# Rapid Assessment Reference Condition Model

*The Rapid Assessment is a component of the LANDFIRE project. Reference condition models for the Rapid Assessment were created through a series of expert workshops and a peer-review process in 2004-2005. For more information, please visit www.landfire.gov. Please direct questions to helpdesk@landfire.gov.*

## *Potential Natural Vegetation Group (PNVG):*

**R4NESP** **Nebraska Sandhills Prairie**

## *General Information*

**Contributors** *(additional contributors may be listed under "Model Evolution and Comments")*


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**Vegetation Type**

Grassland

**Dominant Species***

anha bohi2
calo stco4
scsc spcr
bogr2

**General Model Sources**

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

**LANDFIRE Mapping Zones**

33
31

**Rapid Assessment Model Zones**

- [ ] California
- [ ] Great Basin
- [ ] Great Lakes
- [ ] Northeast
- [x] Northern Plains
- [ ] N-Cent.Rockies
- [ ] Pacific Northwest
- [ ] South Central
- [ ] Southeast
- [ ] S. Appalachians
- [ ] Southwest

### Geographic Range

Nebraska Sandhills Prairie is found in central and western Nebraska, south central South Dakota and northeast Colorado covering approximately 5.5 million ha (Bleed and Flowerday, 1990).

### Biophysical Site Description

Within the last 10,000 years, much of this area is thought to have shifted between active dune fields and more stabilized , grass-covered dunes depending on shifts in climate and changes to disturbance regimes. The area is dissected by several rivers, and includes wetlands, wet prairies, and fens which increase in frequency from east to west. The Sandhills are the primary recharge area for the Ogallala aquifer maintaining one of the most consistent groundwater levels in the world. Soil types shift from sands in the west and on uplands, to sandy loams and loams further east and in floodplains. Soils in the Sandhills are often undeveloped and highly permeable. Blowouts and sand draws characterize some of the wind-driven disturbances of the region. When disturbed, the fragile nature of the soils can profoundly impact vegetation composition and succession within this system. On a coarse scale, the system may be divided into riparian, sands, choppy sands, and dry valleys, each of which supports slightly different fire behavior and vegetation dynamics. Generally, dry valleys, sands, and choppy sands may be combined for modeling purposes.

### Vegetation Description

Dominant vegetation includes Prairie Sandreed (Calamovilfa longifolia), Sand Bluestem (Andropogon halii), Little Bluestem (Schizachyrium scoparium), Blue Grama (Bouteloua gracilis), Hairy Grama (B. hirsuta), Needle and Thread (Stipa comata), Sand Dropseed (Sporobolus cryptandrus). Rooting morphology, photosynthetic pathway (C3 or C4), and mechanisms to avoid transpiration loss are important plant characteristics that may account for the composition, distribution, and productivity of plant communities in the Sandhills (Bragg, 1997).

*Dominant and Indicator Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.

## Disturbance Description

Fire, grazing, and drought were the primary disturbances in the Nebraska Sandhills. Disturbances were cyclic with the earliest and latest seral stages fluctuating widely on a scale of centuries in accordance with changes in climate. The principal large grazer of the sandhills was most likely bison (Bison 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. Another ubiquitous grazer of the Sandhills would have been the plains pocket gopher (Geomys bursarius). Pocket gophers graze largely below ground but their activities also result in localized areas of bare sand. Gopher diets are strongly linked to forbs thus having an effect on species composition. Prairie dogs were a minor component of the Sandhills prairie, with towns located only in areas of finer textured soils primarily in the eastern areas of the sandhills or in low areas well above the water table. Where they occurred, prairie dogs grazed vegetation close to the ground which provided a local firebreak but also being a favored location for native grazers such as bison and pronghorn. These towns were unlikely to persist for more than a few decades due to the dynamic characteristics of the sandhills system

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. One to three fire-free years produce enough litter to carry another fire. Post-fire shifts in species composition depend on the timing and condition of fire. Maximum temperature differences of only 20 degrees C, for example, can change the response of various species to a fire.

Extended periods of severe drought is likely to have effected both species composition and the stability of the sandhill soil, particularly when compounded by wind and heavy grazing. These conditions may have lead to the development of blowouts making it difficult for vegetation to re-establish quickly. The occurrence of Blowout penstemon (Penstemon haydenii) suggests long periods when blowouts were common across the landscape although causes resulting in this feature have not been determined

## Adjacency or Identification Concerns

The Sandhills are dissected by riparian areas which provided fire breaks and effected the movement of bison herds.

## Scale Description

**Sources of Scale Data** ☑ Literature ☐ Local Data ☑ Expert Estimate

Droughts could affect the entire region, but deep-percolation of precipitation in the coarse-grained sandy soils would have ameliorated the effects of moderate or short droughts in the uplands. The shallow water table would have protected vegetation of the lowland valleys from the effects of short droughts . During drought periods, grazing pressure would be more concentrated near water sources.

## Issues/Problems

Very little data are available from presettlement times, but written accounts describe a much more sparsely vegetated landscape. However, these accounts often followed bison paths which would bias estimates of landscape cover towards more sparse vegetation. The presence of Blowout penstemon (Penstemon haydenii), a species endemic to blowouts indicates that bare sand in some form has been present in the area for some time.

## Model Evolution and Comments

## Succession Classes

*Succession classes are the equivalent of "Vegetation Fuel Classes" as defined in the Interagency FRCC Guidebook (www.frcc.gov).*

### *Class A* 28 %

Early1 Open

**Description**

Class A represents a mix of bare sand, including blowouts and sand draws, and extensive areas of sparse vegetative cover. Drought would have been the main cause of this condition so the area occupied by this class is likely to have varied considerably, expanding during severe, extended droughts, and contracting during wetter years. The persistence of this class depends on continual disturbance that inhibits the establishment of vegetation.

**Indicator Species* and Canopy Position**

| | |
|---|---|
| spcr | Upper |
| scsc | Upper |
| REFL | Upper |
| MUPU2 | Lower |

**Upper Layer Lifeform**

- ☑ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model** no data

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0 % | 10 % |
| *Height* | Herb Short <0.5m | Herb Tall > 1m |
| *Tree Size Class* | no data | |

☐ Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

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### *Class B* 22 %

Early2 Open

**Description**

Class B represents immediate to three year post disturbance conditions. Vegetation consists of resprouting and seedling grass and forbs. Total bare soil is greater than before the disturbance particularly on upper slopes and dune tops. The vigor of new growth and the specific species effected depend on the season of the disturbance and on pre- and post-disturbance environmental conditions (e.g. available soil moisture). Litter is low initially but increases until, by year three, there is enough to support fire under average burning conditions. In uplands. where soil-type is dominated by coarse-grained sands with low water-holding capacity, post-disturbance primary production initially decreases thus fire may only carry under ideal

**Indicator Species* and Canopy Position**

| | |
|---|---|
| anha | Middle |
| scsc | Mid-Upper |
| calo | Upper |
| bohi2 | Lower |

**Upper Layer Lifeform**

- ☑ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model** 1

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0 % | 60 % |
| *Height* | Herb Short <0.5m | Herb Tall > 1m |
| *Tree Size Class* | no data | |

☐ Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

*Dominant and Indicator Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.

conditions. Under these conditions, grazing is likely to be light. In lowlands, with finer-textured soils, primary production is determined largely by moisture availability. Repeated grazing of these areas will prevent succession to Class D.

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### *Class C* 2%

Early3 Open

**Description**

Class C represents prairie dog towns characterized by short-stature vegetation. Prairie dog towns were a minor component of the Sandhills landscape occurring where soils were finer textured and in flat uplands and in valleys and the eastern Sandhills where the water table was not high. Unlike elsewhere in the Great Plains mixed and shortgrass prairie, prairie dog towns in the Sandhills are believed to have persisted for decades (20-80 years) rather than centuries. As prairie dog towns become established in an area, short-statured ecotypes of taller grasses and forbs predominated and plant composition is likely to have shifted from mixed-grass species, such as Little Bluestem, to short-grass species, such as Hairy Grama and Buffalo grass, and annual forbs.

**Indicator Species* and Canopy Position**

| | |
|---|---|
| bohi2 | All |
| buda | All |
| bogr2 | All |

**Upper Layer Lifeform**

- ☑ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model** 1

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0 % | 50 % |
| *Height* | no data | Herb Short <0.5m |
| *Tree Size Class* | no data | |

☐ Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

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*Dominant and Indicator Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.

### *Class D* 36 %

Mid1 Open

**Description**

This mid seral stage may either have persisted for up to three years after a fire or may be the consequence of mixed-severity fire. This stage includes moderate grazing by native ungulates and insects.

**Indicator Species* and Canopy Position**

| | |
|---|---|
| anha | Upper |
| calo | Upper |
| scsc | Middle |
| bohi2 | Lower |

**Upper Layer Lifeform**

- ☑ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model** 3

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 20 % | 70 % |
| *Height* | Herb Short <0.5m | Herb Tall > 1m |
| *Tree Size Class* | no data | |

☐ Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

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### *Class E* 12 %

Late1 Closed

**Description**

Grasses are well established averaging 85-95% cover in uplands (Bragg 1998), but occurring with as low as 40% canopy cover in some locations. Canopy cover may reach 100% in wetter low areas. Litter accumulates providing continuous fuels for fires thereby increasing the probability of larger fires. This stage rarely persists more than 10 years but, when it does, woody species such as chokecherry (Prunus virginiana) snowberry (Symphoricarpos occidentalis), and smooth sumac (Rhus glabra) may begin to become established in more protected areas. Since woody plants shade herbaceous species, some disturbance – for example fire or drought – is required to revert this class to an earlier one.

**Indicator Species* and Canopy Position**

| | |
|---|---|
| anha | All |
| calo | Upper |
| spcr | Mid-Upper |
| scsc | Middle |

**Upper Layer Lifeform**

- ☑ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model** 3

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 70 % | 100 % |
| *Height* | Herb Short <0.5m | Shrub Short 0.5-0.9m |
| *Tree Size Class* | no data | |

☐ Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

## *Disturbances*

**Non-Fire Disturbances Modeled**

- ☐ Insects/Disease
- ☐ Wind/Weather/Stress
- ☑ Native Grazing
- ☐ Competition
- ☑ Other: Prairie Dogs
- ☑ Other: Multiple severe disturbances

**Fire Regime Group:** 2

I: 0-35 year frequency, low and mixed severity
II: 0-35 year frequency, replacement severity
III: 35-200 year frequency, low and mixed severity
IV: 35-200 year frequency, replacement severity
V: 200+ year frequency, replacement severity

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**Historical Fire Size (acres)**

Avg: 7000
Min: 1
Max: 500000

***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 the 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. All values are estimates and not precise.

| | *Avg FI* | *Min FI* | *Max FI* | *Probability* | *Percent of All Fires* |
|---|---|---|---|---|---|
| *Replacement* | 11 | 2 | 20 | 0.09091 | 58 |
| *Mixed* | 20 | | | 0.05 | 32 |
| *Surface* | 67 | | | 0.01493 | 10 |
| *All Fires* | 6 | | | 0.15583 | |

**Sources of Fire Regime Data**

- ☑ Literature
- ☑ Local Data
- ☑ Expert Estimate

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