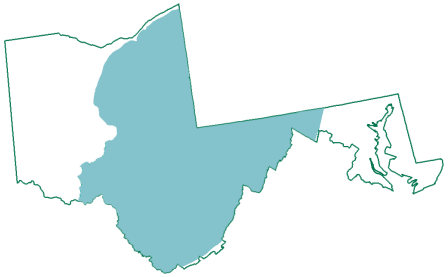
CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES

CENTRAL APPALACHIANS

The region's forests will be affected by a changing climate during this century. A team of forest managers and researchers created an assessment that describes the vulnerability of forests in the Central Appalachians (Butler et al. 2015). 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 types. This handout is summarized from the full assessment.



TREE SPECIES INFORMATION:

This assessment uses two climate scenarios to "bracket" a range of possible futures. These future climate projections were used with two forest impact models (Tree Atlas and LANDIS) to provide information about how individual tree species may respond to a changing climate. More information on the climate and forest impact models can be found in the assessment. Results for "low" and "high" climate scenarios can be compared on page 2 of this handout.

Remember that models are just tools, and they're not perfect. Model projections don't account for some factors that could be modified by climate change, like droughts, wildfire activity , and invasive species. If a species is rare or confined to a small area, Tree Atlas results may be less reliable. These factors, and others (see table below), 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. The model results presented here were combined with information from published reports and local management expertise to draw conclusions about potential risk and change in the region's forests.

SPECIES	ADDITIONAL CONSIDERATIONS - 30 MOST COMMON SPECIES
MAY DECREASE	
American basswood	Tolerates shade, susceptible to fire
American beech	Susceptible to beech bark disease, extremely shade tolerant
American elm	Grows on a variety of sites, susceptible to Dutch elm disease
Black cherry	Susceptible to insects and fire, somewhat drought-tolerant
Black locust	Early-successional colonizer, susceptible to insect pests
Chestnut oak	Establishes from seed or sprout, adapted to fire
Eastern white pine	Good disperser, but susceptible to drought and insects
Flowering dogwood	Shade tolerant
Red maple	Competitive colonizer in diverse sites, tolerant of disturbance
Sassafras	Early-successional colonizer, susceptible to fire topkill
Scarlet oak	Establishes from seed or sprout, susceptible to fire and disease
Slippery elm	Shade-tolerant, susceptible to disease and fire topkill
Sugar maple	Grows across a variety of sites, tolerates shade
Sweet birch	Susceptible to drought, fire topkill, and insects
Tulip tree	Competitive colonizer tolerant of diverse sites
White ash	Emerald ash borer causes mortality

SPECIES	ADDITIONAL CONSIDERATIONS - 30 MOST COMMON SPECIES
NO CHANGE	
American hornbeam	Tolerates shade, susceptible to fire and drought
Blackgum	Shade tolerant, fire adapted
Cucumber tree	Susceptible to fire topkill
Pignut hickory	Susceptible to insect pests and drought
MIXED MODEL RESULTS	
Northern red oak	Susceptible to insect pests
Sourwood	Competitive in a range of site conditions
MAY INCREASE	
Black oak	Drought tolerant, susceptible to insect pests and diseases
Black walnut	Good disperser, but intolerant of shade and drought
Boxelder	Drought and shade tolerant, competitive in a range of site conditions
Eastern hophornbeam	Grows across a variety of sites, tolerates shade
Mockernut hickory	Susceptible to fire topkill
Serviceberry	Competative colonizer, susceptible to drought
Virginia pine	Intolerant of shade and pollution
White oak	Fire-adapted, grows on a variety of sites

FUTURE PROJECTIONS

Data for the end of the century are summarized for the Climate Change Tree Atlas (www.fs.fed.us/nrs/atlas) under two climate change scenarios. Tree Atlas models future suitable habitat, while LANDIS models changes in forest growth over time (future tree density presented in this table; additional data are available in the assesment).

- ▲ **INCREASE** *Projected increase of >20% by 2100*
- ● **NO CHANGE** *Little change (<20%) projected by 2100*
- ▼ **DECREASE** *Projected decrease of >20% by 2100*
- ★ **NEW HABITAT** *Tree Atlas projects new habitat for species not currently present*

ADAPTABILITY

Factors not included in the Tree Atlas model, such as the ability to respond favorably to disturbance, may make a species more or less able to adapt to future stressors (see reverse page for considerations for the 30 most common species).

- \+ high *Species may perform better than modeled*
- . medium
- – low *Species may perform worse than modeled*

SPECIES	LOW CLIMATE CHANGE (PCM B1) TREE ATLAS	LOW CLIMATE CHANGE (PCM B1) LANDIS	HIGH CLIMATE CHANGE (GFDL A1FI) TREE ATLAS	HIGH CLIMATE CHANGE (GFDL A1FI) LANDIS	ADAPT
American basswood	●	●	▼	▼	.
American beech	●		▼		.
American chestnut	●		●		.
American elm	●		▼		.
American holly	●		●		.
American hornbeam	●		●		.
Balsam fir	▼		▼		–
Bigtooth aspen	▼		▼		.
Black ash	▼		▼		–
Black cherry	▼	●	▼	●	–
Black hickory	★		★		.
Black locust	●		▼		.
Black maple	●		▼		.
Black oak	●	●	▲	●	.
Black walnut	▲		●		.
Black willow	▼		▲		–
Blackgum	●		●		+
Blackjack oak	▲		▲		+
Boxelder	●		▲		+
Bur oak	●		▲		+
Butternut	●		▼		–
Cedar elm			★		.
Chestnut oak	●	●	▼	●	+
Chinkapin oak	▲		▲		.
Common persimmon	▲		▲		+
Cucumbertree	●		●		.
Eastern hemlock	●	●	▼	▼	–
Eastern hophornbeam	●		▲		+
Eastern red cedar	▲	●	▲	▲	.
Eastern redbud	▲		▲		.
Eastern white pine	●	●	▼	▼	.
Flowering dogwood	●		▼		.
Green ash	▲		▲		.
Hackberry	▲		▲		+
Honeylocust	▲		▲		+
Loblolly pine	●	▲	▲	▲	.
Mockernut hickory	●		▲		+
Mountain maple	●		●		+
Northern pin oak	●		▼		+
Northern red oak	●	▲	▼	▲	+

SPECIES	LOW CLIMATE CHANGE (PCM B1) TREE ATLAS	LOW CLIMATE CHANGE (PCM B1) LANDIS	HIGH CLIMATE CHANGE (GFDL A1FI) TREE ATLAS	HIGH CLIMATE CHANGE (GFDL A1FI) LANDIS	ADAPT
Osage-orange	▲		▲		+
Pawpaw	●		▼		.
Pignut hickory	●	●	●	●	.
Pin cherry	▼		▼		.
Pin oak	●		▲		–
Pitch pine	●		●		.
Post oak	▲		▲		+
Quaking aspen	▼		▼		.
Red maple	●	●	▼	●	+
Red pine	▼		▼		.
Red spruce	●	●	▼	●	–
Sassafras	●		▼		.
Scarlet oak	●	●	▼	●	.
Serviceberry	●		●		.
Shagbark hickory	▲		▲		.
Shingle oak	▲		▲		.
Shortleaf pine	▲		▲		.
Silver maple	▼		▲		+
Slippery elm	●		▼		.
Sourwood	▲		▼		+
Southern magnolia	●		▼		.
Southern red oak	▲		▲		+
Striped maple	▼		▼		.
Sugar maple	●	●	▼	▼	+
Sugarberry	▲		▲		.
Swamp white oak	●		▼		.
Sweet birch	●		▼		–
Sweetgum	▲		▲		.
Sycamore	●		▲		.
Table Mountain pine	●		▲		+
Tamarack (native)	▼		●		–
Tulip tree	●	●	▼	●	+
Virginia pine	▲		●		.
Water locust			★		.
Water oak			★		.
White ash	●	●	▼	●	–
White oak	●	●	▲	●	+
Winged elm	▲		▲		.
Yellow birch	▼		▼		.
Yellow buckeye	●		●		–

SOURCE: Butler, et al. 2015. Central Appalachians forest ecosystem vulnerability assessment and synthesis: a report from the central Appalachians climate change response framework project. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 322p. Available at https://www.fs.fed.us/nrs/pubs/gtr/gtr_nrs146.pdf.