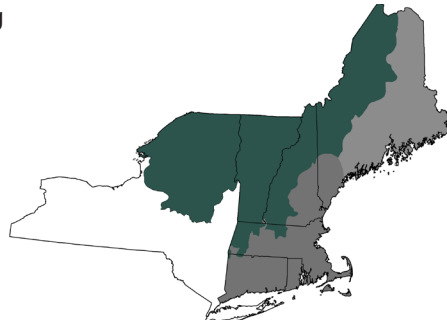# CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES
THE NORTHERN FOREST

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 New England and northern New York (Janowiak et al. in press). 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, 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
LIKELY TO DECREASE	
Black spruce	Requires cold climate, susceptible to insect pests and drought
Mountain maple	Susceptible to some insect pests
Northern white-cedar	Shade tolerant, but susceptible to fire and herbivory
Paper birch	Early-sucessional colonizer, but susceptible to insects and drought
Red spruce	Needs a particular type of habitat, limited seedling establishment
White spruce	Requires cold climate, susceptible to insect pests
MAY DECREASE	
Eastern hemlock	Shade tolerant, Hemlock woolly adelgid causes mortality
Eastern white pine	Good disperser, but susceptible to drought, fire topkill, and insects
Pin cherry	Fast-establishing colonizer following fire and disturbance
Striped maple	Shade tolerant and easily established, but susceptible to drought
Yellow birch	Good disperser, but susceptible to fire, insects, and disease
NO CHANGE	
Bigtooth aspen	Early-sucessional colonizer, but susceptible to drought
Gray birch	High dispersal, but susceptible to drought, fire topkill, and insects

SPECIES	ADDITIONAL CONSIDERATIONS
MIXED MODEL RESULTS	
American beech	Extremely shade tolerant, but affected by beech bark disease
Balsam fir	Shade tolerant, but susceptible to drought, fire topkill, and insects
Northern red oak	Susceptible to some insect pests
Quaking aspen	Early-sucessional colonizer, but susceptible to drought
Sugar maple	Shade tolerant and associated with a specific type of habitat
White ash	Susceptible to emerald ash borer
MAY INCREASE	
American elm	Needs a particular type of habitat, affected by Dutch elm disease
Black cherry	Limited drought tolerance and susceptible to some insect pests
Eastern hophornbeam	Shade tolerant and associated with a specific type of habitat
Red maple	Competitive colonizer tolerant of disturbance and diverse sites
Serviceberry	Competative colonizer but susceptible to drought
Sweet birch	High dispersal, but susceptible to drought, fire topkill, and insects

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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 models, such as the ability to respond favorably to disturbance, 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

SPECIES	LOW CLIMATE CHANGE (PCM B1)		HIGH CLIMATE CHANGE (GFDL A1FI)		ADAPT
	TREE ATLAS	LANDIS	TREE ATLAS	LANDIS	
American basswood	●		▲		·
American beech	●	●	▼	▲	·
American chestnut	●		●		·
American elm	●		▲		·
American holly	●		★		·
American hornbeam	●		▲		·
American mountain-ash	●		▼		−
Atlantic white-cedar	●		●		−
Balsam fir	▼	▲	▼	▲	−
Balsam poplar	▼		▼		·
Bear oak/Scrub oak	●		●		·
Bigtooth aspen	●		●		·
Bitternut hickory	●		▲		+
Black ash	▼		▼		−
Black cherry	●	●	▲	▲	−
Black hickory			★		·
Black locust	●		▲		·
Black oak	▲	▲	▲	▲	·
Black spruce	▼	●	▼	▼	·
Black walnut	●		▲		·
Black willow	▲		▲		−
Blackgum	▲		▲		+
Blackjack oak			★		+
Boxelder	●		▲		+
Bur oak	●		▲		+
Butternut	▲		▼		−
Chestnut oak	▲	▲	▲	▲	+
Chinkapin oak			★		·
Common persimmon			★		+
Eastern cottonwood	▲		▲		·
Eastern hemlock	●	●	●	▼	−
Eastern hophornbeam	●		▲		+
Eastern redbud			▲		·
Eastern redcedar	▲		▲		·
Eastern white pine	●	▼	●	●	·
Flowering dogwood	▲		▲		·
Gray birch	●		●		·
Green ash	●		▲		·
Hackberry	★		★		+
Honeylocust	●		▲		+

SPECIES	LOW CLIMATE CHANGE (PCM B1)		HIGH CLIMATE CHANGE (GFDL A1FI)		ADAPT
	TREE ATLAS	LANDIS	TREE ATLAS	LANDIS	
Jack pine	▼		●		·
Loblolly pine			★		·
Mockernut hickory	●		▲		+
Mountain maple	▼		▼		+
Northern pin oak	●		▲		+
Northern red oak	▲	▼	▲	●	+
Northern white-cedar	▼	▼	▼	▼	·
Ohio buckeye	●		▲		·
Osage-orange			★		+
Paper birch	▼		▼		·
Pignut hickory	▲	●	▲	▲	·
Pin cherry	●		▼		·
Pin oak	▲		▲		−
Pitch pine	●	●	●	▲	·
Post oak			★		+
Quaking aspen	●	●	▼	▲	·
Red maple	●	●	●	▲	+
Red pine	●		▲		·
Red spruce	▼	▼	▼	▼	−
Sassafras	●		▲		·
Scarlet oak	▲	▲	▲		·
Serviceberry	▲		▲		·
Shagbark hickory	▲	●	▲		·
Shortleaf pine			★		·
Silver maple	▲		▲		+
Slippery elm	▲		▲		·
Southern red oak			★		+
Striped maple	●		▼		·
Sugar maple	●	●	▼	▲	+
Swamp white oak	●		▲		·
Sweet birch	▲		▲		−
Sweetgum			★		·
Sycamore	●		▲		·
Tamarack	▼		●		−
Virginia pine		★	★	★	·
White ash	●	▼	●	▲	−
White oak	▲	●	▲	▲	+
White spruce	▼		▼		·
Yellow birch	●	▼	▼	●	·
Yellow-poplar	▲	▲	▲	▲	+

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