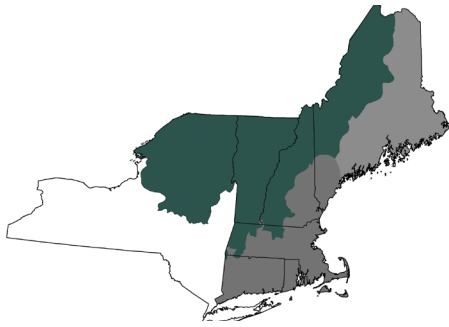


CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES

THE NORTHERN FOREST



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 ([Janowiak 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 Northern Forest region, available at www.fs.fed.us/nrs/atlas/combined/resources/summaries. More information on vulnerability and adaptation in the New England region can be found at www.forestadaptation.org/new-england. 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

Balsam fir	Gray birch
Balsam poplar	Mountain maple
Black ash	Pin cherry
Black willow	Red pine
Bur oak	Striped maple
Eastern cottonwood	Tamarack (native)

FAIR CAPABILITY

American elm	Red spruce
Bitternut hickory	Silver maple
Black spruce	White ash
Boxelder	White spruce
Jack pine	Yellow birch

GOOD CAPABILITY

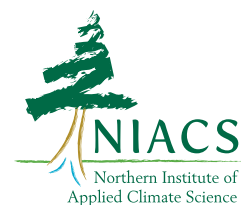
American basswood	Mockernut hickory
Bigtooth aspen	Northern red oak
Black cherry	Pignut hickory
Black locust	Pitch pine
Black oak	Quaking aspen
Blackgum	Red maple
Chestnut oak	Scarlet oak
Eastern redcedar	Sugar maple
Eastern white pine	Sweet birch
Hackberry	White oak
Ironwood	

MIXED RESULTS

American beech	Northern white cedar
Eastern hemlock	Paper birch
Flowering dogwood	Serviceberry
Green ash	Shagbark hickory

NEW HABITAT WITH MIGRATION POTENTIAL

Chinkapin oak	Pin oak
Common persimmon	Southern red oak
Cucumbertree	Sweetgum
Eastern redbud	Virginia pine
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		LOW CLIMATE CHANGE (RCP 4.5)		HIGH CLIMATE CHANGE (RCP 8.5)		SPECIES	ADAPT		LOW CLIMATE CHANGE (RCP 4.5)		HIGH CLIMATE CHANGE (RCP 8.5)	
	ABUN	HABITAT	CHANGE	CAPABILITY	CHANGE	CAPABILITY		ABUN	HABITAT	CHANGE	CAPABILITY	CHANGE	CAPABILITY
American basswood	•	•	▲	△	▲	△	Mockernut hickory	+	-	▲	△	▲	△
American beech	•	+	●	△	▼	○	Mountain maple*	+	-	▼	▼	▼	▼
American elm	•	•	●	○	●	○	Northern red oak	+	•	▲	△	▲	△
American hornbeam*	•	-	●	▼	●	▼	Northern white-cedar	•	•	▼	▼	●	○
American mountain-ash*	-	-	▼	▼	▼	▼	Osage-orange	+	-	★		★	
Bald cypress	•	-	★		★		Paper birch	•	•	●	○	▼	▼
Balsam fir	-	+	▼	▼	▼	▼	Pawpaw*	•	-	★		★	
Balsam poplar	•	-	▼	▼	▼	▼	Pecan*	-	-	★		★	
Bigtooth aspen	•	•	▲	△	▲	△	Pignut hickory	•	-	▲	△	▲	△
Bitternut hickory*	+	-	●	○	●	○	Pin cherry*	•	-	▼	▼	▼	▼
Black ash	-	-	▲	▼	▲	▼	Pin oak*	-	-	★		★	
Black cherry	-	•	▲	△	▲	△	Pitch pine	•	-	▲	△	▲	△
Black locust*	•	-	▲	△	▲	△	Quaking aspen	•	•	▲	△	▲	△
Black oak	•	-	▲	△	▲	△	Red maple	+	+	▲	△	●	△
Black spruce	•	•	●	○	●	○	Red pine	-	•	●	▼	●	▼
Black walnut*	•	-	▲	△	▲	△	Red spruce	-	+	▼	○	▼	○
Black willow*	-	-	▼	▼	●	▼	Sassafras*	•	-	▲	△	▲	△
Blackgum	+	-	▲	△	▲	△	Scarlet oak	•	-	▲	△	▲	△
Boxelder*	+	-	●	○	●	○	Serviceberry*	•	-	●	▼	▲	○
Bur oak	+	-	▼	▼	▼	▼	Shagbark hickory	•	-	▲	○	▲	△
Chestnut oak	+	-	▲	△	▲	△	Shortleaf pine	•	-	★		★	
Chinkapin oak	•	-	★		★		Silver maple*	+	-	●	○	●	○
Common persimmon*	+	-	★		★		Southern red oak	+	-	★		★	
Cucumber tree*	•	-	★		★		Striped maple	•	•	▼	▼	▼	▼
Eastern cottonwood*	•	-	●	▼	●	▼	Sugar maple	+	+	●	△	●	△
Eastern hemlock	-	+	▲	△	●	○	Swamp white oak*	•	-	●	▼	▲	○
Eastern redbud*	•	-	★		★		Sweet birch	-	•	▲	△	▲	△
Eastern redcedar	•	-	▲	△	▲	△	Sweetgum	•	-	★		★	
Eastern white pine	-	+	▲	△	▲	△	Sycamore*	•	-	▲	△	▲	△
Flowering dogwood	•	-	▲	○	▲	△	Tamarack (native)	-	-	●	▼	●	▼
Gray birch*	•	-	▼	▼	▼	▼	Virginia pine	•	-	★		★	
Green ash*	•	-	●	▼	▲	○	White ash	-	•	▲	○	▲	○
Hackberry	+	-	▲	△	▲	△	White oak	+	-	▲	△	▲	△
Ironwood*	+	•	▲	△	▲	△	White spruce	•	•	●	○	●	○
Jack pine	+	-	●	○	●	○	Yellow birch	•	+	▼	○	▼	○
Loblolly pine	•	-			★		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).