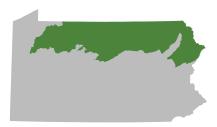
CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES

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

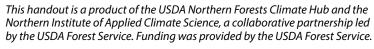
CLIMATE CHANGE CAPABILITY

POOR CAPABILITY							
Black ash	Quaking aspen						
Cucumbertree	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 M	IGRATION POTENTIA						
Eastern redbud	Post oak						
Hackberry	Sourwood						
Pin oak	Sweetgum						











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 AI		LOW CLIMATE CHANGE (RCP 4.5) HABITAT CHANGE CAPABILITY		HIGH CLIMATE CHANGE (RCP 8.5) HABITAT Y CHANGE CAPABILITY		SPECIES			LOW CLIMATE CHANGE (RCP 4.5)		HIGH CLIMATE CHANGE (RCP 8.5) HABITAT CHANGE CAPABILITY	
		ABUN						ADAPT ABUN		HABITAT CHANGE	CAPABILITY		
American basswood		•	A	Δ	A	Δ	Pin cherry*		•	▼	∇	•	∇
American beech	•	+	_	0	_	0	Pin oak*	_	_	*		*	
American elm	•	_	A	0	_	Δ	Pitch pine	•	_	•	∇	•	∇
American hornbeam	•	•	_	∇	•	0	Post oak	+	_	*		*	
Bigtooth aspen	•	•	A	Δ	_	∇	Quaking aspen	•	•	_	∇	•	∇
Bitternut hickory*	+	_	•	0	•	0	Red maple	+	+	•	Δ	•	Δ
Black ash	_	_	•	∇	_	∇	Red pine	_		•	∇	•	∇
Black cherry	_	+	•	0	•	0	Red spruce	_	_	V	∇	_	∇
Black locust*	•	•	_	Δ	_	Δ	Sassafras*	•	•	_	Δ	A	Δ
Black oak	•	•	A	Δ	_	Δ	Scarlet oak	•	•	A	Δ	A	Δ
Black walnut*	•	_	_	0	_	Δ	Serviceberry*	•	•	_	∇	_	∇
Blackgum	+	•	A	Δ	_	Δ	Shagbark hickory		-	A	Δ	A	Δ
Chestnut oak	+	•	_	Δ	_	Δ	Shingle oak	•	_	_	∇	_	∇
Cucumbertree*		_	•	∇	_	∇	Sourwood	+	_	*		*	
Eastern cottonwood*	•	_	•	∇	•	∇	Striped maple	•	_	_	∇	_	∇
Eastern hemlock	_	+	_	0	_	lacksquare	Sugar maple	+	+	_	Δ	_	Δ
Eastern hophornbeam	+	•	•	Δ	_	Δ	Sweet birch	_	+	•	0	_	0
Eastern redbud*	•	_	*		*		Sweetgum		_	*		*	
Eastern redcedar	•	_	<u> </u>	Δ	_	Δ	Sycamore*	•	_	<u> </u>	Δ	A	Δ
Eastern white pine	_	•	•	∇	•	∇	Tamarack (native)	_	_	▼	∇	_	∇
Flowering dogwood		_	•	∇	_	0	Virginia pine		_	<u> </u>	Δ	A	Δ
Gray birch*	•	_	_	∇	_	∇	White ash	_	+	•	0	•	0
Hackberry	+	_	*		*		White oak	+	•	<u> </u>	Δ	A	Δ
Mockernut hickory	+	_	_	Δ	_	Δ	White spruce	•	_	_	∇	_	∇
Northern red oak	+	+	_	Δ	A	Δ	Yellow birch	•	•	▼	∇	_	∇
Paper birch		_	_	∇	_	∇	Yellow-poplar	+	_	A	Δ	A	Δ
Pignut hickory	•	•	<u> </u>	Δ	_	Δ							