

CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES ILLINOIS



This region's forests will be affected by a changing climate and other stressors during this century. A team of managers and researchers created an assessment that describes the vulnerability of forests in the region (Brandt et al. 2014). This report 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.

CLIMATE CHANGE CAPABILITY

POOR CAPABILITY

American basswood	Pawpaw
American beech	Pignut hickory
Bald cypress	Pin oak
Black cherry	Red mulberry
Black locust	River birch
Black maple	Sassafras
Bur oak	Scarlet oak
Chinkapin oak	Serviceberry
Cucumbertree	Shagbark hickory
Eastern cottonwood	Shingle oak
Eastern redbud	Swamp white oak
Eastern white pine	Water tupelo
Ohio buckeye	

FAIR CAPABILITY

Black oak	Overcup oak
Black walnut	Pecan
Black willow	Shortleaf pine
Chestnut oak	White ash
Flowering dogwood	White oak
Hackberry	Yellow-poplar
Northern red oak	

GOOD CAPABILITY

American elm	Nuttall oak
American hornbeam	Osage-orange
Bitternut hickory	Post oak
Black hickory	Red maple
Blackgum	Shellbark hickory
Blackjack oak	Shumard oak
Boxelder	Silver maple
Cherrybark oak	Slippery elm
Common persimmon	Southern red oak
Eastern hophornbeam	Sugar maple
Eastern redcedar	Sugarberry
Green ash	Swamp chestnut oak
Honeylocust	Sweetgum
Loblolly pine	Sycamore
Mockernut hickory	Winged elm

NEW HABITAT WITH MIGRATION POTENTIAL

Cittamwood	Water hickory
Florida maple	Water oak

SOURCE: This handout summarizes the full model results for the Central Hardwoods region, available at www.fs.fed.us/nrs/atlas/combined/resources/summaries. More information on vulnerability and adaptation in the Central Hardwoods region can be found at www.forestadaptation.org/central-hardwoods. 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).

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	LOW CLIMATE CHANGE (RCP 4.5)				HIGH CLIMATE CHANGE (RCP 8.5)				SPECIES	LOW CLIMATE CHANGE (RCP 4.5)				HIGH CLIMATE CHANGE (RCP 8.5)			
	ADAPT	ABUN	HABITAT CHANGE	CAPABILITY	HABITAT CHANGE	CAPABILITY	HABITAT CHANGE	CAPABILITY		ADAPT	ABUN	HABITAT CHANGE	CAPABILITY	HABITAT CHANGE	CAPABILITY		
American basswood	•	-	▼	▼	▼	▼	▼	Nuttall oak	+	-	●	○	▲	▲			
American beech	•	-	●	▼	●	▼	▼	Ohio buckeye*	•	-	▼	▼	▼	▼			
American elm	•	•	▲	▲	▲	▲	▲	Osage-orange	+	-	●	○	▲	▲			
American hornbeam*	•	-	▲	▲	▲	▲	▲	Overcup oak	-	-	▲	○	▲	○			
Bald cypress	•	-	▼	▼	●	▼	▼	Pawpaw*	•	-	▼	▼	▼	▼			
Bitternut hickory*	+	•	▲	▲	▲	▲	▲	Pecan*	-	-	▲	○	▲	○			
Black cherry	-	•	●	▼	●	▼	▼	Pignut hickory	•	•	▼	▼	▼	▼			
Black hickory	•	-	▲	○	▲	▲	▲	Pin oak*	-	-	▼	▼	▼	▼			
Black locust*	•	-	●	▼	●	▼	▼	Post oak	+	•	▲	▲	▲	▲			
Black maple*	+	-	▼	▼	▼	▼	▼	Red maple	+	•	●	▲	●	▲			
Black oak	•	•	●	○	●	○	○	Red mulberry*	•	-	▼	▼	●	▼			
Black walnut*	•	•	●	○	●	○	○	River birch*	•	-	▼	▼	▼	▼			
Black willow*	-	•	●	▼	▲	○	○	Sassafras*	•	•	▼	▼	▼	▼			
Blackgum	+	-	▲	▲	▲	▲	▲	Scarlet oak	•	-	▼	▼	▼	▼			
Blackjack oak	+	-	▲	▲	▲	▲	▲	Serviceberry*	•	-	▼	▼	▼	▼			
Boxelder*	+	•	●	▲	●	▲	▲	Shagbark hickory	•	•	▼	▼	▼	▼			
Bur oak	+	-	▼	▼	▼	▼	▼	Shellbark hickory*	•	-	▲	○	▲	▲			
Cherrybark oak	•	-	▲	▲	▲	▲	▲	Shingle oak	•	•	▼	▼	▼	▼			
Chestnut oak	+	-	●	○	●	○	○	Shortleaf pine	•	•	●	○	●	○			
Chinkapin oak	•	-	●	▼	●	▼	▼	Shumard oak*	+	-	▲	▲	▲	▲			
Cittamwood*	+	-	★		★			Silver maple*	+	•	●	▲	●	▲			
Common persimmon*	+	-	▲	▲	▲	▲	▲	Slippery elm*	•	-	▲	○	▲	▲			
Cucumbertree*	•	-	▼	▼	▼	▼	▼	Southern red oak	+	-	▲	▲	▲	▲			
Eastern cottonwood*	•	•	▼	▼	▼	▼	▼	Sugar maple	+	•	●	▲	●	▲			
Eastern hophornbeam*	+	-	▲	▲	▲	▲	▲	Sugarberry	•	-	▲	▲	▲	▲			
Eastern redbud*	•	-	▼	▼	●	▼	▼	Swamp chestnut oak*	•	-	▲	○	▲	▲			
Eastern redcedar	•	-	▲	▲	▲	▲	▲	Swamp white oak*	•	-	▼	▼	▼	▼			
Eastern white pine	-	-	▼	▼	▼	▼	▼	Sweetgum	•	•	▲	▲	▲	▲			
Florida maple*	+	-	★		★			Sycamore*	•	•	▲	▲	▲	▲			
Flowering dogwood	•	-	●	▼	▲	○	○	Water hickory	•	-	★		★				
Green ash*	•	•	▲	▲	▲	▲	▲	Water oak	•	-	★		★				
Hackberry	+	•	▼	○	▼	○	○	Water tupelo	-	-	▼	▼	▼	▼			
Honeylocust*	+	•	●	▲	▲	▲	▲	White ash	-	•	▲	○	▲	○			
Loblolly pine	•	-	▲	▲	▲	▲	▲	White oak	+	•	●	▲	▼	○			
Mockernut hickory	+	-	▲	▲	▲	▲	▲	Winged elm	•	•	▲	▲	▲	▲			
Northern red 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).