

LANDFIRE Biophysical Setting Model

Biophysical Setting 2911410

Northwestern Great Plains Mixedgrass Prairie

☒ This BPS is lumped with: 1150

☐ This BPS is split into multiple models: 1150 Tallgrass Prairie was lumped into the Mixedgrass Prairies 1132 and 1141, as we don't want to map this 1150 BpS for these mapzones. We would have to have a "fine-tooth comb" to do as such. There are individual associations of tallgrass in extreme northeast Montana, but not tallgrass communities. We might have 1/4 acre of the plant associations - andropogon, hali, but not a whole system. The tiny inclusions of tallgrass would just be a portion of a mixedgrass community. If 1150 does occur in MZs 29 or 30, it might be in small, small areas, and it might not be able to be mapped. Tallgrass communities are in MZs 39 and 40. In MZs 29 and 30 only in small microsites - some species but not much. There is not tallgrass prairie west of the Missouri River historically.

General Information

Contributors (also see the Comments field)

Date 4/6/2006

Modeler 1 Shannon Downey sdowney@blm.gov

Reviewer Steve VanFossen Steve.VanFossen@mt.usda.gov

Modeler 2 Steve Cooper scooper@mt.gov

Reviewer Brian Martin bmartin@tnc.org

Modeler 3 Jeff DiBenedetto jdBenedetto@fs.fed.us

Reviewer Jon Siddoway jon.siddoway@mt.usda.gov

<u>Vegetation Type</u>	<u>Dominant Species</u>	<u>Map Zone</u>	<u>Model Zone</u>	
Upland	PSSP6	29	☐ Alaska	☐ Northern Plains
Grassland/Herbaceous	NAVI4		California	N-Cent.Rockies
<u>General Model Sources</u>	PASM		☐	☒
☒ Literature	HECOC8		☐ Great Basin	☐ Pacific Northwest
☒ Local Data	SCSC		☐ Great Lakes	☐ South Central
☒ Expert Estimate	KOMA		☐ Hawaii	☐ Southeast
	POSE		☐ Northeast	☐ S. Appalachians
	BOGR2			☐ Southwest

Geographic Range

This vegetation group covers the northern prairies east of the Rocky Mountains from north central MT to southeastern MT and northeastern WY.

This BpS occurs in every section throughout the MZ20. It occurs predominantly in subsections 331Dh (central and eastern portion) and 331La.

Subsection 331La coincides quite closely to the Brown Central Glaciated Plains MLRA52, as defined by the NRCS. The central and eastern part of 331Dh coincides with Northern Glaciated Plains MLRA. Also - MLRA 58a includes southeastern MT. This BpS also resides in MLRA53A Northern Dark Brown Glaciated Plains, Northern Rolling High Plains, MLRAs 58A,B,C,D, and Pierre Shale Plains, MLRAs

**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.

60A and 60B.

This system's extent also coincides with EPA Ecoregions Level III and IV, 42-Northern Glaciated Plains, 43n-Montana Central Grasslands, 43m-Judith Basin Grasslands, 43o-Montana Unglaciated high Plains, and 43a-Missouri High Plateau (Woods et al 2002).

Historically, this BpS could also have extended throughout the subsections for 331Kb, most of d, f and e; in present, it might be more of a shrub community.

This BpS occurs in every subsection throughout the MZ29 and 30. It occurs predominantly depending on soil types and precipitation zones. It typically does not occur within mountain subsections. Mixedgrass prairie is the dominant vegetation type in the Northern Great Plains Steppe Ecoregion.

For the lump of 1150 Tallgrass Prairie with this type (1141): we would "have to have a fine-tooth comb" to map tallgrass prairie in these mapzones. There are individual associations in extreme northeast MT, but not tallgrass communities. There might be 1/4 acre of plant associations, but not a whole system. It is thought that Tallgrass Prairie 1150 system occurs mostly in Eastern Dakotas and NE, and maybe just small areas north of the Black Hills. This will not be found in the western part of MZ30, rather only the eastern part of MZ30 in small patches.

Biophysical Site Description

Elevations range from 1900-4000ft, or up to 6500ft in MZ29. The continental climate entails long cold winters, hot summers with low humidity and strong winds between November through April.

The northwestern part of this BpS is characterized by Chinook winds in winter commonly resulting in "red belt mortality" in adjacent coniferous forests (Van Fossen, pers comm).

Mean annual precipitation is generally 10-15in with most falling as rain or snow from April through June. The western part of this BpS is characterized by C3-cool-season plants and the eastern part of the BpS has an increase in abundance of C4-warm season plants, almost to the point of dominance in the plant community.

Occurs ubiquitously across soil types, except alkaline flats. Kinds, amounts and proportions of plants vary widely relative to soil texture, soil depth, percent slope and aspect. Bunchgrass communities dominate on shallow soils. Mid, short and bunchgrass communities comprise the remainder.

Topography is level to sloping.

Reviewers of this model (B.J. Rhodes, Bill Volk and John Carlson) for MZ20 stated that this system resides in the soil survey studies done by NRCS, and that their original modeling for this effort relied heavily on the Ecological Site Descriptions for MLRA 52 (USDA-NRCS 2004), 58A, 60B (USDA-NRCS 2003). However, MLRA 52 is dominantly deep, well drained clay loam, clay and loam textures, whereas MLRA 58A and 60B have a significant component of moderately deep and shallow silt loam, silty clay loam and loam soils (Van Fossen, pers comm). It has been suggested by one reviewer that Glaciated Plains be separated from Northern Rolling High Plains. However, this model was not split as such.

In terms of the tallgrass prairie 1150 (B. Martin): This BpS occurs in little depressional areas with greater than 16in precipitation in the area, in riparian stringers. It is too dry in MZs 29 and 30 for this

****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.**

type to occur but rarely.

Vegetation Description

The vegetation is dominated by cool and warm season perennial grasses (50-85% canopy cover). Grama grasses, rhizomatous grasses (western and thickspike wheatgrass, etc.) dominate the visual aspect of the community, though bunchgrasses (bluebunch wheatgrass, needle grasses, etc.) often comprised more than 50% of the community composition.

The timing of precipitation/precipitation flushes that occur in mid-June through mid-July, as one moves from west to east geographically, result in warm season grasses that are more prominent than cool season grasses. As go further east and north, MT and ND have a more typical ustic moisture regime and frigid temperature regimes. As one moves further west, there is a more aridic ustic frigid temperature regime. SD is more typical ustic; mesic as one moves further south (WY, south SD), due to latitudinal gradients and changes in elevation. Western (MLRA52) versus Eastern (MLRA53) Glaciated Plains: typical ustic - capture timing of precipitation changes. Eastern captures more warm season grasses, including, side oats grama, little bluestem, sand bluestem in sandy areas, big bluestem and prairie sandreed.

Thickspike wheatgrass (*Elymus macrourus*) (on lighter soils) and western wheatgrass (on heavier soils) are also present. CALO can also be a dominant species. Idaho fescue is a community dominant in MZ29 where precipitation is greater than 17in (Ashland Ranger District). Prairie sandreed and upland sedges occupy sandy textured soils throughout MZs 29 and 30. Bluebunch wheatgrass is more prevalent within WY and eastern MT in MZ29. Bluebunch only occurs on shallow sites, and occurs more on the west. Bluebunch more in MZ20 vs MZ29.

Carex filifolia also present, but not that prominent.

A diverse array of perennial summer forbs (black samson, scurfpea, prairieclovers, flax, dotted gayfeather, scarlet globemallow, etc.) occupy 10% of the community.

Shrubs and sub-shrubs (Wyoming big sagebrush, silver sagebrush, rabbitbrush, fringed sagewort, western snowberry, etc.) obtain less than five percent cover. Most of the ground surface is covered and bare ground is <10% on more mesic sites and 20% on more xeric sites (e.g. glacial till and claypan soils).

The most common shrub is silver sagebrush which resprouts after fire.

In pre-European conditions, there was a component of this BpS that had significant prairie dog impact and was characterized by broom snakeweed, prairie sagewort, sixweeks fescue and plains pricklypear.

Current conditions are different - please see Identification Concerns or Issues/Problems boxes.

In terms of the 1150 Tallgrass Prairie: The dominant grass is switchgrass. Big bluestem only occurs in Sidney, MT. Might have 1/4ac of plant associations *Andropogon* or *Halii*, but not whole system.

Disturbance Description

Grazing by large, concentrated herds of ungulates (bison, elk, pronghorn and deer) along with aboriginal and natural fire maintained healthy, productive and diverse grasslands. (This grazing regime is referred to as "Native Grazing" in the VDDT model.) Such grazing may have resulted in heavy defoliation and/or some soil churning, but was transitory. Temporary impact followed by rest-recovery time is characteristic. A reviewer stated that ungulate grazing might have limited the potential for replacement fires at times, as

****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 might have been significant areas that couldn't carry a fire for very long periods of time. However, this comment was not integrated into the model.

A small portion of the landscape was subjected to repeated or prolonged heavy animal impact, including heavy defoliation and repeated soil churning and/or compaction. Such areas included watering points for herds, bison or elk wallows, and prairie dog towns. This heavy animal impact disturbance was modeled as "Optional2" in the VDDT model and includes its impacts in its own class. Repetitive heavy animal impact sends the community to an alternative open successional pathway. This small prairie-dog impacted portion of the landscape was also characterized by different grasses (see Veg Description).

Periodic grazing and replacement fire, when it occurred in an intact community, resulted in removal of most of the above-ground biomass, but resulted in little mortality and relatively rapid recovery times.

Because MLRA 52 versus MLRA 58A and 60B are physiographically different enough due to soils, etc., response to fire might change in different areas of the map zone (VanFossen, pers comm).

Historically, the fire return interval averaged 8-12yrs for the region, but naturally occurring fuel breaks on slopes and badlands probably lengthened the mean interval. Fire-scarred tree-rings from areas within and adjacent to the northern Great Plains provide intervals within the 0-35yr range over the past 500yrs (Henderson 2005).

Fuel load recovery times are an alternative means by which to estimate the minimum average return interval for grassland fires, though this approach has not been formally attempted. A general decrease in productivity of ungrazed northern mixed-grass prairie is reported for 1-3yrs post-burn, and litter loads may take 11-16yrs to completely recover (as per various studies) (Henderson 2005). The total standing crop of fuel, combining both current year production and litter, is capable of recovering to pre-burn conditions in 4-8yrs (Shay et al. 2001). Theoretically, for repeated fires to occur without altering long-term grassland productivity and species composition, the mean return interval should be eight years or greater (Henderson 2005).

Given a minimum return interval of 0.5yrs, mode of 8yrs, and 95% probability of a fire occurring within 35yrs, the resulting right-skewed distribution makes possible return intervals >35yrs but probably never longer than 100yrs (Henderson 2005).

A negative exponential distribution probably best describes the historic fire size distribution, with a large number <1ha, median 10-100ha, mean 1000-10000ha and a low frequency of 50,000-1,000,000ha (Henderson 2005).

Grazing and prairie dog towns also reduced fuel loads and fire frequency, size and intensity; with the most substantial impacts in valley bottom shrublands and grasslands, and upland grasslands near water. Historically, the majority of human caused ignitions were concentrated in spring and fall seasons, while lightning-caused fires were concentrated in late summer. However, in the north central part of MT, in MZ20, lightning ignitions outside of the mountains are not primarily a late summer phenomenon, but rather, late spring and early to mid-summer phenomenon (not much happening after the end of July). Ignitions occur prior to green-up. If fall storms occur with lightning, those will also cause fires - and are often associated with heavy winds.

The prairie dogs towns would have shifted slightly over long periods of time – becoming more flammable

**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.

when the dogs move away (or periodically decrease). At their largest expansion periods, prairie dogs would have occupied up to 80% of their potential habitat. So, this would have had, periodically, a huge effect on ungulate grazing, fire and, probably, soil hydrology changes as they change with litter and dominant species (Lata, pers comm).

The absence of grazing and replacement fire for many years (eg, 50yrs) would lead to an increased shrub component (snowberry and green ash) in precipitation zones greater than 14in, and a buildup of dead grass. (Buildups of litter generally result in decreased diversity and lower basal area of remaining grass plants.) Within 10-14in precipitation zones, Wyoming big sagebrush and silver sagebrush may also increase. Productivity of the grasses is decreased, resulting in greater mortality from smoldering fire.

Mormon crickets, grasshoppers and great plains locust might have had more of an impact in this system than currently defined, but unsure of historic impact and frequency (Siddoway).

Drought also occurs somewhat frequently. Some modelers felt it occurred every 30yrs, and some believed it occurred every five years. Short term precipitation variability may also influence species productivity. Drought periodicities centering around 58yrs were characteristic of southeast MT and eastern WY for the last ~300yrs. A 22yr rhythm was characteristic from 1892 to 1977, but less clear for the time between 1801 and 1889 and did not occur in 1714 to 1801. Ten or more years without drought in any of the four study areas occurred once or twice per century (Stockton and Meko 1983). In a Northern Great Plains HRV draft study by Judy von Ahlefeldt states that the frequency of droughts was greater than five years in length for 2-300yrs (Weakley 1943).

Adjacency or Identification Concerns

Areas with similar soils but steeper topography (>15%) are less productive and have a higher dominance of shrubs.

The natural grazing regime has been replaced with domestic livestock grazing that is targeted toward "moderate" grazing intensity. This is often characterized by grazing each year with removal of herbage over an extended period of the growing season without adequate rest and recovery from grazing. This is contrasted with the expected historic shorter, episodic grazing patterns. One result is more structural homogeneity. Under this grazing regime, taller, palatable grasses such as green needlegrass and bluebunch wheatgrass decrease, and short grasses (western wheatgrass, needle and thread grass, blue grama and Sandberg bluegrass) increase. Also under this grazing regime, litter may increase (depending on precipitation and intensity of grazing) with the expected results of decreased diversity and decreased vigor of remaining grasses. Only under season long grazing will warm-season grasses like little bluestem decrease. Season of use and/or twice-over grazing will impact the prevalence of little bluestem and other C4 plants.

Shrubs (Wyoming big sagebrush, silver sagebrush, western snowberry, rabbitbrush and fringed sagewort) increase greatly over the historic plant community. Compare the ecological site description to avoid using a shrub model for historic plant community when considering a grass site that has changed as a result of uncharacteristic grazing or unnaturally long fire return intervals. Unnaturally long intervals without fire may contribute to an increased shrub component (shrubs might include *Opuntia* spp and *Yucca* spp in NE). Xeric sites will experience an increase in sagebrush, whereas western snowberry will increase in mesic areas.

In modern times, invasive grasses such as smooth brome (only in small areas), *Poa pratensis*, crested

****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.**

wheatgrass, Kentucky bluegrass (Kentucky bluegrass and *Poa pratensis* only in small areas) have become widely established in some areas and are locally abundant and expanding. Other invasive species of concern include spotted, diffuse and Russian knapweeds, often along roads and stream corridors; leafy spurge and Canadian thistle, along stream corridors; yellow sweetclover; dalmatian toadflax; and annual bromes, including Japanese brome. Dense clubmoss stands are also a problem in this class, as is blue grama - limiting productivity and diversity in this system.

Long-term high intensity grazing by domestic livestock without periods of rest and recovery can result in a conversion in the vegetation states from a mid-grass dominated community to shortgrass dominated communities (blue grama, sedges, Sandberg bluegrass, buffalograss in southern portions, and junegrass). This should be distinguished from the succession class (class B) that's influenced more by presence of prairie dog towns - which have a higher forb component with less of a midgrass component than the other classes. In species composition, the prairie dog versus domestic grazed communities, are very different.

In current conditions, there has also been an increase in the amount of woody vegetation on the plains, particularly increases in snowberry on mesic sites and expansion of ponderosa pine into grasslands and shrublands which were probably maintained in a grassland state under historic fire frequencies. The lack of fire has shifted grassland systems to shrublands or woodlands.

The expansion of ponderosa pine and shrubs, including snowberry, yucca and prickly pear is noticeable, but more so (at least for these species) in the eastern portion of MZs 29 and 30.

This BpS may be similar to the PNVG R4PRMGn from the Northern Plains model zone. Reviewers (Rhodes, Volk and Adams) of this model felt that the Northern Great Plains shrubland might have been a subcomponent of this BpS that was historically limited to less productive soil types, and with a much longer fire cycle. However, other reviewers (VanFossen, pers comm) disagreed with that statement and stated that silver sagebrush, in particular, is and has been a natural component of deep, well-drained, productive soils.

In MZ20, historically, this BpS could also have extended throughout the subsections for 331K; in present, 331Kb, most of d, f and e might be more of a shrub community. Big sagebrush is more susceptible to fire and so probably less prevalent historically.

There could well have been areas that were surrounded by prairie dog towns and protected from fire in that way historically. As per Clarke McClung, it occurs as such in NE (Lata, pers comm).

There might be places, as there are further south and east of MZs 29 and 30, that now have crested wheatgrass as a major component, as it was heavily seeded in the 1930s (Lata, pers comm).

There is more woody species invasion further east. At 20in precipitation, deciduous trees invade from the draws. If an area is not burned, it will lose the prairie. In eastern ND and SD, there are trees that will invade the prairie systems if they remain unburned. (The preceding refers to the tallgrass prairie, which is almost all agriculture now. Much of the mixedgrass prairie is converted to agriculture as well.). That wouldn't occur in the west as much. Trees would be restricted to the microclimate situation or in draws (Martin, pers comm).

When thinking about similarity or departure from historic or uncharacteristic communities at landscape levels, the following situations might be useful to check mapping results against classification and model

**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.

logic. The major influences on current vegetation composition and structure in the Great Plains are (diBenedetto, pers comm):

- 1) Conversion of grassland/shrublands to cropland (uncharacteristic types)
- 2) Introduction of introduced species, primarily crested wheatgrass, annual bromes, smooth brome etc., and yellow sweetclover (uncharacteristic type)
- 3) Shift from mid-grass dominated grassland communities to short-grass dominated communities through season long heavy grazing (departure from historic condition, if percentage is outside range of variability. Prairie dog towns would fit into this category. This dynamic can be a response to long-term periodic drought as well (departure from historic range). The mid-grass to short grass change is a shift that has occurred historically in response to fluctuating climate (drought, above normal precipitation cycles) and grazing intensity/recovery. More may be in short-grass, under current intensive pastoral grazing systems vs. migratory grazing patterns that occurred historically. Grazing would shift mid-grass communities to short-grass dominated communities. (Bison may or may not have influenced this, but season long heavy livestock grazing seems to cause this shift.) So a high percentage of the landscape in short-grass, versus mid-grass would indicate a departure.
- 4) Shift from grassland communities to forest, wooded or shrub dominated communities in absence of fire (departure or uncharacteristic for grass BpS). This may be a key shift that has occurred or is occurring on the Great Plains along with conversion of rangeland to cropland and planting of exotic grass species (CRP lands). This is probably more meaningful in terms of fire disturbance relationships than the short-grass, mid-grass shift.

With the exception of areas occupied by prairie dog towns, the characteristic late successional communities should be dominated by mid-grass dominated plant communities. Tall grass dominated communities would only occur as unmapped inclusions associated with topo-edaphic positions. Tall grass dominated communities include those dominated by prairie sandreed, big bluestem and prairie cordgrass.

DISTINGUISHING BTWN 1132 AND 1141:

This would be difficult to distinguish from BpS 1132. 1132 has more tallgrass species that wouldn't grow in MT, however. Dominant species in 1132, however, as listed by NatureServe, are dominants in many other systems (Martin, pers comm).

There are slight nuances of the models of 1141 and 1132 that distinguish them, but they are inconsequential in terms of the FRI and percentages within classes and general functioning of the model. Nuances are due to differing modelers and perspective of disturbances.

The central mixed-grass prairie is not well defined but in general is a transition area between the tall grass prairie and mixed grass prairie. There is higher precipitation and taller grasses than in 1141. There are more shrubby species. 1141 is further west. And has ARTR2, whereas 1132 has more chokecherry/sumac.

This BpS is easily confused with Central mixed grass prairie (BpS 1132). Main difference is 1132 has higher moisture regime, more tall grass plants, and lack of fire results in more shrubs and trees.

This wouldn't function differently than 1132. And it wouldn't key out differently (Cooper, pers comm). The only way you might be able to tell this apart is by geography. 1141 is further west. Also - chokecherry and sumac in 1132 versus ARTR2 in 1141.

****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.**

Productivity might be lower in 1141 - soils generally not quite as deep, less rain and probably less litter build up as well, although the higher moisture in 1132 would allow litter to decompose at a faster rate (Lata, pers comm).

Native Uncharacteristic Conditions

With lack of fire, increased shrub or tree cover would be uncharacteristic.

Scale Description

Historically, natural grazing and fire generally encompassed hundreds to hundreds of thousands of acres. Repeated heavy animal impact such as prairie dog towns occurred at the scale of 10s-1000s of acres, as well as ungulate impacts - bison.

A negative exponential distribution probably best describes the historic fire size distribution, with a large number <1ha, median 10-100ha, mean 1000-10,000ha, a low frequency of 50,000-1,000,000ha and rare outliers >1,000,000ha (Henderson 2005).

Issues/Problems

This BpS covers a large diverse area with relatively little extensive data or published studies for vegetation classification. Fire frequency is based primarily on inference based on understanding of the plant community dynamics and anecdotes or historical research (mostly oral histories) regarding Native American burning.

Due to issues with mapping grass systems and separating out successional classes by height and cover of grasses, this model has been reduced to a two-box model.

Comments

Model for MZs 29, 20 and 30 was originally adapted from RA model R0PGRn created by Shannon Downey. Model for MZ20 was originally modeled with five boxes - by Shannon Downey and Steve Cooper. However, during a review session, reviewers (BJ Rhodes, John Carlson, Rich Adams and Bill Volk) suggested changes and changed this model to a three-box model. Agreement and input was received from the original modelers. Subsequent review of this model for an adjacent MZ by modelers (Jeff DiBenedetto, Brian Martin, Cody Wienk, George Soehn and Bobby Baker) led to adoption of a different three-box model. After agreement from original modelers and reviewers, this last three-box model is the one that was used for MZ20. Because the original five-box and other three-box models originally developed, were abandoned, the details and the changes are not detailed here. Subsequent to succession class review for MZ20, model for MZs 29 and 30 was changed based on mapping constraints. Therefore, model for MZs 29 and 30, is different than that for MZ20 in succession class proportions, age ranges and cover/height and boxes. Other reviewers for MZs 29 and 30 were Shannon Downey, Jeff Jones, Steve Cooper and Mary Lata.

Other reviewers for this model for MZ20 were Steve Barrett, Mary Manning (USFS), Steve VanFossen (NRCS) and Jon Siddoway (NRCS).

Vegetation 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.

Class A 25 %

Early Development 1 All Structure

Upper Layer Lifeform

- ☒ Herbaceous
☐ Shrub
☐ Tree

Fuel Model**Description**

Class A is the post-fire early-seral stage, combined with the very short-stature vegetation resulting from prairie dog disturbance or repeated high intensity herbivory or trampling (eg, watering points or buffalo wallows).

This class may also be a short term response to severe drought, combined with other impacts (Optional 1 - modeled as occurring very infrequently - 0.001 probability, but causing a transition all the way back to the beginning). (NOTE: Previously, in MZ20, this class was defined as just a prairie dog stage with the herbivory/trampling and severe drought components -and defined as a class B instead of A. But due to mapping constraints and inability of mapping to distinguish grass species and grass heights at a fine level, and therefore a prairie dog stage versus an early successional or mid successional stage, all early post-replacement and very short stage grasses were placed into this class A.)

A variety of forb species such as fetid marigold, scarlet globemallow and curlycup gumweed tend to dominate this class. Common grass species include purple three-awn, buffalo grass, Sandberg bluegrass, blue grama and western wheatgrass. Fringed sagebrush can also be a component of this class.

Also - this represents the immediate post-disturbance intact historic plant community functioning under grazing and/or fire, dominated by cool and warm season rhizomatous perennial grasses, as well as bunchgrasses. Little bluestem, prairie sandreed and bluebunch wheatgrass occur as dominant species in small patches. Other species in this class are Artemisia, grama grasses, western yarrow and prairie junegrass. Other species might include blue grama and western yarrow. STIPA, PSSP6 and SCSC might also be indicators.

Due to the combination of the prairie dog stage (indicator species: BOGR2, POSE, ARFR and DYPA) and the early successional stage (indicator species: PASM, NAVI4, HECO26 and BOGR2), the indicator species were combined for this class.

Because this is the post-fire early regeneration stage, or a prairie dog stage, this is generally a short grass functional group which are communities dominated by species such as: poas, dryland sedges, blue grama, buffalograss, clubmoss, junegrass and forbs either singly or in combination. It may also be characterized by higher bare soil. This might be a shortgrass EVT. A higher proportion of this class on the landscape today would indicate departure.

This class lasts approximately three years. If in a prairie dog state, then the class would last longer in order to transition out of it; however, this is accounted for, by having a prairie dog disturbance in the model, resetting succession and keeping it in this class. The three year interval attempts to capture what would happen post-fire or post-drought. (Also - post-heavy-grazing in current conditions would take longer to transition out of this class.)

Indicator Species and Canopy Position

PASM
Upper
HECO26
Upper
BOGR2
Upper
ARFR
Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	40 %
Height	Herb 0m	Herb 0.5m
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

**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.

Native grazing (bison, prognhorn and prairie dog) can be locally heavy due to increased succulence of young grasses. This occurs on 20% of this class each year, keeping it in this stage. This was split 50/50 between native grazing and Optional 2, prairie dog grazing. Prairie dog grazing takes this stage back to the beginning, whereas grazing just occurs without causing a transition.

Drought can occur every 30yrs, not causing a transition.

Replacement fire occurs but not as frequently, due to lack of fuel, every 20yrs.

(Note about identifying in current conditions: Long-term high intensity grazing by domestic livestock without periods of rest and recovery can result in a conversion in the vegetation states from a mid-grass dominated community to shortgrass dominated communities (blue grama, sedges, Sandberg bluegrass, buffalograss in southern portions and junegrass). This is different in species composition than a prairie dog community. However, for LANDFIRE mapping purposes, it is not possible to distinguish between the different types of short grasses occurring.)

Prairie dog disease is also a potential impact, but because the prairie dog stage was combined with early succession, this disturbance was not modeled for MZs 29 and 30.

It is thought that a prairie dog class should comprise approximately 5-8% of the landscape, and no more than 10% (Dan Uresk, pers comm). Research for historical Northern Great Plains vegetation would have prairie dog communities within an early successional stage of max 10-15% across an entire landscape. So only a portion of the early successional stage would be a prairie-dog-type community - ie: maybe 5-8%.

Class B 75 %		<u>Indicator Species and Canopy Position</u>	<u>Structure Data (for upper layer lifeform)</u>												
Mid Development 1 Closed		PASM	<table><tr><td></td><td>Min</td><td>Max</td></tr><tr><td>Cover</td><td>41 %</td><td>90 %</td></tr><tr><td>Height</td><td>Herb 0m</td><td>Herb 1.0m</td></tr><tr><td>Tree Size Class</td><td colspan="2"></td></tr></table>		Min	Max	Cover	41 %	90 %	Height	Herb 0m	Herb 1.0m	Tree Size Class		
	Min	Max													
Cover	41 %	90 %													
Height	Herb 0m	Herb 1.0m													
Tree Size Class															
<u>Upper Layer Lifeform</u>		Upper													
☒ Herbaceous		NAVI4													
☐ Shrub		Upper													
☐ Tree	<u>Fuel Model</u>	HECO26													
		Upper													
		BOGR2													
		Upper													
<u>Description</u>															

☒ Upper layer lifeform differs from dominant lifeform.

Shrub species could be present with approximately 0-10% cover. Common shrubs - silver sagebrush, winterfat, fringe sagewort and rubber rabbitbrush. Less common would be skunkbush sumac, mostly on slopes and shallow soils.

Class B represents the intact historic plant community functioning under grazing and/or fire, dominated by taller, cool and warm season rhizomatous perennial grasses, as well as bunchgrasses. This is the all-encompassing mid-late-development, functioning fine stage.

This model was originally created as a three-box model; however, post-succession class review for an adjacent mapzone, resulted in a decision to change the model to a more simpler version for LF mapping constraints.

Little bluestem, prairie sandreed and bluebunch wheatgrass occur as dominant species in small patches.

****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.**

Other species in this class are Artemisia, grama grasses, western yarrow and prairie junegrass. Other species might include blue grama and western yarrow. STIPA, PSSP6 and SCSC might also be indicators.

Little below-ground mortality occurs after replacement fire, and resprouting of perennial grasses and forbs often occurs within days or weeks, depending on season. Grasses show greater vigor; some forb establishment may occur as a result of exposure of mineral soil. Canopy cover recovers quickly after resprouting.

Shrub species could be present at 0-10% cover. Silver sagebrush and winterfat (on deeper soils) are the most common shrub, and would start resprouting. Wyoming big sagebrush can also be a component (on shallower soils) of this BpS, although a small component.

Clubmoss might be present in Glaciated Plains at 0-5% cover, but not on shallow clay sites or dense clay sites, sands, saline upland, saline lowland, subirrigated or wet meadow.

Replacement fire occurs every 5-15yrs.

Drought occurs every 30yrs and maintains this stage. A reviewer felt that drought occurred more often, every five years, but because most wanted to model it at 30yrs, it was left as such.

Native grazing by large ungulates could have occurred, including bison grazing. It is likely heavy locally due to increased succulence of young grasses. It might occur with a probability of 0.2 (every five years, or 20% of this class each year).

Native grazing by prairie dogs could also occur on a small portion of the landscape (0.001 probability of 0.1% of this class), bringing this state to A.

Optional 1 was also modeled, which includes a combination of disturbances of drought, native bison grazing and a small amount of fire (not enough to be its own category). When all of these disturbances occur in concurrence, you might get a transition to the short-stature A-class type community. This occurs on a small portion of the landscape (0.001 probability of 0.1% of this class).

Insect/disease occurs very infrequently with a probability of 0.0001. It has been suggested that grasshoppers and Mormon crickets might have a larger impact historically than the probability assigned here. However, unsure of impact and frequency.

With a lack of fire, this class might shift to having more shrubs and tree invasion.

Class C	0 %	<u>Indicator Species and Canopy Position</u>	<u>Structure Data (for upper layer lifeform)</u>												
[Not Used]	[Not Used]		<table border="1"> <thead> <tr> <th></th> <th>Min</th> <th>Max</th> </tr> </thead> <tbody> <tr> <td>Cover</td> <td>%</td> <td>%</td> </tr> <tr> <td>Height</td> <td></td> <td></td> </tr> <tr> <td>Tree Size Class</td> <td colspan="2"></td> </tr> </tbody> </table>		Min	Max	Cover	%	%	Height			Tree Size Class		
	Min	Max													
Cover	%	%													
Height															
Tree Size Class															
<u>Upper Layer Lifeform</u>															
☒ Herbaceous ☐ Shrub ☐ Tree		<u>Fuel Model</u>	☐ Upper layer lifeform differs from dominant lifeform.												

**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.

Description

Class D 0 %

[Not Used] [Not Used]

Indicator Species and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover	%	%
Height		
Tree Size Class		

Upper Layer Lifeform

- ☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class E 0 %

[Not Used] [Not Used]

Indicator Species and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover	%	%
Height		
Tree Size Class		

Upper Layer Lifeform

- ☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

☐ Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

Fire Regime Group:** II

Historical Fire Size (acres)

Avg

Min

Max

Sources of Fire Regime Data

- ☐ Literature
☐ Local Data
☒ Expert Estimate

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	13	2	40	0.07692	100
Mixed					
Surface					
All Fires	13			0.07694	

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 ☒ Native Grazing ☒ Other (optional 1) drought+native bison grazing + small fire portion
☒ Wind/Weather/Stress ☐ Competition ☒ Other (optional 2) prairie dog grazing

References

Anderson, R.C. 1990. The historic role of fire in the North American grassland. Pages 8-18 in: S.L. Collins

**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.

and L.L. Wallace, editors. Fire in North American tallgrass prairies. Norman, OK: University of Oklahoma Press.

Benkobi, L. and D.W. Uresk. 1996. Seral stage classification and monitoring model for big sagebrush/western wheatgrass/blue grama habitat. In: J.R. Barrow, E.D. McArthur, R.E. Sosebee and R.J. Tausch, compilers. Proceedings: shrubland ecosystem dynamics in a changing environment; 1996 May 23-25; Las Cruces, NM. Gen. Tech. Rep. INT-GTR-338. Ogden, UT: USDA Forest Service, Intermountain Research Station.

Bragg, T.B. and A.A. Steuter. 1995. Mixed prairie of the North American Great Plains. Trans. 60th No. Am. Wild. & Natur. Resour. Conf. 335-348.

Collins, S.L. and L.L. Wallace (editors). 1990. Fire in North American tallgrass prairies. Norman, Oklahoma: University of Oklahoma Press.

Henderson, D.C. 2005. Fire Regime for the Grasslands National Park Fire Management Plan, Second Draft, September 8, 2005

Higgins, K.F. 1984. Lightning fires in North Dakota grasslands and in pine-savanna lands of South Dakota and Montana. Journal of Range Management 37(2): 100-103.

Higgins, K.F. 1986. Interpretation and compendium of historical fire accounts in the Northern Great Plains. USDI Fish and Wildlife Service Resource Publication 161, Washington, D. C., USA.

Knight, D.H. 1994. Mountains and Plains, The Ecology of Wyoming Landscapes. Yale University Press, New Haven, CT.

NatureServe. 2006. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA, U.S.A. Data current as of 18 July 2006.

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

Shay, J, D. Kunec and B. Dyck. 2001. Short-term effects of fire frequency on vegetation composition and biomass in mixed prairie in south-western Manitoba. Plant Ecology. 155: 157-167.

Singh, J.S., W.K. Lauenroth, R.K. Heitschmidt and J.L. Dodd. 1983. Structural and functional attributes of the vegetation of northern mixed prairie of North America. The Botanical Review 49(1): 117-149.

Stockton, C.W. D.M. Meko. 1983. Drought recurrence in the Great Plains as reconstructed from long-term tree ring records. Journal of Climate and Applied Meteorology. 22: 17-29.

USDA-NRCS. 2003. eFOTG: Electronic Field Office Technical Guide. Available at: <http://www.nrcs.usda.gov/technical/efotg/>.

Weakley, H.E. 1943. A tree ring record of precipitation in western Nebraska. Journal of Forestry.

**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.

Weaver, J.E. and F.W. Albertson. 1956. Grasslands of the Great Plains: their nature and use. Johnsen Publishing Company, Lincoln, NE.

Woods, Omernik, Nesser, Shelder, Comstock and Azevedo. 2002. Ecoregions of Montana, 2nd edition.

Wright, H.A. and A.W. Bailey. 1980. Fire ecology and prescribed burning in the Great Plains—a research review. General Technical Report INT-77. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station.

****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.**