LANDFIRE Biophysical Setting Model

Biophysical Setting 3814210 Central Tallgrass Prairie

☑ *This BPS is lumped with: 1420*
☐ *This BPS is split into multiple models:*

General Information

Contributors (also see the Comments field) **Date** 3/21/2008

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Modeler 3			**Reviewer**		

Vegetation Type
Upland Grassland/Herbaceous

General Model Sources
☑ Literature
☐ Local Data
☑ Expert Estimate

Dominant Species
ANGE
SONU2
SPHE
SPPE

Map Zone
38

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

This type is found across Central Midwestern states with typical Prairie Border forests and Prairie Peninsula region of eastern states IA, northwest MO, MN, WI, IL, IN, KY, and OH. The system interfaces and mingles on the east with the Oak Savanna and on the west with Mixed Grass Prairie. It is distributed with north central sand and gravel tallgrass which represents the dry prairie segment and likely intermingles with the northern tallgrass prairie to the north. Central tallgrass prairie is found in ECOMAP sections 222Ma, 222Mb, 222Na, 222L, 222K and 222Jb, Jh, and Ji, 251Cf, Ch, 251Ga, Gb, and Gc. In MZ38, found primarily in subsections of 251H and 251G.

Biophysical Site Description

Prairie dominated the landscape with oak-hickory forests existing within fire-protected ravines or along stream corridors forming gallery forests (Abrams 1992). While the region is strongly influenced by dry continental air flow patterns and periodic drought, historic fire frequency determined the prairie-forest boundary with much variation based on topography, fuel breaks, ignition sources, and climate (Whitney 1994, Anderson and Bowles 1999). Much has been written concerning these systems and excellent reviews can be found in Curtis (1959), Whitney (1994) and Anderson, Fralish and Baskin (1999). The area is primarily mollic grassland soils incorporating mesic and hydric prairie types (Curtis 1959). Mesic prairies occurred on flat and rolling topography including some on glacial outwash with porous subsoil of sand and gravel. Rolling areas were characterized by glacial till of recessional moraines or on residual aeolian loess deposits. Soil profiles consist of a black surface layer rich in organic material with high water-holding capacity. Wet prairies were found on poorly drained soils in drainage ways and concave

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positions on uplands an din lowlands along waterways or in areas subject to inundation. Lowland prairies were in and along waterways or in areas subject to frequent inundation. Soils are rich in organic matter and show evidence of inundation in a gleying layer three to four feet below the surface. The region is strongly influenced by dry continental air flow patterns and periodic drought (Whitney 1994).

Vegetation Description

Dominated by big bluestem (Andropogon gerardii), Indiangrass (Sorghastrum nutans) and prairie dropseed (Sporobolus heterolepsis) on more mesic sites with prairie cordgrass (Spartina pectinata) and bluejoint grass dominating the wet sites. Secondary species such as little bluestem (Schizachyrium scoparium) and porcupine grass (Stipa spartea) occupied the drier portions of these uplands and soil types and varied in importance. Forb families had their largest representation in Aster and legume. Conspicuous perennial forbs included the genera Asclepias, Aster, Echinacea, Helianthus, Solidago, Liatris, Dalea, and Viola. Prairie shrubs include the genera Amorpha, Rosa spp. and Ceanothus.

Disturbance Description

Frequent fires impacted this prairie system every one to four years, maintaining grass and forb vegetation. Insect and small mammal herbivory impacts composition and dominance. Large mammals were present including bison, elk and deer. Fire played an important role in the maintenance of the tallgrass prairie (Curtis 1959, Vogl 1974, Anderson 1990). Fire could occur throughout the year with larger, less frequent fires occurring during the dormant season and smaller, more frequent fires occurring during the growing season. Native American burning, essential to maintaining the eastern tallgrass prairie, was bimodal in distribution, peaking in April and October with lightning ignition occurring primarily during July and August (Higgins 1986). Bison grazing as a major disturbance was likely much more limited than prairies further west. Elk probably contributed to the impact of grazing and browsing as well but it is assumed that the total contributions of these two species was still less than to the west. The elk may have contributed to the reduction of young woody saplings invading prairie adjacent to protected woody areas.

Adjacency or Identification Concerns

Central tallgrass prairie would be adjacent to north-central interior oak savanna, north-central oak barrens, north central interior sand and gravel prairie, and sedge meadows and wet prairie.

Synonymous names for this system include: mesic prairie, wet prairie, deep soil prairie, and blacksoil prairie.

This Bps might be confused with the north central interior sand and gravel prairie.

In the absence of historic fire invasive problems have increased dramatically, including gray dogwood, american plum, hazelnut. Exotics that have become invasive due to agricultural practices and roadside plantings include reed canary grass, smooth brome, leafy spurge (Euphorbia esula), sweet clover (Melilotus alba), and crown vetch, yellow parsnip, and birds foot trefoil. Domestic livestock grazing is also an issue.

Today this system has a severely reduced native cover (approx. 99.9% loss) particularly for the mesic component of this type due to conversion to other uses such as agriculture. In addition to the massive reduction in extent of mesic prairie, the scale of its occurrence has also severely been altered. Currently this type occurs in fragmented small patches ranging from 1-10ac. Altering of the type is due to grazing and reduced fire resulting in greater shrub and tree component and a variety of native and non native shrubs, and non native cool season grasses (brome, bluegrass, quackgrass, redtop) resulting in reduced diversity.

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This system has mainly been converted to agriculture and other development. Invasion of cool season grasses and shrubs often mask the identification of this type. It may be difficult to determine the difference between old fields and native prairie patches by using aerial photos or remote sensing data.

Again, species composition and structure were dependent on local factors such as topography, soil conditions, fire regime, plant competition, and plant-animal interactions (Anderson and Bowles 1999).

As indicated this system interfaces and mingles on the east with Oak Savanna and on the west with Mixed Grass Prairie (in NE and the Dakotas). On the east there would be limited woody invasion from protected areas during periods of increased precipitation. The woody component would be limited to the edge the prairie and would not exhibit any appreciable effect overall. Since Mixed Grass Prairie is to the west, there would be little effect except in periods of extended drought the percentage of the mixed grass species would increase.

This system differs functionally from North-Central Interior Sand and Gravel Tallgrass prairie due to fire intensity - heavier fuels leading to higher fire intensity and a stronger grass competition for trees and shrubs to come in; so it's more difficult for trees and shrubs to come into this system.

Native Uncharacteristic Conditions

Many small trees and shrubs would be uncharacteristic of this system historically but occurs today due to the lack of fire. Domestic livestock grazing has also severely degraded this system. Haying would also have altered the species composition, especially for forbs species. Insects may not be as prevalent in modern times due to fragmentation (hypothesis by Tim Christiansen, pers. comm.).

Scale Description

Within regions of varied topography, type patches are typically large (>1000ac) most prevalent on flat to rolling topography. Most fires were stand replacement in nature. Once ignited, dormant season fires would have spread over a large area until reaching a major firebreak (e.g. previously burned area, major river, rugged terrain, etc.). Growing season fires may have been frequent but smaller in size than dormant season fires due to the greenness of the fuel and rain following lightning ignition. Growing season fires during drought years would have been much like dormant season fires. Mixed fires were probably limited to patchy grazed areas or areas where fuel was not uniformly cured.

Issues/Problems

This system was lumped with NorthernTallgrass Prairie (BpS 2420) and this model is the one used for both 2420 and 2421. For mapping, 2421 should stay on the map, using this model as guidance. 2420 lacks a model as experts did not feel that it would be distinguishable from 2421. The plant/animal interactions are not fully understood for this model and numerous studies of these phenomena are ongoing. Research exists for bison/fire interaction in detail in the western range of this system (i.e. KS and NE). Also, there is possible overlap with the North Central Interior Oak Savanna model (BpS ID 1394, MZs 41, 50 and 51). There is variation in oak species composition across the broad region covered by this model (i.e., bur oak [Quercus macrocarpa] increases in prevalence in the western portion of the range). There is also great variation in prairie type across this region. Within the western ranges of this type there was a grazing and fire interaction. As one moves east in this region fire increases to where it is the major disturbance factor for this type and grazing drops out as an influence. The species composition also changes from east to west. Much of the literature on fire in the tallgrass prairie does not include interaction with herbivory (Engle and Bidwell 2001) thus interpreting effects must be qualified. In

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addition, little is know about native ungulate grazing in this area. It is generally accepted that bison grazing was less in this grassland than in grasslands to the west. Even within this type grazing likely played a larger role as one moves from east to west. Further, it has been recently suggested that elk populations may have been large enough to have an effect on vegetative composition. Some woody plant invasion may have occurred but it was limited to areas close to seed sources such as along the eastern interface with the savanna and around woody pockets and river valleys.

Comments

For MZs 38, 42 and 43, the model was imported from th same BpS in MZ51 with minor changes in text - made by Susanne Hickey (shickey@tnc.org).

For MZ44 this model was imported from MZ50 without changes except that in MMZ50 BpS 1421 was lumped with BpS 1488 and 1420. This lump does not apply in MZ44 because BpS 1488 and 1420 do not occur in the zone.

The MZ50 this model was developed by John Harrington and Rich Henderson and reviewed by Robert Dana (Robert.Dana@dnr.state.mn.us), Dave Cleland (dcleland@fs.fed.us) and Tim Christiansen (tim.christiansen@us.army.mil). Modelership was not changed in MZ44 because no changes were made to the description or the model. No review was received for MZ44.

Suggested reviewers: Dave Borneman, see also sand and gravel parried reviewers. This model was reviewed at the Landfire Vegetation Modeling Workshop for MZ50, 51 and 41 by Elena Conteras, Randy Swaty, Mike Kost, Chris Weber, Doug Cox, and Becky Schillo.

This model for GL was adapted from the RA model R4PRTGc Tallgrass Prairie - Central created by Daryl Smith daryl.smith@uni.edu and reviewed by Tom Bragg tom.bragg@mail.unomaha.edu and John Ortmann jortmann@tnc.org and an anonymous reviewer.

Vegetation Classes

Class A **41 %**

Early Development 1 Open

Upper Layer Lifeform

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

Fuel Model

3

Indicator Species and Canopy Position

ANGE
Upper
SONU2
Upper
SPPE
Upper
SPHE
Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	70 %
Height	Herb 0m	Herb >1.1m
Tree Size Class		

- [ ] Upper layer lifeform differs from dominant lifeform.

Open refers to absence of tree or shrub canopy cover.

Description

Post Fire Regrowth Stage - Duration: two years. From blackened state, rapid regrowth of fire positive and fire neutral perennial vegetation to maximum height by end of growing season. Warm season grasses and fire positive forbs display increased height, flowering and fruiting and appear to be more abundant depending on season of the burn. Annual, biennial and short-lived perennial species occupy space opened by litter removal. Fire neutral perennial forbs maintain pre-fire composition, but may appear to be reduced. Fire negative species are reduced. No litter accumulation in this class. Probability of a replacement fire is 1.00 as all surface fires are replacement in this system.

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The cover in this class is defined as 0-70% for mapping purposes. However, it could really go up to 100% cover.

Class B **57 %**

Mid Development 1 Open

Upper Layer Lifeform

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

Fuel Model

3

Indicator Species and Canopy Position

ANGE
Upper
SONU2
Upper
SPPE
Upper
SPHE
Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	71 %	100 %
Height	Herb 0m	Herb >1.1m
Tree Size Class		

- [ ] Upper layer lifeform differs from dominant lifeform.

SPHE refers to Sporobolus heterolepsis

Description

Unburned Stage - Duration: 2 - 4yrs. This unburned stage continues to be dominated by big bluestem (Andropogon gerardii), Indiangrass (Sorghastrum nutans) and prairie dropseed on more mesic sites with prairie cordgrass (Spartina pectinata) and bluejoint grass dominating the wet sites. Secondary species such as little bluestem (Schizachyrium scoparium) and porcupine grass (Stipa spartea) occupied the drier portions of these uplands and soil types and varied in importance. Perennial forbs include genera such as Asclepias, Aster, Echinacea, Helianthus, Solidago, Liatris, Dalea, and Viola. Noticeable scattered shrubs, Amorpha, Rosa spp. and Coenothus, annually increase in size. Litter accumulates annually. Annuals, biennials and short lived perennials gradually become less abundant.

Probability of a replacement fire is 0.33. If it's a cool fire, and intensity is low, it'll probably stay in B; won't remove all thatch and some shrubs will survive. However, with a lot of fuels, and if hot - could go all the way back to A. Without fire for about 6yrs, sometimes it will move to C.

The cover in this class is defined for mapping purposes as 71-100%. Some shrubs might be coming up in this stage

Class C **2 %**

Late Development 1 All Structures

Upper Layer Lifeform

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

Fuel Model

3

Indicator Species and Canopy Position

ANGE
Middle
SPPE
Middle
SALI
Upper
CORA6
Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	30 %
Height	Shrub 0.6m	Shrub 3.0m
Tree Size Class		

- [ ] Upper layer lifeform differs from dominant lifeform.

SALI refers to Salix spp. Herbaceous layer is still dominant. But grass cover declining due to thatch; won't be as dense

Description

Unburned Thatch Accumulation Stage - Duration 5 - 20yrs. Continuation of unburned state from class B, however, with lack of fire for the long term, the prairie matrix weakens and it is succeeded by woody cover of shrubs and trees, depending on proximity of woody seed sources. Without fire the length of this stage is dependent on ppt and temperature as well as topography and soils. It can be inferred that the effect of large ungulates, bison and elk, was highly limited in this region of this type. Probability of a replacement fire is

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0.33 approximately.

As thatch builds up, grasses will start to lose vigor and become less competitive, and then shrubs or trees might start moving in more, which would be uncharacteristic, because that would be due in part to lack of fire.

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 Group:** II

Historical Fire Size (acres)

Avg 10000
Min 10
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	3.570	2	5	0.28009	100
Mixed					
Surface					
All Fires	4			0.28011	

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
☑ Wind/Weather/Stress
☐ Native Grazing
☐ Competition
☐ Other (optional 1)
☐ Other (optional 2)

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