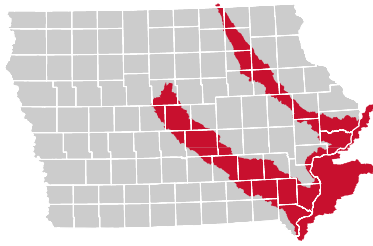


# CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES UPPER MISSISSIPPI-SKUNK-WAPSIPINICON WATERSHED IN IOWA



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/](http://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](http://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](http://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](http://www.nrs.fs.fed.us/pubs/57857) and [www.nrs.fs.fed.us/pubs/59105](http://www.nrs.fs.fed.us/pubs/59105)) and Peters et al. 2019 ([www.nrs.fs.fed.us/pubs/58353](http://www.nrs.fs.fed.us/pubs/58353)).

## CLIMATE CHANGE CAPABILITY

### POOR CAPABILITY

American basswood	Eastern white pine
American hornbeam	Northern pin oak
Bigtooth aspen	Ohio buckeye
Black ash	Quaking aspen
Black maple	River birch
	Serviceberry

### FAIR CAPABILITY

Black cherry	Slippery elm
Chinkapin oak	Swamp white oak
Mockernut hickory	White ash
Shagbark hickory	White oak

### GOOD CAPABILITY

American elm	Hackberry
Black oak	Honeylocust
Black walnut	Osage-orange
Blackjack oak	Pin oak
Boxelder	Post oak
Bur oak	Red mulberry
Eastern cottonwood	Shingle oak
Eastern redcedar	Silver maple
Green ash	Sugar maple
	Sycamore

### MIXED RESULTS

Eastern redbud	Eastern hophornbeam
Bitternut hickory	Northern red oak
Black willow	Pignut hickory

### NEW HABITAT WITH MIGRATION POTENTIAL

Black hickory	Shumard oak
Cedar elm	Sugarberry
Common persimmon	Winged elm
Pecan **	Yellow-poplar
Sassafras	

\*\* 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)	
			HABITAT CHANGE	CAPABILITY	HABITAT CHANGE	CAPABILITY
American basswood	•	-	▼	▼	▼	▼
American elm	•	•	●	▲	●	▲
American hornbeam; musclewood*	•	-	▼	▼	▼	▼
Bigtooth aspen	•	-	▼	▼	▼	▼
Bitternut hickory*	+	-	▲	▲	●	●
Black ash	-	-	▼	▼	▼	▼
Black cherry	-	•	▼	●	▼	●
Black hickory	•	-	★		★	
Black maple*	+	-	▼	▼	▼	▼
Black oak	•	•	●	▲	●	▲
Black walnut*	•	•	●	▲	●	▲
Black willow*	-	-	▼	▼	▲	▲
Blackjack oak	+	-	▲	▲	▲	▲
Boxelder*	+	•	●	▲	●	▲
Bur oak	+	-	▲	▲	▲	▲
Cedar elm	-	-	★		★	
Chinkapin oak	•	-	●	●	●	●
Common persimmon*	+	-	★		★	
Eastern cottonwood*	•	-	▲	▲	▲	▲
Eastern hophornbeam; ironwood*	+	-	●	●	▼	▼
Eastern redbud*	•	-	●	●	▲	▲
Eastern redcedar	•	-	▲	▲	▲	▲
Eastern white pine	-	-	▼	▼	▼	▼
Green ash*	•	-	▲	▲	▲	▲
Hackberry	+	•	▲	▲	▲	▲
Honeylocust*	+	•	▲	▲	▲	▲
Mockernut hickory	+	-	●	●	●	●
Northern pin oak	+	-	▼	▼	▼	▼
Northern red oak	+	-	●	●	▼	▼

SPECIES	ADAPT	ABUN	LOW CLIMATE CHANGE (RCP 4.5)		HIGH CLIMATE CHANGE (RCP 8.5)	
			HABITAT CHANGE	CAPABILITY	HABITAT CHANGE	CAPABILITY
Ohio buckeye*	•	-	▼	▼	▼	▼
Osage-orange	+	•	▲	▲	▲	▲
Pecan* **	-	-	★		★	
Pignut hickory	•	-	●	●	▼	▼
Pin oak*	-	-	▲	▲	▲	▲
Post oak	+	-	▲	▲	▲	▲
Quaking aspen	•	-	▼	▼	▼	▼
Red mulberry*	•	•	●	▲	●	▲
River birch*	•	-	▼	▼	▼	▼
Sassafras*	•	-	★		★	
Serviceberry*	•	-	▼	▼	▼	▼
Shagbark hickory	•	•	▼	●	▼	●
Shingle oak	•	-	▲	▲	▲	▲
Shumard oak*	+	-	★		★	
Silver maple*	+	•	●	▲	●	▲
Slippery elm*	•	-	●	●	●	●
Sugar maple	+	-	▲	▲	▲	▲
Sugarberry	•	-	★		★	
Swamp white oak*	•	-	●	●	●	●
Sycamore*	•	-	▲	▲	▲	▲
White ash	-	-	●	●	●	●
White oak	+	•	▼	●	▼	●
Winged elm	•	-	★		★	
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](http://www.fs.fed.us/nrs/atlas/combined/resources/summaries)).

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