10451

Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest - Ponderosa Pine-Douglas-fir

BpS Model/Description Version: Aug. 2020

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

Forest and Woodland

Map Zone

20

Model Splits or Lumps

This Biophysical Setting (BpS) is split into multiple models. This model (10451) represents areas where ponderosa pine is present and lodgepole pine is absent or not well represented. It is typically found on well-drained, thin soils, generally on relatively warm settings. However, it also includes cooler, more mesic sites in the Missouri Breaks. Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest - Lodgepole Pine (10454) represents areas where lodgepole pine is well represented.

Geographic Range

Northern Rocky Mountains in north and central Montana, including the island mountain ranges in map zone (MZ) 20 (Moccasins, Judiths, Bear Paws, Little Rockies, Sweetgrass Hills, and Snowies).

Biophysical Site Description

This ponderosa pine BpS split is found on well-drained, thin soils, generally on relatively warm settings. In the Missouri Breaks, however, it includes relatively cool, moist areas. In the Missouri Breaks, this BpS is generally found on northerly aspects or in narrow coulees on clay soils with slow permeability. Sites are always sloped and are usually steep.

Elevation ranges from 2,200-6,500ft. On southerly aspects, elevation ranges from 4,000-6,500ft. On northerly aspects, elevation ranges from 4,000-4,500ft. In the Breaks, elevation ranges from 2,200-3,500ft.

Vegetation Description

In MZ20, ponderosa pine is generally the dominant species on southerly aspects and drier sites, with Douglas-fir dominating on northerly aspects and more mesic sites.

Southerly aspects support relatively open stands. Northerly aspects support more closed stands. On mesic sites with longer fire return intervals (FRIs), Douglas-fir often co-dominates the upper canopy layers. In the absence of fire, Douglas-fir dominates stand understories.

In this split for ponderosa pine, it is possible that lodgepole could be present in the island mountain ranges, but it is poorly represented. Lodgepole pine is absent in the Missouri Breaks. At lower elevations in the Snowy Range, hybrids can occur of Engelmann and white spruce.

The understory shrubs in the island ranges are dominated by snowberry, common juniper, chokecherry, creeping barberry (Oregon-grape), white spirea, mallow ninebark, and kinnikinnick. Other shrubs on cool sites include Rocky Mountain maple and paper birch. On cool slopes, especially in the Little Rockies, paper birch and aspen pioneer alongside conifers. Common understory forbs and graminoids include arrowleaf balsamroot, heartleaf arnica, Idaho fescue, Columbia needlegrass, pinegrass, and bluebunch wheatgrass.

Understory shrubs in the Missouri Breaks are dominated by Rocky Mountain juniper (shrub form), common snowberry, and chokecherry. Other common shrubs include rose and currant. Common forbs and graminoids include western yarrow, carex, western wheatgrass, and prairie sandreed.

Common montane habitat types include warm dry Douglas-fir and moist Douglas-fir, including: PSME/SYAL/PSSPI and PSME/SYAL/SYAL, PSME/CAGE2 (mostly PSME in PSME/CAGE2 -- too high for PIPO, too dry for PICO, can have PIFL and PIAL), PSME/ARUV and PSME/ LIBO3SYAL (although PIPO present west Montana, absent eastward for PSME/LIBO3/SYAL), PSME/PSSPI, PSME/FEAL, PSME/SPBE2, and PSME/CARU/SPSPI. In the Snowy Mountains: PICEA/LIBO3. In the Breaks: PSME/SYAL; PSME/JUSC2 (Rocky Mountain Juniper), and PSME/MUCU3 (Plains muhly).

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| PIPO | *Pinus ponderosa* | Ponderosa pine |
| PSME | *Pseudotsuga menziesii* | Douglas-fir |
| JUCO | *Juncus compressus* | Roundfruit rush |
| SYAL | *Symphoricarpos albus* | Common snowberry |
| PRVI | *Prunus virginiana* | Chokecherry |
| JUSC | *Juncus scirpoides* | Needlepod rush |
| MARE11 | *Mahonia repens* | Creeping barberry |
| PICO | *Pinus contorta* | Lodgepole pine |

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

Disturbance Description

Low- and mixed-severity fires occurred at varying intervals (mean fire return intervals [MFRIs] range from 10-80yrs), but there is very little published information on fire frequency in this region. Losensky (1993) reported an MFRI of 5.4, with maximum MFRIs ranging from 21-41yrs (minimum MFRIs were not reported).

West of MZ20 in Montana, Arno (1980) reported that moderate-severity fires were historically common in ponderosa pine stands on relatively moist, steep slopes. Barrett (1998) reports the same for the Flathead National Forest, and Barrett (1983, 1984) documents extensive mixed-severity fires on the Salmon National Forest. Leiberg (1900) reported severe fires on what are now the Idaho Panhandle and Bitterroot National Forests. Since the 1910 fires happened only a decade later, these numbers may underestimate the importance -- and certainly the frequency -- of replacement fires and certainly underestimate the frequency of moderate-severity fires.

Mixed-severity fire increases and surface fire decreases on relatively mesic sites and on north-facing slopes in the Breaks due to more fuel-limited terrain.

Insects and disease play an important role, especially in the absence of fire. Bark beetles such as mountain pine beetle, western pine beetle, and Douglas-fir beetle are active in the mid- and late structural stage, especially in closed canopies. Ips beetles can be active in all structural stages, especially when other disturbances such as drought or windthrow occur. Western gall rust is the dominant disease on pine and increases in occurrence with lack of fire. Root rot and dwarf mistletoe are minor concerns in the northern extent of this BpS.

Weather and climate, including drought, tend to affect the late-closed structure more than other structural stages. Windthrow affects mid- and late structural stands.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 166 | 13 |  |  |
| Moderate (Mixed) | 52 | 40 |  |  |
| Low (Surface) | 44 | 47 |  |  |
| All Fires | 21 | 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 were probably highly variable. Surface and mixed-severity fires may have been variable in size and potentially achieve large sizes due to wind influence (10s to 1,000s of acres), with patchy fires in rocky, fuel-limited terrain and larger fires occurring in areas bordering continuous forest or grassland fuel.

Adjacency or Identification Concerns

Because of fire exclusion, ponderosa pine types may be invaded by Douglas-fir today. It may be especially difficult in fire-excluded areas to distinguish between ponderosa pine and ponderosa pine-Douglas-fir BpS units. Other than elevational range differences, it may be difficult to distinguish between this BpS split and 1054 -- Southern Rocky Mountain Ponderosa Pine Woodland mid- and late-closed seral states. Please see elevational descriptions in the site description for differences between the types.

The mixed conifer zone in the Northern Rockies is broad, with moisture and temperature gradients that affect fire regimes and species dominance. This BpS split out (excluded) areas dominated by PICO.

At lower elevations or southerly aspects, this type generally borders dry ponderosa pine, shrub, or grassland systems (BpS 1054). At higher elevations or on northerly aspects, this split (10451) borders the lodgepole split (10454). At higher elevations or northerly aspects in the Snowies and Sweetgrass Hills, it borders spruce and subalpine fir. In the other island ranges, spruce and fir are minor components.

At ecotones, it may be very difficult to distinguish between this BpS and 1053 (Northern Rocky Mountain Ponderosa Pine Woodland) in mid and late-closed seral states. (BpS 1166 seems to fit the island ranges of central Montana; however, BpS 1166 is not being modeled for MZ20, as BpS 1045 sufficiently addresses that system.)

Issues or Problems

Native Uncharacteristic Conditions

Canopy closure of >80% is considered to be uncharacteristic for this BpS.

Comments

Janet Fryer reviewed this BpS during the 2016 BpS Review and suggested that replacement fire and mixed fire should be more frequent based on fire history literature (see discussion in the Disturbance Description). Kori Blankenship implemented these changes in consultation with Fryer and also decreased the surface fire frequency to maintain the overall fire frequency at ~20yrs.

For LANDFIRE National, the MZ20 model was originally created by Steve Cooper, Lee Clark, Dan Rasmussen, Jim Roessler, and Shannon Downey Iverson and was adapted from the model for 1910451. Changes to description and species were made as well as significant changes to model and fire intervals. Model was unsplit for MZ20. However, review of the model led to splitting the system between lodgepole and ponderosa pine. Additional modelers for the split effort were Dan Rasmussen and Steve Cooper. Original modelers were contacted to receive input on new split model. Steve Barrett was a reviewer of the split model; however, he provided most of the input regarding the probabilities and successional pathways. Therefore, his input is regarded as a modeler's input.

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

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 16 Early Development 1 - All Structures

Indicator Species

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

Description

Openings of shrubs, grass, and forbs are created by infrequent, stand-replacement fire. Some sites exhibit resprouting shrubs such as chokecherry as the dominant lifeform. Other sites may be dominated by grasses or sedges. Cool sites may include scattered deciduous trees in the canopy (birch and aspen). Seedlings and saplings are PSME and PIPO.

Resprouting shrubs such as common snowberry, chokecherry, rose, white spirea, and mallow ninebark are dominant in the understory. Dominant forbs and graminoids may include arnica, western yarrow, pinegrass, and sedges. Depending on site, additional understory shrub species may include Saskatoon serviceberry, skunkbush sumac, russet buffaloberry, and *Ribes* spp.

Drought may result in conifer seedling mortality.

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

Class B 12 Mid Development 1 - Closed

Indicator Species

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

Description

Pole- to medium-sized PIPO, with sapling to pole-sized PSME. Also contains medium-sized PIPO with some large, pole- to medium-sized PSME. Understory initially has abundant herbaceous/shrub cover, which decreases without disturbance.

Regeneration contributes to ladder fuel, increasing the likelihood of stand-replacing fire in this class.

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

Class C 35 Mid Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIPO | Pinus ponderosa | Ponderosa pine | All |
| PSME | Pseudotsuga menziesii | Douglas-fir | All |

Description

This is a stage maintained by fires and disturbances. Medium-sized PIPO with some large, pole-to medium-sized PSME. Also contains pole- to medium-sized PIPO and sapling to pole-sized PSME.

After a period, regeneration contributes to ladder fuels so that stand-replacing fire is more likely in this class. Regeneration is developing in openings.

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

Class D 30 Late Development 1 - Open

Indicator Species

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

Description

Fire-resistant stands of large PIPO and PSME. Surface fires, mixed fires, and insects/pathogens will maintain the open condition.

*Maximum Tree Size Class*  
Very Large >33" DBH

Class E 7 Late Development 1 - Closed

Indicator Species

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

Description

Dense canopy cover of large PIPO and PSME.

*Maximum Tree Size Class*  
Very Large >33" DBH

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Mid1:CLS | 30 |
| Mid1:OPN | 31 | Late1:OPN | 110 |
| Mid1:CLS | 31 | Late1:CLS | 110 |
| Late1:OPN | 111 | Late1:OPN | 999 |
| Late1:CLS | 111 | 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** |
| Wind or Weather or Stress | Early1:ALL | Early1:ALL | 0.002 | 500 | Yes | 0 |
| Replacement Fire | Early1:ALL | Early1:ALL | 0.005 | 200 | Yes | 0 |
| Alternative Succession | Early1:ALL | Mid1:OPN | 0.01 | 100 | Yes | 0 |
| Mixed Fire | Early1:ALL | Early1:ALL | 0.01 | 100 | No | 0 |
| Surface Fire | Early1:ALL | Early1:ALL | 0.0167 | 60 | No | 0 |
| Alternative Succession | Mid1:OPN | Mid1:CLS | 1 | 1 | Yes | 40 |
| Wind or Weather or Stress | Mid1:OPN | Mid1:OPN | 0.002 | 500 | No | 0 |
| Insects or Disease | Mid1:OPN | Mid1:OPN | 0.002 | 500 | No | 0 |
| Replacement Fire | Mid1:OPN | Early1:ALL | 0.005 | 200 | Yes | 0 |
| Mixed Fire | Mid1:OPN | Mid1:OPN | 0.02 | 50 | No | 0 |
| Surface Fire | Mid1:OPN | Mid1:OPN | 0.0267 | 37 | No | 0 |
| Wind or Weather or Stress | Mid1:CLS | Mid1:OPN | 0.002 | 500 | Yes | 0 |
| Insects or Disease | Mid1:CLS | Mid1:OPN | 0.002 | 500 | Yes | 0 |
| Competition or Maintenance | Mid1:CLS | Mid1:CLS | 0.002 | 500 | No | 0 |
| Surface Fire | Mid1:CLS | Mid1:CLS | 0.0067 | 149 | No | 0 |
| Replacement Fire | Mid1:CLS | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Mixed Fire | Mid1:CLS | Mid1:OPN | 0.04 | 25 | Yes | 0 |
| Alternative Succession | Late1:OPN | Late1:CLS | 1 | 1 | Yes | 40 |
| 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 |
| Mixed Fire | Late1:OPN | Late1:OPN | 0.0143 | 70 | No | 0 |
| Surface Fire | Late1:OPN | Late1:OPN | 0.0333 | 30 | No | 0 |
| Wind or Weather or Stress | Late1:CLS | Late1:OPN | 0.002 | 500 | Yes | 0 |
| Insects or Disease | Late1:CLS | Late1:OPN | 0.002 | 500 | Yes | 0 |
| Competition or Maintenance | Late1:CLS | Late1:CLS | 0.002 | 500 | No | 0 |
| Surface Fire | Late1:CLS | Late1:CLS | 0.0067 | 149 | No | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.0133 | 75 | Yes | 0 |
| Mixed Fire | Late1:CLS | Late1:OPN | 0.025 | 40 | Yes | 0 |

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