

# CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES SOUTHWESTERN GREAT LAKES MORAINAL (SECTION 222K)



Wisconsin's forests will be affected by a changing climate and other stressors during this century. A team of managers and researchers created a field guide that describes the vulnerability of forests in the southern part of the state ([Handler et al. 2021](#)). This guide 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/](http://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 model results for the Southwestern Great Lakes Morainal (Section 222K). Download the *Climate Change Field Guide for Southern Wisconsin Forests and handouts for other Ecological Sections in southern Wisconsin* at [www.forestadaptation.org/southern\\_WI\\_fieldguide](http://www.forestadaptation.org/southern_WI_fieldguide). A full description of the models and variables are provided in Iverson et al. 2019 ([www.nrs.fs.fed.us/pubs/57857](http://www.nrs.fs.fed.us/pubs/57857)) and Peters et al. 2019 ([www.nrs.fs.fed.us/pubs/58353](http://www.nrs.fs.fed.us/pubs/58353)).

## CLIMATE CHANGE CAPABILITY

### POOR CAPABILITY

American beech	Flowering dogwood
Balsam fir	Jack pine
Balsam poplar	Northern white-cedar
Bigtooth aspen	Paper birch
Black ash	Red pine
Black cherry	River birch
Black spruce	Tamarack (native)
Black willow	White spruce
Eastern hemlock	Yellow birch
Eastern white pine	

### FAIR CAPABILITY

American basswood	Quaking aspen
Black locust	Red mulberry
Boxelder	Shagbark hickory
Mockernut hickory	Slippery elm
Northern pin oak	White ash

### GOOD CAPABILITY

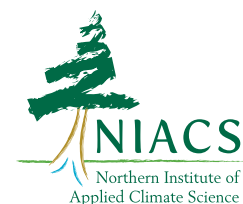
American elm	Hackberry
Bitternut hickory	Ironwood
Black oak	Northern red oak
Black walnut	Osage-orange
Bur oak	Pignut hickory
Eastern cottonwood	Silver maple
Eastern redcedar	Sugar maple
Green ash	White oak

### MIXED RESULTS

Blackgum	Swamp white oak
Red maple	Yellow-poplar

### NEW HABITAT WITH MIGRATION POTENTIAL

Black hickory	Ohio buckeye
Blackjack oak	Post oak
Chinkapin oak	Shingle oak
Common persimmon	Shumard oak
Eastern redbud	Winged elm



**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 CHANGE	CAPABILITY	HABITAT CHANGE	CAPABILITY	HABITAT CHANGE	CAPABILITY
American basswood	•	•	●	○	●	○		
American beech	•	-	●	▼	▼	▼		
American elm	•	•	▲	▲	▲	▲		
Balsam fir	-	-	▼	▼	▼	▼		
Balsam poplar	•	-	▼	▼	▼	▼		
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	+	•	▲	▲	▲	▲		
Chinkapin oak	•		★		★			
Cittamwood*	+				★			
Common persimmon*	+		★		★			
Eastern cottonwood*	•	-	▲	▲	▲	▲		
Eastern hemlock	-	-	▼	▼	▼	▼		
Eastern redbud*	•		★		★			
Eastern redcedar	•	•	▲	▲	▲	▲		
Eastern white pine	-	•	▼	▼	▼	▼		
Flowering dogwood	•	-	▼	▼	▼	▼		
Green ash*	•	•	▲	▲	▲	▲		
Hackberry	+	-	▲	▲	▲	▲		
Honeylocust*	+	-	▲	▲	▲	▲		
Ironwood*	+	-	▲	▲	▲	▲		
Jack pine	+	-	▼	▼	▼	▼		
Mockernut hickory	+	-	●	○	●	○		
Northern pin oak	+	•	▼	○	▼	○		
Northern red oak	+	•	▲	▲	▲	▲		
Northern white-cedar	•	-	▼	▼	▼	▼		
Ohio buckeye*	•		★		★			
Osage-orange	+	-	▲	▲	▲	▲		
Paper birch	•	-	●	▼	●	▼		
Pecan*	-		★		★			
Pignut hickory	•	-	▲	▲	▲	▲		
Pin cherry*	•	-	▼	▼	▼	▼		
Pin oak*	-	-	▲	○	▲	○		
Post oak	+		★		★			
Quaking aspen	•	•	●	○	●	○		
Red maple	+	•	●	▲	▼	○		
Red mulberry*	•	-	▲	○	▲	○		
Red pine	-	•	▼	▼	▼	▼		
River birch*	•	-	▼	▼	▼	▼		
Sassafras*	•	-	▲	▲	▲	▲		
Serviceberry*	•	-	▼	▼	▼	▼		
Shagbark hickory	•	•	●	○	●	○		
Shingle oak	•		★		★			
Shumard oak*	+		★		★			
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](http://www.fs.fed.us/nrs/atlas/combined/resources/summaries)).