

**10580**

## **Sierra Nevada Subalpine Lodgepole Pine Forest and Woodland**

BpS Model/Description Version: Aug. 2020

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### **Vegetation Type**

Forest and Woodland

### **Map Zone**

4

### **Geographic Range**

Dry subalpine lodgepole pine is distributed in the upper montane of the central and southern portions of the Sierra Nevada and in the subalpine Transverse and Peninsular ranges; White, Inyo, and Sweetwater ranges; in the montane to subalpine in the Klamath Mountains, Modoc Plateau, and Winter Range. Stands are typically located at elevations ranging from approximately 2,400-3,200m.

In map zone (MZ) 4, this type may be found in subsections M262Be, M262Bh, and M262Bm.

### **Biophysical Site Description**

Lodgepole dominates on upper montane dry sites, often located on benches but also on moderate slopes. Stands are typically in broken terrain and, thus, few large contiguous areas of this type exist. Stands persist on nutrient-poor granitic or pumice soils (Sheppard and Lassoie 1988; Agee 1993; Keifer 1991). Climate is Mediterranean with wet winters (Nov-Apr) and dry summers, although summer thunderstorms occur sporadically. Forest understory is typically sparse with few shrubs and low-to-moderate herbaceous cover. Fuel is considered sparse (Parker 1986; van Wagtendonk 1991).

### **Vegetation Description**

*Pinus contorta murrayana* stands can exist in a range of densities, from open woodland to stands with a closed canopy (Potter 1994, 1998). In the south-central Sierra Nevada, stands grade into foxtail pine at dry upper elevations (Rourke 1988; Keifer 1991). Western hemlock dominance increases at wetter sites in the central Sierra. At lower elevations and as available moisture increases, there is a growing dominance of red fir and western white pine. On warmer, dry, lower elevation sites, lodgepole is associated with Jeffrey pine and western juniper. *Abies concolor*, *Pinus lambertiana*, and *Arctostaphylos parryana* occur in MZ04. Understory species include *Antennaria* spp., *Arabis* spp., *Eriogonum* spp., and *Gayophytum* spp. (Potter 1994).

### **BpS Dominant and Indicator Species**

| <b>Symbol</b> | <b>Scientific Name</b> | <b>Common Name</b> |
|---------------|------------------------|--------------------|
| PICO          | <i>Pinus contorta</i>  | Lodgepole pine     |
| PIFL2         | <i>Pinus flexilis</i>  | Limber pine        |

|        |                                 |                      |
|--------|---------------------------------|----------------------|
| ABCO   | <i>Abies concolor</i>           | White fir            |
| PILA   | <i>Pinus lambertiana</i>        | Sugar pine           |
| PIMO3  | <i>Pinus monticola</i>          | Western white pine   |
| CHSE11 | <i>Chrysolepis sempervirens</i> | Bush chinquapin      |
| CECO   | <i>Ceanothus cordulatus</i>     | Whitethorn ceanothus |
| ARPA4  | <i>Arctostaphylos parryana</i>  | Parry manzanita      |

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. Stands in the southern Sierra have been described as self-perpetuating (regeneration from treefall gaps), with long intervals between fires (Parker 1986; Keeley 1980; Potter 1998). Lightning strikes typically impact the stands locally, with one or more trees and surrounding accumulated litter affected. In the San Jacinto Mountains, Vogl (1976) noted that lightning-struck conifers -- particularly large and old trees -- are susceptible to bark beetle attack and are often then killed by insects. Sparse fuels are believed to limit ignition and fire spread (Parker 1986). In contrast, fire history studies from dry subalpine lodgepole pine forests in the southern Sierra have found a moderate fire return interval (FRI) in some stands (Keifer 1991; Caprio in review, unpubl. data). Intervals ranged from 31-74yrs (Chagoopa Plateau, Sequoia National Par, and Palisades Canyon, Kings Canyon National Park). Fire severity was mixed and ranged from understory burns on areas up to hundreds of hectares to high-severity crown fire in patches up to tens of hectares. Fire regime group III. Fire season was late summer or early fall. Seasonal fire scar position on Chagoopa and Palisades (SEKI) was 40.7% and 15% latewood and 59.3% and 80% dormant, respectively (Caprio unpubl. data). Other important disturbance agents in this system include the lodgepole needle miner, windthrow, and stress from extreme climatic events, which act as occasional disturbance agents.

Shepherd and Lassoie's (1998) work shows that most fires are primarily single-tree events. However, aerial photographs of pre-suppression disturbance and 1938 aerial photographs of the San Bernardino Mountains (Minnich 1988) show evidence of local stand-replacement fires in dense, sheltered forests as well as in open forests with dense montane chaparral understory (Minnich 1988). Fires are followed by a layer of montane chaparral dominated by *Arctostaphylos patula*, *Ceanothus cordulatis*, and *Chrysolepis sempervirons*, with recruitment of lodgepole and limber pine. Mature tree stature and cover are reached in perhaps a century, after which conifer recruitment is stalled by the canopy layer. Tree establishment by long-range seed dispersal from living stands as serotiny is not characteristic of these pines in California (see work of Critchfield).

### Fire Frequency

| Severity         | Avg FI | Percent of All Fires | Min FI | Max FI |
|------------------|--------|----------------------|--------|--------|
| Replacement      | 278    | 18                   | 31     | 500    |
| Moderate (Mixed) | 103    | 48                   | 31     | 350    |
| Low (Surface)    | 145    | 34                   | 9      | 350    |
| All Fires        | 50     | 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

Disturbance scale in persistent stands is small (0.1ha from treefall [Parker 1986]). Disturbance scale in areas with long to short FRIs is variable. Most fires are small (<1ha), but the less common large fires affect large areas (tens to hundreds of hectares) and may have the greatest influence on forest dynamics. Range of fire severity is generally low (understory burns, with individual to scattered groups of trees impacted) to less common stand-replacing fires -- either high-severity understory fire or canopy fire (patches up to tens of hectares on 5-20% of burned area) -- and occur with more extreme weather (wind; observations by Sequoia and Kings Canyon national parks fire monitors during the 1996 Chagoopa Fire and 2003 Williams Fire burning in PICO).

### Adjacency or Identification Concerns

S-class distribution today is probably similar to what it was historically.

### Issues or Problems

Limited information about disturbance is available, and what information is available is from limited geographic sites. There is great variability in fire occurrence patterns, ranging from moderate frequency to very long FRI. Differences may be related to ignition and fire spread probabilities.

### Native Uncharacteristic Conditions

### Comments

## Succession Classes

### Mapping Rules

| Upper<br>Layer<br>Lifeform | Height<br>(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

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|                |          |                                             |
|----------------|----------|---------------------------------------------|
| <b>Class A</b> | <b>9</b> | <b>Early Development 1 - All Structures</b> |
|----------------|----------|---------------------------------------------|

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*Indicator Species*

| Symbol | Scientific Name          | Common Name          | Canopy Position |
|--------|--------------------------|----------------------|-----------------|
| PICO   | Pinus contorta           | Lodgepole pine       | Upper           |
| ABCO   | Abies concolor           | White fir            | Upper           |
| CHSE11 | Chrysolepis sempervirens | Bush chinquapin      | Mid-Upper       |
| CECO   | Ceanothus cordulatus     | Whitethorn ceanothus | Mid-Upper       |

*Description*

Lodgepole pine regeneration following stand-replacing fire (severe understory fire or canopy fire). Moderate density to dog-hair thickets, plus resprouting grasses and forbs, and seed-germinating shrubs. Mineral soil cover is high in this system due to low soil moisture and poor soil development.

Surface fire maintains and replacement fire resets stand age.

*Maximum Tree Size Class*

Seedling <4.5ft

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|                |           |                                   |
|----------------|-----------|-----------------------------------|
| <b>Class B</b> | <b>10</b> | <b>Mid Development 1 - Closed</b> |
|----------------|-----------|-----------------------------------|

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*Indicator Species*

| Symbol | Scientific Name          | Common Name     | Canopy Position |
|--------|--------------------------|-----------------|-----------------|
| PICO   | Pinus contorta           | Lodgepole pine  | Upper           |
| ABCO   | Abies concolor           | White fir       | Upper           |
| PIJE   | Pinus jeffreyi           | Jeffrey pine    | Upper           |
| CHSE11 | Chrysolepis sempervirens | Bush chinquapin | Middle          |

*Description*

Mid-maturity lodgepole pine undergoing intrinsic stand thinning. Considerable surface fuel from tree mortality from previous fire.

Replacement fire resets. Surface fire and mixed-severity fire open up the stand. Insect/disease may reset or open the stand.

*Maximum Tree Size Class*

Medium 9-21" DBH

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|                |           |                                 |
|----------------|-----------|---------------------------------|
| <b>Class C</b> | <b>12</b> | <b>Mid Development 1 - Open</b> |
|----------------|-----------|---------------------------------|

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*Indicator Species*

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



Remains indefinitely. Replacement fire resets, but mixed-severity fire opens stand. Surface fire maintains stand. Insect/disease may reset or open up, but wind/weather will maintain.

Maximum Tree Size Class

Large 21-33" DBH

**Model Parameters**

**Deterministic Transitions**

| From Class | Begins at (yr) | Succeeds to | After (years) |
|------------|----------------|-------------|---------------|
| Early1:ALL | 0              | Mid1:CLS    | 19            |
| Mid1:OPN   | 20             | Late1:OPN   | 69            |
| Mid1:CLS   | 20             | Late1:CLS   | 69            |
| Late1:OPN  | 70             | Late1:OPN   | 999           |
| Late1:CLS  | 70             | 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 |
|---------------------------|-----------------------|---------------------|-------------------------|-----------------------|-----------------------------------------------------|------------------------------|
| Replacement Fire          | Early1:ALL            | Early1:ALL          | 0.005                   | 200                   | Yes                                                 | 0                            |
| Surface Fire              | Early1:ALL            | Early1:ALL          | 0.013                   | 77                    | No                                                  | 0                            |
| 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          | 0.005                   | 200                   | Yes                                                 | 0                            |
| Surface Fire              | Mid1:OPN              | Mid1:OPN            | 0.007                   | 143                   | No                                                  | 0                            |
| Mixed Fire                | Mid1:OPN              | Mid1:OPN            | 0.01                    | 100                   | No                                                  | 0                            |
| Insects or Disease        | Mid1:CLS              | Early1:ALL          | 0.001                   | 1000                  | Yes                                                 | 0                            |
| Surface Fire              | Mid1:CLS              | Mid1:OPN            | 0.005                   | 200                   | Yes                                                 | 0                            |
| Insects or Disease        | Mid1:CLS              | Mid1:OPN            | 0.005                   | 200                   | Yes                                                 | 0                            |
| Replacement Fire          | Mid1:CLS              | Early1:ALL          | 0.005                   | 200                   | Yes                                                 | 0                            |
| Mixed Fire                | Mid1:CLS              | Mid1:OPN            | 0.02                    | 50                    | 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          | 0.003                   | 333                   | Yes                                                 | 0                            |
| Surface Fire              | Late1:OPN             | Late1:OPN           | 0.007                   | 143                   | No                                                  | 0                            |
| Mixed Fire                | Late1:OPN             | Late1:OPN           | 0.01                    | 100                   | No                                                  | 0                            |
| Surface Fire              | Late1:CLS             | Late1:CLS           | 0.001                   | 1000                  | No                                                  | 0                            |
| Insects or Disease        | Late1:CLS             | Early1:ALL          | 0.001                   | 1000                  | Yes                                                 | 0                            |

|                           |           |            |       |     |     |   |
|---------------------------|-----------|------------|-------|-----|-----|---|
| Wind or Weather or Stress | Late1:CLS | Late1:OPN  | 0.002 | 500 | Yes | 0 |
| Mixed Fire                | Late1:CLS | Late1:OPN  | 0.002 | 500 | Yes | 0 |
| Insects or Disease        | Late1:CLS | Late1:OPN  | 0.002 | 500 | Yes | 0 |
| Replacement Fire          | Late1:CLS | Early1:ALL | 0.002 | 500 | Yes | 0 |

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