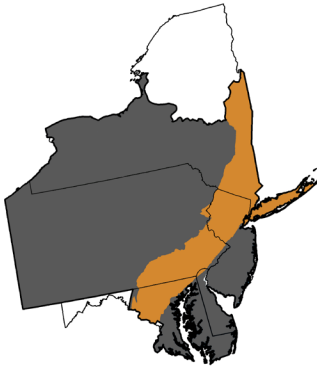


CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES PIEDMONT (SUBREGION 5)



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

Balsam fir	Pitch pine
Bigtooth aspen	Quaking aspen
Black ash	Red pine
Black cherry	Red spruce
Bur oak	Shingle oak
Eastern cottonwood	Striped maple
Eastern hemlock	Swamp white oak
Eastern white pine	Sweet birch
Jack pine	Tamarack (native)
Northern pin oak	White ash
Paper birch	White spruce
Pin oak	Yellow birch

FAIR CAPABILITY

American basswood	Shagbark hickory
Flowering dogwood	Silver maple
Hackberry	Sycamore
Osage-orange	Virginia pine

GOOD CAPABILITY

American beech	Loblolly pine
American elm	Mockernut hickory
American holly	Northern red oak
Bitternut hickory	Pignut hickory
Black locust	Post oak
Black oak	Red maple
Black walnut	Sassafras
Blackgum	Scarlet oak
Boxelder	Southern red oak
Chestnut oak	Sugar maple
Chinkapin oak	Sweetbay
Eastern hophornbeam	Sweetgum
Eastern redcedar	White oak
Green ash	Yellow-poplar

NEW HABITAT WITH MIGRATION POTENTIAL

Atlantic white-cedar	Shortleaf pine
Bald cypress	Sourwood
Blackjack oak	Swamp tupelo
Cherrybark oak	Water oak
Laurel oak	Water tupelo
Pond pine	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)		SPECIES	LOW CLIMATE CHANGE (RCP 4.5)		HIGH CLIMATE CHANGE (RCP 8.5)	
	ADAPT	ABUN	HABITAT CHANGE	CAPABILITY		ADAPT	ABUN	HABITAT CHANGE	CAPABILITY
American beech	•	•	▲	▲	Paper birch	•	-	▼	▼
American basswood	•	-	▲	○	Pignut hickory	•	•	▲	▲
American elm	•	•	●	○	Pin oak*	-	•	●	▼
American holly	•	-	▲	▲	Pitch pine	•	•	▼	▼
Atlantic white-cedar*	-		★		Pond pine	-		★	
Bald cypress	•		★		Post oak	+	-	▲	▲
Balsam fir	-	-	▼	▼	Quaking aspen	•	-	●	▼
Bigtooth aspen	•	-	▼	▼	Red maple	+	+	●	▲
Bitternut hickory*	+	•	▲	▲	Red pine	-	-	▼	▼
Black ash	-	-	▼	▼	Red spruce	-	-	▼	▼
Black cherry	-	•	●	▼	Sassafras*	•	•	▲	▲
Black locust*	•	•	▲	▲	Scarlet oak	•	•	▲	▲
Black oak	•	•	▲	▲	Shagbark hickory	•	•	●	○
Black walnut*	•	•	▲	▲	Shingle oak	•	-	▼	▼
Blackgum	+	•	▲	▲	Shortleaf pine	•		★	
Blackjack oak	+		★		Silver maple*	+	-	●	○
Boxelder*	+	•	●	▲	Sourwood	+		★	
Bur oak	+	-	▼	▼	Southern red oak	+	-	▲	▲
Cherrybark oak	•		★		Striped maple	•	-	▼	▼
Chestnut oak	+	•	●	▲	Sugar maple	+	•	●	▲
Chinkapin oak	•	-	▲	▲	Swamp tupelo	-		★	
Eastern cottonwood*	•	-	▼	▼	Swamp white oak*	•	•	▼	▼
Eastern hemlock	-	•	▼	▼	Sweet birch	-	•	▼	▼
Eastern hophornbeam*	+	•	▲	▲	Sweetbay	•	-	▲	▲
Eastern redcedar	•	•	▲	▲	Sweetgum	•	-	▲	▲
Eastern white pine	-	•	▼	▼	Sycamore*	•	-	▲	○
Flowering dogwood	•	-	▲	○	Tamarack (native)	-	-	▼	▼
Green ash*	•	•	▲	▲	Virginia pine	•	-	●	○
Hackberry	+	-	●	○	Water oak	•		★	
Jack pine	+	-	▼	▼	Water tupelo	-		★	
Laurel oak	•		★		White ash	-	•	●	▼
Loblolly pine	•	-	▲	▲	White oak	+	•	▲	▲
Mockernut hickory	+	•	▲	▲	White spruce	•	-	▼	▼
Northern pin oak	+	-	▼	▼	Winged elm	•		★	
Northern red oak	+	•	●	▲	Yellow birch	•	-	●	▼
Osage-orange	+	-	▼	○	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).