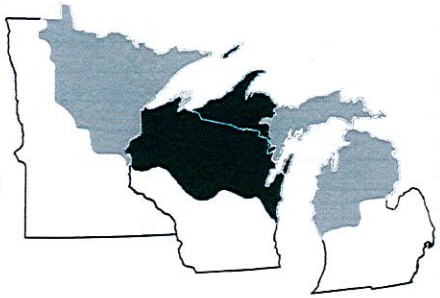
CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES

NORTHERN WISCONSIN AND WESTERN UPPER MICHIGAN

Northern forests will be affected by climate change during this century. A team of forest managers and researchers created a report that describes the vulnerability of forests in northern Wisconsin and western Upper Michigan (Janowiak et al. 2014). This report includes information on the current landscape, observed climate trends, and a range of projected future climates. It also describes many potential climate change impacts to forests and summarizes key vulnerabilities for major forest types. This handout is summarized from the full report.



Remember that models are just tools, and they're not perfect. Models don't account for some factors that could be modified by climate change, like droughts, wildfire activity, and invasive species. If a species is rare or confined to a small area, Tree Atlas results may also be less reliable. These factors, and others, could cause a particular species to perform better or worse than a model projects. Human choices will also continue to influence forest distribution, especially for tree species that are projected to increase. Planting programs may assist the movement of future-adapted species, but this will depend on management decisions.

TREE SPECIES INFORMATION:

This report uses two climate scenarios to "bracket" a range of possible futures. These future climate projections were used with two forest impact models (Tree Atlas and LANDIS) to provide information about how individual tree species may respond to a changing climate. More information on the climate and forest impact models can be found in the full report. This page shows the most common tree species in this local area, organized into general categories of future expectations. Results for all species can be compared side-by-side on page 2.

Despite these limits, models provide useful information about future expectations. It's perhaps best to think of these projections as indicators of possibility and potential change. The model results presented here were combined with information from published reports and local management expertise to draw conclusions about potential risk and change in the region's forests.

SPECIES	ADDITIONAL CONSIDERATIONS
LIKELY TO DECREASE	
Balsam fir	Requires cold climate and susceptible to drought, fire, and insects
Black ash	Emerald ash borer causes mortality
Black spruce	Requires cold climate, susceptible to insect pests and drought
Northern white-cedar	Requires cold climate and susceptible to fire and herbivory
Paper birch	Early-sucessional colonizer, but susceptible to insects and drought
Quaking aspen	Early-sucessional colonizer, but susceptible to heat and drought
White spruce	Requires cold climate, susceptible to insect pests
Yellow birch	Good disperser, but susceptible to fire, insects, and disease
MAY DECREASE	
Balsam poplar	Early-sucessional colonizer, but susceptible to drought
Eastern white pine	Good disperser, but susceptible to drought and insects
Jack pine	Tolerates drought and fire, but susceptible to insect pests
Red pine	Susceptible to insect pests and diseases, and limited dispersal.
Sugar maple	Grows across a variety of sites and tolerates shade
Tamarack	Requires cold climate and susceptible to drought, fire, and insects

SPECIES	ADDITIONAL CONSIDERATIONS
MIXED MODEL RESULTS	
Bigtooth aspen	Early-sucessional colonizer, but susceptible to drought
Eastern hemlock	Hemlock woolly adelgid causes mortality
Green ash	Emerald ash borer causes mortality
Red maple	Competitive colonizer tolerant of disturbance and diverse sites
NO CHANGE	
Northern red oak	Susceptible to some insect pests and oak wilt
MAY INCREASE	
American basswood	Tolerates shade but susceptible to fire
American elm	Affected by Dutch elm disease, grows across a variety of sites
American hornbeam	Shade-tolerant, but susceptible to fire and drought
Black cherry	Susceptible to insects and fire, tolerates some drought
Bur oak	Tolerates drought and fire
Ironwood	Grows across a variety of sites and tolerates shade
Northern pin oak	Tolerates drought and fire
White ash	Emerald ash borer causes mortality
White oak	Fire-adapted and grows on a variety of sites

NIACS Northern Institute of Applied Climate Science

www.forestadaptation.org

Get this handout online at: www.forestadaptation.org/Northwoods_treehandouts

FUTURE PROJECTIONS

Data for the end of the century are summarized for two forest impact models under two climate change scenarios. The Climate Change Tree Atlas (www.fs.fed.us/nrs/atlas) models future suitable habitat, while LANDIS models changes in forest growth over time (future biomass presented in this table).

- ▲ **INCREASE** *Projected increase of >20% by 2100*
- ● **NO CHANGE** *Little change (<20%) projected by 2100*
- ▼ **DECREASE** *Projected decrease of >20% by 2100*
- ★ **NEW HABITAT** *Tree Atlas projects new habitat for species not currently present*

ADAPTABILITY

Factors not included in the models, such as the ability to respond favorably to disturbance, may make a species more or less able to adapt to future stressors.

- \+ high *Species may perform better than modeled*
- . medium
- – low *Species may perform worse than modeled*

SPECIES	LOW CLIMATE CHANGE (PCM B1) TREE ATLAS	LOW CLIMATE CHANGE (PCM B1) LANDIS	HIGH CLIMATE CHANGE (GFDL A1FI) TREE ATLAS	HIGH CLIMATE CHANGE (GFDL A1FI) LANDIS	ADAPT
American basswood	●	▲	▲	▲	.
American beech	▲	▲	▲	▲	.
American elm	▲		▲		.
American hornbeam	▲		▲		.
Balsam fir	▼	▼	▼	▼	–
Balsam poplar	▼	●	●	▼	.
Bigtooth aspen	●	▲	▼	●	.
Bitternut hickory	▲	▲	▲	▲	+
Black ash	▼	●	▼	▼	–
Black cherry	▲	●	▲	▲	–
Black hickory			★		.
Black oak	▲	▲	▲	▲	.
Black spruce	▼	▼	▼	▼	.
Black walnut	▲		▲		.
Black willow	▲		▲		–
Blackgum			★		+
Blackjack oak	★		★		+
Boxelder	▲		▲		+
Bur oak	▲	▲	▲	▲	+
Butternut	▲		▼		–
Chestnut oak			★		+
Chinkapin oak	★		★		.
Chokecherry	●		▼		.
Common persimmon			★		+
Eastern cottonwood	▲		▲		.
Eastern hemlock	▲	▲	▼	▲	–
Eastern redbud	▼		▲		.
Eastern redcedar	★		★		.
Eastern white pine	●	●	▼	▼	.
Flowering dogwood	★		★		.
Gray birch	★		★		.
Green ash	▼	▲	▲	●	.
Hackberry	▲		▲		+
Honeylocust	★		★		+
Ironwood	●		▲		+
Jack pine	●	▼	▼	▼	.
Mockernut hickory	★		★		+
Mountain maple	▼		▼		+
Northern catalpa			★		.

SPECIES	LOW CLIMATE CHANGE (PCM B1) TREE ATLAS	LOW CLIMATE CHANGE (PCM B1) LANDIS	HIGH CLIMATE CHANGE (GFDL A1FI) TREE ATLAS	HIGH CLIMATE CHANGE (GFDL A1FI) LANDIS	ADAPT
Northern pin oak	●	▲	●	▲	+
Northern red oak	▲	●	●	●	+
Northern white-cedar	▼	●	▼	▼	.
Ohio buckeye	★		★		.
Osage-orange	★		★		+
Paper birch	▼	▼	▼	▼	.
Peachleaf willow			▲		.
Pignut hickory	★		★		.
Pin cherry	●		▼		.
Pin oak	★		★		–
Post oak	★		★		+
Quaking aspen	▼	▼	▼	▼	.
Red maple	●	▲	▼	▲	+
Red mulberry	▲		▲		.
Red pine	●	▼	●	▼	.
River birch	▲		▲		.
Rock elm	▼		●		–
Sassafras	★		★		.
Scarlet oak	★		★		.
Serviceberry	★		★		.
Shagbark hickory	▲		▲		.
Shellbark hickory			★		.
Shingle oak	★		★		.
Silver maple	▲		▲		+
Slippery elm	▲		▲		.
Striped maple	●		●		.
Sugar maple	●	●	▼	▼	+
Sugarberry			★		.
Swamp white oak	●		▲		.
Sweet birch	★		★		–
Sweetgum			★		.
Sycamore	★		★		.
Tamarack	●		▼		–
White ash	▲	▲	▲	▲	–
White oak	▲	▲	▲	▲	+
White spruce	▼	▼	▼	▼	.
Wild plum	▼		▲		.
Yellow birch	▼	●	▼	▼	.
Yellow-poplar	★		★		+

SOURCE: Janowiak, M.K., et al. 2014. Forest ecosystem vulnerability assessment and synthesis for northern Wisconsin and western Upper Michigan. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. GTR-NRS-136. 247p. **www.nrs.fs.fed.us/pubs/46393**