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):

R6BSOH **Mosaic of Bluestem Prairie and Oak-Hickory**

General Information

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

Modelers

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Vegetation Type

Grassland

Dominant Species*

ANGE QUERC
SONU2 CARYA
SPPE
PAVI2

General Model Sources

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

LANDFIRE Mapping Zones

42 52
49 41
50 51

Rapid Assessment Model Zones

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

Geographic Range

Largest expanse (11-13 million ha) across Central Midwestern states with typical Prairie Border forests and Prairie Peninsula region of eastern states Iowa, Minnesota, Wisconsin, Illinois, Indiana, Kentucky, and Ohio.

Biophysical Site Description

Within the area of the Prairie Border forests (Abrams 1992), prairie vegetation dominated the landscape with oak-hickory forests existing within fire-protected ravines or along stream corridors forming gallery forests (Abrams 1992). Our model abstracts prairie types to include xeric, mesic, and lowland prairie types (Curtis 1959). Xeric prairies were maintained by shallow soils (< 4 inches) on steep slopes (usually to the southwest) with extreme runoff of rainwater. Xeric prairies may also have occurred on flat uplands where soil is shallow and has low water holding capacity. Mesic prairies occurred on flat and rolling topography. Level sites occurred on glacial outwash with a very porous subsoil of sand and gravel. Rolling areas were characterized by glacial till of recessional moraines or on residual loess soils. Soil profiles consist of a black surface layer rich in organic material and with high water-holding capacity (51-90%). Soil types in Wisconsin include Elliot-Beecher-Morley series along the former bed of Glacial Lake Chicago, and Parr, Waupun, Warsaw, and Waukegan types in glaciated areas. In the driftless zone of southwest Wisconsin, mesic prairies were found on Tama, Downs, and Muscatine soils. Lowland prairies were found in lowlands, along waterways, or in areas subject to frequent inundation. Soils are rich in organic matter and show evidence of inundation in a gleying layer 3-4' below the surface. Soil groups include Ashkum and Bryce in southeast Wisconsin, as well as the Elba, Kokomo, and Brookston series in glaciated areas, and Garwin and Judon series in the driftless region (southwest Wisconsin). 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). Over time, forest edges expanded and contracted based on

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

topographic variability and fire frequency and intensity exhibiting a continuum of grassland, “grub”, open savanna woodlands, or canopied forests. Much has been written concerning these systems and excellent reviews can be found in Whitney (1994) and Anderson, Fralish and Baskin (1999).

Vegetation Description

Grasses formed the matrix of the prairie with big bluestem (Andropogon gerardii), Indian grass (Sorghastrum nutans), prairie cordgrass (Spartina pectinata) and switchgrass (Panicum virgatum) dominating many tallgrass prairies (Whitney 1994). Numerous forbs such as Helianthus spp. (sunflower genus), prairie clovers (Petalostemum spp.), and coneflowers (Echinacea pallida and Ratibida pinnata), amongst many others, were also present. Fuel complexes consisted of short- or tall-grass prairie forbs and shrubs with little or no tree regeneration.
Oak grubs characterize that portion of this vegetation sequence that experienced recurring fires in advanced oak regeneration, which stimulates the resprouting response evidenced by the ‘grubs’ or multi-stemmed stump sprouts of shingle oak (Quercus imbricaria), black oak (Q. velutina), blackjack oak (Q. marilandica), and others (Abrams 1992). Over a period of years, massive root systems developed, and the term ‘grub’ (from the German gruben, 'to dig'), referenced the laborious method of removing these root wads in clearing areas for planting (Anderson and Bowles 1999). Fuel complexes were characterized as “stunted brush prairie” comprised of mixed prairie grasses and forbs with coppicing oak stems about 1-1.5 m in height (Curtis 1959, Anderson and Bowles 1999).

Savannas and woodlands represent relatively open forest systems along the prairie-forest continuum (for extreme variety see Anderson et al. 1999). Generally, these systems have example species from true open prairies, woodlands, and closed canopy forests, with oak species dominating the arboreal layer (Abrams 1992). For the purposes of FRCC we have adopted fairly average canopy closure values of 10-25% closure to indicate savanna, while woodlands exhibit 25-60% canopy closure (see discussion in Anderson and Bowles 1999 for variation across range). Fuel complexes for savanna areas were largely prairie grasses and forbs in the understory, with widely scattered fire-resistant oak stems forming the overstory. In woodland areas, tree density would have been higher (47-99 trees/ha) but canopy closure rarely exceeded 50-60%. Fuel complexes in these open woodlands probably consisted of flashy prairie fuels as well as some accumulated hardwood leaf litter.

Mature oak-hickory forest represented a small portion of this vegetation group and has been discussed in the Oak-Hickory PNVG.

Disturbance Description

Frequent fires impacted prairie systems every 2-5 years, maintaining grass and forb vegetation. However, as oak-hickory regeneration becomes established, these species become largely fire resistant with age. Surface fires within woodland and forest types occurred every 12-15 years, reducing duff layers and allowing recruitment of oak-hickory stems. Also see the vegetation description.

Adjacency or Identification Concerns

Again, species composition and structure was dependent on local factors such as topography, soil conditions, fire regime, plant competition, and plant-animal interactions (Anderson and Bowles 1999). Because of the wide variation found across this vegetation type, strict definitions of savanna and woodland characteristics are equivocal (Curtis 1959, Nuzzo 1986).

Scale Description

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

Issues/Problems

The plant/animal interactions are not yet accounted for in this model. The FRCC model for Bluestem Prairie (PRAR5) describes the bison/fire interaction in detail. Also, there is possible overlap with the

Northern Oak Savanna model (NOKS). There is variation in oak species composition across the broad region covered by this model (i.e., bur oak [Quercus macrocarpa] occurs in the western portion of the range). There is also great variation in prairie type across this region.

Model Evolution and Comments

This model was created 5/26/04 for the Fire Regime Condition Class (FRCC) Interagency Handbook. An additional modeler was involved in this process, Charles Ruffner. The original document was coded BLST1 and then subsequently BLST2 for the FRCC code. There is some disagreement about the fire interval. FEIS indicates an 18-20 year fire interval. The Northern Oak Savanna model (NOKS) indicates an 8 year fire interval. The original model was altered in the Rapid Assessment Workshop (1/24/05) by Todd Hawbaker (tjhawbaker@wisc.edu) and Tricia Knoot (tknoot@iastate.edu). Specifically, parameter values and disturbance types were changed from the original VDDT model Class C (Mid-seral, open). In the original model, succession progressed from Class C to D after 20 years, and Class C could experience a stand-replacing fire with a 100 year frequency. We changed to model with succession progressing from Class C to D after 15 years without disturbance (via an alternate disturbance pathway). We also altered the stand replacing fire interval to a 200 year frequency. Originally, in Class B, there was a .33 probability of alternate succession to Class D. This violated the Rapid Assessment modeling rules. We changed this probability to 1, with very little affect on model results. These model alterations were based on expert opinion as collected during the Rapid Assessment workshop. These changes resulted in a different proportions of classes. The original model projected class composition as being A=60%, B=1%, C=10%, D=25%, and E=4%. The new model projects class composition to be A=65%, B=2%, C=20%, D=10%, and E=3%. We used a 1000 year simulation to reach the stable class values.

Succession Classes

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

Class A 65 %

Early1 All Structures

Description

This class is the prairie matrix dominated by big bluestem (Andropogon gerardii), Indian grass (Sorghastrum nutans), prairie cordgrass (Spartina pectinata) and switchgrass (Panicum virgatum) (Whitney 1994). Numerous forbs such as Helianthus spp. (sunflower genus), prairie clovers (Petalostemum spp.), and coneflowers (Echinacea pallida and Ratibida pinnata), amongst many others, were present. Fuel complexes consisted of short- or tall-grass prairie forbs and shrubs with little or no tree regeneration. Replacement fires occur frequently in early successional sere A. In this class, the model violates the rule of having a probability <1 in an

Indicator Species* and Canopy Position

ANGE	Upper
SONU2	Upper
SPPE	Upper
PAVI2	Upper

Upper Layer Lifeform

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

Fuel Model 3

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
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:

alternate succession pathway. This rule is violated because not all prairie will succeed to brushland in the absence of a fire disturbance (competition with grass species).

Class B **2 %**

Mid1 Open

Description

This is the oak grub representing prairie with scattered seedling sprouts or grubs. This vegetation is experiencing recurring fires in advanced oak regeneration, which stimulates the resprouting grubs. Fuel complexes are characterized as "stunted brush prairie" comprised of mixed prairie grasses and forbs with coppicing oak stems about 1-1.5m in height (Curtis 1959; Anderson and Bowles 1999).

Indicator Species* and Canopy Position

ANGE	Middle
SONU2	Middle
SPPE	Middle
QUERC	Upper

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Fuel Model 1

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	0 %	10 %
Height	Shrub Short 0.5-0.9m	Shrub Medium 1.0-2.9m
Tree Size Class	no data	

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

Perennial grasses dominate this class with < 10% oak/shrub canopy.

Class C **20 %**

Mid1 Open

Description

Fuel complexes for savanna areas were largely prairie grasses and forbs in the understory with widely scattered fire-resistant oak stems forming the overstory.

Indicator Species* and Canopy Position

ANGE	Lower
SONU2	Lower
SPPE	Lower
QUERC	Upper

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model 3

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	10 %	25 %
Height	Tree Regen <5m	Tree Medium 10-24m
Tree Size Class	Large 21-33"DBH	

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

Perennial grasses dominate this class with 10-25% oak canopy.

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

Class D 10 %

Late1 Open

Description

In woodland areas, tree density would have been higher (47-99 trees/ha) but canopy closure rarely exceeded 50-60%. Fuel complexes in these open woodlands probably consisted of flashy prairie fuels as well as some accumulated hardwood leaf litter. Carlen suggests using 9 fuel model.

Indicator Species* and Canopy Position

ANGE	Lower
SONU2	Lower
SPPE	Lower
QUERC	Upper

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model 2

Structure Data (for upper layer lifeform)

	Min	Max
Cover	25 %	60 %
Height	Tree Regen <5m	Tree Medium 10-24m
Tree Size Class	Very Large >33"DBH	

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

In general, perennial grasses dominate this class with 25-60% oak canopy.

Class E 3 %

Late2 Closed

Description

Mature oak-hickory forest represented a small portion of this vegetation group and has been discussed in the Oak-Hickory PNVG.

Indicator Species* and Canopy Position

QUERC	Upper
CARYA	Upper
ANGE	Lower
SONU2	Lower

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model 9

Structure Data (for upper layer lifeform)

	Min	Max
Cover	60 %	100 %
Height	Tree Short 5-9m	Tree Tall 25-49m
Tree Size Class	Very Large >33"DBH	

☐ 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:
- ☐ Other:

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

Historical Fire Size (acres)

Avg: 1000
Min: 1
Max: 100000

Sources of Fire Regime Data

- ☐ Literature
- ☐ Local Data
- ☑ Expert Estimate

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	5	1	8	0.2	79
Mixed	260			0.00385	2
Surface	20		33	0.05	20
All Fires	4			0.25385	

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PERSONAL COMMUNICATION (if applicable):
Oak-Hickory FRCC modeling group