

# CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES

## NORTHERN ALLEGHENY PLATEAU (PENNSYLVANIA SUBREGION 3)



Pennsylvania's forests will be affected by a changing climate and other stressors during this century. Researchers and managers created an assessment that describes the vulnerability of forests in the Mid-Atlantic region (Butler-Leopold et al. 2018: [doi.org/10.2737/NRS-GTR-181](https://doi.org/10.2737/NRS-GTR-181)). This report includes

information on the current landscape, observed climate trends, and a range of projected future climates. It also describes many potential climate change impacts to forests and summarizes key vulnerabilities for major forest ecosystems. This handout summarizes data from the U.S. Forest Service's Climate Change Tree Atlas ([fs.usda.gov/nrs/atlas/tree/](https://fs.usda.gov/nrs/atlas/tree/)). 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 Tree Atlas provides information 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.

**CREDIT:** This handout summarizes the full model results for Northern Allegheny Plateau (Pennsylvania Subregion 3). Data provided by the USDA Forest Service ( M.P. Peters, A.M Prasad, S.N. Matthews, & L.R. Iverson) as part of the Climate Change Tree Atlas ([fs.usda.gov/nrs/atlas](https://fs.usda.gov/nrs/atlas)). Models and variables are described in Iverson et al. 2019 and Peters et al. 2019 (available at [fs.usda.gov/nrs/atlas/products/pubs](https://fs.usda.gov/nrs/atlas/products/pubs)). More information on vulnerability and adaptation in the region can be found at [forestadaptation.org/mid-atlantic](https://forestadaptation.org/mid-atlantic).

### CLIMATE CHANGE CAPABILITY

#### POOR CAPABILITY

Black ash	Quaking aspen
Cucumber tree	Red pine
Eastern cottonwood	Red spruce
Eastern hemlock	Serviceberry
Eastern white pine	Shingle oak
Gray birch	Striped maple
Paper birch	Tamarack (native)
Pin cherry	White spruce
Pitch pine	Yellow birch

#### FAIR CAPABILITY

American beech	Sweet birch
Bitternut hickory	White ash
Black cherry	

#### GOOD CAPABILITY

American basswood	Pignut hickory
American elm	Red maple
Black locust	Sassafras
Black oak	Scarlet oak
Black walnut	Shagbark hickory
Blackgum	Sugar maple
Chestnut oak	Sycamore
Eastern hophornbeam	Virginia pine
Eastern redcedar	White oak
Mockernut hickory	Yellow-poplar
Northern red oak	

#### MIXED CAPABILITY

American hornbeam	Flowering dogwood
Bigtooth aspen	

#### NEW HABITAT WITH MIGRATION POTENTIAL

Eastern redbud	Post oak
Hackberry	Sourwood
Pin oak	Sweetgum



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**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	CHANG	HABITAT	CAPABILITY	HABITAT	CAPABILITY		ABUN	CHANG	HABITAT	CAPABILITY	HABITAT	CAPABILITY
American basswood	•	•	▲	△	▲	△	Pin cherry*	•	•	▼	▼	▼	▼
American beech	•	+	▼	○	▼	○	Pin oak*	-	-	★		★	
American elm	•	-	▲	○	▲	△	Pitch pine	•	-	●	▼	▼	▼
American hornbeam	•	•	▼	▼	●	○	Post oak	+	-	★		★	
Bigtooth aspen	•	•	▲	△	▼	▼	Quaking aspen	•	•	▼	▼	▼	▼
Bitternut hickory*	+	-	●	○	●	○	Red maple	+	+	▼	△	▼	△
Black ash	-	-	▼	▼	▼	▼	Red pine	-	•	▼	▼	▼	▼
Black cherry	-	+	●	○	●	○	Red spruce	-	-	▼	▼	▼	▼
Black locust*	•	•	▲	△	▲	△	Sassafras*	•	•	▲	△	▲	△
Black oak	•	•	▲	△	▲	△	Scarlet oak	•	•	▲	△	▲	△
Black walnut*	•	-	▲	○	▲	△	Serviceberry*	•	•	▼	▼	▼	▼
Blackgum	+	•	▲	△	▲	△	Shagbark hickory	•	-	▲	△	▲	△
Chestnut oak	+	•	▲	△	▲	△	Shingle oak	•	-	▼	▼	▼	▼
Cucumbertree*	•	-	●	▼	▼	▼	Sourwood	+	-	★		★	
Eastern cottonwood*	•	-	●	▼	●	▼	Striped maple	•	-	▼	▼	▼	▼
Eastern hemlock	-	+	▼	○	▼	▼	Sugar maple	+	+	▼	△	▼	△
Eastern hophornbeam	+	•	●	△	▲	△	Sweet birch	-	+	●	○	▼	○
Eastern redbud*	•	-	★		★		Sweetgum	•	-	★		★	
Eastern redcedar	•	-	▲	△	▲	△	Sycamore*	•	-	▲	△	▲	△
Eastern white pine	-	•	●	▼	●	▼	Tamarack (native)	-	-	▼	▼	▼	▼
Flowering dogwood	•	-	●	▼	▲	○	Virginia pine	•	-	▲	△	▲	△
Gray birch*	•	-	▼	▼	▼	▼	White ash	-	+	●	○	●	○
Hackberry	+	-	★		★		White oak	+	•	▲	△	▲	△
Mockernut hickory	+	-	▲	△	▲	△	White spruce	•	-	▼	▼	▼	▼
Northern red oak	+	+	▲	△	▲	△	Yellow birch	•	•	▼	▼	▼	▼
Paper birch	•	-	▼	▼	▼	▼	Yellow-poplar	+	-	▲	△	▲	△
Pignut hickory	•	•	▲	△	▲	△							

\*Species with low model reliability based on five statistical metrics of the habitat models that affect change class. See tables for more information ([fs.usda.gov/nrs/atlas/combined/resources/summaries](https://fs.usda.gov/nrs/atlas/combined/resources/summaries)).