LANDFIRE Biophysical Setting Model

Biophysical Setting 3211480 Western Great Plains Sand Prairie

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

General Information

Contributors (also see the Comments field) **Date** 1/10/2007

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Vegetation Type
Upland Grassland/Herbaceous

General Model Sources
☐ Literature
☐ Local Data
☑ Expert Estimate

Dominant Species
ANHA
CALO
PAVI2
BOGR2
SONU
HECOC8
ARFI2
PRPUB

Map Zone
32

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

Northeast CO, part of southwest NE, western KS, southeast WY, south to OK, NM and TX. In MZ34, this system can found throughout the mapzone except possibly to a limited extent in 332Fb (where it may not occur at all). In MZ32 this type can be found in ECOMAP subsection 332Fb and 332Fd as well as in 315Fb and 315Fc.

Biophysical Site Description

Soils are going to be sandy to loamy sands in this BpS. Soils are highly permeable and low in organic matter. This BpS is referenced as a Deep Sand or sandhills Ecological Site Description (USDA-NRCS ESD). Occurs on rolling topography and along river drainages (such as the Canadian River). Precipitation ranges from 40-60cm (15-24in).

Vegetation Description

Graminoid species, such as sand bluestem (Andropogon hallii), sand dropseed (Sporobolus cryptandrus), prairie sandweed (Calamovilfa longifolia), needle and thread (Hesperostipa comata), little bluestem (Schizachyrium scoparium), blue grama (Bouteloua gracilis) (dominant) and hairy grama (B. hirsuta), can be found within this system. It structurally resembles a tallgrass prairie system. Shrub species that may occur include sand sagebrush (Artemesia filifolia), Harvard oak (Quercus havardii), yucca (Yucca elata), sandcherry (Prunus angustifolia) and skunkbush sumac (Rhus trilobata). Also present – switchgrass (Panicum virgatum), western wheatgrass (Pascopyrum smithii) and more rarely – Indiangrass (Sorghastrum nutans). Herbaceous cover is variable ranging from sparse cover (sometimes resulting in highly erodable areas) to >70%.

**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.

Disturbance Description

Grazing, drought and fire were the primary disturbances. Fire and drought disturbances were cyclic with the earliest and latest seral stages fluctuating widely on a scale of centuries in accordance with changes in climate. Every year, there was probably some grazing - intensity and number of animals probably varied greatly over time. The principal large grazer of the sandhills was most likely bison which, when occurring in large numbers, would have locally disturbed large areas due both to grazing impact and physical disturbances such as trampling and wallowing. Elk and deer were other large grazers. Other ubiquitous grazers of the sandhills would have been numerous rodent species such as pocket gophers and kangaroo rats. Prairie dogs were a minor component of the sandhills prairie, with towns located only in areas of finer textured soils.

Grazing and drought would modify fire effects. Fires could occur in a mosaic pattern or may have burned extensively with high severity. The most extensive fires are likely to have occurred in years with wet springs followed by hot, dry summers when grazing pressure was low. Wet springs would have resulted in more productive and more continuous plant cover (i.e. fuel) that would have supported and expanded fires ignited under dry conditions occurring later in the season. In addition, litter accumulation over several fire-free years would also have supported widespread fire in any conditions. The litter component, a determining factor in fire size and frequency, is correlated with seral stage. Fire intervals could have ranged from a few years to over 50yrs; however the return interval was likely similar to that of adjacent grasslands wich probably burned at intervals of less than 10yrs. Post fire recovery of the plant community can occur in 2-4yrs (Vermeire et al. 2004 and 2005). Post-fire shifts in species composition depend on the timing and condition of fire.

Extended periods of severe drought are likely to affect both species composition and the stability of the sandhill soil, particularly when compounded by effects of wind, grazing, and fire. These conditions may have led to the development of blowouts making it difficult for vegetation to re-establish quickly. In early development immediately after disturbance, when herbaceous cover is low, wind erosion tends to maintain that class.

Adjacency or Identification Concerns

Classes of this BpS will resemble occurrences of Western Great Plains Sandhill Shrubland (BpS 1094). We have modeled the two systems separately because the species composition is different--the shrubland will be dominated by shinnery oak whereas the shrubs in the prairie will be domintaed by cherry and sagebrush. Shrub dominated occurrences of the present BpS result from current grazing and altered fire regime.

In current conditions this BpS has much less tallgrasses than historically – switchgrass and bluestem. Some experts believe that there is also a greater amount of sandsage and shortgrass (blue grama) (denser, more basal area) today than there was historically. These experts contend that this system has largely been converted to a shortgrass sandsage plant community primarily due to long-term continuous grazing and/or overstocking. The changes in grazing in current conditions have had a much greater effect on this system than changes in fire regimes (fire suppression). However, other experts indicate that it is difficult to explain how this system would be more extensive today than it was historically becasue sandsage in not limited by fire.

Native Uncharacteristic Conditions

Eastern redcedar (Juniperus virginiana) has invaded this type due to lack of fire.

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Scale Description

Can occur as a large patch (1000ac). More commonly occurs as a small patch.

Issues/Problems

This habitat was important to lesser prairie chicken and greater prairie chicken and plains sharp-tailed grouse.

Very little research has been published on sand-sagebrush communities, but Sam Fuelendorf (OK State University) has ongoing studies looking at the fire/grazing interaction in this type.

In MZ32 a reviewer suggested that this system be represented by a two box model, but other reviers disagreed and prefered the existing three-box model that was created for MZ34. For consistancy across zones and to represent the majority opinion received by modelers and reviewers, the regional lead chose to retain the three-box model from MZ34.

Comments

For MZ32 this model was adapted from the same BpS in MZ34. Minor descriptive changes were made to the description but no changes were made to the VDDT model so MZ34 modelership was retained.

Minor changes to the description were made during review of BpS 1148 in MZ34.

Vegetation Classes

Class A **25 %**

Early Development 1 Open

Upper Layer Lifeform

- ☑ Herbaceous
- ☐ Shrub
- ☐ Tree

Fuel Model

Indicator Species and Canopy Position

ANHA Upper
CALO Upper
PAVI2 Upper
BOGR2 Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	0 %	20 %
Height	Herb 0m	Herb 0.5m
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

(Early post-replacement 0-3yrs) This class represents an array of early species including annuals and resprouting perennials. Class A represents a mix of bare sand, including blowouts and sand draws and extensive areas of sparse vegetative cover up to 20%. The persistence of this class depends on continual disturbance that inhibits the establishment of vegetation such as wind erosion drought and grazing. This class lasts for three years. Buckwheat (Eriogonum annuum) and horseweed (Conyza canadensis) may dominate after disturbance.
Frequent wind/weather stress (every three years) in this class is referring to high wind events which occur normally. But the fire and drought are what create the conditions to have the wind affect the class and reset it. Native grazers (probability = 0.5) maintain this stage.

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Class B 65 %

Mid Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

1

Indicator Species and Canopy Position

ANHA
Upper
CALO
Upper
PAVI2
Upper
PRPUB
Mid-Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	21 %	80 %
Height	Herb 0.6m	Herb >1.1m
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class B is sandhill grassland, the dominant historical condition. This class has a moderatly dense herbaceous layer (20-80% cover) up to one meter tall. Fire (every 10yrs) would return this class to A, while lack of fire (after 40yrs) would move it toward C. Shrubs may make up to 25% of the cover but is more commonly 0-10%. Native grazing maintains this class. Severe, multiple year drought (every 100yrs) moves this class to C by reducing grass cover and fuel loads and giving a competitive advantage to the usually spare shrub cover.

Class C 10 %

Late Development 1 All Structures

Upper Layer Lifeform

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

Fuel Model

1

Indicator Species and Canopy Position

ARFI2
Upper
QUHA3
Upper
PRAN3
Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	21 %	100 %
Height	Shrub 0.6m	Shrub 3.0m
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class C is the shrub dominated sandhill grassland and differs from the sandhill shrubland (BpS 1094) which is modeled separately based on edaphic differences. Fire returns this class to A (MFRI = 0.10). Dominate shrubs include sand sagebrush, shinnery oak and sand cherry.

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

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

References

Bragg, T.B. 1986. Fire history of a North American sandhills prairie. In: In Program of the IVth International Congress of Ecology, Syracuse University, Syracuse, New York. 10-16 August 1986. Page 99.

Bragg, T.B. 1997. Response of a North American sandhills grassland to spring, summer, and fall burning: Community resistance to disturbance (1984-1996). In 'Bushfires 97 Proceedings, B.J. McKaige, R.J. Williams and W.M. Waggitt, editors. Parks Australia North and CSIRO Tropical Ecosystems Research Centre, Darwin, Northern Territory, Australia.

Bragg, T.B. 1998. Fire in the Nebraska Sandhills Prairie. In Fire in ecosystem management: Shifting the paradigm from suppression to prescription, T.L. Pruden and L.A. Brennan, editors. Tall Timbers Fire Ecology Conference Proceedings No. 20, Tall Timbers Research Station, Tallahassee, Florida.179-194.

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

Steuter, A.A., E. M. Steinauer, G.L. Hill, P.A. Bowers and L.L. Tieszen. 1995. Distribution and diet of bison and pocket gophers in a sandhills prairie. Ecological Applications 5(3):756-766.

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USDA-NRCS Ecosite/Range Site Descriptions, Section II, Field Office Technical Guides. http://www.nrcs.usda.gov/Technical/efotg/.

Vermeire, L.T., R.B. Mitchell, S.D. Fuhlendorf and R.L. Gillen. 2004. Patch burning effects on grazing distribution. Journal of Range Management. 57: 248-252.

Vermeire, L.T., D.B. Wester, R.B. Mitchell, and S.D. Fuhlendorf. 2005. Fire and grazing effects on wind erosion, soil water content, and soil temperature. Journal of Environmental Quality. 34: 1559-1565.

Wright, H.A. and A.W. Bailey. 1982. Fire Ecology, United States and Southern Canada. John Wiley & Sons, Inc. New York.

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