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):

R6JAPlop **Great Lakes Pine Barrens**

General Information

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

Modelers **Reviewers**

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Vegetation Type

Woodland

Dominant Species*

PIBA2 VAAN
CAPE6 ANGE
QUEL PIRE
SCSC

General Model Sources

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

LANDFIRE Mapping Zones

51 40
50
41

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

System occurs in northern Lower Michigan, northern Wisconsin, northern Minnesota, and eastern Ontario, north of the climatic tension zone (Curtis 1959 and is concentrated in the High Plains Subsection in northern Lower Michigan and in central Wisconsin (Vora 1993). Also occurs in several locations in the Upper Peninsula of Michigan and is associated with the upper Mississippi and St. Croix Rivers in Minnesota and Wisconsin (Comer 1996).

Biophysical Site Description

The Great Lakes pine barrens system is endemic to very dry, nutrient-impoverished landscape ecosystems. These ecosystems occur in landforms deposited by high-energy glacial melt waters, principally outwash plains and glacial lakebeds, underlain by well-sorted, coarse-textured sandy soils with low water retaining capacity. They also occur in bedrock-controlled landforms with shallow soils of limited moisture storage capacity (Cleland et al. 2004). They are generally found in cooler climates north of the tension zone. The topography is flat to gently rolling, typically with long expanses capable of carrying wildfires with few natural fire breaks. In rolling topography, pine barrens are found among depressions that collect cold air, forming frost pockets. The soils of this community are sandy, acidic, droughty, and relatively infertile (Comer 1996). They become established in areas with continental climate, in which summers are typically short and warm to cool, and winters are cold (Pregitzer and Saunders 1999).

Vegetation Description

Pinus banksiana (jack pine) typically dominates the scattered overstory canopy. Trees can occur as scattered individuals or in scattered clumps. Several other tree species can be found in this community. Historically, there was commonly a scattered supercanopy of Pinus resinosa (red pine). Most of these trees were likely removed during the logging era. Pinus resinosa and Pinus strobus (white pine) were occasionally common sub-dominants in Michigan pine barrens, especially in Lake County. Quercus ellipsoidalis (northern pin oak), Prunus serotina (black cherry), and Populus spp. (aspens) are often found

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

as stunted or young trees. Vaccinium angustifolium (low bush blueberry), Comptonia peregrina (sweet-fern), Prunus pumila (sand cherry), Salix humilis (prairie willow) and Corylus spp. (hazelnuts) make up most of the shrub layer when present. Danthonia spicata (poverty grass), Schizachyrium scoparium [Andropogon scoparius] (little bluestem), and Carex pensylvanica are dominant herbaceous species across the range of this community. Other herbs and forbs vary from one location to another, depending on local site conditions. Andropogon gerardii (big bluestem), Deschampsia flexuosa (hair grass), Viola pedata (birdfoot violet), Aster oolentangiensis (prairie heart-leaved aster), Cirsium hillii (Hill's thistle), Koeleria macrantha (June grass), Liatris aspera (rough blazing star), Potentilla arguta (prairie cinquefoil), and Stipa spartea (needle grass) are found on most sites (Comer 1996). At Crex Meadows in western Wisconsin, Vogl (1961) studied pine barrens as described by original land survey records. He estimated that there were 20 trees greater than 15 cm (6 inches) in diameter per hectare. This translates to an average distance between trees of 24 meters (65 ft). The trees in this community had typical open-grown shapes. They had branches most of the way down their trunks with many needles. Many burned jack pine snags were encountered by land surveyors in Michigan. Zimmerman (1956) reported that the tallest tree in his 50 study sites was 16 meters (52 ft). The average tree height was only 8 meters (26 ft). This may be misleading because past logging may have eliminated the largest trees and there has not been enough time to regenerate the tallest pines. Vogl (1961), in his analysis of General Land Office surveys conducted in western Wisconsin, found that the average diameter of Pinus banksiana was 25 cm (10 in) and of P. resinosa was 50 cm (20 in). This indicates that taller trees may have existed before logging and the subsequent slash-fires that swept through most barrens.

Disturbance Description

Frequent fire and, in some places, frost and drought conditions, maintain open canopy conditions by limiting the development of woody vegetation and thereby allowing the maintenance of a mixture of grasses and sedges. Pine barrens were found in the most fire-prone and driest areas of the landscape, often west of fire breaks. Barrens typically occur within long expanses capable of carrying wildfires with few natural fire breaks. In rolling topography, pine barrens are found in depressions that collect cold air, forming frost pockets (Comer 1996). It is likely that frequent surface fires occurred at least every 10 years. There are numerous estimates of fire return interval for upland jack pine systems depending on scale and geographic location of study. Whitney (1986) estimated average return time for canopy replacement fire in jack pine forests of northern Lower Michigan to be about 80 years. Similar return times (50-100 years) have been estimated by Heinselman (1981) in Minnesota. Whitney (1986) also estimated that surface fires occurred every 25 years, while Heinselman (1981) suggested that on drier sites light to moderate surface fires may have occurred every 20-40 years. Simard & Blank (1982) calculated presettlement fire frequency in the Mack Lake area of Oscoda County, Michigan to have averaged in the range of 13 to 41 years. Historical reports document near-annual fires in barrens (Curtis 1959). Insect infestations in jack pine are also an important disturbance factor, often followed by canopy fire. GLO data indicate that fire and windthrow were important in some barrens landscapes (Comer et al. 1995, Corner and Albert 1999). This system falls within Fire Regimes I and II.

Adjacency or Identification Concerns

Jack pine barrens often occurred on extensive areas of outwash plain intermixed with dry sand prairie and closed-canopy jack pine systems. Other classifications:
Michigan Natural Features Inventory (MNFI) natural community classification: pine barrens. The Nature Conservancy National Classification: CODE: (III.A.4a.SW2.00). Alliance: Pinus banksiana-P. resinosa (sparse woodland alliance) Association: Pinus banksiana-P. resinosa/Schizachyrium scoparium-prairie forb (sparse woodland). NatureServe Terrestrial Ecological Classification: Laurentian Pine-Oak Barrens.

Scale Description

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

There is considerable variation in the size of burned areas. In northern Lower Michigan, GLO surveyors frequently reported the occurrence of large wildfires. These fires were among the largest in the state, covering several square miles (Corner and Albert 1999). Mean patch size of fire in xeric areas dominated by jack pine in the eastern Upper Peninsula of Michigan varied widely (34ha - 3,436ha) (Comer et al. 1995).

Issues/Problems

Need to acquire more detailed information about distribution of pine barrens in Wisconsin and Minnesota. Need more research on frequency of historical surface fire. What constitutes pine barrens versus jack pine forest or dry sand prairie depends on temporal and spatial scales.

Model Evolution and Comments

Eric Epstein, Dave Cleland, Bill Patterson, Greg Nowacki, Andi Koonce, Jim Merzenich, Pat Fowler, Rich Corner, Pat Comer, Dennis Albert. Cleland, Patterson, Nowacki, Koonce, and Merzenich developed an FRCC model for the coarse assessment for jack pine/open land with frequent (high) fire return interval specific to northern Minnesota.

Succession Classes

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

Class A 20 %

Early1 All Structures

Description

Sedges and grasses are dominant, with scattered jack pine regeneration and low shrubs.

Indicator Species* and Canopy Position

CAPE6	Lower
SCSC	Lower
PIBA2	Lower
ANGE	Lower

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model 1

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	0 %
Height	Tree Regen <5m	Tree Regen <5m
Tree Size Class	Seedling <4.5ft	

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

Grasses and sedges are dominant lifeforms. Typically, herbaceous species are less than a meter in height. Minimum cover for herbaceous species is approximately 40% while maximum coverage is 90%.

Class B 50 %

Early1 Open

Description

Dominated by jack pine regeneration (seedlings or saplings).

Indicator Species* and Canopy Position

PIBA2	Low-Mid

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model 9

Structure Data (for upper layer lifeform)

	Min	Max
Cover	60 %	100 %
Height	Tree Regen <5m	Tree Regen <5m
Tree Size Class	Seedling <4.5ft	

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

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Class C 5 %

Mid1 Open

Description

Sedges and grasses are dominant, with scattered jack pine trees and low shrubs. Frequent surface fires and mixed-severity fires maintain this class.

Indicator Species* and Canopy Position

CAPE6	Lower
PIBA2	Upper
ANGE	Lower
SCSC	Lower

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Structure Data (for upper layer lifeform)

	Min	Max
Cover	25 %	50 %
Height	Shrub Medium 1.0-2.9m	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:

Grasses and sedges are dominant lifeform. Typically herbaceous species are less than a meter in height. Minimum cover for herbaceous species is approximately 40%, while maximum coverage is 70%.

Fuel Model 1

Class D 25 %

Late1 Closed

Description

Closed-canopy jack pine forest that results after prolonged periods of fire suppression or microtopography that protects forest from fires (approximately 25 years).

Indicator Species* and Canopy Position

PIBA2	Upper
QUEL	Upper
ANGE	Lower
PIRE	Upper

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Structure Data (for upper layer lifeform)

	Min	Max
Cover	60 %	100 %
Height	Tree Short 5-9m	Tree Medium 10-24m
Tree Size Class	Medium 9-21"DBH	

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

Fuel Model 9

Class E 0 %

Late1 All Structures

Description

Indicator Species* and Canopy Position

All	
All	
All	
All	

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	0 %
Height	no data	no data
Tree Size Class	no data	

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

Fuel Model 0

Disturbances

Non-Fire Disturbances Modeled

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

Fire Regime Group: 1

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: 200
Min: 100
Max: 1000

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	41	10	80	0.02439	8
Mixed	36	10	80	0.02778	9
Surface	4	1	20	0.25	83
All Fires	3			0.30217	

References

Cleland, D., B. Patterson, G. Nowacki, A. Koonce, and J. Merzenich. 2004. Fire Regime Condition Class Model for Jack Pine/Open Lands with frequent (high) fire interval.

Comer P.J. 1996. Natural community abstract for pine barrens. Michigan Natural Features Inventory, Lansing, MI. 3 pp.

Comer, P.J., D.A. Albert, H.A. Wells, B.L. Hart, J.B. Raab, D.L. Price, D.M. Kashian, R.A. Corner, and D.W. Schuen. 1995. Michigan's Presettlement Vegetation, as Interpreted from the General Land Office Surveys 1816-1856. Michigan Natural Features Inventory, Lansing, MI. Digital map.

Corner, R. A., and D. A. Albert. 1999. Landtype Associations of The High Plains: Subsection VII.2. Prepared for the Northern Lower Michigan Ecosystem Management Project. Michigan Natural Features Inventory report number 1999-03. 177pp. + maps.

Curtis, J.T. 1959. Vegetation of Wisconsin: An Ordination of Plant Communities. U. of Wis. Press, Madison, WI. 657 pp.

Heinselman, M.L. 1981. Fire intensity and frequency as factors in the distribution and structure of northern ecosystems. Pp. 7-57 in H. Mooney, J.M. Bonnicksen, N.L. Christensen, J.E. Lotan and W.A. Reiners, eds., Fire regimes and ecosystem properties. General Technical Report WO-26, U.S. Department of Agriculture, Forest Service, Washington, D.C.

Pregitzer, K.S., and S.C. Saunders. 1999. Jack pine barrens of the northern Great Lakes region. Pp. 343-361 in R.C. Anderson, J.S. Fralish, and J.M. Baskin (eds.) Savannas, Barrens, and Rock Outcrop Plant Communities of North America. Cambridge, United Kingdom.

Simard, A.J. and R.W. Blank. 1982. Fire history of a Michigan jack pine forest. Mich. Acad. 15:59-71.

Vogl, R.J. 1970. Fire and the northern Wisconsin pine barrens. Proceedings of the Tall Timbers Fire Ecology Conference 10:175-209.

Vora, R.S. 1993. Moquah barrens: Pine barrens restoration experiment initiated in Chequamegon National Forest. Restor. And Mgmt. Notes 11(1):39-44.

Whitney, G.G. 1986. Relation of Michigan's presettlement pine forests to substrate and disturbance history. Ecology 67(6):1548-1559.

Zimmerman, D.A. 1956. The jack pine association in the Lower Peninsula of Michigan: Its structure and composition. PhD. Thesis. U. of Mich., Ann Arbor, MI.