10542

Southern Rocky Mountain Ponderosa Pine Woodland - North

BpS Model/Description Version: Aug. 2020

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| --- | --- | --- | --- |
| **Modelers** |  | **Reviewers** |  |
| Regional Lead MZ27 | None | Mike Babler | mbabler@tnc.org |
| None | None | None | None |
| None | None | None | None |

Vegetation Type

Forest and Woodland

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 to represent differences in regimes and covers and rocky nature. The northern version is found north of ECOMAP subsections M331Ii (Cleland et al. 2007), and the southern version is found south of subsection M331Ii on rocky soils. This northern model is to represent all PIPO Woodlands except for the PIPO Woodlands on very rocky sites/terrain in New Mexico.

Geographic Range

In map zone (MZ) 28, this is the dominant forest type along the eastern slope of the continental divide but is scarce on the western side of the divide. The montane zone borders the Plains grasslands to the east and in the foothills of the eastern slope includes shrublands and meadows.

For MZs 27 and 33 northern version, this would be above ECOMAP subsections M331Ii, which will include Black Forest and subsections 331Ig, 331Ih.

Biophysical Site Description

The montane zone (1,650-2,900m/4,900-8,700ft). Lower montane <2,120m and upper montane >2,120m. Northern Front Range -- ponderosa pine tends to be associated with xeric, south-facing slopes, and Douglas-fir tends to be associated with mesic, north-facing slopes. South of I-70 the southern Front Range southward to Pikes Peak, ponderosa-pine/Douglas-fir forest exists on all site conditions (i.e., aspect) >1,970m (6,500 ft) elevation, pure ponderosa pine exists <1,970m (6,500 ft). Below 1,970m (6,500ft) in the southern Front Range is similar to the lower montane of the northern Front Range. Differences exist in the upper montane stands between the northern and southern Front Range.

For MZs 27 and 33 north, this occurs as woodlands on north exposures or steep slopes greater than ~25% slope.

Vegetation Description

The lower montane zone dominated by ponderosa pine (historically <30% canopy cover <2,000m [6,600ft]), more dense stands of Douglas-fir on north-facing slopes. In the upper montane zone, the ponderosa pine cover type occurs both as relatively pure stands and with significant components of Douglas-fir. In the northern Front Range, typically striking contrast in stand density and species composition on south- as opposed to north-facing slopes. Douglas-fir prominent on north-facing slopes. Structural stages will greatly vary depending on past disturbance history (i.e., 50% cover of Class B would not be outside of the historical range of variability following widespread high-severity fire, which has occurred in the past over the last few hundred years prior to the 20th century). In the southern Front Range, historically most Douglas-fir was confined to north-facing slopes with occasional larger Douglas-fir on other aspects.

South of Denver along the Front Range, gambel oak is a component, and as you move into northern New Mexico, it may be a major understory species. It is unsure how much white fir mixes in generally south of Colorado Springs into New Mexico.

BpS Dominant and Indicator Species

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

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

Disturbance Description

Mixed-severity fire regime -- typical average fire frequency ranges from 40-100yrs (5-100ha) (Kaufmann et al. 2000; Veblen et al. 2000; Ehle and Baker 2003; Sherriff 2004). These fires range from low-severity to high-severity fires, and the forest structure was shaped by the pattern of fire at a landscape scale. Drought and other weather events (e.g., blowdown); insects such as mountain pine beetle, Douglas-fir beetle, and western spruce budworm (Swetnam and Lynch 1993); and pathogens such as dwarf mistletoe (Hawksworth 1961) also play important roles in this type.

Replacement fire rotation is uncertain, and this affects the amount of forest in each class.

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).

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 502 | 5 |  |  |
| Moderate (Mixed) | 159 | 15 |  |  |
| Low (Surface) | 31 | 80 |  |  |
| All Fires | 24 | 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

Northern range -- fire history sites range from 1-200ha, average of 100ha areas for fire regime information over 10s of 1,000s of acres. Southern range -- patch sizes from <1ha to a landscape scale of 35km2 plus.

Adjacency or Identification Concerns

Please also see Adj/ID concerns for BpS MZs 27 and 33 10541\_south.

Adjacent BpSs would be pinyon-juniper on south-facing slopes south of Denver, mixed conifer/ lodgepole in northern areas, and mountain shrubs on south- and east-facing slopes.

Juniper might have invaded currently into ponderosa pine south of Denver due to less fire. There is also loss of old growth, a loss of open stages, increased Douglas-fir, and increased density of small-diameter ponderosa pine.

Cheatgrass is an exotic today.

Issues or Problems

Replacement fire rotation is uncertain, and this affects the amount of forest in each class.

Native Uncharacteristic Conditions

Tree density is increased. Douglas-fir, juniper, and possibly white fir and gambel oak have invaded.

Comments

This model for MZs 27 and 33 northern version is adapted from the model from the same BpS from MZ28, created by Merrill Kauffmann, Rosemary Sherriff, and an anonymous modeler and reviewed by Paul Langowski, Laurie Huckaby, and Chuck Kostecka. For MZs 27 and 33, low-severity fire frequency was increased by Regional Lead for MZs 27 and 33 based on literature and comments from experts in PIPO system and other PIPO models; this did not change the percentage in classes. However, because quantitative changes were made, modeler names changed.

The MZ28 model was based on the Rapid Assessment model R3PPDF, by Merrill Kaufmann (mkaufmann@fs.fed.us), Rosemary Sherriff (sherriff@colorado.edu), Jose Negron, Brian Kent, and an anonymous modeler. It was also reviewed in workshop by Vic Ecklund (vecklund@csu.org) on 25 July 2005.

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 | B | B | B | B | B | B |
| Tree | 10-25 | C | C | C | C | B | B | B | B | B | B |
| 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 10 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| CERCO | Cercocarpus | Mountain mahogany | Low-Mid |
| PIPO | Pinus ponderosa | Ponderosa pine | All |
| PSME | Pseudotsuga menziesii | Douglas-fir | All |
| BOGR2 | Bouteloua gracilis | Blue grama | Lower |

Description

Openings with up to 10% by overstory dominated by ponderosa pine and sometimes Douglas-fir. Some openings may persist.

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

Class B 9 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIPO | Pinus ponderosa | Ponderosa pine | Upper |
| PSME | Pseudotsuga menziesii | Douglas-fir | Upper |
| CERCO | Cercocarpus | Mountain mahogany | None |

Description

Closed, mid seral stands. Cover can vary: >50% canopy cover in the northern Front Range (above ~6,500ft) and >30% canopy cover in the southern Front Range.

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

Class C 23 Mid Development 1 - Open

Indicator Species

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

Description

Open, mid seral stands. Cover can vary: <50% canopy cover in the northern Front Range (above ~6,500ft) and <30% canopy cover in the southern Front Range.

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

Class D 40 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 |
| CERCO | Cercocarpus | Mountain mahogany | Lower |

Description

Open, mature stands. Cover can vary: >50% canopy cover in the northern Front Range (above ~6,500ft) and <30% canopy cover in the southern Front Range.

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

Class E 18 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 |
| CERCO | Cercocarpus | Mountain mahogany | Lower |

Description

Closed, mature stands. Cover can vary: >50% canopy cover in the northern Front Range (above ~6,500ft) and >30% canopy cover in the southern Front Range.

*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:OPN | 49 |
| Mid1:OPN | 50 | Late1:OPN | 199 |
| Mid1:CLS | 50 | Late1:CLS | 199 |
| Late1:OPN | 200 | Late1:OPN | 999 |
| Late1:CLS | 200 | 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 | 0.0063 | 159 | No | 0 |
| Alternative Succession | Early1:ALL | Mid1:CLS | 0.01 | 100 | Yes | 0 |
| Surface Fire | Early1:ALL | Early1:ALL | 0.0333 | 30 | No | 0 |
| Replacement Fire | Mid1:OPN | Early1:ALL | 0.0022 | 455 | Yes | 0 |
| Mixed Fire | Mid1:OPN | Mid1:OPN | 0.0031 | 323 | No | 0 |
| Mixed Fire | Mid1:OPN | Early1:ALL | 0.0031 | 323 | Yes | 0 |
| Surface Fire | Mid1:OPN | Mid1:OPN | 0.04 | 25 | No | 0 |
| Replacement Fire | Mid1:CLS | Early1:ALL | 0.0022 | 455 | Yes | 0 |
| Mixed Fire | Mid1:CLS | Mid1:OPN | 0.0063 | 159 | Yes | 0 |
| Surface Fire | Mid1:CLS | Mid1:CLS | 0.0333 | 30 | No | 0 |
| Replacement Fire | Late1:OPN | Early1:ALL | 0.0022 | 455 | Yes | 0 |
| Alternative Succession | Late1:OPN | Late1:CLS | 0.003 | 333 | Yes | 0 |
| Mixed Fire | Late1:OPN | Late1:OPN | 0.0063 | 159 | No | 0 |
| Surface Fire | Late1:OPN | Late1:OPN | 0.04 | 25 | No | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.0022 | 455 | Yes | 0 |
| Mixed Fire | Late1:CLS | Late1:OPN | 0.0063 | 159 | Yes | 0 |
| Surface Fire | Late1:CLS | Late1:CLS | 0.0063 | 159 | No | 0 |

References

Alington, C. 1998. Fire History and Landscape Pattern in the Sangre de Cristo Mountains, Colorado. Dissertation. Colorado State University, Fort Collins, CO.

Allen, C.D., technical editor. 1996. Fire Effects in Southwestern Forests. Proceedings of the second La Mesa fire symposium. USDA Forest Service General Technical Report RM-GTR-286, Fort Collins Co.

Allen, C.D. 1989. Changes in the landscape of the Jemez Mountains, New Mexico. Ph.D. dissertation, University of California, Berkeley.

Allen, C.D., R. Touchan and T.W. Swetnam. 1995. Landscape-scale fire history studies support fire management action at Bandelier. Park Science: Summer, pp. 18-19.

Cleland, D.T.; Freeouf, J.A.; Keys, J.E.; Nowacki, G.J.; Carpenter, C.A.; and McNab, W.H. 2007. Ecological Subregions: Sections and Subsections for the conterminous United States. Gen. Tech. Report WO-76D [Map on CD-ROM] (A.M. Sloan, cartographer). Washington, DC: U.S. Department of Agriculture, Forest Service, presentation scale 1:3,500,000; colored

Cooper, C.F. 1960. Changes in vegetation, structure, and growth of Southwestern pine forests since white settlement. Ecological Monographs 30(2): 129-164.

Allen, R.B., R.K. Peet and W.L. Baker. 1991. Gradient analysis of latitudinal variation in Southern Rocky Mountain forests. Journal of Biogeography 18: 123-139.

Baker, W.L. and D.S. Ehle. 2001. Uncertainty in surface-fire history: The case of ponderosa pine forests in the western United States. Canadian Journal of Forest Research 31: 1205-1226.

Baker, W.L. and D.S. Ehle. 2003. Uncertainty in fire history and restoration of ponderosa pine forests in the western United States. Pages 319-333 in: Omi, Philip N.; Joyce, Linda A., tech. eds. Fire, fuel treatments, and ecological restoration: conference proceedings; 2002 April 16-18; Fort Collins, CO. Proceedings RMRS-P-29. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station.

Barrett, S.W. 2004. Altered fire intervals and fire cycles in the Northern Rockies. Fire Management Today 64(3): 25-29.

Barrett, S.W. 2004. Fire Regimes in the Northern Rockies. Fire Management Today 64(2): 32-38.

Bradley, A.F., N.V. Noste and W.C. Fischer. 1992. Fire ecology of the forests and woodland in Utah. GTR-INT-287. Ogden, UT: Intermountain Research Station.

Brown, P.M, M.W. Kaye, L.S. Huckaby and C.H. Baisan. 2001. Fire history along environmental gradients in the Sacramento Mountains, New Mexico: Influences of local patterns and regional processes. Ecoscience 8(1): 115-126.

Brown, P.M, M.R. Kaufmann and W.D. Shepperd. 1999. Long-term, landscape patterns of past fire events in a montane ponderosa pine forest of central Colorado. Landscape Ecology 14: 513–532.

Brown, P.M. 2004. Final Report: Bar NI Fire History. Rocky Mountain Tree-Ring Research, Fort Collins, CO.

Brown, P.M. and W.D. Shepperd. 2001. Fire history and fire climatology along a 5 degree gradient in latitude in Colorado and Wyoming, USA. Palaeobotanist 50: 133-140.

Brown, P.M., M.R. Kauffman and W.D. Sheppard. 1999. Long-term, landscape patterns of past fire events in a montane ponderosa pine forest of central Colorado. Landscape Ecology 14: 513-532.

Ehle, D.S. and W.L. Baker. 2003. Disturbance and stand dynamics in ponderosa pine forests in Rocky Mountain National Park, USA. Ecological Monographs 73: 543-566.

Fule, P., Covington and M.M. Moore. 1997. Determining reference conditions for ecosystem management of southwestern ponderosa pine forests. Ecological Applications 7: 895-908.

Hawksworth, F.G. 1961. Dwarf mistletoe of ponderosa pine in the Southwest. US For.

Serv. Tech. Bull. 1246. 112 p.

Huckaby, L.S. and M.R. Kaufmann. 2000. Bar NI Ranch Fire History Study. Unpublished report. USDA Forest Service, Rocky Mountain Research Station.

Huckaby, L.S., M.R. Kaufmann, J.M. Stoker and P.J. Fornwalt. 2001. Landscape patterns of montane forest age structure relative to fire history at Cheesman Lake in the Colorado Front Range. Pages 19-27 in R.K. Vance, C.B. Edminster, W. Covington and J.A. Blake, editors. Pondersoa Pine Ecosystems Restoration and Conservation: Steps Toward Stewardship, Conference Proceedings, Flagstaff, AZ, April 25-27, 2000. USDA Forest Service, Rocky Mountain Research Station, Ogden, UT.

Kaufmann, M.R., P.J. Fornwalt, L.S. Huckaby and J.M. Stoker. 2001. Cheesman Lake--A historical ponderosa pine landscape guiding restoration in the South Platte watershed of the Colorado Front Range. Pages 9-18 In: R.K. Vance, C.B. Edminster, W.W. Covington and J.A. Blake, editors. Ponderosa pine ecosystems restoration and conservation: Steps

toward stewardship, conference proceedings [Flagstaff, AZ--April 25-27, 2000]. USDA Forest Service Proceedings RMRS-P-22, Rocky Mountain Research Station, Fort Collins, Colorado.

Kaufmann, M.R., L.S. Huckaby, C.M. Regan and J. Popp. 1998. Forest Reference Conditions for Ecosystem Management in the Sacramento Mountains, New Mexico. General Technical Report RMRS-GTR 19, USDA / Forest Service, Fort Collins, CO.

Kaufmann, M.R., C.M. Regan and P.M. Brown. 2000. Heterogeneity in ponderosa pine/Douglas-fir forests: age and size structure in unlogged and logged landscapes of central Colorado. Can. J. For. Res. 30: 698-711.

Kauffmann, M.R., Veblen, T.T. and Romme, W.H. 2006. Historical fire regimes in ponderosa pine forests of the Colorado Front Range, and recommendations for ecological restoration and fuels management. Report for The Nature Conservancy and the Front Range Fuels Treatment Partnership.

Marr, J.W. 1961 Ecosytems of the East Slope of the Front Range in Colorado. University of Colorado Studies, Series in Biology, No. 8: 1-134.

Mast, J.N., T.T. Veblen and Y.B. Linhart. 1998. Disturbance and climatic influences on age structure of ponderosa pine at the pine/grassland ecotone, Colorado Front Range. Journal of Biogeography 25: 743-755.

NatureServe. 2007. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. Data current as of 10 February 2007.

NatureServe. 2004. International Ecological Classification Standard: Terrestrial Ecological Classifications, NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of November 4, 2004.

Peet, R.K. 1981. Forest vegetation of the Colorado Front Range: Composition and dynamics. Vegetation 45: 3-75.

Peet, R.K. 1978. Latitudinal variation in southern Rocky Mountain forests. Journal of Biogeography 5: 275-289.

Pohl, K. 2004. History of the Upper Purgatoire Basin. Report prepared for the Culebra Range Community Coalition and The Fire Learning Network.

Romme, W., M.L. Floyd, D. Hanna and J. Redders. 1999. DRAFT Ch. 4 Mixed Conifer Forests in Landscape Condition Analysis for the South Central Highlands Section, Southwestern Colorado and Northwestern New Mexico.

Sherriff, R.L. 2004. The historic range of variability of ponderosa pine in the northern Colorado Front Range: Past fire types and fire effects. Ph.D. Dissertation. University of Colorado, Boulder.

Swetnam, T.W. and A.M. Lynch, 1993. Multi-century, regional-scale patterns of western spruce budworm history. Ecological Monographs 63(4): 399-424.

Touchan, R., T.W. Swetnam and H.D. Grissino-Mayer. 1995. Effects of livestock grazing on pre-settlement fire regimes in New Mexico. Pages 268-272 in Brown, J.K., R.W. Mutch, C.W. Spoon and R.H. Wakimoto, Technical Coordinators. Proceedings: Symposium on fire in wilderness and park management. Missoula, Montana, March 30-April 1, 1993. USDA Forest Service Intermountain Research Station General Technical Report INT-320.

Veblen, T.T. and D.C. Lorenz. 1986. Anthropogenic disturbance and recovery patterns in montane forests, Colorado Front Range. Physical Geography 7: 1-24.

Veblen, T.T., T. Kitzberger and J. Donnegan. 2000. Climatic and human influences on fire regimes in ponderosa pine forests in the Colorado Front Range. Ecological Applications 10: 1178-1195.

White, M.A. and J.L. Vankat. 1993. Middle and high elevation coniferous forest communities of the North rim region of Grand Canyon National Park, Arizona, USA.

Wu, R. 1999. Fire History and Forest Structure in the Mixed Conifer Forests of Southwest Colorado. Master Thesis. Colorado State University, CO.