CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES

ERIE AND ONTARIO LAKE PLAIN (SUBREGION 2)

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 Mid-Atlantic region (Butler-Leopold et al. in review). 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.

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, 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.

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.

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
LIKELY TO DECREASE	
American beech	Susceptible to beech bark disease, very shade tolerant
Black ash	Narrow requirements; Emerald ash borer causes mortality
Black walnut	Good disperser, but intolerant of shade and drought
Chokecherry	Shade intolerant, sensitive to browsing and competition
Red pine	Shade intolerant; susceptible to many pests & diseases
Slippery elm	Shade-tolerant, susceptible to Dutch elm disease & fire
MAY DECREASE	
American basswood	Tolerates shade, susceptible to fire
Black willow	Intolerant of shade, fire, and drought
Eastern hemlock	Hemlock woolly adelgid causes widespread mortality
Eastern hophornbeam	Drought-tolerant, intolerant of shade, fire, and insects
Eastern white pine	Good disperser, but susceptible to drought and insects
Quaking aspen	Early-successional colonizer, susceptible to heat and drought
Silver maple	Early colonizer, susceptible to fire topkill and drought
Sugar maple	Grows across a variety of sites, tolerates shade
Yellow birch	Good disperser, susceptible to fire, insects, and disease

SPECIES	ADDITIONAL CONSIDERATIONS - 30 MOST COMMON SPECIES
NO CHANGE	
American elm	Susceptible to Dutch elm disease
American hornbeam	Tolerates shade, susceptible to fire and drought
Bigtooth aspen	Early-successional colonizer, susceptible to drought
Green ash	Shade- intolerant; emerald ash borer causes mortality
MAY INCREASE	
Black cherry	Susceptible to insects and fire, mildly drought-tolerant
Boxelder	Widespread and tolerant of drought and shade
Eastern cottonwood	Intolerant of shade, fire, defoliators and cankers
Mockernut hickory	Susceptible to fire topkill
Pignut hickory	Susceptible to bark beetles and drought
Red maple	Competitive colonizer in many sites, disturbance-tolerant
White ash	Emerald ash borer causes widespread mortality
White oak	Fire-adapted, grows on a variety of sites
LIKELY TO INCREASE	
Black locust	Early colonizer, but susceptible to locust borer & heart rot
Northern red oak	Susceptible to insect pests
Serviceberry	Competitive colonizer, susceptible to drought

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FUTURE PROJECTIONS

Data for the end of the century are summarized for two forest impact models under two climate change scenarios. The Climate Change Tree Atlas (www.fs.fed.us/nrs/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 assessment).

- ▲ **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 elm	●		●		.
American hornbeam	●		●		.
Atlantic white-cedar	▼		▼		-
Balsam fir	▼	▲	▼	▼	-
Bigtooth aspen	●		●		.
Bitternut hickory	●		▲		+
Black ash	▼		▼		-
Black cherry	●	●	▲	●	-
Black locust	▲		▲		.
Black oak	●	●	▲	●	.
Black walnut	▲		▲		.
Black willow	●		▼		-
Blackgum	▲		▲		+
Blackjack oak	N/A		★		+
Boxelder	●		▲		+
Bur oak	▼		▼		+
Butternut	▼		▼		-
Cedar elm	N/A		★		.
Chestnut oak	▲	▼	▲	▲	+
Chinkapin oak	●		▲		.
Chokecherry	▼		▼		.
Cucumbertree	●		▼		.
Eastern cottonwood	●		▲		.
Eastern hemlock	▼	●	▼	▼	-
Eastern hophornbeam	●		▼		+
Eastern redbud	★		★		.
Eastern redcedar	▲		▲		.
Eastern white pine	▼	●	▼	▼	.
Flowering dogwood	▲		▲		.
Gray birch	▼		▼		.
Green ash	●		●		.
Hackberry	N/A		★		+
Honeylocust	N/A		★		+
Loblolly pine	N/A		★		.
Mockernut hickory	●		▲		+
Northern red oak	●	●	▲	▲	+
Northern white-cedar	▼	▼	▼	▼	.
Ohio buckeye	★		★		.

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	▲		▲		+
Paper birch	▼		▼		.
Pawpaw	★		★		.
Persimmon	N/A		★		+
Pignut hickory	●	●	▲	●	.
Pin cherry	▼		▼		.
Pin oak	N/A		★		-
Pitch pine	●	▼	●	●	.
Post oak	N/A		★		+
Quaking aspen	▼	●	▼	▼	.
Red maple	●	●	▲	●	+
Red mulberry	★		★		.
Red pine	▼		▼		.
Red spruce	▼	▼	▼	▼	-
Rock elm	▼		●		-
Sassafras	▲		▲		.
Scarlet oak	▲	●	▲	▲	.
Serviceberry	▲		▲		.
Shagbark hickory	●	●	▲	▲	.
Shellbark hickory	N/A		★		.
Shingle oak	●		★		.
Shortleaf pine	N/A		★		.
Shumard oak	N/A		★		+
Silver maple	●		▼		+
Slippery elm	▲		▲		.
Southern red oak	N/A		★		+
Striped maple	▼		▼		.
Sugarberry	N/A		★		.
Sugar maple	●	●	▼	●	+
Swamp white oak	▼		▼		.
Sweet birch	●		▲		-
Sweetgum	N/A		★		.
Sycamore	▲		▲		.
Tamarack	▼		▼		-
Tulip tree	▲	●	▲	▲	+
Virginia pine	★		★		.
White ash	●	●	●	▲	-
White oak	●	●	▲	▲	+
White spruce	▼		▼		.
Yellow birch	▼	●	▼	▼	.

SOURCE: Butler-Leopold et al. (in review). Mid-Atlantic forest ecosystem vulnerability assessment and synthesis: a report from the Mid-Atlantic Climate Change Response Framework, Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station.
www.forestadaptation.org/mid-atlantic/vulnerability-assessment

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