10540

Southern Rocky Mountain Ponderosa Pine Woodland

BpS Model/Description Version: Aug. 2020

Reviewers: Rob Addington, Amy Waltz

Vegetation Type

Forest and Woodland

Map Zone

28

Geographic Range

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

Biophysical Site Description

The montane zone (1,650-2,900m, 4,900-8,700ft). Lower montane below 2,120m and upper montane above 2,120m. In the northern Front Range, Ponderosa pine (*Pinus ponderosa*) tends to be associated with xeric, south-facing slopes, and Douglas-fir (*Pseudotsuga menziesii*) 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) above 1,970m (6,500 ft) elevation, and pure ponderosa pine exists below 1,970m (6,500 ft). Below 1,970m (6,500ft) in the southern Front Range, it is similar to the lower montane of the northern Front Range.

Vegetation Description

The lower montane zone is dominated by ponderosa pine (historically <30% canopy cover below 2,000m [6,600ft]). More dense stands of Douglas-fir occur 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 where transitions to dry mixed conifer and additional species such as limber pine are present. Rocky Mountain juniper may be present.

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. In the southern Front Range, historically most Douglas-fir was confined to north-facing slopes with occasional larger Douglas-fir on other aspects.

Fire-maintained ponderosa pine stands are generally open and characterized by a grass, forb, and shrub understory. Dominant grasses include blue grama (*Bouteloua gracilis*), mountain muhly (*Muhlenbergia montana*), little bluestem (*Schizachyrium scoparium*), western wheatgrass (*Pascopyrum smithii*), and spike fescue (*Leucopoa kingii*) (Marr 1961; Peet 1981). Mountain mahogany (*Cercocarpus montanus*), skunkbrush (*Rhus trilobata*), buckbrush (*Ceanothus fendleri*), wax currant (*Ribes cereum*), and bitterbrush (*Purshia tridentata*) often make up the shrub component, with common juniper (*Juniperus communis*) and kinnikinnick (*Arctostaphylos uva-ursi*) also prevalent as groundcover woody plants

BpS Dominant and Indicator Species

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

Disturbance Description

Primarily low-severity fire regime with patches of mixed- and occasional high-severity fire. Along the Colorado Front Range, the average fire frequency was about 20yrs (range 10-45) for low-severity fire and about 200yrs (range 150-300) for mixed-severity fire (Brown et al. 2015; Brown et al. 1999; Brown and Shepperd 2001; Kaufmann et al. 2000; Veblen et al. 2000; Ehle and Baker 2003; Sherriff 2004). At the forest ecotone with oak and grasslands, average fire frequency was 10-20yrs with mixed-severity fires occurring about every 300yrs. At higher elevations and on north-facing slopes, fire frequency was 15-45yrs with mixed-severity fires becoming more common, about every 150yrs. Brown and Shepperd (2001) found a latitudinal shift in fire frequency in ponderosa-pine-dominated forests in the Rocky Mountains with southern stands burning more frequently than northern ones. The forest structure was shaped by the pattern and severity of fire at a landscape scale. The replacement fire frequency is uncertain, and this affects the amount of forest in each class.

Drought and other weather events (e.g., blowdown); insects such as mountain pine beetle, Douglas-fir beetle, and western spruce budworm (Negron 1998; Negron 2004; Swetnam and Lynch 1993); and pathogens such as dwarf mistletoe also play important roles in this type.

Fire Frequency

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 1,000s of hectares.

Adjacency or Identification Concerns

This Biophysical Setting (BpS) grades into the Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland BpS (10510) with increases in soil moisture availability.

Issues or Problems

Replacement fire rotation uncertain, and this affects the amount of forest in each class (e.g., Williams and Baker 2012; Fule et al. 2014). Return intervals historically for insect and disease outbreaks are uncertain as well and are not incorporated in the disturbance pathways below.

Native Uncharacteristic Conditions

Comments

Rob Addington and Amy Waltz reviewed this BpS during the 2016 BpS review. Both suggested that the literature supports more frequent surface fires. Surface fire frequency was modified, and an alternative succession pathway from mid-open to mid-closed that can occur in the absence of fire was added to the model, making the model consistent with modifications made to this same model by the Upper Monument Creek Collaborative (UMCC 2014; Low 2013 Appendix C shows quantitative state-and-transition model information).

DBH and height range estimates in the succession class descriptions below come from the Upper Monument Creek Project (UMCC 2014) on the southern Front Range in Colorado near Colorado Springs and are believed to be representative for the entire zone. Monitoring data from Colorado suggest that >70% canopy cover is unlikely on these dry BpS sites (Rob Addington, personal communication).

Succession Classes

**Mapping Rules**

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

Description

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

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

Class B 15 Mid Development 1 - Closed

Indicator Species

Description

Mosaic composition with tree groups, scattered individual trees, and openings, though tree groups are larger and canopy cover more continuous compared to Class C. Shrubs and herbaceous vegetation dominate the understory. Old trees likely present, as is tree regeneration. Uneven-age stand structure is developing. Trees are 5-9in DBH, 5-15m tall.

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

Class C 22 Mid Development 1 - Open

Indicator Species

Description

Mosaic composition with tree groups, scattered individual trees, and openings. Shrubs and herbaceous vegetation dominate the understory. Old trees likely present, as is tree regeneration. Uneven-age stand structure is developing. Trees are 5-9in DBH, 5-15m tall.

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

Class D 35 Late Development 1 - Open

Indicator Species

Description

Mosaic composition with tree groups, scattered individual trees, and openings. Shrubs and herbaceous vegetation dominate the understory. Old trees likely present, as is tree regeneration. Uneven-age stand structure dominates. Trees are 9-21in DBH, 15-25m tall.

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

Class E 18 Late Development 1 - Closed

Indicator Species

Description

Mosaic composition with tree groups, scattered individual trees, and openings. Tree groups would contain more trees here compared to Class D, and openings would be smaller in scale. Shrubs and herbaceous vegetation dominate the understory. Old trees likely present, as is tree regeneration. Uneven-age stand structure dominates. Trees are 9-21in DBH, 15-25m tall.

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

Model Parameters

Deterministic Transitions

Probabilistic Transitions

References

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

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 18-19.

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.

Bradley, Anne F., Nonan Noste, and William C. Fischer. 1992. Fire and Ecology of Forests and Woodlands in Utah. USDA Forest Service, GTR INT-287.

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 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., M.A. Battaglia, P.J. Fornwalt, B. Gannon, L.S. Huckaby, C. Julian and A.S. Cheng. 2015. Historical (1860) forest structure in ponderosa pine forests of the northern Front Range, Colorado. Canadian Journal of Forest Research. 45: 1462-1473.

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.

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

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

Fulé P.Z.; Swetnam, T.W.; Brown, P.M.; Falk, D.A.; Peterson, D.L.; Allen, C.D.; Aplet, G.H.; Battaglia, M.A.; Binkley, D.; Farris, C.; Keane, R.E.; Margolis, E.Q.; Grissino-Mayer, H.; Miller, C.; Sieg, C.H.; Skinner, C.; Stephens, S.L.; Taylor, A. 2014. Unsupported inferences of high-severity fire in historical dry forests of the western United States: response to Williams and Baker. Global Ecology and Biogeography 23: 825-830.

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, CO.

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. 2000b. 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.

Low, G. 2013. Landscape Conservation Forecasting for Upper Monument Creek. Report to Upper Monument Creek Collaborative Landscape Restoration Initiative. Available: https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/Colorado/Documents/Appendix%20A\_UMC%20LCF%20Report%202013-07-30.pdf.

Marr, J.W. 1961 Ecosystems 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. 2004. International Ecological Classification Standard: Terrestrial Ecological Classifications, NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of November 4, 2004.

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

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.H., M.L. Floyd, D. Hanna and J.S. Redders. 1999. Landscape condition analysis for the South Central Highlands Section, southwestern Colorado & northwestern New Mexico. Draft report to San Juan National Forest, Durango, Colorado.

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.

UMCC (Upper Monument Creek Collaborative). 2014. Upper Monument Creek Landscape Restoration Initiative: Summary report and collaborative recommendations. Prepared by The Nature Conservancy, Colorado Chapter, Boulder, CO. 62 p. Available: https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/Colorado/Pages/umc.aspx.

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.

Williams, M.A.; Baker, W.L. 2012. Comparison of the higher-severity fire regime in historical (A.D. 1800s) and modern (A.D. 1984–2009) montane forests across 624,156 ha of the Colorado Front Range. Ecosystems 15: 832-847.

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