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)

R6JPOPmn Jack Pine / Open Lands with frequent (high) fire return interval

General Information

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

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Vegetation Type

Woodland

Dominant Species*

PIBA2
CARE

General Model Sources

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

LANDFIRE Mapping Zones

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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

Portions of northern Minnesota.

Biophysical Site Description

The jack pine - openland community 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. They also occur in bedrock controlled landforms with shallow soils of limited moisture storage capacity. Within Minnesota, low rainfall coupled with high spring and summer temperatures results in frequent fires.

Vegetation Description

Jack pine is a fast growing, short-lived fire-dependent species that grows farther north than any other American pine and is the most widely distributed pine species in Canada. It is generally regarded as a pioneer species or “fire-disclimax”, and is capable of self-replacement. In the absence of fire or other catastrophes, jack pine is succeeded by more tolerant or longer-lived species, but on the poorest, driest sites it may persist as an edaphic climax (Brubaker 1975). Jack pine is one of the most shade-intolerant trees in its native range, requiring full light for growth and survival. It usually grows in even-aged pure stands, although mixed stands also
occur.

Jack pine’s adaptation to catastrophic fire is largely due to its capacity to produce viable seed within a decade or so of establishment, aerial seed protection and storage in serotinous cones, delayed seed release following fire, and prolific germination of released seed. High seedling densities (2,000 to 5,000 per acre) effectively compete with other re-establishing or invading species and self-thin over time. In the southern

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part of its range, cones are both serotinous and nonserotinous (Zasada et al. 1992).

Following ignition, jack pine promotes crown fires due to high concentrations of volatile foliar substances, dense foliage, and retention of lower branches that form fuel ladders. Thus surface fires are not common within well stocked jack pine communities. Fires recurring in less than 10 to 15 year intervals prevent jack pine from surviving long enough to produce viable seed, maintaining associated barrens and openlands that comprised 40-50% of the landscape. Jack pine regenerates successfully after high intensity crown fires, although a relatively low temperature of 120°F is required to open jack pine cones, so even low intensity fires are capable of releasing seed. Jack pine trees are susceptible to mortality during or following a fire, and populations of jack pine tend to survive as seeds (McCune 1988).

Jack pine stands become susceptible to mortality through natural senescence, as well as insects and disease, after 60 to 80 years. However, vigorous trees 185 years old have been found in northwestern Minnesota. Dead stands pose a severe crown fire risk throughout the year, until snags blow down and decompose.
Carex grasses and herbaceous plants dominate barrens with trees comprising less than 10% of the canopy coverage. Because of the high frequency of wildfire, red pine is a minor component of these systems (comprising less than 5% of the total area)

Disturbance Description

Fire regime groups I and II with fires occurring every 15 to 25 years. Most fires are replacement. Severe wind events affect mature stands on an approximate 200 year interval. Because stands seldom reach the age where they are susceptible to wind, the overall wind rotation is about 700 years.
Fire behavior in jack pine stands is usually of the highest intensity observed in the boreal forest (de Groot et al. 2004). Jack pine is not only highly adapted to frequent crown fire regimes, it usually requires catastrophic fire to regenerate successfully or to compete with longer-lived or more shade tolerant species. Within Minnesota, low rainfall coupled with high spring and summer temperature result in fires occurring so frequently that jack pine is often unable to produce viable seed and self-replace.
Openlands are created as a consequence, and frequent surface fires maintain openlands and barrens for extended periods. All classes burn at an average rate of 8% per year with the caveat that stands would not reburn for 10 years. This is equivalent to a 22 year fire return interval. In jack pine stands fire severity increases with age with nearly 100% mortality in mature stands. Cones are serotinous and areas quickly regenerate to jack pine. With this high frequency of wildfire, red pine stands comprise less than 5% of the total area and are not significant.

A: Barrens: All fires are replacement. Barrens persist for 25 years before they regenerate to jack pine.

B: Jack pine < 15 years of age. Fires are 60% replacement and 40% mixed. Since jack pine do not produce viable seed until age 15, replacement fires result in barrens.

C: Jack pine 15-100 years of age. Fires are 80% replacement and 20% mixed. Fire severity increases with age. Replacement fires result in a young jack pine stand. Stands that escape replacement fire die after age 100 and revert to barrens.

Adjacency or Identification Concerns

Scale Description

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

Issues/Problems

This model was created for the northern portion of Minnesota for the coarse scale assessment. Need local experts to provide more input on fields in access database with limited information.

Model Evolution and Comments

Bill Patterson, Dave Cleland, Janet Boe, and Sarah Hoffman. This model was created for the northern portion of Minnesota for the coarse scale assessment. Need local experts to asses whether or not this model can be combined with Great Lakes Pine Barrens. Josh Cohen incorporated descriptions into access database, ran model according to Rapid Assessment protocol, and made minor modifications to access database based on results from model.

*Succession Classes***

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

Class A 41 %

Early1 All Struct

Description

Barrens dominated by carex, grasses, and herbaceous plants. Trees comprise less than 10% canopy coverage.

Dominant Species* and Canopy Position

CAREX Lower
PIBA2 Mid-Upper

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model 1

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Tree Regen <5m	Tree Short 5-9m
Tree Size Class	Medium 9-21"DBH	

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

Barrens with trees comprising less than 10% canopy coverage.

Class B 30 %

Mid1 Open

Description

Young jack pine stands less than 15 years of age.

Dominant Species* and Canopy Position

PIBA2 Lower

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model 9

Structure Data (for upper layer lifeform)

	Min	Max
Cover	50 %	80 %
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:

Class C 29 %

Mid2 Closed

Description

Jack pine dominated stands 15 to 100 years. In absence of fire most jack pine die by age 100 and this class reverts to barrens (80%) or red pine (20%).

Dominant Species* and Canopy Position

PIBA2 Upper
PIRE Upper

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model 9

Structure Data (for upper layer lifeform)

	Min	Max
Cover	80 %	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:

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Class D **0 %**

Late1 All Structu

Description

Dominant Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	0 %
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

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: 1000
Min: 100
Max: 10000

Sources of Fire Regime Data

☑ Literature
☑ Local Data
☑ Expert Estimate

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

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	26	10	100	0.03846	83
Mixed	125	10	100	0.008	17
Surface					
All Fires	22			0.04647	

References

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