11170

Southern Rocky Mountain Ponderosa Pine Savanna

BpS Model/Description Version: Aug. 2020

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

Steppe/Savanna

Map Zone

29

Geographic Range

This Biophysical Setting (BpS) is located in the Bighorns of Wyoming, Laramie Range. This might describe areas in map zones (MZs) 29 and 20. Could occur in MZ29 in sections (Cleland et al. 2007) M331B, M331I, 342A, and subsection 342Fb.

Biophysical Site Description

The geology is typically sedimentary in origin. Often found on buttes, hogbacks, rocky outcrops, and steep, rocky slopes. Elevations range from 3,200-4,400ft but in the Bighorns may be found up to 5,700ft on southern aspects. In eastern Montana and northeast Wyoming, it is also found on southern aspects.

Vegetation Description

This type is dominated by interior ponderosa pine and is often the only tree present. Understory composition varies but Rocky Mountain Juniper, skunkbush sumac, mountain-mahogany (in southern Black Hills and the eastern Pine Ridge), snowberry, and yucca are common woody species (one reviewer noted that under the historic fire regime, the occurrence of yucca would have been a bit lower than at present). Currant and chokecherry are found in the Montana portion of the BpS's range.

(Regional lead asked about JUSC2 as an indicator: JUSC2 can be considered an indicator for Laramie Peak Range. Rocky Mountain Juniper is listed as present in late successional communities for ponderosa pine/Idaho fescue, ponderosa pine/sun sedge and ponderosa pine/bluebunch wheatgrass habitat types by Hanson and Hoffman [1988] for southeastern Montana. But it's not mentioned as present in the other ponderosa pine habitat types [ponderosa pine/common juniper, ponderosa pine/chokecherry]. Rocky Mountain juniper is not an indicator for ponderosa pine habitat types in southeastern Montana or western North Dakota.)

Herbaceous species include needlegrasses, grama grasses, little bluestem, western wheatgrass, sedges, and bluebunch wheatgrass. There is Idaho fescue as far east as Ashland, Montana.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| PIPO | *Pinus ponderosa* | Ponderosa pine |
| JUSC2 | *Juniperus scopulorum* | Rocky mountain juniper |
| RHAR4 | *Rhus aromatica* | Fragrant sumac |
| PSSP6 | *Pseudoroegneria spicata* | Bluebunch wheatgrass |
| PASM | *Pascopyrum smithii* | Western wheatgrass |
| CAREX | *Carex* | Sedge |
| SCSC | *Schizachyrium scoparium* | Little bluestem |
| QUMA2 | *Quercus macrocarpa* | Bur oak |

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

Disturbance Description

Generally frequent fires of low severity (Fire Regime Group I). Mixed-severity fire occurs in the closed canopy conditions, and stand-replacement fire is very infrequent (300yrs+). Low-severity fires are frequent and range from <10yrs to >20yrs (Brown and Sieg 1999; Fisher et al. 1987) but probably not >40yrs at the high end (3-70yrs range). The mean fire return interval (MFRI) is ~12-15yrs for low-severity fires.

There is considerable debate over the role of mixed-severity and surface fires in the historical range of variability in this and other ponderosa pine forests in the northern and central Rockies (Baker and Ehle 2001, 2003; Barrett 2004; Veblen et al. 2000). Brown (2006) argues that surface fire was the dominant mode of fire disturbance and that the role of mixed-severity fires is overstated.

In the Rapid Assessment (RA) Workshop, review indicated that more mixed fire should occur in the early stage and that surface fire should be modeled in all structural stages. Peer review comments during the RA disagreed on the role of mixed and surface fire in this type. The majority of reviewers agreed with the original model's parameters for mixed fire but thought surface fire could be slightly less frequent. One reviewer contended that there is no evidence of mixed-severity fire in this type at all and that the overall MFRI should be ~25yrs.

For MZs 29 and 30, it was suggested that mixed fire be removed from this model; reviewers agreed, and therefore mixed fire is not in the model.

Variation in precipitation and temperature interacting with fire, tip moths, and ungulate grazing affects pine regeneration. Windthrow, storm damage, and mountain pine beetles were minor disturbances in this type unless stands reach high densities. The interactions among drought, insects, and disease are not well understood.

Bark beetles can cause significant mortality among pole-sized and larger-diameter pines, especially those weakened by drought, fire injury, and the hail-related native disease *diplodia*. This serves to maintain the late-development open stage and move the late-development closed stage to the late-development open stage.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 379 | 4 |  |  |
| Moderate (Mixed) |  |  |  |  |
| Low (Surface) | 15 | 96 | 3 | 70 |
| All Fires | 15 | 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 patch size probably ranged from 10s to 10,000s of acres.

System would be a patchy mosaic of 10s to 1,000 of acres. It could be a range of patches, such as in Missouri Breaks where it could be up to 10,000ac patches.

Adjacency or Identification Concerns

This type is either surrounded by Northern Plains grasslands and shrublands or is a transition between Northern Plains grasslands and shrublands and higher-elevation coniferous forests. Ponderosa pine in this BpS has encroached into the Northern Plains grassland and shrubland types in many areas due to fire suppression and grazing.

As this system model and description is copied to the BpS Northwestern Great Plains-Black Hills Ponderosa Pine Woodland and Savanna -- Savanna, this system will be difficult to distinguish from that one and is only distinguished by geography.

Invasive species in this system include cheatgrass, Japanese brome, crested wheatgrass, Kentucky bluegrass, and intermediate wheatgrass. Crested wheatgrass and cheatgrass are at lower elevations mostly. Cheatgrass has altered the fire frequency and extent (although not on the Pine Ridge).

Currently, there have probably been at least 5-10 fire cycles that have been missed due to suppression, grazing, etc. Therefore, the system today would look much more like the late-closed stage with ~50-80% canopy closure -- uncharacteristic. Also encroachment into prairies by pine and juniper is an issue today (juniper becomes more of an issue further east; it’s primarily ponderosa pine that is encroaching in the Nebraska area), although JUSC2 is an indicator at least in the Black Hills. Generally. the juniper that is an issue with the prairies east of the Black Hills is the eastern redcedar. As it continues to be incorporated into windbreaks, it is continuing to increase into new areas.

Hardwoods exist in drainages, which encompass a separate BpS. In Nebraska, there is green ash, chokecherry, hackberry, and American elm, which get crowded out by the ponderosa pine.

Currently expanding into grasslands because of fire suppression, grazing, and natural expansion from Holocene rebound (Norris 2006).

Issues or Problems

Native Uncharacteristic Conditions

Currently, there have probably been at least 5-10 fire cycles that have been missed due to suppression, grazing, etc. Therefore, the system today would look much more like the late-closed stage with ~50-80% canopy closure -- uncharacteristic. Some areas have been thinned to "even spacing," rather than the "clumpier" arrangement that is shown in early photos.

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 | 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 | C | C | C | C | C | B | B | B | B | B |
| 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 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | >50 | UN | UN | UN | UN | UN | UN | UN | UN | 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 5 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| NAVI4 | Nassella viridula | Green needlegrass | Mid-Upper |
| PASM | Pascopyrum smithii | Western wheatgrass | Mid-Upper |
| PSSP6 | Pseudoroegneria spicata | Bluebunch wheatgrass | Mid-Upper |
| CAREX | Carex | Sedge | Low-Mid |

Description

This community is dominated by herbaceous and woody species, including the graminoids needlegrasses, western wheatgrass, bluebunch wheatgrass, sedges, Idaho fescue, and little bluestem in moister areas and various shrubs including skunkbush and snowberry. Shrub cover is <20%. Ponderosa pine seedlings are scattered and found in small clumps.

Little bluestem will also be indicator species.

Needlegrasses can be tall up to 1m, but other graminoids are typically <0.5m.

*Maximum Tree Size Class*  
Seedling <4.5ft

Class B 2 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIPO | Pinus ponderosa | Ponderosa pine | Upper |

Description

Multi-story stands of small and medium trees with saplings and seedlings coming in as clumps. Understory is sparse. Some juniper might be present -- could be an outlier. Grasses and shrubs are shaded out.

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

Class C 8 Mid Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIPO | Pinus ponderosa | Ponderosa pine | Upper |
| NAVI4 | Nassella viridula | Green needlegrass | Lower |
| PASM | Pascopyrum smithii | Western wheatgrass | Lower |
| PSSP6 | Pseudoroegneria spicata | Bluebunch wheatgrass | Lower |

Description

Predominantly single-story stands with a few pockets of regeneration. Low shrubs such as snowberry and skunkbush and poison ivy are dominant as well as grass and forbs. Graminoids could have up to 60-80% cover (Hansen and Hoffmann 1988). Grasses co-dominate. Rocky Mountain juniper present in patches.

*Carex* spp. and little bluestem will also be indicator species.

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

Class D 80 Late Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIPO | Pinus ponderosa | Ponderosa pine | Upper |
| NAVI4 | Nassella viridula | Green needlegrass | Lower |
| PASM | Pascopyrum smithii | Western wheatgrass | Lower |
| PSSP6 | Pseudoroegneria spicata | Bluebunch wheatgrass | Lower |

Description

Predominantly single-story stands of large ponderosa pine with pockets of smaller size classes (replacement). Snowberry, skunkbush, and patches of Rocky Mountain juniper. Understory is dominated by shrub species and grasses and poison ivy. Graminoids could have up to 60-80% cover. Grasses co-dominate.

*Carex* spp. and little bluestem will also be indicator species.

It is thought that the late-open stage should occupy approximately 80% of the historical landscape.

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

Class E 5 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIPO | Pinus ponderosa | Ponderosa pine | Upper |

Description

This is a somewhat uniform late-development stage, multi-story stands of large, medium, small, and seedling ponderosa pine. Shrubs and grasses are sparse. This type generally exceeds 70% canopy cover. DBH is less in this class than late-open.

Low-severity surface fires occur every 15yrs and cause a transition back to the late-open stage. Replacement fires occur every 300yrs.

Insect/disease occurs every 250yrs, causing a transition back to the late-open stage. Drought can also occur -- every 500yrs, causing a transition to the late-open stage.

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

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Mid1:OPN | 29 |
| Mid1:CLS | 26 | Late1:CLS | 95 |
| Mid1:OPN | 30 | Late1:OPN | 80 |
| Late1:OPN | 81 | Late1:OPN | 999 |
| Late1:CLS | 96 | 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** |
| Alternative Succession | Early1:ALL | Mid1:CLS | 1 | 1 | Yes | 25 |
| Replacement Fire | Early1:ALL | Early1:ALL | 0.02 | 50 | Yes | 0 |
| Surface Fire | Early1:ALL | Early1:ALL | 0.03 | 33 | No | 0 |
| Alternative Succession | Mid1:OPN | Mid1:CLS | 1 | 1 | Yes | 40 |
| Replacement Fire | Mid1:OPN | Early1:ALL | 0.0015 | 667 | Yes | 0 |
| Surface Fire | Mid1:OPN | Mid1:OPN | 0.0667 | 15 | No | 0 |
| Replacement Fire | Mid1:CLS | Early1:ALL | 0.0033 | 303 | Yes | 0 |
| Insects or Disease | Mid1:CLS | Mid1:CLS | 0.02 | 50 | No | 0 |
| Surface Fire | Mid1:CLS | Mid1:OPN | 0.0667 | 15 | Yes | 0 |
| Alternative Succession | Late1:OPN | Late1:CLS | 1 | 1 | Yes | 40 |
| Replacement Fire | Late1:OPN | Early1:ALL | 0.0015 | 667 | Yes | 0 |
| Insects or Disease | Late1:OPN | Late1:OPN | 0.02 | 50 | No | 0 |
| Surface Fire | Late1:OPN | Late1:OPN | 0.0667 | 15 | No | 0 |
| Wind or Weather or Stress | Late1:CLS | Late1:OPN | 0.002 | 500 | Yes | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.0033 | 303 | Yes | 0 |
| Insects or Disease | Late1:CLS | Late1:OPN | 0.004 | 250 | Yes | 0 |
| Surface Fire | Late1:CLS | Late1:OPN | 0.0667 | 15 | Yes | 0 |

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