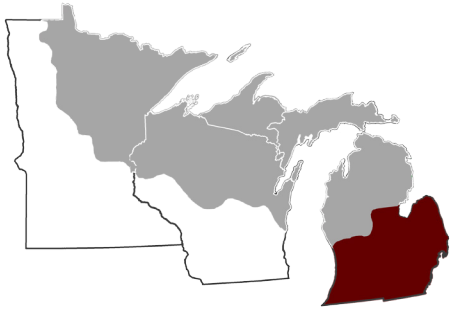
CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES

SOUTHERN MICHIGAN

Michigan's forests will be affected by climate change during this century. Several reports describe the climate change risks to the state's forests (Handler 2014, Handler 2012). Foresters and researchers can use experience and information from past events to develop expectations about how future change might affect forests, but there are limits to what we can learn from the past. For example, future climate change may be beyond what has been experienced in recent centuries. Tools like computer models can help provide answers by testing scenarios that haven't been experienced before.



Remember that models are just tools, and they're not perfect. Models 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 also 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:

The "Tree Atlas" tool uses climate scenarios and current distribution information to project future habitat suitability for individual tree species (Landscape Change Research Group 2014). This page shows the most common tree species in this local area, organized into general categories of future expectations. Full results for all species for two climate scenarios can be compared side-by-side on page 2 to get a sense for the range of possible outcomes.

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 can be combined with information from published reports and local management expertise to draw conclusions about potential risk and change in southern Michigan.

SPECIES	ADDITIONAL CONSIDERATIONS
LIKELY TO DECREASE	
American basswood	Tolerates shade but susceptible to fire
Bigtooth aspen	Early-sucessional colonizer, but susceptible to drought
Black ash	Emerald ash borer causes mortality
Eastern white pine	Good disperser, but susceptible to drought and insects
Paper birch	Early-sucessional colonizer, but susceptible to insects and drought
Quaking aspen	Early-sucessional colonizer, but susceptible to heat and drought
Red maple	Competitive colonizer tolerant of disturbance and diverse sites
Red pine	Susceptible to insect pests and diseases, and limited dispersal.
MAY DECREASE	
Black cherry	Susceptible to insects and fire, tolerates some drought
Ironwood	Grows across a variety of sites and tolerates shade
Northern red oak	Susceptible to some insect pests and oak wilt
Sugar maple	Grows across a variety of sites and tolerates shade
White ash	Emerald ash borer causes mortality
White oak	Fire-adapted and grows on a variety of sites

SPECIES	ADDITIONAL CONSIDERATIONS
MIXED MODEL RESULTS	
American beech	Beech bark disease causes mortality
Green ash	Emerald ash borer causes mortality
NO CHANGE	
American elm	Affected by Dutch elm disease, grows across a variety of sites
American hornbeam	Establishes well, but susceptible to drought and fire
MAY INCREASE	
Bitternut hickory	Tolerates some drought, but not shade
Black oak	Tolerates drought, but susceptible to pests and diseases
Black walnut	Doesn't tolerate drought or shade
Black willow	Susceptible to drought and fire
Boxelder	Tolerates drought, also disperses and establishes well
Eastern cottonwood	Establishes well, but susceptible to drought, pests, and diseases
Sassafras	Susceptible to fire
Shagbark hickory	Susceptible to insects and fire
Silver maple	Good disperser and tolerates wet soils, but vulnerable to drought
Slippery elm	Affected by Dutch elm disease, but tolerates shade

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 cliamte change scenarios. Tree Atlas models future suitable habitat.

▲ **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 model, 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 (HAD A1FI)	ADAPT
American basswood	▼	▼	·
American beech	▲	▼	·
American elm	●	●	·
American hornbeam	●	●	·
Balsam fir	▼	▼	-
Balsam poplar	▼	▲	·
Bigtooth aspen	▼	▼	·
Bitternut hickory	▲	▲	+
Black ash	▼	▼	–
Black cherry	●	▼	–
Black hickory		★	·
Black locust	▲	▲	·
Black oak	▲	●	·
Black walnut	▲	▲	·
Black willow	●	▲	–
Blackgum	▲	▲	+
Blackjack oak		★	+
Boxelder	●	▲	+
Bur oak	●	▲	+
Butternut	▼	▼	–
Cedar elm		★	·
Chestnut oak	▲		+
Chinkapin oak	▲	▲	·
Chokecherry	▼	▼	·
Common persimmon	★	★	+
Eastern cottonwood	●	▲	·
Eastern hemlock	▼	▼	-
Eastern red cedar	▲	▲	·
Eastern redbud	▲	▲	·
Eastern white pine	▼	▼	·
Flowering dogwood	▲	●	·
Green ash	▼	▲	·
Hackberry	▲	▲	+
Honeylocust	▲	▲	+
Ironwood	●	▼	+
Jack pine	▼	▲	·
Mockernut hickory	▲	▲	+
Northern catalpa		▲	·

SPECIES	LOW CLIMATE CHANGE (PCM B1)	HIGH CLIMATE CHANGE (HAD A1FI)	ADAPT
Northern pin oak	▼	▲	+
Northern red oak	●	▼	+
Northern white-cedar	▼	▼	·
Ohio buckeye	▲	●	·
Osage-orange	▲	▲	+
Paper birch	▼	▼	·
Pawpaw	▲	▲	·
Peachleaf willow		★	·
Pecan	★	★	-
Pignut hickory	▲	▲	·
Pin cherry	▼	▼	-
Pin oak	▲	▲	-
Post oak	★	★	+
Quaking aspen	▼	▼	·
Red maple	▼	▼	+
Red mulberry	▲	▲	·
Red pine	▼	▼	·
River birch	▲	▲	·
Rock elm	▲	▲	-
Sassafras	▲	●	·
Scarlet oak	▲	▲	·
Shagbark hickory	▲	▲	·
Shellbark hickory	▼	▲	·
Shingle oak	★	★	·
Silver maple	▲	▲	+
Slippery elm	▲	▲	·
Sugar maple	●	▼	+
Sugarberry		★	·
Swamp white oak	●	▲	·
Sycamore	▲	▲	·
Tamarack	▼	●	-
White ash	●	▼	-
White oak	●	▼	+
White spruce	▼	●	·
Wild plum	▲	▲	·
Winged elm		★	·
Yellow birch	▼	▼	·
Yellow-poplar	▲	▲	+

RESOURCES: Handler, S.D., et al. 2014. Michigan forest ecosystem vulnerability assessment and synthesis. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. GTR-NRS-133. ***www.nrs.fs.fed.us/pubs/45688***

Handler, S.D., et al., 2012. Climate change vulnerabilities within the forestry sector for the Midwestern United States. In: U.S. National Climate Assessment Midwest Technical Input Report. J. Winkler, J. Andresen, J. Hatfield, D. Bidwell, and D. Brown, coordinators. ***www.glisa.umich.edu/media/files/NCA/MTIT_Forestry.pdf***

Landscape Change Research Group. 2014. Climate Change Atlas. Northern Research Station, U.S. Forest Service, Delaware, OH. ***www.fs.fed.us/nrs/atlas/***