10310

California Montane Jeffrey Pine(-Ponderosa Pine) Woodland

BpS Model/Description Version: Aug. 2020

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| --- | --- | --- | --- |
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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 | *Pinus jeffreyi* | Jeffrey pine |
| PIPO | *Pinus ponderosa* | Ponderosa pine |
| PUTR2 | *Purshia tridentata* | Antelope bitterbrush |
| ARTRV | *Artemisia tridentata ssp. vaseyana* | Mountain big sagebrush |
| FEID | *Festuca idahoensis* | Idaho fescue |
| ACHNA | *Achnatherum* | Needlegrass |
| ELEL5 | *Elymus elymoides* | Squirreltail |
| CARO5 | *Carex Rossii* | 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 bine 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.

Both Native Americans and lightning were significant ignition sources for fires in this area. In some cases in low-density stands (e.g., on very rocky soil), fires are spotty, attacking individual trees and extinguishing.

Adjacency or Identification Concerns

This BpS often intergrades into the mixed-conifer BpSs in areas with greater precipitation and at higher elevations. At lower elevations, it intergrades with sagebrush-steppe and juniper BpSs. It also commonly intergrades with riparian vegetation along streams.

This BpS covers sites where Jeffrey pine and/or ponderosa pine are dominant, and other tree species do not occur in high abundance, if at all. Jeffrey pine found on ultra-mafic soils is represented by BpS 11700 Klamath-Siskiyou Xeromorphic Serpentine Savanna and Chaparral.

Issues or Problems

Harvesting has removed much of the large ponderosa pine and created frost pockets now dominated by lodgepole pine, even beyond depressions and drainages. At this point it is not always clear whether a given site should be considered poor-site lodgepole pine or ponderosa pine-Jeffrey pine.

Several reviewers suggested that Jeffrey pine in the eastern Sierra Nevada might need a different state-and-transition model to represent differences in growth and disturbance rates, but this was not done because there was very few data to support the development of a new model specific to that area.

Native Uncharacteristic Conditions

Presence of 10% or more of white fir indicates a mixed-conifer BpS. Presence of 10% or more of lodgepole pine indicates a lodgepole pine BpS. Ponderosa pine canopy cover in excess of 40% is an uncharacteristic condition, and any upper layer tree cover >60% is uncharacteristic.

Comments

During the 2016 review, Gregg Riegel revised the state-and-transition model to comply with LANDFIRE modeling rules (e.g., eliminating the use of the proportion function for probabilistic transitions); Kori Blankenship made descriptive changes to clarify the geographic range to which the model applies.

Succession Classes

**Mapping Rules**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Upper Layer Lifeform** | **Height (m)** | **Canopy Cover (%)** | | | | | | | | | |
| **0-10** | **11-20** | **21-30** | **31-40** | **41 - 50** | **51-60** | **61-70** | **71-80** | **81-90** | **91-100** |
| Herb | 0-0.5 | A | A | A | A | A | A | A | A | A | A |
| Herb | 0.5-1.0 | A | A | A | A | A | A | A | A | A | A |
| Herb | >1.0 | A | A | A | A | A | A | A | A | A | A |
| Shrub | 0-0.5 | A | A | A | A | A | A | A | A | A | A |
| Shrub | 0.5-1.0 | A | A | A | A | A | A | A | A | A | A |
| 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 | Arctostaphylos patula | Greenleaf manzanita | Upper |
| CEVE | Ceanothus velutinus | Snowbrush ceanothus | Upper |
| PIJE | Pinus jeffreyi | Jeffrey pine | Mid-Upper |
| PIPO | Pinus ponderosa | Ponderosa pine | Mid-Upper |

Description

Shrubs such as greenleaf manzanita (*Arctostapylos 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 | Pinus jeffreyi | Jeffrey pine | Upper |
| PIPO | Pinus ponderosa | Ponderosa pine | Upper |
| PUTR2 | Purshia tridentata | 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 | Pinus jeffreyi | Jeffrey pine | Upper |
| PIPO | Pinus ponderosa | Ponderosa pine | Upper |
| ARPA6 | Arctostaphylos patula | Greenleaf manzanita | Middle |
| PUTR2 | Purshia tridentata | 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 | Pinus jeffreyi | Jeffrey pine | Upper |
| ARPA6 | Arctostaphylos patula |  | Middle |
| ARTRV | Artemisia tridentata Nutt. subsp. vaseyana |  | Middle |
| PUTR2 | Purshia tridentata | 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 | Pinus jeffreyi | Jeffrey pine | Upper |
| PIPO | Pinus ponderosa | Ponderosa pine | Upper |
| PUTR2 | Purshia tridentata | 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 |

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