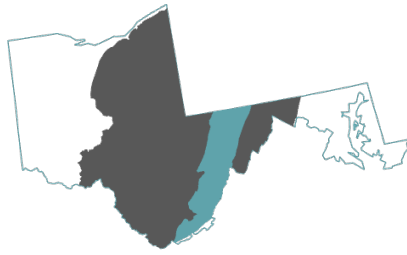


CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES CENTRAL APPALACHIANS EASTERN WEST VIRGINIA



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 et al. 2015](#)). 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 Central Appalachians region, available at www.fs.fed.us/nrs/atlas/combined/resources/summaries. More information on vulnerability and adaptation in the Central Appalachians region can be found at www.forestadaptation.org/central-appalachians. 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

American elm	Red spruce
American holly	Shingle oak
Balsam fir	Striped maple
Bigtooth aspen	Sweet birch
Pin cherry	Yellow birch
Quaking aspen	Yellow buckeye
Red pine	

FAIR CAPABILITY

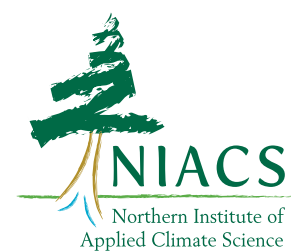
American basswood	Pitch pine
Black cherry	Serviceberry
Black locust	Sycamore
Eastern hemlock	Table Mountain pine
Eastern white pine	White ash
Mountain magnolia	

GOOD CAPABILITY

American beech	Post oak
Bitternut hickory	Red maple
Black oak	Sassafras
Blackgum	Scarlet oak
Chestnut oak	Shagbark hickory
Cucumbertree	Shortleaf pine
Eastern hophornbeam	Slippery elm
Eastern redcedar	Sourwood
Flowering dogwood	Southern red oak
Hackberry	Sugar maple
Mockernut hickory	Virginia pine
Northern red oak	White oak
Pignut hickory	Yellow-poplar

NEW HABITAT WITH MIGRATION POTENTIAL

Blackjack oak	Shumard oak
Florida maple	Sugarberry
Red mulberry	Sweetgum
River birch	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 basswood	•	•	●	○	Pitch pine	•	-	▲	○
American beech	•	+	●	▲	Post oak	+	-	▲	▲
American elm	•	-	●	▼	Quaking aspen	•	-	▼	▼
American holly	•	-	▼	▼	Red maple	+	+	▼	▲
American hornbeam*	•	-	▼	▼	Red mulberry*	•		★	★
Balsam fir	-	-	▼	▼	Red pine	-	-	▼	▼
Bigtooth aspen	•	-	▼	▼	Red spruce	-	•	▼	▼
Bitternut hickory*	+	-	▲	▲	River birch*	•		★	★
Black cherry	-	+	▼	○	Sassafras*	•	•	▲	▲
Black locust*	•	•	●	○	Scarlet oak	•	•	▲	▲
Black oak	•	•	▲	▲	Serviceberry*	•	•	●	○
Black walnut*	•	-	●	▼	Shagbark hickory	•	•	▲	▲
Blackgum	+	•	▲	▲	Shingle oak	•	-	▼	▼
Blackjack oak	+		★	★	Shortleaf pine	•	-	▲	▲
Chestnut oak	+	+	▲	▲	Shumard oak*	+		★	★
Chinkapin oak	•	-	●	▼	Slippery elm*	•	•	●	○
Cucumbertree*	•	•	▲	▲	Sourwood	+	•	▲	▲
Eastern hemlock	-	•	▲	○	Southern red oak	+	-	▲	▲
Eastern hophornbeam*	+	-	▲	▲	Striped maple	•	•	▼	▼
Eastern redcedar	•	-	▲	▲	Sugar maple	+	+	●	▲
Eastern white pine	-	•	▲	○	Sugarberry	•		★	★
Florida maple*	+		★	★	Sweet birch	-	•	●	▼
Flowering dogwood	•	-	▲	▲	Sweetgum	•		★	★
Hackberry	+	-	●	○	Sycamore*	•	-	▲	○
Honeylocust*	+			★	Table Mountain pine*	+	-	●	○
Longleaf pine	•			★	Virginia pine	•	•	▲	▲
Mockernut hickory	+	•	▲	▲	Water oak	•			★
Mountain magnolia*	-	-	▲	○	White ash	-	•	▲	○
Northern red oak	+	+	●	▲	White oak	+	+	▲	▲
Osage-orange	+			★	Winged elm	•		★	★
Pecan*	-			★	Yellow birch	•	•	▼	▼
Pignut hickory	•	•	▲	▲	Yellow buckeye*	-	-	●	▼
Pin cherry*	•	•	▼	▼	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).