10550

Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland

BpS Model/Description Version: Aug. 2020

Update: 3/18

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

Forest and Woodland

Map Zones

27

Geographic Range

Colorado, northern New Mexico and parts of Arizona and Utah. It is questionable if this Biophysical Setting (BpS) occurs in map zone (MZ) 25. It is thought that this BpS might occur on the very tip of the Sandias in MZ27, but probably <100ac. It might also occur in higher elevations on the mapzone border in Colorado.

Engelmann spruce and subalpine fir forests comprise a substantial part of the subalpine forests of the Cascades and Rocky Mountains from southern British Columbia east into Alberta, south into New Mexico and the Intermountain region.

Biophysical Site Description

Engelmann Spruce and Subalpine Fir Forests are the matrix forests of the subalpine zone, with elevations ranging from 1,275m in the north to 3,500m in the south (4,100-11,500ft). They often represent the highest elevation forests in an area. Despite their wide distribution, the tree canopy characteristics are remarkably similar, with *Picea engelmannii* and *Abies lasiocarpa* dominating either mixed or individually. In some areas, such as Wyoming, *Picea engelmannii*-dominated forests are on limestone or dolomite, while nearby co-dominated spruce-fir forests are on granitic or volcanic rocks. Xeric species may include *Juniperus communis, Linnaea borealis, Mahonia repens* or *Vaccinium scoparium*.

BpS occurs in the subalpine zone on gentle to moderately steep terrain (e.g., 10-60% slope). Sites within this system are cold year-round, and precipitation is predominantly in the form of snow, which may persist until late summer (not in Southwest). Snowpacks are deep and late-lying, and summers are cool. Frost is possible almost all summer and may be common in restricted topographic basins and benches.

Vegetation Description

The overstory is typically dominated by subalpine fir, or possibly Engelmann spruce in the north of the mapzone. Other tree species may include, aspen, limber pine and Douglas-fir. Cork bark fir also may occur in the southern part of the zone.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| PIEN | *Picea engelmannii* | Engelmann spruce |
| ABLA | *Abies lasiocarpa* | Subalpine fir |
| POTR5 | *Populus tremuloides* | Quaking aspen |

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

Disturbance Description

Disturbance includes occasional blow-down, insect outbreaks and stand-replacing fire. Fire regime characterized by primarily long-interval (e.g., 150-300yr) stand replacement fires, with minor amount of terrain influenced by moderately long-interval mixed severity fires. Disturbances also include insect/disease and windthrow events.

A disturbance regime dominated by infrequent, stand-scale disturbance by crown fire, wind, pests, and pathogens is well documented for the central and northern Rockies, but has not yet been documented for the Southwest. For example, there is little evidence for a crown fire regime in the Southwest, but there is clear evidence for a mixed-severity fire regime in at least the southern Colorado Plateau. For example, Fule et al. (2003) report mean fire return intervals of 8.8 years for 10% scarring and 31yrs for 25% scarring. The presence of a mixed severity fire regime may reflect the relatively low elevation of many spruce-fir stands in the Southwest and the proximity of these stands to mixed conifer forest; however, it also could represent a shift from climate related factors determining the fire regime of spruce-fir forest at central and northern latitudes (Schoennagel et al. 2004) to a mix of climate- and fuel-related related factors at southern latitudes (Vankat 2005).

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 206 | 69 | 150 | 300 |
| Moderate (Mixed) | 452 | 31 |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 141 | 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 vary but are mostly in the 100s of acres (much smaller in the Southwest), with occasional very large patches (disturbances) in the thousands of acres. There may be frequent small disturbances in the 10s of acres or less.

Adjacency or Identification Concerns

Most similar to 1056, Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland.

This system 1055 would be adjacent to BpS 1051, 1052, 1055, 1057, 1146, and tundra.

This BpS might also be confused with BpS 1052 and to a lesser degree 1051. BpS 1055 and 1056 can also be confused because low-elevation spruce-fir intermingles with mid-and-high-elevation mixed conifer with spruce-fir in drainages and north-facing slopes and mixed conifer on other topographic positions. Fire exclusion likely resulted in high elevation mixed conifer having greater resemblance to spruce-fir.

Exotics are not yet common in Southwestern spruce-fir forest. Many stands have recently undergone dramatic insect-related mortality. It is questionable whether this thinning represents a natural cycle or has been promoted by global climate warming.

Prior to the insect-related mortality mentioned above, stands were likely denser because of fire exclusion, assuming that stands in the Southwest had been characterized by a mixed severity fire regime.

Spruce-fir may be a case when different units should be recognized for the Southwest (including MZ25) (see Disturbance Description for differences). Most people assume that research findings for spruce-fir in Colorado also apply to the Southwest, but there is little or no evidence of this. Either we haven't done enough research in the Southwest or spruce-fir functions differently in the Southwest. Research suggests the latter.

Issues or Problems

This system might not occur in MZs 27 or 33; however, the MZs 27 and 33 version received good review and comments for the Southwest in general. Model changes were suggested, but because this system would occur so infrequently in MZs 27 or 33, they were not implemented.

Native Uncharacteristic Conditions

Comments

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 13 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIEN | Picea engelmannii | Engelmann spruce | All |
| ABLA | Abies lasiocarpa | Subalpine fir | All |

Description

Early succession after moderately long- to long-interval replacement fires. This class succeeds to a mid-closed stage. Alternatively, it might succeed to a mid-open stage, under the right conditions.

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

Class B 19 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIEN | Picea engelmannii | Engelmann spruce | Upper |
| ABLA | Abies lasiocarpa | Subalpine fir | Upper |

Description

Shade tolerant and mixed conifer saplings to poles.

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

Class C 18 Mid Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIEN | Picea engelmannii | Engelmann spruce | Upper |
| ABLA | Abies lasiocarpa | Subalpine fir | Upper |

Description

Primarily moderately tolerant saplings to poles (1-6.9in DBH).

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

Class D 17 Late Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIEN | Picea engelmannii | Engelmann spruce | Upper |
| ABLA | Abies lasiocarpa | Subalpine fir | Upper |
| POTR | Poa tracyi | Tracy's bluegrass | Middle |

Description

Poles (5in+ DBH) and larger diameter moderately shade tolerant conifer species in small to moderate size patches, generally on south aspects.

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

Class E 33 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIEN | Picea engelmannii | Engelmann spruce | Upper |
| ABLA | Abies lasiocarpa | Subalpine fir | Upper |
| POTR | Poa tracyi | Tracy's bluegrass | Middle |

Description

Pole- and larger diameter moderately to shade tolerant conifer species, in moderate to large size patches, all aspects.

*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 | 39 |
| Mid1:OPN | 40 | Late1:OPN | 79 |
| Mid1:CLS | 40 | Late1:CLS | 129 |
| Late1:OPN | 80 | Late1:CLS | 129 |
| Late1:CLS | 130 | Late1:CLS | 429 |

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** |
| Competition or Maintenance | Early1:ALL | Early1:ALL | 0.002 | 500 | No | 0 |
| Replacement Fire | Early1:ALL | Early1:ALL | 0.005 | 200 | Yes | 0 |
| Alternative Succession | Early1:ALL | Mid1:OPN | 0.02 | 50 | Yes | 0 |
| Mixed Fire | Mid1:OPN | Mid1:OPN | 0.002 | 500 | No | 0 |
| Replacement Fire | Mid1:OPN | Early1:ALL | 0.005 | 200 | Yes | 0 |
| Alternative Succession | Mid1:OPN | Mid1:CLS | 0.0125 | 80 | Yes | 0 |
| Competition or Maintenance | Mid1:CLS | Mid1:CLS | 0.001 | 1000 | No | 0 |
| Insects or Disease | Mid1:CLS | Mid1:OPN | 0.002 | 500 | Yes | 0 |
| Replacement Fire | Mid1:CLS | Early1:ALL | 0.005 | 200 | Yes | 0 |
| Mixed Fire | Mid1:CLS | Mid1:OPN | 0.01 | 100 | Yes | 0 |
| Wind or Weather or Stress | Late1:OPN | Late1:OPN | 0.002 | 500 | No | 0 |
| Insects or Disease | Late1:OPN | Late1:OPN | 0.003 | 333 | No | 0 |
| Replacement Fire | Late1:OPN | Early1:ALL | 0.005 | 200 | Yes | 0 |
| Insects or Disease | Late1:CLS | Late1:OPN | 0.002 | 500 | Yes | 0 |
| Wind or Weather or Stress | Late1:CLS | Mid1:OPN | 0.005 | 200 | Yes | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.005 | 200 | Yes | 0 |

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