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 and 2005. For more information, please visit www.landfire.gov. Please direct questions to helpdesk@landfire.gov.

Potential Natural Vegetation Group (PNVG)

R6MABA Maple Basswood

General Information

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

Modelers

Greg Nowacki gnowacki@fs.fed.us
Dave Cleland dcleland@fs.fed.us
Jim Gallagher jagallagher@fs.fed.us

Reviewers

Vegetation Type

Forested

Dominant Species*

ACSA QURU
TILIA
POTR5
BEPA

General Model Sources

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

LANDFIRE Mapping Zones

41
50

Rapid AssessmentModel Zones

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

Geographic Range

This forest type extends from northern Minnesota and Wisconsin southward into Iowa and Illinois, and from the forest-prairie margin eastward to Lake Michigan. This forest type is fringed by northern hardwoods to the north and prairies to the west. The western range of beech forms the eastern boundary, whereas its southern margin roughly parallels the maximum extent of past glaciation. The Big Woods of southeastern Minnesota is representative of this forest type (Grimm 1984).

Biophysical Site Description

Following retreat of the glaciers, most of the present Big Woods became prairie between 9000 and 6000 years before present (Webb et al. 1993). Oak woodland began invading the prairie about 5000 years ago, becoming fully established 2400 years ago (Grimm 1981). Oak woodland persisted until 300 years ago, when elm, basswood, and sugar maple rapidly expanded and became dominant. The changes from prairie to oak woodland, and from oak woodland to 'bigwoods' must have resulted from reductions in fire frequency, which were probably caused by increased precipitation and possibly decreased temperatures (ibid). Historically, elm dominated the overstory within the maple-beech component (Grimm 1981). However, this species has been largely eliminated from this system due to Dutch elm disease.

The elm-basswood-maple forests occurred on rich, mesic sites that were protected from fire by the oak-aspen buffer lying between this community and the prairie and by natural fuel breaks. They also occurred on upland sites with moist soils, usually in settings protected from fire. Plants in these communities have access to predictable supplies of water and nutrients, but they are often limited by light because of the dense forest canopy. Typical sites are buffered from seasonal drought by fine-textured moisture-retaining soils or dense subsoil layers. Essential nutrients are mineralized from decaying organic matter at twice the rate of that in fire-dependent forest or wet forest communities.

Vegetation Description

Sites are characterized by continuous, often dense, canopies of deciduous trees and understories of shade-adapted shrubs and herbs. Distribution of basswood is limited in northeastern Minnesota to areas inland

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

from Lake Superior. Vegetation Type and Structure Class* Percent of Landscape Description
A: Early-seral all (5%): Early-successional aspen, white birch, oak and openlands (< 60 yrs)
B: Mid-seral 1 open (10%): Mid-succession maturing forests (61-100 yrs)
C: Mid-seral closed (10%): Late-successional maturing forests (101-150 yrs) D: Late-seral closed (75%): Old late-seral forests (> 150 yrs)
Total 100%
*Formal codes for classes A-E are: AE1A, BM1O, CM1C, and DL1C, respectively.

Disturbance Description

Fire Regime V characterizes this system, dominated by high-intensity, low-frequency fires that occur at about 1,000-year intervals. Although low-intensity fires are more frequent (average 500-year interval), they do little more than prolong the time it takes to develop mature, fire-resistant stands. Historically, this forest type, composed of fire-sensitive species, was not disturbed by fire except during periods following catastrophic wind events or extreme drought. Grimm (1984) states "The fire regimes of deciduous forests, such as bigwoods, are much different from the commonly perceived model of fire regime, in which fuels and fire danger increase with time and in which intense crown fires cause great destruction of the forest." In the Great Lakes region, this model is appropriate for some of the northern coniferous forests (Heinselman 1983, Ahlgren 1974). However, in the southern deciduous forests, decomposition of potential fuels is rapid, and is particularly rapid on base-rich soils (Bormann and Likens 1979), such as those of the Big Woods. Because of the dense shade, the cover of herbs and shrubs is sparse. Thus little fuel exists at the ground level, tree trunks are not very flammable, and the open tree crowns do not carry fire very well. Moreover, low solar radiation, high humidity, and low wind speeds prolong the moisture retention of ground-level fuels (Kucera 1952), thereby inhibiting the ignition and spread of fire. These forests are sometimes referred to as the " asbestos forests" because of their fireproof character (Vogl 1967). Ordinarily, only the leaf litter ever reaches a flammable state, and only patchy creeping ground fires occur (Hall and Ingall 1911, Niering et al. 1970, Barden and Woods 1973).

Two primary disturbance factors are used to model this system. Catastrophic windthrow affects mature stands and occurs on an approximately 600-year rotation. Replacement fire occurs primarily in young and windthrown stands and occurs on a rotation of approximately 1,000 years. In addition, surface fires occur in young stands < 100 years of age which contain a significant component of oak. The disturbance probabilities by class applied in the model are contained in the VDDT documentation section.

Adjacency or Identification Concerns

Among other characteristics, this setting is distinguished from R6MBOA by more mesic conditions. As described, this setting extends to the prairie edge (see Issues/Problems). Setting is distinguished from R6NHHEgl by lack of hemlock and physical site. Uncharacteristic conditions in this setting include infestation by exotic earthworms of European species that have affected or begun to affect soil conditions, herb/forb species representation, and tree regeneration (Hale et al. 1999). Habitat for the rare Great Lakes endemic fern, Botrychium mormo, is largely eliminated after worm invasion.

Scale Description

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

The most common disturbance extent could best be characterized as a single-tree or small-group gap-phase dynamic. Replacement events would have encompassed hundreds to thousands of acres. Patch sizes would generally conform to landforms on which they are found.

Issues/Problems

Issues are similar to those of R6MBMHW, but with surface fire and more frequent stand replacement. They are also similar to R6MBOA, but with less disturbance and less ecotonal influence of the prairie transition. Mapping issues remain given the coarse mapping options in Rapid Assessment; however, better mapping tools are available at the state level.

Model Evolution and Comments

This model is unmodified from FRCC model for MABA. REVIEWERS: John Almendinger, Ecological Services, MN Department of Natural Resources. Jim Barott, Chippewa National Forest. Reviewed and entered by Jim Gallagher, Chippewa NF.

*Succession Classes***

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

Class A 5 %

Early1 All Struct

Description

Characterized by early-seral aspen, birch, oak < 60 yrs. Class A succeeds to mid-age stands (Class B). Burn frequency is approximately 50 years due to presence of oak and openings (20 % replacement; 80 % surface).

Dominant Species* and Canopy Position

POTR5 Upper
BEPA Upper
QURU Upper
ACSA3 Upper

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model 5

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	95 %
Height	Shrub Medium 1.0-2.9m	Tree Medium 10-24m
Tree Size Class	Pole 5-9" DBH	

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

Class B 10 %

Mid1 Open

Description

Characterized by mid-succession maturing forests (61-100 yrs) which succeed to class C. Windthrow in older classes returns vegetation to this class. Replacement fires (mostly in slash) result in early-seral type. Surface fires are associated with oak component.

Dominant Species* and Canopy Position

ACSA3 Upper
TILIA Upper
QURU Upper
BEPA Mid-Upper

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model 8

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	40 %
Height	Tree Medium 10-24m	Tree Tall 25-49m
Tree Size Class	Medium 9-21"DBH	

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

Class C 10 %

Mid1 Closed

Description

Characterized by late-successional maturing forests (101-150 yrs) which succeed to class D. Windthrow exceeds fire probabilities by a factor of 10.

Dominant Species* and Canopy Position

ACSA3 Upper
TILIA Upper
QURU Upper

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model 8

Structure Data (for upper layer lifeform)

	Min	Max
Cover	40 %	95 %
Height	Tree Medium 10-24m	Tree Tall 25-49m
Tree Size Class	Medium 9-21"DBH	

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

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

Class D 75 %

Late1 Closed

Description

These old late-seral forests (> 150 yrs) are the end point of succession. Small gap disturbances predominate to maintain a high proportion of the acreage in this class.

Dominant Species* and Canopy Position

ACSA3 Upper
TILIA Upper
QURU Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	40 %	95 %
Height	Tree Medium 10-24m	Tree Tall 25-49m
Tree Size Class	Large 21-33"DBH	

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

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

Fuel Model 8

Class E 0 %

Late1 All Structu

Description

Dominant Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover	%	%
Height	no data	no data
Tree Size Class	no data	

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

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

Fuel Model no data

Disturbances

Disturbances Modeled

- ☑ Fire
- ☐ Insects/Disease
- ☑ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other:
- ☐ Other

Historical Fire Size (acres)

Avg: 5000
Min: 10
Max: 10000

Sources of Fire Regime Data

- ☑ Literature
- ☐ Local Data
- ☐ Expert Estimate

Fire Regime Group: **5**

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

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. All values are estimates and not precise.

	Avg FI	*Min FI*	*Max FI*	*Probability*	*Percent of All Fires*
Replacement	1000			0.001	33
Mixed					
Surface	500			0.002	66
All Fires	333			0.00301	

References

Bormann, F. Herbert and Likens, Gene E., 1979. Catastrophic disturbance and the steady state in northern hardwood forests. American Scientist. 67:660-669.

Brown, James K. and Smith, Jane Kapler, eds., 2000. Wildland fire in ecosystems: effects of fire on flora. Gen. Tech. Rep. RMRS-GTR-42-vol. 2. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky

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

Mountain Research Station. 257 p.
Canham, Charles D. and Louck, Orie L., 1984. Catastrophic windthrow in presettlement forests of Wisconsin. Ecology. 65(3):803-809.
Cleland, D.T., S.C. Saunders, T.R. Crow, D.I. Dickmann, A.L. Maclean, J.K. Jordan, R.L. Watson, and A.M. Sloan, 2004. Characterizing historical and modern fire regimes in the lake states: a landscape ecosystem approach. Landscape Ecology 19: 311–325, 2004.
Frelich, Lee E. and Lorimer, Craig G., 1991. Natural disturbance regimes in hemlock-hardwood forests of Upper Great Lakes region. Ecological Monographs. 61:145-164.
Grimm, Eric C., 1981. Chronology and dynamics of vegetation change in the prairie-woodland region of southern Minnesota, U.S.A. New Phytologist. 93:311-350.
Grimm, E.C., 1984. Fire and other factors controlling the Big Woods vegetation of Minnesota in the mid-nineteenth century. Ecological Monographs 54:291-311.
Hale, C., L. Frelich and P. Reich, 1999. Unpublished. Research proposal concerning earthworms and population dynamics and diversity of native plant species. University of Minnesota. St. Paul, Minnesota.
Runkle, James Reade, 1982. Patterns of disturbance in some old growth mesic forests of eastern North America. Ecology. 63(5):1533-1546.
Schmidt, Kirsten M.; Menakis, James P.; Hardy, Colin C.; Hann, Wendel J.; Bunnell, David L.; 2002. Development of coarse-scale spatial data for wildland fire and fuel management. Gen. Tech. Rep. RMRS-GTR-87. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 41 p. + CD.
Webb, T., III; Bartlein, P.J.; Harrison, S.P.; Anderson, K.H., 1993. Vegetation, lake levels, and climate in eastern North America for the past 18,000 years. Pp. 415-467. In: Wright, H.E, Jr..; Kutzbach, J.E.; Webb, T., III; Ruddiman, W.F.; Street-Perrot, F.A.; Bartlein, P.J., eds. Global Climates since the Last Glacial Maximum. Minneapolis, MN: University of Minnesota Press.
U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (2002, December). Fire Effects Information System, [Online]. Available: http://www.fs.fed.us/database/feis/.

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