10581

Sierra Nevada Subalpine Lodgepole Pine Forest and Woodland -- Wet

BpS Model/Description Version: Aug. 2020

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

Forest and Woodland

Map Zone

6

Model Splits or Lumps

This Biophysical Setting (BpS) is split into multiple models: this cold, wet type (10581) and a dry type (10582). BpS 10581 is found predominantly on gently rolling lower slopes and drainage bottoms whereas 10582 is predominantly found on benches and moderate slopes.

Geographic Range

Cold, wet lodgepole pine is distributed in the upper montane of the central and southern portions of the Sierra Nevada. Stands are typically located at elevations ranging from ~2,000-3,200m (Potter 1994).

Biophysical Site Description

Cold, wet lodgepole pine occurs on upper montane sites, usually on gently rolling lower slopes and drainage bottoms (Potter 1994, 1998). Stands are typically in broken terrain and, thus, few large contiguous areas of this type exist. The climate is Mediterranean with wet winters (Nov-Apr) and dry summers, although summer thunderstorms occur sporadically. Sites are moist and more productive than dry, cool subalpine lodgepole. Fuels are composed of a matrix of herbaceous vegetation and pine debris.

Vegetation Description

The understory is diverse with graminoids and forbs (cover >50%). Tree cover is generally moderate to dense. There is an increasing dominance of red fir and western white pine at lower elevations. Lodgepole can be seral to these species and, at higher elevations, mountain hemlock is present. Associated plant species include *Arctostaphylos nevadensis*, *Ceanothus cordulatus*, *Chrysolepis sempervirens*, *Phyllodoce breweri*, and *Ribes montigenum*. Common graminoids include *Poa wheeleri*, *Carex filifolia*, *Carex rossii*, and *Carex exserta*.

BpS Dominant and Indicator Species

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

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

Disturbance Description

Disturbance patterns have been poorly studied in Sierra lodgepole pine. Sierra lodgepole has been described as not being a fire type (Barbour and Minnich 2000) or as having long intervals between fires (Parker 1986; Keeley 1980; Potter 1998). Somewhat similar wet lodgepole types in the Klamath Mountains and Oregon had a fire return interval (FRI) range of 70-100yrs. Fire season is generally late summer to early fall. Stand-replacement fire occurs at long intervals, resulting in low stand complexity. Mixed-severity fire occurs when fuel conditions remain moist and result in mixed-age stands. Very infrequently, surface fires can occur.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 158 | 23 | 37 | 764 |
| Moderate (Mixed) | 51 | 69 |  |  |
| Low (Surface) | 460 | 8 |  |  |
| All Fires | 36 | 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

Fire size ranges from small (a few hectares) to hundreds of hectares. The disturbance scale in areas with long-to-short FRIs is variable. Most fires are small (<1 ha), but the less common large fires affect large areas (10s-100s ha).

Adjacency or Identification Concerns

This type can be distinguished from 10582 because it is heavily dominated by lodgepole pine, with other conifers possibly present but not co-dominant. It occurs more along canyon bottoms, meadow fringes, and on toe-slope positions where there is more soil moisture.

Issues or Problems

Limited information about disturbance is available, and that information is from a limited geographic range of sites. Divergent fire occurrence patterns, ranging from moderate frequency to very long FRIs in this vegetation type, result in imprecise measures. Differences may be related to ignition and fire spread probabilities or to lack of data. Information applied to this type in most reviews was derived from studies in the Klamath Mountains rather than the Sierra Nevada.

Native Uncharacteristic Conditions

Comments

A reviewer proposed an alternative model with a time-since-fire transition from Class D to Class E, and less mixed fire in Class A. This alternative model resulted in 5%, 20%, 10%, 30%, and 35% in Classes A-E, respectively, with about the same amount of fire (mean FRI, 27yrs). Another reviewer felt that the fire interval range (70-100yrs) cited for the Klamaths and Oregon likely pertains in the Sierra, too.

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 | C | C | C | C | C | B | B | B | B | B |
| Tree | 10-25 | D | D | D | D | D | E | E | E | E | E |
| Tree | 25-50 | D | D | D | D | D | E | E | E | E | E |
| Tree | >50 | D | D | D | D | D | E | E | E | E | E |

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** |
| PICO | Pinus contorta | Lodgepole pine | Upper |
| CAREX | Carex | Sedge | Lower |
| POA | Poa | Bluegrass | Lower |

Description

Lodgepole pine regeneration follows stand-replacing fire (severe understory fire or canopy fire). Moderate density to dog-hair thickets. Mixed or severe fires can occur.

*Maximum Tree Size Class*  
None

Class B 28 Mid Development 1 - Closed

Indicator Species

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

Description

Mid-maturity lodgepole pine undergoes intrinsic stand thinning. Considerable surface fuel from tree mortality from previous fire. Replacement fire resets. Mixed fire and insects/disease open the stand. Other insect/disease disturbance can either reset or maintain.

*Maximum Tree Size Class*  
None

Class C 6 Mid Development 1 - Open

Indicator Species

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

Description

Mid-maturity lodgepole pine occurs where surface fire or other disturbance has opened the stand. Replacement fire, insects/disease, or wind/weather events can all reset. Mixed-severity or surface fires maintain. Without fire, the stand eventually transitions.

*Maximum Tree Size Class*  
None

Class D 5 Late Development 1 - Open

Indicator Species

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

Description

Areas that have experienced one or more low-severity understory fires that reduced stand density or old stands that have not experienced fire but have been thinned by other processes (treefalls, etc.) are dominant. Stands are uneven age. Replacement fire, insects, and disease can all reset. Mixed-severity or surface fires and wind/weather events maintain.

*Maximum Tree Size Class*  
None

Class E 55 Late Development 1 - Closed

Indicator Species

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

Description

Old stands where fire has had minimal influence. Replacement fire or insects/disease reset. Mixed fire maintains. Insects/disease or wind/weather events can open the stand. Other insect/disease events can either reset or maintain.

*Maximum Tree Size Class*  
None

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Mid1:CLS | 9 |
| Mid1:CLS | 10 | Late1:CLS | 49 |
| Mid1:OPN | 15 | Late1:OPN | 69 |
| Late1:CLS | 50 | Late1:CLS | 480 |
| Late1:OPN | 70 | Late1:CLS | 119 |

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 | 0.001 | 1000 | Yes | 0 |
| Mixed Fire | Early1:ALL | Early1:ALL | 0.033 | 30 | No | 0 |
| Alternative Succession | Mid1:OPN | Mid1:CLS | 1 | 1 | Yes | 15 |
| Wind or Weather or Stress | Mid1:OPN | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Insects or Disease | Mid1:OPN | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Replacement Fire | Mid1:OPN | Early1:ALL | 0.004 | 250 | Yes | 0 |
| Surface Fire | Mid1:OPN | Mid1:OPN | 0.02 | 50 | No | 0 |
| Mixed Fire | Mid1:OPN | Mid1:OPN | 0.033 | 30 | No | 0 |
| Insects or Disease | Mid1:CLS | Mid1:CLS | 0.0005 | 2000 | No | 0 |
| Insects or Disease | Mid1:CLS | Early1:ALL | 0.0005 | 2000 | Yes | 0 |
| Insects or Disease | Mid1:CLS | Mid1:OPN | 0.001 | 1000 | Yes | 0 |
| Replacement Fire | Mid1:CLS | Early1:ALL | 0.007 | 143 | Yes | 0 |
| Mixed Fire | Mid1:CLS | Mid1:OPN | 0.01 | 100 | Yes | 0 |
| Wind or Weather or Stress | Late1:OPN | Late1:OPN | 0.001 | 1000 | No | 0 |
| Insects or Disease | Late1:OPN | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Replacement Fire | Late1:OPN | Early1:ALL | 0.004 | 250 | Yes | 0 |
| Surface Fire | Late1:OPN | Late1:OPN | 0.02 | 50 | No | 0 |
| Mixed Fire | Late1:OPN | Late1:OPN | 0.033 | 30 | No | 0 |
| Wind or Weather or Stress | Late1:CLS | Late1:OPN | 0.001 | 1000 | Yes | 0 |
| Insects or Disease | Late1:CLS | Late1:OPN | 0.001 | 1000 | Yes | 0 |
| Insects or Disease | Late1:CLS | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.007 | 143 | Yes | 0 |
| Mixed Fire | Late1:CLS | Late1:CLS | 0.02 | 50 | No | 0 |

References

Agee, James K. 1990. The Historical Role of Fire in Pacific Northwest Forests. In: Walstad, J.K., S.R. Radosevich and D.V. Sandberg, eds. Natural and Prescribed Fire in Pacific Northwest Forests. Corvallis, OR: Oregon State University Press. 25-38.

Agee, James K. 1993. Fire Ecology of Pacific Northwest Forests. Washington, DC: Island Press. 493 pp.

Husari, S.J. and K.S. Hawk. 1994. The role of past and present disturbance in California ecosystems. Draft Region 5 Ecosystem Management Guidebook, Vol. 2, Appendices I–C. San Francisco, CA: USDA. Forest Service, Pacific Southwest Region.

Keeley, J.E. 1980. Reproductive cycles and fire regimes. In: Mooney, H.A., T.M. Bonnicksen, N.L. Christensen, J.E. Lotan and W.A. Reiners, tech. coords. Proceedings of the Conference: Fire Regimes and Ecosystem Properties. 11-15 December 1978, Honolulu, Hawaii. GTR- WO-26. USDA Forest Service. 231-277.

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

Potter, Don. 1994. Guide to Forested Communities of the Upper Montane in the Central and Southern Sierra Nevada. R5-ECOL-TP-003. San Francisco, CA: USDA Forest Service, Pacific Southwest Region.

Potter, Donald A. 1998. Forested communities of the upper montane in the central and southern Sierra Nevada. Gen. Tech. Rep. PSW-GTR-169. Albany, CA: USDA Forest Service, Pacific Southwest Research Station. 319 pp.

Parker, A.J. 1986. Persistence of lodgepole pine forests in the central Sierra Nevada. Ecology 67: 1560–67.

Parker, A.J. 1988. Stand structure in subalpine forests of Yosemite National Park, California. For. Sci. 34: 1047-1058.

Taylor, A.H. and M.N. Solem. 2001. Fire regimes and stand dynamics in an upper montane forest landscape in the southern Cascades, Caribou Wilderness, California. J. Torrey Bot. Soc. 128: 350-361.