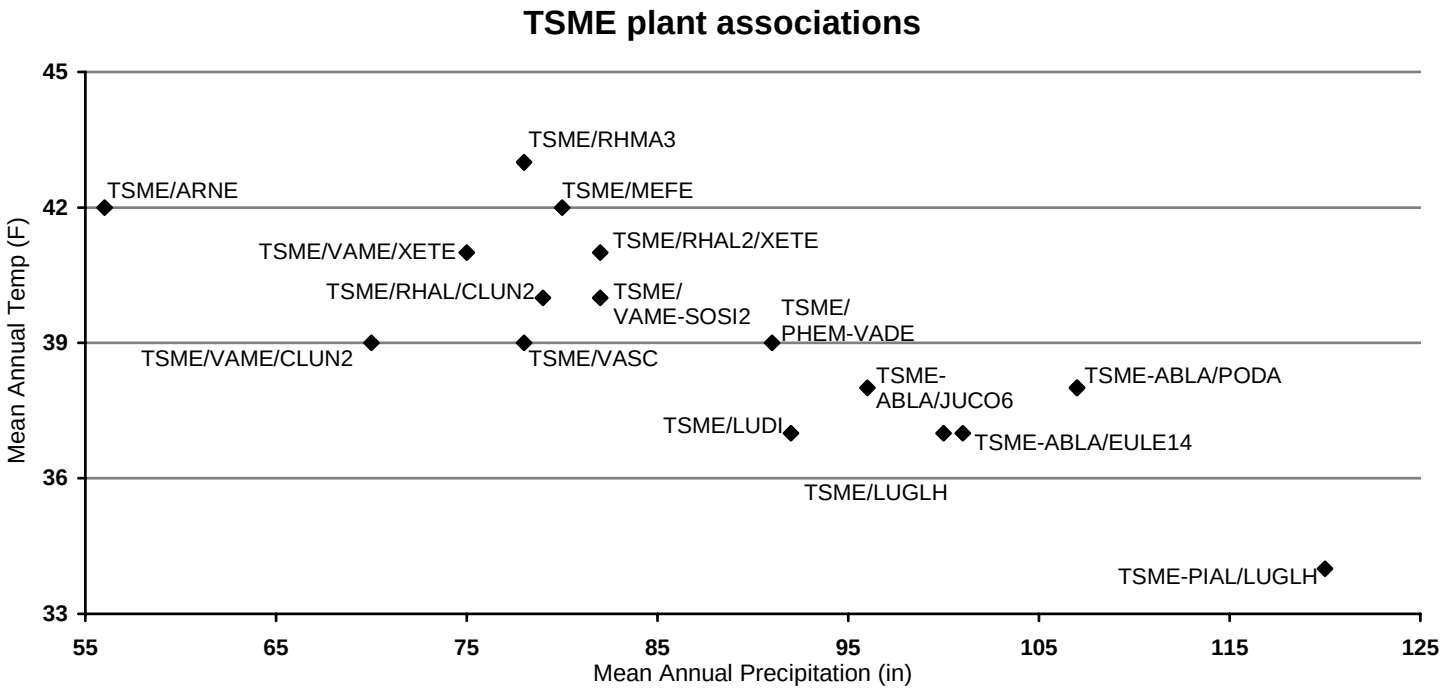
Introduction to mountain hemlock series

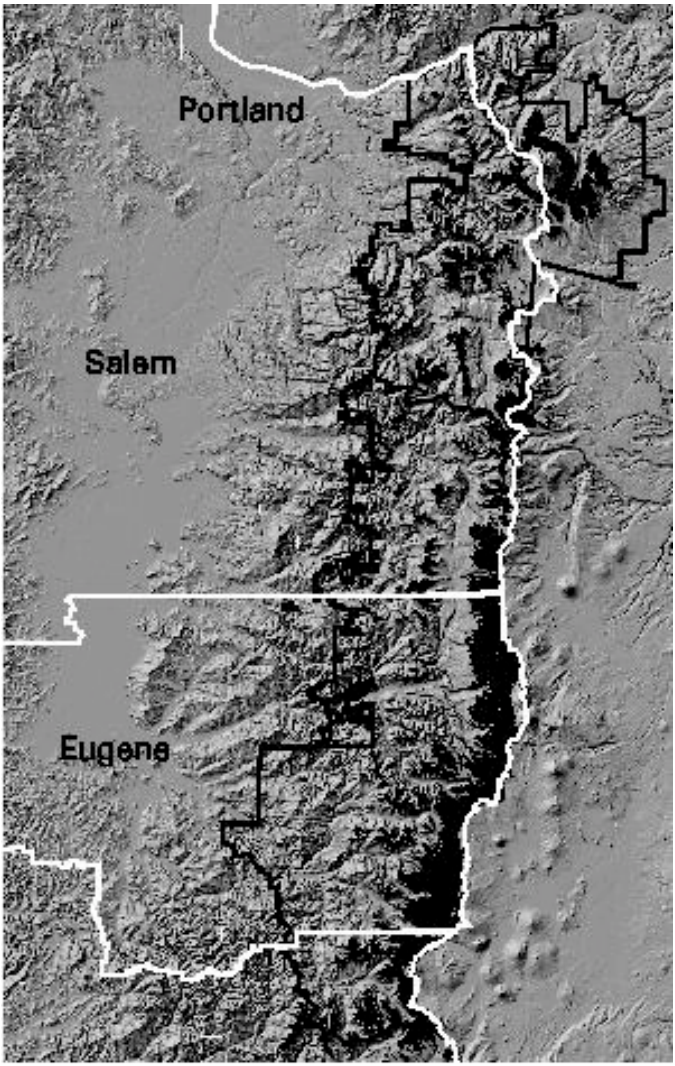
The mountain hemlock series is the highest and coldest of the closed forest types of the NW Oregon Cascades. Deep snow packs and summer frosts mean a short growing season. Snowmelt generally occurs after the summer dry season begins. Soil moisture is usually available throughout the growing season, but subsurface temperatures can be low enough to slow decomposition and also slow root growth in some conifer species. Mountain hemlock series' soil profiles also show the shallowest effective rooting depths and coarsest soil textures (largely sandy loams to loamy sands). Altogether, these harsh site conditions mean that productivity in the mountain hemlock series is low compared to the more moderate environments of the silver fir and western hemlock series.

The mountain hemlock zone gradually changes to open subalpine mosaic of forested stringers or tree islands and meadows. Plant associations typically found in the transitional open subalpine forest or subalpine forest/meadow mosaic include mountain hemlock-subalpine fir/Cascade aster, mountain hemlock-sublapine fir/juniper, mountain hemlock-white bark pine/smooth woodrush, and mountain hemlock/forked woodrush. Also, mountain hemlock-sublapine fir/Newberry's fleeceflower (TSME-ABLA/PODA) is present in the Mt. Hood National Forest, although there was only one plot that represented this type. It may be more common on the Gifford Pinchot National Forest (see Plant Association and Management Guide for the Mountain Hemlock Zone; Gifford Pinchot and Mt. Hood National Forests (Diaz and others 1997).

Plant associations described in this guide are derived from plots in NW Oregon. The earlier guides may have associations with with similar names, but species and environmental variables can differ. Please refer to the plant associations in this guide by their unique codes.

The graph below shows the relative distribution of the plant association plot averages for mean annual temperature versus total annual precipitation (data from Oregon Climate Service's statewide GIS layers).





Mountain hemlock series distribution

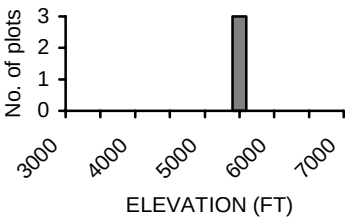
Series distribution (in black) from 2001 draft USFS R6 Potential Natural Vegetation model (Henderson, in prep).

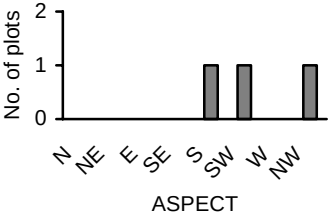
Mountain hemlock-subalpine fir/Cascades aster
Tsuga mertensiana-Abies lasiocarpa/Eucephalus ledophyllus
TSME-ABLA/EULE14
Old code: TSME-ABLA2/ASLE3
CAF312
N=3 (MTH=3)

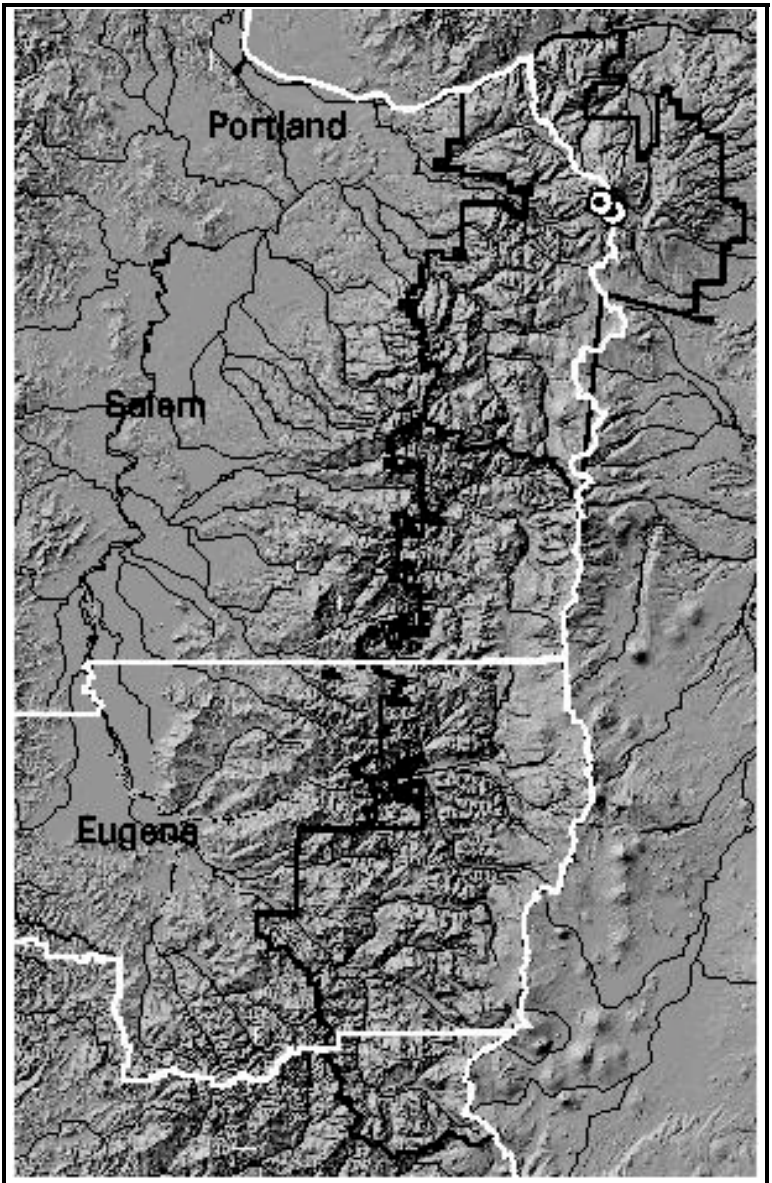
Environment and Distribution

This is principally a subalpine plant association. Plots are on steep slopes averaging 45% (range 30-70%), on mid slope to ridge slope positions. This association occurs at high elevations on Mt. Hood, averaging 5,750 feet (range 5,600-6000 ft.).

No soil pits were described on the Mt. Hood N.F.







TSME-ABLA/EULE14

Vegetation Composition, Structure, and Diversity

The TSME-ABLA/EULE14 association generally occurs as open-canopy tree islands or stringers in the subalpine zone. The overstory in this association is dominated by Pacific silver fir and mountain hemlock. Canopy closure of mature trees on plots averages 42%. Cover of understory trees averages 8%. Shrub cover is minor, averaging 3%. Some common shrubs may include dwarf bramble and western mountain ash. Herbaceous cover averages 67%, and is dominated by Cascades aster, smooth woodrush, broadleaf lupine and skunkleaf polemonium. No moss cover was recorded. The average number of species found on the plots is 18.

Common name	Code	Constancy	Cover
Overstory trees			
Pacific silver fir	ABAM	100	14
Mountain hemlock	TSME	100	18
Subalpine fir	ABLA	67	15
Whitebark pine	PIAL	33	5
Understory trees			
Mountain hemlock	TSME	100	3
Pacific silver fir	ABAM	67	3
Subalpine fir	ABLA	33	3
Whitebark pine	PIAL	33	1
Shrubs			
Dwarf bramble	RULA2	67	2
Western mountain ash	SOSI2	67	2
Blue huckleberry	VAME	33	1
Herbaceous			
Cascades aster	EULE14	100	10
Smooth woodrush	LUGLH	100	2
Broadleaf lupine	LULA4	100	12
Skunkleaf polemonium	POPU3	100	33
California brome	BRCA	67	1
Houndstongue hawkweed	HICY	67	1

Average age for the 3 stands sampled in TSME-ABLA/EULE14 is 149 years (range 138-154 years). Live basal area averages 273 ft^2/acre (range 200-320 ft^2/acre) in the 3 plots sampled.

Management Implications

TSME-ABLA/EULE14 sites have severe winters, deep late-melting snowpack, and cool summers. These stands are not areas where silvicultural prescriptions are usually carried out. These are sites that are difficult to reforest once the overstory has been removed. Because decomposition is slow in this series, most of the soil nitrogen is in the litter and duff, and could be easily lost during site preparation and slash removal. Recreational values, however, are very high.

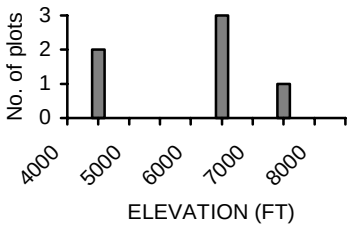
	Site Index PSME
Mean	143
SE	26
Range	120-180
Age	309
n	3

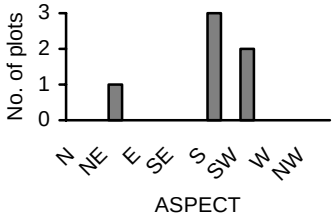
Mountain hemlock-subalpine fir/juniper
Tsuga mertensiana-Abies lasiocarpa/Juniperus communis
TSME-ABLA/JUCO6
Old code: TSME-ABLA2/JUCO4
CAS412
N=6 (MTH=5; WILL=1)

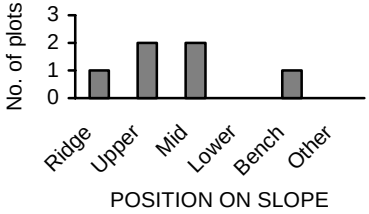
Environment and Distribution

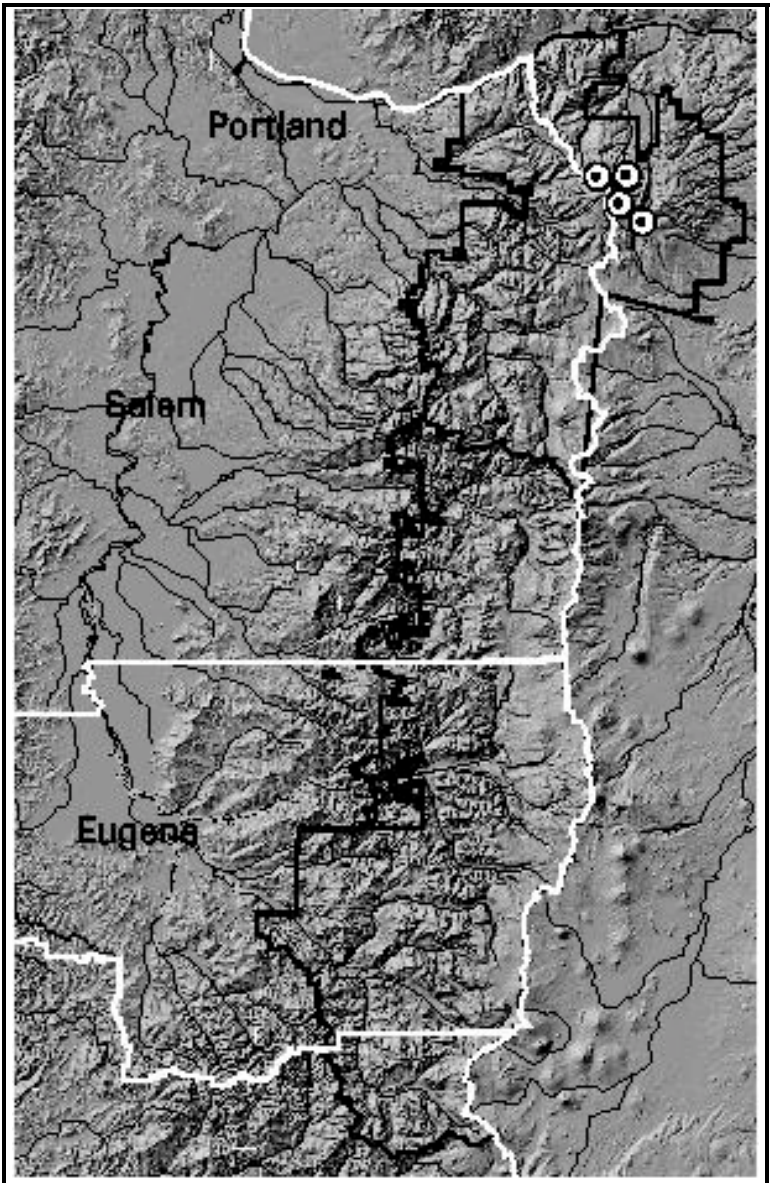
This is principally a subalpine parkland association. Plots are on slopes averaging 41% (range 5-76%) on middle slopes to ridge positions. Most plots are on southerly aspects. This association occurs at high elevations along the crest of the Cascades, averaging 6,035 feet (range 4,720-7,250 ft.).

Soils data for this plant association come from 3 soils pits. Average effective rooting depth is 58 cm (range 31-86). Soils are loamy sand, and parent materials are volcanic ash/andesite.









TSME-ABLA/JUCO6

Vegetation Composition, Structure, and Diversity

This association occurs as small tree islands in subalpine parkland. The overstory in the TSME-ABLA/JUCO6 association is dominated by whitebark pine and mountain hemlock. Canopy closure of mature trees on plots averages 22%. Cover of understory trees averages 7%. Shrub cover averages 44%. Common shrubs include juniper and pinemat manzanita. Herbaceous cover averages 20%, and is dominated primarily by yarrow. Moss cover averages <1%. The average number of species found on the plots is 17.

Common name	Code	Constancy	Cover
Overstory trees			
Whitebark pine	PIAL	83	16
Mountain hemlock	TSME	83	6
Subalpine fir	ABLA	50	4
Understory trees			
Whitebark pine	PIAL	67	3
Mountain hemlock	TSME	50	1
Subalpine fir	ABLA	50	4
Shrubs			
Common juniper	JUCO6	100	29
Pinemat manzanita	ARNE	33	3
Oregon boxwood	PAMY	33	21
Western mountain ash	SOSI2	33	2
Herbaceous			
Yarrow	ACMI2	83	2
Smooth woodrush	LUGLH	50	6
Davis' knotweed	PODA	50	2
Jacob's ladder	POPU3	50	11

Average age for the 2 stands sampled in TSME-ABLA/JUCO6 is 179 years (range 112-246 years). Live basal area averages 227 ft^2/acre (range 80-300 ft^2/acre) in the 3 plots sampled.

Management Implications

TSME-ABLA/JUCO6 sites are open parkland forests with very cold winters, deep snowpacks, and cool summers. These cold, dry subalpine stands have a short growing season and coarse dry soils, and are not areas where silvicultural prescriptions are usually carried out. These are sites that are difficult to reforest once the overstory has been removed. Because decomposition is slow in this series, most of the soil nitrogen is in the litter and duff, and could be easily lost during site preparation and slash removal. Recreational values, however, are very high.

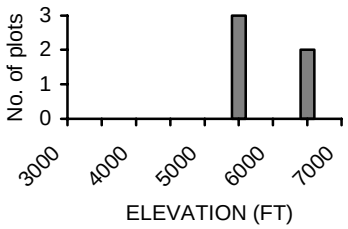
	Site Index PSME
Mean	145
SE	17
Range	130-170
Age	256
n	4

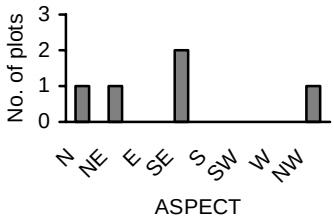
Mountain hemlock-whitebark pine/smooth woodrush
Tsuga mertensiana-Pinus albicaulis/Luzula glabrata var. hitchcockii
TSME-PIAL/LUGLH
Old code: TSME-PIAL/LUHI
CAG313
N=5 (MTH=5)

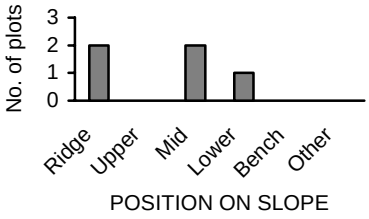
Environment and Distribution

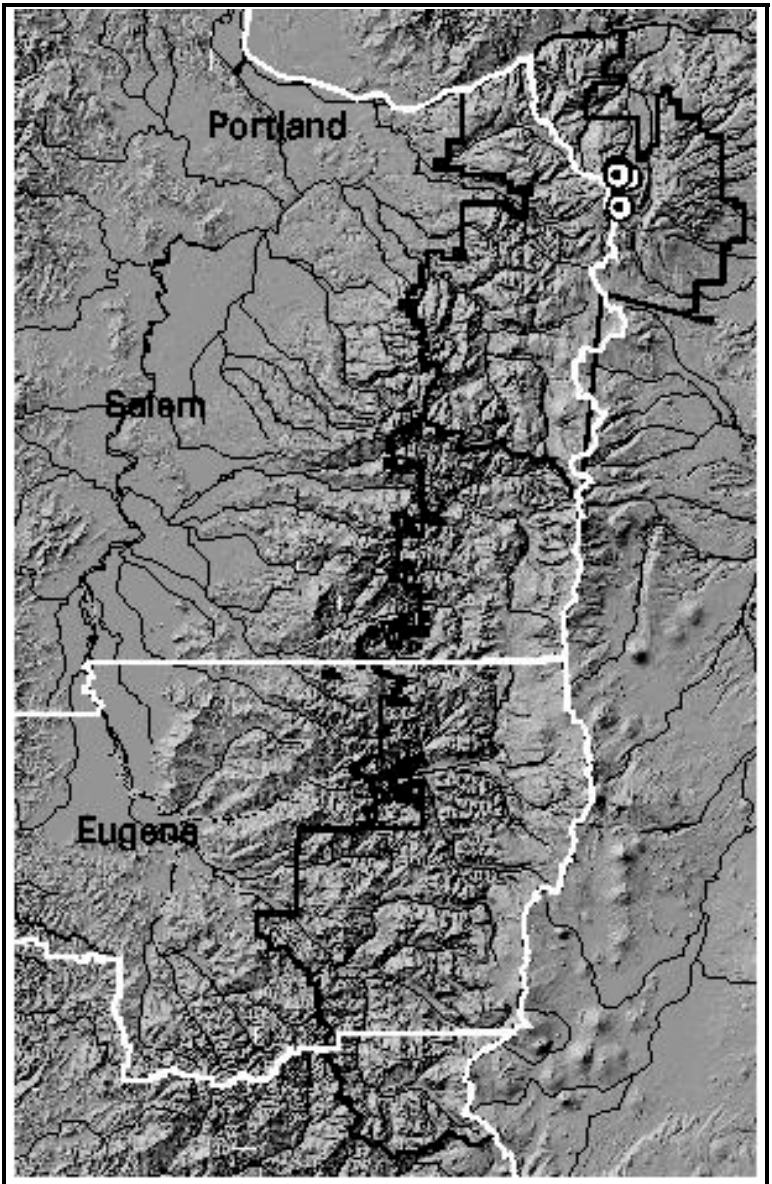
This is a generally subalpine association. Plots are on slopes averaging 29% (range 5-68%) on varying slope positions. Aspects also vary. This association occurs at an elevation averaging 5,888 feet (range 5,370-6,200 ft.) on Mt. Hood.

Soils data for this plant association come from the Plant Association and Management Guide for the Mountain Hemlock Zone (1997). The 5 soil pits used to describe this plant association occur on Mt. Hood and Mt. Adams. Average soil depth is 92cm (62-100cm), average rooting depth is 84cm (58-100cm), average effective depth is 65cm (6-96cm), and parent materials are volcanic ash, andesite, and glacial drift. Soils are sandy loam to loamy sand.









TSME-PIAL/LUGL2

Vegetation Composition, Structure, and Diversity

The overstory in the TSME-PIAL/LUGLH association is dominated by whitebark pine, Pacific silver fir and mountain hemlock. Canopy closure of mature trees on plots averages 36%. Cover of understory trees averages 10%. Shrub cover is low, averaging only 3%. Herbaceous cover averages 41%, and is dominated by broadleaf arnica, smooth woodrush, and broadleaf lupine. No moss cover was recorded. The average number of species found in the plots is 17.

Common name	Code	Constancy	Cover
Overstory trees			
Whitebark pine	PIAL	100	7
Pacific silver fir	ABAM	80	10
Mountain hemlock	TSME	80	21
Subalpine fir	ABLA	40	4
Understory trees			
Pacific silver fir	ABAM	80	10
Mountain hemlock	TSME	80	3
Whitebark pine	PIAL	60	2
Subalpine fir	ABLA	40	1
Shrubs			
Western mountain ash	SOSI2	80	1
Dwarf bramble	RULA2	40	2
Blue huckleberry	VAME	40	5
Herbaceous			
Broadleaf arnica	ARLA8	80	9
Smooth woodrush	LUGLH	80	11
Broadleaf lupine	LULA4	80	10
Jacob's ladder	POPU3	80	2
Cascade aster	EULE14	40	1
Subalpine daisy	ERPE3	40	1
Biscuitroot	LOMA5	40	1
Partridge foot	LUPE	40	3
Brewer's miterrwort	MIBR6	40	3
Woodland beardtongue	NONE3	40	1
Arrowleaf groundsel	SETR	40	1
Sitka valerian	VASI	40	1

Average age for the 5 stands sampled in TSME/PIAL/LUGLH is 158 years (range 126-182 years). Live basal area averages 242 ft^2/acre (range 88-440 ft^2/acre) in the 5 plots sampled.

Management Implications

TSME-PIAL/LUGLH sites are cold and mesic stands in the transition between continuous forest and subalpine parkland. They have deep snowpacks, late snowmelt, and cool summers. This association is not in areas where silvicultural prescriptions are usually carried out.

This plant association has a moderately high productivity for the mountain hemlock series, although, none of the plant associations in this series can be considered productive. These are areas that are difficult to reforest once the overstory has been removed. Because decomposition is slow in this series, most of the soil nitrogen is in the litter and duff, and could be easily lost during site preparation and slash removal. Recreational values, however, are very high.

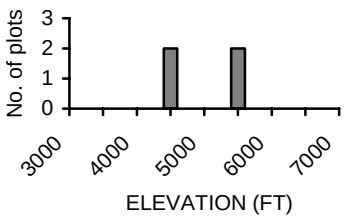
	Site Index PSME
Mean	152
SE	26
Range	130-200
Age	223
n	5

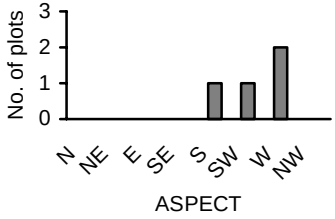
Mountain hemlock/pinemat manzanita
Tsuga mertensiana/Arctostaphylos nevadensis
TSME/ARNE
CMS117
N=4 (MTH=1; WILL=3)

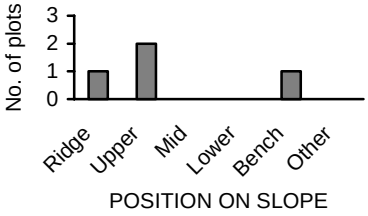
Environment and Distribution

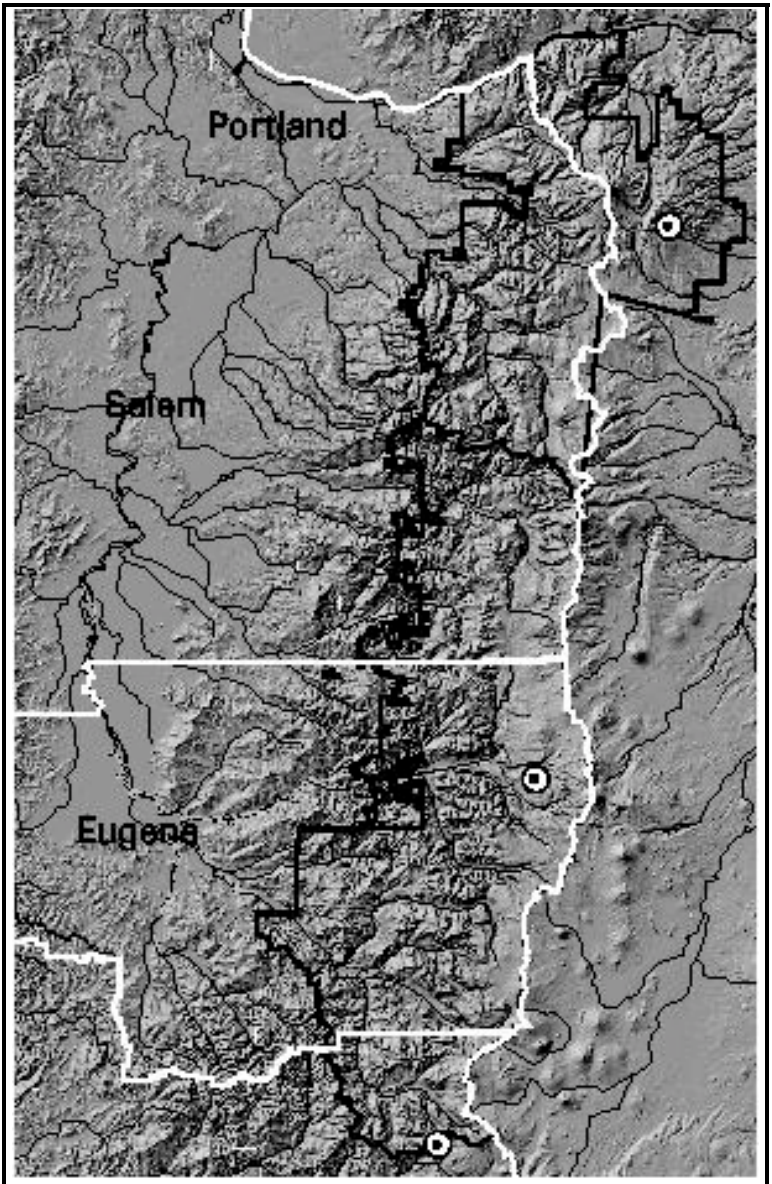
This association is found in dry microsites in low precipitation zones in the mountain hemlock zone. Plots are on slopes averaging 16% (range 5-25%) on ridges and upper slope positions. Plots are on warm southerly to westerly aspects. This association occurs at moderate elevations in the TSME series, averaging 4,849 feet (range 4,264-5400 ft.). TSME/ARNE has the lowest mean annual precipitation (56") and the second warmest mean annual temperature in the series.

Soils data are available for only two plots on the Willamette National Forest. The average effective rooting depth is 48 cm (range 38-61 cm). The soils are sand to sandy loam, developed from pumice.









TSME/ARNE

Vegetation Composition, Structure, and Diversity

The overstory in the TSME/ARNE association is dominated by mountain hemlock, often with a large component of lodgepole pine, western whitepine and Douglas-fir. Canopy closure of mature trees on plots averages 25%. Cover of understory trees averages 15%. Shrubs average 26% cover. The shrub layer is dominated by pinemat manzanita and blue huckleberry, both of which are always present. Herbaceous cover averages 30%, and is usually dominated by beargrass. Moss is nearly absent. The average number of species found on the plots is 14.

Common name	Code	Constancy	Cover
Overstory trees			
Mountain hemlock	TSME	100	11
Lodgepole pine	PICO	75	11
Western whitepine	PIMO	75	9
Douglas-fir	PSME	75	11
Noble fir	ABPR	50	5
Understory trees			
Mountain hemlock	TSME	100	10
Pacific silver fir	ABAM	75	4
Lodgepole pine	PICO	75	8
Western whitepine	PIMO	75	5
Subalpine fir	ABLA	50	3
Noble fir	ABPR	50	1
Shrubs			
Pinemat manzanita	ARNE	100	14
Blue huckleberry	VAME	100	7
Prince's pine	CHUM	75	4
Wintergreen	GAOV2	50	1
Oregon boxwood	PAMY	50	1
Herbaceous			
Beargrass	XETE	75	13
Sidebells wintergreen	ORSE	50	1

Average age for the 2 stands sampled in TSME/ARNE is 86 years (range 66-106 years). Live basal area averages 133 ft^2/acre (range 52-200 ft^2/acre) in the 4 plots sampled.

Management Implications

TSME/ARNE sites have a short growing season, and are not areas where silvicultural prescriptions are usually carried out. Comparing the Douglas-fir site index to other plant associations within this series, TSME/ARNE is one of the least productive of a relatively unproductive series. These are sites that are difficult to reforest once the overstory has been removed. Because decomposition is slow in this series, most of the soil nitrogen is in the litter and duff, and could be easily lost during site preparation and slash removal. Recreational values, however, are very high.

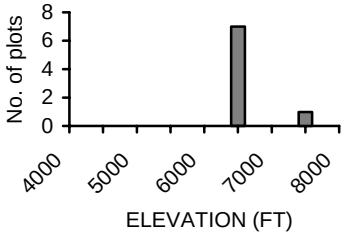
	Site Index PSME	Site Index ABPR	Site Index PIMO
Mean	123	60	60
SE	48	-	-
Range	80-190	-	-
Age	336	269	218
n	3	1	1

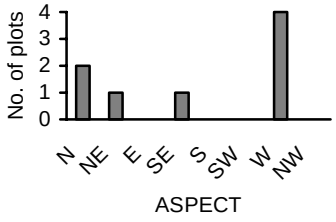
Mountain hemlock/forked woodrush
Tsuga mertensiana/Luzula divaricata
TSME/LUDI
CMG212
N=8 (WILL=8)

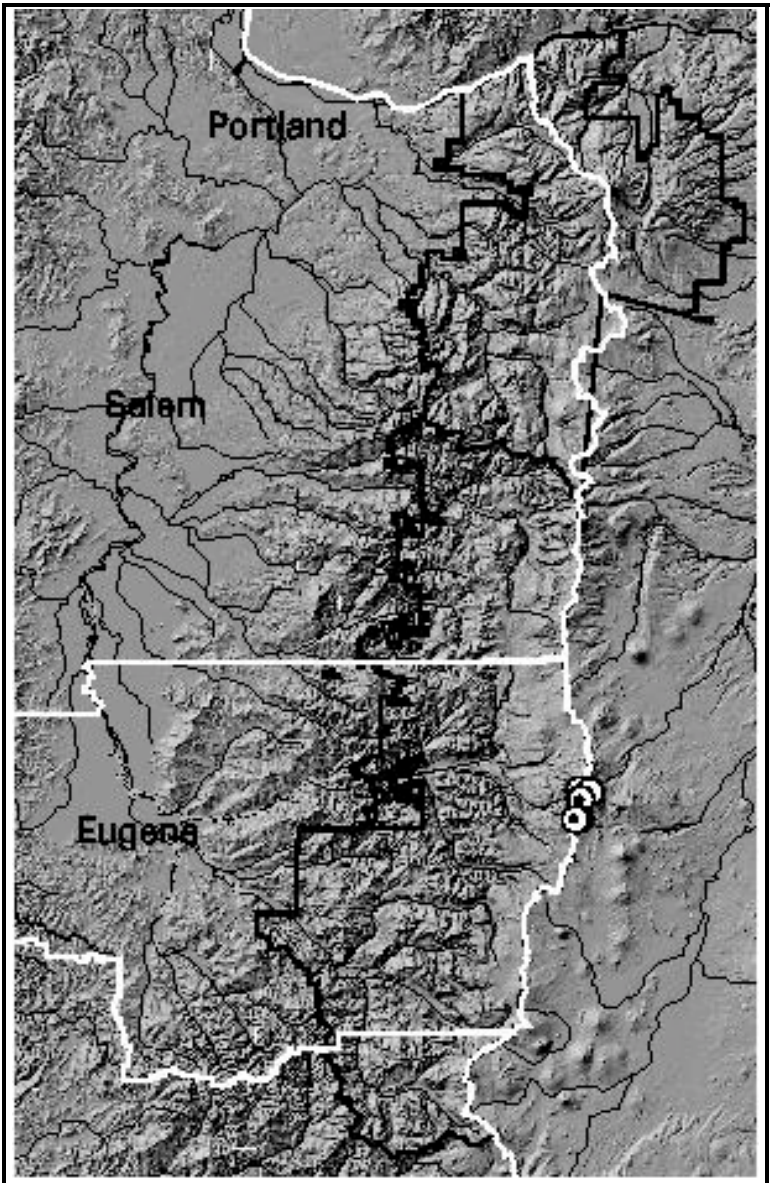
Environment and Distribution

This uncommon association occurs at the highest elevations for the TSME series, averaging 6,437 feet (range 6,035-7,183 ft.). Distribution appears to be from the Three Sisters Wilderness south along the crest of the Cascades. Plots are on slopes averaging 24% (range 0-62%) on ridges or benches. Mean annual temperatures are cold, but precipitation is relatively high (92").

There are no soils data for this plant association.







TSME/LUDI

Vegetation Composition, Structure, and Diversity

The overstory in the TSME/LUDI association is dominated by mountain hemlock. Canopy closure of mature trees on plots averages 57%. Cover of understory trees averages 5%. This association has a poorly developed shrub layer, with tall shrubs averaging trace amounts of cover and low shrubs averaging 13% cover. Herbaceous cover averages 19%, and is dominated by forked woodrush. Moss cover averages <1%. The average number of species found on the plots is 9, which makes this the least diverse plant association found in the mountain hemlock series.

Common name	Code	Constancy	Cover
Overstory trees			
Mountain hemlock	TSME	100	55
Subalpine fir	ABLA	38	2
Understory trees			
Mountain hemlock	TSME	100	3
Subalpine fir	ABLA	67	5
Pacific silver fir	ABAM	25	1
Shrubs			
Grouse huckleberry	VASC	75	14
Dwarf bramble	RULA2	63	1
Herbaceous			
Forked woodrush	LUDI	100	15
Partridge foot	LUPE	63	2
Brewer's miterwort	MIBR6	50	3

Average age for the stands in TSME/LUDI is not available. Live basal area averages 448 ft^2/acre (range 261-627 ft^2/acre) in the 8 plots sampled.

Management Implications

TSME/LUDI sites have a short growing season, and are not areas where silvicultural prescriptions are usually carried out. These are sites that are difficult to reforest once the overstory has been removed. Because decomposition is slow in this series, most of the soil nitrogen is in the litter and duff, and could be easily lost during site preparation and slash removal. Recreational values, however, are very high.

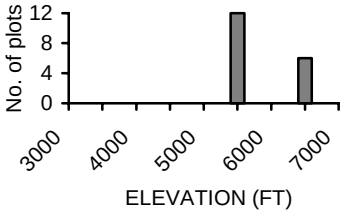
	Site Index TSME	Site Index PICO
Mean	80	90
SE	0	-
Range	80-80	-
Age	385	155
n	3	1

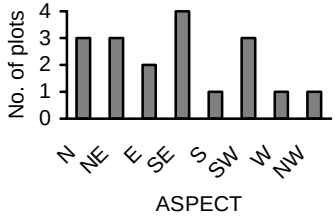
Mountain hemlock/smooth woodrush
Tsuga mertensiana/Luzula glabrata
TSME/LUGLH
(Old code: TSME/LUHI)
CAG314
N=18 (MTH=17; WILL=1)

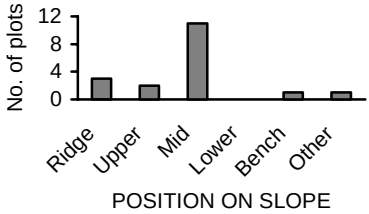
Environment and Distribution

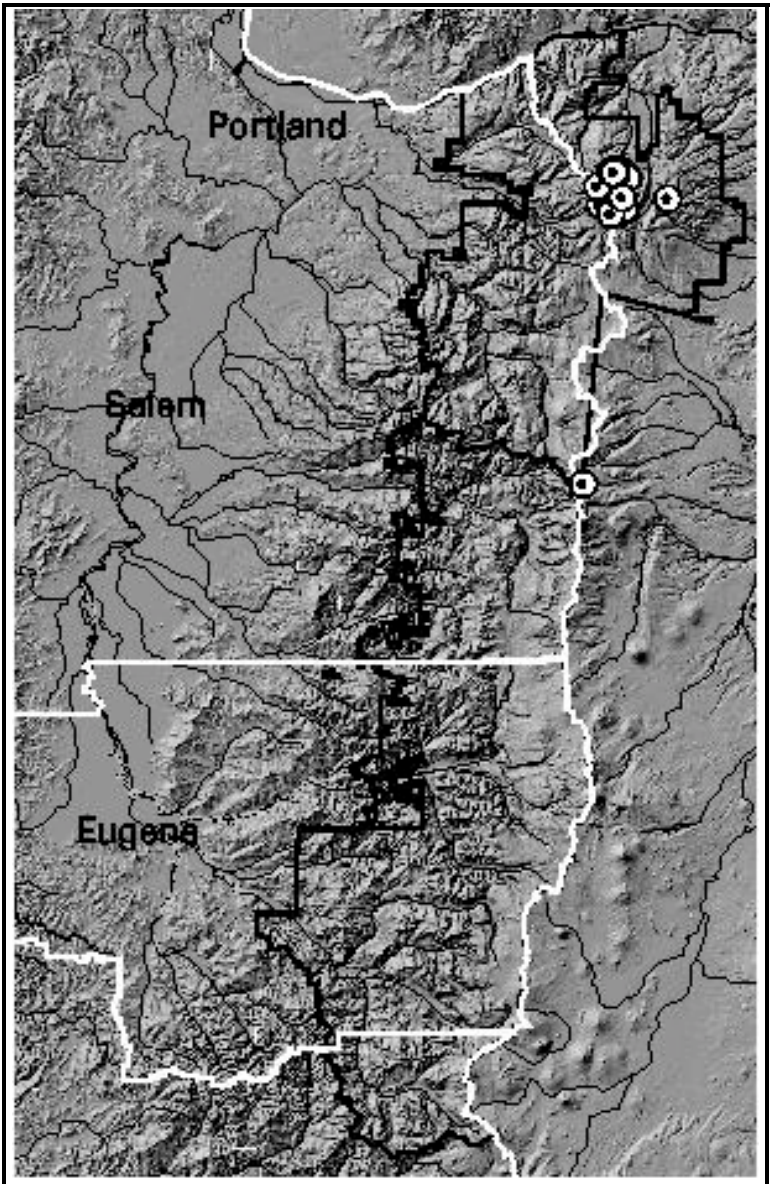
This subalpine association is found in the north half of the study area. Plots are on slopes averaging 26% (range 9-76%) on mid to upper slope positions. Plot aspects vary. This association occurs at an elevation averaging 5,797 feet (range 5,210-6,600 ft.) near the crest of the Cascades.

Soils data came from 13 soils pits. Three pits had spodic horizons, and in two gleying was noted, indicating poor drainage. Average effective rooting depth is 74 cm (15-102 cm). Soils are sandy loam to loamy sand, and parent materials are volcanic ash and andesite.









TSME/LUGL2

Vegetation Composition, Structure, and Diversity

The overstory in the TSME/LUGLH association is dominated by mountain hemlock. Canopy closure of mature trees on plots averages 41%. Cover of understory trees averages 14%. This association has a poorly developed shrub layer, with tall shrubs averaging 2% cover and low shrubs averaging 11% cover. Herbaceous cover averages 41%, dominated primarily by smooth woodrush and broadleaf lupine. Moss cover averages 5%. The average number of species found on the plots is 15.

Common name	Code	Constancy	Cover
Overstory trees			
Mountain hemlock	TSME	94	31
Pacific silver fir	ABAM	56	7
Subalpine fir	ABLA	44	15
Understory trees			
Pacific silver fir	ABAM	83	9
Mountain hemlock	TSME	72	5
Shrubs			
Dwarf bramble	RULA2	56	11
Blue huckleberry	VAME	44	3
Western mountain ash	SOSI2	39	2
Herbaceous			
Smooth woodrush	LUGLH	94	14
Broadleaf lupine	LULA4	83	9
Jacob's ladder	POPU3	67	5
Arrowleaf groundsel	SETR	56	3
Broadleaf arnica	ARLA8	44	5
Brewer's miterwort	MIBR6	44	6
Sitka valerian	VASI	44	8

Average age for the 11 stands sampled in TSME/LUGLH is 157 years (range 105-218 years). Live basal area averages 328 ft^2/acre (range 160-620 ft^2/acre) in the 13 plots sampled.

Management Implications

TSME/LUGLH sites have deep, long-lasting snowpacks, cool summers, and short growing season. These are not areas where silvicultural prescriptions are usually carried out. Comparing the Douglas-fir site index to other plant associations within this series, TSME/LUGLH is the most productive. However, the mountain hemlock series is one of the least productive series and should be managed with care. These are sites that are difficult to reforest once the overstory has been removed. Because decomposition is slow in this series, most of the soil nitrogen is in the litter and duff, and could be easily lost during site preparation and slash removal. Recreational values, however, are very high.

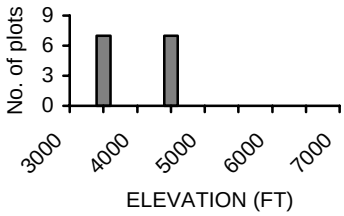
	Site Index PSME
Mean	177
SE	21
Range	140-210
Age	282
n	14

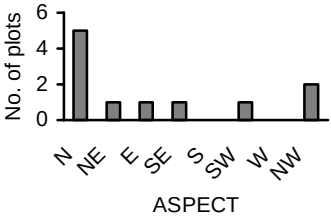
Mountain hemlock/fool's huckleberry-NWO
Tsuga mertensiana/Menziesia ferruginea-NWO
TSME/MEFE-NWO
CMS225
N=14 (MTH=14)

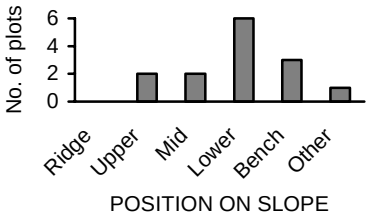
Environment and Distribution

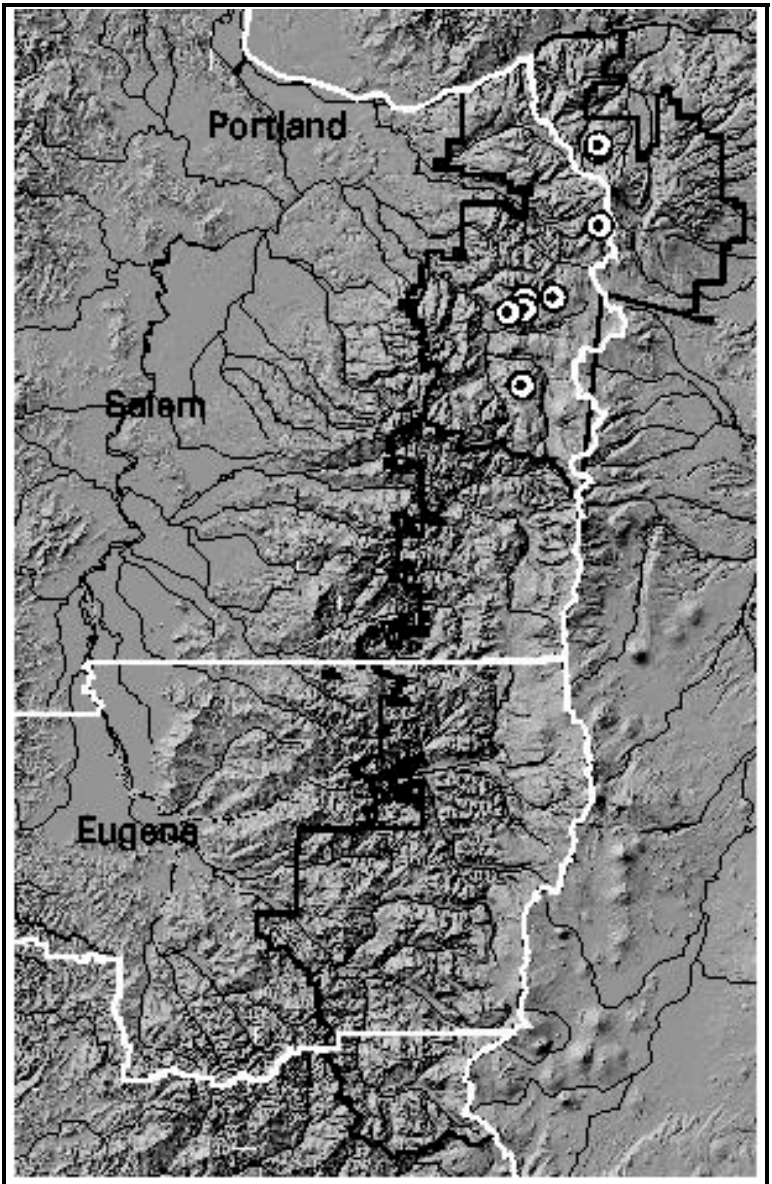
This is a closed forest association in the lower elevations of the mountain hemlock zone. TSME/MEFE-NWO occurs at relatively low elevations for the TSME series, averaging 4,079 feet (range 3,400-4,700 ft.) in moist to wet sites in moderate precipitation zones on the Mt. Hood N.F. Plots are on slopes averaging 25% (range 5-52%) on varied slope positions. Plot aspects are generally cool.

Soils data came from the Plant Association and Management Guide for the Mountain Hemlock Zone (1997). Average effective rooting depth is 58 cm (15-95 cm) and parent materials are volcanic ash and pumice/andesite, glacial drift.









TSME/MEFE

Vegetation Composition, Structure, and Diversity

The overstory in the TSME/MEFE-NWO association is dominated by Pacific silver fir and mountain hemlock. Canopy closure of mature trees on plots averages 62%. Cover of understory trees averages 27%. This association has a well-developed shrub layer, for the mountain hemlock series, with tall shrubs averaging 47% cover and low shrubs averaging 33% cover. The shrub layer is dominated by fool's huckleberry and blue huckleberry, both of which are always present. Other common shrubs include dwarf bramble and wintergreen. Herbaceous cover averages 19%, and is dominated by beargrass. Moss cover averages 23% cover, which is highest in the series. The average number of species found on the plots is 14.

Common name	Code	Constancy	Cover
Overstory trees			
Pacific silver fir	ABAM	100	24
Mountain hemlock	TSME	100	24
Western hemlock	TSHE	64	14
Douglas-fir	PSME	43	13
Understory trees			
Pacific silver fir	ABAM	100	17
Western hemlock	TSHE	50	2
Mountain hemlock	TSME	50	7
Shrubs			
Fool's huckleberry	MEFE	100	29
Blue huckleberry	VAME	100	14
Dwarf bramble	RULA2	86	3
Wintergreen	GAOV2	71	6
Rhododendron	RHMA3	57	16
Western mountain ash	SOSI2	57	2
Oval-leaf huckleberry	VAOV	57	16
Herbaceous			
Beargrass	XETE	100	23
Bunchberry dogwood	COCA13	36	7
Rattlesnake plantain	GOOB2	36	1
Round leaf violet	VIOR	36	3

Average age for the 8 stands sampled in TSME/MEFE-NWO is 247 years (range 205-340 years). Live basal area averages 307 ft^2/acre (range 210-400 ft^2/acre) in the 9 plots sampled.

Management Implications

TSME/MEFE-NWO sites are relatively productive for the mountain hemlock series. Summer frost and shrub competition after overstory is removed can be reforestation problems. Compaction of moist, fine textured soil should be avoided. Leaching following disturbance of the subsurface spodic horizon may cause nutrient loss.

Because decomposition is slow in this series, most of the soil nitrogen is in the litter and duff, and could be easily lost during site preparation and slash removal.

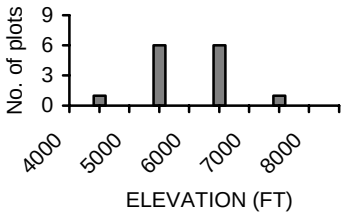
	Site Index PSME
Mean	130
SE	20
Range	110-150
Age	83
n	2

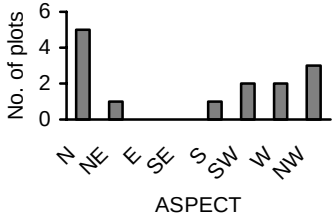
Mountain hemlock/red mountain heather-blueleaf huckleberry-NWO
Tsuga mertensiana/Phyllodoce empetriformis-Vaccinium deliciosum-NWO
TSME/PHEM-VADE-NWO
CAS212
N=14 (MTH=8; WILL=6)

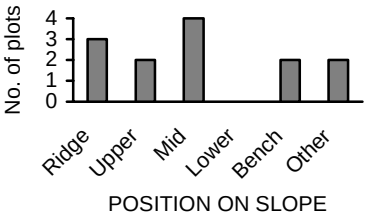
Environment and Distribution

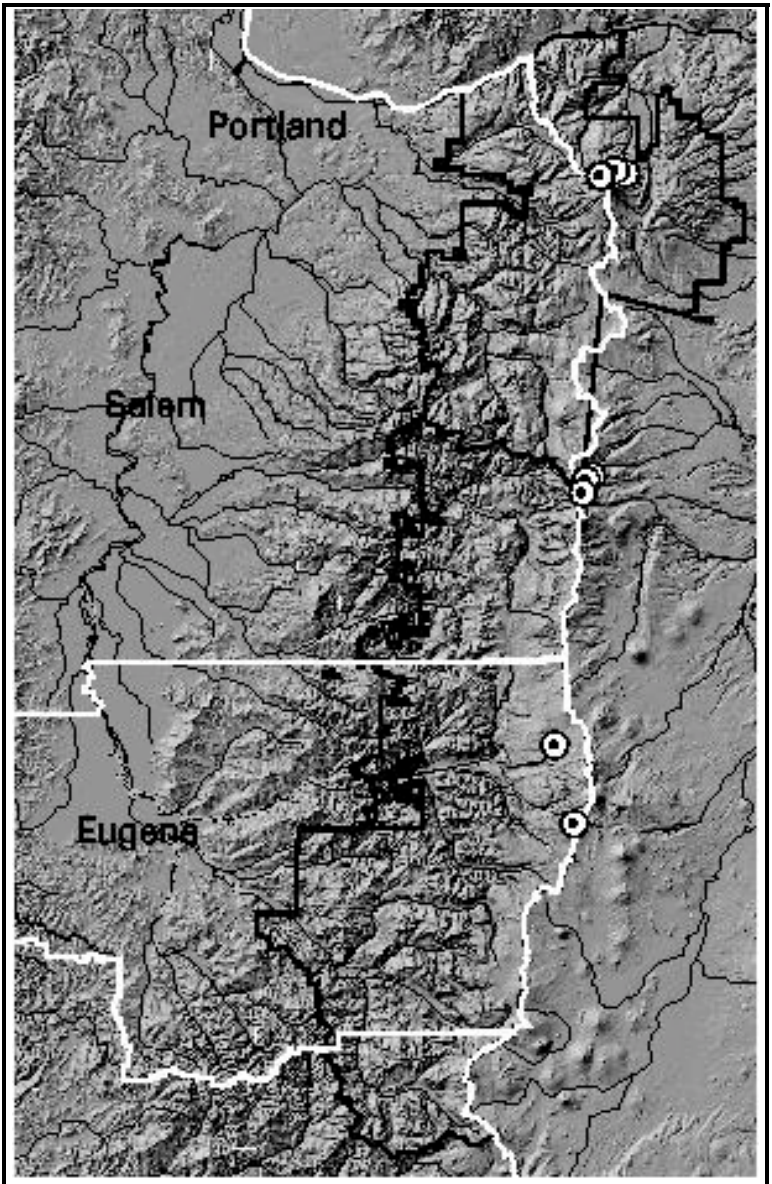
Plots sampled in this plant association are located in cold, moist subalpine parkland sites on slopes averaging 20% (range 2-55%) on upper to mid slope positions. Most plots are on westerly to northerly aspects. This association occurs at an elevation averaging 6,011 feet (range 4,900-7,050 ft.) along the crest of the Cascades.

Soils data for this plant association came from five soils pits. Average effective rooting depth is 89 cm (range 25-132 cm). Soils are sandy or silty loams to sand, and parent materials are volcanic ash andesite.









TSME/PHEM-VADE

Vegetation Composition, Structure, and Diversity

This association is part of the subalpine forest-meadow mosaic. The overstory in the TSME/PHEM-VADE-NWO association is dominated by mountain hemlock. Canopy closure of mature trees on plots averages 30%. Cover of understory trees averages 19%. Tall shrubs average 4% cover and low shrubs average 34% cover. The shrub layer is sometimes dominated by red mountain heather, although a complex of red mountain heather, western mountain ash, blueleaf huckleberry, blue huckleberry or grouse whortleberry are usually present. Herbaceous cover averages 29%, and partridge foot is often present. The average number of species found on the plots is 15.

Common name	Code	Constancy	Cover
Overstory trees			
Mountain hemlock	TSME	100	21
Pacific silver fir	ABAM	57	10
Subalpine fir	ABLA	43	6
Understory trees			
Mountain hemlock	TSME	93	9
Subalpine fir	ABLA	71	4
Pacific silver fir	ABAM	57	9
Whitebark pine	PIAL	36	1
Shrubs			
Red mountain heather	PHEM	64	14
Western mountain ash	SOSI2	43	7
Blueleaf huckleberry	VADE	43	19
Blue huckleberry	VAME	43	19
Grouse huckleberry	VASC	43	9
White mountain heather	CAME7	36	16
Dwarf bramble	RULA2	36	3
Herbaceous			
Partridge foot	LUPE	71	3
Slender hawkweed	HIGR	36	1
Gray's lovage	LIGR	36	1
Broadleaf lupine	LULA4	36	9
Sitka valerian	VASI	36	6

Average age for the 5 stands sampled in TSME/PHEM-VADE-NWO is 129 years (range 67-198 years). Live basal area averages 273 ft^2/acre (range 140-470 ft^2/acre) in the 9 plots sampled.

Management Implications

TSME/PHEM-VADE-NWO sites have deep late-melting snowpacks and cool summers. Subalpine parklands such as these are not areas where silvicultural prescriptions are usually carried out. These are sites that are difficult to reforest once the overstory has been removed. Because decomposition is slow in this series, most of the soil nitrogen is in the litter and duff, and could be easily lost during site preparation and slash removal. Recreation values are very high. Vegetation in this association is sensitive to trampling and off-trail hiking, which can lead to soil compaction, rutting, and erosion.

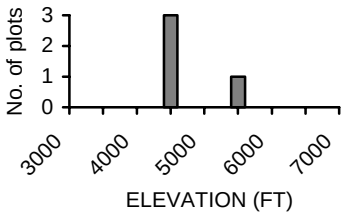
	Site Index PSME	Site Index TSME	Site Index PICO
Mean	140	85	46
SE	34	-	-
Range	68-180	-	-
Age	247	133	115
n	7	1	1

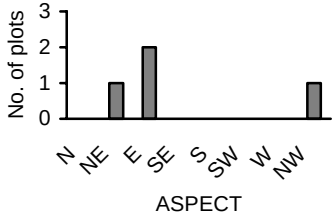
Mountain hemlock/Cascades azalea/queencup beadlily
Tsuga mertensiana/Rhododendron albiflorum/Clintonia uniflora
TSME/RHAL2/CLUN2
CMS226
N=5 (MTH=5)

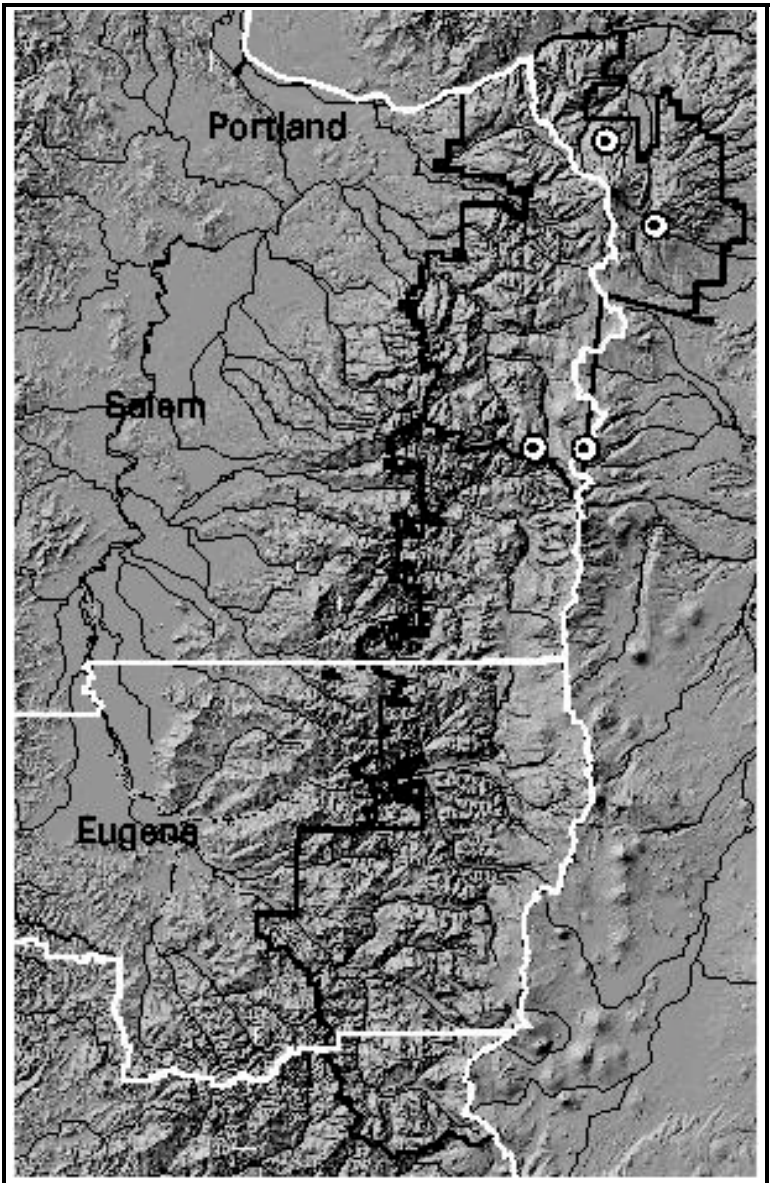
Environment and Distribution

This is a cool, moist closed-canopy plant association. Plots are located on gentle slopes averaging 13% (range 5-30%) on upper slope positions or benches. Most plots are on NE to NW aspects. This association occurs at an elevation averaging 4,668 feet (range 4,200-5,140 ft.), mainly on the Mt. Hood N.F.

The soils in this plant association are usually deep and loamy, developed from volcanic ash. Soils are moist throughout the growing season.







TSME/RHAL2/CLUN2

Vegetation Composition, Structure, and Diversity

The overstory in the TSME/RHAL2/CLUN2 association is dominated by Pacific silver fir and mountain hemlock, often with a component of western whitepine and Douglas-fir. Canopy closure of mature trees on plots averages 57%. Cover of understory trees averages 20%.

Common name	Code	Constancy	Cover
Overstory trees			
Pacific silver fir	ABAM	100	19
Mountain hemlock	TSME	100	20
Western white pine	PIMO3	60	2
Douglas-fir	PSME	60	9
Engelmann's spruce	PIEN	60	8
Western hemlock	TSHE	40	10
Understory trees			
Pacific silver fir	ABAM	80	19
Mountain hemlock	TSME	60	8
Engelmann's spruce	PIEN	40	1
Western white pine	PIMO3	40	3
Western hemlock	TSHE	40	3
Shrubs			
Cascade azalea	RHAL2	100	26
Dwarf bramble	RULA2	100	4
Blue huckleberry	VAME	100	27
Oval-leaf huckleberry	VAOV	80	16
Wintergreen	GAOV2	40	4
Dwarf Oregongrape	MANE2	40	1
Sitka mountain ash	SOSI2	40	2
Herbaceous			
Queencup beadlily	CLUN2	100	3
Vanilla leaf	ACTR	100	8
Three-leaved anemone	ANDE	80	3
Three-leaf foamflower	TITR	80	4
Pacific trillium	TROV2	80	2
Broadleaf arnica	ARLA8	60	30
Bunchberry dogwood	COCA13	60	7
Sidebells wintergreen	ORSE	60	1
Twinflower	LIBO3	40	9
Northwestern twayblade	LICA10	40	1
Starry false Solomon's seal	MAST4	40	2
Rosy twistedstalk	STRO	40	3
Sitka valerian	VASI	40	11
Beargrass	XETE	40	23

This association has a relatively well-developed shrub layer, for the mountain hemlock series, with tall shrubs averaging 47% cover and low shrubs averaging 38% cover. The shrub layer is dominated by Cascade azalea, dwarf bramble, and blue huckleberry, all of which are always present. Herbaceous cover averages 67%, and is dominated by vanilla leaf, queencup beadlily, and Pacific trillium. Broadleaf arnica is often present in large quantities. Moss cover averages 21%. The lush understory and moss have almost twice the cover found in TSME/RHAL2/XETE, which is slightly warmer and on drier microsites.

The average number of species found on the plots is 23, which makes TSME/RHAL2/CLUN2 the most diverse plant association in the mountain hemlock series.

Average age for the 3 stands sampled is 243 years (range 207-275 years). Live basal area averages 300 ft^2/acre (range 300-300 ft^2/acre) in the 2 plots sampled.

Management Implications

TSME/RHAL2/CLUN2 sites have a short, relatively cool growing season. Summer frosts are likely. High soil moisture should be anticipated, and compaction and displacement avoided. This is probably one of the more productive plant associations within the mountain hemlock series, based on its suite of plants and environmental conditions. Information on site index is very limited.

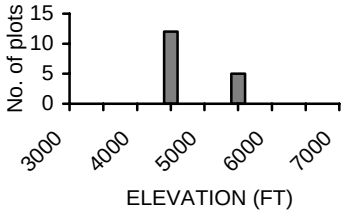
	Site Index TSHE
Mean	100
SE	-
Range	-
Age	102
n	1

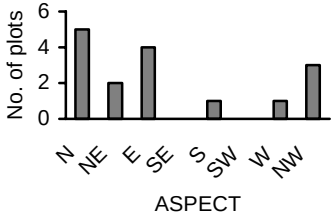
Mountain hemlock/Cascades azalea/beargrass
Tsuga mertensiana/Rhododendron albiflorum/Xerophyllum tenax
TSME/RHAL2/XETE
CMS227
N=17 (MTH=16; WILL=1)

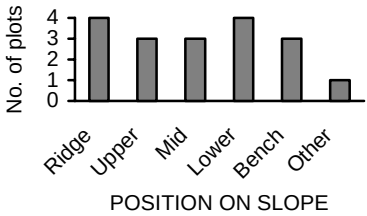
Environment and Distribution

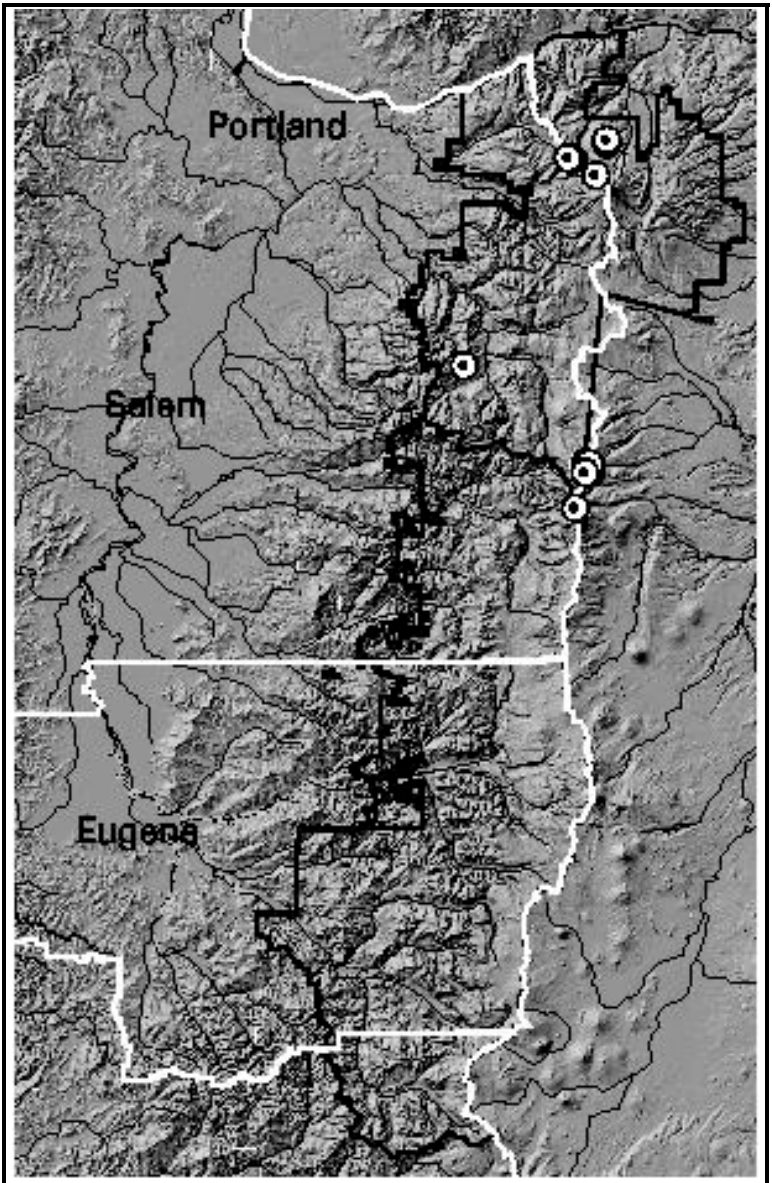
This is a cool, closed-canopy plant association. Plots are located on slopes averaging 29% (range 5-72%) on varied slope positions. Aspects are generally cool and northerly. This association occurs at an elevation averaging 4,805 feet (range 4,100-5,700 ft.) in the northern Willamette and Mt. Hood N.F.s.

Soils data for this plant association came from 2 soil pits. Average effective rooting depth is 23 cm (range 18-28 cm). Soils are sandy loams to silty clay loam or silty loam, and the parent material is volcanic ash.









TSME/RHAL2/XETE

Vegetation Composition, Structure, and Diversity

The overstory in the TSME/RHAL2/XETE association is dominated by mountain hemlock, often with a large component of Pacific silver fir. Canopy closure of mature trees on plots averages 57%. Cover of understory trees averages 28%. This association has a fairly well-developed shrub layer with, tall shrubs averaging 31% cover and low shrubs averaging 29% cover. The shrub layer is dominated by Cascade azalea, and other common shrubs include blue huckleberry and dwarf bramble. Herbaceous cover averages 23%, dominated primarily by beargrass. Moss cover averages 9%. Moss and herb cover are about half that of the similar but moister TSME/RHAL2/CLUN2 association. The average number of species found on the plots is 11.

Common name	Code	Constancy	Cover
Overstory trees			
Mountain hemlock	TSME	94	26
Pacific silver fir	ABAM	88	23
Alaska cedar	CHNO	29	8
Understory trees			
Pacific silver fir	ABAM	82	21
Alaska cedar	CHNO	29	7
Mountain hemlock	TSME	24	10
Shrubs			
Cascade azalea	RHAL2	100	27
Blue huckleberry	VAME	88	15
Dwarf bramble	RULA2	82	4
Western mountain ash	SOSI2	47	2
Fool's huckleberry	MEFE	35	12
Oval-leaf huckleberry	VAOV	35	10
Grouse huckleberry	VASC	29	4
Herbaceous			
Beargrass	XETE	94	15
White avalanche lily	ERMO8	41	18

Average age for the 10 stands sampled in TSME/RHAL2/XETE is 210 years (range 87-328 years). Live basal area averages 317 ft^2/acre (range 120-520 ft^2/acre) in the 15 plots sampled.

Management Implications

TSME/RHAL2/XETE sites have heavy snowpacks and a short, relatively cool growing season. Summer frosts are likely in openings. These are sites that are difficult to reforest once the overstory has been removed. Because decomposition is slow in this series, most of the soil nitrogen is in the litter and duff, and could be lost during site preparation and slash removal if the nutrient-rich bottom duff layers are not retained.

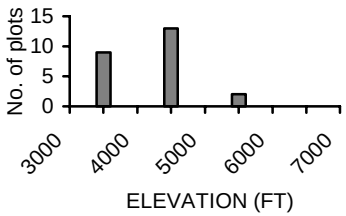
	Site Index PSME
Mean	150
SE	0
Range	150-150
Age	217
n	3

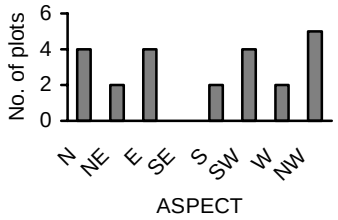
Mountain hemlock/western rhododendron-NWO
Tsuga mertensiana/Rhododendron macrophyllum-NWO
TSME/RHMA3-NWO
CMS613
N=24 (MTH=13; WILL=10; SBLM=1)

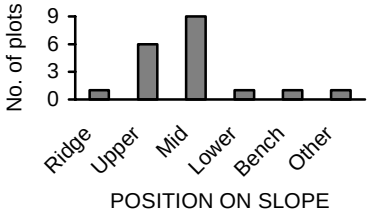
Environment and Distribution

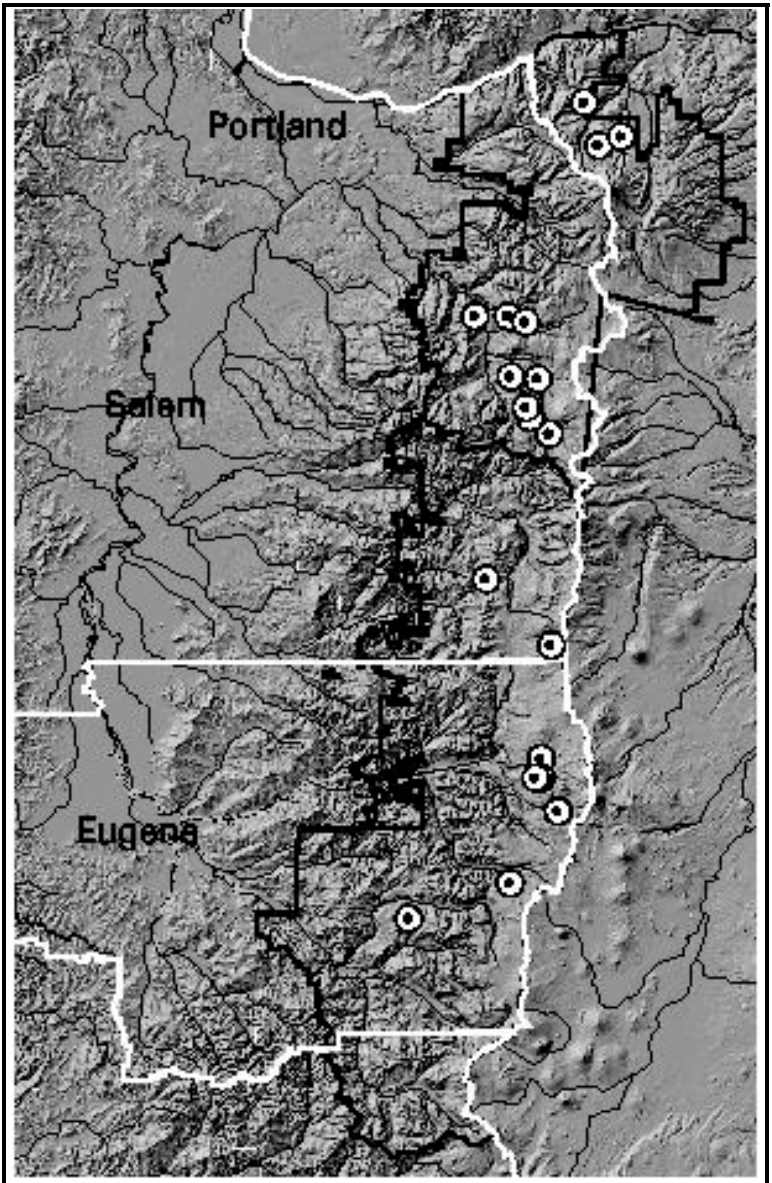
This relatively dry, low elevation association has the highest mean annual temperate (43°F) in the series. Plots are located on slopes averaging 27% (range 3-90%), on mid to upper slope positions. Plot aspects are varied. This association occurs at an average elevation of 4,160 feet (range 3,150-5,314 ft.). It is often in the transition zone between the silver fir and mountain hemlock series.

On the Willamette National Forest, soils are usually shallow and stony or skeletal, often derived from glacial till. On the Mt. Hood, total soil depth averages 102 cm and effective rooting depth averages 61 cm. Soil nitrogen is often low. Soils are sandy loam to loamy sand, and parent material is pumice or colluvial deposits (Diaz and others 1997).









TSME/RHMA3

Vegetation Composition, Structure, and Diversity

The overstory in the TSME/RHMA3-NOW association is dominated by mountain hemlock, usually with a large component of Douglas-fir. Canopy closure of mature trees on plots averages 62%. Cover of understory trees averages 17%. This association has a fairly well developed shrub layer, with tall shrubs averaging 44% cover and low shrubs averaging 15% cover. The shrub layer is dominated by rhododendron, which is always present. Herbaceous cover averages 30%, and is usually dominated by beargrass. Moss cover averages 8%. The average number of species found on the plots is 14.

Common name	Code	Constancy	Cover
Overstory trees			
Mountain hemlock	TSME	100	24
Douglas-fir	PSME	89	17
Pacific silver fir	ABAM	73	9
Western hemlock	TSHE	50	23
Noble fir	ABPR	31	20
Whestern white pine	PIMO3	31	5
Understory trees			
Mountain hemlock	TSME	85	6
Pacific silver fir	ABAM	81	10
Western hemlock	TSHE	58	5
Shrubs			
Rhododendron	RHMA3	100	45
Blue huckleberry	VAME	77	6
Wintergreen	GAOV2	65	4
Prince's pine	CHUM	54	5
Dwarf Oregon grape	MANE2	39	8
Oregon boxwood	PAMY	27	3
Dwarf bramble	RULA2	27	2
Herbaceous			
Beargrass	XETE	92	26
Twinflower	LIBO3	31	4
White vein pyrola	PYPI2	31	2

Average age for the 9 stands sampled in TSME/RHMA3-NWO is 185 years (range 102-257 years). Live basal area averages 329 ft^2/acre (range 100-556 ft^2/acre) in the 20 plots sampled.

Management Implications

TSME/RHMA3-NWO sites have relatively early snowmelt and the longest growing season in the series, but summer frosts are likely. Comparing the Douglas-fir site index to others within this series, TSME/RHMA3-NWO has the lowest productivity for closed-canopy plant associations in the mountain hemlock series, possibly due to shallow, stony soils. Low nitrogen may be a problem in some stands. These are sites that can be difficult to reforest once the overstory has been removed. Because decomposition is slow in this series, most of the soil nitrogen is in the litter and duff, and could be easily lost during site preparation and slash removal.

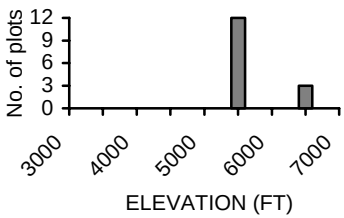
	Site Index PSME	Site Index TSHE	Site Index TSME	Site Index PIMO
Mean	118	50	75	60
SE	51	-	7	-
Range	70-200	-	60-80	-
Age	192	191	252	150
n	4	1	4	1

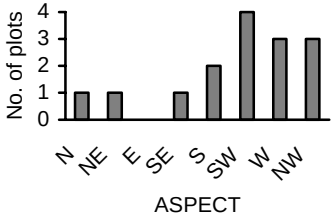
Mountain hemlock/big huckleberry-Sitka mountain ash
Tsuga mertensiana/Vaccinium membranaceum-Sorbus sitchensis
TSME/VAME-SOSI2
CMS228
N=15 (MTH=3; WILL=12)

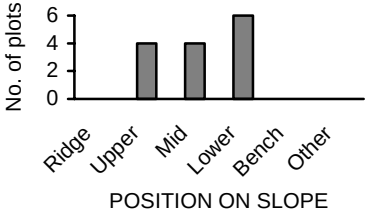
Environment and Distribution

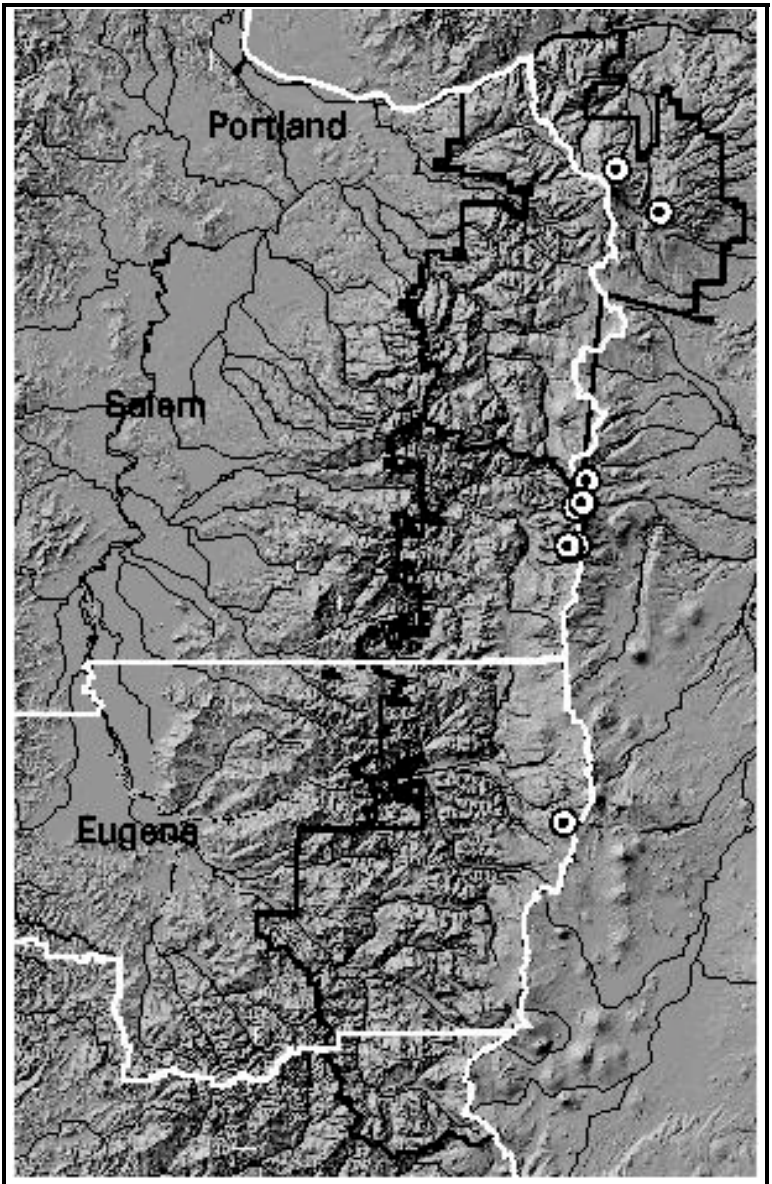
Plots sampled in this plant association are located on slopes averaging 40% (range 13-70%) on middle to upper slope positions. Most plots are on westerly aspects. This association occurs at an elevation averaging 5,628 feet (range 5,120-6,480 ft.) along the crest of the Cascades.

Soils data in this plant association came from two soil pits. Average effective rooting depth is 28 cm. Soils are silty loam, and parent material is volcanic ash or pumice.









TSME/VAME-SOSI2

Vegetation Composition, Structure, and Diversity

The overstory in the TSME/VAME-SOSI2 association is dominated by Pacific silver fir and mountain hemlock. Canopy closure of mature trees on plots averages 59%. Cover of understory trees averages 20%. Tall shrubs average trace amounts of cover and low shrubs average 35% cover. The shrub layer is dominated by blue huckleberry and dwarf bramble, and western mountain ash is common. This plant association has the lowest herbaceous cover in the series, averaging 4%. Moss cover averages less than 1%. The average number of species found in the plots is 11.

Common name	Code	Constancy	Cover
Overstory trees			
Pacific silver fir	ABAM	93	19
Mountain hemlock	TSME	93	30
Understory trees			
Pacific silver fir	ABAM	93	11
Mountain hemlock	TSME	80	1
Shrubs			
Blue huckleberry	VAME	100	22
Dwarf bramble	RULA2	93	4
SItka mountain ash	SOSI2	73	1
Herbaceous			
Broadleaf arnica	ARLA8	60	1
Evergreen violet	VISE3	47	1
Broadleaf lupine	LULA4	40	1
Partridge foot	LUPE	40	1
Sidebells wintergreen	ORSE	40	1
Sitka valerian	VASI	40	1
False hellebore	VEVI	40	1

Average age for the 2 stands sampled in TSME/VAME-SOSI2 is 140 years (range 123-156 years). Live basal area averages 335 ft^2/acre (range 320-360 ft^2/acre) in the 4 plots sampled.

Management Implications

TSME/VAME-SOSI2 sites have a deep, late-melting snowpack and short growing season. These are not areas where silvicultural prescriptions are usually carried out. These are sites that are difficult to reforest once the overstory has been removed. Because decomposition is slow in this series, most of the soil nitrogen is in the litter and duff, and could be easily lost during site preparation and slash removal. Recreational values are high.

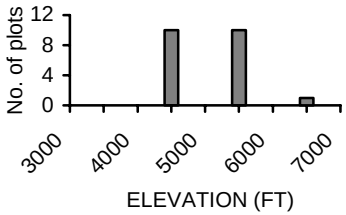
	Site Index PSME
Mean	130
SE	8
Range	120-140
Age	181
n	3

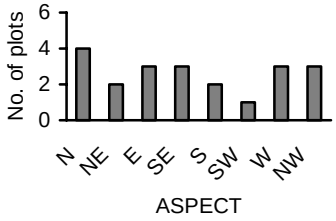
Mountain hemlock/big huckleberry/queencup beadlily-NWO
Tsuga mertensiana/Vaccinium membranaceum/Clintonia uniflora-NWO
TSME/VAME/CLUN2-NWO
CMS229
N=21 (MTH=16; WILL=5)

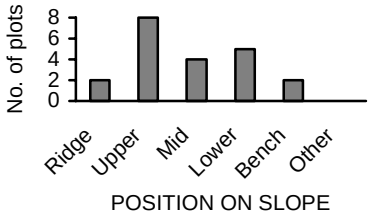
Environment and Distribution

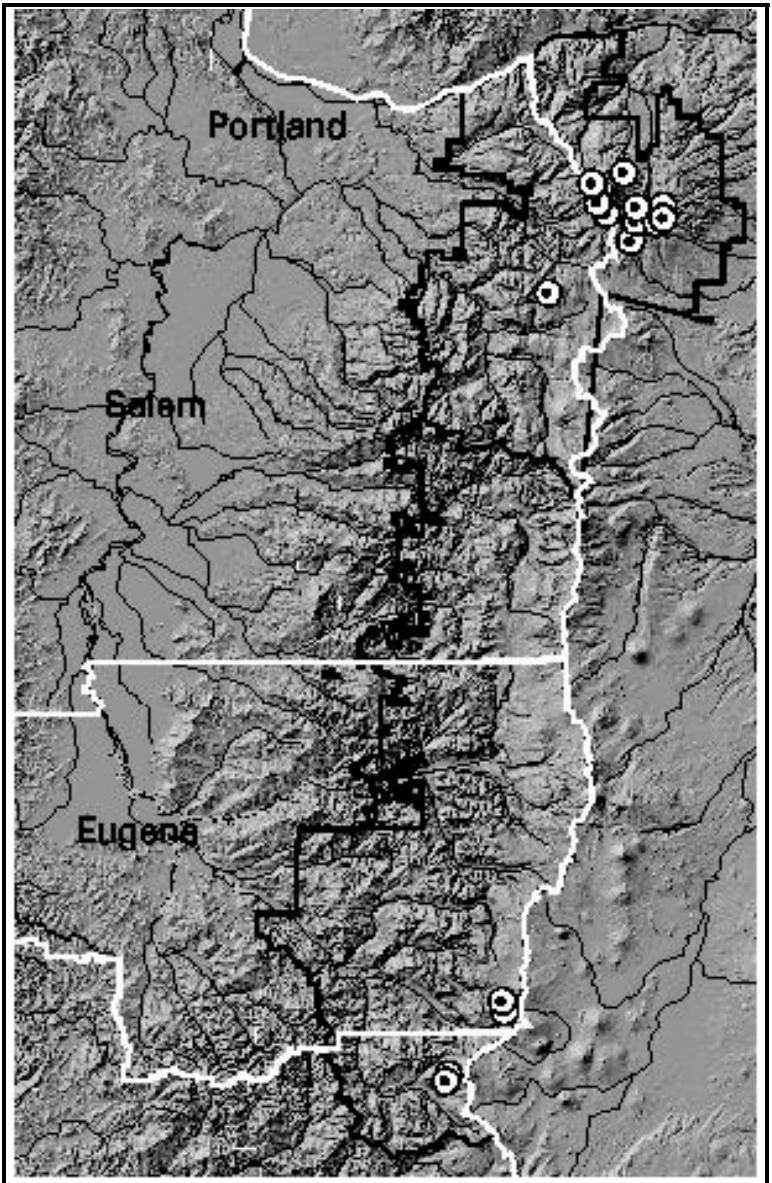
Plots sampled in this plant association are located on slopes averaging 36% (range 3-74%) on varied slope positions. Plot aspects also vary. This association occurs at an elevation averaging 5,029 feet (range 4,400-6,080 ft.). It is a relatively cool mesic closed–canopy forest. It is most common in northeastern Mt. Hood N.F., but also occurs along the crest of the Cascades in southern Willamette N.F.

Soils data for this plant association came from eight soil pits. Two pits had spodic subsurface layers. Average effective rooting depth is 66 cm (25-104 cm). Soils are sandy to silty loams, and parent materials are volcanic ash or pumice.









TSME/VAME/CLUN2

Vegetation Composition, Structure, and Diversity

The overstory in the TSME/VAME/CLUN2-NWO association is dominated by Pacific silver fir and mountain hemlock. Canopy closure of mature trees on plots averages 61%. Cover of understory trees averages 21%. Tall shrubs average 2% cover and low shrubs average 25% cover. The shrub layer is dominated by blue huckleberry and dwarf bramble. Herbaceous cover averages 18%, dominated primarily by sidebells wintergreen and queencup beadlily. Moss cover is low, averaging 3%. The average number of species in the plots is 17.

Common name	Code	Constancy	Cover
Overstory trees			
Pacific silver fir	ABAM	95	24
Mountain hemlock	TSME	95	21
Noble fir	ABPR	57	19
Understory trees			
Pacific silver fir	ABAM	100	18
Mountain hemlock	TSME	57	4
Shrubs			
Dwarf bramble	RULA2	81	11
Blue huckleberry	VAME	81	22
Prince's pine	CHUM	29	5
Herbaceous			
Sidebells wintergreen	ORSE	86	3
Queencup beadlily	CLUN2	71	2
Evergreen violet	VISE3	57	1
Vanilla leaf	ACTR	52	3
Pacific trillium	TROV2	52	1
Starry false Solomon's seal	MAST4	48	2
Beargrass	XETE	48	2

Average age for the 15 stands sampled in TSME/VAME/CLUN2-NWO is 199 years (range 65-266 years). Live basal area averages 331 ft^2/acre (range 120-540 ft^2/acre) in the 18 plots sampled.

Management Implications

TSME/VAME/CLUN2-NWO sites have a short, cool growing season. Comparing the Douglas-fir site index to other plant associations within this series, TSME/VAME/CLUN2-NWO is one of the most productive. Summer frost and gophers can be problems during reforestation. Because decomposition is slow in this series, most of the soil nitrogen is in the litter and duff, and could be easily lost with soil disturbance from stand treatments, ski run development, etc. Huckleberry management potential is high.

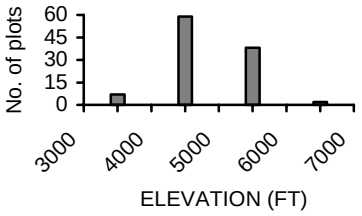
	Site Index PSME	Site Index TSHE	Site Index ABAM	Site Index ABPR	Site Index ABGR
Mean	165	90	40	100	110
SE	28	-	-	-	-
Range	120-210	-	-	-	-
Age	406	109	295	236	138
n	10	1	1	1	1

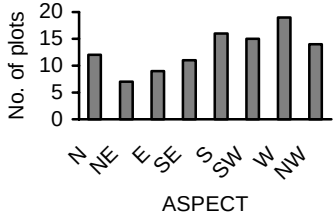
Mountain hemlock/big huckleberry/beargrass-NWO
Tsuga mertensiana/Vaccinium membranaceum/Xerophyllum tenax-NWO
TSME/VAME/XETE-NWO
CMS224
N=106 (MTH=48; WILL=57; SBLM=1)

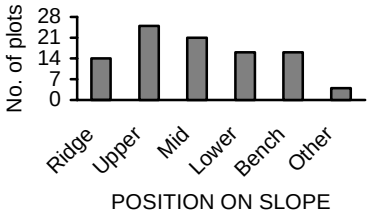
Environment and Distribution

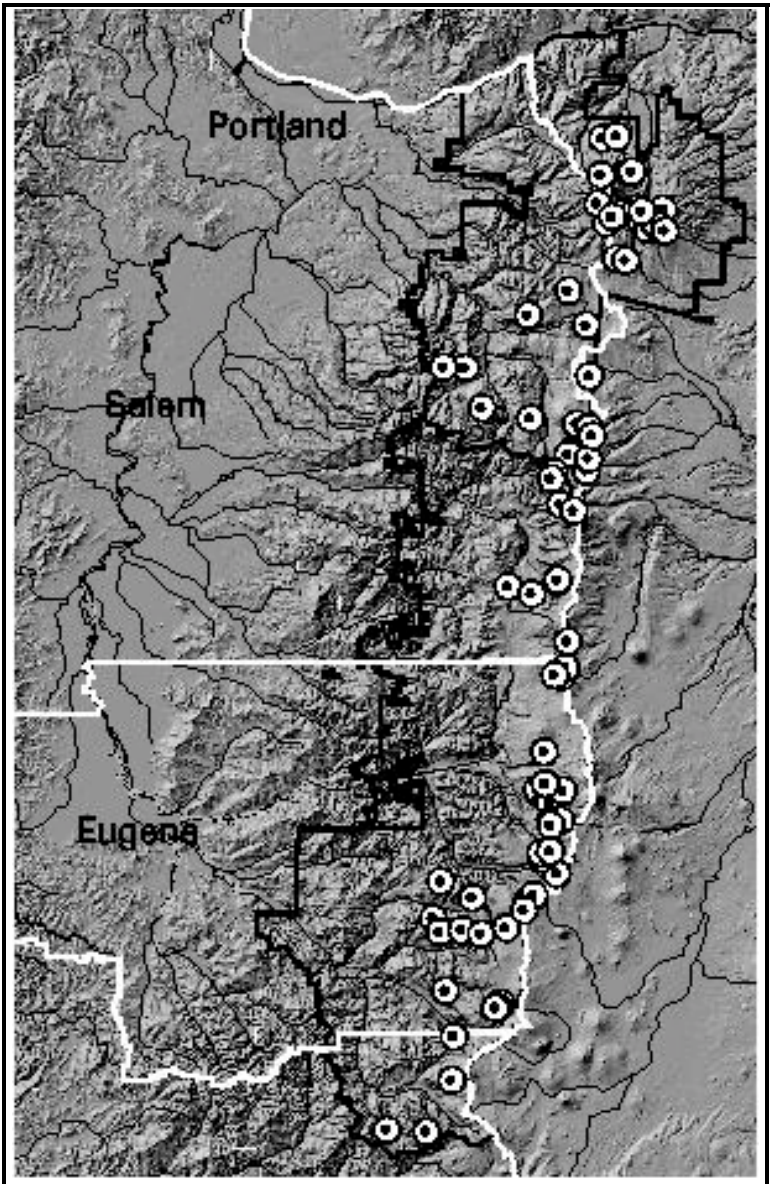
This association is the most common and widely distributed of the mountain hemlock series, ranging from the Cascade crest to high ridges extending to the west. It is the dominant mountain hemlock association on the Mt. Hood N.F. Plots are located on slopes averaging 19% (range 0-70%) on varied slope positions. Plot aspects also vary. This association occurs at an elevation averaging 4,875 feet (range 3,390-6,060 ft.).

Soils data for this plant association come from 24 soil pits. Average effective rooting depth is 69 cm (range 10-150 cm). Soils are sandy loam to silty loam, and parent material is pumice, ash or volcanic sands, and often occur as colluvial deposits. On the Mt. Hood N.F., eight soil samples had elluvial surface layers and four of these had spodic subsurface layers (Diaz and others 1997).









TSME/VAME/XETE

Vegetation Composition, Structure, and Diversity

The overstory in the TSME/VAME/XETE-NWO association is dominated by mountain hemlock, often with a large component of Pacific silver fir. Lodgepole pine is an early seral component in this plant association, and is found on 22% of the plots. Canopy closure of mature trees on plots averages 55%. Cover of understory trees averages 23%. Tall shrubs average 2% cover and low shrubs average 17% cover. The shrub layer is dominated by blue huckleberry. Herbaceous cover averages 38%, and is usually dominated by beargrass. Moss cover averages 9%. The average number of species found on the plots is 13.

Common name	Code	Constancy	Cover
Overstory trees			
Mountain hemlock	TSME	96	24
Pacific silver fir	ABAM	73	18
Douglas-fir	PSME	33	16
Noble fir	ABPR	29	15
Understory trees			
Pacific silver fir	ABAM	77	16
Mountain hemlock	TSME	70	7
Subalpine fir	ABLA	26	6
Shrubs			
Blue huckleberry	VAME	98	18
Dwarf bramble	RULA2	59	3
Prince's pine	CHUM	46	2
Grouse huckleberry	VASC	32	1
Herbaceous			
Beargrass	XETE	93	32
Sidebells wintergreen	ORSE	41	2
Queencup beadlily	CLUN2	24	2
Rattlesnake plantain	GOOB2	24	1

Average age for the 40 stands sampled in TSME/VAME/XETE-NWO is 168 years (range 90-270 years). Live basal area averages 278 ft^2/acre (range 60-560 ft^2/acre) in the 73 plots sampled.

Management Implications

TSME/VAME/XETE-NWO sites have a short, cool, dry growing season with frequent summer frosts. The westerly distribution of this association means that more is outside Wilderness land allocations and timber management is more likely than for most associations within the mountain hemlock series. These are sites that are difficult to reforest once the overstory has been removed. Cold subsurface temperatures and high soil surface temperatures after snowmelt hinder seedling survival. Pocket gophers and beargrass-long-stolon sedge mats can also be regeneration problems. Because decomposition is slow in this series, most of the soil nitrogen is in the litter and duff, and could be easily lost during site preparation and slash removal. Huckleberry management potential is high.

	Site Index PSME	Site Index TSHE	Site Index TSME	Site Index ABGR	Site Index ABPR
Mean	131	70	90	50	90
SE	37	-	9	4	22
Range	60-200	-	80-100	45-55	60-130
Age	237	203	202	111	160
n	31	1	5	3	11

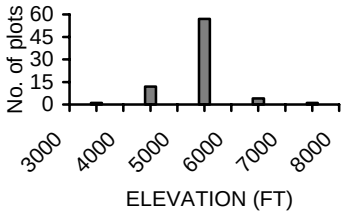
Click here to go back to Table of Contents

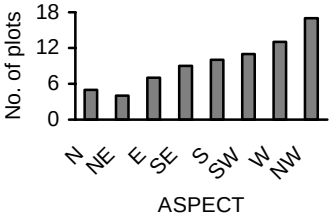
Mountain hemlock/grouse huckleberry-NWO
Tsuga mertensiana/Vaccinium scoparium-NWO
TSME/VASC-NWO
CMS118
N=76 (MTH=9; WILL=67)

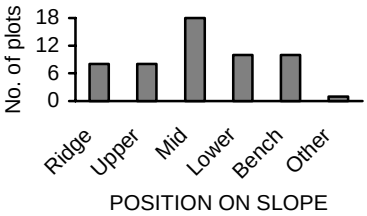
Environment and Distribution

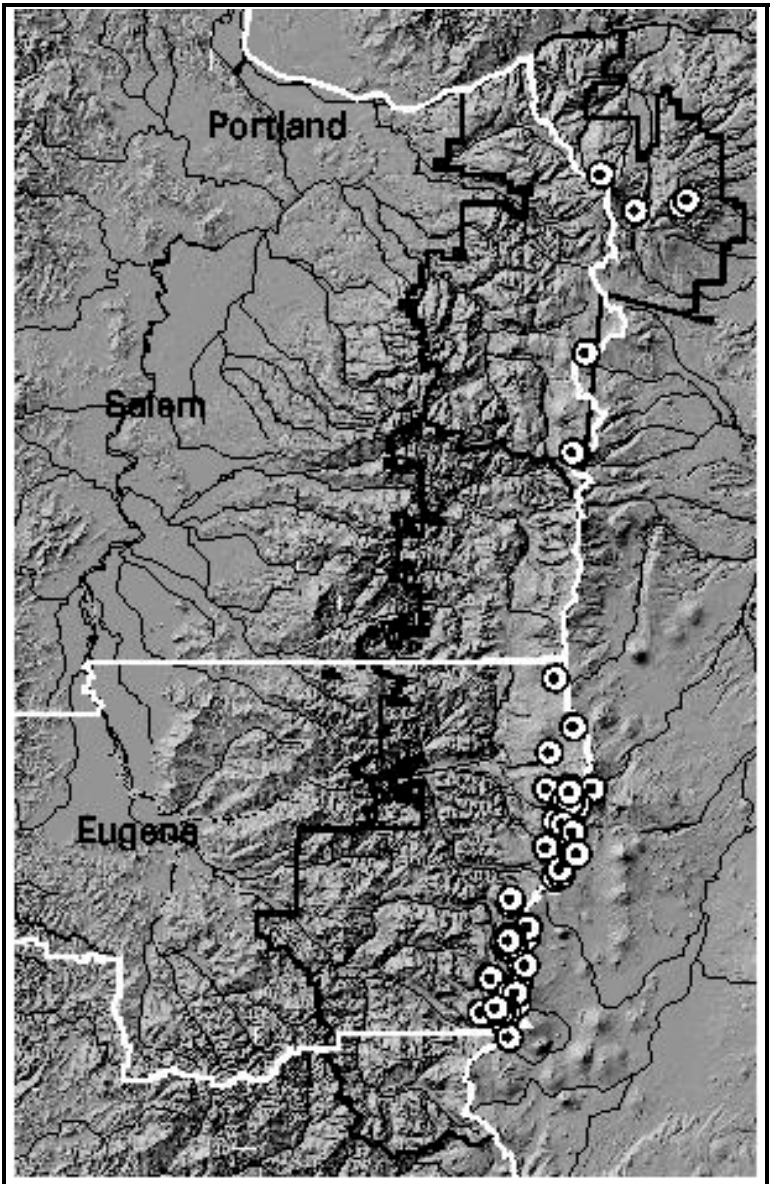
This association is common along the cold, dry portions of the Cascade crest. It is the dominant mountain hemlock association on the Willamette N.F. It is found as closed- to open-canopy forest, on the montane forest side of the transition to parkland types. Plots are located on slopes averaging 14% (range 0-67%), often on middle slope positions. Most plots are on westerly aspects. This association occurs at an elevation averaging 5,428 feet (range 4,000-7,347 ft.).

Soils data for this plant association came from 30 soil pits. Average effective rooting depth is 66 cm (range 15-155 cm). Soils are sandy loam to sand, and parent material is pumice, ash, or volcanic sands, often occurring as colluvial deposits or over glacial till.









TSME/VASC

Vegetation Composition, Structure, and Diversity

The overstory in the TSME/VASC-NWO association is dominated by mountain hemlock. Canopy closure of mature trees on plots averages 43%. Cover of understory trees averages 16%. Lodgepole pine is an early seral component in this plant association, and is found on 33% of the plots. Tall shrubs average a trace amount of cover and low shrubs average 27% cover. The shrub layer is dominated by grouse whortleberry, which is always present. Herbaceous cover averages 13%. Moss cover averages 3%. The average number of species found on the plots is 10, which makes this one of the least diverse plant associations in the mountain hemlock series.

Common name	Code	Constancy	Cover
Overstory trees			
Mountain hemlock	TSME	96	28
Pacific silver fir	ABAM	66	14
Western white pine	PIMO3	42	5
Lodgepole pine	PICO	33	11
Subalpine fir	ABLA2	29	7
Understory trees			
Mountain hemlock	TSME	71	6
Pacific silver fir	ABAM	68	10
Western white pine	PIMO3	32	2
Shrubs			
Grouse huckleberry	VASC	100	20
Blue huckleberry	VAME	72	15
Dwarf bramble	RULA2	41	4
Herbaceous			
Beargrass	XETE	37	16

Average age for the 20 stands sampled in TSME/VASC-NWO is 136 years (range 59-228 years). Live basal area averages 411 ft^2/acre (range 140-786 ft^2/acre) in the 17 plots sampled.

Management Implications

TSME/VASC-NWO sites have a short, frosty growing season. Soils are cold, with limited soil moisture and nutrients and high rock content. These are sites that are difficult to reforest once the overstory has been removed. Because decomposition is slow in this series, most of the soil nitrogen is in the litter and duff, and could be easily lost with soil disturbance from stand treatments, road or trail construction, ski run development, etc. Those sites with abundant blue huckleberry may have some huckleberry management potential, though not as high as the TSME/VAME/ XETE or TSME/VAME/CLUN2 associations.

	Site Index PSME	Site Index TSME	Site Index ABAM	Site Index ABPR	Site Index PICO	Site Index PIMO
Mean	141	89	61	103	38	59
SE	26	18	45	5	12	16
Range	100-170	60-130	3-130	100-110	18-50	40-80
Age	211	303	201	124	94	170
n	8	26	8	3	4	6

This page left blank on purpose.