

CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES NORTHERN HIGHLANDS (SECTION 212X)



Wisconsin'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 Northern Wisconsin ([Janowiak 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 model results for the Northern Highlands (Section 212X). Download the *Climate Change Field Guide for Northern Wisconsin Forests and handouts for other Ecological Sections in northern Wisconsin* at www.forestadaptation.org/northern_WI_fieldguide. 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	Black spruce
Balsam poplar	Pin cherry
Black ash	Tamarack (native)

FAIR CAPABILITY

American basswood	Red pine
Bitternut hickory	Silver maple
Eastern white pine	Yellow birch

GOOD CAPABILITY

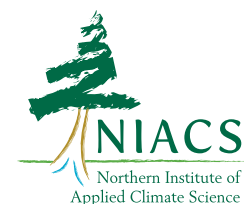
American beech	Northern pin oak
American elm	Northern red oak
Bigtooth aspen	Northern white-cedar
Black cherry	Paper birch
Boxelder	Red maple
Bur oak	Sugar maple
Green ash	White ash
Ironwood	White oak

MIXED RESULTS

Balsam fir	White spruce
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NEW HABITAT WITH MIGRATION POTENTIAL

Blackgum	Hackberry
Eastern cottonwood	Sassafras
Eastern redcedar	Shagbark hickory



ADAPTABILITY: Life-history factors, such as the ability to respond favorably to disturbance, 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	ADAPT		LOW CLIMATE CHANGE (RCP4.5)		HIGH CLIMATE CHANGE (RCP8.5)		SPECIES	ADAPT		LOW CLIMATE CHANGE (RCP4.5)		HIGH CLIMATE CHANGE (RCP8.5)	
	ABUN	CHANG	HABITAT	CAPABILITY	HABITAT	CAPABILITY		ABUN	CHANG	HABITAT	CAPABILITY	HABITAT	CAPABILITY
American basswood	•	•	●	○	●	○	Mockernut hickory	+		★		★	
American beech	•	-	▲	▲	▲	▲	Mountain maple*	+	-	▼	▼	▼	▼
American elm	•	•	▲	▲	▲	▲	Northern pin oak	+	•	▲	▲	▲	▲
American hornbeam*	•	-	▼	▼	●	▼	Northern red oak	+	•	▲	▲	▲	▲
American mountain-ash*	-	-	▼	▼	▼	▼	Northern white-cedar	•	•	▲	▲	▲	▲
Balsam fir	-	+	▼	▼	▼	○	Paper birch	•	•	▲	▲	▲	▲
Balsam poplar	•	-	▼	▼	▼	▼	Pignut hickory	•		★		★	
Bigtooth aspen	•	•	▲	▲	▲	▲	Pin cherry*	•	-	▼	▼	▼	▼
Bitternut hickory*	+	-	●	○	●	○	Post oak	+		★		★	
Black ash	-	•	●	▼	●	▼	Quaking aspen	•	+	▼	○	▼	○
Black cherry	-	•	▲	▲	▲	▲	Red maple	+	+	●	▲	●	▲
Black hickory	•		★		★		Red pine	-	•	▲	○	▲	○
Black locust*	•		★		★		Sassafras*	•		★		★	
Black maple*	+	-	▼	▼	▼	▼	Scarlet oak	•		★		★	
Black oak	•		★		★		Serviceberry*	•	-	▼	▼	▼	▼
Black spruce	•	•	▼	▼	▼	▼	Shagbark hickory	•		★		★	
Black walnut*	•	-	▲	▲	▲	▲	Silver maple*	+	-	●	○	●	○
Black willow*	-		★		★		Slippery elm*	•	-	●	▼	▲	○
Blackgum	+		★		★		Sugar maple	+	+	▼	▲	▼	▲
Boxelder*	+	-	▲	▲	▲	▲	Sugarberry	•				★	
Bur oak	+	•	▲	▲	▲	▲	Swamp white oak*	•	-	●	▼	▲	▲
Eastern cottonwood*	•		★		★		Sycamore*	•		★		★	
Eastern hemlock	-	•	▲	○	●	▼	Tamarack (native)	-	•	●	▼	●	▼
Eastern redcedar	•		★		★		White ash	-	•	▲	▲	▲	▲
Eastern white pine	-	•	▲	○	▲	○	White oak	+	-	▲	▲	▲	▲
Green ash*	•	•	▲	▲	▲	▲	White spruce	•	•	●	○	▲	▲
Hackberry	+		★		★		Yellow birch	•	•	●	○	●	○
Ironwood*	+	•	▲	▲	▲	▲	Yellow-poplar	+		★		★	
Jack pine	+	•	●	▲	●	▲							

*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/).