11490

Western Great Plains Shortgrass Prairie

BpS Model/Description Version: Aug. 2020

Vegetation Type

Herbaceous

Map Zones

27, 38

Geographic Range

The range of this system is essentially limited to the Central Shortgrass Prairie and Southern Shortgrass Prairie ecogregions, although it may be peripheral in a few other ecoregions such as the Central Mixedgrass Prairie, Northern Great Plains Dry Steppe, and Osage Plains/Flint Hills Prairie (Comer et al. 2003).

This occurs in the southern Great Plains from northeastern to southeastern Colorado and south through western Oklahoma, eastern and northeastern New Mexico, and western Texas Panhandle. Historically, some stages of this type might have been less extensive than currently. This system probably didn't occur much throughout Kansas historically. But southeastern Colorado and the eastern third of Colorado, southwestern Kansas, and in southeastern Wyoming, it did occur. It does not/did not occur in the center of New Mexico, as that would be a desert grassland type. (However, it does occur on the western-facing piedmonts of the central mountain chains of New Mexico in the northern Rio Grande corridor.) Precipitation, grazing, and decadal fluctuations could have changed the historic distribution, and this is most likely to have occurred along the ecotone with the mixedgrass prairie (Lauenroth et al. 1994).

Some feel that this type does not occur/extend into the westernmost areas of New Mexico and the south/southwestern corner of map zone (MZ) 27, such as portions of ECOMAP subsections 315Ad western half, 315Ab, M313Bd, M313Bb, M331Fh, 321Ad, M313Bf, and M313Bg (Laurenroth and Milchunas 1991), which would be drier and desert grassland types. However, modelers from New Mexico state that this type does occur and is dominant historically and currently throughout most of MZ27, except for the southern portions of subsections 315Ad and Ab. In MZ38, this Biophysical Setting (BpS) would occur as small areas in the extreme western edge of the zone (subsection 315Fb perhaps?).

Shortgrass occurs mostly west of the Kansas border (although it also occurs in western Kansas) -- see precipitation gradients. However, west of Kansas, there is a mix of more productive shortgrass prairie and mixedgrass. West of the I-25 border is drier shortgrass. Some shortgrass, however, is in southwestern corner of Kansas. (Mixedgrass is in the northern portion of Kansas and in Nebraska.) There are north-south bands (isoclines) of productivity of shortgrass vegetation, corresponding to increased precipitation going east due to the rainshadow of the Rocky Mountains. See Lauenroth and Milchunas (1991).

The northern boundary is near the Colorado-Wyoming border at the 41°N latitude and extends south to latitude 32°N in western Texas (Laurenroth and Milchunas 1991).

Biophysical Site Description

This system occurs primarily on flat to rolling uplands with loamy, ustic soils ranging from sandy to clayey. In New Mexico, it is more aridic than ustic. This type typically occurs on loamy to clayey uplands (moderate to fine textures).

In New Mexico and Colorado, elevations range from 1,500-2,000m. In Kansas, elevations can be 1,000m.

Shortgrass prairie occurs dependent on precipitation gradients -- long-term precipitation patterns and north-south bands or isoclines of productivity of shortgrass vegetation, corresponding to increased precipitation going east due to the rainshadow of the Rocky Mountains.

Mean annual precipitation is ~300-500mm (Lauenroth and Milchunas 1991) (ranges from 8-14in and might go up to 16-18in in MZ27 New Mexico in the northeast), but there is a gradient into the mixedgrass prairie at the higher end, and there is a band against the Rocky Mountains that occurs in the ~350-375mm split, between drier versus wetter area. As you go east, it becomes wetter with higher precipitation, and you move out of the shortgrass system. In rainshadow, probably lower end of 10in in MZ33.

Most precipitation occurs in the summer months.

The windiest areas of the United States occur in the shortgrass steppe (Lauenroth and Milchunas 1991).

Vegetation Description

Historically, vegetation was dominated by shortgrass, and the subdominants were midgrasses and a small amount of shrubs. Dominant species include blue grama, western wheatgrass, needlegrasses (needle-and-thread more associated with sandier sites), buffalo grass (some question whether or not buffalo grass is more abundant currently versus historically in some areas; buffalo grass is the more sod-forming grass), with intermingled forbs. *Hesperostipa neomexicana* is more common on gravelly soils in New Mexico.

Shrub species such as *Artemisia frigida* (prairie sagewort), *Gutierrezia sarothrae* (broom snakeweed, which is cyclical and often abundant following drought or heavy grazing), *Artemisia filifolia* (not that common except on sandy sites), and *Chrysothamnus* (rabbitbrush) spp. may also be present. Other shrubs include four-wing saltbush, winterfat, with lesser amounts of rabbitbrush, broom snakeweed, fringed sage, and also plains prickly pear. Walking stick cholla, yucca glauca, ring muhly, and mat muhly, which would occur on soils with coarser texture control section in NM. (Ring muhly and mat muhly are also grazing increasers.) (Some feel that today, however, there is lower diversity -- with buffalo grass in Colorado, blue grama in New Mexico, and cactus and snakeweed increasing since historic times. However, this is not known for sure and is questioned by some.) Also *Sphaeralcea coccinea* is a common forb in New Mexico and the dominant forb in Colorado. Currently, there might be more mesquite widespread in the very southern end of New Mexico and low-statured, although historically it might have been present but not as prominent.

The dominant species list covers mostly MZ33-Colorado (NAVI4 was initially listed, but questioned by some, so it was removed and replaced by ARPU9). For New Mexico, other cool-season species include New Mexico feathergrass (http://lib.nmsu.edu/subject/agnic/introduction.html). Other elements in New Mexico: *Artemisia frigida*, *Yucca glauca*, *Muhlenbergia wrightii*, *Eragrostis intermedia*, *Pleuraphis jamesii*, *B. curtipendula*, and *Hesperostipa neomexicana*.

For MZ27-New Mexico, HENE5 might replace HECO26. ARFI2 might replace ARPU9.

BpS Dominant and Indicator Species

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

Disturbance Description

Large-scale processes such as climate, fire, and grazing influence this system. The often dry, semi-arid climate conditions can decrease the fuel load and thus the relative fire frequency within the system. However, historically, fires that did occur were often very expansive.

There is debate as to the mean fire return interval (MFRI) for this shortgrass system. Because of the lack of long-lived trees and because trees that do exist are in relatively productive sites, there is absolutely no way to reconstruct a reliable historic fire return interval (FRI). All estimates of historic FRIs must be based on those for surrounding vegetation types that do have means for reconstruction and then extrapolated based on differences in primary production and herbivore removal of fuel loads. Therefore, there is no means to directly obtain the estimate, and the range is varied. It depends on many factors -- portions will be drier, and portions will vary in frequency over time, and there will be decadal variation. There is a wide variability of MFRIs across this system, based on precipitation and fuel.

One camp feels that the MFRI was historically ~25-35yrs (Harvey Sprock, Terri Schulz, Rich Sterry, Este Muldavin et al. personal communication). Bison grazing created patchy fuels and therefore small fires at times. So FRI to one spot was longer than expected -- i.e., a fire can burn somewhere on the landscape often, but it may not necessarily return to the same spot for 25-50yrs or more (Chris Pague, Terri Schulz, and Harvey Sprock, personal communication).

However, another camp feels that the MFRI was shorter. It is thought that some of the differences and suggestions for a longer MFRI could come from present range management applications. It is thought that the range of MFRI in shortgrass for MZs 27 and 33 is between 5-20yrs, dependent on the precipitation gradient east to west (David Augustine, USFS, personal communication). Some feel, however, that 5yrs is too short, as that is more like a tallgrass system (multiple MZs 27 and 33 reviewers).

An arbitrary precipitation gradient between drier versus wetter somewhere around ~350-375mm annual precipitation delineates a change in fuels and fire behavior across the west-to-east gradient in precipitation/above-ground primary productivity. While there is no precise line, we may make a general rule of thumb that prescribed burns <375mm are generally more difficult to burn. Farther east, with a higher precipitation, it is easier to burn. At generally ~470mm, fire easily burns through the landscape (David Augustine, USFS, personal communication), especially where some growing season deferment occurs.

Some feel that in the western portion of MZs 27 and 33, the MFRI would be a little longer, in the 15-20yr range, whereas in the eastern portion, it would be shorter, in the 5-10yr range. It is a gradient. It is thought that the areas intergrading with mixedgrass would be even shorter as one goes farther east into western Kansas -- approximately 5yrs (David Augustine, USFS, personal communication).

Also both lightning-induced fire and spring fires set by Native Americans are recognized as important pre-European components of the fire regime (Williams 2003). The rates of lightning ignitions are high in both the wet and drier areas of the shortgrass. The shortgrass prairie also probably burned more frequently with Native Americans (Williams 2003).

Some studies from other systems have inferred a short historical FRI for the shortgrass (David Augustine, USFS, personal communication). The MFRI should be somewhere between the frequency from mixedgrass prairie to desert grassland. A review of the role of fire in desert grasslands indicated that the natural frequency of fire was probably on the order of every 7-10yrs (McPherson 1995). Even though this is a shortgrass system we're describing, production in the shortgrass is higher, so MFRI should be similar, even though historical grazing would have affected the MFRI in portions of the shortgrass more than others (David Augustine, USFS, personal communication). Studies on mixedgrass prairies indicate variable FRIs that typically range from 3-5yrs (Bragg and Hulbert 1976; Bragg 1986; Umbanhowar et al. 1996). Given rainfall on the shortgrass prairie that is intermediate between desert grasslands and mixedgrass prairie, historic fire frequency may have been between these estimates, i.e., on the order of 5-10yrs (David Augustine, USFS, personal communication). There are also good arguments for shortgrass having a higher MFRI either than desert or mixedgrass, primarily because the shortgrass region gets more dry lightning storms (higher ignition probability) than mixedgrass, and has more times of the year when fuels are dry and “ignitable” than mixed grass. The eastern two-thirds of MZs 27 and 33 shortgrass also has much more continuous fuels than the desert grasslands, hence there is a greater probability of large fires than the desert grasslands (David Augustine, USFS, personal communication). This is contested by others.

A counter-argument does not feel that shortgrass should be in between the desert grassland and mixedgrass intervals and should, rather, be longer. Both of those systems are more productive and less variable in terms of precipitation and therefore production, compared to shortgrass. This argument states that sandhills and bluestem (the references listed above regarding short FRIs in mixedgrass) are very productive special areas within the mixedgrass. Also note that in Zak et al. (1994), the productivity for desert grasslands is actually greater than that for shortgrass. This could be due to a variety of factors, some of which are timing, event size, longer growing season, or even methodology. Also, evidence from the Sevilleta suggests the desert grasslands may burn more readily than shortgrass, but they may not be as resilient (Este Muldavin, personal communication).

Augustine (personal communication) cites evidence of large fires historically as evidence of the shorter interval. Older examples include the following from Wright and Bailey (1982): “In the semiarid areas, big prairie fires in the past usually occurred during drought years that followed one to three years of above average precipitation, because of the abundant and continuous fuel. Consequently, wildfires traveled for many kms when the winds and air temperatures were high and relative humidity was low. An example is an account of a fire (Haley 1929) that started in the fall of 1885 in the Arkansas River country of western Kansas. It jumped the Cimarron River, burned across the North Plains of Texas, and did not stop until it reached the rugged Canadian River Breaks, a distance of 282 km (175 miles). About 0.4 million ha (1.0 million acres) of the XIT Ranch alone burned in Texas.”

However, some feel that there is little reason to believe that fires swept the shortgrass so often (5-10yrs) due to high variability. There may be a discrepancy about MFRI and the occurrence or records of some large fires. Some large fires occurred, and that probably is not rare. However, there is scant to no evidence in much of the shortgrass prairie that large fires are frequent in the same locations. Even the evidence stated above only reports on some fires -- all in different locations. Really small fires might also have been common but rarely occurred in the spot that another fire struck. Patchiness, lack of probability, and lack of opportunity were all players. We do not know how often fires occurred in the same location. We do not even know exactly how bison grazed the landscape nor how indigenous people used fire in the shortgrass. Most of the myths of these practices are myths indeed. In 15yrs in Colorado, there have been few repeat fires in shortgrass, i.e., at the same place. This may indicate that the FRI is long while fire itself is not particularly rare. This would match the rainfall pattern as well, i.e., rainfall is not easily predictable (Chris Pague, TNC, personal communication).

Some feel that the ecological reasons for a shorter interval might not be evident until near the mixedgrass.

Overlap in agreement between the long- versus short-interval perspectives probably occurs in the eastern edge of the shortgrass zone (i.e., Baca County and east as well as northeastern Colorado). There are likely to be more consistent fuels -- and probably a shorter FRI. There are also probably more dry strikes in shortgrass (but not consistently more fuel). The Palmer Divide might also have more fuels in most years.

However, there is also other evidence for a shorter interval in northeastern New Mexico. Ford and Johnson (2006) found that a 6yr dormant-season fire (i.e., burned once in 6yrs) as a fire treatment shows the potential for increased site production relative to “reference condition” unburned grassland, which might imply that shortgrass might have had a similarly short FRI. However, there is a question as to whether or not this would be similar to historic conditions, considering the prevalence of heavy grazers pre-settlement.

It was also thought that the MFRI in MZs 27 and 33 should be similar to that for shortgrass in MZ34, which is approximately 10-15yrs. The MFRI for shortgrass in Rapid Assessment (RA) model R3PGRs, which covered this same area, was 10 FRI. The MFRI for southern plains grassland in the FRCC model PGRA4 was approximately 10yrs, varying due to effects stated in this MZs 27 and 33 description. The MFRI for the original model from the MZ27 NM modelers was 15 FRI. In terms of having consistency across MZs and between MZs and between all sources of information and weighing all factors and resources, Regional Lead (RL) chose a similar interval of approximately 20-25yrs to account for the west-to-east gradient for these MZs and the confounding evidence and opinions. All modelers/reviewers informed.

Note that changing the MFRI from 22 to 15 or 10 only slightly altered percentages in each of the successional stages to where ~5% more was in A and 5% less in C. Also, Fire Regime Group (FRG) II is consistent.

Note that large fires might be currently rare in some areas due to several factors, including aggressive suppression action, fuels reduction caused by continuous grazing being more uniform across the landscape, heavy stocking, presence of roads, and discontinuous land ownership (checkerboard effect). In recent years, the combined extent of prescribed and wildland fires on the Grasslands has varied annually but has been ~0.5-2% of the total area or a FRI of >50yrs (coarse filter analysis of habitat conditions on the grasslands).

Fire return interval could be extended (longer return interval) by continuous ungulate grazing. FRIs are now occurring more infrequently -- over 50yrs (Harvey Sprock, Terri Schulz, and Rich Sterry, personal communication).

The shortgrasses that dominate this system are extremely drought- and grazing-tolerant. These species evolved with drought and large herbivores and, because of their stature, are relatively resistant to overgrazing. The shortgrass system adapted evolutionarily with historical heavy grazing (Milchunas et al. 1988). The FRIs for grazing varied. There were probably areas distant from water sources that were not grazed as heavily as those near water. However, the shortgrass steppe is probably the system with the highest intensity of grazing than other systems historically (Milchunas 2006; Lauenroth et al. 1994).

Black-tailed prairie dogs (BTPD) are an ecologically important component of the grazing regime in shortgrass prairie and would have occurred extensively. (Prairie dogs were less important both historically and currently in sandsage prairie, canyonlands, and riparian habitats due to edaphic and topographic limitations on burrow construction.) There were some very large towns, but there were also areas without any towns. Quantitative historical estimates of BTPD abundance are difficult to obtain, but the U.S. Fish and Wildlife Service estimated that about 160 million hectares (395 million acres) of potential habitat historically existed in the United States and that ~20% was occupied at any one time (Gober 2000). (Coarse filter analysis of habitat conditions on the grasslands.) Shortgrass has most of the suitable soil types for prairie dogs. In general, they need loamy or clay soil.

In historic times, there was frequent and broad-scale grazing by bison, elk, deer, pronghorn. Through growing season, bison might have been there for relatively short periods in some years; however, they might have been there longer in other years. There were also resident herds of bison in areas of Colorado. Historically, such areas would also have been populated by bison in sufficient numbers to support populations of wolves. Bamforth (1987) suggested that bison herds under relatively undisturbed conditions (prior to 1846) most often ranged in size from several hundred to several thousand.

Shaw and Lee (1997) reviewed diaries of European travels in the southern Great Plains from 1806-1857. Organized by historical period and biome type, the authors suggest populations of three major large herbivores -- bison, elk, and pronghorn -- changed in the first half of the 19th century; bison were most numerous on the shortgrass prairie prior to 1821, and pronghorn were most abundant on the shortgrass prairie between 1806-1820, again in the 1850s.

In drier areas in the western portion of MZs 27 and 33, distance from water was probably a factor in grazing gradients. Individual herds were probably tied to river drainages and migrations from those drainages.

The dry half of the Great Plains has high interannual rainfall variability, so historically, the population declined faster in dry years. This resulted in a time lag or temporal variability, in which density could be reduced greatly. Bison historically moved nomadically in response to vegetation changes associated with rainfall, fire, and prairie dog colonies. The time lag for return movements provided deferment during the regrowth period, which according to both historic and archeological records may have ranged from 1-8yrs (Malainey and Sherriff 1996 and others).

If there was a series of droughts followed by a wetter year, there would have been little grazing pressure, which would then result in higher severity or frequency of fire. Drought and grazing were probably most important disturbances historically and greatly influenced fire frequency and extent. This is a drought-tolerant system. However, extended drought (>3-4yrs) will reduce cover.

Historic variability in bison grazing appears to have been on the temporal and spatial scales of years and 10s to 100s of square miles, while current variability in livestock grazing is at scales of weeks to months and acres to several square miles (David Augustine, USFS, personal communication).

Insects were also a natural disturbance agent on the landscape -- grasshoppers, range caterpillars, Mormon crickets.

Note that we are also not modeling the white grub disturbance interaction, which could be an important disturbance. It can cause a shift in stages and could cause a large impact. Combined with drought, it could be highly impacting and could cause a similar impact as prairie dogs. However, it was not modeled.

A healthy shortgrass prairie system should support prairie dog complexes and viable populations of pronghorn, endemic grassland birds, and other Great Plains mammals.

However, currently in areas, there is overgrazing and continuous grazing, creating more areas heavily dominated by shortgrass (in areas where there might have been more mixedgrass) and increasing FRIs (less fire).

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 variables are climate (drought, low rainfall, etc.), grazing, and to a lesser extent fire.

In portions of the Western Great Plains, this system occurs in very large contiguous areas, and its resilience and resistance to large-scale disturbances make it function as a matrix-forming system (The Nature Conservancy 1998).

Adjacency or Identification Concerns

This system is similar to Kuchler's (1964) "*Bouteloua-Buchloe*" vegetation type except at the northern border (Lauenroth and Milchunas 1991).

This system occurs in the area corresponding to Kuchler's Plains Grassland PNVG and the RA's R3PGRs Shortgrass Prairie and FRCC PGRA4 Southern Plains Grassland.

This system could be confused with mixedgrass prairie. Production is less in shortgrass versus mixedgrass prairie. They can be distinguished -- higher occurrence of blue grama, thus shortgrass. If have more mixedgrasses, should be considered mixedgrass prairie. If have 50% or more midgrasses, would probably be mixedgrass.

Shortgrass occurs mostly west of the Kansas border; however, west of Kansas there is a mix of more productive shortgrass prairie and mixedgrass. Some shortgrass, however, is in the southeastern corner of Kansas. Mixedgrass is in the northern portion of Kansas and in Nebraska. There is a gradient into mixedgrass. West of approximately the I-25 border in Colorado, there is drier shortgrass. These boundaries are relevant to fuel loading. On the eastern border of MZ27, it also grades into mixedgrass prairie of small remaining quantities near Texas (those areas of Texas not in agriculture).

This system should not be confused with the desert grassland and plains mesa types occurring in the southern-skewing west/southwest corners of MZ27. See RA's depiction of the plains mesa and desert grassland types versus this shortgrass type. See RA PNVGs and Kuchler types and Laurenroth and Milchunas (1991) for historic potential. The desert grassland types have more tobosa, galleta grasses. Consider BpS 1122 Gyp, 1504 Bottomland Swale/Tobosa Flats, 1503 Loamy Plains, 1147 Foothill/Piedmont.

Some (John Tunberg, NRCS et al, Este Muldavin, personal communication), however, state that shortgrass occurs in all sections/subsections of MZ27 in New Mexico.

In MZ27 in New Mexico, in the west end near Las Vegas, it grades into pinyon-juniper (PJ) and ponderosa pine, as it does in Colorado near Trinidad.

This system could be adjacent to Foothill/Piedmont Grassland. It is also adjacent to desert grasslands in the south -- sand dune/mesquite dunelands in the south and east. It is also adjacent to tobosa plains in the south and gyp hills in the eastern end of MZ27 New Mexico east of Estancia. On the eastern edge of MZ27 in New Mexico, it is adjacent to playas scattered throughout (closed depressional wetland systems).

Some (Harvey Sprock, Terri Schulz, Rich Sterry et al., personal communication) feel that there is more shortgrass now than historically in areas at the ecotone with mixedgrass prairie -- due to management practices today. Shortgrass prairie has expanded currently due to continuous grazing. Central Mixedgrass Prairie has been greatly reduced currently due to agricultural conversion. In Colorado, some believe that historically there were lower-producing mixedgrass, but now it is shortgrass (Harvey Sprock, Terri Schulz, Rich Sterry et al., personal communication) and that even some of the shortgrass prairie today that would have existed historically is departed. Much is continuously grazed.

In contrast, Milchunas et al. (1998) consider the shortgrass to be climatically determined, with large herbivores and aridity being convergent selection pressures. Grazing and climatic cycles do, however, result in shifts in the location of the mixedgrass-shortgrass ecotone (Lauenroth et al. 1994). Research on short-duration grazing shows no difference with continuous grazing on plant community composition (Derner and Hart submitted). Long rest periods would be necessary to increase heterogeneity (Fuhlendorf and Engle 2001).

Currently, fire suppression and certain grazing patterns in the region have likely decreased the fire frequency from historical regimes, and it is unlikely that these processes could occur at a natural scale today.

A large part of the range for this system (especially in the east and near rivers) has been converted to agriculture. Areas of the central and western range have been impacted by the unsuccessful attempts to develop dryland cultivation during the Dust Bowl of the 1930s.

There is also much residential development in this system.

Currently, there are some non-natives - cheatgrass, kochia -- but not a big invasive problem.

Some mesquite hummocks might also occur currently in MZ27 New Mexico more than historically. Currently, there might be more mesquite widespread and low-statured, although historically it might have been present but not as prominent. If mesquite is >3ft high, it's a different BpS. There might be more mesquite, cholla, prickly pear currently -- which is uncharacteristic. There are few data on this, however.

There is also some encroachment of juniper into these grasslands currently in MZ27 New Mexico. If there is >10% juniper canopy cover in grasslands, that would be uncharacteristic.

In MZ27 in southeastern Colorado, this system might have been former prairie chicken habitat.

There are conflicting views about what this landscape looked like historically versus currently.

One viewpoint states that currently most of the landscape is in Class B. The departure in this system would be in the lack of classes A and C on the landscape today (Daniel Milchunas, CSU, and David Augustine, USFS, personal communication). This is because cattle have been evenly distributed throughout the landscape. Historically, there was a mix of heavily grazed, heavily disturbed areas, moderately grazed areas more distant from water, and lightly grazed areas even more distant from water, during low population cycles of bison or where bison had not returned recently. Management today, together with water improvements on the range, results in a relatively greater amount of the middle class. Management today is also removing prairie dogs and fire. Therefore, historically there were more disturbed areas (Class A) and undisturbed areas (Class C).

Another view, however (Harvey Sprock, Terri Schulz, Rich Sterry et al., personal communication), states that currently, continuous, heavy grazing practices have turned Class B stage more into Class A, the sod portion -- which didn't happen often historically. This opposing view also states that there is not much of the Class B, historic climax plant community today. This opposing view also states that the sod class Class A, which would have been a very small, localized condition historically, would be very prevalent today. Historically, the landscape would have just had small areas of continuous grazing or migration corridors.

Another similar viewpoint states that the go-back-cropland would be in Class A, and today there are extensive areas of abandoned Dust Bowl cropland that now have Blue grama sod with low cover and productivity. The surface soil horizon is eroded by wind and is no longer apparent. Bedrock is exposed in some areas (John Tunberg, Rex Pieper, and Clarence Chavez, personal communication). This viewpoint also states that most would be in the sod class today.

Grazers, combined with prairie dogs and fire, would allow the native bison grazers to beat up an area. That stage no longer exists today, which is in part why some of those shortgrass prairie grassland birds are in such significant decline today (Herkert 1994; Knopf 1994; Peterjohn and Sauer 1999).

Note that there is a difference in cover amounts between southern New Mexico MZ27 and northern New Mexico MZ27; however, the model and probabilities are the same. Also note some species order differences between southern and central shortgrass.

Issues or Problems

This system was originally modeled with two models -- one for Colorado MZs 27 and 33 and one for New Mexico southern version of MZ27. Even though there are monsoonal and climatic differences/factors -- differences in geography, moisture, and function -- between the two areas, those factors were easily textually represented. Therefore, the southern and central versions were combined into a more all-encompassing model for all of MZs 27 and 33, which includes southern and central shortgrass. Cover will be different between the two (state line – New Mexico vs. Colorado Raton Pass, Mesa de Maya), and this is described textually in the successional class descriptions. Note that there is a difference in cover amounts between southern New Mexico MZ27 and northern New Mexico MZ27; however, the model and probabilities are the same. Also note some species order differences between southern and central shortgrass.

There is some disagreement about historical versus current manifestation of this system.

Also instead of calling the classes early, mid, and late, which do not actually apply in shortgrass prairie and the different stages that we are describing, we are calling all of the stages “mid-development.” Succession in a grassland system does not abide by typical definitions as in a forested community. The stages of the grassland are created and/or maintained by disturbances or lack thereof.

Native Uncharacteristic Conditions

If grass is >1/2m, it would be uncharacteristic because it would be in a different BpS. Please see Adjacency/Identification Concerns for more issues and uncharacteristics.

Comments

The canopy cover information in the Succession Classes below are arbitrary and are only being used for LANDFIRE mapping purposes. Please note that this system should be distinguished on the ground by biomass and not cover. These covers do not reflect reality on the ground. Cover in Class A ranges from a low, mosaic-bare-ground cover to a high sod cover, which includes litter, too. It was originally suggested that Class A include 0-70% cover and Class B include 61-80% cover.

Alternate succession is used in two ways in this model: 1) in Class A to represent a pathway to Class B in the absence of fire and grazing (prairie dog or other grazing), which maintain A, and 2) in Class B to represent a pathway to Class C, the high biomass stage, in the absence of grazing and fire for multiple years.

MZ27 description was used for both MZ27 and MZ38 models, which are duplicates (except for rounding differences). Some comments specific to MZ38 were added for completeness.

For MZ38, this model was adopted from the same BpS in MZ33 by Randy Swaty (rswaty@tnc.org). Only minor editing of the description was done to fit the geographic range to MZ43, so the model was not changed.

The draft model for MZs 27 and 33 in Colorado was based on the model for the same BpS from MZ28 created by Galen Green, Wayne Robbie, and Anne Bradley and reviewed by Vic Ecklund and Chuck Kostecka. Modelers for the draft MZ33 and MZ27 CO model were Harvey Sprock (harvey.sprock@co.usda.gov), Terri Schulz (tschulz@tnc.org), Rich Sterry (richard\_sterry@fws.gov), Dan Nosal, and Keith Schulz. The model was changed significantly from MZ28 due to different climate, environment, and evolutionary history with grazing. However, after thorough review by multiple experts, the model was again changed significantly and a new model was adopted by the Regional Lead (RL) due to reasons identified within the description. Modeler names also changed. All were kept informed.

Furthermore, this system was originally modeled with two models -- one for Colorado MZs 27 and 33 and one for New Mexico southern version of MZ27. Even though there are monsoonal and climatic differences/factors -- differences in geography, moisture, and function -- between the two areas, those factors were easily textually represented. Therefore, the southern and central versions were combined into a more all-encompassing model for all of MZs 27 and 33, which includes southern and central shortgrass. Cover will be different between the two (state line – New Mexico vs. Colorado Raton Pass, Mesa de Maya), and this is described textually in the successional class descriptions. Modelers for the MZ27 NM draft version were Rex Pieper (rpieper@nmsu.edu), John Tunberg (john.tunberg@nm.usda.gov), Clarence Chavez (clarence.chavez@nm.usda.gov), and Lee Elliott (lelliott@tnc.org). Another reviewer for new version was Steve Kettler. Other reviewers for new version were Este Muldavin, Keith Schulz, and Paulette Ford.

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 21 Mid Development 1 - Open

Indicator Species

Description

Instead of calling the classes early, mid, and late, which do not actually apply in shortgrass prairie and the different stages that we are describing, we are calling all the stages “mid-development.” Succession in a grassland system does not abide by typical definitions as in a forested community. The stages of the grassland are created and/or maintained by disturbances or lack thereof.

Class A is the low biomass (0-1in based on the Robel pole density/visual obstruction method), heavy disturbance-dependent community. It combines two types of communities. One consists of the high-cover blue grama/buffalo grass sod that looks like a golf course (high cover in patches). The other is the low-cover bare soil, *Aristida*, and forb stage, which could have taller grasses than the sod, but they are spaced apart due to bare soil between. See biomass in Milchunas et al. (1994) and Milchunas and Lauenroth (1989) and basal cover for sod class by point frame in Milchunas et al. (1989).

There are relatively few cool-season grasses in this stage. There is always blue grama in this stage, as in the others. Cactus is present (and could even be a dominant in the Class A sod depending on soil type). *Aristida* is present, which increases with prairie dog colonies. Annual grasses -- sixweeks fescue, red threeawn, ragweed, annual forbs. (Currently, you would see non-native annuals in this class, such as cheatgrass and kochia -- only in the high biomass type, annuals and exotics are actually less abundant in the sod type than any other class [Milchunas et al. 1989; Milchunas and Lauenroth 1989; Milchunas et al. 1988]; the landscape might also have non-natives of bindweed on prairie dog towns today, but not historically.) On loamier or sandier sites, there is sand dropseed. For the southern New Mexico version, other indicator species are lemonweed, showy goldeneye, verbena.

Original draft model indicator species for the prairie dog stage also included ARPUL, AMPS, SPCR. Original indicator species for the sod stage also included OPPO.

There are low-intensity fires in the low-biomass, high-cover sod and relatively rare fire in the low-biomass, low-cover bare soil. Fires are spotty through here and not as frequent as in other stages.

This stage is produced by heavy grazing and long-term prairie dog colonies, which will maintain this stage long term. This stage can also be maintained by heavy continuous grazing if the area is near water. Also, if an area is burned and grazed, the high-cover version of this stage will be reached if not continuously grazed.

Grazing that gives adequate plant recovery periods occurs in this stage.

It is thought that there should be ~20-30% of this stage historically, based on historical prairie dog communities combined with bison grazing (Gober 2000; David Augustine, USFS, personal communication). However, the viewpoint that created this model feels that there is very little of this stage on the landscape today. Prairie dog plague today would also not allow this class to be maintained for long.

Another opposing viewpoint feels that the sod portion of this class would have been a very small, localized condition historically and that today it would be very prevalent. This view states that historically there would just have been small areas of continuous grazing or migration corridors.

This stage would also include buffalo wallows (Harvey Sprock, Terri Schulz, Rich Sterry et al., personal communication). (Today, it might be go-back-cropland.) It is also thought, however, that today there are extensive areas of abandoned Dust Bowl cropland that now have blue grama sod with low cover and productivity. The surface soil horizon is eroded by wind and is no longer apparent. Bedrock or subsoil/parent material is exposed in some areas (Harvey Sprock, Terri Schulz, Rich Sterry et al., personal communication). This view is questioned, however, by others.

Class A was originally modeled in the draft model as the prairie dog stage, as it would take a long time to move out of this stage due to the prairie dog communities. Class C was originally modeled as the sod class.

Also the New Mexico draft older version had a cover of 0-20% for the prairie-dog-type stage and the sod class with a cover of 41-50%.

*Maximum Tree Size Class*  
None

Class B 58 Mid Development 2 - Closed

Indicator Species

Description

Instead of calling the classes early, mid, and late, which do not actually apply in shortgrass prairie and the different stages that we are describing, we are calling all of the stages “mid-development.” Succession in a grassland system does not abide by typical definitions as in a forested community. The stages of the grassland are created and/or maintained by disturbances or lack thereof.

Class B is the mid-biomass (2-4in based on the Robel pole density/visual obstruction method), mid-cover stage. See biomass in Milchunas et al. (1994) and Milchunas and Lauenroth (1989).

This stage again consists of blue grama. Cactus is often present and could even be the second dominant depending on soil type. There are less needle-and-thread and western wheatgrass than in Class C. This also includes the “historic climax plant community” with blue grama, buffalo grass, western wheatgrass, galleta grass, green needlegrass (not in New Mexico much), fringed sage, New Mexico feather grass in the south. Historically, there would have been more midgrasses (Harvey Sprock et al., personal communication). In New Mexico, there would be scatterings of black grama, vine mesquite on heavier soils.

Grazing that allows adequate plant recovery periods occurs and can maintain this state, but heavy grazing can cause a transition to the early stage.

The current modelers (Augustine et al.) feel that currently most of the landscape is in Class B. However, another viewpoint feels that there probably is not much of Class B on the landscape today.

Scattered shrubs may be present (up to 15%, maybe up to 1m) – four-wing, winterfat. There might be scattered cholla in MZ27, east of Colorado Springs. Once cholla gets thick, shifts to another BpS.

Note that the draft New Mexico southern version of the Historic Climax Plant Community (HCPC) class had a cover of 21-40%.

*Maximum Tree Size Class*  
None

Class C 21 Mid Development 3 - Closed

Indicator Species

Description

Instead of calling the classes early, mid, and late, which do not actually apply in shortgrass prairie and the different stages that we are describing, we are calling all of the stages “mid-development.” Succession in a grassland system does not abide by typical definitions as in a forested community. The stages of the grassland are created and/or maintained by disturbances or lack thereof.

Class C is the high-biomass (4+in based on the Robel pole density/visual obstruction method), high-cover stage. See biomass in Milchunas et al. (1994) and Milchunas and Lauenroth (1989) and basal cover in Milchunas et al. (1989).

The same grasses are present as the previous. However, there are also more C3 perennial cool-season grasses. (However, some have questioned the increase in cool-season grasses with succession as being speculative. There are definite edaphic differences. Gravelly sites in New Mexico often support *H. neomexicana* even under intense grazing regimes.) Blue grama is still present and dominant. Needle-and-thread, galleta grass, and also western wheatgrass are more prominent. Note also that more annuals and exotics occur in the ungrazed than in the heavily grazed sod class (Milchunas et al. 1989; Milchunas et al. 1992).

Scattered shrubs may be present -- snakeweed, prickly pear cactus.

This stage is arrived at through lack of fire and grazing; although, while already in this stage, fire would be more likely to occur due to the increased biomass.

Fire and grazing together can cause a state transition. Fire alone may not cause a transition but can especially on coarser-textured soils.

Prairie dogs are unlikely to occur in this class, but when they do, they will occur as a patch within the matrix and can cause a state transition.

As per the current modelers (Augustine et al.), it is thought that there should be ~10-20% of this stage historically. However, there might be very little of this stage on the landscape today, although some feel that there might be a large amount of it on the landscape today in New Mexico.

*Maximum Tree Size Class*  
None

Model Parameters

Deterministic Transitions

Probabilistic Transitions

Optional Disturbances

Optional 1: prairie dogs

Optional 2: heavy grazing and fire

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