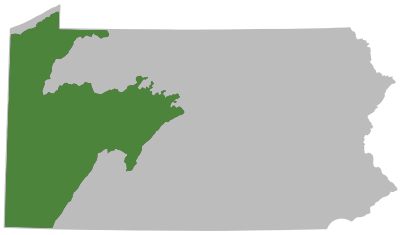
CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES

WESTERN ALLEGHENY PLATEAU (PENNSYLVANIA SUBREGION 1)



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*). 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/)*. 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). Models and variables are described in Iverson et al. 2019 and Peters et al. 2019 (available at fs.usda.gov/nrs/atlas/products/pubs). More information on vulnerability and adaptation in the region can be found at forestadaptation.org/mid-atlantic.*

CLIMATE CHANGE CAPABILITY

POOR CAPABILITY	
American holly	Pin cherry
Balsam poplar	Pin oak
Bigtooth aspen	Pitch pine
Black ash	Quaking aspen
Black cherry	Red pine
Black maple	Serviceberry
Black willow	Shingle oak
Cucumbertree	Striped maple
Eastern hemlock	Swamp white oak
Eastern white pine	Sweet birch
Flowering dogwood	White ash
Jack pine	White spruce
Paper birch	Yellow birch
FAIR CAPABILITY	
American beech	Silver maple
Boxelder	Sycamore
Scarlet oak	
GOOD CAPABILITY	
American elm	Pignut hickory
Bitternut hickory	Red maple
Black locust	Sassafras
Black oak	Shagbark hickory
Black walnut	Slippery elm
Blackgum	Sourwood
Chestnut oak	Sugar maple
Chinkapin oak	Sweetgum
Eastern hophornbeam	Virginia pine
Hackberry	White oak
Mockernut hickory	Yellow-poplar
Northern red oak	
MIXED CAPABILITY	
American basswood	Green ash
American hornbeam	Honeylocust
Eastern cottonwood	Osage-orange
NEW HABITAT WITH MIGRATION POTENTIAL	
Common persimmon	Shortleaf pine
Eastern redcedar	Southern red oak
Northern white-cedar	Winged elm
Post oak	

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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*

			LOW CLIMATE CHANGE (RCP 4.5)		HIGH CLIMATE CHANGE (RCP 8.5)	
SPECIES	ADAPT	ABUN	HABITAT CHANGE	CAPABILITY	HABITAT CHANGE	CAPABILITY
American basswood	•	•	▲	△	●	○
American beech	•	•	●	○	●	○
American elm	•	•	●	○	▲	△
American holly	•	–	▼	▽	▼	▽
American hornbeam	•	•	▼	▽	●	○
Balsam poplar	•	–	▼	▽	▼	▽
Bigtooth aspen	•	•	▼	▽	▼	▽
Bitternut hickory*	+	•	▲	△	▲	△
Black ash	–	–	▼	▽	▼	▽
Black cherry	–	+	▼	○	▼	▽
Black locust*	•	•	●	○	▲	△
Black maple*	+	–	▼	▽	▼	▽
Black oak	•	•	▲	△	▲	△
Black walnut*	•	•	▲	△	▲	△
Black willow*	–	•	▼	▽	▼	▽
Blackgum	+	•	▲	△	▲	△
Boxelder*	+	–	●	○	●	○
Chestnut oak	+	•	▲	△	▲	△
Chinkapin oak	•	–	▲	△	▲	△
Common persimmon*	+	–	★		★	
Cucumbertree*	•	–	▼	▽	▼	▽
Eastern hemlock	–	•	▼	▽	▼	▽
Eastern hophornbeam	+	•	●	△	▲	△
Eastern redcedar	•	–	★		★	
Eastern white pine	–	•	▼	▽	▼	▽
Flowering dogwood	•	–	●	▽	●	▽
Green ash*	•	–	●	▽	▲	○
Hackberry	+	–	▲	△	▲	△
Jack pine	+	–	▼	▽	▼	▽
Mockernut hickory	+	–	▲	△	▲	△
Northern red oak	+	+	●	△	●	△
Osage-orange	+	–	▼	▽	●	○

			LOW CLIMATE CHANGE (RCP 4.5)		HIGH CLIMATE CHANGE (RCP 8.5)	
SPECIES	ADAPT	ABUN	HABITAT CHANGE	CAPABILITY	HABITAT CHANGE	CAPABILITY
Paper birch	•	–	▼	▽	▼	▽
Pignut hickory	•	–	▲	△	▲	△
Pin cherry*	•	–	▼	▽	▼	▽
Pin oak*	–	–	●	▽	●	▽
Pitch pine	•	–	▼	▽	▼	▽
Post oak	+	–	★		★	
Quaking aspen	•	•	▼	▽	▼	▽
Red maple	+	+	▼	△	▼	△
Red pine	–	–	▼	▽	▼	▽
Sassafras*	•	•	▲	△	▲	△
Scarlet oak	•	•	●	○	●	○
Serviceberry*	•	–	▼	▽	▼	▽
Shagbark hickory	•	•	▲	△	▲	△
Shingle oak	•	–	▼	▽	▼	▽
Shortleaf pine	•	–	★		★	
Silver maple*	+	–	●	○	●	○
Slippery elm*	•	•	●	○	▲	△
Sourwood	•	–	▲	△	▲	△
Southern red oak	+	–	★		★	
Striped maple	•	–	▼	▽	▼	▽
Sugar maple	+	+	●	△	●	△
Swamp white oak*	•	–	▼	▽	▼	▽
Sweet birch	–	•	▼	▽	▼	▽
Sweetgum	•	–	▲	△	▲	△
Sycamore*	•	–	▲	○	▲	○
Virginia pine	•	–	▲	△	▲	△
White ash	–	•	●	▽	●	▽
White oak	+	•	▲	△	▲	△
White spruce	•	–	▼	▽	▼	▽
Winged elm	•	–	★		★	
Yellow birch	•	•	▼	▽	▼	▽
Yellow-poplar	+	•	▲	△	▲	△

**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).*

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