**11320**

**Central Mixedgrass Prairie**

BpS Model/Description Version: Aug. 2020

**Reviewers:** Christine H. Bielski, Jessica L. Burnett, Victoria M. Donovan, Dirac Twidwell, and Carissa L. Wonkka. Derrick Holdstock reviewed map zone (MZ) 34.

**Vegetation Type**

Herbaceous

**Map Zones**

32, 34, 35

**Geographic Range**

This type historically occurs in western Kansas, western Nebraska, eastern Colorado, northeastern New Mexico, eastern Texas panhandle into central Texas, and along the western portion of Oklahoma proper. This Biophysical Setting (BpS) comprises the eastern half of MZ34 in ECOMAP (Cleland et al. 2007) sections 332F and 315C. This type occurs in the western half of MZ32 and in the northern half of MZ35 (west of Interstate 35).

**Biophysical Site Description**

This type occurs on sandy loam, loamy, or clayey upland sites of the southern Great Plains. In Texas and Oklahoma, elevations range from 275-915m (Wright and Bailey 1982). Precipitation ranges from 20-28in (Wright and Bailey 1982), although mixedgrass can occur on sites with up to 32in and occurs mostly from May through September.

**Vegetation Description**

Historically, vegetation was generally dominated by midgrass, with some areas occupied by tallgrasses or shortgrasses, as an effect of grazing, edaphic, and topographic conditions. (Species in order of dominance in boxes.) Dominant species include mostly midgrasses with some mix of tall and short grass -- sideoats grama (*Bouteloua curtipendula*), needlegrasses, little bluestem (*Schizachyrium scoparium*), *Bothriochloa barbinodis*, *Nassella leucotricha*, and *Eragrostis intermedia*. Tallgrasses such as yellow indiangrass (*Sorghastrum nutans*), big bluestem (*Andropogon gerardii*), and switchgrass (*Panicum virgatum*) also occur. Blue grama (*B. gracilis*) can be prevalent, especially following significant grazing and on poor sites. Forbs present can include purple prairie clover (*Dalea purpurea*), vervain (*Verbena bipinnatifida*), dotted gayfeather (*Liatris punctata*). Mesquite (*Prosopis glandulosa*), lotebush (*Ziziphus obtusifolia*), soapweed yucca (*Yucca glauca*), Juniper species, and prickly pear (*Opuntia* spp.) are present and may dominate large portions of the landscape under current conditions.

Shrubs included four-wing saltbush (*Atriplex canescens*), winterfat (*Krascheninnikovia lanata*), with lesser amounts of rabbitbrush (*Chrysothamnus nauseosus*), broom snakeweed (*Gutierrezia sarothrae*), fringed sage (*Artemisia frigida*), and sunsedge (*Carex inops* ssp. *heliophila*), present mostly in MZ34. In MZs 32 and 35, dominant shrub species include broom snakeweed (*Gutierrezia sarothrae*), shinnery oak (*quercus havardii*), sand sage brush, sumac (*reus glabra*), and chickasaw plum (*Prunus angustifolia*).

**BpS Dominant and Indicator Species**

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

**Disturbance Description**

Guyette et al. (2012) estimated mean fire return intervals (MFRIs) to be <2-4yrs. Frost (1998) suggested fire return intervals (FRIs) occurred between 1-6yrs.

No data or modeling information are available on the maximum or mean fire intensities possible for this vegetation type.

Episodic disturbance caused by insect infestation (grasshoppers, range caterpillars, Mormon crickets). Large herds of bison went through this system -- as well as deer and pronghorn. Grazing impact would be greatest in recently burned areas because grasses are more palatable and nutritious.

This is a drought-tolerant system. However, extended drought (>3-4yrs) will reduce cover.

Drought, grazing, and fire were probably most important disturbances historically.

In LANDFIRE National Model, there was a wind/weather/stress disturbance. In the 2017 BpS review, this disturbance was removed due to recent research by Arterburn et al. (2017) demonstrating that drought does not cause a meaningful shift in biomass or species composition in these systems (Arterburn et al. 2017).

Additionally, while other original pathways were retained, the Late2:CLS to Late2:CLS mixed fire was renamed “surface fire” and a Late2:CLS to Late1:CLS mixed fire was added. Additionally, in line with aforementioned Guyette and Frost papers, the replacement FRI was changed from 10yrs to 5yrs in the Early1:OPN class.

**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 is a matrix community -- small to large patches. Disturbances can also occur within a matrix -- small to large, huge patches. Driving variable is climate (drought, low rainfall, etc.), grazing, and to a lesser extent fire.

Between 1984 and 2014, 252 wildfires occurred within the Central Mixedgrass Prairie in MZ32 (MTBS 2016). The largest wildfire in MZ32 was >85,000ac, with a mean fire size of ~6500ac (MTBS 2016).

Between 1984 and 2014, 197 wildfires occurred within the Central Mixedgrass Prairie in MZ35 (MTBS 2016). The largest wildfire was 209,000ac in size, with a mean fire size of ~8400ac (MTBS 2016).

**Adjacency or Identification Concerns**

This system could be confused with shortgrass prairie to the west and tallgrass prairie to the east. Production is less in shortgrass versus mixedgrass prairie. Grasses are taller in mixedgrass than shortgrass prairie. These systems are intermixed, with the shorter grasses further west with less precipitation (other than the foothills areas).

Naturally occurring shrub-dominated areas on sandy soils, on deposits associated with riparian areas can be found throughout the mixedgrass prarie type. It is hard to distinguish whether these shrub areas should be considered as part of the mixedgrass or if they should be considered sand sagebrush or sand shinnery oak. At finer scales, these types are easily distinguished and likely can be mapped at 30m resolution as a shrub community rather than grass.

What adds to the confusion is that current overgrazing has transitioned large portions of the region from mixedgrass to shortgrass. In addition, the areas that have transitioned to a shortgrass prairie have also been invaded by woody shrubs, mainly honey mesquite (*Prosopis glandulosa*) and eastern redcedar (*Juniperus virginiana*).

What has historically been a mixedgrass prairie has been converted to row crops/ag. The mixedgrass prairie is primarily in rural areas, so there is not as much residential development; however, urbanization is coming at an alarming rate. Mixedgrass prairie is now extremely rare as a result of land conversion to agriculture and woody species invasion.

Current condition is a mesquite or mixed shrub-dominated landscape, resulting from spread of mesquite and loss of fire in the system.

**Issues or Problems**

A reviewer for MZs 32 and 35 indicated that both Class A and Class B could start immediately after a fire (i.e., age 0) and that grazing could be removed as a disturbance from the model because it is the grazing/fire interaction, which could be represented by the fire alone, that causes the transition between states in the model. The regional lead could not change the start age of Class A and Class B to 0 because LANDFIRE rules only allow one class to start at age 0. However, the regional lead did run the model without grazing, as suggested by the reviewer, and found that it did not change the class percents or the FRI. The regional lead chose to leave grazing in the model to maintain consistency with MZ34, but it should be recognized that the same results can be achieved if grazing is removed from the model. Furthermore, it should be recognized that there is an interaction between fire and grazing in this BpS even though the two disturbances are represented independently in the VDDT model.

**Native Uncharacteristic Conditions**

Mesquite (*P. glandulosa*), eastern redcedar (*Juniperus virginiana*), and Ashe’s juniper (*J. asheii*) have expanded well beyond their expected historical range and/or density. The introduction of cattle and their eating of the mesquite bean have promoted the expansion of the woody shrub. Also, overgrazing of the grasses has also allowed the mesquite to expand. Fire suppression has allowed eastern redcedar to encroach into grasslands.

**Comments**

Comments below are prior to 2017 BpS review.

For MZ35, this model was adopted without changes from the same BpS for MZ32.

For MZs 35 and 32, this model was adopted from the same BpS in MZ34 modeled by Delbert Bassett. Lee Elliott reviewed the model for MZ34 and altered it for MZs 35, 34, and 32. The same description and VDDT model now represent this BpS in MZs 35, 34, and 32. Sam Fulendorf reviewed this system for MZs 32 and 35.

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 39 Early Development 1 - Open

*Indicator Species*

*Description*

Class A is early succession stage. Grasses that exert more dominance in the early stages include western wheatgrass (*Pascopyrum smithii*) and tumble windmill grass (*Chloris verticillata*). Indicator grasses, such as blue grama (*Bouteloua gracilis*) and buffalograss (*Buchloe dactyloides*), will still be present but in lesser amounts than the climax community. Annual forbs such as broomweed (*Amphiachyris dracunculoides*), ragweed (*Ambrosia psilostachya*), and false mesquite (*Calliandra eriophylla*) will typically be present early.

In this early stage, grasses will be more nutritious and palatable, and grazing by bison, antelope, deer, rodents and lagomorphs would be common and maintain this class. Replacement fire might occur.

*Maximum Tree Size Class*  
None

Class B 37 Late Development 1 - Closed

*Indicator Species*

*Description*

This is the historic climax plant community with big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), switchgrass (*Panicum virgatum*), yellow indiangrass (*Sorghastrum nutans*), blue grama (*Bouteloua gracilis*), buffalograss (*Buchloe dactyloides*), sideoats grama (*Bouteloua curtipendula*), and hairy grama (*Bouteloua hirsuta*). For MZ 32, sideoats grama (*Bouteloua curtipendula*) and little bluestem (*Schizachyrium scoparium*) are the diagnostic species.

There would also be scatterings of black grama (*B. eriopoda*) and vine mesquite (*P. obtusum*) on heavier soils.

Scattered shrubs may be present (up to 10%, maybe up to 1m) -- honey mesquite, Ashe’s juniper (*Juniperus ashei*), Pinchot’s juniper (*Juniperous pinchotii*), and lotebush (*Ziziphus obtusifolia*), yucca (sandy sites), and elbowbush (*Forestiera pubescens*).

Multiple disturbance pathways exist and are determined by the distribution of species on site. The disturbance pathway following fire depends on fire intensity. High-intensity fire can cause juniper mortality. Low to moderate fire intensities will likely result in this class remaining in a late development state.

Given that one of the indicator species is mesquite, a resprouting tree, it is likely that portions of the land area dominated by mesquite will remain in the Late2 stage due to resprouting following replacement fire. There is some evidence, however, that high-intensity fires conducted during drought can cause high mortality of resprouting woody plants (Twidwell et al. 2016). In areas dominated by Ashe’s juniper, surface and mixed fires can cause high mortality and a return to early successional vegetation under (Twidwell et al. 2009, 2013).

Replacement fires occur more often in this class. Native grazing maintains this class. Drought, which by definition is not a permanent reduction in rainfall, is not capable of causing a state shift back to open grassland in this system (Twidwell et al. 2014; Breshears et al. 2016) Without disturbance, this class will succeed to class C.

*Maximum Tree Size Class*  
None

Class C 24 Late Development 2 - Closed

*Indicator Species*

*Description*

Shrubs -- honey mesquite, Ashe’s juniper (*Juniperus ashei*), lotebush (Ziziphus obtusifolia), yucca (sandy sites) and elbowbush (Forestiera pubescens). Native grazing maintains this class. Drought could drive this class to B.

Multiple disturbance pathways exist and are determined by the distribution of species on site. The disturbance pathway depends on fire intensity (Twidwell et al. 2013). High-intensity fire can cause juniper mortality. Low to moderate fire intensities will likely move this class to a late development – 1 class, or this class will remain in late development - 2 closed. Replacement fires occur in this class.

*Maximum Tree Size Class*  
None

Model Parameters

Deterministic Transitions

Probabilistic Transitions

References

Arterburn, J.R., Twidwell, D., Schacht, W.H., Wonkka, C.L. and Wedin, D.A., 2017. Resilience of Sandhills Grassland to Wildfire During Drought. Rangeland Ecology & Management.

Brown, James K. and Jane Kapler Smith, eds. 2000. Wildland fire in ecosystems: effects of fire on flora. Gen. Tech. Rep. RMRS-GTR-42-vol. 2. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station. 257 pp.

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

Dick-Peddie, W.A. 1993. New Mexico vegetation, past, present and future. Albuquerque, NM: Univ. New Mexico Press. Xxxii, 244 pp.

Engle, D. M., Coppedge, B. R., & Fuhlendorf, S. D. (2008). From the dust bowl to the green glacier: human activity and environmental change in Great Plains grasslands. In *Western North American Juniperus Communities* (pp. 253-271). Springer New York.

Ford, P.L. 1999. Response of buffalograss (Buchloe dactyloides) and blue grama (Bouteloua gracilis) to fire. Great Plains Research 9: 261-276.

Frost, C. C. (1998). Presettlement ﬁre frequency regimes of the United States: A ﬁrst approximation. In Fire in ecosystem management: shifting the paradigm from suppression to pre—scription (TL Pruden and LA Brennan, Eds). Tall Timbers Fire Ecology Conference Proceed—ings (No. 20, pp. 70-81).

Fuhlendorf, S.D. and D. Engle. 2004. Application of the fire grazing interaction to restore a shifting mosaic on tallgrass prarie. Journal of applied ecology 41: 604-614.

Fuhlendorf, S.D. and D. Engle. 2001. Restoring heterogeneity on rangelands: ecosystem management based on evolutionary grazing patterns. Bioscience 51: 625-632.

Fuhlendorf, S. D., Archer, S. A., Smeins, F., Engle, D. M., & Taylor Jr, C. A. (2008). The combined influence of grazing, fire, and herbaceous productivity on tree–grass interactions. In *Western North American Juniperus Communities* (pp. 219-238). Springer New York.

Guyette, R. P., Stambaugh, M. C., Dey, D. C., & Muzika, R. M. (2012). Predicting fire frequency with chemistry and climate. *Ecosystems*, *15*(2), 322-335.

Howard, Janet L. 1995. Buchloe dactyloides. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2005, May 4].

Miller, Greg et al. 1993. Terrestrial Ecosystem Survey of the Santa Fe National Forest. USDA Forest Service Southwestern Region.

Morrison, L. C., J. D. DuBois, and L. A. Kapustka. 1986. The vegetational response of a Nebraska Sandhills grassland to a naturally occurring fall burn. Prairie Naturalist 18:179–184.

MTBS Data Access: National Geospatial Data. (2016, April - last revised). MTBS Project (USDA Forest Service/U.S. Geological Survey). Available online: http://www.mtbs.gov/nationalregional/burnedarea.html [2016, April 29].

NatureServe. 2007. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA, U.S.A. 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 4, 2005).

Schmeisser, R. L., D. B. Loope, and D. A. Wedin. 2009. Clues to the medieval destabilization of the Nebraska Sand Hills, USA, from ancient pocket gopher burrows. Palaios 24:809–817.

Taylor, C. A., Twidwell, D., Garza, N. E., Rosser, C., Hoffman, J. K., & Brooks, T. D. (2012). Long-term effects of fire, livestock herbivory removal, and weather variability in Texas semiarid savanna. Rangeland Ecology & Management, 65(1), 21-30.

Twidwell, D., Fuhlendorf, S. D., Engle, D. M., & Taylor, C. A. (2009). Surface fuel sampling strategies: linking fuel measurements and fire effects. *Rangeland Ecology & Management*, *62*(3), 223-229.

Twidwell, D., Fuhlendorf, S. D., Taylor, C. A. and Rogers, W. E. (2013), Refining thresholds in coupled fire–vegetation models to improve management of encroaching woody plants in grasslands. J Appl Ecol, 50: 603–613.

Twidwell, D., W. E. Rogers, C. L. Wonkka, C. A. Taylor, and U. P. Kreuter. 2016. Extreme prescribed fire during drought reduces survival and density of woody resprouters. Journal of Applied Ecology.

Volesky, J. D., and S. B. Connot. 2000. Vegetation response to late growing-season wildfire on Nebraska Sandhills rangeland. Journal of Range Management:421–426.

Wright, H.A. and A.W. Bailey. 1982. Fire Ecology, United States and Southern Canada. John Wiley & Sons, Inc. New York.