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):

R6NHHEgl **Northern Hardwood-Hemlock Forest (Great Lakes)**

General Information

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

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Vegetation Type

Forested

Dominant Species*

ACCA3	ABBA
TSUGA	POTR5
BEAL2	BEPA
PIST	

General Model Sources

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

LANDFIRE Mapping Zones

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

This system occurs throughout the Upper Peninsula of Michigan and northern Wisconsin.

Biophysical Site Description

This type occurs principally on moraines composed of well-to-moderately-well-drained heterogeneous soils with inherently high moisture and nutrient availability.

Vegetation Description

Structurally, these uneven-aged forests were characterized by large volumes of coarse, woody debris lying beneath multi-storied canopies of different-aged cohorts, with supercanopies composed of trees centuries old (Tyrell and Crow 1994). The dominant tree species are among the most moisture and nutrient-demanding species in the eastern U.S.A., and their distribution is
confined to glacial landforms underlain by fertile soils (Woods 2000, Whitney 1986). Composition of the ground flora and understory varies along a moisture-nutrient gradient, and typically consists of high densities of shade-tolerant tree species and mesophilic herbaceous species including blue cohosh, yellow violet, sweet cicely, various ferns, and ginseng.

In the mid-1800's, there were 5.8 million acres of northern hardwood ecosystems in the Upper Peninsula of Michigan (Cleland 2004a, ongoing R-9/SRS/MTU study). Sugar maple, hemlock, yellow birch, balsam fir, cedar in swales, spruce, and beech were the dominant late-successional species recorded along section lines by GLO surveyors (figure 1). Early-successional aspen and white birch comprised only 2.0% of the GLO line trees. Large openings likely occurred on less than 1% of the landscape.

In the mid-1800's, there were 8.4 million acres of northern hardwood ecosystems within the 17.8 million acres of forest lands in northern Wisconsin (ongoing R-9/SRS/MTU study). Yellow birch, sugar maple, hemlock, white pine, beech, elm, and basswood were the dominant late-successional species (figure 2). Early-successional aspen, white birch, and oak species comprised 4.8% of the GLO corner trees. Large openings likely occurred on less than 1% of the landscape.

Disturbance Description

These wind-driven ecosystems historically changed slowly over centuries due to fine-scale blowdowns, relatively rare broad-scale catastrophic storms, and even rarer fire events (Cleland et al. 2004, Woods 2000, Canham and Loucks 1984, Frelich and Lorimer 1991, Grimm 1984, Runkle 1982). Blowdowns affected conifers more than hardwoods, and older trees more than younger trees (Foster and Boose1992, Webb 1984). These "asbestos" forests seldom burned (Grimm 1984, Stearns 1949), and exhibited a repeating and shifting steady state of fine-scaled mosaics of species whose overall proportions remained essentially constant (Borman and Likens 1979).   Fire Regime Description: Composed of fire-sensitive species, fires only occurred within this forest type following catastrophic wind events or during periods of extreme drought. This fire-resistance is due to high rates of organic matter decomposition and low rates of fuel accumulation, closed and multistoried canopy effects on microclimate, succulent ground-flora and herbaceous layers, high soil moisture storage capacity, and the dispersed canopies of volatile coniferous foliage within a fire-resistant
deciduous hardwood matrix. The principal cause of fuel formation leading to fire in northern hardwood ecosystems is broadscale, storm-driven windthrow of catastrophic proportions (Canham and Loucks 1984, Dunn et al. 1983, Runkle 1982). Canham and Loucks (1984) estimated the return interval for catastrophic storms to be about 1,200 years in northern Wisconsin. Their comparisons of the presettlement disturbance regime with contemporary climatological records suggest that catastrophic thunderstorms were the principal mechanism for large-scale windthrow, followed by tornadoes that accounted for one-third of blowdown recorded by surveyors. Not only were these storms nearly stand-replacing events in themselves, but after the slash resulting from them cured, the probability of fire increased exponentially. However, fires within undisturbed, intact systems that did start or that moved into these stands from adjacent areas tended to smolder in the duff layer and move very slowly, eventually going out and causing little damage to the overstory (Frelich and Lorimer 1991, Stearns 1949).
Within the 5.8 million acres of northern hardwood ecosystems in the Upper Peninsula of Michigan, there were 146,028 acres of blown down forests and 54,903 acres of burned areas based on analyses of General Land Office survey notes recorded between 1840 and 1855 (Cleland et al. 2004a, Maclean and Cleland 2003). Assuming a 15-year recognition window, the historical fire rotation was 1,568 years. If surveyors recognized a blow-down 20 years after the event, catastrophic wind rotations would have been 786 years, with a 30-year recognition window estimate of 1,179 years. Because of the fire-resistance of undisturbed mesic deciduous forests, these estimates suggest that approximately 40% of the blown-down areas within this forest type in the Upper Peninsula subsequently burned.
Within the 8.4 million acres of northern hardwood ecosystems in northern Wisconsin, there were 396,485 acres of blown-down forests and 61,800 acres of burned areas based on analyses of General Land Office survey notes recorded between 1840 and 1855 (Cleland et al. 2004a). Assuming a 15-year recognition window, the historical fire rotation was 2,039 years. If surveyors recognized a blow-down 20 years after the event, catastrophic wind rotations would have been 425 years, with a 30-year recognition window estimate of 637 years. Because of the fire-resistance of undisturbed mesic deciduous forests, these estimates suggest that approximately 16% of the blown-down areas in this forest type in Wisconsin subsequently burned. Wisconsin's
northern hardwood communities experienced more wind and less fire disturbance than those in Michigan's Upper Peninsula. Although wind rotations differed across the two-state area, fire rotations for northern hardwoods were uniformly very long, ranging from 1,400 to more than 2,000 years.
Fire Regime Group V is applicable to this system. Severe wind events were assumed to reset mature stands on an approximate 1,100-year rotation in Michigan's Upper Peninsula in the following VDDT models. Most replacement fire occurs in slash created by these wind events. Forty percent of the blowdown areas burn and revert to an openland or an early-seral aspen-birch stage that lasts 60 years. Replacement fires without

associated wind events are very rare.

Adjacency or Identification Concerns

Large areas of red pine and white pine occur on sandy, drier soils adjacent to this type. Embedded within this Northern Hardwood-Hemlock forest are lowland complexes. Similar PNVGs are mesic maple-beech-hemlock forest and maple-basswood. The maple-basswood forest type is usually associated with more nutrient-rich and moisture-rich sites.

Scale Description

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

This type was the dominant PNVG across Northern Wisconsin and the Upper Peninsula of Michigan.

Issues/Problems

In the course-scale assessment, this type was called Northern Hardwoods (#51). Kuchler typed the Wisconsin portion as Northern Hardwoods, but the UP portion as Northern Hardwood-Fir. We based this description on the FRCC Northern Hardwood-Fir description document.

Model Evolution and Comments

In the course-scale assessment, this type was called Northern Hardwoods (#51). Kuchler typed the Wisconsin portion as Northern Hardwoods, but the UP portion as Northern Hardwood-Fir. We based this description on the FRCC Northern Hardwood-Fir description document. At the Great Lakes Rapid Assessment workshop it was agreed to rename as Northern Hardwood-Hemlock Forest (Great Lakes). Suggested reviewers: Eric Epstein (WDNR Natural Heritage Ecologist, Randy Hoffman (WDNR Natural Areas program), Eunice Padley (WDNR Div of Forestry), Mike Kost (Mich NFI), John Almendinger (MN DNR).

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 Structures

Description

Class A contains early-seral stands characterized by aspen and paper birch 0-39 years of age. It occurs due to the combination of blowdown followed by fire. Forty percent of blowndown areas burn and revert to this class.

Indicator Species* and Canopy Position

POTR5 Upper
BEPA Upper

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model no data

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	0 %	100 %
Height	Tree Regen <5m	Tree Short 5-9m
Tree Size Class	Pole 5-9" DBH	

☐ 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.

Class B **10%**

Early2 All Structures

Description

Class B contains regenerating stands 0-39 years of age dominated by mid-tolerant northern hardwood species. Windthrow of mature stands (without subsequent fire) generally results in this class.

Indicator Species* and Canopy Position

BEAL2	Upper
ACSA3	Upper
PIST	Upper
BEPA	Upper

Upper Layer Lifeform

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

Fuel Model no data

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Tree Regen <5m	Tree Short 5-9m
Tree Size Class	Pole 5-9" DBH	

- [ ] Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

Class C **5%**

Mid1 Closed

Description

Class C contains mid-aged mixed hardwood-conifer stands 40 to 150 years of age. The susceptibility to windthrow increases after age 75 on 1000-year basis. This class succeeds to class D.

Indicator Species* and Canopy Position

ACSA3	Upper
TSUGA	Upper
BEAL2	Upper

Upper Layer Lifeform

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

Fuel Model no data

Structure Data (for upper layer lifeform)

	Min	Max
Cover	80 %	100 %
Height	Tree Medium 10-24m	Tree Tall 25-49m
Tree Size Class	Large 21-33"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

Class D **80%**

Late1 Closed

Description

Class D represents old late-seral forests and the end point of succession. These stands are greater than 150 years old. Sugar maple, hemlock, and yellow birch are co-dominants. A white pine component is common, especially in the supercanopy.

Indicator Species* and Canopy Position

ACSA3	Upper
TSUGA	Upper
BEAL2	Upper

Upper Layer Lifeform

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

Fuel Model no data

Structure Data (for upper layer lifeform)

	Min	Max
Cover	80 %	100 %
Height	Tree Tall 25-49m	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:

Class E **0%**

Late1 All Structures

Description

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

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

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

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

Non-Fire Disturbances Modeled

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

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

Historical Fire Size (acres)

Avg: 500
Min:
Max:

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.

Sources of Fire Regime Data

☑ Literature
☑ Local Data
☑ Expert Estimate

	Avg FI	*Min FI*	*Max FI*	*Probability*	*Percent of All Fires*
Replacement	3000			0.00033	94
Mixed					
Surface					
All Fires	2982			0.00035	

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