

CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES LAKE WHITTLESEY GLACIOLACUSTRINE PLAIN (SECTION 222U)



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 Lake Whittlesey Glaciolacustrine Plain, 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 basswood	Paper birch
American hornbeam	Pignut hickory
American mountain-ash	Pin cherry
Balsam fir	Pin oak
Balsam poplar	Quaking aspen
Bigtooth aspen	Red mulberry
Black ash	Red pine
Black maple	Sassafras
Black willow	Serviceberry
Eastern hemlock	Slippery elm
Eastern white pine	Swamp white oak
Flowering dogwood	Tamarack (native)
Ironwood	White spruce
Jack pine	Yellow birch

Northern white-cedar

FAIR CAPABILITY

Bitternut hickory	Boxelder
Black oak	Mockernut hickory
Black walnut	Northern pin oak
Blackgum	White ash

GOOD CAPABILITY

American elm	Northern red oak
Black locust	Red maple
Bur oak	Silver maple
Eastern cottonwood	Sugar maple
Eastern redcedar	White oak

Honeylocust

MIXED RESULTS

American beech	Hackberry
Black cherry	Shagbark hickory

Green ash

NEW HABITAT WITH MIGRATION POTENTIAL

Ashe juniper	Osage-orange
Black hickory	Pecan
Blackjack oak	Post oak
Cedar elm	Sugarberry
Chinkapin oak	Sweetgum
Common persimmon	Sycamore
Eastern redbud	Winged elm
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*	-	-	▼	▼	▼	▼		
Ashe juniper	•		★		★			
Balsam fir	-	-	▼	▼	▼	▼		
Balsam poplar	•	-	▼	▼	▼	▼		
Bigtooth aspen	•	•	▼	▼	▼	▼		
Bitternut hickory*	+	-	●	○	●	○		
Black ash	-	-	▼	▼	▼	▼		
Black cherry	-	•	▲	○	●	▼		
Black hickory	•		★		★			
Black locust*	•	-	▲	▲	▲	▲		
Black maple*	+	-	▼	▼	▼	▼		
Black oak	•	•	●	○	●	○		
Black walnut*	•	•	●	○	●	○		
Black willow*	-	-	●	▼	●	▼		
Blackgum	+	-	●	○	●	○		
Blackjack oak	+		★		★			
Boxelder*	+	•	▼	○	▼	○		
Bur oak	+	•	●	▲	●	▲		
Cedar elm	-		★		★			
Chinkapin oak	•		★		★			
Common persimmon*	+		★		★			
Eastern cottonwood*	•	•	▲	▲	▲	▲		
Eastern hemlock	-	-	▼	▼	▼	▼		
Eastern redbud*	•		★		★			
Eastern redcedar	•	-	▲	▲	▲	▲		
Eastern white pine	-	•	▼	▼	▼	▼		
Flowering dogwood	•	-	▼	▼	▼	▼		
Green ash*	•	+	●	▲	▼	○		
Hackberry	+	-	●	○	▲	▲		
Honeylocust*	+	-	●	○	▲	▲		
Ironwood*	+	-	▼	▼	▼	▼		
Jack pine	+	-	▼	▼	▼	▼		
Live oak	•		★		★			
Mockernut hickory	+	-	●	○	●	○		
Northern pin oak	+	•	▼	○	▼	○		
Northern red oak	+	•	●	▲	●	▲		
Northern white-cedar	•	-	▼	▼	▼	▼		
Osage-orange	+		★		★			
Paper birch	•	•	▼	▼	▼	▼		
Pecan*	-		★		★			
Pignut hickory	•	-	●	▼	●	▼		
Pin cherry*	•	-	▼	▼	▼	▼		
Pin oak*	-	-	●	▼	▲	▼		
Post oak	+		★		★			
Quaking aspen	•	•	▼	▼	▼	▼		
Red maple	+	+	▼	▲	▼	▲		
Red mulberry*	•	-	●	▼	●	▼		
Red pine	-	•	●	▼	▼	▼		
Sassafras*	•	-	●	▼	●	▼		
Serviceberry*	•	-	▼	▼	▼	▼		
Shagbark hickory	•	•	●	○	▼	▼		
Silver maple*	+	•	▲	▲	▲	▲		
Slippery elm*	•	-	▼	▼	●	▼		
Sugar maple	+	•	▲	▲	▲	▲		
Sugarberry	•		★		★			
Swamp white oak*	•	-	●	▼	●	▼		
Sweetgum	•		★		★			
Sycamore*	•		★		★			
Tamarack (native)	-	-	●	▼	●	▼		
White ash	-	•	▲	○	▲	○		
White oak	+	•	▲	▲	▲	▲		
White spruce	•	-	▼	▼	▼	▼		
Winged elm	•	-	★		★			
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).