**11171**

Southern Rocky Mountain Ponderosa Pine Savanna - South

BpS Model/Description Version: Aug. 2020

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 the map zones (MZs) 27 and 33 has higher production in the understory, and fire is more frequent.

Geographic Range

This occurs in the far southwestern corner of MZ27 in the Sandia Mountains and Manzana Mountains -- east of Albuquerque. It also occurs in ECOMAP subsections 321Ad, 313Bb, 331Fa, Fc. This version starts at subsection M331Ii and goes south and snakes along the edge of the MZ down south. 331If on the west side only, M331Fa,b,c,f, 331Ii, M331Fh, 331Bd on western edge, along the western edge of New Mexico.

Biophysical Site Description

This system occurs on a variety of topographic features, including ridges, mesas, and canyons. In the southern portion of MZs 27 and 33, 6,500-8,000ft in ridges, canyons, and mountain side slopes, which is where it's more prominent.

Mean annual precipitation ranges from ~16-20in in the southern portion 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. So 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, needle-and-thread, little bluestem, or mountain muhly. For MZs 27 and 33 1117 southern version, removed YUGL and JUSC from dominant species list. *Yucca bacata* might occur but in very limited areas and bunches.

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*. Also sideoats grama.

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.

NAVI4 might not occur as much in MZs 27 and 33 BpS 1117 southern version, due to drier nature of southern area.

BpS Dominant and Indicator Species

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

Disturbance Description

Mean surface fire intervals are estimated to be 10-20yrs (Brown and Shepperd 2001; Sherriff 2004). Infrequent stand-replacement fire on the order of several hundred years possible.

Climate forcing (drought) and insects more important for large-scale mortality events than fire.

In the southern version of MZs 27 and 33 BpS 1117, fire does not carry as much due to less productive, sparser understory. As fire moves through, the system could even move to a more juniper stand. With fire, pinyon-juniper could be removed again. However, fire modeled very similarly to northern version and, in fact, slightly more frequent in southern version.

Drought and other weather events (e.g., blowdown), parasites, and disease may play a minor or major role, depending on the period, and could have very long rotations.

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 by large ungulates likely affected the understory components of these areas.

This system is maintained by a fire regime of frequent, low-intensity surface fires.

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

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 southern MZs 27 and 33 version of this BpS 1117 has lower production in the understory than the northern version. The southern version is drier, sparser.

In the southern version of MZs 27 and 33 BpS 1117, fire does not carry as much as the northern version, due to less productive, sparser understory.

In the southern version 11171, there is some juniper invasion. Pinyon-juniper, however, could move back to PIPO with fire or drought.

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. As a result, 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.

There is probably some pinyon-juniper encroachment in this system due to fire suppression. For instance, around Las Vegas, there is much pinyon-juniper, which might have been PIPO.

Livestock grazing has also been removing much of the fine fuels in this system currently and has been since the late 1800s.

For the southern version of this MZ 271117 model, this system can be mistaken for BpS 1054 PIPO Woodland. It can be distinguished in the southern versions because 1054 will have more rock outcrop, stones, and cobbles in and above the surface. BpS 1117 will be more on mountain toeslopes, whereas 1054 will be on mesatops, canyons, sidewalls. There will be more of a shrub component in 1054. Tree spacing should be wider in this system historically; however, presently you might not be able to distinguish because it's more closed due to fire suppression. (This paragraph was questioned by a reviewer. 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 as to whether this split is relevant or necessary for these BpSs. It was retained, however, for this MZ.)

This BpS is adjacent to Douglas-fir systems 1051 and 1052. This would also be adjacent to pinyon-juniper system in lower elevations. It could also be adjacent to shortgrass prairie if it doesn't have the pinyon-juniper transition zone. In limited spots, could have aspen 1011 adjacent. And could have 1146 Southern Rocky Mountain Subalpine grassland adjacent.

With lack of fire, Douglas-fir and white fir could invade. This could conceivably be another late successional stage. However, unsure if this occurred in historical conditions -- as burning by Native Americans was frequent. However, occurs in current conditions. Invading firs provide ladder fuels causing catastrophic crown fires in this BpS -- mostly happening in current conditions.

Issues or Problems

It is questionable whether or not we need a separate model 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 incorporated. And 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 as to whether this split is relevant or necessary for these BpSs.

Native Uncharacteristic Conditions

Departure seen because canopy closing. Also -- Douglas-fir, oak, and pinyon-juniper invading. If tree cover is >30% and you're a tree between 0-25m, then it's uncharacteristic. Over 50% canopy cover with the large trees would be uncharacteristic. Cover is lower in southern version of MZs 27 and 33 1117 than compared to the typical 1117 model, because of topography, and therefore trees are scragglier.

Comments

This model for MZs 27 and 33 was adapted from a draft model from MZ33 for BpS 1117 created by Allen Gallamore and Herman Garcia. Another modeler for MZ27 was Lee Elliot. This model for 1117 MZs 27 and 33 south was changed quantitatively and descriptively and changed to a three-box model. Therefore, modeler names changed. Regional Lead for MZs 27 and 33 also made some consistency and quantitative changes based on review and exploration of adjacent MZs. Original MZs 27 and 33 modelers did not express concern, and therefore their names were retained.

Original northern MZ33 model for BpS 1117 was adapted from the model from MZ28 for BpS 1117 created by Jeff Redders, Patrick Medina, and anonymous and reviewed by Brenda Willmore, anonymous, and Laurie Huckaby.

Model for MZ28 1117 based on the Rapid Assessment model R3PPGRsw by J. Redders (jredders@fs.fed.us), anonymous, and P. Medina (pmedina@fs.fed.us). Original model reviewed by Brenda Wilmore (bwilmore@fs.fed.us).

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

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 4 Early Development 1 - All Structures

Indicator Species

Description

Bunchgrass-dominated. Dominant lifeform will be herbaceous, with <50% canopy cover and height of 0.4m. Most of the ground will be litter and bare ground. 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.

NAVI4 could be another indicator; however, it is thought that it might not occur as much in the southern MZs 27 and 33 1117 version due to the drier area. Sideoats grama could also be an indicator here.

There will be fire in this stage that will, over time, cull out some of the ponderosa pine seedlings. Modeled as low-severity fire occurring approximately every 12yrs. This was originally modeled (in MZs 27 and 33) as replacement fire since it's a grass stage primarily. However, since trees are in the upper canopy and because regional lead (RL) for MZs 27 and 33 did not want to imply that replacement fires occurred so often, it was changed to low-severity fire, more in line with other PIPO models.

Drought modeled as wind/weather stress, occurring every 50yrs, not causing a transition. Drought would open up areas -- could then be subject to pinyon-juniper invasion. Seedling recruitment of PIPO would decrease during drought.

Native grazing can occur. Alternate succession is modeled here as grazing disturbance that removes the herbaceous component and facilitates succession to the next stage, with a probability of 0.05.

Historically, there's probably a very small amount of this class -- i.e., 5-10% (whereas currently also very little in this class -- probably even <5%.)

*Maximum Tree Size Class*  
Seedling <4.5ft

Class B 13 Mid Development 1 - Open

Indicator Species

Description

Small and medium-sized ponderosa pine, with moderate bunchgrass cover. Dominant lifeform will be herbaceous, with canopy cover up to 50% cover and height of 1m. More mature stands of oak motts scattered in patches.

NAVI4 could be another indicator; however, it is thought that it might not occur as much in the southern MZs 27 and 33 1117 version due to the drier area. Arizona fescue could also be an indicator.

There will be maintenance fires on a periodic basis, which will suppress ponderosa pine regeneration and pinyon-juniper invasion and algerita expansion. (Currently, that is occurring without active management.) The trees that have established in this class have escaped the effects of the maintenance fires. Surface/low-severity fires maintain this class.

There would be much native grazing in this class -- deer, elk, turkey, and mountain quail; preferable class for them. However, not included in model because it's not causing a difference in the canopy and therefore don't want to put it in the model because then it's preventing succession.

This is the highest producing stage for the herbaceous vegetation. Resistant to erosion by wind and water in this class as well. This is also the best water-producing stage for springs and seeps.

Native grazing effect attributed to understory but not significant to transition overstory into another class. In other words, if there were overgrazing, this stage might go to a closed stage (i.e., could happen in current conditions).

Replacement fire occurs very infrequently.

Drought occurs every 50yrs and doesn't cause a transition.

Reference conditions -- probably ~15-20% on the landscape of this class. (Current probably about the same.)

Insect/disease just opens patches in stands. Occurs every 35yrs.

This class was originally modeled with taller trees of 5-25m. However, upon review and comparison with MZ28, Regional Lead for MZs 27 and 33 changed height to 5-10m, as MZ28 has better precipitation than MZ27 and there is more competition in MZ27 with grasses and trees; therefore, the heights could not vary as much.

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

Class C 83 Late Development 1 - Open

Indicator Species

Description

Large and very large old ponderosa pine (>149yrs), with medium to high cover of bunchgrasses. Bunchgrasses starting to decline and not quite as vigorous. Higher density of fescues. Less groundcover in this stage. Bare ground areas become more continuous. Under trees, less grass and continuous layer of duff. The duff can sometimes carry the fire. Difficult for herbaceous to germinate in duff.

NAVI4 could be another indicator; however, it is thought that it might not occur as much in the southern MZs 27 and 33 1117 version due to the drier area. Mountain muhly could also be an indicator here.

Old growth attributes include occasional down wood, snags, diseased trees. Disease more prevalent in mature stands. Insects also more prevalent. Insects and disease occur every 25yrs and cause no transition.

Maintenance burns still occurring and suppressing juvenile ponderosa pines and other tree species and maintain this stage.

Catastrophic replacement fires probably occurred in the range of 300-400yrs.

With lack of fire, Douglas-fir and white fir could invade. This could conceivably be another late successional stage. However, unsure if this occurred in historical conditions -- as burning by Native Americans was frequent. However, occurs in current conditions. These firs invading provide ladder fuels causing catastrophic crown fires in this BpS -- mostly happening in current conditions.

Grazing occurs on 10% of this class each year and causes no transition.

Drought also occurs every 50yrs, as in the other classes, and causes no transition.

Historically, most should be in this class.

This class was originally modeled in MZs 27 and 33 with taller trees of 25-50m. However, upon review and comparison with MZ28, RL changed height to 10-50m, as MZ28 has better precipitation than MZ27 and there is more competition in MZ27 with grasses and trees; therefore, the heights could not vary as much.

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

Model Parameters

Deterministic Transitions

Probabilistic Transitions

References

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 4(6): 513-532.

Brown, P.M, and W.D. Shepperd. 2001. Fire history and fire climatology along a 5o gradient in latitude in Colorado and Wyoming, USA. The Paleobotanist 50 (1): 133-140.

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

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 (4): 543-566.

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. Canadian Journal of Forest Research 30: 698- 711.

Marr, J.W. 1961. Ecosystems of the east slope of the Front Range in Colorado. University of Colorado Studies Series in Biology 8, Boulder, CO.

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. 2005. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: May 2, 2005).

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

Peet, R.K. 2000. Forests of the Rocky Mountains. Pages 75-122 in M. G. Barbour & W. D. Billings, (eds.). North American Terrestrial Vegetation. 2nd edition. Cambridge University Press, New York.

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, CO.

Swetnam, T.W. and C.H. Baisan. 1994. Historical fire regime patterns in the southwestern United States since AD 1700. Pages 11-32 in: C.D. Allen, ed. Fire effects in southwestern forests: proceedings of the second La Mesa fire symposium. General Technical Report RM-GTR-286. Fort Collins, CO: USDA Forest Service Rocky Mountain Forest and Range Experiment Station.

Swetnam, T.W. and A.M. Lynch. 1993. Multicentury, regional-scale patterns of western spruce budworm outbreaks. Ecological Monographs 63: 399-424.

Teague, K.R. 2004. The role of recent climatic variability on episodic Pinus ponderosa recruitment patterns along the forest-grassland ecotone of northern Colorado. MS Thesis, Univ. of Colorado-Boulder.

USDA-NRCS Ecological Site/Range Site Descriptions, Section II, Field Office Technical Guides. http://www.nrcs.usda.gov/Technical/efotg/.

USDA-NRCS Ecological Site Descriptions Ponderosa Loam, July 1984. Available online: http://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx.

USDA-NRCS Ecological Site Description, Limestone, August 2002. Available online: http://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx.

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.

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