

CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES NORTHERN LOWER PENINSULA (SECTION 212H)



This region's forests will be affected by a changing climate and other stressors during this century. A team of managers and researchers created an assessment that describes the vulnerability of forests in Michigan ([Handler et al. 2014](#)). This report includes information on observed and future climate trends, and also summarizes key vulnerabilities for forested natural communities. The Landscape Change Research Group recently updated the Climate Change Tree Atlas, and this handout summarizes that information. Full Tree Atlas results are available online at

www.fs.fed.us/nrs/atlas/. Two climate scenarios are presented to “bracket” a range of possible futures. These future climate projections (2070 to 2099) provide information about how individual tree species may respond to a changing climate. Results for “low” and “high” emissions scenarios can be compared on the reverse side of this handout.

The updated Tree Atlas presents additional information helpful to interpret tree species changes:

- **Suitable habitat** - calculated based on 39 variables that explain where optimum conditions exist for a species, including soils, landforms, and climate variables.
- **Adaptability** - based on life-history traits that might increase or decrease tolerance of expected changes, such as the ability to withstand different forms of disturbance.
- **Capability** - a rating of the species' ability to cope or persist with climate change in this region based on suitable habitat change (statistical modeling), adaptability (literature review and expert opinion), and abundance (FIA data). The capability rating is modified by abundance information; ratings are downgraded for rare species and upgraded for abundant species.
- **Migration Potential Model** - when combined with habitat suitability, an estimate of a species' colonization likelihood for new habitats. This rating can be helpful for assisted migration or focused management (see the table section: “New Habitat with Migration Potential”).

Remember that models are just tools, and they're not perfect. Model projections can't account for all factors that influence future species success. If a species is rare or confined to a small area, model results may 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. 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.

SOURCE: This handout summarizes the full model results for Michigan's Northern Lower Peninsula, available at www.fs.fed.us/nrs/atlas/combined/resources/summaries. More information on vulnerability and adaptation in the Northwoods region can be found at www.forestadaptation.org/northwoods. A full description of the models and variables are provided in Iverson et al. 2019 (www.nrs.fs.fed.us/pubs/57857) and www.nrs.fs.fed.us/pubs/59105) and Peters et al. 2019 (www.nrs.fs.fed.us/pubs/58353).

CLIMATE CHANGE CAPABILITY

POOR CAPABILITY

American hornbeam	Mountain maple
Balsam fir	Northern white-cedar
Balsam poplar	Pin cherry
Black ash	Serviceberry
Black spruce	Slippery elm
Black willow	Striped maple
Eastern hemlock	Tamarack (native)
Eastern white pine	White spruce
Flowering dogwood	

FAIR CAPABILITY

Bigtooth aspen	Paper birch
Bitternut hickory	Pin oak
Bur oak	Quaking aspen
Ironwood	Red pine
Jack pine	Swamp white oak
Northern pin oak	Yellow birch

GOOD CAPABILITY

American basswood	Green ash
American beech	Northern red oak
American elm	Red maple
Black locust	Sassafras
Black oak	Shagbark hickory
Blackgum	Silver maple
Boxelder	Sugar maple
Eastern cottonwood	White oak
Eastern redcedar	

MIXED RESULTS

Black cherry	White ash
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NEW HABITAT WITH MIGRATION POTENTIAL

American mountain-ash	Mockernut hickory
Bigleaf magnolia	Pignut hickory
Black hickory	Post oak
Black walnut	Scarlet oak
Blackjack oak	Shortleaf pine
Chestnut oak	Shumard oak
Common persimmon	Sweet birch
Eastern redbud	Sweetgum
Hackberry	Sycamore
Laurel oak	Virginia pine
Live oak	Yellow-poplar



ADAPTABILITY: Life-history factors, such as the ability to respond favorably to disturbance, that are not included in the Tree Atlas model and 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

HABITAT CHANGE: Projected change in suitable habitat between current and potential future conditions.

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

ABUNDANCE: Based on Forest Inventory Analysis (FIA) summed Importance Value data, calibrated to a standard geographic area.

- + **ABUNDANT**
- **COMMON**
- **RARE**

CAPABILITY: An overall rating that describes a species' ability to cope or persist with climate change based on suitable habitat change class (statistical modeling), adaptability (literature review and expert opinion), and abundance within this region.

- ▲ **GOOD** Increasing suitable habitat, medium or high adaptability, and common or abundant
- **FAIR** Mixed combinations, such as a rare species with increasing suitable habitat and medium adaptability
- ▼ **POOR** Decreasing suitable habitat, medium or low adaptability, and uncommon or rare

SPECIES	LOW CLIMATE CHANGE (RCP 4.5)				HIGH CLIMATE CHANGE (RCP 8.5)			
	ADAPT	ABUN	HABITAT	CAPABILITY	HABITAT	CAPABILITY	HABITAT	CAPABILITY
American basswood	•	•	▲	▲	▲	▲	▲	▲
American beech	•	•	▲	▲	▲	▲	▲	▲
American elm	•	•	▲	▲	▲	▲	▲	▲
American hornbeam*	•	-		▼	▼	▼	▼	▼
American mountain-ash*	-		★		★			
Balsam fir	-	•	▼	▼	▼	▼	▼	▼
Balsam poplar	•	•	▼	▼	▼	▼	▼	▼
Bigleaf magnolia*	•				★			
Bigtooth aspen	•	+	▼	○	▼		○	
Bitternut hickory*	+	-	●	○	●		○	
Black ash	-	•	●	▼	▼	▼	▼	▼
Black cherry	-	•	▲	▲	▲		○	
Black hickory	•		★		★			
Black locust*	•	-	▲	▲	▲	▲	▲	▲
Black oak	•	•	▲	▲	▲	▲	▲	▲
Black spruce	•	•	▼	▼	▼	▼	▼	▼
Black walnut*	•		★		★			
Black willow*	-	-	●	▼	▲		▼	
Blackgum	+	-	▲	▲	▲	▲	▲	▲
Blackjack oak	+		★		★			
Boxelder*	+	-	●	○	▲		▲	
Bur oak	+	-	●	○	●		○	
Chestnut oak	+		★		★			
Common persimmon*	+		★		★			
Eastern cottonwood*	•	-	▲	▲	▲	▲	▲	▲
Eastern hemlock	-	•	●	▼	▼	▼	▼	▼
Eastern redbud*	•		★		★			
Eastern redcedar	•	-	▲	▲	▲	▲	▲	▲
Eastern white pine	-	•	▼	▼	▼	▼	▼	▼
Flowering dogwood	•	-	▼	▼	●		▼	
Green ash*	•	•	▲	▲	▲	▲	▲	▲
Hackberry	+		★		★			
Ironwood*	+	•	▼	○	▼		○	
Jack pine	+	•	▼	○	▼		○	
Laurel oak	•				★			
Live oak	•		★		★			
Mockernut hickory	+		★		★			
Mountain maple*	+	-	▼	▼	▼	▼	▼	▼
Northern pin oak	+	•	▼	○	▼		○	
Northern red oak	+	+	●	▲	●		▲	
Northern white-cedar	•	•	▼	▼	▼	▼	▼	▼
Paper birch	•	•	●	○	●		○	
Pignut hickory	•		★		★			
Pin cherry*	•	-	▼	▼	▼	▼	▼	▼
Pin oak*	-	-	●	▼	▲		○	
Post oak	+		★		★			
Quaking aspen	•	+	▼	○	▼		○	
Red maple	+	+	●	▲	▼		▲	
Red pine	-	+	▼	○	▼		○	
Sassafras*	•	-	▲	▲	▲	▲	▲	▲
Scarlet oak	•		★		★			
Serviceberry*	•	-	▼	▼	▼	▼	▼	▼
Shagbark hickory	•	-	▲	▲	▲	▲	▲	▲
Shortleaf pine	•		★		★			
Shumard oak*	+		★		★			
Silver maple*	+	•	●	▲	●		▲	
Slippery elm*	•	-	▼	▼	▼	▼	▼	▼
Striped maple	•	-	▼	▼	▼	▼	▼	▼
Sugar maple	+	+	▼	▲	▼		▲	
Swamp white oak*	•	-	▲	○	▲		○	
Sweet birch	-		★		★			
Sweetgum	•		★		★			
Sycamore*	•		★		★			
Tamarack (native)	-	•	●	▼	●		▼	
Virginia pine	•		★		★			
White ash	-	•	●	▼	▲		○	
White oak	+	•	▲	▲	▲	▲	▲	▲
White spruce	•	•	▼	▼	▼	▼	▼	▼
Yellow birch	•	-	▲	○	▲		○	
Yellow-poplar	+		★		★			

*Species with low model reliability based on five statistical metrics of the habitat models that affect change class. See maps and tables for more information (www.fs.fed.us/nrs/atlas/combined/resources/summaries).