricted to microsites . . . .ABCO-ABGR/CLUN
2b Not as above 3a

3a *Achlys triphylla* (>1%) and not restricted to microsites . . . . .ABCO-ABGR/ACTR
3b Not as above 4a

4a *Linnaea borealis* (>1%) and not restricted to microsites . . . ABCO-ABGR/LIBO2
4b Not as above 5a

5a *Trientalis latifolius* (>1%) and not restricted to microsites . . ABCO-ABGR/TRLA2
5b Not as above 6a

6a *Castanopsis chrysophylla* (>5%) and not restricted to microsites . . . . ABCO-ABGR/CACH
6b Not as above 7a

7a *Smilicina stellata* (>1%) and not restricted to microsites . . . .ABCO-ABGR/SMST
7b Not as above 8a

8a *Symphoricarpos mollis* (>5%) and not restricted to microsites . . . . ABCO-ABGR/SYMO
8b Not as above 9a

9a *Chimaphila umbellata* (>1%) and not restricted to microsites . . . . ABCO-ABGR/CHUM
9b Not as above 10a

10a *Holodiscus discolor* (>1%) and not restricted to microsites . . ABCO-ABGR/HODI
10b Not as above 11a

11a *Symphoricarpos albus* (>1%) and not restricted to microsites. . . . . ABCO-ABGR/SYAL
11b Not as above 12a

12a *Calamagrostis rubescens* (>5%) and not restricted to microsites . . . . ABCO-ABGR/CARU
12b Not as above 13a

13a *Arctostaphylos nevadensis* (>5%) not restricted to microsites . . . . ABCO-ABGR/ARNE
13b Not as above 14a

14a *Ceanothus prostratus* (>5%) and not restricted to microsites . . . . ABCO-ABGR/CEPR
14b Not as above 15a

15a *Carex inops* (>1%) and not restricted to microsites ABCO-ABGR/CAIN4
15b Not as above 16a

16a *Wyethia mollis* (>1%) and not restricted to microsites . . . . .ABCO-ABGR/WYMO
16b Not as above 17a

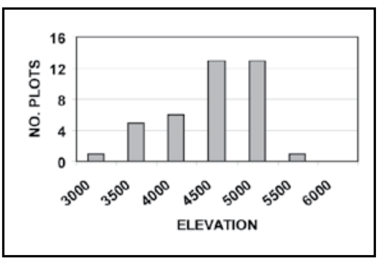
17a *Arctostaphylos patula* (>5%) and not restricted to microsites . . . . .ABCO-ABGR/ARPA
17b Not as above 18a

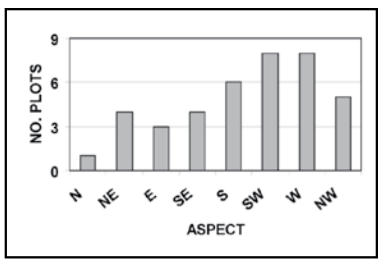
18a *Stellaria jamesiana* (>1%) and not restricted to microsites . . . . ABCO-ABGR/STJA (CT)
18b Not as above . . . . return to the start of the key and relax cover%

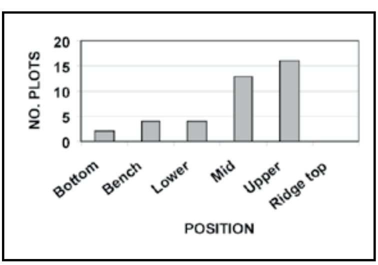
ABCO-ABGR/ASCA3 — ABCO-ABGR Wet

CWF551 (ABCO-ABGR/ASCA2)
Abies concolor-Abies grandis/Asarum caudatum
white fir–grand fir/wild ginger
Plots 39

Distribution and Environment— Plot locations from the eastside of the Cascade Crest are known from Surveyor's Mountain south of Lake of the Woods, the Metolius drainage, and the South east side of the Mt. Hood National Forest. No plots are known within deep Mazama ash deposits. ABCO-ABGR/ASCA3 represents warm, wet sites within the ABCO-ABGR Series with high effective moisture. Adjacent drier sites are generally ABCO-ABGR/CLUN, ABCO-ABGR/ACTR, or ABCO-ABGR/LIBO2 plant associations. Cooler sites grade into ABAM/CLUN associations. Typical sites are somewhat poorly drained or accumulate sub-surface moisture. Average elevation is 4650 feet (range 3221-5516 feet). Average slope is 25% (range 2-84%). Aspects are south to west, with notably few found on a north aspect. Slope positions are typically upper to mid slopes.

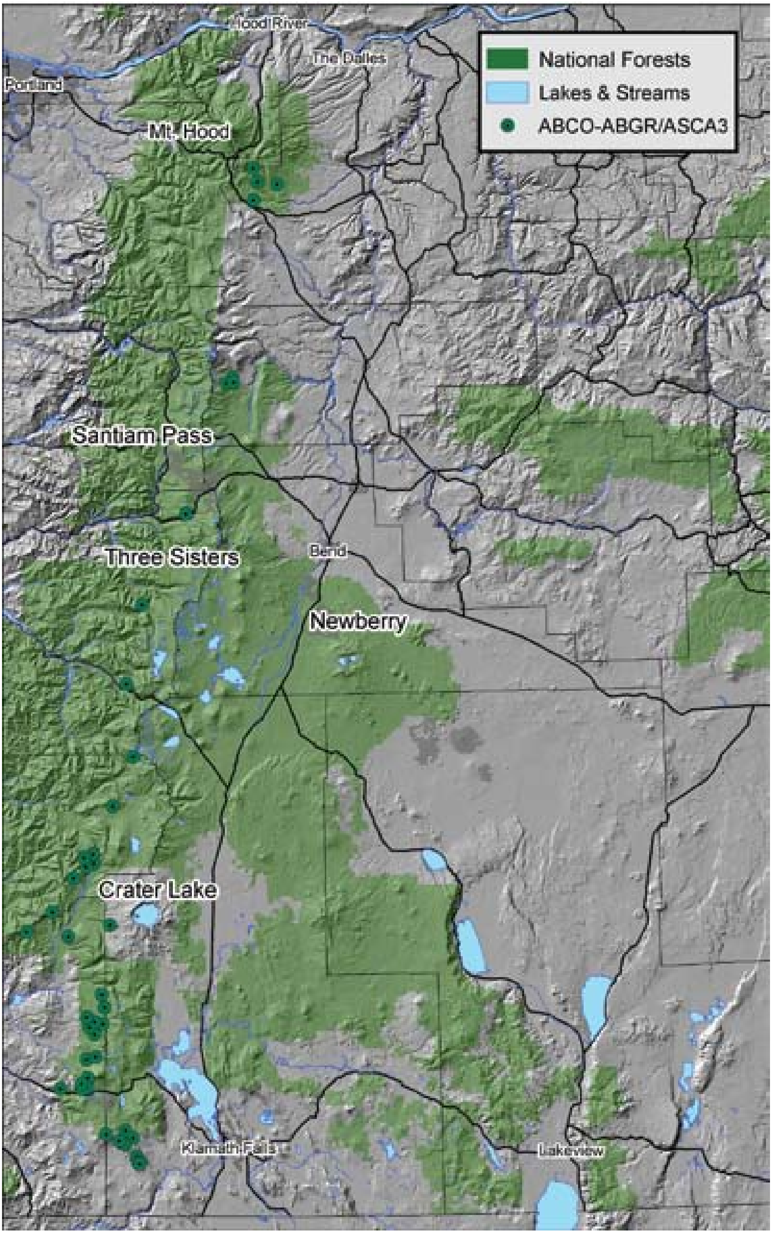






Mean Precip.	49.1”	33-87”
Mean Temp.	43.4°F	40-47°F

Figure 5-3. Map of ABCO-ABGR/ASCA3 Plot Distribution—



Vegetation— ABCO-ABGR/ASCA3 associations have the highest species diversity within the series. Moist site herbs dominate the understory layer. PSME and ABCO or ABGR usually dominate the overstory tree layer. Diverse shrub layers can occur on ABCO-ABGR/ASCA3 sites. BENE, CHUM and ROGY are the most common shrub species. Higher cover values of CACH and CEVE may indicate past disturbance. Scattered reproduction of TSHE, ABAM, or THPL indicates a transition to the TSHE or ABAM Series.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABCO	*Abies concolor-Abies grandis*	92	100	27.6	18.3
ABMAS	*Abies magnifica shastensis*	36	28	15.9	9.0
CADE3	*Calocedrus decurrens*	31	36	11.5	7.1
PSME	*Pseudotsuga menziesii*	85	54	31.3	9.2
Shrubs					
AMAL	*Amelanchier alnifolia*	31		5.4	
BENE	*Berberis nervosa*	67		7.0	
CACH	*Castanopsis chrysophylla*	46		5.4	
CHUM	*Chimaphila umbellata*	77		7.7	
COCO2	*Corylus cornuta*	56		3.5	
PAMY	*Pachistima myrsinites*	44		1.2	
ROGY	*Rosa gymnocarpa*	85		2.0	
RUPA	*Rubus parviflorus*	41		1.9	
RUUR	*Rubus ursinus*	56		5.2	
SYMO	*Symphoricarpos mollis*	74		2.5	
Herbaceous					
ACTR	*Achlys triphylla*	49		12.8	
ADBI	*Adenocaulon bicolor*	79		2.7	
ARMA3	*Arenaria macrophylla*	54		1.2	
ASCA3	*Asarum caudatum*	100		3.5	
CLUN	*Clintonia uniflora*	54		3.3	
DIHO	*Disporum hookeri*	38		1.1	
FRVE	*Fragaria vesca*	56		1.2	
GOOB	*Goodyera oblongifolia*	62		1.0	
HIAL	*Hieracium albiflorum*	77		1.4	
LIBO2	*Linnaea borealis*	49		10.6	
OSCH	*Osmorhiza chilensis*	72		1.7	
PTAQ	*Pteridium aquilinum*	46		3.8	
PYPI	*Pyrola picta*	41		1.0	
PYSE	*Pyrola secunda*	62		1.5	
SMST	*Smilacina stellata*	87		2.3	
TITR	*Tiarella trifoliata*	33		2.7	
TRLA2	*Trientalis latifolia*	74		1.8	

* Species with a constancy of 30% or greater are shown here.

Productivity and Management—

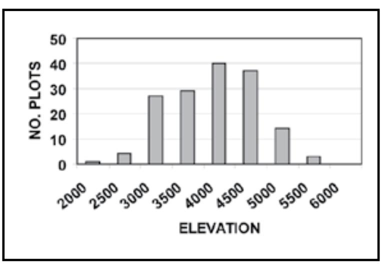
Plant Assoc	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
ABCO-ABGR/ASCA3							
ABCO-ABGR	121	3	44	362	16	91	201
ABMAS	109	4	11	390	39	11	196
CADE3	101	2	13	498	21	13	231
PIPO	148	3	5	340	57	6	231
PSME	131	4	38	394	10	149	237

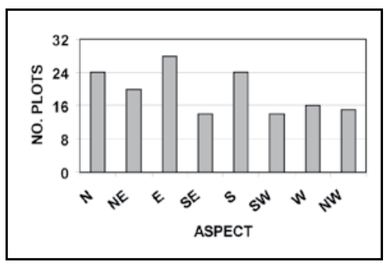
Relationships to Other Classifications— ABGR/ASCA3 has been previously described in northern Idaho (Cooper et al 1987). Warmer and wetter portions of the ABGR/ACCI/CLUN association described for central Washington (Lillybridge et al 1995) would key here.

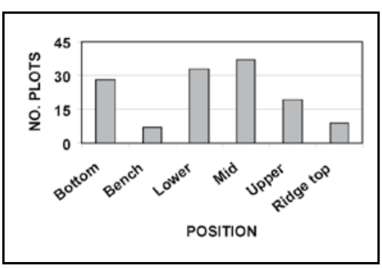
ABCO-ABGR/CLUN **ABCO-ABGR Wet**

CWF431 (ABCO-ABGR/CLUN2)
Abies concolor-Abies grandis/Clintonia uniflora
white fir–grand fir/queencup beadlily
Plots 165

Distribution and Environment— ABCO-ABGR/CLUN is a widespread association. It is found on the eastside of the Cascade Crest from Klamath River north to the eastside of Mt. Hood. Many sites accumulate subsurface moisture, but in general have better drainage than ABCO-ABGR/ASCA3 association sites. This association is found less frequently within the Mazama ash plume. Sites within deep Mazama airfall ash deposits are usually sub-irrigated bottoms, outside the plume slope positions are typically mid to lower slopes. Average elevation is 4150 feet (range 2480-5620 feet). Average slope is 16% (range 0-75%). Plot aspects varied. Wetter slope positions often transition to ABAM or TSHE Series associations. Colder positions transition to TSME Series.

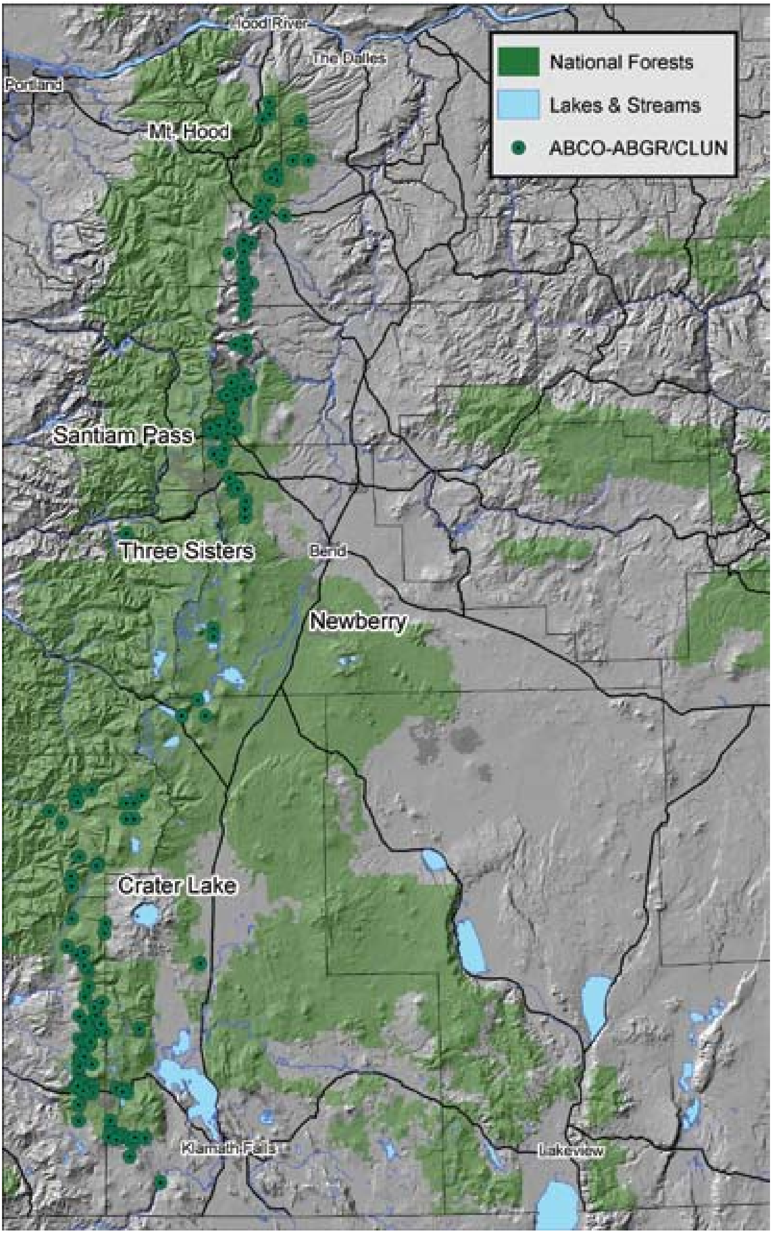






Mean Precip.	44.1”	19-81”
Mean Temp.	44.1°F	40-50°F

Figure 5-4. Map of ABCO-ABGR/CLUN Plot Distribution–



Vegetation— ABCO-ABGR/CLUN is an herb-rich association. PSME, ABCO, or ABGR (north of Metolius River) often are important overstory species. TSME, ABAM, and TSHE are only minor or accidental species in this type. Increased amounts of TSME, ABAM, or TSHE indicate transition to a wetter or colder series. Diverse shrub layers occur on ABCO-ABGR/CLUN sites following disturbance of the tree layers. BENE, CHUM, ROGY, RUUR, and CACH are the shrubs with highest constancy in mid to late seral stands. Higher cover values of ACCI, ACGL, CACH, or CEVE may indicate past disturbance.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABCO	*Abies concolor-Abies grandis*	88	98	25.4	12.3
PIPO	*Pinus ponderosa*	50	24	9.7	2.0
PSME	*Pseudotsuga menziesii*	85	64	29.8	6.7
Shrubs					
AMAL	*Amelanchier alnifolia*	59		1.5	
BENE	*Berberis nervosa*	61		9.2	
CACH	*Castanopsis chrysophylla*	50		4.7	
CHME	*Chimaphila menziesii*	32		1.1	
CHUM	*Chimaphila umbellata*	87		3.4	
COCO2	*Corylus cornuta*	36		4.0	
PAMY	*Pachistima myrsinites*	40		1.7	
ROGY	*Rosa gymnocarpa*	80		2.0	
RUPA	*Rubus parviflorus*	31		1.7	
RUUR	*Rubus ursinus*	55		3.3	
SYAL	*Symphoricarpos albus*	31		9.9	
SYMO	*Symphoricarpos mollis*	58		4.5	
VAME	*Vaccinium membranaceum*	30		3.5	
Herbaceous					
ADBI	*Adenocaulon bicolor*	40		1.5	
ARMA3	*Arenaria macrophylla*	30		0.9	
CLUN	*Clintonia uniflora*	100		1.7	
FRVE	*Fragaria vesca*	47		1.9	
GOOB	*Goodyera oblongifolia*	54		0.9	
HIAL	*Hieracium albiflorum*	48		1.0	
LIBO2	*Linnaea borealis*	62		9.9	
OSCH	*Osmorhiza chilensis*	48		1.2	
PTAQ	*Pteridium aquilinum*	45		4.6	
PYPI	*Pyrola picta*	33		1.1	
PYSE	*Pyrola secunda*	62		1.2	
SMST	*Smilacina stellata*	70		1.8	
TRLA2	*Trientalis latifolia*	65		2.2	

* Species with a constancy of 30% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
ABCO-ABGR/CLUN							
ABCO-ABGR	116	2	105	279	6	382	149
ABPR	123	5	3	393	24	72	222
ABMAS	113	8	8	273	29	32	142
CADE3	111	7	8	231	24	23	118
PIEN	106	7	15	262	13	30	128
PILA	138	5	8	325	24	8	207
PIMO	103	4	4	260	38	7	123
PIPO	106	3	40	216	6	170	105
PSME	130	2	153	254	5	528	152

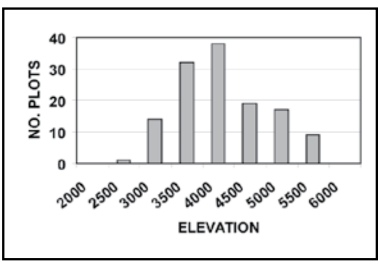
Relationships to Other Classifications— ABGR/CLUN associations have been widely described in the Pacific Northwest. Pfister et al (1977), Steele et al (1981), Zamora (1983), and Cooper et al (1987) describe similar associations for western Montana, central Idaho, eastern Washington and northern Idaho respectively. In Oregon, Johnson and Simon (1987), Johnson and Clausnitzer (1992) have described ABGR/CLUN, and Kovalchick (1987) described a ABCO/CLUN association. The concept of the type described here is very similar to the previous ABGR/CLUN or ABCO/CLUN classifications and plots from them would also key here easily.

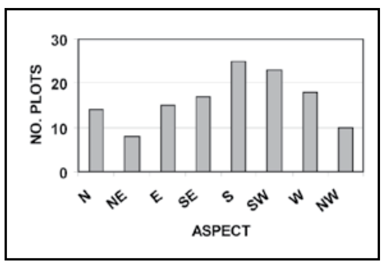
ABCO-ABGR/ACTR

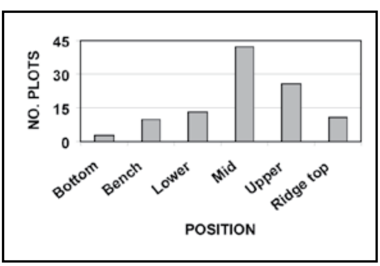
ABCO-ABGR Wet

CWF522 (ABCO-ABGR/ACTR)
Abies concolor-Abies grandis/Achlys triphylla
white fir–grand fir/vanilla leaf
Plots 131

Distribution and Environment— ABCO-ABGR/ACTR associations have a limited distribution east of the Cascade Crest. Sampled sites are located from Santiam pass north through the Bear Springs, Dufur, and Hood River Ranger Districts on the Mt. Hood National Forest. Mean precipitation and mean annual temperature are slightly higher than ABCO-ABGR/CLUN associations, however ABCO-ABGR/ACTR associations favor sites with less topographic moisture. This is reflected in an affinity for mid to upper slope positions. Average elevation is 3797 feet (range 2440-5300 feet). Average slope is 25% (range 1-65%). Many plots were found on a south to western aspect. Adjacent wetter slope positions are often in the TSHE or ABAM Series.

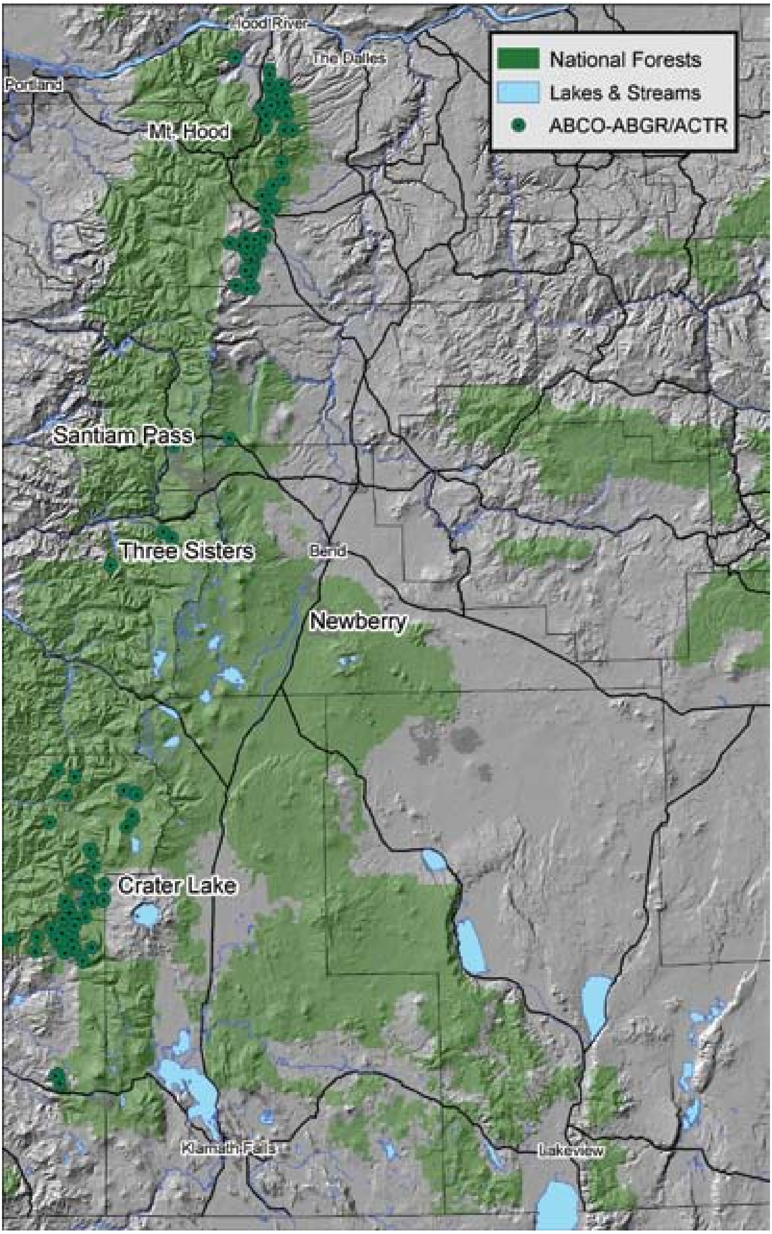






Mean Precip.	49.5”	25-83”
Mean Temp.	44.6°F	41-48°F

Figure 5-5. Map of ABCO-ABGR/ACTR Plot Distribution—



Vegetation— ABCO-ABGR/ACTR is an herb-rich association. PSME, ABCO, or ABGR (north of Metolius River) often are important overstory species. TSME, ABAM, and TSHE are only minor or accidental species in this type. Scattered reproduction of TSME, ABAM, or TSHE indicates transition to the TSME, ABAM, or TSHE series. Diverse shrub layers occur following disturbance of the tree layers. BENE, CHUM, ROGY, RUUR, and CACH are the shrubs with highest constancy in mid to late seral stands. Higher cover values of ACCI, ACGL, CACH, RHMA, or PTAQ may indicate past disturbance.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABCO	*Abies concolor-Abies grandis*	86	95	24.3	16.0
CADE3	*Calocedrus decurrens*	17	36	9.1	8.4
PIPO	*Pinus ponderosa*	34	15	7.8	1.7
PSME	*Pseudotsuga menziesii*	94	63	39.9	7.9
Shrubs					
AMAL	*Amelanchier alnifolia*	35		2.1	
BEAQ	*Berberis aquifolium*	30		2.2	
BENE	*Berberis nervosa*	73		8.8	
CACH	*Castanopsis chrysophylla*	61		4.6	
CHME	*Chimaphila menziesii*	50		1.1	
CHUM	*Chimaphila umbellata*	77		5.5	
COCO2	*Corylus cornuta*	46		4.6	
HODI	*Holodiscus discolor*	34		3.0	
PAMY	*Pachistima myrsinites*	47		1.4	
ROGY	*Rosa gymnocarpa*	70		2.6	
RUUR	*Rubus ursinus*	53		2.0	
SYAL	*Symphoricarpos albus*	30		3.0	
SYMO	*Symphoricarpos mollis*	64		4.8	
Herbaceous					
ACTR	*Achlys triphylla*	100		3.8	
ADBI	*Adenocaulon bicolor*	48		1.3	
ARMA3	*Arenaria macrophylla*	40		1.4	
FRVE	*Fragaria vesca*	55		1.3	
GOOB	*Goodyera oblongifolia*	63		1.1	
HIAL	*Hieracium albiflorum*	47		1.0	
LIBO2	*Linnaea borealis*	55		6.3	
OSCH	*Osmorhiza chilensis*	30		0.9	
PTAQ	*Pteridium aquilinum*	40		1.8	
PYPI	*Pyrola picta*	50		1.1	
PYSE	*Pyrola secunda*	45		1.3	
SMRA	*Smilacina racemosa*	32		1.1	
SMST	*Smilacina stellata*	41		1.2	
TRLA2	*Trientalis latifolia*	76		2.1	

* Species with a constancy of 30% or greater are shown here.

Productivity and Management—

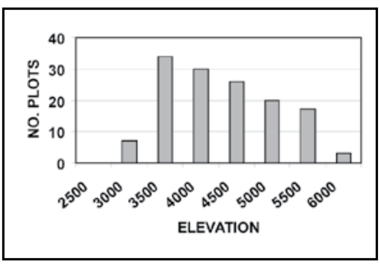
Plant Assoc	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
ABCO-ABGR/ACTR							
ABCO-ABGR	126	4	50	279	12	81	162
ABMAS	150	10	6	372	49	6	256
CADE3	118	5	9	441	29	9	239
PILA	114	7	4	405	93	4	221
PIMO	142	10	4	339	36	4	221
PIPO	123	7	7	240	34	15	136
PSME	133	3	71	358	9	213	220

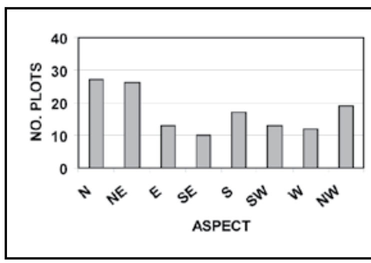
Relationships to Other Classifications— ABGR/ACTR has been previously described for the east side of the Mt. Hood National Forest (Topik et al 1988) and for the Wenatchee National Forest (Lillybridge et al 1995). Topik also described ABGR/ACCI/ACTR for eastside Mt. Hood and ABGR/BENE/ACTR and ABGR/SYMO/ACTR for the Gifford Pinchot National Forest which are closely related (Topik et al 1988, Topik 1989). In southwest Oregon, Atzet et al (1996) have described ABCO-ABMAS/ACTR and ABCO/BENE/ACTR associations which may have plots that would key to ABCO-ABGR/ACTR in this classification.

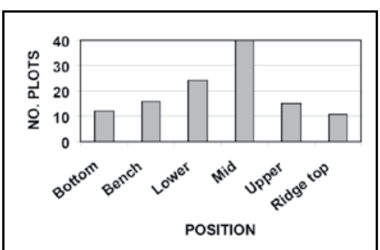
ABCO-ABGR/LIBO2 — ABCO-ABGR Wet

CWF341 (ABCO-ABGR/LIBO3)
Abies concolor-Abies grandis/Linnaea borealis
white fir–grand fir/twinflower
Plots 141

Distribution and Environment— ABCO-ABGR/LIBO2 is a widespread association. It is found on the eastside of the Cascade Crest from BLM lands south of Lake of the Woods to the eastside of Mt. Hood. Scattered locations are known east of the Cascades proper near Newberry Crater, Yamsey Mountain, and Jack Creek. ABCO-ABGR/LIBO2 association sites are often the wettest sites in the series within the Mazama ashfall plume. Within the ash plume, ABCO-ABGR/LIBO2 sites often occur in sub-irrigated bottoms. Outside the Mazama ashfall plume, slope positions are typically mid to lower slopes. Average elevation is 4037 feet (range 2600-5875 feet). Average slope is 14% (range 0-70%). Plot aspects are varied, with a slight trend toward northerly aspects.

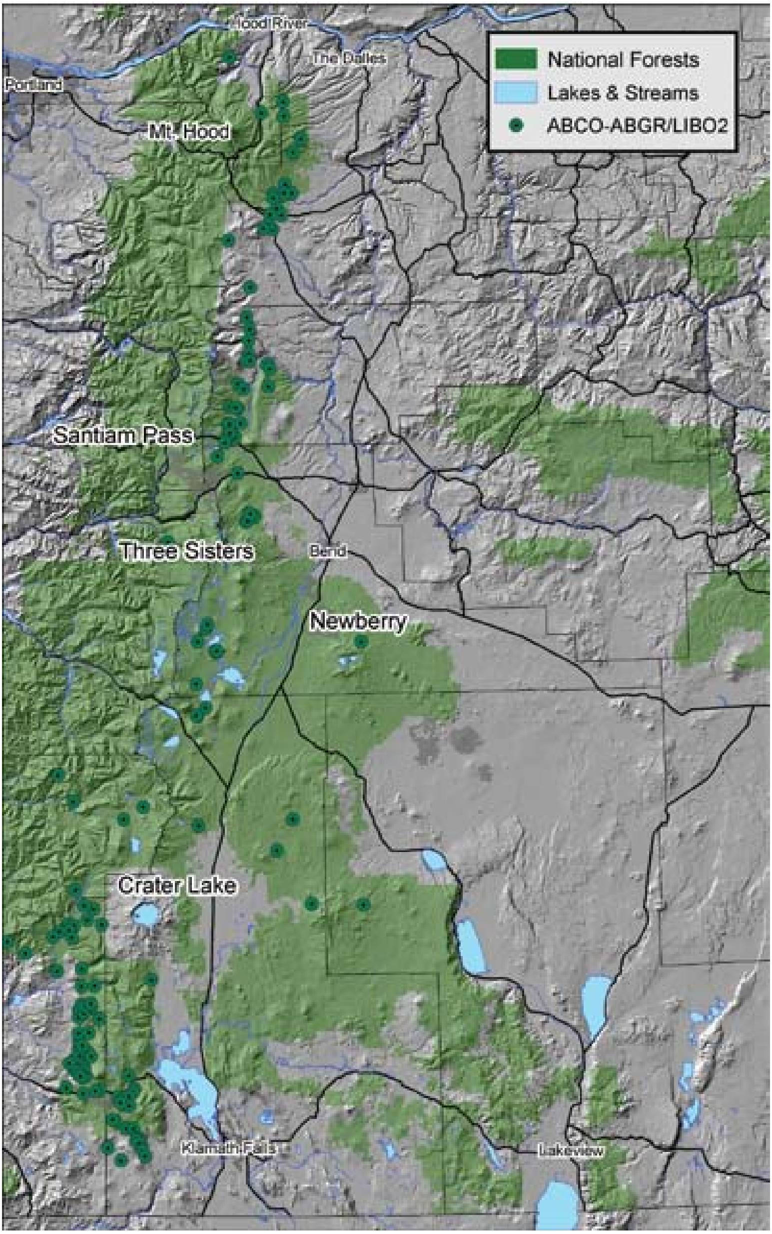






Mean Precip.	40.6”	17-75”
Mean Temp.	44.2°F	39-48°F

Figure 5-6. Map of ABCO-ABGR/LIBO2 Plot Distribution—



Vegetation— ABCO-ABGR/LIBO2 is an herb-rich association. PSME, ABCO, or ABGR (north of Metolius River) often are important overstory species. TSME and TSHE are only minor or accidental species in this type. Increased amounts of TSME, ABAM, or TSHE indicate transition to a wetter or colder series. PSME may be absent on sites with deep Mazama ash/pumice deposits. Diverse shrub layers occur on these sites following disturbance of the tree layers. BENE, CHUM, ROGY, RUUR, and CACH are the shrubs with highest constancy in mid to late seral stands. Higher cover values of ACCI, ACGL, CACH, or CEVE may indicate past disturbance. The herb layer is less diverse than other associations in the PAG, but is still dominated by mesic species.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABCO	*Abies concolor-Abies grandis*	82	98	23.6	14.1
PIPO	*Pinus ponderosa*	57	35	13.2	4.6
PSME	*Pseudotsuga menziesii*	82	74	31.7	8.3
Shrubs					
AMAL	*Amelanchier alnifolia*	47		3.6	
BENE	*Berberis nervosa*	57		6.1	
CACH	*Castanopsis chrysophylla*	52		6.1	
CHME	*Chimaphila menziesii*	30		0.9	
CHUM	*Chimaphila umbellata*	78		6.8	
PAMY	*Pachistima myrsinites*	36		1.2	
ROGY	*Rosa gymnocarpa*	60		1.8	
RUUR	*Rubus ursinus*	43		5.3	
SYMO	*Symphoricarpos mollis*	45		3.8	
Herbaceous					
FRVE	*Fragaria vesca*	35		1.7	
GOOB	*Goodyera oblongifolia*	45		0.9	
HIAL	*Hieracium albiflorum*	38		0.9	
LIBO2	*Linnaea borealis*	100		5.7	
PYPI	*Pyrola picta*	35		0.8	
PYSE	*Pyrola secunda*	35		1.0	
SMST	*Smilacina stellata*	43		1.4	
TRLA2	*Trientalis latifolia*	62		1.9	

* Species with a constancy of 30% or greater are shown here.

Productivity and Management—

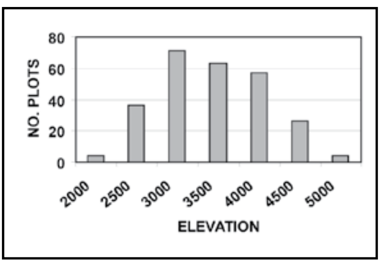
Plant Assoc	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
ABCO-ABGR/LIBO2							
ABCO-ABGR	124	3	83	264	8	257	150
PICO	80	7	7	136	5	86	50
PIPO	100	2	67	204	8	92	93
PSME	129	3	79	285	9	254	168

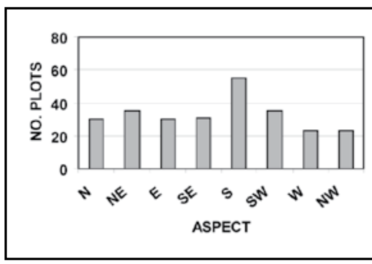
Relationships to Other Classifications— ABGR/LIBO2 associations have been widely described in the Pacific Northwest. Steele et al (1981), Zamora (1983), and Cooper et al (1987) describe similar associations for central Idaho, eastern Washington and northern Idaho respectively. In Oregon, Johnson and Simon (1987) and Johnson and Clausnitzer (1992), have described ABGR/LIBO2 associations for the Wallowa, Blue, and Ochoco Mountains. ABCO-ABGR/LIBO2, as described here, is similar to these previously described types with the addition of BENE, CACH, RUUR, and TRLA2 which do not occur farther east. Many plots that previously keyed to ABCO-PSME/SYAL/LIBO in Volland's (1985) classification will now key here.

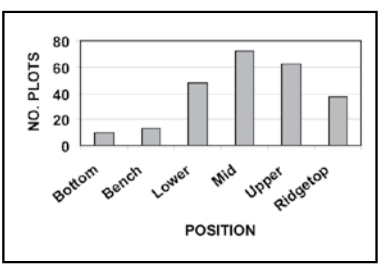
ABCO-ABGR/TRLA2 ABCO-ABGR Moist

CWF521 (ABCO-ABGR/TRBOL)
Abies concolor-Abies grandis/Trentalis latifolia
white fir–grand fir/western starflower
Plots 267

Distribution and Environment— ABCO-ABGR/TRLA2 is common from McKenzie Pass north to Hood River, and from Pelican Butte south to the Klamath River. The association is absent from the recent deep ash-pumice deposits of the Mazama plume and apparently absent on ash deposits from Middle and South Sister. However, the association is present on older ash deposits from Mt. Jefferson. Slope position is typically mid to upper slopes. Average elevation is 3671 feet (range 2000-5120 feet). Average slope is 19% (range 0-70%). Plots are found on all aspects with south exposures slightly more common than others.

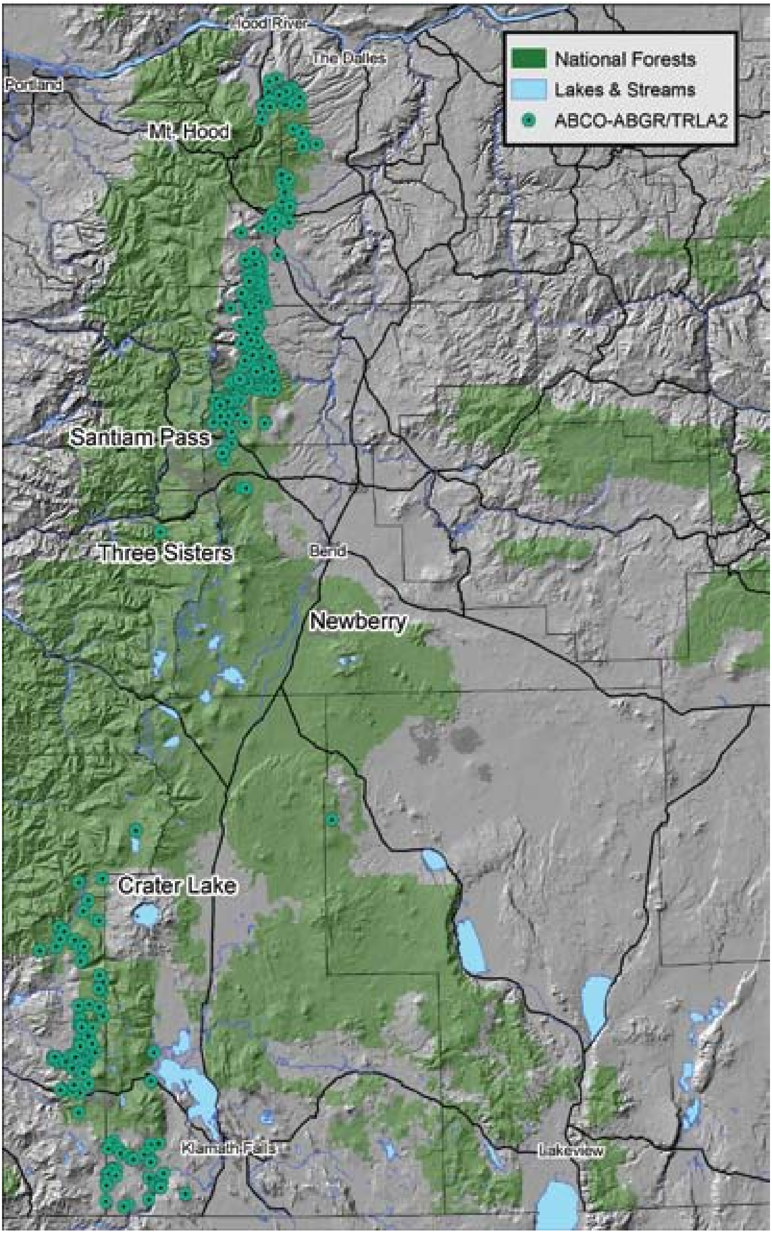






Mean Precip.	39.1”	17-79”
Mean Temp.	45.2°F	41-48°F

Figure 5-7. Map of ABCO-ABGR/TRLA2 Plot Distribution—



Vegetation— Overstory tree layers are usually a mixture of white fir-grand fir, Douglas-fir, and ponderosa pine. Conifer regeneration is typically dominated by white fir-grand fir and Douglas-fir. Shrub layers are diverse. In mid to late seral stands serviceberry, prince's pine, baldhip rose, and creeping snowberry are most common. With disturbance, shrub cover may increase dramatically. Increased cover of Snowbrush ceanothus, greenleaf manzanita, and golden chinquapin are indicators of past disturbance. Herb layers are less diverse than in the ABCO-ABGR Wet associations.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABCO	*Abies concolor-Abies grandis*	76	96	20.0	9.1
CADE3	*Calocedrus decurrens*	21	39	4.8	4.2
PIPO	*Pinus ponderosa*	79	42	15.7	3.0
PSME	*Pseudotsuga menziesii*	88	76	34.6	7.0
Shrubs					
AMAL	*Amelanchier alnifolia*	65		2.4	
ARPA	*Arctostaphylos patula*	30		2.9	
BEAQ	*Berberis aquifolium*	43		3.2	
BENE	*Berberis nervosa*	30		8.7	
CACH	*Castanopsis chrysophylla*	48		5.7	
CEVE	*Ceanothus velutinus*	34		6.9	
CHME	*Chimaphila menziesii*	45		1.0	
CHUM	*Chimaphila umbellata*	60		2.7	
COCO2	*Corylus cornuta*	30		4.2	
HODI	*Holodiscus discolor*	42		4.2	
PAMY	*Pachistima myrsinites*	34		7.0	
ROGY	*Rosa gymnocarpa*	73		1.8	
RUUR	*Rubus ursinus*	32		3.1	
SYAL	*Symphoricarpos albus*	45		5.5	
SYMO	*Symphoricarpos mollis*	51		4.6	
Herbaceous					
ARMA3	*Arenaria macrophylla*	43		1.3	
FRVE	*Fragaria vesca*	56		1.7	
GOOB	*Goodyera oblongifolia*	36		1.0	
HIAL	*Hieracium albiflorum*	36		1.4	
OSCH	*Osmorhiza chilensis*	39		1.1	
PTAQ	*Pteridium aquilinum*	37		2.3	
SMST	*Smilacina stellata*	30		1.4	
TRLA2	*Trientalis latifolia*	100		2.1	
Graminoids					
CARU	*Calamagrostis rubescens*	36		6.8	
FEOC	*Festuca occidentalis*	37		2.2	

* Species with a constancy of 30% or greater are shown here.

Productivity and Management—

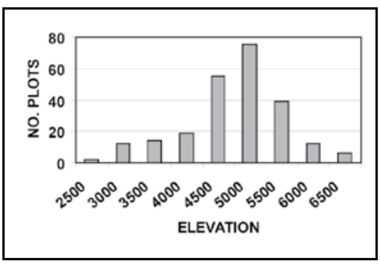
Plant Assoc	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
ABCO-ABGR/TRLA2							
ABCO-ABGR	136	3	62	276	12	138	172
CADE3	96	2	5	297	27	22	131
PILA	120	9	13	259	22	25	143
PIPO	106	1	139	210	6	260	102
PSME	128	2	165	274	5	480	161

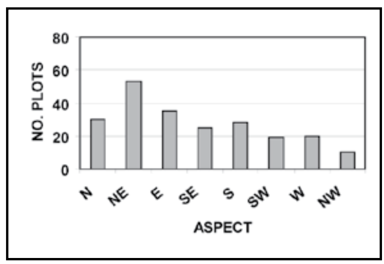
Relationships to Other Classifications— ABGR/TRLA2 has been previously described for the east side of Mt. Hood (Topik et al 1988). A similar type, ABCO-CADE3/TRLA2, has been described for southwest Oregon (Atzet et al 1996). Other types described for southwest Oregon which may have plots that key here are ABCO/BENE and PSME-ABCO/SYMO. Many plots originally included in Volland's (1985) ABCO-PSME/CEVE-CACH/PTAQ, ABCO-PSME/CEVE-CACH/CARU, PSME-ABCO/SYAL/LIBO, and PSME-ABCO/SYAL/FORB will now fit in this classification unit.

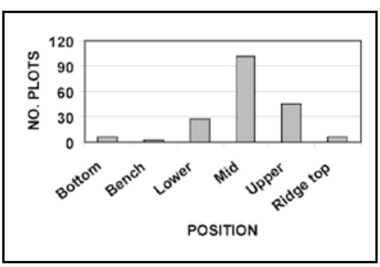
ABCO-ABGR/CACH — ABCO-ABGR Moist

CWS533 (ABCO-ABGR/CHCH7)
Abies concolor-Abies grandis/Castanopsis chrysophylla
white fir–grand fir/golden chinquapin
Plots 260

Distribution and Environment— ABCO-ABGR/CACH is a widespread type on the east slope of the Oregon Cascades. It occurs from the eastside of Mt. Hood to the California border and extends east of the Cascades proper on the Fremont-Winema National Forest. Sites are well drained. Typical slope positions are mid to upper slopes. Average elevation is 5002 feet (range 2620-6900 feet). Average slope is 21% (range 1-67%). Plot aspects are predominantly north to east.

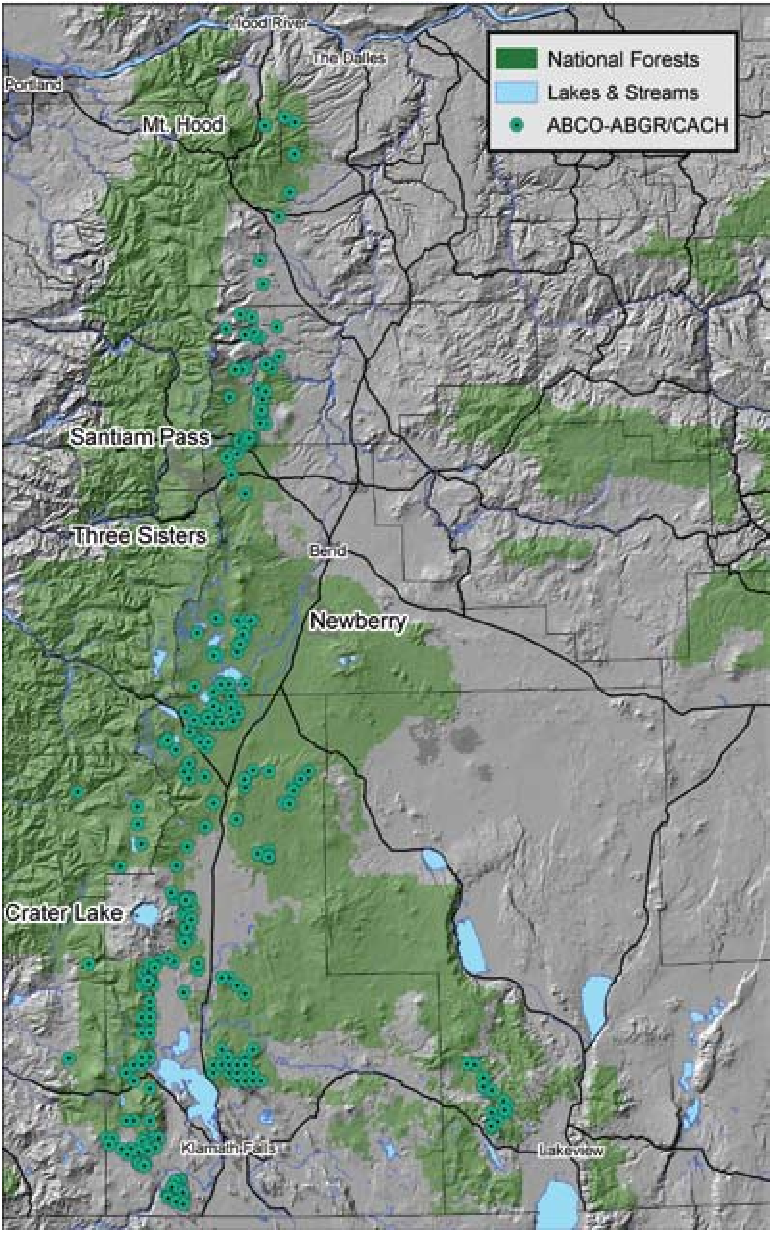






Mean Precip.	34.9”	17-81”
Mean Temp.	42.8°F	40-48°F

Figure 5-8. Map of ABCO-ABGR/CACH Plot Distribution—



Vegetation— Overstory tree layers are usually a mixture of white fir-grand fir, Douglas-fir, and ponderosa pine. Douglas-fir is often missing in the deepest Mazama ash/pumice deposits. Conifer regeneration is typically dominated by white fir-grand fir and Douglas-fir where Douglas-fir occurs. Shasta red fir may be present in cooler portions of ABCO-ABGR/CACH. Shrub layers are less diverse than ABCO-ABGR/TRLA2. Herb layers are species poor and mesic species such as SMST, OSCH, DIHO, and GOOB are usually absent.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABCO	*Abies concolor-Abies grandis*	87	84	21.1	13.8
PICO	*Pinus contorta*	35	35	6.0	3.4
PIPO	*Pinus ponderosa*	84	60	13.6	3.5
PSME	*Pseudotsuga menziesii*	45	39	17.1	4.6
Shrubs					
ARNE	*Arctostaphylos nevadensis*	49		7.2	
ARPA	*Arctostaphylos patula*	58		3.2	
CACH	*Castanopsis chrysophylla*	100		6.9	
CEVE	*Ceanothus velutinus*	61		8.4	
CHUM	*Chimaphila umbellata*	58		2.8	
Herbaceous					
FRVI	*Fragaria virginiana*	34		0.8	
PYPI	*Pyrola picta*	30		0.5	
Graminoids					
CAIN4	*Carex inops*	45		2.1	
CARO	*Carex rossii*	32		0.6	
STOC	*Stipa occidentalis*	36		0.8	

* Species with a constancy of 30% or greater are shown here.

Productivity and Management—

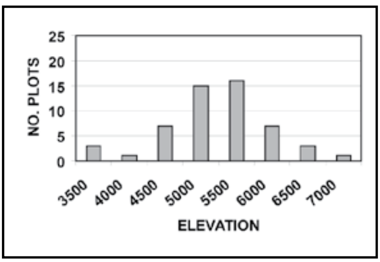
Plant Assoc	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
ABCO-ABGR/CACH							
ABCO-ABGR	94	1	252	230	3	1285	99
ABMAS	95	4	38	284	10	169	125
PICO	65	4	12	126	5	210	38
PILA	93	3	10	176	6	139	75
PIMO	102	5	7	240	16	28	113
PIPO	95	1	173	180	3	623	79
PSME	100	2	106	235	10	200	108

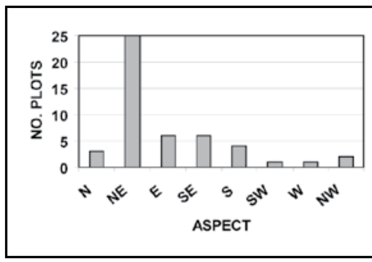
Relationships to Other Classifications— ABGR/CACH has been previously described for the east side of Mt. Hood (Topik et al 1988). Topik's type is somewhat wetter than the type described here as evidenced by the constancy and coverage of ACTR, LIBO2, and TRLA2. However, it appears that at least one plot would fit the classification as described here. ABCO/CEVE-CACH was described for central Oregon by Volland (1985) and ABCO/CACH-PAMY/CHUM was described for south-central Oregon by Hopkins (1979b). ABCO-ABGR/CACH, as described here, would encompass both of these associations.

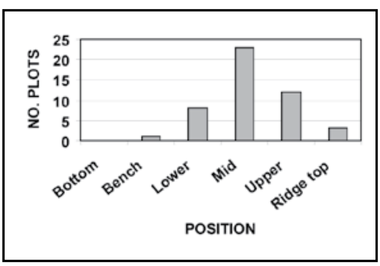
ABCO-ABGR/SMST — ABCO-ABGR Moist

CWF562 (ABCO-ABGR/MAST4)
Abies concolor-Abies grandis/Smilacina stellata
white fir–grand fir/starry false-solomonseal
Plots 56

Distribution and Environment— ABCO-ABGR/SMST is an association of the central and southern Cascades and also occurs as far east as the northern Warner Mountains. It is absent in areas with deep Mazama ash/pumice depositions. Average elevation is 5494 feet (range 2800-7070 feet). Average slope is 26% (range 0-67%). Most plots were found on a northeast aspect.

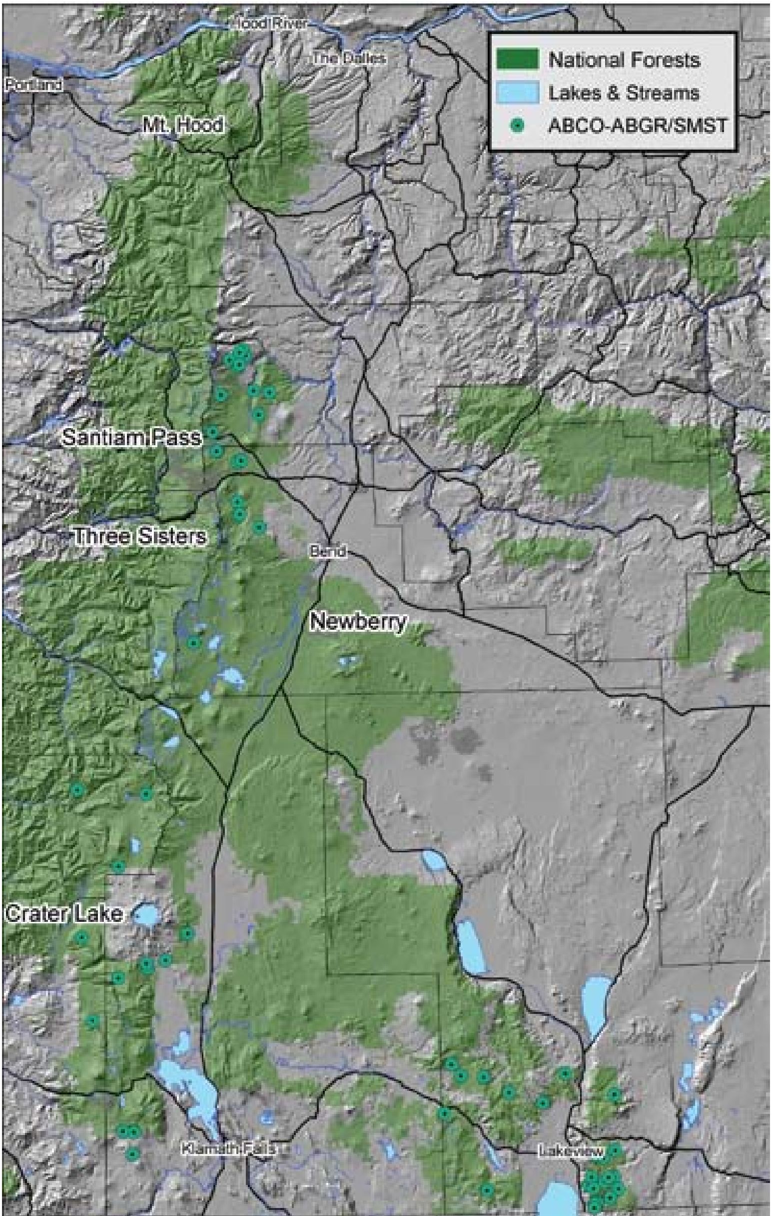






Mean Precip.	38.7”	19-69”
Mean Temp.	43.0°F	41-47°F

Figure 5-9. Map of ABCO-ABGR/SMST Plot Distribution—



Vegetation— Overstory tree layers are usually a mixture of ABCO-ABGR and PIPO. Plots in the Metolius Basin usually have PSME as a significant component. Understory tree layers are usually dominated by ABCO-ABGR with lesser amounts of PSME or PIPO. With disturbance, shrub cover may increase dramatically. Increased cover of snowbrush ceanothus, greenleaf manzanita, and sticky currant are indicators of past disturbance. Herb layers are less diverse than in the ABCO-ABGR wet and ABCO-ABGR/TRLA2 associations, but more diverse than ABCO-ABGR/CACH.

Code	Species Latin Name	% Constancy		% Cover	
Trees		Over	Regen	Over	Regen
ABCO	*Abies concolor-Abies grandis*	92	96	17.0	15.6
PICO	*Pinus contorta*	27	17	13.8	2.7
PIPO	*Pinus ponderosa*	88	69	16.9	7.8
Shrubs					
AMAL	*Amelanchier alnifolia*	56		4.7	
ARPA	*Arctostaphylos patula*	33		3.2	
BERE	*Berberis repens*	37		6.4	
CHME	*Chimaphila menziesii*	27		0.8	
CHUM	*Chimaphila umbellata*	42		1.3	
RICE	*Ribes cereum*	25		2.2	
RIVI	*Ribes viscosissimum*	25		4.8	
SYAL	*Symphoricarpos albus*	37		4.1	
Herbaceous					
ARCO	*Arnica cordifolia*	38		8.9	
HIAL	*Hieracium albiflorum*	42		2.1	
OSCH	*Osmorhiza chilensis*	40		2.7	
PYPI	*Pyrola picta*	29		0.9	
PYSE	*Pyrola secunda*	25		1.0	
SMST	*Smilacina stellata*	100		3.0	
STJA	*Stellaria jamesiana*	42		3.8	
Graminoids					
CAIN4	*Carex inops*	60		5.4	
PONE	*Poa nervosa*	38		7.7	
SIHY	*Sitanion hystrix*	38		2.6	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

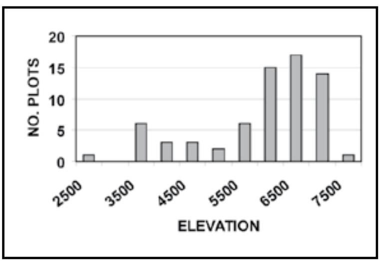
Plant Assoc	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
ABCO-ABGR/SMST							
ABCO-ABGR	102	5	12	288	36	13	135
PIPO	93	2	30	195	13	69	84
PSME	94	4	9	273	46	9	118

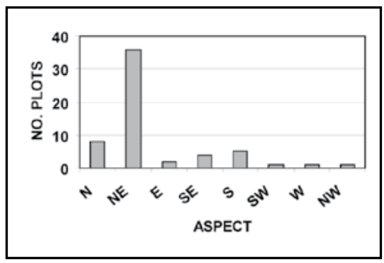
Relationships to Other Classifications— ABGR-PIEN/SMST has been previously described for the east side of Mt. Hood (Topik et al 1988). Topik's type is somewhat wetter than the type described here as evidenced by the constancy and coverage of CLUN and ACTR. These plots would key to ABCO-ABGR/CLUN or ABCO-ABGR/ACTR in this classification. Wetter portions of Volland's ABCO/CEVE-ARPA/CAPE-PEEU and Hopkin's ABCO-PIPO/SYAL/STJA will key here (Volland 1985, Hopkins 1979b).

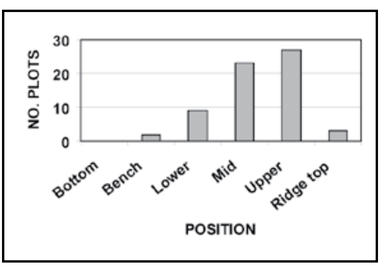
ABCO-ABGR/SYMO ABCO-ABGR Moist

CWS361 (ABCO-ABGR/SYMO)
Abies concolor-Abies grandis/Symphoricarpos mollis
white fir–grand fir/creeping snowberry
Plots 69

Distribution and Environment— ABCO-ABGR/SYMO is predominantly a Winema-Fremont National Forest association. Ten plots are known from the Metolius River north to the east side of Mt. Hood. It is absent from areas with deep recent ash/pumice deposits. Average elevation is 5581 feet (range 2240-7210 feet). Average slope is 18% (range 1-53%). Aspects are predominantly north to northeast and sites are typically mid to upper slopes.

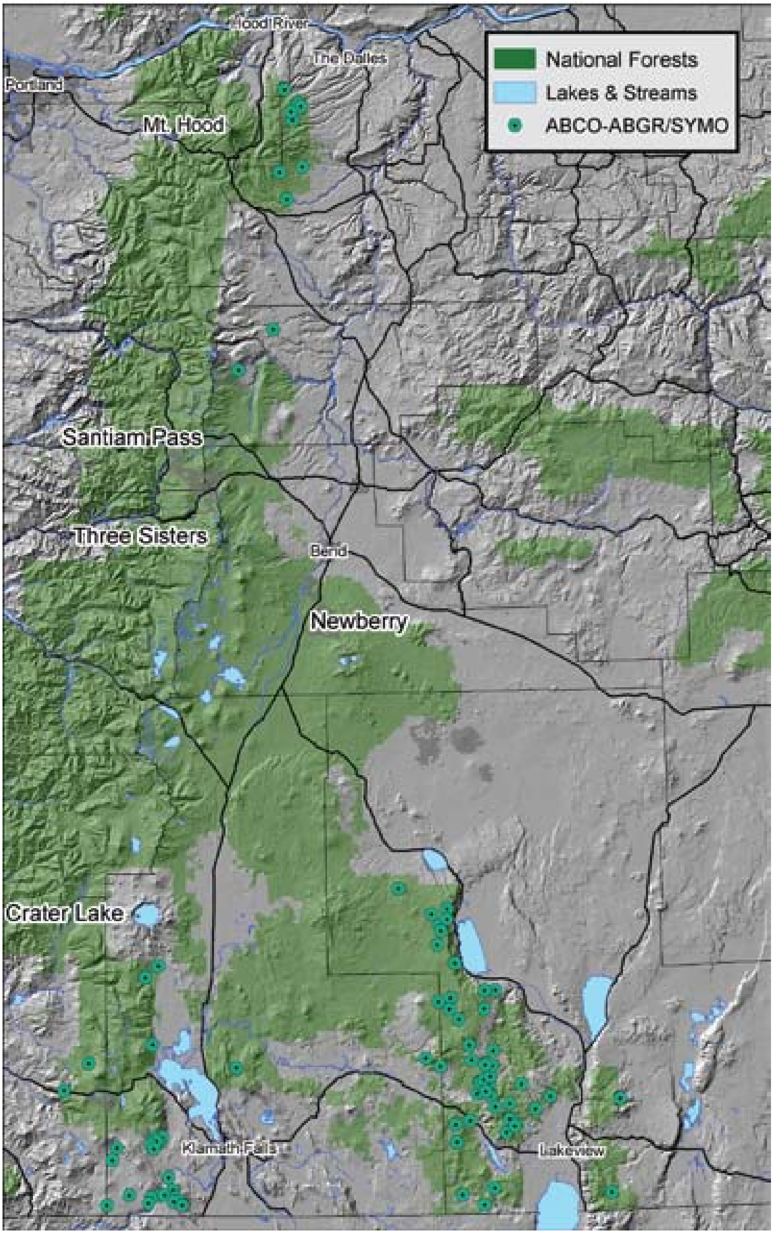






Mean Precip.	30.3”	19-53”
Mean Temp.	43.4°F	39-48°F

Figure 5-10. Map of ABCO-ABGR/SYMO Plot Distribution—



Vegetation— Overstory tree layers are usually a mixture of ABCO-ABGR and PIPO. Plots north of the Metolius Basin usually have PSME as a significant component. Understory tree layers are usually dominated by ABCO-ABGR with lesser amounts of PSME or PIPO. With disturbance, shrub cover may increase dramatically. Increased cover of snowbrush ceanothus, greenleaf manzanita, and sticky currant are indicators of past disturbance. Herb layers are less diverse than in the ABCO-ABGR wet and ABCO-ABGR/TRLA2 associations, but more diverse than ABCO-ABGR/CACH.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABCO	*Abies concolor-Abies grandis*	84	90	17.8	22.4
PICO	*Pinus contorta*	25	28	3.8	2.7
PIPO	*Pinus ponderosa*	93	75	16.5	9.6
Shrubs					
AMAL	*Amelanchier alnifolia*	44		2.9	
ARPA	*Arctostaphylos patula*	29		4.4	
BERE	*Berberis repens*	49		4.3	
CEVE	*Ceanothus velutinus*	25		7.8	
SYMO	*Symphoricarpos mollis*	100		6.7	
Herbaceous					
ARCO	*Arnica cordifolia*	44		11.0	
FRVI	*Fragaria virginiana*	50		2.0	
HIAL	*Hieracium albiflorum*	53		1.6	
LUAR3	*Lupinus argenteus*	26		4.5	
OSCH	*Osmorhiza chilensis*	28		1.3	
STJA	*Stellaria jamesiana*	46		3.0	
Graminoids					
CAIN4	*Carex inops*	56		7.3	
PONE	*Poa nervosa*	69		7.4	
SIHY	*Sitanion hystrix*	49		2.0	
STOC	*Stipa occidentalis*	34		2.7	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

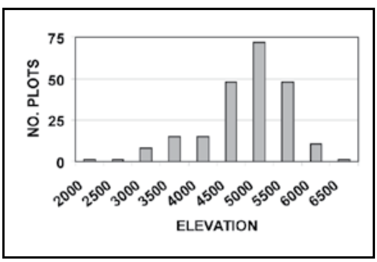
No data available for this plant association.

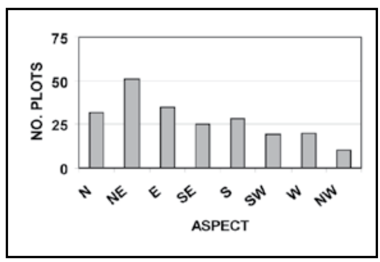
Relationships to Other Classifications— ABGR/SYMPH has been previously described for the east side of Mt. Hood (Topik et al 1988). Topik's type is somewhat wetter than the type described here as evidenced by the constancy and coverage of TRLA2. About 50% of his plots would key to ABCO-ABGR/TRLA2 in this classification. The rest of the plots likely fit ABCO-ABGR/SYMO as described here. In south-central Oregon portions of the ABCO-PIPO/SYAL/STJA, ABCO-PIPO-CADE/AMAL, and ABCO-PIPO-PILA/ARPA described by Hopkins (1979b) have plots that would key here.

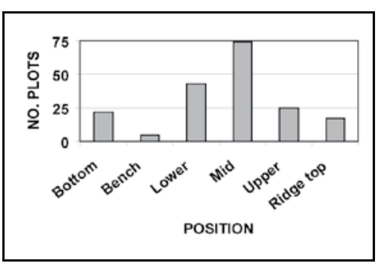
ABCO-ABGR/CHUM — ABCO-ABGR Moist

CWF241 (ABCO-ABGR/CHUM)
Abies concolor-Abies grandis/Chimaphila umbellata
white fir–grand fir/common prince's pine
Plots 233

Distribution and Environment— ABCO-ABGR/CHUM is a widespread association on the east slope of the Oregon Cascades. It is common from Shitike Creek on the Warm Springs south to the vicinity of Klamath Falls. This association shows the greatest tendency to occupy sites with deep recent ash/pumice deposits in the ABCO-ABGR Moist plant association group. ABCO-ABGR/CHUM sites are typically mid to lower slopes. Average elevation is 5015 feet (range 2300-6550 feet). Average slope is 14% (range 0-90%). Aspects are varied with an affinity to north and east slopes.

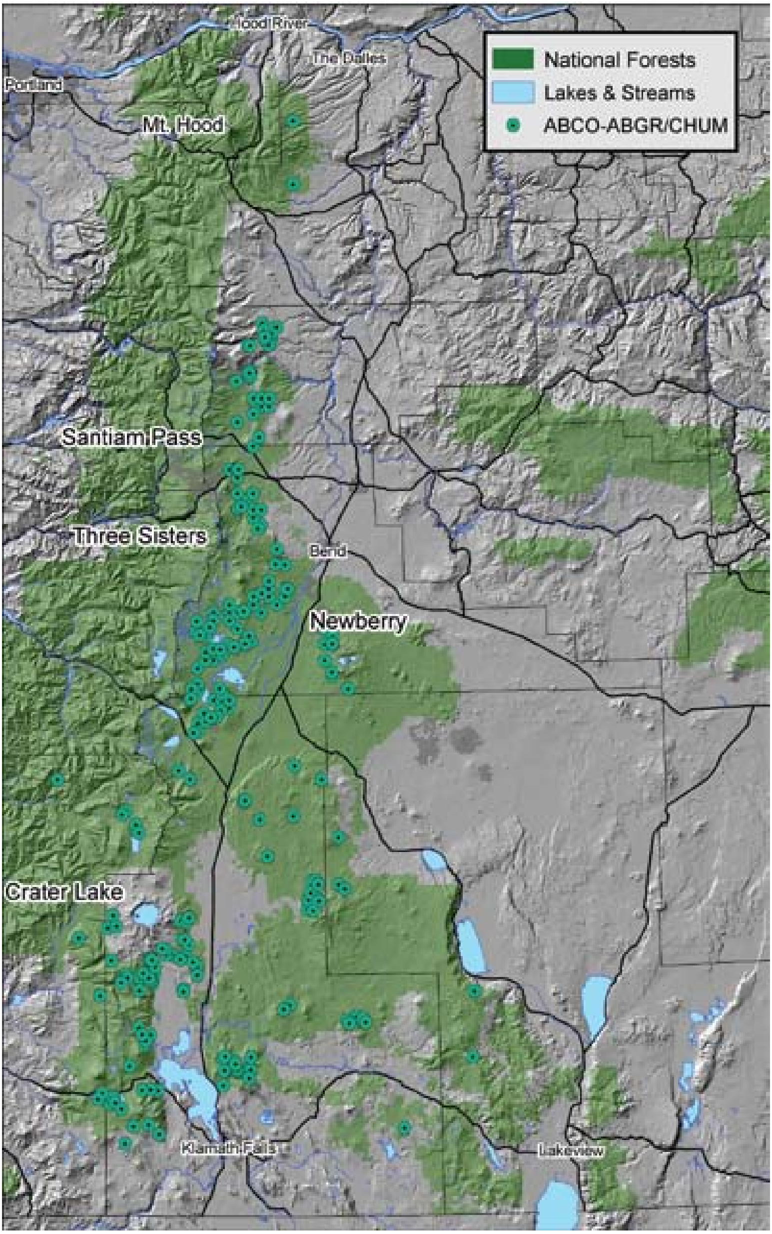






Mean Precip.	36.9”	19-67”
Mean Temp.	42.5°F	39-48°F

Figure 5-11. Map of ABCO-ABGR/CHUM Plot Distribution—



Vegetation— Overstory tree layers are usually a mixture of ABCO-ABGR and PIPO. Plots north of the Metolius Basin usually have PSME as a significant component. Understory tree layers are usually dominated by ABCO-ABGR with lesser amounts of PSME or PIPO. With disturbance, shrub cover may increase dramatically. Increased cover of snowbrush ceanothus, greenleaf manzanita, and sticky or wax currant are indicators of past disturbance. Herb layers are less diverse than in the ABCO-ABGR wet PAG and other associations in the ABCO-ABGR moist PAG.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABCO	*Abies concolor-Abies grandis*	82	91	21.3	12.9
PICO	*Pinus contorta*	44	41	11.2	6.2
PIPO	*Pinus ponderosa*	80	61	16.5	5.1
PSME	*Pseudotsuga menziesii*	33	33	18.6	5.0
Shrubs					
ARNE	*Arctostaphylos nevadensis*	30		6.6	
ARPA	*Arctostaphylos patula*	46		4.2	
CEVE	*Ceanothus velutinus*	48		9.5	
CHUM	*Chimaphila umbellata*	100		4.5	
Herbaceous					
FRVI	*Fragaria virginiana*	51		1.2	
HIAL	*Hieracium albiflorum*	25		0.8	
PYPI	*Pyrola picta*	32		0.7	
PYSE	*Pyrola secunda*	26		0.7	
Graminoids					
CAIN4	*Carex inops*	54		3.7	
CARO	*Carex rossii*	35		2.4	
SIHY	*Sitanion hystrix*	36		1.3	
STOC	*Stipa occidentalis*	41		1.0	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

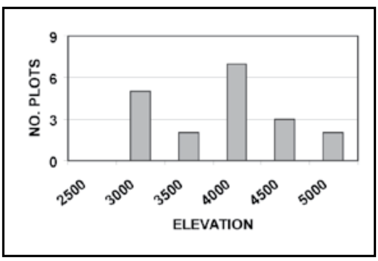
Plant Assoc	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
ABCO-ABGR/CHUM							
ABCO-ABGR	92	2	180	221	4	673	94
ABMAS	87	4	12	289	22	43	116
PICO	69	2	83	133	4	324	42
PILA	99	2	6	210	19	6	96
PIPO	91	1	175	182	4	520	76
PSME	104	4	42	237	12	127	113

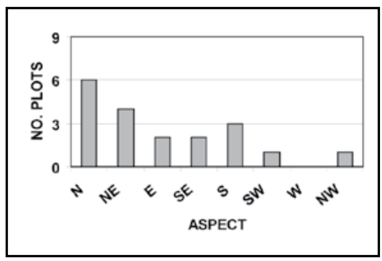
Relationships to Other Classifications— ABGR/CHUM has been described for northwest Oregon by Hemstrom et al (1986) and by McCain and Diaz (2002). ABCO-ABGR/CHUM as described here is drier than described by Hemstrom or McCain and Diaz. Only sites without twinflower or vanillaleaf would key here.

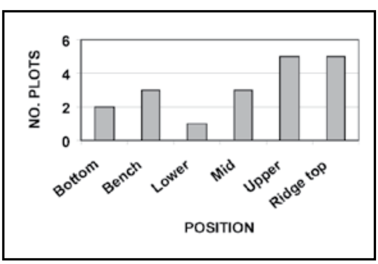
ABCO-ABGR/HODI ABCO-ABGR Moist

CWS531 (ABCO-ABGR/HODI)
Abies concolor-Abies grandis/Holodiscus discolor
white fir–grand fir/oceanspray
Plots 18

Distribution and Environment— ABCO-ABGR/HODI is found from Sisters north to the east side of Mt. Hood. This association is transitional to the Douglas-fir series. Average elevation is 3575 feet (range 2620-4600 feet). Average slope is 15% (range 2-65%). Most plots were found on north to northeast aspects. Slope positions are typically mid to upper slopes or ridgetops.

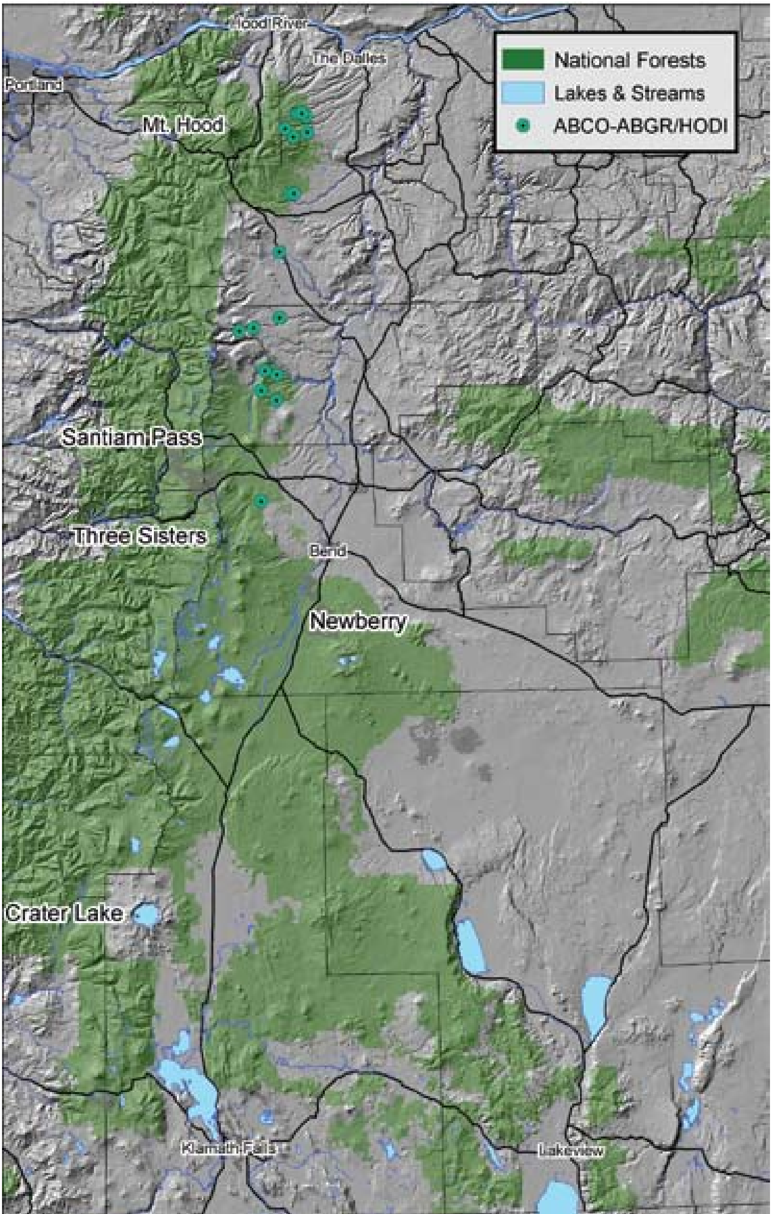






Mean Precip.	31.4”	19-49”
Mean Temp.	46.1°F	44-48°F

Figure 5-12. Map of ABCO-ABGR/HODI Plot Distribution—



Vegetation— Overstory tree layers are dominated by Douglas-fir with lesser cover of ponderosa pine and white fir-grand fir. Understory tree layers are also mixtures of the above species with Douglas-fir and white fir-grand fir having more importance. Shrub layers are usually diverse mixtures of dry site shrubs. Oceanspray, common snowberry, greenleaf manzanita, and serviceberry are the most common species. Herb layers are varied; only mountain sweet-root (OSCH) and western hawkweed (HIAL2) are present at least 50% of the time. Elk sedge (CAGE) and pinegrass (CARU) have average cover values between 10-15% but constancy is low (about 20%).

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABCO	*Abies concolor-Abies grandis*	61	94	8.2	1.8
PIPO	*Pinus ponderosa*	100	44	14.9	3.4
PSME	*Pseudotsuga menziesii*	89	83	36.9	4.3
Shrubs					
AMAL	*Amelanchier alnifolia*	44		1.6	
ARPA	*Arctostaphylos patula*	50		1.4	
BEAQ	*Berberis aquifolium*	33		1.6	
CEVE	*Ceanothus velutinus*	39		1.3	
HODI	*Holodiscus discolor*	100		1.8	
PUTR	*Purshia tridentata*	39		3.9	
ROGY	*Rosa gymnocarpa*	39		2.0	
SYAL	*Symphoricarpos albus*	78		5.6	
Herbaceous					
FRVE	*Fragaria vesca*	44		2.1	
FRVI	*Fragaria virginiana*	28		1.1	
HIAL2	*Hieracium albertinum*	50		1.0	
OSCH	*Osmorhiza chilensis*	50		1.7	
Graminoids					
FEID	*Festuca idahoensis*	39		3.2	
FEOC	*Festuca occidentalis*	33		1.5	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

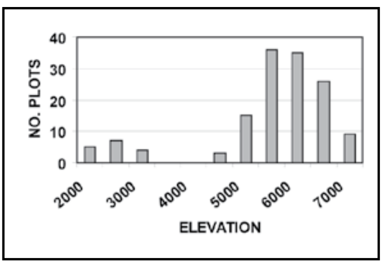
Plant Assoc	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
ABCO-ABGR/HODI							
ABCO-ABGR	87	9	2	119	31	6	48
PIPO	94	5	8	142	8	45	62
PSME	85	11	3	140	13	25	55

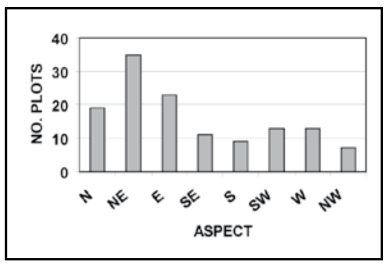
Relationships to Other Classifications— ABGR/HODI has been described for the east side of Mt. Hood and Gifford Pinchot National Forests (Topik et al 1988, Topik 1989). ABGR/HODI/CARU (CT) has been described for central Washington (Lillybridge et al 1995). ABGR/HODI as described by Topik is slightly wetter than described here. Many of the Topik plots would key to ABCO-ABGR/TRLA2 in this classification. Lillybridge's association consistently has CAGE and CARU which occur in the central Oregon data set, but at much lower constancy than in central Washington.

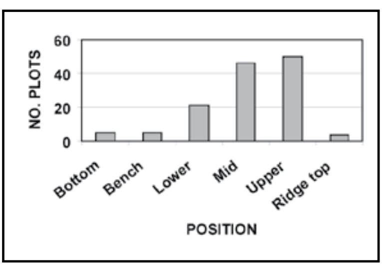
ABCO-ABGR/SYAL — ABCO-ABGR Dry

CWS362 (ABCO-ABGR/SYAL)
Abies concolor-Abies grandis/Symphoricarpos albus
white fir–grand fir/common snowberry
Plots 181

Distribution and Environment— ABCO-ABGR/SYAL has a split distribution. The association is missing in deep Mazama ash/pumice deposits. The single plot within the Mazama ash plume is located on the edge of a more recent lava flow. The northern plots occur at much lower elevations than plots south of the ash plume. Average elevation for all plots is 5700 feet (range 2190-7400 feet). Average elevation for the northern plots is only 2910 feet (range 2190-4800 feet). Average slope is 19% (range 1-60%). Most plots were found on a northeastern aspect. Positions are usually mid to upper slopes.

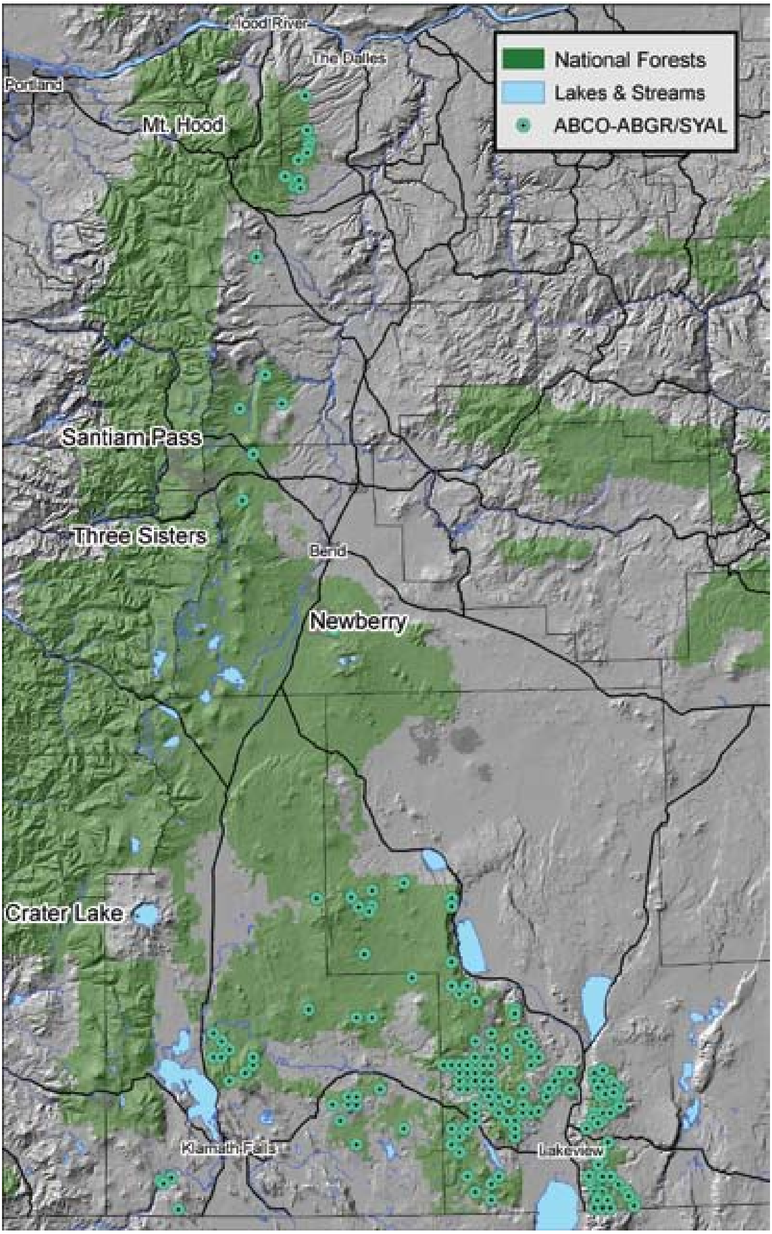






Mean Precip.	27.3”	17-65”
Mean Temp.	43.4°F	39-48°F

Figure 5-13. Map of ABCO-ABGR/SYAL Plot Distribution—



Vegetation— Overstory tree layers are dominated by white fir-grand fir and ponderosa pine. Douglas-fir is common north of the Mazama ash/pumice plume. Understory tree layers are dominated by white fir-grand fir with lesser amounts of ponderosa pine. Stream bottom positions may have scattered aspen. Shrub layers are less diverse than ABCO-ABGR/HODI associations. Increased cover of greenleaf manzanita, snowbrush ceanothus, sticky currant or wax currant may indicate past disturbance. Manzanita and ceanothus increase after fire disturbance and the currants are favored by mechanical disturbance. Herb layers are dominated by heartleaf arnica (ARCO), starwort (STJA) and various graminoids such as bluegrass (PONE), squirreltail (SIHY), western needlegrass (STOC), and Ross's sedge (CARO).

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABCO	*Abies concolor-Abies grandis*	90	93	21.7	11.9
PIPO	*Pinus ponderosa*	93	78	17.9	6.2
Shrubs					
AMAL	*Amelanchier alnifolia*	64		1.2	
ARPA	*Arctostaphylos patula*	34		1.5	
ARTR	*Artemisia tridentata*	33		8.2	
CEVE	*Ceanothus velutinus*	40		2.1	
RICE	*Ribes cereum*	37		1.3	
RIVI	*Ribes viscosissimum*	28		2.1	
SYAL	*Symphoricarpos albus*	100		3.5	
Herbaceous					
ARCO	*Arnica cordifolia*	58		3.3	
FRVI	*Fragaria virginiana*	41		1.4	
STJA	*Stellaria jamesiana*	46		1.9	
WYMO	*Wyethia mollis*	29		2.2	
Graminoids					
CAIN4	*Carex inops*	27		3.3	
CARO	*Carex rossii*	62		0.8	
FEID	*Festuca idahoensis*	25		3.6	
PONE	*Poa nervosa*	65		2.8	
SIHY	*Sitanion hystrix*	81		1.5	
STOC	*Stipa occidentalis*	68		0.9	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

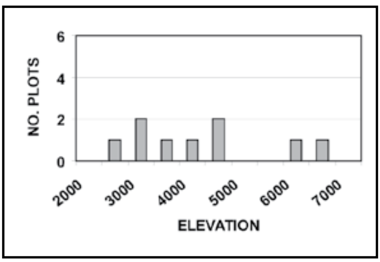
Plant Assoc	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
ABCO-ABGR/SYAL							
ABCO-ABGR	78	2	162	250	4	1291	90
ABMAS	72	10	3	329	12	70	109
PICO	64	3	28	190	5	194	56
PIMO	66	5	4	364	23	49	110
PIPO	79	1	169	179	3	1131	65
PSME	101	5	12	191	10	81	89

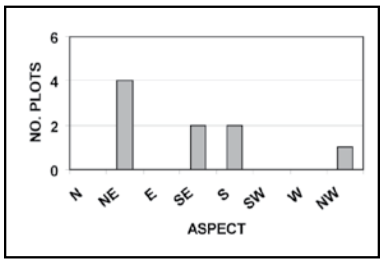
Relationships to Other Classifications— ABGR/SYAL is a widely described type in the Pacific Northwest east of the Cascade Crest. It has been described for central Washington (Lillybridge et al 1995), east side Mt. Hood (Topik et al 1988), Warm Springs Indian Reservation (Marsh et al 1987), central Oregon (Volland 1985), and south-central Oregon (Hopkins 1979b). The type as described here is drier than most sites described by Topik and Marsh, it includes portions of the PSME-ABCO/SYAL/CARU association described by Volland without moist site herbs, and it includes most of the ABCO/SYAL/FRVI association described by Hopkins. Some of the sites north of the Mazama ash/pumice plume are similar to the Wenatchee variant.

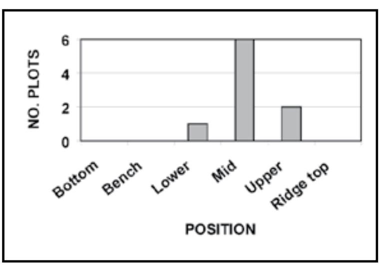
ABCO-ABGR/CARU ABCO-ABGR Dry

CWG141 (ABCO-ABGR/CARU)
Abies concolor-Abies grandis/Calamagrostis rubescens
white fir–grand fir/pinegrass
Plots 9

Distribution and Environment— ABCO-ABGR/CARU has a very limited distribution on the east slope of the Cascade Mountains. It is found from Sisters north to the southern portions of the Warm Springs Indian Reservation. This portion of the distribution appears to be a western extension of ABGR/CARU associations in the Ochoco Mountains. Two plots occur in the northern Warner Mountains. Average elevation is 4486 feet (range 2710-6770 feet). The plots in the Warner Mountains occur at higher elevations (6380 feet, 6770 feet). Average slope is 18% (range 2-40%). There are too few plots to see a pattern in aspects, however, many plots were found on northeast slopes. Positions are typically mid slopes.

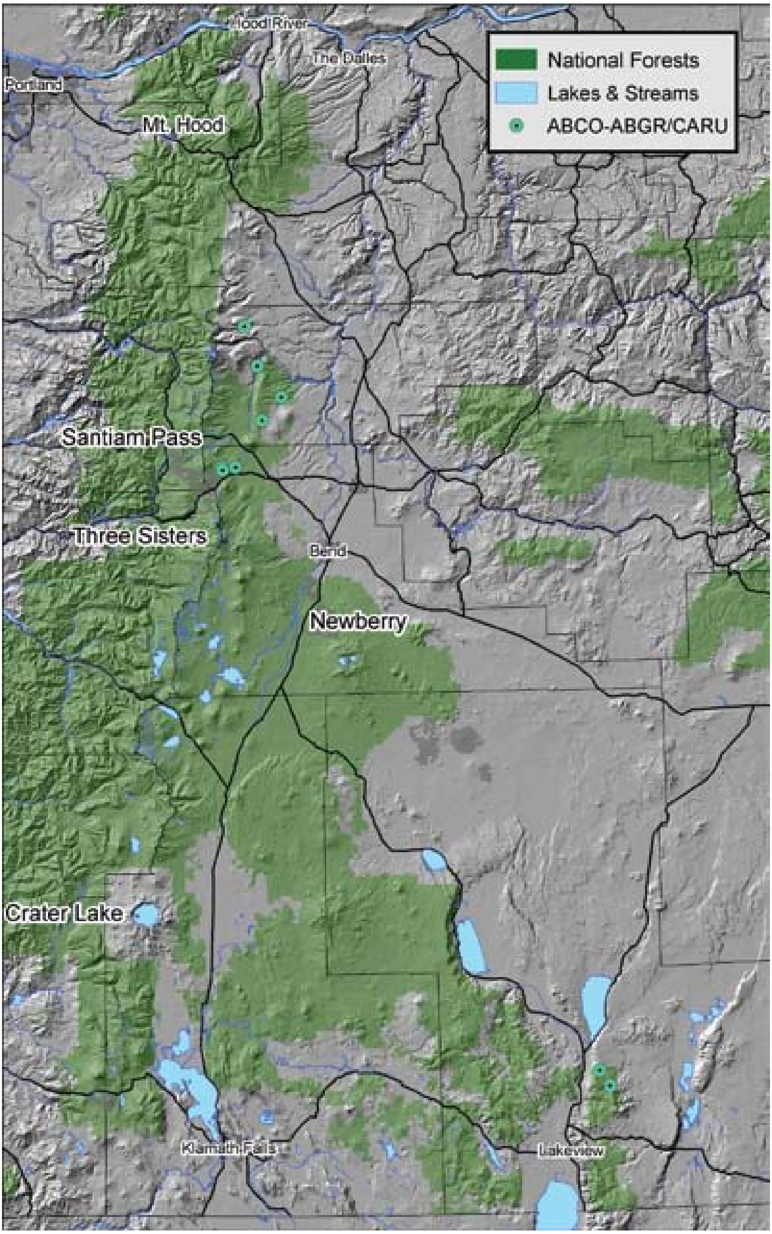






Mean Precip.	34.3”	17-49”
Mean Temp.	43.6°F	41-46°F

Figure 5-14. Map of ABCO-ABGR/CARU Plot Distribution—



Vegetation— Overstory tree layers are dominated by ponderosa pine and occasionally Douglas-fir with some mature white fir-grand fir. Understory tree layers are dominated by white fir-grand fir with lesser amounts of ponderosa pine or Douglas-fir. Shrub layers are not well developed. Only greenleaf manzanita (ARPA) and prince's pine (CHME, CHUM) are present more than a third of the time with low cover values. Increased cover of snowbrush ceanothus (CEVE), ARPA, or wax currant (RICE) may indicate past disturbance. The herb layer is dominated by pinegrass (CARU). Heartleaf arnica (ARCO), silvery lupine (LUAR3), western hawkweed (HIAL2), and starwort (STJA) occur with significant cover (>3%) on more than 1 plot.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABCO	*Abies concolor-Abies grandis*	67	100	11.7	9.8
PIPO	*Pinus ponderosa*	100	56	29.1	9.5
PSME	*Pseudotsuga menziesii*	33	33	27.3	2.5
Shrubs					
ARPA	*Arctostaphylos patula*	56		1.7	
CHME	*Chimaphila menziesii*	33		0.4	
CHUM	*Chimaphila umbellata*	44		0.4	
Herbaceous					
HIAL	*Hieracium albiflorum*	44		2.6	
Graminoids					
CAIN4	*Carex inops*	67		1.9	
CARU	*Calamagrostis rubescens*	100		23.1	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

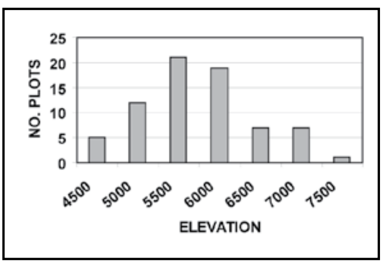
No data available for this plant association.

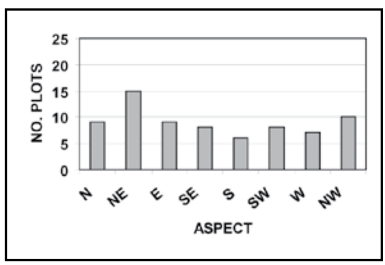
Relationships to Other Classifications— ABGR/CARU has been previously described in central Washington (Lillybridge et al 1995), Blue and Wallowa Mountains of Oregon (Johnson and Clausnitzer 1992; Johnson and Simon 1987), and central Idaho (Steele et al 1981).

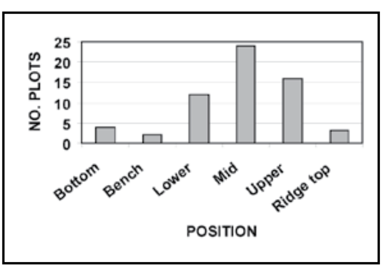
ABCO-ABGR/ARNE — ABCO-ABGR Dry

CWS363 (ABCO-ABGR/ARNE)
Abies concolor-Abies grandis/Arctostaphylos nevadensis
white fir–grand fir/pinemat manzanita
Plots 79

Distribution and Environment— ABCO-ABGR/ARNE is found from Black Butte south to Crater Lake and east to Gearheart Mountain and Cougar Peak on the Fremont National Forest. A single location is known in the Warner Mountains south of Crane Mountain. This association occurs on cold dry sites. Average elevation is 5977 feet (range 4500-7680 feet). Average slope is 16% (range 0-60%). Aspects are typically north to east except at higher elevations. Positions are mid to upper slopes. Adjacent cooler sites transition to Shasta Red Fir (ABMAS), Mountain Hemlock (TSME), or Whitebark Pine-Lodgepole Pine (PIAL-PICO) Series. Soils are well drained and poorly developed. They are derived from air-laid pumice, lava colluvium, or cinders (Volland 1985).

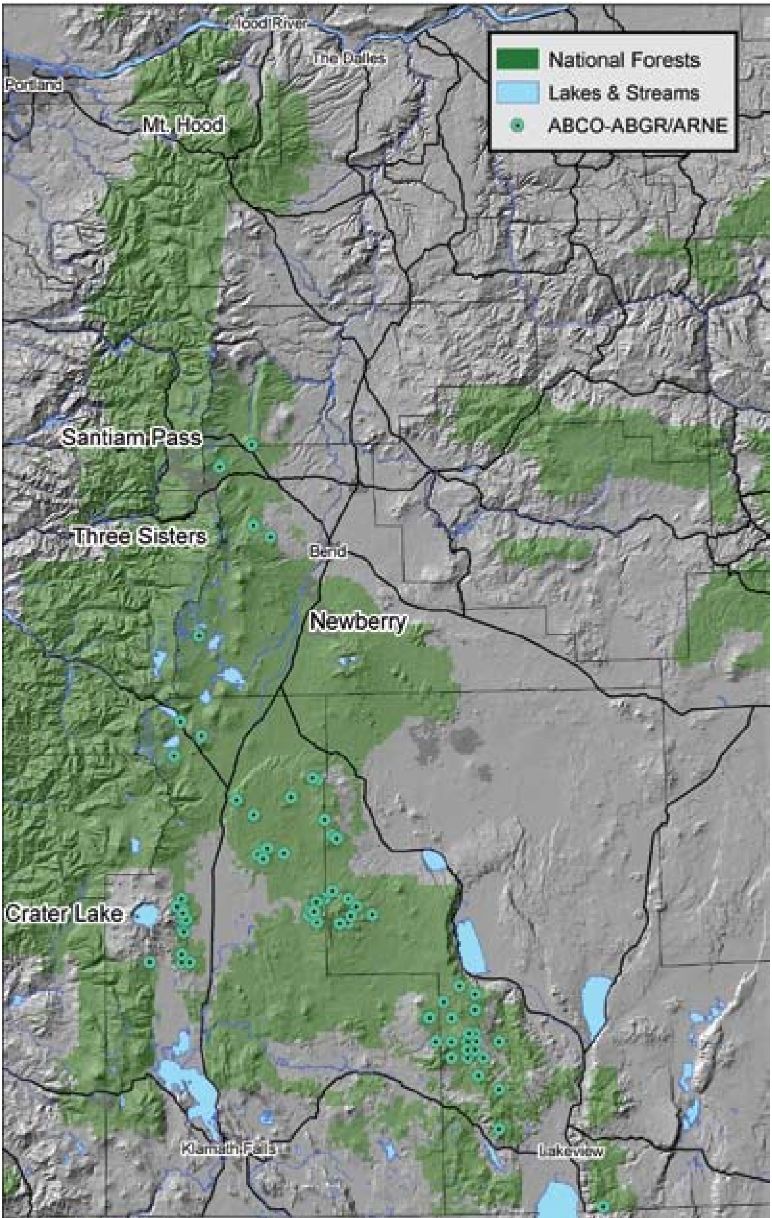






Mean Precip.	34.1”	19-55”
Mean Temp.	41.4°F	39-44°F

Figure 5-15. Map of ABCO-ABGR/ARNE Plot Distribution—



Vegetation— White fir and to a lesser extent ponderosa pine are the primary overstory dominants in mid to late seral stands. Stands are rarely dominated by a single tree species. Lodgepole pine can dominate sites after stand replacement fire. Pinemat manzanita dominates a species-poor understory. Snowbrush ceanothus and greenleaf manzanita increase after disturbance. The herbaceous layer is species poor and typically has low cover.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABCO	*Abies concolor-Abies grandis*	86	82	17.3	11.8
PICO	*Pinus contorta*	77	73	14.7	8.3
PIMO	*Pinus monticola*	28	18	5.3	3.1
PIPO	*Pinus ponderosa*	64	47	12.7	3.6
Shrubs					
ARNE	*Arctostaphylos nevadensis*	100		5.9	
ARPA	*Arctostaphylos patula*	55		3.6	
CEVE	*Ceanothus velutinus*	51		7.8	
RICE	*Ribes cereum*	40		3.7	
Herbaceous					
FRVI	*Fragaria virginiana*	41		1.0	
Graminoids					
CAIN4	*Carex inops*	49		3.4	
CARO	*Carex rossii*	64		0.8	
SIHY	*Sitanion hystrix*	56		0.5	
STOC	*Stipa occidentalis*	74		1.6	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

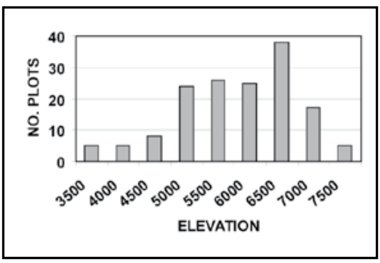
Plant Assoc	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
ABCO-ABGR/ARNE							
ABCO-ABGR	77	4	44	236	6	326	83
ABMAS	99	7	4	367	25	55	167
PICO	57	2	68	145	3	416	38
PIPO	80	4	20	183	7	193	67

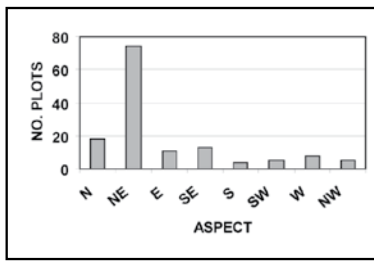
Relationships to Other Classifications— ABGR/ARNE is described from central Washington (Lillybridge et al 1995). The central and south-central Oregon variant is missing Douglas-fir and pinegrass which are absent from most of the area within or south of the Mazama ash/pumice deposits. Sites appear cooler and occur at much higher elevations. ABCO-ABGR/ARNE has many affinities to ABMAS/ARNE described by Volland (1985).

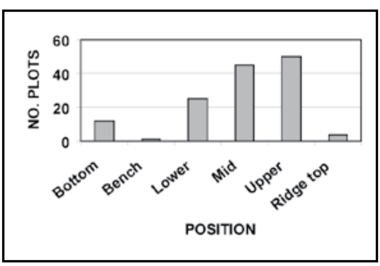
ABCO-ABGR/CAIN4 — ABCO-ABGR Dry

CWG142 (ABCO-ABGR/CAIN9)
Abies concolor-Abies grandis/Carex inops
white fir–grand fir/long-stolen sedge
Plots 163

Distribution and Environment— ABCO-ABGR/CAIN4 is found from Black Butte south to Mountain Lakes Wilderness and east to the northern Warner Mountains. This association occurs on cold, dry sites with excessively drained soils. Average elevation is 6038 feet (range 3575-7850 feet). Average slope is 17% (range 0-70%). Aspects display a strong trend toward northeast slopes. Positions are typically mid to upper slopes.

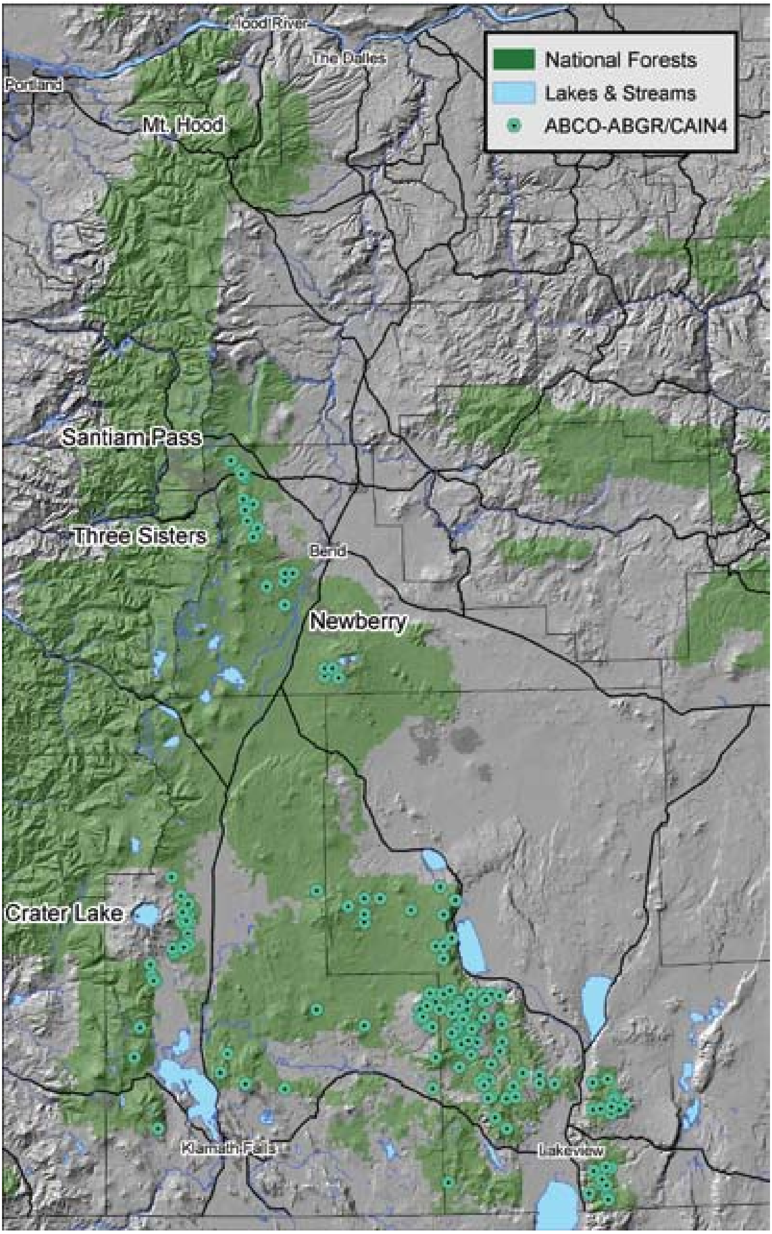






Mean Precip.	30.7”	17-59”
Mean Temp.	41.6°F	37-45°F

Figure 5-16. Map of ABCO-ABGR/CAIN4 Plot Distribution—



Vegetation—Overstory tree layers are typically a mixture of white fir-grand fir and ponderosa pine or lodgepole pine. Understory tree layers are dominated by white fir-grand fir. Understory vegetation is sparse, shrubs are almost non-existent and herbaceous plants have low cover values (<10%). Long-stolon sedge, squirreltail, and western needlegrass have the highest constancy and long-stolon sedge and Wheeler's bluegrass have the highest cover in the understory.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABCO	*Abies concolor-Abies grandis*	63	92	14.0	12.4
PICO	*Pinus contorta*	63	56	19.7	9.1
PIPO	*Pinus ponderosa*	64	55	17.2	9.9
Shrubs					
RICE	*Ribes cereum*	30		0.9	
Herbaceous					
FRVI	*Fragaria virginiana*	42		1.1	
Graminoids					
CAIN4	*Carex inops*	100		5.0	
CARO	*Carex rossii*	26		1.1	
PONE	*Poa nervosa*	50		4.3	
SIHY	*Sitanion hystrix*	72		1.4	
STOC	*Stipa occidentalis*	61		1.6	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

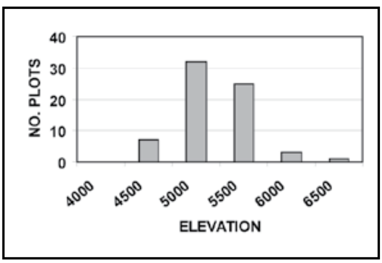
Plant Assoc	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
ABCO-ABGR/CAIN4							
ABCO-ABGR	84	3	42	298	11	256	116
PICO	64	2	70	132	3	428	39
PILA	82	1	3	135	12	13	51
PIPO	84	2	122	158	4	390	62

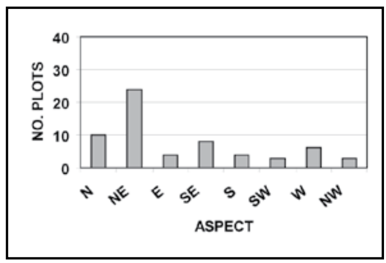
Relationships to Other Classifications— ABCO-ABGR/CAIN4 has not been previously described. It is similar to Hopkins (1979a) ABCO-PICO/STOC-CAPE association described for the Fremont National Forest, and most plots originally included there will key here. It also encompasses moister portions of PICO/SIHY/CAPE and PICO-PIAL/ARCO2 which have white fir.

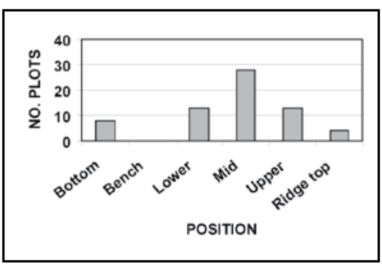
ABCO-ABGR/CEPR — ABCO-ABGR Dry

CWS364 (ABCO-ABGR/CEPR)
Abies concolor-Abies grandis/Ceanothus prostratus
white fir–grand fir/mahala mat
Plots 77

Distribution and Environment— ABCO-ABGR/CEPR is a southern east slope Cascades association. It is found from Crater Lake and Silver Lake south to the California border. It is not known from the Warner Mountains. Average elevation is 5416 feet (range 4600-6540 feet). Average slope is 16% (range 1-64%). Most plots were found on a north to northeast aspect.

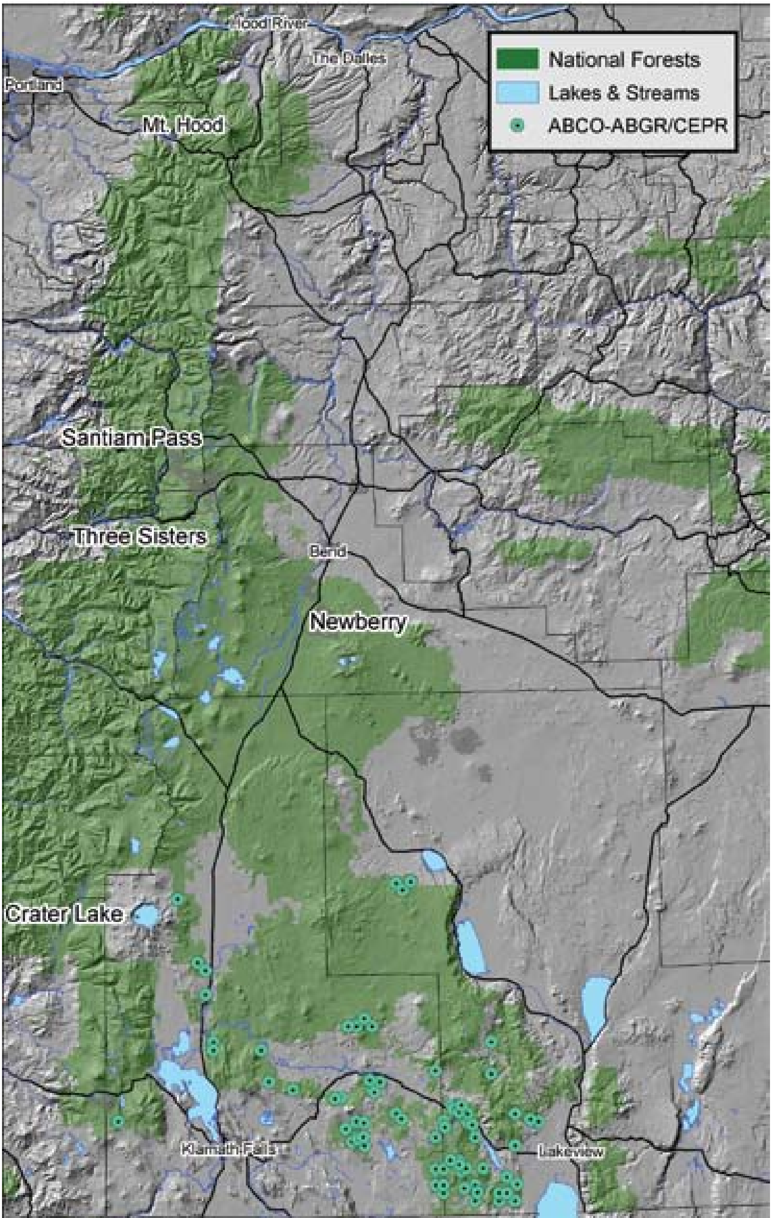






Mean Precip.	23.1”	17-49”
Mean Temp.	44.5oF	41-47oF

Figure 5-17. Map of ABCO-ABGR/CEPR Plot Distribution—



Vegetation— Overstory tree layers are dominated by ponderosa pine with lesser amounts of white fir-grand fir. Incense cedar is a common component. Western juniper is an occasional component. It is most common on sites adjacent to non-forest or juniper woodland communities. Understory tree layers are a mixture of ponderosa pine and white fir-grand fir. Shrub layers are various mixtures of squawcarpet, greenleaf manzanita, mountain mahogany, and bitterbrush. Squawcarpet is always present and serviceberry is usually present at low coverage. Disturbed stands have increased cover of manzanita and snowbrush ceanothus. Herb layers are dominated by graminoids. Squirreltail, Ross's sedge, western needlegrass, and Wheeler's bluegrass are the most common graminoid species. Heartleaf arnica and Virginia strawberry are the most common dicots.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABCO	*Abies concolor-Abies grandis*	81	88	11.1	8.1
CADE3	*Calocedrus decurrens*	40	50	9.2	4.2
JUOC	*Juniperus occidentalis*	18	32	7.1	2.7
PIPO	*Pinus ponderosa*	99	95	21.0	14.0
Shrubs					
AMAL	*Amelanchier alnifolia*	91		1.2	
ARPA	*Arctostaphylos patula*	77		6.1	
CELE	*Cercocarpus ledifolius*	50		6.8	
CEPR	*Ceanothus prostratus*	100		9.0	
CEVE	*Ceanothus velutinus*	47		2.6	
PUTR	*Purshia tridentata*	51		4.8	
Herbaceous					
ARCO	*Arnica cordifolia*	40		4.2	
FRVI	*Fragaria virginiana*	63		2.1	
HIAL	*Hieracium albiflorum*	26		2.9	
WYMO	*Wyethia mollis*	36		2.5	
Graminoids					
CARO	*Carex rossii*	79		2.5	
FEID	*Festuca idahoensis*	28		5.7	
PONE	*Poa nervosa*	60		2.6	
SIHY	*Sitanion hystrix*	87		2.4	
STOC	*Stipa occidentalis*	67		1.3	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

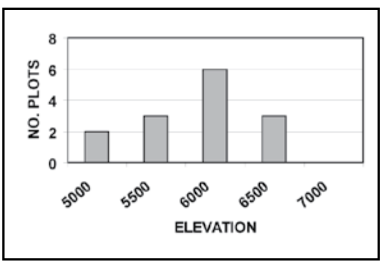
Plant Assoc	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
ABCO-ABGR/CEPR							
ABCO-ABGR	79	3	49	211	6	286	77
CADE3	58	6	8	157	7	97	42
PICO	79	5	8	154	4	190	56
PILA	77	2	2	224	22	20	79
PIPO	75	2	74	153	3	618	53

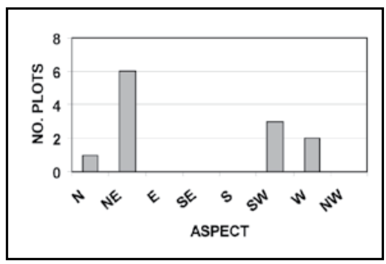
Relationships to Other Classifications— ABCO-ABGR/CEPR has not been previously described in the Pacific Northwest. Portions of Hopkins (1979a) ABCO-PIPO-CADE/AMAL, ABCO-PIPO/ARPA-BERE, ABCO-PIPO/SYAL/STJA will key here.

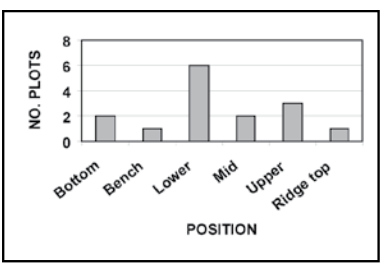
ABCO-ABGR/WYMO ABCO-ABGR Dry

CWF741 (ABCO-ABGR/WYMO)
Abies concolor-Abies grandis/Wyethia mollis
white fir–grand fir/woolly mule-ears
Plots 14

Distribution and Environment— ABCO-ABGR/WYMO has a limited distribution in southern and central portions of the Fremont National Forest. Average elevation is 6117 feet (range 5200-6840 feet). Average slope is 15% (range 5-26%). There are too few plots to see a pattern in aspect, however, almost half the plots were found on a northeastern aspect. Positions are also somewhat variable. Lower slope, bottoms, and benches occur about 64% of the time.

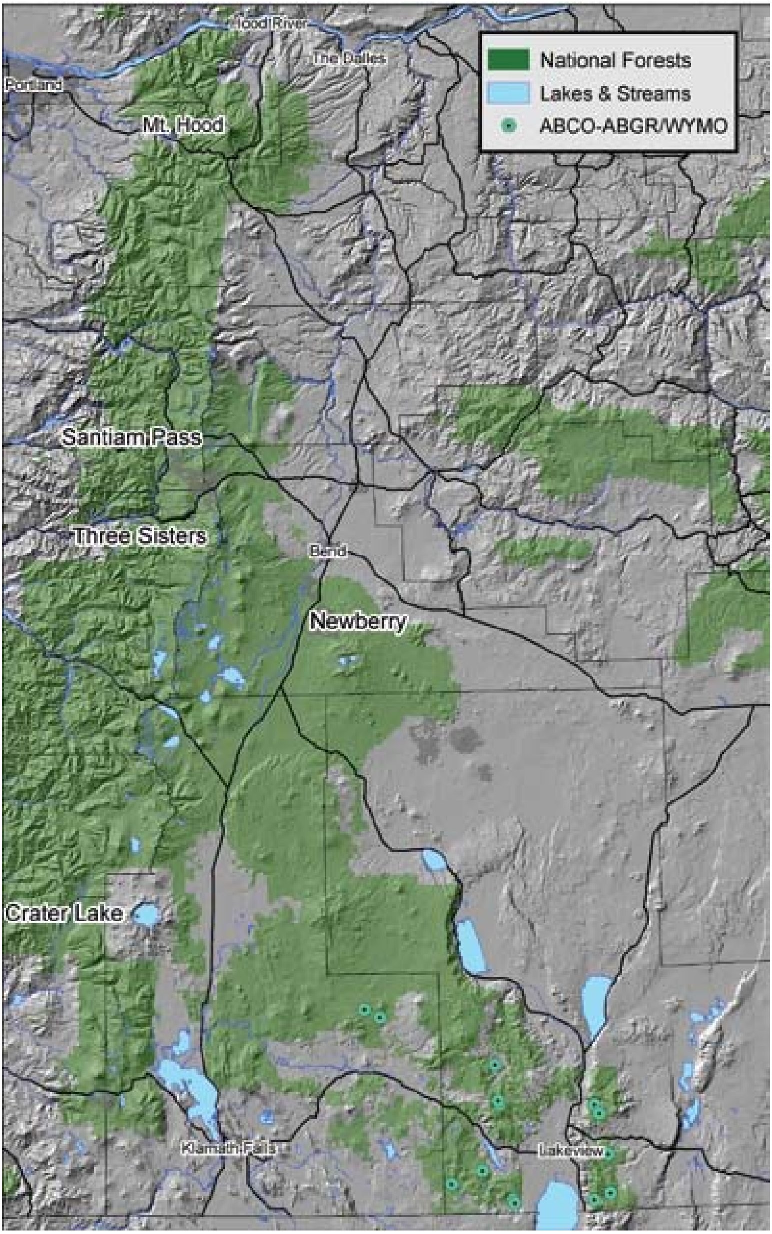






Mean Precip.	27.5”	21-35”
Mean Temp.	43.5°F	42-45°F

Figure 5-18. Map of ABCO-ABGR/WYMO Plot Distribution—



Vegetation— Overstory tree layers are dominated by ponderosa pine with lower cover of white fir. Understory tree layers always have both ponderosa pine and white fir. Shrub layers are variable. Serviceberry is always present at low covers, but is mixed with various combinations of manzanita, snowbrush ceanothus, mountain mahogany, and bitterbrush. Sites with higher covers of manzanita and ceanothus may indicate past disturbances. Herb layers always have woolly mule-ears (WYMO) and squirreltail (SIHY).

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABCO	*Abies concolor-Abies grandis*	80	100	10.7	7.1
PICO	*Pinus contorta*	27	33	6.8	7.1
PIPO	*Pinus ponderosa*	100	100	22.5	11.6
Shrubs					
AMAL	*Amelanchier alnifolia*	100		2.5	
ARPA	*Arctostaphylos patula*	27		5.1	
CELE	*Cercocarpus ledifolius*	33		12.9	
CEVE	*Ceanothus velutinus*	47		1.9	
PUTR	*Purshia tridentata*	40		6.0	
Herbaceous					
ARCO	*Arnica cordifolia*	67		6.7	
FRVI	*Fragaria virginiana*	33		2.5	
HIAL	*Hieracium albiflorum*	27		5.5	
LUAR3	*Lupinus argenteus*	47		11.9	
STJA	*Stellaria jamesiana*	53		2.7	
WYMO	*Wyethia mollis*	100		4.7	
Graminoids					
CAIN4	*Carex inops*	47		5.1	
CARO	*Carex rossii*	47		1.2	
PONE	*Poa nervosa*	87		4.5	
SIHY	*Sitanion hystrix*	100		2.9	
STOC	*Stipa occidentalis*	53		1.9	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

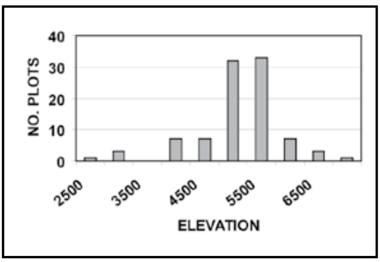
Plant Assoc	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
ABCO-ABGR/WYMO							
ABCO-ABGR	120	9	3	183	15	24	101
PIPO	79	6	12	120	5	81	44

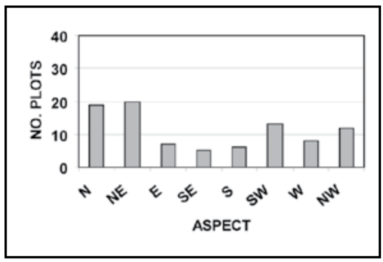
Relationships to Other Classifications— ABCO-ABGR/WYMO has not been previously described in the Pacific Northwest. It represents wetter and perhaps cooler portions of the PIPO/WYMO association previously described by Hopkins (1979a).

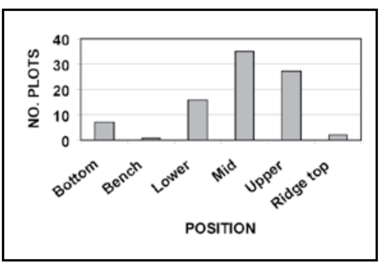
ABCO-ABGR/ARPA — ABCO-ABGR Dry

CWS141 (ABCO-ABGR/ARPA6)
Abies concolor-Abies grandis/Arctostaphylos patula
white fir–grand fir/greenleaf manzanita
Plots 109

Distribution and Environment— ABCO-ABGR/ARPA is a widely distributed association from the Metolius Basin south to the California border. The association occurs mostly east of the Cascades proper. Most of the plots occur within the Mazama ash/pumice plume. Sites outside deep ash/pumice deposits may be seral community types related to more mesic ABCO-ABGR associations instead of an actual potential vegetation type. Average elevation is 5336 feet (range 2965-7070 feet). Average slope is 15% (range 1-58%). Many plots were found on a northern aspect.

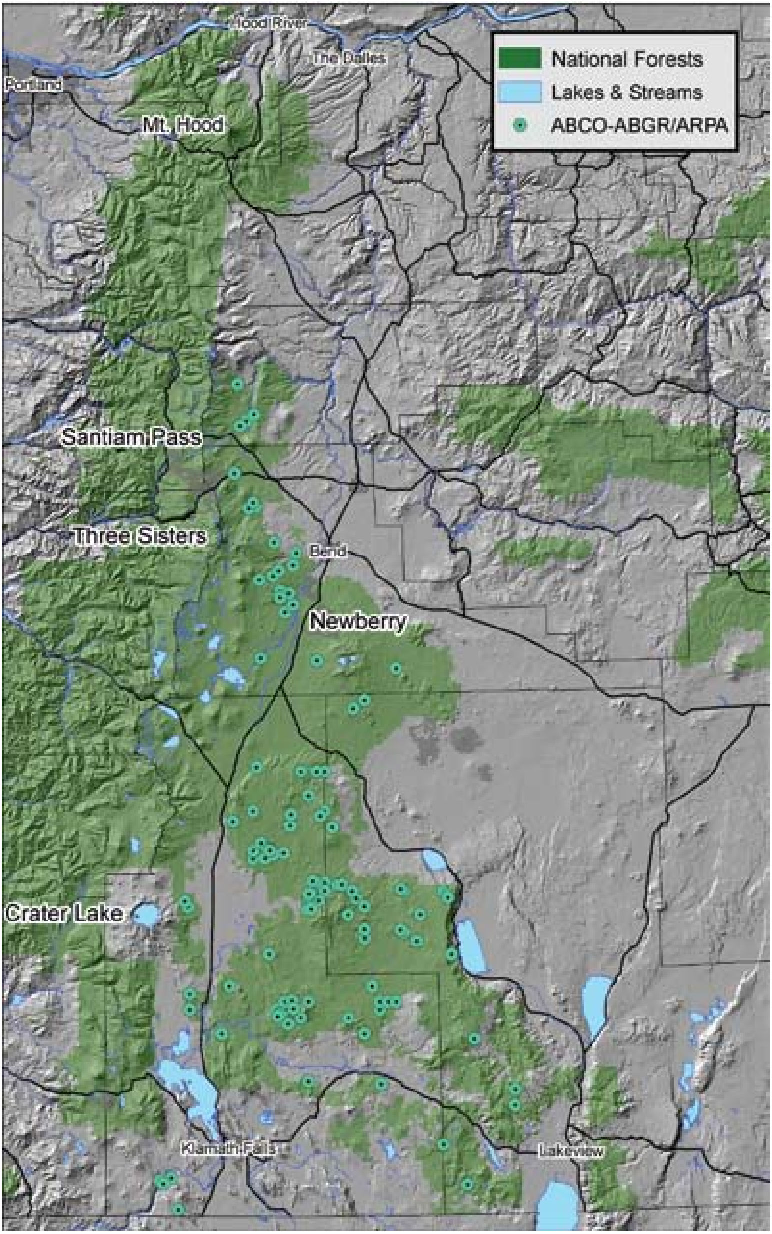






Mean Precip.	27.2”	11-45”
Mean Temp.	42.6°F	39-46°F

Figure 5-19. Map of ABCO-ABGR/ARPA Plot Distribution—



Vegetation— Tree overstory layers are dominated by various mixtures of ponderosa pine and white fir-grand fir. Lodgepole pine indicates cooler temperature regimes or frost pockets. Sites with lodgepole pine may have more mixed fire regime. Understory tree layers have slightly greater constancy and cover of white fir-grand fir than the overstory. Shrub layers are dominated by greenleaf manzanita, snowbrush ceanothus, and bitterbrush. Herbaceous layers have low cover. The most common species are grasses (squirreltail and western needlegrass) and upland sedges (Ross's sedge). The only herb with greater than 50% constancy is Virginia strawberry (FRVI).

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABCO	*Abies concolor-Abies grandis*	74	85	11.1	9.4
PICO	*Pinus contorta*	45	48	10.0	9.4
PIPO	*Pinus ponderosa*	90	83	17.1	8.2
Shrubs					
ARPA	*Arctostaphylos patula*	100		5.4	
CEVE	*Ceanothus velutinus*	67		12.3	
PUTR	*Purshia tridentata*	67		6.2	
RICE	*Ribes cereum*	33		0.8	
Herbaceous					
FRVI	*Fragaria virginiana*	60		1.6	
Graminoids					
CARO	*Carex rossii*	77		1.1	
SIHY	*Sitanion hystrix*	72		0.9	
STOC	*Stipa occidentalis*	78		1.5	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
ABCO-ABGR/ARPA							
ABCO-ABGR	84	3	41	182	6	226	70
PICO	65	2	39	134	5	267	40
PILA	90	4	10	171	8	54	71
PIPO	87	1	166	137	3	535	55
PSME	128	11	2	89	10	8	52

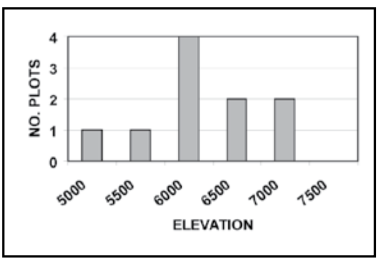
Relationships to Other Classifications—

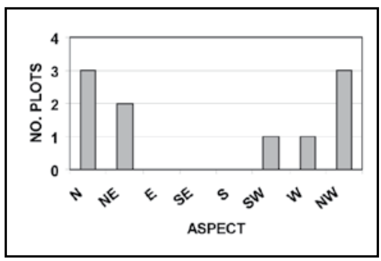
Higher precipitation sites (>35”) may be seral communities related to more mesic ABCO-ABGR series associations.

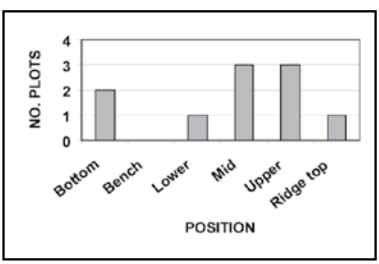
ABCO-ABGR/STJA (CT) — ABCO-ABGR Dry

CWF362 (ABCO-ABGR/STJA3)
Abies concolor-Abies grandis/Stellaria jamesiana
white fir–grand fir/sticky starwort
Plots 10

Distribution and Environment— ABCO-ABGR/STJA is a minor type closely related to ABCO-ABGR/SYAL. All the plots come from the CVS data set. Most plots had a substantial disturbance evident. One plot had dense overstory and depauperate understory. Two sites were located at the edge of scablands with an ecotone to western juniper and to mountain big sagebrush. This community type is likely a seral stage of the ABCO-ABGR/SYAL association. Bottom or draw positions may have quaking aspen. Average elevation is 6290 feet (range 5400-7000 feet). Average slope is 14% (range 3-27%). Many plots were found on a northern aspect, while none were found on a southeastern aspect.

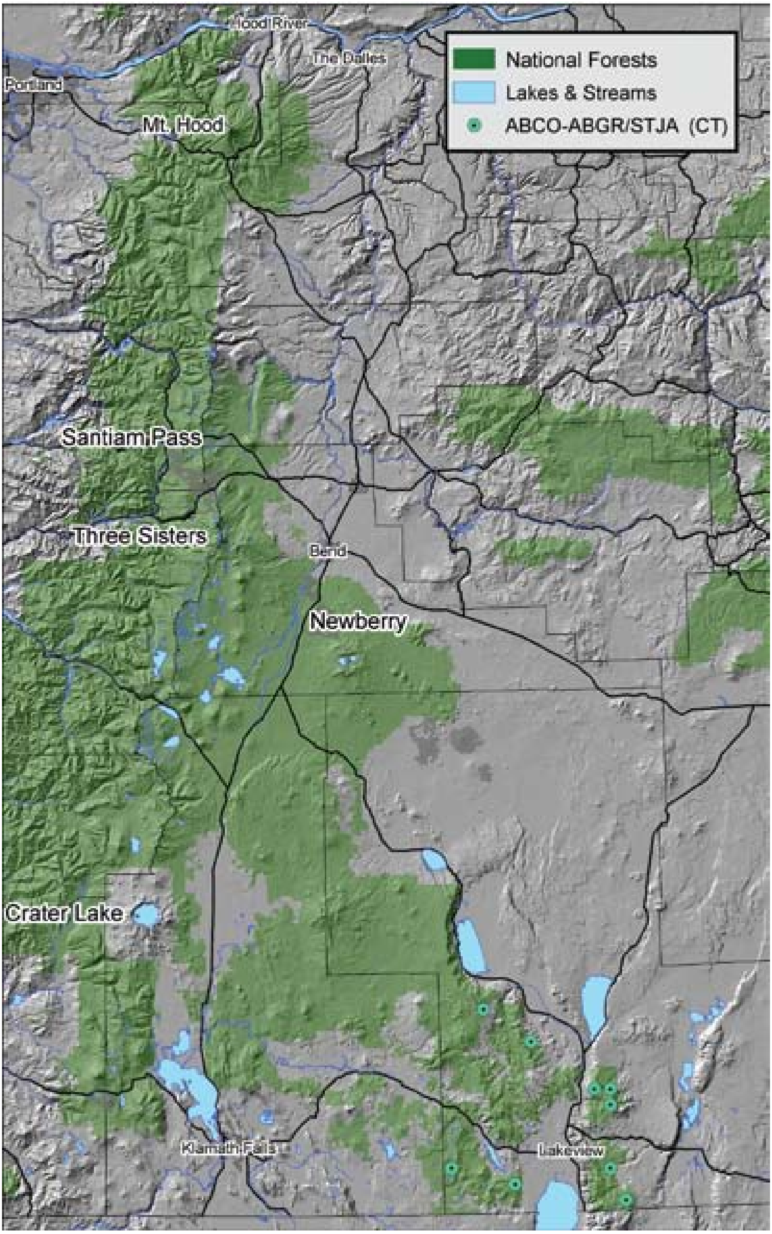






Mean Precip.	27.6”	23-33”
Mean Temp.	42.8°F	40-45°F

Figure 5-20. Map of ABCO-ABGR/STJA (CT) Plot Distribution—



Vegetation— Overstory tree layers are dominated by white fir-grand fir and ponderosa pine. Juniper occurrence indicates transitions to adjacent juniper woodlands or to adjacent sagebrush (ARTR or ARAR) communities. Understory tree layers are dominated by white fir-grand fir with lesser amounts of ponderosa pine. Stream bottom positions may have scattered aspen. Increased cover of sticky currant or wax currant may indicate past disturbance. The currants are favored by mechanical disturbance. Herb layers are dominated by heartleaf arnica (ARCO), starwort (STJA) and various graminoids such as bluegrass (PONE), squirreltail (SIHY), western needlegrass (STOC), and Ross's sedge (CARO). Some sites that key here may have extremely dense overstory cover and a depauperate understory.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABCO	*Abies concolor*	90	80	31.0	10.4
JUOC	*Juniperus occidentalis*	10	30	6.9	4.7
PIPO	*Pinus ponderosa*	90	70	16.1	4.0
Shrubs					
AMAL	*Amelanchier alnifolia*	100		1.3	
ARTR	*Artemisia tridentata*	30		16.8	
RICE	*Ribes cereum*	40		1.1	
RIVI	*Ribes viscosissimum*	40		0.7	
Herbaceous					
ARCO	*Arnica cordifolia*	90		3.2	
LUAR3	*Lupinus argenteus*	30		1.5	
STJA	*Stellaria jamesiana*	100		0.9	
Graminoids					
CARO	*Carex rossii*	70		0.5	
PONE	*Poa nervosa*	100		1.5	
SIHY	*Sitanion hystrix*	70		0.5	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
ABCO-ABGR/STJA							
ABCO-ABGR	69	4	18	281	10	155	89
PICO	60	9	4	196	7	69	54
PIPO	78	4	8	197	10	123	71

Relationships to Other Classifications— ABCO/STJA (CT) has not been previously described in the Pacific Northwest. It is likely a seral community related to the Mixed Conifer/SYAL/STJA association described by Hopkins (1979a) and to ABCO-ABGR/SYAL as described previously in this document.

Shasta Red Fir Series

Shasta Red Fir Series

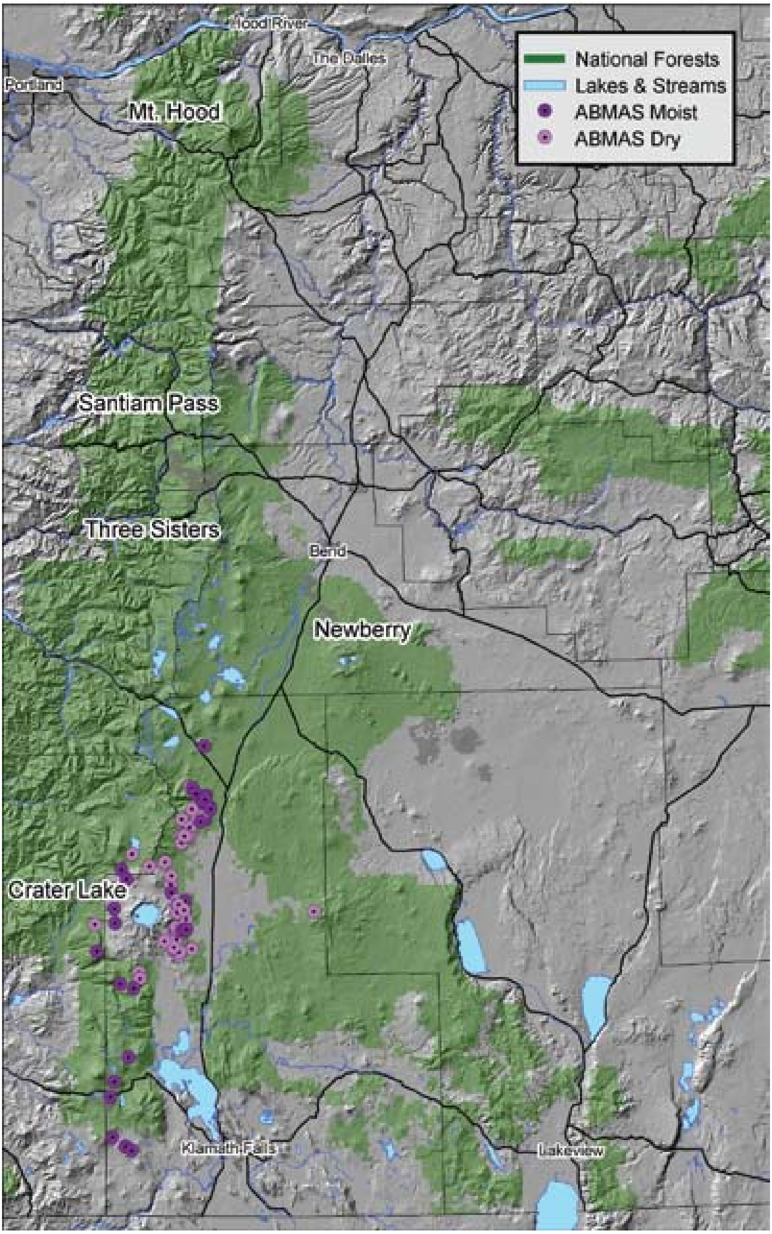
ABMAS
Abies magnifica var. shastensis
Shasta red fir
Total plots 128

Distribution and Environment— Shasta red fir (*Abies magnifica* var. *shastensis)* is a variety of California red fir (*Abies magnifica*) found in southwest Oregon and northern California. It is interfertile with noble fir (*Abies procera*) and California red fir. Morphological and genetic characteristics of the trio are similar, thus complicating identification in southwest Oregon. Populations north of the McKenzie River are recognizable as noble fir and south of Mt. Lassen as California red fir. Shasta red fir is generally found at high elevations where the climate is cool to cold and moist, however, it is able to tolerate summer dry spells common to the Mediterranean environment of southwest Oregon (Atzet et al. 1996).

The Shasta Red Fir Series (ABMAS Series) as described here is a northern extension of the California Red Fir Series. The Red Fir Series is widespread in the Sierra Nevada Mountains of California. Northern California and southern Oregon populations appear to be closely related to Noble Fir (Franklin 1981, Zavarin et al. 1978). In the central and southern Sierra Nevada of California, red fir is clearly a climax dominant in subalpine forests of the Sierra Nevada Mountains. From the southern Cascades in California north into Oregon and west into the California Coast Ranges, Shasta red fir begins to lose its clear climax status, perhaps as a result of taking on characteristics of noble fir, which is never a climax species in the northern Cascades (Laake 1990). Shasta red fir is replaced successionally by white fir at lower elevations and by mountain hemlock at upper elevations. Due to its successional relationships with white fir and mountain hemlock in southern Oregon, the Shasta Red Fir Series occupies a narrow zone between the Mountain Hemlock Series on cooler sites and the White Fir-Grand Fir Series warmer sites.

The ABMAS Series in southern Oregon occurs from the vicinity of Willamette Pass to the California border. A single plot is known from Yamsey Mountain east of the Cascades proper. Although ABMAS occurs elsewhere east of the Cascades (Newberry Crater and Walker Rim), in those locations enough mountain hemlock or white fir-grand fir is present to consider them seral to TSME or ABCO-ABGR associations. Other locations east of the Cascades may occur, however, successful reproduction of TSME or ABCO-ABGR indicates a transition to one of these alternate series.

Figure 6-1. Map of ABMAS Plot Distribution by PAG—

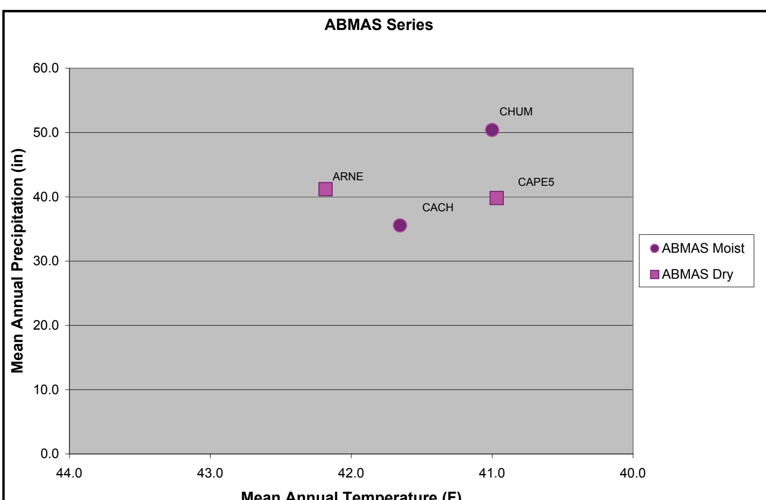


Vegetation— Major associated conifer species include western white pine, sugar pine, ponderosa pine and lodgepole pine. Douglas-fir is largely missing from this series occurring in less than 10% of the plots. The absence of Douglas-fir appears related to the predominance of deep ash/pumice derived soils from Mt. Mazama within the ABMAS Series.

Four associations are defined for the ABMAS Series on the east side of the Cascades in Oregon. These plant associations have been further grouped into two plant association groups (PAGs) which reflect effective moisture zones and are correlated with productivity. Mean precipitation does not vary greatly between the ABMAS Moist and ABMAS Dry PAGs (figure 6-2). However excessive soil drainage within the ABMAS Dry associations effectively make moisture more limiting.

ABMAS Moist consists of ABMAS/CACH and ABMAS/CHUM associations. The ABMAS Moist PAG has the most moderate environments within the Shasta Red Fir Series. Ponderosa pine and sugar pine are important seral species. Western white pine is often present at low cover. Canopy cover of tree layers is often high and significantly reduces the cover and species richness in shrub and herbaceous layers.

Figure 6-2. Temperature – Precipitation Relationships for Plant Associations and Plant Association Groups within ABMAS Series.



ABMAS Dry consists of ABMAS/ARNE and ABMAS/CAIN4. Lodgepole pine is the primary seral species in the tree layer. Western white pine often is present at covers less than 10%. Shrub and herbaceous layers have low diversity and relatively low cover even though typical canopy cover of the tree layer is much lower than ABMAS Moist PAG sites.

Fire— Agee (1993) described Shasta red fir fire regimes as moderate severity, with fire frequencies and intensities intermediate to those of other Pacific Northwest forests. Shlisky (2003) considered red fir as having a mixed severity fire regime (Fire Regime IIIb), with a fire return interval of 40-60 years. Agee and Chappell (1991) and McNeil and Zobel (1980) found mean fire return intervals of 39 – 42 years in Crater Lake National Park. However, fire free intervals varied widely (15-157 years). Similar return intervals have been reported from California. Taylor and Halpern (1991) found 40-42 year fire free intervals (range 5-65 years) on 2 plots in mixed Shasta red fir white fir stands at Swain Mountain Experimental Forest near Mt. Lassen and Pitcher (1987) found a 65 year fire free interval (range 5-126 years) in pure California red fir forests in Sequoia National Park.

Volland (1985) documented fires on 40 plots within the ABMAS Series. Multiple fires were recorded on 18 sites. Thirteen plots in the ABMAS Moist PAG recorded 20 fires and average fire free intervals of 32 years (range 22-40 years). Five plots in ABMAS Dry PAG sites had fire free intervals of 39 years (range 20-65 years).

Because Shasta red fir occurs at higher elevations with heavy snowpacks, it is not normally considered a priority for fuels treatment projects. A wildland fire use plan may be a more appropriate strategy for this series.

Productivity and Management— Productivity for ABMAS within the ABMAS/CACH and ABMAS/CHUM associations appears to be 1.5-2 times greater than in the ABMAS Dry associations (Table 6-1).

Key Insects and Diseases: Mountain pine beetle, fir engraver, Armillaria root disease, annosus root disease, white pine blister rust, western and lodgepole pine dwarf mistletoes.

Secondary Insects and Diseases: Dwarf mistletoe in Shasta red fir, laminated root rot, rust red stringy rot.

<u>*Important Effects*</u>: Armillaria root disease is the most important disease of these sites especially bordering the white fir climax communities. Armillaria favors Shasta red fir and creates canopy openings, altering stand structure. Laminated root rot may be present in the ABMAS/CHUM association on the western side of Crater Lake NP. Annosus root disease acts as a butt decay when ABMAS reaches pathological rotation or when it has experienced basal wounds. The fir engraver is most commonly associated with trees infected with root disease, either producing top-kill or killing trees.

Table 6-1. Site Index (SI standard error), Growth Basal Area (GB A standard error), Yield Capability (Ft$^{3)}$ by Species and Plant Association Group within the ABMAS Series

PAG	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
ABMAS Dry							
ABMAS	46	3	29	196	9	82	42
PIAL				135	15	3	
PICO	59	2	102	86	5	200	23
PILA	77	2	5				
PIMO	64	5	17	138	15	8	40
PIPO	76	6	17	122		1	43
ABMAS Moist							
ABMAS	91	9	4	428	63	18	179
PICO	54	4	6	130	6	91	32
PILA				255	25	21	
PIPO				202	91	3	

White pine blister rust, a non-native disease introduced in the early 1900s, is a detrimental factor in retaining sugar and western white pine on these sites. CVS plots had 30% infection from blister rust and all cankers were considered lethal. Deployment of rust resistant stock maybe the only way to retain five needle pines on these sites.

The mountain pine beetle could be an important mortality agent for all of the seral pine species, especially under high stand densities. Data from CVS plots show infection by dwarf mistletoes infection on 65% of the 15 CVS plots that occur in this series. Incidence is high in the ponderosa pine and lodgepole pine.

Wildlife Management— Because wildlife habitats do not precisely match plant associations or even plant series, Appendix C in this guide is provided. Please see page C-8 for a discussion on Shasta red fir.

Relationships to Other Classifications— A Shasta Red Fir Series has been defined for central, south-central, and southwest Oregon (Volland 1985, Hopkins 1979, Atzet et al. 1996). California red fir associations have been described for the central and southern Sierra Nevada Mountains in California (Potter 1998).

Key to Plant Associations of the Shasta Red Fir Series:

1a *Castanopsis chrysophylla* (>1%) not restricted to microsites ABMAS/CACH
1b Not as above 2a

2a *Chimaphila umbellata* (>1%) and not restricted to micrositesABMAS/CHUM
2b Not as above 3a

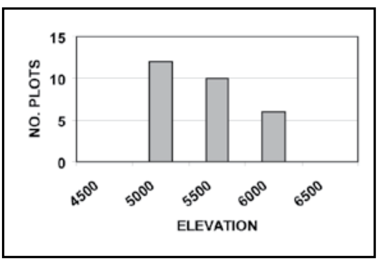
3a *Arctostaphylos nevadensis* (>1%) not restricted to microsites . ABMAS/ARNE
3b Not as above 4a

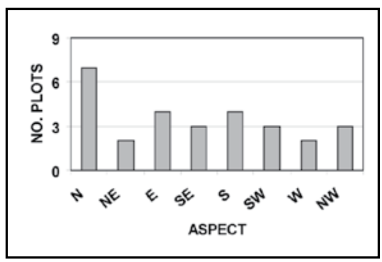
4a *Carex inops* (>1%) not restricted to microsites ABMAS/CAIN4
4b Not as above . . . . return to start of key and relax cover %

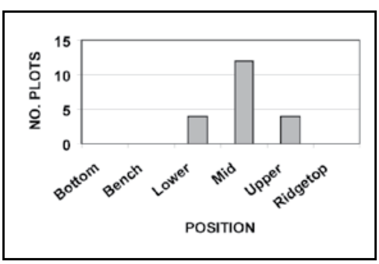
ABMAS/CACH — ABMAS Moist

CRS314 (ABMAS/CHCH7)
Abies magnifica var. *shastensis/Castanopsis chrysophylla*
Shasta red fir/golden chinquapin
Plots 26

Distribution and Environment— ABMAS/CACH is a southern eastside Cascades association. It occurs in a narrow band between mountain hemlock and white fir-grand fir sites south of Willamette Pass. Successful reproduction of TSME or ABCO-ABGR may indicate transition to one of these adjacent series. Sites are well drained most are in deep ash/pumice deposits from Mt. Mazama. Slope positions are strongly mid slope with occasional lower or upper slope. Average elevation is 5633 feet (range 5100-6400 feet). Average slope is 27% (range 3-65%). Aspects are variable, north aspects are most common.

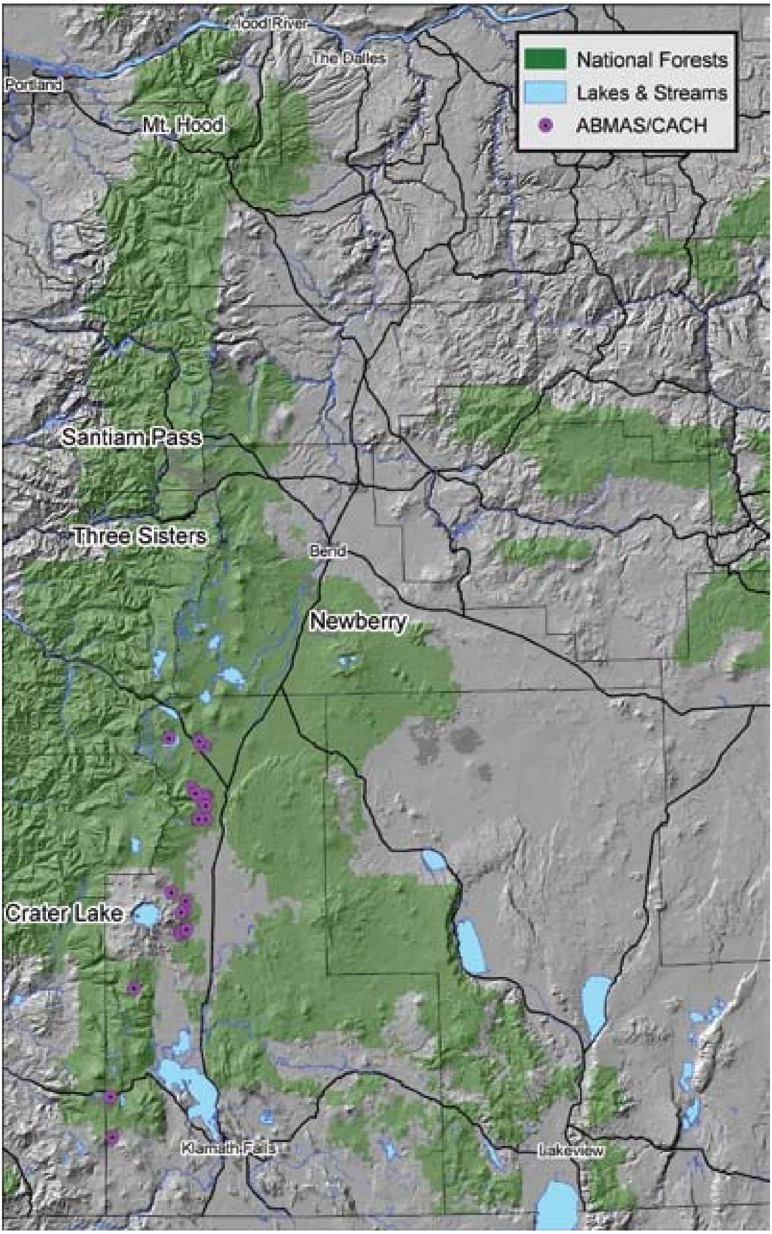






Mean Precip.	36.0”	29-65”
Mean Temp.	41.6°F	41-43°F

Figure 6-3. Map of ABMAS/CACH Plot Distribution—



Vegetation— Overstory tree layers are usually a mixture of Shasta red fir, lodgepole pine, sugar pine, and ponderosa pine. Conifer regeneration is typically dominated by Shasta red fir. Shrub layers are dominated by chinquapin (CACH), pinemat manzanita (ARNE), and greenleaf manzanita (ARPA). Constancy of ARNE is higher (86% to 49%) than the similar ABCO-ABGR/CACH association. Disturbance will favor greenleaf manzanita and snowbrush ceanothus. Herb layers are species poor and mesic species such as SMST, OSCH, DIHO, and GOOB are usually absent.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABMAS	*Abies magnifica shastensis*	79	82	15.4	7.9
PICO	*Pinus contorta*	71	64	8.3	5.8
PILA	*Pinus lambertiana*	46	39	9.5	4.2
PIMO	*Pinus monticola*	46	32	4.7	1.5
PIPO	*Pinus ponderosa*	50	39	11.3	3.0
Shrubs					
ARNE	*Arctostaphylos nevadensis*	86%		8.2	
ARPA	*Arctostaphylos patula*	79%		6.7	
CACH	*Castanopsis chrysophylla*	100%		10.6	
CEVE	*Ceanothus velutinus*	46%		9.4	
CHUM	*Chimaphila umbellata*	36%		3.4	
Herbaceous					
PYPI	*Pyrola picta*	39%		0.3	
Graminoids					
CAIN4	*Carex inops*	25%		3.4	
CARO	*Carex rossii*	29%		0.5	
STOC	*Stipa occidentalis*	25%		1.4	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

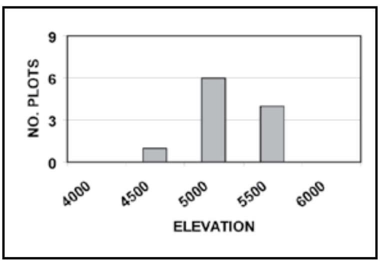
Plant Assoc	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft³
ABMAS/CACH							
ABMAS	91	9	4	553	103	120	231
PICO	54	4	6	130	6	93	32
PILA				255	25	21	
PIPO				202	91	3	

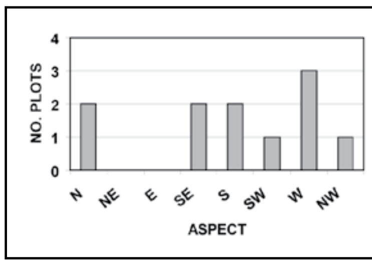
Relationships to Other Classifications— The ABMAS/CACH plant association is similar to ABMAS-ABCO/CACH/CHUM-CAPE association as described by Hopkins (1979b) for the Winema National Forest and to the ABCO/CEVE-CACH association described by Volland (1985). Hopkins's type is defined more broadly; plots with white fir less than 10% and chinquapin greater than 1% in his classification would key here. Volland's association mentions ABMAS especially on north slopes in the vegetation description and has some stands without ABCO. Stands without ABCO may key here.

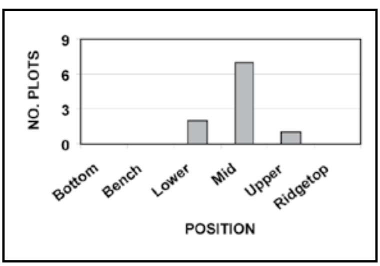
ABMAS/CHUM **ABMAS Moist**

CRF301 (ABMAS/CHUM)
Abies magnifica var. *shastensis/Chimaphila umbellata*
Shasta red fir/common prince's pine
Plots 10

Disribution and Environment— ABMAS/CHUM occurs from Little Deschutes Canyon south to Lake of the Woods. The center of the type distribution is Crater Lake National Park. Soils are well drained and poorly developed from ash/pumice deposits. Average elevation is 5428 feet (range 4560-5982 feet). Average slope is 11% (range 2-20%). Plot aspects varied.

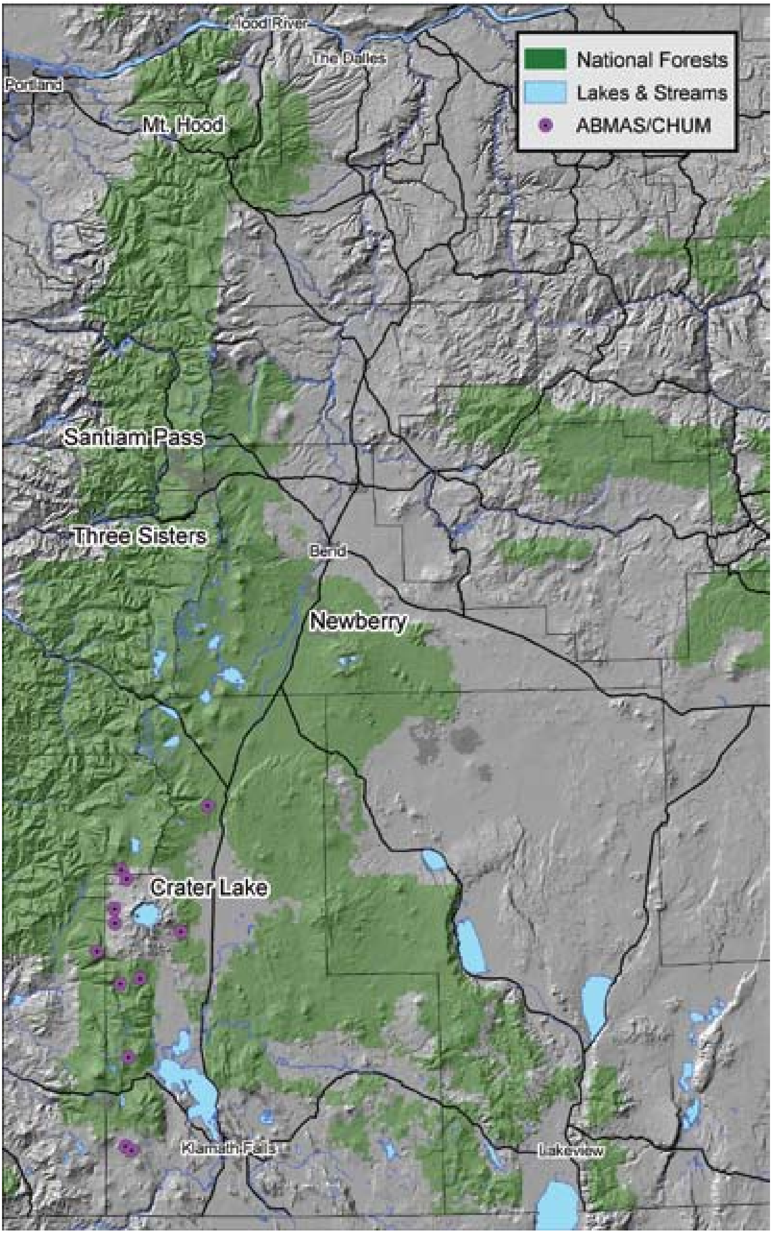






Mean Precip.	50.3"	31-57"
Mean Temp.	41.2°F	40-42°F

Figure 6-4. Map of ABMAS/CHUM Plot Distribution—



Vegetation— Shasta red fir and lodgepole pine are the primary overstory dominants in mid to late seral stands. Lodgepole pine can dominate sites after stand replacement fire. Ponderosa pine may occasionally be an important seral overstory component. Understory vegetation is species poor. Depauperate understories are common under stands of ABMAS with high canopy closure. Prince's pine (CHUM) is always present usually with low cover (<5%). Long-stolon sedge (CAIN4) and western needlegrass (STOC) may have significant cover. Disturbance is likely to favor CAIN4, STOC, as well as the manzanitas (ARNE and ARPA).

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABMAS	*Abies magnifica shastensis*	50	80	37.1	13.8
PICO	*Pinus contorta*	80	80	23.2	13.7
PIMO	*Pinus monticola*		20		0.8
PIPO	*Pinus ponderosa*	30	20	22.5	2.0
Shrubs					
ARNE	*Arctostaphylos nevadensis*	30%		2.2	
ARPA	*Arctostaphylos patula*	20%		2.5	
CHUM	*Chimaphila umbellata*	100%		1.6	
Herbaceous					
FRVE	*Fragaria vesca*	20%		0.8	
HIAL	*Hieracium albiflorum*	30%		0.8	
PYPI	*Pyrola picta*	40%		0.8	
PYSE	*Pyrola secunda*	40%		0.9	
Graminoids					
CAIN4	*Carex inops*	70%		11.6	
SIHY	*Sitanion hystrix*	20%		5.3	
STOC	*Stipa occidentalis*	30%		10.8	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

No data available for this plant association.

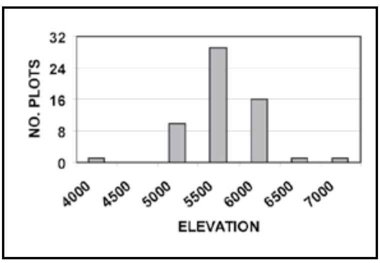
Relationships to Other Classifications— The Southwest Oregon Ecology program (Atzet et al. 1996) has defined an ABMAS-PICO/ARNE/CHUM associations with ABMAS as an important overstory species and CHUM as an important understory associate. ABMAS-TSME/ARNE/CHUM has plots that may key to ABMAS/CHUM in this classification. The ABMAS/CHUM association as defined here has more effective moisture and is cooler than ABMAS/ARNE plots that do not have CHUM. Atzet et al. (1996) also describe TSME-ABMAS/VAME/CHUM which may have a few plots that key to ABMAS/CHUM here. ABMAS/CHUM as defined in this guide is likely slightly drier and warmer than TSME-ABMAS/VAME/CHUM.

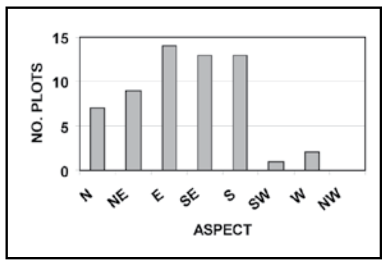
ABMAS/CHUM as described here includes most of the ABMAS/CAPE association described by Hopkins (1979b).

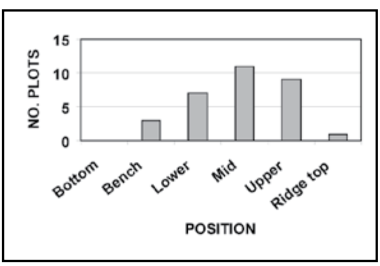
ABMAS/ARNE — ABMAS Dry

CRS111 (ABMAS/ARNE)
Abies magnifica var. *shastensis/Arctostaphylos nevadensis*
Shasta red fir/pinemat manzanita
Plots 62

Distribution and Environment— ABMAS/ARNE occurs from just north of Little Deschutes Canyon to just south of Crater Lake National Park. A single location is known on the west side of Yamsey Mountain east of the Cascades proper. Soils are well drained and poorly developed from Mazama ash/pumice deposits. Average elevation is 5775 feet (range 4437-7010 feet). Average slope is 12% (range 2-31%). Aspects are typically south to northeast aspects. Slope position is usually on mid to upper slopes.

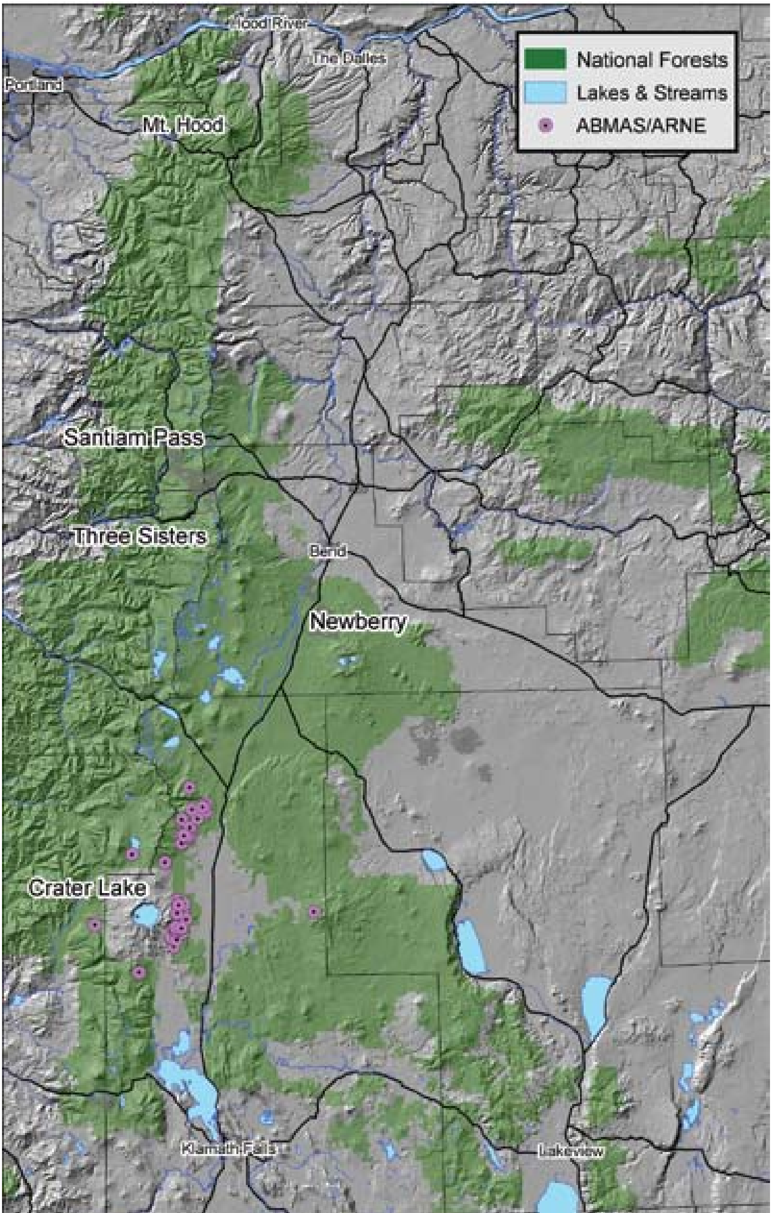






Mean Precip.	39.5”	29-57”
Mean Temp.	41.0°F	39-43°F

Figure 6-5. Map of ABMAS/ARNE Plot Distribution—



Vegetation— Tree overstory layers are typically a mixture of Shasta red fir (ABMAS) and lodgepole pine (PICO) with occasional western white pine (PIMO). Ponderosa pine (PIPO) is only present on the warmest locations within the type. High cover values of PIPO may indicate transition to the ABCO-ABGR Series. Understory tree layers are also a mixture of ABMAS and PICO. Shrub layers are dominated by pinemat and greenleaf manzanita (ARNE and ARPA). Herbaceous layers are species poor and dominated by graminoids. Only long-stolon sedge (CAIN4), Ross's sedge (CARO) and western needlegrass (STOC) are common and usually they occur at low cover values (<5%).

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABMAS	*Abies magnifica shastensis*	76	63	13.0	6.2
PICO	*Pinus contorta*	81	69	11.9	13.8
PIMO	*Pinus monticola*	55	50	3.1	2.5
PIPO	*Pinus ponderosa*	26	23	5.6	3.6
Shrubs					
ARNE	*Arctostaphylos nevadensis*	100%		9.2	
ARPA	*Arctostaphylos patula*	73%		9.2	
Graminoids					
CAIN4	*Carex inops*	44%		3.6	
CARO	*Carex rossii*	52%		0.6	
STOC	*Stipa occidentalis*	55%		1.2	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
ABMAS/ARNE							
ABMAS	52	4	20	206	14	83	50
PICO	52	2	34	81	5	191	20
PILA	77	2	5	102		1	36
PIMO	59	4	14	138	15	8	37
PIPO	69	6	3	122		1	39

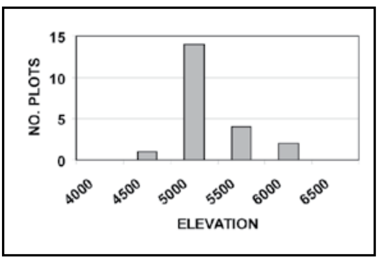
Relationships to Other Classifications— The ABMAS/ARNE plant association has been described for Central Oregon by Volland (1985). Volland's type is broader than the association described here and included white fir and mountain hemlock. Only plots with mountain hemlock and white fir less than 10% cover that were included in Volland's original type still key here.

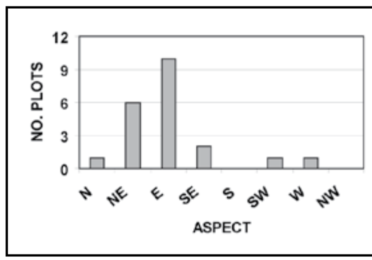
It is drier than ABMAS-PICO/ARNE/CHUM described for southwest Oregon by Atzet et al. (1996). ABMAS/ARNE as described here has more affinities in vegetation to the ABMA/ARNE and ABMA-PIMO/ARNE associations described for the central and southern Sierra Nevada Mountains of California by Potter (1998).

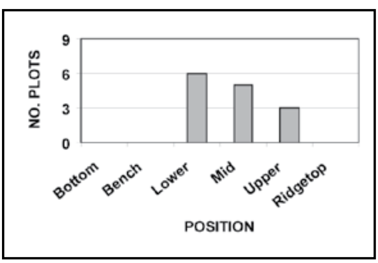
ABMAS/CAIN4 — ABMAS Dry

CRG112 (ABMAS/CAIN9)
Abies magnifica var. *shastensis/Carex inops*
Shasta red fir/long-stolen sedge
Plots 22

Distribution and Environment— ABMAS/CAIN4 occurs in a narrow band east of the Cascade Crest adjacent to Crater Lake National Park. Sites are located on excessively well drained sites on deep ash/pumice deposits from Mt. Mazama. It is apparently absent on adjacent soils derived from pyroclastic flows. Average elevation is 5491 feet (range 4905-6225 feet). Average slope is 4% (range 1-8%). Aspects are typically east to northeast aspects, while none were found on south or northwest aspects. Slope positions are usually gentle lower to mid slopes.

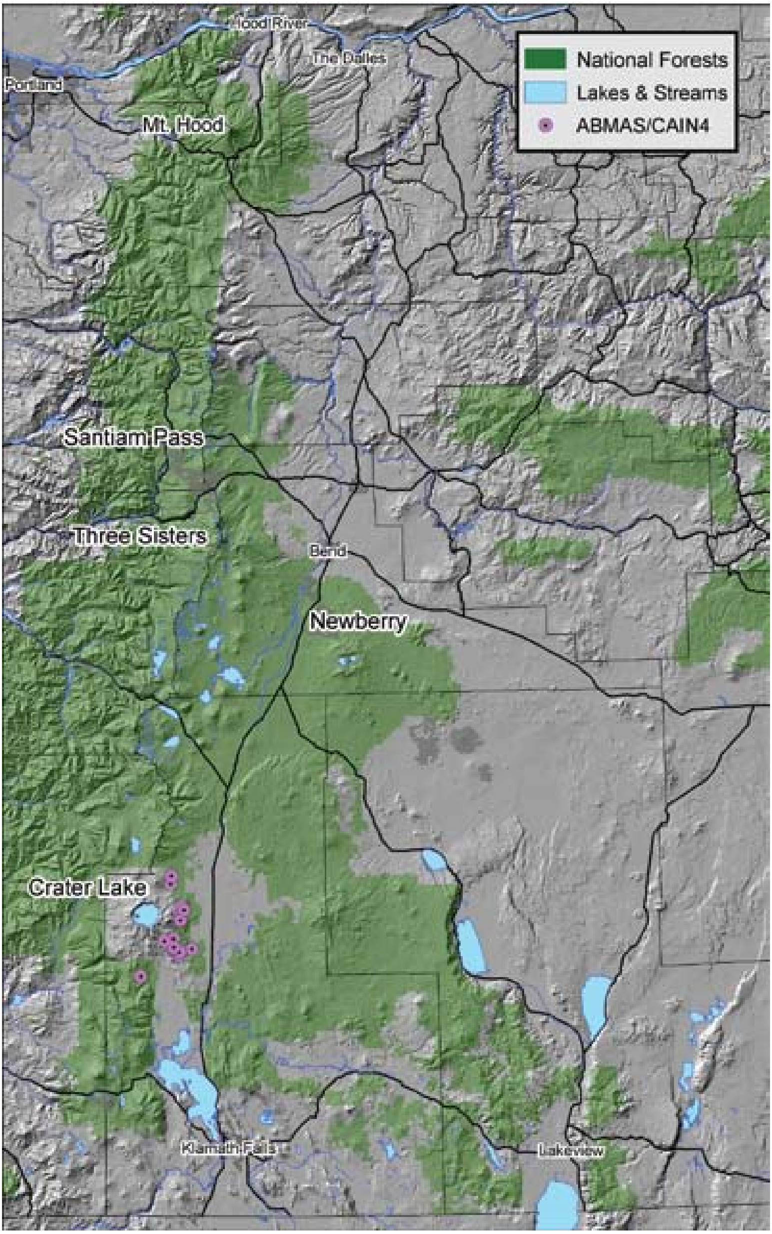






Mean Precip.	41.2”	31-55”
Mean Temp.	42.2°F	41-43°F

Figure 6-6. Map of ABMAS/CAIN4 Plot Distribution—



Vegetation— Overstory tree layers are typically dominated by lodgepole pine (PICO) with small amounts of Shasta red fir (ABMAS). Western white pine is rare in this type. Understory tree layers when they occur have both PICO and ABMAS. Shrub layers are species poor. Only wax currant (RICE) and bitterbrush (PUTR) have constancies above 40% and mean cover greater than 5%. Herbaceous layers are also species poor and dominated by graminoids. Long-stolon sedge (CAIN4) is always present and its mean cover is greater than 10%. Western needlegrass (STOC) and squirreltail (SIHY) are very common associates. STOC often is a co-dominant understory species.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABMAS	*Abies magnifica shastensis*	59	55	3.5	2.7
PICO	*Pinus contorta*	77	64	22.0	6.4
Shrubs					
ARPA	*Arctostaphylos patula*	23%		0.3	
PUTR	*Purshia tridentata*	41%		6.2	
RICE	*Ribes cereum*	64%		6.6	
Herbaceous					
LULE2	*Lupinus lepidus*	23%		0.8	
Graminoids					
CAIN4	*Carex inops*	100%		10.6	
CARO	*Carex rossii*	50%		0.9	
SIHY	*Sitanion hystrix*	86%		1.2	
STOC	*Stipa occidentalis*	91%		5.5	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
ABMAS/CAIN4							
ABMAS	37	4	3				
PICO	70	2	51	129	14	14	41
PIMO	87	2	3				
PIPO	81	7	13				

Relationships to Other Classifications—Shasta red fir/long-stolon sedge association (ABMAS/CAPE) has been previously described by Hopkins (1979b). Most of the plots described by Hopkins would key to ABMAS/CHUM in this guide. ABMAS/CAIN4 as described here has less effective moisture than ABMAS/CAPE as described by Hopkins. Volland (1985) described a PICO/CAPE-STOC association with scattered ABMAS. Plots with over 10% cover of ABMAS will key here.

Douglas-Fir Series

Douglas-fir Series

PSME
Pseudotsuga menziesii
Douglas-fir
Total Plots 256

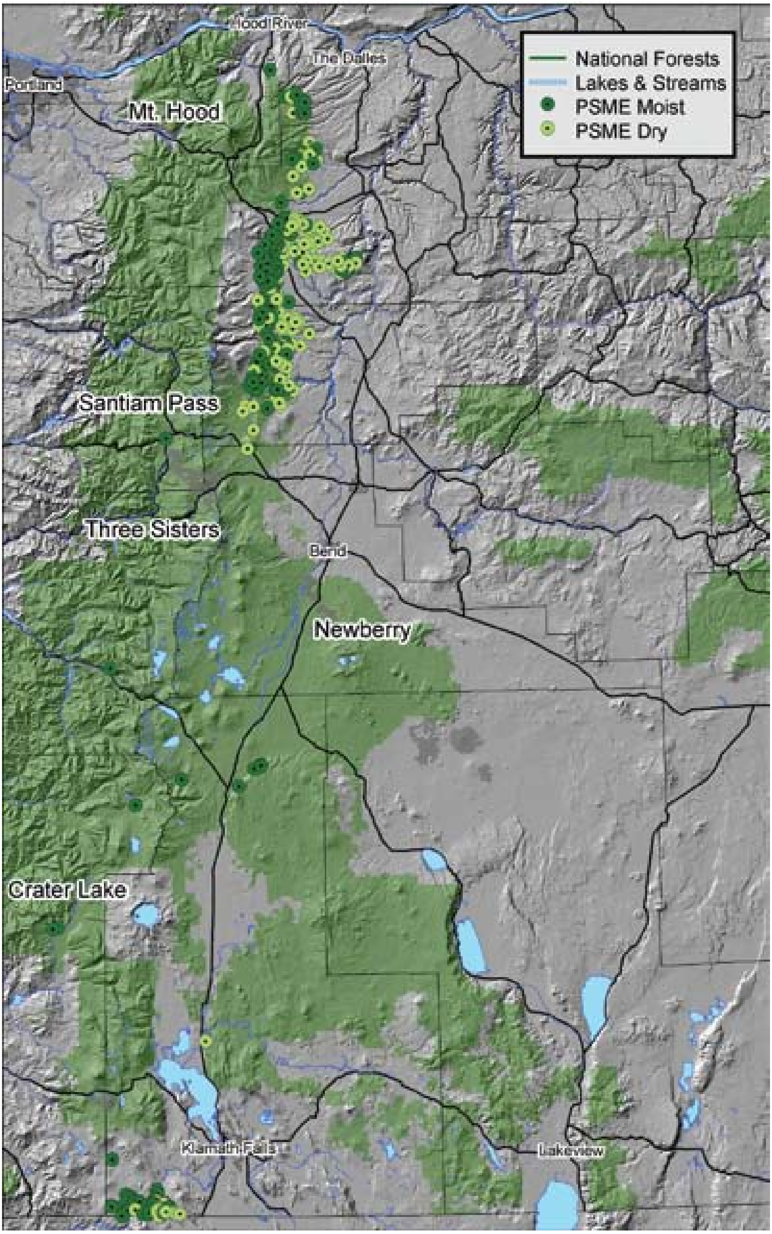
Distribution and Environment— Douglas-fir is one of the most important tree species in the Pacific Northwest. It is the dominant seral or climax species over a very broad range of habitats and economically has been the preferred species of the regional softwood industry. It is the climax tree species on habitats either too dry for, or beyond the geographic range of, more shade-tolerant species such as western hemlock, western red cedar, white fir-grand fir or mountain hemlock. Information from other areas appears to indicate stands of the Douglas-fir Series have greater moisture losses at 12- and 20-inch soil depths than stands in other series, except for the ponderosa pine and Western Juniper or Oregon White Oak Series.

Douglas-fir is often the dominant or co-dominant species within stands of the Western Hemlock, Pacific Silver Fir and White Fir-Grand Fir Series, and is prominent on warmer sites in the Mountain Hemlock Series. Within these series, Douglas-fir is a long-lived pioneer. The White Fir-Grand Fir Series is found on somewhat more mesic sites, while the Mountain Hemlock Series is typical of cooler habitats on north slopes or bottoms, or at higher elevations.

Climax Douglas-fir forests form a prominent forest zone in the drier portions of the Deschutes National Forest north of Hwy 20 through the Warm Springs Indian Reservation to the Hood River Ranger District on the Mt. Hood National Forest. On warmer, drier sites, the Douglas-fir Series grades into non-forest communities or into the Ponderosa Pine Series.

The Douglas-fir Series is essentially missing in central and south-central Oregon where deep pumice deposits from Mazama, Newberry Crater, the South and Middle Sisters, Shasta, and Lassen occur. Within these ash/pumice plumes the series is found only on steep slopes where ash and pumice did not accumulate. South and west of Keno in the Klamath River Canyon, the Douglas fir Series reappears in areas with mean annual precipitation and mean annual temperature similar to sites north of Sisters (i.e. precipitation 10-31” and temperature 44-48°F).

Figure 7-1. Map of PSME Plot Distribution by PAG—



Vegetation— Ponderosa pine is a major seral species throughout the PSME Series in central Oregon. Incense cedar is a minor climax species from Sisters north to the White River east of Mt. Hood and from Chiloquin though the Klamath River Canyon into northern California. Oregon white oak is a common early successional species from the Mutton Mountains north to Hood River and in the Klamath River Canyon.

Understory vegetation is similar to moist and dry White Fir-Grand Fir Series sites minus dwarf bramble (RUUR), cascade Oregon-grape (BENE), starry solomonplume (SMST), and boxwood (PAMY). These species are replaced by dry site species such as heartleaf arnica (ARCO), arrowleaf balsamroot (BASA), bitterbrush (PUTR), and elk sedge (CAGE).

The PSME Series plant associations have been further grouped into plant association groups (PAGs) which reflect effective temperature-precipitation zones. The PSME Moist PAG consists of PSME/TRLA2, PSME/CACH, PSME/SYMO, PSME/CHUM, and PSME/HODI. The PSME Dry PAG consists of PSME/SYAL, PSME/CEPR, PSME/CAGE, PSME/ARPA, and PSME/PUTR. Species diversity declines as the plant associations change from moist to dry and from cool to warm.

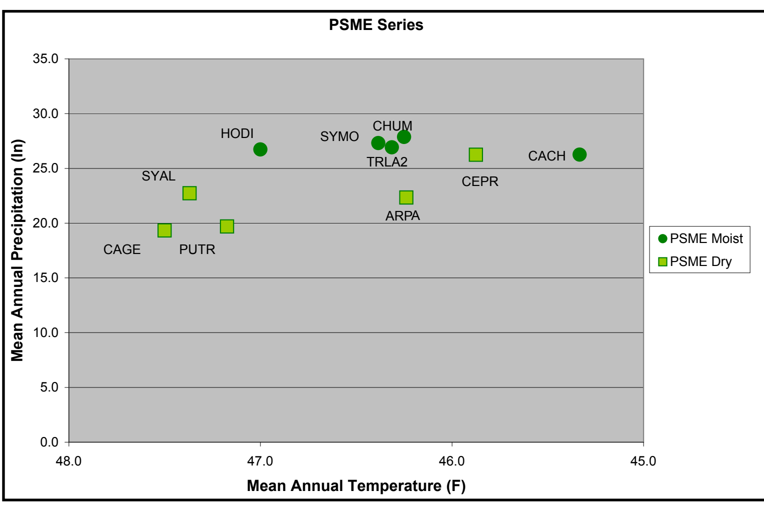
PSME Moist PAG plant association tree layers are dominated by Douglas-fir. Typical composition of the tree layer is 65% Douglas-fir, 29% ponderosa pine, with the balance made up of incense cedar and sugar pine. Mid to late seral stands have an average of about 20% cover of shrubs and 10-15% cover of herbaceous species. The most common shrub species in mid to late seral stands are: BEAQ, CACH, CHUM, ROGY, and SYMO. Typical herbaceous species in mid to late seral conditions are ARMA3, TRLA2, OSCH, and FEOC. After disturbance of the overstory, dense shrub fields are common. These shrub fields are dominated by ARPA, CEVE, and CACH with ACCI, ACGL, and SASC occasionally showing significant increases in cover. Disturbance will also favor PTAQ, BRVU, CARU, CAGE, BASA, and various lupines. Increased cover of these species may indicate past disturbance.

PSME Dry PAG plant associations are various mixtures of Douglas-fir and ponderosa pine. Composition of the tree layer averages about 45% Douglas-fir and 53% ponderosa pine. Oregon white oak is present in about 33% of sampled stands in this PAG. Where QUGA occurs, it averages between 10-15% cover in mid to late seral conditions.

Disturbance favors ponderosa pine and white oak in the tree layer. Understory cover is slightly lower than PSME Moist plant associations. Shrub cover averages 14% and herbaceous cover averages 11% in mid to late seral conditions. As in the PSME Moist associations, disturbance of the overstory will dramatically increase the total cover of the understory. Common shrubs in mid to late seral stands include AMAL, BEAQ, PUTR, and SYAL. Herbaceous species common to mid to late seral conditions include BASA, OSCH, FEID and FEOC. Understory species favored by disturbance are ARPA, CEVE, and PUTR in the shrub layer and BASA and various lupines in the herbaceous layer.

Fire— Both Douglas-fir moist and dry PAGs comprise a fire regime that historically was frequent low intensity. The Douglas-fir moist PAG corresponds to the Douglas-fir Interior Pacific Northwest (or "DFIR1") FRCC description document (Pohl 2003), with an estimated historic fire return interval of 10-20 years. The dry Douglas-fir PAG corresponds to the FRCC description document for Ponderosa Pine-Douglas-fir (Inland Northwest), or "PPDF1" (Havlina 2003), with an estimated historic fire return interval of less than 25 years. Agee (1994) described these forests as a Douglas-fir zone within a mixed-conifer group. Both

Figure 7-2. Temperature – Precipitation Relationships for Plant Associations and Plant Association Groups within the PSME Series.



he and Havlina (2003) stress this type often occurs in a matrix with grand fir. The latter follows more of a mixed severity regime (Fire Regime III). From a landscape perspective, therefore, Douglas-fir PAGs often fall within a complex setting of fire regimes. Douglas-fir is well adapted to fire (Agee 1994), and attains fire resistance around age 40 (Havlina 2003).

Low-intensity surface fires (underburns) have significantly influenced the development of many stands, and many pre-European-settlement stands in the Douglas-fir Series were open and park-like in response to frequent surface fire, often started by Native Americans (Barrett and Arno 1982, Agee 1994). Individual Douglas-firs, ponderosa pine and western larch are resistant to fires after they have matured enough to develop the characteristic thick, corky, insulating bark typical of the species. Stand-replacement fires were rare in stands in this condition. Fire scars are common, especially on ponderosa pine, which is especially favored by underburns. But without underburning, ponderosa pine is eventually replaced by the more shade-tolerant but somewhat less fire-resistant Douglas-fir. The advent of vigorous fire protection has resulted in longer periods between surface fires and dense Douglas-fir stands have developed in the absence of underburns. Surface fuel and "ladders" of Douglas-firs of various age classes have developed on more mesic sites, increasing the potential for stand-replacing fires (as well as for severe forest health problems). Douglas-fir stands are therefore often good candidates for thinning, followed by slash removal and maintenance burning, whether the management objective is restoring the fire ecology of the area or protecting the wildland urban interface (WUI).

Clearcutting and burning often result in extensive and persistent shrubfields or grasslands that resist reforestation efforts for years. Shrubfields may be an essential part of the successional process after disturbance, functioning to restore organic matter and nutrients before forest restoration can be successful.

Productivity and Management— Plant growth on many associations in the Douglas-fir Series is limited by lack of growing season moisture. Summer soil drought is severe in many types. Douglas-fir sites have low to moderate timber productivity due to low stocking and slow growth rates (TABLE 7-1). The average stand site index for Douglas-fir in these dry Associations ranged from 70 to 90 feet (base 100), while ponderosa pine ranged from 75 to 95 feet (base

100). More mesic Associations such as PSME/TRLA2, PSME/CACH and PSME/SYMO have moderate growth rates. The average stand site index for Douglas-fir ranged from 90 to 138 feet (base 100), while ponderosa pine ranged from 80 to 104 feet (base 100). Shade tolerant trees such as western hemlock, western redcedar, subalpine fir and grand fir are unable to successfully occupy habitats within the Douglas-fir Series, due mainly to drought stress.

Many herbs and shrubs in the Series are rhizomatous and respond quickly to disturbances. This is a vegetative reproduction strategy that gives species such as pinegrass, elk sedge, mahala mat, creeping snowberry, and common snowberry a competitive advantage over species that rely entirely on seeds, especially early in succession.

Key Insects and Diseases: Douglas-fir tussock moth (PSME), western spruce budworm (PSME), western pine beetle, mountain pine beetle, Douglas-fir beetle, western and Douglas-fir dwarf mistletoe, white pine blister rust, Armillaria and annosus root diseases.

Secondary Insects and Diseases: Douglas-fir pole beetle, pine engraver.

Important Effects: Both the Douglas-fir tussock moth and western spruce budworm currently have much more available habitat than they did historically, and their damage has become more severe than it was historically. The tussock moth is on a 9-10 year outbreak cycle

Table 7-1. Site Index (SI standard error), Growth Basal Area (GB A standard error), Yield Capability ($Ft^{3)}$ by Species and Plant Association Group within the PSME Series

PAG	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
PSME Dry							
CADE3				143	27	7	
JUOC				161	43	2	
PIPO	87	2	59	141	6	158	56
PSME	85	4	10	110	7	32	43
PSME Moist							
PILA	78	7	4				
PIPO	103	2	41	174	10	60	82
PSME	116	4	51	167	8	104	90

with each outbreak lasting only three years, while budworm cycles are unpredictable in both occurrence and duration. The Douglas-fir tussock moth tends to have its most dramatic effects in low to mid-elevation late seral stands that were traditionally fire-climax ponderosa pine (Hessburg et al. 1994). Budworm outbreaks can persist for many years as host trees are repeatedly defoliated year after year. Complex forests with several ages of trees and a high percentage of host component are most heavily damaged by the budworm. Common effects from the spruce budworm include tree mortality in smaller host trees and top-kill in larger trees.

The western pine beetle is most important as a mortality agent of older low-vigor ponderosa pines, especially those growing under dense conditions. Dense stands of second-growth ponderosa pine can also be affected. Mountain pine beetle is common in dense second-growth stands of ponderosa pine, especially on the driest sites, where trees are killed in groups. Douglas-fir beetle populations typically arise only after a major disturbance such as defoliation, wildfire or extensive wind-throw. Following such events, the beetles can be problematic for several years, especially because of their attraction to large-diameter trees.

Dwarf mistletoe is the most damaging disease agent in these communities and is present in both the Douglas-fir and ponderosa pine. Incidence of dwarf mistletoes are highest on the PSME dry PAG and slightly lower on the moist PAG (33 and 20% respectively). Western dwarf mistletoe commonly causes mortality of ponderosa pine. This effect is elevated on drier sites. Western dwarf mistletoe changes the stand structure, prevents old-growth development, as well as increasing fuel loadings. These infection levels are likely elevated from historic times due to retention of diseased overstory trees and fire suppression, which historically kept mistletoe in check. PIPO-PSME/PUTR association described in Marsh et al. 1987 is similar to the PSME dry PAG. Marsh et al. (1987) describe dwarf mistletoe incidence as locally severe. Mortality of ponderosa pine from drought on the ridgetops of the Mutton Mountains on the Confederated Tribes of Warm Springs Indian Reservation is common (John Arena pers. Comm.). Armillaria and annosus root diseases may be locally present.

Wildlife Management— Because wildlife habitats do not precisely match plant associations or even plant series, Appendix C in this guide is provided. Please see page C-9 for a discussion on Douglas fir.

Relationships to Other Classifications— The Douglas-fir Series has been described by numerous authors up and down the Cascades and east into the northern Rocky Mountains. Some authors include: Pfister et al. 1977 (Montana); Cooper et al. 1991 (Idaho); Williams et al. 1990 (Colville NF); Williams and Lillybridge 1983 (Okanogan NF); Williams et al. 1991 (Wenatchee NF Draft); Clausnitzer and Zamora 1987 (Colville Ind. Res.); Zamora 1983 (Spokane Ind. Res.); John et al. 1988 (Yakima Ind. Res.); and Johnson and Clausnitzer 1992 (northeastern Oregon).

Key to Plant Associations of the Douglas-fir Series:

1a *Trientalis latifolius* (≥1%) and not restricted to microsites PSME/TRLA2
1b Not as above 2a

2a *Castanopsis chrysophylla* (≥1%) and not restricted to microsites.PSME/CACH
2b Not as above 3a

3a *Symphoricarpos mollis* (≥1%) and not restricted to microsites .... PSME/SYMO
3b Not as above 4a

4a *Chimaphila umbellata* (≥1%) and not restricted to microsites ...... PSME/CHUM
4b Not as above 5a

5a *Holodiscus discolor* (≥1%) and not restricted to microsites............PSME/HODI
5b Not as above 6a

6a *Symphoricarpos albus* (≥1%) and not restricted to microsites .... PSME/SYAL
6b Not as above 7a

7a *Ceanothus prostratus* (≥1%) and not restricted to microsites ......PSME /CEPR
7b Not as above 11a

8a *Carex geyeri* (>1%) and not restricted to microsites ....PSME/CAGE
8b Not as above 8a

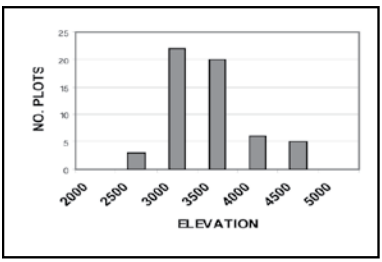
9a *Arctostaphylos patula* (≥5%) .... PSME /ARPA
9b Not as above 12a

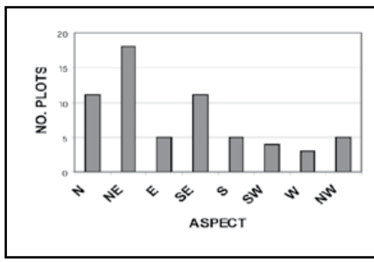
10a *Purshia tridentata* (≥5%) ....PSME /PUTR
10b Not as above .... return to the start of the key and relax cover %.

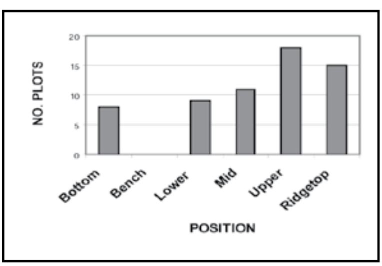
PSME/TRLA2 — PSME Moist

CDF341 (PSME/TRBOL)
Pseudotsuga menziesii/Trientalis latifolia
Douglas-fir/starflower
Plots 61

Distribution and Environment— PSME/TRLA2 is common from Bear Springs on the east side of Mt. Hood to Green Ridge on the Deschutes National Forest and from Grizzly Mountain to Hammaker Mountain west of Keno. Slope positions are typically mid- to upper-slopes or broad ridgetops. Average elevation is 3126 feet (range 2240-4243 feet). Average slope is 16% (range 0-55%). Plots are found on all aspects, although southeast, northeast and north are most common. Mean precipitation is 13” less and mean annual temperature is 1.5°F warmer than that of the similar ABCO-ABGR/TRLA2 association.

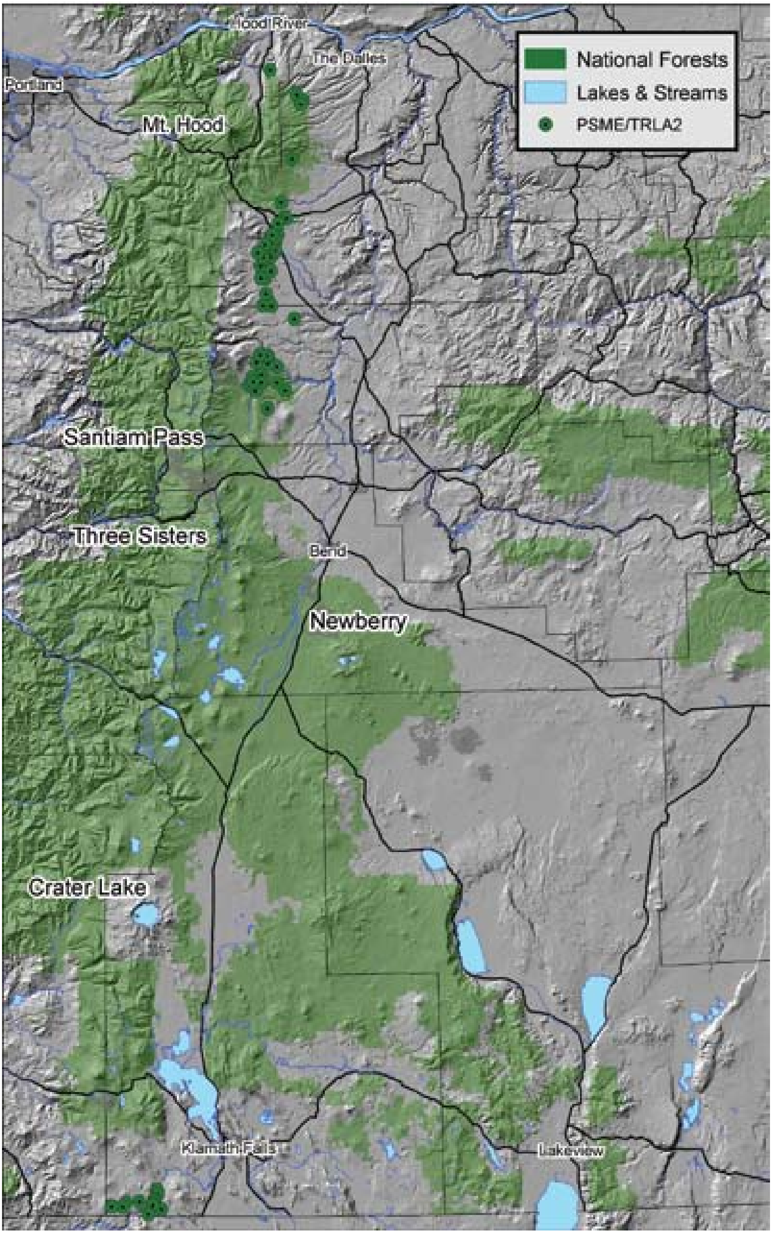






Mean Precip.	26.0”	13-51”
Mean Temp.	46.5°F	44-48°F

Figure 7-3. Map of PSME/TRLA2 Plot Distribution—



Vegetation— Overstory tree layers are usually a mixture of Douglas-fir, ponderosa pine and incense cedar. Conifer regeneration is typically dominated by Douglas-fir. Shrub layers are diverse. In mid to late seral stands serviceberry, princes pine, baldhip rose, and common snowberry are most common. With disturbance, shrub cover may increase dramatically. Increased cover of snowbrush ceanothus, greenleaf manzanita, and golden chinkapin are indicators of past disturbance. Herb layers are less diverse than the similar ABCO-ABGR/TRLA2 association.

Code	Species Latin Name	% Constancy		% Cover	
Trees		Over	Regen	Over	Regen
CADE3	*Calocedrus decurrens*	39	55	4.7	3.7
PIPO	*Pinus ponderosa*	96	59	14.7	2.1
PSME	*Pseudotsuga menziesii*	100	96	40.2	5.1
Shrubs					
AMAL	*Amelanchier alnifolia*	86		1.4	
ARPA	*Arctostaphylos patula*	47		2.3	
BEAQ	*Berberis aquifolium*	55		1.4	
CACH	*Castanopsis chrysophylla*	47		6.3	
CEVE	*Ceanothus velutinus*	49		3.3	
CHME	*Chimaphila menziesii*	49		1.0	
CHUM	*Chimaphila umbellata*	67		2.4	
COCO2	*Corylus cornuta*	29		3.8	
HODI	*Holodiscus discolor*	29		5.4	
PUTR	*Purshia tridentata*	47		4.1	
ROGY	*Rosa gymnocarpa*	73		2.2	
SYAL	*Symphoricarpos albus*	73		4.2	
SYMO	*Symphoricarpos mollis*	43		3.5	
Herbaceous					
ARMA3	*Arenaria macrophylla*	65		1.9	
BASA	*Balsamorhiza sagittata*	47		1.5	
FRVE	*Fragaria vesca*	65		2.2	
HIAL	*Hieracium albiflorum*	25		0.7	
OSCH	*Osmorhiza chilensis*	47		1.7	
PTAQ	*Pteridium aquilinum*	27		3.5	
TRLA2	*Trientalis latifolia*	100		2.6	
Graminoids					
CAGE	*Carex geyeri*	27		4.5	
FEOC	*Festuca occidentalis*	67		2.5	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PSME/TRLA2							
PIPO	104	4	20	183	18	30	87
PSME	133	5	24	204	13	44	125

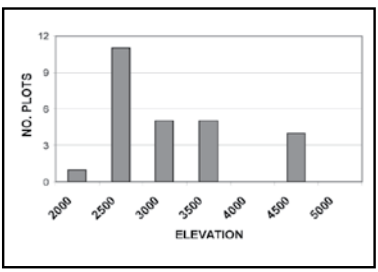
Relationships to Other Classifications— The PSME/TRLA2 plant association has not been previously described in the Pacific Northwest.

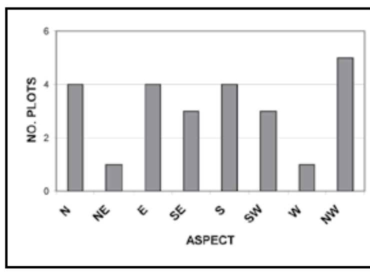
PSME/CACH

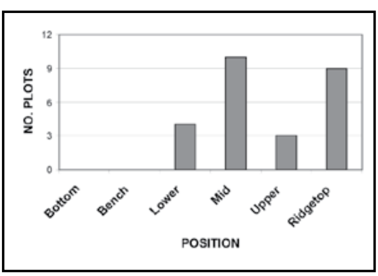
PSME Moist

CDH525 (PSME/CHCH7)
Pseudotsuga menziesii/Castanopsis chrysophylla
Douglas-fir/chinquapin
Plots 27

Distribution and Environment— PSME/CACH is common from Beaver Creek on the Warm Springs Indian Reservation south to Green Ridge on the Deschutes National Forest. Disjunct sites are known on steep scarp faces of Walker Rim and on Chinquapin Butte south of Crescent. Average elevation is 3299 feet (range 2325-4820 feet). Average slope is 20% (range 2-61%). Plot aspects are variable. Slope positions are typically mid slopes or broad ridgetops. Mean annual precipitation is 10” less and mean annual temperature is 3°F warmer than the similar ABCO-ABGR/CACH plant association.

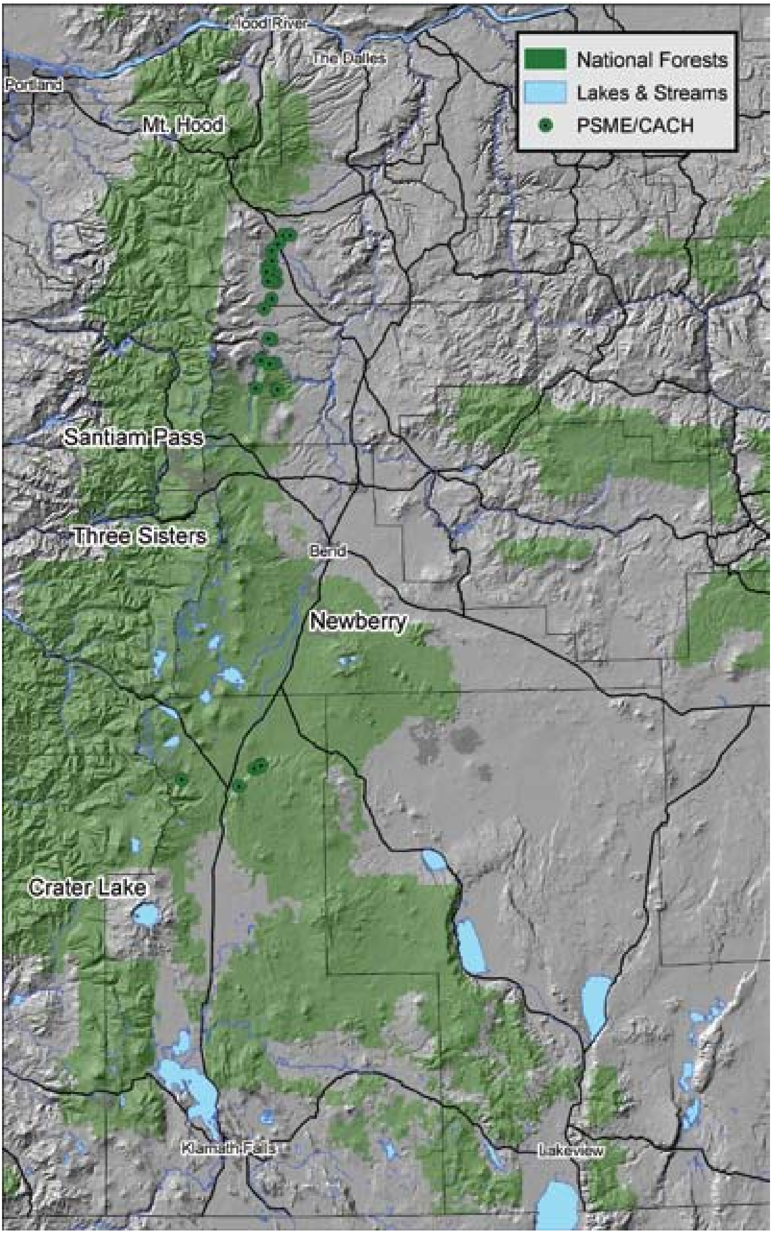






Mean Precip.	25.8”	17-37”
Mean Temp.	45.5°F	41-47°F

Figure 7-4. Map of PSME/CACH Plot Distribution—



Vegetation—Overstory tree layers are usually a mixture of Douglas-fir and ponderosa pine with minor amounts of incense cedar or sugar pine. Conifer regeneration is typically dominated by Douglas-fir and incense cedar. CACH dominates a diverse shrub layer. Herb layers are species poor and mesic species such as SMST, DIHO, and GOOB are usually absent.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
CADE3	*Calocedrus decurrens*	44	67	3.3	1.8
PILA	*Pinus lambertiana*	26	26	4.7	2.4
PIPO	*Pinus ponderosa*	96	78	17.8	1.8
PSME	*Pseudotsuga menziesii*	100	89	26.2	5.5
Shrubs					
AMAL	*Amelanchier alnifolia*	59%		1.2	
ARPA	*Arctostaphylos patula*	70%		2.7	
BEAQ	*Berberis aquifolium*	30%		1.3	
CACH	*Castanopsis chrysophylla*	100%		6.1	
CEVE	*Ceanothus velutinus*	78%		3.5	
CHUM	*Chimaphila umbellata*	70%		1.2	
PUTR	*Purshia tridentata*	74%		3.4	
ROGY	*Rosa gymnocarpa*	44%		1.5	
SYAL	*Symphoricarpos albus*	30%		2.2	
Herbaceous					
BASA	*Balsamorhiza sagittata*	41%		2.3	
FRVE	*Fragaria vesca*	37%		1.0	
OSCH	*Osmorhiza chilensis*	26%		1.1	
PYPI	*Pyrola picta*	26%		0.6	
Graminoids					
FEOC	*Festuca occidentalis*	48%		1.8	
SIHY	*Sitanion hystrix*	33%		1.0	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management— Individual tree data is only available for this plant association from the Deschutes National Forest. It is presented below.

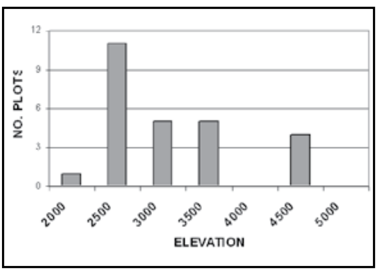
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PSME/CACH							
PILA	78	7	4				
PIPO	103	3	15	142	9	15	67
PSME	104	3	19	177	15	14	85

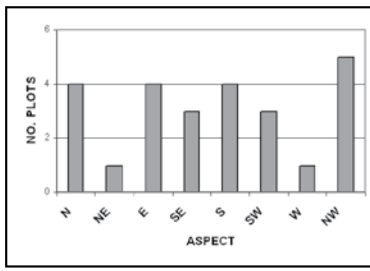
Relationships to Other Classifications— PSME/CACH has not been previously described in the Pacific Northwest. Sites are warmer and drier than the similar ABCO-ABGR/CACH.

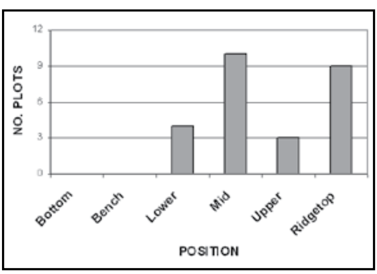
PSME/SYMO **PSME Moist**

CDS643 (PSME/SYMO)
Pseudotsuga menziesii/Symphoricarpos mollis
Douglas-fir/creeping snowberry
Plots 31

Distribution and Environment— PSME/SYMO occurs sporadically from Fifteen Mile Creek west of Dufur on the Mt. Hood National Forest south to Mill Creek on the Warm Springs Indian Reservation. The type is common from the Chicken Hills west of Worden to lower slopes of Grizzly Mountain west of the Klamath River Canyon and just north of the California border. Average elevation is 3080 feet (range 2100-3830 feet). Average slope is 18% (range 1-60%). Plot aspects varied. Slope positions are typically mid to upper slopes. Mean annual precipitation is 6.5” less and mean annual temperature is 3.5°F warmer than the similar ABCO-ABGR/SYMO plant association.

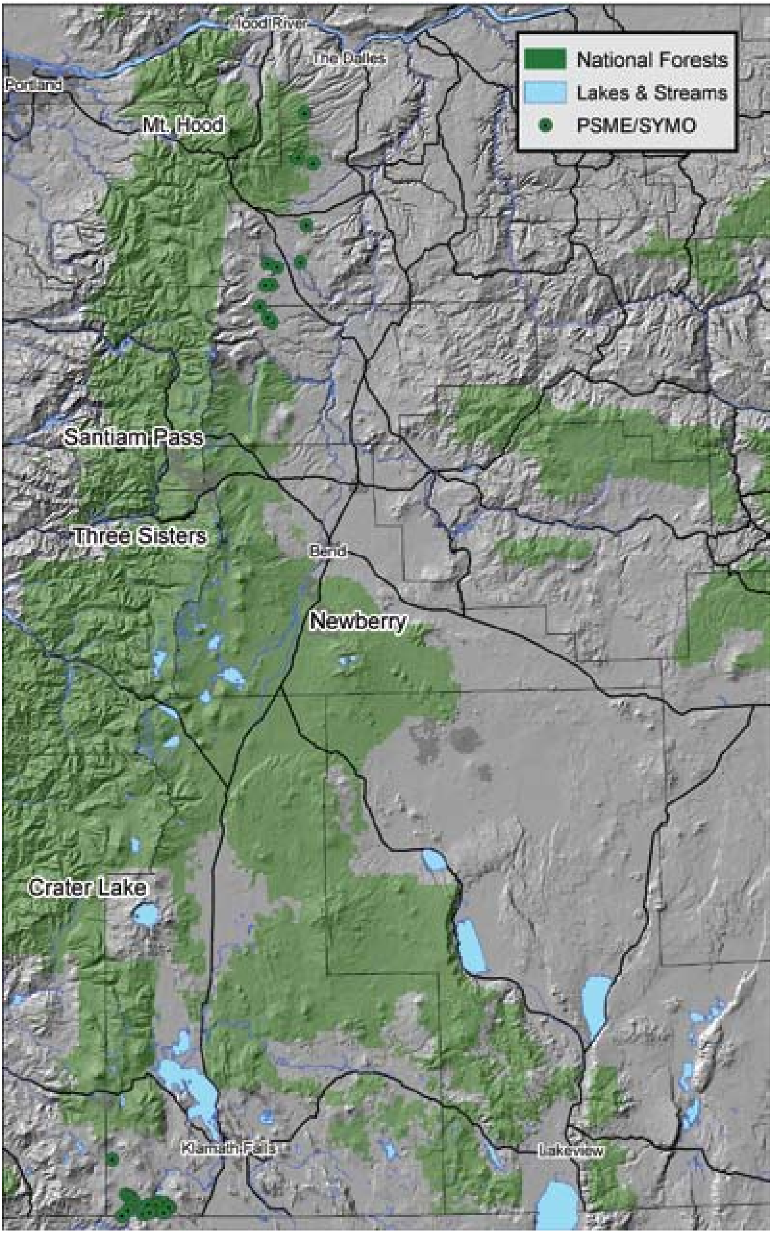






Mean Precip.	24.4”	19-35”
Mean Temp.	46.9°F	45-48°F

Figure 7-5. Map of PSME/SYMO Plot Distribution—



Vegetation— Overstory tree layers are usually a mixture of PSME and PIPO. Understory tree layers are usually dominated by PSME or CADE3. With disturbance, shrub cover may increase dramatically. Increased cover of snowbrush ceanothus, greenleaf manzanita, and bitterbrush are indicators of past disturbance. Herb layers are less diverse than in ABCO-ABGR/SYMO associations.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
CADE3	*Calocedrus decurrens*	36	36	3.3	5.8
PIPO	*Pinus ponderosa*	91	45	15.7	1.2
PSME	*Pseudotsuga menziesii*	100	91	33.4	1.9
QUGA	*Quercus garryana*	27	18	3.7	2.0
Shrubs					
AMAL	*Amelanchier alnifolia*	82%		1.6	
ARPA	*Arctostaphylos patula*	45%		2.6	
BEAQ	*Berberis aquifolium*	73%		1.8	
CEPR	*Ceanothus prostratus*	27%		4.0	
CEVE	*Ceanothus velutinus*	36%		3.0	
PUTR	*Purshia tridentata*	45%		5.2	
ROGY	*Rosa gymnocarpa*	64%		1.9	
SYAL	*Symphoricarpos albus*	73%		2.8	
SYMO	*Symphoricarpos mollis*	100%		1.5	
Herbaceous					
ARCO	*Arnica cordifolia*	27%		4.3	
ARMA3	*Arenaria macrophylla*	45%		1.4	
BASA	*Balsamorhiza sagittata*	73%		3.0	
FRVE	*Fragaria vesca*	82%		1.8	
OSCH	*Osmorhiza chilensis*	73%		1.4	
Graminoids					
CAGE	*Carex geyeri*	36%		8.5	
CARU	*Calamagrostis rubescens*	27%		17.7	
FEID	*Festuca idahoensis*	55%		1.3	
FEOC	*Festuca occidentalis*	55%		1.8	
PONE	*Poa nervosa*	27%		2.0	
SIHY	*Sitanion hystrix*	36%		1.0	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

Warm Springs data for PIPO-PSME/SYMPH.

Plant Assoc	Avg SI	SI Base	# Plots	Avg GBA	GBA St Dev	# Plots	Ft^3
PIPO-PSME/SYMPH							
PIPO	80	100	6	138	37	6	56
PSME	92	100	5	174	64	5	77

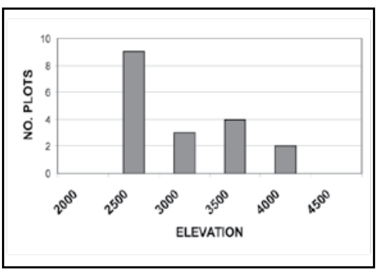
Relationships to Other Classifications— PSME/SYMO was described in the guide Willamette NF Plant Associations (Hemstrom, Logan and Pavlat 1986). A very similar type, PIPO-PSME/SYMPH was also descibed for the Warm Springs Indian Reservation by Marsh et al. (1987). The wetter end of the PIPO-PSME/SYMPH will key here.

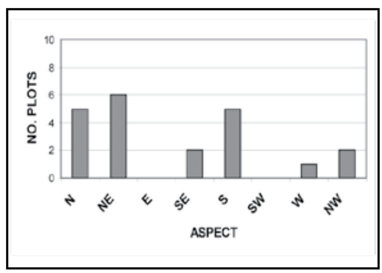
PSME/CHUM

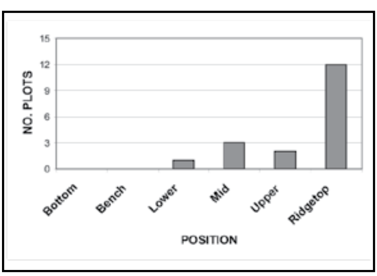
PSME Moist

CDF342 (PSME/CHUM)
Pseudotsuga menziesii/Chimaphila umbellata
Douglas-fir/prince's pine
Plots 16

Distribution and Environment— PSME/CHUM is primarily found on the Warm Springs Indian Reservation. It occurs from Beaver Creek south to Seekseequa Creek. Two outlier sites are known from the Klamath River Canyon area in extreme south-central Oregon. Average elevation is 3080 feet (range 2100-4216 feet). Slopes are gentle. Average slope is 8% (range 1-28%). Plot aspects varied with a slight preference to north and northeast. Slope positions are strongly associated with broad ridgetops. Mean annual precipitation is 10" less and mean annual temperature is 3.5°F warmer than the similar ABCO-ABGR/CHUM plant association.

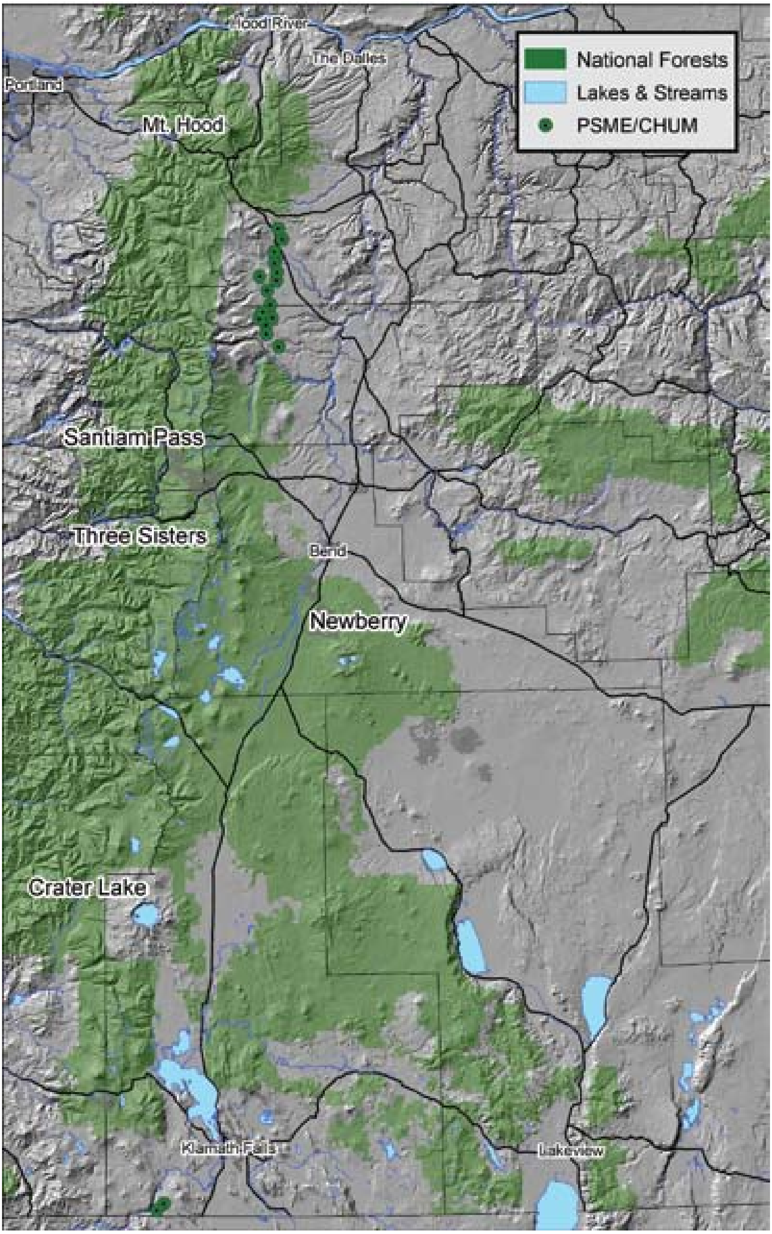






Mean Precip.	27.1"	21-41"
Mean Temp.	46.2°F	45-47°F

Figure 7-6. Map of PSME/CHUM Plot Distribution—



Vegetation— Overstory tree layers are usually a mixture of PSME, CADE3, and PIPO. Understory tree layers are depauperate. Understory tree layers average only 5% cover. PSME and CADE3 occur most frequently with lesser amounts of PIPO. With disturbance, shrub cover may increase dramatically. Increased cover of snowbrush ceanothus, greenleaf manzanita, and sticky or wax currant are indicators of past disturbance. Herb layers are less diverse than in the similar ABCO-ABGR/CHUM association.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
CADE3	*Calocedrus decurrens*	63	88	4.0	2.2
PIPO	*Pinus ponderosa*	100	56	18.6	1.4
PSME	*Pseudotsuga menziesii*	100	94	44.3	1.9
Shrubs					
AMAL	*Amelanchier alnifolia*	88%		1.3	
ARPA	*Arctostaphylos patula*	50%		1.6	
BEAQ	*Berberis aquifolium*	56%		1.2	
CEPR	*Ceanothus prostratus*	38%		4.7	
CEVE	*Ceanothus velutinus*	56%		3.8	
CHME	*Chimaphila menziesii*	44%		1.0	
CHUM	*Chimaphila umbellata*	100%		1.5	
PUTR	*Purshia tridentata*	44%		10.0	
ROGY	*Rosa gymnocarpa*	44%		1.0	
SYAL	*Symphoricarpos albus*	50%		2.1	
Herbaceous					
ARMA3	*Arenaria macrophylla*	38%		1.2	
BASA	*Balsamorhiza sagittata*	75%		4.0	
FRVE	*Fragaria vesca*	75%		1.1	
OSCH	*Osmorhiza chilensis*	38%		1.2	
Graminoids					
FEOC	*Festuca occidentalis*	69%		1.3	
SIHY	*Sitanion hystrix*	38%		1.2	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—There is no individual tree data available for this plant association. Productivity is likely similar to PSME/SYMO and PSME/CACH. Data for these similar associations is displayed below for reference.

Warm Springs data for PIPO-PSME/SYMPH.

Plant Assoc	Avg SI	SI Base	# Plots	Avg GBA	GBA St Dev	# Plots	Ft^3
PIPO-PSME/SYMPH							
PIPO	80	100	6	138	37	6	56
PSME	92	100	5	174	64	5	77

Deschutes National Forest Data for PSME/CACH

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PSME/CACH							
PILA	78	7	3				
PIPO	103	3	15	142	9	15	67
PSME	104	3	19	177	15	14	85

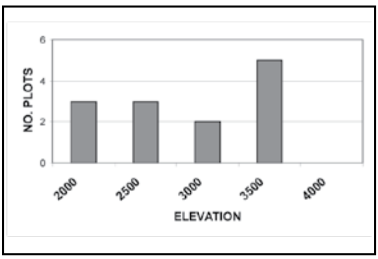
Relationships to Other Classifications— PSME/CHUM associations have not been previously described in the Pacific Northwest. Warm Springs Indian Reservation plots included here key to Mixed Conifer/CEVE (those plots that do not have grand fir), PIPO-PSME/PUTR-CEVE, PIPO-PSME/SYMPH, or were unclassified in the Warm Springs plant association classification (Marsh et al. 1987). These plots represent more mesic portions of the broader types Marsh described.

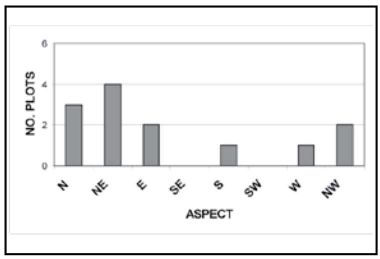
The southern Oregon plots have some affinity to PSME-PIPO/RHDI in the southwest Oregon plant association classification (Atzet et al. 1996), but do not contain poison-oak. The species composition, mean annual precipitation, and mean annual temperature all fit well with the Warm Springs plots.

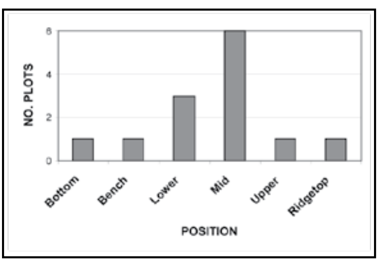
PSME/HODI **PSME Moist**

CDS210 (PSME/HODI)
Pseudotsuga menziesii/Holodiscus discolor
Douglas-fir/oceanspray
Plots 16

Distribution and Environment— PSME/HODI occurs from the Horn of the Metolius River across the Warm Springs Indian Reservation north to 15 Mile Creek on the Mt. Hood National Forest. Average elevation is 3074 feet (range 2400-3890 feet). Average slope is 25% (range 4-64%). Aspects are typically north to east. Positions are lower to mid slopes. Mean annual precipitation is 5" less and mean annual temperature is 1°F warmer than the similar ABCO-ABGR/HODI plant association.

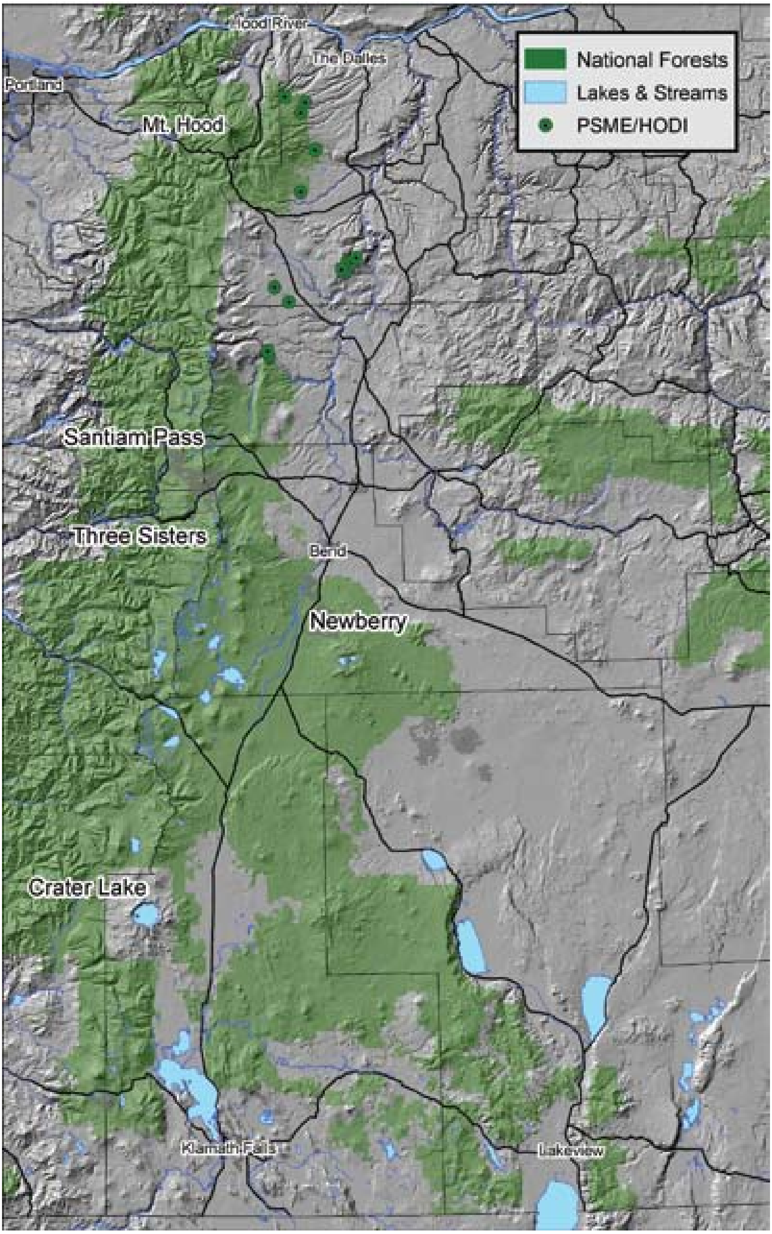






Mean Precip.	25.5"	17-49"
Mean Temp.	47.2°F	46-48°F

Figure 7-7. Map of PSME/HODI Plot Distribution—



Vegetation— PSME/HODI is characterized by brushy stands of Douglas-fir and ponderosa pine. Oregon white oak and western juniper are the only other tree species present. Juniper is only an incidental species in this type. Tree canopies are relatively continuous. Patches of oceanspray (HODI), serviceberry (AMAL), and common snowberry (SYAL) concentrate in the scattered openings in the canopy. Western fescue (FEOC), sweet-cicely (OSCH), and strawberry (FRVI) are the most common herbaceous species.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
JUOC	*Juniperus occidentalis*	7	33	2.0	1.2
PIPO	*Pinus ponderosa*	93	67	14.9	2.9
PSME	*Pseudotsuga menziesii*	93	93	41.7	5.7
QUGA	*Quercus garryana*	33	33	10.3	4.7
Shrubs					
AMAL	*Amelanchier alnifolia*	87%		1.0	
BEAQ	*Berberis aquifolium*	47%		1.4	
HODI	*Holodiscus discolor*	100%		4.3	
PUTR	*Purshia tridentata*	40%		4.2	
ROGY	*Rosa gymnocarpa*	60%		1.4	
SYAL	*Symphoricarpos albus*	93%		7.0	
Herbaceous					
ARMA3	*Arenaria macrophylla*	27%		1.7	
BASA	*Balsamorhiza sagittata*	33%		1.6	
FRVE	*Fragaria vesca*	67%		1.7	
HIAL	*Hieracium albiflorum*	27%		0.6	
HIAL2	*Hieracium albertinum*	27%		0.4	
OSCH	*Osmorhiza chilensis*	67%		1.5	
Graminoids					
BRVU	*Bromus vulgaris*	33%		2.8	
CAGE	*Carex geyeri*	27%		2.8	
FEID	*Festuca idahoensis*	27%		2.3	
FEOC	*Festuca occidentalis*	60%		4.4	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management— Individual tree data is only available for this plant association from the Mt. Hood National Forest. It is presented below.

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PSME/HODI							
PIPO	98	4	6	224	29	6	101
PSME	93	8	5	221	25	5	94

Relationships to Other Classifications— PSME/HODI has been described for the Blue and Ochoco Mountains (Johnson and Clausnitzer 1992) and Colville Indian Reservation (Clausnitzer and Zamora 1987). The north-central Oregon version described here lacks spirea, Rocky Mountain maple, and ninebark that occur in the Blue and Ochoco Mountains variant. Otherwise the Blue and Ochoco Mountain version is very similar.

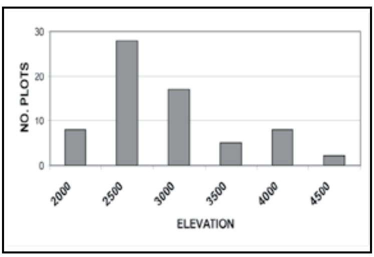
A PSME/HODI/CAGE association has been described for the east side of Mt. Hood (Topik et al. 1988). PSME/HODI/CAGE as described by Topik is wetter and more productive than the PSME/HODI type described here. Most plots included in PSME/HODI/CAGE in Topik's treatment will key to ABCO-ABGR/TRLA2 or PSME/TRLA2 in this classification.

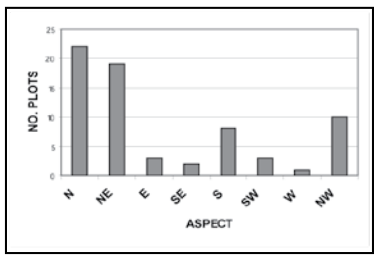
Warm Springs plots included here originally were included within mixed conifer (PSME)/SYMPH/CAGE or PIPO-PSME/SYMPH as described by Marsh et al. 1987. These plots represent more mesic portions of the broader types Marsh described.

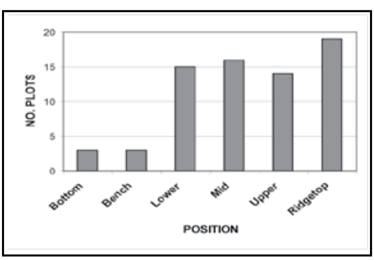
PSME/SYAL — PSME Dry

CDS633 (PSME/SYAL)
Pseudotsuga menziesii/Symphoricarpos albus
Douglas-fir/common snowberry
Plots 68

Distribution and Environment— PSME/SYAL occurs from Fly Creek on the Deschutes National Forest north across the Warm Springs Indian Reservation to Fifteen Mile Creek west of Dufur. PSME/SYAL is common in the Mutton Mountains. Average elevation is 3133 feet (range 2180-4869 feet). Average slope is 20% (range 1-85%). Most plots were found on a northern aspect. Mean annual precipitation is 5” less and mean annual temperature is 3.5°F warmer than the similar ABCO-ABGR/SYAL plant association.

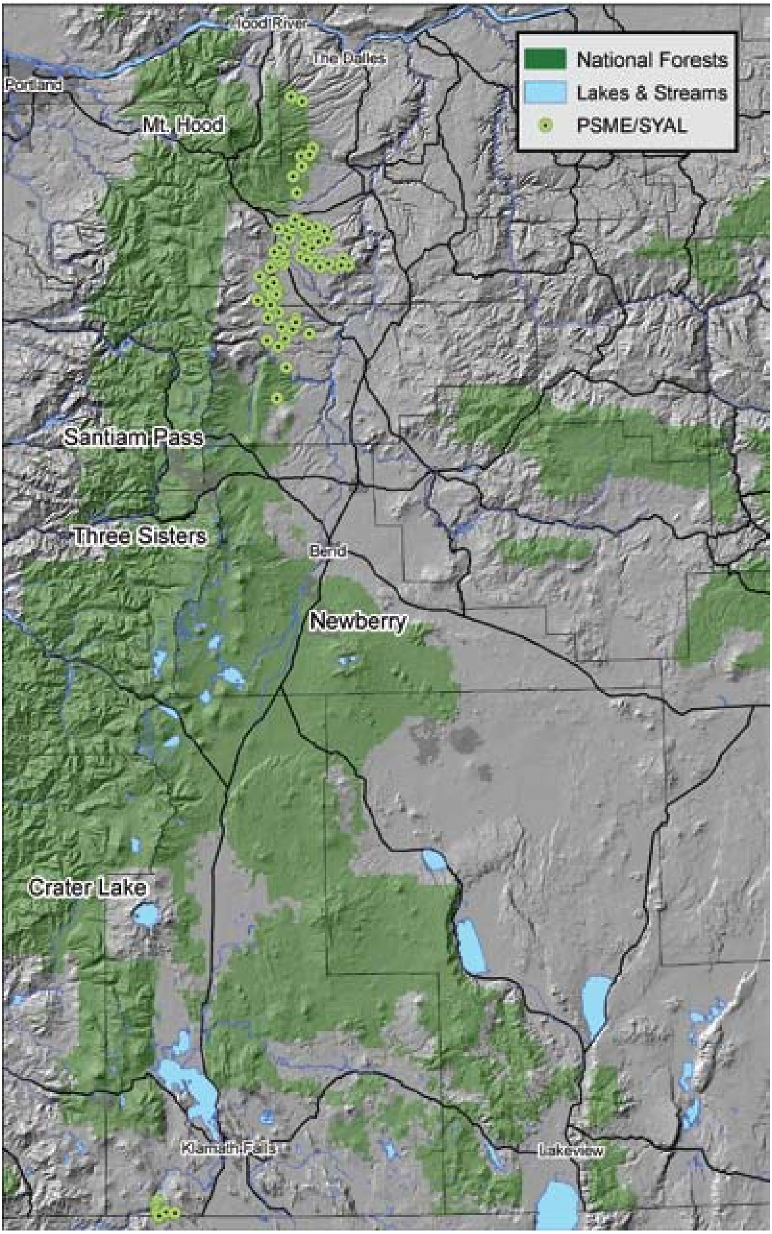






Mean Precip.	22.7”	13-41”
Mean Temp.	47.1°F	44-50°F

Figure 7-8. Map of PSME/SYAL Plot Distribution—



Vegetation— Overstory tree layers are dominated by Douglas-fir and ponderosa pine. Stream bottom positions may have scattered aspen. Shrub layers are less diverse than PSME/HODI associations. Increased cover of greenleaf manzanita (ARPA), snowbrush ceanothus (CEVE), or wax currant (RICE) may indicate past disturbance. Manzanita and ceanothus increase after fire disturbance and the currants are favored by mechanical disturbance. Common herb layer species are sweetroot (OSCH), arrowleaf balsamroot (BASA) and various graminoids such as Idaho fescue (FEID), western fescue (FEOC), squirreltail (SIHY), and elk sedge (CAGE).

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
JUOC	*Juniperus occidentalis*	11	33	3.7	1.5
PIPO	*Pinus ponderosa*	93	76	23.6	1.6
PSME	*Pseudotsuga menziesii*	93	87	33.1	2.0
QUGA	*Quercus garryana*	43	39	7.8	3.1
Shrubs					
AMAL	*Amelanchier alnifolia*	89%		2.0	
BEAQ	*Berberis aquifolium*	63%		1.8	
PUTR	*Purshia tridentata*	48%		6.1	
ROGY	*Rosa gymnocarpa*	61%		2.4	
SYAL	*Symphoricarpos albus*	100%		4.9	
Herbaceous					
ARCO	*Arnica cordifolia*	31%		2.6	
BASA	*Balsamorhiza sagittata*	65%		4.7	
FRVE	*Fragaria vesca*	35%		1.6	
OSCH	*Osmorhiza chilensis*	65%		1.8	
Graminoids					
AGSP	*Agropyron spicatum*	28%		4.9	
CAGE	*Carex geyeri*	28%		6.1	
FEID	*Festuca idahoensis*	43%		4.7	
FEOC	*Festuca occidentalis*	54%		2.1	
SIHY	*Sitanion hystrix*	46%		1.2	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management— Individual plot tree data was not available for this association. However, much of the PIPO-PSME/SYMPH type described by Marsh et al. (1987) for the Warm Springs Indian Reservation, the PSME/SYAL/AGSP from central Washington, and the PSME/SYAL from the Blue and Ochoco Mountains would key here. Productivity for these closely related types is displayed below for reference.

Plant Assoc	Avg SI	SI St.Dev	# Plots	Avg GBA	GBA St Dev	# Plots	Ft^3
PIPO-PSME/SYMPH (Mutton)							
PIPO	74		14	168	65	6	65
PSME	81		18	182	71	5	75
PSME/SYAL/AGSP (Wenatchee)							
PIPO	85	6	23	151		26	59
PSME	104	5	19	123		19	59
PSME/SYAL (Blue and Ochoco Mtns)							
PIPO	83	6	23	119	23	23	43
PSME	89	5	22	138	22	22	56

Relationships to Other Classifications— PSME/SYAL is a widely described plant association in the Pacific Northwest. The distribution of the described types is predominantly east of the Cascade Crest. Closely related types have been described for the Warm Springs Indian Reservation (Marsh et al. 1987), eastside of Mt. Hood (Topik et al. 1988), central Washington (Lillybridge et al. 1995, Williams and Lillybridge 1983), Blue and Ochoco Mountains (Johnson and Clausnitzer 1992), Wallowa-Snake Province (Johnson and Simon 1987), eastern Washington (Zamora 1983, Clausnitzer and Zamora 1987), central and northern Idaho (Steele et al. 1981, Cooper et al. 1987), western Montana (Pfister et al. 1977), and eastern Idaho and western Wyoming (Steele et al. 1983).

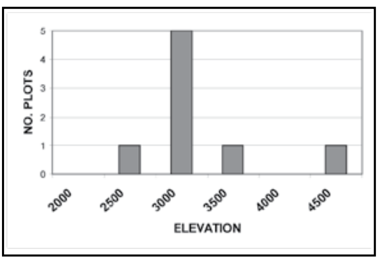
The central Oregon version of the association as described here is most similar to the PSME/SYAL/AGSP described for central Washington (Lillybridge et al. 1995). The Blue Mountain version is also very similar with the addition of spirea which does not occur in much of central Oregon.

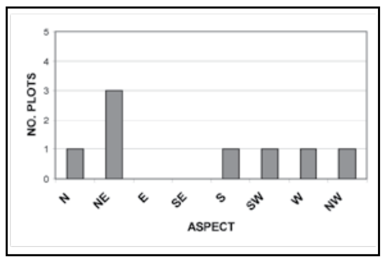
PSME/CEPR

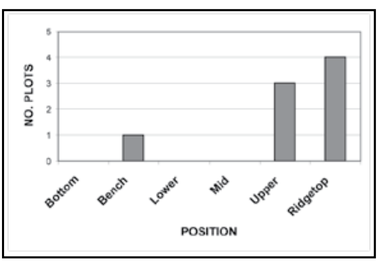
PSME Dry

CDS645 (PSME/CEPR)
Pseudotsuga menziesii/Ceanothus prostratus
Douglas-fir/mahala mat
Plots 8

Distribution and Environment— PSME/CEPR occurs from Fly Creek on the Deschutes National Forest north to Mill Creek on the Warm Springs Indian Reservation. Average elevation is 3483 feet (range 3130-4800 feet). Average slope is 11% (range 0-50%). Most plots were located on northeastern aspects, while none were found on east or southeastern aspects. Slope position is typically upper slopes or broad ridgetops.

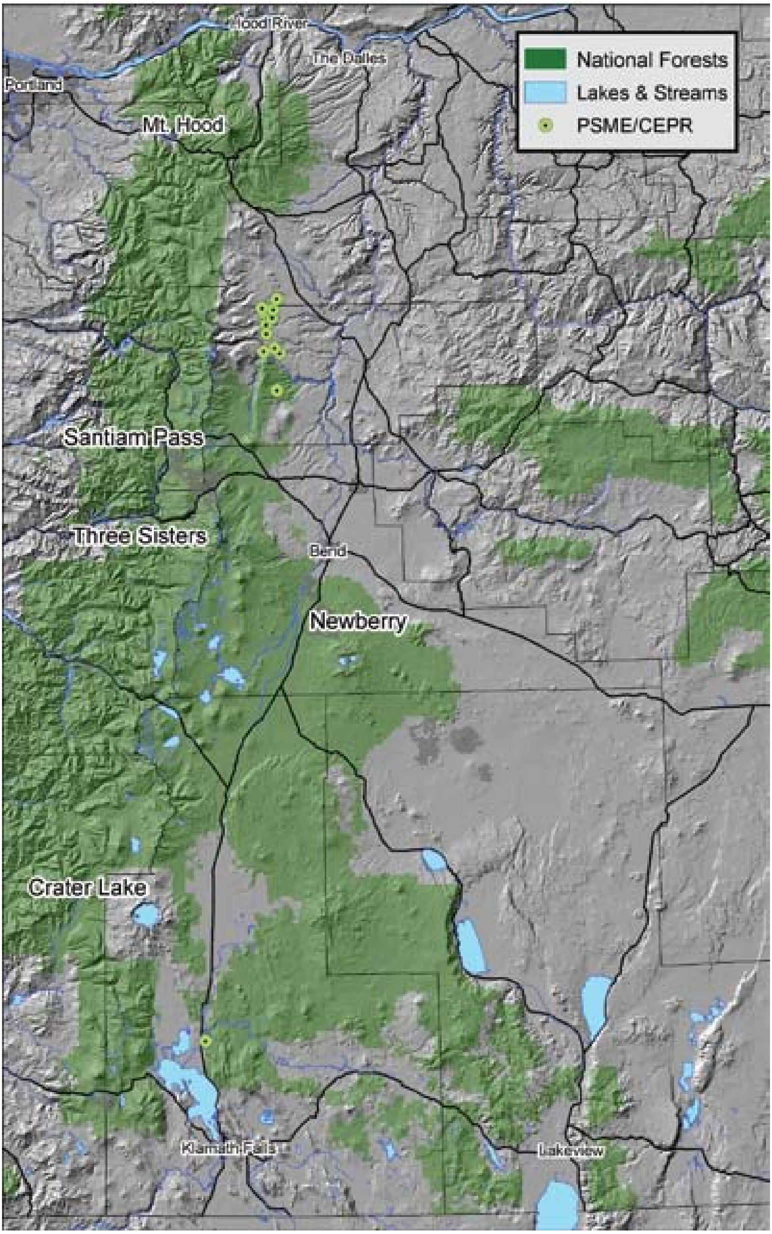






Mean Precip.	26.3”	19-39”
Mean Temp.	45.9°F	43-47°F

Figure 7-9. Map of PSME/CEPR Plot Distribution—



Vegetation— Overstory tree layers are dominated by ponderosa pine with lesser amounts of Douglas-fir. Incense cedar is always a component. Understory tree layers are a mixture of the three overstory tree species. Shrub layers are various mixtures of mahala mat (CEPR), greenleaf manzanita (ARPA), and bitterbrush (PUTR). Mahala mat and bitterbrush are always present and serviceberry (AMAL) is usually present at low coverage. Disturbed stands have increased cover of manzanita and snowbrush ceanothus. Herb layers are dominated by graminoids. Bluebunch wheatgrass, Idaho fescue, western fescue, and Wheeler's bluegrass are the most common graminoid species. Arrowleaf balsamroot (BASA), littleleaf pussytoes (ANMI2), and woodland strawberry (FRVE) are the only common dicots.

Codes	Species Latin Name	Constancy		Cover %	
Trees		**Over**	**Regen**	**Over**	**Regen**
CADE3	*Calocedrus decurrens*	75	100	4.4	6.3
PIPO	*Pinus ponderosa*	100	100	24.5	4.9
PSME	*Pseudotsuga menziesii*	88	75	13.7	2.8
Shrubs					
AMAL	*Amelanchier alnifolia*	75		1.4	
ARPA	*Arctostaphylos patula*	75		8.4	
BEAQ	*Berberis aquifolium*	38		1.0	
CEPR	*Ceanothus prostratus*	100		3.6	
PUTR	*Purshia tridentata*	100		7.4	
Herbaceous					
ANMI2	*Antennaria microphylla*	38		1.0	
BASA	*Balsamorhiza sagittata*	63		1.4	
FRVE	*Fragaria vesca*	38		1.3	
Graminoids					
AGSP	*Agropyron spicatum*	25		1.5	
CARO	*Carex rossii*	25		1.0	
FEID	*Festuca idahoensis*	88		4.9	
FEOC	*Festuca occidentalis*	38		2.3	
POPR	*Poa pratensis*	25		1.3	
SIHY	*Sitanion hystrix*	50		0.6	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management— Individual tree data is not available for this plant association. Productivity for ponderosa pine and incense cedar are likely similar to the PIPO-CADE3/CEPR association. The PIPO-CADE3/CEPR data is presented below for reference. Productivity for Douglas-fir is likely similar to PSME/SYAL.

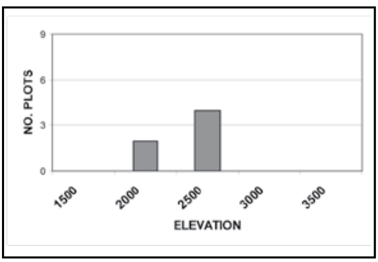
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PIPO-CADE3/CEPR							
CADE3				147	50	4	
JUOC				161	43	2	
PIPO	74	10	4	140	8	57	48
PSME				104	8	19	

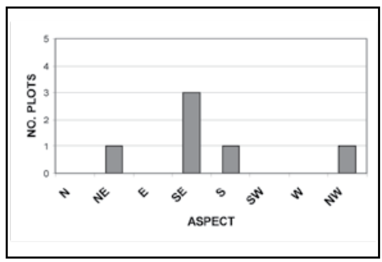
Relationships to Other Classifications— PSME/CEPR has not been previously described in the Pacific Northwest.

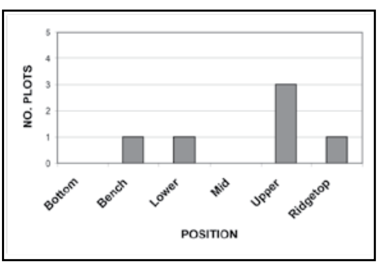
PSME/CAGE — PSME Dry

CDG111 (PSME/CAGE2)
Pseudotsuga menziesii/Carex geyeri
Douglas-fir/elk sedge
Plots 6

Distribution and Environment— PSME/CAGE is a minor type in the east Cascades of Oregon. Plot locations are known from Mill Creek on the Warm Springs Indian Reservation, north to Tygh Valley east of Mt. Hood. Average elevation is 2457 feet (range 2100-2640 feet). Average slope is 20% (range 5-45%). Half of the plots were located on a southeast aspect. Upper-slopes are the most common slope positions.

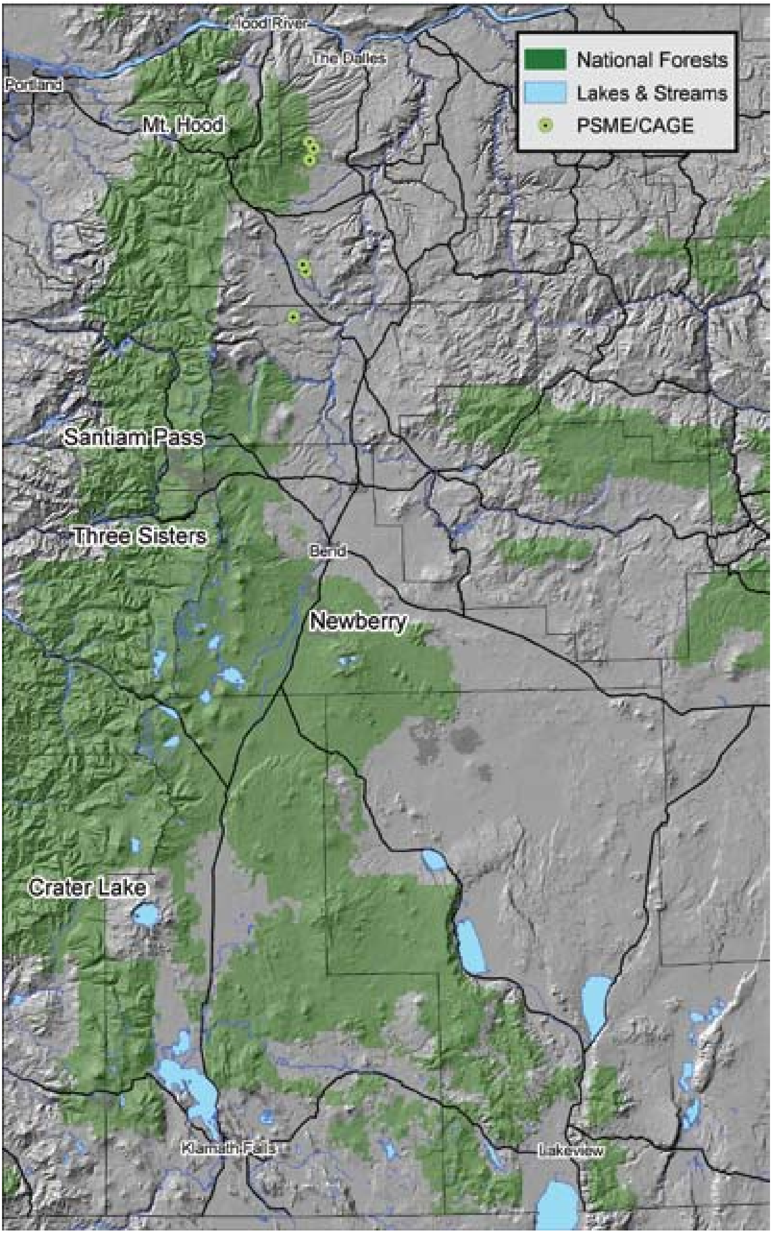






Mean Precip.	19.3”	19-21”
Mean Temp.	47.5°F	47-48°F

Figure 7-10. Map of PSME/CAGE Plot Distribution—



Vegetation— Tree layers typically are relatively dense mixtures of ponderosa pine and Douglas-fir. Oregon white oak is an important seral species which is eventually excluded by dense stands of Douglas-fir in the absence of fire. Shrub layers are poorly developed; only bitterbrush (PUTR), serviceberry (AMAL), and wax currant (RICE) are common species in mid to late seral stands. Herbaceous layers are species poor, perhaps due to relatively dense tree cover in these dry forests. Low cover of elk sedge (CAGE), Idaho fescue (FEID), squirreltail (SIHY), and arrowleaf balsamroot (BASA) is typical in these understories.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
PIPO	*Pinus ponderosa*	100	67	17.5	2.5
PSME	*Pseudotsuga menziesii*	100	83	23.8	2.0
QUGA	*Quercus garryana*	50	67	12.0	1.5
Shrubs					
AMAL	*Amelanchier alnifolia*	50		2.0	
PUTR	*Purshia tridentata*	67		6.0	
RICE	*Ribes cereum*	33		1.5	
Herbaceous					
BASA	*Balsamorhiza sagittata*	50		11.3	
HIAL2	*Hieracium albertinum*	33		1.5	
Graminoids					
CAGE	*Carex geyeri*	100		2.3	
FEID	*Festuca idahoensis*	100		5.7	
SIHY	*Sitanion hystrix*	67		1.0	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management— Individual tree data was not available for this association. However, much of the PSME/CAGE type described in the Blue and Ochoco Mountains would key here. Portions of the PSME/CAGE described for Mt. Hood (Topik et al. 1988) would also key here, however average productivity of the Mt. Hood variant is likely higher than the type as described here. Only the driest plots used in the Mt. Hood classification are included here. SI may only be slightly affected, but GBA and yield capability (Ft3) are likely much lower.

Productivity for these closely related types is displayed below for reference. In the absence of the raw tree data for plots included here, the productivity estimates from the Blue and Ochoco Mountains should give a closer approximation to the PSME/CAGE as defined here.

Plant Assoc	# Plots	Avg SI	SI StDev	Avg GBA	GBA St Dev	Ft^3
PSME/CAGE (Blue and Ochoco Mtns)						
PIPO	6	68	6	83	17	23
PSME	4	71	10	123	52	23
PSME/CAGE (Mt. Hood)						
PIPO	6	74		196		66
PSME	4	82		160		60

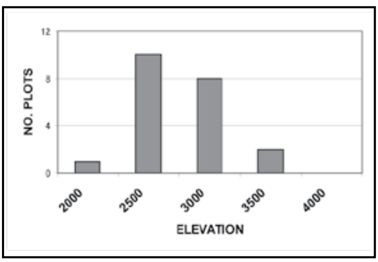
Relationships to Other Classifications— PSME/CAGE has been previously described for the east side of Mt. Hood (Topik et al. 1988), Blue and Ochoco Mountains (Johnson and Clausnitzer 1992), central Washington (Lillybridge et al. 1995), central Idaho (Steele et al. 1981), northern Idaho (Cooper et al. 1987), and western Montana (Pfister et al. 1977).

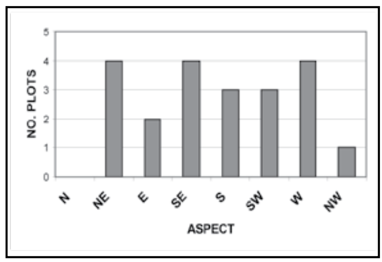
PSME/CAGE as defined here has many affinities to the Blue and Ochoco Mountain type described by Johnson and Clausnitzer (1992). It includes only the drier end (3 plots) of the east side Mt. Hood variant described by Topik et al. (1988).

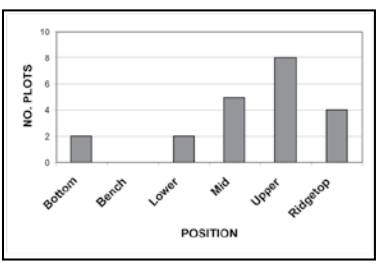
PSME/ARPA **PSME Dry**

CDS141 (PSME/ARPA6)
Pseudotsuga menziesii/Arctostaphylos patula
Douglas-fir/greenleaf manzanita
Plots 21

Distribution and Environment— PSME/ARPA occurs from Black Butte near Sisters north through the Warm Springs Indian Reservation to the vicinity of Bear Springs on the Mt. Hood National Forest. Average elevation is 2993 feet (range 2270-3525 feet). Average slope is 18% (range 2-63%). Aspects are variable. Slope positions are usually mid to upper slopes or ridgetops.

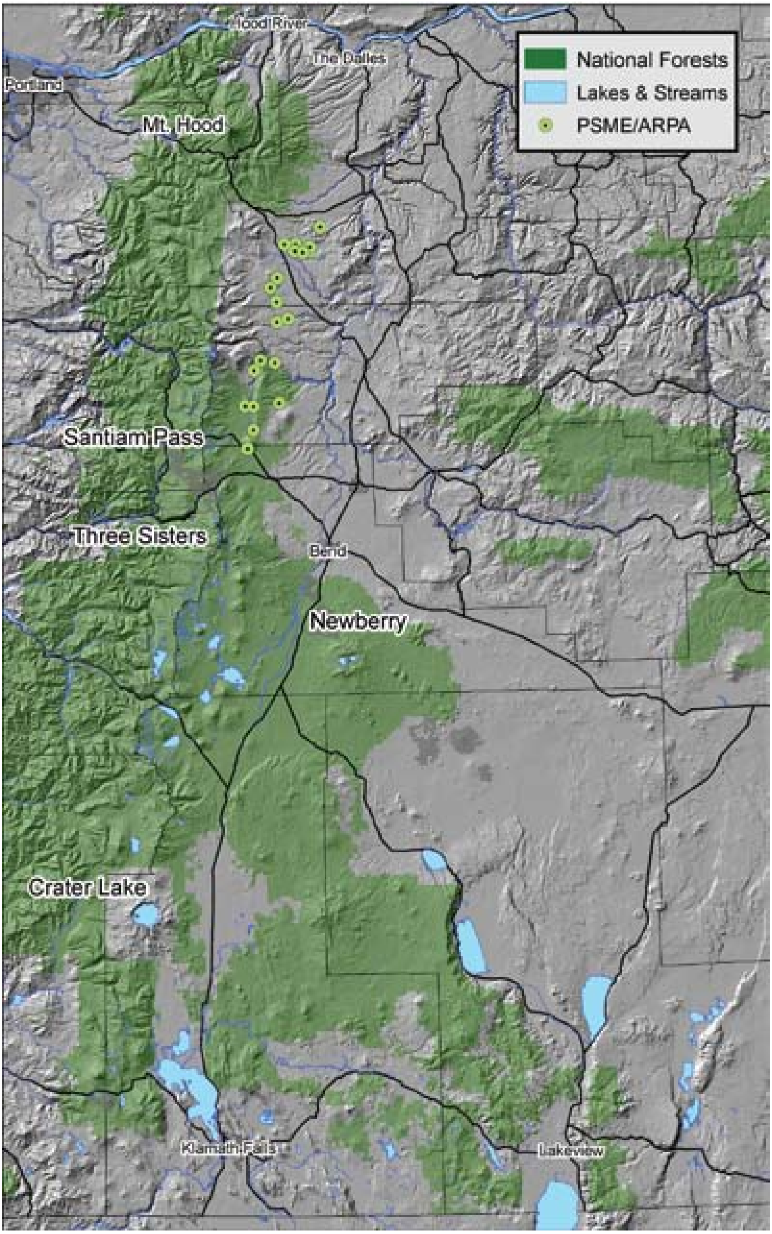






Mean Precip.	22.3”	17-31”
Mean Temp.	46.2°F	44-47°F

Figure 7-11. Map of PSME/ARPA Plot Distribution—



Vegetation— Tree overstory layers are dominated by various mixtures of Douglas-fir, ponderosa pine and incense cedar. Shrub layers are dominated by greenleaf manzanita (ARPA), snowbrush ceanothus (CEVE), and bitterbrush (PUTR). Herbaceous layers have low cover. The most common species are grasses (squirreltail and western needlegrass) and upland sedges (CARO). The only herb with > 50% constancy is arrowleaf balsamroot (BASA). Increasing amounts of bracken fern (PTAQ) and prince's pine (CHUM) may indicate a transition to either a more mesic Douglas-fir association or to an ABCO-ABGR Series association.

Codes	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
CADE3	*Calocedrus decurrens*	43	67	3.7	2.9
PIPO	*Pinus ponderosa*	100	95	19.2	5.0
PSME	*Pseudotsuga menziesii*	95	67	17.8	5.4
QUGA	*Quercus garryana*	19	29	2.0	1.3
Shrubs					
AMAL	*Amelanchier alnifolia*	38		0.8	
CEVE	*Ceanothus velutinus*	71		4.4	
PUTR	*Purshia tridentata*	90		5.9	
Herbaceous					
BASA	*Balsamorhiza sagittata*	71		2.5	
Graminoids					
CARO	*Carex rossii*	33		0.9	
FEID	*Festuca idahoensis*	33		3.3	
SIHY	*Sitanion hystrix*	67		1.1	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PSME/ARPA							
PIPO	85	3	31	156	12	65	61
PSME	90	5	7	96	13	9	40

Relationships to Other Classifications— PSME/ARPA is closely related to the PIPO-PSME/ARPA-CEVE, PIPO-PSME/PUTR-CEVE, and wetter portions of PIPO/PUTR-ARPA associations described for the Warm Springs Indian Reservation (Marsh et al. 1987).

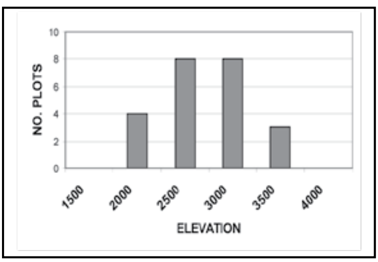
Higher precipitation sites (>25") may be seral communities related to more mesic ABCO-ABGR Series associations.

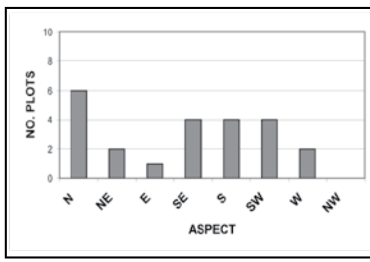
PSME/PUTR

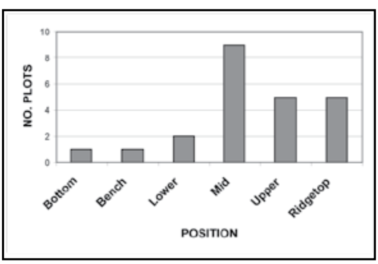
PSME Dry

CDS673 (PSME/PUTR2)
Pseudotsuga menziesii/Purshia tridentata
Douglas-fir/bitterbrush
Plots 23

Distribution and Environment— PSME/PUTR occurs in the north end of the Metolius Basin, Fly Creek on the Deschutes National Forest through the Warm Springs Indian Reservation to Tygh Valley east of Mt. Hood, and the Mutton Mountains also on the Warm Springs Indian Reservation. These are some of the driest sites in the Douglas-fir Series. Adjacent drier sites transition to ponderosa pine, western juniper, or to non-forest series. Average elevation is 2922 feet (range 2075-3900 feet). Average slope is 26% (range 1-85%). Plot aspects are variable. Slope positions are typically mid to upper slopes and ridgetops.

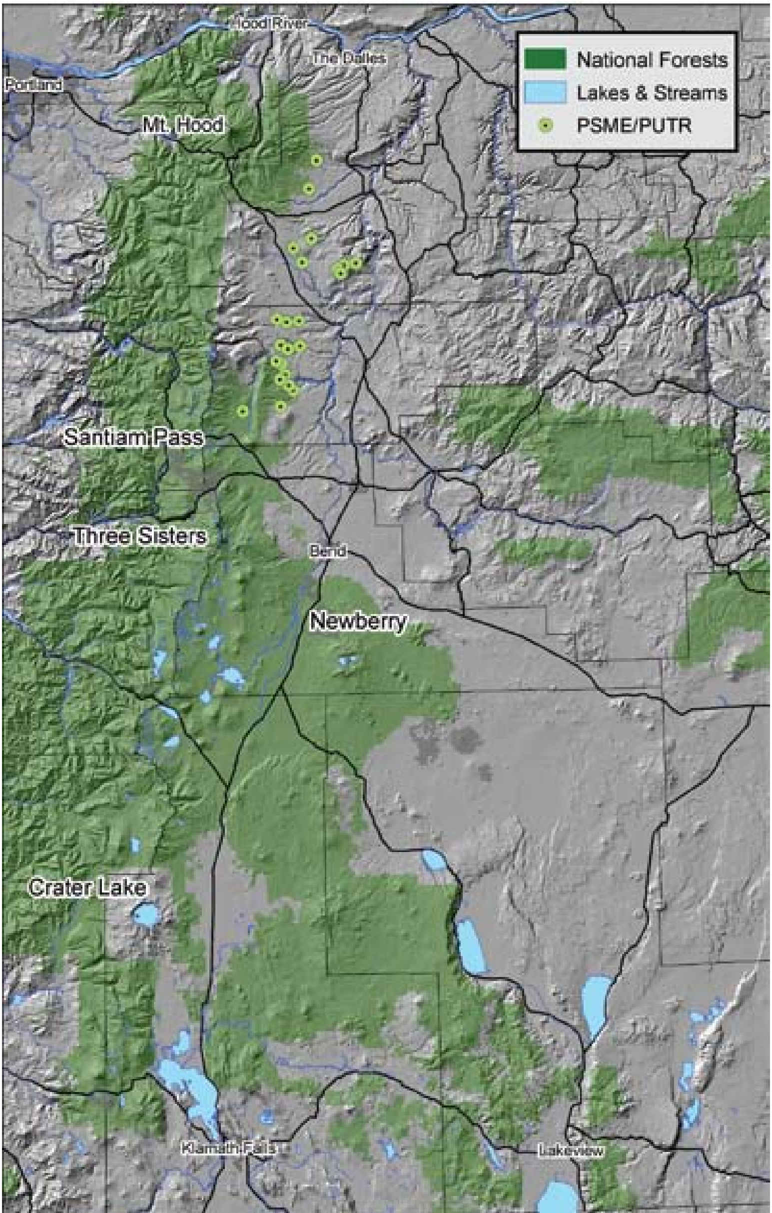






Mean Precip.	19.7”	13-27”
Mean Temp.	47.2°F	45-49°F

Figure 7-12. Map of PSME/PUTR Plot Distribution—



Vegetation— Ponderosa pine dominates the overstory tree layer. Douglas-fir, incense cedar, and occasionally Oregon white oak north of the Mutton Mountains may constitute up to 33% of the tree layer composition. Western juniper (JUOC) is an incidental component. JUOC occurrence increases near sharp ecotones with drier sites. Shrub layers are dominated by bitterbrush, although cover values are generally low. Herbaceous layers are typically sparse; only arrowleaf balsamroot (BASA) and Idaho fescue (FEID) have constancies over 50% and combined their cover averages less than 10%.

Codes	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
CADE3	*Calocedrus decurrens*	35	39	4.0	4.5
JUOC	*Juniperus occidentalis*	17	43	2.2	1.1
PIPO	*Pinus ponderosa*	100	100	20.9	2.9
PSME	*Pseudotsuga menziesii*	91	78	14.0	2.2
Shrubs					
AMAL	*Amelanchier alnifolia*	74		1.0	
PUTR	*Purshia tridentata*	100		10.0	
RICE	*Ribes cereum*	26		1.8	
Herbaceous					
BASA	*Balsamorhiza sagittata*	78		4.1	
Graminoids					
AGSP	*Agropyron spicatum*	39		1.9	
FEID	*Festuca idahoensis*	70		5.2	
SIHY	*Sitanion hystrix*	52		1.0	

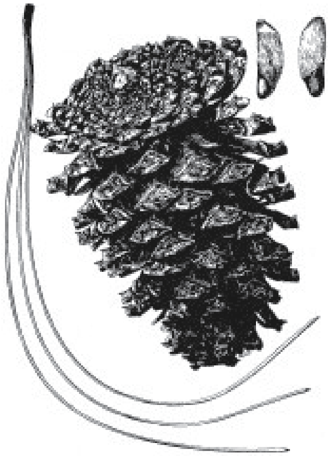
* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PSME/PUTR							
PIPO	92	3	24	115	7	36	48
PSME	75	2	3	172	18	4	59

Relationships to Other Classifications— PSME/PUTR is closely related to the PIPO-PSME/PUTR-CEVE and PIPO-PSME/PUTR associations described for the Warm Springs Indian Reservation (Marsh et al. 1987). Two PSME/PUTR associations have also been described for central Washington (Lillybridge et al. 1995). The central Oregon variant of PSME/PUTR is most like the Wenatchee PSME/PUTR/AGSP as described by Lillybridge (1995).

Ponderosa Pine Series



PONDEROSA PINE SERIES

PIPO
Pinus ponderosa
ponderosa pine
Total Plots 1387

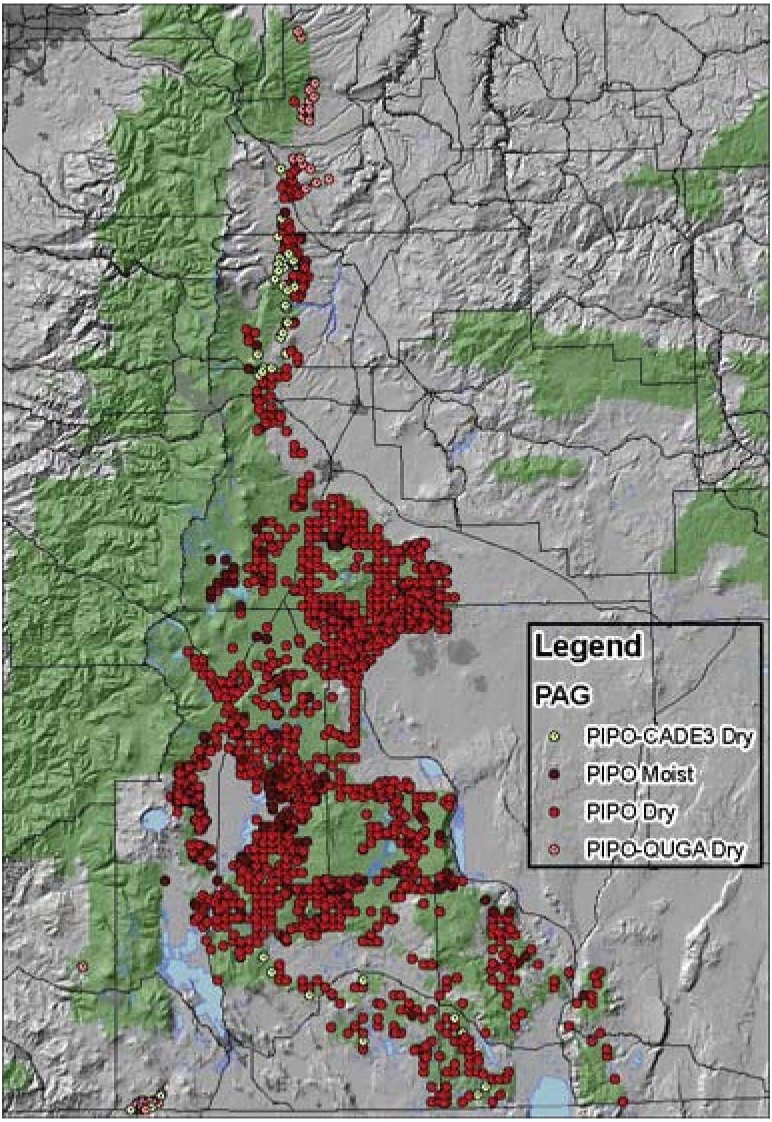
Distribution and Environment— Ponderosa pine (PIPO) forests are widely distributed on the east slope of the Oregon Cascades. Climax PIPO forests occupy a narrow band 5-10 miles wide on the eastern flanks of the Cascade Range from the Columbia River south to Bend. Within the pumice/ash deposits from Mt. Mazama, south of Bend, the ponderosa pine zone is up to 35-40 miles wide.

The climate of the Ponderosa Pine Series is characterized by a short growing season and minimal summer precipitation (Franklin and Dyrness 1973). Since ponderosa pine occupies drier sites than any other forest type except western juniper or occasionally lodgepole pine, its distribution is tied closely to available soils moisture. Mean annual precipitation for the Ponderosa Pine Series in central Oregon varies from slightly less than 12" to about 35". Sites with high mean annual precipitation have low effective moisture due to excessive soil drainage (ash/pumice, cinder deposits) or shallow soils (recent lava flows).

Vegetation— Climax ponderosa pine stands outside the pumice/ash deposits typically grow as very open forests or woodlands. Ponderosa pine is often the only tree species present, although, some 'accidental' Douglas-fir or white fir-grand fir can be found. Sites are too dry for these species to assume dominance. They are usually found growing in favorable microsites or on ecotones to Douglas-fir and White Fir-Grand Fir Series sites. Many stands of ponderosa pine appear to be relatively uniform in size and spacing, which leads to the impression that they are even-aged. Some stands are even-aged, but most stands contain several age classes. Stand age structure and patterns result from past disturbance events as well as from depth to rock or bedrock.

Outside the pumice/ash deposits, ponderosa pine, incense cedar, western juniper, and Oregon white oak are usually the only tree species regenerating. Incense cedar, where it occurs, is interpreted as a minor climax species. Ponderosa pine is well known for its episodic regeneration (Oliver and Ryker, 1990). Many stands have few trees, if any, in the seedling or sapling size classes. Seed crops for ponderosa pine appear frequently in central Oregon, and episodic reproduction of pine appears to be more related to moisture availability in June and July

Figure 8-1. Map of PIPO Series Plot Distribution by PAG—



in a given year. Years of higher precipitation may result in most of the successful seedling establishment. Under natural conditions, successful reproduction and recruitment is only needed every few decades for stand maintenance.

Within the deep recent pumice/ash deposits, lodgepole pine is an important seral species within the series and may never be completely excluded, especially in areas with little or no slope that accumulate cold air. Sugar pine may also be found in association with ponderosa pine, especially on slopes with good cold air drainage within the Mt. Mazama deposits. Where sugar pine occurs, it indicates more effective moisture and slightly cooler temperatures and often a transition to the White Fir-Grand Fir Series.

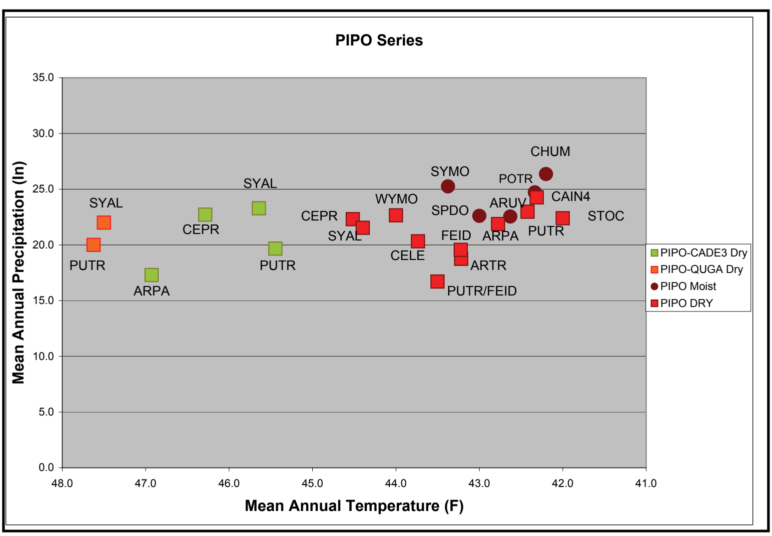
Shrubs are important in some associations (e.g., PIPO/ARPA, PIPO/CELE, PIPO/PUTR/FEID, PIPO/PUTR), but even in these associations, shrubs do not always form a continuous layer. Bluebunch wheatgrass is the most dominant and characteristic grass of the series. Pinegrass and elk sedge may occur on more mesic types. Many of the important forbs and grasses found in the series are species also characteristic of nearby shrublands and grasslands that occur under conditions too harsh for trees. Some important taxa include Sandberg's bluegrass, Wheeler's bluegrass, western yarrow, lupines, balsamroots, and lomatiums.

The PIPO Series plant associations have been further grouped into four plant association groups (PAGs) which reflect effective temperature-precipitation zones. The PIPO Moist PAG consists of PIPO/SPDO, PIPO-POTR, PIPO/SYMO, PIPO/ARUV, and PIPO/CHUM. The PIPO Dry PAG consists of PIPO/SYAL, PIPO/CEPR, PIPO/WYMO, PIPO/CELE, PIPO/CAIN4, PIPO/ARPA, PIPO/PUTR, PIPO/PUTR/FEID, and PIPO/ARTR. The PIPO-CADE3 Dry PAG consists of PIPO-CADE3/SYAL, PIPO-CADE3/CEPR, PIPO-CADE3/ARPA, and PIPO-CADE3/PUTR. The PIPO-QUGA Dry PAG consists of two associations, PIPO-QUGA/SYAL and PIPO-QUGA/PUTR. Species diversity declines as the plant associations change from moist to dry and from cool to warm within a PAG.

PIPO Moist PAG plant associations have higher effective moisture regimes than the other three PAGs in the series. The increased moisture often results from sub-irrigation due to adjacency to streams or riparian zones. This situation is typical for PIPO/SPDO, PIPO-POTR, and PIPO/ARUV plant associations. Within the deep ash/pumice deposits from Mt. Mazama, the ecotones between the PIPO Moist associations and PIPO Dry associations may be very abrupt. The rest of the PIPO Moist PAG associations (PIPO/SYMO and PIPO/CHUM) are usually transitional to the ABCO-ABGR Series. These associations occupy similar moisture-temperature regimes to PSME/SYMO and PSME/CHUM plant associations, but occur within the Mazama ash/pumice deposits where the Douglas-fir Series is missing.

Tree layers in the PIPO Moist PAG plant associations have average total tree cover of 40-50%. This occurs in various mixtures of ponderosa and lodgepole pines. Typical composition of the tree layer is 54% ponderosa pine and 46% lodgepole pine. Aspen may be a locally important component of PIPO/SPDO or PIPO-POTR tree layers. Where it occurs, aspen averages 30-35% cover. Mid to late seral stands have an average of about 20% shrub cover and 10-15% cover of herbaceous species (mostly graminoids). The shrub layers are less diverse (3-5 species per plot) than PSME Moist or ABCO-ABGR Moist sites. The most common shrub species are bitterbrush (PUTR), bearberry (ARUV), greenleaf manzanita (ARPA), wax currant (RICE), and prince's pine (CHUM).

Figure 8-2. Temperature – Precipitation Relationships for Plant Associations and Plant Association Groups within the PIPO Series.



Typical herbaceous species are strawberry (FRVI), Wheeler's bluegrass (PONE), long-stolon sedge (CAIN4), and Idaho fescue (FEID). After disturbance of the overstory, shrubfields dominated by ARPA, snowbrush ceanothus (CEVE), and currants (RIVI, RICE) are likely. Disturbance will also favor lupines (LUAR3, LULE2), CAIN4, and FEID.

The PIPO Dry PAG plant associations have average total tree cover of 30-35%. Composition of the tree layers varies depending on whether the site is on deep Mazama deposits or on residual soils. On Mazama deposits, the average composition is close to 50% ponderosa pine and 50% lodgepole pine. On residual soils, or ash/pumice deposits that are less than 2 feet deep, average composition of ponderosa pine is usually 70-100% in mid to late seral conditions. Western juniper can occupy up to 30% of the tree layer and lodgepole (rarely) can occupy up to 25%. Total shrub cover averages between 10-20%. The most common species are PUTR, ARPA, CEVE, ARTR, CELE, and RICE. Herbaceous cover averages about 10%. Forbs only contribute about 1% cover in mid to late seral conditions; the rest of the herbaceous cover is contributed by graminoids.

PIPO-CADE3 Dry PAG sites are transitional to the ABCO-ABGR or PSME Series. Total tree cover is approximately 45-50%. Composition of the tree layers is typically 20-25% incense cedar and 70-75% ponderosa pine. The PIPO-CADE3 Dry PAG has analogous understories to the PIPO Dry PAG on residual soils. Total shrub cover is about 20%. The most common shrub species are PUTR, ARPA, CEVE, CEPR, SYAL, and AMAL. Manzanita and ceanothus will likely increase with disturbance of the overstory. Common herbaceous species are BASA, FRVE, FEID, FEOC, SIHY, STOC, and CARO.

PIPO-QUGA Dry PAGs sites are transitional to Oregon white oak woodlands or non-forest communities. These sites are the warmest and driest sites that support ponderosa pine. Total tree cover averages 40-50%, which is high considering how low the mean annual precipitation is on these sites. The PIPO-QUGA Dry PAG has analogous understories to the PIPO Dry PAG on residual soils. Shrub cover averages 5-10% in mid to late seral conditions. The most common shrub species are SYAL, SYMO, ROGY, BEAQ, PUTR, and AMAL. Herbaceous cover is typically 5-10%. Common herbaceous species are BASA, HIAL2, OSCH, FEID, FEOC, POPR, SIHY, CAGE, and CARO.

Fire— Ponderosa pine represents the classic low-intensity, high-frequency fire regime (Fire Regime I) (Franklin and Dyrness, 1988). It is also among the forest types most heavily impacted by fire exclusion. Observed changes include increased dominance of shrubs in the understory, especially antelope bitterbrush, and concurrent loss of herbaceous species; increased fuel loadings; increased duff depths; and deep buildups of bark flakes and needles around the bases of large, old trees (pedestals). Exclusion has made ponderosa pine areas more homogeneous and more prone to large, stand-replacing fires (Hessburg et al. 2005). Prolonged smoldering in the deep duff, large logs and pedestals can also result in high mortality of the large, old trees even for low intensity fires and where smaller trees remain relatively unaffected. Increased shrub dominance results in increased flame lengths, particularly where shrubs carry a heavy loading of suspended pine needles (needle drape), increasing the probability of torching, crowning and high scorch damage to tree crowns. For these reasons thinning and slash removal, followed by maintenance burning, is recommended when restoration ecology (moving the landscape towards the historic/natural range of variation) is the management goal. This can also help maintain large ponderosa pine. Open-canopy ponderosa pine old-growth is probably the least common old-growth type in the Region.

Productivity and Management— Plant growth on sites in the Ponderosa Pine Series is limited by lack of growing season moisture. Summer soil drought is severe in many types. Ponderosa pine sites have low to moderate timber productivity due to low stocking and slow growth rates (TABLE 8-1). The average stand site index for ponderosa pine in the series ranged from 68 to 90 feet (base 100). Average SI values do not vary much between plant association groups within the PIPO Series, however, stockability as measured by GBA varies significantly between PAGs for ponderosa pine. GBA averages only 71 ft^2 in the PIPO-QUGA PAG while the more mesic PIPO-CADE3 Dry and PIPO Moist PAGs average 134 ft^2 and 152 ft^2 respectively.

Ponderosa pine series sites are important wildlife areas. They supply forage and browse for deer and elk during spring and early summer, and at lower elevations provide important winter range. Snags and logs provide valuable habitat and perches, and are especially critical because tree density is low and therefore snag and log recruitment will also be slow or episodic.

Invasion of noxious weeds is a serious problem, especially spotted knapweed. Coarse soils are easily displaced on steep slopes. Heavy grazing reduces cover of bluebunch wheatgrass, and Idaho fescue. Introduced grasses and forbs may persist for many years in these open environments.

Key Insects and Diseases: Western pine beetle, mountain pine beetle, pine engraver, western dwarf mistletoe, Armillaria and annosus root diseases.

Secondary Insects and Diseases: Red turpentine beetle, pine butterfly, pine sawfly, needle miner, western pineshoot borer, sugar pine tortrix, pandora moth, black stain root disease, elytroderma needle disease, Dothistroma needle disease, western gall rust, comandra blister rust, red ring rot, porcupine damage.

Important Effects: Several species of bark beetles are common in this series and host trees of all sizes can be killed when they are damaged or under stress. Typically, western pine beetle is associated with larger, older trees with reduced vigor, mountain pine beetle occurs in second-

Table 8-1 Site Index (SI standard error), Growth Basal Area (GB A standard error), Yield Capability (Ft$^{3)}$ by Species and Plant Association Group within the PIPO Series

PAG	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
PIPO-QUGA Dry							
PIPO	77	12	4	71	7	23	25
PIPO Dry							
JUOC				89	3	293	
PICO	66	1	774	107	1	3500	33
PIPO	80	0	2312	115	1	7592	42
PIPO-CADE3 Dry							
CADE3	57	10	3	126	10	43	33
JUOC				97	7	17	
PIPO	79	2	77	134	4	310	49
PIPO Moist							
JUOC				71		1	
PICO	68	2	111	127	5	282	40
PIPO	84	2	142	152	5	301	58
POTR				131	30	8	

growth stands, and pine engravers affect small pines around 4-5” in diameter. Turpentine beetles are also common, especially if a pine has been wounded to the point of exuding pitch. Trees are often killed in groups, creating an opening in the stand. In second growth stands, mountain pine is said to thin stands “from above” on poor sites and thin “from below” on the best sites (Sartwell 1971). The effects of the bark beetles become greater as stand densities increase and as sites become drier. On the driest sites in the series, care must be taken when slash is created because pine engravers can utilize this material and then infest standing trees. There are numerous defoliating insects, but none are particularly important from a management standpoint. The largest and most impressive is the pandora moth which can periodically defoliate pines over vast areas on all sites, but trees usually recover unless they are very old with poor vigor.

Western dwarf mistletoe occurs in 32% of the PIPO dry and PIPO moist PAGs and was not documented in the PIPO-QUGA dry and PIPO-QUGA moist PAGS. It commonly causes reduced tree vigor and eventually mortality when infection becomes severe. Dwarf mistletoe changes tree and stand structure, prevents large tree development, and increases fuel loadings. The level of infection on the landscape has likely increased in abundance due to fire suppression.

Annosus and Armillaria root disease occur on 7% of PIPO dry and PIPO moist PAGs. Annosus is more common on the dry PIPO PAG especially in PIPO series with western juniper present. Annosus root disease was infrequent before the era of resource management and has increased by infecting stumps from harvest activities. Mortality tends to be impressive after planting but losses are insignificant after 20 years. Annosus will remain on site for longer periods of time in areas that were entered for selective cutting. Incidence of annosus in western juniper is most frequently associated with large ponderosa pine stumps. Armillaria occasionally occurs in the PIPO series. Where Armillaria occurs it is fairly site specific and is likely to be more pathogenic than commonly found in this area. Mortality from Armillaria root diseases is common in ponderosa pine on the Pringle Falls Experimental Forest.

Comandra blister rust is found throughout the range of ponderosa pine. There is an elevated incidence of it on Sisters Ranger District. New infection localized and a wave year is thought to have occurred in the 1930s. Porcupine damage in ponderosa pine has historically been severe causing forked tops. Today, damage is infrequent.

Quaking aspen is periodically defoliated by the satin moth. There is a high incidence of aspen trunk rot caused by *Phellinus tremulae* in aspen stands. Aspen are prone to a wide range of canker and foliage diseases (Schmitt 2000).

Wildlife Management— Because wildlife habitats do not precisely match plant associations or even plant series, Appendix C in this guide is provided. Please see page C-12 for a discussion on ponderosa pine.

Relationships to Other Classifications— The Ponderosa Pine Series has been described by numerous authors up and down the Cascades and east into the northern Rocky Mountains. Sometimes the Ponderosa Pine Series has been included in the Douglas-fir Series. Some of the authors include: Pfister et al. (1977) for Montana; Cooper et al. (1987) for Idaho; Williams et al. (1990) for Colville NF; Williams and Lillybridge (1983) for Okanogan NF; Williams and Smith (1991) for Wenatchee NF Draft; Clausnitzer and Zamora (1987) for Colville Indian Res.; Zamora (1983) for Spokane Indian Res.; John et al. (1988) for Yakima Indian Res.; and Johnson and Clausnitzer (1992) for northeastern Oregon.

Key to the Plant Associations of the Ponderosa Pine Series:

1a *Calocedrus decurrens* (>5%) 3a
1b *Calocedrus decurrens* (<5%) 2a

2a *Quercus garryana* (>5%) 6a
2b *Quercus garryana* (<5%) 9a

3a *Symphoricarpos albus* (>5%) PIPO-CADE3/SYAL
3b Not as above 4a

4a *Ceanothus prostratus* (>5%) PIPO-CADE3/CEPR
4b Not as above 5a

5a *Arctostaphylos patula* (>1%) PIPO-CADE3/ARPA
5b Not as above 6a

6a *Purshia tridentata* (>1%) PIPO-CADE3/PUTR
6b Not as above . . . . return to 3a and relax cover %

7a *Symphoricarpos albus* (>5%) and not restricted to microsites . . PIPO-QUGA/SYAL
7b Not as above 8a

8a *Purshia tridentata* (>1%) and not restricted to microsites . . PIPO-QUGA/PUTR
8b Not as above . . . . .return to 6a and relax cover %

9a *Spiraea douglasii* (>1%) and not restricted to microsites . . . . PIPO/SPDO
9b Not as above 10a

10a *Populus tremuloides* (>1%) and not restricted to microsites . . . . . . PIPO-POTR
10b Not as above 11a

11a *Arctostaphylos uva-ursi* (>1%) and not restricted to microsites. . . . PIPO/ARUV
11b Not as above 12a
. . . . 8a

12a *Symphoricarpos mollis* (>1%) and not restricted to microsites . . . .PIPO/SYMO
12b Not as above 13a

13a *Chimaphila umbellata* (>1%) and not restricted to microsites . . . . .PIPO/CHUM
13b Not as above 14a

14a *Symphoricarpos albus* (>1%) and not restricted to microsites . . . . .PIPO/SYAL
14b Not as above 15a

15a *Ceanothus prostratus* (>1%) and not restricted to microsites . . . . . PIPO/CEPR
15b Not as above 16a

16a *Wyethia mollis* (>1%) and not restricted to microsites. . . . . PIPO/WYMO
16b Not as above 17a

17a *Cercocarpus ledifolius* (>1%) not restricted to microsites . . . . PIPO/CELE
17b Not as above 18a

18a *Carex inops* (>1%). PIPO/CAIN4
18b Not as above 19a

19a *Arctostaphylos patula* (>1%) and not restricted to microsites . . . . . PIPO/ARPA
19b Not as above 20a

20a *Purshia tridentata* (>1%) and not restricted to microsites
and *Festuca idahoensis* (>1%) . . . . PIPO/PUTR/FEID
and *Festuca idahoensis* (<1%), ... PIPO/PUTR
20b Not as above 21a

21a *Artemisia tridentata* (>1%) and not restricted to microsites. . . . . . . PIPO/ARTR
21b Not as above 22a

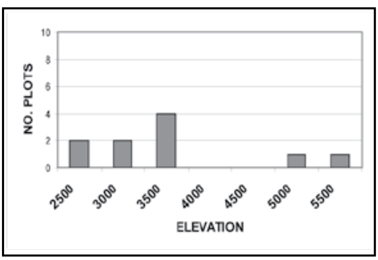
22a *Festuca idahoensis* (>1%) and not restricted to microsites . . .PIPO/FEID CT
22b Not as above 23a

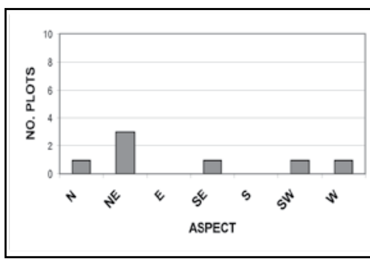
23a *Stipa occidentalis* (>1%) and not restricted to microsites . . .PIPO/STOC CT
23b Not as above . . . . .return to start of key and relax cover %

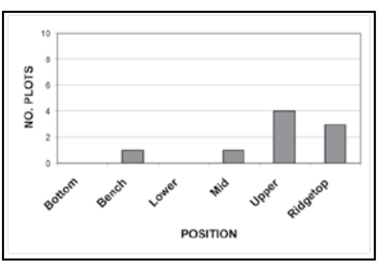
PIPO-CADE3/SYAL PIPO-CADE3 Dry

CPC731 (PIPO-CADE27/SYAL)
Pinus ponderosa-Calocedrus decurrens/Symphoricarpos albus
ponderosa pine-incense cedar/common snowberry
Plots 10

Distribution and Environment— PIPO-CADE3/SYAL is a minor type that represents the transition zone between PIPO/SYAL and PSME/SYAL or ABCO-ABGR/SYAL. It occurs from Beaver Creek on the Warm Springs Indian Reservation south to the Metolius River, and again from the Klamath River Canyon area along the California border, and scattered locations east of Klamath Falls from Bly Mountain to Quartz Mountain Pass. Average elevation is 3836 feet (range 2700-5700 feet). The plots east of Klamath Falls occur at higher elevations than the other sites included in the type. However, species compositions and precipitation are similar, and mean annual temperatures are a few degrees cooler than the rest of the plots. Average slope is 7% (range 1-22%). Many plots were found on a northeastern aspect. Slope positions are typically upper slopes to ridgetops.

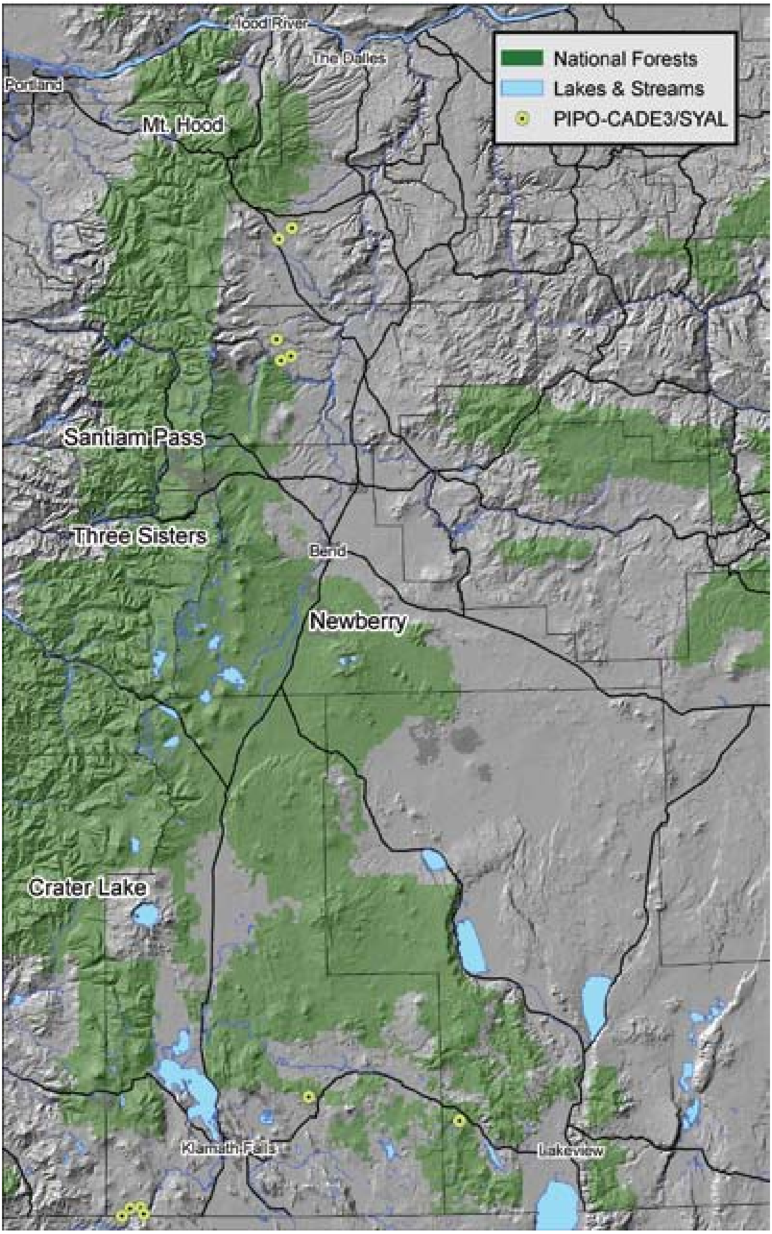






Mean Precip.	22.8”	19-27”
Mean Temp.	46.7°F	44-48°F

Figure 8-3. Map of PIPO-CADE3/SYAL Plot Distribution—



Vegetation— Overstory tree layers are dominated by ponderosa pine. Shrub layers are less diverse than the similar PIPO/SYAL associations. Increased cover of greenleaf manzanita (ARPA), snowbrush ceanothus (CEVE), or wax currant (RICE) may indicate past disturbance. Manzanita and ceanothus increase after fire disturbance and the currants are favored by mechanical disturbance. Herb layers have low cover. Common species are sweetroot (OSCH), arrowleaf balsamroot (BASA), and various graminoids such as Idaho fescue (FEID), squirreltail (SIHY), and Ross' sedge (CARO).

Codes	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
CADE3	*Calocedrus decurrens*	83%	83%	4.0	4.9
JUOC	*Juniperus occidentalis*	33%	83%	6.0	2.1
PIPO	*Pinus ponderosa*	100%	100%	33.0	9.3
Shrubs					
AMAL	*Amelanchier alnifolia*	83%		1.1	
ARPA	*Arctostaphylos patula*	33%		2.5	
BEAQ	*Berberis aquifolium*	50%		1.0	
CEPR	*Ceanothus prostratus*	50%		2.7	
PUTR	*Purshia tridentata*	83%		13.7	
RICE	*Ribes cereum*	33%		0.6	
SYAL	*Symphoricarpos albus*	100%		1.3	
Herbaceous					
BASA	*Balsamorhiza sagittata*	83%		4.5	
OSCH	*Osmorhiza chilensis*	33%		1.2	
WYMO	*Wyethia mollis*	33%		0.1	
Graminoids					
AGSP	*Agropyron spicatum*	33%		0.8	
CARO	*Carex rossii*	33%		1.0	
FEID	*Festuca idahoensis*	50%		2.3	
POSA	*Poa sandbergii*	33%		1.0	
SIHY	*Sitanion hystrix*	100%		0.9	
STOC	*Stipa occidentalis*	33%		1.4	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

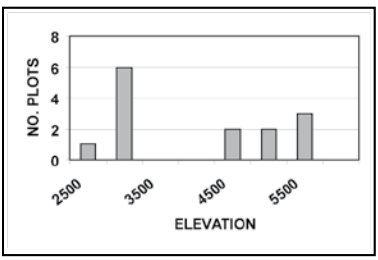
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PIPO-CADE3/SYAL							
CADE3	38		1	99	14	5	17
JUOC				96	6	6	
PILA				111		1	
PIPO	79		1	125	7	36	46

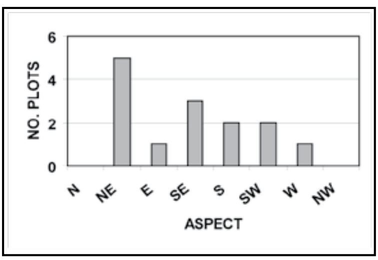
Relationships to Other Classifications— PIPO-CADE3/SYAL has not been previously described in the Pacific Northwest.

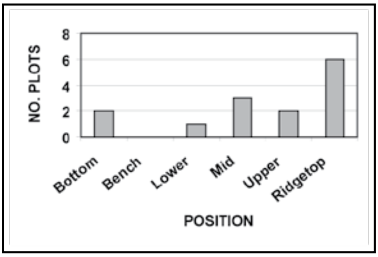
PIPO-CADE3/CEPR   PIPO-CADE3 Dry

CPC732 (PIPO-CADE27/CEPR)
Pinus ponderosa-Calocedrus decurrens/Ceanothus prostratus
ponderosa pine-incense cedar/mahala mat
Plots 14

Distribution and Environment— PIPO-CADE3/CEPR occurs from Fly Creek on the Deschutes National Forest north to Mill Creek on the Warm Springs Indian Reservation. The association is missing within the Mt. Mazama ash/pumice deposits. South of the Mazama deposits, PIPO-CADE3 occurs from Saddle Mountain east of Chiloquin to south of Dog Lake on the Winema-Fremont National Forest. Average elevation is 4297 feet (range 2930-5800 feet). Average slope is 10% (range 3-26%). Northeast aspects are most frequent. Positions are typically broad ridge tops to mid slopes.

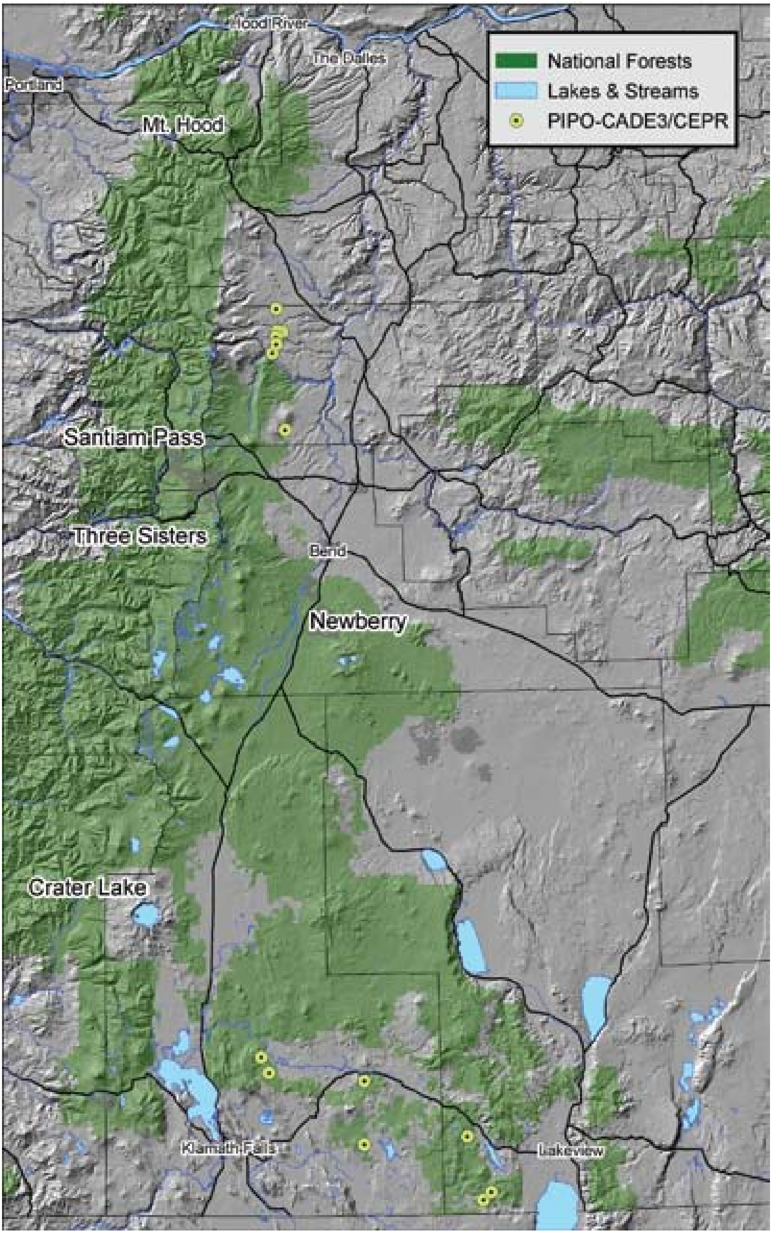






Mean Precip.	23.3”	15-27”
Mean Temp.	45.6°F	44-47°F

Figure 8-4. Map of PIPO-CADE3/CEPR Plot Distribution—



Vegetation— Overstory tree layers are dominated by ponderosa pine with lesser amounts of incense cedar. Western juniper is occasionally a component. Understory tree layers are a mixture of the three overstory tree species. Shrub layers are various mixtures of mahala mat (CEPR), greenleaf manzanita (ARPA), and bitterbrush (PUTR). Mahala mat and bitterbrush are always present and serviceberry (AMAL) is usually present at low coverage. Disturbed stands have increased cover of manzanita and snowbrush. Herb layers are dominated by graminoids. Squirreltail, Ross's sedge, western needlegrass, and Wheeler's bluegrass are the most common graminoid species. Arrowleaf balsamroot (BASA), heartleaf arnica (ARCO), and strawberry (FRVI or FRVE) are the only common forbs.

Codes	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
CADE3	*Calocedrus decurrens*	86%	79%	8.0	6.7
JUOC	*Juniperus occidentalis*	36%	21%	8.9	2.5
PIPO	*Pinus ponderosa*	100%	100%	28.9	7.9
Shrubs					
AMAL	*Amelanchier alnifolia*	71%		1.3	
ARPA	*Arctostaphylos patula*	79%		6.1	
CELE	*Cercocarpus ledifolius*	43%		3.4	
CEPR	*Ceanothus prostratus*	100%		6.5	
CEVE	*Ceanothus velutinus*	50%		0.9	
PUTR	Purshia tridentata	100%		8.5	
Herbaceous					
ARCO	*Arnica cordifolia*	21%		8.7	
BASA	*Balsamorhiza sagittata*	71%		3.4	
FRVE	Fragaria vesca	21%		1.0	
FRVI	*Fragaria virginiana*	29%		2.4	
WYMO	*Wyethia mollis*	36%		0.3	
Graminoids					
CARO	Carex rossii	64%		1.2	
FEID	*Festuca idahoensis*	57%		2.2	
PONE	*Poa nervosa*	21%		1.4	
SIHY	*Sitanion hystrix*	86%		2.7	
STOC	*Stipa occidentalis*	50%		1.8	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

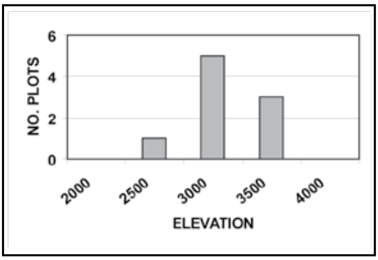
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PIPO-CADE3/CEPR							
CADE3	71		1	136	13	29	44
JUOC				98	10	11	
PIPO	68	2	26	146	5	176	46

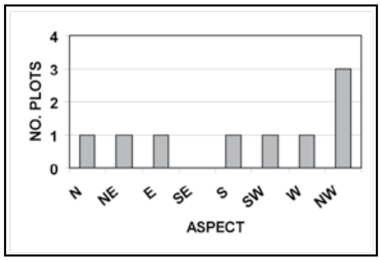
Relationships to Other Classifications— PIPO-CADE3/CEPR has not been previously described in the Pacific Northwest. It is similar to PIPO-CADE3/PUTR/BASA described for the Modoc Plateau by Smith (1994).

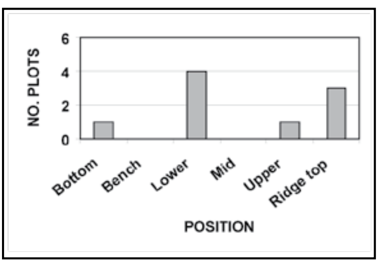
PIPO-CADE3/ARPA PIPO-CADE3 Dry

CPC733 (PIPO-CADE3/ARPA6)
Pinus ponderosa-Calocedrus decurrens/Arctostaphylos patula
ponderosa pine-incense cedar/greenleaf manzanita
Plots 9

Distribution and Environment— PIPO-CADE3/ARPA occurs from Black Butte north of Sisters to the Sidwalter Buttes area on the Warm Springs Indian Reservation. Average elevation is 3336 feet (2830-3600 feet). Average slope is 9% (range 1-41%). Aspects vary with the highest frequency on northwestern slopes. Positions also vary with lower slopes and broad ridgetops most common.

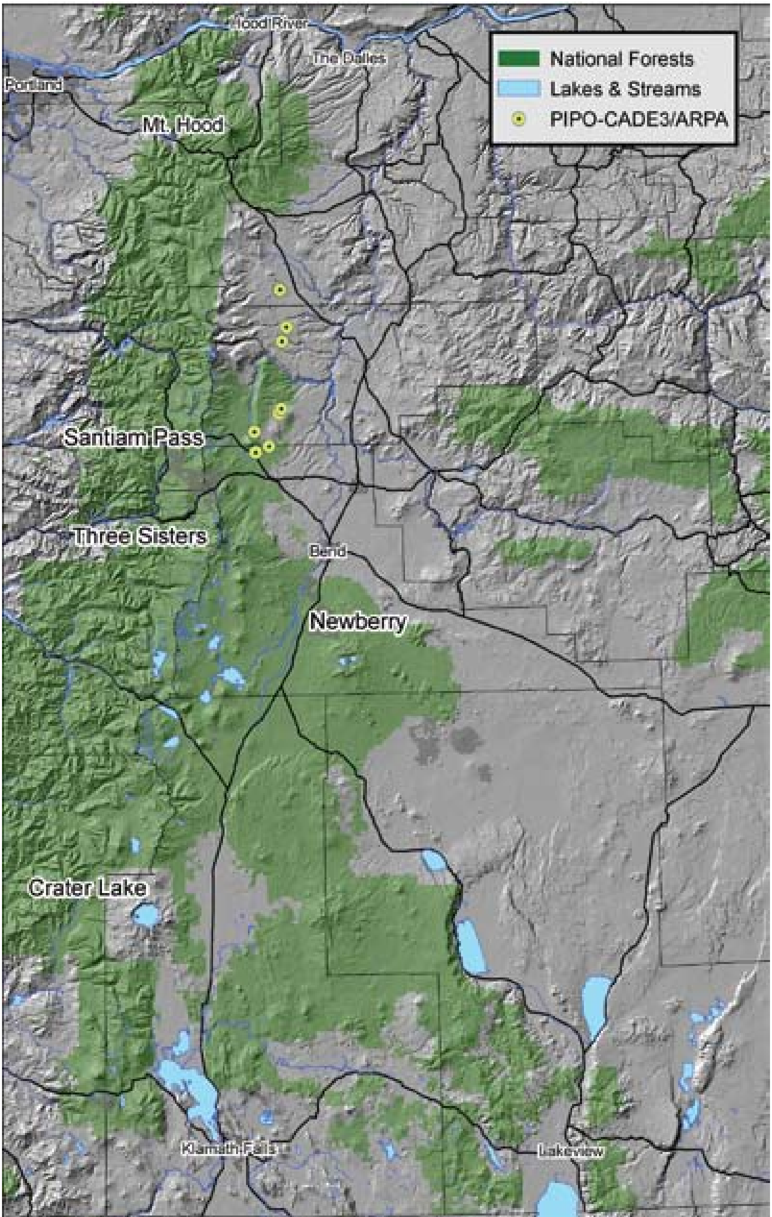






Mean Precip.	19.7”	15-23”
Mean Temp.	45.4°F	44-47°F

Figure 8-5. Map of PIPO-CADE3/ARPA Plot Distribution—



Vegetation— Tree overstory layers are dominated by various mixtures of ponderosa pine and incense cedar. Shrub layers are dominated by greenleaf manzanita (ARPA), snowbrush ceanothus (CEVE), and bitterbrush (PUTR). Herbaceous layers have low cover. The most common species are grasses (squirreltail and Idaho fescue) and upland sedges (CARO). The only herb with > 20% constancy is arrowleaf balsamroot (BASA).

Codes	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
CADE3	*Calocedrus decurrens*	22%	100%	7.2	3.0
JUOC	*Juniperus occidentalis*	11%	78%	4.0	0.7
PIPO	*Pinus ponderosa*	100%	100%	21.2	4.3
PSME	*Pseudotsuga menziesii*	0	22%	0	0.5
Shrubs					
AMAL	*Amelanchier alnifolia*	56%		0.8	
ARPA	*Arctostaphylos patula*	100%		3.8	
CEVE	*Ceanothus velutinus*	56%		4.5	
PUTR	*Purshia tridentata*	100%		21.8	
Herbaceous					
BASA	*Balsamorhiza sagittata*	44%		1.5	
Graminoids					
CARO	*Carex rossii*	67%		0.6	
FEID	*Festuca idahoensis*	78%		5.1	
POSA3	*Poa sandbergii*	22%		0.3	
SIHY	*Sitanion hystrix*	78%		0.5	
STOC	*Stipa occidentalis*	33%		0.4	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

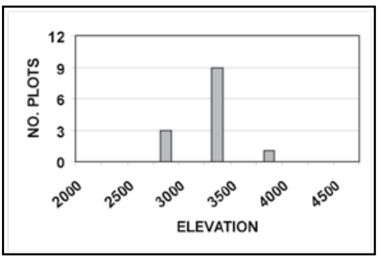
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PIPO-CADE3/ARPA							
CADE3				130	32	6	
PIPO	80	3	32	123	8	57	45

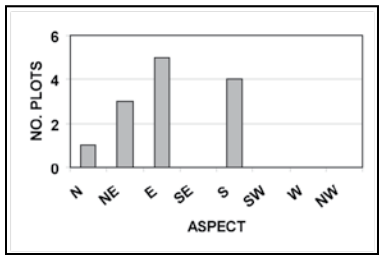
Relationships to Other Classifications— PIPO-CADE3/ARPA has not been previously described in the Pacific Northwest.

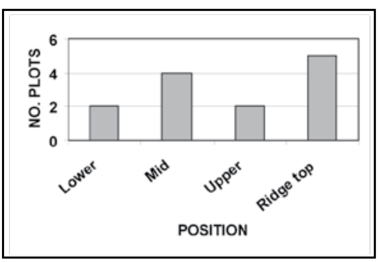
PIPO-CADE3/PUTR **PIPO-CADE3 Dry**

CPC734 (PIPO-CADE27/PUTR2)
Pinus ponderosa-Calocedrus decurrens/Purshia tridentata
ponderosa pine-incense cedar/bitterbrush
Plots 14

Distribution and Environment— PIPO-CADE3/PUTR is a minor type that occurs from Black Butte north to Sidwalter Buttes on the Warm Springs Indian Reservation. Average elevation is 3102 feet (range 2780-3565 feet). Average slope is 10% (1-43%). Many plots were found on an eastern aspect, while none were found on a western aspect.

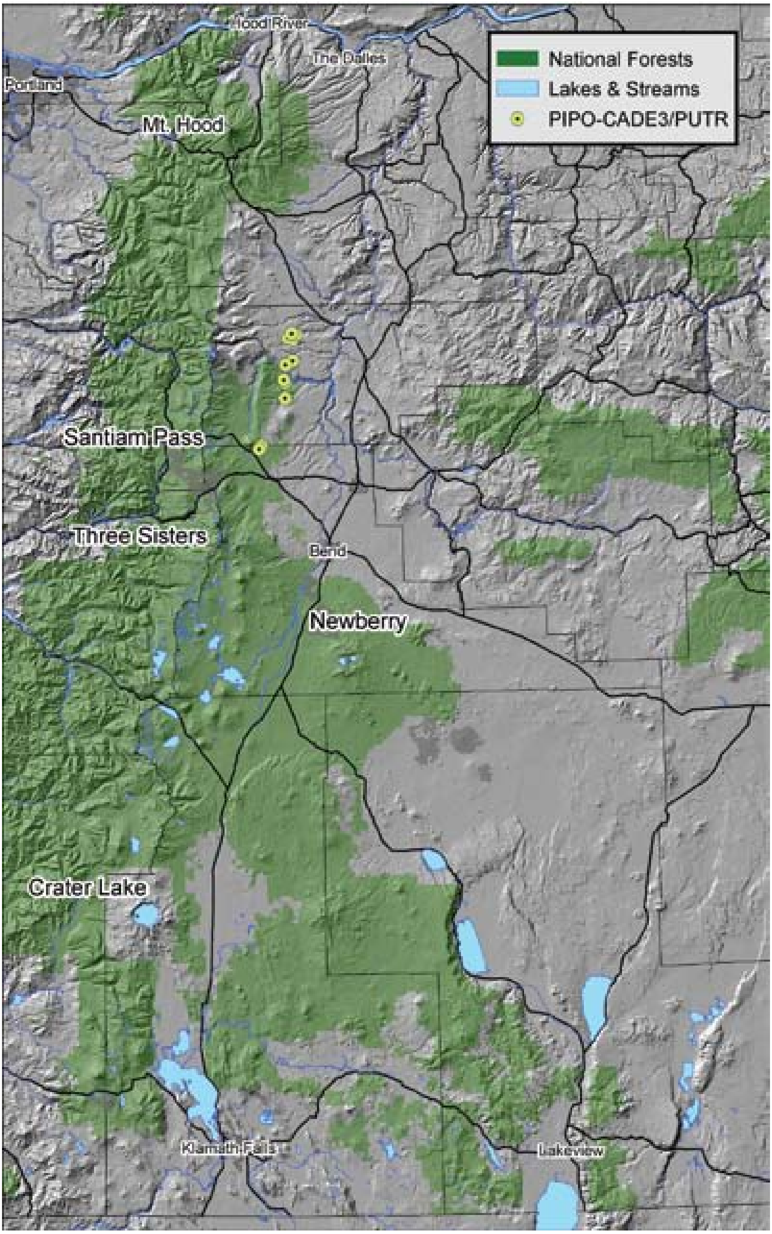






Mean Precip.	17.3”	13-21”
Mean Temp.	46.9°F	44-48°F

Figure 8-6. Map of PIPO-CADE3/PUTR Plot Distribution—



Vegetation— Ponderosa pine dominates the overstory tree layer. Incense cedar and occasionally western juniper (JUOC) are minor components. JUOC occurrence increases near sharp ecotones with drier sites. Shrub layers are dominated by bitterbrush, although, cover values are generally low. Presence of greenleaf manzanita (ARPA) at low cover may indicate sites transitional to PIPO-CADE3/ARPA plant associations. Green rabbitbrush (CHVI) is a disturbance indicator. Herbaceous layers are typically sparse; arrowleaf balsamroot (BASA), Ross' sedge (CARO), squirreltail (SIHY) and Idaho fescue (FEID) have constancies over 50%, but combined their cover averages only about 10%.

Codes	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
CADE3	*Calocedrus decurrens*	64%	100%	3.0	2.7
PIPO	*Pinus ponderosa*	93%	100%	31.1	4.1
Shrubs					
AMAL	*Amelanchier alnifolia*	43%		0.9	
ARPA	*Arctostaphylos patula*	29%		0.7	
CHVI	*Chrysothamnus viscidiflorus*	21%		1.0	
PUTR	*Purshia tridentata*	100%		19.4	
RICE	*Ribes cereum*	29%		1.9	
Herbaceous					
ANMI2	*Antennaria microphylla*	21%		1.0	
BASA	*Balsamorhiza sagittata*	71%		4.5	
Graminoids					
CARO	*Carex rossii*	57%		0.7	
FEID	*Festuca idahoensis*	100%		4.3	
SIHY	*Sitanion hystrix*	64%		1.1	
STOC	*Stipa occidentalis*	36%		0.7	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

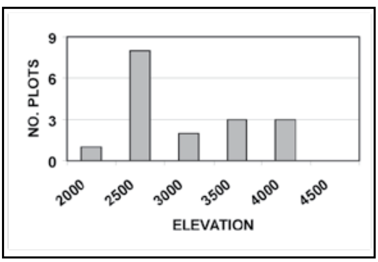
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PIPO-CADE3/PUTR							
CADE3	63		1	75	32	3	22
PIPO	95	1	18	106	6	41	46

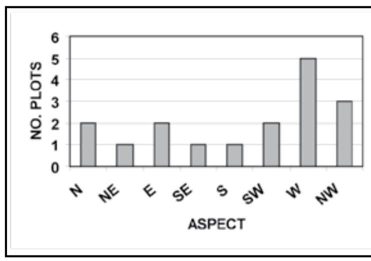
Relationships to Other Classifications— PIPO-CADE3/PUTR has not been previously described in the Pacific Northwest.

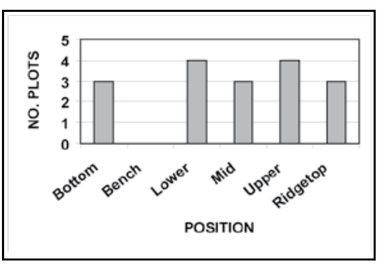
PIPO-QUGA/SYAL PIPO-QUGA Moist

CPH215 (PIPO-QUGA4/SYAL)
Pinus ponderosa-Quercus garryana/Symphoricarpos albus
ponderosa pine-Oregon white oak /common snowberry
Plots 17

Distribution and Environment— PIPO-QUGA/SYAL occurs from Fifteen Mile Creek west of Dufur south to the Mutton Mountains on the Warm Springs Indian Reservation. PIPO-QUGA/SYAL plots also occur in the Klamath River Canyon area west of Keno near the California border. Average elevation is 3191 feet (range 2200-4052 feet). Average slope is 8% (range 2-30%). Plot aspects varied with the highest frequencies on west to northwest slopes. PIPO-QUGA/SYAL plots occurred on all slope positions except benches.

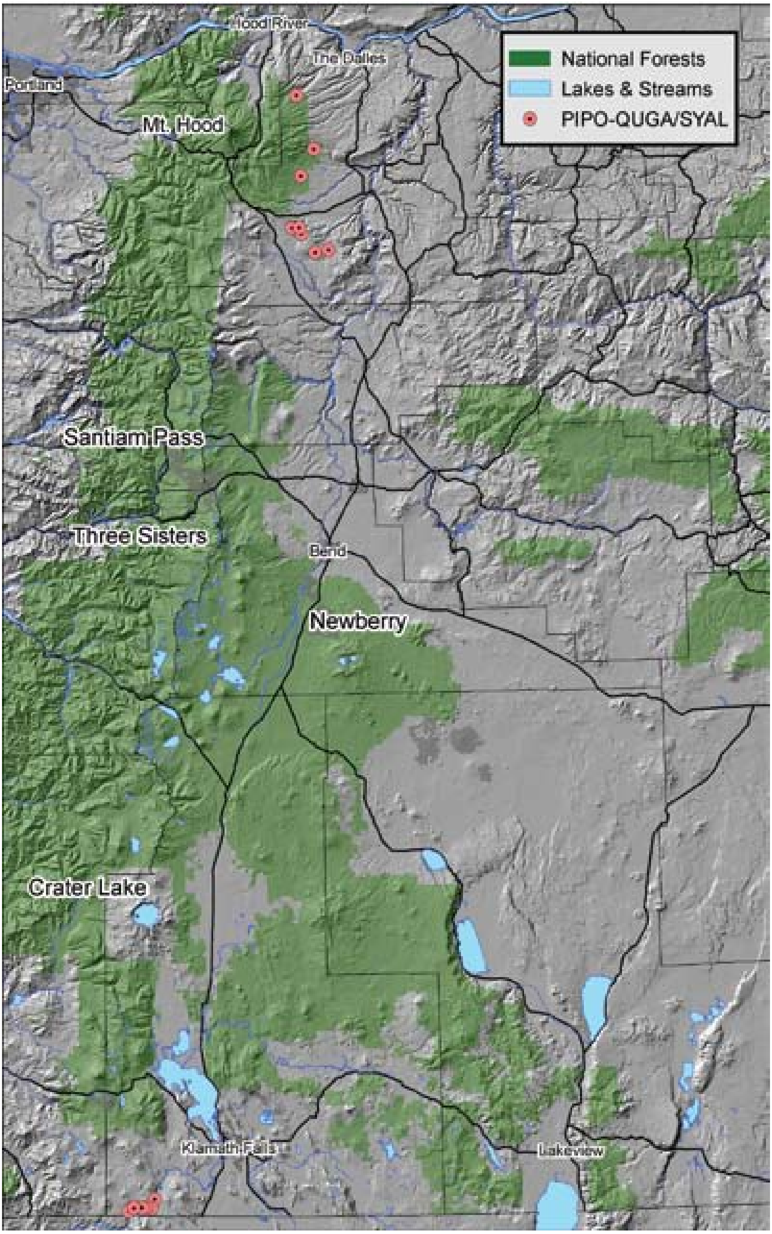






Mean Precip.	22.7”	19-27”
Mean Temp.	46.3°F	44-48°F

Figure 8-7. Map of PIPO-QUGA/SYAL Plot Distribution—



Vegetation— Overstory tree layers are dominated by ponderosa pine. Shrub layers are less diverse than the similar PIPO/SYAL and PIPO-CADE3/SYAL associations. Increased cover of greenleaf manzanita (ARPA), snowbrush ceanothus (CEVE), or wax currant (RICE) may indicate past disturbance. Sites with SYMO, CAGE, FEOC, and ELGL have greater effective moisture and may indicate transitions to the PSME Series. Ceanothus may increase after fire disturbance and wax currant is favored by mechanical disturbance. Herb layers have low cover. Common species are arrowleaf balsamroot (BASA), sweetroot (OSCH), and various graminoids such as western fescue (FEOC), squirreltail (SIHY), and Ross' sedge (CARO).

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
JUOC	*Juniperus occidentalis*	33	87	4.4	1.3
PIPO	*Pinus ponderosa*	93	87	39.1	3.1
QUGA	*Quercus garryana*	67	100	8.4	4.9
Shrubs					
AMAL	*Amelanchier alnifolia*	67%		1.2	
BEAQ	*Berberis aquifolium*	47%		1.0	
PUTR	*Purshia tridentata*	47%		3.3	
ROGY	*Rosa gymnocarpa*	27%		2.8	
SYAL	*Symphoricarpos albus*	100%		2.0	
SYMO	*Symphoricarpos mollis*	40%		1.0	
Herbaceous					
BASA	*Balsamorhiza sagittata*	60%		3.7	
FRVE	*Fragaria vesca*	33%		1.4	
OSCH	*Osmorhiza chilensis*	47%		1.1	
Graminoids					
CAGE	*Carex geyeri*	27%		1.3	
CARO	*Carex rossii*	20%		1.7	
ELGL	*Elymus glaucus*	33%		1.4	
FEID	*Festuca idahoensis*	20%		1.3	
FEOC	*Festuca occidentalis*	53%		1.9	
PONE	*Poa nervosa*	20%		1.0	
POPR	*Poa pratensis*	47%		1.9	
SIHY	*Sitanion hystrix*	87%		1.2	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

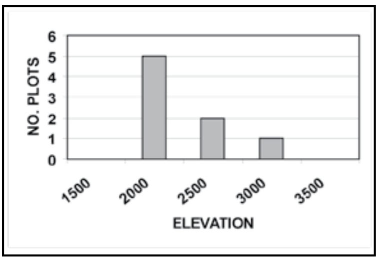
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PIPO-QUGA/SYAL							
PIPO				72		1	

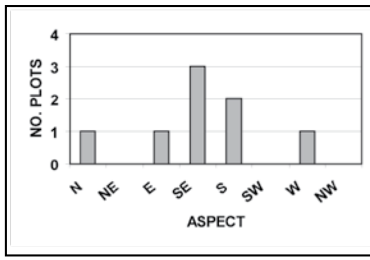
Relationships to Other Classifications— PIPO-QUGA/SYAL includes moister portions of PIPO-QUGA/PUTR described by Topik et al. (1988) for the eastside of Mt. Hood. Sites with snowberry (SYAL) and low cover of Douglas-fir will key here.

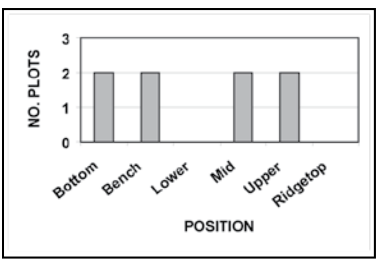
PIPO-QUGA/PUTR — PIPO-QUGA Dry

CPH212 (PIPO-QUGA4/PUTR2)
Pinus ponderosa-Quercus garryana/Purshia tridentata
ponderosa pine-Oregon white oak/bitterbrush
Plots 8

Distribution and Environment— PIPO-QUGA/PUTR occurs from Five Mile Creek northwest of Dufur, south to the Mutton Mountains on the Warm Springs Indian Reservation. Average elevation is 2540 feet (range 2050-3000 feet). Average slope is 14% (0-31 %). Although trends are difficult to assess with so few plots, most plots were found on south to southeast aspects. Slope positions are variable.

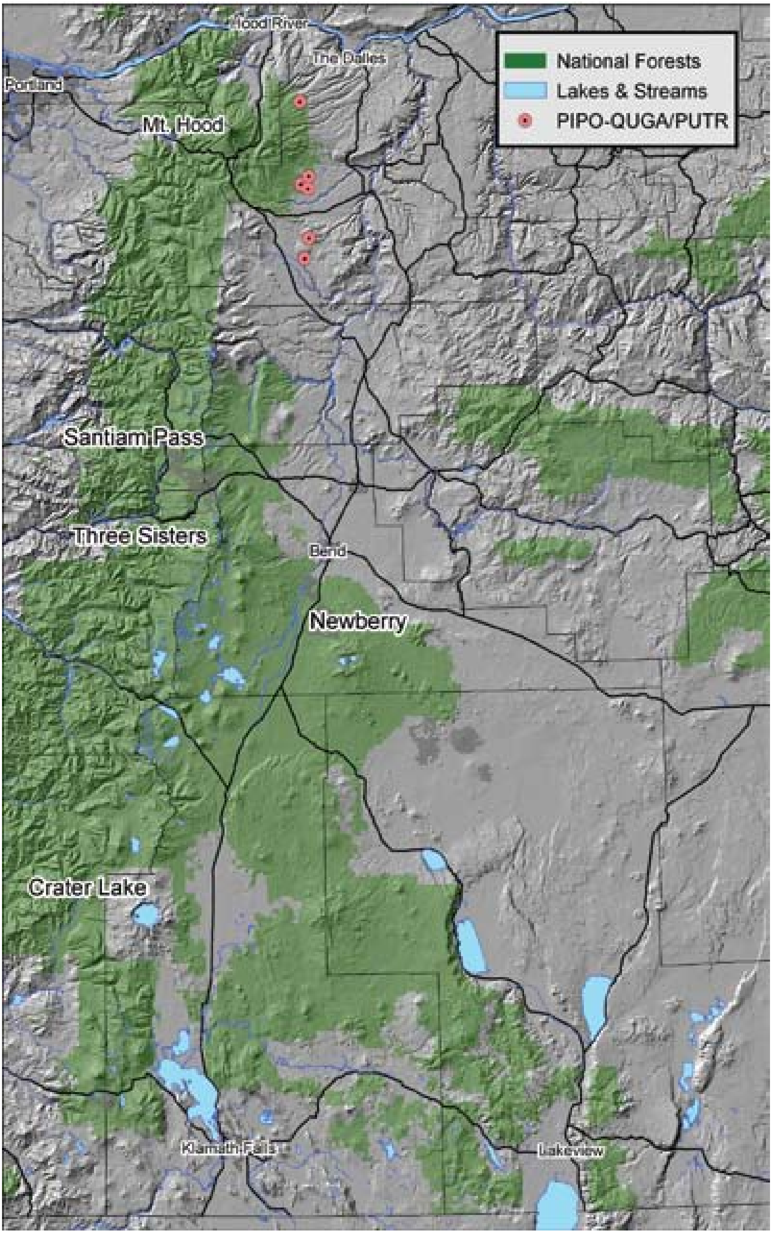






Mean Precip.	20.0”	19-31”
Mean Temp.	47.6°F	47-48°F

Figure 8-8. Map of PIPO-QUGA/PUTR Plot Distribution—



Vegetation— Ponderosa pine and Oregon white oak are always present in the tree layers. Western juniper is only present occasionally and at low cover. Bitterbrush (PUTR) dominates the shrub layer. Herbaceous layers are variable; only yellow hawkweed (HIAL2) occurs 50% of the time. The most common herbaceous species are arrowleaf balsamroot (BASA), bluebunch wheatgrass (AGSP), and Idaho fescue (FEID). Western fescue (FEOC) and mahala mat (CEPR) indicate sites with higher available moisture and may be transitional to the PSME Series.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
JUOC	*Juniperus occidentalis*	25	13	4.0	3.0
PIPO	*Pinus ponderosa*	100	63	28.1	2.8
QUGA	*Quercus garryana*	88	100	13.9	4.5
Shrubs					
AMAL	*Amelanchier alnifolia*	38%		1.7	
CEPR	*Ceanothus prostratus*	25%		1.0	
PUTR	*Purshia tridentata*	100%		6.7	
ROGY	*Rosa gymnocarpa*	25%		3.5	
Herbaceous					
BASA	*Balsamorhiza sagittata*	38%		7.3	
HIAL2	*Hieracium albertinum*	50%		1.8	
Graminoids					
AGSP	*Agropyron spicatum*	38%		9.0	
FEID	*Festuca idahoensis*	38%		8.7	
FEOC	*Festuca occidentalis*	25%		1.5	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

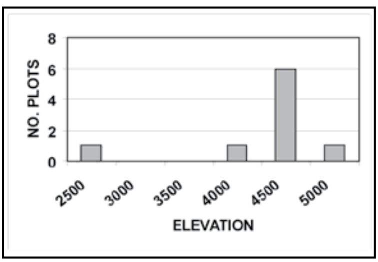
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PIPO-QUGA/PUTR							
PIPO				92	14	5	47

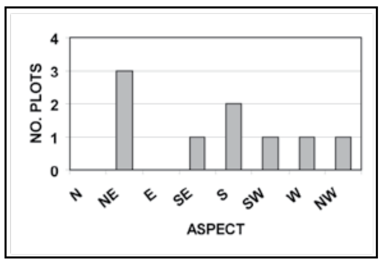
Relationships to Other Classifications— PIPO-QUGA/PUTR includes drier portions of PIPO-QUGA/PUTR described by Topik et al. (1988) for the eastside of Mt. Hood. Sites without snowberry (SYAL) and low cover of Douglas-fir will key here.

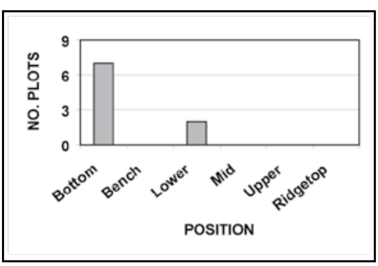
PIPO/SPDO — PIPO Moist

CPS541 (PIPO/SPDO)
Pinus ponderosa/Spiraea douglasii
ponderosa pine/Douglas spiraea
Plots 10

Distribution and Environment— PIPO/SPDO is a minor type that occurs from Mill Creek Flat on the Warm Springs Indian Reservation south at least to the Sprague River. Average elevation is 4471 feet (range 2625-5280 feet). The plot that represents the lowest elevation was located adjacent to a stream on the Warm Springs Indian Reservation and is disjunct from the majority of sites. The precipitation zone which supports the Ponderosa Pine Series occurs at much lower elevations here which may help explain the elevation outlier. Average slope is 4% (range 1-18%). Plot aspect varied. Slope positions are strongly associated with riparian stream bottoms. Most sites are at least seasonally sub-irrigated.

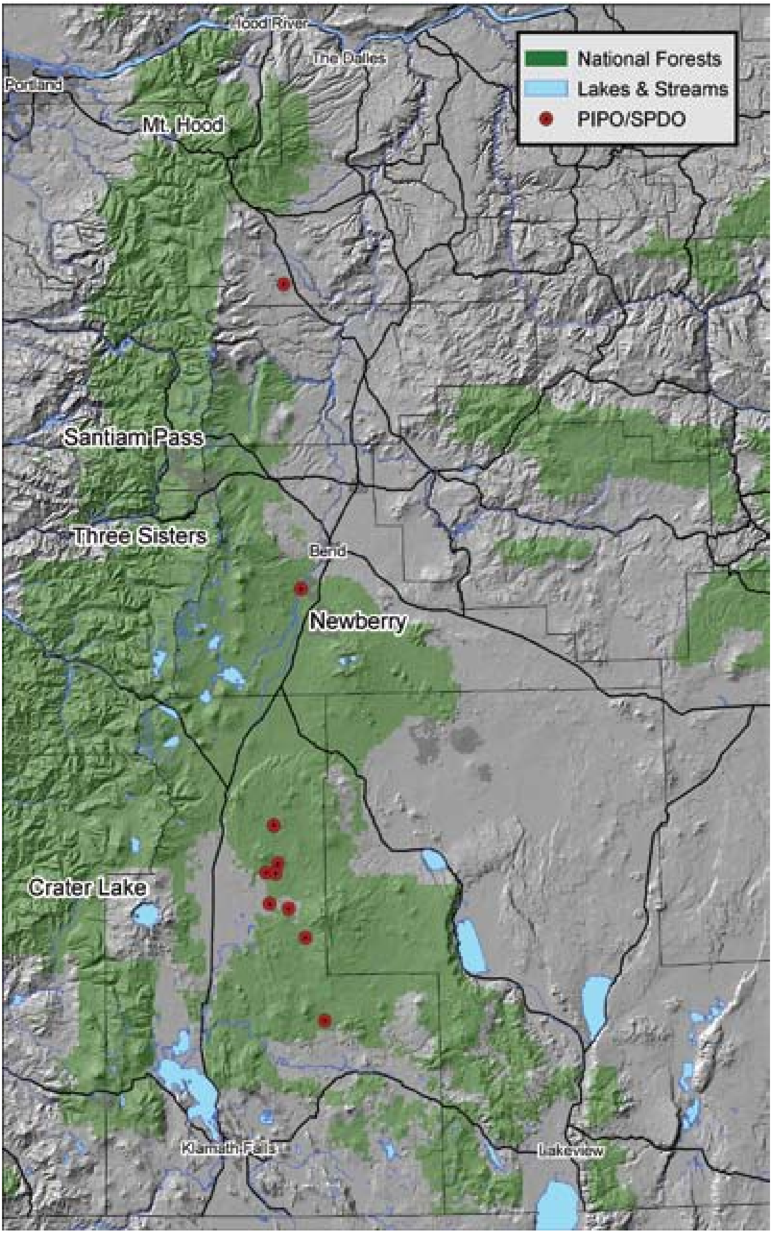






Mean Precip.	22.6”	17-35”
Mean Temp.	43.0°F	42-47°F

Figure 8-9. Map of PIPO/SPDO Plot Distribution—



Vegetation— Overstory tree layers are dominated by mixtures of ponderosa pine (PIPO), lodgepole pine (PICO), and aspen (POTR). Shrub layers are diverse. Douglas spiraea is always present, but may be joined by various mixtures of other moisture loving shrubs such as honeysuckle (LOIN), prickly currant (RILA), and Lemmon's willow (SALE). Herbaceous layers are quite variable with blue wildrye (ELGL), bluejoint reedgrass (CACA), strawberry (FRVI), and starry false solomon's seal (SMST) having the highest constancy and/or cover.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
PICO	*Pinus contorta*	80	40	14.0	10.5
PIPO	*Pinus ponderosa*	80	60	13.3	2.2
POTR	*Populus tremuloides*	50	40	27.6	3.0
Shrubs					
AMAL	*Amelanchier alnifolia*	50%		0.8	
ARUV	*Arctostaphylos uva-ursi*	50%		1.7	
LOIN	*Lonicera involucrata*	20%		1.6	
RILA	*Ribes lacustre*	20%		0.3	
ROGY	*Rosa gymnocarpa*	20%		5.1	
SALE	*Salix lemmonii*	20%		2.6	
SPDO	*Spiraea douglasii*	100%		4.9	
SYAL	*Symphoricarpos albus*	40%		7.5	
Herbaceous					
ACRU	*Actaea rubra*	30%		0.1	
FRVI	*Fragaria virginiana*	90%		2.3	
OSCH	*Osmorhiza chilensis*	20%		0.6	
SMST	*Smilacina stellata*	60%		0.3	
Graminoids					
CACA	*Calamagrostis canadensis*	50%		3.8	
CAEU	*Carex eurycarpa*	30%		8.0	
CARO	*Carex rossii*	20%		2.0	
ELGL	*Elymus glaucus*	70%		14.6	
POPR	*Poa pratensis*	30%		2.4	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PIPO/SPDO							
PICO	67	5	18	252	57	7	78
PIPO	90	12	4	30		1	13

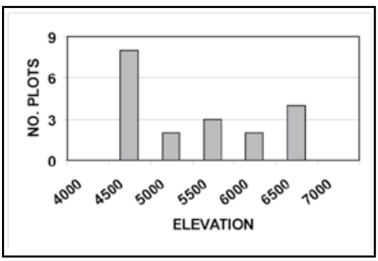
Relationships to Other Classifications— PIPO/SPDO has not been previously described in the Pacific Northwest. It has some affinities to the POTR/SYAL/FORB community type descried by Kovalchik (1987) with the addition of lodgepole pine (PICO).

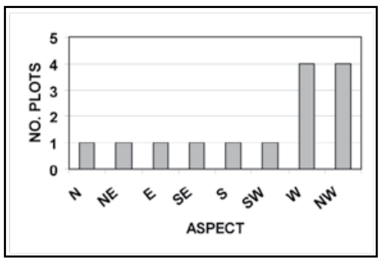
PIPO-POTR

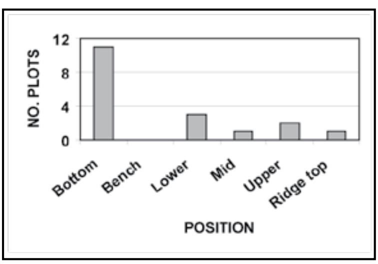
PIPO Moist

CPH312 (PIPO-POTR5)
Pinus ponderosa-Populus tremuloides
ponderosa pine-aspen
Plots 21

Distribution and Environment— PIPO-POTR associations occur on the Winema and Fremont National Forests. PIPO-POTR sites are known from the vicinity of Sugar Pine Mountain south to Chiloquin and east to the northern end of the Warner Mountains. Average elevation is 5514 feet (range 4500-6920 feet). Average slope is 8% (range 0-25%). Aspects are typically west to northwest facing slopes, although, all aspects have been sampled. Slope positions are typically stream bottoms, draws, or broad sub-irrigated flats.

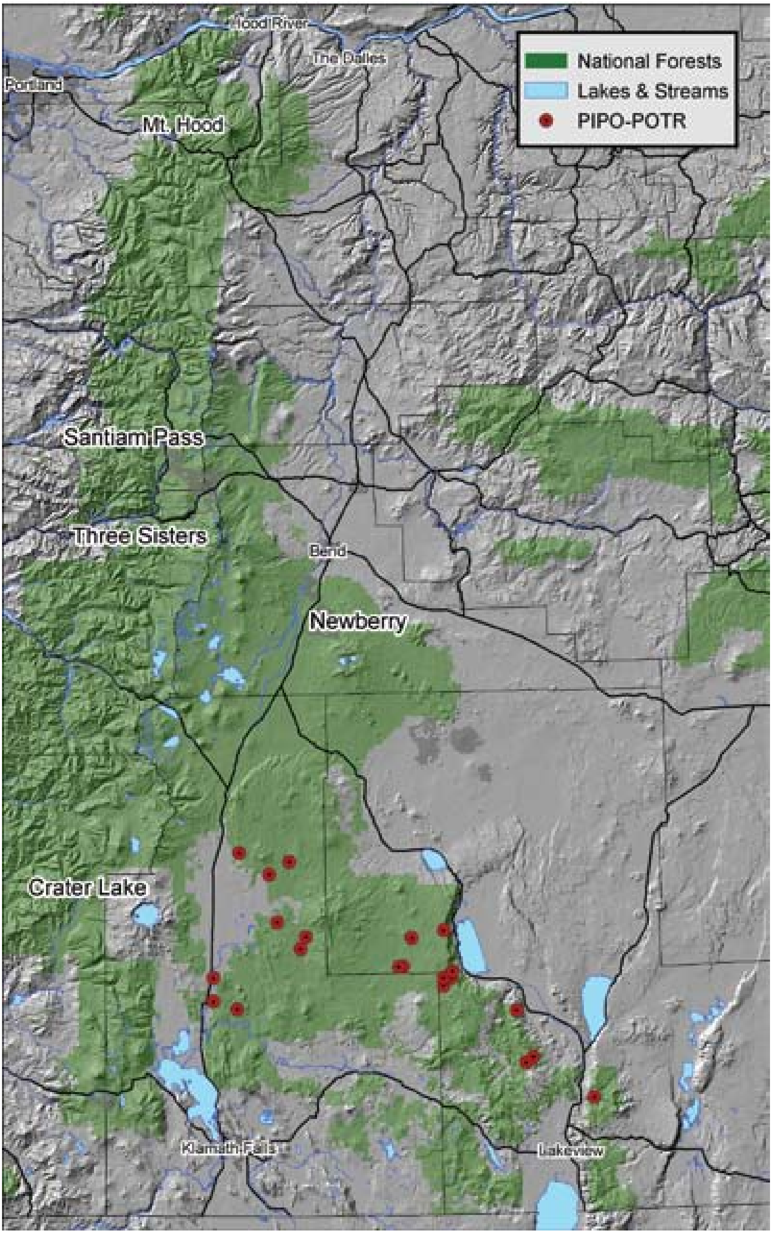






Mean Precip.	24.7”	21-29”
Mean Temp.	42.3°F	40-44°F

Figure 8-10. Map of PIPO-POTR Plot Distribution—



Vegetation— Overstory tree layers are dominated by mixtures of ponderosa pine (PIPO), lodgepole pine (PICO), and aspen (POTR). Shrub layers are diverse, but, in contrast to the PIPO/SPDO association, shrub layers are dominated by drier site shrubs such as mountain big sage (ARTR) and bitterbrush (PUTR). Herbaceous layers are sparse and usually dominated by graminoids. The most common species are strawberry (FRVI), squirreltail (SIHY), Wheeler's bluegrass (PONE), and western needlegrass (STOC).

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
PICO	*Pinus contorta*	52	33	13.7	5.2
PIPO	*Pinus ponderosa*	95	81	17.3	13.2
POTR	*Populus tremuloides*	76	76	27.4	6.0
Shrubs					
AMAL	*Amelanchier alnifolia*	48%		0.4	
ARTR	*Artemisia tridentata*	67%		11.4	
CELE	*Cercocarpus ledifolius*	24%		3.9	
PUTR	*Purshia tridentata*	43%		6.6	
RICE	*Ribes cereum*	43%		1.5	
ROGY	*Rosa gymnocarpa*	29%		0.7	
SYAL	*Symphoricarpos albus*	29%		2.3	
Herbaceous					
FRVI	*Fragaria virginiana*	62%		1.2	
Graminoids					
CAIN4	*Carex inops*	38%		4.7	
CARO	*Carex rossii*	38%		0.8	
FEID	*Festuca idahoensis*	29%		3.0	
PONE	*Poa nervosa*	48%		6.4	
POSA3	*Poa sandbergii*	29%		1.0	
SIHY	*Sitanion hystrix*	67%		1.4	
STOC	*Stipa occidentalis*	52%		2.0	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PIPO-POTR							
PICO	69	11	4	130	9	38	41
PIPO	78	3	22	179	8	134	64
POTR				131	30	6	

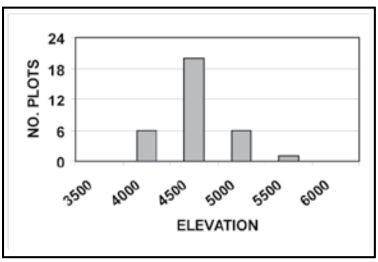
Relationships to Other Classifications— PIPO-POTR has not been previously described in the Pacific Northwest. Hopkins (1979a) defined a PIPO-POTR/PONE for the Fremont National Forest which would key here. PIPO-POTR has some affinities to the POTR/SYAL/FORB and PIPO/SYAL community types described by Kovalchik (1987) with the addition of lodgepole pine (PICO). The type as described here is drier at least at the soil surface than the types described by Kovalchik.

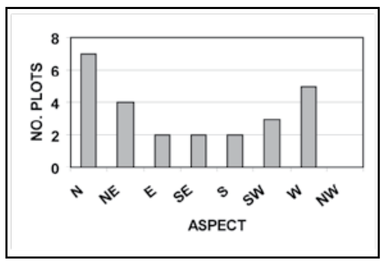
PIPO/ARUV

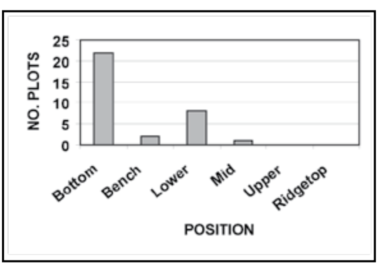
PIPO Moist

CPS641 (PIPO/ARUV)
Pinus ponderosa/Arctostaphylos uva-ursi
ponderosa pine/kinnikinnick
Plots 35

Distribution and Environment— PIPO/ARUV associations occur from Mt. Bachelor south to the lower Williamson River and east to the Sycan River. The type occurs on deep ash/pumice deposits from Mt. Mazama that have a perched water table within 5 feet of the surface during the growing season. Average elevation is 4682 feet (range 4300-5600 feet). Average slope is 2% (range 0-10%). Plot aspects varied. Slope positions are strongly associated with broad flats, stream bottoms, and draws.

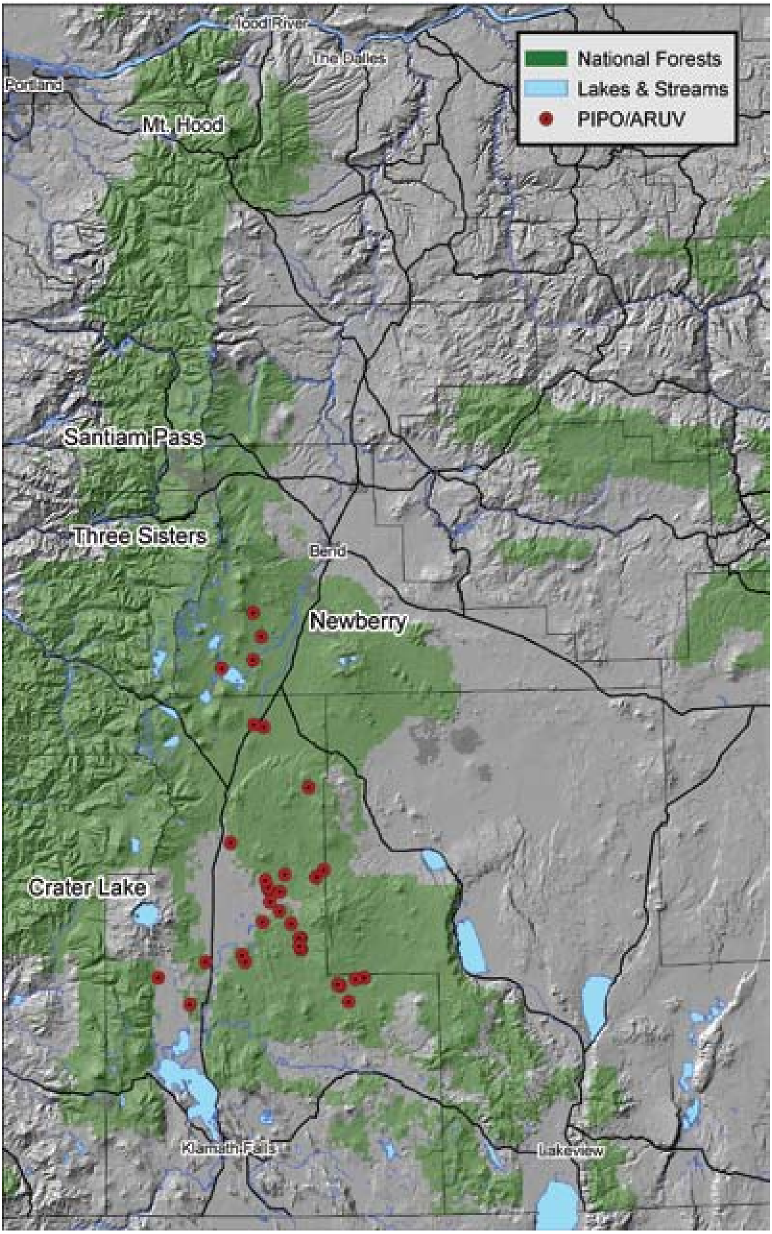






Mean Precip.	22.5”	19-31”
Mean Temp.	42.6°F	42-43°F

Figure 8-12. Map of PIPO/ARUV Plot Distribution—



Vegetation— Overstory tree layers typically have widely scattered ponderosa pine over lodgepole pine. Shrub layers are dominated by kinnikinnick (ARUV) and bitterbrush (PUTR). Snowbrush ceanothus (CEVE) is likely to increase after fire. Herbaceous layers are variable and have low cover in mid to late seral stands. Lupines (LULE2 and LUAR3) will increase with disturbance of the tree and shrub layers.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
PICO	*Pinus contorta*	89	54	19.7	13.0
PIPO	*Pinus ponderosa*	57	66	10.1	3.2
Shrubs					
AMAL	*Amelanchier alnifolia*	23%		0.1	
ARUV	*Arctostaphylos uva-ursi*	100%		13.1	
PUTR	*Purshia tridentata*	77%		7.4	
RICE	*Ribes cereum*	66%		1.1	
SPDO	*Spiraea douglasii*	20%		0.4	
Herbaceous					
FRVI	*Fragaria virginiana*	94%		1.1	
LULE2	*Lupinus lepidus*	23%		0.7	
Graminoids					
CARO	*Carex rossii*	54%		0.9	
FEID	*Festuca idahoensis*	37%		4.0	
SIHY	*Sitanion hystrix*	91%		0.7	
STOC	*Stipa occidentalis*	77%		1.2	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management— Sites have moderate productivity. Compaction is a hazard due to moist soils during the summer. Pocket gophers are common and will increase with disturbance as the forb layers (especially lupines) develop. Dwarf mistletoe is common in both ponderosa and lodgepole pines.

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PIPO/ARUV							
PICO	68	2	45	117	5	712	37
PIPO	78	7	8	145	9	65	52

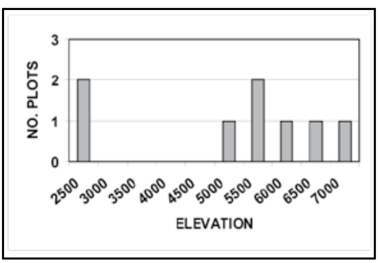
Relationships to Other Classifications— PIPO/ARUV has not been previously described in the Pacific Northwest. It is closely related to PICO/ARUV described by Volland (1985).

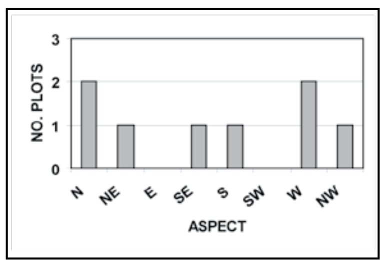
PIPO/SYMO

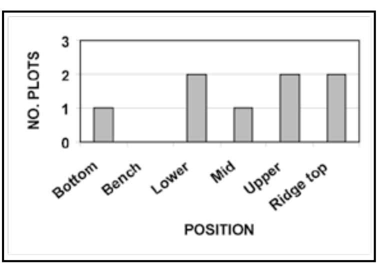
PIPO Moist

CPS542 (PIPO/SYMO)
Pinus ponderosa/Symphoricarpos mollis
ponderosa pine/creeping snowberry
Plots 8

Distribution and Environment— PIPO/SYMO occurs from lower Mill Creek on the Warm Springs Indian Reservation to just northeast of Gerber Reservoir on the Bly Ranger District. Average elevation is 5356 feet (range 2710-7080 feet). The Warm Springs plots are elevation outliers (2700-2900 feet), however, they occur in a precipitation zone similar to the Fremont National Forest plots which occur at much higher elevations. PIPO/SYMO associations do not occur on deep ash/pumice deposits from Mt. Mazama. Average slope is 8% (range 1-25%). Plot aspects and slope positions are variable.

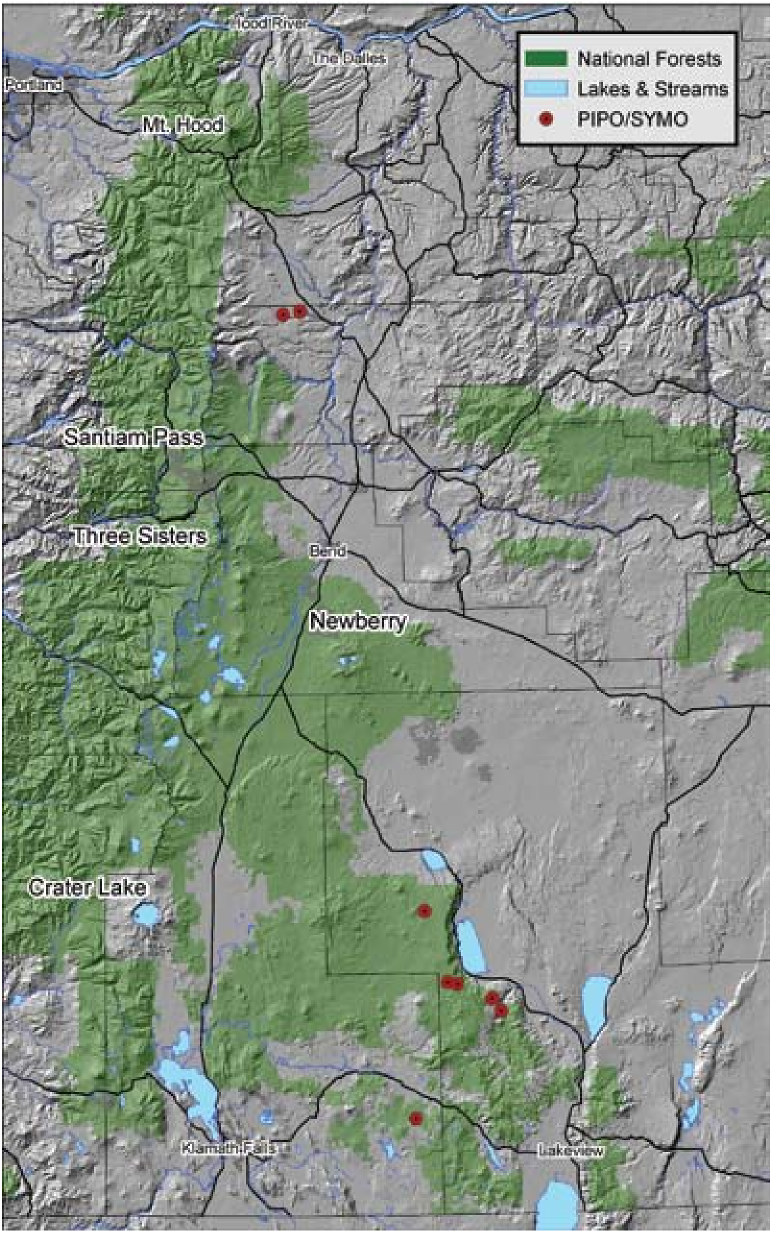






Mean Precip.	25.3”	19-31”
Mean Temp.	43.4°F	39-48°F

Figure 8-11. Map of PIPO/SYMO Plot Distribution—



Vegetation— Overstory tree layers are dominated by ponderosa pine (PIPO) with occasional lodgepole pine (PICO). Understory tree layers are usually dominated by PIPO with occasional low cover of white fir-grand fir (ABCO-ABGR). If ABCO-ABGR cover is greater than 5%, the site is likely transitional to the ABCO-ABGR Series. With disturbance, shrub cover may increase dramatically. Increased cover of snowbrush ceanothus, greenleaf manzanita, and bitterbrush are indicators of past disturbance. Herb layers are less diverse than in ABCO-ABGR/SYMO associations. The most common herbaceous species are strawberry (FRVI), white-flowered hawkweed (HIAL), Ross' sedge (CARO), Wheeler's bluegrass (PONE), and squirreltail (SIHY).

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABCO-ABGR	*Abies concolor*	-	25		0.5
PICO	*Pinus contorta*	38	25	1.3	10.3
PIPO	*Pinus ponderosa*	100	100	25.5	24.1
Shrubs					
AMAL	*Amelanchier alnifolia*	50%		1.4	
ARPA	*Arctostaphylos patula*	25%		3.0	
ARTR	*Artemisia tridentata*	63%		13.8	
BERE	*Berberis repens*	38%		3.8	
CELE	*Cercocarpus ledifolius*	25%		4.3	
PUTR	*Purshia tridentata*	50%		8.8	
RICE	*Ribes cereum*	75%		2.3	
ROGY	*Rosa gymnocarpa*	25%		3.0	
SYAL	*Symphoricarpos albus*	25%		1.0	
SYMO	*Symphoricarpos mollis*	100%		2.8	
Herbaceous					
ANMI2	*Antennaria microphylla*	25%		1.0	
BASA	*Balsamorhiza sagittata*	38%		1.2	
FRVI	*Fragaria virginiana*	63%		2.0	
HIAL	*Hieracium albiflorum*	63%		1.5	
Graminoids					
CAIN4	*Carex inops*	38%		4.7	
CARO	*Carex rossii*	63%		1.6	
FEID	*Festuca idahoensis*	38%		16.3	
PONE	*Poa nervosa*	75%		6.7	
SIHY	*Sitanion hystrix*	100%		5.9	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—Values in the table below were calculated from Hopkins' plot data, that is, not from individual tree data but from plot data previously calculated by Bill Hopkins. These values give a general idea of productivity, but should be used with caution. They were probably calculated using slightly different formulas than the SI and GBA in other plant associations.

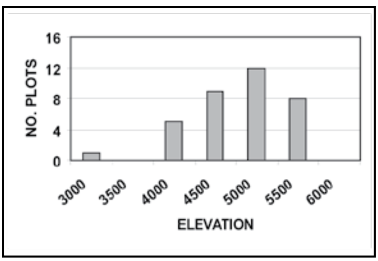
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PIPO/SYMO							
PIPO	78			165			59

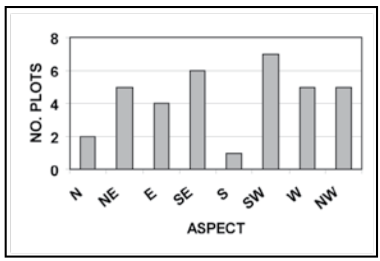
Relationships to Other Classifications— PIPO/SYMO has not been previously described in the Pacific Northwest. It has many affinities to PIPO/SYAL associations that have been widely described, but has more effective moisture than SYAL communities without creeping snowberry. It is similar to the ABCO-PIPO/SYAL/STJA association described by Hopkins (1979a) without white fir.

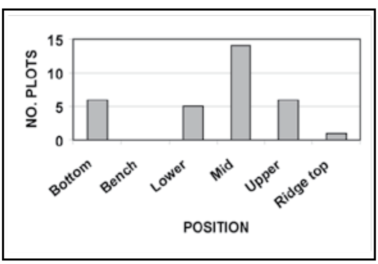
PIPO/CHUM — PIPO Moist

CPF141 (PIPO/CHUM)
Pinus ponderosa/Chimaphila umbellata
ponderosa pine/prince's pine
Plots 40

Distribution and Environment— PIPO/CHUM associations occur from Green Ridge on the Deschutes National Forest south to Crater Lake and east to the vicinity of Fuego and Yamsey Mountains. The type is predominantly found on Mt. Mazama ash/pumice deposits. Average elevation is 5039 feet (range 3100-5900 feet). Average slope is 9% (range 1-45%). Plot aspects varied. Slope positions are typically mid to lower slopes and broad flats.

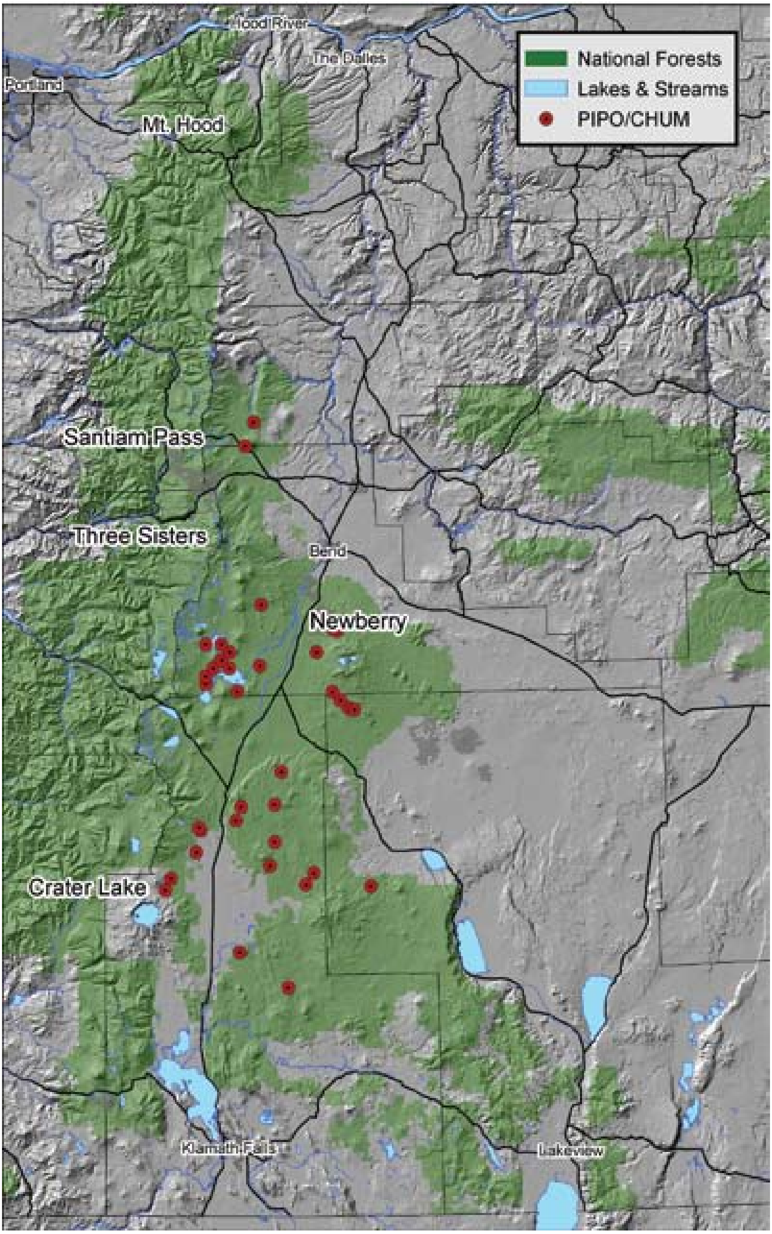






Mean Precip.	26.4"	19-43"
Mean Temp.	42.2°F	40-45°F

Figure 8-13. Map of PIPO/CHUM Plot Distribution—



Vegetation— Overstory tree layers are dominated by various mixtures of ponderosa and lodgepole pine. Both pines are usually present in regeneration layers. Shrub layers are dominated by snowbrush (CEVE), bitterbrush (PUTR), and greenleaf manzanita (ARPA). Herbaceous layers are poorly developed and graminoid dominated. The most common species are strawberry (FRVI), Ross' sedge (CARO), western needlegrass (STOC), and squirreltail (SIHY).

Code	Species Latin Name	% Constancy		% Cover	
Trees		Over	Regen	Over	Regen
PICO	*Pinus contorta*	80	80	11.3	5.4
PIPO	*Pinus ponderosa*	98	100	22.7	6.6
Shrubs					
ARPA	*Arctostaphylos patula*	85%		4.5	
CEVE	*Ceanothus velutinus*	65%		15.7	
CHUM	*Chimaphila umbellata*	100%		1.0	
PUTR	*Purshia tridentata*	95%		9.2	
RICE	*Ribes cereum*	38%		1.5	
Herbaceous					
FRVI	*Fragaria virginiana*	53%		1.6	
Graminoids					
CAIN4	*Carex inops*	40%		4.7	
CARO	*Carex rossii*	85%		0.8	
FEID	*Festuca idahoensis*	20%		2.5	
SIHY	*Sitanion hystrix*	63%		1.0	
STOC	*Stipa occidentalis*	83%		1.5	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PIPO/CHUM							
PICO	70	2	41	176	23	25	57
PIPO	86	2	106	122	8	101	48

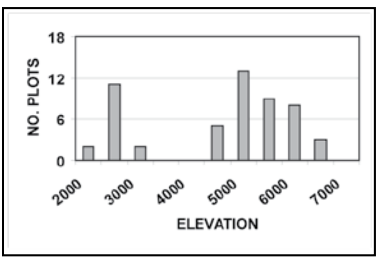
Relationships to Other Classifications— PIPO/CHUM has not been previously described in the Pacific Northwest. Volland (1985) originally described plots that would key here to PICO/CEVE-ARPA, PIPO/PUTR-CEVE/STOC, or ABCO/CEVE-ARPA. Volland's interpretation of the PICO/CEVE-ARPA type was that it represented a successional state seral to ponderosa pine or white fir following stand replacement fire. Some plots that he originally called ABCO/CEVE-ARPA have no white fir in the plot data. Sites in areas with mean annual precipitation > 30" are likely to be seral to White Fir Series; however, without any other evidence of white fir in the sampled stands, they are placed here.

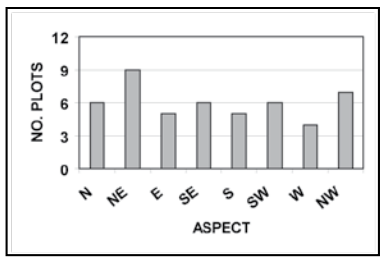
PIPO/SYAL

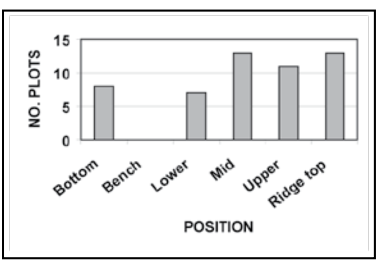
PIPO Dry

CPS524 (PIPO/SYAL)
Pinus ponderosa/Symphoricarpos albus
ponderosa pine/common snowberry
Plots 68

Distribution and Environment— PIPO/SYAL has a split distribution much like the analogous ABCO-ABGR/SYAL association. The association is absent in deep Mazama ash/pumice deposits. The northern plots occur at much lower elevations than plots south of the ash plume, however, the precipitation zone in which PIPO/SYAL occurs is very similar both north and south of the Mazama deposits. Average elevation is 4788 feet (range 2230-6900 feet). Average slope is 16% (range 1-60%). Plot aspects and plot slope positions are variable.

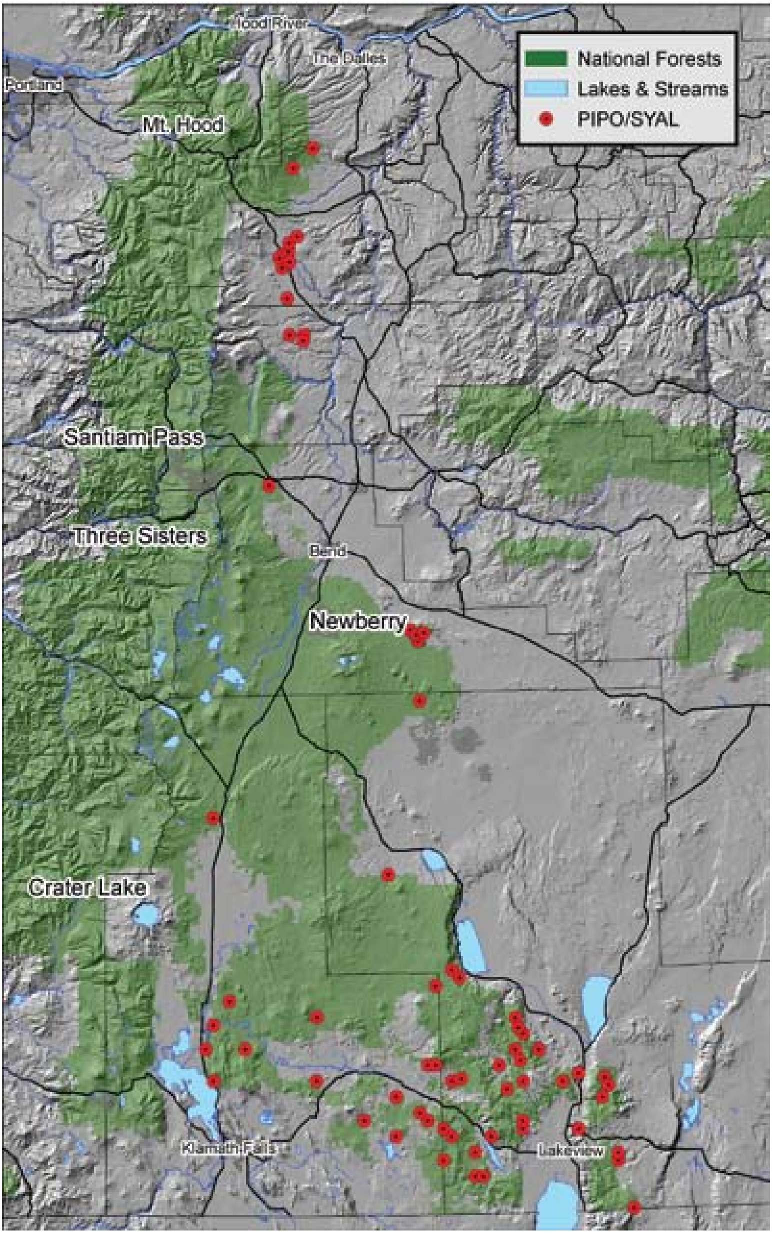






Mean Precip.	21.1”	11-29”
Mean Temp.	44.5°F	41-49°F

Figure 8-14. Map of PIPO/SYAL Plot Distribution—



Vegetation— Tree layers are dominated by ponderosa pine. Shrub layers are relatively diverse. Typically there are 4-5 species of shrubs on a given site. Total shrub cover averages 18%. Herbaceous layers are dominated by graminoids. The most common species are squirreltail (SIHY), Idaho fescue (FEID), and western needlegrass (STOC).

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
JUOC	*Juniperus occidentalis*	38	53	11.5	3.4
PIPO	*Pinus ponderosa*	96	84	27.2	7.0
Shrubs					
AMAL	*Amelanchier alnifolia*	54%		1.3	
ARPA	*Arctostaphylos patula*	37%		5.6	
ARTR	*Artemisia tridentata*	28%		5.3	
CELE	*Cercocarpus ledifolius*	44%		4.5	
CEVE	*Ceanothus velutinus*	22%		8.3	
PUTR	*Purshia tridentata*	68%		7.5	
RICE	*Ribes cereum*	35%		2.1	
ROGY	*Rosa gymnocarpa*	25%		1.0	
SYAL	*Symphoricarpos albus*	100%		1.5	
Herbaceous					
BASA	*Balsamorhiza sagittata*	29%		2.5	
FRVI	*Fragaria virginiana*	37%		1.0	
Graminoids					
AGSP	*Agropyron spicatum*	41%		1.9	
CARO	*Carex rossii*	57%		0.8	
FEID	*Festuca idahoensis*	62%		4.8	
PONE	*Poa nervosa*	44%		2.7	
POSA3	*Poa sandbergii*	41%		0.7	
SIHY	*Sitanion hystrix*	87%		1.7	
STOC	*Stipa occidentalis*	59%		0.6	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PIPO/SYAL							
JUOC				110	7	87	
PICO	76	4	2	132	16	10	46
PIPO	74	1	87	121	2	413	41

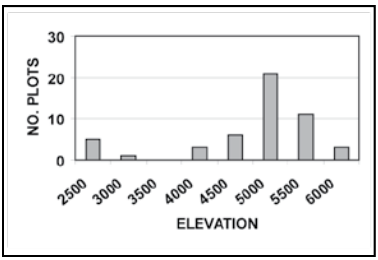
Relationships to Other Classifications— PIPO/SYAL has been previously described for the Blue and Ochoco Mountains (Johnson and Clausnitzer 1992), Wallowa Mountains (Johnson and Simon 1987), northern Idaho (Cooper et al. 1987), Columbia Gorge (Diaz and Mellen 1996), and riparian zones of central Oregon (Kovalchik 1987). The type as described here is slightly drier than the variants listed above.

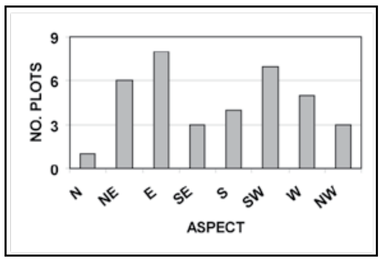
PIPO/CEPR

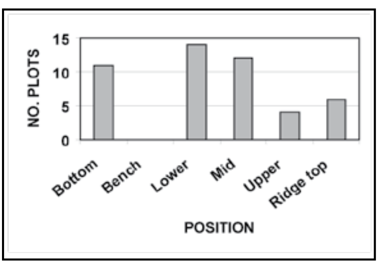
PIPO Dry

CPS341 (PIPO/CEPR)
Pinus ponderosa/Ceanothus prostratus
ponderosa pine/mahala mat
Plots 59

Distribution and Environment— PIPO/CEPR has a split distribution much like the analogous ABCO-ABGR/CEPR association. The association is absent in deep Mazama ash/pumice deposits. The northern plots occur at much lower elevations than plots south of the ash plume, however, the precipitation zone where PIPO/CEPR occurs is very similar both north and south of the Mazama deposits. Average elevation is 4956 feet (range 2700-6200 feet). Average slope is 8% (range 0-25%). Plot aspects varied.

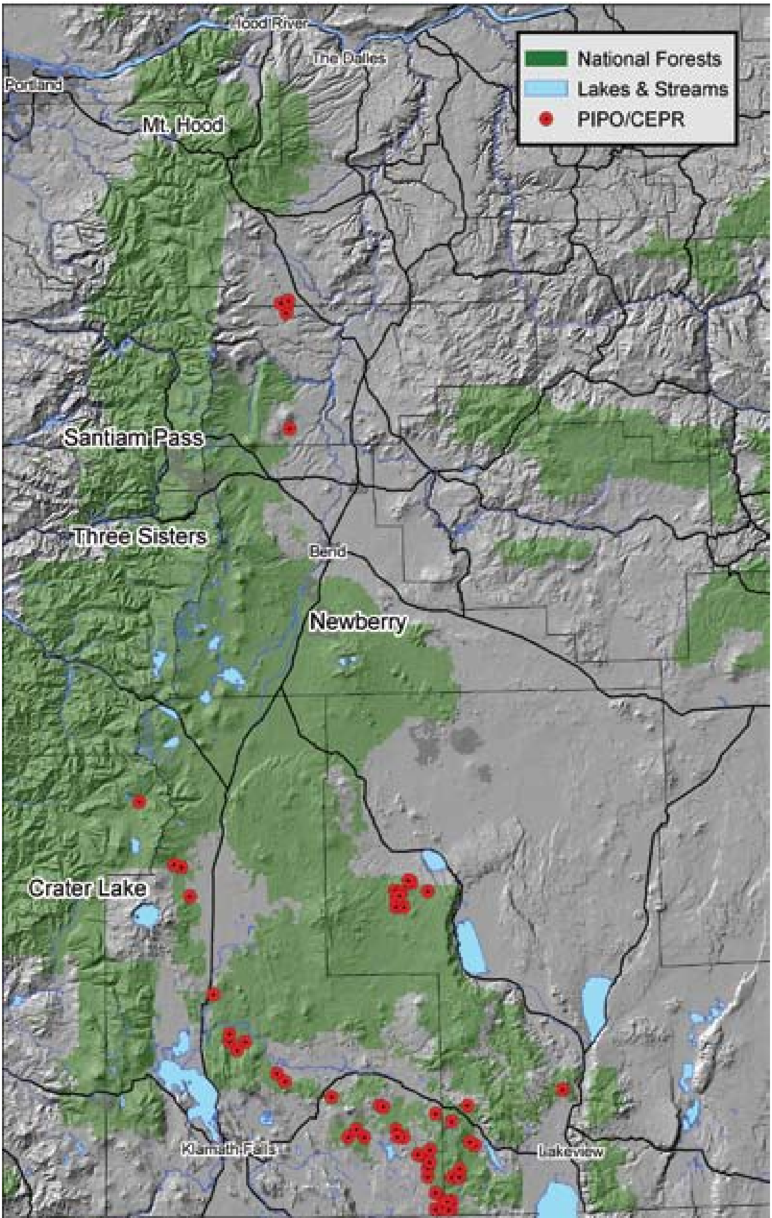






Mean Precip.	22.4”	15-37”
Mean Temp.	44.5°F	41-48°F

Figure 8-15. Map of PIPO/CEPR Plot Distribution—



Vegetation— Tree layers are dominated by ponderosa pine. Western juniper is an occasional component. It is most common on sites adjacent to non-forest or juniper woodland communities. Shrub layers are various mixtures of mahala mat (CEPR), greenleaf manzanita (ARPA), mountain mahogany (CELE), and bitterbrush (PUTR). Disturbed stands have increased cover of manzanita and snowbrush ceanothus. Herb layers are dominated by graminoids. Squirreltail, Ross' sedge, western needlegrass, and Wheeler's bluegrass are the most common graminoid species. Heartleaf arnica, and blueleaf strawberry are the most common forbs.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
JUOC	Juniperus occidentalis	43	60	10.7	3.9
PIPO	*Pinus ponderosa*	95	86	24.6	10.5
Shrubs					
AMAL	*Amelanchier alnifolia*	53%		2.2	
ARAR	Artemisia arbuscula	26%		3.9	
ARPA	*Arctostaphylos patula*	60%		2.1	
ARTR	*Artemisia tridentata*	21%		2.8	
CELE	*Cercocarpus ledifolius*	47%		4.9	
CEPR	*Ceanothus prostratus*	100%		4.7	
CEVE	*Ceanothus velutinus*	29%		4.7	
PUTR	*Purshia tridentata*	84%		7.6	
Herbaceous					
BASA	*Balsamorhiza sagittata*	33%		4.7	
FRVI	*Fragaria virginiana*	53%		2.1	
WYMO	*Wyethia mollis*	34%		4.6	
Graminoids					
CARO	*Carex rossii*	81%		1.9	
FEID	*Festuca idahoensis*	71%		6.7	
PONE	*Poa nervosa*	45%		2.7	
POSA3	*Poa sandbergii*	43%		0.9	
SIHY	*Sitanion hystrix*	93%		1.9	
STOC	*Stipa occidentalis*	64%		1.1	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

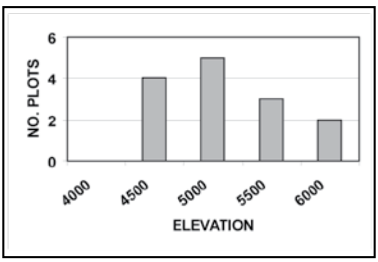
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PIPO/CEPR							
JUOC				78	6	39	
PICO				216	11	10	
PIPO	73	2	73	120	3	478	40

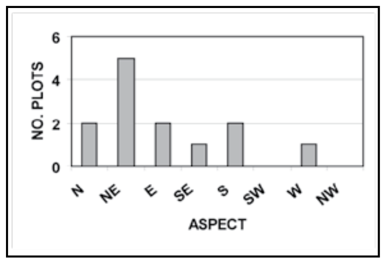
Relationships to Other Classifications— PIPO/CEPR has not been previously described in the Pacific Northwest. It is similar to PIPO/AMAL-BERE/ARCO association described by Smith (1994) for the Modoc Plateau and southern Warner Mountains in California. Moister portions of Hopkins' (1979a) PIPO/WYMO will key here.

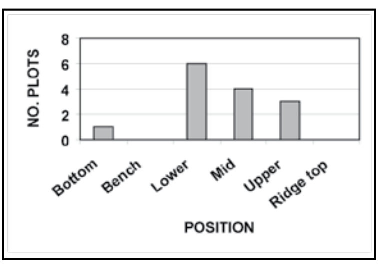
PIPO/WYMO PIPO Dry

CPF111 (PIPO/WYMO)
Pinus ponderosa/Wyethia mollis
ponderosa pine/woolly wyethia
Plots 17

Distribution and Environment— PIPO/WYMO occurs on the Winema and Fremont National Forests south and east of the Mazama ash plume. Average elevation is 5360 feet (range 4700-6500 feet). Average slope is 14% (range 3-30%). Plot aspects varied. The highest frequency occurs on northeast slopes. Slope positions are typically mid to lower slopes.

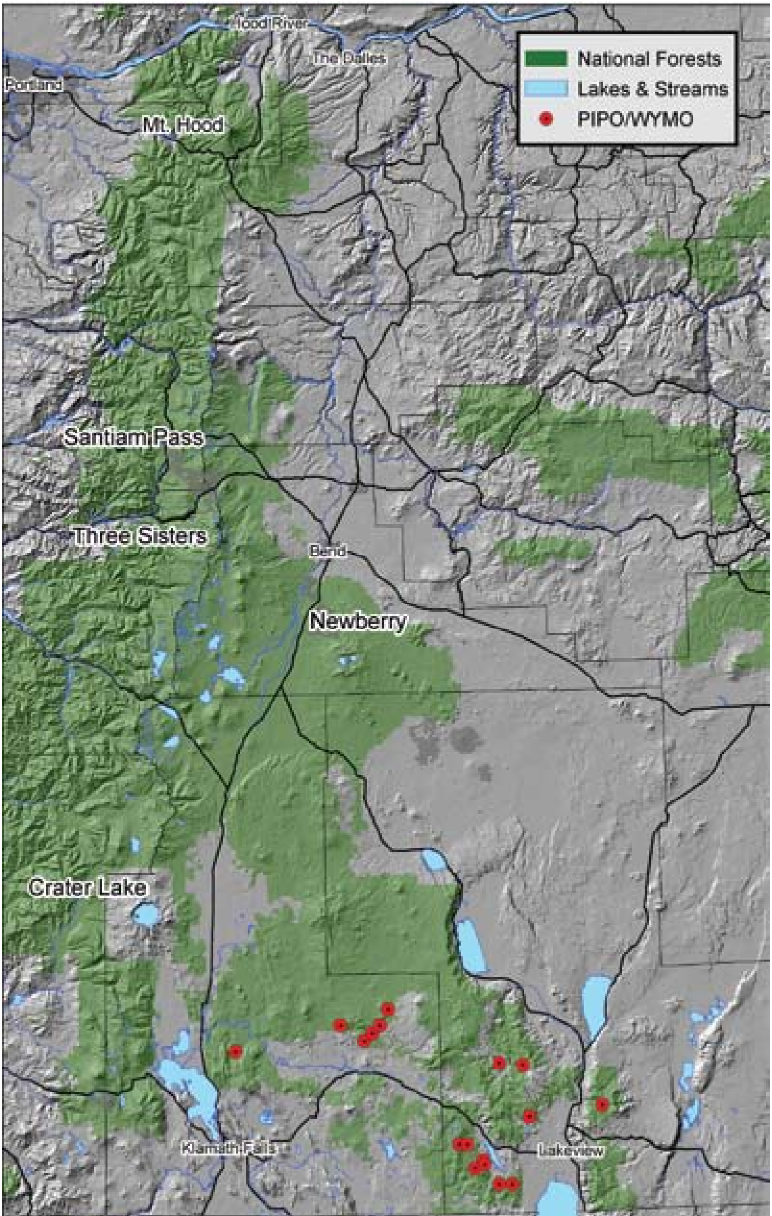






Mean Precip.	22.6”	19-29”
Mean Temp.	44.0°F	41-45°F

Figure 8-16. Map of PIPO/WYMO Plot Distribution—



Vegetation— Tree layers are dominated by ponderosa pine. Western juniper is a component especially on sites adjacent to non-forest or juniper woodland communities. Shrub layers are various mixtures of greenleaf manzanita (ARPA), mountain mahogany (CELE), and bitterbrush (PUTR). Disturbed stands have increased cover of manzanita and snowbrush ceanothus. Herb layers are dominated by graminoids. Squirreltail (SIHY), Ross's sedge (CARO), western needlegrass (STOC), and Wheeler's bluegrass (PONE) are the most common graminoid species. Woolly wyethia (WYMO), heartleaf arnica (ARCO), and blueleaf strawberry (FRVI) are the most common forbs.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
JUOC	*Juniper occidentalis*	41	59	8.5	4.5
PIPO	*Pinus ponderosa*	94	88	20.0	11.4
Shrubs					
AMAL	*Amelanchier alnifolia*	47%		0.5	
ARAR	*Artemisia arbuscula*	29%		14.0	
ARPA	*Arctostaphylos patula*	35%		1.4	
ARTR	*Artemisia tridentata*	29%		4.7	
CELE	*Cercocarpus ledifolius*	47%		3.9	
CEVE	*Ceanothus velutinus*	29%		1.0	
PUTR	*Purshia tridentata*	82%		6.2	
ROGY	*Rosa gymnocarpa*	24%		0.9	
Herbaceous					
ARCO	*Arnica cordifolia*	29%		7.2	
FRVI	*Fragaria virginiana*	59%		1.1	
WYMO	*Wyethia mollis*	100%		5.5	
Graminoids					
AGSP	*Agropyron spicatum*	24%		0.6	
CARO	*Carex rossii*	82%		1.9	
FEID	*Festuca idahoensis*	76%		3.0	
PONE	*Poa nervosa*	35%		2.1	
POSA3	*Poa sandbergii*	53%		0.3	
SIHY	*Sitanion hystrix*	94%		1.6	
STOC	*Stipa occidentalis*	82%		1.0	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PIPO/WYMO							
JUOC				39	2	10	
PICO				60	6	2	
PIPO	79	3	21	95	3	150	35

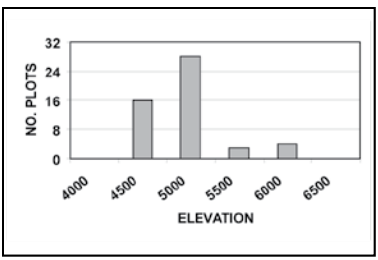
Relationships to Other Classifications— PIPO/WYMO has been previously described for south-central Oregon by Hopkins (1979b). Plots with mahala mat (CEPR) will key to PIPO/CEPR in this classification, otherwise the type as described here is essentially the same as described by Hopkins.

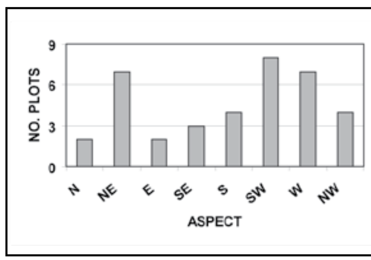
PIPO/CELE

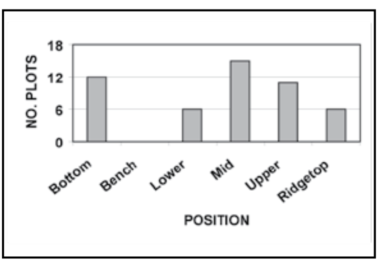
PIPO Dry

CPS325 (PIPO/CELE3)
Pinus ponderosa/Cercocarpus ledifolius
ponderosa pine/curl-leaf mountain mahogany
Plots 62

Distribution and Environment— PIPO/CELE predominantly occurs south and east of the Mt. Mazama ash/pumice deposits. Sites within the plume occur on residual soils. These are sites that did not retain the volcanic ash and pumice due to wind or water redistribution. Average elevation is 5185 feet (range 4500-6410 feet). Average slope is 15% (range 1-46%). Plot aspects varied. Slope positions are typically mid to upper slopes or broad flats.

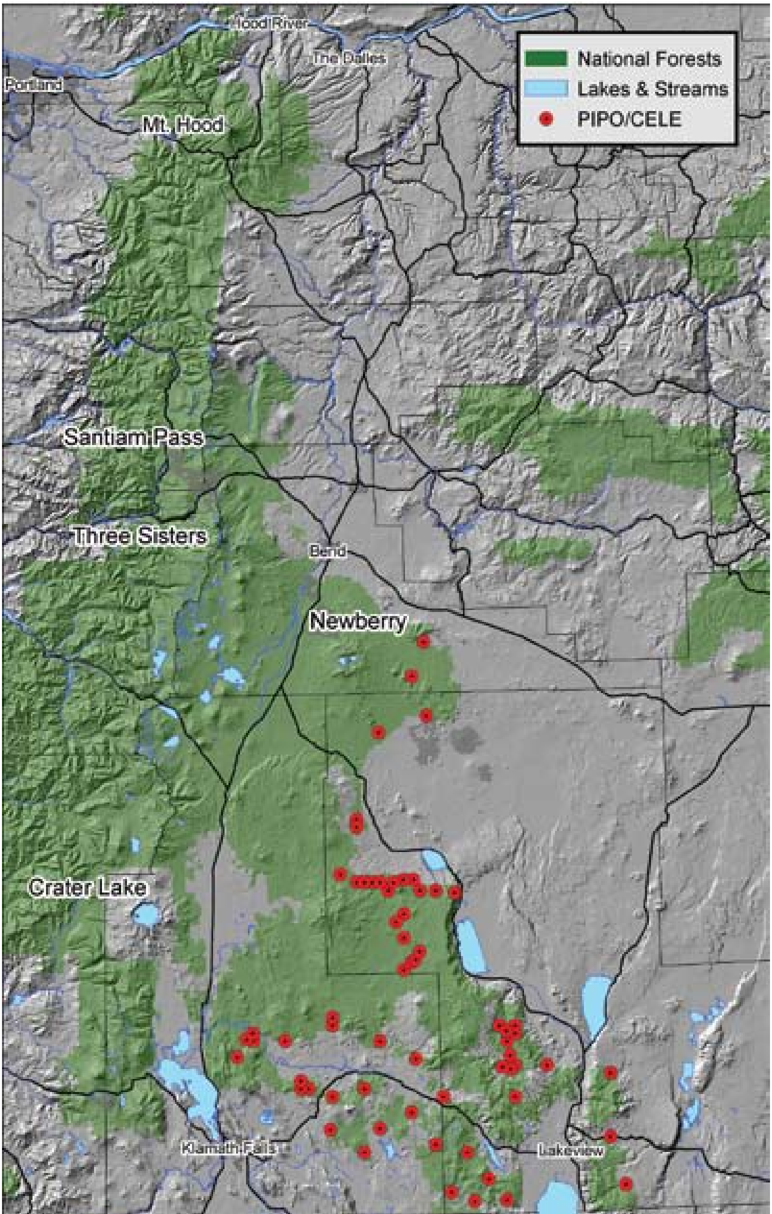






Mean Precip.	20.3”	15-37”
Mean Temp.	44.5°F	41-48°F

Figure 8-17. Map of PIPO/CELE Plot Distribution—



Vegetation— Tree layers form an open forest of ponderosa pine and western juniper. Mountain mahogany (CELE), bitterbrush (PUTR), and mountain big sage (ARTR) are the most common species in a diverse shrub layer. Herbaceous layers are dominated by graminoids. Idaho fescue (FEID), squirreltail (SIHY), Ross' sedge (CARO), and western neeedlegrass (STOC) have the highest constancies. Forb species are poorly represented since no species have >20% constancy. Arrowleaf balsamroot (BASA) occurred on 19% of the plots and averaged 4% cover.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
JUOC	*Juniperus occidentalis*	66	73	12.5	4.6
PIPO	*Pinus ponderosa*	97	80	19.6	9.8
Shrubs					
AMAL	*Amelanchier alnifolia*	39%		0.9	
ARAR	*Artemisia arbuscula*	41%		4.4	
ARTR	*Artemisia tridentata*	47%		5.7	
CELE	*Cercocarpus ledifolius*	100%		6.8	
PUTR	*Purshia tridentata*	86%		4.5	
RICE	*Ribes cereum*	28%		1.0	
Graminoids					
AGSP	*Agropyron spicatum*	31%		3.2	
CARO	*Carex rossii*	75%		0.9	
FEID	*Festuca idahoensis*	80%		10.4	
PONE	*Poa nervosa*	52%		1.6	
POSA3	*Poa sandbergii*	55%		1.1	
SIHY	*Sitanion hystrix*	94%		1.6	
STOC	*Stipa occidentalis*	69%		0.8	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

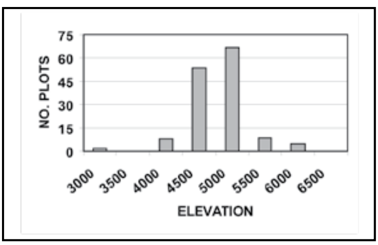
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PIPO/CELE							
JUOC				77	4	99	
PIPO	69	2	65	115	3	399	36

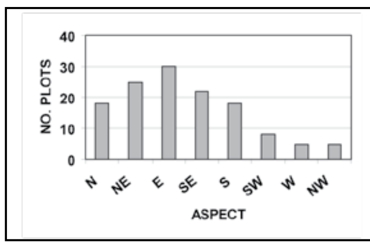
Relationships to Other Classifications— PIPO/CELE plant associations have been previously described for the Blue and Ochoco Mountains (Johnson and Simon 1987). The type as described here is similar in productivity to PIPO/CELE/CAGE, but has more affinities to PIPO/CELE/FEID-AGSP in species composition. Portions of Volland's (1985) PIPO/PUTR/FEID with Mt. Mahogany may also key here.

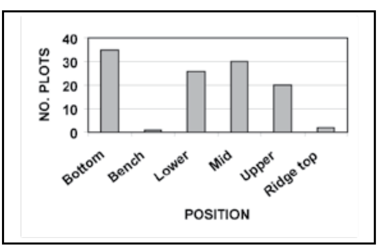
PIPO/CAIN4 — PIPO Dry

CPG211 (PIPO/CAIN9)
Pinus ponderosa/Carex inops
Ponderosa pine/long-stolon sedge
Plots 170

Distribution and Environment— PIPO/CAIN4 is a major type in south-central Oregon. It occurs from just south of Sisters, south to the vicinity of Drews Reservoir. Most sites are within the deep Mazama ash/pumice deposits. Sites are excessively drained. Most parent materials are airfall pumice, scoria/pumice flows, or volcanic sands/outwash. Soil textures are loamy, coarse sand to sandy loams. Average elevation is 5023 feet (range 3400-6450 feet). Average slope is 6% (range 0-45%). PIPO/CAIN4 has a strong preference for eastern aspects. Slope positions are typically mid to lower slopes and broad flats.

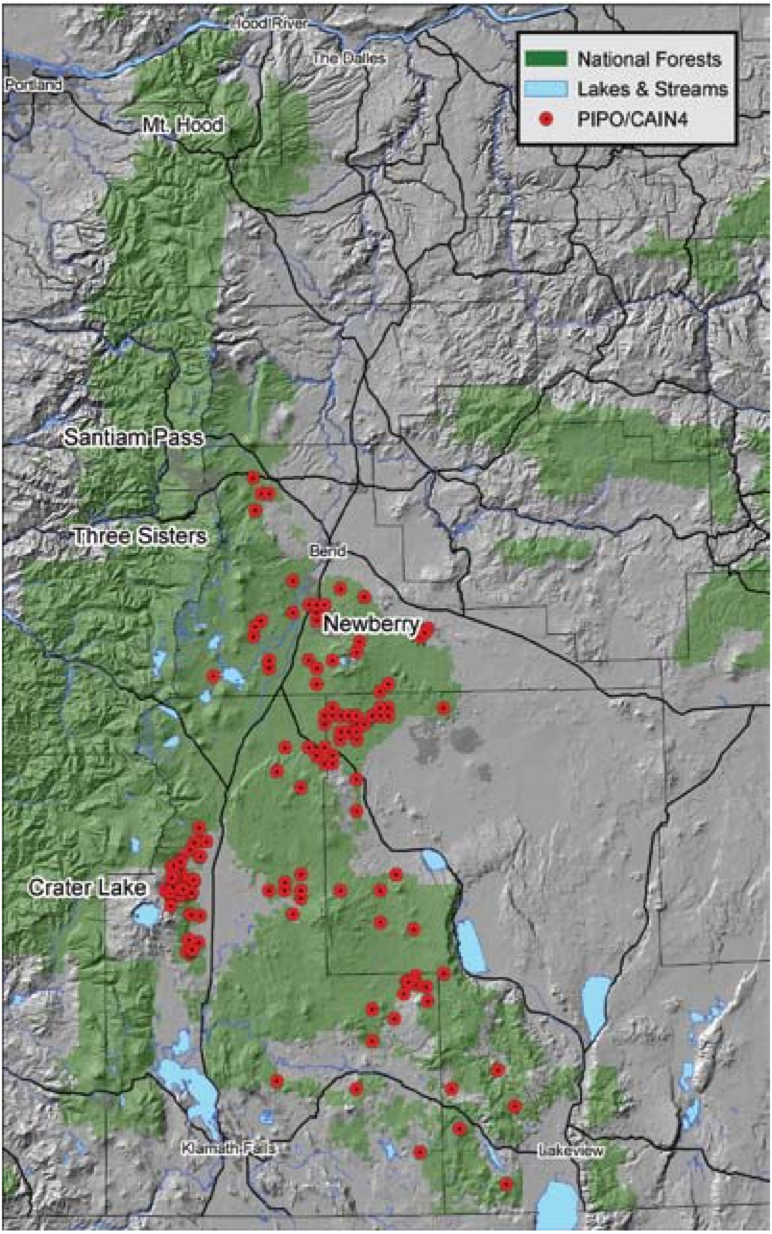






Mean Precip.	24.3”	11-37”
Mean Temp.	42.3°F	37-45°F

Figure 8-18. Map of PIPO/CAIN4 Plot Distribution—



Vegetation—Overstory tree layers are typically dominated by ponderosa pine. Lodgepole pine is a significant component on broad flats and lower slopes that accumulate cold air drainage. Understory tree layers are dominated by ponderosa pine. Shrub layers are dominated by mixtures of bitterbrush (PUTR), manzanita (ARPA), and snowbrush ceanothus (CEVE). ARPA and CEVE are likely to increase with disturbance of the tree layers. Herbaceous layers are graminoid dominated. Forbs are almost nonexistent; cover averages <1%. Long-stolon sedge (CAIN4), squirreltail (SIHY), and western needlegrass (STOC) have the highest constancy. Cover of graminoids typically is between 10-15% in late seral stands, but is likely to increase significantly following disturbance. Long-stolon sedge (CAIN4) and western needlegrass (STOC) consistently have the highest cover values.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
PICO	Pinus contorta	52	59	9.1	5.0
PIPO	*Pinus ponderosa*	85	88	19.0	10.7
Shrubs					
ARPA	*Arctostaphylos patula*	41%		5.8	
CEVE	Ceanothus velutinus	26%		3.8	
PUTR	*Purshia tridentata*	92%		10.6	
RICE	*Ribes cereum*	31%		1.5	
Herbaceous					
FRVI	Fragaria virginiana	28%		0.6	
Graminoids					
CAIN4	*Carex inops*	100%		5.5	
CARO	*Carex rossii*	68%		2.3	
FEID	*Festuca idahoensis*	41%		6.7	
SIHY	*Sitanion hystrix*	79%		1.1	
STOC	*Stipa occidentalis*	88%		3.1	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PIPO/CAIN4							
JUOC				77	5	14	
PICO	66	2	59	104	3	308	
PIPO	80	1	360	116	2	1068	42

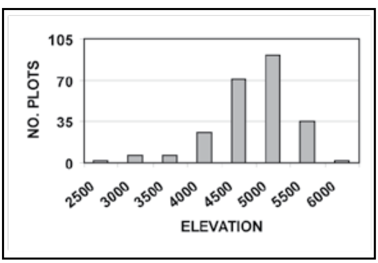
Relationships to Other Classifications— Volland (1985) described several ponderosa pine dominated communities with a significant component of long-stolon sedge, with and without a shrub component. PIPO/CAIN4 as described here includes most sites that were originally included in the following associations described by Volland (1985), where *Carex pensylvanica* (CAPE5) has since been renamed and recoded to *C. inops* (CAIN4):

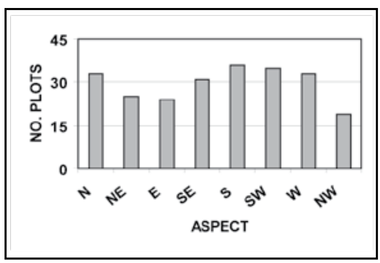
1. CPG212 PIPO/CAPE5-FEID-LALA
2. CPS214 PIPO/PUTR-ARPA/CAPE5
3. CPS215 PIPO/PUTR/CAPE5
4. CPS312 PIPO/PUTR-CEVE/CAPE5
5. CPS314 PIPO/PUTR-CEVE/FEID

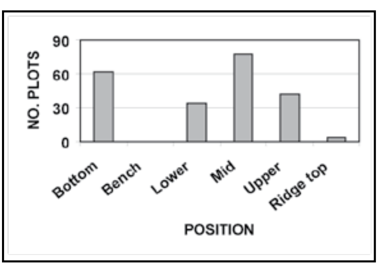
PIPO/ARPA **PIPO Dry**

CPS219 (PIPO/ARPA6)
Pinus ponderosa/Arctostaphylos patula
ponderosa pine/greenleaf manzanita
Plots 290

Distribution and Environment— PIPO/ARPA is a widely distributed association from Beaver Creek on the Warm Springs Indian Reservation south to the Sprague River. The association occurs mostly east of the Cascades proper. Most of the plots occur within the Mazama ash/pumice plume. Sites outside deep ash/pumice deposits or in high precipitation zones (>35”) may be seral community types related to more mesic ABCO-ABGR or PIPO associations, instead of an actual potential vegetation type (Plant Association). Average elevation is 4930 feet (range 2610-6120 feet). Average slope is 10% (range 0-52%). Plot aspects are variable with a slight trend toward south to west facing slopes. Mid slopes and broad flats are typical slope positions. Mean annual precipitation is 5” less than the similar ABCO-ABGR/ARPA association and similar to the PSME/ARPA association that occurs outside the Mazama ash/pumice plume.

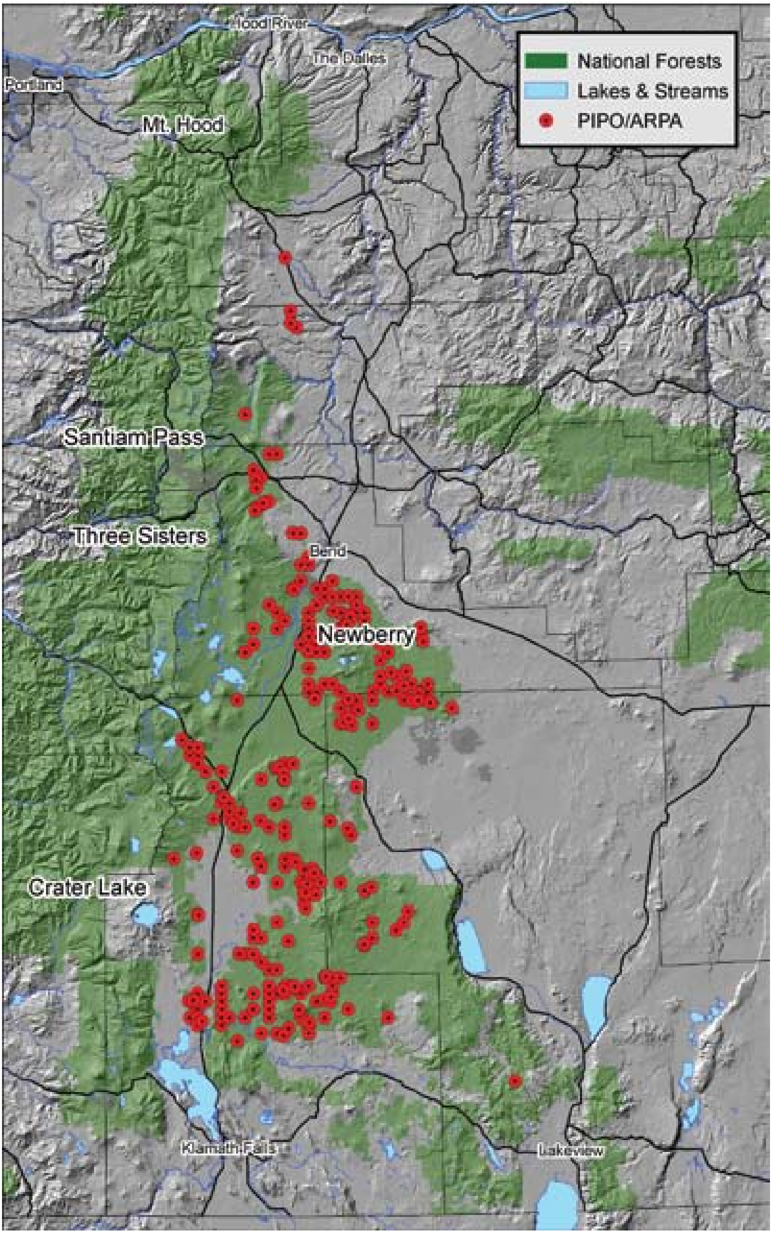






Mean Precip.	21.9”	11-41”
Mean Temp.	42.8°F	40-48°F

Figure 8-19. Map of PIPO/ARPA Plot Distribution—



Vegetation— Tree overstory layers are dominated by ponderosa pine. Lodgepole pine, where it occurs, indicates cooler temperature regimes or frost pockets. Sites with lodgepole pine may have a more mixed fire regime. Shrub layers are dominated by greenleaf manzanita(ARPA), snowbrush (CEVE), and bitterbrush (PUTR). Shrub cover averages 25%. Herbaceous layers have low cover (<10%). The most common species are grasses (squirreltail (SIHY) and western needlegrass (STOC)) and upland sedges (Ross' sedge (CARO)). The only herb with greater than 50% constancy is mountain strawberry (FRVI).

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
PICO	*Pinus contorta*	46	48	10.3	6.9
PIPO	*Pinus ponderosa*	93	92	21.9	6.6
Shrubs					
ARPA	*Arctostaphylos patula*	100%		4.7	
CEVE	*Ceanothus velutinus*	47%		6.5	
PUTR	*Purshia tridentata*	96%		11.8	
RICE	Ribes cereum	34%		1.4	
Herbaceous					
FRVI	*Fragaria virginiana*	42%		0.9	
Graminoids					
CARO	*Carex rossii*	90%		1.2	
FEID	*Festuca idahoensis*	37%		6.8	
SIHY	*Sitanion hystrix*	83%		0.8	
STOC	*Stipa occidentalis*	93%		1.3	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PIPO/ARPA							
PICO	65	1	106	103	2	862	31
PIPO	84	1	626	120	2	2259	47

Relationships to Other Classifications— Volland (1985) described several ponderosa pine dominated communities with a greenleaf manzanita as an indicator or significant component. Hopkins (1979a) also described a PIPO/PUTR-ARPA/FEID association which is essentially the same as Volland's plant association of the same name. PIPO/ARPA as described here includes most sites originally included in the following associations described by Volland (1985):

1. CPG213 PIPO/ PUTR-ARPA/STOC
2. CPS217 PIPO/PUTR-ARPA/FEID
3. CPS311 PIPO/PUTR-CEVE/STOC

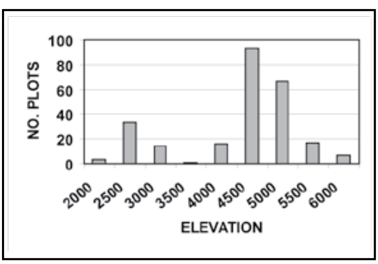
PIPO/PUTR/FEID **PIPO Dry**

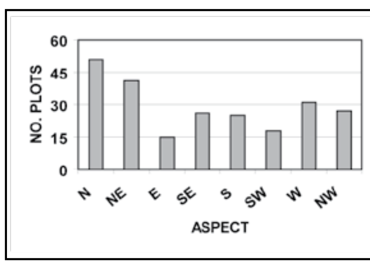
CPS211 (PIPO/PUTR2/FEID)
Pinus ponderosa/Purshia tridentata/Festuca idahoensis
ponderosa pine/bitterbrush/Idaho fescue
Plots 289

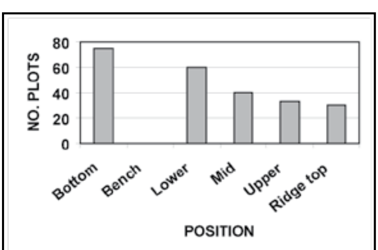
Distribution and Environment— PIPO/PUTR/FEID occurs from the Mutton Mountains on the Warm Springs Indian Reservation south to the California border. Adjacent drier sites grade into juniper woodlands or into non-forest communities. PIPO/PUTR/FEID associations avoid ash/pumice deposits greater than 2 feet deep. Where they do occur on deeper pumice deposits (La Pine – Crescent and Klamath Marsh areas), there is a shallower water table. On deeper pumice they are replaced by PIPO/PUTR associations.

Soils are typically highly mixed pumice with buried soils. Surface textures are sandy loam to loam. Plots north and south of the Mazama plume may have loam to clay loam surface textures. Subsurface layers have higher percentages of coarse fragments than similar PIPO/PUTR associations.

Average elevation is 4536 feet (range 2170-6100 feet). Average slope is 6% (range 0-53%). Many plots were found on a northern aspect. Slope positions are lower slopes and broad flats.

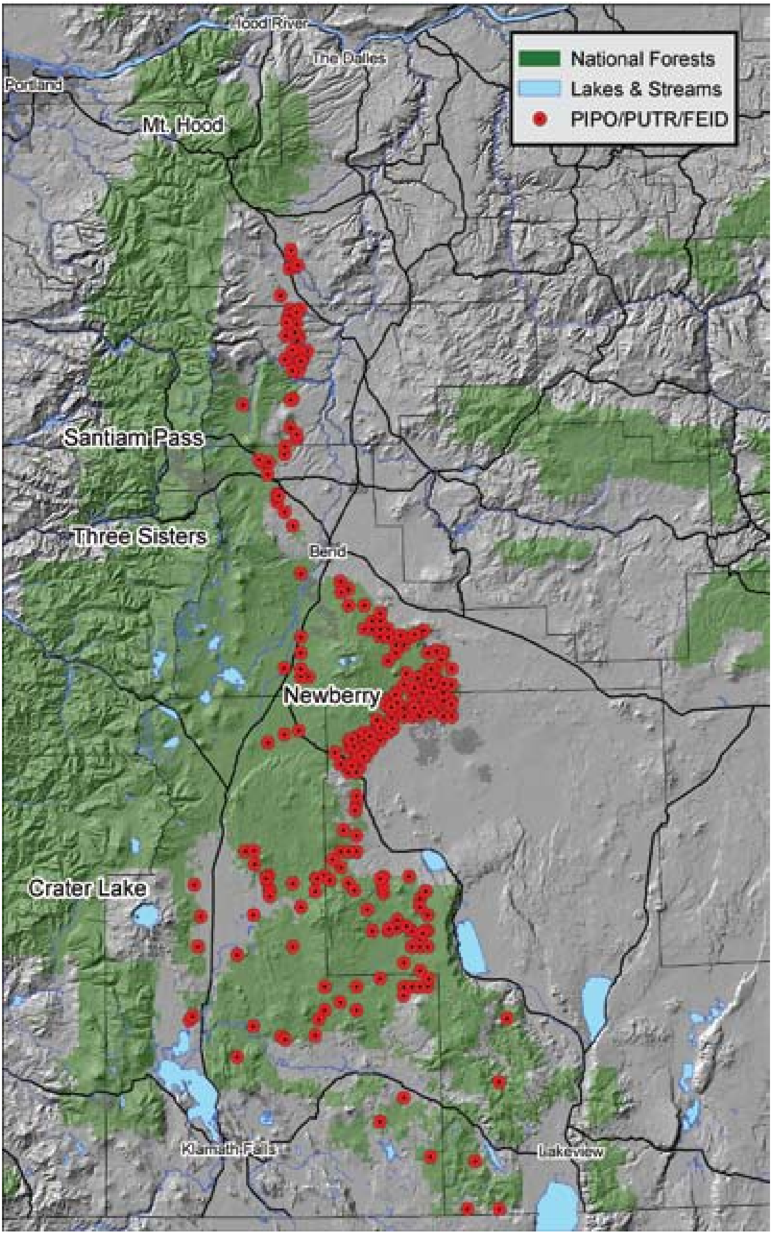






Mean Precip.	16.8”	9-31”
Mean Temp.	43.6°F	41-49°F

Figure 8-20. Map of PIPO/PUTR/FEID Plot Distribution—



Vegetation— Ponderosa pine forms an open forest to savanna. Western juniper increases both north and south of the Mazama ash plume. Lodgepole pine is restricted to ash/pumice influenced areas with poor cold air drainage. Both juniper and lodgepole pine can be important seral species after disturbance where they occur. Shrub cover averages 15-20%. Shrub layers are dominated by bitterbrush (PUTR) and big sagebrush (ARTR). Green and gray rabbitbrush (CHVI, CHNA) are likely to increase with mechanical or fire disturbances. Sites outside the ash/plume influence may also have a low sage component (ARAR). Idaho fescue (FEID) typically supplies the majority of herbaceous cover. Grass cover averages 15-20% cover. Squirreltail (SIHY), Ross' sedge (CARO), and western needlegrass (STOC) have high constancy, but generally low cover. Strawberry (FRVI) is the only forb species that occurs more than 20% of the time. Herbaceous species such as prairie lupine (LULE2), western needlegrass (STOC), and squirreltail (SIHY) are likely to increase following disturbance.

Code	Species Latin Name	% Constancy		% Cover	
Trees		Over	Regen	Over	Regen
JUOC	*Juniperus occidentalis*	12	24	7.7	1.8
PICO	*Pinus contorta*	27	30	11.2	5.9
PIPO	*Pinus ponderosa*	96	87	19.5	8.1
Shrubs					
ARTR	*Artemisia tridentata*	26%		7.6	
PUTR	*Purshia tridentata*	100%		12.3	
RICE	*Ribes cereum*	35%		1.7	
Herbaceous					
FRVI	*Fragaria virginiana*	28%		1.5	
Graminoids					
CARO	*Carex rossii*	82%		1.6	
FEID	*Festuca idahoensis*	100%		12.4	
SIHY	*Sitanion hystrix*	93%		1.4	
STOC	*Stipa occidentalis*	72%		1.7	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PIPO/PUTR/FEID							
JUOC				64	8	21	
PICO	67	1	90	91	2	363	28
PIPO	77	1	490	105	2	1267	37

Relationships to Other Classifications— Volland (1985) described several ponderosa pine dominated communities with bitterbrush and Idaho fescue as indicators or significant components. Hopkins (1979a) also described a PIPO/PUTR/FEID association which is essentially the same as Vollands' plant association of the same name. PIPO/PUTR/FEID, as described here, includes most sites that were originally included in the following associations described by Volland (1985):

1. CPS111 PIPO/PUTR-ARTR/FEID
2. CPS211 PIPO/PUTR/FEID
3. CPS216 PIPO/PUTR/FEID-AGSP

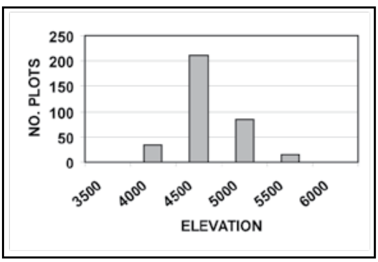
PIPO/PUTR plant associations have also been described for the Blue and Ochoco Mountains (Johnson and Clausnitzer 1992), Warm Springs Indian Reservation (Marsh et al. 1987), central Idaho (Steele et al. 1981), and western Montana (Pfister et al. 1977). PIPO/PUTR/FEID associations have more affinities to these types than the PIPO/PUTR type defined here.

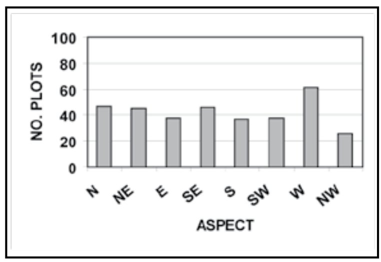
PIPO/PUTR

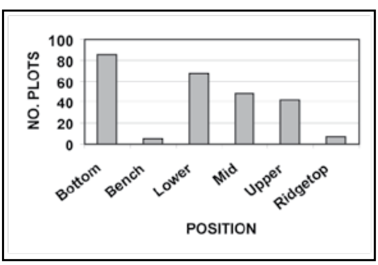
PIPO Dry

CPS210 (PIPO/PUTR2)
Pinus ponderosa/Purshia tridentata
ponderosa pine/bitterbrush
Plots 394

Distribution and Environment— PIPO/PUTR associations are restricted to Mt. Mazama and Newberry ash/pumice deposits deeper than 2 feet. They occur from just south of Bend to the Sprague River east of Chiloquin. Sites are excessively drained. Surface textures are coarse sand to sandy loams. Subsurface layers have high percentages of coarse fragments by volume (30-90%). Average elevation is 4749 feet (range 2280- 6000 feet). Average slope is 7% (range 0-55%). Plot aspects varied. Slope positions are typically mid to lower slopes or broad flats.

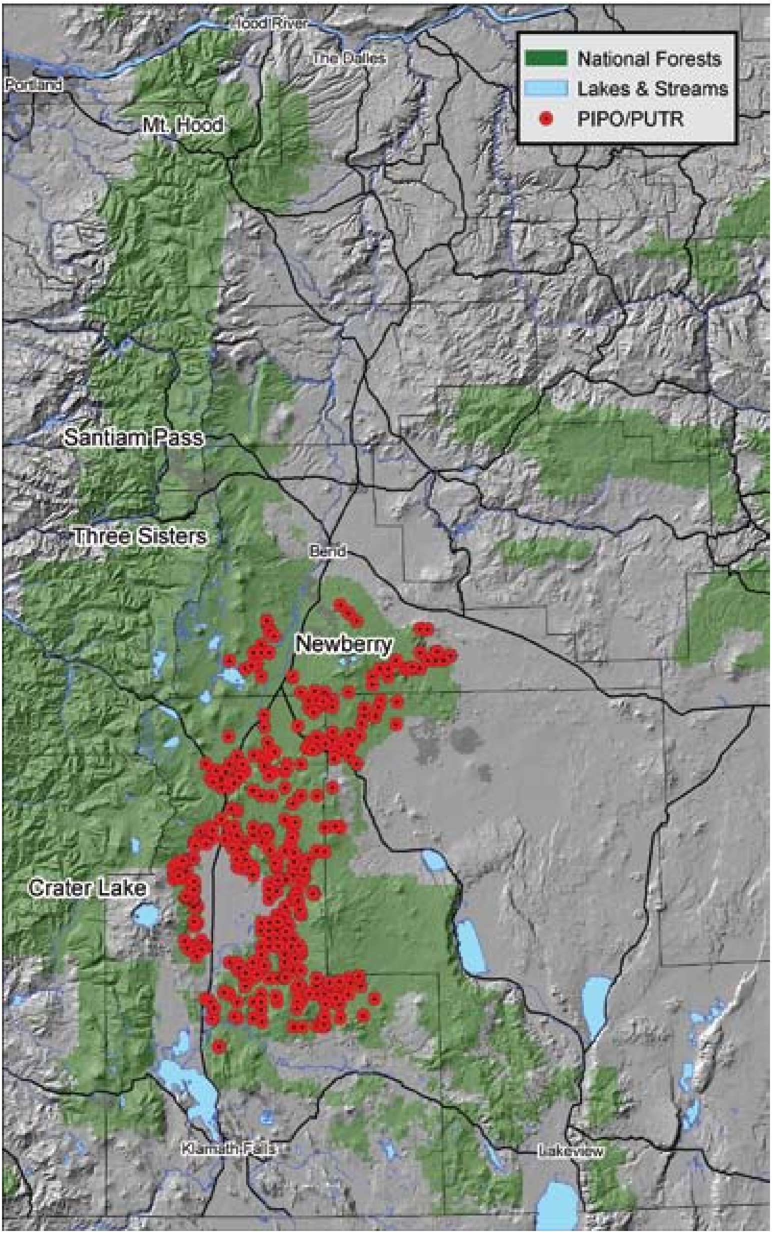






Mean Precip.	23.2”	9-37”
Mean Temp.	42.4°F	41-49°F

Figure 8-21. Map of PIPO/PUTR Plot Distribution—



Vegetation— Ponderosa and lodgepole pines occur in various mixtures in the tree layers. In hummocky topography, lodgepole dominates in swales while ponderosa pine is more prominent on microridges (Volland 1985). Shrub cover averages 10-15%. Shrub layers are dominated by bitterbrush (PUTR). Western needlegrass (STOC) typically supplies the majority of herbaceous cover in a depauperate understory. Grass cover averages 5-10%. Squirreltail (SIHY) and Ross' sedge (CARO) have high constancy but generally low cover. No forb species occur more than 20% of the time. Herbaceous species such as prairie lupine (LULE2), western needlegrass (STOC), and squirreltail (SIHY) are likely to increase following disturbance.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
PICO	*Pinus contorta*	69%	71%	14.0	7.0
PIPO	*Pinus ponderosa*	69%	84%	14.0	4.3
Shrubs					
PUTR	Purshia tridentata	100%		11.4	
RICE	*Ribes cereum*	48%		1.3	
Graminoids					
CARO	*Carex rossii*	92%		1.3	
SIHY	*Sitanion hystrix*	84%		0.8	
STOC	*Stipa occidentalis*	95%		3.0	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PIPO/PUTR							
PICO	67	1	468	110	1	1774	34
PIPO	84	1	470	111	1	1174	43

Relationships to Other Classifications— Volland (1985) described several ponderosa pine dominated communities with bitterbrush as an indicator species. Hopkins (1979a) also described a PIPO/PUTR/STOC association which is essentially the same as Volland's plant association of the same name. PIPO/PUTR as described here includes most sites that were originally included in the following associations described by Volland (1985):

1. CPS112 PIPO/PUTR-ARTR/SIHY
2. CPS212 PIPO/PUTR/STOC
3. CPS218 PIPO/PUTR/SIHY

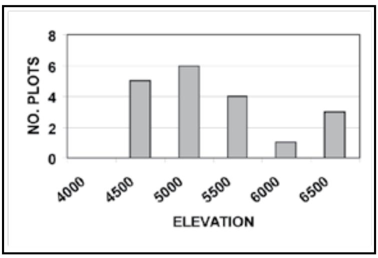
PIPO/PUTR plant associations have also been described for the Blue and Ochoco Mountains (Johnson and Clausnitzer 1992), Warm Springs Indian Reservation (Marsh et al. 1987), central Idaho (Steele et al. 1981), and western Montana (Pfister et al. 1977). The Warm Springs plots would key to PIPO/PUTR/FEID in this classification. The Blue and Ochoco Mountain and the Idaho and Montana variants are also most like the PIPO/PUTR/FEID association defined here.

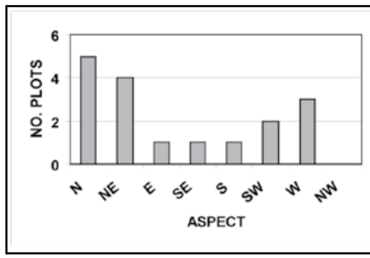
PIPO/ARTR

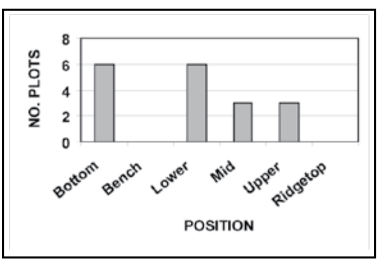
PIPO Dry

CPS141 (PIPO/ARTR2)
Pinus ponderosa/Artemisia tridentata
ponderosa pine/big sagebrush
Plots 19

Distribution and Environment— PIPO/ARTR occurs from Pine Mountain east of Bend to the Warner Mountains east of Lakeview. Average elevation is 5421 feet (range 4600-6800 feet). Average slope is 7% (range 1-22%). Aspects are often north to northeast. Slope positions are typically lower slopes or broad flats.

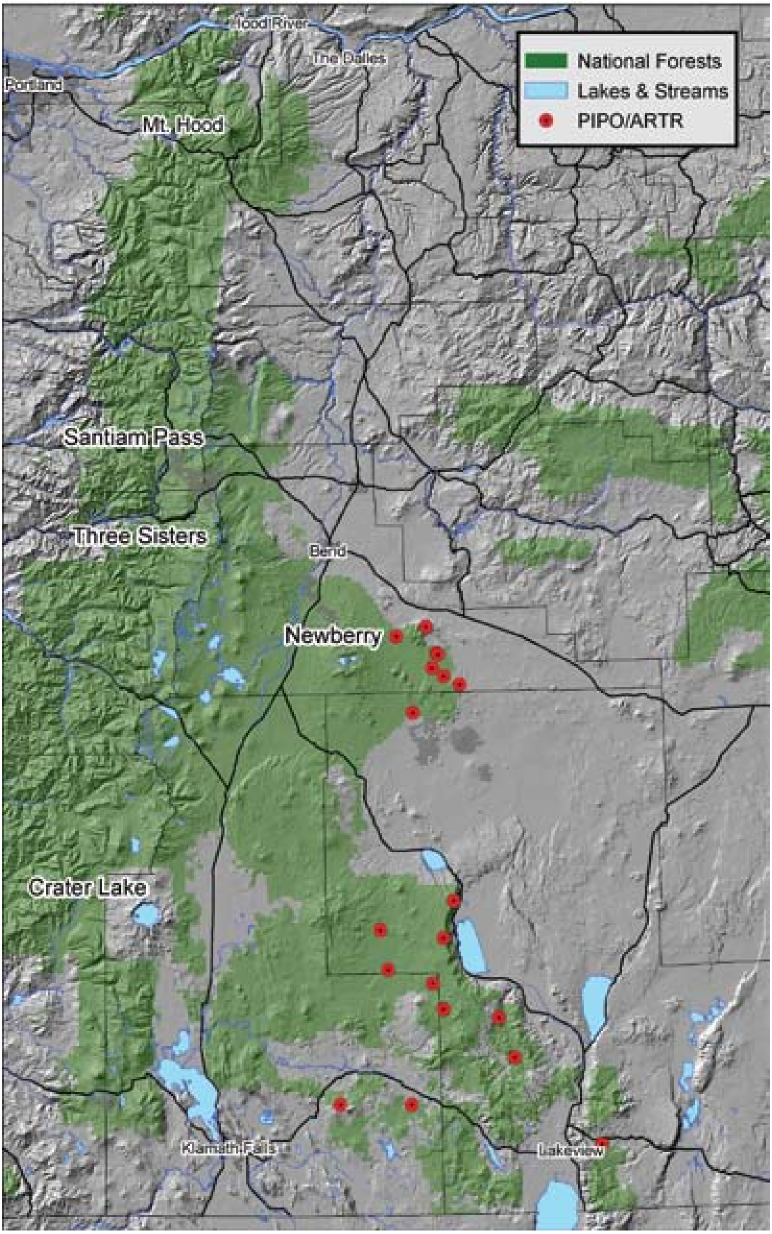






Mean Precip.	18.3”	11-29”
Mean Temp.	43.0°F	41-45°F

Figure 8-22. Map of PIPO/ARTR Plot Distribution—



Vegetation— Ponderosa pine forms an open forest to savanna over an understory of Vasey big sagebrush. Western juniper increases both north and south of the Mazama ash plume. Lodgepole pine is more restricted in this type than in the PIPO/PUTR/FEID association. It is found only in ash/pumice influenced areas with poor cold air drainage. Juniper is the only important seral species after disturbance. Shrub cover averages 10-15% in mid to late seral conditions. Shrub layers are dominated by big sagebrush (ARTR). Green and gray rabbitbrush (CHVI, CHNA) are likely to increase with mechanical or fire disturbances. Sites outside the ash/plume influence may also have a low sage component (ARAR). Idaho fescue (FEID) typically supplies the majority of herbaceous cover. Grass cover averages 15-20% cover. Squirreltail (SIHY), Ross' sedge (CARO), and western needlegrass (STOC) have high constancy, but generally low cover. Strawberry (FRVI) is the only forb species that occurs more than 20% of the time. Herbaceous species such as prairie lupine (LULE2), western needlegrass (STOC), and squirreltail (SIHY) are likely to increase following disturbance.

Code	Species Latin Name	% Constancy		% Cover	
Trees		Over	Regen	Over	Regen
JUOC	*Juniperus occidentalis*	22	13	14.0	7.5
PICO	*Pinus contorta*	21	26	1.1	1.5
PIPO	*Pinus ponderosa*	95	63	21.4	10.1
Shrubs					
AMAL	*Amelanchier alnifolia*	47%		0.4	
ARTR	*Artemisia tridentata*	100%		11.4	
RICE	*Ribes cereum*	47%		0.9	
Herbaceous					
FRVI	*Fragaria virginiana*	37%		0.7	
Graminoids					
AGSP	*Agropyron spicatum*	26%		2.7	
CARO	*Carex rossii*	78%		1.2	
FEID	*Festuca idahoensis*	74%		9.3	
PONE	*Poa nervosa*	37%		3.4	
POSA3	*Poa sandbergii*	42%		1.8	
SIHY	*Sitanion hystrix*	84%		2.5	
STOC	*Stipa occidentalis*	68%		1.0	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PIPO/ARTR							
JUOC				138	5	21	
PIPO	72	2	43	127	5	132	42

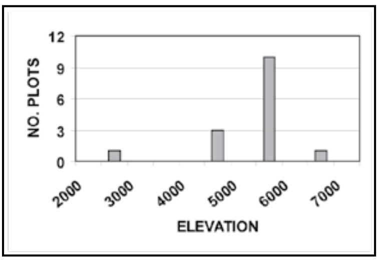
Relationships to Other Classifications— Volland (1985) described two associations with big sagebrush as an indicator species for central Oregon. Hopkins (1979a) also described a PIPO/ARTR/PONE type for the Fremont National Forest. PIPO/ARTR as described here includes Hopkins' association and those portions of Volland's associations without bitterbrush or with very little bitterbrush (<1%):

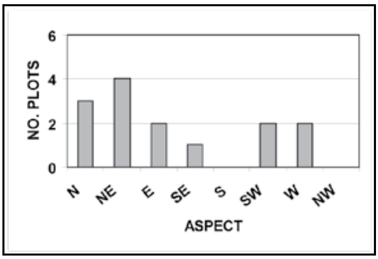
1. CPS111 PIPO/PUTR-ARTR/FEID
2. CPS112 PIPO/PUTR-ARTR/SIHY
3. CPS121 PIPO/ARTR/PONE

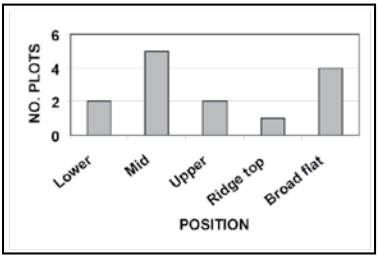
PIPO/FEID Community Type — PIPO Dry

CPG135 (PIPO/FEID)
Pinus ponderosa/Festuca idahoensis
ponderosa pine/Idaho fescue
Plots 18

Environment— PIPO/FEID CT occurs from the Mutton Mountains on the Warm Springs Indian Reservation south to the California border. Adjacent drier sites grade into juniper woodlands or into non-forest communities. This community type is seral to PIPO/PUTR/FEID or PIPO/ARTR, where bitterbrush (PUTR) and/or big sagebrush (ARTR) has been removed by past fire or mechanical disturbance. Average elevation is 5075 feet (range 2770-6110 feet). Average slope is 8 % (range 0-23 %). Many plots were found on a northeastern aspect.

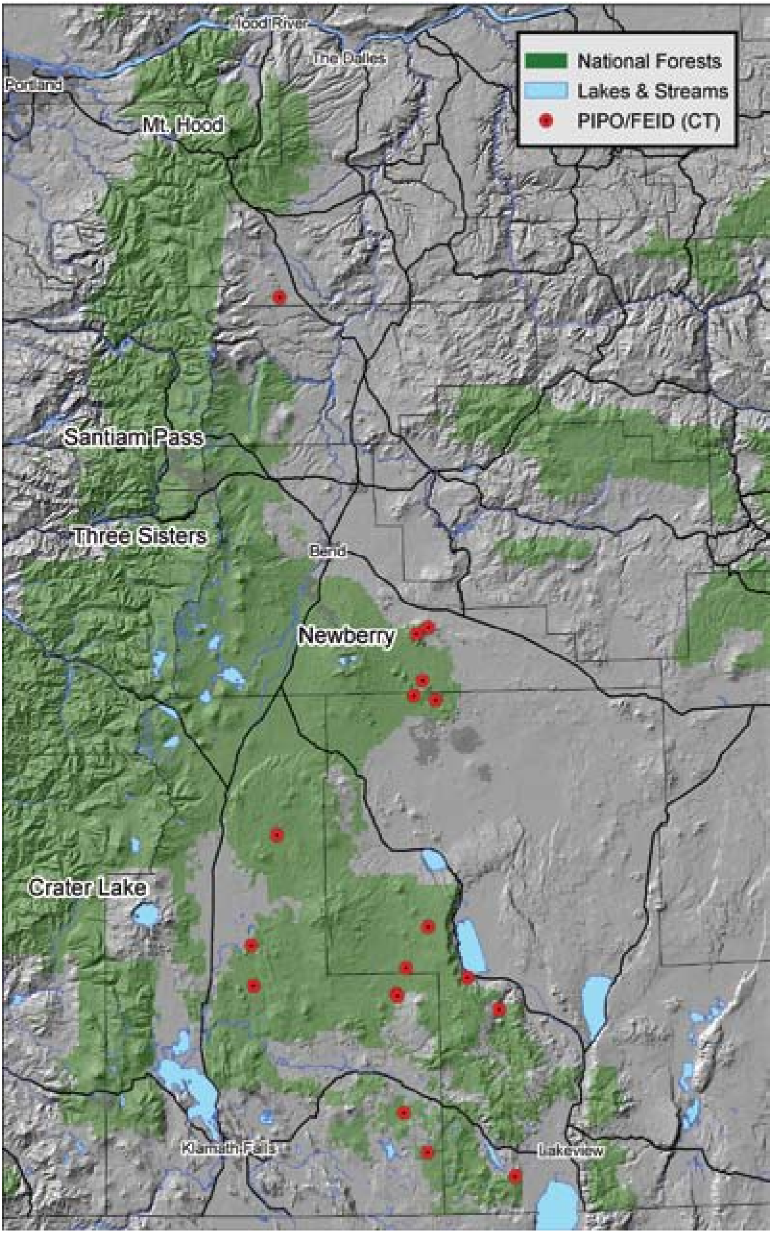






Mean Precip.	19.6”	11-31”
Mean Temp.	43.2°F	41-47°F

Figure 8-23. Map of PIPO/FEID Plot Distribution—



Vegetation— Ponderosa pine forms an open forest to savanna. Western juniper increases both north and south of the Mazama ash plume. Lodgepole pine is restricted to ash/pumice influenced areas with poor cold air drainage. Both Juniper and lodgepole pine can be important seral species after disturbance where they occur. Shrub cover averages 15-20%. Shrub layers are dominated by bitterbrush (PUTR) and big sagebrush (ARTR). Green and gray rabbitbrush (CHVI, CHNA) are likely to increase with mechanical or fire disturbances. Sites outside the ash/plume influence may also have a low sage component (ARAR). Idaho fescue (FEID) typically supplies the majority of herbaceous cover. Grass cover averages 15-20% cover. Squirreltail (SIHY), Ross' sedge (CARO), and western needlegrass (STOC) have high constancy, but generally low cover. Strawberry (FRVI) is the only forb species that occurs more than 20% of the time. Herbaceous species such as prairie lupine (LULE2), western needlegrass (STOC), and squirreltail (SIHY) are likely to increase following disturbance.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
PICO	*Pinus contorta*	44	50	19.3	10.0
PIPO	*Pinus ponderosa*	89	78	15.2	10.1
Shrubs					
CELE	*Cercocarpus ledifolius*	28%		0.2	
PUTR	*Purshia tridentata*	28%		0.5	
RICE	*Ribes cereum*	56%		0.5	
Herbaceous					
FRVI	*Fragaria virginiana*	44%		1.7	
Graminoids					
CARO	*Carex rossii*	50%		2.4	
FEID	*Festuca idahoensis*	100%		14.9	
PONE	*Poa nervosa*	33%		1.9	
POSA3	*Poa sandbergii*	22%		0.4	
SIHY	*Sitanion hystrix*	89%		1.6	
STOC	*Stipa occidentalis*	89%		1.3	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

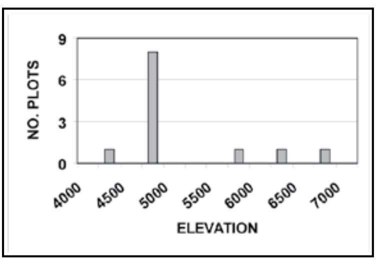
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PIPO/FEID							
JUOC				57		1	
PICO	72	17	3	169	8	62	56
PIPO	84	4	20	125	11	22	48

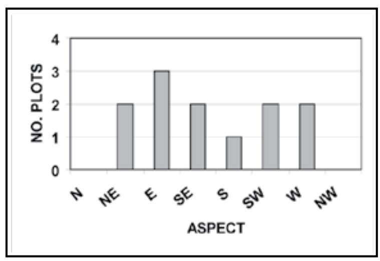
Relationships to Other Classifications— PIPO/FEID plant associations have been previously described for the Wallowa Mountains (Johnson and Simon 1987), central Idaho (Steele et al. 1981), northern Idaho (Cooper et al. 1987), Spokane Indian Reservation in northeastern Washington (Zamora 1983), and western Montana (Pfister et al. 1977). The PIPO/FEID CT as described here is a repeating community formed from disturbance of PIPO/PUTR/FEID, PIPO/ARTR, or PIPO/CELE plant associations. The type as described here is more productive for tree growth, but has lower cover in shrub and herbaceous layers than the types described in central Idaho and eastern Washington.

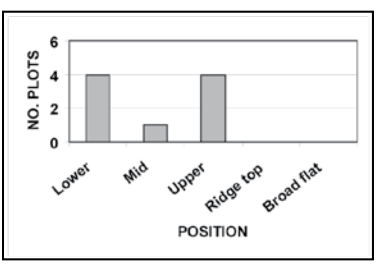
PIPO/STOC Community Type — PIPO Dry

CPG125 (PIPO/ACOC3)
Pinus ponderosa/Stipa occidentalis
ponderosa pine/western needlegrass
Plots 13

Distribution and Environment— PIPO/STOC community types are mostly restricted to Mt. Mazama and Newberry ash/pumice deposits deeper than 2 feet. They are likely seral communities to PIPO/PUTR associations. They occur from just south of Bend to the Sprague River east of Chiloquin. One outlier occurs on the north end of Winter Rim. Sites are excessively drained. Surface textures are coarse sand to sandy loams. Subsurface layers have high percentages of coarse fragments by volume (30-90%). Average elevation is 5046 feet (range 4230-6950 feet). Average slope is 6% (range 1-17%). Many plots were found on an eastern aspect.

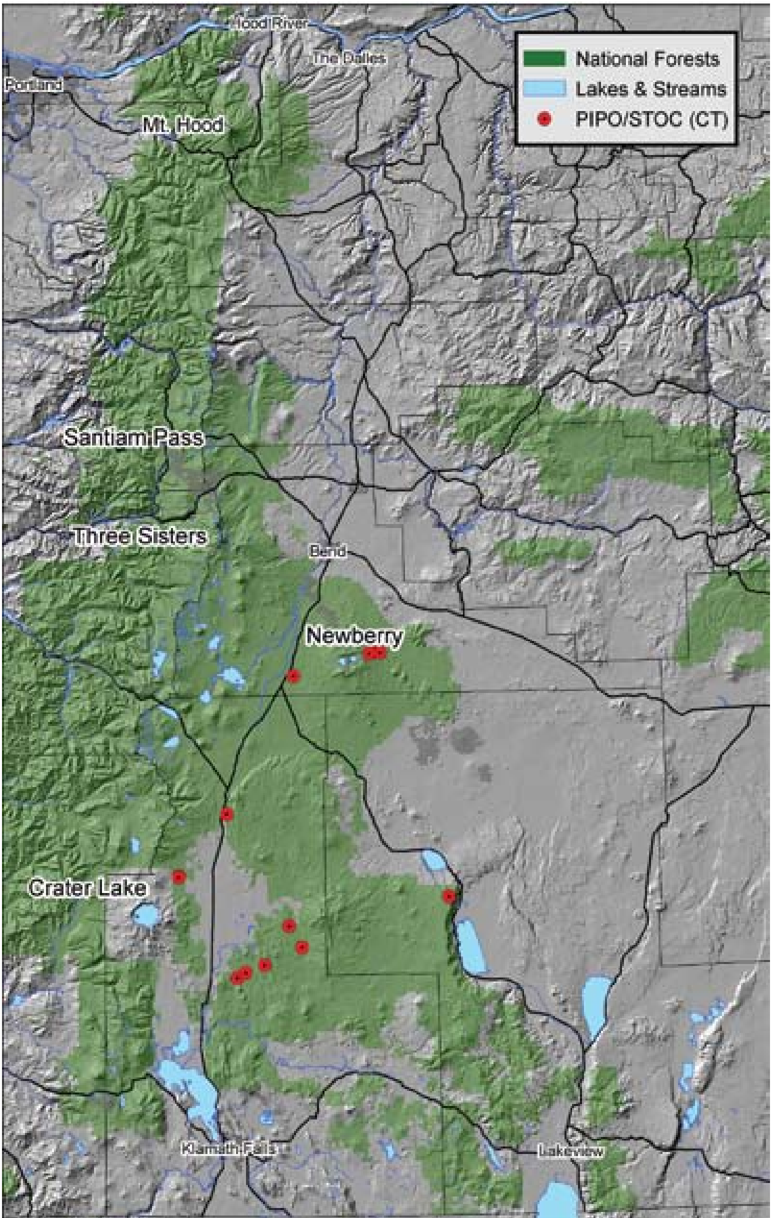






Mean Precip.	22.4”	17-29”
Mean Temp.	42.0°F	39-43°F

Figure 8-24. Map of PIPO/STOC Plot Distribution—



Vegetation—Lodgepole pine is often dominant in overstory tree layers with scattered ponderosa pine. These communities resulted from stand replacement fire. Shrub layers are poorly represented. The most common species are bitterbrush (PUTR) and wax currant (RICE). Western needlegrass (STOC) typically supplies the majority of herbaceous cover in a depauperate understory. Grass cover averages 5-10% cover. Squirreltail (SIHY) and Ross' sedge (CARO) have high constancy, but generally low cover. Strawberry (FRVI) and pussytoes (SPUM) are the only species that occur more than 20% of the time. Herbaceous species such as prairie lupine (LULE2), western needlegrass (STOC), and squirreltail (SIHY) are likely to increase following disturbance.

Code	Species Latin Name	% Constancy		% Cover	
Trees		Over	Regen	Over	Regen
PICO	*Pinus contorta*	62	69	23.6	6.6
PIPO	*Pinus ponderosa*	46	92	5.5	1.1
Shrubs					
PUTR	*Purshia tridentata*	54%		0.3	
RICE	*Ribes cereum*	54%		1.0	
Herbaceous					
FRVI	*Fragaria virginiana*	31%		1.2	
SPUM	*Spraguea umbellata*	23%		0.5	
Graminoids					
CARO	*Carex rossii*	92%		1.0	
SIHY	*Sitanion hystrix*	77%		1.1	
STOC	*Stipa occidentalis*	100%		7.4	

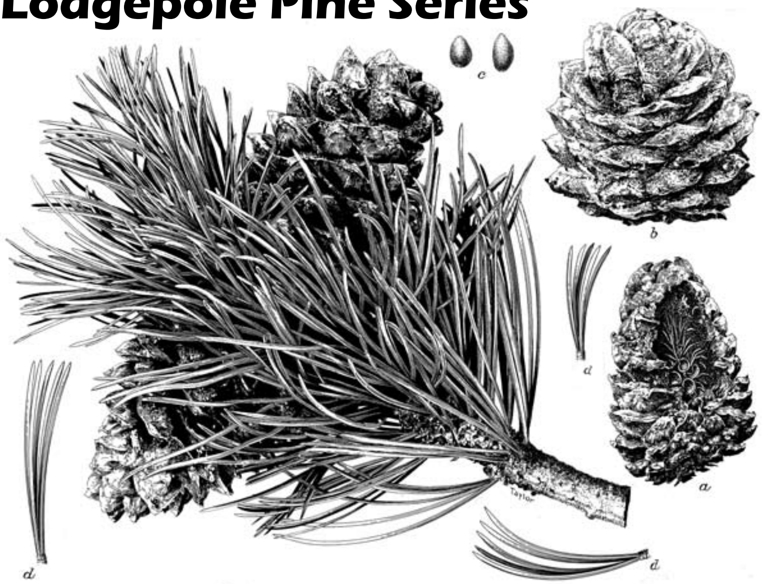
* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PIPO/STOC							
PICO	74	1	27	104	5	37	35
PIPO	83	2	6	103	8	18	39

Relationships to Other Classifications—PIPO/STOC plant associations have been previously described for central Idaho (Steele et al. 1981), the Spokane Indian Reservation in northeastern Washington (Zamora 1983), and western Montana (Pfister et al. 1977). The PIPO/STOC CT as described here is a repeating community formed from disturbance of PIPO/PUTR plant associations. The type as described here is more productive for tree growth, but has lower cover in shrub and herbaceous layers than the types described in central Idaho and eastern Washington.

Lodgepole Pine Series



LODGEPOLE PINE SERIES

PICO
Pinus contorta
lodgepole pine
Total Plots 400

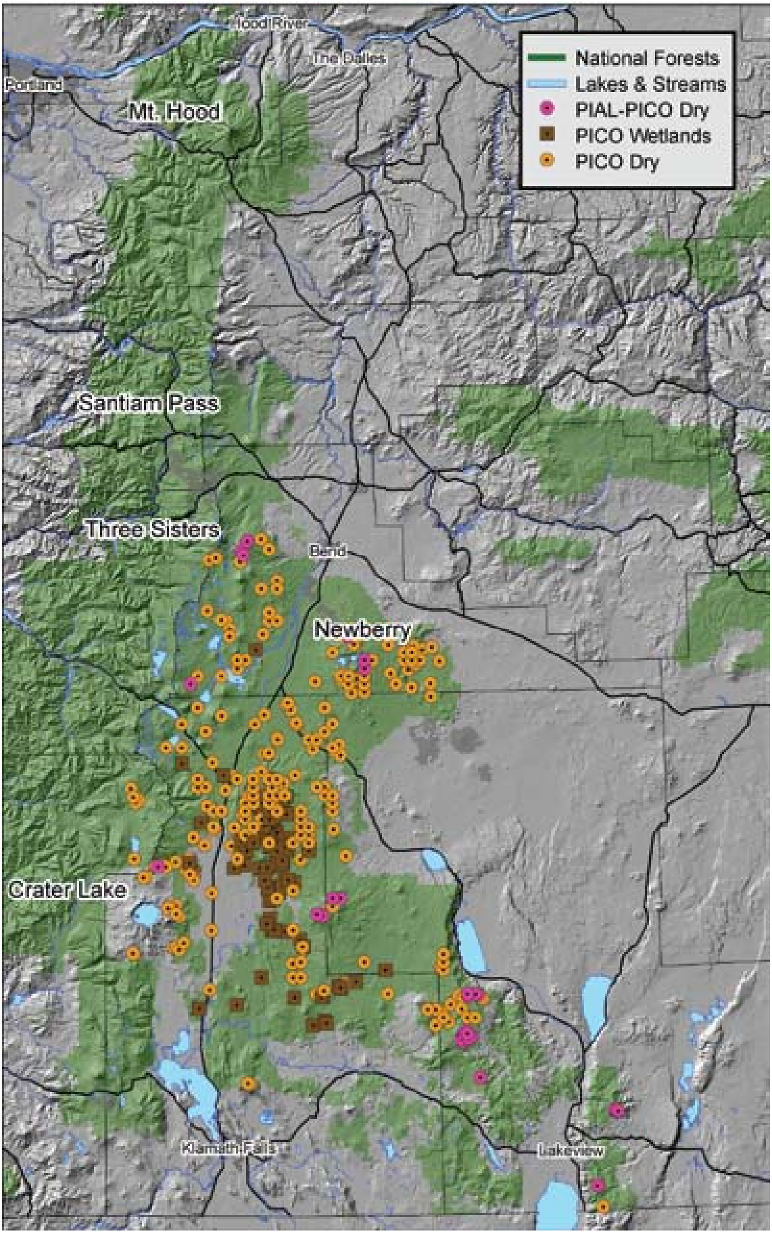
Distribution and Environment— Pure or nearly pure stands of lodgepole pine are widely distributed throughout forested areas of eastern Oregon and Washington. Most lodgepole pine stands are seral and developed following stand replacement fire or timber harvest (Franklin and Dyrness 1973). In central Oregon, distribution of the Lodgepole Pine Series is tied directly to ash/pumice deposits, mostly from Mt. Mazama. Lodgepole pine is considered an edaphic or topoedaphic climax on deep ash/pumice deposits especially where slope positions allow cold air to accumulate.

Three situations occur with lodgepole pine as a major climax tree species. The first situation (edaphic) has poorly drained sites with deep ash/pumice deposits. Sites are either inundated through much of the growing season or are sub-irrigated with water tables within 2 feet of the soil surface for extended times during the growing season. The second situation (topoedaphic) has deep ash/pumice deposits that are excessively well-drained and occur in small basins that trap cold air and create frost pockets. In the third situation (edaphic), lodgepole pine occurs with whitebark pine at high elevations on deep ash/pumice deposits that are excessively well-drained. Precipitation and temperatures on these sites appear suitable to support mountain hemlock or subalpine fir, but these species are missing, presumably because the effective moisture on the ash/pumice deposits is inadequate to support them.

Vegetation— Lodgepole pine has the widest ecologic amplitude of all the conifers that occur in central Oregon. It dominates sites that are either too wet or dry for its competitors (ponderosa pine, white fir-grand fir, Shasta red fir, or mountain hemlock).

Thirteen plant associations and two community types are defined for the Lodgepole Pine Series in central Oregon. These plant associations have been further grouped into three plant association groups (PAGs) which reflect temperature-precipitation zones. PICO Riparian consists of PICO/ELPA2, PICO/CAEU, PICO/VAOC2/CAEU, PICO/SPDO/CAEU, PICO/VAOC2, PICO/SPDO, and PICO/ARUV. PICO Dry

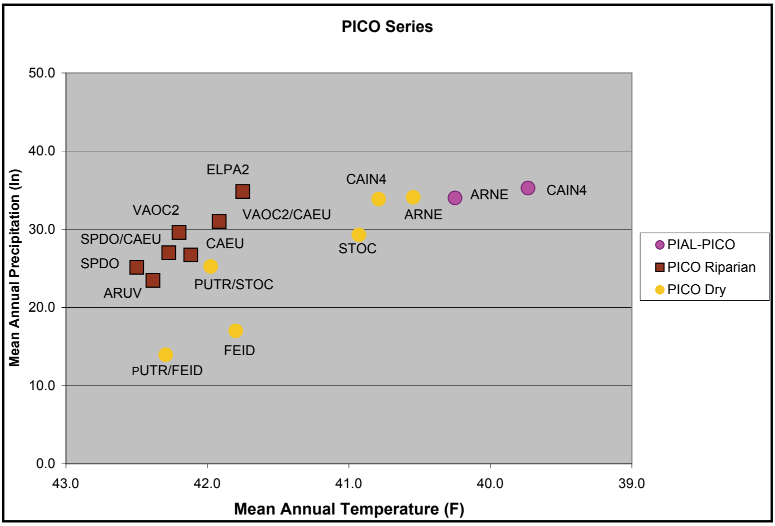
Figure 9-1. Map of Lodgepole Pine Plot Distribution by PAG—



consists of PICO/ARNE, PICO/CAIN4, PICO/PUTR/FEID, PICO/PUTR/STOC, PICO/FEID Community Type and PICO/STOC Community Type. PICO-PIAL PAG consists of two plant associations, PICO-PIAL/ARNE and PICO-PIAL/CAIN4. Species diversity and productivity decline as the PAGs change from wet to dry and warm to cold.

PICO Riparian PAG plant associations have higher effective moisture regimes than the other two PAGs in the series. The increased moisture is a result of sub-irrigation. The sub-irrigation is due to site adjacency to streams or riparian zones. Within the deep ash/pumice deposits from Mt. Mazama, the ecotones between the PICO Riparian PAG associations and PICO Dry associations may be very abrupt. PICO Riparian PAG sites average 20-25% cover of lodgepole pine over a well developed understory. The understory vegetation typically has 15-20% shrub cover and 25-35% cover in sedges and grasses. Forb layers are diverse, but only average 1-5% cover. Common understory species are: bearberry, bog birch, Geyer's and Lemmon's willows, Douglas spiraea, bog blueberry, strawberry, bluejoint reedgrass, widefruit sedge, tufted hairgrass, blue wildrye, Baltic rush, and Kentucky bluegrass.

Figure 9-2. Temperature – Precipitation Relationships for Plant Associations and Plant Association Groups within the PIAL & PICO Series.



PICO Dry PAG plant associations have depauperate understory vegetation, due to the excessively drained soils. Tree layers average 20-30% cover of lodgepole pine. Understory vegetation is depauperate compared to PICO Riparian PAG sites. Shrubs and graminoids typically average 5-10% each, and forbs are not well represented, averaging less than 1% cover. Common understory species are: bitterbrush, wax currant, strawberry, long-stolon sedge, Ross's sedge, squirreltail, and western needlegrass.

PIAL-PICO PAG plant associations have higher total cover of trees (35-45%) than either of the other PICO PAGs. Whitebark and lodgepole pines are always present. Understory vegetation is more depauperate than PICO Dry associations. Shrub cover when it occurs at all only averages 1-5% cover. Graminoids average 5-10% cover and forbs typically average only 1-3% cover. Common understory species are: pinemat manzanita, King's sandwort, long-stolon sedge, Ross's sedge, Wheeler's bluegrass, squirreltail, and western needlegrass.

Fire— Climax lodgepole pine sites in south-central Oregon have a mixed severity fire regime. A combination of low, moderate, and high severity fires occurs in space and time (Agee 1993). Stuart (1983) found fire intervals ranging from 60-350 years in stands on the Fremont National Forest. Within Crater Lake National Park, Agee (1981) estimated a return interval of 60 years. In the southern Cascades near Mt. Lassen, Taylor and Solem (2001) reported a mean fire return interval of 63 years with range of 59-67 years, and Becker and Taylor (2001) reported a mean return interval of 47 years with a range of 38-54 years.

Except for the PICO Riparian PAG sites, most PICO Series sites in the analysis area are fine surface fuel limited. The limited surface fuels can cause climax lodgepole pine sites to act as a natural fire barrier except under extreme fire weather (Agee 1993). Herbaceous and shrub fuels are often too scattered to effectively carry fire, and litter fuels in climax lodgepole pine are sparse in older PICO Dry and PIAL-PICO Dry stands. The most continuous fire vector is partially decayed down logs in these depauperate conditions. Gara et al. (1985) describe the log to log smoldering pattern from three separate fire events on the Silver Lake District of the Fremont National Forest.

Volland documented fires on 79 plots within the PICO Series. Sixteen sites had records of multiple fires. Eleven of the 16 multiple fire plots occurred in the PICO Dry plant association group. These plots documented 15 previous fires. Return intervals for non-stand replacement fires averaged 34 years on these plots and ranged from 18-98 years. The remaining 5 plots that documented multiple fires occurred in the PICO Riparian plant association group. These 5 plots documented 7 previous fires. Return intervals for non-stand replacement fires on PICO Riparian sites averaged 24 years and ranged from 12-38 years. Volland's plot data suggest a stand replacement interval of 66-120 years in PICO Dry and 75-132 years in PICO Riparian plant association groups.

Very little data exists for fire frequencies in PIAL-PICO plant association group sites. Because most PIAL-PICO sites have such depauperate understory vegetation and discontinuous fuels, they likely have somewhat longer fire frequencies than adjacent forest types.

Fire return intervals for all PICO series sites appear to vary based on the composition of the surrounding forest types. Where they are adjacent to ponderosa pine, white fir, Shasta red fir, or mountain hemlock the fire frequency approaches the frequencies of the surrounding forest types.

Productivity and Management—

Key Insects and Diseases: Mountain pine beetle, white pine blister rust, lodgepole pine and whitebark pine dwarf mistletoe.

Secondary Insects and Diseases: Pine engraver, fir engraver, western pineshoot borer, pandora moth, needle miner, Armillaria and annosus root diseases, Lophodermella needle cast, western gall rust, red ring rot, stalactiform rust, aspen trunk rot.

Table 9-1 Site Index (SI standard error), Growth Basal Area (GB A standard error), Yield Capability ($Ft^{3)}$ by Species and Plant Association Group within the PICO Series

PAG	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
PICO Dry							
PICO	62	1	534	101	1	1602	29
PIAL-PICO Dry							
PIAL				131	8	22	
PICO	49	2	29	126	3	311	29
PICO Riparian							
PICO	64	2	98	119	3	208	35

Important Effects: When lodgepole pine stands reach about 100 years of age, they become particularly vulnerable to infestation by the mountain pine beetle. Outbreaks can last for several years and most of the larger trees in the stand are typically killed. Pandora moth feeds on lodgepole pine as readily as on ponderosa pine and large-scale outbreaks occur at irregular intervals throughout the host type. Infestation by Pandora moth causes a reduction in growth but is otherwise not important.

Lodgepole pine dwarf mistletoe was the most damaging disease agent across all PAGS in the PICO series with infection frequencies of 35% of the CVS plots. The dry and moist PAGS had 31% infection, with infection increasing to 41% in the PICO riparian PAG. Infection by *Arceuthobium americanum* and associated brooming in lodgepole pine alter the crown height, crown base height, and live crown ratio (Godfree et al. 2002) this causes changes in stand structure. Root diseases can be locally important disturbance agents in these systems and were more prevalent in the dry PICO PAGS (10% of CVS plots had infection). Root disease was not found in the PICO riparian PAG.

White bark pine is least threatened by white pine blister rust in the PIAL-PICO series due to low humidity/moisture levels which cause infection. Shoal and Aubry (2006) found that blister rust infection in southern Oregon, especially on the Fremont, was low with infection rates at 0% on most of their transects. However, infection rates were higher on sites near the Cascades Crest where they averaged 24% on Pelican Butte and Maiden Peak. Deployment of native stock of all five needle pines may be possible due to low rust levels on most sites in southern Oregon. On sites closer to the Cascade crest, such as those on Maiden peak and Pelican Butte, the stands should be assessed for rust hazard before native stock is deployed.

Lophodermella needle cast causes defoliation in years where favorable cool, moist environmental conditions occur, however, needle loss is typically inconsequential to lodgepole vigor and health. Western gall rust stem and branch infections develop across the range of lodgepole pine and can lead to stem deformation and breakage. Red ring rot is common in lodgepole pine, however, fruiting bodies are rarely produced, therefore identification of the disease can be difficult.

Quaking aspen is periodically defoliated by the satin moth. There is a high incidence of white heartwood rot caused by *Phellinus tremulae* in aspen stands. Aspen are prone to a wide range of canker and foliage diseases (Schmitt 2000).

Wildlife Management— Because wildlife habitats do not precisely match plant associations or even plant series, Appendix C in this guide is provided. Please see page C-11 for a discussion on lodgepole pine.

Relationships to Other Classifications— The Lodgepole Pine Series has been previously described in south-central Oregon by Hopkins (1979a, 1979b), Volland (1985), and Kovalchik (1987).

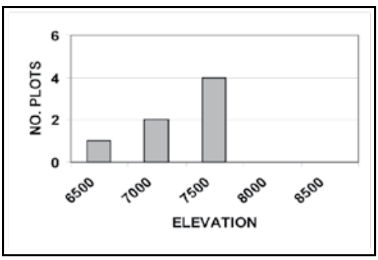
Key to Plant Associations of the Lodgepole Pine Series:

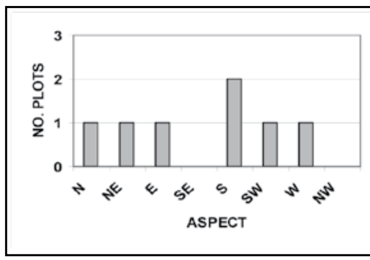
1a	*Pinus albicaulis* (>5%)	2a
1b	*Pinus albicaulis* (<5%)	4a
2a	*Arctostaphylos nevadensis* (>1%)	PIAL-PICO/ARNE
2b	Not as above	3a
3a	*Carex inops* (>1%) not restricted to microsite	PIAL-PICO/CAIN4
3b	Not as above	return to start of key and relax cover %
4a	*Eleocharis pauciflora* (>10%)	PICO/ELPA2
4b	Not as above	2a
5a	*Carex eurycarpa* (>5%) and *Vaccinium occidentale* (>5%)	PICO/VAOC2/CAEU
	Vaccinium occidentale (<5%) and *Spiraea douglasii* (>5%)	PICO/SPDO/CAEU
	Neither VAOC2 or SPDO well represented (> 5%)	PICO/CAEU
5b	Not as above	6a
6a	*Vaccinium occidentale* (>5%)	PICO/VAOC2
6b	Not as above	7a
7a	*Spiraea douglasii* (>5%)	PICO/SPDO
7b	Not as above	8a
8a	*Arctostaphylos uva-ursi* (>1%)	PICO/ARUV
8b	Not as above	9a
9a	*Arctostaphylos nevadensis* (>1%)	PICO/ARNE
9b	Not as above	10a
10a	*Carex inops* (>1%)	PICO/CAIN4
10b	Not as above	11a
11a	*Purshia tridentata* (>1%) and *Festuca idahoensis* (>1%)	PICO/PUTR/FEID
	Festuca idahoensis (<1%) and *Stipa occidentalis* (>1%)	PICO/PUTR/STOC
11b	Not as above	9a
12a	*Festuca idahoensis* (>1%) and not restricted to microsites	PICO/FEID CT
12b	Not as above	10a
13a	*Stipa occidentalis* (>1%) and not restricted to microsites	PICO/STOC CT
13b	Not as above	return to start of key and relax cover %

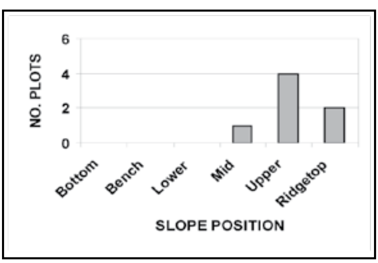
PIAL-PICO/ARNE **PIAL-PICO Dry**

CLC113 (PIAL-PICO/ARNE)
Pinus albicaulis-Pinus contorta/Arctostaphylos nevadensis
whitebark pine-lodgepole pine/pinemat manzanita
Plots 8

Distribution and Environment— Elevation is high, averaging 7336 feet (range 6600-7820 feet), which makes the growing season short and damage from heavy snow loads an obstacle for understory development. The position of these plots was generally at the top of slopes or on ridges and aspect varied.

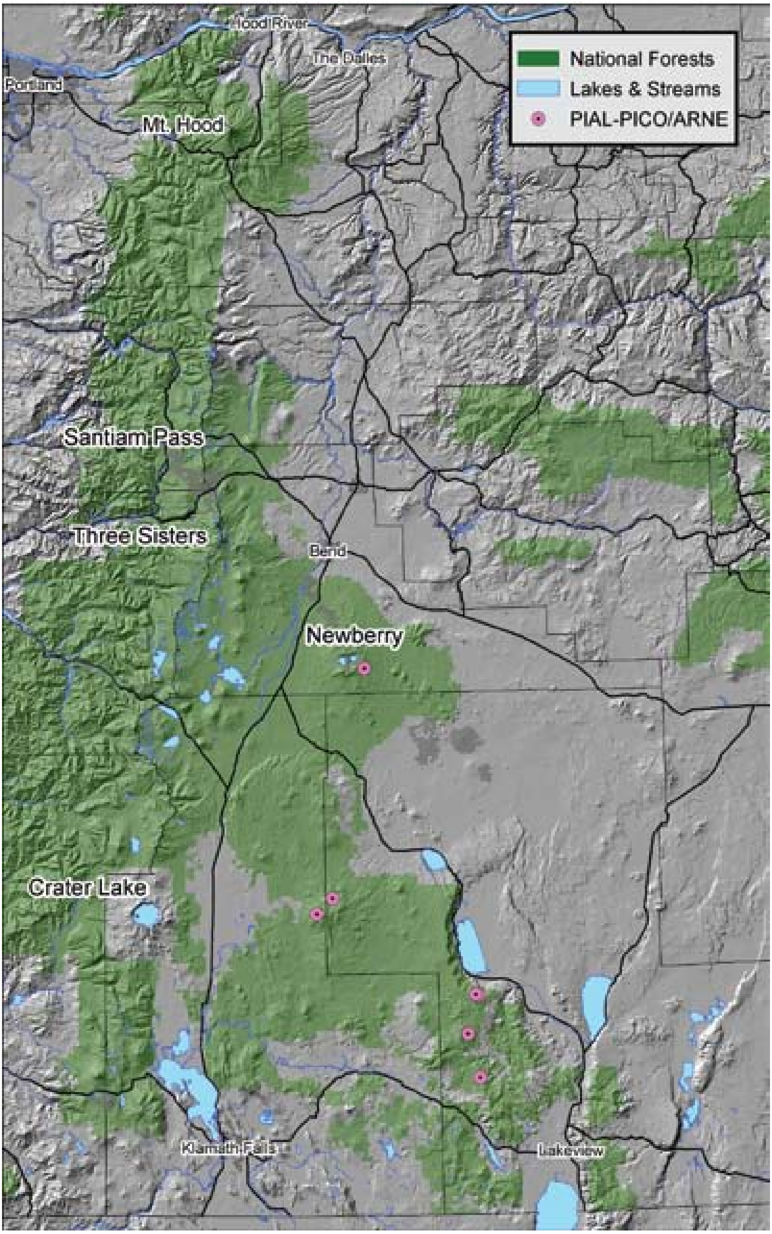






Mean Precip.	34.0”	25-41”
Mean Temp.	40.2°F	39-43°F

Figure 9-3. Map of PIAL-PICO/ARNE Plot Distribution—



Vegetation— Whitebark and lodgepole pines dominate the overstory and understory tree layers, with trace amounts of western white and ponderosa pines in a few of the plots. The understory is sparse; pinemat manzanita (ARNE) occurred in all plots with high constancies of long-stolon sedge (CAIN4) and western needlegrass (STOC).

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
PIAL	*Pinus albicaulis*	88	100	6.5	4.1
PICO	*Pinus contorta*	100	100	24.2	12.6
Shrubs					
ARNE	*Arctostaphylos nevadensis*	100		2.9	
ARTR	*Artemisia tridentata*	38		1.2	
CHVI	*Chrysothamnus viscidiflorus*	25		1.8	
RICE	*Ribes cereum*	25		0.1	
Herbaceous					
ARKI	*Arenaria kingii*	38		3.7	
Graminoids					
CAIN9	*Carex inops*	88		2.4	
CARO	*Carex rossii*	50		0.2	
PONE	*Poa nervosa*	50		2.8	
SIHY	*Sitanion hystrix*	25		0.3	
STOC	*Stipa occidentalis*	88		1.4	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—Whitebark pine is semi-tolerant to fire and has been known to invade burned sites (Arno and Hoff 1989). Whitebark pine has a relatively thin bark, but its open and depauperate habitat reduces its vulnerability to fire. White pine blister rust is an important non native disease in whitebark pine, however these sites appear to be some of the least susceptible to blister rust infection, due to their low humidity and moisture.

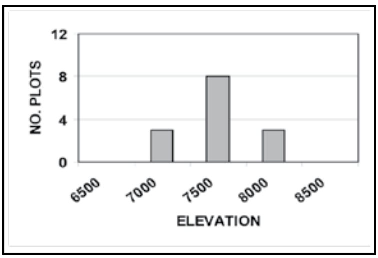
Plant Assoc	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
PIAL-PICO /ARNE							
PICO	41	3	3	114	11	12	19

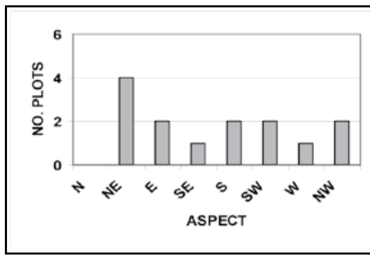
Relationships to other classifications— This association is similar to lodgepole pine-whitebark pine/gay penstemon (PICO-PIAL/PELA, CL-C1-11) and lodgepole pine-whitebark pine-western white pine/sandwort (PICO-PIAL/ARKI, CL-C1-12) described by Hopkins (1979a). Both of these plant associations have high PICO and PIAL with PONE and CAIN9 in the understory, but the PICO-PIAL/ARKI plant association also has high constancies of ABCO and ARKI. Daubenmire and Daubenmire (1968), Steele et al. (1981), and Williams et al. (1995) describe only a PIAL series.

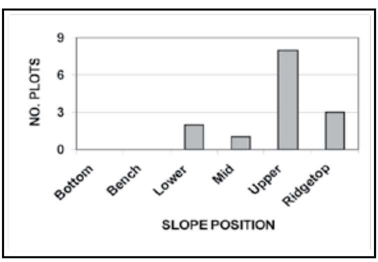
PIAL-PICO/CAIN4 **PIAL-PICO Dry**

CLC114 (PIAL-PICO/CAIN9)
Pinus albicaulis-Pinus contortus/Carex inops
whitebark pine-lodgepole pine/long-stolon sedge
Plots 15

Distribution and Environment— PIAL-PICO/CAIN4 is a high-elevation plant association. Sampled sites average 7747 feet (range 7260-8212 feet). PIAL-PICO/CAIN4 occurs from Yamsey Mountain south to Crane Mountain in the Warner Mountains east of Lakeview. Growing seasons are short and damage from heavy snow loads is common. Slope positions of sampled sites are typically upper slopes or ridgetops. Aspects are variable.

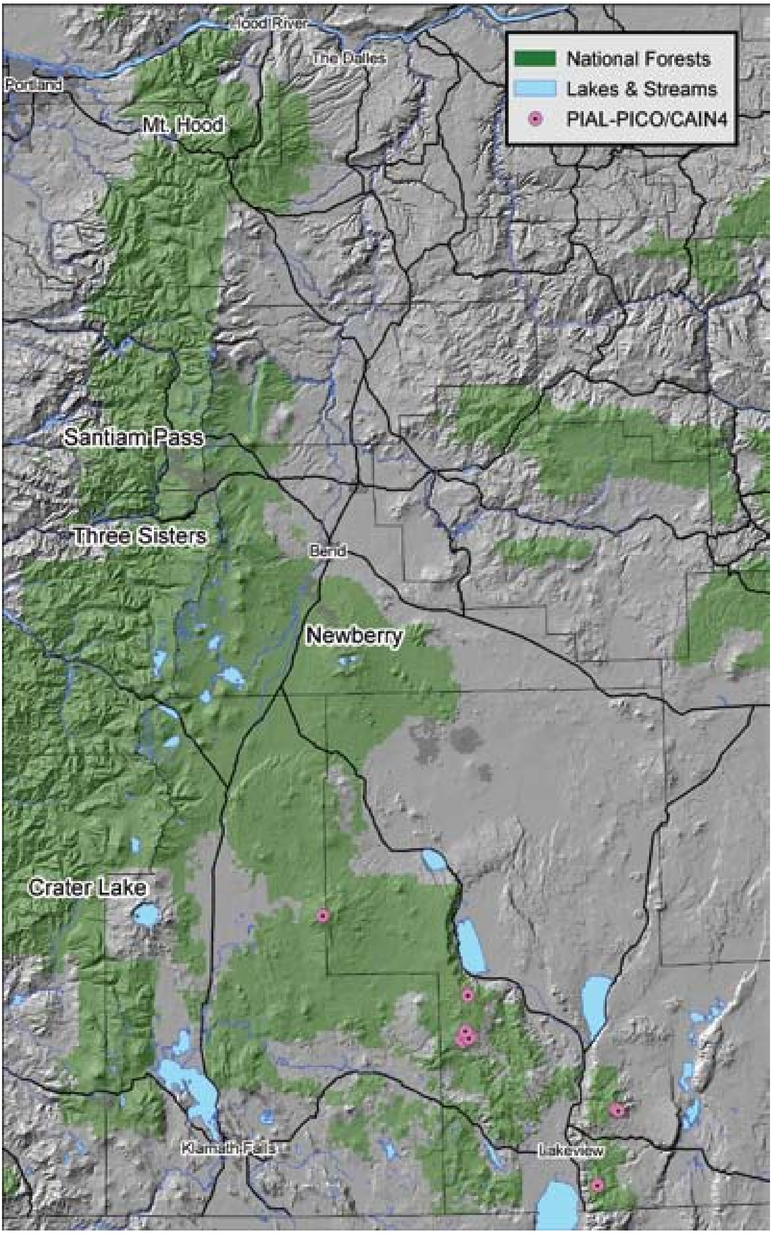






Mean Precip.	35.3”	29-41”
Mean Temp.	39.7°F	38-42°F

Figure 9-4. Map of PIAL-PICO/CAIN4 Plot Distribution—



Vegetation— Whitebark and lodgepole pines dominate the overstory and understory tree layers, with trace amounts of western white pine, ponderosa pine, and white fir-grand fir in a few of the plots. The understory is sparse. Long-stolon sedge (CAIN4) and Wheeler's bluegrass (PONE) are the most common species. Long-stolon sedge occurred in all plots. PICO/CAIN4 differs from PIAL-PICO/ARNE in the dominance of grasses and rarity of shrubs.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
ABCO	*Abies concolor*	-	20	-	0.5
PIAL	*Pinus albicaulis*	93	100	6.8	2.5
PICO	*Pinus contorta*	100	100	20.5	5.0
Herbaceous					
ARKI	*Arenaria kingii*	27		7.8	
SPUM	*Spraguea umbellata*	20		0.5	
Graminoids					
CAIN4	*Carex inops*	100		3.8	
PONE	*Poa nervosa*	73		6.2	
SIHY	*Sitanion hystrix*	53		1.7	
STOC	*Stipa occidentalis*	33		2.5	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—Whitebark pine is semi-tolerant to fire and has been known to invade burned sites (Arno and Hoff 1989). The whitebark pine has a relatively thin bark, but its open and depauperate habitat reduces its vulnerability to fire. White pine blister rust is an important non native disease in whitebark pine, however these sites appear to be some of the least susceptible to blister rust infection, due to their low humidity and moisture.

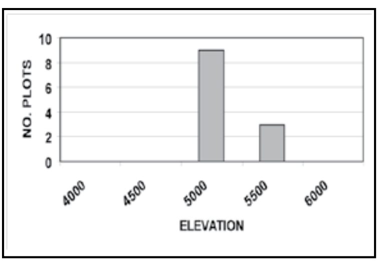
Plant Assoc	Avg SI	SI SE	# Trees	GBA	GBA SE	# Trees	Ft^3
PIAL-PICO /CAIN4							
PICO	48	2	5	129	6	63	29

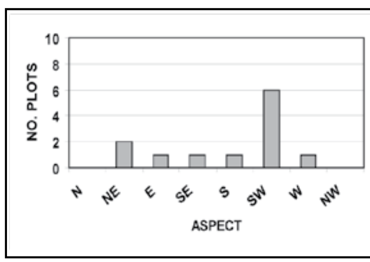
Relationships to other classifications— This association has affinities to lodgepole pine-whitebark pine/gay penstemon (PICO-PIAL/PELA, CL-C1-11) and lodgepole pine-whitebark pine-western white pines/ sandwort (PICO-PIAL/ARKI, CL-C1-12) described by Hopkins (1979a). Both of these plant associations have high PICO and PIAL with PONE and CAIN9 in the understory, but the PICO-PIAL/ARKI plant association also has high constancies of ABCO and ARKI. Daubenmire and Daubenmire (1968), Steele et al. (1981), and Williams et al. (1995) describe only a PIAL series.

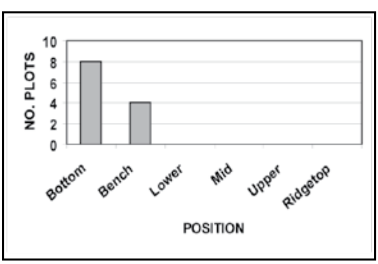
PICO/ELPA2 — PICO Riparian

CLM912 (PICO/ELQU2)
Pinus contorta/Eleocharis pauciflora
lodgepole pine/few-flowered spikerush
Plots 12

Distribution and Environment— PICO/ELPA2 is a minor type that is known to occur south of Walker Rim to Sugar Pine Mountain on the Chemult Ranger District of the Winema National Forest. It occurs in moderate elevation basins filled with deep pumice deposits resulting in bog formation. Sites are relatively cold and poorly drained. Soils have organic surface horizons derived from sedges, sphagnum, and moss peats. The soil surface is inundated through most of the summer. Adjacent wetter positions cannot support trees and transition to wet meadows dominated by few-flowered spikerush (ELPA2) and/or beaked sedge (CAUT). Average elevation is 5360 feet (range 5020-5570 feet). Plot aspect varied. Average slope is 4% (range 1-15%). Slope positions are always bottoms or wet benches.

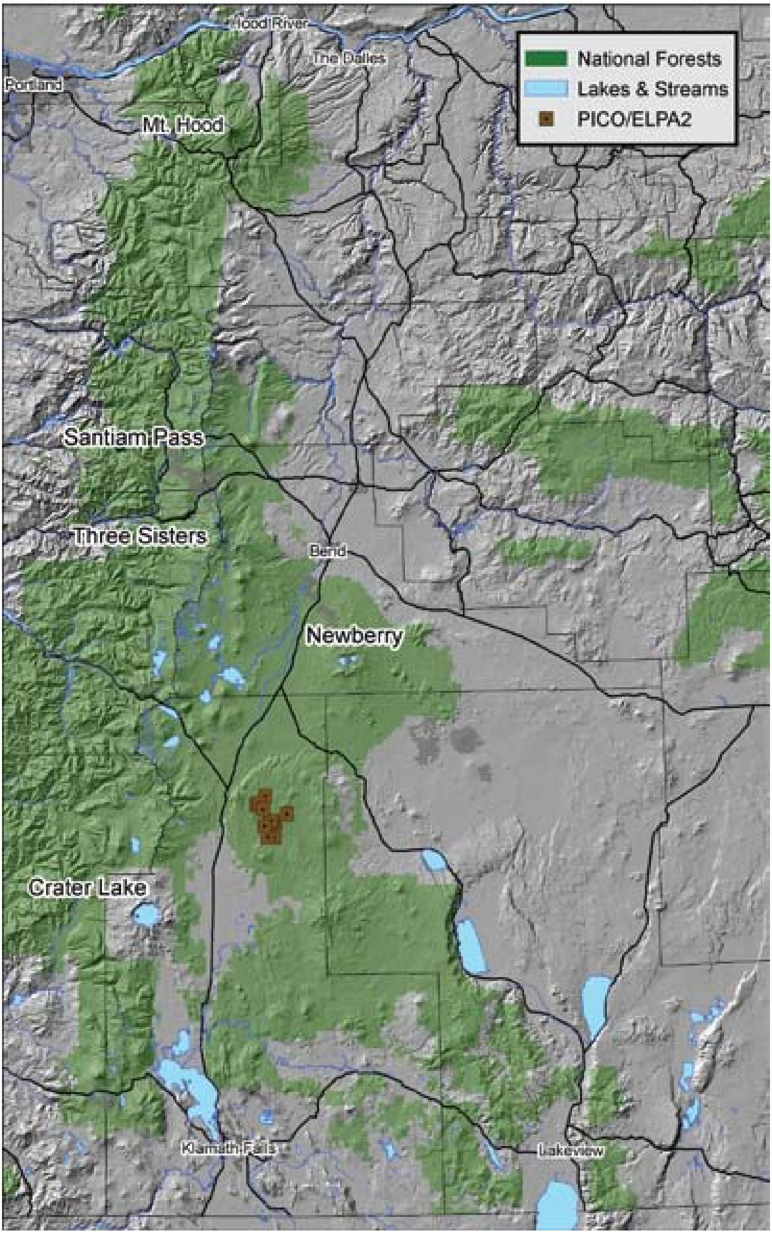






Mean Precip.	34.8”	31-37”
Mean Temp.	41.8°F	41-42°F

Figure 9-5. Map of PICO/ELPA2 Plot Distribution—



Vegetation— Lodgepole pine forms a very thin cover over dwarfed shrubs. The most common shrubs are bog blueberry (VAOC2), bog birch (BEGL), and willows (SAGE, SALE). Trees and shrubs are most common on hummocks or other places that have slightly improved drainage. Herbaceous layers are dominated by few-flowered spikerush (ELPA2), widefruit sedge (CAEU), and short-beak sedge (CASI2). Aquatic sedge may be locally abundant in areas that have more aeration (moving water). ELPA2 is most abundant in swale positions.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
PICO	*Pinus contorta*	75	25	8.6	2.4
Shrubs					
BEGL	*Betula glandulosa*	75%		7.1	
SAGE	*Salix geyeriana*	42%		6.2	
SALE	*Salix lemmonii*	50%		0.7	
SPDO	*Spiraea douglasii*	29%		7.6	
VAOC2	*Vaccinium occidentale*	83%		11.3	
Herbaceous					
FRVI	*Fragaria virginiana*	33%		0.6	
Graminoids					
CAAQ	*Carex aquatilis*	33%		11.5	
CACA	*Calamagrostis canadensis*	42%		0.7	
CAEU	*Carex eurycarpa*	92%		10.2	
CASI2	*Carex simulata*	83%		4.7	
CAUT	*Carex utriculata*	25%		5.4	
DECA	*Deschampsia caespitosa*	75%		1.7	
ELPA2	*Eleocharis pauciflora*	100%		36.3	
JUBA	*Juncus balticus*	67%		2.5	

* Species with a constancy of 25% or greater are shown here.

Productivity and Management—

No data available for this plant association.

Relationships to Other Classifications— The PICO-PIEN/ELPA2 plant association has been previously described for central Oregon by Kovalchik (1987). This classification is consistent with Kovalchik's definition of the type, although no Engelmann spruce occurs in the sites sampled here.

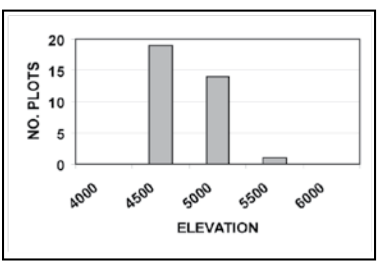
PICO/CAEU — PICO Riparian

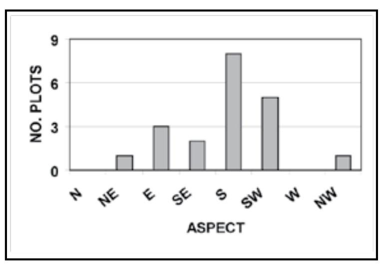
CLM113 (PICO/CAAN15)
Pinus contorta/Carex eurycarpa
lodgepole pine/widefruit sedge
Plots 35

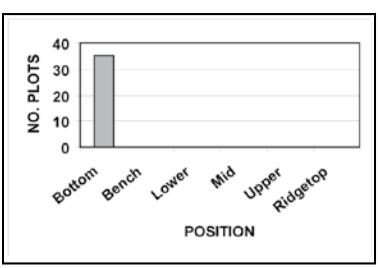
Distribution and Environment— PICO/CAEU associations are a forested wetland type that is strongly associated with deep pumice mantles. Sites are located on forested floodplains, small forested basins, margins of wet meadows, and shallow concave sub-irrigated drainages. Sampled plot locations are restricted to Chemult and Chiloquin Ranger Districts on the Winema, however Kovalchik (1987) also reported this association along the Deschutes River, Little Deschutes River, Falls Creek, and Crescent Creek on the Deschutes National Forest.

Soils are deep air-fall pumice alluvium. Water tables are at, or above, the soil surface from April to August and recede to 1-2 feet below the soil surface by September or October. Surface horizons have a grassy organic horizon over mucky diatomaceous silt over coarse pumice gravels (Dorr et al. 2005).

Elevations are low to moderate. Average elevation is 4985 feet (range 4525-5540 feet). Most plots were found on a southern aspect. Average slope is 2% (range 0-6%). Slope positions are wet sub-irrigated bottoms.

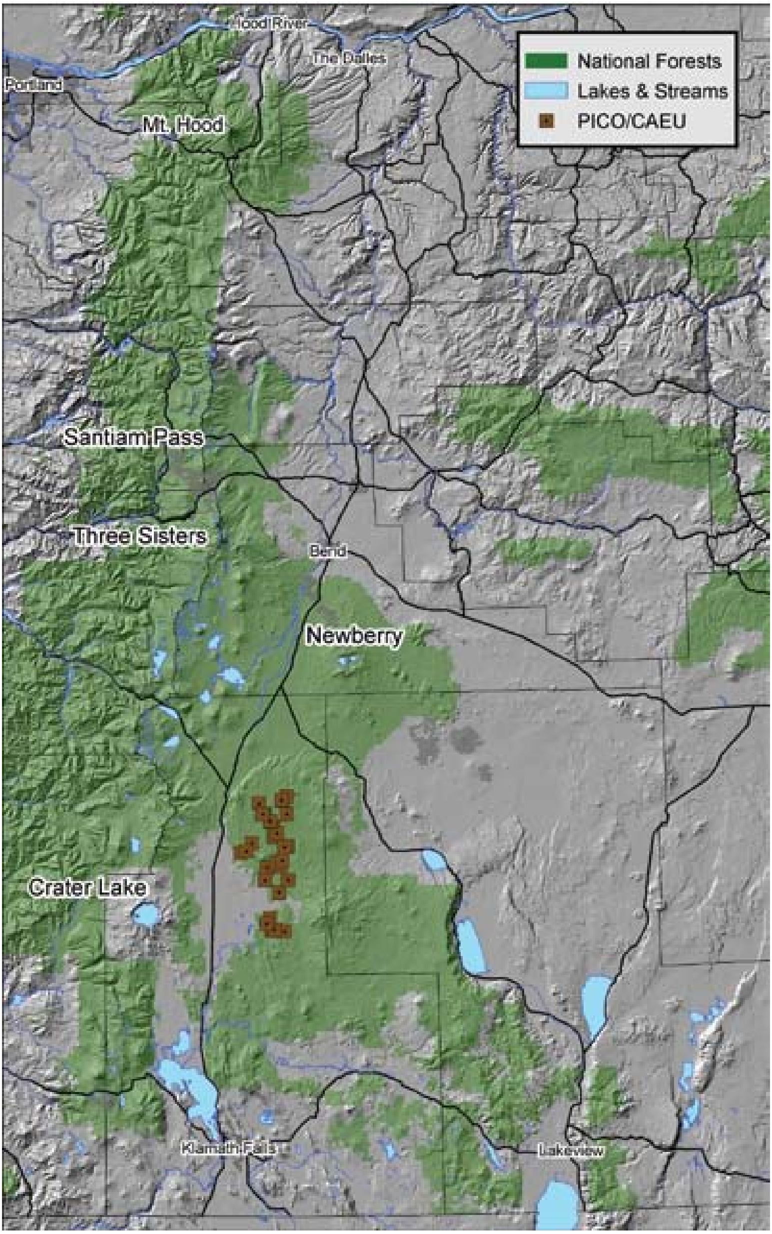






Mean Precip.	26.7”	19-37”
Mean Temp.	42.1°F	41-43°F

Figure 9-6. Map of PICO/CAEU Plot Distribution—



Vegetation— Lodgepole pine is the dominant tree. Widefruit sedge (CAEU) forms a dense sward often with bluejoint reedgrass (CACA). Shrubs are often present at low covers. The most common shrub species are Douglas spirea (SPDO), bog birch (BEGL), and Geyer's willow (SAGE). Strawberry (FRVI) is the only forb species with high constancy. It also typically occurs at low cover.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
PICO	*Pinus contorta*	94	6	17.9	0.6
Shrubs					
BEGL	*Betula glandulosa*	32%		1.3	
RILA	*Ribes lacustre*	21%		0.2	
SAGE	*Salix geyeriana*	29%		1.3	
SPDO	*Spiraea douglasii*	50%		0.9	
Herbaceous					
FRVI	*Fragaria virginiana*	71%		1.6	
Graminoids					
CACA	Calamagrostis canadensis	79%		6.8	
CAEU	*Carex eurycarpa*	100%		22.1	
DACA	*Danthonia californica*	21%		9.3	
DECA	*Deschampsia caespitosa*	56%		4.0	
ELGL	*Elymus glaucus*	65%		4.2	
JUBA	*Juncus balticus*	53%		1.8	
POPR	*Poa pratensis*	62%		4.7	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

No data available for this plant association.

Relationships to Other Classifications— The PICO/CAEU plant association has been previously described for central Oregon by Kovalchik (1987). This classification is consistent with Kovalchik's definition of the type.

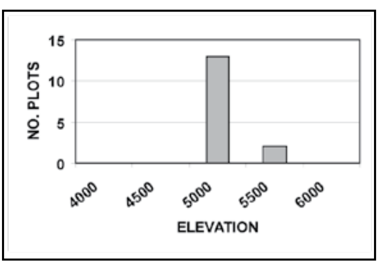
PICO/VAOC2/CAEU — PICO Riparian

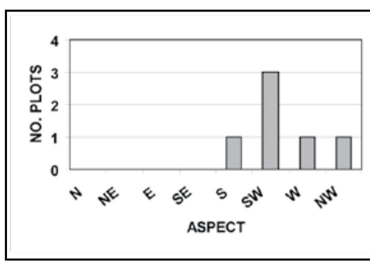
CLM312 (PICO/VAUL/CAAN15)
Pinus contorta/Vaccinium occidentale/Carex eurycarpa
lodgepole pine/bog blueberry/widefruit sedge
Plots 12

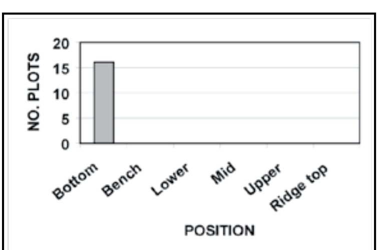
Distribution and Environment— The PIPO/VAOC2/CAEU association is a forested wetland type that is strongly associated with deep pumice mantles. Sites are located on flat, wet, cold floodplain and basin landforms. Sampled plot locations are restricted to the Chemult Ranger District on the Winema, however Kovalchik (1987) also reported this association along Fall River, and Crescent Creek on the Deschutes National Forest and adjacent to Lake of the Woods on the Klamath Ranger District of the Winema National Forest.

Soils are deep air-fall pumice alluvium. Water tables are at, or above, the soil surface from April to August and recede to 2-5 feet below the soil surface by September or October. Surface horizons have an organic horizon 4-18" over diatomaceous silt over coarse pumice sands and gravels (Dorr et al. 2005).

Average elevation is 5255 feet (range 5020-5570 feet). Average slope is 3% (range 0-12%). Most plots were found on a southwestern aspect.

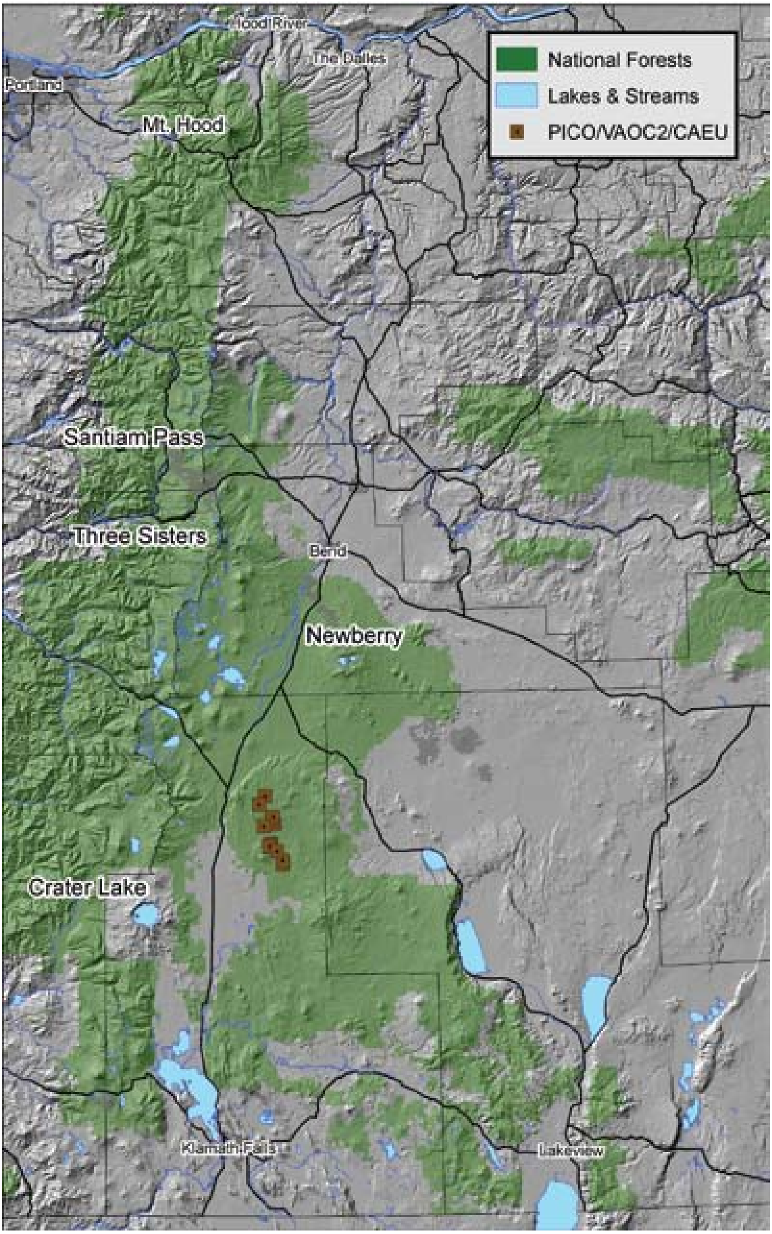






Mean Precip.	31.0"	23-37"
Mean Temp.	41.9°F	41-42°F

Figure 9-7. Map of PICO/VAOC2/CAEU Plot Distribution—



Vegetation— Lodgepole pine is the climax and dominant tree species. Bog blueberry and Douglas spirea are the dominant shrubs. A variety of willows is present within stands and may increase cover with reduction in cover of the lodgepole pine overstory. Cover of the herbaceous layers is similar to the closely related PICO/CAEU association.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
PICO	*Pinus contorta*	100	-	20.3	-
Shrubs					
BEGL	*Betula glandulosa*	42%		6.4	
SAGE	Salix geyeriana	25%		1.1	
SALE	*Salix lemmonii*	42%		1.8	
SALU	*Salix lutea*	50%		3.9	
SPDO	*Spiraea douglasii*	100%		5.6	
VAOC2	*Vaccinium occidentale*	100%		40.0	
Herbaceous					
FRVI	*Fragaria virginiana*	92%		1.1	
LIBO2	*Linnaea borealis*	25%		4.7	
Graminoids					
CACA	*Calamagrostis canadensis*	100%		3.3	
CAEU	*Carex eurycarpa*	100%		14.5	
DECA	*Deschampsia caespitosa*	67%		1.1	
ELGL	*Elymus glaucus*	33%		0.6	
ELPA2	*Eleocharis pauciflora*	25%		2.3	
FEOC	*Festuca occidentalis*	20%		0.1	
JUBA	*Juncus balticus*	67%		1.2	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management— Kovalchik (1987) reported average 100 year site index for lodgepole pine was 89 and average basal area of 169.

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PICO/VAOC2/CAEU							
PICO	89						

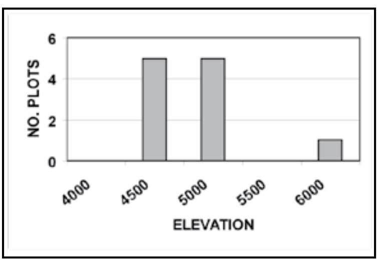
Relationships to Other Classifications— The PICO/VAOC2/CAEU plant association has been previously described for central Oregon by Kovalchik (1987). This classification is consistent with Kovalchik's definition of the type.

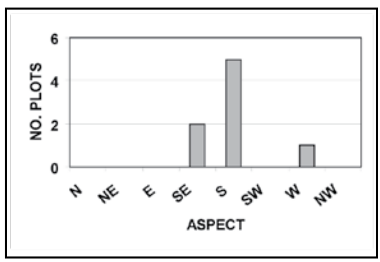
PICO/SPDO/CAEU **PICO Riparian**

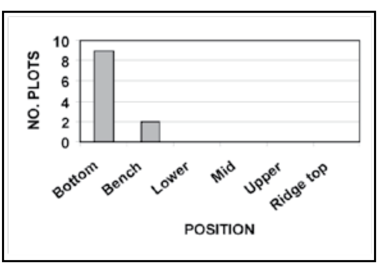
CLM314 (PICO/SPDO/CAAN15)
Pinus contorta/Spiraea douglasii/Carex eurycarpa
lodgepole pine/Douglas spiraea/widefruit sedge
Plots 11

Distribution and Environment— The PIPO/SPDO/CAEU association is a forested wetland type that is strongly associated with deep pumice mantles. Sites are located on low gradient, pumice-filled basins and drainages. Sampled plot locations are restricted to the Chemult and Chiloquin Ranger Districts on the Winema National Forest, however Kovalchik (1987) also reported this association along Tumalo Creek, Deschutes River, and Little Deschutes River on the Deschutes National Forest. Soils are deep air-fall pumice alluvium. Water tables are at, or above, the soil surface from April to August and recede to 2-5 feet below the soil surface by September or October. Surface horizons have a thin organic horizon over coarse pumice sands and gravels (Dorr et al. 2005).

Average elevation is 5178 feet (range 4840-6160 feet). Average slope is 3% (range 1-15%). Most plots were found on a southern aspect.

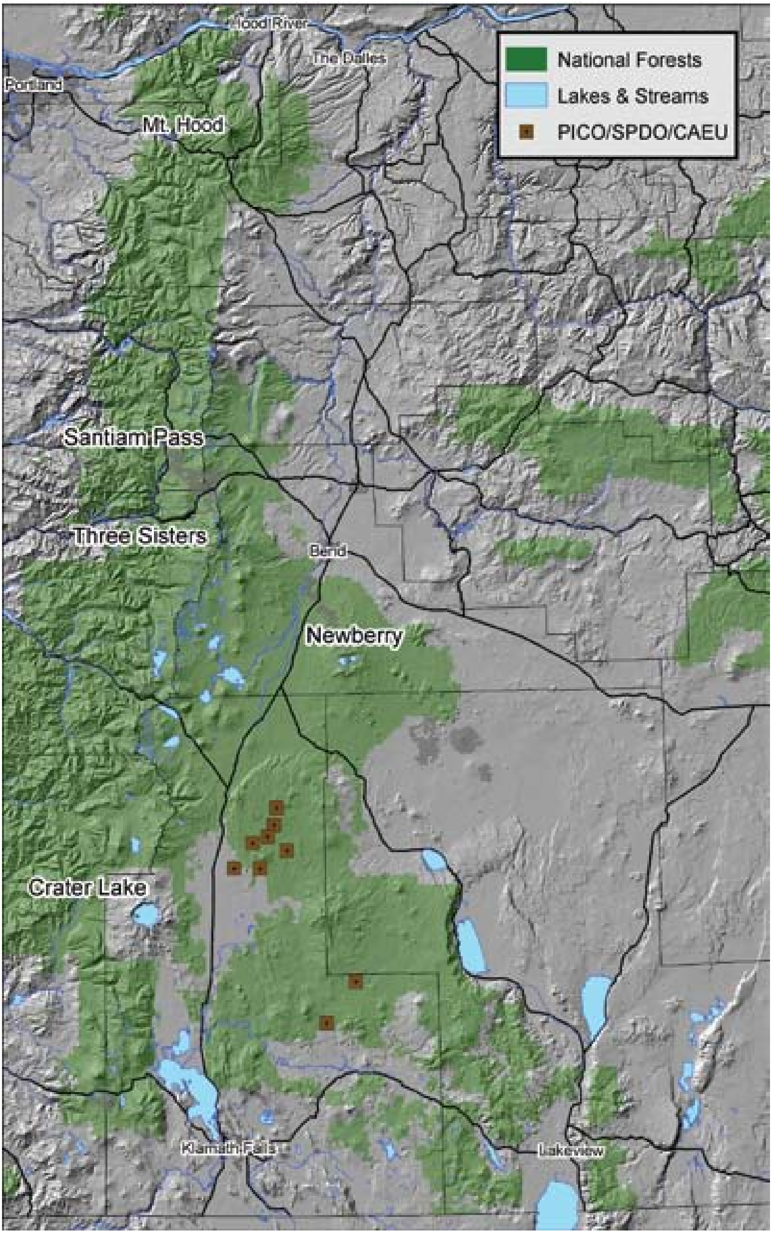






Mean Precip.	27.0”	21-35”
Mean Temp.	42.3°F	42-43°F

Figure 9-8. Map of PICO/SPDO/CAEU Plot Distribution—



Vegetation— Lodgepole pine is the climax and dominant tree species. Douglas spiraea (SPDO) and Lemmon's willow (SALE) are the dominant shrubs. A variety of willows is present within stands and may increase cover with reduction in cover of the lodgepole pine overstory. Cover of the herbaceous layers is similar to the closely related PICO/VAOC2/CAEU association.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
PICO	*Pinus contorta*	73	27	17.3	5.7
POTR	*Populus tremuloides*	18	27	17.5	6.8
Shrubs					
SALE	*Salix lemmonii*	42%		4.2	
SPDO	*Spiraea douglasii*	100%		9.1	
Herbaceous					
FRVI	*Fragaria virginiana*	82%		0.4	
SMST	*Smilacina stellata*	36%		3.1	
Graminoids					
CACA	*Calamagrostis canadensis*	91%		3.8	
CAEU	*Carex eurycarpa*	100%		19.5	
DECA	*Deschampsia caespitosa*	27%		6.7	
ELGL	*Elymus glaucus*	64%		3.3	
JUBA	*Juncus balticus*	45%		1.3	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management— Kovalchik (1987) reported average 100 year site index for lodgepole pine was 97 and average basal area of 188.

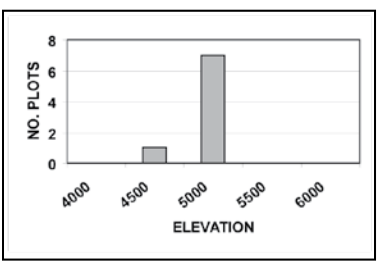
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PICO/SPDO/CAEU							
PICO	97						

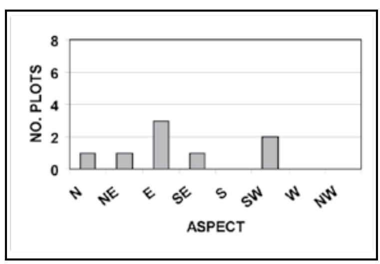
Relationships to Other Classifications— The PICO/SPDO/CAEU plant association has been previously described for central Oregon by Kovalchik (1987). This classification is consistent with Kovalchik's definition of the type.

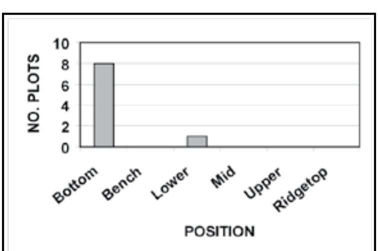
PICO/VAOC2 — PICO Riparian

CLM311 (PICO/VAUL)
Pinus contorta/Vaccinium occidentale
lodgepole pine/bog blueberry
Plots 10

Distribution and Environment— The PIPO/VAOC2 association is a forested wetland type that is strongly associated with deep pumice mantles, but it also occurs outside of the Mazama ash/pumice plume. Sites are located on drier forested margins of meadow, lake, and forested basin landforms. Sampled plot locations are restricted to the Crescent District on the Deschutes National Forest, Chemult, and Chiloquin Ranger Districts on the Winema National Forest; however Kovalchik (1987) also reported this association adjacent to Quinn Meadows on the Deschutes National Forest and Seven Mile Marsh and Heavenly Twin Lakes on the Klamath Ranger District of the Winema National Forest. Kovalchik also suggests that the type occurs on the western fringe of the Fremont National Forest, but does not list any specific locations. Sampled soils are deep air-fall pumice alluvium. Maximum water tables are 6” below the soil surface in June and recede to 2-5 feet below the soil surface by August or September (Kovalchik 1987). Average elevation is 5140 feet (range 4575-5400 feet). Average slope is 2% (range 1-6%). Plot aspects varied.

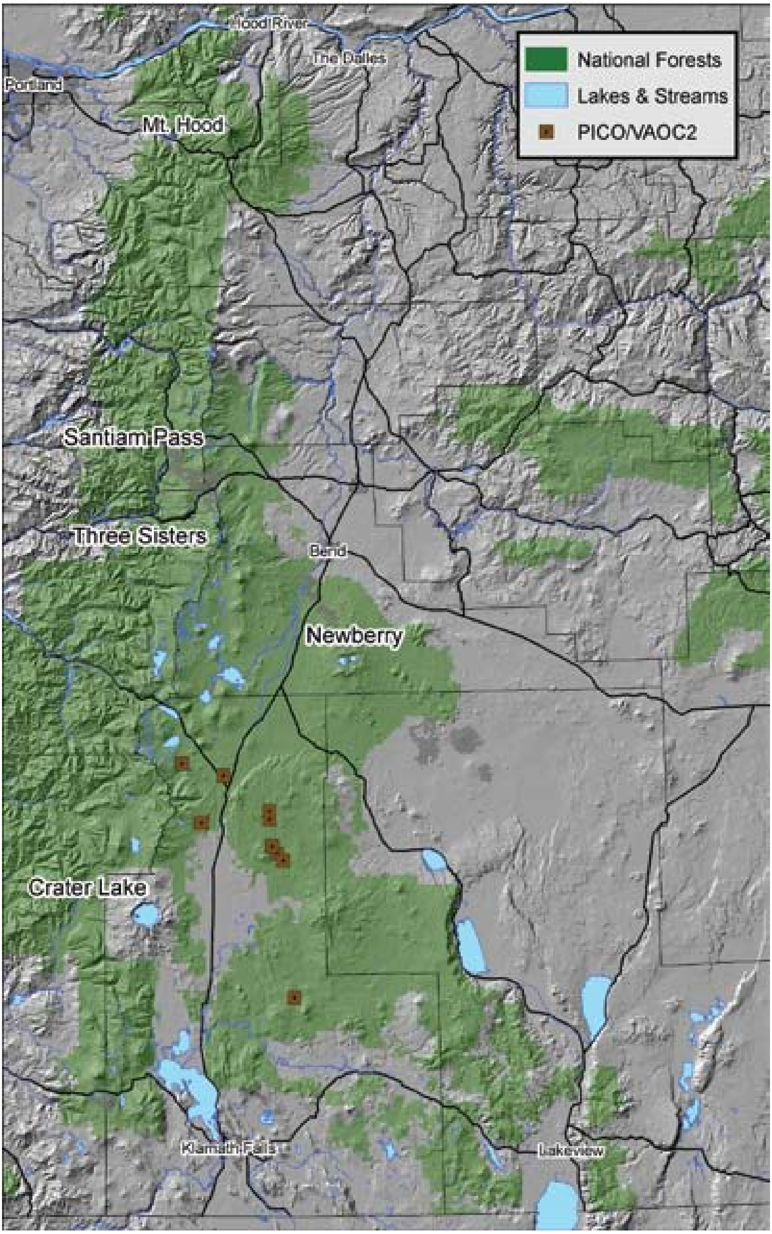






Mean Precip.	29.0”	23-37”
Mean Temp.	42.2°F	23-37°F

Figure 9-9. Map of PICO/VAOC2 Plot Distribution—



Vegetation— Lodgepole pine forms a moderately dense canopy over a dense layer of low shrubs. The shrub layer is dominated by bog blueberry (VAOC2) and Douglas spiraea (SPDO). Herbaceous layers are dominated by graminoids. The most common species are blue wildrye (ELGL), Nebraska sedge (CANE), and bluejoint reedgrass (CACA). Strawberry (FRVI) is the only forb that consistently occurs.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
PICO	*Pinus contorta*	100	70	26.3	25.4
POTR	*Populus tremuloides*	10	20	2.0	16.5
Shrubs					
ARUV	Arctostaphylos uva-ursi	40%		2.4	
LOIN	*Lonicera involucrata*	20%		3.0	
PUTR	*Purshia tridentata*	20%		1.2	
RICE	*Ribes cereum*	20%		0.6	
SAGE	*Salix geyeriana*	40%		3.2	
SPDO	*Spiraea douglasii*	60%		16.7	
VAOC2	*Vaccinium occidentale*	100%		27.3	
Herbaceous					
FRVI	*Fragaria virginiana*	100%		5.1	
Graminoids					
CACA	*Calamagrostis canadensis*	30%		1.4	
CALA3	*Carex lanuginosa*	20%		2.0	
CANE	*Carex nebraskensis*	60%		6.4	
CAIN4	*Carex inops*	20%		8.5	
CARO	*Carex rossii*	20%		0.2	
DACA	*Danthonia californica*	20%		4.3	
ELGL	*Elymus glaucus*	50%		8.0	
JUBA	*Juncus balticus*	40%		1.5	
SIHY	*Sitanion hystrix*	20%		0.3	
STOC	*Stipa occidentalis*	20%		1.2	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PICO/VAOC2							
PICO	75	3	29	107	6	65	37

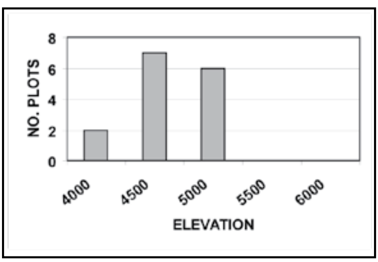
Relationships to Other Classifications— The PICO/VAOC2 plant association has been previously described for central Oregon by Kovalchik (1987). This classification is consistent with Kovalchik's definition of the type.

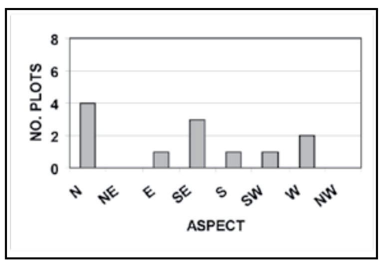
PICO/SPDO

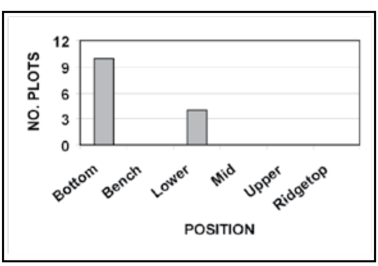
PICO Riparian

CLM313 (PICO/SPDO)
Pinus contorta/Spiraea douglasii
lodgepole pine/Douglas spiraea
Plots 15

Distribution and Environment— PICO/SPDO is a transitional association. It occurs predominantly within the Mazama ash/pumice plume. Sites are located in either low gradient, shallowly incised pumice-filled basins or narrow, deeply incised moderate-gradient drainages. Effective soil moisture is less than similar PICO/SPDO/CAEU associations. Soils are derived from deep-pumice alluvium or air-fall pumice. Surface textures are loamy sands to fine sandy loams. Surface organic matter accumulation is insignificant. Subsurface soils consist of very coarse pumice. Soils are sub-irrigated. Maximum water tables are 6-24" below the soil surface in May and June. The water table recedes to 3-4 feet below the surface by September. Average elevation is 4812 feet (range 4240-5410 feet). Average slope is 1% (range 0-4%). Plot aspects varied.

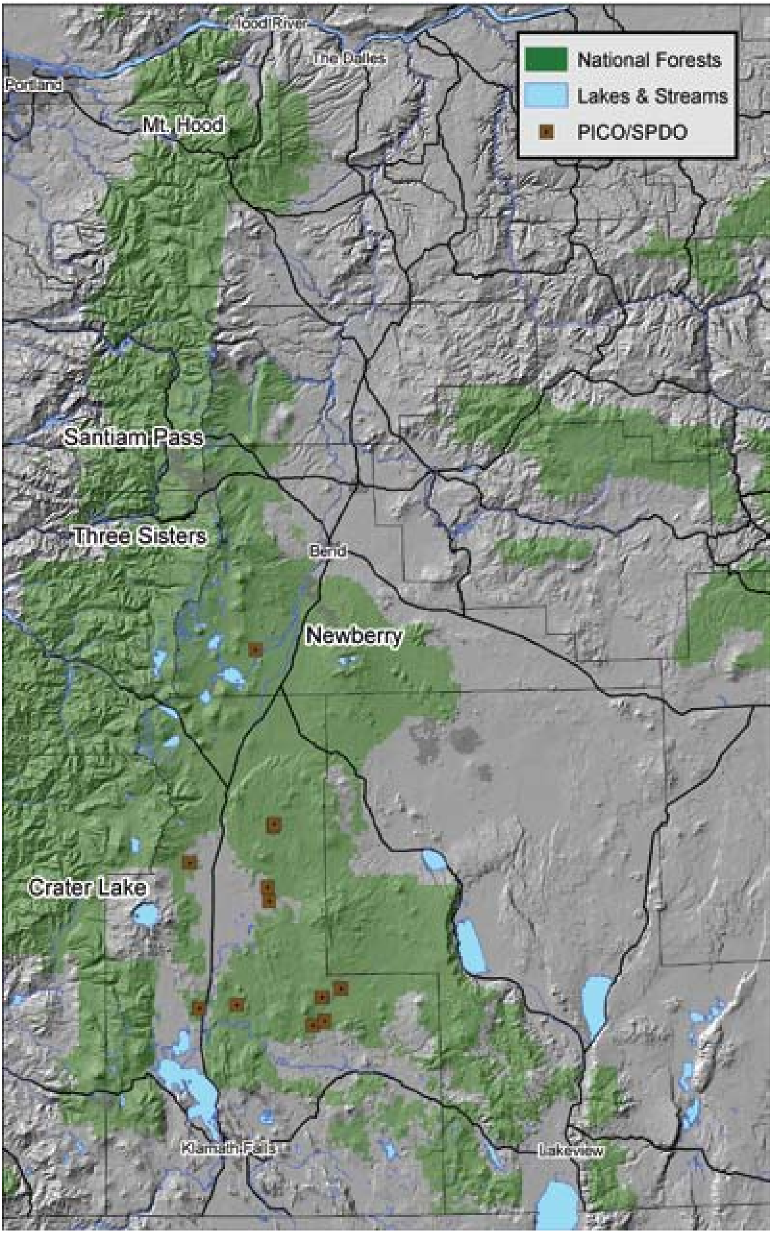






Mean Precip.	25.1"	19-35"
Mean Temp.	42.5°F	42-43°F

Figure 9-10. Map of PICO/SPDO Plot Distribution—



Vegetation— Overstory tree layers are dominated by lodgepole pine (PICO). Shrub layers are diverse. Douglas spiraea is always present, but may be joined by various mixtures of other moisture-loving shrubs such as bearberry (ARUV), prickly currant (RILA), and Booth's willow (SABO2). Herbaceous layers are quite variable with blue wildrye (ELGL), bluejoint reedgrass (CACA), strawberry (FRVI), and starry false solomon's seal (SMST) having the highest constancy and/or cover.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
PICO	*Pinus contorta*	53	73	38.0	10.7
PIPO	*Pinus ponderosa*	-	27	-	0.2
Shrubs					
ARUV	*Arctostaphylos uva-ursi*	80%		16.4	
PUTR	*Purshia tridentata*	27%		15.5	
RILA	*Ribes lacustre*	20%		0.1	
SABO2	*Salix boothii*	20%		3.4	
SPDO	*Spiraea douglasii*	100%		8.4	
Herbaceous					
FRVI	*Fragaria virginiana*	100%		2.9	
LUPO	*Lupinus polyphyllus*	20%		0.7	
OSCH	*Osmorhiza chilensis*	27%		1.6	
Graminoids					
CACA	*Calamagrostis canadensis*	33%		17.8	
CAEU	*Carex eurycarpa*	20%		0.1	
DACA	*Danthonia californica*	20%		2.4	
DECA	*Deschampsia caespitosa*	27%		17.5	
ELGL	Elymus glaucus	53%		4.7	
JUBA	*Juncus balticus*	20%		0.7	
SIHY	*Sitanion hystrix*	27%		1.5	
STOC	*Stipa occidentalis*	27%		5.9	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

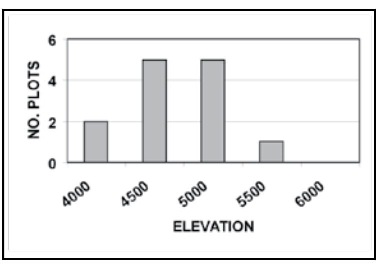
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PICO/SPDO							
PICO	65	4	22	124	14	14	37

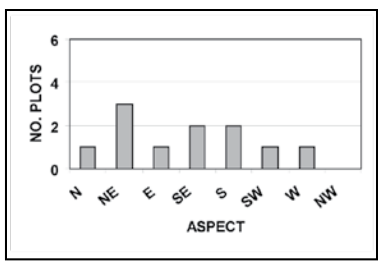
Relationships to Other Classifications— The PICO/SPDO plant association has been previously described for central Oregon by Kovalchik (1987). This classification is consistent with Kovalchik's definition of the type.

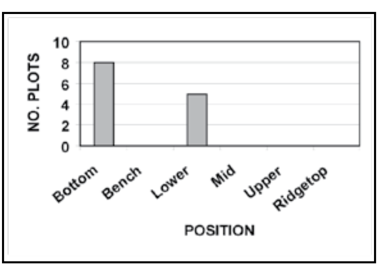
PICO/ARUV **Pico Riparian**

CLM211 (PICO/ARUV)
Pinus contorta/Arctostaphylos uva-ursi
lodgepole pine/bearberry
Plots 13

Distribution and Environment— PICO/ARUV association sites are found predominantly within the Mt. Mazama ash/pumice plume. Sampled locations occur from Walker Rim south to the vicinity of Fuego Mountain and east to Sycan Marsh. Kovalchik (1987) reported that PICO/ARUV is also common in the La Pine basin. Sites are low gradient landforms adjacent to meadows, stream terraces in forested drainages, and moist forested basins. Soils are derived from deep pumice alluvium or air-fall pumice. Surface textures are loamy, coarse sands to sandy loams. Surface organic accumulation is insignificant. Subsurface soils consist of very coarse pumice sands. Soils are sub-irrigated. Maximum water tables are 2 feet below the soil surface in May and June. The water table recedes to 4-5 feet below the surface by August (Kovalchik 1987). Average elevation is 4817 feet (range 4200-5500 feet). Average slope is 1% (range 0-3%). Aspects varied.

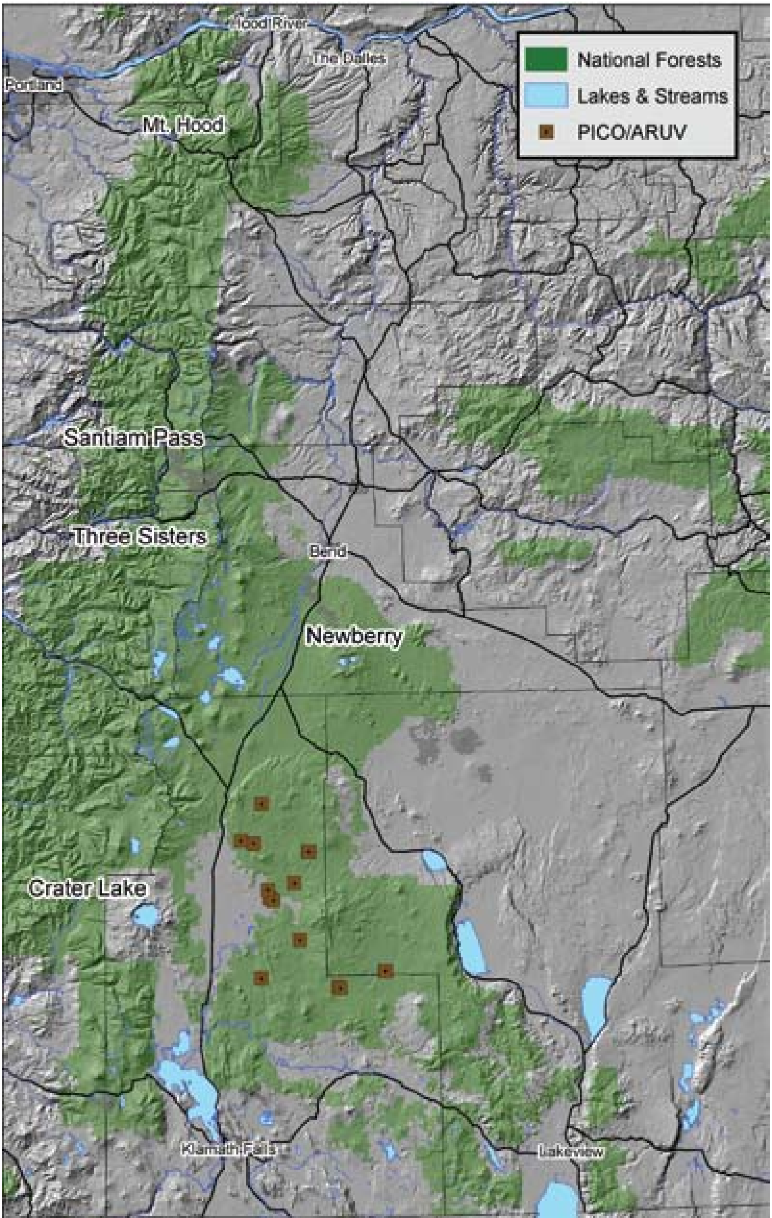






Mean Precip.	23.5”	19-35”
Mean Temp.	42.4°F	41-43°F

Figure 9-11. Map of PICO/ARUV Plot Distribution—



Vegetation— Overstory tree layers typically have only lodgepole pine. Shrub layers are dominated by bearberry (ARUV) and bitterbrush (PUTR). Snowbrush ceanothus (CEVE) is likely to increase after fire or mechanical disturbance. Herbaceous layers are variable and have low cover in mid to late seral stands. Lupines (LULE2 and LUAR3) will increase with disturbance of the tree and shrub layers.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
PICO	*Pinus contorta*	85	77	31.3	15.5
Shrubs					
ARUV	*Arctostaphylos uva-ursi*	100%		5.5	
PUTR	*Purshia tridentata*	54%		1.3	
RICE	*Ribes cereum*	46%		3.7	
Herbaceous					
FRVI	*Fragaria virginiana*	92%		2.2	
LULE2	*Lupinus lepidus*	23%		0.9	
Graminoids					
CARO	*Carex rossii*	38%		1.3	
ELGL	*Elymus glaucus*	31%		3.0	
FEID	*Festuca idahoensis*	38%		2.7	
PONE	*Poa nervosa*	23%		1.4	
POPR	*Poa pratensis*	23%		9.5	
SIHY	*Sitanion hystrix*	77%		0.6	
STOC	*Stipa occidentalis*	54%		2.6	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PICO/ARUV							
PICO	60	3	26	124	4	123	34

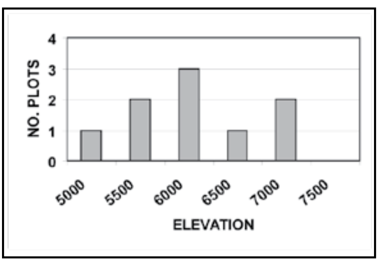
Relationships to Other Classifications— The PICO/ARUV plant association has been previously described for central Oregon by Volland (1985) and Kovalchik (1987). This classification is consistent with Kovalchik's definition of the type.

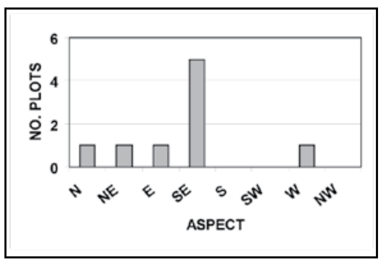
PICO/ARNE

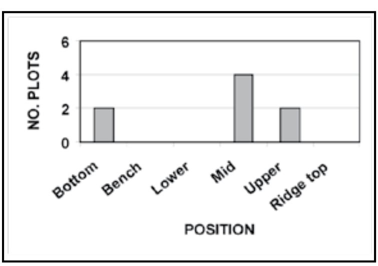
PICO Dry

CLS311 (PICO/ARNE)
Pinus contorta/Arctostaphylos nevadensis
lodgepole pine/pinemat manzanita
Plots 11

Distribution and Environment— PICO/ARNE associations are found within deep ash/pumice deposits from Mt. Mazama. It occurs from Newberry Crater south to Jack Creek on the Chemult Ranger District of the Winema National Forest. Two sites occur on the east slope of the Cascades near Crescent Lake and the north entrance to Crater Lake National Park. Sites located on bottom slope positions (Broad Flats) are climax lodgepole pine. Sites on mid to upper slopes are likely seral to White Fir-Grand Fir, Shasta Red Fir, or Mountain Hemlock Series where they are located adjacent to stands with white fir-grand fir, Shasta red fir or mountain hemlock present. Soils are derived from air-fall pumice and pumice alluvium/lava colluvium. Surface textures are loamy, coarse sand. Soils are excessively drained and poorly developed. Average elevation is 6301 feet (range 5400-7360 feet). Average slope is 12% (range 1-44%). Many plots were found on a southeastern aspect.

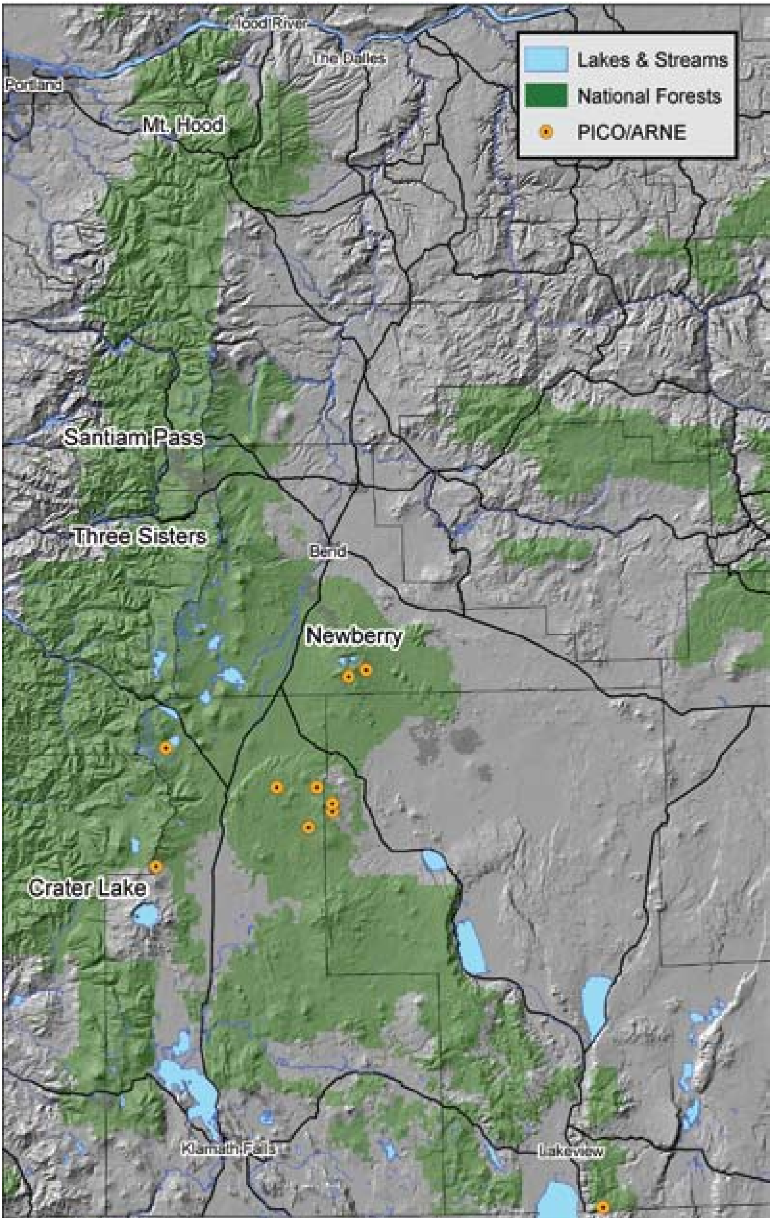






Mean Precip.	33.7”	23-49”
Mean Temp.	40.4°F	39-42°F

Figure 9-12. Map of PICO/ARNE Plot Distribution—



Vegetation— Lodgepole pine can dominate sites after stand replacement fire. Sites with western white pine are likely seral to White Fir, Shasta Red Fir, or Mountain Hemlock Series and originated following stand replacement fire. Pinemat manzanita dominates a species poor understory. Snowbrush ceanothus and greenleaf manzanita increase after disturbance. The herbaceous layer is species poor and typically has low cover. Only long-stolon sedge (CAIN4) and Ross' sedge average over 1% cover and both species occur less than 50% of the time.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
PICO	*Pinus contorta*	82	100	16.9	14.0
PIMO	*Pinus monticola*	27	18	5.0	1.9
Shrubs					
ARNE	*Arctostaphylos nevadensis*	100%		2.8	
ARPA	*Arctostaphylos patula*	36%		2.3	
PUTR	*Purshia tridentata*	27%		1.1	
RICE	Ribes cereum	36%		0.3	
Herbaceous					
FRVI	*Fragaria virginiana*	27%		0.1	
Graminoids					
CAIN4	*Carex inops*	36%		5.5	
CARO	*Carex rossii*	45%		1.3	
SIHY	*Sitanion hystrix*	55%		0.2	
STOC	*Stipa occidentalis*	82%		0.5	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management— PICO/ARNE sites have very low site productivity and may be non-commercial in many areas. Sites are difficult to successfully regenerate. Frost heaving and soil displacement are significant issues on disturbed sites. Windthrow, dwarf mistletoe, and stem breakage are common.

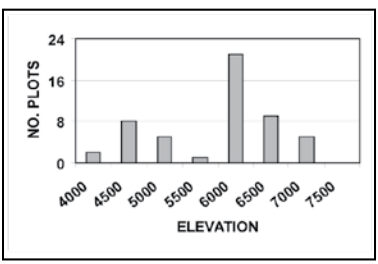
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PICO/ARNE							
PICO	37	2	6	97	5	81	16

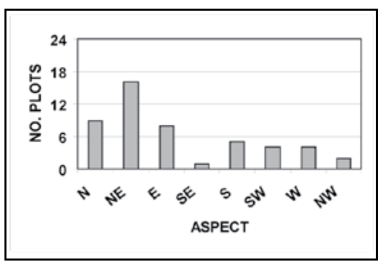
Relationships to Other Classifications— A PICO/ARNE (CLS311) plant association has been previously described in central Oregon by Volland (1985). Volland included minor amounts of white fir and Shasta red fir in his treatment of the type. PICO/ARNE as described here is essentially the same as Volland's type. Sites with >5% cover of white fir-grand fir, Shasta red fir, or mountain hemlock are not included here.

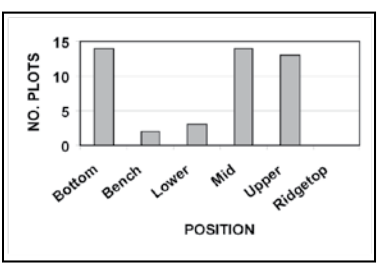
PICO/CAIN4 — PICO Dry

CLG419 (PICO/CAIN9)
Pinus contorta/Carex inops
lodgepole pine/long-stolon sedge
Plots 54

Distribution and Environment— PICO/CAIN4 occurs from the vicinity of Mt. Bachelor on the Deschutes National Forest south to Crater Lake National Park and east to Slide Mountain on the Fremont National Forest. The majority of sites are within the Mt. Mazama ash/pumice deposits. Sites on the Fremont National Forest outside of the Mazama plume are also derived from ash/pumice (source undetermined). Sites located on bottom slope positions (Broad Flats) are usually climax lodgepole pine. Sites on mid to upper slopes may be seral to White Fir-Grand Fir, Shasta Red Fir, or Mountain Hemlock Series where they are located adjacent to stands with white fir-grand fir, Shasta red fir or mountain hemlock present. Soils are derived from air-fall pumice and pumice alluvium/lava colluvium. Surface textures are gravelly coarse sand. Soils are excessively drained and poorly developed. Average elevation is 6032 feet (range 4200-7480 feet). Average slope is 6% (range 0-30%). Aspects are typically north to east. Slope positions are mid to upper slope or broad flats.

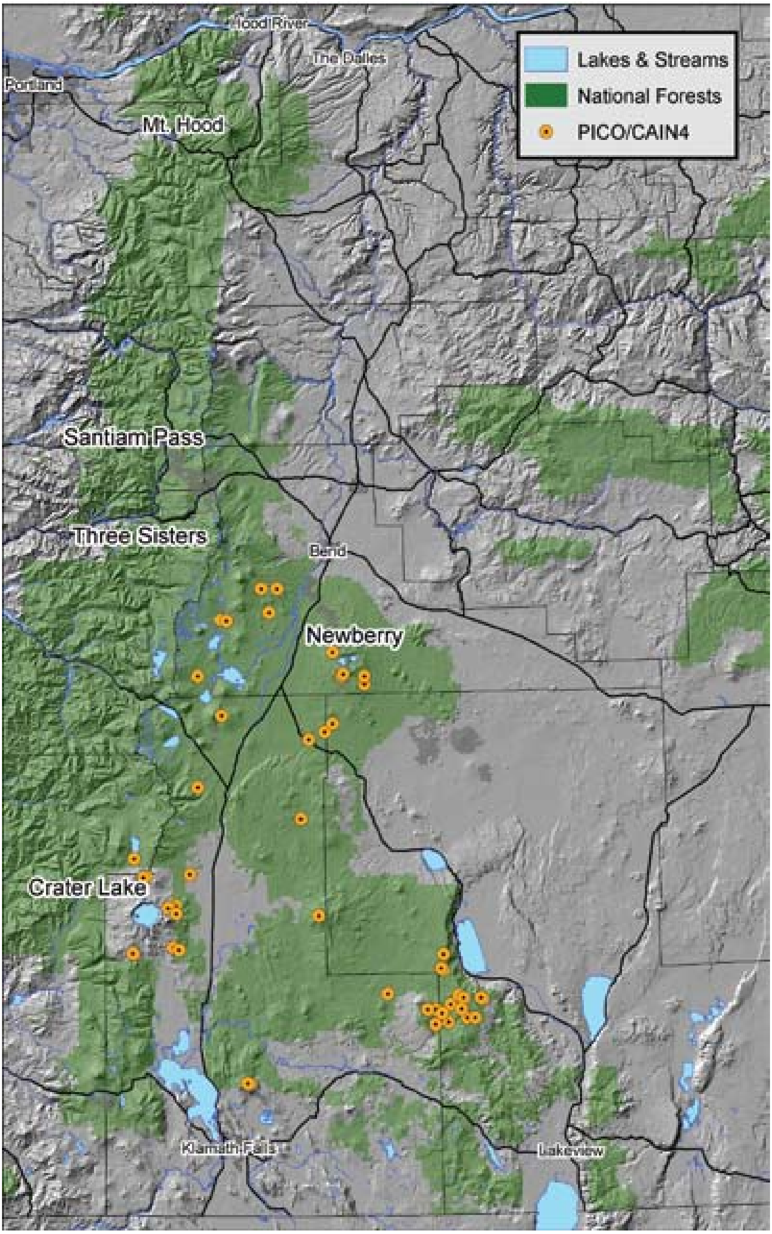






Mean Precip.	33.6”	19-63”
Mean Temp.	40.7°F	39-43°F

Figure 9-13. Map of PICO/CAIN4 Plot Distribution—



Vegetation— Tree layers are typically dominated by lodgepole pine. Shrub layers are dominated by mixtures of bitterbrush (PUTR). Herbaceous layers are graminoid dominated. Forbs are almost nonexistent; cover averages <1%. Silvery lupine (LUAR3) is likely to increase with disturbance. Long-stolon sedge (CAIN4), squirreltail (SIHY), and western needlegrass (STOC) have the highest constancy. Cover of graminoids typically is between 10-15% in late seral stands, but is likely to increase significantly following disturbance. Long-stolon sedge (CAIN4) and western needlegrass (STOC) consistently have the highest cover values.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
PICO	*Pinus contorta*	91	100	30.3	11.4
Shrubs					
PUTR	*Purshia tridentata*	33%		10.0	
RICE	*Ribes cereum*	49%		1.1	
Herbaceous					
FRVI	*Fragaria virginiana*	40%		1.0	
LUAR3	*Lupinus argenteus*	23%		4.5	
Graminoids					
CAIN4	*Carex inops*	100%		4.7	
CARO	*Carex rossii*	40%		0.8	
SIHY	*Sitanion hystrix*	82%		1.0	
STOC	*Stipa occidentalis*	81%		2.6	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management— PICO/CAIN4 sites have very low site productivity and may be non-commercial in many areas. Sites are difficult to successfully regenerate. Frost heaving and soil displacement are significant issues on disturbed sites. Pocket gophers may increase as lupines and long-stolon sedge increase following disturbance. Windthrow, dwarf mistletoe, and stem breakage are common.

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PICO/CAIN4							
PICO	65	1	78	113	3	458	34

Relationships to Other Classifications— PICO/CAIN4 plant associations have been previously described in south-central Oregon by Hopkins (1979a) and Volland (1985). Volland (1985) described several lodgepole pine-dominated communities with a significant component of long-stolon sedge with and without a shrub component. Both Volland and Hopkins included minor amounts of white fir and ponderosa pine in their treatments of the type.

Sites with the >5% cover of mountain hemlock, Shasta red fir, white fir-grand fir and ponderosa pine are not included here and are included in the appropriate series based on which species is present. PICO/CAIN4 as described here includes most sites that were originally included in the following associations described by Volland (1985) and Hopkins (1979a):

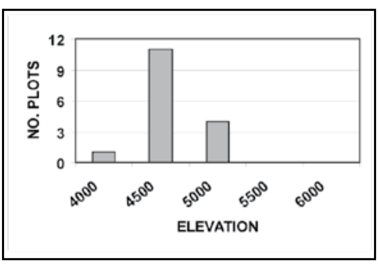
1. CLS212 PICO/PUTR/CAIN4
2. CLG313 PICO/STOC-LUCA-LINU
3. CLG411 PICO/CAIN4-LUAR
4. CLG413 PICO/CAIN4-STOC BASINS
5. CLG415 PICO/SIHY-CAIN4

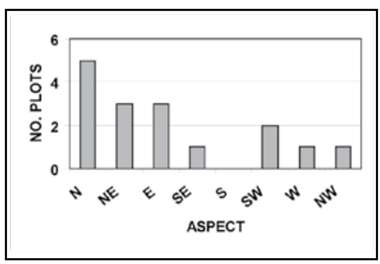
PICO/PUTR/FEID

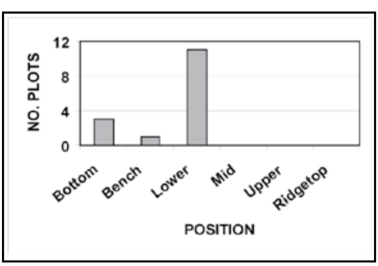
PICO Dry

CLS214 (PICO/PUTR2/FEID)
Pinus contorta/Purshia tridentata/Festuca idahoensis
lodgepole pine/bitterbrush/Idaho fescue
Plots 17

Distribution and Environment— PICO/PUTR/FEID sites are restricted to ash/pumice influenced areas with poor cold air drainage. Sampled sites occur from Pine Mountain on the Deschutes National Forest south to Sand Creek on the Chemult Ranger District of the Winema National Forest. Soils are derived from air-fall ash/pumice or pyroclastic flow pumice. Surface textures are loamy coarse sand to sandy loams. Subsurface layers have noticeable lack of coarse pumice. These sites have greater effective-moisture in a buried soil; a similar situation occurs in PICO/PUTR/STOC associations, but the soil with greater effective-moisture is not as deep. Average elevation is 4782 feet (range 4305-5020 feet). Average slope is 3% (range 1-6%). Slope direction is typically north to east. Slope positions are lower slopes and bottoms.

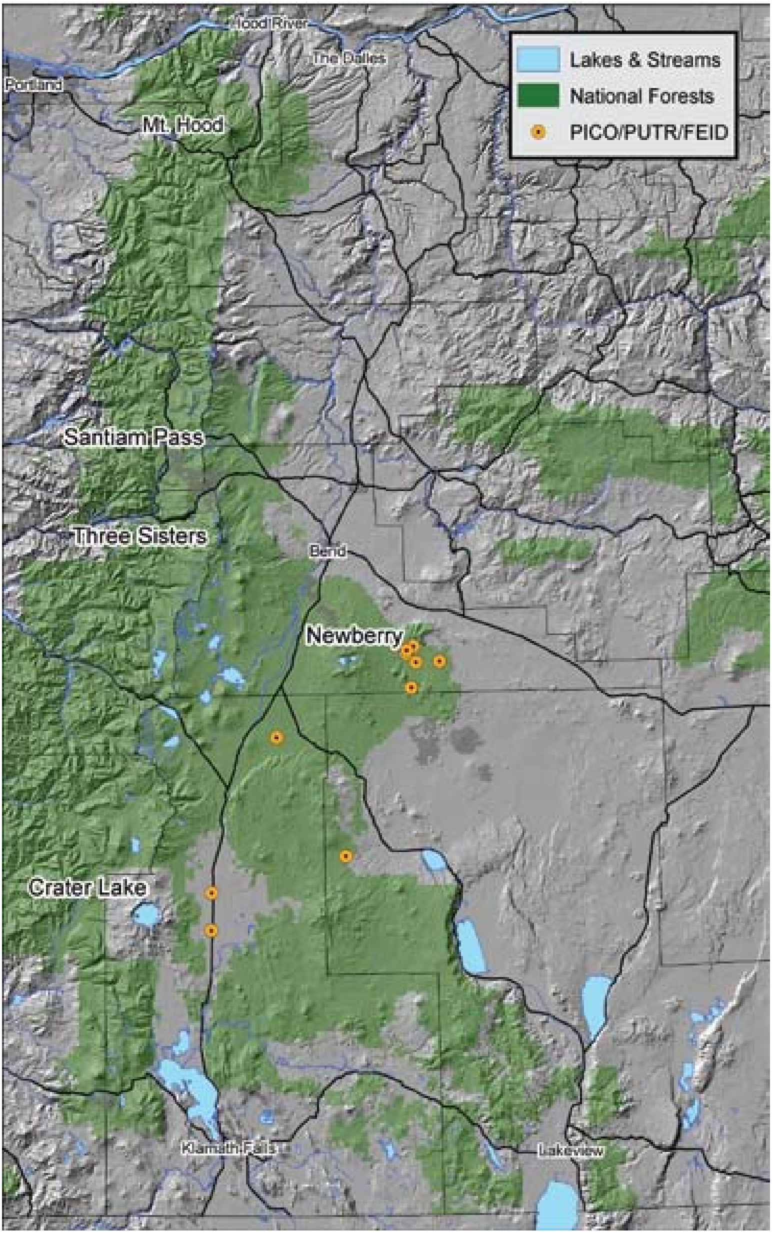






Mean Precip.	14.1”	9-25”
Mean Temp.	42.3°F	42-43°F

Figure 9-14. Map of PICO/PUTR/FEID Plot Distribution—



Vegetation— Lodgepole pine forms an open forest to savanna. Shrub cover averages 10-15%. Shrub layers are dominated by bitterbrush (PUTR) and big sagebrush (ARTR). Green rabbitbrush (CHVI) is likely to increase with mechanical or fire disturbances. Idaho fescue (FEID) typically supplies the majority of herbaceous cover. Grass cover averages 15-20% cover. Squirreltail (SIHY), Ross' sedge (CARO), and western needlegrass (STOC) have high constancy, but generally low cover. Strawberry (FRVI) is the only forb species that occurs more than 20% of the time. Herbaceous species such as prairie lupine (LULE2), western needlegrass (STOC), and squirreltail (SIHY) are likely to increase following disturbance.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
PICO	*Pinus contorta*	83%	92%	20.6	5.7
Shrubs					
ARTR	Artemisia tridentata	50%		5.2	
CHVI	*Chrysothamnus viscidiflorus*	33%		1.1	
PUTR	*Purshia tridentata*	100%		8.0	
RICE	*Ribes cereum*	58%		1.6	
Herbaceous					
FRVI	*Fragaria virginiana*	42%		1.1	
LULE2	*Lupinus lepidus*	25%		2.0	
Graminoids					
CARO	Carex rossii	92%		3.1	
FEID	*Festuca idahoensis*	100%		12.4	
SIHY	*Sitanion hystrix*	100%		2.6	
STOC	*Stipa occidentalis*	92%		3.7	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

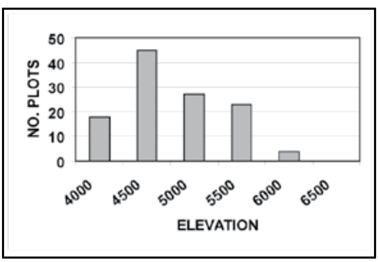
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PICO/PUTR/FEID							
PICO	63	1	32	80	4	101	23

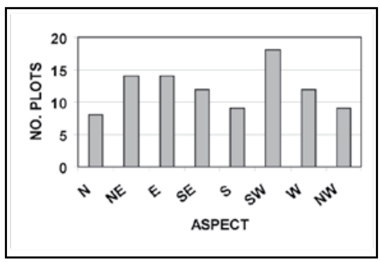
Relationships to Other Classifications— A PICO/PUTR/FEID (CLS214) plant association has been previously described in south-central Oregon by Volland (1985). Volland also described a PICO/ARTR/FEID (CLS111) association that included bitterbrush. These two types are combined in this treatment.

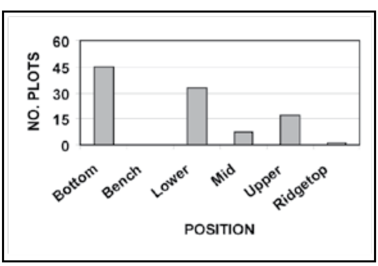
PICO/PUTR/STOC — PICO Dry

CLS211 (PICO/PUTR2/ACOC3)
Pinus contorta/Purshia tridentata/Stipa occidentalis
lodgepole pine/bitterbrush/western needlegrass
Plots 131

Distribution and Environment— PICO/PUTR/STOC sites are restricted to ash/pumice influenced areas with poor cold air drainage. Sampled sites occur from Pine Mountain on the Deschutes National Forest south to Sand Creek on the Chemult Ranger District of the Winema National Forest. Soils are derived from air-fall ash/pumice or pyroclastic flow pumice. Surface textures are loamy coarse sand to sandy loams. Subsurface layers typically have coarse pumice. Sites have less effective moisture at the soil surface and depth to a buried soil is much greater than similar PICO/PUTR/FEID associations. Average elevation is 4997 feet (range 4220-6375 feet). Average slope is 2% (range 0-22%). Plot aspects varied.

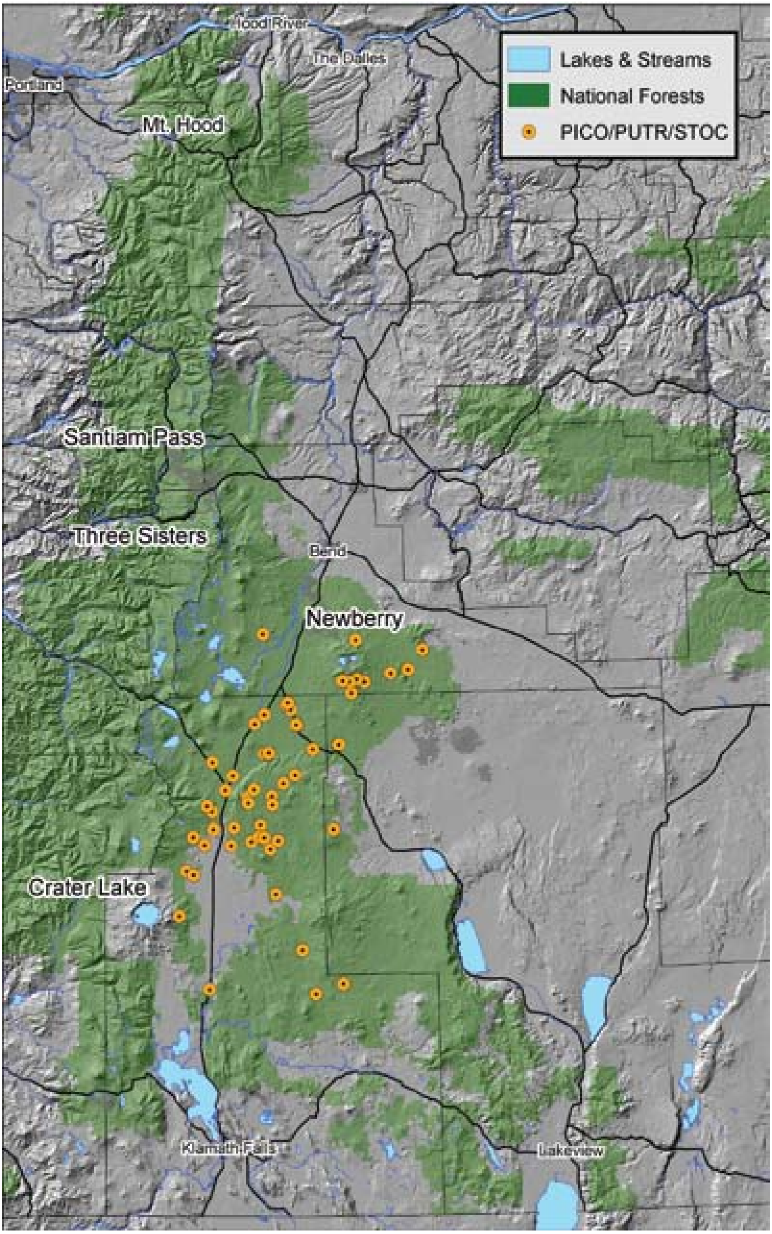






Mean Precip.	25.0”	11-39”
Mean Temp.	42.0°F	38-43°F

Figure 9-15. Map of PICO/PUTR/STOC Plot Distribution—



Vegetation— Lodgepole pine forms an open forest to savanna. Shrub cover averages 15-20%. Shrub layers are dominated by bitterbrush (PUTR). *Stipa occidentalis* (STOC) typically supplies the majority of herbaceous cover. Grass cover averages 15-20% cover. Squirreltail (SIHY) and Ross's sedge (CARO) have high constancy, but generally low cover. Strawberry (FRVI) is the only forb species that occurs more than 20% of the time. Herbaceous species such as prairie lupine (LULE2), western needlegrass (STOC), and squirreltail (SIHY) are likely to increase following disturbance.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
PICO	*Pinus contorta*	85%	91%	16.4	8.3
Shrubs					
PUTR	*Purshia tridentata*	100%		9.9	
RICE	*Ribes cereum*	52%		1.6	
Herbaceous					
LULE2	*Lupinus lepidus*	35%		1.7	
Graminoids					
CARO	*Carex rossii*	90%		1.9	
SIHY	*Sitanion hystrix*	89%		1.7	
STOC	*Stipa occidentalis*	100%		6.7	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PICO/PUTR/STOC							
PICO	62	1	344	85	2	683	24

Relationships to Other Classifications— PICO/PUTR plant associations have been previously described in south-central Oregon by Volland (1985). Volland (1985) described several lodgpole pine dominated communities with a significant component of bitterbrush and western needlegrass. Volland included minor amounts of ponderosa pine in his treatments of the type.

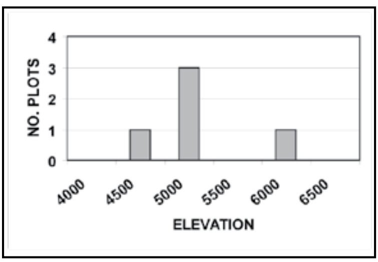
Sites with the >5% cover ponderosa pine are not included here and are included in the Ponderosa Pine Series. PICO/PUTR/STOC as described here includes most sites that were originally included in the following associations described by Volland (1985):

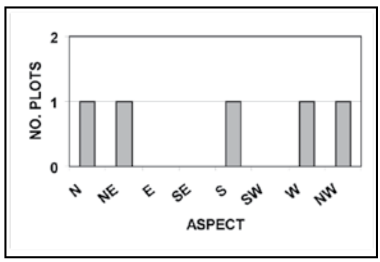
1. CLS112 PICO/PUTR (rhyolite)
2. CLS211 PICO/PUTR/STOC
3. CLS215 PICO/RICE-PUTR/STOC
4. CLG311 PICO/STOC BASINS

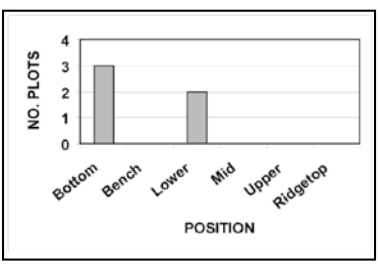
PICO/FEID Community Type — PICO Dry

CLG316 (PICO/FEID Community Type)
Pinus contorta/Festuca idahoensis
lodgepole pine /Idaho fescue
Plots 5

Distribution and Environment— PICO/FEID represents a disturbance community related to PICO/PUTR/FEID or PIPO/PUTR/FEID plant associations. Therefore, it can be expected to occur anywhere within the distribution of PICO/PUTR/FEID or PIPO/PUTR/FEID associations. Sampled sites occur on the southeastern portions of the Deschutes National Forest, northeast of Fuego Mountain on the Winema National Forest, and near Lee Thomas Crossing on the Fremont National Forest.
Average elevation is 5299 feet (range 4990-6200 feet). Average slope is 3% (range 1-9%). Plot aspects varied. Slope positions are lower slopes and broad flats.

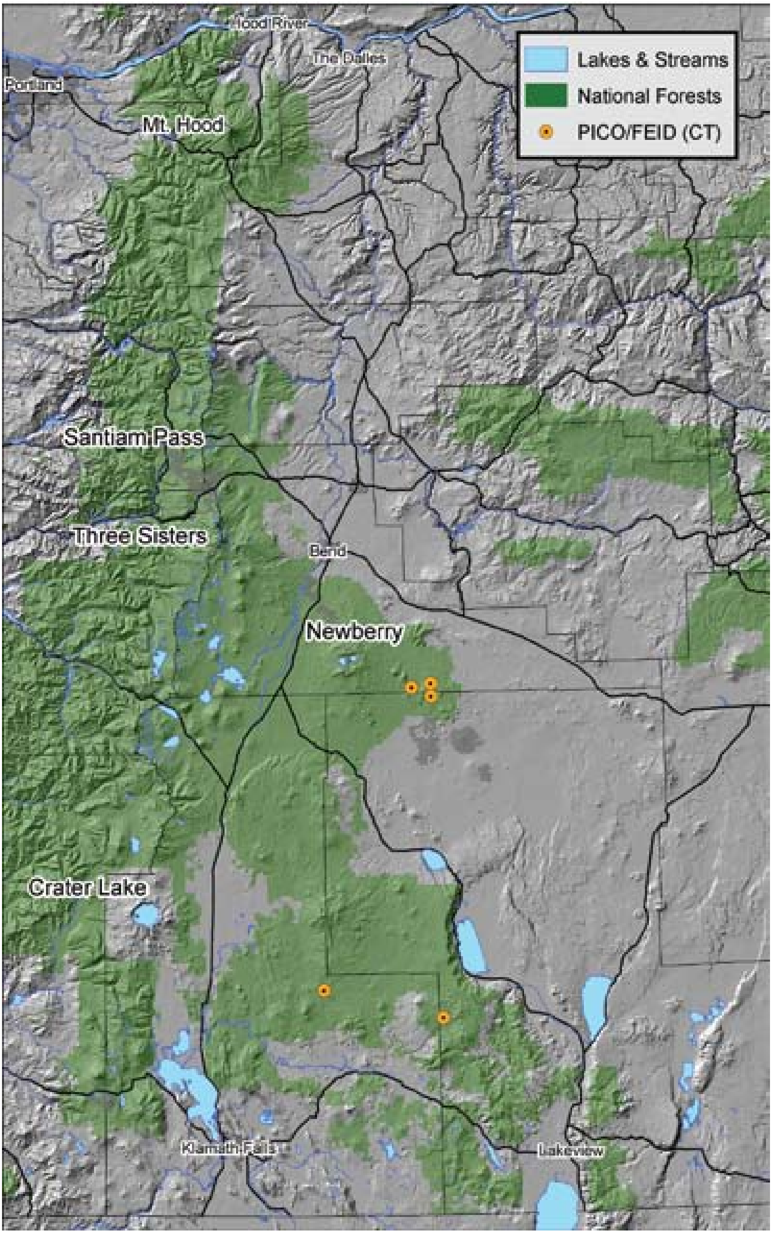






Mean Precip.	17.0”	11-29”
Mean Temp.	41.8°F	40-43°F

Figure 9-16. Map of PICO/FEID CT Plot Distribution—



Vegetation—Lodgepole pine dominates overstory and understory tree layers. Presence of ponderosa pine may indicate sites that are seral to PIPO/PUTR/FEID associations. Shrub layers are almost nonexistent. Bitterbrush (PUTR) has the highest constancy at 40%, however cover is less than 1%. Herbaceous vegetation is graminoid dominated. Idaho fescue (FEID), squirreltail (SIHY), and western needlegrass (STOC) are the most common species.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
PICO	*Pinus contorta*	80%	100%	32.3	5.6
Shrubs					
CHVI	*Chrysothamnus viscidiflorus*	20%		0.1	
PUTR	*Purshia tridentata*	40%		0.5	
RICE	*Ribes cereum*	20%		0.5	
Herbaceous					
FRVI	*Fragaria virginiana*	20%		5.0	
SPUM	*Spraguea umbellata*	20%		0.5	
Graminoids					
CARO	*Carex rossii*	40%		1.8	
FEID	*Festuca idahoensis*	100%		8.2	
FEOC	*Festuca occidentalis*	20%		0.1	
JUBA	*Juncus balticus*	20%		0.1	
PONE	*Poa nervosa*	20%		4.0	
POSA3	*Poa sandbergii*	20%		0.1	
SIHY	*Sitanion hystrix*	100%		1.4	
STOC	*Stipa occidentalis*	80%		2.5	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

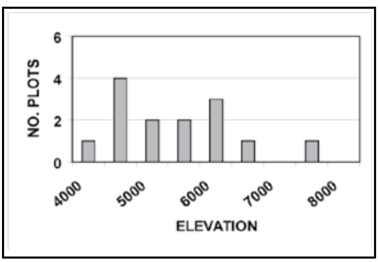
Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PICO/FEID Community Type							
PICO	67	3	12	132	7	12	40

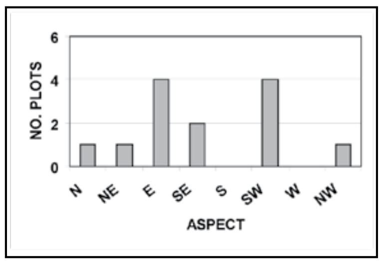
Relationships to Other Classifications— Hopkins (1979a) described a PICO/FRVI-FEID plant association that may also key here. However, most sites (90%) included in Hopkins PICO/FRVI-FEID had ponderosa pine cover up to 5%. Sites with past stand replacement fire and presence of ponderosa pine likely belong in the Ponderosa Pine Series.

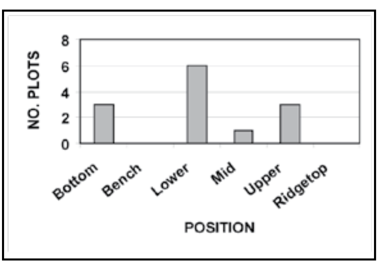
PICO/STOC Community Type — PICO Dry

CLG317 (PICO/ACOC3 Community Type)
Pinus contorta/Stipa occidentalis
lodgepole pine/western needlegrass
Plots 17

Distribution and Environment— PICO/STOC community type represents a disturbance community related to PICO/PUTR/STOC or perhaps PIPO/PUTR plant associations. Therefore, it can be expected to occur anywhere within the distribution of PICO/PUTR/STOC or PIPO/PUTR associations. Sampled sites occur from Newberry Crater on the Deschutes National Forest south to Crater Lake National Park and east to Yamsey Mountain on the Winema National Forest. Average elevation is 5503 feet (range 4325-7550 feet). Average slope is 5% (1-18%). Plot aspects varied.

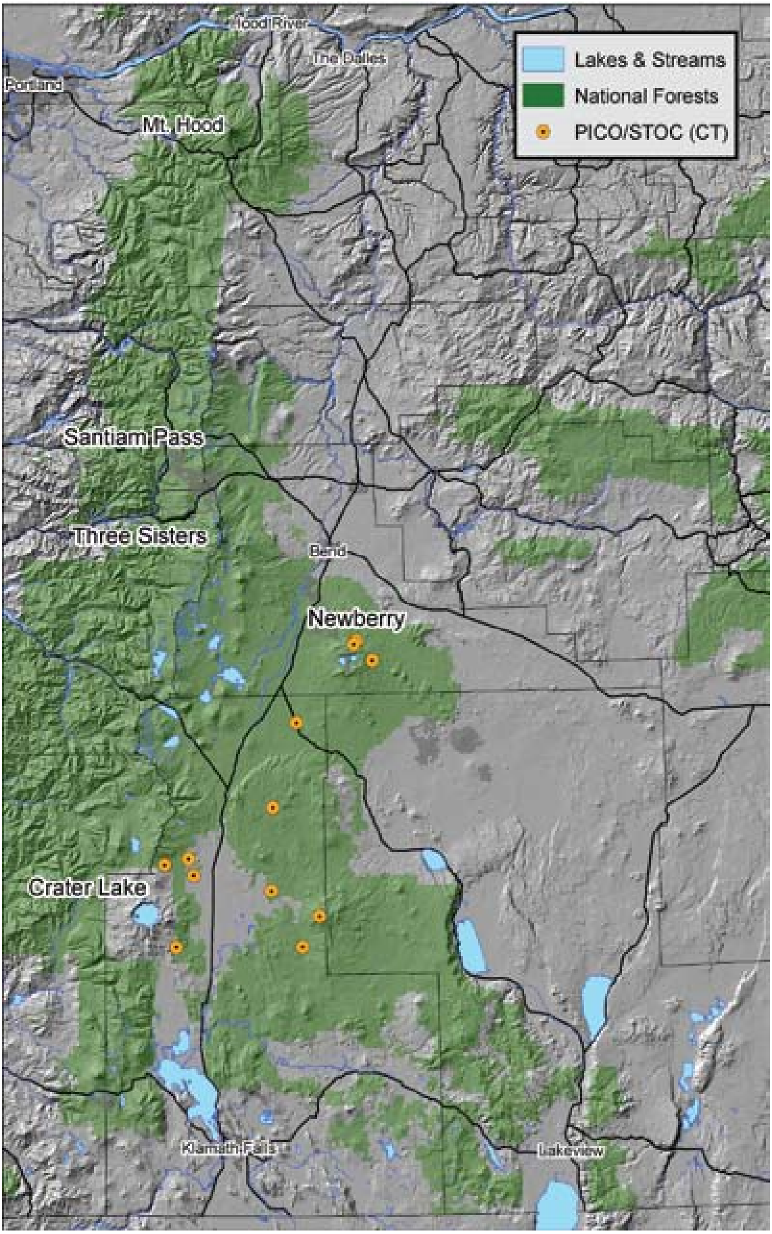






Mean Precip.	29.3”	17-43”
Mean Temp.	40.9°F	38-43°F

Figure 9-17. Map of PICO/STOC Community Type Plot Distribution—



Vegetation— Lodgepole pine dominates overstory and understory tree canopies. Presence of ponderosa pine may indicate sites are seral to PIPO/PUTR associations. Shrub layers are almost nonexistent. Wax currant (RICE) and bitterbrush (PUTR) have the highest constancies at 54% and 23%, however cover is less than 2%. Herbaceous vegetation is graminoid dominated. Idaho fescue (FEID), squirreltail (SIHY), and western needlegrass (STOC) are the most common species.

Code	Species Latin Name	% Constancy		% Cover	
Trees		**Over**	**Regen**	**Over**	**Regen**
PICO	*Pinus contorta*	54%	85%	19.5	3.6
Shrubs					
PUTR	*Purshia tridentata*	23%		0.5	
RICE	*Ribes cereum*	54%		1.8	
Herbaceous					
FRVI	*Fragaria virginiana*	23%		1.3	
LULE2	*Lupinus lepidus*	38%		0.7	
SPUM	*Spraguea umbellata*	23%		0.5	
Graminoids					
CARO	*Carex rossii*	92%		2.6	
SIHY	*Sitanion hystrix*	85%		4.0	
STOC	*Stipa occidentalis*	100%		9.3	

* Species with a constancy of 20% or greater are shown here.

Productivity and Management—

Plant Assoc	Avg SI	SI SE	# Trees	Avg GBA	GBA SE	# Trees	Ft^3
PICO/STOC Community Type							
PICO	65	2	26	128	7	13	38

Relationships to Other Classifications— Volland (1985) described a PICO/STOC-LUCA (CLS314) and a PICO/STOC-LUCA-LINU (CLS313) that may key here.

Appendix A: Latin Name, Common Name, and Plant Symbols for selected plant species in the Oregon East Cascades

R6 Symbol	PLANTS Symbol (old PLANTS)	Latin Name (new Latin name)	Common Name
Trees			
ABAM	ABAM	*Abies amabilis*	Pacific silver fir
ABCO	ABCO	*Abies concolor*	white fir
ABGR	ABGR	*Abies grandis*	grand fir
ABLA2	ABLA	*Abies lasiocarpa*	subalpine fir
ABMAS	ABMAS	*Abies magnifica shastensis*	Shasta red fir
ABPR	ABPR	*Abies procera*	noble fir
ACMA	ACMA3	*Acer macrophyllum*	bigleaf maple
ALRU	ALRU2	*Alnus rubra*	red alder
CACH	CHCH7	*Castanopsis chrysophylla (Chrysolepis chrysophylla)*	golden chinquapin
CADE3	CADE27	*Calocedrus decurrens*	incense cedar
CELE	CELE3	*Cercocarpus ledifolius*	curlleaf mountain mahogany
CONU	CONU4	*Cornus nuttallii*	Pacific dogwood
JUOC	JUOC	*Juniperus occidentalis*	western juniper
LAOC	LAOC	*Larix occidentalis*	western larch
PIAL	PIAL	*Pinus albicaulis*	whitebark pine
PICO	PICO	*Pinus contorta*	lodgepole pine
PIEN	PIEN	*Picea engelmannii*	Engelmann's spruce
PILA	PILA	*Pinus lambertiana*	sugar pine
PIMO	PIMO3	*Pinus monticola*	western white pine
PIPO	PIPO	*Pinus ponderosa*	ponderosa pine
POTR	POTR5	*Populus tremuloides*	quaking aspen
PSME	PSME	*Pseudotsuga menziesii*	Douglas fir
QUGA	QUGA4	*Quercus garryana*	Oregon white oak
SASC	SASC	*Salix scouleriana*	Scouler's willow
TABR	TABR2	*Taxus brevifolia*	Pacific yew
THPL	THPL	*Thuja plicata*	western redcedar
TSHE	TSHE	*Tsuga heterophylla*	western hemlock
TSME	TSME	*Tsuga mertensiana*	mountain hemlock
Tall Shrubs			
ACCI	ACCI	*Acer circinatum*	vine maple
ACGL	ACGL	*Acer glabrum*	Rocky Mt. maple

Appendix A: Latin Name, Common Name, and Plant Symbols for selected plant species in the Oregon East Cascades

R6 Symbol	PLANTS Symbol (old PLANTS)	Latin Name (new Latin name)	Common Name
ALIN	ALIN2	*Alnus incana*	mountain alder
AMAL	AMAL2	*Amelanchier alnifolia*	serviceberry
ARPA	ARPA6	*Arctostaphylos patula*	greenleaf manzanita
ARTR	ARTR2	*Artemisia tridentata*	big sagebrush
BEAQ	MAAQ2	*Berberis aquifolium* *(Mahonia aquifolium)*	tall Oregongrape
BEGL	BENA	*Betula glandulosa* *Betula nana*	bog birch
CEVE	CEVE	*Ceanothus velutinus*	Snowbrush
COCO2	COCO6	*Corylus cornuta*	beaked hazelnut
HODI	HODI	*Holodiscus discolor*	oceanspray
LOIN	LOIN5	*Lonicera involucrata*	twinberry honeysuckle
LOUT2	LOUT2	*Lonicera utahensis*	Utah honeysuckle
OPHO	OPHO	*Oplopanax horridum*	Devil's club
PUTR	PUTR2	*Purshia tridentata*	antelope bitterbrush
RHAL	RHAL2	*Rhododendron albiflorum*	Cascade azalea
RHMA	RHMA3	*Rhododendron macrophyllum*	Pacific rhododendron
RICE	RICE	*Ribes cereum*	wax currant
RILA	RILA	*Ribes lacustre*	prickly currant
RIVI	RIVI3	*Ribes viscosissimum*	sticky currant
ROGY	ROGY	*Rosa gymnocarpa*	dwarf rose
RUPA	RUPA	*Rubus parviflorus*	thimbleberry
SAGE	SAGE2	*Salix geyeriana*	Geyer's willow
SALE	SALE	*Salix lemmonii*	Lemmon's willow
SALU	SALU2	*Salix lutea*	yellow willow
SPDO	SPDO	*Spiraea douglasii*	Douglas' spiraea
SYAL	SYAL	*Symphoricarpos albus*	common snowberry
SYMO	SYMO	*Symphoricarpos mollis*	creeping snowberry
SYOR	SYOR2	*Symphoricarpos oreophilus*	mountain snowberry
VAAL VAOV	VAOV	*Vaccinium alaskaense* *(Vaccinium ovalifolium)*	Alaska blueberry oval-leafed huckleberry
VAME	VAME	*Vaccinium membranaceum*	thinleaf huckleberry
VAOC2 VAUL	VAUL	*Vaccinium occidentale* *(Vaccinium uliginosum)*	western bog blueberry bog blueberry

Appendix A: Latin Name, Common Name, and Plant Symbols for selected plant species in the Oregon East Cascades

R6 Symbol	PLANTS Symbol (old PLANTS)	Latin Name (new Latin name)	Common Name
Low shrubs			
ARAR	ARAR8	*Artemisia arbuscula*	low sagebrush
ARNE	ARNE	*Arctostaphylos nevadensis*	pinemat manzanita
ARUV	ARUV	*Arctostaphylos uva-ursi*	Kinnikinnick
BENE	MANE2	*Berberis nervosa (Mahonia nervosa)*	Cascade Oregongrape
BERE	MARE11	*Berberis repens (Mahonia repens)*	creeping Oregongrape
CEPR	CEPR	*Ceanothus prostratus*	mahala mat
CHME	CHME	*Chimaphila menziesii*	little prince's pine
CHUM	CHUM	*Chimaphila umbellata*	common prince's pine
CHVI	CHVI8	*Chrysothamnus viscidiflorus*	green rabbitbrush
GASH	GASH	*Gaultheria shallon*	salal
JUCO4	JUCO6	*Juniperus communis*	common juniper
KAMI	KAMI	*Kalmia microphylla*	alpine laurel
PAMY	PAMY	*Pachistima myrsinites*	boxleaf myrtle
PHEM	PHEM	*Phyllodoce empetriformis*	pink mountainheath
RUUR	RUUR	*Rubus ursinus*	California blackberry
SABO2	SABO2	*Salix boothii*	Booth's willow
VADE	VADE	*Vaccinium deliciosum*	Cascade bilberry
VASC	VASC	*Vaccinium scoparium*	grouse whortleberry
Herbs			
ACRU	ACRU2	*Actaea rubra*	red baneberry
ACTR	ACTR	*Achlys triphylla*	vanilla leaf
ADBI	ADBI	*Adenocaulon bicolor*	American trailplant
ANMI2	ANMI3	*Antennaria microphylla*	littleleaf pussytoes
ANRA	ANRA	*Antennaria racemosa*	raceme pussytoes
ARCO	ARCO9	*Arnica cordifolia*	heartleaf arnica
ARKI	ARKI	*Arenaria kingii*	King's sandwort
ARLA	ARLA8	*Arnica latifolia*	broadleaf arnica
ARMA3	(ARMA18) MOMA3	*Arenaria macrophylla (Moehringia macrophylla)*	bigleaf sandwort
ASCA3	ASCA2	*Asarum caudatum*	wild ginger

Appendix A: Latin Name, Common Name, and Plant Symbols for selected plant species in the Oregon East Cascades

R6 Symbol	PLANTS Symbol (old PLANTS)	Latin Name (new Latin name)	Common Name
ATFI	ATFI	*Athyrium filix-femina*	common ladyfern
BASA	BASA3	*Balsamorhiza sagittata*	arrowleaf balsamroot
CABI	(CABI2) CALE4	*Caltha biflora* (*Caltha leptosepala* ssp. Howellii)	broadleaf marshmarigold
CIAL	CIAL	*Circaea alpina*	enchanter's nightshade
CLUN	CLUN2	*Clintonia uniflora*	queencup beadlily
COCA	COCA13	*Cornus canadensis*	bunchberry dogwood
DIHO	DIHO3	*Disporum hookeri*	Hooker's fairybells
FRVE	FRVE	*Fragaria vesca*	woodland strawberry
FRVI	FRVI	*Fragaria virginiana*	Virginia strawberry
GOOB	GOOB2	*Goodyera oblongifolia*	western rattlesnake plantain
HIAL	HIAL2	*Hieracium albiflorum*	white-flowered hawkweed
HIAL2	(HIAL) HICY	*Hieracium albertinum* (*Hieracium cynoglossoides*)	western hawkweed
LIBO2	LIBO3	*Linnaea borealis*	twinflower
LUAR3	LUAR3	*Lupinus argenteus*	silvery lupine
LULE2	LULE2	*Lupinus lepidus*	Pacific lupine
LUPE	LUPE	*Luetkea pectinata*	partridgefoot
LUPO	LUPO2	*Lupinus polyphyllus*	bigleaf lupine
LYAM	LYAM3	*Lysichitum americanum*	American skunkcabbage
OSCH	OSCH	*Osmorhiza chilensis* *Osmorhiza berteroi*	mountain sweetroot
OSOC	OSOC	*Osmorhiza occidentalis*	western sweetroot
OXOR	OXOR	*Oxalis oregana*	Oregon oxalis
POMU	POMU	*Polystichum munitum*	western swordfern
PTAQ	PTAQ	*Pteridium aquilinum*	western brackenfern
PYPI	PYPI2	*Pyrola picta*	whiteveined wintergreen
PYSE	ORSE	*Pyrola secunda* *Orthilia secunda*	sidebells pyrola
SMRA	MARA7	*Smilacina racemosa* (*Maianthemum racemosum*)	*western false-solomonseal*
SMST	MAST4	*Smilacina stellata* (*Maianthemum stellatum*)	*starry false-solomonseal*
SPUM	CIUM	*Spraguea umbellata* (*Cistanthe umbellata* var. *umbellata*)	Mt. Hood pussypaws

Appendix A: Latin Name, Common Name, and Plant Symbols for selected plant species in the Oregon East Cascades

R6 Symbol	PLANTS Symbol (old PLANTS)	Latin Name (new Latin name)	Common Name
STJA	STJA3	*Stellaria jamesiana* *(Pseudostellaria jamesiana)*	sticky starwort
TITR	TITR	*Tiarella trifoliata*	threeleaf foamflower
TIUN	(TIUN3) TITRU	*Tiarella unifoliata* *(Tiarella trifoliata* var. *unifoliata)*	coolwort foamflower
TRLA2	(TRLA6) TRBOL	*Trientalis latifolia* *(Trientalis borealis* ssp. *latifolia)*	western starflower
VIGL	VIGL	*Viola glabella*	pioneer violet
WYMO	WYMO	*Wyethia mollis*	woolly mule-ears
XETE	XETE	*Xerophyllum tenax*	common beargrass
Graminoids			
AGSP	PSSP6	*Agropyron spicatum* *(Pseudoroegneria spicata)*	bluebunch wheatgrass
BRVU	BRVU	*Bromus vulgaris*	Columbia brome
CAAQ	CAAQ	*Carex aquatilis*	water sedge
CACA	CACA4	*Calamagrostis canadensis*	bluejoint reedgrass
CAEU	(CAEU2) CAAN15	*Carex eurycarpa* *Carex angustata*	widefruit sedge
CAGE	CAGE2	*Carex geyeri*	elk sedge
CAIN4	CAPES CAIN9	*Carex perisyl vanica* *Carex inops*	long-stolon sedge
CALA3	CALA30	*Carex lanuginosa*	woolly sedge
CANE	CANE2	*Carex nebraskensis*	Nebraska sedge
CARO	CARO5	*Carex rossii*	Ross' sedge
CARU	CARU	*Calamagrostis rubescens*	pinegrass
CASI2	CASI2	*Carex simulata*	analogue sedge
CAUT	CAUT	*Carex utriculata*	Northwest Territory sedge
CAVE	CAVE6	*Carex vesicaria*	blister sedge
DACA	DACA3	*Danthonia californica*	California oatgrass
DECA	DECA18	*Deschampsia caespitosa*	tufted hairgrass
ELGL	ELGL	*Elymus glaucus*	blue wildrye
ELPA2	(ELPA6) ELQU2	*Eleocharis pauciflora* *Eleocharis quinqueflora*	few flowered spikerush
FEID	FEID	*Festuca idahoensis*	Idaho fescue
FEOC	FEOC	*Festuca occidentalis*	western fescue

Appendix A: Latin Name, Common Name, and Plant Symbols for selected plant species in the Oregon East Cascades

R6 Symbol	PLANTS Symbol (old PLANTS)	Latin Name (new Latin name)	Common Name
JUBA	JUBA	*Juncus balticus*	Baltic rush
LUHI	(LUHI4) LUGL2	*Luzula hitchcockii* *Luzula glabrata*	smooth woodrush
PONE	PONE2	*Poa nervosa*	Wheeler bluegrass
POPR	POPR	*Poa pratensis*	Kentucky bluegrass
POSA3	(POSA12) POSE	*Poa sandbergii* *Poa secunda*	Sandberg's bluegrass
SIHY	ELEL5	*Sitanion hystrix* *(Elymus elymoides)*	squirreltail
STOC	(STOC2) ACOC3	*Stipa occidentalis* *(Achnatherum occidentale)*	western needlegrass

Appendix B: Species Comparison by Plant Association

Clarifying some terms used in this appendix:

A species' **constancy** is the percentage of plots in which that species occurred, out of the total number of plots in that plant association.

A species' **cover** is the average cover of that species for only those plots in which the species occurred. In other words, it is a relative average in which zero values are not included.

Tree Regeneration is all trees less than 5" dbh.

Tree Overstory equals trees greater or equal to 5" dbh.

	TSME/ASCA3		TSME/CLUN		TSME/ACTR		TSME/LIBO2	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
Tree Regeneration								
ABAM	28	18.1	51	13.8	53	8.8	53	14.3
ABCO-ABGR	48	18.3	48	10.5	53	19.2	44	7.8
ABLA2	8	10.0	19	4.7	32	4.0	13	1.9
ABMAS	44	12.0	30	9.6	34	11.9	24	7.6
ABPR	20	1.2	15	3.2	16	6.3	31	4.3
ALRU	4	8.6	1	2.3				
CADE3	16	1.5	6	2.3	11	5.0	1	3.0
JUOC								
LAOC			2	1.5			5	0.8
PIAL			1	0.7				
PICO			18	4.0	13	1.1	37	2.9
PIEN	16	6.0	18	2.9	13	0.2	11	1.5
PILA			1	4.3				
PIMO	24	2.5	39	2.0	26	1.6	64	3.1
PIPO			3	2.8	3	1.0	1	4.2
POTR	4	4.0						
PSME	52	9.3	31	4.1	42	4.8	48	6.3
QUGA								
THPL	8	2.9	2	6.8	5	10.2	3	14.8
TSHE	24	15.7	30	9.5	18	9.0	41	8.3
TSME	92	10.3	89	10.0	87	9.6	96	9.0
Tree Overstory								
ABAM	24	14.4	46	21.3	47	13.0	43	11.2
ABCO-ABGR	36	18.1	37	16.3	37	15.6	35	10.5
ABLA2	8	6.8	17	8.0	24	14.0	11	4.6
ABMAS	48	21.7	34	25.1	34	23.8	21	20.6
ABPR	24	27.0	22	15.8	29	14.6	43	12.8
ALRU							1	12.9
CADE3			2	7.9	8	16.0	1	3.7
JUOC								
LAOC			9	4.4	5	11.0	17	4.2
PIAL			0	3.3			1	1.0
PICO			30	12.5	24	4.1	55	10.5
PIEN	8	3.5	19	9.9	13	3.9	9	7.1
PILA			1	3.0			1	3.2
PIMO	16	6.6	41	5.1	37	6.0	68	5.0
PIPO	4	2.0	7	11.9	5	10.5	4	2.7
POTR								
PSME	80	26.4	62	21.9	71	27.1	87	23.0
QUGA								
THPL	8	18.1	2	18.1	5	24.6	3	18.8
TSHE	16	35.4	25	23.1	18	29.1	36	29.4
TSME	48	18.4	79	18.5	76	15.0	81	20.6
Shrub								
ACCI	20	22.3	6	5.2	16	10.2	5	1.3
ALIN								
AMAL	28	2.3	15	1.3	8	1.3	13	0.9
ARAR								
ARNE	16	1.4	11	4.8	13	2.4	48	6.6
ARPA			4	1.0			4	5.8
ARTR								
ARUV			1	0.6			4	2.8
BEAQ	4	0.1	1	1.0			3	0.6
BEGL								
BENE	64	3.5	41	4.7	53	3.3	51	3.4
BERE			1	0.1				
CACH	32	2.5	32	4.8	29	8.3	57	6.2
CELE								
CEPR			2	4.4				
CEVE	4	10.0	2	3.4			7	5.6
CHME	20	0.6	14	1.0	11	0.8	7	1.0
CHUM	76	3.1	79	4.4	87	8.3	92	3.8

(Cov = Cover, Con = Constancy)

	TSME/ASCA3		TSME/CLUN		TSME/ACTR		TSME/LIBO2	
	Con	**Cov**	**Con**	**Cov**	**Cov**	**Con**	**Cov**	**Con**
HODI	24	1.1	2	2.2	5	0.1	3	1.1
PAMY	52	1.6	46	4.3	55	1.1	43	2.6
PHEM								
PUTR								
RHMA	12	1.6	9	14.5	26	30.6	24	26.8
RICE	12	1.0	5	2.9			1	0.1
RILA	8	1.1	5	2.2	8	0.1	1	0.1
RIVI	12	2.7	8	1.0			4	1.1
ROGY	48	1.8	41	1.4	39	0.9	25	0.8
RUUR	16	5.0	22	1.4	26	3.7	13	0.7
SASC			1	1.4			3	3.8
SPDO			0	1.2			1	6.0
SYAL	8	2.3	7	1.9	3	2.1	3	2.6
SYMO	12	1.6	15	2.0	16	1.1	9	0.6
VADE								
VAME	64	14.8	82	16.2	76	11.9	81	7.6
VAOC2			0	22.8				
VASC	8	3.5	23	8.4	16	1.2	31	5.3
Herbs								
ACRU	16	1.3	1	0.6				
ACTR	60	7.4	50	5.3	100	3.3	1	1.0
ADBI	32	1.6	7	1.1	5	1.0		
ARCO	4	0.1	2	1.3				
ASCA3	100	4.4	1	0.3				
BASA								
CLUN	80	1.5	100	2.2			1	0.1
COCA	20	1.8	15	3.8	13	3.3	1	0.1
DIHO	28	1.6	8	1.1	3	1.0		
GOOB	48	1.0	39	0.9	37	0.7	32	0.9
LIBO2	56	10.1	49	6.3	45	3.6	100	2.8
LUAR3								
LUPO								
LYAM								
OSCH	36	1.6	21	1.3	8	0.7	3	1.0
SMRA	28	0.5	8	0.8	8	0.5	1	1.0
SMST	64	1.6	33	1.6	26	1.0	5	0.8
STJA								
TIUN	16	6.3	10	1.5	3	0.1		
TRLA2	20	1.3	8	1.2	13	0.8		
WYMO								
XETE	16	10.3	44	13.6	37	14.9	63	10.7
Graminoids								
AGSP								
BRVU			6	1.5			1	1.0
CAAQ								
CACA								
CAEU								
CAGE	4	1.0	2	1.0				
CAIN4	4	10.0	8	1.5			4	1.3
CARO	8	1.0	2	0.9	3	1.0	3	0.6
CARU			5	4.0			3	1.0
DECA								
ELGL	12	2.7	2	4.2	3	1.0		
ELPA2								
FEID			3	0.4				
FEOC			2	3.7	3	3.0		
LUHI			0	3.0				
POSA3								
STOC			2	2.7			3	1.6
Ferns								
ATFI	8	1.0						
POMU	36	0.8	8	0.7	8	0.5	1	1.0
PTAQ	16	2.6	22	4.5	24	3.0	11	1.0

(Cov = Cover, Con = Constancy)

	TSME/LUHI		TSME/PHEM-VADE		TSME/BENE		TSME/VAME/XETE	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
Tree Regeneration								
ABAM	9	11.3	35	10.8	51	7.3	73	13.5
ABCO-ABGR	1	5.0			39	9.3	10	1.7
ABLA2	25	4.1	35	3.1	20	4.5	43	5.5
ABMAS	51	5.5			17	8.8		
ABPR					49	1.6	25	3.3
ALRU							1	4.0
CADE3								
JUOC								
LAOC					2	1.0	1	1.0
PIAL	11	1.7	22	1.0			7	1.1
PICO	27	2.3	9	7.5	39	3.5	40	3.0
PIEN			4	1.0	2	1.0	5	1.9
PILA								
PIMO	6	1.0	9	0.6	61	2.2	44	2.4
PIPO					2	1.0	2	1.7
POTR								
PSME					39	7.7	19	4.1
QUGA								
THPL							1	0.1
TSHE	1	0.1			44	7.0	9	4.9
TSME	96	12.8	83	4.0	100	6.6	86	7.9
Tree Overstory								
ABAM	7	14.9	26	14.5	41	11.6	63	20.9
ABCO-ABGR					32	15.4	6	5.5
ABLA2	16	5.2	26	4.3	17	8.0	38	6.6
ABMAS	32	19.7			17	25.2	1	1.0
ABPR					44	11.0	29	8.2
ALRU								
CADE3								
JUOC								
LAOC					5	2.0	3	7.3
PIAL	7	3.3	17	6.3			4	2.7
PICO	26	7.5	4	15.0	49	15.9	57	14.3
PIEN			4	2.0	2	5.0	8	5.3
PILA								
PIMO	1	4.0	4	1.0	66	4.6	47	3.9
PIPO					7	4.0	5	4.5
POTR								
PSME					78	14.2	34	8.8
QUGA								
THPL					2	6.0		
TSHE					37	19.9	11	13.5
TSME	93	42.4	74	32.3	83	26.5	95	30.7
Shrub								
ACCI					12	2.5	1	1.0
ALIN								
AMAL	1	0.8	4	1.0	10	1.0	5	1.4
ARAR								
ARNE	5	10.9	9	2.0	34	6.5	31	5.1
ARPA							5	1.5
ARTR								
ARUV	1	0.1					3	0.9
BEAQ					2	1.0	1	1.0
BEGL								
BENE					100	1.7	1	0.1
BERE					2	0.1		
CACH					59	4.9	16	7.8
CELE								
CEPR								
CEVE					5	7.5	3	6.0
CHME	4	1.0	4	1.0	10	0.8	4	0.9
CHUM	15	1.4			80	1.7	55	1.0

(Cov = Cover, Con = Constancy)

	TSME/LUHI		TSME/PHEM-VADE		TSME/BENE		TSME/VAME/XETE	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
HODI	1	1.0			5	1.3	1	0.1
PAMY	1	2.0	4	2.0	51	2.4	23	1.8
PHEM	1	1.0	65	9.0				
PUTR								
RHMA					39	36.9	12	24.7
RICE								
RILA	1	1.0						
RIVI	1	10.0			5	2.3	1	2.1
ROGY					20	0.8	3	1.0
RUUR					20	0.9	3	0.5
SASC							3	2.8
SPDO								
SYAL							1	1.0
SYMO					10	1.0	1	1.0
VADE	1	1.0	48	9.2			1	0.1
VAME	12	16.9	39	15.3	80	7.0	101	14.2
VAOC2								
VASC	34	11.8	48	9.6	27	13.0	48	13.1
Herbs								
ACRU								
ACTR								
ADBI								
ARCO	1	10.0			2	2.0	2	2.3
ASCA3								
BASA								
CLUN							1	0.1
COCA					5	1.0	1	1.0
DIHO								
GOOB	1	1.0			29	0.8	14	0.7
LIBO2	1	1.0					1	0.1
LUAR3	2	1.4						
LUPO								
LYAM								
OSCH	3	1.0	4	1.0	2	1.0	1	1.5
SMRA	1	0.1					3	0.6
SMST	1	1.0			10	0.6	4	0.8
STJA								
TIUN							1	0.6
TRLA2					2	0.1	1	1.0
WYMO								
XETE	4	3.8	17	18.0	63	8.6	100	16.6
Graminoids								
AGSP								
BRVU	1	0.5						
CAAQ								
CACA								
CAEU								
CAGE					2	1.0	2	1.3
CAIN4	38	3.1	17	6.5	2	0.3	6	6.9
CARO	1	0.1	9	1.0			1	0.1
CARU					2	2.0	3	4.5
DECA			4	2.0				
ELGL	3	0.3						
ELPA2								
FEID								
FEOC					2	1.0		
LUHI	99	14.7	35	1.5			1	0.6
POSA3								
STOC	7	1.0	9	1.5			1	3.5
Ferns								
ATFI					2	0.1		
POMU	1	0.1			2	0.1	1	0.1
PTAQ					12	2.1	6	3.4

(Cov = Cover, Con = Constancy)

	TSME/VAME		TSME/CACH		TSME/XETE		TSME/CHUM	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
Tree Regeneration								
ABAM	59	13.6			29	11.7	10	11.2
ABCO-ABGR	14	5.3	56	17.4	18	3.5	28	7.4
ABLA2	27	5.2	15	5.9	62	11.7	15	4.9
ABMAS	29	11.3	74	9.5			70	11.8
ABPR	3	1.3			3	0.0	0	15.9
ALRU			3	1.0				
CADE3	1	1.0	3	2.0			0	1.0
JUOC								
LAOC	2	2.0						
PIAL	9	1.2	6	1.8	3	5.0	5	2.2
PICO	22	5.8	50	4.4	38	3.5	49	6.2
PIEN	6	3.6	3	1.0			3	3.5
PILA	1	0.0	3	1.2			1	2.0
PIMO	29	2.3	74	2.1	15	1.1	54	2.1
PIPO	3	2.3	12	1.5	6	1.0	3	2.6
POTR								
PSME	10	1.8	47	5.5	3	1.0	7	4.9
QUGA								
THPL								
TSHE	5	12.0	9	8.3			1	7.5
TSME	84	12.5	88	7.4	74	7.1	97	14.3
Tree Overstory								
ABAM	47	22.7			21	19.4	7	15.7
ABCO-ABGR	5	20.2	47	19.3	12	13.9	15	13.5
ABLA2	21	7.3	15	10.8	65	12.0	8	15.7
ABMAS	31	31.1	68	19.6			64	28.8
ABPR	4	10.2			6	16.7	2	11.3
ALRU								
CADE3								
JUOC								
LAOC	3	5.8	3	1.0			0	6.0
PIAL	6	2.9	9	7.1	9	1.7	2	5.4
PICO	24	16.1	50	10.6	68	25.9	51	12.2
PIEN	5	8.7					3	7.0
PILA	1	2.0	3	4.6			1	8.4
PIMO	26	6.0	50	5.3	15	1.8	43	4.9
PIPO	4	6.0	32	3.7	15	10.0	7	14.3
POTR								
PSME	11	13.7	53	25.9	9	22.3	10	19.3
QUGA								
THPL								
TSHE	1	1.0	6	5.0			0	84.3
TSME	85	28.1	62	9.2	79	18.2	71	24.4
Shrub								
ACCI								
ALIN								
AMAL	8	1.5	12	1.3	3	3.0	3	1.0
ARAR								
ARNE	21	7.6	79	9.7	26	11.1	49	4.3
ARPA	5	8.3	50	2.6	12	18.5	8	2.2
ARTR								
ARUV								
BEAQ								
BEGL								
BENE	2	14.7	3	0.1			0	1.0
BERE	1	5.0						
CACH	12	3.6	100	9.7	3	0.1	3	0.5
CELE	1	30.0						
CEPR							2	4.1
CEVE	3	13.5	21	3.2	6	1.1	2	2.2
CHME	8	1.3	6	1.0	9	1.0	20	1.0
CHUM	38	4.2	68	5.3	24	0.8	99	2.5

(Cov = Cover, Con = Constancy)

	TSME/VAME		TSME/CACH		TSME/XETE		TSME/CHUM	
	Con	**Cov**	**Con**	**Cov**	**Con**	**Cov**	**Con**	**Cov**
HODI			3	1.0			1	0.1
PAMY	22	5.5	29	10.3	15	0.8	11	1.7
PHEM	1	2.6						
PUTR							1	3.4
RHMA	1	32.5			3	0.1		
RICE	1	2.0	6	0.6			4	1.9
RILA	3	0.3					0	2.1
RIVI	4	1.0	12	0.6			5	0.6
ROGY	1	1.0	12	0.8	6	0.6		
RUUR							1	1.0
SASC	1	10.2	9	0.7			0	0.5
SPDO								
SYAL	1	1.0	6	0.3	3	8.0	0	0.1
SYMO	1	1.0	3	1.0			1	0.4
VADE								
VAME	100	17.4			6	0.1	1	0.4
VAOC2								
VASC	49	12.5	35	11.4	21	4.5	47	13.5
Herbs								
ACRU								
ACTR					3	0.1		
ADBI								
ARCO	5	3.6					0	0.5
ASCA3								
BASA								
CLUN	1	0.1						
COCA								
DIHO								
GOOB	10	1.2	15	0.3	6	0.6	7	0.6
LIBO2			3	0.1			0	0.1
LUAR3					9	12.0		
LUPO							0	0.1
LYAM								
OSCH	4	0.8			3	1.0	1	0.4
SMRA	1	5.1	3	1.0	6	1.0		
SMST	3	0.8			3	1.0	0	0.5
STJA	1	0.8	3	0.8				
TIUN	1	0.1						
TRLA2								
WYMO								
XETE	2	0.3	3	15.0	100	21.4	0	0.1
Graminoids								
AGSP								
BRVU	1	5.0			3	1.0	2	0.3
CAAQ								
CACA								
CAEU								
CAGE	1	6.0			3	1.0	0	0.1
CAIN4	15	4.5	56	0.9	24	2.9	42	1.6
CARO	4	0.4	9	0.1			5	0.5
CARU	3	8.6	9	9.9	18	3.7	0	21.0
DECA								
ELGL	1	0.6	3	2.0	3	1.0	2	0.6
ELPA2								
FEID	1	1.0					0	1.0
FEOC	1	1.0					1	1.0
LUHI	3	0.9						
POSA3								
STOC	4	1.2	6	0.1	3	1.0	7	0.4
Ferns								
ATFI	1	0.1						
POMU	3	0.6					0	0.1
PTAQ	1	3.0	15	13.7	12	7.3	3	0.9

(Cov = Cover, Con = Constancy)

	TSME/VASC		TSME/ARNE		TSME/CAIN4		ABAM/LYAM	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
Tree Regeneration								
ABAM	27	9.7	4	3.0	1	5.0	73	8.0
ABCO-ABGR	6	3.5	17	3.3	14	7.6	27	3.2
ABLA2	16	4.4	20	6.9	19	4.5	18	0.4
ABMAS	29	4.5	44	5.6	58	6.6		
ABPR	3	2.7					18	1.1
ALRU							36	22.9
CADE3								
JUOC								
LAOC							9	2.5
PIAL	9	1.0	14	3.0	14	3.7		
PICO	51	6.0	70	10.3	69	14.1	9	1.5
PIEN	1	2.8					36	3.3
PILA	1	3.1			2	0.9		
PIMO	39	1.6	57	2.3	13	2.7	36	1.0
PIPO	1	1.0	2	0.6	1	1.0	9	12.7
POTR								
PSME			3	1.7	2	3.2	64	6.7
QUGA								
THPL							73	11.5
TSHE							100	14.4
TSME	89	12.3	76	6.6	97	10.2	9	1.1
Tree Overstory								
ABAM	15	21.3	3	9.7	1	5.0	100	16.4
ABCO-ABGR	3	4.1	14	8.8	8	21.9	27	13.0
ABLA2	16	5.9	14	7.9	16	5.0	9	9.6
ABMAS	19	17.2	43	22.0	44	23.3		
ABPR	4	5.8					27	6.3
ALRU							27	50.1
CADE3								
JUOC								
LAOC							18	4.7
PIAL	7	8.4	14	5.7	13	8.0		
PICO	53	14.1	72	14.3	70	21.2	27	6.5
PIEN	2	6.0					45	9.4
PILA	1	6.5						
PIMO	30	4.7	56	5.2	8	6.4	18	3.4
PIPO	1	5.5	10	5.7	3	3.3		
POTR								
PSME			2	4.0	2	6.0	91	15.6
QUGA								
THPL							82	30.6
TSHE	1	7.1					91	38.8
TSME	84	31.9	77	14.3	69	26.7	9	2.3
Shrub								
ACCI							64	20.4
ALIN								
AMAL	1	0.3	3	3.0	1	0.1	18	0.6
ARAR								
ARNE	25	3.9	100	8.7	1	0.1		
ARPA	3	1.2	38	3.1	2	1.2	9	2.0
ARTR								
ARUV	2	9.0	2	0.1				
BEAQ								
BEGL								
BENE							64	1.6
BERE							9	0.1
CACH			3	0.8				
CELE								
CEPR			1	8.0				
CEVE	1	0.5	4	11.4	1	0.1	9	10.7
CHME	3	0.8	6	1.0	10	0.9	18	0.6
CHUM	10	0.2	11	0.7	3	0.4	64	0.4

(Cov = Cover, Con = Constancy)

	TSME/VASC		TSME/ARNE		TSME/CAIN4		ABAM/LYAM	
	Con	**Cov**	**Con**	**Cov**	**Con**	**Cov**	**Con**	**Cov**
HODI	2	1.0	4	0.7			9	3.0
PAMY	5	0.3	8	2.0			27	0.6
PHEM								
PUTR								
RHMA							45	9.2
RICE	1	2.0	11	2.8	7	1.8		
RILA							45	0.7
RIVI	2	1.5	4	1.4	3	2.1		
ROGY							64	0.7
RUUR							64	0.8
SASC								
SPDO								
SYAL	1	1.0	1	3.0			18	1.3
SYMO	1	0.1	1	1.0			18	0.6
VADE								
VAME	4	0.2					45	2.2
VAOC2								
VASC	98	16.4	7	0.2			9	0.1
Herbs								
ACRU							27	2.0
ACTR							100	0.8
ADBI							36	2.3
ARCO								
ASCA3							45	1.6
BASA								
CLUN							100	0.7
COCA							91	2.1
DIHO							9	0.1
GOOB			1	0.1	1	1.0	45	0.3
LIBO2	1	0.1					82	2.6
LUAR3			1	0.1	5	1.7		
LUPO								
LYAM							100	5.5
OSCH	1	3.0	2	0.6			9	0.1
SMRA							55	0.1
SMST	1	0.5			2	0.3	100	1.3
STJA								
TIUN							82	0.9
TRLA2							27	0.4
WYMO								
XETE	1	0.1	1	0.1			36	1.6
Graminoids								
AGSP								
BRVU					1	0.1		
CAAQ								
CACA								
CAEU								
CAGE								
CAIN4	35	1.0	49	3.8	78	4.0		
CARO	9	0.4	32	0.4	14	1.7		
CARU	2	16.2	3	14.7				
DECA								
ELGL	1	0.5	3	1.3	3	0.8		
ELPA2								
FEID					2	2.5		
FEOC			1	1.0	3	0.2		
LUHI	3	0.3			2	0.8		
POSA3								
STOC	8	1.1	26	0.5	24	1.0		
Ferns								
ATFI							64	2.7
POMU							45	0.6
PTAQ	1	1.1	4	10.0			18	6.5

(Cov = Cover, Con = Constancy)

	ABAM/ASCA3		ABAM/CLUN		ABAM/ACTR		ABAM/LIBO2	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
Tree Regeneration								
ABAM	93	9.1	88	10.8	90	9.6	93	8.7
ABCO-ABGR	49	7.5	32	6.1	27	5.4	21	4.8
ABLA2	3	0.9	8	5.3	4	5.0	3	1.1
ABMAS	5	4.7	4	10.2			1	0.0
ABPR	26	3.5	15	2.2	21	4.1	18	1.1
ALRU	4	15.0	1	16.9	4	5.5		
CADE3	4	3.0	1	3.6	4	3.3		
JUOC								
LAOC			0	2.1				
PIAL			0	1.0				
PICO	1	3.0	5	4.7	8	0.3	11	1.0
PIEN	9	2.9	13	2.0	10	1.5	3	0.0
PILA	1	0.0	2	0.7				
PIMO	14	2.1	22	1.2	27	0.5	39	1.0
PIPO	1	0.0	1	1.0			1	3.6
POTR			0	0.0				
PSME	45	7.1	24	5.4	54	11.9	46	6.2
QUGA								
THPL	14	5.4	9	5.8	33	8.6	26	9.9
TSHE	74	9.5	63	9.5	79	11.9	91	12.2
TSME	30	2.2	32	2.3	27	1.7	26	1.6
Tree Overstory								
ABAM	73	15.3	83	20.6	69	13.3	66	11.3
ABCO-ABGR	45	14.6	27	16.7	25	20.0	9	11.2
ABLA2	2	3.7	8	6.8	2	17.7	1	1.0
ABMAS	4	17.3	5	17.4			8	3.9
ABPR	43	16.6	32	17.2	23	15.3	18	5.7
ALRU			1	32.0			1	17.6
CADE3	5	6.1	1	5.7	4	9.6	4	2.4
JUOC								
LAOC	2	5.0	9	6.0	6	6.1	3	3.3
PIAL			0	1.0				
PICO	1	14.8	15	11.2	8	2.3	9	8.0
PIEN	13	4.1	18	10.5	6	10.8	7	2.1
PILA			1	5.1				
PIMO	18	2.6	30	4.4	19	3.8	25	3.8
PIPO	1	16.8	7	3.4	2	6.9	1	8.0
POTR			0	8.5				
PSME	95	39.8	77	27.3	92	33.3	86	39.4
QUGA								
THPL	11	16.2	10	14.6	29	17.4	22	15.1
TSHE	64	26.8	61	35.2	79	34.2	82	29.0
TSME	24	4.7	34	3.7	21	4.1	20	4.0
Shrub								
ACCI	60	14.3	33	10.8	58	7.8	29	10.6
ALIN					2	7.0		
AMAL	10	1.3	13	1.0	17	1.3	8	1.7
ARAR								
ARNE	1	0.1	5	1.9	2	3.2	14	1.2
ARPA			2	1.4	2	0.3		
ARTR								
ARUV			0	2.0	6	7.0	3	0.8
BEAQ	2	0.1	0	0.1			1	1.0
BEGL								
BENE	79	5.5	64	4.4	83	5.3	79	7.3
BERE			1	2.5	2	0.1		
CACH	23	3.4	34	3.6	58	4.7	51	5.4
CELE								
CEPR								
CEVE			3	1.8	8	6.1	4	7.8
CHME	9	0.8	16	1.5	6	0.4	9	3.2
CHUM	87	3.0	78	2.9	90	2.1	87	2.9

(Cov = Cover, Con = Constancy)

	ABAM/ASCA3		ABAM/CLUN		ABAM/ACTR		ABAM/LIBO2	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
HODI	24	2.5	3	0.8	13	1.7	7	2.4
PAMY	27	1.4	40	2.1	38	1.8	49	1.6
PHEM								
PUTR								
RHMA	41	9.9	17	17.4	50	17.5	62	36.0
RICE			1	2.6				
RILA	13	2.7	16	1.3	2	0.1	4	0.5
RIVI	4	1.0	4	2.2	4	0.9	4	0.7
ROGY	78	0.9	56	1.2	65	0.6	36	1.6
RUUR	34	1.4	36	1.4	35	2.4	46	1.4
SASC			1	5.9				
SPDO			1	5.5				
SYAL	13	1.5	11	1.5	17	1.7	4	0.4
SYMO	48	1.5	23	1.7	44	3.0	7	3.3
VADE			0	3.0				
VAME	77	4.2	87	6.9	71	4.5	79	3.2
VAOC2			2	24.5				
VASC	4	1.9	9	3.0	6	1.8	7	14.4
Herbs								
ACRU	9	2.8	2	3.8				
ACTR	89	7.8	66	3.1	100	1.8	24	2.4
ADBI	30	1.6	12	1.4	10	0.3	5	1.0
ARCO	4	4.1	2	4.4			1	5.0
ASCA3	100	1.6	1	0.1			1	0.1
BASA								
CLUN	82	2.6	97	2.8	2	0.1	1	0.1
COCA	60	3.2	43	4.2	48	3.7	36	5.4
DIHO	13	1.7	7	0.8			3	1.0
GOOB	26	0.9	47	1.0	33	0.4	36	1.0
LIBO2	63	5.4	65	4.1	81	4.4	100	5.6
LUAR3								
LUPO								
LYAM								
OSCH	24	1.3	17	1.5	10	0.1	1	0.1
SMRA	24	0.8	6	0.7	25	0.2	1	0.1
SMST	85	3.8	55	2.3	25	0.4	13	3.2
STJA								
TIUN	18	7.0	23	2.4	6	0.1	5	0.8
TRLA2	11	0.9	18	1.5	17	1.8	11	1.7
WYMO								
XETE	31	2.3	50	8.2	52	8.6	63	9.9
Graminoids								
AGSP								
BRVU	4	0.6	5	1.0				
CAAQ								
CACA								
CAEU								
CAGE								
CAIN4			1	0.2			1	0.1
CARO			2	1.1				
CARU			2	2.6				
DECA								
ELGL	1	0.1	2	1.6	4	0.6		
ELPA2								
FEID	1	1.5	2	1.5			1	0.1
FEOC	1	0.5	2	0.7				
LUHI								
POSA3			0	0.1				
STOC			0	0.1			1	1.0
Ferns								
ATFI	1	0.1	2	0.2			1	0.1
POMU	54	1.0	16	0.5	42	1.8	16	0.7
PTAQ	31	5.5	29	4.5	25	2.0	30	3.5

(Cov = Cover, Con = Constancy)

	ABAM/VAME/XETE		ABAM/VAME		ABAM/VASC		TSHE/LYAM	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
Tree Regeneration								
ABAM	64	8.6	53	11.2	12	15.5		
ABCO-ABGR	8	0.3	9	17.5			33	1.4
ABLA2	15	3.2	9	3.3	4	0.1		
ABMAS								
ABPR	15	0.9	6	0.0				
ALRU							17	6.4
CADE3								
JUOC								
LAOC	2	1.0						
PIAL			3	2.0				
PICO	17	2.1	12	1.6	8	0.1	17	0.0
PIEN	6	3.1	6	6.9			33	6.2
PILA								
PIMO	34	0.6	15	2.2	23	0.1	17	0.0
PIPO	2	1.0						
POTR								
PSME	15	1.8	3	13.3			50	2.2
QUGA								
THPL							83	21.7
TSHE	19	3.1	6	1.0			100	12.5
TSME	62	1.3	47	1.5	42	0.2		
Tree Overstory								
ABAM	77	24.2	88	18.7	100	13.8		
ABCO-ABGR	4	8.0	6	10.2			67	4.2
ABLA2	9	1.6	3	22.0	4	2.0		
ABMAS								
ABPR	9	21.2	6	31.7				
ALRU							50	13.1
CADE3								
JUOC								
LAOC			3	7.0			33	5.6
PIAL								
PICO	25	18.4	15	15.9	4	3.0		
PIEN	2	2.9	12	8.2			33	8.4
PILA								
PIMO	21	4.4	21	6.2	23	3.2	17	4.0
PIPO	6	1.7	6	1.0				
POTR								
PSME	15	14.3	9	16.6			83	43.1
QUGA								
THPL							100	33.4
TSHE	17	24.7	6	1.0			100	30.2
TSME	47	4.3	32	4.9	31	2.5		
Shrub								
ACCI							83	17.7
ALIN								
AMAL	4	1.5						
ARAR								
ARNE	19	7.2	9	21.0	23	2.0		
ARPA	2	3.0	3	5.0				
ARTR								
ARUV								
BEAQ								
BEGL								
BENE	11	1.0	6	2.0			83	1.9
BERE								
CACH	19	2.3	6	2.4			17	0.1
CELE								
CEPR								
CEVE	6	34.0						
CHME	4	1.0	6	0.6			17	1.0
CHUM	40	1.3	15	2.4	15	1.6	50	0.5

(Cov = Cover, Con = Constancy)

	ABAM/VAME/XETE		ABAM/VAME		ABAM/VASC		TSHE/LYAM	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
HODI								
PAMY	26	1.6	24	1.3			17	0.1
PHEM			3	10.0				
PUTR								
RHMA	8	13.9					50	7.4
RICE			3	1.0				
RILA	2	2.0						
RIVI			3	0.1				
ROGY	9	1.6	6	1.5			50	0.4
RUUR	4	0.6					67	0.3
SASC	2	10.0						
SPDO								
SYAL	2	1.0					50	0.7
SYMO							17	0.1
VADE	2	1.0			4	0.1		
VAME	100	13.7	100	18.3	31	0.1	17	2.0
VAOC2								
VASC	51	8.2	50	10.9	100	21.5		
Herbs								
ACRU								
ACTR	8	2.3					50	1.1
ADBI							67	0.3
ARCO			3	3.0				
ASCA3							33	0.6
BASA								
CLUN	2	0.1					33	0.3
COCA	4	0.1					83	3.0
DIHO							17	0.1
GOOB	19	0.3	9	0.7			33	0.1
LIBO2	6	0.4					67	4.6
LUAR3								
LUPO								
LYAM							100	1.2
OSCH			3	2.0				
SMRA								
SMST	4	0.1	9	1.3			67	0.8
STJA								
TIUN			6	1.0			33	0.3
TRLA2	2	1.0					17	0.1
WYMO								
XETE	100	17.1	12	0.1	8	0.1		
Graminoids								
AGSP								
BRVU								
CAAQ								
CACA								
CAEU								
CAGE								
CAIN4	9	11.6	3	15.0				
CARO	2	0.1						
CARU	4	2.0						
DECA								
ELGL	2	0.1						
ELPA2								
FEID								
FEOC								
LUHI								
POSA3								
STOC	2	2.0						
Ferns								
ATFI							67	4.5
POMU	6	0.1	3	0.1			67	3.2
PTAQ	4	2.0	3	2.0			50	0.6

(Cov = Cover, Con = Constancy)

	TSHE/ASCA3		TSHE/CLUN		TSHE/ACTR		TSHE/LIBO2	
	Con	**Cov**	**Con**	**Cov**	**Con**	**Cov**	**Con**	**Cov**
Tree Regeneration								
ABAM	3	0.7	1	0.6			2	0.1
ABCO-ABGR	67	10.0	81	11.6	57	14.3	44	8.4
ABLA2			1	3.0				
ABMAS	3	7.7	7	2.5			1	3.0
ABPR	10	2.5	7	4.0	7	1.3	10	1.7
ALRU	9	15.6	2	4.3	2	7.0	4	22.1
CADE3	35	3.4	30	4.0	33	4.6	17	3.7
JUOC								
LAOC			1	1.6				
PIAL								
PICO			2	0.3	2	1.7	8	1.7
PIEN	3	1.7	4	3.3	2	1.0	2	1.5
PILA	2	1.5	8	1.2	11	0.9	2	1.0
PIMO	16	1.4	34	1.5	24	1.9	24	1.5
PIPO	1	1.0	5	3.0	7	2.1	3	12.8
POTR								
PSME	73	7.4	65	5.4	66	7.1	63	8.3
QUGA								
THPL	30	9.6	9	5.1	23	5.8	30	7.3
TSHE	93	12.3	95	18.9	98	9.8	96	13.1
TSME	3	0.3	2	0.5	3	0.5	1	0.0
Tree Overstory								
ABAM								
ABCO-ABGR	41	15.5	54	18.4	43	15.8	31	15.8
ABLA2								
ABMAS	5	11.8	6	7.1	1	5.0	6	5.4
ABPR	6	23.4	5	13.1	4	20.9	7	12.9
ALRU	6	21.7	1	41.3	2	7.5	2	29.3
CADE3	21	6.0	14	6.5	25	8.7	12	9.2
JUOC								
LAOC	1	1.0	8	5.9	2	6.2	3	3.3
PIAL								
PICO	1	2.4	4	5.5	2	7.3	6	6.4
PIEN	5	4.2	4	13.9	2	4.6	2	2.0
PILA	4	4.3	16	7.0	16	9.1	6	5.2
PIMO	17	3.8	36	5.3	16	4.6	24	6.3
PIPO	5	5.2	10	7.4	10	10.0	3	9.9
POTR								
PSME	96	47.4	96	36.8	96	49.6	87	40.2
QUGA								
THPL	30	19.3	8	12.7	24	20.7	26	20.4
TSHE	66	24.3	72	21.3	59	21.0	62	26.6
TSME			1	1.0			1	1.0
Shrub								
ACCI	68	21.1	44	15.5	57	14.1	49	13.6
ALIN					1	20.0		
AMAL	9	1.6	22	1.2	16	1.4	11	1.6
ARAR								
ARNE	2	2.0	6	1.9	5	1.6	11	2.8
ARPA	2	1.6	1	0.6	5	1.2	2	2.5
ARTR								
ARUV	2	1.0	2	0.4	2	2.8	2	0.1
BEAQ	9	1.1	7	1.2	9	2.8	3	0.7
BEGL								
BENE	87	11.2	94	11.8	96	15.0	93	9.5
BERE	1	0.1	2	0.6	2	1.0		
CACH	39	5.5	72	6.1	66	5.6	53	4.2
CELE								
CEPR			1	1.0				
CEVE	3	3.7	9	7.3	5	8.8	3	19.0
CHME	25	1.1	25	0.9	23	0.9	26	0.5
CHUM	80	3.6	93	3.9	84	3.8	78	3.2

(Cov = Cover, Con = Constancy)

	TSHE/ASCA3		TSHE/CLUN		TSHE/ACTR		TSHE/LIBO2	
	Con	**Cov**	**Con**	**Cov**	**Con**	**Cov**	**Con**	**Cov**
HODI	19	2.5	9	2.0	25	2.8	13	0.9
PAMY	30	1.7	72	1.9	37	1.6	47	0.9
PHEM								
PUTR								
RHMA	32	10.5	17	19.2	35	12.7	39	15.6
RICE	2	2.0	3	2.3	2	0.6	2	1.0
RILA	7	2.1	2	1.0	2	1.0	3	0.6
RIVI	3	1.3	3	0.8			2	0.6
ROGY	79	1.4	82	1.4	74	1.1	46	0.7
RUUR	55	2.3	76	2.1	61	2.5	60	1.3
SASC			1	1.0			1	1.0
SPDO					1	1.0		
SYAL	12	1.2	9	2.2	7	2.3	2	1.4
SYMO	61	3.9	59	2.2	48	3.4	32	5.8
VADE								
VAME	39	1.5	68	3.3	52	2.1	49	1.1
VAOC2								
VASC	1	1.0	5	2.9	2	1.0	8	0.9
Herbs								
ACRU	3	0.7	3	0.6	1	0.1	1	0.1
ACTR	76	9.3	82	5.6	100	4.6	9	0.1
ADBI	44	1.6	38	1.3	33	1.0	17	0.9
ARCO	2	6.0	1	0.1			2	1.0
ASCA3	97	2.5	1	0.1	1	0.1	1	0.1
BASA								
CLUN	53	2.8	100	1.5	2	0.1	1	0.1
COCA	32	5.6	24	3.4	21	3.1	21	3.4
DIHO	24	1.0	34	0.9	20	1.0	9	0.9
GOOB	45	0.9	67	0.9	49	0.9	43	0.7
LIBO2	84	5.4	96	8.2	85	7.1	100	3.5
LUAR3								
LUPO								
LYAM								
OSCH	26	1.1	17	1.2	11	0.8	8	1.3
SMRA	16	0.7	15	0.9	20	0.7	2	0.6
SMST	69	4.1	48	2.1	30	0.8	20	1.0
STJA								
TIUN	11	3.7	6	1.7	2	0.1	2	0.1
TRLA2	45	1.7	58	1.3	52	1.6	33	1.4
WYMO								
XETE	9	1.7	8	1.9	16	3.3	22	3.6
Graminoids								
AGSP								
BRVU	3	1.3	4	0.9	4	1.2	2	1.0
CAAQ								
CACA								
CAEU								
CAGE			2	1.0	2	1.5		
CAIN4			2	0.7	1	5.8	1	0.5
CARO								
CARU			1	0.5				
DECA								
ELGL	1	2.0	1	0.1			1	1.0
ELPA2								
FEID			1	1.0	2	0.7	3	0.6
FEOC	1	2.0	3	0.8	5	1.5	2	1.0
LUHI								
POSA3								
STOC								
Ferns								
ATFI	7	1.3	1	0.1	2	0.6	1	0.1
POMU	56	2.9	29	1.3	55	2.5	31	1.0
PTAQ	40	6.3	36	2.0	43	3.5	33	1.7

	THPL/CLUN		THPL/LIBO2		ABCO-ABGR/ASCA3		ABCO-ABGR/CLUN	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
Tree Regeneration								
ABAM								
ABCO-ABGR	100	6.5	80	9.4	75	18.3	89	12.3
ABLA2							3	7.8
ABMAS					35	7.9	17	7.0
ABPR							2	3.2
ALRU	20	1.0					2	11.1
CADE3			20	2.0	27	7.1	16	4.2
JUOC							1	0.0
LAOC			20	4.9			5	1.0
PIAL								
PICO			20	0.4	4	1.0	13	3.2
PIEN	40	1.0			4	5.0	14	3.7
PILA					2	1.0	9	1.3
PIMO	20	2.0	20	0.0	8	1.0	23	1.2
PIPO			40	0.5	6	6.6	23	1.9
POTR							1	3.3
PSME	40	1.0	60	1.5	40	9.1	61	6.4
QUGA							2	3.6
THPL	60	2.7	40	0.5			1	0.1
TSHE							2	1.0
TSME							2	0.4
Tree Overstory								
ABAM								
ABCO-ABGR	100	33.7	80	20.1	69	27.6	80	25.4
ABLA2							2	4.7
ABMAS					46	24.6	16	21.5
ABPR					2	10.0	2	47.8
ALRU							1	15.4
CADE3			20	1.0	23	11.5	12	4.2
JUOC								
LAOC	40	2.0	80	3.9	2	6.6	11	6.2
PIAL								
PICO					6	5.0	15	10.4
PIEN	20	1.0	20	3.0	4	6.0	10	14.6
PILA					4	2.5	7	6.2
PIMO	60	2.0	40	2.0	12	4.8	24	5.1
PIPO	80	6.3	100	8.2	19	8.1	47	9.9
POTR			20	3.0			1	0.5
PSME	100	21.6	100	34.6	69	29.3	81	29.3
QUGA							1	12.0
THPL	80	4.0	60	3.3				
TSHE								
TSME					2	0.5	2	0.8
Shrub								
ACCI	20	5.7	60	16.0	12	14.1	15	12.0
ALIN							1	4.0
AMAL	60	1.7	20	3.0	31	4.4	48	1.5
ARAR							1	0.1
ARNE			20	0.6			8	1.5
ARPA	20	0.1	20	3.3			15	2.6
ARTR							1	0.1
ARUV								
BEAQ	20	1.0	40	2.0	6	6.0	16	1.8
BEGL								
BENE	80	2.3	40	1.5	50	7.0	55	9.1
BERE	20	1.0			4	0.6	9	1.5
CACH	20	5.0	80	1.3	48	5.0	51	5.7
CELE								
CEPR					2	1.0	5	3.7
CEVE	20	1.1	20	5.8	8	7.0	19	4.3
CHME	80	1.0	40	1.0	19	1.0	29	1.1
CHUM	100	2.7	80	2.5	81	5.9	87	3.6

(Cov = Cover, Con = Constancy)

	THPL/CLUN		THPL/LIBO2		ABCO-ABGR/ASCA3		ABCO-ABGR/CLUN	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
HODI	60	1.2	40	2.1	21	3.0	24	3.4
PAMY	80	1.3	80	1.8	52	1.1	44	1.8
PHEM								
PUTR							3	2.7
RHMA					2	1.8	2	8.7
RICE	20	9.0			6	6.0	7	1.7
RILA	60	0.7			13	2.9	9	0.8
RIVI					19	1.2	19	0.9
ROGY	100	2.3	100	2.3	79	1.9	81	1.9
RUUR	40	2.5	20	1.0	44	5.3	50	3.3
SASC							3	0.8
SPDO								
SYAL	40	0.9	100	2.2	17	6.7	34	9.2
SYMO	100	2.0	60	1.6	73	4.1	62	4.5
VADE								
VAME	20	3.0			21	6.7	32	3.6
VAOC2							1	3.0
VASC							2	1.4
Herbs								
ACRU					6	1.3	2	1.0
ACTR	80	2.0	20	0.1	37	12.8	25	8.2
ADBI	40	1.5	20	1.0	71	2.5	43	1.6
ARCO	20	2.0			4	0.3	5	5.8
ASCA3	20	2.0			100	2.9		
BASA							1	1.6
CLUN	100	2.6			46	3.0	100	1.7
COCA	20	4.0			2	4.0	2	1.0
DIHO	40	0.6			29	1.1	22	1.0
GOOB	100	1.0	20	1.0	60	1.0	54	0.9
LIBO2	100	6.5	100	5.0	38	10.1	60	10.6
LUAR3							3	0.6
LUPO								
LYAM								
OSCH	60	1.0	20	1.0	69	1.6	51	1.2
SMRA	20	0.3	40	1.0	8	2.3	18	0.9
SMST	60	1.0	20	1.0	85	2.1	71	2.0
STJA			20	0.1			3	0.2
TIUN	40	1.0	20	1.0	2	0.4	2	2.2
TRLA2	100	2.6	100	3.0	58	1.8	64	2.1
WYMO							1	0.1
XETE					2	1.0	3	9.9
Graminoids								
AGSP							1	1.0
BRVU					4	1.0	16	1.6
CAAQ								
CACA								
CAEU								
CAGE							7	1.6
CAIN4					2	1.0	12	4.6
CARO					2	1.0	10	3.6
CARU							14	7.8
DECA								
ELGL					19	1.4	6	1.7
ELPA2								
FEID							12	1.0
FEOC	40	0.6	60	1.0	6	0.7	19	1.5
LUHI								
POSA3							1	0.5
STOC							6	0.4
Ferns								
ATFI							1	0.1
POMU	20	1.0	20	1.0	10	0.6	13	1.2
PTAQ	60	1.0	20	1.0	35	3.8	43	5.3

(Cov = Cover, Con = Constancy)

	ABCO-ABGR/ACTR		ABCO-ABGR/LIBO2		ABCO-ABGR/TRLA2		ABCO-ABGR/CACH	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
Tree Regeneration								
ABAM								
ABCO-ABGR	95	16.0	91	14.1	84	9.1	74	13.8
ABLA2								
ABMAS	7	4.1	10	4.5	2	5.4	17	7.2
ABPR	2	0.7	1	1.0	0	1.0		
ALRU	1	1.0			1	7.6		
CADE3	36	8.4	28	5.5	41	4.2	16	2.1
JUOC					1	1.8	1	1.0
LAOC	2	1.5	3	1.4	5	1.7	2	1.2
PIAL					0	1.0	0	1.0
PICO	3	0.8	14	7.2	1	7.5	31	3.3
PIEN	3	1.5	5	1.8			2	0.5
PILA	11	1.6	13	1.8	13	1.3	22	3.1
PIMO	13	1.8	15	2.1	5	1.2	16	1.8
PIPO	15	1.7	34	4.4	42	2.9	57	3.4
POTR			1	3.6			0	2.9
PSME	63	7.9	76	8.0	78	6.6	42	4.8
QUGA	1	1.0			6	1.9		
THPL								
TSHE	8	1.1	3	1.0				
TSME	1	1.0	3	0.2			4	0.6
Tree Overstory								
ABAM					0	4.1		
ABCO-ABGR	86	24.3	76	23.6	67	20.0	76	21.0
ABLA2					1	2.5		
ABMAS	8	17.4	9	7.9	2	5.6	20	16.6
ABPR	1	2.0	1	55.0	1	33.3		
ALRU			1	10.0				
CADE3	17	9.1	11	6.1	22	5.2	9	3.4
JUOC								
LAOC	11	2.5	11	4.8	13	6.0	4	2.8
PIAL							1	4.7
PICO	7	10.7	13	8.0	4	5.0	31	5.9
PIEN	5	5.5	3	3.4	0	1.0		
PILA	12	5.7	12	5.6	14	8.2	27	7.8
PIMO	13	5.0	13	4.3	1	1.7	14	4.4
PIPO	34	7.8	54	13.1	76	15.4	79	13.3
POTR			1	36.7			0	6.5
PSME	94	39.9	82	30.5	89	33.3	48	18.5
QUGA	1	5.1			3	4.2		
THPL	1	1.0						
TSHE	2	1.0			0	2.0		
TSME			1	0.3			1	0.1
Shrub								
ACCI	24	8.7	11	13.4	10	8.8	0	1.0
ALIN								
AMAL	35	2.1	38	3.8	65	2.3	21	1.4
ARAR								
ARNE	4	2.1	16	2.8	7	3.1	46	7.1
ARPA	11	2.0	18	2.5	33	2.6	58	3.0
ARTR							1	0.3
ARUV	1	1.1	2	7.5	0	5.2	1	2.8
BEAQ	30	2.2	22	1.3	46	3.3	10	1.3
BEGL								
BENE	73	8.8	56	5.9	28	8.4	0	1.0
BERE	6	1.8	7	1.5	7	1.1	3	3.0
CACH	61	4.6	55	5.9	50	6.6	100	6.6
CELE					0	3.0	0	0.2
CEPR	2	3.5	7	7.0	8	3.5	9	3.2
CEVE	15	6.2	21	7.6	32	6.5	55	8.1
CHME	50	1.1	28	0.9	39	1.0	15	0.6
CHUM	77	5.5	79	6.7	62	2.7	62	2.6

(Cov = Cover, Con = Constancy)

	ABCO-ABGR/ACTR		ABCO-ABGR/LIBO2		ABCO-ABGR/TRLA2		ABCO-ABGR/CACH	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
HODI	34	3.0	23	2.9	37	4.2	7	2.5
PAMY	47	1.4	39	1.3	40	5.5	26	2.4
PHEM								
PUTR			5	1.9	13	2.3	15	1.0
RHMA	2	6.3	1	10.5				
RICE	4	1.2	5	1.1	3	0.9	9	1.6
RILA	5	1.2	3	3.0	2	1.6	1	1.0
RIVI	5	1.9	5	0.7	4	2.3	7	1.2
ROGY	70	2.6	61	1.8	75	1.9	24	1.3
RUUR	53	2.0	40	5.3	29	3.1	1	1.0
SASC			3	1.0	9	2.7	9	1.2
SPDO			1	0.5				
SYAL	30	3.0	32	4.0	49	5.4	30	2.4
SYMO	64	4.8	49	4.4	54	4.6	19	2.5
VADE								
VAME	16	2.3	8	1.6	3	1.1	0	1.0
VAOC2			1	24.0				
VASC	2	0.6	4	6.2			3	2.8
Herbs								
ACRU	3	0.8	1	0.1	0	1.0		
ACTR	100	3.8						
ADBI	48	1.3	33	1.9	15	1.6	1	1.3
ARCO	5	1.5	6	2.7	7	1.7	4	6.1
ASCA3								
BASA	2	0.9	1	1.0	12	1.1	2	0.8
CLUN	1	0.1	4	0.5	0	0.5		
COCA	2	1.5	1	7.0				
DIHO	21	1.1	19	1.1	7	1.0	0	1.0
GOOB	63	1.1	45	0.9	36	1.0	16	0.5
LIBO2	55	6.3	99	5.6	2	0.5	2	0.4
LUAR3			3	4.5	2	1.7	2	1.3
LUPO					0	3.0		
LYAM								
OSCH	30	0.9	29	1.3	38	1.1	10	1.0
SMRA	32	1.1	12	0.9	20	0.9	4	0.9
SMST	41	1.2	44	1.4	28	1.4	7	1.0
STJA	1	0.1	1	2.8	2	0.4	6	1.9
TIUN	1	0.1	1	0.1				
TRLA2	76	2.1	62	1.9	100	2.1	1	0.8
WYMO			1	4.0	1	0.6	0	0.1
XETE	2	1.3	1	1.0	1	2.0		
Graminoids								
AGSP	2	7.6	1	13.0	0	4.5		
BRVU	10	1.3	5	4.2	12	3.1	2	0.7
CAAQ								
CACA								
CAEU								
CAGE	11	1.1	3	1.6	17	6.7	5	2.2
CAIN4	1	1.0	25	2.5	10	2.2	39	2.2
CARO	2	0.6	11	1.0	13	1.8	32	0.6
CARU	5	2.3	11	3.6	31	6.8	12	7.5
DECA								
ELGL			5	1.1	10	2.2	5	0.9
ELPA2								
FEID	2	1.0	6	0.5	7	4.3	4	0.8
FEOC	24	1.6	19	1.9	40	2.1	12	1.3
LUHI								
POSA3	1	0.1			0	1.4	0	0.1
STOC	2	0.9	12	0.8	6	1.3	31	0.8
Ferns								
ATFI	1	0.1	1	1.0				
POMU	15	1.1	4	1.0	5	1.1	0	1.0
PTAQ	40	1.8	26	2.0	33	2.2	11	3.4

(Cov = Cover, Con = Constancy)

	ABCO-ABGR/SMST		ABCO-ABGR/SYMO		ABCO-ABGR/CHUM		ABCO-ABGR/HODI	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
Tree Regeneration								
ABAM								
ABCO-ABGR	88	15.6	68	22.3	91	13.0	94	1.8
ABLA2	12	3.4	1	0.5	0	3.4		
ABMAS	11	21.0			17	13.8		
ABPR	2	1.0						
ALRU					0	6.8		
CADE3	16	3.8	32	5.8	11	2.1	17	9.7
JUOC	9	3.0	15	1.2	2	0.3		
LAOC	5	1.0			1	0.3		
PIAL	2	1.0	1	7.5	1	2.4		
PICO	16	2.7	22	2.7	41	6.2	11	1.4
PIEN	2	1.0			3	1.7		
PILA	4	10.3	19	4.0	12	2.9		
PIMO	11	1.7	3	3.8	16	1.4		
PIPO	65	7.6	76	8.4	60	5.0	44	3.4
POTR	4	14.0	5	2.3	1	0.5		
PSME	18	3.2	25	5.3	32	5.0	83	4.3
QUGA			3	1.7				
THPL								
TSHE					0	1.0		
TSME	2	1.0			2	0.2		
Tree Overstory								
ABAM								
ABCO-ABGR	84	17.0	64	17.8	82	21.3	61	8.2
ABLA2	9	5.6			0	5.5		
ABMAS	12	24.0			20	18.2		
ABPR	2	2.0						
ALRU					0	8.7		
CADE3	11	2.7	22	4.0	9	4.3	6	11.9
JUOC								
LAOC	7	2.6	1	5.0	1	10.0	11	2.0
PIAL	2	1.0	1	7.5				
PICO	25	13.8	20	3.9	44	11.1	6	6.1
PIEN	4	3.0			1	1.6		
PILA	5	6.9	14	8.9	12	6.3		
PIMO	11	2.4	2	4.3	12	3.2		
PIPO	88	16.5	92	16.8	80	16.4	100	14.9
POTR	5	20.3	1	0.5	1	1.8		
PSME	19	22.9	34	25.9	33	18.6	89	36.9
QUGA			3	4.3			11	3.0
THPL								
TSHE								
TSME	2	0.1			0	0.1		
Shrub								
ACCI	2	1.0						
ALIN	2	2.0						
AMAL	56	4.4	52	2.8	15	1.8	44	1.6
ARAR			2	4.3			6	2.0
ARNE	9	1.2	10	4.4	31	6.9	11	0.6
ARPA	30	3.2	44	3.1	46	4.2	50	1.4
ARTR	5	3.8	7	21.6				
ARUV					1	0.7		
BEAQ			27	1.6	2	1.2	33	1.6
BEGL								
BENE			1	0.5				
BERE	33	6.4	37	4.3	3	3.4	17	2.3
CACH	2	0.2	4	0.5	6	0.3		
CELE	5	1.3	5	2.0				
CEPR	7	18.0	34	8.9	10	9.7	11	1.6
CEVE	23	6.1	25	8.2	48	9.5	39	1.3
CHME	25	0.8	11	0.7	19	0.7	6	1.0
CHUM	46	1.8	32	2.1	100	4.5	6	0.5

(Cov = Cover, Con = Constancy)

	ABCO-ABGR/SMST		ABCO-ABGR/SYMO		ABCO-ABGR/CHUM		ABCO-ABGR/HODI	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
HODI	2	0.5	7	2.8	3	2.5	100	1.8
PAMY	11	6.9	25	1.0	9	3.1	11	2.0
PHEM								
PUTR	7	6.8	5	1.0	24	3.9	39	3.9
RHMA								
RICE	23	2.2	13	1.2	17	1.5	17	0.9
RILA	2	1.0	1	1.0	1	1.7	6	0.5
RIVI	23	4.8	14	3.2	7	2.7	11	0.1
ROGY	23	1.1	35	1.0	7	0.7	39	2.0
RUUR	5	1.3	2	0.6	2	1.2		
SASC			7	1.5	5	0.6	17	1.6
SPDO								
SYAL	35	3.9	33	4.4	8	2.0	78	5.6
SYMO	18	5.0	100	5.7	3	0.4		
VADE								
VAME					1	0.1		
VAOC2								
VASC	2	1.0			3	2.8		
Herbs								
ACRU								
ACTR								
ADBI	5	1.0	1	2.0	0	1.0		
ARCO	35	8.9	34	10.7	3	1.1	17	1.3
ASCA3								
BASA			4	1.5	3	0.8	17	1.0
CLUN								
COCA								
DIHO			3	1.0	0	1.0		
GOOB	14	0.9	5	0.9	13	0.5	11	1.0
LIBO2	2	0.1			1	0.1		
LUAR3	21	4.8	22	4.6	4	1.4		
LUPO								
LYAM								
OSCH	40	2.6	32	1.2	7	1.0	50	1.7
SMRA	12	0.8	12	1.3	2	0.6	6	0.1
SMST	98	2.9	8	0.5	2	0.9		
STJA	39	3.8	36	2.8	6	0.9	6	0.1
TIUN								
TRLA2			2	1.0				
WYMO	11	1.8	4	7.3	0	0.1		
XETE								
Graminoids								
AGSP	7	5.5	5	2.1	0	0.1	6	1.5
BRVU	5	0.6	5	1.0	5	0.5	11	1.0
CAAQ								
CACA	2	0.5						
CAEU								
CAGE	5	1.0	12	18.5	1	0.3	17	13.0
CAIN4	58	5.5	42	7.3	54	3.6		
CARO	5	2.0	21	2.5	35	2.4	11	0.6
CARU	16	12.2	2	1.0	9	8.1	22	14.2
DECA	2	3.0						
ELGL	5	0.7	13	1.1	3	0.5		
ELPA2								
FEID	2	3.0	9	7.4	10	1.2	39	3.2
FEOC	5	1.0	23	1.4	10	1.1	33	1.5
LUHI								
POSA3					1	0.3	6	3.0
STOC	11	0.5	25	2.7	41	1.0		
Ferns								
ATFI							6	0.1
POMU			2	1.5				
PTAQ	16	4.1	2	10.5	10	5.6	11	7.3

(Cov = Cover, Con = Constancy)

	ABCO-ABGR/SYAL		ABCO-ABGR/CARU		ABCO-ABGR/ARNE		ABCO-ABGR/CEPR	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
Tree Regeneration								
ABAM								
ABCO-ABGR	91	11.9	100	9.8	83	11.8	88	8.1
ABLA2					3	2.5		
ABMAS	2	13.3			13	4.7	1	0.0
ABPR								
ALRU								
CADE3	11	4.7	22	0.3	1	0.7	50	4.2
JUOC	19	2.7			3	0.3	32	2.7
LAOC								
PIAL	1	0.5			8	3.2		
PICO	16	4.6	22	1.1	74	8.4	15	9.8
PIEN								
PILA	3	1.4			11	2.3	6	3.1
PIMO	3	3.4			19	2.9		
PIPO	78	6.1	56	9.5	48	3.5	95	14.0
POTR	8	7.7					1	3.6
PSME	10	6.1	33	2.5	5	6.3	5	3.6
QUGA								
THPL								
TSHE								
TSME	1	0.5						
Tree Overstory								
ABAM								
ABCO-ABGR	88	21.7	67	11.7	86	17.1	81	11.1
ABLA2			11	2.0	5	14.8		
ABMAS	2	23.3			23	8.8		
ABPR								
ALRU								
CADE3	12	9.1	22	15.0			40	9.2
JUOC	9	10.1					18	7.1
LAOC	1	0.5						
PIAL	2	4.9			8	5.8		
PICO	17	14.2	22	17.5	78	14.3	13	15.8
PIEN								
PILA	4	4.4			9	4.3	8	5.7
PIMO	3	10.5			28	5.3		
PIPO	93	17.8	100	29.1	64	12.7	99	21.0
POTR	4	17.6			1	4.9	1	15.3
PSME	14	38.8	33	27.3	5	16.6	5	19.4
QUGA	4	4.0						
THPL								
TSHE								
TSME					1	0.1		
Shrub								
ACCI			11	0.1				
ALIN								
AMAL	64	1.5	22	1.8	8	0.3	56	1.4
ARAR	2	1.3					8	0.9
ARNE	6	3.7	11	3.0	100	6.4	1	0.5
ARPA	34	1.5	56	1.7	55	3.6	77	6.1
ARTR	22	10.2			1	1.4	6	2.0
ARUV	1	2.7			1	5.0		
BEAQ	4	3.0	11	1.0				
BEGL								
BENE								
BERE	15	4.3	11	0.5			22	3.7
CACH			11	0.5	4	0.2	1	0.5
CELE	19	2.8			4	1.8	50	6.8
CEPR	21	3.8			3	5.0	100	9.0
CEVE	39	2.1	22	9.5	51	7.9	47	2.6
CHME	2	0.8	33	0.4	8	0.2		
CHUM	4	0.6	44	0.4	13	1.3	1	0.5

(Cov = Cover, Con = Constancy)

	ABCO-ABGR/SYAL		ABCO-ABGR/CARU		ABCO-ABGR/ARNE		ABCO-ABGR/CEPR	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
HODI			11	0.1	1	1.0		
PAMY	4	0.6	11	4.0	4	1.4		
PHEM								
PUTR	18	1.6	22	2.8	21	6.7	51	4.8
RHMA								
RICE	36	1.3	11	3.0	39	3.7	15	0.7
RILA								
RIVI	27	2.1			21	1.4	1	2.0
ROGY	26	1.1	11	0.5			12	0.9
RUUR	1	2.0						
SASC	2	1.5			1	1.6		
SPDO								
SYAL	100	3.5	11	0.5	9	0.3	1	0.5
SYMO					1	0.5	1	0.5
VADE								
VAME								
VAOC2								
VASC					3	14.1	1	0.1
Herbs								
ACRU								
ACTR								
ADBI								
ARCO	57	3.2	22	8.0	5	2.3	40	4.1
ASCA3								
BASA	12	1.1			1	0.1	21	0.4
CLUN								
COCA								
DIHO								
GOOB	1	1.0						
LIBO2								
LUAR3	13	3.4	22	5.5	1	0.5	14	4.2
LUPO								
LYAM								
OSCH	16	2.4	11	0.5			3	2.0
SMRA	2	1.5						
SMST	2	0.5						
STJA	45	1.9	22	3.0	8	0.3	15	0.4
TIUN								
TRLA2					1	0.5		
WYMO	29	2.2			4	0.1	36	2.5
XETE								
Graminoids								
AGSP	8	1.2					9	2.6
BRVU	1	2.0			1	1.0	1	1.0
CAAQ								
CACA								
CAEU								
CAGE	5	20.8	11	20.0				
CAIN4	26	3.3	67	1.9	48	3.4	24	2.8
CARO	61	0.8			64	0.8	79	2.5
CARU	3	3.3	100	23.1	1	0.2		
DECA								
ELGL	2	1.0	11	0.1				
ELPA2								
FEID	24	3.6	22	2.0	6	0.4	28	5.7
FEOC	5	5.7	22	0.1			1	1.0
LUHI								
POSA3	15	0.7			4	0.6	21	0.5
STOC	66	0.9	11	2.0	74	1.6	67	1.3
Ferns								
ATFI								
POMU					1	0.1		
PTAQ	2	2.4	22	2.6	4	1.2		

(Cov = Cover, Con = Constancy)

	ABCO-ABGR/CAIN4		ABCO-ABGR/WYMO		ABCO-ABGR/ARPA		ABCO-ABGR/STJA	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
Tree Regeneration								
ABAM								
ABCO-ABGR	92	12.3	100	7.1	85	9.4	80	10.4
ABLA2	1	1.0						
ABMAS	3	13.9			1	0.1		
ABPR	1	0.1						
ALRU								
CADE3	3	8.6	20	3.7	5	1.5	10	2.4
JUOC	4	2.6	20	2.2	7	1.2	30	4.7
LAOC					2	0.8		
PIAL	10	2.4			1	3.0		
PICO	56	9.1	33	7.1	48	9.4	20	2.2
PIEN	1	0.1						
PILA	6	1.0	7	3.0	17	3.7		
PIMO	12	4.3	7	0.0	1	3.5		
PIPO	55	9.9	100	11.6	83	8.2	70	4.0
POTR	3	6.7	13	0.0	1	3.0	10	13.0
PSME	2	3.8			4	1.0		
QUGA								
THPL								
TSHE								
TSME								
Tree Overstory								
ABAM								
ABCO-ABGR	63	14.0	80	10.7	74	11.1	90	31.0
ABLA2	1	1.0						
ABMAS	4	19.5						
ABPR								
ALRU								
CADE3	4	10.7	20	3.5	6	3.4	10	13.7
JUOC	1	3.3	13	6.9	2	7.6	10	6.9
LAOC					1	3.0		
PIAL	7	7.3			1	3.0		
PICO	63	19.7	27	6.8	45	10.0	20	31.2
PIEN								
PILA	3	5.7	7	3.0	17	9.2		
PIMO	9	11.3			2	2.6		
PIPO	64	17.2	100	22.5	90	17.1	90	16.0
POTR	1	4.4	7	15.8	1	6.0	10	5.8
PSME	2	6.0			4	11.0		
QUGA								
THPL								
TSHE								
TSME								
Shrub								
ACCI								
ALIN								
AMAL	15	1.7	67	3.4	12	0.9	50	1.3
ARAR					1	1.0	20	3.0
ARNE	4	0.4			1	0.5		
ARPA	21	2.4	27	5.1	98	5.4		
ARTR	5	0.8	20	15.2	2	0.6	20	12.7
ARUV								
BEAQ								
BEGL								
BENE								
BERE	13	2.6	13	5.5	5	2.5		
CACH								
CELE	7	2.7	33	12.9	6	4.0	10	5.1
CEPR	1	0.5	7	0.5				
CEVE	24	8.2	47	1.9	67	12.3	20	0.1
CHME	6	0.7			6	0.6		
CHUM	12	0.4			6	0.3		

(Cov = Cover, Con = Constancy)

	ABCO-ABGR/CAIN4		ABCO-ABGR/WYMO		ABCO-ABGR/ARPA		ABCO-ABGR/STJA	
	Con	**Cov**	**Con**	**Cov**	**Con**	**Cov**	**Con**	**Cov**
HODI								
PAMY	1	0.5						
PHEM								
PUTR	23	5.6	40	6.0	67	6.2		
RHMA								
RICE	30	0.9	20	2.0	33	0.8	40	1.1
RILA	1	1.8						
RIVI	15	2.5	7	3.0	6	1.8	40	0.7
ROGY	2	1.1	20	1.1	3	0.2		
RUUR								
SASC					2	0.6		
SPDO								
SYAL	3	0.5			1	0.1		
SYMO	5	0.5			1	0.5		
VADE								
VAME								
VAOC2								
VASC	1	5.0						
Herbs								
ACRU								
ACTR								
ADBI								
ARCO	21	8.8	67	6.7	6	2.7	90	3.2
ASCA3								
BASA	5	0.7	20	0.6	4	0.3	10	1.7
CLUN								
COCA								
DIHO								
GOOB	1	0.5						
LIBO2								
LUAR3	23	6.1	47	11.9	6	1.3	30	1.5
LUPO								
LYAM								
OSCH	7	2.0	20	0.5				
SMRA	1	1.8			1	0.5		
SMST	2	0.5			2	0.5		
STJA	21	2.8	53	2.7	1	0.5	100	0.9
TIUN								
TRLA2								
WYMO	3	0.5	100	4.7	3	0.2	10	0.1
XETE								
Graminoids								
AGSP	2	2.0	7	0.1	1	1.3	10	7.5
BRVU	1	0.6						
CAAQ								
CACA								
CAEU								
CAGE								
CAIN4	99	5.0	47	5.1	16	5.9		
CARO	26	1.1	47	1.2	77	1.1	70	0.5
CARU								
DECA								
ELGL	1	0.1			5	0.7		
ELPA2								
FEID	13	5.4	20	0.2	22	4.5	20	0.1
FEOC								
LUHI								
POSA3	4	1.8	7	0.1	5	0.5	10	1.0
STOC	61	1.6	53	1.9	78	1.5	10	0.6
Ferns								
ATFI								
POMU								
PTAQ								

(Cov = Cover, Con = Constancy)

	ABMAS/CACH		ABMAS/CHUM		ABMAS/ARNE		ABMAS/CAIN4	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
Tree Regeneration								
ABAM			8	0.5				
ABCO-ABGR	4	0.5			3	0.1	14	0.2
ABLA2			8	5.0				
ABMAS	81	7.5	83	13.8	58	6.1	55	2.7
ABPR					5	7.0		
ALRU								
CADE3								
JUOC								
LAOC								
PIAL	4	0.5			2	1.3	5	0.0
PICO	59	6.5	67	13.7	69	13.8	64	6.4
PIEN								
PILA	41	4.2			18	2.4	5	0.0
PIMO	30	1.4	17	0.8	50	2.5	9	3.0
PIPO	41	3.0	25	1.7	23	3.6	14	9.1
POTR								
PSME	7	1.0						
QUGA								
THPL								
TSHE								
TSME	4	0.1	8	0.5	5	0.8		
Tree Overstory								
ABAM								
ABCO-ABGR	4	0.3						
ABLA2								
ABMAS	78	18.1	58	43.6	74	13.2	59	3.5
ABPR					2	3.0		
ALRU								
CADE3								
JUOC								
LAOC								
PIAL					2	4.5		
PICO	70	8.7	67	23.2	81	11.9	77	22.0
PIEN								
PILA	44	10.2			16	5.4		
PIMO	41	3.8			55	3.1	18	1.5
PIPO	52	11.3	25	22.5	26	5.6	18	7.1
POTR								
PSME	11	21.0						
QUGA								
THPL								
TSHE								
TSME					2	1.0		
Shrub								
ACCI								
ALIN								
AMAL	4	0.1	8	0.5	2	0.1		
ARAR								
ARNE	81	7.9	33	1.9	100	9.2		
ARPA	74	7.3	25	2.0	73	9.2	23	0.3
ARTR								
ARUV			8	3.0				
BEAQ								
BEGL								
BENE								
BERE								
CACH	100	10.5			3	0.6		
CELE	4	1.0						
CEPR	7	0.1			6	2.6		
CEVE	48	9.4	17	24.0	18	13.0	9	6.8
CHME			25	0.4	2	0.1	5	1.0
CHUM	33	2.5	100	1.5	13	0.3	5	1.0

(Cov = Cover, Con = Constancy)

	ABMAS/CACH		ABMAS/CHUM		ABMAS/ARNE		ABMAS/CAIN4	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
HODI	11	1.5	8	3.0	3	2.0		
PAMY	11	2.0	25	1.7	2	1.0		
PHEM								
PUTR	15	3.0	8	0.5	15	7.0	41	6.2
RHMA								
RICE	19	0.5	17	10.3	11	1.9	64	6.6
RILA								
RIVI			8	1.0				
ROGY	4	1.0	8	1.0				
RUUR								
SASC					2	1.0		
SPDO								
SYAL					3	0.3		
SYMO	4	1.0	17	1.0			5	0.1
VADE								
VAME	4	1.0						
VAOC2								
VASC			17	10.5				
Herbs								
ACRU								
ACTR								
ADBI	4	1.0						
ARCO								
ASCA3								
BASA								
CLUN								
COCA								
DIHO								
GOOB	7	0.6	8	1.0	2	1.0		
LIBO2								
LUAR3							5	3.0
LUPO								
LYAM								
OSCH			8	1.0				
SMRA								
SMST	4	1.0	17	1.0				
STJA								
TIUN								
TRLA2								
WYMO								
XETE								
Graminoids								
AGSP								
BRVU								
CAAQ								
CACA								
CAEU								
CAGE			8	1.0				
CAIN4	26	3.4	58	11.1	44	3.6	100	10.6
CARO	30	0.5	8	0.5	52	0.6	50	0.9
CARU								
DECA								
ELGL			8	1.0	2	0.1	9	1.3
ELPA2								
FEID	4	1.0					5	1.0
FEOC	4	1.0						
LUHI								
POSA3	4	0.1						
STOC	26	1.4	25	10.8	55	1.2	91	5.5
Ferns								
ATFI								
POMU								
PTAQ			8	20.0				

(Cov = Cover, Con = Constancy)

	PSME/TRLA2		PSME/CACH		PSME/SYMO		PSME/CHUM	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
Tree Regeneration								
ABAM								
ABCO-ABGR								
ABLA2								
ABMAS								
ABPR								
ALRU								
CADE3	58	4.4	67	1.8	65	6.9	83	2.7
JUOC	14	1.2			39	1.2	17	1.0
LAOC	2	0.5						
PIAL								
PICO			11	3.0	3	1.0		
PIEN								
PILA	11	1.4	26	2.4	3	2.0	6	1.0
PIMO	2	0.3	4	7.2				
PIPO	60	2.5	78	1.8	68	3.8	61	1.4
POTR								
PSME	97	5.4	89	5.5	97	5.5	94	2.5
QUGA	20	2.8	4	1.0	32	2.4	11	1.0
THPL								
TSHE								
TSME								
Tree Overstory								
ABAM								
ABCO-ABGR					3	1.0		
ABLA2								
ABMAS								
ABPR								
ALRU								
CADE3	46	5.8	44	3.3	42	8.4	61	4.5
JUOC	2	3.5						
LAOC							6	1.0
PIAL								
PICO	2	1.0	7	14.3				
PIEN								
PILA	12	6.2	26	4.7	6	3.0		
PIMO			4	5.0				
PIPO	97	15.4	96	17.8	97	18.2	100	17.9
POTR								
PSME	97	39.3	100	26.2	97	34.4	100	42.7
QUGA	8	9.6			13	3.3		
THPL							6	3.0
TSHE								
TSME								
Shrub								
ACCI	6	4.3						
ALIN								
AMAL	80	1.5	59	1.2	81	1.5	89	1.4
ARAR								
ARNE	5	1.0	4	3.3				
ARPA	45	2.2	70	2.7	52	3.2	56	1.9
ARTR								
ARUV								
BEAQ	63	3.5	30	1.3	84	2.5	61	1.7
BEGL								
BENE	5	7.3						
BERE	5	1.3			3	2.0		
CACH	37	6.3	100	6.1				
CELE	2	0.5						
CEPR	22	2.0	19	3.4	58	2.0	44	5.1
CEVE	40	3.2	78	3.5	32	2.6	56	3.6
CHME	38	1.0	19	0.9	13	1.0	39	1.0
CHUM	58	2.3	70	1.2	23	1.0	100	1.4

(Cov = Cover, Con = Constancy)

	PSME/TRLA2		PSME/CACH		PSME/SYMO		PSME/CHUM	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
HODI	25	5.1	7	0.8	10	2.3	6	1.0
PAMY	14	1.2			26	3.1	17	6.7
PHEM								
PUTR	37	4.1	74	3.4	19	5.2	39	10.0
RHMA								
RICE	6	0.8			3	1.0		
RILA	2	1.0			3	1.0		
RIVI	2	2.0						
ROGY	72	2.1	44	1.5	68	1.5	50	1.0
RUUR	6	1.3	7	1.0	3	1.0		
SASC	8	1.3	7	1.5	3	1.0		
SPDO	2	3.0						
SYAL	77	3.6	30	2.2	84	2.6	56	2.0
SYMO	52	2.8	15	1.3	100	1.6		
VADE								
VAME								
VAOC2								
VASC								
Herbs								
ACRU								
ACTR								
ADBI	2	1.0						
ARCO	12	1.1	7	1.0	19	2.7	11	2.0
ASCA3								
BASA	38	1.5	41	2.3	52	2.3	72	3.8
CLUN								
COCA								
DIHO	2	1.0						
GOOB	12	1.3			3	1.0		
LIBO2								
LUAR3	2	1.0	4	3.0				
LUPO								
LYAM								
OSCH	55	1.6	26	1.1	65	1.3	39	1.1
SMRA	15	1.4	4	0.1	16	1.2		
SMST	8	1.0	7	0.5	6	1.0		
STJA	2	0.1						
TIUN								
TRLA2	100	2.5	22	1.9	6	1.0		
WYMO								
XETE								
Graminoids								
AGSP	5	6.5	4	1.0			6	1.0
BRVU	11	1.0	4	0.5	6	1.0	11	1.0
CAAQ								
CACA								
CAEU								
CAGE	28	3.8	15	1.5	32	4.2	11	1.0
CAIN4	9	7.3	4	1.0	3	1.0	6	1.0
CARO	15	1.0	19	0.8	10	1.3	11	1.0
CARU	17	1.6	22	6.9	10	17.7	17	9.0
DECA								
ELGL	17	3.1			19	1.0		
ELPA2								
FEID	15	6.7	7	2.8	23	1.3	11	1.0
FEOC	72	2.3	48	1.8	84	2.2	72	2.3
LUHI								
POSA3	3	2.3						
STOC	6	0.5	15	0.6	3	1.0	6	1.0
Ferns								
ATFI								
POMU	5	0.8			3	1.0		
PTAQ	22	3.5	7	2.0	3	1.0		

	PSME/HODI		PSME/SYAL		PSME/CEPR		PSME/CAGE	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
Tree Regeneration								
ABAM								
ABCO-ABGR	7	1.0	2	1.0				
ABLA2								
ABMAS								
ABPR								
ALRU								
CADE3	20	1.0	29	2.3	100	6.3		
JUOC	33	1.2	40	1.6	13	0.0	17	2.0
LAOC								
PIAL								
PICO	7	10.0	1	1.0				
PIEN								
PILA								
PIMO								
PIPO	73	1.9	80	2.6	100	4.9	67	2.5
POTR			1	15.0				
PSME	100	5.2	87	2.6	75	2.8	83	2.0
QUGA	33	4.7	43	2.4			67	1.5
THPL								
TSHE								
TSME								
Tree Overstory								
ABAM								
ABCO-ABGR								
ABLA2								
ABMAS								
ABPR								
ALRU								
CADE3	20	2.0	20	5.3	75	4.4		
JUOC	7	2.0	7	3.7	13	13.6		
LAOC								
PIAL								
PICO	7	25.0						
PIEN								
PILA	7	10.0			13	1.0		
PIMO								
PIPO	93	12.9	95	23.8	100	24.5	100	17.5
POTR			1	5.0				
PSME	93	44.8	92	30.2	88	13.7	100	23.8
QUGA	33	10.3	35	7.4			50	12.0
THPL								
TSHE								
TSME								
Shrub								
ACCI								
ALIN								
AMAL	67	0.9	85	2.0	75	1.4	50	2.0
ARAR								
ARNE	7	1.0	1	2.0				
ARPA	7	1.0	33	2.9	75	8.4	17	5.0
ARTR								
ARUV								
BEAQ	53	1.1	69	3.3	38	1.0	17	1.0
BEGL								
BENE			1	1.0				
BERE	7	0.6	5	1.3			17	1.0
CACH								
CELE			1	1.0				
CEPR	13	8.5	21	3.7	100	3.6		
CEVE	33	1.0	25	6.8	13	1.1	17	1.0
CHME			2	1.0				
CHUM					13	0.1		

(Cov = Cover, Con = Constancy)

	PSME/HODI		PSME/SYAL		PSME/CEPR		PSME/CAGE	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
HODI	100	4.6	1	0.1	13	1.0		
PAMY	20	1.4	6	1.2				
PHEM								
PUTR	33	4.6	48	6.4	100	7.4	67	6.0
RHMA								
RICE	27	1.8	12	1.3	13	1.0	33	1.5
RILA			1	1.0				
RIVI			1	1.0				
ROGY	53	1.4	60	2.1	13	1.0		
RUUR								
SASC			4	1.7				
SPDO								
SYAL	80	7.1	100	3.9				
SYMO	7	0.1						
VADE								
VAME								
VAOC2								
VASC								
Herbs								
ACRU								
ACTR								
ADBI	7	1.0						
ARCO	13	2.0	33	2.1	13	6.0	17	2.0
ASCA3								
BASA	40	1.0	58	3.9	63	1.4	50	11.3
CLUN								
COCA								
DIHO								
GOOB								
LIBO2								
LUAR3								
LUPO								
LYAM								
OSCH	60	1.4	58	1.6	13	1.0	17	1.0
SMRA	7	1.0	5	1.3				
SMST								
STJA	7	0.1	1	0.1				
TIUN								
TRLA2	7	0.1						
WYMO								
XETE								
Graminoids								
AGSP	7	2.0	19	4.8	25	1.5	17	2.0
BRVU	33	2.8	5	1.0				
CAAQ								
CACA								
CAEU								
CAGE	20	3.0	21	5.4			100	2.3
CAIN4	7	2.0						
CARO			8	1.0	25	1.0		
CARU	27	13.7	10	2.0	13	1.0		
DECA								
ELGL			13	1.1			17	2.0
ELPA2								
FEID	27	1.8	33	4.5	88	4.9	100	5.7
FEOC	53	4.8	61	2.4	38	2.3		
LUHI								
POSA3			1	2.6	13	1.0		
STOC			1	1.0	25	0.6	17	1.0
Ferns								
ATFI								
POMU								
PTAQ	7	2.0	1	3.0				

	PSME/ARPA		PSME/PUTR		PIPO-CADE3/SYAL		PIPO-CADE3/CEPR	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
Tree Regeneration								
ABAM								
ABCO-ABGR								
ABLA2								
ABMAS								
ABPR								
ALRU								
CADE3	67	2.9	39	4.5	83	4.4	79	6.7
JUOC			43	1.1	83	1.8	21	2.5
LAOC								
PIAL								
PICO			4	0.5				
PIEN								
PILA	10	3.6	13	0.8				
PIMO								
PIPO	95	5.0	100	2.9	100	10.2	100	7.9
POTR								
PSME	67	5.4	78	2.2	8	1.0	7	1.0
QUGA	29	1.3	17	2.2	33	1.8		
THPL								
TSHE								
TSME								
Tree Overstory								
ABAM								
ABCO-ABGR								
ABLA2								
ABMAS								
ABPR								
ALRU								
CADE3	43	3.7	35	4.0	92	6.0	86	8.0
JUOC			17	2.2	33	4.7	36	8.9
LAOC			4	1.0				
PIAL								
PICO								
PIEN								
PILA	10	4.0			8	6.0		
PIMO								
PIPO	100	19.2	100	20.9	100	32.2	100	28.9
POTR								
PSME	95	17.8	91	14.0			7	1.0
QUGA	19	2.0	9	16.6	8	1.0		
THPL								
TSHE								
TSME								
Shrub								
ACCI								
ALIN								
AMAL	38	0.8	74	1.0	67	1.1	71	1.3
ARAR							7	5.0
ARNE								
ARPA	95	3.5			17	2.5	79	6.1
ARTR	5	1.1			8	3.0		
ARUV								
BEAQ	10	1.0	17	1.0	58	1.6	7	1.0
BEGL								
BENE								
BERE								
CACH								
CELE					8	9.3	43	3.4
CEPR	5	4.0			58	1.9	100	6.5
CEVE	71	4.4	22	1.3	8	1.0	50	0.9
CHME			4	0.5				
CHUM	10	0.1					14	1.0

(Cov = Cover, Con = Constancy)

	PSME/ARPA		PSME/PUTR		PIPO-CADE3/SYAL		PIPO-CADE3/CEPR	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
HODI								
PAMY			4	1.0				
PHEM								
PUTR	90	5.9	100	10.0	58	10.5	100	8.5
RHMA								
RICE	5	0.5	26	1.8	17	0.6	7	2.0
RILA								
RIVI								
ROGY	10	0.6	13	0.7	17	1.0	7	0.1
RUUR								
SASC								
SPDO								
SYAL	5	0.1			100	1.8		
SYMO					33	1.3		
VADE								
VAME								
VAOC2								
VASC								
Herbs								
ACRU								
ACTR								
ADBI								
ARCO	5	1.0			17	4.8	21	8.7
ASCA3								
BASA	71	2.5	78	4.1	75	2.9	71	3.4
CLUN								
COCA								
DIHO								
GOOB								
LIBO2								
LUAR3			4	3.0	8	1.0	14	1.3
LUPO								
LYAM								
OSCH	5	1.0	4	1.0	50	1.2	14	1.0
SMRA	10	0.1						
SMST	10	0.3						
STJA			4	0.1	8	1.0		
TIUN								
TRLA2	10	0.1						
WYMO					17	0.1	36	0.3
XETE								
Graminoids								
AGSP	14	1.4	39	1.9	17	0.8	14	0.9
BRVU	10	2.1	4	1.0				
CAAQ								
CACA								
CAEU								
CAGE	5	0.1			33	1.0		
CAIN4	5	0.1			8	1.0	7	0.1
CARO	33	0.9	9	1.0	33	1.0	64	1.2
CARU								
DECA								
ELGL					8	2.0		
ELPA2								
FEID	33	3.3	70	5.2	25	2.3	57	2.2
FEOC	14	0.8	17	1.0	42	1.4	14	0.7
LUHI								
POSA3	5	0.1	9	0.9	17	1.0	7	0.1
STOC	24	0.5			17	1.4	50	1.8
Ferns								
ATFI								
POMU								
PTAQ	24	2.1	9	3.5				

(Cov = Cover, Con = Constancy)

	PIPO-CADE3/ARPA		PIPO-CADE3/PUTR		PIPO-QUGA/SYAL		PIPO-QUGA/PUTR	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
Tree Regeneration								
ABAM								
ABCO-ABGR								
ABLA2								
ABMAS								
ABPR								
ALRU								
CADE3	100	3.0	100	2.7				
JUOC	78	0.7	29	0.8	78	1.4	13	3.0
LAOC								
PIAL								
PICO								
PIEN								
PILA								
PIMO								
PIPO	100	4.3	100	4.1	100	1.8	63	2.8
POTR								
PSME	22	0.5	14	0.4			13	0.1
QUGA					89	4.1	100	4.5
THPL								
TSHE								
TSME								
Tree Overstory								
ABAM								
ABCO-ABGR								
ABLA2								
ABMAS								
ABPR								
ALRU								
CADE3	22	7.2	64	3.0	11	1.0		
JUOC	11	4.0	7	2.0	44	3.5	25	4.0
LAOC								
PIAL								
PICO								
PIEN								
PILA								
PIMO								
PIPO	100	21.2	93	31.1	89	40.8	100	28.1
POTR								
PSME								
QUGA					67	5.8	88	13.9
THPL								
TSHE								
TSME								
Shrub								
ACCI								
ALIN								
AMAL	56	0.8	43	0.9	78	1.3	38	1.7
ARAR								
ARNE								
ARPA	100	3.8	29	0.7	11	1.0		
ARTR								
ARUV								
BEAQ					22	1.4		
BEGL								
BENE								
BERE							13	1.0
CACH								
CELE								
CEPR					11	1.0	25	1.0
CEVE	56	4.5	14	0.6	11	12.8		
CHME	11	0.5						
CHUM			14	0.6				

(Cov = Cover, Con = Constancy)

	PIPO-CADE3/ARPA		PIPO-CADE3/PUTR		PIPO-QUGA/SYAL		PIPO-QUGA/PUTR	
	Con	**Cov**	**Con**	**Cov**	**Con**	**Cov**	**Con**	**Cov**
HODI								
PAMY								
PHEM								
PUTR	100	21.8	100	19.4	89	3.3	100	6.7
RHMA								
RICE			29	1.9	11	1.0		
RILA								
RIVI								
ROGY					44	2.8	25	3.5
RUUR								
SASC								
SPDO								
SYAL			7	0.1	100	1.1	13	0.1
SYMO					11	1.0		
VADE								
VAME								
VAOC2								
VASC								
Herbs								
ACRU								
ACTR								
ADBI								
ARCO							13	4.0
ASCA3								
BASA	44	1.5	71	4.5	78	4.4	38	7.3
CLUN								
COCA								
DIHO								
GOOB								
LIBO2								
LUAR3								
LUPO								
LYAM								
OSCH					22	1.0	13	2.0
SMRA								
SMST								
STJA								
TIUN								
TRLA2								
WYMO			7	0.1				
XETE								
Graminoids								
AGSP			14	4.5	11	1.0	38	9.0
BRVU							13	1.0
CAAQ								
CACA								
CAEU								
CAGE			7	1.0				
CAIN4	11	0.3	7	2.0				
CARO	67	0.6	57	0.7	11	1.0		
CARU								
DECA								
ELGL					11	1.0		
ELPA2								
FEID	78	5.1	100	4.3	33	1.3	38	8.7
FEOC	11	0.7	14	0.7	22	1.0	25	1.5
LUHI								
POSA3	22	0.3	14	0.2				
STOC	33	0.4	36	0.7			13	2.0
Ferns								
ATFI								
POMU								
PTAQ								

(Cov = Cover, Con = Constancy)

	PIPO/SPDO		PIPO-POTR		PIPO/ARUV		PIPO/SYMO	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
Tree Regeneration								
ABAM								
ABCO-ABGR							25	0.5
ABLA2								
ABMAS								
ABPR								
ALRU								
CADE3								
JUOC	10	0.1	33	4.9			50	2.8
LAOC								
PIAL								
PICO	40	10.5	33	5.2	54	13.0	25	10.3
PIEN								
PILA								
PIMO								
PIPO	60	2.2	81	13.2	66	3.2	100	24.1
POTR	40	3.0	76	6.0	3	1.0	13	0.5
PSME								
QUGA								
THPL								
TSHE								
TSME								
Tree Overstory								
ABAM								
ABCO-ABGR								
ABLA2								
ABMAS								
ABPR								
ALRU								
CADE3								
JUOC			10	21.5				
LAOC								
PIAL								
PICO	80	14.0	52	13.7	89	19.7	38	1.3
PIEN								
PILA								
PIMO								
PIPO	80	13.3	95	17.3	57	10.1	100	25.5
POTR	50	27.6	76	27.4				
PSME								
QUGA								
THPL								
TSHE								
TSME								
Shrub								
ACCI								
ALIN	10	1.0			3	4.0		
AMAL	40	0.8	29	0.4	14	0.1	50	1.4
ARAR			5	2.0				
ARNE					9	0.6		
ARPA			19	0.4	9	2.2	25	3.0
ARTR			48	10.6	3	1.0	63	13.8
ARUV	50	1.7	10	13.7	100	13.1		
BEAQ								
BEGL								
BENE								
BERE			14	3.0			38	3.8
CACH								
CELE			24	3.9	3	0.1	25	4.3
CEPR			5	5.0	3	16.6	13	2.0
CEVE					6	3.1	13	8.0
CHME								
CHUM	10	0.1			9	0.4		

(Cov = Cover, Con = Constancy)

	PIPO/SPDO		PIPO-POTR		PIPO/ARUV		PIPO/SYMO	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
HODI								
PAMY								
PHEM								
PUTR	10	2.0	43	6.6	77	7.4	50	8.8
RHMA								
RICE	10	3.0	43	1.5	66	1.1	75	2.3
RILA	20	0.3	5	0.5	3	0.1		
RIVI					6	0.3		
ROGY	20	5.1	29	0.7	6	0.1	25	3.0
RUUR								
SASC	10	0.5						
SPDO	100	4.9	10	0.1	20	0.4		
SYAL	40	7.5	29	2.3	3	1.0	25	1.0
SYMO			5	0.5			100	2.8
VADE								
VAME	10	3.0						
VAOC2			5	1.0				
VASC								
Herbs								
ACRU	30	0.1						
ACTR								
ADBI								
ARCO			14	2.5			13	20.0
ASCA3								
BASA			10	1.0			38	1.2
CLUN								
COCA								
DIHO								
GOOB					6	0.1		
LIBO2								
LUAR3			5	0.7	6	0.3	63	18.2
LUPO	20	2.6						
LYAM								
OSCH	20	0.6	10	10.3	3	0.1		
SMRA	10	20.0						
SMST	60	0.3	19	2.1	6	0.3		
STJA			14	2.9			13	0.5
TIUN								
TRLA2								
WYMO					3	0.1	13	0.5
XETE								
Graminoids								
AGSP			10	1.0	3	0.1	13	1.0
BRVU	10	3.0			3	0.1		
CAAQ								
CACA	50	3.8	5	40.0	3	0.5		
CAEU	30	8.0	5	7.0				
CAGE								
CAIN4			38	4.7	9	0.2	38	4.7
CARO	20	2.0	38	0.8	54	0.9	63	1.6
CARU							13	1.0
DECA								
ELGL	70	14.6	14	12.7	14	3.7		
ELPA2								
FEID	10	0.5	29	3.0	37	4.0	38	16.3
FEOC	10	0.1			3	0.8		
LUHI								
POSA3			29	1.0	6	0.1		
STOC	10	7.5	52	2.0	77	1.2	13	0.5
Ferns								
ATFI								
POMU								
PTAQ	10	0.1						

(Cov = Cover, Con = Constancy)

	PIPO/CHUM		PIPO/SYAL		PIPO/CEPR		PIPO/WYMO	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
Tree Regeneration								
ABAM								
ABCO-ABGR							6	0.5
ABLA2								
ABMAS								
ABPR								
ALRU								
CADE3								
JUOC			53	3.4	60	3.9	59	4.5
LAOC								
PIAL								
PICO	80	5.4	7	1.1	5	3.5	6	0.0
PIEN								
PILA	3	1.0						
PIMO								
PIPO	100	6.6	84	7.0	86	10.7	88	11.4
POTR			3	0.0				
PSME								
QUGA								
THPL								
TSHE								
TSME								
Tree Overstory								
ABAM								
ABCO-ABGR								
ABLA2								
ABMAS								
ABPR								
ALRU								
CADE3								
JUOC			38	11.5	43	10.7	41	8.5
LAOC								
PIAL								
PICO	80	11.3	9	6.2	2	15.7	6	8.3
PIEN								
PILA								
PIMO								
PIPO	98	23.1	96	27.2	97	24.6	94	20.0
POTR								
PSME								
QUGA								
THPL								
TSHE								
TSME								
Shrub								
ACCI								
ALIN								
AMAL	8	0.6	54	1.3	53	2.2	47	0.5
ARAR			18	5.2	26	3.9	29	14.0
ARNE	5	0.2	1	5.0	2	0.1		
ARPA	85	4.5	37	5.6	60	2.1	35	1.4
ARTR	3	2.0	28	5.3	21	2.8	29	4.7
ARUV								
BEAQ			9	3.2	5	1.3		
BEGL								
BENE								
BERE			13	1.3	9	3.3	12	1.8
CACH			1	1.0				
CELE	5	13.0	44	4.5	47	4.9	47	3.9
CEPR	13	5.7	18	2.2	100	4.7		
CEVE	65	15.7	22	8.3	29	4.7	29	1.0
CHME								
CHUM	100	1.0			2	0.5		

(Cov = Cover, Con = Constancy)

	PIPO/CHUM		PIPO/SYAL		PIPO/CEPR		PIPO/WYMO	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
HODI								
PAMY								
PHEM								
PUTR	95	9.2	68	7.5	84	7.6	82	6.2
RHMA								
RICE	38	1.5	35	2.1	17	1.1	18	0.7
RILA	3	0.1						
RIVI	3	0.1						
ROGY			25	1.0	14	0.8	24	0.9
RUUR								
SASC	3	1.0	1	1.4				
SPDO								
SYAL	3	0.1	100	1.5				
SYMO			1	0.5				
VADE								
VAME								
VAOC2								
VASC								
Herbs								
ACRU								
ACTR								
ADBI								
ARCO			16	1.1	9	1.6	29	7.2
ASCA3								
BASA	3	0.4	29	2.5	33	4.7	12	0.3
CLUN								
COCA								
DIHO								
GOOB	3	0.1					6	0.5
LIBO2								
LUAR3	3	0.1	7	2.4	12	2.8	18	2.0
LUPO								
LYAM								
OSCH	3	1.0	6	1.8				
SMRA	3	0.1						
SMST								
STJA	3	0.1	10	0.9	3	0.8	18	1.2
TIUN								
TRLA2								
WYMO			18	1.0	34	4.6	100	5.5
XETE								
Graminoids								
AGSP			41	1.9	16	3.2	24	0.6
BRVU	3	0.1	3	0.6				
CAAQ								
CACA								
CAEU								
CAGE	3	0.1	3	15.3				
CAIN4	40	4.7	12	2.0	16	2.6	12	24.0
CARO	85	0.8	57	0.8	81	1.8	82	1.9
CARU	8	0.8						
DECA								
ELGL								
ELPA2								
FEID	20	2.5	62	4.8	71	6.7	76	3.0
FEOC			6	2.0				
LUHI								
POSA3	3	0.1	41	0.7	43	0.9	53	0.3
STOC	83	1.5	59	0.6	64	1.1	82	1.0
Ferns								
ATFI								
POMU								
PTAQ	5	3.1						

(Cov = Cover, Con = Constancy)

	PIPO/CELE		PIPO/CAIN4		PIPO/ARPA		PIPO/PUTR/FEID	
	Con	**Cov**	**Con**	**Cov**	**Con**	**Cov**	**Con**	**Cov**
Tree Regeneration								
ABAM								
ABCO-ABGR	3	0.3	1	0.5			1	0.5
ABLA2								
ABMAS								
ABPR								
ALRU								
CADE3			1	0.5			1	1.0
JUOC	73	4.6	11	3.0	8	1.7	24	1.8
LAOC								
PIAL								
PICO			59	5.0	48	7.0	29	5.8
PIEN								
PILA					1	0.0		
PIMO					0	0.0		
PIPO	80	9.8	88	10.7	92	6.5	87	8.0
POTR	2	0.0	1	0.5			0	0.0
PSME					0	0.1		
QUGA								
THPL								
TSHE								
TSME								
Tree Overstory								
ABAM								
ABCO-ABGR								
ABLA2								
ABMAS								
ABPR								
ALRU								
CADE3							1	1.0
JUOC	66	12.5	4	10.6	2	8.0	12	7.7
LAOC								
PIAL								
PICO			52	9.1	46	10.3	26	11.2
PIEN								
PILA								
PIMO								
PIPO	97	19.6	85	19.0	93	21.8	97	19.9
POTR							0	0.5
PSME								
QUGA								
THPL								
TSHE								
TSME								
Shrub								
ACCI								
ALIN								
AMAL	39	0.9	5	1.7	6	1.0	13	1.0
ARAR	41	4.4	3	5.0	0	0.1	9	4.9
ARNE			1	0.1	0	0.1	1	0.1
ARPA	11	3.9	41	5.8	100	4.7	7	0.4
ARTR	47	5.7	6	5.4	2	4.2	26	7.6
ARUV					1	0.1	0	0.1
BEAQ					1	0.6	0	1.0
BEGL								
BENE								
BERE	3	0.1	2	0.3	3	0.7	1	1.1
CACH								
CELE	100	6.8	4	0.4	2	0.8	7	0.4
CEPR	2	0.5					0	0.5
CEVE	9	5.2	26	3.8	47	6.5	3	1.7
CHME			1	0.8	1	1.0		
CHUM	3	0.5	4	0.4	2	0.4	0	0.1

(Cov = Cover, Con = Constancy)

	PIPO/CELE		PIPO/CAIN4		PIPO/ARPA		PIPO/PUTR/FEID	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
HODI							0	3.0
PAMY			1	1.0	0	0.1		
PHEM								
PUTR	86	4.5	92	10.6	96	11.9	100	12.3
RHMA								
RICE	28	1.0	31	1.5	34	1.4	35	1.7
RILA								
RIVI	2	0.1	1	1.1	3	1.3		
ROGY	16	0.4	4	0.8	1	0.5	4	0.6
RUUR							0	1.0
SASC					0	1.0		
SPDO								
SYAL			1	0.5	1	0.5	1	0.4
SYMO								
VADE								
VAME								
VAOC2								
VASC								
Herbs								
ACRU								
ACTR								
ADBI								
ARCO	9	1.3	2	20.0	1	4.0	2	2.3
ASCA3								
BASA	19	3.9			3	2.2	16	5.2
CLUN								
COCA								
DIHO								
GOOB			1	0.1	0	0.1		
LIBO2								
LUAR3	6	1.1	5	1.8	3	2.7	7	2.0
LUPO								
LYAM								
OSCH			1	3.0	1	0.6	0	1.0
SMRA					0	0.1		
SMST							0	1.0
STJA	2	0.5	3	0.3	1	0.2	0	0.5
TIUN								
TRLA2								
WYMO	16	0.1	1	0.3	1	0.2	1	0.1
XETE								
Graminoids								
AGSP	31	3.2	4	0.6	3	3.8	11	3.5
BRVU			1	0.1	1	0.2	1	0.8
CAAQ								
CACA								
CAEU								
CAGE			2	0.3	0	0.1	1	0.1
CAIN4	11	6.8	100	5.5	2	0.3	2	0.5
CARO	75	0.9	68	2.3	90	1.2	82	1.6
CARU	2	0.1	1	0.1			1	0.3
DECA								
ELGL			1	0.1			0	2.0
ELPA2								
FEID	80	10.4	41	6.7	37	6.8	98	12.4
FEOC			1	0.1	2	0.7	3	2.1
LUHI								
POSA3	55	1.1	7	0.4	2	0.6	14	1.1
STOC	69	0.8	88	3.1	93	1.3	72	1.7
Ferns								
ATFI								
POMU								
PTAQ					1	0.6		

	PIPO/PUTR		PIPO/ARTR		PIPO/FEID CT		PIPO/STOC CT	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
Tree Regeneration								
ABAM								
ABCO-ABGR	2	0.2	4	0.5				
ABLA2								
ABMAS								
ABPR								
ALRU								
CADE3								
JUOC	1	0.1	13	7.5	33	1.6		
LAOC								
PIAL								
PICO	71	7.0	22	1.5	50	10.0	69	6.6
PIEN								
PILA								
PIMO								
PIPO	84	4.3	61	10.3	78	10.1	92	1.1
POTR	0	1.0						
PSME	0	0.1						
QUGA								
THPL								
TSHE								
TSME								
Tree Overstory								
ABAM								
ABCO-ABGR								
ABLA2								
ABMAS								
ABPR								
ALRU								
CADE3								
JUOC	0	6.9	22	14.0	17	16.5		
LAOC								
PIAL								
PICO	69	14.0	17	1.1	44	19.3	62	23.6
PIEN								
PILA								
PIMO								
PIPO	69	14.0	91	21.4	89	15.2	46	5.5
POTR								
PSME								
QUGA								
THPL								
TSHE								
TSME								
Shrub								
ACCI								
ALIN								
AMAL	1	0.3	22	0.4	11	0.3		
ARAR			17	5.5	17	1.8		
ARNE	1	0.2						
ARPA	8	0.3						
ARTR	3	10.3	104	13.0	11	1.3		
ARUV	1	0.3			6	0.1		
BEAQ								
BEGL								
BENE								
BERE	0	0.1	4	1.0				
CACH	1	0.1						
CELE	1	0.8			28	0.2		
CEPR								
CEVE	5	1.1	4	1.0	11	0.3	8	0.1
CHME	0	0.1						
CHUM	1	0.2						

(Cov = Cover, Con = Constancy)

	PIPO/PUTR		PIPO/ARTR		PIPO/FEID CT		PIPO/STOC CT	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
HODI	0	0.1						
PAMY								
PHEM								
PUTR	100	11.4	30	0.3	28	0.5	54	0.3
RHMA								
RICE	48	1.3	39	0.9	56	0.5	54	1.0
RILA								
RIVI	1	0.1						
ROGY	1	0.1	13	0.4	6	0.5		
RUUR								
SASC	0	0.1						
SPDO	0	0.1						
SYAL								
SYMO								
VADE								
VAME								
VAOC2								
VASC								
Herbs								
ACRU								
ACTR								
ADBI								
ARCO	0	1.0	13	1.4	11	4.0		
ASCA3								
BASA			9	1.0	6	2.0		
CLUN								
COCA								
DIHO								
GOOB								
LIBO2								
LUAR3	3	0.4	9	2.0	11	4.0	8	0.1
LUPO								
LYAM								
OSCH			4	0.5				
SMRA								
SMST								
STJA	0	0.1			6	0.5	8	0.5
TIUN								
TRLA2								
WYMO	0	0.1	9	0.1				
XETE								
Graminoids								
AGSP	1	0.7	26	2.7	11	0.3		
BRVU	0	0.1						
CAAQ								
CACA								
CAEU								
CAGE	0	0.1						
CAIN4	8	0.3			6	0.5		
CARO	92	1.3	78	1.2	50	2.4	92	1.0
CARU	0	0.1						
DECA								
ELGL								
ELPA2								
FEID	15	0.2	70	8.2	100	14.9		
FEOC	0	0.1						
LUHI								
POSA3	2	0.3	48	1.4	22	0.4		
STOC	95	3.0	74	1.0	89	1.3	100	7.4
Ferns								
ATFI								
POMU								
PTAQ								

(Cov = Cover, Con = Constancy)

	PIAL-PICO/ARNE		PIAL-PICO/CAIN4		PICO/ELPA2		PICO/VAOC2/CAEU	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
Tree Regeneration								
ABAM								
ABCO-ABGR			20	0.5				
ABLA2								
ABMAS								
ABPR								
ALRU								
CADE3								
JUOC								
LAOC								
PIAL	100	4.1	100	2.5				
PICO	100	12.6	100	5.0	25	2.4		
PIEN								
PILA								
PIMO	13	0.9						
PIPO								
POTR								
PSME								
QUGA								
THPL								
TSHE								
TSME								
Tree Overstory								
ABAM								
ABCO-ABGR			7	0.5				
ABLA2								
ABMAS								
ABPR								
ALRU								
CADE3								
JUOC								
LAOC								
PIAL	88	6.5	93	6.8				
PICO	100	24.2	100	20.5	75	8.6	100	20.3
PIEN								
PILA								
PIMO			7	3.0				
PIPO	13	0.5	7	0.5			8	0.1
POTR							8	4.0
PSME								
QUGA								
THPL								
TSHE								
TSME								
Shrub								
ACCI								
ALIN					8	1.0		
AMAL							17	0.6
ARAR								
ARNE	100	2.9						
ARPA	13	2.0						
ARTR	38	1.2						
ARUV								
BEAQ								
BEGL					75	7.1	42	6.4
BENE								
BERE								
CACH								
CELE								
CEPR								
CEVE								
CHME			7	0.5				
CHUM								

(Cov = Cover, Con = Constancy)

	PIAL-PICO/ARNE		PIAL-PICO/CAIN4		PICO/ELPA2		PICO/VAOC2/CAEU	
	Con	**Cov**	**Con**	**Cov**	**Con**	**Cov**	**Con**	**Cov**
HODI								
PAMY								
PHEM								
PUTR								
RHMA								
RICE	25	0.1	13	0.3				
RILA			7	1.0	17	1.0		
RIVI	13	0.5						
ROGY								
RUUR								
SASC							8	1.0
SPDO					8	1.0	100	5.6
SYAL								
SYMO								
VADE								
VAME								
VAOC2					83	11.2	100	40.0
VASC								
Herbs								
ACRU								
ACTR								
ADBI								
ARCO								
ASCA3								
BASA								
CLUN								
COCA								
DIHO								
GOOB								
LIBO2							25	4.7
LUAR3	13	3.0	13	4.6				
LUPO								
LYAM								
OSCH					8	0.1		
SMRA								
SMST					8	0.1		
STJA								
TIUN								
TRLA2								
WYMO								
XETE								
Graminoids								
AGSP								
BRVU								
CAAQ					33	11.5		
CACA					42	0.7	117	3.3
CAEU					92	10.2	100	14.5
CAGE								
CAIN4	88	2.4	100	3.8				
CARO	50	0.2						
CARU								
DECA					75	1.7	67	1.1
ELGL					8	5.0	33	0.6
ELPA2					100	36.3	25	2.3
FEID								
FEOC					17	1.1	25	0.1
LUHI								
POSA3								
STOC	88	1.4	33	2.5				
Ferns								
ATFI								
POMU								
PTAQ								

(Cov = Cover, Con = Constancy)

	PICO/SPDO/CAEU		PICO/CAEU		PICO/VACO2		PICO/SPDO	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
Tree Regeneration								
ABAM								
ABCO-ABGR								
ABLA2								
ABMAS								
ABPR								
ALRU								
CADE3								
JUOC								
LAOC								
PIAL								
PICO	27	5.7	6	0.6	70	25.4	69	10.7
PIEN								
PILA								
PIMO								
PIPO			6	0.1			25	0.2
POTR	27	6.8			20	16.5	6	0.5
PSME								
QUGA								
THPL								
TSHE								
TSME								
Tree Overstory								
ABAM								
ABCO-ABGR								
ABLA2								
ABMAS								
ABPR								
ALRU								
CADE3								
JUOC								
LAOC								
PIAL								
PICO	73	17.3	94	17.9	100	26.3	56	33.9
PIEN								
PILA								
PIMO								
PIPO			3	1.0				
POTR	18	17.5	18	13.0	10	2.0	13	16.5
PSME								
QUGA								
THPL								
TSHE								
TSME								
Shrub								
ACCI								
ALIN	18	0.6	3	1.0			6	0.5
AMAL	18	0.3			10	0.1	6	0.1
ARAR								
ARNE							6	3.0
ARPA							6	0.5
ARTR								
ARUV			12	0.1	40	2.4	75	16.4
BEAQ								
BEGL	9	0.1	32	1.3				
BENE								
BERE								
CACH								
CELE								
CEPR								
CEVE								
CHME								
CHUM					10	0.1		

(Cov = Cover, Con = Constancy)

	PICO/SPDO/CAEU		PICO/CAEU		PICO/VACO2		PICO/SPDO	
	Con	**Cov**	**Con**	**Cov**	**Con**	**Cov**	**Con**	**Cov**
HODI								
PAMY								
PHEM								
PUTR					20	1.2	25	15.5
RHMA								
RICE			15	0.1	20	0.6	13	3.0
RILA	18	0.6	21	0.2			25	0.1
RIVI								
ROGY								
RUUR								
SASC	9	0.5						
SPDO	100	9.1	50	0.9	60	16.7	100	8.3
SYAL	9	10.0	3	0.1			6	20.0
SYMO								
VADE								
VAME								
VAOC2	9	0.1	12	1.1	100	27.4	13	0.1
VASC	9	0.1	3	0.1				
Herbs								
ACRU	9	1.0						
ACTR								
ADBI								
ARCO								
ASCA3								
BASA								
CLUN								
COCA								
DIHO								
GOOB								
LIBO2					10	1.0	6	50.0
LUAR3							6	1.0
LUPO	18	0.6	9	1.1			25	0.8
LYAM								
OSCH	9	1.0	9	0.7			25	1.6
SMRA							6	3.0
SMST	36	3.1	18	0.3			19	1.4
STJA								
TIUN								
TRLA2								
WYMO								
XETE								
Graminoids								
AGSP								
BRVU								
CAAQ	9	2.0	3	2.0				
CACA	91	3.8	76	7.0	20	2.0	38	15.7
CAEU	100	19.5	100	22.1			19	0.1
CAGE								
CAIN4					20	8.5	13	0.8
CARO					20	0.2	6	6.0
CARU								
DECA	27	6.7	56	4.0			25	17.5
ELGL	64	3.3	65	4.2	50	8.0	56	4.2
ELPA2			9	1.4				
FEID							6	0.3
FEOC	9	0.1	6	0.6	10	75.0	13	1.1
LUHI								
POSA3								
STOC					20	1.2	25	5.9
Ferns								
ATFI								
POMU								
PTAQ								

(Cov = Cover,   Con = Constancy)

	PICO/ARUV		PICO/ARNE		PICO/CAIN4		PICO/PUTR/FEID	
	Con	Cov	Con	Cov	Con	Cov	Con	Cov
Tree Regeneration								
ABAM								
ABCO-ABGR	8	0.5						
ABLA2								
ABMAS								
ABPR								
ALRU								
CADE3								
JUOC	8	0.5						
LAOC								
PIAL					2	0.5		
PICO	77	15.5	100	14.0	100	11.4	94	5.3
PIEN								
PILA								
PIMO			18	1.9	5	0.1		
PIPO	8	0.5						
POTR	8	3.0						
PSME								
QUGA								
THPL								
TSHE								
TSME								
Tree Overstory								
ABAM								
ABCO-ABGR								
ABLA2								
ABMAS								
ABPR								
ALRU								
CADE3								
JUOC								
LAOC								
PIAL								
PICO	85	31.3	82	16.9	91	30.3	88	17.2
PIEN								
PILA								
PIMO			27	5.0				
PIPO					2	0.5		
POTR	8	0.5						
PSME								
QUGA								
THPL								
TSHE								
TSME								
Shrub								
ACCI								
ALIN								
AMAL	8	0.5	9	0.1				
ARAR							6	19.3
ARNE			100	2.8				
ARPA			36	2.3	4	0.3	6	0.5
ARTR					7	14.7	41	4.4
ARUV	100	5.5			2	0.1	6	0.1
BEAQ								
BEGL								
BENE								
BERE								
CACH								
CELE								
CEPR								
CEVE					2	0.1		
CHME								
CHUM					11	0.6		

(Cov = Cover, Con = Constancy)

	PICO/ARUV		PICO/ARNE		PICO/CAIN4		PICO/PUTR/FEID	
	Con	**Cov**	**Con**	**Cov**	**Con**	**Cov**	**Con**	**Cov**
HODI					4	0.5		
PAMY								
PHEM								
PUTR	54	1.3	27	1.1	33	10.0	100	8.0
RHMA								
RICE	46	3.7	36	0.3	49	1.2	65	1.6
RILA					2	3.0		
RIVI	8	0.1	9	0.1	4	1.8		
ROGY	8	3.0						
RUUR								
SASC								
SPDO	8	0.1					6	0.1
SYAL								
SYMO								
VADE								
VAME								
VAOC2								
VASC								
Herbs								
ACRU								
ACTR								
ADBI								
ARCO								
ASCA3								
BASA								
CLUN								
COCA								
DIHO								
GOOB								
LIBO2								
LUAR3			9	0.1	23	4.5	6	0.3
LUPO								
LYAM								
OSCH					7	1.1		
SMRA								
SMST	8	5.0						
STJA					2	0.1		
TIUN								
TRLA2								
WYMO								
XETE								
Graminoids								
AGSP					2	6.5		
BRVU								
CAAQ								
CACA								
CAEU								
CAGE								
CAIN4			36	5.5	100	4.7	6	0.5
CARO	38	1.3	45	1.3	40	0.8	88	2.7
CARU								
DECA	8	2.0						
ELGL	31	3.0						
ELPA2								
FEID	38	2.7	9	0.1	14	0.6	100	9.6
FEOC					2	0.7		
LUHI								
POSA3					4	0.9		
STOC	54	2.6	82	0.5	81	2.6	82	3.0
Ferns								
ATFI								
POMU								
PTAQ								

(Cov = Cover, Con = Constancy)

	PICO/PUTR/STOC		PICO/FEID CT		PICO/STOC CT			
	Con	Cov	Con	Cov	Con	Cov		
Tree Regeneration								
ABAM								
ABCO-ABGR	2	0.2						
ABLA2								
ABMAS								
ABPR								
ALRU								
CADE3								
JUOC								
LAOC								
PIAL								
PICO	91	8.3	100	5.6	80	3.5		
PIEN								
PILA								
PIMO	2	0.4						
PIPO	2	0.1						
POTR								
PSME								
QUGA								
THPL								
TSHE								
TSME								
Tree Overstory								
ABAM								
ABCO-ABGR								
ABLA2								
ABMAS								
ABPR								
ALRU								
CADE3								
JUOC								
LAOC								
PIAL								
PICO	85	16.4	80	32.3	53	18.3		
PIEN								
PILA								
PIMO	1	4.3			7	1.0		
PIPO								
POTR								
PSME								
QUGA								
THPL								
TSHE								
TSME								
Shrub								
ACCI								
ALIN								
AMAL								
ARAR	2	0.1						
ARNE	1	0.1			7	0.1		
ARPA	2	0.2						
ARTR	4	12.3						
ARUV	1	0.1						
BEAQ								
BEGL								
BENE								
BERE	1	0.1						
CACH								
CELE								
CEPR								
CEVE	1	0.5						
CHME								
CHUM	2	0.1						

(Cov = Cover, Con = Constancy)

	PICO/PUTR/STOC		PICO/FEID CT		PICO/STOC CT			
	Con	Cov	Con	Cov	Con	Cov		
HODI								
PAMY	1	2.0						
PHEM								
PUTR	100	9.9	40	0.5	20	0.5		
RHMA								
RICE	52	1.6	20	0.5	53	1.8		
RILA								
RIVI	2	0.1						
ROGY								
RUUR								
SASC								
SPDO	1	2.0						
SYAL								
SYMO								
VADE								
VAME								
VAOC2								
VASC								
Herbs								
ACRU								
ACTR								
ADBI								
ARCO	1	1.0						
ASCA3								
BASA								
CLUN								
COCA								
DIHO								
GOOB								
LIBO2								
LUAR3	2	0.2						
LUPO								
LYAM								
OSCH								
SMRA								
SMST								
STJA								
TIUN								
TRLA2								
WYMO								
XETE								
Graminoids								
AGSP								
BRVU								
CAAQ								
CACA								
CAEU								
CAGE								
CAIN4	2	0.4						
CARO	92	1.4	40	1.8	87	2.6		
CARU								
DECA								
ELGL								
ELPA2								
FEID	11	0.2	100	8.2				
FEOC	1	0.1	20	0.1				
LUHI								
POSA3	1	0.1	20	0.1				
STOC	98	3.7	80	2.5	93	10.1		
Ferns								
ATFI								
POMU								
PTAQ								

(Cov = Cover, Con = Constancy)

Appendix C: Wildlife Habitat Considerations, Occurring Within the Deschutes and Fremont-Winema National Forests

Information on wildlife habitat relationships and habitat selection for Oregon has come in eras. Older published information included Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington (Brown 1985), Wildlife Habitat Relationships in Managed Forests: the Blue Mountains of Oregon and Washington (Thomas et al. 1979) and the Atlas of Oregon Wildlife (Csuti, et al. 1997). The newest published information comes from Wildlife Habitat Relationships in Oregon and Washington (Johnson and O'Neil 2001) and the Partners in Flight Landbird Conservation Plans, specifically the Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington (Altman 2000).

Although, these information sources span almost 25 years, the concepts in these documents remain largely the same. Wildlife habitats are described based upon existing habitat condition and not stratified by the potential vegetation of the site where the habitats exist (i.e., Potential Natural Vegetation, Theoretical Climax, etc). Because wildlife habitats described in the above publications do not precisely match plant associations or even plant series, the following crosswalk between Johnson and O'Neil (2001) and Altman (2000) is offered:

Johnson and O'Neil	Altman	Plant Series
Montane Mixed Conifer Forest	Mixed Conifer	Pacific Silver Fir, Mt. Hemlock, Shasta Red Fir
Eastside (Interior) Mixed Conifer Forest	Mixed Conifer	Douglas Fir, White Fir–Grand Fir, Western Hemlock
Eastside (Interior) Mixed Conifer Forest	Whitebark Pine	Whitebark Pine
Lodgepole Pine Forest and Woodlands	Old-Growth Lodgepole Pine	Lodgepole Pine
Ponderosa Pine Forest and Woodlands	Ponderosa Pine	Ponderosa Pine

The above cross walk is highly generalized. Plant association guides group plant associations based upon theoretical potential overstory vegetation. That is, they group vegetation based upon succession over time without a disturbance agent such as fire being present. Typically, classification of wildlife habitats is based upon vegetation present at the site irregardless of the potential of the site to move toward a potential community devoid of disturbance. Some habitats mentioned in Johnson and O'Neil and Altman, could be successional stages of plant communities that have not yet reached climax vegetation. For example, a wildlife habitat that would be classified as a Lodgepole Pine Forest and Woodlands habitat in Johnson and O'Neil (2001) may actually be in the white fir/grand fir plant series and in the absence of a disturbance such as mountain pine beetle or a fire, would become an Eastside Mixed Conifer Forest over time.

Because of the requirements contained in the National Environmental Policy Act of 1970, several approaches have been designed by the USDA Forest Service to evaluate habitats and to analyze effects of management actions. Because it is impossible and impractical to analyze the effect for every single species of the hundreds of species found in central Oregon forest habitats, effects analysis approaches have focused on ways to evaluate effects upon indicators of wildlife communities such as management indicator species, guilds, capstone or keystone species, species of concern and focal species. For use in the USDA Forest Service, an approach was designed during the first iteration of Forest Planning. The concept was called Management Indicator Species (a guild concept). To assist in NEPA planning, the following list of species (see Table C-1) include management indicator species within the Deschutes National Forest.

Since that time, additional effort has been put into identifying species that would indicate the effect of management actions upon wildlife habitats. The following table is a mix of species that represent various lists of important or indicator species that are generally in use by wildlife professionals. These species are either listed under the Endangered Species Act, Regional Forester's Sensitive Species, Forest Plan Management Indicator Species, or Survey and Manage species, or are listed under species that are habitat specialists or exhibit a very narrow ecological niche and should exhibit population changes very quickly when habitat conditions change in their niche. For the series described in this guide the following species are suggested for special attention as indicators of management action/inaction for that series (see Table C-1).

Table C-1: Wildlife Indicator Species by Plant Series

Species	Plant Series Occupied	Use of these Series	Series seral stage	Category of Species	Special Structural or Special Habitat Considerations
American martin	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PICO, PIAL and PIPO	Breeding and foraging	Mid to Late Seral	Management Indicator Species	Uses dense forests >30% cc and down logs/slash; use of ponderosa and whitebark pine require associations with more preferred habitats (more mesic)
American peregrine falcon	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PICO, PIAL and PIPO	Breeding and foraging	All seral stages	RF Sensitive Species	Only breeds when suitable cliff structure is available.
Black-backed wood-pecker	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PICO, PIAL and PIPO	Breeding and foraging	All seral stages	Survey and Manage	Reaches highest densities in recently burned forests or areas of bark beetle infestations
Blue grouse	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PICO, PIAL and PIPO	Breeding and foraging	All seral stages	LCS Focal Species	Very large, high elevation trees important as winter cover; feeds upon true fir needles in the winter' uses recently burned areas adjacent to unburned forests for brooding and fall foraging on soft mast
Brown creeper	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PICO, PIAL and PIPO	Breeding and foraging	All seral stages	LCS Focal Species	Snags necessary for breeding and foraging
Buffle-head	ABAM, TSME, ABMAS	Breeding and foraging	Mid to Late Seral	RF Sensitive Species	Requires cavaties for nesting
California quail	PIPO	Breeding and foraging	Early to Late Seral	Economic Species	Requires open tree stands with highly developed understories of shrubs and grasses
California wolverine	ABAM, TSME, ABMAS	Breeding and foraging	Mid to late seral	RF Sensitive Species	Avoids roads and human activity, associates closely with alpine meadows and talus slopes
Canada lynx	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PICO	Breeding and foraging	Early to late seral	ESA Threat-ened	For the Forests covered under this guide, the USFWS has determined that no habitat exists in a quantity and continuity sufficient to support viable lynx populations

Table C-1: Wildlife Indicator Species by Plant Series

Species	Plant Series Occupied	Use of these Series	Series seral stage	Category of Species	Special Structural or Special Habitat Considerations
Chipping sparrow	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PICO, PIAL and PIPO	Breeding and foraging	All seral stages	Focal species	Needs open forest with well developed understory for breeding
Clarks nut-cracker	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PICO, PIAL and PIPO	Breeding and foraging	All seral stages	Focal species	Only breeds in larger trees in more dense forests
Coopers hawk	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PICO, PIAL and PIPO	Breeding and foraging	All seral stages	Management Indicator Species	Only breeds in larger trees in more dense forests
Flammu-lated owl	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PICO, PIAL and PIPO	Breeding and foraging	Late seral stages	Survey and Manage	Nests in cavaties; will only use stands with large Ponderosa pine component for breeding
Fringed myotis	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PIAL and PIPO	Breeding and foraging	Early to late seral stages	Survey and Manage	More occurrence in the more mesic plant series listed
Golden eagle	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PIAL and PIPO	Breeding and foraging	All seral stages	Management Indicator Species	Only breeds on cliff faces and in large trees in open forest stands
Great grey owl	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PICO, PIAL and PIPO	Breeding and foraging	All seral stages	Management Indicator Species, Survey and Manage	Needs meadow openings and dense pole- sized tree stands for foraging
Harlequin duck	None of the Plant Series in this Guide	None	None	RF Sensitive Species	Breeds adjacent to high velocity streams. Nesting habitat is riparian vegetation

Table C-1: Wildlife Indicator Species by Plant Series

Species	Plant Series Occupied	Use of these Series	Series seral stage	Category of Species	Special Structural or Special Habitat Considerations
Hermit thrush	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PIAL and PIPO	Breeding and foraging	Mid to Late Seral	Focal species	Indicates multi-layed structurally diverse forests
Horned grebe	None of the Plant Series in this Guide	None	None	RF Sensitive Species	Breeds in emergent riparian vegetation in lakes
Lewis wood-pecker	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PIAL and PIPO	Breeding and foraging	Early	Focal species	Forages only in Silver and Shasta Red Fir; in the other Plant Series these birds will forage and breed in very open stand conditions, primarily after a medium or high intensity fire
Long-eared myotis	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PICO, PIAL and PIPO	Breeding and foraging	All seral stages	Survey and Manage	Uses caves, mines, hollow trees, loose bark or rock crevices
Long-legged myotis	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PICO, PIAL and PIPO	Breeding and foraging	All seral stages	Survey and Manage	Uses caves or mines as hibernacula. Uses hollow trees, loose bark or rock crevices for maternity colonies
Mule deer	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PIAL and PIPO	Breeding and foraging	All seral stages	Management Indicator Species	Edges between seral stages are optimum
Northern bald eagle	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PIAL and PIPO	Breeding	All seral stages	ESA Threat-ened	Will use very large trees near water for nesting
Northern goshawk	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PICO, PIAL and PIPO	Breeding and foraging	All seral stages	Management Indicator Species	Will use a variety of habitats for foraging. Needs late seral forests with high canopy closure to establish breeding territories
Northern spotted owl	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO,	Breeding and foraging	Mid to Late Seral	ESA Threat-ened	Will use smaller size stands if there is a residual old tree component

Table C-1: Wildlife Indicator Species by Plant Series

Species	Plant Series Occupied	Use of these Series	Series seral stage	Category of Species	Special Structural or Special Habitat Considerations
Olive-sided fly-catcher	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PICO, PIAL and PIPO	Breeding and foraging	All seral stages	Focal species	Dependant upon early seral edges adjacent to late seral stands
Pacific fisher	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO	Breeding and foraging	Mid to Late Seral	ESA Threat-ened	Only breeds in late seral conditions in presence of snags and logs
Palid Bat	PIPO	Breeding and foraging	Late Seral	Survey and Manage	Requires rock cliffs, caves or mines for breeding. Strong riparian associate for foraging
Pygmy nuthatch	PIPO	Breeding and foraging	Late Seral	Survey and Manage, Focal Species	Requires large tree (mature stand) structure
Pygmy rabbit	None of the Plant Series in this Guide	None	None	RF Sensitive Species	Sagebrush/sandy soils
Red-naped sap-sucker	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PICO, PIAL and PIPO	Breeding and foraging	All seral stages	Focal species	Requires inclusion of hardwoods (primarily aspen) within these stands for breeding; associated with adjacent riparian habitats
Red-necked grebe	None of the Plant Series in this Guide	None	None	RF Sensitive Species	Breeds in emergent riparian vegetation in lakes
Redtailed hawk	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PIAL and PIPO	Breeding and foraging	All seral stages	Management Indicator Species	In high density stands will hunt in interspersed openings; requires large trees for nesting platform
Rocky Mountain elk	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PICO, PIAL and PIPO	Breeding and foraging	All seral stages	Management Indicator Species	Edges between seral stages are optimum. Prefers low human presence
Sandhill crane	None of the Plant Series in this Guide	None	None	Focal species	Uses riparian wetlands for breeding
Sharp-shinned hawk	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PICO, PIAL and PIPO	Breeding and foraging	All seral stages	Management Indicator Species	Only breeds in high density forests

Table C-1: Wildlife Indicator Species by Plant Series

Species	Plant Series Occupied	Use of these Series	Series seral stage	Category of Species	Special Structural or Special Habitat Considerations
Silver-haired Bat	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PICO, PIAL and PIPO	Breeding and foraging	All seral stages	Survey and Manage	Uses trees, bark crevices, and snags for summer roosts; if present in winter, may use caves, mines, or rock crevices for hibernacula
Three-toed wood-pecker	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PICO, PIAL and PIPO	Breeding and foraging	All seral stages	Management Indicator Species	Uses all forest conditions with the presence of suitable nesting snags. Most closely associated with lodgepole pine forests. Populations become abundant after recent burns or bark beetle outbreaks
Tri-colored blackbird	None of the Plant Series in this Guide	None	None	RF Sensitive Species	Wetland associated species
Western Big-eared Bat	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PICO, PIAL and PIPO	Breeding and foraging	All seral stages	Survey and Manage	Forages in all conditions; open water is desirable. Will only breed in these plant series if caves or mines are present
White-headed wood-pecker	PSME, ABGR/ ABCO, PICO and PIPO	Breeding and foraging	Early seral in PSME & ABCO, Late seral in PIPO & PICO	Focal Species, Survey and Manage	Requires a strong, mature ponderosa pine component
William-son's Sap-sucker	ABAM, TSME, ABMAS, TSHE, PSME, ABGR/ABCO, PICO, PIAL and PIPO	Breeding and foraging	All seral stages	Focal species	Needs large snags for breeding, forages in early seral conditions
Yellow rail	None of the Plant Series in this Guide	None	None	RF Sensitive Species	Wetland associated species

Pacific Silver Fir, Mountain Hemlock and Shasta Red Fir Series
Mixed Conifer Forest (Johnson and O'Neil)
Mixed Conifer Forest (Altman)

The Pacific Silver Fir, Mountain Hemlock and Shasta Red Fir Series include the Montane Mixed Conifer Forest as described by Johnson and O'Neil (2001) and the Mixed Conifer habitat as described by Altman (2000). Wildlife habitats in these plant series occupy large areas of the Deschutes and Winema Forests. This habitat is one of the least modified vegetation types by human activity. Large areas of high elevation hemlock and true fir forests in these series are within national parks and wilderness areas. There has probably been little or no decline in the extent of this type over time. Large areas of this habitat are relatively undisturbed and include significant old-growth stands. Smaller areas have been extensively affected by logging, especially dispersed patch clear-cuts, developed into ski areas, and recently burned large and intense wildfires. The habitat is stable in this area, but is probably still declining in condition because of continued logging and wildfires. None of the plant associations within the three vegetation series is listed in the National Vegetation Classification as imperiled (Anderson et al. 1998).

Conservation issues identified by Altman (2000) within the Pacific Silver Fir, Mountain Hemlock and Shasta Red Fir plant series include:

1. Loss of older forests and large diameter trees and snags from timber harvesting, particularly at the lowest elevations;
2. High risk of loss of remaining old forest stands from stand-replacing fires due to high fuel loads in densely stocked understories;
3. Invasion of exotic plants contributing to alteration of understory conditions and increase in fuel loadings;
4. Fragmentation of most of the remaining tracts of old-growth forest outside national parks and wilderness, which negatively impacts species with large area requirements (large carnivores);
5. Areas that are among the most popular and intensively used recreation sites in the west;
6. Restoration issues such as techniques (mowing, thinning, burning) and timing (spring/summer versus fall) of understory removal or prescribed burning;
7. BT spraying ramifications on lepidopterans and other non-target avian species.

Altman (2000) further suggests the following management objectives be included in forest management decision-making in the Pacific Silver Fir, Mountain Hemlock and Shasta Red Fir Series:

1. Retain all large diameter (>53 cm [20 in]) trees and snags.
2. Maintain existing areas of moderate to high quality mature/old-growth conditions, and actively manage to promote their sustainability.
3. Initiate actions to enhance size and connectivity of existing quality mature/old-growth condition patches (i.e., reduce fragmentation).
4. Initiate actions to avoid or minimize further degradation of late seral (shade-tolerant dominated) old-growth conditions (e.g., thinning, introduction of prescribed burning).
5. Initiate actions to improve quality of degraded mature/old-growth conditions through appropriate management, particularly the use of natural disturbance regimes such as fire in early seral dominated large structure tree stands.
6. By 2025, initiate actions to establish/maintain 2 blocks of forest greater than 5,000 acres (on the Deschutes and Winema Forests), that are moving toward dominance by Pacific Silver Fir, Mountain Hemlock and Shasta Red Fir Series, mature/old-growth conditions (can include a mosaic of other conditions).
7. By 2025, initiate actions to establish/maintain greater than 25% of 5th field HUCs, where the Pacific Silver Fir, Mountain Hemlock and Shasta Red Fir Series occur and are moving towards large structure dominated conditions.

Altman (2000) has listed some suggested strategies to meet the above biological objectives for these plant series. Please refer to that document for specific recommendations pertaining to the Pacific Silver Fir, Mountain Hemlock and Shasta Red Fir Series.

Douglas Fir, White–Grand Fir, and Western Hemlock Series Eastside (Interior) Mixed Conifer Forest (Johnson and O'Neil), Mixed Conifer Forest (Altman), Whitebark Pine Forest (Altman)

The Douglas Fir, White Fir–Grand Fir, and Western Hemlock Series include the Eastside (Interior) Mixed Conifer Forest Mixed Conifer Forest as described by Johnson and O'Neil (2001) and the Mixed Conifer habitat as described by Altman (2000). These series also occupy large areas on the east slope of the Cascade Mountains in the Deschutes and Winema National Forests. Quigley and Arbelbide (1997) concluded that Douglas-fir, white fir–grand fir, and Western hemlock trees are found in a greater percentage of existing plant communities now than before 1900, whereas the Western larch and Western white pine trees are significantly less abundant. Twenty percent of Pacific Northwest Douglas-fir, grand fir, western redcedar, western hemlock, and western white pine plant communities listed in the National Vegetation Classification are considered imperiled or critically imperiled (Anderson et al. 1998). Roads, timber harvest, periodic grazing, and altered fire regimes have compromised these forests. Even though this habitat is more extensive than pre-1900, natural processes and functions have been modified enough to alter its natural status as functional habitat for many species.

Conservation issues identified by Altman (2000) within the Douglas Fir, White Fir–Grand Fir and Western Hemlock plant series include those listed above for the Pacific Silver Fir, Mountain Hemlock and Shasta Red Fir Series with the addition of the following for Whitebark Pine:

1. Declines in this cover type, especially early smaller structure whitebark pine stands, from fire suppression, disease and replacement of this tree by more shade tolerant species.

The following management objectives are suggested by Altman (2000) to be included in forest management decision making in the Douglas Fir, White Fir–Grand Fir, and Western Hemlock Series:

1. Within areas mapped as Whitebark pine plant associations, initiate actins in Whitebark Pine habitats to maintain or provide >30% of the trees in large structure stages with >10% cover in early seral stages (seedlings and saplings).
2. Maintain current populations of Clark's nutcrackers, and where appropriate, initiate actions to expand density of breeding populations at these sites through #1 above.

Altman (2000) has listed some suggested strategies to meet the above management objectives for these plant series. Please refer to that document for specific recommendations pertaining to the Whitebark Pine Series.

Lodgepole Pine Series

Lodgepole Pine Forest and Woodlands (Johnson and O'Neil, 2001) Old-Growth Lodgepole Pine (Altman, 2000)

The Lodgepole Pine Series include the Lodgepole Pine Forest and Woodlands as described by Johnson and O'Neil (2001) and the Old-Growth Lodgepole Pine habitat as described by Altman (2000). Quigley and Arbelbide (1997) concluded that the extent of the lodgepole pine cover type in Oregon and Washington is the same as before 1900 and in some regions may exceed its historical extent. Five percent of Pacific Northwest lodgepole pine plant communities listed in the National Vegetation Classification are considered imperiled (Anderson et al. 1998). At a finer scale, these forests have been fragmented by roads, timber harvest, and influenced by periodic livestock grazing and altered fire regimes.

Conservation issues identified by Altman (2000) within the Lodgepole Pine plant series include:

1. A reduction in mature and old-growth stands due to a number of factors including timber harvest, insect outbreaks, fire suppression and over stocked stands.
2. A need to manage for relatively large blocks of habitat to maintain populations of the key focal species, black-backed woodpecker.
3. Salvage logging in decadent stands removes nesting and foraging trees.

The following management objectives are suggested by Altman (2000) to be included in forest management decision making in the Lodgepole Pine Series:

1. Where ecologically appropriate, initiate actions in Lodgepole Pine Forests to maintain or provide large tracts (>1,000 ac) of lodgepole pine forest dominated by and managed for mature and old-growth conditions. Ecologically appropriate refers to the potential vegetation of the site, considering hydrology, soils, topography and natural ecosystem processes.
2. Maintain current populations of black-backed woodpeckers, and where appropriate, initiate actions to expand density of breeding populations at these sites through #1 above.

3. In burns and bug-killed forests, leave it unsalvaged, or if salvaging, maintain >40% of the affected area as unsalvaged.
4. Exempt areas from commercial or salvage timber management and manage these areas to retain mature and old-growth characteristics as long as possible.

Ponderosa Pine Series

Ponderosa Pine Forest and Woodlands (Johnson and O'Neil, 2001) Ponderosa Pine (Altman, 2000)

The Ponderosa Pine Series include the Ponderosa Pine Forest and Woodlands as described by Johnson and O'Neil (2001) and the Ponderosa Pine habitat as described by Altman (2000). Quigley and Arbelbide (1997) concluded that the Interior Ponderosa Pine cover type is significantly less in extent than pre-1900. They included much of this habitat in potential vegetation groups which were classified as Douglas Fir and Grand Fir/White Fir in this guide. Quigley and Arbelbide (1997) reached their conclusion based upon the departure from natural succession and disturbance conditions in the fir series. The greatest structural change in this habitat is the reduced extent of the large tree, single-layer condition. This habitat is also degraded because of increased exotic plants and decreased native bunchgrasses. One third of ponderosa pine plant associations listed in the National Vegetation Classification are considered imperiled or critically imperiled (Anderson et al. 1998).

Conservation issues identified by Altman (2000) within the Ponderosa Pine plant series include:

1. Reduction of old-growth character (spike-top live trees, etc.) and large diameter trees and snags from timber harvest, particularly at low elevations;
2. Loss and degradation of properly functioning ecosystems because of encroachment of urban and residential development;
3. Habitat degradation from fire suppression/exclusion, particularly declines in characteristic herbaceous and shrub understories from increased density of small trees;
4. High risk of loss of remaining ponderosa pine overstories from stand-replacing fires due to high fuel loads in densely stocked understories;

5. Invasion of exotic plants contributing to alteration of understory conditions and increase in fuel loads;
6. Some areas are among the most popular and intensively used recreation sites in the west;
7. Fragmentation of remaining tracts of mature and old-growth stands negatively impacts species with large area requirements;
8. Landscapes in proximity to agricultural and residential areas may have high densities of nest parasites (brown-headed cowbirds), exotic nest competitors (European starling), and domestic predators (cats), and may be subject to high levels of human disturbance;
9. Restoration issues such as techniques (mowing, thinning, burning) and timing (spring/summer versus fall) of understory removal can be especially detrimental to single clutch nesting species;
10. BT spraying could have ramifications on lepidopterans and other non-target avian species.

The following management objectives are suggested by Altman (2000) to be included in forest management decision making in the Ponderosa Pine Series:

1. Institutionalize a policy of "no net loss" of mature/old-growth Ponerosa Pine Forest (i.e., discourage loss and conversion of habitat, but when unavoidable, mitigate with equal or greater restoration efforts).
2. Retain all large diameter (>21 inches) ponderosa pine trees and snags.
3. Maintain existing areas of mature/old-growth Ponderosa Pine Forest, and actively manage to promote their sustainability.
4. Initiate actions to enhance size and connectivity of existing mature/old-growth Ponderosa Pine Forest patches (i.e., reduce fragmentation).
5. Initiate actions to improve the quality of degraded Ponderosa Pine Forest through appropriate management, particularly the use of natural disturbance regimes such as fire.
6. In the short term (25 years), initiate actions to restore/maintain at least 30% of the existing Ponderosa Pine Plant Series within National Forests covered by this guide to be dominated by mature/old-growth ponderosa pine. Specific stand conditions are described using the white-headed woodpecker as the focal species.
7. By 2025, initiate actions to establish/maintain 2 blocks of forests greater than 5,000 acres (on the Deschutes and Winema Forests)

that are moving toward dominance of mature/old-growth conditions in the Ponderosa Pine Series.

Altman (2000) has listed some suggested strategies to meet the above biological objectives for these plant series. Please refer to that document for specific recommendations pertaining to the Ponderosa Pine Series.

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