10510

Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland

BpS Model/Description Version: Aug. 2020

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

Forest and Woodland

Map Zone

29

Geographic Range

As per NatureServe, this system occurs only in the Laramie Range of southern Wyoming in map zone (MZ) 29. This might also occur in the Bighorns. Occurs throughout the southern Rockies, north and west into Utah, Nevada, western Wyoming, and Idaho.

Biophysical Site Description

This is a highly variable ecological system of the montane zone of the Rocky Mountains. These are mixed-conifer forests occurring on all aspects at elevations ranging from 1,200-3,300m. Rainfall averages <75cm per year (40-60cm) with summer "monsoons" during the growing season contributing substantial moisture. The composition and structure of overstory is dependent upon the temperature and moisture relationships of the site and the successional status of the occurrence.

*Abies concolor* dominates at higher, colder locations; *Picea pungens* represents mesic conditions; and *Pseudotsuga menziesii* dominates intermediate zones.

In the Bighorn Mountains, Douglas-fir and ponderosa pine are the dominants of late-successional forests at low elevations.

This type is generally located just above sagebrush ecosystems and adjacent to ponderosa pine woodlands.

Vegetation Description

*Pseudotsuga menziesii* and *Abies concolor* are most frequent, but *Pinus ponderosa* may be present to co-dominant. *Pseudotsuga menziesii* forests occupy drier sites, and *Pinus ponderosa* is a common co-dominant. *Abies concolor*-dominated forests occupy cooler sites, such as upper slopes at higher elevations, canyon side slopes, ridge tops, and north- and east-facing slopes, which burn somewhat infrequently. *Picea pungens* is most often found in cool, moist locations, often occurring as smaller patches within a matrix of other associations. As many as seven conifers can be found growing in the same occurrence.

In the Bighorns, Douglas-fir and ponderosa pine are the dominants of late-successional forests at low elevations. Sometimes Douglas-fir replaces ponderosa pine as the stand matures, but most ponderosa pine stands are dominated by ponderosa pine saplings in the understory. Lodgepole in the Bighorns is generally not seral to Douglas-fir (in Meyer et al. 2005).

There are a number of cold-deciduous shrub and graminoid species common, including *Arctostaphylos uva-ursi*, *Mahonia repens*, *Paxistima myrsinites*, *Symphoricarpos oreophilus*, *Jamesia americana*, *Quercus gambelii*, and *Festuca arizonica*.

*Populus tremuloides* is often present as intermingled individuals in remnant aspen clones or in adjacent patches. The composition and structure of overstory is dependent upon the temperature and moisture relationships of the site and the successional status of the occurrence (DeVelice et al. 1986; Muldavin et al. 1996).

Other important species include *Acer glabrum*, *Acer grandidentatum*, *Amelanchier alnifolia*, *Arctostaphylos patula*, *Holodiscus dumosus*, *Jamesia americana*, *Juniperus communis*, *Physocarpus monogynus*, *Quercus arizonica*, *Quercus rugosa*, *Quercus X pauciloba*, *Quercus hypoleucoides*, *Robinia neomexicana*, *Rubus parviflorus*, and *Vaccinium myrtillus*. Where soil moisture is favorable, the herbaceous layer may be quite diverse, including graminoids *Bromus ciliatus* (=*Bromus canadensis*), Calamagrostis rubescens, *Carex geyeri*, *Carex rossii*, *Carex siccata* (=*Carex foenea*), *Festuca occidentalis*, *Koeleria macrantha*, *Muhlenbergia montana*, *Muhlenbergia virescens*, *Poa fendleriana*, and *Pseudoroegneria spicata*, and forbs *Achillea millefolium*, *Arnica cordifolia*, *Erigeron eximius*, *Fragaria virginiana*, *Linnaea borealis*, *Luzula parviflora*, *Osmorhiza berteroi*, *Packera cardamine* (=*Senecio cardamine*), *Thalictrum occidentale*, *Thalictrum fendleri*, *Thermopsis rhombifolia*, *Viola adunca*, and species of many other genera, including *Lathyrus*, *Penstemon*, *Lupinus*, *Vicia*, *Arenaria*, *Galium*, and others.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| PSEUD7 | *Pseudotsuga* | Douglas-fir |
| ABCO | *Abies concolor* | White fir |
| PIPO | *Pinus ponderosa* | Ponderosa pine |
| PICO | *Pinus contorta* | Lodgepole pine |
| CARU | *Calamagrostis rubescens* | Pinegrass |
| CAGA3 | *Carex garberi* | Elk sedge |

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

Disturbance Description

Areas dominated by Douglas-fir are characterized by a high-frequency, low- and mixed-severity fire regime. Some portions of these sites are transition zones to fire regimes that are characterized by high-frequency, high-severity fires or moderate-frequency, low- and mixed-severity fires. Frequent surface and mixed-severity fires were the common fire regime characteristics. Surface fire intervals ranged from 10-50yrs, and replacement-severity occurred at intervals of 150-400yrs+ (Crane 1986; Barrett 1988; Bradley 1992a and 1992b; Brown 1994; Morgan et al. 1996). Mixed-severity fires were assumed to have an intermediate fire return interval (FRI) of 45-75yrs on average. Stand-replacement fires were generally restricted to the closed canopy forest and the stand initiation conditions.

The high-frequency, low- and mixed-severity fire regime characteristics are facilitated by understory vegetation dominated by fine fuel (grasses, sedges, and forbs), landscape position, and adjacency to other frequent fire Biophysical Settings (BpSs). Much of the forest structure was open canopy overstory that resulted in an understory dominated by healthy and vigorous plants (grasses, sedges, and forbs) and generally continuous fine fuel layer. These fine fuels facilitated fire spread and thinning of the conifer or aspen seedlings (thus promoting aspen suckering).

Other disturbances include insects and disease, including Douglas-fir beetle and mountain pine beetle, and drought, wind, and ice damage. Competition among trees was also a factor that increasingly slowed succession dynamics in more closed stands. Fire was by far the dominant disturbance agent.

*Pseudotsuga menziesii* forests are the only true “fire-tolerant” occurrences in this ecological system. *Pseudotsuga menziesii* forests were probably subject to a moderate-severity fire regime in pre-settlement times, with FRIs of 30-100yrs. Many of the important tree species in these forests are fire-adapted (*Populus tremuloides*, *Pinus ponderosa*, and *Pinus contorta*) (Pfister et al. 1977), and fire-induced reproduction of *Pinus ponderosa* can result in its continued co-dominance in *Pseudotsuga menziesii* forests (Steele et al. 1981). Seeds of the shrub *Ceanothus velutinus* can remain dormant in forest occurrences for 200yrs (Steele et al. 1981) and germinate abundantly after fire, competitively suppressing conifer seedlings. Successional relationships in this system are complex.

*Pseudotsuga menziesii* is less shade-tolerant than many northern or montane trees such as *Tsuga heterophylla*, *Abies concolor*, and *Picea engelmannii*, and seedlings compete poorly in deep shade. At drier locales, seedlings may be favored by moderate shading, such as by a canopy of *Pinus ponderosa*, which helps to minimize drought stress.

Fire suppression has probably led to a longer FRI than in the HRV (Meyer et al. 2005).

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 94 | 11 | 90 | 600 |
| Moderate (Mixed) | 77 | 14 | 45 | 80 |
| Low (Surface) | 14 | 75 | 10 | 50 |
| All Fires | 11 | 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

This BpS occurs in patches ranging from 1,000s to 10,000s of acres.

Adjacency or Identification Concerns

Aspen patches occurred at smaller scales than in more mesic mixed-conifer forests. These more mesic sites would have had grass understories that did not dry as early in the year as surrounding areas, especially under a closed forest canopy, and these mesic areas often experience quicker humidity recovery in the evenings. These circumstances tended to lessen the fire severity in the aspen stands, which acted as fire-safe sites compared to the surrounding landscape. This was important because aspen is much less resistant to fire than Douglas-fir.

If aspen is present in large patches or if conifers are not coming in after ~30yrs, the BpS is probably misclassified, and one of the pure aspen types should be examined (Rocky Mountain Aspen Forest and Woodland [1011] or Intermountain Basins Aspen-Mixed Conifer Forest and Woodland [1061]).

BpS is often transitional between non-forested areas or between *Pinus ponderosa* (at lower elevations) and spruce-fir at higher elevations. It may, thus, grade into Southern Rocky Mountain Ponderosa Pine Woodland (1054) at lower elevations and Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland (1055).

With fire suppression, *Abies concolor* has vigorously colonized many sites formerly occupied by open *Pinus ponderosa* woodlands. These invasions have dramatically changed the fuel load and potential behavior of fire in these forests. In particular, the potential for high-intensity crown fires on drier sites now co-dominated by *Pinus ponderosa* and *Abies concolor* has increased. Increased landscape connectivity, in terms of fuel loadings and crown closure, has also increased the potential size of crown fire.

In some locations, many of these forests have been logged or burned during European settlement, and present-day occurrences are second-growth forests dating from fire, logging, or other occurrence-replacing disturbances (Mauk and Henderson 1984; Chappell et al. 1997).

In general, fire suppression has led to the encroachment of more shade-tolerant, less fire-tolerant species (eg., climax) into occurrences and an attendant increase in landscape homogeneity and connectivity (from a fuel perspective). This has increased the lethality and potential size of fires.

The warmer and sometimes drier conditions in recent years can lead to changes in the successional trajectory at lower elevations and high, particularly due to changes in stand structure. Large conflagrations due to warming and fuel loading could set back some stands to earlier successional stages than would have occurred during the HRV (Meyer et al. 2005).

Issues or Problems

Native Uncharacteristic Conditions

Comments

During a review in 2018 it was found that less than 1% of the BpS was in the the Late1 Closed class on average over the entire simulation. Kori Blankenship reviewed the model and found a discrepancy between the original BpS description and the model: the description noted an alternate succession pathway from Mid1 Open to Late1 Closed, but the state-and-transition model had the pathway from Mid1 Open to Mid1 Closed. Blankenship changed the model pathway to match the original description (alternate succession from Mid1 Open to Late1 Closed), which resulted in approximately 1% of the BpS in Late1 Closed.

During LANDFIRE National review, a reviewer felt that 100% canopy cover was too high for Class B and suggested a maximum cover of 80% would be more appropriate.

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 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Herb | 0.5-1.0 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Herb | >1.0 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Shrub | 0-0.5 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Shrub | 0.5-1.0 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Shrub | 1.0-3.0 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Shrub | >3.0 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | 0-5 | A | A | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | 5-10 | C | C | C | C | B | B | B | B | B | B |
| Tree | 10-25 | D | D | D | D | E | E | E | E | E | E |
| Tree | 25-50 | D | D | D | D | E | E | E | E | E | E |
| Tree | >50 | D | D | D | D | E | 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 22 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| CARU | Calamagrostis rubescens | Pinegrass | Low-Mid |
| CAGA3 | Carex garberi | Elk sedge | Low-Mid |
| PSEUD7 | Pseudotsuga | Douglas-fir | Upper |
| PIPO | Pinus ponderosa | Ponderosa pine | Upper |

Description

Grass/forb/shrub/tree seedlings.

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

Class B 6 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PSEUD7 | Pseudotsuga | Douglas-fir | Upper |
| ABCO | Abies concolor | White fir | Upper |
| PIPO | Pinus ponderosa | Ponderosa pine | Upper |
| PICO | Pinus contorta | Lodgepole pine | Upper |

Description

Closed stand with trees, poles, saplings, grass, and scattered shrub; 75-100% Douglas-fir and/or white fir.

*Maximum Tree Size Class*  
Pole 5-9" DBH

Class C 12 Mid Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PSEUD7 | Pseudotsuga | Douglas-fir | Upper |
| PIPO | Pinus ponderosa | Ponderosa pine | Upper |

Description

Open trees (poles and saplings) of Douglas-fir and occasional ponderosa pine with grass and scattered shrubs.

*Maximum Tree Size Class*  
Pole 5-9" DBH

Class D 59 Late Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PSEUD7 | Pseudotsuga | Douglas-fir | Upper |
| PIPO | Pinus ponderosa | Ponderosa pine | Upper |

Description

Open large tree/grass and scattered shrubs; Douglas-fir with occasional ponderosa pine.

*Maximum Tree Size Class*  
Large 21-33" DBH

Class E 1 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PSEUD7 | Pseudotsuga | Douglas-fir | Upper |
| ABCO | Abies concolor | White fir | Upper |
| PICO | Pinus contorta | Lodgepole pine | Upper |
| PIPO | Pinus ponderosa | Ponderosa pine | Middle |

Description

Closed large trees of Douglas-fir, white fir, and occasional lodgepole pine, scattered shrubs.

*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 | 34 |
| Mid1:OPN | 35 | Late1:OPN | 104 |
| Mid1:CLS | 35 | Late1:CLS | 104 |
| Late1:OPN | 105 | Late1:OPN | 999 |
| Late1:CLS | 105 | 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** |
| Mixed Fire | Early1:ALL | Early1:ALL | 0.01 | 100 | No | 0 |
| Replacement Fire | Early1:ALL | Early1:ALL | 0.04 | 25 | Yes | 0 |
| Alternative Succession | Mid1:OPN | Late1:CLS | 1 | 1 | Yes | 68 |
| Wind or Weather or Stress | Mid1:OPN | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Replacement Fire | Mid1:OPN | Early1:ALL | 0.002 | 500 | Yes | 0 |
| Competition or Maintenance | Mid1:OPN | Mid1:OPN | 0.005 | 200 | No | 0 |
| Insects or Disease | Mid1:OPN | Mid1:OPN | 0.01 | 100 | No | 0 |
| Mixed Fire | Mid1:OPN | Mid1:OPN | 0.013 | 77 | No | 0 |
| Surface Fire | Mid1:OPN | Mid1:OPN | 0.1 | 10 | No | 0 |
| Wind or Weather or Stress | Mid1:CLS | Early1:ALL | 0.004 | 250 | Yes | 0 |
| Replacement Fire | Mid1:CLS | Early1:ALL | 0.007 | 143 | Yes | 0 |
| Insects or Disease | Mid1:CLS | Mid1:OPN | 0.01 | 100 | Yes | 0 |
| Competition or Maintenance | Mid1:CLS | Mid1:CLS | 0.01 | 100 | No | 0 |
| Mixed Fire | Mid1:CLS | Mid1:OPN | 0.0222 | 45 | Yes | 0 |
| Alternative Succession | Late1:OPN | Late1:CLS | 1 | 1 | Yes | 70 |
| Competition or Maintenance | Late1:OPN | Late1:OPN | 0.001 | 1000 | No | 0 |
| Wind or Weather or Stress | Late1:OPN | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Replacement Fire | Late1:OPN | Early1:ALL | 0.002 | 500 | Yes | 0 |
| Insects or Disease | Late1:OPN | Late1:OPN | 0.01 | 100 | No | 0 |
| Mixed Fire | Late1:OPN | Late1:OPN | 0.013 | 77 | No | 0 |
| Surface Fire | Late1:OPN | Late1:OPN | 0.1 | 10 | No | 0 |
| Wind or Weather or Stress | Late1:CLS | Early1:ALL | 0.004 | 250 | Yes | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.007 | 143 | Yes | 0 |
| Competition or Maintenance | Late1:CLS | Late1:CLS | 0.01 | 100 | No | 0 |
| Insects or Disease | Late1:CLS | Mid1:OPN | 0.0125 | 80 | Yes | 0 |
| Insects or Disease | Late1:CLS | Late1:OPN | 0.0125 | 80 | Yes | 0 |
| Surface Fire | Late1:CLS | Late1:CLS | 0.02 | 50 | No | 0 |
| Mixed Fire | Late1:CLS | Late1:OPN | 0.0222 | 45 | Yes | 0 |

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