11172

Southern Rocky Mountain Ponderosa Pine Savanna - North

BpS Model/Description Version: Aug. 2020

|  |  |  |  |
| --- | --- | --- | --- |
| **Modelers** |  | **Reviewers** |  |
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Vegetation Type

Steppe/Savanna

Map Zone

27

Model Splits or Lumps

This Biophysical Setting (BpS) is split into multiple models. This BpS is split into a northern and southern version. The southern version, 11171, is below ECOMAP (Cleland et al. 2007) subsection M331Ii, and the northern version, 11172, is above M331Ii. The northern version of this BpS 1117 in map zones (MZs) 27 and 33 has higher production in the understory.

Geographic Range

The occurrence is in the ECOMAP subsections 331Fk, 331Ha, 331Fr, 331Hf, and 332Cf. This BpS also occurs in scattered areas within Subsections M331Ib, 331Id, 331Ih, 331He -- but may be better represented by comparing to Model 2810540. Also in subsection 331Hb. It occurs in little forest pockets in Chalk Bluffs in Nebraska and some Wyoming pockets and along the extreme edge of MZ33 in Colorado -- the northern edge of Colorado north of Castle Rock. This version starts in subsection M331Ii and goes north.

Biophysical Site Description

In MZs 27 and 33 northern version, 900-2,100m in elevation on a variety of topographic features, including ridges, mesas, and canyons.

Mean annual precipitation ranges from ~12-18in in northern version of MZs 27 and 33. BpS is best described as a savanna that has widely spaced (>150yrs old) *Pinus ponderosa*.

Soils are moderate (loams to heavy sandy loams) to moderately fine (includes clay loams and light clays).

Growing season moisture is through monsoonal (mid-July through mid-September) thunderstorms. Also has winter snowpack; moisture is bimodal -- some in summer, some in winter.

Vegetation Description

Overstory canopy of ponderosa pine with a grassy understory, predominantly composed of the bunchgrasses green needlegrass or Letterman's needlegrass (generic form ACHNA retained for dominant spp. list), needle-and-thread, little bluestem, or mountain muhly. It is thought that some shrub component of soapweed yucca and/or mountain-mahogany might occur, but that might occur in current conditions and not historically.

This system is best described as a savanna that has widely spaced (<25% tree canopy cover) (>150yrs old) *Pinus ponderosa* (primarily var. *scopulorum* and var. *brachyptera*) as the predominant conifer. A healthy occurrence often consists of open and park-like stands dominated by *Pinus ponderosa*. Understory vegetation in the true savanna occurrences is predominantly fire-resistant grasses and forbs that resprout following surface fires; shrubs, understory trees, and downed logs are uncommon. Important species include: *Festuca arizonica*, *Andropogon gerardii*, *Schizachyrium scoparium*, *Festuca* spp., *Muhlenbergia* spp., *Nasella viridula*, and *Bouteloua gracilis*.

Presently, many stands contain understories of more shade-tolerant species, such as *Pseudotsuga menziesii* and/or *Abies* spp., as well as younger cohorts of *Pinus ponderosa*. This is an encroachment, fire-suppression state that does not occur historically.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| PIPO | *Pinus ponderosa* | Ponderosa pine |
| ACHNA | *Achnatherum* | Needlegrass |
| FEAR2 | *Festuca arizonica* | Arizona fescue |
| QUGA | *Quercus gambelii* | Gambel oak |
| MUMO | *Muhlenbergia montana* | Mountain muhly |
| CEMO2 | *Cercocarpus montanus* | Alderleaf mountain mahogany |

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

Disturbance Description

This system is maintained by a fire regime of frequent, low-intensity surface fires. Mean surface fire intervals are estimated to be 10-30yrs (Brown and Shepperd 2001; Sherriff 2004; Kauffmann et al. 2006). Infrequent stand-replacement fire on the order of several hundred years possible. Fire is more frequent in the northern version of MZs 27 and 33 BpS 1117 due to higher production in the understory than the southern version. In the southern version of MZs 27 and 33 BpS 1117, fire does not carry as much due to less productive, sparser understory; however, it is modeled nearly identically to this system and actually more frequent. As fire moves through, the system could even move to a more juniper stand.

Drought and other weather events (e.g., blowdown), parasites, and disease may play a minor to major role, depending on the period, and have very long rotations. Climate forcing (drought) and insects are more important for large-scale mortality events than fire. In a dry series of years during drought, at the lower elevation limit of this BpS, pinyon-juniper will move upslope.

Drought causes trees to be susceptible to insect outbreak. Inappropriate tree spacing (due to lack of fire in current conditions) allows beetles to move from tree to tree. Insects may be a significant, frequent but largely patchy (individual tree to small patch) occurrence.

Native grazing in the form of large ungulates likely affected the understory components of these areas.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 453 | 4 |  |  |
| Moderate (Mixed) |  |  |  |  |
| Low (Surface) | 19 | 96 |  |  |
| All Fires | 19 | 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 as broad, long bands in 100s to few 1,000s of acres.

The disturbances occur in a more patchy distribution.

Adjacency or Identification Concerns

The northern MZs 27 and 33 version of this BpS 1117 has higher production in the understory. The southern version is drier, sparser. If a fire goes through the northern version, it is likely to go to a grass community, whereas the southern version has more of an issue with pinyon-juniper encroachment. However, fire was modeled identically for both versions.

A century of anthropogenic disturbance and fire suppression has resulted in a higher density of *Pinus ponderosa* trees, altering the fire regime and species composition.

There is probably moderate departure from historical conditions in this northern version of MZs 27 and 33 1117, due to logging in the 1800s and grazing today, thus reducing the understory grass composition. There is less mix of structure and dynamics today; therefore, when a fire goes through this landscape, it causes dramatic changes.

Presently, many stands contain understories of more shade-tolerant species, such as *Pseudotsuga menziesii* and/or *Abies* spp., as well as younger cohorts of *Pinus ponderosa*. This is an encroachment, fire-suppression state -- not occurring historically.

Drought causes trees to be susceptible to insect outbreak. Inappropriate tree spacing (due to lack of fire in current conditions) allows beetles to move from tree to tree.

Fire suppression has allowed the canopy of ponderosa pine to close, causing a decline in understory herbaceous vegetation.

Currently, livestock grazing has removed much of the fine fuels in this system, and has been since the late 1800s.

This system can easily be mistaken for BpS 1054 PIPO Woodland. There will be more of a shrub component in BpS 1054 (though this is questioned). Tree spacing should be wider in this system historically; however, it is sometimes difficult to distinguish because fire suppression has made it more closed.

This BpS is adjacent to Douglas-fir BpS 1051 and 1052. In limited spots, there could be aspen 1011 adjacent, as well as 1146 Southern Rocky Mountain Subalpine grassland adjacent.

Issues or Problems

It is questionable whether a separate model is needed for the south versus the north. The northern version is the version most similar to other PIPO models.

Fire was modeled almost identically in both systems after review was incorporated. It is thought that these physiographic features do not control but only modify the vegetation conditions and disturbance regimes across local scales. It is questionable whether this split is relevant or necessary for these BpSs.

Native Uncharacteristic Conditions

Comments

MZs 27 and 33 northern model for BpS 1117 were adapted from model MZ28 for BpS 1117 for LANDFIRE National, created by Jeff Redders, Patrick Medina, and "anonymous," and reviewed by Brenda Willmore, "anonymous," and Laurie Huckaby. Model was changed quantitatively and descriptively. Mike Babler modeled MZs 27 and 33 northern version. Herman Garcia provided further review for MZs 27 and 33 northern version. Peter Brown reviewed model concepts for MZs 27 and 33.

Additional LANDFIRE National reviewers of BpS for MZ28 include Paul Langowski (plangowski@fs.fed.us), Dick Edwards (rledwards@fs.fed.us), Vic Ecklund (vecklund@csu.org), and Chuck Kostecka.

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 | B | B |
| Herb | 0.5-1.0 | A | A | A | A | A | A | A | A | B | B |
| Herb | >1.0 | A | A | A | A | A | A | A | A | B | B |
| 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 | C | C | C | C | C |
| Tree | 5-10 | B | B | B | B | B | C | C | C | C | C |
| 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 8 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ACLE9 | Achnatherum lettermanii | Letterman's needlegrass | Lower |
| SCHIZ4 | Schizachyrium | Little bluestem | Lower |
| PIPO | Pinus ponderosa | Ponderosa pine | All |
| YUGL | Yucca glauca | Soapweed yucca | Lower |

Description

Bunchgrass-dominated (<60% canopy cover and height of 0.4m). Some ponderosa pine individuals also becoming established. Establishment of ponderosa has been historically episodic in many locations around the West, and there are likely lags in timing of recruitment (Teague 2004). Typically, 2-3yrs of above-average moisture will get the seedlings started.

Based on reviewer comments, NAVI4 was removed from the indicator species list and replaced with ACLE9. NAVI4 might also occur.

Native grazing is estimated to occur on 10-15% of this class annually. Low-severity fire occurs every 10-20yrs and does not cause a transition. Low-severity surface fire is thought to occur as the upper lifeform are trees.

*Maximum Tree Size Class*  
Seedling <4.5ft

Class B 19 Mid Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIPO | Pinus ponderosa | Ponderosa pine | Upper |
| ACLE9 | Achnatherum lettermanii | Letterman's needlegrass | Lower |
| YUGL | Yucca glauca | Soapweed yucca | Lower |
| SCHIZ4 | Schizachyrium | Little bluestem | Lower |

Description

Small and medium-sized ponderosa pine (50-149yrs), with moderate bunchgrass cover. Dominant lifeform will be herbaceous, with canopy cover of 80-90% and height of 0.6m.

Based on reviewer comments, NAVI4 was removed from the indicator species list and replaced with ACLE9. NAVI4 might also occur.

Replacement fire occurs every 300-500yrs.

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

Class C 4 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIPO | Pinus ponderosa | Ponderosa pine | Upper |
| ACLE9 | Achnatherum lettermanii | Letterman's needlegrass | Lower |
| MUMO | Muhlenbergia montana | Mountain muhly | Lower |

Description

Small and medium-sized ponderosa pine (50-149yrs), still with moderate bunchgrass cover. Influence from Native American use attributed to pole harvesting and removal of dead and down woody material.

Based on reviewer comments, NAVI4 was removed from the indicator species list and replaced with ACLE9. NAVI4 might also occur.

Replacement fire occurs every 300-500yrs.

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

Class D 65 Late Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIPO | Pinus ponderosa | Ponderosa pine | Upper |
| ACLE9 | Achnatherum lettermanii | Letterman's needlegrass | Lower |
| MUMO | Muhlenbergia montana | Mountain muhly | Lower |

Description

Large and very large old ponderosa pine, with medium to high cover of bunchgrasses. Old growth attributes include occasional down wood, snags, diseased trees.

Based on reviewer comments, NAVI4 was removed from the indicator species list and replaced with ACLE9. NAVI4 might also occur.

This class was originally modeled with shorter trees, but due to mapping rules, reviewers for MZs 27 and 33 raised height to 10-25m so that there was no overlap. If possible in mapping, you can distinguish on DBH. Classes D and E should have larger DBH.

Replacement fire occurs every 300-500yrs.

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

Class E 4 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIPO | Pinus ponderosa | Ponderosa pine | Upper |
| ACLE9 | Achnatherum lettermanii | Letterman's needlegrass | Lower |
| MUMO | Muhlenbergia montana | Mountain muhly | Lower |

Description

Large and very large old growth ponderosa pine, with medium cover of bunchgrasses. Old growth attributes include occasional down wood, snags, diseased trees.

Based on reviewer comments, NAVI4 was removed from the indicator species list and replaced with ACLE9. NAVI4 might also occur.

This class was originally modeled with shorter trees, but due to mapping rules, reviewers for MZs 27 and 33 raised height to 10-25m so that there was no overlap. If possible in mapping, you can distinguish on DBH. Class D and E should have larger DBH.

Replacement fire every 300-500yrs.

*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 | 49 |
| Mid1:CLS | 50 | Late1:CLS | 149 |
| Mid1:OPN | 50 | Late1:OPN | 149 |
| Late1:OPN | 150 | Late1:OPN | 999 |
| Late1:CLS | 150 | 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 | 0.01 | 100 | Yes | 0 |
| Surface Fire | Early1:ALL | Early1:ALL | 0.05 | 20 | No | 0 |
| Native Grazing | Early1:ALL | Early1:ALL | 0.14 | 7 | No | 0 |
| Replacement Fire | Mid1:OPN | Early1:ALL | 0.002 | 500 | Yes | 0 |
| Surface Fire | Mid1:OPN | Mid1:OPN | 0.05 | 20 | No | 0 |
| Native Grazing | Mid1:OPN | Mid1:OPN | 0.2 | 5 | No | 0 |
| Replacement Fire | Mid1:CLS | Early1:ALL | 0.0025 | 400 | Yes | 0 |
| Insects or Disease | Mid1:CLS | Mid1:OPN | 0.02 | 50 | Yes | 0 |
| Surface Fire | Mid1:CLS | Mid1:CLS | 0.02 | 50 | No | 0 |
| Native Grazing | Mid1:CLS | Mid1:CLS | 0.1 | 10 | No | 0 |
| Replacement Fire | Late1:OPN | Early1:ALL | 0.0025 | 400 | Yes | 0 |
| Alternative Succession | Late1:OPN | Late1:CLS | 0.003 | 333 | Yes | 0 |
| Surface Fire | Late1:OPN | Late1:OPN | 0.05 | 20 | No | 0 |
| Native Grazing | Late1:OPN | Late1:OPN | 0.15 | 7 | No | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.0025 | 400 | Yes | 0 |
| Insects or Disease | Late1:CLS | Early1:ALL | 0.003 | 333 | Yes | 0 |
| Surface Fire | Late1:CLS | Late1:OPN | 0.05 | 20 | Yes | 0 |
| Surface Fire | Late1:CLS | Late1:CLS | 0.05 | 20 | No | 0 |
| Native Grazing | Late1:CLS | Late1:CLS | 0.15 | 7 | No | 0 |

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