

10310

California Montane Jeffrey Pine(-Ponderosa Pine) Woodland

BpS Model/Description Version: Aug. 2020

Modelers		Reviewers	
Louisa Evers	Louisa_Evers@or.blm.gov	None	None
Gregg Riegel	griegel@fs.fed.us	None	None
Amy Waltz	awaltz@tnc.org	None	None

Reviewer: Gregg Riegel

Vegetation Type

Forest and Woodland

Map Zones

7

Geographic Range

This biophysical setting (BpS) is found in southern Oregon east of the Cascades and extending south on the Modoc Plateau to about Susanville, California (primarily in map zone (MZ) 7 and a small area in northern MZ 6). Although Jeffrey pine (-ponderosa pine) woodlands are found farther south, they are covered by a different model. This description and model applies to Jeffrey pine (-Ponderosa pine) Woodland within the East Cascades-Modoc Plateau ecoregion and, if present, in the West Cascades ecoregion, excluding Jeffrey pine found on ultra-mafic soils, which is represented by Biophysical Setting (BpS) 11700 Klamath-Siskiyou Xeromorphic Serpentine Savanna and Chaparral.

Biophysical Site Description

This BpS generally occurs in the montane region on mountain side slopes and toe-slope positions. It is found at elevations between 2,000ft and 6,500ft in the Warner Mountains. This area is in the rain shadow of the Cascades and Sierra Nevada ranges, getting less precipitation overall than the western slope. Annual precipitation in the east Cascades and eastern Sierra Nevada ranges from 15-17in; precipitation increases in the western Sierra Nevada and Klamath Mountains (Gucker 2007). On the east side of the Cascade and Sierra Nevada ranges, Jeffrey pine distribution is governed by its tolerance to cold winter and hot summer temperatures, and dry conditions that regulate composition and biomass production. Beginning at about Lakeview, Oregon, the soils are derived from other volcanic rock, such as basalt, andesite, and rhyolite, and tend to support more Jeffrey pine. The BpS is found on sites with limited soil water, shallow soils, or other environmental gradients that make this area less suitable for more mesic forest types.

Vegetation Description

Jeffrey pine and/or ponderosa pine are the dominant tree in the overstory, with an open canopy providing between 20% and 60% cover. In the Carson Range and Warner Mountains, Jeffrey pine may be replaced by Washoe pine (*Pinus washoensis*). Incense cedar and western juniper are infrequent components in the southern part of the BpS. Understories tend to be grassy, with

scattered antelope bitterbrush, mountain big sagebrush, and associated species. The shrub complex present is dependent on the fire history of the site or the microclimate. Bare ground is not uncommon.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
PIJE	<i>Pinus jeffreyi</i>	Jeffrey pine
PIPO	<i>Pinus ponderosa</i>	Ponderosa pine
PUTR2	<i>Purshia tridentata</i>	Antelope bitterbrush
ARTRV	<i>Artemisia tridentata ssp. vaseyana</i>	Mountain big sagebrush
FEID	<i>Festuca idahoensis</i>	Idaho fescue
ACHNA	<i>Achnatherum</i>	Needlegrass
ELEL5	<i>Elymus elymoides</i>	Squirreltail
CARO5	<i>Carex Rossii</i>	Ross' sedge

Species names are from the NRCS PLANTS database. Check species codes at <http://plants.usda.gov>.

Disturbance Description

This BpS is characterized by frequent, low-intensity surface fire intervals of about 3-38yrs. The mixed-intensity fire interval is about 120-130yrs and the stand-replacement fire interval is 300+yrs in open stands, but more probable in closed stands, resulting in an average interval of about 200+yrs. Intervals were shorter on the more productive sites and longer on the less productive sites. The fire regimes in this type are more variable and somewhat longer than the East Cascades Oak-Ponderosa Pine and Rocky Mountain Ponderosa Pine BpSs due to slower fuel accumulation rates. In their summary of pre-settlement fire regimes for California, Van de Water and Safford (2011) report a mean fire return interval (FRI) of 11yrs, a mean minimum FRI of 5yrs, and a mean maximum FRI of 40yrs for yellow pine based on review of many studies.

In the absence of fire, stands tend to close after about 100yrs and become susceptible to mountain and western pine beetle. Bark beetle attack then opens stands. In the pumice zone, Pandora moth outbreaks occur in denser stands during droughts and also serve to control stand densities by completely defoliating small-diameter trees.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	195	10		
Moderate (Mixed)	115	16		
Low (Surface)	25	74		
All Fires	19	100		

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is the central tendency modeled. Percent of all fires is the percent of all fires modeled in that severity class. Minimum and Maximum FIs show the relative range of fire intervals as estimated by model contributors, if known.

Scale Description

Patch sizes were typically thousands to tens of thousands of acres. Individual patches were of uneven age overall and were comprised of small, even-age groups.

[illegible]

Shrub	1.0-3.0	A	A	A	A	A	A	A	A	A	A
Shrub	>3.0	A	A	A	A	A	A	A	A	A	A
Tree	0-5	A	A	A	A	A	A	UN	UN	UN	UN
Tree	5-10	C	C	C	B	B	B	UN	UN	UN	UN
Tree	10-25	C	C	C	B	B	B	UN	UN	UN	UN
Tree	25-50	D	D	D	E	E	E	UN	UN	UN	UN
Tree	>50	D	D	D	E	E	E	UN	UN	UN	UN

Succession class letters A-E are described in the Succession Class Description section. Some classes use a leafform distinction where a qualifier is added to the class letter: Brdl (broadleaf), Con (conifer), or Mix (mixed conifer and broadleaf). UN refers to uncharacteristic native or a combination of height and cover that would not be expected under the reference condition. NP refers to not possible or a combination of height and cover which is not physiologically possible for the species in the BpS.

Description

Class A 6 Early Development 1 - All Structures

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
ARPA6	<i>Arctostaphylos patula</i>	Greenleaf manzanita	Upper
CEVE	<i>Ceanothus velutinus</i>	Snowbrush ceanothus	Upper
PIJE	<i>Pinus jeffreyi</i>	Jeffrey pine	Mid-Upper
PIPO	<i>Pinus ponderosa</i>	Ponderosa pine	Mid-Upper

Description

Shrubs such as greenleaf manzanita (*Arctostaphylos patula*) and snowbrush ceanothus (*Ceanothus velutinus*) sprout and germinate vigorously from seed after fire. Cespitose grasses are found throughout the range and forbs are variable, with more forbs outside the pumice zone. Shrubs tend to dominate early and tend to limit greatly the grasses and forbs after about 10yrs. Scattered Jeffrey pine or ponderosa pine seedlings sprout but may take several years to dominate over the shrub community. Mixed-severity fires on a relatively small scale serve to reduce the shrub density enough to allow trees to establish overtopping the shrubs.

Maximum Tree Size Class

Seedling <4.5ft

Class B 15 Mid Development 1 - Closed

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
PIJE	<i>Pinus jeffreyi</i>	Jeffrey pine	Upper
PIPO	<i>Pinus ponderosa</i>	Ponderosa pine	Upper
PUTR2	<i>Purshia tridentata</i>	Antelope bitterbrush	Middle

Description

This class develops after about 10yrs in Class A, when shrubs are very low or missing. Lack of shrubs may result when the seed bank has been depleted in some manner such that no seed source is present following the stand-replacing fire and most shrubs in the pre-fire stand are killed. A closed forest of sapling and pole-size Jeffrey pine or ponderosa pine develops and then stagnates. Trees have more height growth than diameter growth; thus, they reach heights similar to Class C, but at significantly smaller diameters.

The understory vegetation is almost absent due to the lack of sunlight, and heavy litter and woody debris accumulations. Shrub mortality increases dramatically when tree canopy closure exceeds about 25%-40% (Peek et al. 2001; unpublished monitoring data from the Alternative Fuels Treatment Study, available at Deschutes National Forest). Needles and downed wood are the primary carriers of fire.

Maximum Tree Size Class

Pole 5-9" DBH

Class C 17 Mid Development 1 - Open

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
PIJE	<i>Pinus jeffreyi</i>	Jeffrey pine	Upper
PIPO	<i>Pinus ponderosa</i>	Ponderosa pine	Upper
ARPA6	<i>Arctostaphylos patula</i>	Greenleaf manzanita	Middle
PUTR2	<i>Purshia tridentata</i>	Antelope bitterbrush	Middle

Description

Pole- to medium-size (5-21m) Jeffrey pine or ponderosa pine has become dominant over the shrub layer. Occasional trees may reach 25m in height, but most trees are 10-15m. Shrubs are prevalent in the understory, with scattered forbs and perennial grasses. Typical shrub species include those present in Class A as well as antelope bitterbrush (*Purshia tridentata*). Needle drape in shrubs helps the frequent fires keep the shrub layer relatively low compared to site potential.

Maximum Tree Size Class

Medium 9-21" DBH

Class D 61 Late Development 1 - Open

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
PIJE	<i>Pinus jeffreyi</i>	Jeffrey pine	Upper
ARPA6	<i>Arctostaphylos patula</i>		Middle
ARTRV	<i>Artemisia tridentata</i> Nutt. subsp. vaseyana		Middle
PUTR2	<i>Purshia tridentata</i>	Antelope bitterbrush	Middle

Description

This class differs from Class C primarily by the presence of large to very large (>33in DBH) Jeffrey pine or ponderosa pine. As with Class C, scattered individuals may reach 50m in height, but most trees are closer to 25m. Scattered shrubs are found in the canopy openings, but grasses and forbs are more dominant, especially in the more frequent return intervals. At the longer end, bitterbrush can comprise 15-25% of the understory cover.

Frequent surface fires as well as endemic levels of insects and disease maintain this class indefinitely. The fires are frequent enough that understory seed production is minimized, seed germination from the seed bank is not stimulated due to insufficient temperatures (either maximum temperature triggers or heat duration), and eventually root stocks age enough that sprouting falls off and some plants are eliminated that way.

Grasses and needles are the primary carrier of fire.

Maximum Tree Size Class

Very Large >33" DBH

Class E	1	Late Development 1 - Closed
----------------	----------	------------------------------------

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
PIJE	<i>Pinus jeffreyi</i>	Jeffrey pine	Upper
PIPO	<i>Pinus ponderosa</i>	Ponderosa pine	Upper
PUTR2	<i>Purshia tridentata</i>	Antelope bitterbrush	Middle

Description

This class develops from either Class B or Class D in the prolonged absence of disturbance. In the case of Class B, if enough time elapses without disturbance, enough trees will reach diameter classes large enough to be considered late seral. In the case of Class D, should enough time elapse without disturbance, infill results in a dense, multiple-story stand. In both cases, the understory contains only occasional shrubs and widely scattered clumps of grasses or forbs. Shrub mortality increases dramatically after tree canopy closure exceeds 25-40%. Needles and downed wood are the primary carriers of fire.

On average, the diameter remains smaller than in the open forest due to competition, although very large trees may be present as carryovers from Class D. As with Class D, an occasional tree may reach as high as 50m, but most trees are closer to 25m in height.

The probability of a bark beetle epidemic is quite high in these stands, particularly during drought-prone periods. The fuel complex does not permit surface fires.

Maximum Tree Size Class

Very Large >33" DBH

Model Parameters

Deterministic Transitions

From Class	Begins at (yr)	Succeeds to	After (years)
Early1:ALL	0	Mid1:OPN	29
Mid1:OPN	30	Late1:OPN	79
Mid1:CLS	30	Late1:CLS	129
Late1:OPN	80	Late1:OPN	999
Late1:CLS	130	Late1:CLS	999

Probabilistic Transitions

Disturbance Type	Disturbance occurs In	Moves vegetation to	Disturbance Probability	Return Interval (yrs)	Reset Age to New Class Start Age After Disturbance?	Years Since Last Disturbance
Alternative Succession	Early1:ALL	Mid1:CLS	1	1	Yes	10
Mixed Fire	Early1:ALL	Early1:ALL	0.004	250	No	0
Replacement Fire	Early1:ALL	Early1:ALL	0.01	100	Yes	0
Mixed Fire	Mid1:OPN	Early1:ALL	0.002	500	Yes	0
Replacement Fire	Mid1:OPN	Early1:ALL	0.003	333	Yes	0
Mixed Fire	Mid1:OPN	Mid1:OPN	0.006	167	No	0
Surface Fire	Mid1:OPN	Mid1:OPN	0.05	20	No	0
Insects or Disease	Mid1:OPN	Mid1:OPN	0.05	20	No	0
Mixed Fire	Mid1:CLS	Mid1:OPN	0.0065	154	Yes	0
Mixed Fire	Mid1:CLS	Mid1:CLS	0.0065	154	No	0
Replacement Fire	Mid1:CLS	Early1:ALL	0.013	77	Yes	0
Insects or Disease	Mid1:CLS	Mid1:OPN	0.02	50	Yes	0
Alternative Succession	Late1:OPN	Late1:CLS	1	1	Yes	100
Mixed Fire	Late1:OPN	Early1:ALL	0.002	500	Yes	0
Replacement Fire	Late1:OPN	Early1:ALL	0.003	333	Yes	0
Mixed Fire	Late1:OPN	Late1:OPN	0.006	167	No	0
Surface Fire	Late1:OPN	Late1:OPN	0.05	20	No	0
Insects or Disease	Late1:OPN	Late1:OPN	0.05	20	No	0
Mixed Fire	Late1:CLS	Late1:OPN	0.0065	154	Yes	0
Mixed Fire	Late1:CLS	Early1:ALL	0.0065	154	Yes	0
Replacement Fire	Late1:CLS	Early1:ALL	0.013	77	Yes	0
Insects or Disease	Late1:CLS	Late1:OPN	0.033	30	Yes	0

References

Bork, J.L. 1985. Fire history in three vegetation types on the east side of the Oregon Cascades. PhD thesis. Corvallis, OR: Oregon State University. 94 pp.

Goheen, A. 1998. Buck creek drainage fire analysis: the ecological consequences of aggressive fire suppression. Technical Fire Management 11. Fort Collins, CO: Washington Institute, Colorado State University.

Gucker, C.L. 2007. *Pinus jeffreyi*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: <http://www.fs.fed.us/database/feis/> [2016, October 18].

Miller, R.F. and J.A. Rose. 1999. Fire history and western juniper encroachment in sage-steppe. *Journal of Range Management* 52: 550-559.

Morrow, R.J. 1985. Age structure and spatial pattern of old-growth ponderosa pine in Pringle Falls Experimental Forest, central Oregon. MS thesis. Corvallis, OR: Oregon State University. 80 pp.

NatureServe. 2007. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. Data current as of 10 February 2007.

Peek, J.M., J.J. Korol, D. Gay and T. Hershey. 2001. Overstory-understory biomass changes over a 35-year period in southcentral Oregon. *Forest Ecology and Management*. 150: 267-277.

Rigel, G.M., R.F. Miller, C.N. Skinner and S.E. Smith. 2006. Chapter 11: Northeastern Plateaus Bioregion. In: *Fire in California's Ecosystems*. Eds. N.G. Sugihara, J.V. Wangtendonk, K.E. Shaffer, J. Fites-Kaufman, A.E. Thode. University of California Press, Berkley, CA. 612pp.

Sawyer, J. O., T. Keeler-Wolf, and J. Evens. 2009. A manual of California vegetation. Second edition. California Native Plant Society, Sacramento CA. 1300 pp.

Sexton, T. 1993. Regional ecosystem assessment project: Klamath Basin. Unpublished notes.

Smith, S. 1994. Ecological Guide to Eastside Pine Associations. R5-ECOL-TP-004. San Francisco, CA: USDA Forest Service, Pacific Southwest Region.

Van de Water, K.M. and H.D. Safford. 2011. A summary of fire frequency estimates for California vegetation before Euro-American settlement. *Fire Ecology* 7(3): 26-58. doi: 10.4996/fireecology.0703026.