

CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES

NORTH-CENTRAL DRIFTLESS AND ESCARPMENT (SECTION 222L)



Wisconsin's forests will be affected by a changing climate and other stressors during this century. A team of managers and researchers created a field guide that describes the vulnerability of forests in the southern part of the state ([Handler et al. 2021](#)). This guide 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 model results for the North-Central Driftless and Escarpment (Section 222L). Download the *Climate Change Field Guide for Southern Wisconsin Forests and handouts for other Ecological Sections in southern Wisconsin* at www.forestadaptation.org/southern_WI_fieldguide. 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

| | |
|----------------------|-------------------|
| Balsam fir | Paper birch |
| Balsam poplar | Quaking aspen |
| Bigtooth aspen | Red pine |
| Black ash | River birch |
| Black maple | Swamp white oak |
| Black spruce | Tamarack (native) |
| Black willow | White spruce |
| Eastern white pine | Yellow birch |
| Northern white-cedar | |

FAIR CAPABILITY

| | |
|------------------|--------------|
| Chinkapin oak | Red mulberry |
| Jack pine | Slippery elm |
| Northern pin oak | White ash |
| Red maple | |

GOOD CAPABILITY

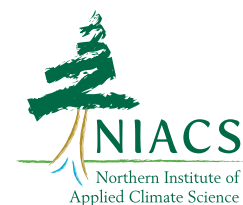
| | |
|--------------------|------------------|
| American elm | Green ash |
| Bitternut hickory | Hackberry |
| Black oak | Ironwood |
| Black walnut | Northern red oak |
| Boxelder | Silver maple |
| Bur oak | Sugar maple |
| Eastern cottonwood | White oak |
| Eastern redcedar | |

MIXED RESULTS

| | |
|-------------------|------------------|
| American basswood | Black locust |
| Black cherry | Shagbark hickory |

NEW HABITAT WITH MIGRATION POTENTIAL

| | |
|-------------------|----------------|
| American beech | Pecan |
| Black hickory | Pignut hickory |
| Blackgum | Post oak |
| Blackjack oak | Sassafras |
| Common persimmon | Shingle oak |
| Eastern redbud | Shumard oak |
| Flowering dogwood | Sycamore |
| Mockernut hickory | Yellow-poplar |
| Osage-orange | |



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 | ADAPT ABUN | | LOW CLIMATE CHANGE (RCP 4.5) | | HIGH CLIMATE CHANGE (RCP 8.5) | | SPECIES | ADAPT ABUN | | LOW CLIMATE CHANGE (RCP 4.5) | | HIGH CLIMATE CHANGE (RCP 8.5) | |
|---------------------|------------|---|------------------------------|------|-------------------------------|------------|----------------------|------------|---|------------------------------|------------|-------------------------------|------------|
| | | | HABITAT CHANGE | | CAPABILITY | | | | | HABITAT CHANGE | | CAPABILITY | |
| | | | ADAPT | ABUN | CHANGE | CAPABILITY | | | | CHANGE | CAPABILITY | CHANGE | CAPABILITY |
| American basswood | • | • | ● | ○ | ▼ | ▼ | Mockernut hickory | + | • | ★ | ★ | ★ | |
| American beech | • | • | ★ | ★ | ★ | ★ | Northern pin oak | + | • | ▼ | ○ | ▼ | ○ |
| American elm | • | + | ● | ▲ | ● | ▲ | Northern red oak | + | + | ● | ▲ | ▼ | ▲ |
| American hornbeam* | • | + | ▼ | ▼ | ▼ | ▼ | Northern white-cedar | • | + | ▼ | ▼ | ● | ▼ |
| Balsam fir | - | + | ▼ | ▼ | ▼ | ▼ | Osage-orange | + | • | ★ | ★ | ★ | |
| Balsam poplar | • | + | ▼ | ▼ | ▼ | ▼ | Paper birch | • | • | ▼ | ▼ | ▼ | ▼ |
| Bigtooth aspen | • | • | ▼ | ▼ | ▼ | ▼ | Pecan* | - | • | ★ | ★ | ★ | |
| Bitternut hickory* | + | • | ● | ▲ | ● | ▲ | Pignut hickory | • | • | ★ | ★ | ★ | |
| Black ash | - | • | ▼ | ▼ | ▼ | ▼ | Pin cherry* | • | + | ▼ | ▼ | ▼ | ▼ |
| Black cherry | - | • | ▲ | ○ | ● | ▼ | Post oak | + | • | ★ | ★ | ★ | |
| Black hickory | • | • | ★ | ★ | ★ | ★ | Quaking aspen | • | • | ▼ | ▼ | ▼ | ▼ |
| Black locust* | • | • | ● | ○ | ▲ | ▲ | Red maple | + | • | ▼ | ○ | ▼ | ○ |
| Black maple* | + | + | ▼ | ▼ | ▼ | ▼ | Red mulberry* | • | • | ● | ○ | ● | ○ |
| Black oak | • | • | ▲ | ▲ | ▲ | ▲ | Red pine | - | • | ▼ | ▼ | ▼ | ▼ |
| Black spruce | • | + | ▼ | ▼ | ▼ | ▼ | River birch* | • | + | ▼ | ▼ | ▼ | ▼ |
| Black walnut* | • | • | ▲ | ▲ | ▲ | ▲ | Sassafras* | • | • | ★ | ★ | ★ | |
| Black willow* | - | + | ▼ | ▼ | ● | ▼ | Scarlet oak | • | • | ★ | ★ | ★ | |
| Blackgum | + | • | ★ | ★ | ★ | ★ | Serviceberry* | • | + | ▼ | ▼ | ▼ | ▼ |
| Blackjack oak | + | • | ★ | ★ | ★ | ★ | Shagbark hickory | • | • | ● | ○ | ▼ | ▼ |
| Boxelder* | + | + | ● | ▲ | ▼ | ▲ | Shingle oak | • | • | ★ | ★ | ★ | |
| Bur oak | + | • | ▲ | ▲ | ● | ▲ | Shumard oak* | + | • | ★ | ★ | ★ | |
| Chinkapin oak | • | + | ▲ | ○ | ▲ | ○ | Silver maple* | + | • | ▲ | ▲ | ▲ | ▲ |
| Cittamwood* | + | • | • | • | ★ | ★ | Slash pine | • | • | • | • | ★ | ★ |
| Common persimmon* | + | • | ★ | ★ | ★ | ★ | Slippery elm* | • | • | ● | ○ | ● | ○ |
| Eastern cottonwood* | • | • | ▲ | ▲ | ▲ | ▲ | Sugar maple | + | • | ▲ | ▲ | ▲ | ▲ |
| Eastern redbud* | • | • | ★ | ★ | ★ | ★ | Sugarberry | • | • | ★ | ★ | ★ | ★ |
| Eastern redcedar | • | • | ▲ | ▲ | ▲ | ▲ | Swamp white oak* | • | + | ● | ▼ | ● | ▼ |
| Eastern white pine | - | • | ▼ | ▼ | ▼ | ▼ | Sycamore* | • | • | ★ | ★ | ★ | ★ |
| Flowering dogwood | • | • | ★ | ★ | ★ | ★ | Tamarack (native) | - | + | ▼ | ▼ | ● | ▼ |
| Green ash* | • | • | ▲ | ▲ | ▲ | ▲ | White ash | - | • | ▲ | ○ | ▲ | ○ |
| Hackberry | + | • | ▲ | ▲ | ▲ | ▲ | White oak | + | • | ▲ | ▲ | ● | ▲ |
| Honeylocust* | + | + | ▲ | ▲ | ▲ | ▲ | White spruce | • | + | ▼ | ▼ | ▼ | ▼ |
| Ironwood* | + | • | ● | ▲ | ● | ▲ | Winged elm | • | • | ★ | ★ | ★ | ★ |
| Jack pine | + | • | ▼ | ○ | ▼ | ○ | Yellow birch | • | + | ▼ | ▼ | ▼ | ▼ |
| Laurel oak | • | • | • | • | ★ | ★ | 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).