LANDFIRE Biophysical Setting Model

Biophysical Setting 3011320 Central Mixedgrass Prairie

☑ *This BPS is lumped with: 1150*

☐ *This BPS is split into multiple models:* *Lumping 1150 Tallgrass Prairie 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 MT, but not tallgrass communities. We might have 1/4 acre of the plant associations - andropogon, halii, 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** 9/30/2005

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Vegetation Type
Upland Grassland/Herbaceous

General Model Sources
☑ Literature
☐ Local Data
☑ Expert Estimate

Dominant Species
PASM
STVI
BOCU
CAFI
KOMA
ANGE
SCSC

Map Zone
30

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

In MZ30, this would occur in sections 331Fu, 331Fv, 331Fs (eastern side), 331Fb (eastern side), 331Mc, 331Mf and 331Ea (eastern side, though questionable in this subsection). Might occur in northeastern MT, but modeling group doesn't have expertise to say one way or the other.

This might occur in the east portion of MZ30, but most of the mixedgrass prairie should be classified as 1141. Only in the far east, based on geography, classify as 1132 (Martin, pers comm).

For the lump of 1150 Tallgrass Prairie. We would have to have a "finetooth comb" to map tallgrass prairie in these mapzones. There are individual associations in extreme northeastern 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.

**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.

Biophysical Site Description

In the 16-18in precipitation zone, there is more true mixedgrass.

Elevations range from 1500-3000ft. Temperatures range between extremes of hot summers and cold winters that are typical of a continental climate. Precipitation increases from west (15in) to east (20in). Most of the precipitation occurs during the growing season. Soils vary, but are generally mollisols. Soils in this BpS are formed from a diverse mixture of various sedimentary deposits. These soils range from clayey to laomy with sandy loams present in the western edge. Terrain consists of gentle rolling hills to large expanses of flat open ground.

In terms of the tallgrass prairie 1150: 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 type to occur but rarely.

Vegetation Description

This vegetation type is characterized by the dominance of grasses such as western wheatgrass (most prominent grass in 1141 too) and little bluestem (also in 1141). Typically contains grass species such as side oats grama (less important in 1141 but still present) and green needle grass (as does 1141). Includes elements from W. Great Plains short grass (BOGR - but in 1141 too) and western Great Plains Tall Grass systems (Andropogon spp - but in 1141 too), but these are probably just microsites. Trees are limited to riparian areas and drainages which may be listed under a different BpS. Silver sagebrush may be found in some floodplains. Other woody species inlcude skunkbrush sumac and snowberry, but these species are limited in abundance. Cool season grasses begin to cure in mid July, making fire more likely than earlier in the growing season.

In terms of the 1150 Tallgrass Prairie: The dominant grass is switchgrass. Big bluestem only occurs in Sidney, Mt. Might have one acre of the plant associations Andropogon, Halii, but not whole system.

Disturbance Description

This area is strongly influenced by wet-dry cycles.

Fire, grazing by large ungulates and small mammals such as prairie dogs and soil disturbances (ie, buffalo wallows and prairie dog towns) are the major disturbances in this vegetation type.

From instrumental weather records, droughts average about one in every 10yrs, but droughts are often semi-periodic lasting 3-4yrs in 30-40yr cycles.

Historically, there were likely close interactions between fire and grazing since large ungulates tend to be attracted to post-fire communities. Average fire intervals are estimated at 5-15yrs, with the average probably 10yrs. Fires were most common in July and August, but probably occurred from about April to September. Seasonality of fires influences vegetation composition. Recurring early season fires (April - May) tend to favor warm-season species, while late season fires (August - September) may affect grass species relatively equally. Replacement fire in our model does remove 75% of the above ground cover as assumed in the literature. However, MZ30 modelers did not think that loss of the above ground cover by the replacement fire will necessarily induce a retrogression back to an earlier seral stage because the main component of dominant grasses remains unharmed to insure the continuity of the seral stage.

MZ30 modelers used two levels of native grazing intensities: heavy with at least 70% biomass removal,

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typical of prairie dog towns and near fresh water for bison, and "regular" native grazing to be less than that. It was assumed that regular grazing would not alter the Early2 community enough to change classes, but it would drive Late class to Early2. It was assumed that regular grazing intensity would not be enough to change Early2 to Early1. Heavy grazing would move the community back to earlier stages. It was also assumed that grazing with drought could move a community to earlier stages. It was also assumed that nothing was enough to drive Late to Early1 in one year, hence no transition probabilities for that. It was assumed that regular levels of grazing had a 5-year return interval.

Data from prairie dog towns (early seral, aka class A) suggest cover ranges from 0-80%. Height is most valuable measure of difference between early and other seral stages, but height in mixed grass prairie often is not much greater than 50cm -- resolution of mapping may not be great enough to distinguish among classes. Cover values shown in vegetation classes therefore are not comfortably reflecting reality.

Height and cover values described in vegetation classes below are at this point expert opinion -- further refinement from literature would be better.

Adjacency or Identification Concerns

This would be difficult to distinguish from BpS 1141. 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 MFRI and percentages within classes and general functioning of the model. Nuances are due to differing modelers and perspective of disturbances.

The central mixedgrass prairie is not well defined but in general is a transition area between the tallgrass praire and mixedgrass praire. There is higher precipitation and taller grasses thanin 1141. There are more shrubby species. 1141 is further west and has ARTR2, whereas 1132 has more chokecherry/sumac.

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

This BpS is easiy confused with NW Great Plains mixed grass praire (BpS 1141). Main difference is this BpS has higher moisture regime, more tall grass plants and lack of fire results in more shrubs and trees.

This wouldn't function differently than 1141. And it wouldn't key out differently than 1141 (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 vs ARTR2 in 1141.

FROM R4PRMGn: This BpS transitions to tallgrass prairie to the east, sagebrush steppe to the west, and sandhills prairie, shortgrass prairie and southern mixed-grass prairie to the south. In the western part of this BpS, big sagebrush can invade with heavy grazing or absence of fire. Cheatgrass currently is increasing in portions of this BpS. This Bps is similar to the BpS R0PGRn from the Northern and Central Rockies model zone.

This BpS is bordered by BpS 1150 on the east; bordered by 1141 to the west; bordered by 1149 to the

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south.

Many areas invaded by exotics such as smooth brome, Kentucky bluegrass, Canada thistle and Japanese brome. Sweet clover can increase during wet springs or following wildlfire.

Some of this BpS has been farmed. In places native range has also been type converted to tame grasses. Farming has helped spread exotic species. Type converted areas can have taller, denser growth of herbaceous plants if not grazed.

There might be more of the early successional, short grass class (A) on the landscape today, due to exotics and grazing.

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 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, primarilly crested wheatgrass, annual bromes, smooth brome etc. and yellow sweetclover (uncharacteristic type)

3) Shift from mid-grass dominanted grassland communities to shortgrass dominated communities through season long heavy grazing (departure from historic, if percentage is outside range of variability. Prairie dog towns would fit into this category. This dynamic can be a response to longterm 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 precip cycles), 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 midgrass 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, vs 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). Probably more meaningful in terms of fire disturbance relationships than the short grass-mid grass shift.

With the exception of areas occupied by prarire 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, prairie cordgrass.

Please see BpS 1141 Adjacency/Identification Concerns box for additional info concerning Mixedgrass Prairie identification.

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Native Uncharacteristic Conditions

See Adjacency/Identification Concerns

Scale Description

Historically and now, fires probably ranged in size from 1000s to 10,000s of acres. The variation depends on build-up of fuel which were influenced by precipitation and grazing. Extent of weather influences (wet-dry cycles) would have been very widespread.

Issues/Problems

This system does not have well defined boundaries and tends to transition gradually into other systems.

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

This model for MZ29 and 30 was adapted from the RA model R4PRMGn Northern Mixed Grass Prairie, created by Cody Wienk and Lakhdar Benkobi and reviewed by David Engle and John Ortmann. Other modeler for MZ30 was Terry Chaplin. Other reviewer was Jim Von Loh. Regional lead for MZ30 also provided input and changes to the model to a great extent. Approval from original modelers/reviewers sought.

Ortmann in his RA review, suggested that in addition to fire, drought and grazing, insect outbreaks (Rocky Mountain locust) would have impacted all classes.

Vegetation Classes

Class A **15 %**

Early Development 1 Open

Upper Layer Lifeform

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

Fuel Model

1

Indicator Species and Canopy Position

ARFR
Upper
BOGR2
Upper
SPCO
Upper
ARPU9
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.

Description

This class is similar to class A in 1141. It was originally created as just a prairie dog stage. However, after review for 1141 in MZ20, 29 and 30, regional lead suggested changing 1132 class A to a prairie dog and an early stage, and therefore change age range to approx 0-3yrs instead of five years. Cover was changed to 0-40% instead of 0-60%.

This is the immediate-post-disturbance-post-fire stage or the very short-stature vegetation resulting from prairie dog disturbance or heavy ungulate grazing. The fuel in this class are generally too sparse and/or too short to carry fire if it is a prairie dog stage. Otherwise can carry fire somewhat.

A variety of forb species such as fetid marigold, scarlet globemallow and curlycup gumweed cab dominate this class, especially in prairie dog towns, but grasses can also be common.

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Common grass species include blue grama, purple three-awn, buffalo grass and prairie junegrass. MFRInged sagebrush can also be a component of this class. Prickly pear, man sage (ARLU), MFRInged sage, and broom snakeweed occur in this class. Abundance of prickly pear is much higher than in other seral stages.

Data from prairie dog town plots at Wind Cave National Park and Devils Tower National Monument (which are west of this mapping zone, but still relevant -- A. Symstad and C. Wienk, pers. comm.) show covers ranging from 0-80%, which cannot be accurately captured with the limitations on cover/height classes used for mapping purposes. The most distinguishing characteristic of this seral stage is its height, which is 0-30cm, and the species composition described above.

This class succeeds to B after three years.

High, prolonged heavy grazing was modeled as Optional 1. This would include prairie dog grazing. This occurs on 20% of this class each year, keeping it in this class.

Drought combined with grazing was modeled as Optional 2. This occurs on 1.2% (0.012 probability - every 80yrs) of this class each year.

Replacement fire occurs every 25yrs.

Class B **85 %**

Mid Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

1

Indicator Species and Canopy Position

BOGR2
Mid-Upper
PASM
Upper
CAFI
Middle
SCSC
Middle

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	41 %	100 %
Height	Herb 0m	Herb 1.0m
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

This class is similar to 1141 class B. Blue grama, western wheatgrass, needlegrasses, prairie junegrass, upland sedges and little bluestem are common grasses. In some areas species such as big bluestem and prairie sandreed are locally common. Western wheatgrass and little bluestem are the most common species as this class ages. In some areas, western wheatgrass forms dense stands.

Common forbs include scurfpea, prairie coneflower, Rocky Mountain beeplant, scarlet globemallow and dotted gayfeather. Prickly pear, man sage (Artemisia ludoviciana), MFRInged sage, snowberry and broom snakeweed occur in this class.

This model was originally created as a three-box model; however, post-sclass-review for an adjacent MZfor model 1141, resulted in a decision to change the model to a more simpler version for LF mapping constraints.

This is a mid-late stage. Cover was changed from 61-100% to 41-100% by regional lead based on suggestions to revise model based on review in MZ20, 29 and 30 for mixedgrass prairie types and mapping constraints.

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Cover in this class would actually range from 60-100%, with the average somewhere around 65-80% (wild guess on average), depending on soils and weather for the year. Height would actually range from 10-130cm, (higher range only in areas with tallgrass species such as big bluestem), averaging around 45-75cm.

Replacement fire occurs but grasses quickly recover. This occurs every 10yrs. Replacement fire was originally modeled as infrequently causing a transition back to the A stage (0.0001 probability). However, replacement fire was changed by regional lead to be more in line with 1141 and also due to the model changes to the entire model - ie: class A representing a suite of earlier, post-disturbance situations and changed from a three to a two-box model. Replacement fire was therefore modeled as occurring every 10yrs, half the time causing a transition back to A, half the time not causing a transition.

Heavy prolonged grazing such as prairie dogs occurs but infrequently causing a transition back to A (0.003 probability).

The effect of drought and grazing also occurs causing a transition back to A, but infrequently (0.006 probability).

Native grazing occurs on 20% of the class each year, maintaining this stage.

Drought can also occur, but infrequently causing a transition back to A (0.003 probability). Regular drought could occur, however, every 50yrs and not cause a transition (this was taken from previous model iteration, class C).

With lack of fire, encroachment might occur after this class. Trees (juniper and chokecherry) and shrubs might appear with higher cover. It would be uncharacteristic to have higher than 10% cover of shrubs/trees.

Class C **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 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.

**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 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 Group:** **II**

Historical Fire Size (acres)

Avg 10000
Min 1000
Max 100000

Sources of Fire Regime Data

☑ Literature
☐ Local Data
☑ Expert Estimate

Fire Intervals	*Avg FI*	*Min FI*	*Max FI*	*Probability*	*Percent of All Fires*
Replacement	11	8	25	0.09091	100
Mixed					
Surface					
All Fires	11			0.09093	

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) heavy prolonged native grazing
☑ Wind/Weather/Stress
☐ Competition
☑ Other (optional 2) drought + grazing

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