

CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES ERIE AND ONTARIO LAKE PLAIN (SUBREGION 2)



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 the region ([Butler-Leopold et al. 2018](#)). 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 the Mid-Atlantic region, available at www.fs.fed.us/nrs/atlas/combined/resources/summaries. More information on vulnerability and adaptation in the Mid-Atlantic region can be found at www.forestadaptation.org/mid-atlantic. 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	Pin cherry
Balsam fir	Pitch pine
Bigtooth aspen	Quaking aspen
Black ash	Red pine
Black spruce	Red spruce
Black willow	Serviceberry
Bur oak	Striped maple
Eastern hemlock	Sweet birch
Eastern white pine	Tamarack (native)
Jack pine	White spruce
Northern white-cedar	Yellow birch
Paper birch	

FAIR CAPABILITY

American beech	Northern pin oak
Black locust	White ash
Eastern cottonwood	

GOOD CAPABILITY

American elm	Northern red oak
Bitternut hickory	Pignut hickory
Black oak	Red maple
Black walnut	Shagbark hickory
Blackgum	Silver maple
Boxelder	Sugar maple
Chestnut oak	Swamp white oak
Eastern hophornbeam	White oak
Eastern redcedar	Yellow-poplar
Green ash	

NEW HABITAT WITH MIGRATION POTENTIAL

Chinkapin oak	Red mulberry
Common persimmon	Scarlet oak
Eastern redbud	Shingle oak
Hackberry	Sourwood
Honeylocust	Southern red oak
Loblolly pine	Sweetgum
Ohio buckeye	Willow oak
Osage-orange	



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	ADAPT ABUN		LOW CLIMATE CHANGE (RCP 4.5) HABITAT		HIGH CLIMATE CHANGE (RCP 8.5) HABITAT		SPECIES	ADAPT ABUN		LOW CLIMATE CHANGE (RCP 4.5) HABITAT		HIGH CLIMATE CHANGE (RCP 8.5) HABITAT	
			CHANGE	CAPABILITY	CHANGE	CAPABILITY				CHANGE	CAPABILITY	CHANGE	CAPABILITY
American basswood	•	•	●	○	▼	▲	Northern white-cedar	•	-	▼	▼	▼	▼
American beech	•	•	●	○	●	○	Ohio buckeye*	•		★		★	
American elm	•	•	▲	▲	▲	▲	Osage-orange	+		★		★	
American hornbeam*	•	-	▼	▼	▼	▼	Paper birch	•	-	▼	▼	▼	▼
Balsam fir	-	-	▼	▼	▼	▼	Pignut hickory	•	-	▲	▲	▲	▲
Bigtooth aspen	•	•	▼	▼	▼	▼	Pin cherry*	•	-	▼	▼	▼	▼
Bitternut hickory*	+	•	▼	○	●	▲	Pitch pine	•	-	▼	▼	▼	▼
Black ash	-	-	▼	▼	▼	▼	Quaking aspen	•	•	▼	▼	▼	▼
Black cherry	-	•	▲	○	●	▼	Red maple	+	+	▼	▲	▼	▲
Black locust*	•	•	●	○	●	○	Red mulberry*	•		★		★	
Black oak	•	-	▲	○	▲	▲	Red pine	-	-	▼	▼	▼	▼
Black spruce	•	-	▼	▼	▼	▼	Red spruce	-	-	▼	▼	▼	▼
Black walnut*	•	•	▲	▲	▲	▲	Scarlet oak	•		★		★	
Black willow*	-	•	▼	▼	●	▼	Serviceberry*	•	-	▼	▼	▼	▼
Blackgum	+	-	●	○	▲	▲	Shagbark hickory	•	•	▲	▲	▲	▲
Boxelder*	+	•	●	▲	▲	▲	Shingle oak	•		★		★	
Bur oak	+	-	▼	▼	▼	▼	Silver maple*	+	•	●	▲	▲	▲
Chestnut oak	+	-	▲	▲	▲	▲	Sourwood	+				★	
Chinkapin oak	•		★		★		Southern red oak	+		★		★	
Common persimmon*	+		★		★		Striped maple	•	-	▼	▼	▼	▼
Eastern cottonwood*	•	•	●	○	●	○	Sugar maple	+	+	●	▲	▼	▲
Eastern hemlock	-	•	▼	▼	▼	▼	Swamp white oak*	•	-	▲	▲	▲	▲
Eastern hophornbeam*	+	•	●	▲	●	▲	Sweet birch	-	-	▲	▼	▲	▼
Eastern redbud*	•		★		★		Sweetgum	•		★		★	
Eastern redcedar	•	-	▲	▲	▲	▲	Tamarack (native)	-	-	▼	▼	▼	▼
Eastern white pine	-	•	▼	▼	▼	▼	Virginia pine	•	-	▼	▼	▲	▲
Green ash*	•	+	●	▲	●	▲	White ash	-	+	▼	○	▼	○
Hackberry	+		★		★		White oak	+	-	▲	▲	▲	▲
Honeylocust*	+		★		★		White spruce	•	•	▼	▼	▼	▼
Jack pine	+	-	▼	▼	▼	▼	Willow oak*	•		★		★	
Loblolly pine	•		★		★		Yellow birch	•	•	▼	▼	▼	▼
Northern pin oak	+	-	●	○	●	○	Yellow-poplar	+	-	▲	▲	▲	▲
Northern red oak	+	•	▲	▲	▲	▲							

*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).