LANDFIRE Biophysical Setting Model

***Biophysical Setting* 3111490** **Western Great Plains Shortgrass Prairie**

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

General Information

Contributors (also see the Comments field) **Date** 2/2/2007

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Vegetation Type
Upland Grassland/Herbaceous

General Model Sources
☑ Literature
☑ Local Data
☑ Expert Estimate

Dominant Species
BOGR2
PASM
SPCR
ATCA2
KRLA2
HECO26
BUDA
ARPU9

Map Zone
31

Model Zone
☐ Alaska
☐ California
☐ Great Basin
☐ Great Lakes
☐ Hawaii
☐ Northeast
☑ Northern Plains
☐ N-Cent.Rockies
☐ Pacific Northwest
☐ South Central
☐ Southeast
☐ S. Appalachians
☐ Southwest

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 CO and south through western OK, eastern and northeastern NM, and the west Texas Panhandle. Historically, some stages of this type might have been less extensive than currently. This system probably didn't occur much throughout KS historically. But southeastern CO and the eastern third of CO, southwestern KS, and in southeastern WY, it did occur. It does not/did not occur in the center of NM, as that would be a desert grassland type. (However, it does occur on the western facing piedmonts of the central mountain chains of NM 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 NM and the south / southwest corner of MZ27 such as portions of of ECOMAP subsections 315Ad western half, 315Ab, M313Bd, M313Bb, M331Fh, 321Ad, M313Bf and M313Bg (Lauenroth and Milchunas 1991), which

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would be drier and desert grassland types. However, modelers from NM 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.

Shortgrass occurs mostly west of KS border (although it also occurs in western KS) - see precipitation gradients. However, west of KS there is a mix of more productive shortgrass prairie and mixedgrass. West of I-25 border, is drier shortgrass. Some shortgrass however, is in southwest corner of KS. (Mixedgrass is in the northern portion of KS and NE.) 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 CO-WY border at the 41° N latitude, and extends south to latitude 32° N in western TX (Lauenroth and Milchunas 1991).

For MZ31, this occurs maybe just on the fringes of NE, in the very far western part of MZ31.

Biophysical Site Description

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

In NM and CO, elevations range from 1500-2000m. In KS, elevations can be 1000m.

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 approximately 300-500mm (Lauenroth and Milchunas 1991) (ranges from 8-14in and might go up to 16-18in in MZ27 NM 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 approximate 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 the rainshadow, precipitation is probably the lower end of 10in in MZ33.

Most precipitation occurs in the summer months.

The windiest areas of the US 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), buffalograss (some question whether or not buffalograss is more abundant currently versus historically in some areas; buffalograss is the more sod-forming grass), with intermingled forbs. Hesperostipa neomexicana is more common on gravelly soils in NM.

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 is 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

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and also plains prickly pear, in NM - 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 buffalograss in CO, blue grama in NM, and cactus and snakeweed increasing since historic. However, this is not known for sure and is questioned by some.) Also - Sphaeralcea coccinea is a common forb in NM and the dominant forb in CO. Currently, there might be more mesquite widespread in the very southern end of NM and low-statured, although historically it might have been present but not as prominent.

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

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 MFRI for this shortgrass system. Because of the lack of long-lived trees, and trees that do exist are in relatively productive sites, there is absolutely no way to reconstruct a reliable historic fire return interval. All estimates of historic fire return intervals must be based on those for surrounding vegetation types that do have means for reconstruction, and then extrapolating 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 MFRI across this system, based on precipitation and fuel.

One camp feels that the MFRI was historically approximately 25-35yrs (Harvey Sprock, Terri Schulz, Rich Sterry, Este Muldavin, et al. pers comm). Bison grazing created patchy fuels, and therefore small fires at times. So return interval 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, Harvey Sprock, pers comm).

However, another camp feels it 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, pers comm). Some feel, however, that five years is too short, as that is more similar to a tallgrass system (multiple MZs 27 and 33 reviewers).

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

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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 further east into western Kansas - approximately five years (David Augustine, USFS, pers comm).

Furthermore, 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 fire return interval for the shortgrass (David Augustine, USFS, pers comm). 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, and 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, pers comm). Studies on mixedgrass prairies indicate variable fire return intervals 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 five to 10yrs (David Augustine, USFS, pers comm). There are also good arguments for shortgrass having a higher MFRI either than desert or mixedgrass, primarily because 1) 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 mixedgrass. The eastern 2/3 of MZs 27 and 33, shortgrass, also has much more continuous fuel than the desert grasslands, hence greater probability of large fires than the desert grasslands (David Augustine, USFS, pers comm.). 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 shortgrasses. This argument states that sandhills and bluestem (the references listed above re: short MFRIs in mixedgrass) are very productive special areas within the mixedgrass, not really mixedgrass and not the drier 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 being timing, event size and 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, pers comm).

Augustine (pers comm.) cites evidence of large fires historically as evidence of the shorter interval. Older examples include 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 KS. It jumped the Cimarron River, burned across the North Plains of TX, and did not stop until it reached the rugged Canadian River Breaks, a distance of 282 km (175 miles). Approximately 0.4 million ha (1.0 million acres) of the XIT Ranch alone burned in TX."

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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 CO there have been few repeat fires in shortgrass, i.e., at the same place. This may indicate that the return interval 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, pers comm.).

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 northeast CO). There are likely to be more consistent fuels -- and probably a shorter MFRI. 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 northeast NM. Ford and Johnson (2006) found that a six-year dormant-season fire (i.e. burned once in six years) 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 return interval. 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 model R3PGRs, which covered this same area, was a 10yr MFRI. 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 a 15yr MFRI. In terms of having consistency across mapzones and between mapzones, and between all sources of information, and weighing all factors and resources, the regional lead (RL) chose a similar interval of approximately 20-25yrs to account for the west to east gradient for these mapzones and the confounding evidence and opinions. All modelers/reviewers informed.

Note that changing the MFRI from 22yrs to 15yrs or 10yrs only slightly altered percentages in each of the successional stages to where approximately five percent more was in A and five percent less in C. Also, FRG 2 is consistent.

Note that large fires might be currently rare in some areas due to several factors, including aggressive suppression action, fuels reduction due to 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 approximately 0.5-2% of the total area, or a fire return interval of >50yrs (Coarse filter analysis of habitat conditions on the grasslands).

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Return interval for fire could be extended (longer return interval) by continuous ungulate grazing. Fire return intervals are now occurring more infrequently - over 50yrs (Harvey Sprock, Terri Schulz, Rich Sterry, pers comm).

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 return intervals 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 US Fish and Wildlife Service estimated that about 160 million hectares (395 million acres) of potential habitat historically existed in the US, and about 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 and pronghorn. Through growing season, bison might have been there for relatively short periods in some years; however they might have been there longer on other years. There were also resident herds of bison in areas of CO. 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 (<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 to 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 nineteenth century; bison were most numerous on the shortgrass prairie prior to 1821, pronghorn were most abundant on the shortgrass prairie between 1806 and 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 for which according to both historic and archeological records may have ranged from 1-8yrs (Malainey and Sherriff 1996 and others).

If there were a series of droughts followed by a wetter year, there would have been little grazing pressure, which would then result in a 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

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tolerant system. However, extended drought (over 3-4yrs) will reduce cover.

Historic variability in bison grazing appears to have been on the temporal and spatial scales of years and tens to hundreds 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, comm).

Insects were also a natural disturbance agent on the landscape - grasshoppers, range caterpillars and 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. It combined with drought 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, 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 fire intervals (less fire).

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 by a higher occurrence of blue grama which would indicate shortgrass. If there is more mixedgrasses, it should be considered mixedgrass prairie. If there are 50% or more midgrasses, it would probably be mixedgrass.

Shortgrass occurs mostly west of the KS border; however, west of KS there is a mix of more productive shortgrass prairie and mixedgrass. Some shortgrass however, is in the southeast corner of KS. Mixedgrass is in the northern portion of KS and NE. There is a gradient into mixedgrass. West of approximately the I-25 border in CO, 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 TX (those areas of TX not in agriculture).

This system should not be confused with the desert grassland and plains mesa types occuring 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 and 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, pers comm), however, state that shortgrass occurs in all sections/subsections of MZ27 in NM.

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In MZ27 in NM, in the west end near Las Vegas, it grades into pinyon-juniper (PJ) and ponderosa pine, as it does in CO 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 east end of MZ27 NM east of Estancia. On the eastern edge of MZ27 in NM, it is adjacent to playas scattered throughout (closed depressional wetland systems).

Some (Harvey Sprock, Terri Schulz, Rich Sterry et al., pers comm) 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 CO, some believe that historically had lower producing mixedgrass, but now it is shortgrass (Harvey Sprock, Terri Schulz, Rich Sterry et al., pers comm) 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) considers 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 2006). 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 such as cheatgrass and kochia, but there is not a big invasive problem.

Some mesquite hummocks might also occur currently in MZ27 NM 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 over three feet high, it's a different BpS. There might be more mesquite, cholla and prickly pear currently - which is uncharacteristic. There is little data on this, however.

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

In MZ27 in southeast CO, this system might have been former prairie chicken habitat.

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

One viewpoint states that currently, today, most of the landscape is in class B. The departure in this system would be in the lack of the classes A and C on the landscape today (Daniel Milchunas, CSU and David Augustine, USFS, pers comm). This is because cattle have been evenly distributed throughout the landscape. Historically, there were 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., pers comm), 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, that would have been a very small, localized condition historically. However, today, it would be very prevalent. 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, Clarence Chavez, pers comm). 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 NM MZ27 and northern NM MZ27; however, the model and probabilities are the same. Also note some species order differences between southern and central shortgrass.

Native Uncharacteristic Conditions

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

Scale Description

This is a matrix community consisting of small to large patches. Disturbances can also occur within a matrix of small to large-huge patches. Driving variable is 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).

Issues/Problems

This system was originally modeled with two models – one for CO MZs 27 and 33 and one for NM

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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 - NM vs CO 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 NM MZ27 and northern NM 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.

Also - Please note that the covers in the dropdown boxes in this system 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.

Comments

This model for MZ31 was adopted as-is from the model from the same BpS from MZs 27 and 33 created by Daniel Milchunas, David Augustine, Harvey Sprock and many others and reviewed by Chris Pague, Rex Pieper, Terri Schulz and many others. No changes were made or review obtained for MZ31, as it is thought to just be on the fringes coming in from the adjacent mapzones.

The draft model for MZ33 and MZ27 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 havery.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 through 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 kept informed. Furthermore, this system was originally modeled with two models - one for CO MZs 27 and 33 and one for NM 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 - NM vs CO 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.go, and Lee Elliott lelliott@tnc.org. Other reviewers for the new version was Steve Kettler, Este Muldavin, Keith Schulz and Paulette Ford.

The model for MZ28 was adapted from the Rapid Assessment model R3PGRS, which was reviewed by B. Baker (bakerwl@wyo.edu). Minor edits made on 5/6/2005 by Mike Babler, mbabler@tnc.org, changed some species and classes.

**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

The Rapid Assessment model was originally based on the FRCC model PGRA6. Review suggest combining all plains grasslands. Because of species composition differences, and class differences, 1147 and 1149 were not combined.

Vegetation Classes

Class A **20 %**

Mid Development 1 Open

Upper Layer Lifeform

- [x] Herbaceous
- [ ] Shrub
- [ ] Tree

Fuel Model

1

Indicator Species and Canopy Position

BOGR2
Upper
BUDA
Upper
ARIST
Upper
VUOC
Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	20 %
Height	Herb 0m	Herb 0.5m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Please note that the covers in the dropdown boxes in this system 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, since the cover in class A actually ranges from a low, mosaic-bare-ground cover to a high sod-cover, which includes litter too. Due to mapping constraints and past issues with mapping herbaceous cover and resultant errors, this class A is being set at 0-20% even though it was originally suggested to be 0-70%. Either way, these covers do not reflect reality on-the-ground. Remote sensing will show part of this stage as litter plus vegetation.

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 A is the low biomass (0-1in based on the Robel pole density / visual obstruction method), heavy disturbance dependent community. It combines 2 types of communities. One consists of the high cover blue grama and buffalograss 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).

Please note that this system should be distinguished on-the-ground by biomass and not cover, since the cover in class A actually ranges from a low, mosaic-bare-ground cover to a high sod-cover, which includes litter too. Due to mapping constraints, we are defining dropdown boxes on cover; however this stage could go up to 70% cover, including litter, with very low biomass. Basal cover for high cover sod is approximately 45% or higher if including litter. Basal cover for low cover prairie dog area is approximately 20-25% cover. On-the-ground, this class should be distinguished by biomass.

**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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 three-awn, ragweed and 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 in prairie dog towns today, but not historically.] On loamier or sandier sites, there is sand dropseed. For the southern NM version, other indicator species are lemonweed, showy goldeneye and verbena.

Original draft model indicator species for the prairie dog stage also included ARPUL, AMPS and 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. They do not cause a change in 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.

If there is no fire and no prairie dog or heavy grazing maintaining this stage, then in approximately 5-10yrs, this stage will transition to the class B stage. This was modeled as "alternate succession" occurring as a probability of 0.1, for modeling purposes.

Drought occurs.

It is thought that there should be approximately 20-30% of this stage historically, based on historical prairie dog communities combined with bison grazing (Gober 2000; David Augustine, USFS, pers comm). However, the viewpoint which 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 today.

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., pers comm). (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., pers comm). This view is questioned, however, by others.

Class A was originally modeled in the draft model as the prairie dog stage lasting 20yrs, 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

**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

sod class.

Please note that the covers in the dropdown boxes in this system 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, since the cover in class A actually ranges from a low, mosaic-bare-ground cover to a high sod-cover, which includes litter too. Due to mapping constraints and past issues with mapping herbaceous cover and resultant errors, this class A is being set at 0-20% even though it was originally suggested to be 0-60%. Either way, these covers do not reflect reality on-the-ground. Remote sensing will show part of this stage as litter plus vegetation.

Note that the NM southern version had a canopy closure of 0-20% for the prairie-dog-type stage class A and 41-50% for the sod class.

Class B **60 %**

Mid Development 2 Closed

Upper Layer Lifeform

- [x] Herbaceous
- [ ] Shrub
- [ ] Tree

Fuel Model

1

Indicator Species and Canopy Position

BOGR2
Upper
PASM
Upper
BUDA
Upper
STIPA
Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	21 %	80 %
Height	Herb 0m	Herb 0.5m
Tree Size Class	None	

- [x] Upper layer lifeform differs from dominant lifeform.

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

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, buffalograss, western wheatgrass, galleta grass, green needle grass (not in NM much), fringed sage and New Mexico feathergrass in the south. Historically, there would have been more midgrasses (Harvey Sprock, et al., pers comm). In NM, there would be scatterings of black grama, vine mesquite on heavier soils.

Fire does occur in this stage. If there is 1-2yrs of no grazing or 4-10yrs of no fire, then 4-10yrs post-fire, this class would transition to the high biomass class C stage. This was modeled as "alternate succession" occurring as a probability of 0.05, for modeling purposes.

Prairie dogs could occur in this stage. If they do, the long-term prairie dog grazing causes a transition to class A.

**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

Proper grazing that allows adequate plant recovery periods occurs but does not cause a transition. With heavy grazing, this class could transition to class A.

Drought was modeled with a probability of every 40yrs and causes no transition.

The current modelers (Augustine, et al) feel that currently, today, 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.

Please note that the covers in the dropdown boxes in this system 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. Due to mapping constraints and past issues with mapping herbaceous cover and resultant errors, this class B is being set at 21-80% even though it was originally suggested to be 61-80%. Either way, these covers do not reflect reality on-the-ground.

Class C **20 %**

Mid Development 3 Closed

Upper Layer Lifeform

- [x] Herbaceous
- [ ] Shrub
- [ ] Tree

Fuel Model

2

Indicator Species and Canopy Position

BOGR2
Upper
HECOC8
Upper
PASM
Upper
STIPA
Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	81 %	100 %
Height	Herb 0m	Herb 0.5m
Tree Size Class	None	

[x] Upper layer lifeform differs from dominant lifeform.

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

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 (4in+ 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 NM 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).

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 does occur in this stage. If there is fire and then grazing, this will over time transition to class B, and with long-term heavy grazing to class A. Fire alone may not cause a transition, but can especially on coarser textured soils and also when fire occurs with heavy grazing. Regular grazing can just move the class to class

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

B.

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

Drought occurs.

As per the current modelers (Augstine, et al), it is thought that there should be approximately 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 NM.

Please note that the covers in the dropdown boxes in this system 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.

Class D **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

Indicator Species and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	%	%
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class E **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

Indicator Species and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	%	%
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

Fire Regime Group:** II

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

- [x] Literature
- [x] Local Data
- [x] Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	22			0.04545	100
Mixed					
Surface					
All Fires	22			0.04547	

Fire Intervals (FI):

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

Additional Disturbances Modeled

- [ ] Insects/Disease
- [x] Wind/Weather/Stress
- [x] Native Grazing
- [ ] Competition
- [x] Other (optional 1) prairie dogs
- [x] Other (optional 2) heavy grazing and fire

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