11670

Rocky Mountain Poor-Site Lodgepole Pine Forest

BpS Model/Description Version: Aug. 2020

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| --- | --- | --- | --- |
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Vegetation Type

Forest and Woodland

Map Zones

1, 7, 9

Geographic Range

Lodgepole pine forest on deep Mazama ash and pumice east of the Cascades in Oregon. This area is dominated by self-replacing stands of non-serotinous lodgepole pine (*Pinus contorta* var. *murryana*), making it distinctive from lodgepole pine stands occurring elsewhere.

Biophysical Site Description

This forest type is generally on two settings: 1) low thermal capacity soils derived primarily from pumice and 2) topographic depressions and river valleys with high water tables. Both settings generally occur between 1,200-1,600m elevation. This forest type is generally restricted to the "pumice plateau" region characterized by internally drained topographic depressions, gentle slopes, and isolated cinder cones. Soils are poorly structured Andisols (A/C horizon) with low bulk density and subject to wide diurnal temperature changes.

Vegetation Description

Generally single-layered forest canopy dominated by lodgepole pine. Multi-canopy stand types can occur locally where moderate to light fires, windthrow, or other canopy disturbance create open conditions. Ponderosa pine, white fir, western white pine, and aspen can be associated with these forests under specific habitat conditions related to soil moisture. Heyerdahl et al. (2014) report 10% ponderosa pine cover (total number of tree stems) at a study site in central Oregon. Franklin and Dyrness (1988) recognize eight plant communities where lodgepole pine is the dominant tree species. Understory species characterizing these communities follow a moisture gradient from dry (dominated by *Purshia tridentada*) to wet (dominated by grasses and sedges).

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| PICO | *Pinus contorta* | Lodgepole pine |
| PUTR2 | *Purshia tridentata* | Antelope bitterbrush |
| FEID | *Festuca idahoensis* | Idaho fescue |
| ARUV | *Arctostaphylos uva-ursi* | Kinnikinnick |
| ACOC3 | *Achnatherum occidental* | Western needlegrass |
| CARO5 | *Carex rossii* | Ross’ sedge |

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

Disturbance Description

This type is driven by moderate- to high-severity (stand-replacing) fires. Heyerdahl et al. (2014) report that moderate-severity fires dominated the pre-1900 fire regime at the Potholes study site in central Oregon at the site (~800ha) and plot (~1ha) scales. Their reconstruction suggested a 60yr median fire interval with a minimum of 26yrs and a maximum of about 82yrs. The authors hypothesize that the fire regime of Potholes, where bitterbrush provides fuel to fires, would not apply to other areas with pure lodgepole pine in Oregon that lack the bitterbrush understory and therefore tend to be fuel-limited.

Fire-scarred trees tend to be more susceptible to beetle attack and blue stain fungi-induced mortality, leading to cyclic-succession that includes these three disturbance agents. Windthrow can also be both locally important (creating canopy gaps), and regionally important (leading to the "unraveling" of the forest canopy). Both conditions promote the self-replacement of lodgepole pine in this forest type. Windthrow may also contribute to local regeneration by promoting favorable micro-climate and local soils conditions. Self-thinning is an important process during the early successional stage of this forest type.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 111 | 50 | 20 | 200 |
| Moderate (Mixed) | 113 | 50 |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 56 | 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

The lodgepole pine pumice ecosystem is dominated by large-scale fires (Heyerdahl et al. 2014) and insect outbreaks. Heyerdahl et al. (2014) report mixed-severity fires covering >800ha. Windthrow can be an important factor modifying canopy conditions and regeneration success in the absence of fire and variable depending on local topography. Microsite conditions are important to successful regeneration where soil moisture is low. Topographic depressions may be important to the separation of lodgepole pine and ponderosa pine near the transition of these forest types as a result of cold air drainage favoring lodgepole pine.

Adjacency or Identification Concerns

The pumice lodgepole pine forests are adjacent to dry ponderosa pine (mesic), mixed ponderosa pine, and juniper steppe.

Issues or Problems

Fire history is poorly described in the literature but can be more accurately determined by age structure than most forest types.

Jim Merzenich brought up the discussion on the historic versus present extent of ponderosa grasslands. This discussion includes other Rapid Assessment pine models (R#PIPOm, R#PIPOxe). He suggests that one of these models should include large extent of ponderosa grassland. It was suggested that the current area in this type may be a significant extension of the historic extent due to fire suppression and grazing (Munger 1914), when according to GLO records, much of this area was more of a ponderosa savanna.

Native Uncharacteristic Conditions

Comments

Emily Heyerdahl reviewed this model during the 2016 Biophysical Setting (BpS) Review. Based on the review, Kori Blankenship modified the model to maintain the approximate overall fire frequency but to shift the fire severity to include more mixed-severity fire based on the work of Heyerdahl et al. (2014).

Future review of this model should consider: 1) the geographic extent to which this model applies, in particular, to map zone (MZ) 1 and 2) the applicability of the Potholes fire regime documented by Heyerdahl et al. (2014) to other areas.

Jim Merzenich ([jmerzenich@fs.fed.us](mailto:jmerzenich@fs.fed.us)) reviewed this model for MZ09. Authors used input from experts in the Chemult Ranger District and in the Winema National Forest to inform this model. Originally, the modelers built a five-box model but later agreed to simplify to a three-box due to detection limitations. Model review for MZ01 proposed a distinct BpS model for the wet type described above. This wet type would have a mean fire return interval possibly as high as 120yrs but definitely greater than the current model's 40yrs. The distribution of the wet type would follow cold-wet conditions and would not be as controlled by fire as the current model is.

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 | A | A | A | A |
| Tree | 5-10 | A | A | A | A | A | A | A | A | A | A |
| Tree | 10-25 | C | C | C | C | B | B | B | B | B | B |
| Tree | 25-50 | C | C | C | C | B | B | B | B | B | B |
| Tree | >50 | C | C | C | C | B | B | B | B | B | B |

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 29 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PICO | Pinus contorta | Lodgepole pine | Upper |

Description

Dense post-fire stands (may exceed 10,000 stems/ha). Tree size is small (<10cm DBH), and ages vary from (< 20yrs to >40yrs) depending on environmental conditions. Regeneration and understory plants are rare. Self-thinning is the predominant process leading to changes in stand structure and leads to high levels of fine to 10hr fuels. However, these stands rarely burn and can act as fire barriers. A small percentage of this BpS is so dry that it never develops a closed canopy.

*Maximum Tree Size Class*  
Sapling >4.5ft; <5" DBH

Class B 34 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PICO | Pinus contorta | Lodgepole pine | Upper |
| PUTR2 | Purshia tridentata | Antelope bitterbrush | Lower |

Description

Lodgepole (>10cm to <50cm DBH) generally <40yrs, but older stands can be >100yrs before bark beetles attack older trees and open up the stand. These trees may be 25-30ft tall but may be taller in protected microhabitats.

*Maximum Tree Size Class*  
Medium 9-21" DBH

Class C 37 Late Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PICO | Pinus contorta | Lodgepole pine | Upper |
| PUTR2 | Purshia tridentata | Antelope bitterbrush | Lower |
| LUPIN | Lupinus | Lupine | Lower |
| RICE | Ribes cereum | Wax currant | Lower |

Description

These stands show open canopy conditions of mature lodgepole resulting from insect-induced tree mortality and/or windthrow or low regeneration. They can be 40-80yrs, and some stands hold together up to 150yrs or more. These are often part of a cyclic pattern of succession involving post-fire stands experiencing a second burn followed by insect outbreaks and windthrow. These trees may be 30-40ft tall.

*Maximum Tree Size Class*  
Medium 9-21" DBH

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Late1:CLS | 20 |
| Late1:CLS | 21 | Late1:OPN | 60 |
| Late1:OPN | 61 | Late1:OPN | 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** |
| Replacement Fire | Early1:ALL | Early1:ALL | 0.0067 | 149 | Yes | 0 |
| Alternative Succession | Early1:ALL | Late1:OPN | 0.008 | 125 | Yes | 0 |
| Replacement Fire | Late1:OPN | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Mixed Fire | Late1:OPN | Late1:OPN | 0.0125 | 80 | No | 0 |
| Insects or Disease | Late1:OPN | Early1:ALL | 0.02 | 50 | Yes | 0 |
| Insects or Disease | Late1:CLS | Late1:OPN | 0.01 | 100 | Yes | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Mixed Fire | Late1:CLS | Late1:CLS | 0.0125 | 80 | No | 0 |

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