

CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES MISSOURI-NISHNABOTNA WATERSHED IN IOWA



The region's forests will be affected by a changing climate and other stressors during this century. The National Climate Assessment describes how a changing climate can increase the vulnerability of forests in the Midwest (NCA 2018). This report includes information on the current landscape, observed climate trends, and a range of projected future climates.

The Landscape Change Research Group recently updated the Climate Change Tree Atlas, and this handout summarizes that information for select HUC 6 watersheds in Iowa. More Tree Atlas results are available online at www.fs.fed.us/nrs/atlas/. In this handout, 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 the full model results for selected HUC 6 watersheds in the state of Iowa, available at www.fs.fed.us/nrs/atlas/combined/resources/summaries. More information on vulnerability and adaptation in Iowa can be found at www.forestadaptation.org/iowa. 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

American basswood	Ohio buckeye
Black cherry	Pawpaw
Chinkapin oak	Red pine
Eastern hophornbeam	Serviceberry
Flowering dogwood	Shagbark hickory
Northern pin oak	Swamp white oak

FAIR CAPABILITY

Bitternut hickory	Silver maple
Eastern cottonwood	Sycamore
Eastern redbud	White ash
Honeylocust	White oak
Red mulberry	

GOOD CAPABILITY

American elm	Eastern redcedar
Black oak	Green ash
Black walnut	Hackberry
Blackjack oak	Osage-orange
Common persimmon	Post oak
	Sugarberry

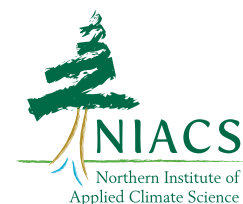
MIXED RESULTS

Black willow	Pin oak
Boxelder	Shingle oak
Bur oak	Slippery elm
Northern red oak	Sugar maple

NEW HABITAT WITH MIGRATION POTENTIAL

Ashe juniper	Pignut hickory
Black hickory	Sassafras
Cedar elm	Shumard oak
Mockernut hickory **	Water oak
Pecan	Winged elm

** Species is likely present but not currently included in the FIA database.



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				HABITAT CHANGE	CAPABILITY		
American basswood	•	-	▼	▼	▼	▼	Northern red oak	+	-	●	●	▼	▼
American elm	•	•	●	▲	●	▲	Ohio buckeye*	•	-	▼	▼	▼	▼
Ashe juniper	•	-	★		★		Osage-orange	+	-	▲	▲	▲	▲
Bitternut hickory*	+	-	●	●	●	●	Pecan*	-	-	★		★	
Black cherry	-	-	▼	▼	▼	▼	Pignut hickory	•	-	★		★	
Black hickory	•	-	★		★		Pin oak*	-	-	▼	▼	●	●
Black locust*	•	-	●	●	●	●	Post oak	+	-	▲	▲	▲	▲
Black oak	•	-	▲	▲	▲	▲	Red mulberry*	•	-	●	●	●	●
Black walnut*	•	•	●	▲	●	▲	Red pine	-	-	▼	▼	▼	▼
Black willow*	-	-	●	●	▲	▲	Sassafras*	•	-	★		★	
Blackjack oak	+	-	▲	▲	▲	▲	Serviceberry*	•	-	▼	▼	▼	▼
Boxelder*	+	-	▼	▼	●	●	Shagbark hickory	•	-	▼	▼	▼	▼
Bur oak	+	-	▲	▲	●	●	Shingle oak	•	-	●	●	▼	▼
Cedar elm	-	-	★		★		Shumard oak*	+	-	★		★	
Chinkapin oak	•	-	▼	▼	▼	▼	Silver maple*	+	-	●	●	●	●
Common persimmon*	+	-	▲	▲	▲	▲	Slippery elm*	•	-	●	●	▲	▲
Eastern cottonwood*	•	-	●	●	●	●	Sugar maple	+	-	●	●	▲	▲
Eastern hophornbeam; ironwood*	+	-	▼	▼	▼	▼	Sugarberry	•	-	▲	▲	▲	▲
Eastern redbud*	•	-	●	●	●	●	Swamp white oak*	•	-	▼	▼	▼	▼
Eastern redcedar	•	-	▲	▲	▲	▲	Sycamore*	•	-	●	●	●	●
Flowering dogwood	•	-	▼	▼	▼	▼	Water oak	•	-	★		★	
Green ash*	•	-	▲	▲	▲	▲	White ash	-	-	●	●	●	●
Hackberry	+	•	●	▲	●	▲	White oak	+	-	●	●	●	●
Honeylocust*	+	•	▼	●	▼	●	Winged elm	•	-	★		★	
Mockernut hickory**	+	-	★		★								
Northern pin oak	+	-	▼	▼	▼	▼							

*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).

** Species is likely present but not currently included in the FIA database.