Introduction to the Vegzone/Subzone Descriptions

Potential Natural Vegetation Map Vegzone and Subzone Descriptions are general descriptions for the potential vegetation types represented in the PNV map. The vegzones are ordered as they are in the ruleset, based on ecological amplitude, shade tolerance, and longevity of species and adheres as much as possible to the logic used to determine series in the various plant association guides used in Region 5 and Region 6 of the USDA-Forest Service. Shade-tolerant species with the narrowest environmental distribution (e.g., Sitka spruce, redwood, and mountain hemlock) are highest in the hierarchy, followed by shade-tolerant species of broader distribution (e.g., Pacific silver fir, western hemlock), followed by less shade-tolerant species that represent earlier-seral conditions in many environments (e.g., Douglas-fir, lodgepole pine).

Constancy Tables

We exploited species composition data from repeated observations of FIA inventory plots used in the GNN imputations to assign each plot location a potential vegzone and subzone. We used repeated field observations corresponding to the entire temporal span of GNN (1986-2017) to maximize the chance of capturing later-seral species for each plot location. As a result, all data used for the constancy tables are from the inventory plots, where N is number of plots used to classify the vegzone or subzone.

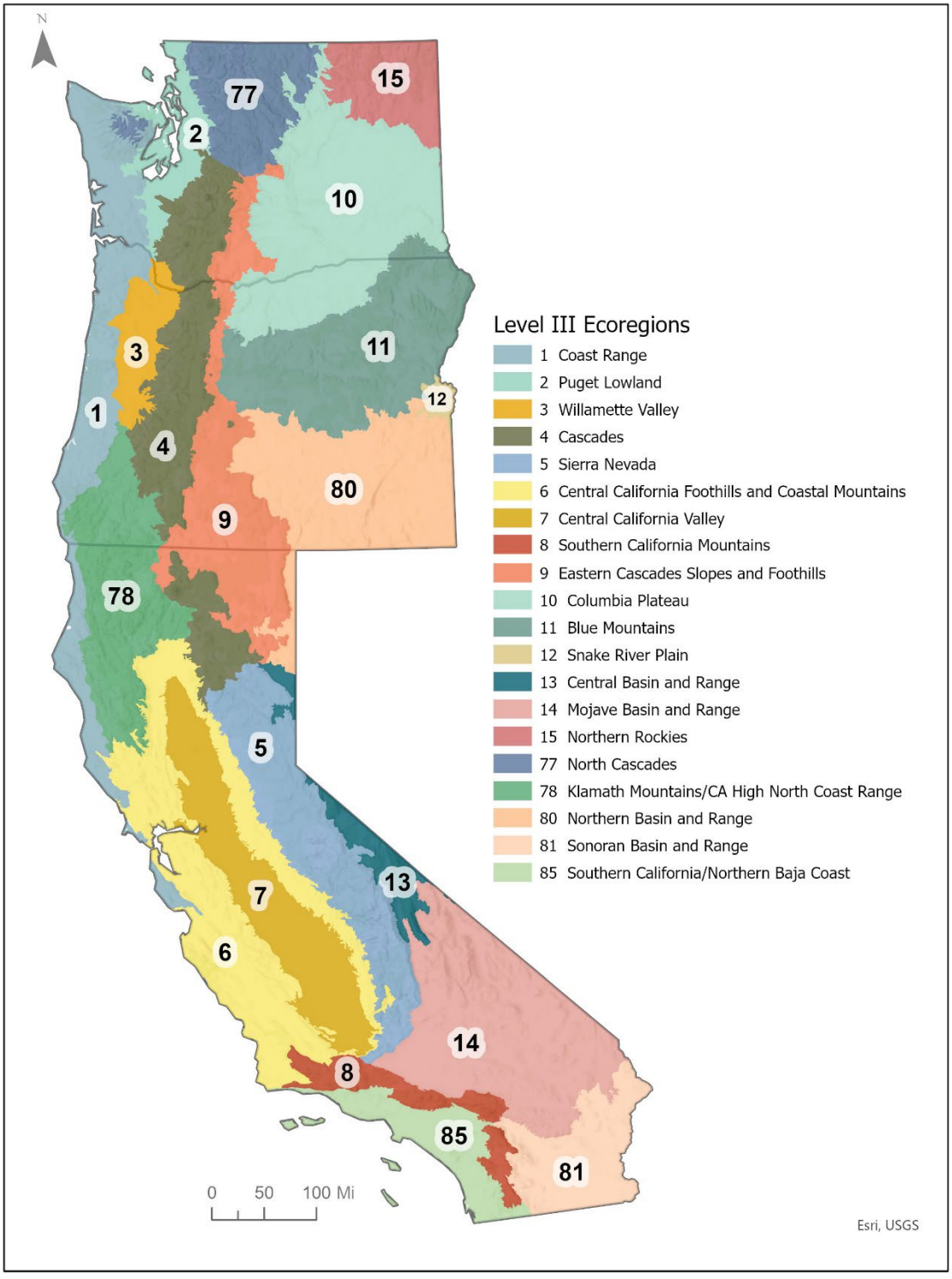
All species codes and common names in the constancy table are listed in the table SpeciesList_20220613.xlsx, along with the scientific name for each code and common name. Species codes are from the NRCS PLANTS database (2018 – 2020).

In the example below, for the Douglas-fir Vegzone (VZ), the 'N Value' represents the number of FIA plots, Constancy (%) indicates that for the Douglas-fir Vegzone, 95% of the 3,649 plots had Douglas-fir present, with a mean cover (Mean Cover (%)) within those plots of 41%. Ponderosa pine was present on 60% of the 3,649 plots, with a mean cover of 15% overall. To be included in the constancy table within the descriptions, a minimum of 33% constancy was needed, along with a minimum cover of 10% for trees, 5% for shrubs, and 1% for forbs and/or graminoids.

Common Name	**Species**	**Constancy (%)**	**Mean Cover (%)**
Douglas-fir VZ; N = 3,649			
Trees			
Douglas-fir	PSME	95	41
Ponderosa pine	PIPO	60	15

In some cases, the constancy tables showed a difference in species by the Omernik Level III Ecoregion (Figure XX). Those cases are noted within the descriptions by vegzone and subzone.

Figure XX. Omernik Level III Ecoregions.


N
77
15
2
10
11
3
12
1
4
80
9
78
5
13
7
6
14
8
85
81
0 50 100 Mi
Level III Ecoregions
1 Coast Range
2 Puget Lowland
3 Willamette Valley
4 Cascades
5 Sierra Nevada
6 Central California Foothills and Coastal Mountains
7 Central California Valley
8 Southern California Mountains
9 Eastern Cascades Slopes and Foothills
10 Columbia Plateau
11 Blue Mountains
12 Snake River Plain
13 Central Basin and Range
14 Mojave Basin and Range
15 Northern Rockies
77 North Cascades
78 Klamath Mountains/CA High North Coast Range
80 Northern Basin and Range
81 Sonoran Basin and Range
85 Southern California/Northern Baja Coast
Esri, USGS

PNV Map Vegzone and Subzone Descriptions

Sitka Spruce Vegzone (9)

Vegzone	Vegzone Name	Subzone	Subzone Name
9	Sitka Spruce	46	Wet
9	Sitka Spruce	47	Very Wet

Sitka spruce (*Picea sitchensis*) extends in a narrow band along the west coast of North America from Alaska into northern California. The Sitka Spruce Vegzone is typified by small annual temperature variation, minor summer plant moisture stress, and very high precipitation. In northwest Washington, the Sitka Spruce Vegzone occurs in lowland, wetter areas, up to about 600 feet in elevation. It generally represents very productive lands due to the warm, moist soils and low atmospheric drought where it occurs. In northwest Oregon, the Sitka Spruce Vegzone occurs in the strongly maritime climate near the ocean and follows the coastal fog up river valleys. This vegzone extends much further inland toward the northern part of the Coast Range than in the south, where ridge systems intercept the fog layer. Southwest Oregon is near the southern end of the species range. Although the species extends further inland along major drainages, most of the vegzone can be found within one mile of the Pacific Ocean, in the wet and mild climate of the coastal plains and headlands. Tanoak (LIDE3) replaces Sitka spruce (PISI) as the potential climax species on inland sites as marine influence wanes. North of Port Orford, the Sitka Spruce Vegzone widens and abuts the Western Hemlock Vegzone on its eastern flank. South of Brookings the Sitka Spruce Vegzone becomes narrow and discontinuous.

This vegzone is characterized by the potential presence of Sitka spruce (PISI) at a minimum of 10% cover or coastal proximity value of 275 [units] or less, where PISI is absent. Sitka spruce is present in the overstory of most stands and averages more than 20% cover. Western hemlock (TSHE) and red alder (ALRU2) are frequently present as well.

In California's Manual of Vegetation, Sitka spruce (PISI) falls within the Sitka Spruce Forest and Woodland Alliance (CNPS/A Manual of California Vegetation Online). Grand fir (ABGR), red alder (ALRU2), redwood (SESE3), and western hemlock (TSHE) may also be present. It is found in bottomlands, upland steep slopes, and seaward bluffs and ravines near the ocean.

Sitka spruce (PISI) grows in dense stands dominating the overstory, or in association with western hemlock (TSHE), red alder (ALRU2), and Douglas-fir (PSME). Occasionally, dense pockets of lodgepole pine (or shore pine) (PICO) are interspersed among the spruce, as well as western redcedar (THPL). The shrub layer is often salmonberry (RUSP), red huckleberry (VAPA), salal (GASH), cascara buckthorn (FRPU7), California blackberry (RUUR), red elderberry (SARA2), vine maple (ACCI), and California huckleberry (VAOV2). Western swordfern (POMU), deer fern (BLSP), Oregon oxalis (OXOR), common ladyfern (ATFI), rusty menziesia (MEFE), and western brackenfern (PTAQ) are common in the herb layer.

Common Name	Species	Constancy (%)	Mean Cover (%)
Sitka Spruce VZ; N = 481			
Trees			
Sitka spruce	PISI	94	20
Western hemlock	TSHE	74	47
Red alder	ALRU2	73	29
Douglas-fir	PSME	69	40
Shrubs			
Salmonberry	RUSP	86	19
Salal	GASH	63	15
Cascara buckthorn	FRPU7	50	7
Vine maple	ACCI	40	13
Forbs/Graminoids			
Western swordfern	POMU	90	21
Deer fern	BLSP	61	3
Oregon oxalis	OXOR	51	15
Common ladyfern	ATFI	37	2

Sitka Spruce Subzones

Sitka Spruce – Very Wet (47) sites represent the wettest sites of the vegzone. This subzone makes up the majority of the vegzone. It is concentrated around the Olympic Peninsula, along the Washington coast, and south along the coast of Oregon. This subzone is found less frequently along the southern Oregon and northern California coast, where the Wet Subzone is more common. Mean annual temperature ranges between 47 and 51°F, while mean annual precipitation ranges from 79 to 116 inches. Sitka spruce (PISI), western hemlock (TSHE), red alder (ALRU2), Douglas-fir (PSME), and western redcedar (THPL) are the most common overstory tree species. Indicator species used to classify this subzone, using the representative Warm Wet group, include salmonberry (RUSP), deer fern (BLSP), common ladyfern (ATFI), false lily of the valley (MADI), and American skunkcabbage (LYAM3).

Common Name	Species	Constancy (%)	Mean Cover (%)
Very Wet; N = 283			
Trees			
Sitka spruce	PISI	97	19
Western hemlock	TSHE	83	46
Red alder	ALRU2	79	30
Douglas-fir	PSME	71	37
Western redcedar	THPL	34	24
Shrubs			
Salmonberry	RUSP	99	26

Salal	GASH	61	14
Cascara buckthorn	FRPU7	50	7
Vine maple	ACCI	44	13
Forbs/Graminoids			
Western swordfern	POMU	94	22
Deer fern	BLSP	75	4
Oregon oxalis	OXOR	57	16
Common ladyfern	ATFI	51	2
False lily of the valley	MADI	36	6
Siberian springbeauty	CLSI2	35	3

Sitka Spruce – Wet (46) sites represent instances of this vegetation zone farther inland from the coast. This subzone is most frequently found along the southern Oregon and northern California coast, and occasionally along the northern Oregon and Washington coast where it is slightly drier. Mean annual temperature ranges between 47 and 53°F, while mean annual precipitation ranges from 63 to 99 inches. Sitka spruce (PISI), along with Douglas-fir (PSME), red alder (ALRU2), and western hemlock (TSHE) dominate the overstory. Western redcedar (THPL), if present, may have high cover. Indicator species used to classify this subzone, using the representative Warm Wet Mesic group, include western swordfern (POMU), salal (GASH), red alder (ALRU2), Oregon oxalis (OXOR), vine maple (ACCI), and Siberian springbeauty (CLSI2).

Common Name	Species	Constancy (%)	Mean Cover (%)
Wet; N = 198			
Trees			
Sitka spruce	PISI	89	22
Douglas-fir	PSME	66	45
Red alder	ALRU2	64	26
Western hemlock	TSHE	62	47
Shrubs			
Salmonberry	RUSP	68	5
Salal	GASH	66	17
Cascara buckthorn	FRPU7	51	7
California blackberry	RUUR	46	5
California huckleberry	VAOV2	40	15
Vine maple	ACCI	34	14
Forbs/Graminoids			
Western swordfern	POMU	85	19
Deer fern	BLSP	42	2
Oregon oxalis	OXOR	42	14
Western brackenfern	PTAQ	39	2

Redwood Vegzone (17)

Vegzone	Vegzone Name	Subzone	Subzone Name
17	Redwood	48	Very Moist
17	Redwood	49	Wet

Redwood (*Sequoia sempervirens*) are the tallest, heaviest, and among the oldest trees on earth, with some individuals exceeding 2,000 years (Fettig et al. 2019). This subzone occurs along a narrow coastal belt, influenced by moisture availability, from southwest Oregon south to the Big Sur coast in central California (Carroll, Sillett and Kramer 2014), which provides the relatively stable temperature, moisture, and fog that redwoods need. These forests depend on a maritime Mediterranean climate where the winters are cool and rainy, and the summers are dry. The mean annual precipitation is 70 inches, with 90 percent falling between October and May. The dry summers are mitigated by a heavy fog belt. Elevations range from sea level up to 3,500 feet and distances of up to 35 miles inland from the coast (https://www.fs.fed.us/database/feis/plants/tree/seqsem/all.html).

This vegzone is characterized by the potential presence of redwood (SESE3) at a minimum of 10% cover. Redwood averages over 60% cover in the overstory. Tanoak (LIDE3) and Douglas-fir (PSME) are also frequently present.

In California's Manual of Vegetation, redwood falls into the Redwood Forest and Woodland Alliance (CNPS/A Manual of California Vegetation Online). The canopy of the redwood forest is often multi-layered; commonly associated species in lower layers of the canopy include western hemlock (TSHE), Douglas-fir (PSME), tanoak (LIDE3), grand fir (ABGR), western redcedar (THPL), Sitka spruce (PISI), Pacific madrone (ARME), bigleaf maple (ACMA3), vine maple (ACCI), and red alder (ALRU2). The understory ranges from sparse to dense and is comprised of shrubs and herbaceous species such as western azalea (RHOC), Pacific rhododendron (RHMA3), California hazel (COCO6), salmonberry (RUSP), California huckleberry (VAOV2), red huckleberry (VAPA), western swordfern (POMU), common ladyfern (ATFI), deer fern (BLSP), and Oregon oxalis (OXOR), among other species (Van Pelt et al. 2016). Coastal redwood forest composition and stand structure vary widely across the range due to changes in moisture availability from north to south (Van Pelt et al. 2016), as well as elevation, coastal proximity, soil type, topographic position (e.g. slope, aspect), and disturbance and management history (Mooney and Dawson 2016).

Common Name	Species	Constancy (%)	Mean Cover (%)
Redwood VZ; N = 327			
Trees			
Redwood	SESE3	100	62
Tanoak	LIDE3	87	46
Douglas-fir	PSME	86	34
Pacific Madrone	ARME	45	11
Shrubs			

California huckleberry	VAOV2	62	16
Poisonoak	TODI	40	5
Forbs/Graminoids			
Western swordfern	POMU	69	10
Western brackenfern	PTAQ	47	3

Redwood Subzones

Redwood – Wet (49) This subzone represents the wetter redwood (SESE3) sites. This subzone is found most frequently north of Eureka along the California coast within the Klamath Mountains. Mean annual temperature ranges between 50 and 57°F, while mean annual precipitation ranges from 46 to 73 inches. Common overstory species include redwood (SESE3), Douglas-fir (PSME), tanoak (LIDE3), California laurel (UMCA), Pacific madrone (ARME), and red alder (ALRU2). Western hemlock (TSHE) and white fir (ABCO) may also be present. Indicator species used to classify this subzone, using the representative Warm Wet Mesic group, include western swordfern (POMU), salal (GASH), Oregon oxalis (OXOR), Pacific rhododendron (RHMA3), California laurel (UMCA), and red alder (ALRU2).

Common Name	Species	Constancy (%)	Mean Cover (%)
Wet; N = 191			
Trees			
Redwood	SESE3	99	69
Douglas-fir	PSME	84	33
Tanoak	LIDE3	83	40
Shrubs			
California huckleberry	VAOV2	65	15
Salal	GASH	46	7
Poisonoak	TODI	36	4
Forbs/Graminoids			
Western swordfern	POMU	83	13
Oregon oxalis	OXOR	43	5
Western brackenfern	PTAQ	42	2

Redwood – Very Moist (48) This subzone represents the drier, slightly more inland redwood (SESE3) sites. Mean annual temperature ranges between 51 and 57°F, while mean annual precipitation ranges from 45 to 63 inches. This subzone is most commonly found south of Eureka, within the Coastal Mountains of northern California. Common overstory species within this subzone include redwood (SESE3), tanoak (LIDE3), Douglas-fir (PSME), and Pacific madrone (ARME). California live oak (QUAG), canyon live oak (QUCH2), and California laurel (UMCA) may also be present. Indicator species used to classify this subzone, using the representative Warm Mesic group, include California huckleberry (VAOV2), common whipplevine (WHMO), starflower (TRBO2), and California blackberry (RUUR).

Common Name	Species	Constancy (%)	Mean Cover (%)
Very Moist; N = 136			
Trees			
Redwood	SESE3	100	52
Tanoak	LIDE3	92	54
Douglas-fir	PSME	89	37
Pacific madrone	ARME	74	13
Shrubs			
California huckleberry	VAOV2	58	17
Poison oak	TODI	46	5
Common whipplevine	WHMO	38	4
Forbs/Graminoids			
Western brackenfern	PTAQ	53	3
Western swordfern	POMU	49	2

Mountain Hemlock Vegzone (23)

Vegzone	Vegzone Name	Subzone	Subzone Name
23	Mountain Hemlock	91	Cold Very Moist
23	Mountain Hemlock	92	Cool Very Moist
23	Mountain Hemlock	93	Cool Wet
23	Mountain Hemlock	94	Cool Very Wet

The Mountain Hemlock (*Tsuga mertensiana*) Vegzone forms a continuous band at higher elevations in the western Olympic Mountains and Cascade Mountains from Washington to central and southern Oregon. In the Klamath-Siskiyou Mountains, northern California Coast Range, southern Cascades of California, and Sierra Nevada, the vegzone can be more scattered, occurring on northerly aspects and environments that favor persistent snowpack. Isolated occurrences of the vegzone east of the Cascades are known from the western Wallowa Mountains in northeast Oregon, as well as Newberry Crater and Yamsey Mountain in Central Oregon.

The Mountain Hemlock Vegzone occurs in cool to cold, moist to wet environments. This vegzone is found at higher elevations and may be the highest elevation forest vegzone in some settings. Environments are characterized by deep, persistent snowpacks, with frequent summer frosts. Cooler temperatures continue far into spring and early summer. Growing seasons are short, and productivity is relatively low.

At the highest elevations, this vegzone usually grades quickly into subalpine parkland. However, subalpine fir (ABLA) or whitebark pine (PIAL) associations can be found at the upper fringe of the vegzone on some sites. At lower elevations, it grades into the Pacific Silver Fir (ABAM) Vegzone in a complex fashion on sites with high maritime influences, or into the White Fir-

Grand Fir (ABGRC) Vegzone or California-Shasta Red Fir (ABMAS) Vegzone on sites with more continental influence or those that are excessively drained. At its driest fringe, it grades into the Subalpine Fir or Whitebark Pine Vegzones. Similar sites further east in the Blue Mountains usually support the Subalpine Fir Vegzone.

This vegzone is characterized by the potential presence of mountain hemlock at a minimum of 10% cover. Mountain hemlock is present in the overstory of most stands and averages over 50% cover. Pacific silver fir (ABAM), a common associate, is found in about 60% of the canopies, and can occur with high cover where present. Subalpine fir (ABLA), Shasta red fir (ABMAS), lodgepole pine (PICO), and occasionally whitebark pine (PIAL) are found within the higher elevation (often transitional to parkland) portion of this vegzone. Stands at the upper elevational limits may also consist of nearly pure canopies of mountain hemlock (TSME), with crowns heavily festooned by lichens. These stands often have a uniform size-class structure, giving the false impression of an even-aged stand. More moderate conditions support an abundance of other tree species, including western hemlock (TSHE), western redcedar (THPL), Douglas-fir (PSME), western larch (LAOC), and western white pine (PIMO3). Reproduction can be sparse.

In California's Manual of Vegetation, mountain hemlock (TSME) falls within the Mountain Hemlock Forest and Woodland Alliance. Mountain hemlock may be co-dominant with California red fir (ABMA), Sierra lodgepole pine (PICOM), western white pine (PIMO3), and whitebark pine (PIAL). It is found on subalpine stream benches, slopes, and most extensively on north-facing aspects and lake margins (CNPS/A Manual of California Vegetation Online).

Understory characteristics in this vegzone vary from dense herbaceous or shrub layers to depauperate conditions characterized by a few scattered plants and deep litter. Thinleaf huckleberry (VAME) is a consistent shrub, and sidebells wintergreen (ORSE) and queen's cup (CLUN2) are herbs found in about a third of the plots characterizing the vegzone.

Common Name	**Species**	**Constancy (%)**	**Mean Cover (%)**
Mountain Hemlock VZ; N = 824			
Trees			
Mountain hemlock	TSME	99	53
Pacific silver fir	ABAM	61	48
Lodgepole pine	PICO	40	20
Noble fir-Shasta red fir	ABPRSH	35	26
Shrubs			
Thinleaf huckleberry	VAME	60	15
Forbs/Graminoids			
Sidebells wintergreen (One-sided pyrola)	ORSE	38	1
Queen's cup (Bride's bonnet)	CLUN2	33	2

Mountain Hemlock Subzones

Mountain Hemlock – Cool Very Wet (94) This subzone most commonly occurs in the western Olympic Mountains and western Cascade Mountains of Washington from Canada south to Mount Rainier. South of Mount Rainier and east of the Cascade Crest into Central Oregon, the subzone distribution is scattered and patchy. This subzone occurs in cool, wet environments, often adjacent to riparian areas or in more poorly drained sites. Mean annual temperature ranges between 39 and 44°F, while mean annual precipitation ranges from 89 to 142 inches. Mountain hemlock (TSME) and Pacific silver fir (ABAM) are often found together in these environments. This is a shrub-rich subzone, with many cool, wet indicator shrubs. Wet site herb indicators are also found in the herb layer. Indicator species used to classify this subzone, using the representative Warm Wet group, include common ladyfern (ATFI), salmonberry (RUSP), deer fern (BLSP), western oakfern (GYDR), devilsclub (OPHO), bunchberry dogwood (COCA13), and false lily of the valley (MADI).

Common Name	Species	Constancy (%)	Mean Cover (%)
Cool Very Wet; N = 83			
Trees			
Mountain hemlock	TSME	100	50
Pacific silver fir	ABAM	92	53
Western hemlock	TSHE	49	36
Green alder	ALVI5	35	14
Shrubs			
Oval-leaf blueberry	VAOV	83	25
Thinleaf huckleberry	VAME	82	8
Salmonberry	RUSP	72	7
Stawberryleaf raspberry	RUPE	71	5
Rusty menziesia	MEFE	70	6
Forbs/Graminoids			
Common ladyfern	ATFI	76	5
Queen's cup (Bride's bonnet)	CLUN2	73	2
Threeleaf foamflower	TITR	70	3
Deer fern	BLSP	64	3
Twistedstalk	STLA16	57	2
Western oakfern	GYDR	53	4
Sitka valerian	VASI	47	4
Starry false Solomon's-seal	MAST4	36	2
False lily of the valley	MADI	34	5

Mountain Hemlock – Cool Wet (93) This subzone is the most common subzone within the vegzone and occurs throughout the described vegzone distribution. In the central and southern

Oregon Cascades, the Cool Wet subzone is usually found west of the Cascade Crest and borders warmer vegzones (Silver Fir (ABAM), Western Hemlock (TSHE), White Fir-Grand Fir (ABGRC), or California-Shasta Red Fir (ABMAS)).

The Cool Wet Subzone represents the warmest and most productive environment in the Mountain Hemlock Vegzone. Mean annual temperature ranges between 39 and 43°F, while mean annual precipitation ranges from 61 to 97 inches. Pacific silver fir (ABAM), western hemlock (TSHE), and subalpine fir (ABLA) are common associates. Early seral communities can contain western white pine (PIMO3) and noble fir (ABPR) or Shasta red fir (ABMAS), with Douglas-fir (PSME) a significant component of overstory canopies in warmer microsites. Diverse shrub layers often form after disturbance. Oregon boxleaf (PAMY), rusty menziesia (MEFE), and grouse whortleberry (VASC) are found in at least a quarter of the FIA plots. This subzone typically has a variable, diverse, herb-rich understory. Indicator species used to classify this subzone, using the representative Warm Wet Mesic group, include sidebells wintergreen (ORSE), western white pine (PIMO3), queen's cup (CLUN2), threeleaf foamflower (TITR), twinflower (LIBO3), and starry false Solomon's seal (MAST4).

Common Name	Species	Constancy (%)	Mean Cover (%)
Cool Wet; N = 473			
Trees			
Mountain hemlock	TSME	100	53
Pacific silver fir	ABAM	77	49
Douglas-fir	PSME	40	31
Noble fir-Shasta red fir	ABPRSH	38	21
Western hemlock	TSHE	36	28
Subalpine fir	ABLA	34	21
Shrubs			
Thinleaf huckleberry	VAME	78	18
Oval-leaf blueberry	VAOV	39	13
Forbs/Graminoids			
Sidebells wintergreen (One-sided pyrola)	ORSE	45	1
Common beargrass	XETE	41	15
Queen's cup (Bride's bonnet)	CLUN2	37	2

Mountain Hemlock – Cool Very Moist (92) This subzone occurs south of Snoqualmie Pass in the Washington Cascades to the Central Sierra Nevada Mountains of California. It is the most common Mountain Hemlock subzone in the Klamath-Siskiyou and North Coast Range Mountains of southwest Oregon and northwest California. Locations west of the Cascade Crest in Oregon and Washington and throughout California usually occur where topographic positions and/or soils do not hold moisture. The Cool Very Moist Subzone often borders the White Fir-Grand Fir (ABGRC) or California Red Fir-Shasta Red Fir (ABMAS) Vegzones from central Oregon to the central Sierra Nevada Mountains.

This subzone occurs in moderate environments. Mean annual temperature ranges between 39 and 44°F, while mean annual precipitation ranges from 52 to 77 inches. This subzone's environment falls between the Cool Wet and the Cold Very Moist Subzones. Mountain hemlock may occur as a single-species overstory in some places, with white fir-grand fir (ABGRC) and Shasta red fir (ABMAS) associated in warmer microsites. Early seral conifers include lodgepole pine (PICO), western white pine (PIMO3), and Douglas-fir (PSME). The shrub layer is varied and has relatively low cover. Indicator species used to classify this subzone, using the representative Warm Mesic group, include common prince's-pine (CHUM), white hawkweed (HIAL2), whiteveined pyrola (PYPI2), common beargrass (XETE), western rattlesnake plantain (GOOB2), and vanillaleaf (ACTR).

Common Name	Species	Constancy (%)	Mean Cover (%)
Cool Very Moist; N = 105			
Trees			
Mountain hemlock	TSME	97	46
Lodgepole pine	PICO	53	22
Noble fir-Shasta red fir	ABPRSH	50	43
Douglas-fir	PSME	37	26
Grand fir-White fir	ABGRC	36	29
Shrubs			
Pinemat manzanita	ARNE	41	6
Grouse whortleberry	VASC	34	9
Forbs/Graminoids			
Sidebells wintergreen (One-sided pyrola)	ORSE	50	1
White hawkweed	HIAL2	39	1

Mountain Hemlock – Cold Very Moist (91) This subzone occurs south of Snoqualmie Pass in the Washington Cascades to the Central Sierra Nevada Mountains of California. It is absent in the Klamath-Siskiyou and North Coast Range Mountains of southwest Oregon and northwest California. The Cold Very Moist Mountain Hemlock Subzone is best expressed from Santiam Pass in central Oregon to the Mount McLoughlin area in southern Oregon, where it occurs on coarse ash/pumice-derived soils. It is also common, although much more scattered, in the central and southern Sierra Nevada Mountains in California. As noted for the Cool Very Moist Subzone, this subzone also occurs where topographic positions and/or soils do not hold moisture (either deep coarse pumice/ash deposits or shallow bedrock). The effective moisture is expected to be less in the Cold Very Moist Subzone than the Cool Very Moist Subzone and the temperatures colder in sites supporting the Cold Very Moist Subzone than in sites supporting the Cool Very Moist Subzone.

This subzone occurs in cold, dry environments. Mean annual temperature ranges between 38 and 42°F, while mean annual precipitation ranges from 50 to 69 inches. Plant communities in this group are extremely species-poor. Lodgepole pine (PICO) is the dominant early seral conifer of higher cover, although western white pine (PIMO3) may be present. Subalpine fir (ABLA), noble fir (ABPR), and Pacific silver fir (ABAM) may also be occasionally present. Very few

understory species are consistently found. Shrub and herb cover is low and not very diverse. Indicator species used to classify this subzone, using the representative Cool Mesic group, include lodgepole pine (PICO), grouse whortleberry (VASC), pinemat manzanita (ARNE), and long-stolon sedge (CAIN9).

Common Name	Species	Constancy (%)	Mean Cover (%)
Cold Very Moist; N = 163			
Trees			
Mountain hemlock	TSME	97	58
Lodgepole pine	PICO	83	27
Shrubs			
Grouse whortleberry	VASC	60	16
Pinemat manzanita	ARNE	42	7
Forbs/Graminoids			
Long-stolon sedge	CAIN9	42	2

Pacific Silver Fir Vegzone (22)

Vegzone	Vegzone Name	Subzone	Subzone Name
22	Silver Fir	87	Mild Wet
22	Silver Fir	88	Mild Very Wet
22	Silver Fir	89	Cold Wet

The Pacific Silver Fir (*Abies amabilis*) Vegzone occurs in the Olympic Mountains as well as the Cascades from northern Washington to the Rogue-Umpqua Divide in southern Oregon. This vegzone is found only in areas of strong maritime climatic influence, usually within a few miles of the Cascade crest. This vegzone 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 0ºF.

Pacific silver fir (ABAM) climax sites are more moderate than those in the Mountain Hemlock (TSME) Vegzone. Most sites are over 4,000 feet but stands of Pacific silver fir may follow cold air down valley bottoms to as low as 2,200 feet. The vegzone is normally bounded by the Mountain Hemlock (TSME) and (Nobel Fir) California Red Fir-Shasta Red Fir (ABPRSH) Vegzones on yet cooler sites with deeper snowpacks, or by the Western Hemlock (TSHE) or the White Fir-Grand Fir (ABGRC) Vegzones on warmer, less snowy sites.

This vegzone is characterized by the potential presence of Pacific silver fir at a minimum of 5% cover. Pacific silver fir is present in the overstory of most stands and averages 36% cover, with western hemlock almost as frequent with an average of 52% cover.

Common tree species in the Pacific Silver Fir Vegzone include western hemlock (TSHE), western redcedar (THPL), Douglas-fir (PSME), noble fir (ABPR), and Shasta red fir (ABMAS).

The seral role of each species varies by location and environment. For example, western hemlock is more important on warmer sites and noble fir (ABPR) and western larch (LAOC) are only components north of Santiam Pass.

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

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. Most frequently found understory species include thinleaf huckleberry (VAME), oval-leaf blueberry (VAOV), western swordfern (POMU), queen's cup (CLUN2), red huckleberry (VAPA), and bunchberry dogwood (COCA13).

Common Name	**Species**	**Constancy (%)**	**Mean Cover (%)**
Pacific Silver Fir VZ; N = 1,450			
Trees			
Pacific silver fir	ABAM	89	36
Western hemlock	TSHE	83	52
Douglas-fir	PSME	74	40
Noble fir-Shasta red fir	ABPRSH	39	19
Western redcedar	THPL	39	27
Shrubs			
Thinleaf huckleberry	VAME	66	9
Oval-leaf blueberry	VAOV	64	10
Vine maple	ACCI	45	14
Dwarf Oregongrape	MANE2	51	5
Salmonberry	RUSP	43	5
Forbs/Graminoids			
Western swordfern	POMU	60	3
Queen's cup (Bride's bonnet)	CLUN2	57	2
Threeleaf foamflower	TITR	54	2
Twinflower	LIBO3	50	4
Vanillaleaf	ACTR	47	3
Common prince's-pine	CHUM	43	1
Common ladyfern	ATFI	42	3
Starry false Solomon's-seal	MAST4	42	2
Deer fern	BLSP	40	3
Common beargrass	XETE	39	8
Sidebells wintergreen	ORSE	38	1

White hawkweed	HIAL2	34	1

Pacific Silver Fir Subzones

Pacific Silver Fir – Mild Very Wet (88) This subzone is somewhat common within this vegzone and occurs in the Olympic Mountains as well as the Cascades from northern Washington to the Rogue-Umpqua Divide in southern Oregon. The Mild Very Wet Subzone represents the warm-moderate environments that typically have high precipitation with moderate snowpack. As a result, they are the most productive sites within the Pacific Silver Fir Vegzone. This subzone occurs on lower to middle slopes within the Pacific Silver Fir Vegzone (650 to 3,500 feet elevation in the Olympics, 2,000 to 3,500 feet elevation in the northern Cascades, and about 3,500 to 5,000 feet in the southern Cascades of Oregon) (Landfire BpS 10420). These sites typically have herb rich understory vegetation. Mean annual temperature ranges between 41 and 46°F, while mean annual precipitation ranges from 84 to 130 inches. Western hemlock (TSHE) is almost always present, with a mean cover of 59%, and Douglas-fir (PSME) is also often a significant component of overstory canopies and is a primary early seral conifer. The shrub layer is variable, with the most common species being oval-leaf blueberry (VAOV), salmonberry (RUSP), bunchberry dogwood (COCA13), devilsclub (OPHO), red huckleberry (VAPA) and vine maple (ACCI). Diverse shrub layers often form after disturbance. Indicator species used to classify this subzone, using the representative Warm Wet group, include salmonberry (RUSP), common ladyfern (ATFI), deer fern (BLSP), bunchberry dogwood (COCA13), devilsclub (OPHO), western oakfern (GYDR), and false lily of the valley (MADI).

Common Name	**Species**	**Constancy (%)**	**Mean Cover (%)**
Mild Very Wet; N = 498			
Trees			
Pacific silver fir	ABAM	94	39
Western hemlock	TSHE	91	59
Douglas-fir	PSME	58	31
Western redcedar	THPL	48	30
Green alder	ALVI5	35	15
Shrubs			
Oval-leaf blueberry	VAOV	83	12
Salmonberry	RUSP	82	8
Bunchberry dogwood	COCA13	65	5
Devilsclub	OPHO	65	5
Thinleaf huckleberry	VAME	53	7
Vine maple	ACCI	46	13
Forbs/Graminoids			
Common ladyfern	ATFI	76	4
Threeleaf foamflower	TITR	75	3
Western swordfern	POMU	71	3

Queen's cup (Bride's bonnet)	CLUN2	70	2
Deer fern	BLSP	69	4
Starry false Solomon's-seal	MAST4	51	2
Western oakfern	GYDR	47	2
Fragrant bedstraw	GATR3	45	1
Twinflower	LIBO3	42	4
Twistedstalk	STLA16	41	1
False lily of the valley	MADI	40	2
Vanillaleaf	ACTR	40	4
Sidebells wintergreen	ORSE	34	1

Pacific Silver Fir – Mild Wet (87) This subzone is the most common subzone within this vegzone and occurs in the Olympic Mountains as well as the Cascades from northern Washington to the Rogue-Umpqua Divide in southern Oregon. This is the lowest-elevation type, ranging from 1,500 to 2,600 feet elevation in the north and 5,200 to 6,000 feet in the south (Landfire BpS 11740). Sites have herb-rich understory vegetation. Mean annual temperature ranges between 41 and 47°F, while mean annual precipitation ranges from 72 to 109 inches. Overstory species frequently found within this subzone include Pacific silver fir (ABAM), Douglas-fir (PSME), western hemlock (TSHE), and noble fir-Shasta red fir (ABPRSH). Western redcedar (THPL) may be present. Indicator species used to classify this subzone, using the representative Warm Wet Mesic group, include western swordfern (POMU), twinflower (LIBO3), queen's cup (CLUN2), vine maple (ACCI), threeleaf foamflower (TITR), Pacific trillium (TROV2), starry false Solomon's-seal (MAST4), sidebells wintergreen (ORSE), salal (GASH), Pacific rhododendron (RHMA3), and evergreen violet (VISE3).

Within the Coast Range Ecoregion, species composition indicates a wetter environment than that of the overall Pacific Silver Fir – Mild Wet Subzone. The overstory species include western hemlock (TSHE), Pacific silver fir (ABAM), Douglas-fir (PSME), and western redcedar (THPL). Understory species include red huckleberry (VAPA), western swordfern (POMU), salal (GASH), oval-leaf blueberry (VAOV), deer fern (BLSP), dwarf Oregongrape (MANE2), threeleaf foamflower (TITR), Oregon oxalis (OXOR), vanillaleaf (ACTR), and salmonberry (RUSP).

Common Name	**Species**	**Constancy (%)**	**Mean Cover (%)**
Mild Wet; N = 805			
Trees			
Douglas-fir	PSME	87	45
Pacific silver fir	ABAM	86	33
Western hemlock	TSHE	84	48
Noble fir-Shasta red fir	ABPRSH	51	19
Western redcedar	THPL	38	25
Shrubs			

Thinleaf huckleberry	VAME	70	8
Dwarf Oregongrape	MANE2	70	6
Oval-leaf blueberry	VAOV	56	9
Vine maple	ACCI	52	15
Salal	GASH	33	10
Forbs/Graminoids			
Western swordfern	POMU	61	2
Twinflower	LIBO3	61	4
Common prince's-pine	CHUM	58	1
Vanillaleaf	ACTR	57	3
Queen's cup (Bride's bonnet)	CLUN2	55	2
Common beargrass	XETE	50	9
Threeleaf foamflower	TITR	48	1
Starry false Solomon's-seal	MAST4	42	2
White hawkweed	HIAL2	41	1
Sidebells wintergreen	ORSE	40	1
Western brackenfern	PTAQ	33	4

Pacific Silver Fir – Cold Wet (89) This is the least common subzone within the Pacific Silver Fir Vegzone. It mostly occurs along the western slopes of the Cascades in Washington and northern Oregon, as well as the Olympic Mountains in Washington. Sites represent the colder, higher elevation sites within this vegzone. These sites are often adjacent to and transitional to Mountain Hemlock (TSME) or Subalpine Parkland Vegzones. Mean annual temperature ranges between 38 and 42°F, while mean annual precipitation ranges from 61 to 99 inches. Overstory species frequently found within this subzone include Pacific silver fir (ABAM), Douglas-fir (PSME), western hemlock (TSHE), mountain hemlock (TSME), and, less frequently, noble fir-Shasta red fir (ABPRSH). Indicator species used to classify this subzone, using the representative Cool Wet Mesic group, include thinleaf huckleberry (VAME), dwarf bramble (RULA2), oval-leaf blueberry (VAOV), rusty menziesia (MEFE), strawberryleaf raspberry (RUPE), western mountain ash (SOSI2), and slender salal (GAOV2).

Common Name	Species	Constancy (%)	Mean Cover (%)
Cold Wet; N = 147			
Trees			
Pacific silver fir	ABAM	95	45
Douglas-fir	PSME	57	32
Western hemlock	TSHE	53	48
Subalpine fir	ABLA	39	34
Shrubs			
Thinleaf huckleberry	VAME	91	17
Dwarf bramble	RULA2	58	5

Oval-leaf blueberry	VAOV	47	11
Cascade azalea	RHAL2	40	9
Forbs/Graminoids			
Sidebells wintergreen	ORSE	47	1
Common beargrass	XETE	39	11

Western Hemlock Vegzone (19)

Vegzone	Vegzone Name	Subzone	Subzone Name
19	Western Hemlock	82	Moist
19	Western Hemlock	83	Very Moist
19	Western Hemlock	84	Wet

Western hemlock (*Tsuga heterophylla*), like Pacific silver fir (ABAM), is one of the most shade tolerant and environmentally restricted conifers. This vegzone is found in areas with the strongest maritime climatic influence where Pacific silver fir and mountain hemlock (TSME) are absent. On the east side of the Cascades Mountains the Western Hemlock (TSHE) Vegzone is most extensive on the Warm Springs Indian Reservation and the Mount Hood National Forest. There are considerable intergradations between the Western Hemlock (TSHE), Pacific Silver Fir (ABAM), and White Fir-Grand Fir (ABGRC) Vegzones. White fir (ABCO) and grand fir (ABGR) occupy drier sites, while Pacific silver fir (ABAM) prefers cooler, more maritime environments.

This vegzone is extensive in the Pacific Northwest, from northern Washington to southwest Oregon, where it transitions to the tanoak (LIDE3) and Douglas-fir (PSME) Vegzones. South of the Metolius River the distribution of the vegzone becomes discontinuous and is rare south of Santiam Pass on the east side of the Cascade Crest. Small amounts of the Western Hemlock Vegzone occur as far south as Cache Mountain and Willamette Pass on the Deschutes National Forest.

Western hemlock (TSHE) is considered the climax dominant on sites too warm for Pacific silver fir (ABAM) and mountain hemlock (TSME). 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. Sites with western redcedar (THPL) that lack western hemlock represent warm-dry environments within the Western Hemlock Vegzone. Consequently, in areas where western redcedar is present and western hemlock is absent, the sites are typically placed within the Western Hemlock Vegzone, except in the Northern Rockies Ecoregion in Washington, where the Western Redcedar Vegzone occurs. Mid-seral stands (100-200 years old) often have abundant, vigorous grand fir (ABGR) under a canopy of long-lived seral species such as western larch (LAOC) or western white pine (PIMO3).

On the westside of the Cascades of northwest Oregon the Very Moist Western Hemlock Subzone dominates the landscape. It spans a wide range in precipitation and temperature, but generally

lies above the Douglas-fir (PSME) and White Fir-Grand Fir (ABGRC) Vegzones and below the Pacific Silver Fir (ABAM) Vegzone. Precipitation falls as rain or snow, but winter snowpacks are not deep or long-lasting (McCain and Diaz, 2002).

Southwest Oregon is the southern end of the range of the Western Hemlock Vegzone, which is abundant on the Umpqua National Forest. It is likely limited by dry conditions and is replaced by the White Fir-Grand Fir (ABGRC) Vegzone to the south. In the coast range of the Rogue River-Siskiyou National Forest, this vegzone extends south to the Gold Beach Ranger District, where it is replaced by the Tanoak (LIDE3) Vegzone where temperatures are warmer. As a result of frequent disturbances in southwest Oregon, Douglas-fir (PSME) is the dominant overstory tree species in the Western Hemlock Vegzone, with western hemlock (TSHE) being the dominant understory species (Atzet et al. 1996).

In California's Manual of Vegetation, western hemlock (TSHE) falls within the Western Hemlock Forest Alliance. Western hemlock (TSHE) is dominant or co-dominant in the tree canopy with Pacific madrone (ARME), Port-Orford cedar (CHLA), tanoak (LIDE3), Douglas-fir (PSME), redwood (SESE3), and California laurel (UMCA). It is found in raised stream benches, terraces, and lower slopes (CNPS/A Manual of California Vegetation Online).

This vegzone is characterized by the presence of western hemlock (TSHE) at a minimum of 10% cover or a minimum of 10% cover when western redcedar (THPL) and western hemlock covers are combined.

Ponderosa pine (PIPO) is typically found only on the warmest sites. Douglas-fir (PSME) is found on nearly all sites within the Western Hemlock Vegzone. Understory species most commonly found include western swordfern (POMU), dwarf Oregongrape (MANE2), red huckleberry (VAPA), California blackberry (RUUR), vine maple (ACCI), salal (GASH), western brackenfern (PTAQ), red alder (ALRU2), baldhip rose (ROGY), salmonberry (RUSP), oceanspray (HODI), and twinflower (LIBO3).

Common Name	**Species**	**Constancy (%)**	**Mean Cover (%)**
Western Hemlock VZ; N = 4,219			
Trees			
Douglas-fir	PSME	95	56
Western hemlock	TSHE	70	34
Western redcedar	THPL	43	28
Red alder	ALRU2	43	22
Shrubs			
Dwarf Oregongrape	MANE2	72	9
California blackberry	RUUR	69	5
Vine maple	ACCI	66	17
Salal	GASH	66	16
Salmonberry	RUSP	38	11

Forbs/Graminoids			
Western swordfern	POMU	87	17
Western brackenfern	PTAQ	52	4
Twinflower	LIBO3	35	4
Oregon oxalis	OXOR	33	10

Western Hemlock Subzones

Western Hemlock – Wet (84) This subzone occupies low montane elevations of western Washington and Oregon. In Washington, it occurs on the north, south, and west side of the Olympic Peninsula and along the low to moderate elevation western slopes of the Cascade Range. In Oregon, this type is found in mesic to wet microsites, on northerly slopes and upper elevations of the Cascades, and on the west side and upper east side of the Coast Range (Landfire BpS 10390). This subzone generally occurs between the Sitka Spruce (PISI) Vegzone and the Very Moist Western Hemlock Subzone. Sites represent the wettest environments within the Western Hemlock Vegzone. Mean annual temperature ranges between 46 and 51°F, while mean annual precipitation ranges from 55 to 99 inches. This subzone is often adjacent to riparian areas and/or poorly drained sites. Overstory species frequently include Douglas-fir (PSME), western hemlock (TSHE), and western redcedar (THPL). Indicator species used to classify this subzone, using the representative Warm Wet group, include salmonberry (RUSP), common ladyfern (ATFI), deer fern (BLSP), devilsclub (OPHO), and false lily of the valley (MADI).

Common Name	Species	Constancy (%)	Mean Cover (%)
Wet; N = 777			
Trees			
Douglas-fir	PSME	85	42
Western hemlock	TSHE	75	40
Red alder	ALRU2	65	28
Western redcedar	THPL	51	32
Shrubs			
Salmonberry	RUSP	86	21
Vine maple	ACCI	61	17
California blackberry	RUUR	54	5
Salal	GASH	50	11
Cascara buckthorn	FRPU7	38	7
Forbs/Graminoids			
Western swordfern	POMU	90	24
Common ladyfern	ATFI	61	3
Deer fern	BLSP	57	3
Oregon oxalis	OXOR	44	16
Western brackenfern	PTAQ	40	3

Fragrant bedstraw	GATR3	38	1
Threeleaf foamflower	TITR	36	3

Western Hemlock – Very Moist (83) This is the most common subzone within the Western Hemlock Vegzone. In Washington, this subzone occurs in the rain shadow of the Olympic Mountains, in the Puget trough, and in lower montane elevations on the western side of the Cascade Mountains. In Oregon, it occupies low montane elevations of the upper foothills of the Willamette Valley and in the eastern Coast Range and western Cascades, as far south as southwest Oregon (Landfire BpS 10370). Sites typically have rich herbaceous understory vegetation. These types represent warm-moderate environments and the most productive sites in the Western Hemlock Vegzone. Mean annual temperature ranges between 46 and 51°F, while mean annual precipitation ranges from 53 to 86 inches. Diverse shrub layers often form following disturbance. Douglas-fir (PSME) is a significant component of overstory canopies and a primary early seral conifer. Western redcedar (THPL) is also commonly present. Indicator species used to classify this subzone, using the representative Warm Wet Mesic group, include western swordfern (POMU), salal (GASH), vine maple (ACCI), twinflower (LIBO3), red alder (ALRU2), Pacific trillium (TROV2), bigleaf maple (ACMA3), Oregon oxalis (OXOR), Pacific rhododendron (RHMA3), starry false Solomon's-seal (MAST4), and Oregon fairybell (DIHO3).

Common Name	**Species**	**Constancy (%)**	**Mean Cover (%)**
Very Moist; N = 3,340			
Trees			
Douglas-fir	PSME	97	59
Western hemlock	TSHE	69	33
Western redcedar	THPL	41	27
Red alder	ALRU2	39	19
Shrubs			
Dwarf Oregongrape	MANE2	79	10
California blackberry	RUUR	73	5
Salal	GASH	71	17
Vine maple	ACCI	69	17
Beaked hazelnut	COCO6	34	5
Forbs/Graminoids			
Western swordfern	POMU	88	16
Western brackenfern	PTAQ	56	5
Twinflower	LIBO3	39	4
Starflower	TRBO2	36	1

Western Hemlock - Moist (82) This subzone represents the driest sites where western hemlock (TSHE) and western redcedar (THPL) are climax tree species. It is a minor subzone within Washington and Oregon. Sites on the east side of the Cascade Crest north of McKenzie Pass, apparently beyond the warmer ecological limits of western hemlock (TSHE) that support western red cedar (THPL), are grouped into the Western Hemlock - Moist Subzone, which is the driest

subzone within the Western Hemlock Vegzone. Mean annual temperature ranges between 40 and 48°F, while mean annual precipitation ranges from 36 to 57 inches. Western Hemlock - Moist Subzone locations are often adjacent to and transitional to White Fir-Grand Fir (ABGRC) Vegzone sites. Douglas-fir (PSME) is common on almost all sites within this subzone. Indicator species used to classify this subzone, using the representative Warm Mesic group, include dwarf Oregongrape (MANE2), baldhip rose (ROGY), California blackberry (RUUR), common prince's-pine (CHUM), white hawkweed (HIAL2), oceanspray (HODI), round-leaved violet (VIOR), starflower (TRBO2), vanillaleaf (ACTR), beaked hazelnut (COCO6), red huckleberry (VAPA), thimbleberry (RUPA), Rocky Mountain maple (ACGL), American trailplant (ADBI), fragrant bedstraw (GATR3), western rattlesnake plantain (GOOB2), western larch (LAOC), and common whipplevine (WHMO).

Common Name	Species	Constancy (%)	Mean Cover (%)
Moist; N = 102			
Trees			
Douglas-fir	PSME	91	55
Western hemlock	TSHE	70	34
Western redcedar	THPL	52	36
Grand fir-White fir	ABGRC	37	28
Shrubs			
Dwarf Oregongrape	MANE2	60	8
Forbs/Graminoids			
Common prince's-pine	CHUM	46	1
Western brackenfern	PTAQ	43	7
Twinflower	LIBO3	41	2
Western swordfern	POMU	41	1
White hawkweed	HIAL2	39	1

Western Redcedar Vegzone (18)

Vegzone	Vegzone Name	Subzone	Subzone Name
18	Western Redcedar	76	Mild
18	Western Redcedar	77	Cool

The Western Redcedar (*Thuja plicata*) Vegzone is only found in Washington. Compared to western hemlock (TSHE), western redcedar (THPL) is more tolerant of high soil moisture, summer drought, and temperature extremes (Minore 1979). The Western Redcedar Vegzone, where western redcedar is the indicated climax dominant, occurs only on that part of the species' range beyond the environmental and geographic range of western hemlock (TSHE). Western redcedar (THPL) regeneration without western hemlock (TSHE) indicates the Western Redcedar Vegzone. Only minor amounts of western hemlock, confined to moist microsites, are acceptable in the Western Redcedar Vegzone (Williams, Clint et al. 1995).

This vegzone is only mapped to areas of the Northern Rockies Ecoregion (cite ecoregion map) where environment and species composition otherwise indicate the Western Hemlock vegzone, but western hemlock is absent and western redcedar (THPL) is present with a minimum cover of 5%.

The Western Redcedar Vegzone is a very species-rich vegzone, with about 30 species being present at least 50 percent of the time, the highest number across all vegzones. The most common overstory species are western redcedar (THPL), Douglas-fir (PSME), western larch (LAOC), white fir-grand fir (ABGRC), and lodgepole pine (PICO). The most common understory species include twinflower (LIBO3), common snowberry (SYAL), Rocky Mountain maple (AGCL), thimbleberry (RUPA), queen's cup (CLUN2), Oregon boxleaf (PAMY), baldhip rose (ROGY), western serviceberry (AMAL2), pinegrass (CARU), tall Oregongrape (MAAQ2), white spirea (SPBE2), common prince's-pine (CHUM), Scouler's willow (SASC), Utah honeysuckle (LOUT2), white hawkweed (HIAL2), starry false Solomon's-seal (MAST4), oceanspray (HODI), western false Solomon's-seal (MARA7), one-sided pyrola (ORSE), round-leaved violet (VIOR), mallow ninebark (PHMA5), sweetcicely (OSBE), thin huckleberry (VAME), green alder (ALVI5), fragrant bedstraw (GATR3), northwestern sedge (CACO11), and path finder (ADBI).

Common Name	**Species**	**Constancy (%)**	**Mean Cover (%)**
Western Redcedar VZ; N = 149			
Trees			
Western redcedar	THPL	100	40
Douglas-fir	PSME	97	40
Western larch	LAOC	84	11
Grand fir-White fir	ABGRC	67	25
Paper birch	BEPA	36	15
Shrubs			
Common snowberry	SYAL	83	6
Oregon boxleaf	PAMY	77	6
Oceanspray	HODI	62	6
Mallow ninebark	PHMA5	57	9
Forbs/Graminoids			
Twinflower	LIBO3	85	11
Queen's cup (Bride's bonnet)	CLUN2	79	2
Pinegrass	CARU	75	7
Common prince's-pine	CHUM	73	2
White hawkweed	HIAL2	66	1
Starry false Solomon's-seal	MAST4	64	2
Western false Solomon's-seal	MARA7	61	1
Sidebells wintergreen	ORSE	60	1
Round-leaved (darkwoods) violet	VIOR	58	1

Sweetcicely	OSBE	56	1
Fragrant bedstraw	GATR3	52	1
Northwestern sedge	CACO11	51	1
American trailplant (pathfinder)	ADBI	50	2
Woodland strawberry	FRVE	47	2
Heartleaf arnica	ARCO9	44	2
Western fescue	FEOC	44	1
Roughfruit fairybells	DITR2	40	1
Ross' sedge	CARO5	38	1
Western meadow-rue	THOC	37	1
Oregon fairybell (Drops-of-gold)	DIHO3	36	1

Western Redcedar Subzones

Western Redcedar – Cool (77) This subzone occupies maritime-influenced sites in eastern Washington. This subzone represents the cooler western redcedar sites, and like the overall vegzone is very species-rich. Mean annual temperature ranges between 39 and 43°F, while mean annual precipitation ranges from 27 to 35 inches. Eight tree species are present at least 50 percent of the time. The most common overstory species are Douglas-fir (PSME), western redcedar (THPL), western larch (LAOC), Engelmann spruce (PIEN), and white fir/grand fir (ABGRC). Indicator species used to classify this subzone, using the representative Warm Wet group, include common ladyfern (ATFI), bunchberry dogwood (COCA13), claspleaf twistedstalk (STAM2), western oakfern (GYDR), and devilsclub (OPHO).

Common Name	Species	Constancy (%)	Mean Cover (%)
Cool; N = 16			
Trees			
Douglas-fir	PSME	100	27
Western redcedar	THPL	100	30
Green alder	ALVI5	94	16
Western larch	LAOC	88	16
Engelmann spruce	PIEN	88	11
Grand fir-White fir	ABGRC	75	14
Lodgepole pine	PICO	69	12
Subalpine fir	ABLA	56	31
Balsam poplar	POBA2	44	12
Shrubs			
Thimbleberry	RUPA	100	7
Oregon boxleaf	PAMY	81	8
Common snowberry	SYAL	75	9

Thinleaf huckleberry	VAME	75	7
Bunchberry dogwood	COCA13	63	5
Russet buffaloberry	SHCA	50	6
Forbs/Graminoids			
Queen's cup (Bride's bonnet)	CLUN2	88	4
Fragrant bedstraw	GATR3	88	2
White hawkweed	HIAL2	81	1
Starry false Solomon's-seal	MAST4	81	3
Sweetcicely	OSBE	81	1
Round-leaved (darkwoods) violet	VIOR	81	2
American trailplant (pathfinder)	ADBI	75	2
Common ladyfern	ATFI	75	2
Common prince's-pine	CHUM	75	3
Western false Solomon's-seal	MARA7	75	1
Sidebells wintergreen	ORSE	75	1
Pioneer violet	VIGL	75	2
Twinflower	LIBO3	69	22
Pinegrass	CARU	63	4
Threeleaf foamflower	TITR	63	1
Liverleaf wintergreen	PYAS	56	2
Pacific trillium	TROV2	56	1
Heartleaf arnica	ARCO9	50	1
Field horsetail	EQAR	50	1
Woodland strawberry	FRVE	50	2
Western wildginger	ASCA2	44	1
Western oakfern	GYDR	44	2
Western brackenfern	PTAQ	44	3
Western meadow-rue	THOC	44	2
Carolina bugbane	TRCA	38	8

Western Redcedar – Mild (76) This subzone occupies maritime-influenced sites in eastern Washington (Landfire BpS 10180). This subzone represents the warmer western redcedar sites, and like the vegzone, is very species-rich. Mean annual temperature ranges between 41 and 45°F, while mean annual precipitation ranges from 24 to 32 inches. The most common overstory species are western redcedar (THPL), Douglas-fir (PSME), western larch (LAOC), white fir/grand fir (ABGRC), and lodgepole pine (PICO). Paper birch (BEPA) may be present. Indicator species used to classify this subzone, using the representative Warm Wet Mesic group, include twinflower (LIBO3), queen’s cup (CLUN2), starry false Solomon’s-seal (MAST4), sidebells wintergreen (ORSE), Oregon fairybell (DIHO3), prickly currant (RILA), and threeleaf foamflower (TITR).

Common Name	Species	Constancy (%)	Mean Cover (%)
Mild; N = 133			
Trees			
Western redcedar	THPL	100	41
Douglas-fir	PSME	96	41
Western larch	LAOC	83	10
Grand fir-White fir	ABGRC	66	27
Paper birch	BEPA	38	15
Shrubs			
Common snowberry	SYAL	83	6
Oregon boxleaf	PAMY	76	6
Oceanspray	HODI	65	6
Mallow ninebark	PHMA5	62	9
Forbs/Graminoids			
Twinflower	LIBO3	86	10
Queen's cup (Bride's bonnet)	CLUN2	77	2
Pinegrass	CARU	77	7
Common prince's-pine	CHUM	73	2
White hawkweed	HIAL2	64	1
Starry false Solomon's-seal	MAST4	62	2
Western false Solomon's-seal	MARA7	59	1
Sidebells wintergreen	ORSE	59	1
Round-leaved violet	VIOR	56	1
Sweetcicely	OSBE	53	1
Northwestern sedge	CACO11	49	1
Fragrant bedstraw	GATR3	47	1
American trailplant (pathfinder)	ADBI	47	1
Woodland strawberry	FRVE	47	2
Western fescue	FEOC	44	1
Heartleaf arnica	ARCO9	43	2
Roughfruit fairybells	DITR2	41	1
Ross' sedge	CARO5	36	1
Western meadow-rue	THOC	36	1
Oregon fairybell (Drops-of-gold)	DIHO3	35	1

Subalpine Fir-Engelmann Spruce Vegzone (25)

Vegzone	Vegzone Name	Subzone	Subzone Name
25	Subalpine Fir - Engelmann Spruce	61	Cold Moist

25	Subalpine Fir - Engelmann Spruce	62	Cool Dry
25	Subalpine Fir - Engelmann Spruce	63	Cool Wet
25	Subalpine Fir - Engelmann Spruce	64	Cool Very Moist

The Subalpine Fir-Engelmann Spruce (*Abies lasiocarpa – Picea engelmannii*) Vegzone occurs in the Olympic and Blue Mountains of Washington, the Blue and Ochoco Mountains in Oregon, and on both slopes of the Cascade Mountains as far south as southern Oregon.

This vegzone occurs in the coolest and wettest forested areas at high elevations. It generally occupies sites with a short growing season caused by cold winters, cool summers, frequent summer frosts, and heavy snowpack. The cool summers and cold winters, along with the deep winter snowpack, is more important than total precipitation in differentiating where subalpine fir (ABLA) grows in relation to other species. Engelmann spruce (PIEN) is usually associated with subalpine fir and occurs as either a climax codominant or as a persistent, long-lived seral species in most subalpine fir habitat types. Throughout much of the Cascade Mountains subalpine fir grows as a shade-tolerant, seral species and is gradually replaced by more shade-tolerant associates such as Pacific silver fir (ABAM), grand fir (ABGR), and mountain hemlock (TSME).

In California's Manual of Vegetation, subalpine fir falls within the Subalpine Fir Forest and Woodland Alliance. Subalpine fir is dominant in the tree canopy, with Shasta red fir (ABMAS), Brewer spruce (PIBR), Engelmann spruce (PIEN), whitebark pine (PIAL), Sierra lodgepole pine (PICOM), western white pine (PIMO3), Pacific yew (TABR2), and mountain hemlock (TSME). It is found in wet meadows, along lakes and streams, and on open, glaciated slopes and ridges (CNPS/A Manual of California Vegetation Online).

This vegzone is characterized by the presence of subalpine fir (ABLA) at a minimum of 20% cover. At lower elevations, the Subalpine Fir Vegzone transitions into the Mountain Hemlock (TSME) Vegzone or the Shasta Red Fir (ABMAS) Vegzone. Lodgepole pine (PICO), Engelmann spruce (PIEN), Douglas-fir (PSME), and western larch (LAOC) are species most commonly associated with subalpine fir (ABLA). Common understory species frequently found within the vegzone include white hawkweed (HIAL2), heartleaf arnica (ARCO9), pinegrass (CARU), Oregon boxwood (PAMY), sidebells wintergreen (ORSE), northwestern sedge (CACO11), common prince's-pine (CHUM), thinleaf huckleberry (VAME), grouse whortleberry (VASC), prickly currant (RILA), and Ross' sedge (CARO5).

Common Name	**Species**	**Constancy (%)**	**Mean Cover (%)**
Subalpine Fir – Engelmann Spruce VZ; N = 715			
Trees			
Subalpine fir	ABLA	81	34
Lodgepole pine	PICO	76	22
Engelmann spruce	PIEN	68	17
Douglas-fir	PSME	61	34
Western larch	LAOC	44	11

Shrubs			
Thinleaf huckleberry	VAME	54	10
Grouse whortleberry	VASC	53	15
Scouler's willow	SASC	48	6
Forbs/Graminoids			
White hawkweed	HIAL2	66	1
Pinegrass	CARU	64	15
Sidebells wintergreen (One-sided pyrola)	ORSE	57	1
Northwestern sedge	CACO11	57	2
Common prince's-pine	CHUM	56	2
Ross' sedge	CARO5	51	2
Common yarrow	ACMI2	49	1
Western meadow-rue	THOC	42	2
Sweetcicely	OSBE	41	1
Geyer's sedge	CAGE2	38	4
Twinflower	LIBO3	36	9
Silky lupine	LUSE4	33	3

Subalpine Fir-Engelmann Spruce Subzones

Subalpine Fir-Engelmann Spruce – Cool Very Moist (64) This subzone occurs in the Blue and Wallowa Mountains of northeast Oregon and southeast Washington, as well as east of the Cascades from northern to southern Washington. This subzone is somewhat minor and represents the wettest sites within this vegzone. Mean annual temperature ranges between 37 and 42°F, while mean annual precipitation ranges from 24 to 38 inches. This is the most species-rich subzone within this vegzone. The most common overstory species are Engelmann spruce (PIEN), lodgepole pine (PICO), subalpine fir (ABLA), Douglas-fir (PSME), western larch (LAOC), and green alder (ALVI5). Indicator species used to classify this subzone, using the representative Warm Wet group, include claspleaf twistedstalk (STAM2), bunchberry dogwood (COCA13), common ladyfern (ATFI), gray alder (ALIN2), and western oakfern (GYDR).

Common Name	Species	Constancy (%)	Mean Cover (%)
Cool Very Moist; N = 92			
Trees			
Engelmann spruce	PIEN	83	21
Lodgepole pine	PICO	79	23
Green alder	ALVI5	76	16
Subalpine fir	ABLA	74	31
Douglas-fir	PSME	63	27
Western larch	LAOC	46	11
Shrubs			

Thinleaf huckleberry	VAME	62	7
Oregon boxleaf	PAMY	60	5
Scouler's willow	SASC	57	8
Thimbleberry	RUPA	55	5
Grouse whortleberry	VASC	48	11
Bunchberry dogwood	COCA13	42	7
Whortleberry	VAMY2	41	10
Redosier dogwood	COSE16	36	5
Common snowberry	SYAL	34	6
Forbs/Graminoids			
Sidebells wintergreen (One-sided pyrola)	ORSE	68	2
Northwestern sedge	CACO11	61	2
Common prince's-pine	CHUM	61	2
Sweetcicely	OSBE	61	2
Fragrant bedstraw	GATR3	60	1
Twinflower	LIBO3	60	9
Pinegrass	CARU	59	7
White hawkweed	HIAL2	57	1
Round-leaved (darkwoods) violet	VIOR	54	1
Starry false Solomon's-seal	MAST4	53	1
Queen's cup (Bride's bonnet)	CLUN2	50	3
Western meadow-rue	THOC	50	2
Pioneer violet	VIGL	48	2
Liverleaf wintergreen	PYAS	47	1

Subalpine Fir – Engelmann Spruce – Cool Wet (63) This subzone occurs in the Blue and Wallowa Mountains of northeast Oregon and southeast Washington, as well as east of the Cascades from northern to southern Washington. This subzone represents the cool wet sites within this vegzone. Mean annual temperature ranges between 37 and 42°F, while mean annual precipitation ranges from 26 to 48 inches. This subzone is one of the most species-rich subzones in this vegzone. Most common overstory species are subalpine fir (ABLA), lodgepole pine (PICO), Engelmann spruce (PIEN), Douglas-fir (PSME), and western larch (LAOC). Indicator species used to classify this subzone, using the representative Warm Wet Mesic group, include sidebells wintergreen (ORSE), prickly currant (RILA), twinflower (LIBO3), queen's cup (CLUN2), starry false Solomon's-seal (MAST4), and threeleaf foamflower (TITR).

Common Name	**Species**	**Constancy (%)**	**Mean Cover (%)**
Cool Wet; N = 296			
Trees			
Subalpine fir	ABLA	86	34
Engelmann spruce	PIEN	80	18

Lodgepole pine	PICO	74	17
Douglas-fir	PSME	68	36
Western larch	LAOC	53	12
Shrubs			
Thinleaf huckleberry	VAME	76	14
Oregon boxleaf	PAMY	67	5
Scouler's willow	SASC	52	5
Grouse whortleberry	VASC	49	13
Whortleberry	VAMY2	37	9
Kinnikinnick	ARUV	34	6
Forbs/Graminoids			
White hawkweed	HIAL2	75	1
Sidebells wintergreen (One-sided pyrola)	ORSE	72	1
Common prince's-pine	CHUM	70	2
Pinegrass	CARU	61	18
Northwestern sedge	CACO11	58	2
Western meadow-rue	THOC	56	2
Sweetcicely	OSBE	49	1
Ross' sedge	CARO5	49	1
Common yarrow	ACMI2	47	1
Twinflower	LIBO3	47	12
Queen's cup (Bride's bonnet)	CLUN2	38	2
Round-leaved (darkwoods) violet	VIOR	37	1
Geyer's sedge	CAGE2	33	2
Fragrant bedstraw	GATR3	33	1
Western fescue	FEOC	33	1
Silky lupine	LUSE4	33	2

Subalpine Fir – Engelmann Spruce – Cool Dry (62) This subzone occurs in the Blue and Wallowa Mountains of northeast Oregon and southeast Washington, as well as east of the Cascades from northern to southern Washington. Mean annual temperature ranges between 37 and 42°F, while mean annual precipitation ranges from 28 to 43 inches. This subzone represents the driest sites within this vegzone. Most common overstory species are subalpine fir (ABLA), lodgepole pine (PICO), Engelmann spruce (PIEN), Douglas-fir (PSME), and western larch (LAOC). Indicator species used to classify this subzone, using the representative Warm Mesic group, include heartleaf arnica (ARCO9), common prince's-pine (CHUM), Scouler's willow (SASC), white spirea (SPBE2), western larch (LAOC), sticky currant (RIVI3), western meadow-rue (THOC), sweetcicely (OSBE), and kinnikinnick (ARUV).

Common Name	Species	Constancy (%)	Mean Cover (%)
Cool Dry; N = 229			

Trees			
Subalpine fir	ABLA	83	32
Lodgepole pine	PICO	76	24
Douglas-fir	PSME	64	35
Engelmann spruce	PIEN	57	13
Western larch	LAOC	42	10
Shrubs			
Grouse whortleberry	VASC	52	17
Scouler's willow	SASC	50	6
Forbs/Graminoids			
Pinegrass	CARU	74	15
White hawkweed	HIAL2	69	1
Ross' sedge	CARO5	59	2
Common yarrow	ACMI2	55	2
Northwestern sedge	CACO11	53	1
Common prince's-pine	CHUM	51	1
Sidebells wintergreen (One-sided pyrola)	ORSE	49	1
Geyer's sedge	CAGE2	49	5
Western meadow-rue	THOC	38	2
Sweetcicely	OSBE	36	1
Silky lupine	LUSE4	35	4

Subalpine Fir – Engelmann Spruce – Cold Moist (61) This subzone occurs in northern Washington, as well as the Blue Mountains of Washington, and the Blue and Ochoco Mountains in Oregon and represents the coldest and slightly drier sites within this vegzone. Mean annual temperature ranges between 36 and 40°F, while mean annual precipitation ranges from 33 to 60 inches. This subzone is the least species-rich of the four subzones. Most common overstory species are subalpine fir (ABLA), lodgepole pine (PICO), Engelmann spruce (PIEN), and Douglas-fir (PSME). Indicator species used to classify this subzone, using the representative Cool Mesic group, include lodgepole pine (PICO), grouse whortleberry (VASC), Oregon boxwood (PAMY), silky lupine (LUSE4), whortleberry (VAMY2), broadleaf lupine (LULA4), and pinemat manzanita (ARNE).

Common Name	**Species**	**Constancy (%)**	**Mean Cover (%)**
Cold Moist; N = 97			
Trees			
Lodgepole pine	PICO	84	30
Subalpine fir	ABLA	70	38
Engelmann spruce	PIEN	41	14
Douglas-fir	PSME	32	23
Shrubs			

Grouse whortleberry	VASC	77	17
Forbs/Graminoids			
Northwestern sedge	CACO11	57	2
Ross' sedge	CARO5	56	5
Common yarrow	ACMI2	54	2
Pinegrass	CARU	51	10
Geyer's sedge	CAGE2	43	4
White hawkweed	HIAL2	42	1
Silky lupine	LUSE4	37	5

White Fir-Grand Fir Vegzone (20)

Vegzone	Vegzone Name	Subzone	Subzone Name
20	White Fir-Grand Fir	56	Warm Xeric
20	White Fir-Grand Fir	57	Warm Dry
20	White Fir-Grand Fir	58	Warm Moist
20	White Fir-Grand Fir	59	Cool Moist

The White Fir-Grand Fir (*Abies concolor-Abies grandis*) Vegzone is defined by both species of fir. Grand fir (*Abies grandis*) interbreeds with white fir (*Abies concolor*) and is difficult to distinguish. Zobel (1973, 1974) has described a zone of morphological and physiological intergradation between the two species. The overlap occurs in a diagonal band extending from the Blue Mountains (northeast Oregon and west-central Idaho) through the southern Oregon Cascades into the Klamath Mountain Province (northwest California and southwest Oregon) (Steinhoff 1978). Individuals exhibiting characteristics of both species are often referred to as *Abies grandicolor* (sic). The ecological and silvicultural differences are not significant enough to warrant any distinctions (Atzet et al. 1996).

White fir (ABCO), compared to grand fir (ABGR), 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. 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 Vegzone sites have an affinity for modified maritime climates. White fir and grand fir do not tolerate dry and/or extended cold temperatures well, although they tolerate drier conditions than do western hemlock (TSHE) or western redcedar (THPL), which share a similar geographical distribution across Oregon and Washington.

The White Fir-Grand Fir Vegzone is a major mid-elevation potential vegetation type throughout Washington, Oregon, and California. In eastern Washington, the White Fir-Grand Fir Vegzone is

largely missing north of Lake Chelan to the Canadian Border and east to the Kettle Range of northeast Washington, where it is replaced by the Douglas-fir (PSME) Vegzone. West of the Cascade Crest the White Fir-Grand Fir Vegzone is absent in Washington, while in Oregon the White Fir-Grand Fir Vegzone forms a narrow band in the foothills on both sides of the Willamette Valley and in small, scattered patches at higher elevations in the Cascades north of Santiam Pass. South of the Willamette Valley and Santiam Pass, prevalence of the White Fir-Grand Fir Vegzone gradually increases, eventually replacing the Western Hemlock (TSHE) Vegzone in the southern Cascades and Klamath-Siskiyou Mountains.

The White Fir-Grand Fir Vegzone occurs across an environmental range from cool to very warm, and dry to very moist. Climax white fir-grand fir stands are a major component of the east slope Cascade forests as well as at higher elevations in southwest Oregon. In the Cascade Range, the White Fir-Grand Fir Vegzone occurs at elevations above 4,900 feet where white fir (ABCO) is clearly dominant in nearly pure stands with Douglas-fir (PSME), sugar pine (PILA), ponderosa pine (PIPO), western white pine (PIMO3), and lodgepole pine (PICO) as associates. The Douglas-fir Vegzone often intermingles with the White Fir-Grand Fir Vegzone on harsh sites in warm, dry environments, while the Western Hemlock Vegzone may intermingle in moist cool valleys in the foothills. (McCain and Diaz, 2002).

In California, the White Fir-Grand Fir Vegzone occurs in the North Coast, Klamath-Siskiyou, Southern Cascades, Warner, and Sierra Nevada Mountains, as well as the southern California Transverse and Peninsular Ranges. On the North Coast, Klamath-Siskiyou Mountains, the Southern Cascades, and central to northern Sierra Nevada, the White Fir-Grand Fir Vegzone generally occurs between the Tanoak (LIDE3) Vegzone (westside) or Douglas-fir (PSME) Vegzone (eastside) at lower elevations and the California red fir-Shasta Red Fir (ABMA/ABMAS) Vegzone at higher elevations. On the eastern slopes of the California Cascades, Sierra Nevada, and throughout the Modoc Plateau, warmer and drier sites transition directly to either Ponderosa Pine (PIPO) or Jeffery Pine (PIJE) Vegzones.

In California's Manual of Vegetation, white fir (ABCO) falls within the White Fir Forest and Woodland Alliance. White fir is dominant or co-dominant in the tree canopy with incense cedar (CADE27), Jeffrey pine (PIJE), sugar pine (PILA), ponderosa pine (PIPO), Douglas-fir (PSME), giant chinquapin (CHCH7), California black oak (QUKE), and Pacific dogwood (CONU). It is found on raised stream benches, terraces, slopes, and ridges (CNPS/A Manual of California Vegetation Online).

This vegzone is characterized by the presence of white fir-grand fir (ABGRC) at a minimum of 5% cover. White fir-grand fir was present in most stands with a mean cover of 32%. Douglas-fir (PSME) or ponderosa pine (PIPO), or both, dominate the overstory canopy of most stands in the vegzone, in part due to environmental and frequent disturbance conditions. White fir-grand fir (ABGRC) often occur as co-dominants, especially in the moister associations and community types, but is less often found as a dominant. Western larch (LAOC) and lodgepole pine (PICO) are seral species found in some habitats. Western white pine (PIMO3) is a significant component only in wetter and cooler types.

A number of understory species are common to this vegzone and almost never found in the drier Douglas-fir (PSME), Ponderosa Pine (PIPO), or Oak Vegzones. Generally, stands containing starry false Solomon's-seal (MAST4), queen's cup (CLUN2), Oregon fairybell (DIHO3), vine maple (ACCI), dwarf Oregongrape (MANE2), twinflower (LIBO3), or vanillaleaf (ACTR) are able to support a vegzone more moist than the Douglas-fir, Ponderosa Pine or Lodgepole Pine Vegzones. Along with white fir/grand fir, Douglas-fir, ponderosa pine, and incense cedar (CADE27) are frequently found in this vegzone. Common understory species include common snowberry (SYAL), white hawkweed (HIAL2), common prince's-pine (CHUM), pinegrass (CARU), Geyer's sedge (CAGE2), heartleaf arnica (ARCO9), baldhip rose (ROGY), and common yarrow (ACMI2).

Common Name	Species	Constancy (%)	Mean Cover (%)
White Fir-Grand Fir VZ; N = 5,596			
Trees			
Grand fir-White fir	ABGRC	96	32
Douglas-fir	PSME	61	35
Ponderosa pine	PIPO	58	15
Shrubs			
Common snowberry	SYAL	34	5
Forbs/Graminoids			
White hawkweed	HIAL2	33	1

White Fir-Grand Fir Subzones

White Fir-Grand Fir – Warm Moist (58) The White Fir-Grand Fir Warm Moist Subzone occurs from northeast Washington to the central Sierra Nevada in California. The Warm Moist Subzone is best developed on the east side of the Columbia River Gorge and in the northern Blue Mountains and is prominent in the foothills surrounding the Willamette Valley, southwest Oregon, and northwest California. This type represents the wettest and most productive sites in the White Fir-Grand Fir Vegzone. Mean annual temperature ranges between 42 and 52°F, while mean annual precipitation ranges from 31 to 59 inches.

The shrub layer is variable; the most common species in mid-late seral stands are baldhip rose (ROGY), thinleaf huckleberry (VAME), common snowberry (SYAL), dwarf Oregongrape (MANE2), and oceanspray (HODI). Douglas-fir (PSME) is typically a significant component of overstory canopies and is a primary early seral conifer. These sites are often transitional to Western Hemlock (TSHE), Pacific Silver Fir (ABAM), or Mountain Hemlock (TSME) Vegzones. This subzone typically has an herb-rich understory. Indicator species used to classify this subzone, using the representative Warm Wet Mesic group, include twinflower (LIBO3), queen's cup (CLUN2), western swordfern (POMU), starry false Solomon's-seal (MAST4), prickly currant (RILA), vine maple (ACCI), sidebells wintergreen (ORSE), Oregon fairybell (DIHO3), and Pacific trillium (TROV2).

Within the Coast Range Ecoregion, species composition indicates a wetter environment than that of the overall White Fir-Grand Fir – Warm Moist Subzone. Understory species include western swordfern (POMU) as the most dominant species, along with the presence of California blackberry (RUUR), oceanspray (HODI), dwarf Oregongrape (MANE2), salal (GASH), poisonoak (TODI), red alder (ALRU2), red huckleberry (VAPA), western brackenfern (PTAQ), beaked hazelnut (COCO6), California huckleberry (VAOV2), vine maple (ACCI), and bigleaf maple (ACMA3).

Within the Blue Mountains Ecoregion, species composition indicates a drier environment from that of the overall White Fir-Grand Fir – Warm Moist Subzone. Additional overstory species include western larch (LAOC), Engelmann spruce (PIEN), lodgepole pine (PICO), and ponderosa pine (PIPO). Understory species include thinleaf huckleberry (VAME), Geyer's sedge (CAGE2), heartleaf arnica (ARCO9), pinegrass (CARU), white spirea (SPBE2), twinflower (LIBO3), white hawkweed (HIAL2), Columbia brome (BRVU), western fescue (FEOC), common snowberry (SYAL), northwestern sedge (CACO11), prickly current (RILA), pathfinder (ADBI), western meadow-rue (THOC), woodland strawberry (FRVE), and common prince's-pine (CHUM).

Common Name	Species	Constancy (%)	Mean Cover (%)
Warm Moist; N = 1,044			
Trees			
Grand fir-White fir	ABGRC	97	34
Douglas-fir	PSME	88	40
Shrubs			
Thinleaf huckleberry	VAME	50	11
Common snowberry	SYAL	46	6
Dwarf Oregongrape	MANE2	40	7
Oceanspray	HODI	38	5
Heartleaf arnica	ARCO9	38	5
Forbs/Graminoids			
Twinflower	LIBO3	56	10
White hawkweed	HIAL2	54	1
American trailplant (pathfinder)	ADBI	48	2
Pinegrass	CARU	41	11
Woodland strawberry	FRVE	41	2
Western brackenfern	PTAQ	38	3
Queen's cup	CLUN2	38	2
Western swordfern	POMU	38	7
Geyer's sedge	CAGE2	38	4
Western fescue	FEOC	35	1
Columbia brome	BRVU	33	3

White Fir-Grand Fir – Warm Dry (57) The White Fir-Grand Fir Warm Dry Subzone is a common subzone within the White Fir-Grand Fir Vegzone and occurs throughout the described vegzone distribution. This subzone is most abundant in the Blue Mountains and East Cascades of Oregon and Washington, the Klamath-Siskiyou and North Coast Ranges of California and Southwest Oregon, and the western slopes of the Southern Cascades to Central Sierra Nevada in California and Oregon.

These sites occupy the moderate environments within the White Fir-Grand Fir Vegzone. Mean annual temperature ranges between 41 and 49°F, while mean annual precipitation ranges from 27 to 53 inches. Douglas-fir (PSME) is an important component of these types outside the deep ash/pumice deposits of the Mazama ash plume. Typical species on colder sites transition to Shasta Red Fir (ABMAS) (south of Lookout Mountain on the Deschutes National Forest) or to Mountain Hemlock (TSME) Vegzones. Many sites have high precipitation but are well drained, especially within the Mazama ash/pumice deposits.

Ponderosa pine (PIPO) and Douglas-fir (PSME) are frequently present alongside white fir-grand fir (ABGRC). Indicator species used to classify this subzone, using the representative Warm Mesic group, include white hawkweed (HIAL2), common prince's-pine (CHUM), heartleaf arnica (ARCO9), baldhip rose (ROGY), white spirea (SPBE2), oceanspray (HODI), western larch (LAOC), dwarf Oregongrape (MANE2), American trailplant (pathfinder) (ADBI), Columbia brome (BRVU), Scouler's willow (SASC), western rattlesnake plantain (GOOB2), creeping snowberry (SYMO), and Rocky Mountain maple (ACGL).

Within the Klamath Mountains Ecoregion, the species composition indicates a more variable environment from that of the overall White Fir-Grand Fir – Warm Dry Subzone. Along with the overstory species of white fir-grand fir, Douglas-fir, and ponderosa pine, incense cedar (CADE27) and sugar pine (PILA) are also frequently present. Common understory species include common prince's-pine (CHUM), dwarf Oregongrape (MANE2), baldhip rose (ROGY), starflower (TRBO2), creeping snowberry (SYMO), and western brackenfern (PTAQ).

Common Name	Species	Constancy (%)	Mean Cover (%)
Warm Dry; N = 1,946			
Trees			
Grand fir-White fir	ABGRC	96	34
Douglas-fir	PSME	76	37
Ponderosa pine	PIPO	63	13
Shrubs			
Common snowberry	SYAL	46	6
Heartleaf arnica	ARCO9	41	5
Forbs/Graminoids			
White hawkweed	HIAL2	47	1
Pinegrass	CARU	45	15
Geyer's sedge	CAGE2	43	8
Common yarrow	ACMI2	35	1

White Fir-Grand Fir – Cool Moist (59) The White Fir-Grand Fir Cool Moist Subzone is a minor subzone within the White Fir-Grand Fir Vegzone. This subzone is most abundant in the East Cascades of Oregon and California with scattered distributions of the vegetation type in the Blue Mountains and Sierra Nevada.

This subzone occupies cold, dry environments within the White Fir-Grand Fir Vegzone. Mean annual temperature ranges between 40 and 44°F, while mean annual precipitation ranges from 27 to 40 inches. These sites are often transitional to Mountain Hemlock (TSME) or Subalpine Fir (ABLA) Vegzones. Although average precipitation on some of these sites is relatively high, effective moisture is much lower than the White Fir-Grand fir Warm Dry Subzone sites due to excessively drained soils. Plant communities in this group are extremely species poor. These sites are generally too cold to support high constancy or cover of Douglas-fir (PSME). Lodgepole pine (PICO) is the dominant early seral conifer on these sites. The White Fir-Grand Fir Cool Moist Subzone may support Shasta red fir (ABMAS) south of Lookout Mountain on the Deschutes National Forest. Overstory species include lodgepole pine (PICO), white fir-grand fir (ABGRC), and ponderosa pine (PIPO). Indicator species used to classify this subzone, using the representative Cool Mesic group, include lodgepole pine (PICO), pinemat manzanita (ARNE), long-stolon sedge (CAIN9), and grouse whortleberry (VASC).

Common Name	Species	Constancy (%)	Mean Cover (%)
Cool Moist; N = 340			
Trees			
Lodgepole pine	PICO	93	27
Grand fir-White fir	ABGRC	87	31
Ponderosa pine	PIPO	54	16
Shrubs			
Pinemat manzanita	ARNE	47	9
Snowbrush ceanothus	CEVE	33	11
Forbs/Graminoids			
Ross' sedge	CARO5	45	2
Virginia strawberry	FRVI	41	1
Western needlegrass	ACOC3	41	2
Squirreltail	ELEL5	36	1

White Fir-Grand Fir – Warm Xeric (56) The White Fir-Grand Fir Warm Xeric Subzone is a common subzone within the White Fir-Grand Fir Vegzone. This subzone is most abundant in the East Cascades and Blue Mountains of Oregon and Washington, eastern portions of the Klamath-Siskiyou and North Coast Ranges of California, and throughout the Cascade and Sierra Nevada mountains in California. It is also prominent in higher elevations of the Transverse and Peninsular Ranges of southern California. In California, most sites within this subzone have been called California Mixed Conifer in other classifications.

These sites occupy the warmest, driest true fir climax communities in the Pacific Northwest. Mean annual temperature ranges between 42 and 50°F, while mean annual precipitation ranges

from 25 to 52 inches. Adjacent sites with less effective moisture transition to Douglas-Fir or Ponderosa Pine Vegzones. The dominant seral conifer in these locations is ponderosa pine (PIPO). Incense cedar (CADE27), Douglas-fir (PSME), and sugar pine (PILA) are also often present. Jeffrey pine (PIJE) and California black oak (QUKE) may be occasionally present. This subzone is not species-rich. Indicator species used to classify this subzone, using the representative Warm Dry group, include incense cedar (CADE27), sugar pine (PILA), greenleaf manzanita (ARPA6), common snowberry (SYAL), and snowbrush ceanothus (CEVE).

Within the Eastern Cascades Slopes and Foothills Ecoregion, the species composition indicates a drier environment than that of the overall White Fir-Grand Fir Warm Xeric Subzone. White fir-grand fir and ponderosa pine are the most frequent overstory species, with incense cedar and Douglas-fir present about 25% of the time. Understory species most frequently seen include squirreltail (ELEL5), greenleaf manzanita (ARPA6), snowbrush ceanothus (CEVE), Ross' sedge (CARO5), and western needlegrass (ACOC3).

Within the Blue Mountains Ecoregion, the species composition also indicates a drier environment from that of the overall White Fir-Grand Fir Warm Xeric Subzone. Overstory species include white fir-grand fir, Douglas-fir, and ponderosa pine. Most common understory species include Geyer's sedge (CAGE2), pinegrass (CARU), heartleaf arnica (ARCO9), common yarrow (ACMI2), common snowberry (SYAL), creeping Oregongrape (MARE11), houndstongue hawkweed (HICY), Wheeler's bluegrass (POWH2), California brome (BRCA5), western fescue (FEOC), white hawkweed (HIAL2), western needlegrass (ACOC3), Idaho fescue (FEID), Ross' sedge (CARO5), and bluebunch wheatgrass (PSSP6).

Common Name	Species	Constancy (%)	Mean Cover (%)
Warm Xeric; N = 2,266			
Trees			
Grand fir-White fir	ABGRC	98	30
Ponderosa pine	PIPO	63	19
Incense cedar	CADE27	42	18
Douglas-fir	PSME	41	30

California Red Fir-Shasta Red Fir Vegzone (21)

Vegzone	Vegzone Name	Subzone	Subzone Name
21	California Red Fir-Shasta Red Fir	71	Cool Moist
21	California Red Fir-Shasta Red Fir	72	Mild Very Moist
21	California Red Fir-Shasta Red Fir	73	Cool Very Moist

The California Red Fir-Shasta Red Fir Vegzone is defined by either California red fir or Shasta red fir. California red fir (*Abies magnifica*) is found in southwest Oregon and northern California, with Shasta red fir (*Abies magnifica* var. *shastensis)* more common in southwest Oregon. California red fir (*Abies magnifica*) often exists in extensive high elevation stands in the

Sierra Nevada; its close relative noble fir (*Abies procera*) occurs in small mountaintop populations relatively isolated from one another. Where the two species meet in southern Oregon and northern California, many populations are intermediate; these have been called Shasta red fir (*Abies magnifica var. shastensis*). In California and southern Oregon, red fir is limited to high elevations. Its range extends from the central and southern Cascade Mountains of Oregon southward to Lake County in the Coast Ranges of northwest California and Kern County in the southern Sierra Nevada,

Shasta red fir (*Abies magnifica* var. *shastensis)* is a variety of California red fir (*Abies magnifica*) that is found in southwest Oregon and northern California. It is interfertile with both 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 recognized as noble fir and south of Mt. Lassen as California red fir. Shasta red fir (ABMAS) grows best in areas with cold, wet winters and warm, dry summers. The growing season is short, with snow often on the ground in July. Shasta red fir is generally found at high elevations where the climate is cool to cold and moist, however, it can tolerate summer dry spells common to the Mediterranean environment of southwest Oregon (Atzet et al 1996).

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

In California's Manual of Vegetation, Shasta red fir/red fir falls within the Red Fir Forest and Woodland Alliance. California red fir (ABMA), noble fir (ABPR), or Shasta red fir (ABMAS) are dominant or co-dominant in the tree canopy with white fir (ABCO), incense cedar (CADE27), Brewer spruce (PIBR), Sierra lodgepole pine (PICOM), Jeffrey pine (PIJE), sugar pine (PILA), western white pine (PIMO3), Douglas-fir (PSME), and mountain hemlock (TSME). It is found on upland slopes, ridges, raised stream benches, and terraces (CNPS/A Manual of California Vegetation Online).

This vegzone is characterized by the potential presence of California Red Fir-Shasta red fir (ABPRSH) at a minimum of 5% cover. This is a very depauperate vegzone. Major associated conifer species include western white pine (PIMO3), lodgepole pine (PICO), and white fir-grand fir (ABGRC), with Jeffrey pine (PIJE) present occasionally. Pinemat manzanita (ARNE) is the

most frequently seen shrub. Jeffrey pine appears in the California Red Fir Vegzone, and ponderosa pine (PIPO) appears on the eastside within this vegzone. Douglas-fir (PSME) is largely missing from this vegzone, occurring in less than 5% of the plots. The absence of Douglas-fir (PSME) appears related to the predominance of deep ash/pumice derived soils from Mount Mazama within the California Red Fir-Shasta Red Fir Vegzone.

Common Name	Species	Constancy (%)	Mean Cover (%)
California Red Fir-Shasta Red Fir VZ; N = 444			
Trees			
Noble fir-California red fir-Shasta red fir	ABPRSH	100	44
Western white pine	PIMO3	51	10
Lodgepole pine	PICO	49	27

California Red Fir-Shasta Red Fir Subzones

California Red Fir-Shasta Red Fir – Cool Very Moist (73) This subzone occurs from Diamond Lake Oregon south through the Cascade and Klamath mountains, into northern California, to the Great Basin and the Sierra Nevada. This subzone occurs in the upper montane zone at elevations ranging from 4,500-7,000 feet in northern California and southwest Oregon, and at 7,900-9,200 feet in southern California (Landfire BpS 10320, 10322). This subzone is relatively minor. Sites represent the coolest and wettest environments of the California Red Fir-Shasta Red Fir Vegzone. Mean annual temperature ranges between 39 and 44°F, while mean annual precipitation ranges from 43 to 61 inches. Western white pine (PIMO3) is frequently present. Lodgepole pine (PICO), white fir-grand fir (ABGRC), and mountain hemlock (TSME) may also be present, along with Jeffrey pine (PIJE) in California. Shrub and herbaceous layers have low diversity and relatively low cover. Indicator species used to classify this subzone, using the representative Warm Wet Mesic group, include western white pine (PIMO3) and sidebells wintergreen (ORSE).

Common Name	Species	Constancy (%)	Mean Cover (%)
Cool Very Moist; N = 146			
Trees			
Noble fir-Shasta red fir	ABPRSH	100	49
Western white pine	PIMO3	77	13

California Red Fir-Shasta Red Fir – Mild Very Moist (72) This subzone occurs from Diamond Lake Oregon south through the Cascade and Klamath mountains, into northern California, to the Great Basin and the Sierra Nevada. This subzone occurs in the upper montane zone at elevations ranging from 4,500-7,000 feet in northern California and southwest Oregon, and at 7,900-9,200 feet in southern California (Landfire BpS 10320). Sites within this subzone have the most moderate environments within the California Red Fir-Shasta Red Fir Vegzone. This is the warmest subzone within this vegzone. Mean annual temperature ranges between 40

and 45°F, while mean annual precipitation ranges from 44 to 63 inches. Common overstory species, along with California red fir (ABMA)/Shasta red fir (ABMAS) include white fir-grand fir (ABGRC), western white pine (PIMO3), and lodgepole pine (PICO). Jeffrey pine (PIJE) may also be present in California forests. Canopy cover of tree layers is often high and significantly reduces the cover and species richness in shrub and herbaceous layers. Indicator species used to classify this subzone, using the representative Warm Mesic group, include mountain monardella (MOOD), bush chinquapin (CHSE11), and whiteveined pyrola (PYPI2).

Common Name	Species	Constancy (%)	Mean Cover (%)
Mild Very Moist; N = 101			
Trees			
Noble fir-Shasta red fir	ABPRSH	100	51
Grand fir-White fir	ABGRC	47	10
Lodgepole pine	PICO	41	22
Shrubs			
Pinemat manzanita	ARNE	40	11
Forbs/Graminoids			
Mountain monardella	MOOD	39	3

California Red Fir-Shasta Red Fir – Cool Moist (71) This subzone represents the driest subzone and occurs from Diamond Lake, Oregon south through the Cascade and Klamath mountains, into northern California, to the Great Basin and Sierra Nevada. This subzone occurs in the upper montane zone at elevations ranging from 4,500-7,000 feet in northern California and southwest Oregon, and at 7,900-9,200 feet in southern California (Landfire BpS 10320, 10322). Mean annual temperature ranges between 40 and 44°F, while mean annual precipitation ranges from 43 to 59 inches. Lodgepole pine (PICO) is the primary seral species in the tree layer. Western white pine (PIMO3) and white fir-grand fir (ABGRC) are often present at covers less than 10%. Jeffrey pine (PIJE) may also be present within California forests. Shrub and herbaceous layers have low diversity and relatively low cover even though typical canopy cover of the tree layer is much lower than California Red Fir-Shasta Red Fir Mild Very Moist Subzone sites. Indicator species used to classify this subzone, using the representative Cool Mesic group, include lodgepole pine (PICO) and pinemat manzanita (ARNE).

Common Name	Species	Constancy (%)	Mean Cover (%)
Cool Moist; N = 197			
Trees			
Noble fir-Shasta red fir	ABPRSH	99	36
Lodgepole pine	PICO	69	31

Giant Sequoia Vegzone (16)

Vegzone	Vegzone Name	Subzone	Subzone Name

16	Giant Sequoia	54	Giant Sequoia

The Giant Sequoia (*Sequoiadendron giganteum*) Vegzone is only found in California, mainly restricted to a limited area of the western Sierra Nevada, California. Giant sequoia is usually found in a humid climate characterized by dry summers and snowy winters. Mean annual temperature ranges between 43 and 49°F, while mean annual precipitation ranges from 40 to 47 inches. The elevation of giant sequoia groves generally ranges from 4,600–6,600 feet in the north, to 5,580–7,050 feet to the south. Giant sequoias generally occur on the south-facing sides of northern mountains, and on the northern faces of more southerly slopes. Cones are serotinous.

In California's Manual of Vegetation, giant sequoia (SEGI2) falls within the Giant Sequoia Forest and Woodland Alliance. Giant sequoia is dominant or co-dominant in the tree canopy with white fir (ABCO), California red fir (ABMA), incense cedar (CADE27), Sierra lodgepole pine (PICOM), Jeffrey pine (PIJE), sugar pine (PILA), ponderosa pine (PIPO), Douglas-fir (PSME), and California black oak (QUKE). It can be found on montane flats to middle slopes. Soils are generally granitic-derived and well drained (CNPS/A Manual of California Vegetation Online).

The vegzone and subzone are the same for Giant Sequoia (SEGI2). This vegzone is characterized by the presence of giant sequoia at a minimum of 10% cover. The most common species present include giant sequoia (SEGI2), Jeffrey pine (PIJE), and ponderosa pine (PIPO). Crested wheatgrass (AGCR) and bitter cherry (PREM) may be present. Indicator species used to classify this subzone, using the representative Warm Dry group, include spreading dogbane (APAN2), incense cedar (CADE27), whitethorn ceanothus (CECO), sugar pine (PILA), and wax current (RICE).

Common Name	**Species**	**Constancy (%)**	**Mean Cover (%)**
Giant Sequoia VZ; N = 5			
Trees			
Giant sequoia	SEGI2	100	48
Jeffrey pine	PIJE	40	9
Ponderosa pine	PIPO	40	5

Port-Orford Cedar Vegzone (13)

Vegzone	**Vegzone Name**	**Subzone**	**Subzone Name**
13	Port-Orford Cedar	79	Port-Orford Cedar

The Port-Orford Cedar (*Chamaecyparis lawsoniana*) Vegzone is located in the Klamath Mountains, the southern end of the Coast Range in Oregon, and the northern end of the Coast Range in California. Port-Orford cedar occurs where moisture stress is dampened by summer fog (topographically protected drainages, on north aspects). This vegzone occupies a restricted range, as a result of Port-Orford cedar being native only to southwestern Oregon and northwestern California (Little 1971). The Port-Orford Cedar Vegzone may occur in various topographic

conditions throughout the landscape. In northern California and inland southwest Oregon, this vegzone is restricted to bottoms and lower slope positions (Jimerson 1994).

Climate in the Port-Orford Cedar Vegzone is characterized by warm, dry summers and cool, wet winters. Precipitation across the range varies between 35 to 140 inches annually. California environments receive at least 59 inches of precipitation annually; at high elevations on the west side of the Rogue River-Siskiyou National Forest in southwest Oregon (formerly the Siskiyou National Forest), Port-Orford cedar stands receive an average of 90 inches of annual precipitation. Inland disjunct stands in the eastern Klamath Ranges of California receive at least 49 inches of precipitation annually (USDAFS – W.O. Website; Atzet et al. 1996).

Throughout its range, Port-Orford cedar (CHLA) occurs on ultramafic parent material, particularly where the water table is close to the surface (perched). Scattered, perched water tables are characteristic of ultramafic parent material. Indicator species for this vegzone are frequently the dominant species on these ultramafic substrates (e.g., serpentinite, peridotite) where competition from other species is reduced due to the ultramafic soils. At lower elevations, particularly in California, it is often restricted to these nutrient-poor soils (Hawk 1977; Zobel et al. 1985). Common habitats for this vegzone include streamsides, bogs, and other wet areas. It is an important component of these riparian zones as the long-lasting wood provides persistent structure to these riparian areas for fish, amphibians, and other aquatic organisms.

This vegzone is characterized by the presence of Port-Orford cedar (CHLA) at a minimum of 10% cover. Port-Orford cedar was present in all stands with a mean cover of 19%. Douglas-fir (PSME) was almost always present within the stand, with a mean cover of 45%. This ecosystem is characterized by long-lived stands (many greater than 300 years old), which may have relatively open canopies where serpentine soils and/or soil saturation reduce site potential compared to other ecosystems but can also have canopy closure greater than 70%.

In California's Manual of Vegetation, Port-Orford Cedar (CHLA) falls within the Port-Orford Cedar Forest and Woodland Alliance. Port-Orford cedar is dominant or co-dominant in the tree canopy along with white fir (ABCO), noble fir (ABPR), Shasta red fir (ABMAS), white alder (ALRH2), incense cedar (CADE27), Jeffrey pine (PIJE), sugar pine (PILA), western white pine (PIMO3), and Douglas-fir (PSME). It is found in low-gradient depositions along rivers, concave slopes, raised stream benches, and terraces with perched water tables (CNPS/A Manual of California Vegetation Online).

Large Port-Orford cedar trees that have been infected with *Phytophthora lateralis* root disease may result in a reduction of the proportion of late-seral states and canopy closure, especially if Port Orford cedar (CHLA) individuals grew in areas too wet for Douglas-fir (PSME) to successfully replace them (Jules et al. 2014).

The vegzone and subzone are the same for Port-Orford cedar. The most common tree species present include Port-Orford cedar (CHLA), Douglas-fir (PSME), western white pine (PIMO3), and tanoak (LIDE3). Indicator species used to classify this subzone, using the representative Warm Wet Mesic group, include western swordfern (POMU), salal (GASH), Oregon fairybell

(DIHO3), western white pine (PIMO3), Pacific rhododendron (RHMA3), twinflower (LIBO3), and California laurel (UMCA).

Common Name	Species	Constancy (%)	Mean Cover (%)
Port-Orford Cedar VZ/Subzone; N = 48			
Trees			
Port-Orford cedar	CHLA	100	19
Douglas-fir	PSME	96	45
Western white pine	PIMO3	46	17
Tanoak	LIDE3	42	28
Shrubs			
Salal	GASH	63	19
Huckleberry oak	QUVA	52	21
California huckleberry	VAOV2	48	9
Western azalea	RHOC	46	7
Pacific rhododendron	RHMA3	38	15
Pinemat manzanita	ARNE	35	5
Forbs/Graminoids			
Western swordfern	POMU	73	7
Common beargrass	XETE	69	3
Starflower	TRBO2	60	1
Common prince's-pine	CHUM	35	1
Western brackenfern	PTAQ	35	1
Twinflower	LIBO3	33	1

Tanoak Vegzone (15)

Vegzone	Vegzone Name	Subzone	Subzone Name
15	Tanoak	51	Very Moist
15	Tanoak	52	Very Wet

The Tanoak (*Lithocarpus densiflorus*) Vegzone is limited to southwest Oregon and northwest California. It is most common in the Coast ranges and Siskiyou Mountains in California, as well as inland, where it ranges east to the Siskiyou and Klamath mountains. This vegzone is found in coastal areas where marine air softens severe frosts and reduces summer evapotranspirational demand, in an inland mid-slope elevational belt below the high elevation cold, but above cold air accumulation in the valleys (mostly 2,000 to 4,000 feet), in protected inland, often north facing, coves, and on ultramafic sites heavily modified by precipitation or by other normal rock types (Atzet et al. 1996). It is most common just above the Redwood (*Sequoia sempervirens*) Vegzone in coastal locations in California. In southwest Oregon, this vegzone is found in the moist middle

of southwest Oregon's environmental gradient, where it is bracketed by the Western Hemlock (TSHE) Vegzone and the Douglas-fir (PSME) Vegzone.

The Tanoak Vegzone occurs in areas with relatively high moisture levels and mild temperatures. It is best adapted to a Mediterranean climate modified by cool-moist coastal air currents, with rainy winters and dry summers and falls. Productive sites within this vegzone are found in areas of high humidity, with plentiful moisture from soil, rain, fog, low clouds, and/or high humidity. In some areas, such as redwood (SESE3) forests of coastal Monterey County, California, tanoak (LIDE3) attains greatest abundance and largest size on mesic sites above the fog zone.
Soils supporting this vegzone are typically deep and well drained. Frost and drought limit its range.

In California's Manual of Vegetation, tanoak (LIDE3) falls within the Tanoak Forest Alliance and the Douglas-fir-Tanoak Forest and Woodland Alliance. In both alliances, tanoak is dominant or co-dominant in the tree canopy with Douglas-fir (PSME), bigleaf maple (ACMA3), red alder (ALRU2), Pacific madrone (ARME), incense cedar (CADE27), Port-Orford cedar (CHLA), giant chinquapin (CHCH7), Pacific dogwood (CONU4), coulter pine (PICO3), sugar pine (PILA), California live oak (QUAG), canyon live oak (QUCH2), California black oak (QUKE), redwood (SESE3), California nutmeg (TOCA), western hemlock (TSHE), and California laurel (UMCA). It is found on raised stream benches, terraces, slopes, and ridges of all aspects. Soils are deep and well drained (CNPS/A Manual of California Vegetation Online).

This vegzone is characterized by the potential presence of tanoak at a minimum of 20% cover. Tanoak (LIDE3) was present in all plots with a mean cover of 52%. Douglas-fir (PSME) was almost always present with a mean cover of 47%, as well as Pacific madrone (ARME), with a mean cover of 14%. The most frequently found understory species in this vegzone include western swordfern (POMU), western brackenfern (PTAQ), poisonoak (TODI), canyon live oak (QUCH2), dwarf Oregongrape (MANE2), California huckleberry (VAOV2), common whipplevine (WHMO), and salal (GASH).

Common Name	Species	Constancy (%)	Mean Cover (%)
Tanoak VZ; N = 659			
Trees			
Tanoak	LIDE3	99	52
Douglas-fir	PSME	94	47
Pacific Madrone	ARME	73	14
Canyon live oak	QUCH2	44	21
Shrubs			
California huckleberry	VAOV2	41	21
Salal	GASH	38	11
Forbs/Graminoids			
Western swordfern	POMU	62	5
Western brackenfern	PTAQ	56	2

Tanoak Subzones

Tanoak – Very Wet (52) This subzone occurs along the coastal side of the Tanoak Vegzone, where precipitation is higher and temperatures are warmer. Mean annual temperature ranges between 50 and 55°F, while mean annual precipitation ranges from 62 to 105 inches. Tanoak and Douglas-fir (PSME) are co-dominants, with Pacific madrone (ARME) frequently present. Bigleaf maple (ACMA3) and California laurel (UMCA) are common. Indicator species used to classify this subzone, using the representative Warm Wet Mesic group, include western swordfern (POMU), salal (GASH), bigleaf maple (ACMA3), California laurel (UMCA), Pacific rhododendron (RHMA3), Oregon fairybell (DIHO3), Oregon oxalis (OXOR), and red alder (ALRU2).

Common Name	Species	Constancy (%)	Mean Cover (%)
Very Wet; N = 311			
Trees			
Tanoak	LIDE3	100	55
Douglas-fir	PSME	98	49
Pacific madrone	ARME	62	11
Bigleaf maple	ACMA3	41	16
California laurel	UMCA	38	16
Canyon live oak	QUCH2	33	17
Shrubs			
Salal	GASH	61	14
California huckleberry	VAOV2	59	21
Pacific rhododendron	RHMA3	35	14
Forbs/Graminoids			
Western swordfern	POMU	80	8
Western brackenfern	PTAQ	62	2
Starflower	TRBO2	36	1

Tanoak – Very Moist (51) This subzone represents the inland, drier environments in this vegzone. Mean annual temperature ranges between 50 and 56°F, while mean annual precipitation ranges from 53 to 82 inches. Tanoak and Douglas-fir (PSME) are co-dominants, with Pacific madrone (ARME) frequently present. Sugar pine (PILA), California black oak (QUKE), and giant chinquapin (CHCH7) may also be present. Indicator species used to classify this subzone, using the representative Warm Mesic group, include common whipplevine (WHMO), dwarf Oregongrape (MANE2), starflower (TRBO2), dwarf (baldhip) rose (ROGY), California huckleberry (VAOV2), California blackberry (RUUR), western rattlesnake plantain (GOOB2), and giant chinquapin (CHCH7).

Species composition shifts in the more southerly range of this subzone, within the Central California Foothills and Coastal Mountains Ecoregion. Douglas-fir (PSME) is not as frequent, however, there are more species of oak present. Tanoak (LIDE3), Pacific madrone (ARME), canyon live oak (QUCH2), California live oak (QUAG), interior live oak (QUWI2), California black oak (QUKE), and California laurel (UMCA) are common. Ponderosa pine (PIPO) and

coulter pine (PICO3) may also be present. The most common understory species include poisonoak (TODI), western brackenfern (PTAQ), and western swordfern (POMU). California huckleberry (VAOV2) may be present with high covers.

Common Name	Species	Constancy (%)	Mean Cover (%)
VeryMoist; N = 348			
Trees			
Tanoak	LIDE3	98	50
Douglas-fir	PSME	91	45
Pacific Madrone	ARME	83	16
Canyon live oak	QUCH2	53	24
Forbs/Graminoids			
Western brackenfern	PTAQ	49	3
Western swordfern	POMU	45	1

Douglas-Fir Vegzone (14)

Vegzone	Vegzone Name	Subzone	Subzone Name
14	Douglas-Fir	40	Bigcone Douglas-Fir
14	Douglas-Fir	41	Very Warm Dry
14	Douglas-Fir	42	Warm Dry
14	Douglas-Fir	43	Very Warm Moist

The Douglas-fir (*Pseudotsuga menziesii*) Vegzone is present in Northern Washington on the east side of the Cascades, scattered throughout most of Oregon, and prominent in southwest Oregon and northern California. The Douglas-fir Vegzone is essentially missing in central and south-central Oregon where deep pumice deposits from Mount Mazama, the South and Middle Sisters, Shasta, and Lassen occur. Within these ash/pumice deposits the vegzone is found only on steep slopes where ash and pumice did not accumulate. On warmer, drier sites, the Douglas-fir Vegzone grades into non-forest communities or into the Ponderosa Pine (PIPO) Vegzone on the eastside of the Cascades. – Need to work on this – make a little more general. Also generally grades into the ABCO and LIDE3 VZs

Douglas-fir (PSME) is the dominant tree species west of the Cascade Mountains in the Pacific Northwest and is the dominant seral or climax species over a very broad range of habitats. 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 (TSHE), western redcedar (THPL), white fir-grand fir (ABGRC), or mountain hemlock (TSME).

Presence and dominance in the understory can indicate hot, dry conditions characteristic of the vegzone. In southwest Oregon, this vegzone occurs in the hottest, driest forest environments, except for the isolated occurrences of climax stands of Oregon white oak (QUGA4) and

ponderosa pine (PIPO) (Atzet et al. 1996). Because Mediterranean ecosystems are hotter, drier, and have more clear days and nights (temperature extremes not dampened by cloud cover or high humidity) than temperate systems, Douglas-fir has the potential to attain climax status (is the climax dominant) on a wide variety of soil conditions across the landscape. In southwest Oregon, this vegzone distribution is not totally associated with a particular elevational band or continuum, like the White Fir-Grand Fir (ABGRC) Vegzone. Instead, the Douglas-fir Vegzone can be found on the hotter, drier sites at high elevations or on the coastal side of the Coastal Crest mixed with the Western Hemlock (TSHE) or Tanoak (LIDE3) Vegzone (Atzet et al. 1996).

In central Oregon, Ponderosa pine (PIPO) is a major seral species throughout the Douglas-fir Vegzone. Incense cedar (CADE27) is a minor climax species from Sisters north to the White River east of Mount Hood and from Chiloquin though the Klamath River Canyon into northern California. Oregon white oak (QUGA4) 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 (ABGRC) Vegzone sites minus dwarf bramble (RULA2), dwarf Oregongrape (MANE2), starry false Solomon's-seal (MAST4), and Oregon boxleaf (PAMY). These species are replaced by dry site species such as heartleaf arnica (ARCO9), arrowleaf balsamroot (BASA3), antelope bitterbrush (PUTR2), and Geyer's sedge (CAGE2).

In California's Manual of Vegetation, Douglas-fir falls within the Douglas-fir Forest and Woodland Alliance. Douglas-fir is dominant or co-dominant with white fir (ABCO), bigleaf maple (ACMA3), white alder (ALRH2), Pacific madrone (ARME), incense cedar (CADE27), Port-Orford cedar (CHLA), giant chinquapin (CHCH7), Pacific dogwood (CONU4), lodgepole pine (PICO), Jeffrey pine (PIJE), sugar pine (PILA), California live oak (QUAG), canyon live oak (QUCH2), Oregon white oak (QUGA4), California black oak (QUKE), and redwood (SESE3). It is found on all slope positions and all aspects (CNPS/A Manual of California Vegetation Online).

This vegzone is characterized by the presence of Douglas-fir at a minimum of 5% cover. Douglas-fir is present in most plots with a mean cover of 40%. Ponderosa pine (PIPO) is frequently found in this vegzone. California black oak (QUKE) and canyon live oak (QUCH2) are common, as well as incense cedar (CADE27). Common understory species include common snowberry (SYAL), common yarrow (ACMI2), pinegrass (CARU), western serviceberry (AMAL2), baldhip rose (ROGY), white spirea (SPBE2), white hawkweed (HIAL2), oceanspray (HODI), heartleaf arnica (ARCO9), Idaho fescue (FEID), poisonoak (TODI), and bluebunch wheatgrass (PSSP6).

Common Name	Species	Constancy (%)	Mean Cover (%)
Douglas-fir VZ; N = 3,649			
Trees			
Douglas-fir	PSME	95	41
Ponderosa pine	PIPO	60	15
Shrubs			
Common snowberry	SYAL	43	8

Forbs/Graminoids			
Common yarrow	ACMI2	38	2
Pinegrass	CARU	38	17

Douglas-Fir Subzones

Douglas-Fir – Very Warm Moist (43) This subzone represents a wetter environment than the other Douglas-fir subzones. It is found south of Olympia, along the fringes of the Willamette Valley, in southwest Oregon and Northern California, as well as scattered farther south in California. Mean annual temperature ranges between 48 and 55°F, while mean annual precipitation ranges from 41 to 66 inches. Ponderosa pine (PIPO) is less frequently found while bigleaf maple (ACMA3) becomes common. Indicator species used to classify this subzone, using the representative Warm Wet Mesic group, include western swordfern (POMU) and bigleaf maple (ACMA3).

Within the Northern Rockies Ecoregion, species composition is slightly different than that of the overall Douglas-Fir – Very Warm Moist Subzone. It is a species-rich ecoregion within this subzone, with forty species having a constancy of greater than 40 percent. Overstory species include Douglas-fir and western larch (LAOC), with ponderosa pine (PIPO) and lodgepole pine (PICO) common. Most common understory species include pinegrass (CARU), common snowberry (SYAL), white spirea (SPBE2), western serviceberry (AMAL2), twinflower (LIBO3), Oregon boxleaf (PAMY), kinnikinnick (ARUV), Rocky Mountain maple (ACGL), common prince's-pine (CHUM), heartleaf arnica (ARCO9), thimbleberry (RUPA), tall Oregongrape (MAAQ2), baldhip rose (ROGY), Scouler's willow (SASC), western false Solomon's-seal (MARA7), common yarrow (ACMI2), and white hawkweed (HIAL2).

Common Name	Species	Constancy (%)	Mean Cover (%)
Very Warm Moist; N = 497			
Trees			
Douglas-fir	PSME	99	50
Bigleaf maple	ACMA3	46	22
Shrubs			
Poisonoak	TODI	43	7
Beaked hazelnut	COCO6	42	7
Oceanspray	HODI	39	5
California blackberry	RUUR	38	7
Common snowberry	SYAL	35	6
Forbs/Graminoids			
Western swordfern	POMU	61	8
Western brackenfern	PTAQ	36	4

Douglas-Fir – Warm Dry (42) This subzone represents the warm, dry Douglas-fir sites. It appears less often than the Very Warm Dry Subzone and is more prevalent in northern Washington. Mean annual temperature ranges between 42 and 48°F, while mean annual precipitation ranges from 19 to 36 inches. The tree layers are dominated by Douglas-fir (PSME), with ponderosa pine (PIPO) very common. Indicator species used to classify this subzone, using the representative Warm Mesic group, include white spirea (SPBE2), oceanspray (HODI), heartleaf arnica (ARCO9), white hawkweed (HIAL2), dwarf rose (ROGY), Scouler's willow (SASC), kinnikinnick (ARUV), Rocky Mountain maple (ACGL), dwarf Oregongrape (MANE2), and western false Solomon's-seal (MARA7).

Within the Klamath Mountains Ecoregion, species composition is somewhat different from the overall Douglas-Fir – Warm Dry Subzone. Graminoids are mostly absent in this Ecoregion, and ponderosa pine (PIPO) is not found as frequently as in the overall subzone (38% constancy versus 62%). Canyon live oak (QUCH2), California black oak (QUKE), incense cedar (CADE27), and sugar pine (PILA) are also commonly found. Understory species frequently found include poisonoak (TODI), common whipplevine (WHMO), Pacific madrone (ARME), baldhip rose (ROGY), western swordfern (POMU), starflower (TRBO2), pink honeysuckle (LOHI2), beaked hazelnut (COCO6), California blackberry (RUUR), oceanspray (HODI), western brackenfern (PTAQ), dwarf Oregongrape (MANE2), white hawkweed (HIAL2), tall Oregongrape (MAAQ2), and creeping snowberry (SYMO).

Common Name	Species	Constancy (%)	Mean Cover (%)
Warm Dry; N = 1,402			
Trees			
Douglas-fir	PSME	97	46
Ponderosa pine	PIPO	62	14
Shrubs			
Common snowberry	SYAL	60	10
White spirea	SPBE2	54	6
Oceanspray	HODI	49	6
Heartleaf arnica	ARCO9	46	7
Forbs/Graminoids			
Pinegrass	CARU	62	20
Common yarrow	ACMI2	55	2
White hawkweed	HIAL2	44	1
Idaho fescue	FEID	33	5

Douglas-Fir – Very Warm Dry (41) This subzone is scattered throughout Washington but is very prevalent in southwest Oregon and California. It is the most common subzone within the Douglas-fir Vegzone. This subzone represents the warmest and driest Douglas-fir (PSME) sites. Mean annual temperature ranges between 44 and 55°F, while mean annual precipitation ranges from 23 to 51 inches. This subzone is found across the range of the vegzone, generally at lower elevations. Tree layers are various mixtures of Douglas-fir (PSME) and ponderosa pine (PIPO), with California black oak (QUKE), canyon live oak (QUCH2), incense cedar (CADE27), sugar

pine (PILA), and Oregon white oak (QUGA4) also common. Disturbance of the overstory will dramatically increase the total cover of the understory. Indicator species used to classify this subzone, using the representative Warm Dry group, include common snowberry (SYAL), poisonoak (TODI), canyon live oak (QUCH2), pinegrass (CARU), Geyer's sedge (CAGE2), western serviceberry (AMAL2), sugar pine (PILA), and incense cedar (CADE27).

Within the Central California Foothills and Coastal Mountains Ecoregion, species composition indicates a drier environment than that of the overall Douglas-Fir – Very Warm Dry Subzone. This Ecoregion includes the presence of more oaks, such as California black oak (QUKE), canyon live oak (QUCH2), California live oak (QUAG), interior live oak (QUWI2), Oregon white oak (QUGA4), and valley oak (QULO). California laurel (UMCA) is also commonly found within this Ecoregion. Common understory species present include poisonoak (TODI), Pacific madrone (ARME), toyon (HEAR5), and bristly dogtail grass (CYEC).

Within the Blue Mountains Ecoregion, species composition lacks the oaks but includes many graminoids, also indicating a drier environment than that of the overall Douglas-Fir – Very Warm Dry Subzone. The only tree species frequently present are Douglas-fir (PSME) and ponderosa pine (PIPO). Common understory species include Geyer's sedge (CAGE2), common snowberry (SYAL), common yarrow (ACMI2), bluebunch wheatgrass (PSSP6), Idaho fescue (FEID), pinegrass (CARU), heartleaf arnica (ARCO9), Wheeler's bluegrass (POWH2), California brome (BRCA5), cheatgrass (BRTE), creeping Oregongrape (MARE11), houndstongue hawkweed (HICY), western serviceberry (AMAL2), Sandberg bluegrass (POSE), western juniper (JUOC), and arrowleaf balsamroot (BASA3).

Common Name	Species	Constancy (%)	Mean Cover (%)
Very Warm Dry; N = 68			
Trees			
Douglas-fir	PSME	96	34
Ponderosa pine	PIPO	71	16
California black oak	QUKE	38	18
Shrubs			
Common snowberry	SYAL	33	6
Forbs/Graminoids			
Common yarrow	ACMI2	33	2

Bigcone Douglas-Fir (40) This subzone is only found in California. Low elevation bigcone Douglas-fir (*Pseudotsuga macrocarpa*) forest communities are disjunct, surrounded by extensive areas of chamise (ADFA) chaparral or coastal sage scrub. In canyon bottoms, bigcone Douglas-fir communities intergrade with riparian forest. As elevation increases, stands of bigcone Douglas-fir are more widespread. Canyon live oak (QUCH2) is almost always found in these stands. Coulter pine (PICO3) replaces bigcone Douglas-fir on more xeric sites at these elevations. Bigcone Douglas-fir grows in a Mediterranean climate, characterized by hot summers and wet, mild winters. Mean annual temperature ranges between 52 and 59°F, while mean annual precipitation ranges from 20 to 32 inches. It is one of only a few western conifers capable

of sprouting following fire. Mature trees sprout vigorously from the branches and bole after burning.

In California's Manual of Vegetation, Bigcone Douglas-fir (PSMA) falls within the Bigcone Douglas-fir Forest. Bigcone Douglas-fir is dominant or co-dominant in the tree canopy with Pacific madrone (ARME), tanoak (LIDE3), Coulter pine (PICO3), Jeffrey pine (PIJE), California live oak (QUAG), canyon live oak (QUCH2), interior live oak (QUWI2), and California laurel (UMCA). It is found in deep, convex canyons, draws, benches, hillsides, and cliff faces favoring rapidly eroding, north-facing slopes. Soils are shallow and well drained (CNPS/A Manual of California Vegetation Online).

Canyon live oak (QUCH2) is frequently present alongside bigcone Douglas-fir (PSMA). Sugar pine (PILA), Coulter pine (PICO3), singleleaf pinyon (PIMO), Jeffrey pine (PIJE), interior live oak (QUWI2), and California black oak (QUKE) are somewhat common. Indicator species used to classify this subzone, using the representative Warm Dry group, include canyon live oak (QUCH2), alderleaf mountain mahogany (CEMO2), and sugar pine (PILA).

Common Name	Species	Constancy (%)	Mean Cover (%)
Bigcone Douglas-fir; N = 68			
Trees			
Bigcone Douglas-fir	PSMA	99	18
Canyon live oak	QUCH2	85	37

Jeffrey Pine Vegzone (12)

Vegzone	Vegzone Name	Subzone	Subzone Name
12	Jeffrey Pine	37	Warm Xeric
12	Jeffrey Pine	38	Warm Dry
12	Jeffrey Pine - Knobcone Pine	39	Knobcone Pine

The Jeffrey Pine (*Pinus jeffreyi*) Vegzone occurs throughout southwest Oregon, the Klamath Mountains, and south through much of California, including the Sierras, Coast Ranges, Transverse Range and Peninsular Range, to northern Baja California. Southwest Oregon is the northern extent of the range of Jeffrey pine, and therefore, this vegzone.

Environments within the Jeffrey Pine Vegzone are characterized by shallow, rocky, infertile soils as well as dry pumice and bare granitic substrates. About 20% of Jeffrey pine's distribution occurs on ultramafic soils; the rest occurs on volcanic and granitic parent materials. In southwest Oregon and northwest California, Jeffrey pine is most typical of ultramafic soils, including serpentine. Ultramafic bedrock, mainly serpentine and peridotite, is high in ferromagnesium silicate minerals with an unusually high proportion of nickel and chromium. This chemical composition, toxic to most plants, results in a unique and diverse flora. Soils weathered from ultramafic rock strongly reflect the elemental composition of the parent rock with high

concentrations of magnesium, iron, and silica (Kruckeberg 1984). Short growing seasons, drought, and cold are tolerated by Jeffrey pine.

Jeffrey pine (PIJE) is often the dominant tree species on soils derived from ultramafic parent material, especially in interior valleys and foothills. Tanoak (LIDE3), western hemlock (TSHE), or Port-Orford cedar (CHLA) may replace Jeffrey pine as the stand dominant near the coast.

In California's Manual of Vegetation, Jeffrey pine (PIJE) falls within the Jeffrey Pine Forest and Woodland Alliance. Jeffrey pine (PIJE) is dominant or co-dominant in the tree canopy with white fir (ABCO), California red fir (ABMA), incense cedar (CADE27), Port-Orford cedar (CHLA), western juniper (JUGR7), knobcone pine (PIAT), foxtail pine (PIBA), Sierra lodgepole pine (PICOM), coulter pine (PICO3), western white pine (PIMO3), ponderosa pine (PIPO), Douglas-fir (PSME), giant chinquapin (CHCH7), California black oak (QUKE), and interior live oak (QUWI2). It is found in on raised stream benches, all slopes and aspects, ridges, and plateaus. Soils are commonly infertile and shallow (CNPS/A Manual of California Vegetation Online).

This vegzone is characterized by the presence of Jeffrey pine at a minimum of 5% cover. Jeffrey pine was present in almost all plots with a mean cover of 23%. As a result of the serpentine/peridotite parent material influence, there are many unique species found in this vegzone, e.g., rock fern (ASDE6), dwarf ceanothus (CEPU), Tolmie star-tulip (CATO), dwarf silktassel (GABU2), California buckthorn (FRCA12), huckleberry oak (QUVA), and common beargrass (XETE). These species may be frequently found yet may have low covers. Douglas-fir (PSME) and incense-cedar (CADE27) are consistently present in the overstory and the understory, as well as ponderosa pine (PIPO) in California.

In California, the Jeffrey Pine Vegzone is also found on non-serpentine soils, and it incorporates ponderosa pine (PIPO) and white fir (ABCO). Big sagebrush (ARTR2), antelope bitterbrush (PUTR2), squirreltail (ELEL5), and cheatgrass (BRTE) are also more common in California than in Oregon. The Jeffrey Pine Vegzone has the highest frequency of sensitive and rare plants of forest zones in northwest California (Jimerson et al. 1995).

Common Name	Species	Constancy (%)	Mean Cover (%)
Jeffrey Pine VZ; N = 751			
Trees			
Jeffrey pine	PIJE	96	23

Jeffrey Pine Subzones

Jeffrey Pine – Warm Dry (38) This subzone is found in southwest Oregon and northern California. This subzone represents dry environments that receive more annual precipitation than the Warm Xeric Subzone. Mean annual temperature ranges between 43 and 51°F, while mean annual precipitation ranges from 21 to 43 inches. Jeffrey pine (PIJE), incense cedar (CADE27), ponderosa pine (PIPO), and white fir-grand fir (ABGRC) are the most frequently found overstory species. Indicator species used to classify this subzone, using the representative Warm

Dry group, include sticky whiteleaf manzanita (ARPA6), incense cedar (CADE27), and prostrate ceanothus (CEPR).

Species composition in the Southern California Mountains Ecoregion is somewhat different than that of the northern variant of the Warm Dry Subzone. The most frequently occurring species include Jeffrey pine (PIJE), California black oak (QUKE), canyon live oak (QUCH2), singleleaf pinyon (PIMO), sugar pine (PILA), white fir (ABCO), and coulter pine (PICO3). Interior live oak (QUWI2), sticky whiteleaf manzanita (ARPA6), incense cedar (CADE27), and whitethorn ceanothus (CECO) may be occasionally present.

Species composition in the Klamath Mountains Ecoregion is also somewhat different from that of the overall Jeffrey Pine – Warm Dry Subzone. Jeffrey pine (PIJE), incense cedar (CADE27), Douglas-fir (PSME), and sugar pine (PILA) are the most common overstory species. Frequently found understory species include huckleberry oak (QUVA), sticky whiteleaf manzanita (ARVI4), common yarrow (ACMI2), rock fern (ASDE6), California buckthorn (FRCA12), and Idaho fescue (FEID).

Common Name	Species	Constancy (%)	Mean Cover (%)
Warm Dry; N = 532			
Trees			
Jeffrey pine	PIJE	99	23

Jeffrey Pine – Warm Xeric (37) This subzone is found along the eastern edge of California along the Sierra Nevada mountains, as well as further south into southern California. This subzone represents the driest Jeffrey pine sites. Mean annual temperature ranges between 42 and 48°F, while mean annual precipitation ranges from 16 to 22 inches. Jeffrey pine (PIJE) is always present in this subzone, with ponderosa pine (PIPO) and singleleaf pinyon (PIMO) occasionally present. Indicator species used to classify this subzone, using the representative Warm Xeric group, include western juniper (JUOC), big sagebrush (ARTR2), antelope bitterbrush (PUTR2), squirreltail (ELEL5), and curl-leaf mountain mahogany (CELE3).

Species composition in the Southern California Mountains Ecoregion is somewhat different than the northern variant of the Warm Xeric Subzone. There are fewer species overall, with Jeffrey pine (PIJE) and singleleaf pinyon (PIMO) the most commonly found tree species. White fir (ABCO) may be also be common. Ponderosa pine (PIPO) and California black oak (QUKE) may be occasionally present. The only somewhat common understory species are common juniper (JUOC), big sagebrush (ARTR2), and curl-leaf mountain mahogany (CELE3).

Common Name	Species	Constancy (%)	Mean Cover (%)
WarmXeric; N = 195			
Trees			
Jeffrey pine	PIJE	100	22
Shrubs			
Western juniper	JUOC	65	13

Big sagebrush	ARTR2	37	11
Antelope bitterbrush	PUTR2	34	8

Jeffrey Pine – Knobcone Pine (39) This subzone represents those sites that are climax to knobcone pine (*Pinus attenuata*) and is found in California and Oregon in minor amounts. Knobcone pine (PIAT) is always present on these sites while Jeffrey pine (PIJE) is mostly absent. This subzone was placed within this vegzone due to its serpentine affinity. Ponderosa pine (PIPO) may be present. Canyon live oak (QUCH2), interior live oak (QUWI2), California black oak (QUKE), scrub oak (QUBE5), and California live oak (QUAG) are commonly found in this subzone. Common understory species include sticky whiteleaf manzanita (ARVI4), chamise (ADFA), poisonoak (TODI), toyon (HEAR5), greenleaf manzanita (ARPA6), whiteleaf manzanita (ARMA), buckbrush (CECU), deerbrush (CEIN3), and alderleaf mountain mahogany (CEMO2). Mean annual temperature ranges between 51 and 58°F, while mean annual precipitation ranges from 31 to 45 inches.

Species composition in the Cascades Ecoregion is somewhat different than that of the overall Jeffrey Pine – Knobcone Pine Subzone. Knobcone pine (PIAT), bitter cherry (PREM), California black oak (QUKE), greenleaf manzanita (ARPA6), prostrate ceanothus (CEPR), snowbrush ceanothus (CEVE), squirreltail (ELEL5), and antelope bitterbrush (PUTR2) are the most common species present.

Species composition in the Klamath Mountains Ecoregion is also somewhat different than that of the overall Jeffrey Pine – Knobcone Pine Subzone. Knobcone pine (PIAT) is the only common conifer, with ponderosa pine (PIPO) possibly present. Understory species include sticky whiteleaf manzanita (ARVI4), poisonoak (TODI), canyon live oak (QUCH2), California black oak (QUKE), chamise (ADFA), greenleaf manzanita (ARPA6), and alderleaf mountain mahogany (CEMO2).

Common Name	**Species**	**Constancy (%)**	**Mean Cover (%)**
Knobcone Pine; N = 24			
Trees			
Knobcone pine	PIAT	100	19
Canyon live oak	QUCH2	50	27
Interior live oak	QUWI2	42	28
California black oak	QUKE	38	23
Shrubs			
Poisonoak	TODI	50	4
Sticky whiteleaf manzanita	ARVI4	63	18
Chamise	ADFA	54	8
Toyon	HEAR5	33	7

Ponderosa Pine Vegzone (10)

Vegzone	Vegzone Name	Subzone	Subzone Name
10	Ponderosa Pine	30	Ponderosa Pine-Juniper Woodlands
10	Ponderosa Pine	31	Warm Xeric
10	Ponderosa Pine	33	Ponderosa Pine-Lodgepole Pine
10	Ponderosa Pine	34	Ponderosa Pine-Oak

Ponderosa pine (*Pinus ponderosa*) forests are widely distributed on the east slope of the Oregon Cascades, as well as east of the Cascades in Washington, and extensively scattered throughout California on the XXNF (Northeast) and on the eastern edge of the Central Valley. Climax ponderosa pine forests occupy a narrow band 5-10 miles wide on the eastern flanks of the Cascade Range from the Columbia River south to Bend. South of Bend, within the pumice/ash deposits from Mount Mazama, the Ponderosa Pine Vegzone is up to 35-40 miles wide.

The climate of the Ponderosa Pine Vegzone is characterized by a short growing season and minimal summer precipitation (Franklin and Dyrness 1973). Since ponderosa pine (PIPO) occupies drier sites than any other forest type except western juniper (JUOC) or occasionally lodgepole pine (PICO), its distribution is tied closely to available soil moisture. Sites with high mean annual precipitation have low effective moisture due to excessive soil drainage (ash/pumice, cinder deposits) or shallow soils (lava flows).

While ponderosa pine behaves as a fast growing, seral species on hot, dry sites with shallow, droughty soils, it is the climax species on only a few sites in the Klamath and Cascade Province in southwestern Oregon (Atzet 1992). Ponderosa pine can be found in frost pockets and on vertisols, soils with high shrink-swell characteristics (Atzet et al. 1996).

Climax ponderosa pine (PIPO) 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 (PSME) or white fir-grand fir (ABGRC) can be found. Sites are generally too dry for Douglas-fir or white fir-grand fir to assume dominance. Outside the pumice/ash deposits, ponderosa pine (PIPO), incense cedar (CADE27), western juniper (JUOC), and Oregon white oak (QUGA4) are usually the only tree species regenerating.

Within the deep recent pumice/ash deposits, lodgepole pine (PICO) is an important seral species within this vegzone and may never be completely excluded especially in flat areas and depressions that accumulate cold air. Sugar pine (PILA) may also be found in association with ponderosa pine (PIPO), especially on slopes with good cold air drainage within the Mount 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 Vegzone.

In California’s Manual of Vegetation, ponderosa pine (PIPO) falls within the Ponderosa Pine Forest and Woodland Alliance. Ponderosa pine is dominant or co-dominant with white fir (ABCO), incense cedar (CADE27), western juniper (JUGR7), western juniper (JUOC), tanoak (LIDE3), Sierra lodgepole pine (PICOM), Coulter pine (PICO3), Jeffrey pine (PIJE), sugar pine (PILA), Douglas-fir (PSME), canyon live oak (QUCH2), California black oak (QUKE), and

interior live oak (QUWI2). It is found on all upland topography, floodplains, low-gradient depositions along streams, and raised benches (CNPS/A Manual of California Vegetation Online).

This vegzone is characterized by the presence of ponderosa pine (PIPO) at a minimum of 5% cover. Shrubs are important in some Ponderosa Pine subzones, but typically shrubs do not form a continuous layer. The most common shrub is antelope bitterbrush (PUTR2). Squirreltail (ELEL5), Ross' sedge (CARO5), Idaho fescue (FEID), and western needlegrass (ACOC3) are the most dominant graminoids of the vegzone. Many of the important forbs and graminoids found in the vegzone are species also characteristic of nearby shrublands and grasslands that occur under conditions too harsh for trees. Some important taxa include Sandberg bluegrass (POSE), Wheeler's bluegrass (POWH2), cheatgrass (BRTE), bluebunch wheatgrass (PSSP6), and common yarrow (ACMI2).

Common Name	Species	Constancy (%)	Mean Cover (%)
Ponderosa Pine VZ; N = 2,615			
Trees			
Ponderosa pine	PIPO	96	25
Shrubs			
Antelope bitterbrush	PUTR2	55	11
Forbs/Graminoids			
Squirreltail	ELEL5	52	2
Ross' sedge	CARO5	45	2
Idaho fescue	FEID	44	10
Western needlegrass	ACOC3	44	2
Common yarrow	ACMI2	43	1
Cheatgrass	BRTE	33	7

Ponderosa Pine Subzones

Ponderosa Pine – Warm Xeric (31) This subzone is found interspersed throughout the vegzone from eastern Washington, into Central and eastern Oregon, to northern California, and has an average total tree cover of 30-35%. Mean annual temperature ranges between 42 and 47°F, while mean annual precipitation ranges from 17 to 23 inches. Ponderosa pine forms an open forest to savanna. Total shrub cover averages between 10-20%. The most common species is antelope bitterbrush (PUTR2), found 50% of the time. Herbaceous cover averages less than 10%. Forbs only contribute about 1% cover in mid to late seral conditions; the rest of the herbaceous cover is contributed by graminoids. Indicator species used to classify this subzone, using the representative Warm Dry group, include Ross' sedge (CARO5), western needlegrass (ACOC3), wax current (RICE), common snowberry (SYAL), Wheeler's bluegrass (POWH2), Geyer's sedge (CAGE2), snowbrush ceanothus (CEVE), greenleaf manzanita (ARPA6), western serviceberry (AMAL2), and pinegrass (CARU).

Within the Columbia Plateau Ecoregion, species composition is somewhat different than that of the overall Ponderosa Pine – Warm Xeric Subzone. There are fewer overall species present within 30% constancy, and fewer graminoids present overall, with more forbs present. Most common understory species include common snowberry (SYAL), western serviceberry (AMAL2), common yarrow (ACMI2), pinegrass (CARU), bluebunch wheatgrass (PSSP6), Idaho fescue (FEID), cheatgrass (BRTE), and arrowleaf balsamroot (BASA3).

Common Name	Species	Constancy (%)	Mean Cover (%)
Warm Xeric; N = 1,122			
Trees			
Ponderosa pine	PIPO	98	29
Shrubs			
Antelope bitterbrush	PUTR2	50	8
Common snowberry	SYAL	34	5
Forbs/Graminoids			
Common yarrow	ACMI2	53	1
Squirreltail	ELEL5	51	2
Ross' sedge	CARO5	47	2
Idaho fescue	FEID	46	7
Western needlegrass	ACOC3	45	2
Cheatgrass	BRTE	36	7
Bluebunch wheatgrass	PSSP6	35	7

Ponderosa Pine-Lodgepole Pine (33) This subzone is found in Central Oregon, interspersed with and along the edges of the Lodgepole Pine (PICO) Vegzone. This subzone occurs on deep (>2') ash/pumice deposits. Mean annual temperature ranges between 41 and 44°F, while mean annual precipitation ranges from 20 to 29 inches. Both ponderosa pine (PIPO) and lodgepole pine (PICO) occur in various mixtures in the tree layers. In hummocky topography, lodgepole pine dominates in swales while ponderosa pine is more prominent on micro-ridges (Volland 1985). Shrub cover averages 10-15%. Shrub layers are dominated by antelope bitterbrush (PUTR2). Western needlegrass (ACOC3) typically supplies the majority of herbaceous cover in a depauperate understory. Graminoid cover averages 5-10%. Ross' Sedge (CARO5) and squirreltail (ELEL5) have high constancy but generally low cover. Indicator species used to classify this subzone, using the representative Cool Mesic group, include lodgepole pine (PICO) and long-stolon sedge (CAIN9).

Common Name	Species	Constancy (%)	Mean Cover (%)
Ponderosa Pine-Lodgepole Pine; N = 357			
Trees			
Lodgepole pine	PICO	99	37
Ponderosa pine	PIPO	89	21
Shrubs			

Antelope bitterbrush	PUTR2	92	15
Forbs/Graminoids			
Western needlegrass	ACOC3	90	2
Ross' sedge	CARO5	90	2
Squirreltail	ELEL5	83	1
Virginia strawberry	FRVI	43	1

Ponderosa Pine-Oak (34) This subzone is found east of the Cascades in southern Washington and northern Oregon, north and south of the Columbia River, scattered throughout the Rogue Valley of southwest Oregon, and throughout northern California near the edge of the Foothill Pine-Oak and Oak Woodlands Subzones. There is a band of this subzone on the west side of the Sierra Nevada's in California, between the Oak Woodlands and Foothill Pine-Oak Subzones on the westside and the White Fir-Grand Fir (ABGRC) and Douglas-fir (PSME) Vegzones on the eastside of this subzone. This subzone is transitional to Oregon White Oak (QUGA4) Woodlands or non-forest communities. These sites are the warmest sites that support ponderosa pine (PIPO). Mean annual temperature ranges between 48 and 58°F, while mean annual precipitation ranges from 27 to 44 inches.

Total tree cover averages 40-50%, which is high considering how low the mean annual precipitation is on these sites. Shrub cover averages 5-10% in mid to late seral conditions. Frequently found overstory species include ponderosa pine (PIPO), California black oak (QUKE), canyon live oak (QUCH2), incense cedar (CADE27), and Oregon white oak (QUGA4). Indicator species used to classify this subzone, using the representative Warm Mesic group, include creeping snowberry (SYMO), California buckthorn (FRCA12), oceanspray (HODI), white hawkweed (HIAL2), California blackberry (RUUR), dwarf Oregongrape (MANE2), dwarf (baldhip) rose (ROGY), and common whipplevine (WHMO).

Within the Central California Foothills and Coastal Mountains Ecoregion, species composition is somewhat different than that of the overall Ponderosa Pine-Oak Subzone. More species of oak are present, including California black oak (QUKE), interior live oak (QUWI2), canyon live oak (QUCH2), and blue oak (QUDO). California foothill pine (PISA2) is also common. Most common understory species include poisonoak (TODI), toyon (HEAR5), sticky whiteleaf manzanita (ARVI4), bristly dogtail grass (CYEC), spreading hedgeparsley (TOAR), and whitethorn ceanothus (CECU).

Within the Eastern Cascades Slopes and Foothills Ecoregion, species composition is also somewhat different than that of the overall Ponderosa Pine-Oak Subzone. The only oaks commonly found are Oregon white oak (QUGA4) and California black oak (QUKE). Common understory species include cheatgrass (BRTE), common yarrow (ACMI), bulbous bluegrass (POBU), antelope bitterbrush (PUTR2), Idaho fescue (FEID), common snowberry (SYAL), Geyer's sedge (CAGE2), and squirreltail (ELEL5).

Common Name	Species	Constancy (%)	Mean Cover (%)
Ponderosa Pine-Oak; N = 405			
Trees			

Ponderosa pine	PIPO	100	17
California black oak	QUKE	71	19
Canyon live oak	QUCH2	40	28
Incense cedar	CADE27	36	16
Shrubs			
Poisonoak	TODI	35	10

Ponderosa Pine-Juniper Woodlands (30) This subzone is found in northeast Washington, through eastern and central Oregon, and into northern California. This subzone is transitional to Western Juniper or Shrub-Steppe Vegzones. Mean annual temperature ranges between 42 and 47°F, while mean annual precipitation ranges from 15 to 20 inches. Ponderosa pine (PIPO) forms an open forest to savanna over an understory of antelope bitterbrush (PUTR2), western juniper (JUOC), big sagebrush (ARTR2), curl-leaf mountain mahogany (CELE3), and wax current (RICE). Indicator species used to classify this subzone, using the representative Warm Xeric group, include antelope bitterbrush (PUTR2), Idaho fescue (FEID), squirreltail (ELEL5), western juniper (JUOC), bluebunch wheatgrass (PSSP6), Sandberg bluegrass (POSE), big sagebrush (ARTR2), mountain mahogany (CELE3), and little sagebrush (ARAR8).

Within the Columbia Plateau Ecoregion, species composition is somewhat different than that of the overall Ponderosa Pine-Juniper Woodlands Subzone. Common juniper (JUOC) is rarely present in this subzone. Common shrubs include (AMAL2), wax current (RICE), antelope bitterbrush (PUTR2), common snowberry (SYAL), and big sagebrush (ARTR2). Common forbs and graminoids include arrowleaf balsamroot (BASA3), cheatgrass (BRTE), bluebunch wheatgrass (PSSP6), Idaho fescue (FEID), common yarrow (ACMI2), silky lupine (LUSE4), and bulbous bluegrass (POBU).

Common Name	Species	Constancy (%)	Mean Cover (%)
Ponderosa Pine-Juniper Woodlands; N = 731			
Trees			
Ponderosa pine	PIPO	96	25
Shrubs			
Antelope bitterbrush	PUTR2	71	10
Western juniper	JUOC	49	12
Big sagebrush	ARTR2	36	7
Forbs/Graminoids			
Idaho fescue	FEID	68	14
Squirreltail	ELEL5	64	2
Common yarrow	ACMI2	53	1
Cheatgrass	BRTE	51	6
Ross' sedge	CARO5	46	2
Bluebunch wheatgrass	PSSP6	44	8
Western needlegrass	ACOC3	42	1

Sandberg bluegrass	POSE	42	5

Parklands Vegzone (30)

Vegzone	Vegzone Name	Subzone	Subzone Name
30	Parklands	-114	Subalpine Grassland-Forbland
30	Parklands	-113	Subalpine Shrub
30	Parklands	65	Subalpine Fir Parklands
30	Parklands	95	Mountain Hemlock Parklands
30	Parklands	96	Limber Pine
30	Parklands	97	Bristlecone-Foxtail Pine
30	Parklands	98	Western White Pine
30	Parklands	99	Whitebark Pine Parklands
30	Parklands	100	Subalpine Larch Parklands
30	Parklands	101	Sierra Lodgepole Pine Parklands

The Parklands Vegzone occurs in the highest mountain ranges of Oregon and Washington. This vegzone constitutes a broad ecotone (often occurring over a 1,000 – 1,500-foot elevation gradient) where tree dominance gives way to alpine meadows. Tree cover is typically between 10 and 30%, with highly variable openings. Often this vegzone appears as a mosaic of tree patches and meadow communities with the tree patches becoming smaller in size and stature as elevations increase. Climate is characterized by cool summers and cold winters with deep snowpack. Summer soil drought may be possible in rain shadow parklands (east of the mountain crest) but is rare in westside areas. The species that are most frequently present include whitebark pine (PIAL), lodgepole pine (PICO), subalpine fir (ABLA), mountain hemlock (TSME), Ross' sedge (CARO5), pink mountainheath (PHEM), grouse whortleberry (VASC), and thinleaf huckleberry (VAME).

To map to Parklands, the following species needed to be present: whitebark pine (PIAL), subalpine larch (LALY), limber pine (PIFL2), bristlecone pine (PIAR), Great Basin bristlecone pine (PILO), or foxtail pine (PIBA). The upper elevational boundary of this vegzone is defined by the National Landcover Dataset non-forest mask (NLCD citation and maybe citation to methods section in GTR).

Common Name	Species	Constancy (%)	Mean Cover (%)
Parklands VZ; N = 570			
Trees			
Whitebark pine	PIAL	50	18
Lodgepole pine	PICO	47	28
Subalpine fir	ABLA	44	41
Forbs/Graminoids			
Ross' sedge	CARO5	33	2

Parklands Subzones

Mountain Hemlock Parklands (95) This subzone occurs throughout the mountains of the Pacific Northwest, in the Blue Mountains as well as the Oregon and Washington Cascades. It occurs at elevations above 7,500 feet in the Blue Mountains and above 5,000 feet in the Cascades. It also occurs in the southern Sierra Nevada, from 9,400 feet to as high as 11,000 feet in elevation (Landfire BpS 10330, 10380, 10460). Sites represent the coldest environments that support forested vegetation in the Oregon Cascades. Mean annual temperature ranges between 36°F and 40°F, while mean annual precipitation ranges from 59 inches to 109 inches. Plant communities in the Mountain Hemlock (*Tsuga mertensiana*) 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 (PSME), white fir (ABCO), or grand fir (ABGR). Most common overstory species are mountain hemlock (TSME), subalpine fir (ABLA), Pacific silver fir (ABAM), and whitebark pine (PIAL). Indicator species used to classify this subzone, using the representative Cold Wet Mesic group, include pink mountainheath (PHEM), Cascade azalea (RHAL2), whitebark pine (PIAL), Cascade bilberry (VADE), partridgefoot (LUPE), smooth woodrush (LUGL2), Sitka valerian (VASI), western moss heather (CAME7), and Alaska cedar (CHNO).

Within the Sierra Nevada Ecoregion, species composition varies slightly from the other Ecoregions where this subzone occurs. The most common tree species are mountain hemlock (TSME), whitebark pine (PIAL), and lodgepole pine (PICO), but the understory is much more depauperate, with purple mountainheath (PHBR4) and squirreltail (ELEL5) being most common.

Common Name	Species	Constancy (%)	Mean Cover (%)
Mountain Hemlock Parklands; N = 154			
Trees			
Mountain hemlock	TSME	96	52
Subalpine fir	ABLA	50	35
Pacific silver fir	ABAM	49	32
Whitebark pine	PIAL	42	16
Shrubs			
Pink mountainheath	PHEM	58	20
Thinleaf huckleberry	VAME	56	10
Cascade azalea	RHAL2	44	15
Cascade bilberry	VADE	41	19
Grouse whortleberry	VASC	33	10
Forbs/Graminoids			
Partridgefoot	LUPE	36	5
Smooth woodrush	LUGL2	36	5

Subalpine Fir Parklands (65) sites represent the coldest environments that support subalpine fir (*Abies lasiocarpa*) in the Blue Mountains, Wallowa Mountains, the Oregon and Washington Cascades, and the Northern Rockies. This subzone occurs at elevations over 7,500 feet in the

Blue Mountains and above 5,000 feet in the Cascades (Landfire BpS 10460). These sites are transitional between closed forest and subalpine meadows. Subalpine Fir Parklands occur in areas with a more continental climate, colder in winter and warmer in summer, than sites that support mountain hemlock (TSME). Mean annual temperature ranges between 34 and 38°F, while mean annual precipitation ranges from 48 to 72 inches. Common overstory species are subalpine fir (ABLA), whitebark pine (PIAL), Engelmann spruce (PIEN), and lodgepole pine (PICO). Indicator species used to classify this subzone, using the representative Cold Wet Mesic group, include whitebark pine (PIAL), smooth woodrush (LUGL2), pink mountainheath (PHEM), Sitka valerian (VASI), Cascade azalea (RHAL2), Jacob's-ladder (POPU3), and subalpine larch (LALY).

Common Name	Species	Constancy (%)	Mean Cover (%)
Subalpine Fir Parklands; N = 184			
Trees			
Subalpine fir	ABLA	93	45
Whitebark pine	PIAL	64	15
Engelmann spruce	PIEN	61	14
Lodgepole pine	PICO	44	20
Shrubs			
Grouse whortleberry	VASC	59	19
Pink mountainheath	PHEM	40	6
Thinleaf huckleberry	VAME	40	7
Forbs/Graminoids			
Ross' sedge	CARO5	61	2
Common yarrow	ACMI2	49	1
Smooth woodrush	LUGL2	46	5
Broadleaf arnica	ARLA8	41	3
Northwestern sedge	CACO11	41	2
Sitka valerian	VASI	38	5
Broadleaf lupine	LULA4	36	5
Silky lupine	LUSE4	34	5
Geyer's sedge	CAGE2	33	5

Bristlecone-Foxtail Pine Parklands (97) This subzone is found in eastern California. Bristlecone pine (*Pinus aristata/Pinus longaeva*) and foxtail pine (*Pinus balfouriana*) appear on all slopes, especially ridges and upper slopes, at and below the forest tree line, at elevations of 7,000 to 12,000 feet. The understory is composed of a scattering of shrubs and herbs within a mosaic of extensive, rocky, bare ground. In eastern California, bristlecone pine is the timberline tree of high desert ranges, where it endures harsh, dry, high-elevation conditions (Landfire BpS 10200). Mean annual temperature ranges between 35 and 39°F, while mean annual precipitation ranges from 18 to 26 inches. Soils are nutrient deficient. Foxtail pines exist in scattered open, woodlands. The surface of the ground is composed of peridotite rock and bare mineral soil in varying degrees of serpentinization.

In California's Manual of Vegetation, bristlecone pine (PILO) falls within the Bristlecone Pine Woodland Alliance. Bristlecone pine is dominant or co-dominant in the tree canopy with limber pine (PIFL2). Shrubs include Rocky Mountain maple (ACGL), tarragon (ARDR4), big sagebrush (ARTR2), littleleaf mountain mahogany (CEIN7), curl-leaf mountain mahogany (CELE3), yellow rabbitbrush (CHVI8), whitestem goldenbush (ERDI14), wax current (RICE), or gooseberry currant (RIMO2). It can be found on all slopes, especially ridges and upper slopes at or below the forest tree line. Soils are nutrient deficient (CNPS/A Manual of California Vegetation Online).

In California's Manual of Vegetation, foxtail pine (PIBA) falls within the Foxtail Pine Woodland Alliance. Foxtail pine is dominant or co-dominant in the tree canopy with white fir (ABCO), California red fir (ABMA), Shasta red fir (ABMAS), whitebark pine (PIAL), Sierra lodgepole pine (PICOM), limber pine (PIFL2), western white pine (PIMO3), and mountain hemlock (TSME). It is most extensive on upper slopes, crests, ridges, summits, and upper slopes to the forest line. Soils are loose, well drained, and often rocky (CNPS/A Manual of California Vegetation Online).

Most common overstory species are foxtail pine (PIBA), lodgepole pine (PICO), limber pine (PIFL2), Great Basin bristlecone pine (PILO), and western white pine (PIMO3). Indicator species used to classify this subzone, using the representative Cold Wet Mesic group, include foxtail pine (PIBA), limber pine (PIFL2), and Great Basin bristlecone pine (PILO).

Common Name	**Species**	**Constancy (%)**	**Mean Cover (%)**
Bristlecone-Foxtail Pine Parklands; N = 24			
Trees			
Foxtail pine	PIBA	79	33
Lodgepole pine	PICO	38	20

Whitebark Pine Parklands (99) This subzone occurs in the Oregon and Washington Cascades, as well as the Blue Mountains, generally at elevations above 5,000 feet in the Cascades and above 7,500 feet in the Blue Mountains. It also occurs in the southern Sierra Nevada in California, from elevations of 9,400 feet to 11,000 feet (Landfire BpS 10330, 10460). Whitebark pine (*Pinus albicaulis*) sites occur between Mountain Hemlock (TSME) Parkland or Subalpine Fir (ABLA) Parkland Subzones and Subalpine Shrub or Subalpine Grassland-Forbland Subzones. In the Blue Mountains of eastern Oregon and Washington, whitebark pine (PIAL) co-dominates with subalpine fir (ABLA) and assumes increasing dominance with elevation; it is the only tree on the highest sites. In Washington, whitebark pine (PIAL) communities in the Cascade Range are often mixed with or adjacent to big sagebrush (ARTR2) or mountain grassland communities. In California, pure or nearly pure whitebark pine communities occur at tree line in the Sierra Nevada and Cascade Range.

Whitebark pine (PIAL) grows in cold, snowy, moist to semiarid climates and is common on ridges and near timberline, where trees are exposed to strong, desiccating winds. Mean annual temperature ranges between 35 and 39°F, while mean annual precipitation ranges from 31 to 50 inches. The species (or the vegzone?) is most common on rocky, well-drained sites. These sites

are too cold, snowy, and/or effectively dry for mountain hemlock (TSME) or subalpine fir (ABLA) to attain a minimum of 10% cover and are transitional to Subalpine Non-Forest Subzones or to true alpine vegetation types.

In south-central Oregon, precipitation and temperatures on these sites appear suitable to support mountain hemlock (TSME) or subalpine fir (ABLA), but these species are missing, presumably because the effective moisture on the ash/pumice deposits is inadequate to support them. Common overstory species are whitebark pine (PIAL) and lodgepole pine (PICO). Indicator species used to classify this subzone, using the representative Cold Wet Mesic group, include whitebark pine (PIAL) and purple mountainheath (PHBR4).

In California's Manual of Vegetation, whitebark pine (PIAL) falls within the Whitebark Pine Forest and Woodland Alliance. Whitebark pine is dominant or co-dominant in the tree canopy with California red fir (ABMA), curl-leaf mountain mahogany (CELE3), foxtail pine (PIBA), Sierra lodgepole pine (PICOM), limber pine (PIFL2), western white pine (PIMO3), and mountain hemlock (TSME). It is most extensive on upper slopes, crests, ridges, summits, and upper slopes up to and above timberline. Soils are loose, well drained, and may be rocky (CNPS/A Manual of California Vegetation Online).

Within the Blue Mountains Ecoregion, species composition differs slightly than the overall subzone with only whitebark pine being present, as well as a presence of pink mountainheath (PHEM) and poke knotweed (POPH).

Common Name	Species	Constancy (%)	Mean Cover (%)
Whitebark Pine Parklands; N = 102			
Trees			
Whitebark pine	PIAL	95	23
Lodgepole pine	PICO	60	34
Forbs/Graminoids			
Squirreltail	ELEL5	34	1

Limber Pine Parklands (96) This subzone occurs in eastern California, on the eastern slopes of the Sierra Nevada into the Great Basin. Limber pine (*Pinus flexilis*) is most extensive on upper slopes, crests, ridges, summits, and upper high-elevation slopes to timberline, elevations ranging from 7,200 to 11,000 feet (Landfire BpS 10200). Mean annual temperature ranges between 36 and 41°F, while mean annual precipitation ranges from 16 to 21 inches. Soils are often rocky. Tree stands are open to very open (usually less than 20 percent overall vegetative cover) with scattered shrubs and grasses. Most common overstory species are limber pine (PIFL2), lodgepole pine (PICO), and singleleaf pinyon (PIMO). The only indicator species present used to classify this subzone, using the representative Cold Wet Mesic group, is limber pine (PIFL2).

In California's Manual of Vegetation, limber pine (PIFL2) falls within the Limber Pine Woodland Alliance. Limber pine is dominant in the tree canopy with white fir (ABCO), whitebark pine (PIAL), foxtail pine (PIBA), Sierra lodgepole pine (PICOM), Jeffrey pine (PIJE),

and Great Basin bristlecone pine (PILO). Shrubs include big sagebrush (ARTR2), curl-leaf mountain mahogany (CELE3), bush chinquapin (CHSE11), yellow rabbitbrush (CHVI8), sulphur-flower buckwheat (ERUM), or wax current (RICE). It is most extensive on upper slopes, crests, ridges, summits, and upper high elevation slopes to the timberline. Soils are commonly granitic, loose, well drained, and often rocky (CNPS/A Manual of California Vegetation Online).

Common Name	Species	Constancy (%)	Mean Cover (%)
Limber Pine Parklands; N = 14			
Trees			
Limber pine	PIFL2	100	18
Lodgepole pine	PICO	36	27
Shrubs			
Big sagebrush	ARTR2	57	11
Curl-leaf mountain mahogany	CELE3	36	11

Western White Pine Parklands (98) In California, western white pine (*Pinus monticola*) is most common along raised stream benches and terraces, all slopes, but is most extensive around subalpine lake margins, on plateaus, and upper elevation slopes and ridgetops. Soils may be ultramafic. In the Siskiyou Mountains, western white pine as a vegzone is found primarily on ultramafic soils. The Western White Pine Vegzone can occur in a variety of climates, ranging from warm and wet to cool and dry. Mean annual temperature ranges between 37 and 48°F, while mean annual precipitation ranges from 43 to 64 inches. Most common overstory species include western white pine (PIMO3) and lodgepole pine (PICO). The only indicator species present used to classify this subzone, from the Warm Wet Mesic group, is western white pine (PIMO3).

In California's Manual of Vegetation, western white pine (PIMO3) falls within the Western White Pine Forest and Woodland Alliance. Western white pine is dominant or co-dominant in the tree canopy with white fir (ABCO), California red fir (ABMA), Shasta red fir (ABMAS), knobcone pine (PIAT), foxtail pine (PIBA), Sierra lodgepole pine (PICOM), Jeffrey pine (PIJE), ponderosa pine (PIPO), Douglas-fir (PSME), and mountain hemlock (TSME). It is found on raised stream benches and terraces, all slopes, but is most extensive above subalpine lake margins, on plateaus, and upper elevation slopes and ridgetops. Soils are granitic, ultramafic, or volcanic derived (CNPS/A Manual of California Vegetation Online).

Common Name	Species	Constancy (%)	Mean Cover (%)
Western White Pine Parklands; N = 26			
Trees			
Western white pine	PIMO3	100	16
Lodgepole pine	PICO	69	31
Shrubs			
Pinemat manzanita	ARNE	35	6

Subalpine Larch Parklands (100) Subalpine larch (*Larix lyallii*) occurs in the northern Cascades. Typical subalpine larch stands are often isolated pockets of open, parklike groves. Subalpine larch (LALY) is a dominant species occupying the timberline habitat type interspersed with the Subalpine Fir (ABLA) Vegzone. Subalpine larch is most commonly found in very cold, moist, high elevation sites. Mean annual temperature ranges between 33 and 35°F, while mean annual precipitation ranges from 52 to 65 inches. It commonly grows on slopes covered with granite or quartzite talus, not previously occupied by vascular plants. This tree species will also establish itself in cracks between big boulders. Soil development on subalpine larch sites is extremely poor due to low temperatures and short growing seasons.

Most common overstory species include subalpine larch (LALY) and whitebark pine (PIAL), along with subalpine fir (ABLA) and Engelmann spruce (PIEN). Indicator species used to classify this subzone, using the representative Cold Wet Mesic group, include subalpine larch (LALY), smooth woodrush (LUGL2), pink mountainheath (PHEM), partridgefoot (LUPE), whitebark pine (PIAL), and western moss heather (CAME7).

Common Name	Species	Constancy (%)	Mean Cover (%)
Subalpine Larch Parklands; N = 7			
Trees			
Subalpine larch	LALY	100	27
Whitebark pine	PIAL	43	8
Shrubs			
Grouse whortleberry	VASC	43	13
Forbs/Graminoids			
Smooth woodrush	LUGL2	86	2
Ross' sedge	CARO5	71	2
Northwestern sedge	CACO11	57	2
Western Labrador tea	LEGL	43	5
Partridgefoot	LUPE	43	3

Sierra Lodgepole Pine Parklands (101) Sierra lodgepole pine (*Pinus contorta murrayana*) occurs in the Cascade Range of southern Washington, Oregon, and California as well as in the Sierra Nevada and Klamath Mountains. Sierra lodgepole pine is a dominant or codominant species in upper montane and subalpine forests.

Sierra lodgepole pine (PICOM) grows in areas with cold, wet winters and dry, warm summers. Mean annual temperature ranges between 36 and 41°F, while mean annual precipitation ranges from 24 to 48 inches. In the southern part of its range, Sierra lodgepole pine grows under xeric conditions. It grows in a variety of site conditions, including cold air drainages, stream banks, lakeshores, wet meadows, and dry, upland settings.

In California's Manual of Vegetation, Sierra lodgepole pine (PICOM) falls within the Lodgepole Pine Forest and Woodland Alliance. Sierra lodgepole pine is dominant or co-dominant in the tree

canopy with white fir (ABCO), California red fir (ABMA), Shasta red fir (ABMAS), western juniper (JUGR7), whitebark pine (PIAL), foxtail pine (PIBA), limber pine (PIFL2), western white pine (PIMO3), quaking aspen (POTR5), and mountain hemlock (TSME). It occurs on terraces, lake and meadow margins, and depressions that flood seasonally, as well as upland slopes and ridges to the tree line (CNPS/A Manual of California Vegetation Online).

This is a species-depauperate subzone. The most common overstory species is lodgepole pine. Indicator species used to classify this subzone, using the representative Cold Wet Mesic group, include purple mountainheath (PHBR4) and whitebark pine (PIAL).

Common Name	Species	Constancy (%)	Mean Cover (%)
Sierra Lodgepole Pine Parklands; N = 59			
Trees			
Lodgepole pine	PICO	100	39

Subalpine Shrub Parklands (-113) This ecological system occurs throughout the mountains of the Pacific Northwest, as well as above upper timberline throughout the Sierra Nevada and Southern Cascades, including alpine areas of ranges in California and Oregon. It occurs at the transition zone of forest to alpine, forming a subalpine forest-shrub-meadow ecotone. Fell-fields often intermingle with alpine dwarf-shrubland. These systems are controlled by snow retention, wind desiccation, and permafrost. When vegetation is present (averaging <35% cover), it is typically dwarf (prostrate) shrubs and lichens. Sites vary from heather communities dominated by dense closed canopy ericaceous shrubs in moister maritime portions of the Pacific Northwest to open sagebrush grasslands in southern interior areas with a more continental climate (Landfire BpS 10680, 10710). Understory species that define the subzone include pink mountainheath (PHEM), Cascade bilberry (VADE), western moss heather (CAME7), and partridgefoot (LUPE).

Common Name	Species	Constancy (%)	Mean Cover (%)
Subalpine Shrub; N = 1			
Shrubs			
Pink mountainheath	PHEM	100	35
Western moss heather	CAME7	100	24

Subalpine Grassland-Forbland Parkland (-114) This subzone occurs in the eastern Cascades and Olympic Mountains. It is also found in California on Mount Shasta, the Sierra Nevada, and as far south as the Peninsular Ranges and White Mountains. This is a high-elevation (>6,000 feet), grassland system dominated by perennial grasses and forbs, on dry sites, particularly south-facing slopes, typically imbedded in or above subalpine forests and woodlands. Subalpine grasslands are small meadows to large open parks surrounded by conifer trees but lacking continuous tree cover within them. Sites are dominated by herbaceous vegetation. Snow pack is retained for much of the year and the growing season is short with few days warm enough for plant growth. Exposure is extreme with high insolation and severe desiccating winds. The average daily minimum temperatures are very low. Low temperatures mean slow organic decomposition, so nutrients tend to be locked up in organic matter for relatively long periods of time (Landfire BpS 10670, 11710).

This subzone includes subalpine sedge meadows, grasslands, and elements of alpine fellfields. The mosaic of meadow, grassland, and fellfield communities is an intricate and sharp response to local variations in substrate, moisture conditions, and durations of winter snowpack (Franklin and Dyrness 1973). Fellfields are a type of alpine ecosystem characterized by rather flat relief, very stony soil, and low often widely spaced cushion plants that occur in areas where wind scour limits snow accumulation. Plants occupying these sites are adapted to strong winds, ice shearing, and drought induced desiccation. To cope with these extreme environments, cushion plants are matted or cushioned, low in stature, and are either succulent, hairy, or heavily cutinized to reduce transpiration loss (Johnson 2004). Understory species that define the subzone include Davis' knotweed (PODA), white avalanche-lily (ERMO8), partridgefoot (LUPE), greenleaf fescue (FEVI), black alpine sedge (CANI2), showy sedge (CASP5), Brewer's sedge (CABR12), broom sedge (CASC11), Drummond's Rush (JUDR), and tufted hairgrass (DECE).

Lodgepole Pine Vegzone (8)

Vegzone	Vegzone Name	Subzone	Subzone Name
8	Lodgepole Pine	25	Cool Dry
8	Lodgepole Pine	27	Lodgepole Pine Wetlands
8	Lodgepole Pine	29	Monterey Pine-Bishop Pine

Pure or nearly pure stands of lodgepole pine (*Pinus contorta*) are widely distributed throughout forested areas of eastern Oregon and Washington. Lodgepole pine is a fire-dependent species, requiring wildfires to maintain healthy populations of diverse ages. The bark of the lodgepole pine is fairly thin, minimizing the tree's resistance to fire; however, the heat of fire opens the cones to release the seeds. This allows the species to regenerate and maintain its place in the forest habitat. Most lodgepole pine stands are seral and developed following stand replacement fire or timber harvest (Franklin and Dyrness 1973). In central and southwest Oregon, distribution of the Lodgepole Pine Vegzone is tied directly to ash/pumice deposits, mostly from Mount Mazama. Lodgepole pine is considered an edaphic or topo-edaphic climax species on deep ash/pumice deposits especially where slope positions allow cold air to accumulate. Lodgepole pine in California grows in a variety of site conditions, including cold air drainages, stream banks, lakeshores, wet meadows, and dry, upland settings. Stands are most common and extensive in the Sierra Nevada. Montane stands are associated with moist meadow and lake margins; subalpine stands occupy upland settings on glaciated surfaces and till with skeletal soils (Fites-Kaufman et al. 2007). Lodgepole pine, or shore pine, is often found along the Northwest coast. Shore pine is often found in nutrient-poor or exposed sites, like bogs, dunes, rocky crests, and exposed shorelines.

Three situations occur with lodgepole pine (PICO) 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 two feet of the soil surface for extended times during the growing season. The second situation (topo-edaphic) has deep ash/pumice deposits that are excessively well-drained and enclosed small basins that trap cold air and create frost pockets. In the third situation (edaphic), lodgepole pine

occurs with whitebark pine (PIAL) 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 (TSME) or subalpine fir (ABLA), but these species are missing presumably because the effective moisture on the ash/pumice deposits is inadequate to support them.

Lodgepole pine (PICO) 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, such as ponderosa pine (PIPO), white fir-grand fir (ABGRC), Shasta red fir (ABMAS), or mountain hemlock (TSME).

In the southern Oregon Cascades, it occurs as a pioneer on young soils developed from deep pumice in cold environments. Lodgepole pine (PICO) is usually succeeded by more tolerant species, such as white fir (ABCO), as the increasing canopy ameliorates the frosty conditions. In areas with deep pumice soils, cold air ponding and frequent frosts, lodgepole pine (PICO) remains the dominant climax tree species due to its tolerance of cold temperatures, resistance to drought, and minimal need for mineralized elements (Atzet et al. 1996).

In California's Manual of Vegetation, Lodgepole pine (PICOM) falls within the Lodgepole Pine (PICOM) Forest and Woodland Alliance. Sierra lodgepole pine is dominant or co-dominant in the tree canopy with white fir (ABCO), California red fir (ABMA), Shasta red fir (ABMAS), western juniper (JUGR7), whitebark pine (PIAL), foxtail pine (PIBA), limber pine (PIFL2), western white pine (PIMO3), quaking aspen (POTR5), and mountain hemlock (TSME). It is found on terraces, lake and meadow margins, and depressions that flood seasonally, as well as on upland slopes and ridges to the tree line (CNPS/A Manual of California Vegetation Online).

This vegzone is characterized by the presence of lodgepole pine and no other climax conifers present. The most common species found in the overall Lodgepole Pine Vegzone include western needlegrass (ACOC3), Ross' sedge (CARO5), antelope bitterbrush (PUTR2), squirreltail (ELEL5), wax current (RICE), common yarrow (ACMI2), Virginia strawberry (FRVI), and Idaho fescue (FEID).

Common Name	**Species**	**Constancy (%)**	**Mean Cover (%)**
Lodgepole Pine VZ; N = 160			
Trees			
Lodgepole pine	PICO	95	46
Shrubs			
Antelope bitterbrush	PUTR2	68	13
Forbs/Graminoids			
Western needlegrass	ACOC3	69	2
Ross' sedge	CARO5	69	2
Squirreltail	ELEL5	67	1
Common yarrow	ACMI2	42	2
Virginia strawberry	FRVI	36	2

Lodgepole Pine Subzones

Lodgepole Pine Wetlands (27) This subzone occurs in western Washington to southwest Oregon, up to the Cascade crest. Sites have higher effective moisture regimes than the other two subzones in this vegzone. The increased moisture is a result of sub-irrigation by adjacent streams or riparian zones. Within the deep ash/pumice deposits from Mount Mazama, the ecotones between the riparian lodgepole pine communities and dry lodgepole pine communities may be very abrupt. Riparian lodgepole pine sites average 20-25% cover of lodgepole pine (PICO) 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 include kinnikinnick (ARUV), bog birch (BEGL2), Geyer willow (SAGE2), Lemmon's willow (SALE), rose spirea (SPDO), bog blueberry (VAUL), woodland or Virginia strawberry (FRVE or FRVI), bluejoint (CACA4), widefruit sedge (CAAN15), analogue sedge (CASI2), Sitka sedge (CAAQD), tufted hairgrass (DECE), sand spikerush (ELMO2), blue wildrye (ELGL), Baltic rush (JUBA), and Kentucky bluegrass (POPR).

The mapped extent of the Lodgepole Pine Wetlands Subzone comes from the National Wetlands inventory data. The type was described by Kovalchik in his riparian guide and also in the East Cascades Guide. I don't think there were many plots available in the FIA inventory data and it didn't map well until I used the Palustrine Conifer classes in the NWI layer.

Lodgepole Pine – Cool Dry (25) This subzone occurs east of the Cascades in central Oregon. It may also occur in the Blue Mountains of Washington, as well as the Blue and Ochoco Mountains in Oregon. Sites have depauperate understory vegetation due to excessively drained soils. Mean annual temperature ranges between 41 and 43°F, while mean annual precipitation ranges from 22 to 31 inches. Generally, this subzone consists of a single forest canopy of lodgepole pine (PICO) with an average of 45% cover. Understory vegetation is depauperate compared to Lodgepole Pine Wetland sites. Shrubs and graminoids typically average about 2% cover each, except for antelope bitterbrush (PUTR2), with an average cover of 13%. Forbs are not well represented, averaging less than 1% cover. Indicator species used to classify this subzone, using the representative Cool Mesic group, include lodgepole pine (PICO), long-stolon sedge (CAIN9), and pinemat manzanita (ARNE).

Common Name	Species	Constancy (%)	Mean Cover (%)
Cool Dry; N = 156 (25)			
Trees			
Lodgepole pine	PICO	97	46
Shrubs			
Antelope bitterbrush	PUTR2	69	13
Forbs/Graminoids			
Western needlegrass	ACOC3	71	2
Ross' sedge	CARO5	71	2
Squirreltail	ELEL5	69	1
Common yarrow	ACMI2	43	2

Virginia strawberry	FRVI	37	2

Monterey Pine-Bishop Pine (29) This subzone only occurs in California, from Monterey Bay to Baja California, Mexico, including the Channel Islands. Habitats include dry ridges, headlands, maritime terraces, rocky ridges, and sand dunes. It is limited to coastal areas with a moderate maritime climate and likely receives more annual precipitation than nearby coastal chaparral. Mean annual temperature ranges between 53 and 62°F, while mean annual precipitation ranges from 13 to 17 inches. If dominated by Monterey pine (*Pinus radiata*), the soils may be well drained as well as nutrient poor and acidic. It is found in maritime zones with summer fog. Bishop pine *(Pinus muricata)* grows in areas with spring and summer fog, which is important to its survival and sometimes occurs in palustrine habitats (Landfire BpS 11770). Overall, this subzone is species depauperate. The most common species found within this subzone are California live oak (QUAG), Monterey pine (PIRA2), California blackberry (RUUR), and poisonoak (TODI).

In California's Manual of Vegetation, Monterey Pine-Bishop Pine (PIRA2-PIMU) falls within the Bishop Pine-Monterey Pine Forest and Woodland Alliance. Bishop pine (PIMU) or Monterey pine (PIRA2) is dominant or co-dominant in the tree canopy with white fir (ABCO), bigleaf maple (ACMA3), white alder (ALRH2), Pacific madrone (ARME), Gowen cypress (HEGO3), pygmy cypress (HEPI11), tanoak (LIDE3), knobcone pine (PIAT), lodgepole pine (PICO), California live oak (QUAG), island live oak (QUTO), interior live oak (QUWI2), Arroyo willow (SALA6), Scouler's willow (SASC), redwood (SESE3), western hemlock (TSHE), or California laurel (UMCA) (CNPS/A Manual of California Vegetation Online).

Common Name	Species	Constancy (%)	Mean Cover (%)
Monterey Pine; N = 4 (29)			
Trees			
California live oak	QUAG	100	29
Monterey pine	PIRA2	75	34
Shrubs			
California blackberry	RUUR	75	7
Poisonoak	TODI	75	4

California Foothill Pine-Coulter Pine Vegzone (7)

Vegzone	Vegzone Name	Subzone	Subzone Name
7	California Foothill Pine-Coulter Pine	35	Coulter Pine-Oak
7	California Foothill Pine-Coulter Pine	36	Foothill Pine-Oak

The California Foothill Pine (*Pinus sabiniana*) Vegzone/Subzone occurs from Siskiyou County south through the foothills of the Klamath, Cascade, and Coast Ranges, and the Sierra Nevada to Ventura County in California. Foothill pine (PISA2) grows at elevations between sea level and 4,000 feet and is common in the northern and interior portions of California. California foothill

pine (PISA2) and blue oak (QUDO) almost always occur together. The species is adapted to long hot and dry summers with a wide range in precipitation. It prefers rocky, well drained soils, but also grows on serpentine soil and heavy, poorly drained clay soils.

In California's Manual of Vegetation, California foothill pine (PISA2) falls within the Foothill Pine Woodland Alliance. California foothill pine is dominant or co-dominant in the tree canopy with California buckeye (AECA), California juniper (JUCA7), western juniper (JUOC), Coulter pine (PICO3), canyon live oak (QUCH2), and interior live oak (QUWI2). It is found on streamside terraces, valleys, slopes, and ridges. Soils are shallow, often stony, infertile, and moderately excessively drained (CNPS/A Manual of California Vegetation Online).

The Coulter Pine (*Pinus coulteri*) Vegzone/Subzone occurs in a Mediterranean environment, from Contra Costa County south through the Coastal, Transverse, and Peninsular Ranges in California. Communities that are dominated by Coulter pine (PICO3) intergrade with chaparral and lower montane coniferous forest. Coulter pine is an indicator of serpentine soils, although it also occurs on a variety of other substrates.

In California's Manual of Vegetation, Coulter pine (PICO3) falls within the Coulter Pine Forest and Woodland Alliance. Coulter pine (PICO3) is dominant or co-dominant in the tree canopy with incense cedar (CADE27), Jeffrey pine (PIJE), foothill pine (PISA2), bigcone Douglas-fir (PSMA), California live oak (QUAG), canyon live oak (QUCH2), California black oak (QUKE), and interior live oak (QUWI2). It is found on steep upper slopes and ridges. Soils vary in fertility, typically are dry, and are on granitic, and, more locally, sandstone or serpentine substrates (CNPS/A Manual of California Vegetation Online).

This vegzone is characterized by the presence of either California foothill pine or Coulter pine at a minimum of 5% cover and in the absence of dominant tree species that would indicate another vegzone. Most common overstory species for the vegzone include foothill pine (PISA2), blue oak (QUDO), interior live oak (QUWI2), and canyon live oak (QUCH2). Common understory species include poisonoak (TODI), buckbrush (CECU), toyon (HEAR5), alderleaf mountain mahogany (CEMO2), and spreading hedgeparsley (TOAR).

Common Name	**Species**	**Constancy (%)**	**Mean Cover (%)**
Foothill Pine-Coulter Pine VZ; N = 399			
Trees			
California foothill pine	PISA2	90	7
Blue oak	QUDO	51	25
Interior live oak	QUWI2	42	29
Shrubs			
Poisonoak	TODI	48	7

California Foothill Pine-Coulter Pine Subzones

California Foothill Pine-Oak (36) The Foothill Pine-Oak Subzone occurs from Siskiyou County south through the foothills of the Klamath, Cascade, and Coast Ranges, and the Sierra Nevada to Ventura County in California. Foothill pine (PISA2) is found in a Mediterranean environment, at elevations between sea level and 4,000 feet and is common in the northern and interior portions of California. Mean annual temperature ranges between 54 and 60°F, while mean annual precipitation ranges from 21 to 36 inches. Foothill pine (PISA2) and blue oak (QUDO) occur together over much of California's oak woodlands. At lower elevations, this vegzone grades into chaparral, valley oak (QULO) or Oregon white oak (QUGA4) woodland. At higher elevations it transitions with California black oak (QUKE) or ponderosa pine (PIPO) forests.

California foothill pine is the most common overstory species, with blue oak (QUDO), interior live oak (QUWI2), and canyon live oak (QUCH2) also common. California black oak (QUKE), California live oak (QUAG), valley oak (QULO), scrub oak (QUBE5), and California laurel (UMCA) may also be present. Common understory species include poisonoak (TODI), buckbrush (CECU), toyon (HEAR5), alderleaf mountain mahogany (CEMO2), spreading hedgeparsley (TOAR), ripgut brome (BRDI3), and hollyleaf redberry (RHIL). Indicator species used to classify this subzone, using the representative Warm Dry group, include poisonoak (TODI), whitethorn ceanothus (CECU), alderleaf mountain mahogany (CEMO2), canyon live oak (QUCH2), sticky whiteleaf manzanita (ARVI4), and greenleaf manzanita (ARPA6).

Common Name	Species	Constancy (%)	Mean Cover (%)
California Foothill Pine-Oak; N = 366			
Trees			
California foothill pine	PISA2	98	7
Blue oak	QUDO	55	25
Interior live oak	QUWI2	43	29
Shrubs			
Poisonoak	TODI	52	7

Coulter Pine-Oak (35) This is a minor subzone and represents a generally drier environment than that of Ponderosa Pine (PIPO) or Jeffrey Pine (PIJE) Vegzones. Mean annual temperature ranges between 52 and 58°F, while mean annual precipitation ranges from 18 to 30 inches. These sites are transitional to oak-pine woodlands.

Coulter pine (PICO3) is the most common overstory species, with canyon live oak (QUCH2), interior live oak (QUWI2), California live oak (QUAG), California black oak (QUKE), and scrub oak (QUBE5) also common. Understory species include chamise (ADFA), cheatgrass (BRTE), chaparral ceanothus (CELE2), and chaparral yucca (YUWH). Indicator species used to classify this subzone, using the representative Warm Dry group, include canyon live oak (QUCH2), incense cedar (CADE27), poisonoak (TODI), whitethorn ceanothus (CECO), and alderleaf mountain mahogany (CEMO2).

Common Name	Species	Constancy (%)	Mean Cover (%)
Coulter Pine-Oak; N = 33			
Trees			
Coulter pine	PICO3	97	11
Canyon live oak	QUCH2	52	38

Pinyon-Juniper-Cypress Vegzone (6)

Vegzone	Vegzone Name	Subzone	Subzone Name
6	Pinyon-Juniper-Cypress	21	Juniper Scablands
6	Pinyon-Juniper-Cypress	22	Juniper Woodlands
6	Pinyon-Juniper-Cypress	23	Pinyon Woodlands
6	Pinyon-Juniper-Cypress	24	Cypress Woodlands

The Pinyon-Juniper-Cypress Vegzone occurs throughout eastern Oregon and the Great Basin of California, as well as scattered throughout southern California. It generally has an open woodland to savanna structure and occupies environments intermediate in moisture between ponderosa pine forests and steppe or shrub-steppe communities. This is the most xeric tree-dominated vegzone in the Pacific Northwest (Franklin and Dryness 1973). The most common species in the vegzone include western juniper (JUOC), big sagebrush (ARTR2), cheatgrass (BRTE), squirreltail (ELEL5), Sandberg bluegrass (POSE), Idaho fescue (FEID), antelope bitterbrush (PUTR2), bluebunch wheatgrass (PSSP6), and yellow rabbitbrush (CHVI8).

Common Name	Species	Constancy (%)	Mean Cover (%)
Pinyon-Juniper-Cypress VZ; N = 1,089			
Shrubs			
Western juniper	JUOC	67	15
Big sagebrush	ARTR2	62	8
Forbs/Graminoids			
Cheatgrass	BRTE	57	9
Squirreltail	ELEL5	42	2
Sandberg bluegrass	POSE	41	6
Idaho fescue	FEID	40	8
Bluebunch wheatgrass	PSSP6	34	8

Pinyon-Juniper-Cypress Subzones

Pinyon Woodlands (23) occurs on dry mountain ranges in southern California in the Sierra Nevada. Pinyon woodlands occur primarily on shallow rocky soils or rock-dominated sites, such as rocky ridges, steep slopes, broken topography, and mesa tops (Landfire BpS 10190). Mean annual temperature ranges between 43 and 53°F, while mean annual precipitation ranges from 11 to 17 inches. Singleleaf pinyon (PIMO) may be the only tree species present. Utah juniper

(JUOS), California juniper (JUCA7), and western juniper (JUOC) may occasionally be present. Indicator species used to classify this subzone, using the representative Warm Xeric group, include big sagebrush (ARTR2), antelope bitterbrush (PUTR2), and squirreltail (ELEL5). Utah juniper (JUOS) may be present.

In California's Manual of Vegetation, singleleaf pinyon (PIMO) belongs to the Singleleaf Pinyon-Utah Juniper Woodlands Alliance. Singleleaf pinyon is dominant or co-dominant in the tree canopy with California juniper (JUCA7), western juniper (JUGR7), Utah juniper (JUOS), Jeffrey pine (PIJE), or canyon live oak (QUCH2). Shrubs include little sagebrush (ARAR8), black sagebrush (ARNO4), big sagebrush (ARTR2), yellow rabbitbrush (CHVI8), Mormon tea (EPVI), rubber rabbitbrush (ERNA10), spiny hopsage (GRSP), grizzlybear pricklypear (OPPOE), Stansbury cliffrose (PUST), antelope bitterbrush (PUTR2), Muller oak (QUCO7), Tucker oak (QUJO3), or banana yucca (YUBA). The singleleaf pinyon woodlands habitat includes alluvial fans, pediments, slopes, ridges, canyons, and ravines. Soils are commonly well drained (CNPS/A Manual of California Vegetation Online).

Within the Southern California Mountains Ecoregion, species composition differs slightly from the other Ecoregions. Chaparral yucca (YUWH) is present while eastern Mojave buckwheat (ERFA2) is more common.

Common Name	Species	Constancy (%)	Mean Cover (%)
Pinyon Woodlands; N = 260			
Trees			
Singleleaf pinyon	PIMO	98	23
Shrubs			
Big sagebrush	ARTR2	59	9
Antelope bitterbrush	PUTR2	33	5
Forbs/Graminoids			
Cheatgrass	BRTE	34	11
Squirreltail	ELEL5	32	1

Juniper Woodlands (22) This subzone occurs in eastern Washington, eastern Oregon, northeast California, and scattered throughout southern California. This is the most extensive subzone of this vegzone. It is found on rocky outcrops, lava blisters and flows, and soils that are shallow and rocky, as well as on deep, well-drained, loamy to sandy soils. Mean annual temperature ranges between 43 and 49°F, while mean annual precipitation ranges from 12 to 17 inches. Cover of juniper on these sites ranges from a low of 10-15% to a high of 35-60% (Miller et al. 2005). Indicator species used to classify this subzone, using the representative Warm Xeric group, include western juniper (JUOC), big sagebrush (ARTR2), Idaho fescue (FEID), Sandberg bluegrass (POSE), bluebunch wheatgrass (PSSP6), squirreltail (ELEL5), antelope bitterbrush (PUTR2), yellow rabbitbrush (CHVI8), and rubber rabbitbrush (ERNA10).

The Juniper Woodlands Subzone is defined by the presence of California juniper (JUCA7), western juniper (JUOC), Rocky Mountain juniper (JUSC2), Utah juniper (JUOS), or oneseed juniper (JUMO) and absence of other tree species.

In California's Manual of Vegetation, western juniper (JUOC) belongs to the Western Juniper Woodland Alliance. Western juniper is dominant in the tree canopy with white fir (ABCO), Jeffrey pine (PIJE), ponderosa pine (PIPO), Washoe pine (PIPOW2), Oregon white oak (QUGA4), and California black oak (QUKE). Western juniper may also be emergent above the shrub canopy with greenleaf manzanita (ARPA6), big sagebrush (ARTR2), curl-leaf mountain mahogany (CELE3), alderleaf mountain mahogany (CEMO2), yellow rabbitbrush (CHVI8), rubber rabbitbrush (ERNA10), or antelope bitterbrush (PUTR2). The western juniper habitat includes gentle slopes, alluvial fans, canyon slopes, and steep rocky escarpments (CNPS/A Manual of California Vegetation Online).

Common Name	**Species**	**Constancy (%)**	**Mean Cover (%)**
Juniper Woodlands; N = 612			
Shrubs			
Western juniper	JUOC	84	16
Big sagebrush	ARTR2	68	8
Forbs/Graminoids			
Cheatgrass	BRTE	67	9
Idaho fescue	FEID	49	9
Sandberg bluegrass	POSE	49	7
Bluebunch wheatgrass	PSSP6	44	8
Squirreltail	ELEL5	43	2

Juniper Scablands (21) are scattered throughout eastern Oregon and northeast California. This subzone occurs on shallow fine textured claypan soils, often at higher elevations, with more precipitation and surrounded by more mesic forest types on deeper soils. Mean annual temperature ranges between 42 and 48°F, while mean annual precipitation ranges from 12 to 18 inches. Cover of juniper is much sparser on these sites than in the Juniper Woodland Subzone, averaging 5-20% (Miller et al. 2005). Indicator species used to classify this subzone, using the representative Warm Xeric group, include western juniper (JUOC), Sandberg bluegrass (POSE), Idaho fescue (FEID), little sagebrush (ARAR8), squirreltail (ELEL5), big sagebrush (ARTR2), bluebunch wheatgrass (PSSP6), antelope bitterbrush (PUTR2), and yellow rabbitbrush (CHVI8).

Common Name	**Species**	**Constancy (%)**	**Mean Cover (%)**
Juniper Scablands; N = 214			
Shrubs			
Western juniper	JUOC	90	15
Little sagebrush	ARAR8	58	9
Big sagebrush	ARTR2	48	6
Forbs/Graminoids			
Sandberg bluegrass	POSE	64	6
Idaho fescue	FEID	64	7
Cheatgrass	BRTE	56	6

Squirreltail	ELEL5	50	1
Bluebunch wheatgrass	PSSP6	44	7

Cypress Woodlands (24) This subzone only occurs in California and is species depauperate. It is a very minor subzone. Mean annual temperature ranges between 52 and 58°F, while mean annual precipitation ranges from 40 to 49 inches. This subzone is defined by the presence of Sargent's cypress (CUSA3/HESA17), Modoc cypress (CUBA/HEBA5), McNab's cypress (CUMA/HEMA21), or Monterey cypress (CUMA2/HEMA22). Characteristic species in this subzone include Sargent's cypress (CUSA3), leather oak (QUDU4), scrub oak (QUBE5), Indian warrior (PEDE), Oregon boxleaf (PAMY), buckbrush (CECU), sticky whiteleaf manzanita (ARVI4), and chamise (ADFA). Indicator species used to classify this subzone, using the representative Warm Dry group, include sticky whiteleaf manzanita (ARVI4) and buckbrush (CECU).

In California's Manual of Vegetation, Cypress Woodlands belongs to the *Hesperocyparis* (*sargentii* and *macnabiana*) Woodland Alliance (Ultramafic Cypress Woodland). McNab's cypress (CUMA/HEMA21) and/or Sargent's cypress (CUSA3/HESA17) is dominant in the tree canopy with knobcone pine (PIAT), California foothill pine (PISA2), Douglas-fir (PSME), interior live oak (QUWI2), and California laurel (UMCA). Whiteleaf manzanita (ARVI4) is frequently present. The cypress habitat includes benches and terraces, open slopes and ridges. Soils are generally sterile and derived from basalt, conglomerate, gabbro, greenstone, serpentine, or other ultramafic substrates (CNPS/A Manual of California Vegetation Online).

Within the Coast Range Ecoregion, there were only two species present in the constancy table, Sargent's cypress (CUSA3) and Oregon boxleaf (PAMY).

Common Name	Species	Constancy (%)	Mean Cover (%)
Cypress Woodlands; N = 3			
Trees			
Sargent's cypress	CUSA3	100	15
Scrub oak	QUBE5	33	25
Leather oak	QUDU4	33	10
Shrubs			
Chamise	ADFA	33	11
Sticky whiteleaf manzanita	ARVI4	33	33
Forbs/Graminoids			
Indian warrior	PEDE	33	0

Hardwoods Vegzone (11)

Vegzone	Vegzone Name	Subzone	Subzone Name
11	Hardwoods	15	Riparian Shrub

11	Hardwoods	16	Riparian Hardwood Forest
11	Hardwoods	17	Other Hardwoods
11	Hardwoods	18	Oak Woodlands
11	Hardwoods	19	Desert Hardwoods

The Hardwoods Vegzone is scattered throughout Washington and Oregon, and is common in California, where it intermingles throughout the Tanoak and Douglas-fir Vegzones. This vegzone becomes increasingly common from north to south towards the Central Valley, where large concentrations can be found between the Grassland-Meadow Vegzone and the Foxtail-Coulter Pine Vegzone on the west side of the Central Valley as well as between the Shrublands Vegzone and the Foxtail-Coulter Pine Vegzone to the east, and south into the Southern California coast, mountains, and Basin and Range ecoregions.

The Hardwoods Vegzone includes sites dominated by deciduous and evergreen hardwoods. This vegzone includes upland forests of aspen and oaks and riparian habitats dominated by deciduous hardwood trees or shrubs without a significant conifer component. The most common overall species for this vegzone include blue oak (QUDO), poisonoak (TODI), California live oak (QUAG), interior live oak (QUWI2), canyon live oak (QUCH2), with California black oak (QUKE), Oregon white oak (QUGA4), and (UMCA) being somewhat common.

Common Name	Species	Constancy (%)	Mean Cover (%)
Hardwoods VZ; N = 1,219			
Trees			
Blue oak	QUDO	36	29
Shrubs			
Poisonoak	TODI	37	9

Hardwoods Subzones

Riparian Hardwood Forest (16) This subzone consists of riparian woody vegetation, dependent upon annual or periodic flooding and associated sediment scour and/or annual rise in the water table for growth and reproduction. Stands occur on streambanks and floodplains and consist of open to closed woodlands with tall deciduous trees and shrubs, forming linear bands following stream and river courses and alluvial floodplains.

These riparian hardwood forest systems are found in the central and inner northern Coast Ranges of California and north into the Klamath Mountains. These systems also occur throughout the Pacific Northwest and are more abundant in the central and southern portions of the Pacific Northwest coast. Mean annual temperature ranges between 49 and 62°F, while mean annual precipitation ranges from 22 to 36 inches. These forests and tall shrublands are linear in character, occurring on floodplains or terraces of rivers and streams and are associated with riverine or other poorly drained sites subject to annual flooding, which includes springs, seeps, and perennial and intermittent streams in both non-serpentine and serpentine substrates. This subzone often occurs as a mosaic of multiple communities that are tree-dominated with a diverse

shrub component (Landfire BpS 11520, 11560). This subzone includes upland aspen sites without conifers.

This subzone is characterized by the presence of tree cover at a minimum of 10% cover. Tree species that are common within this subzone include bigleaf maple (ACMA3), Oregon ash (FRLA), California live oak (QUAG), and California laurel (UMCA). Canyon live oak (QUCH2), red alder (ALRU2), balsam poplar (POBA2), California black oak (QUKE), quaking aspen (POTR5), interior live oak (QUWI2), white alder (ALRH2), and Oregon white oak (QUGA4) may be present. Most common understory species include poisonoak (TODI) and common snowberry (SYAL).

Species composition within this subzone varies substantially between ecoregions. Within the Willamette Valley Ecoregion, there are fewer overall tree species, predominantly Oregon ash (FRLA), Oregon white oak (QUGA4), bigleaf maple (ACMA3), red alder (ALRU2), balsam poplar (POBA2), and bitter cherry (PREM). Understory species include beaked hazelnut (COCO6), western swordfern (POMU), Indian plum (OECE), common snowberry (SYAL), California blackberry (RUUR), stinging nettle (URDI), and red elderberry (SARA2).

Within the Sierra Nevada Ecoregion, species composition reflects drier conditions. The most common tree species include canyon live oak (QUCH2), California black oak (QUKE), quaking aspen (POTR5), and California laurel (UMCA). Understory species include big sagebrush (ARTR2), sticky whiteleaf manzanita (ARVI4), deerbrush (CEIN3), poisonoak (TODI), mountain monardella (MOOD), and squirreltail (ELEL5).

Within the Northern Basin and Range Ecoregion, quaking aspen is the only common tree species. Common understory species include common snowberry (SYAL), big sagebrush (ARTR2), little sagebrush (ARAR8), yellow rabbitbrush (CHVI8), blue wildrye (ELGL), curl-leaf mountain mahogany (CELE3), and squirreltail (ELEL5).

Within the Southern California/Northern Baja Coast Ecoregion, characteristic species include California live oak (QUAG), scrub oak (QUBE5), poisonoak (TODI), coastal woodfern (DRAR3), Oregon ash (FRLA), toyon (HEAR5), common deerweed (LOSC2), birdeye primrose (PLRA), and hollyleaf redberry (RHIL).

Common Name	Species	Constancy (%)	Mean Cover (%)
Riparian Hardwood Forest; N = 172			
Shrubs			
Poisonoak	TODI	31	8

The **Riparian Shrub (15)** subzone is associated with riverine or other poorly drained sites subject to annual flooding that do not support a significant tree component. This subzone is found in eastern Oregon and Washington, the Great Basin, and the eastern slopes of the Sierra Nevada of California. Mean annual temperature ranges between 41 and 45°F, while mean annual precipitation ranges from 31 to 38 inches. The Riparian Shrub Subzone requires periodic flooding and bare moist substrates, such as gravels, for reestablishment.

Common species include willows, such as Gooding's willow (SAGO), red willow (SALA3), and Pacific willow (SALUL), as well as water birch (BEOC2), gray alder (ALIN2), white alder (ALRH2), western serviceberry (AMAL2), Lewis' mock orange (PHLE4), black hawthorn (CRDO2), and red-osier dogwood (COSE16).

Common Name	Species	Constancy (%)	Mean Cover (%)
Riparian Shrub; N = 2			
Shrubs			
Black hawthorn	CRDO2	50	16
Bog blueberry	VAUL	50	5
Forbs/Graminoids			
Water sedge	CAAQ	50	59
Bull thistle	CIVU	50	1
American skunkcabbage	LYAM3	50	1

Oak Woodlands (18) sites include forest stands, groves, and savannas dominated by deciduous oaks. In Washington, this subzone is rare west of the Cascades, but forms a prominent zone on the east side of the Columbia Gorge north to the lower Yakima Valley. In Oregon, it is generally found at lower elevations within the Willamette, Umpqua, and Rogue River Valleys as well as the eastern Columbia Gorge south to the Confederated Tribes of Warm Springs Reservation. It is most frequently found in California, scattered throughout, but primarily surrounding the Sacramento and San Joaquin Valleys. On the eastern edge of the two valleys, it is generally between the Shrublands Vegzone and the Foothill Pine-Coulter Pine Vegzone. On the western side of the valleys, it is generally between the Grasslands Vegzone and the Foothill Pine-Coulter Pine Vegzone. Soils are characteristically poor, drought prone, and moderately to excessively well drained. Climate is Mediterranean, with hot, dry summers and cool, wet winters. Mean annual temperature ranges between 54 and 61°F, while mean annual precipitation ranges from 19 to 32 inches.

The primary species that define the subzone include blue oak (QUDO), interior live oak (QUWI2), California black oak (QUKE), and Oregon white oak (QUGA4). Canyon live oak (QUCH2), California live oak (QUAG), valley oak (QULO), and scrub oak (QUBE5) may also be present, as well as California laurel (UMCA). Understory species include poisonoak (TODI), ripgut brome (BRDI3), buckbrush (CECU), and spreading hedgeparsley (TOAR).

In California's Manual of Vegetation, this subzone falls within the Mixed Oak Forest and Woodland Alliance. California live oak (QUAG), blue oak (QUDO), Oregon white oak (QUGA4), California black oak (QUKE), valley oak (QULO), and/or interior live oak (QUWI2) are co-dominant in the tree canopy with California buckeye (AECA), Pacific madrone (ARME), California foothill pine (PISA2), Douglas-fir (PSME), and California laurel (UMCA). The habitat includes valleys, gentle to steep slopes, on moderately deep soils (CNPS/A Manual of California Vegetation Online).

Within the Klamath Mountains Ecoregion, species composition is different than that of the overall Oak Woodlands Subzone. The most common oaks include Oregon white oak (QUGA4)

and California black oak (QUKE), with canyon live oak (QUCH2) occasionally present, as well as Pacific madrone (ARME). Common understory species include poisonoak (TODI), bristly dogstail grass (CYEC), buckbrush (CECU), alderleaf mountain mahogany (CEMO2), common yarrow (ACMI2), cheatgrass (BRTE), and sticky whiteleaf manzanita (ARVI4).

Common Name	Species	Constancy (%)	Mean Cover (%)
Oak Woodlands; N = 809			
Trees			
Blue oak	QUDO	54	29
Shrubs			
Poisonoak	TODI	35	8

Other Hardwoods (17) Hardwood dominated forests, woodlands, and savannas, dominated by California live oak (*Quercus agrifolia*), form a minor subzone scattered along the western edge of southern California in the Coast Ranges, Transverse Ranges, and Peninsular Ranges from Sonoma County to northern Baja California. This subzone occurs mainly below 1600 feet in elevation in foothill environments (Landfire BpS 11130). Mean annual temperature ranges between 54 and 63°F, while mean annual precipitation ranges from 16 to 25 inches. For the most part, it is found between the coast and the Oak Woodlands Vegzone. The most common species found include California live oak (QUAG), poisonoak (TODI), canyon live oak (QUCH2), toyon (HEAR5), California laurel (UMCA), ripgut brome (BRDI3), chamise (ADFA), and birchleaf mountain mahogany (CEBE3).

This subzone is defined by the absence of species that would indicate another vegzone or subzone, and the presence of indicator species bigtooth maple (ACGR3), California buckeye (AECA), tree of heaven (AIAL), Pacific madrone (ARME), giant chinquapin (CHCH7), Russian olive (ELAN), Tasmanian bluegum (EUGL), honeylocust (GLTR), southern California walnut (JUCA), northern California walnut (JUHI), sweetgum (LIST2), American plum (PRAM), sweet cherry (PRAV), common pear (PYCO), California live oak (QUAG), canyon live oak (QUCH2), black locust (ROPS), or California laurel (UMCA).

Common Name	Species	Constancy (%)	Mean Cover (%)
Other Hardwoods; N = 225			
Trees			
California live oak	QUAG	59	42
Canyon live oak	QUCH2	35	53
Shrubs			
Poisonoak	TODI	50	11

Desert Hardwoods (19) is a very minor subzone and is only located in southern California. Mean annual temperature ranges between 64 and 74°F, while mean annual precipitation ranges from 3 to 5 inches. Species present includes desert ironwood (OLTE), creosote bush (LATR2),

fourwing saltbush (ATCA2), white sage (SAAP2), sawtooth goldenbush (HASQ2), and winterfat (KRLA2).

In California's Manual of Vegetation, this subzone falls into the Blue Palo Verde-Desert Ironwood Woodland Alliance. Desert ironwood (OLTE) and/or blue paloverde (PAFL) are co-dominant, or either species is dominant, in the tree or tall shrub canopy along with desert willow (CHLI2), ocotilla (FOSP2), honey mesquite (PRGL2), screwbean mesquite (PRPU), and smoketree (PSSP3). Shrubs may include white bursage (AMDU2), burrobrush (AMSA7), sweetbush (BEJU), fairyduster (CAER), Las Animas nakedwood (COCA18), brittlebush (ENFA), California barrel cactus (FECY), desert lavender (HYEM), beloperone (JUCA8), water jacket (LYAN), Baja desert-thorn (LYBR), catclaw acacia (SEGR4), jojoba (SICH), or creosote bush (LATR2) (CNPS/A Manual of California Vegetation Online).

Common Name	Species	Constancy (%)	Mean Cover (%)
Desert Hardwoods; N = 11			
Shrubs			
Desert ironwood	OLTE	73	17

Grassland–Meadow Vegzone (4)

Vegzone	Vegzone Name	Subzone	Subzone Name
4	Grasslands - Meadows	-9	Wet Meadow
4	Grasslands - Meadows	-8	Moist Meadow
4	Grasslands - Meadows	-7	Dry Meadow
4	Grasslands - Meadows	-6	Upland grass
4	Grasslands - Meadows	-5	Scabland grass

The Grassland - Meadow Vegzone indicates sites where trees and shrubs are not capable of becoming dominant, often due to edaphic or topo-edaphic factors. The Grassland - Meadow Vegzone includes mountain meadows which are conspicuous, essentially permanent, herbaceous habitats found on gentle topography along and near the heads of streams (Franklin and Dyrness 1973). The most common species include soft brome (BRHO2), wild oat (AVFA), Idaho fescue (FEID), big sagebrush (ARTR2), ripgut brome (BRDI3), and spreading hedgeparsley (TOAR).

Grassland-Meadow Subzones

Wet Meadow (-9) This subzone of perennial herbaceous wet meadows is found in montane, subalpine, and lower alpine elevations (about 4,000 – 11,000 feet) of western mountain ranges in the Pacific Northwest, the Great Basin, and California. Sites are meadows that remain wet at or near the surface throughout the growing season and the soil surfaces remain damp-wet into late fall. Wet meadows occur in open depressions, basins, and flats with low-velocity surface and subsurface flows. They can be large meadows in montane or subalpine valleys, or occur as narrow strips bordering ponds, lakes and streams, or along toe-slope seeps. They are typically

found on flat areas or gentle slopes but may also occur on sub-irrigated sites with slopes up to 10%. In alpine regions, sites typically are small depressions located below late-melting snow patches. They may have surface water for part of the year, but depths rarely exceed a few centimeters. Wet meadows can be tightly associated with snowmelt and typically are not subjected to high velocity disturbance but can be flooded by slow-moving waters (NatureServe. 2017)**.**

Common shrubs include bog birch (BEPU4), bog blueberry (VAUL), low willow (SALU2), diamondleaf willow (SAPL2), Wolf's willow (SAWO), grayleaf willow (SAGL), undergreen willow (SACO2), mountain willow (SAEA), timberline sagebrush (ARRO4), shrubby cinquefoil (DAFR6), and alpine laurel (KAMI). Wetland graminoids may include bluejoint (CACA4), Holm sedge (CAHEC), water sedge (CAAQ), sheep sedge (CAIL), twotipped sedge (CALA10), black alpine sedge (CANI2), native sedge (CAVE5), nearlyblack sedge (CASU7), shorthair reedgrass (CABR), shorthair sedge (CAEX4), tufted hairgrass (DECA18), Drummond's rush (JUDR), and Mertens' rush (JUME3). Characteristic forbs include western yarrow (ACMIO), tundra aster (ORAL4), Mt. Hood pussypaws (CIUM), frosted buckwheat (ERIN9), purple false horkelia (HOPU8), spike trisetum (TRSP2), Rocky Mountain pussytoes (ANME2), Drummond's cinquefoil (PODR), alpine Lewisia (LEPY2), stalked fleabane (ERAL18), alpine shooting star (DOAL), Rocky Mountain goldenrod (SOMU), Pacific lupine (LULE2), white marsh marigold (CALE4), American globeflower (TRLA14), fringed grass of Parnassus (PAFI3), icegrass (PHAL), American bistort (POBI6), alpine yellowcress (ROAL), creeping sibbaldia (SIPR), and Parry's clover (TRPA5) (Landfire BpS 11370; Landfire BpS 11600; NatureServe. 2017).

Moist Meadow (-8) This subzone is found in the Sierra Nevada, Oregon Cascades, and occasionally in northern California, generally at subalpine elevations. These upland communities occur on gentle to moderate gradient slopes. Sites are wet to moist in the spring and are sub-irrigated or have freely available water within the rooting zone throughout the growing season. Soil surfaces dry by mid to late summer (July-August). Forb communities found on talus and scree slopes with subsurface moisture are included here, in particular when they are not sparsely vegetated.

This subzone represents typically lush meadows dominated by a diversity of tall forbs, with grasses intermingled in many of them. In the Cascades, this group includes greenleaf fescue (FEVI) meadows. Grasses and sedges are common, typically being taxa with broad and soft blades, such as tufted hairgrass (DECA18), prairie Junegrass (KOMA), smooth woodrush (LUGL2), perennial *Bromus spp.*, and a number of *Carex* species, such as shorthair reedgrass (CABR), shorthair sedge (CAEX4), nearlyblack sedge (CASU7), and native sedge (CAVE5). Taller forbs found in this subzone include common yarrow (ACMI2), nettleleaf giant hyssop (AGUR), arrowleaf balsamroot (BASA3), sticky purple geranium (GEVI2), western coneflower (RUOC2), western meadow-rue (THOC), Sitka valerian (VASI), common beargrass (XETE), tundra aster (ORAL4), Mt. Hood pussypaws (CIUM), frosted buckwheat (ERIN9), purple false horkelia (HOPU8), spike trisetum (TRSP2), Rocky Mountain pussytoes (ANME2), Drummond's cinquefoil (PODR), alpine Lewisia (LEPY2), stalked fleabane (ERAL18), alpine shooting star (DOAL), Rocky Mountain goldenrod (SOMU), and Pacific lupine (LULE2) (Landfire BpS 11370, NatureServe. 2017)**.**

Dry Meadow (-7) sites include open dry meadows and grasslands on the west side of the Cascades and northern Sierra Nevada. They occur in montane elevations up to 8,500 feet. They are moist to wet in the spring, but dry moderately to severely by fall. These sites do not have a perched water table or freely available water within the rooting zone throughout the growing season. Species that define the subzone include Cusick's bluegrass (POCU3), Kentucky bluegrass (POPR), Idaho fescue (FEID), nodding needlegrass (NACE), and wildrye (ELYMU) (Landfire BpS 11380).

Upland Grass (-6) sites occur in eastern Washington and Oregon within the Pacific Northwest. Upland Grassland Subzone communities are not as common in Eastern Oregon as in the Columbia Basin and may often be found mixed in a mosaic with Shrub-Steppe and Forest Vegzones. The Upland Grass Subzone is characterized by rolling topography composed of loess hills and plains over basalt plains. These sites often have deep loamy ash or loess influenced soils (Mollisols or Mollic intergrades) and are typically dominated by perennial bunchgrasses. Climate of this region has warm-hot, dry summers and cool, wet winters (Landfire BpS 11420). Mean annual temperature ranges between 55 and 62°F, while mean annual precipitation ranges from 14 to 23 inches. These sites rarely have a shrub component and few forbs of consequence (Franklin and Dyrness 1973). Characteristic species include bluebunch wheatgrass (PSSP6), Idaho fescue (FEID), needle and thread (HECO26), Scribner needlegrass (ACSC11), giant wildrye (LECO12), basin wildrye (LECI4), prairie Junegrass (KOMA), western wheatgrass (PASM), Sandberg bluegrass (POSE), western serviceberry (AMAL2), common snowberry (SYAL), and black hawthorn (CRDO2).

This subzone also occurs within California, ranging from the coast to the lower foothills of the Sierra Nevada. Here these annual grasslands and meadows occur on upland slopes, broad valleys, and ocean bluffs, from sea level to over 3,600 feet elevation. Soils are generally fine-textured from loam to clay soils, especially those of volcanic and serpentine parent materials. This subzone is dominated by graminoids, such as downy ryegrass (LEIN6), western needlegrass (ACOC3), Richardson's needlegrass (ACRI8), slender wheatgrass (ELTR7), Hood's sedge (CAHO5), obtuse sedge (CAOB4), northern singlespike sedge (CASC10), small fescue (VUMI), giant wildrye (LECO12), California melicgrass (MECA2), nodding needlegrass (NACE), foothill needlegrass (NALE2), and purple needlegrass (NAPU4). Menzies' fiddleneck (AMME), spreading groundsmoke (GADI2), American bird's-foot trefoil (LOUN), rusty popcornflower (PLNO), and whitetip clover (TRVA) may also be present (NatureServe. 2017)**.**

Scabland Grass (-5) This subzone is found in the Channeled Scablands of the Columbia Plateau in Washington, between the Spokane, Columbia, and Snake Rivers. Soils are very shallow skeletal basalt soils with limited water-holding capacity over fractured basalt and a high rock content. This xeric subzone occurs under relatively extreme soil-moisture conditions. Because of poor drainage through basalt, these soils are often saturated from fall to spring by winter precipitation but typically dry out completely to bedrock by midsummer. Frost-heaving in winter is also common. Precipitation ranges from 6-20 inches, mostly falling as winter snow at higher elevations (Landfire BpS 10650; NatureServe. 2017).
Total vegetation cover is typically low, generally less than 50% and often much less. Characteristic species include scabland sagebrush (ARRI2), arrowleaf buckwheat (ERCO12), Douglas' buckwheat (ERDO), slender buckwheat (ERMI4), snow buckwheat (ERNI2), rock

buckwheat (ERSP7), Blue Mountain buckwheat (ERST4), thymeleaf buckwheat (ERTH4), or purple sage (SADO4). These stands are characterized by low cover of perennial bunchgrasses, primarily Sandberg bluegrass (POSE), but may include onespike danthonia (DAUN), squirreltail (ELEL5), Idaho fescue (FEID), or bluebunch wheatgrass (PSSP6). Forbs may be present, usually with low cover, include bitter root (LERE7), desertparsley (LOMAT), narrowleaf mock goldenweed (NEST5), onion (ALLIU), pussytoes (ANTEN), and balsamroot (BALSA). Other species that may be present in pockets of deeper soil include big sagebrush (ARTR2), threetip sagebrush (ARTR4), and CHVI8 (yellow rabbitbrush) (Landfire BpS 10650; NatureServe. 2017).

Shrub-Steppe (Shrublands) Vegzone (5)

Vegzone	Vegzone Name	Subzone	Subzone Name
5	Shrublands	-17	Creosote-Bursage Scrub
5	Shrublands	-16	Desert Scrub
5	Shrublands	-15	Coastal Scrub
5	Shrublands	-14	Chaparral
5	Shrublands	-13	Montane Shrub
5	Shrublands	-12	Upland Shrub
5	Shrublands	-11	Scabland Shrub
5	Shrublands	-10	Salt Desert Shrub

The Shrublands (Shrub-Steppe) Vegzone occurs in the rain shadow between the Cascades and Sierra Nevada, and extends from northeastern Washington, through eastern Oregon, and into eastern California. This vegzone is dominated by low-lying shrubs, with too little rain for tree growth. The sites have a continental climate and occur in arid to semi-arid areas with warm-hot dry summers and cold winters. In most of central and southeast Washington, and much of eastern Oregon, shrub-steppe communities occur in areas with low precipitation (less than 6-8 inches adjacent to juniper woodlands or less than 10-14 inches adjacent to ponderosa pine communities) or where soil texture or soil depth limit forest vegzone community development. The most frequently found species include big sagebrush (ARTR2), squirreltail (ELEL5), chamise (ADFA), curl-leaf mountain mahogany (CELE3), and Sandberg bluegrass (POSE).

Shrublands (Shrub-Steppe) Subzones

Montane Shrub (-13) Montane shrub ecosystems include chaparral and open shrubby woodlands found among montane forests above 4,550 feet in elevation from the southern Cascades of Oregon, including the northern Great Basin, the Columbia Basin, the Blue Mountains, and the Hells Canyon region of northeastern Oregon, to the Peninsular Ranges of California. This subzone generally occurs between the steppe or shrub-steppe ecotone and the forest (Landfire BpS 11060). It is often located on steep, exposed slopes with rocky and/or shallow soils, often glaciated, but with some soil development, either loess deposits or volcanic clays. Sites may be located on ridgetops and upper to middle mountain slopes and are more

common on sunny southern aspects. Soils tend to be moist but will typically dry out in late spring or summer. Much of the annual precipitation occurs as snow (Landfire BpS 11060; NatureServe. 2017). Mean annual temperature ranges between 41 and 59°F, while mean annual precipitation ranges from 7 to 30 inches.

Rocky Mountain maple (ACGL) and quaking aspen (POTR5) may be present, while common shrub species include mountain snowberry (SYOR2), common snowberry (SYAL), western serviceberry (AMAL), bitter cherry (PREM), chokecherry (PRVI), snowbrush ceanothus (CEVE), antelope bitterbrush (PUTR2), curl-leaf mountain mahogany (CELE3), wax current (RICE), yellow rabbitbrush (CHVI8), oceanspray (HODI), mallow ninebark (PHMA5), white spirea (SPBE2), Lewis' mock orange (PHLE4), smooth sumac (RHGL), prickly currant (RILA), thimbleberry (RUPA), rose meadowsweet (SPSP2), grouse whortleberry (VASC), and thinleaf huckleberry (VAME) (Landfire BpS 11060; NatureServe. 2017).

Upland Shrub (-12) This subzone occurs across the Great Basin, Snake River Plains, Modoc Plateau, and the more xeric portions of the Columbia Plateau. Sites typically occur on deeper soils that are typically well drained, and that do not have the potential for tree dominance. Mean annual temperature ranges between 42 and 51°F, while mean annual precipitation ranges from 13 to 22 inches. Most precipitation is in the winter and spring.

Big sagebrush (ARTR2) is the dominant shrub, with antelope bitterbrush (PUTR2) a common co-dominant on the warmer sites. In some cases, xeric shrubs such as fourwing saltbush (ATCA2), shadescale saltbush (ATCO), Nevada jointfir (EPNE), Mormon tea (EPVI), rubber rabbitbrush (ERNA10), spiny hopsage (GRSP), and greasewood (SAVE4) may also be co-dominants. On cooler sites, western serviceberry (AMAL) and mountain snowberry (SYOR2) may also be present. Herbaceous diversity is typically high, with deep-rooted bunchgrasses common, e.g., Idaho fescue (FEID), rough fescue (FECA4), bluebunch wheatgrass (PSSP6), and Columbia needlegrass (ACNE9) (Landfire BpS 11260; NatureServe. 2017)**.**

Chaparral (-14) This subzone represents a shrubland community primarily found in California and southern Oregon, away from the fog belt. In the Sierra Nevada, chaparral occurs in the foothills on the western slopes. In the coast ranges, chaparral is found largely on interior slopes and in large patches in the Siskiyou, Cascade, and Klamath Mountains. The northern limits are the dry areas of the Rogue River Watershed in Oregon. Chaparral is shaped by a Mediterranean climate of mild wet winters and hot dry summers, along with infrequent, high-intensity fires, generally in late summer and early fall (Landfire BpS 11050). Mean annual temperature ranges between 55 and 63°F, while mean annual precipitation ranges from 17 to 25 inches.

This shrubland group includes chaparral in patches restricted by edaphic conditions (sands, sandstones, other marine sediments, and stabilized sand dunes) within the summer coastal fog belt in scattered locations in the southern, central and northern California coast. This subzone also includes both frost-intolerant mesic chaparrals at lower elevations and the montane chaparrals with a composition including more frost-tolerant species. It occurs in mesic site conditions, such as north-facing slopes, concavities, or toe slopes, with well-drained soils throughout Mediterranean California, mostly inland from the coastal fog belt (USNVC 2021).

This subzone is characterized by a combination of locally endemic species of *Arctostaphylos* and *Ceanothus*, species that primarily reproduce by seed rather than resprouting. Examples include woollyleaf manzanita (ARTO2), glossyleaf manzanita (ARNU3), Hooker's manzanita (ARHO3), Pajaro manzanita (ARPA3), Montara manzanita (ARMO5), Baker's manzanita (ARBA4), Bonny Doon manzanita (ARSI), Mason's ceanothus (CEMA3), Carmel ceanothus (CEGR2), and barranca brush (CEVE2), Stanford's manzanita (ARST), California flannelbush (FRCA6), tree poppy (DERI), whiteleaf manzanita (ARMA), bigberry manzanita (ARGL4), Eastwood's manzanita (ARGL3), Medocino bushmallow (MAFA), and chaparral pea (PIMO5). Additional species that occur in Jackson and Josephine counties in Oregon include buckbrush (CECU), birchleaf mountain mahogany (CEBE3), bearbush (GAFR), Klamath plum (PRSU2), and poisonoak (TODI) (Landfire BpS 11050; NatureServe. 2017).

Coastal Scrub (-15) This subzone occurs from the central California coast in Monterey and San Luis Obispo Counties north to about the Oregon border. The subzone is usually within five to ten miles of the coast and is within the zone of summer fog. This subzone occurs on sea bluffs and rocky headlands well above the tidal zone throughout rugged portions of the Pacific Coast, as well as on coastal sand dunes and beaches. It occurs below 3,000 feet elevation and may extend inland from the maritime zone in hotter, drier (less fog-drenched) conditions than northern shrublands (NatureServe. 2017)**.**

Plant communities along these often-vertical slopes are typically sparse, with many succulents and prostrate shrubs, along with species that readily withstand salt spray and saline soils as well as seasonal drought. This subzone may be dominated by drought-deciduous shrubs but at times may have characteristic resprouting, deep-rooted sclerophyllous shrubs. Characteristic species include coyotebrush (BAPI), coastal sagebrush (ARCA11), eastern Mojave buckwheat (ERFA2), California jointfir (EPCA2), Mexican bush sage (SALE9), white sage (SAAP2), black sage (SAME3), seaside woolly sunflower (ERST9), California brittlebush (ENCA), yellow bush lupine (LUAR), coastal pricklypear (OPLI3), seaside fleabane (ERGL3), seacliff buckwheat (ERPA8), goose tongue (PLMA3), sawtooth goldenbush (HASQ2), coastal buckwheat (ERCI5), lemonade sumac (RHIN2), beach wormwood (ARPY3), California goldenbush (ERER11), Menzies' goldenbush (ISME5), and Chamisso bush lupine (LUCH) (NatureServe. 2017)**.**

Scabland Shrub (-11) This subzone is most common in the channeled scablands of the Columbia Plateau of Washington, between the Spokane, Columbia, and Snake Rivers, as well as small, isolated inclusions in other sagebrush types and within forested types of the Blue Mountains in southeastern Oregon. This subzone is also found in the Sierra Nevada and forms extensive low-stature shrublands. It typically occurs on mountain ridges and flanks and broad terraces, ranging from 3,000 to 9,000 feet in elevation. Sites are generally xeric and may be on wind-blown, shallow substrates, poorly drained clays, and very stony, gravelly, or finer-textured alkaline soils. Soils may include shrink-swell clays that annually strip fine roots. These xeric shrublands also occur in soils with limited water-holding capacity over fractured basalt. Because of poor drainage through basalt, these soils are often saturated from fall to spring by winter precipitation but typically dry out completely to bedrock by midsummer (Landfire BpS 10650; NatureServe. 2017)**.** Precipitation ranges from 6-20 inches, mostly falling as winter snow at higher elevations.

Total vegetation cover is typically low, generally less than 50%, and often much less. Vegetation is characterized by an open dwarf-shrub canopy dominated by scabland sagebrush (ARRI2), purple sage (SADO4), black sagebrush (ARNO4), little sagebrush (ARAR8), Bigelow sage (ARBI3), threetip sagebrush (ARTR4), and prairie sagewort (ARFR4). Other dwarf-shrub species, particularly diagnostic Eriogonum species such as arrowleaf buckwheat (ARCO12), Douglas' buckwheat (ERDO), slender buckwheat (ERMI4), snow buckwheat (ERNI2), rock buckwheat (ERSP7), Blue Mountain buckwheat (ERST4), and thymeleaf buckwheat (ERTH4) may also be present. Sandberg bluegrass (POSE), squirreltail (ELEL5), bitter root (LERE7), narrowleaf mock goldenweed (NEST5), and other dry-site grasses and forbs may be present, usually with low cover (Landfire BpS 10650; NatureServe. 2017)**.**

Salt Desert Shrub (-10) Salt Desert Shrub communities are most frequent in the Great Basin of southeast Oregon and south-central Oregon where interior drainage and large historic lake basins support significant patches of salt desert habitat. This subzone is semi-arid and is found on windswept basins and plains. Stands occur on gentle slopes and rolling plains. Substrates are shallow, typically saline, alkaline, fine-textured soils developed from often marine shale or alluvium that may be associated with shale badlands. Infiltration rate is typically low. The water table is generally shallow and these areas remain dry through most growing seasons. Average annual precipitation is 5-8 inches, with a mean temperature of 45 – 50°F (Landfire BpS 11530; NatureServe. 2017). These sites are often intermingled in a mosaic with upland shrub communities dominated by big sagebrush (ARTR2).

The vegetation is characterized by an open canopy of dwarf-shrubs. Dominant or codominant dwarf-shrubs may include longleaf wormwood (ARLO7)*,* pygmy sagebrush (ARPY2), or bud sagebrush (PIDE4), sometimes with a mix of other low shrubs, such as winterfat (KRLA2) or shortspine horsebrush (TESP2). The herbaceous layer is typically sparse, with scattered perennial forbs such as smooth woodyaster (XYGL) and gooseberryleaf globemallow (SPGR2). Perennial grasses, such as Indian ricegrass (ACHY), blue grama (BOGR2), squirreltail (ELEL5), thickspike wheatgrass (ELLA3), western wheatgrass (PASM), Sandberg bluegrass (POSE), or alkali sacaton (SPAI) may dominate the herbaceous layer. In less saline areas, there may be inclusions of grasslands dominated by needle and thread (HECO26), saline wildrye (LESA4), or bluebunch wheatgrass (PSSP6) (NatureServe. 2017)**.**

Desert Scrub (-16) The Desert Scrub Subzone is in the transition zone above the Creosote-White Bursage Scrub Subzone and below the lower montane woodlands that occurs in the eastern and central Mojave Desert. Elevation ranges from 2,200-6,500 feet. Precipitation ranges from 5-12 inches, with most occurring from November through April. Summers are hot and dry with many days reaching above 100°F (Landfire BpS 10820).

The vegetation in this group is quite variable. Creosote bush (LATR2) may be absent or present, but typically does not dominate. Characteristic species include wooly fruit bur ragweed (AMER), greenleaf manzanita (ARPA6), blackbrush (CORA), Cooper's goldenbush (ERCO23), Eastern Mojave buckwheat (ERFA2), California jointfir (EPCA2), Nevada jointfir (EPNE), Torrey's jointfir (EPTO), Mormon tea (EPVI), crispleaf buckwheat (ERCO14), spiny hopsage (GRSP), water jacket (LYAN), spiny menodora (MESP2), Bigelow's nolina (NOBI), sacahuista (NOMI), Parry's beargrass (NOPA), buckhorn cholla (CYAC8), desert bitterbrush (PUGL2), Stansbury

cliffrose (PUST), Mexican bladdersage (SAME), turpentinebroom (THMO), Parish's goldeneye (VIPA14), Joshua tree (YUBA), or Mojave yucca (YUSC2) (NatureServe. 2017).

In California's Manual of Vegetation, the Desert Scrub Subzone falls within the Black Brush Scrub Alliance and the Joshua Tree Woodland Alliance. Blackbrush (CORA) is dominant or co-dominant in the shrub canopy with big sagebrush (ARTR2), shadscale saltbush (ATCO), green rabbitbrush (ERTE18), Mojave buckwheat (ERFA2), spiny hopsage (GRSP), winterfat (KRLA2), creosote bush (LATR2), spiny menodora (MESP2), bud sagebrush (PIDE4), Stansbury cliffrose (PUST), Mexican bladdersage (SAME), turpentinebroom (THMO), and Mojave yucca (YUSC2). The Black Brush Scrub Alliance is found on alluvial fans bordering intermountain basins, slopes, upper bajadas, and rocky highlands. The soils are thin and sandy, with abundant exposed rock from mixed alluvium and colluvium (CNPS/A Manual of California Vegetation Online). The Joshua tree (YUBR), an emergent small tree within a shrub or grass layer, occurs with white bursage (AMDU2), burrobrush (AMSA7), big sagebrush (ARTR2), yellow rabbitbrush (CHVI8), blackbrush (CORA), buckhorn cholla (CYAC8), Nevada jointfir (EPNE), Mojave buckwheat (ERFA2), threadleaf snakeweed (GUMI), winterfat (KRLA2), creosote bush (LATR2), water jacket (LYAN), banana yucca (YUBA), and Mojave yucca (YUSC2). This alliance is found on gentle alluvial fans, ridges, and gentle to moderate slopes. Soils are coarse sands, very fine silts, gravel, or sandy loams (CNPS/A Manual of California Vegetation Online).

Creosote-Bursage Scrub (-17) This subzone is found in broad valleys, lower bajadas, plains, and low hills in the Mojave, western Sonoran, and Lower Colorado deserts where winter (cool-season) precipitation prevails. It is typically found on well-drained alluvial flats and slopes above the saltbrush zone, where available water capacity is very low, and runoff is moderate to rapid. Average annual precipitation is four inches while average annual temperature ranges from 64 - 74°F. This subzone is characterized by a sparse to moderately dense layer (2-50% cover) of xeromorphic, microphyllous, and broad-leaved shrubs. Creosote bush (LATR2) and white bursage (AMDU2) typically dominate, but many different shrubs, dwarf-shrubs, and cacti may co-dominate or form typically sparse understory layers. Associated species may include brittlebush (ENFA), Nevada jointfir (EPNE), ocotilla (FOSP2), water jacket (LYAN), beavertail pricklypear (OPBA2), and teddybear cholla (CYBI9). The herbaceous layer is typically sparse but may be seasonally abundant with ephemerals (NatureServe. 2017).

In California's Manual of Vegetation, this subzone falls within the Creosote Bush – White Bursage Scrub Alliance. White bursage (AMDU2) and creosote bush (LATR2) are co-dominant in the shrub canopy with burrobrush (AMSA7), Fremont's chaffbush (AMFR2), shadscale saltbush (ATCO), desertholly (ATHY), cattle saltbush (ATPO), sweetbush (BEJU), California croton (CRCA5), buckthorn cholla (CYAC8), branched pencil cholla (CYRA9), soft prairie clover (DAMO2), cottontop cactus (ECPO2), brittlebush (ENFA), Virgin River brittlebush (ENVI), eastern Mojave buckwheat (ERFA2), desert pepperweed (LEFR2), water jacket (LYAN), Mexican bladdersage (SAME), desert senna (SEAR8), Parish's goldeneye (VIPA14), and Mojave yucca (YUSC2). Habitats typically include washes and rills, alluvial fans, bajadas, valleys, basins, upland slopes, mesas, and erosional highlands. Soils are well-drained, alluvial, colluvial, sandy, sometimes underlain by a hardpan that may be calcareous, igneous, and/or covered with desert pavement (CNPS/A Manual of California Vegetation Online).

[Works Cited]