



United States Department of Agriculture
Northern Forests Climate Hub

Climate change And Wisconsin's Woods



Danielle Shannon

Northern Institute of Applied Climate Science
ForestAdaptation.org

Lake Michigan Day

August 17, 2020

Northern Institute of Applied Climate Science



- Practical information on **climate adaptation** and **carbon management**
- Adaptation resources
- Technical assistance

Chartered by USDA Forest Service, universities, non-profit and tribal conservation organizations



www.niacs.org



Michigan Technological University

ncasi



UNIVERSITY OF MINNESOTA



AMERICAN FORESTS



The UNIVERSITY of VERMONT

Outline

- What climate-related stresses do forests face over the next 50-100 years?
- What local factors may influence change at my site?
- What tools can I use to address these changes?



Forests are a key component of a “healthy” watershed

- Regulate streamflow
- Purify regional air quality
 - Reduce erosion
- Maintain clean water supplies
 - Sequester carbon

... and more!



Climate Affects Everyone

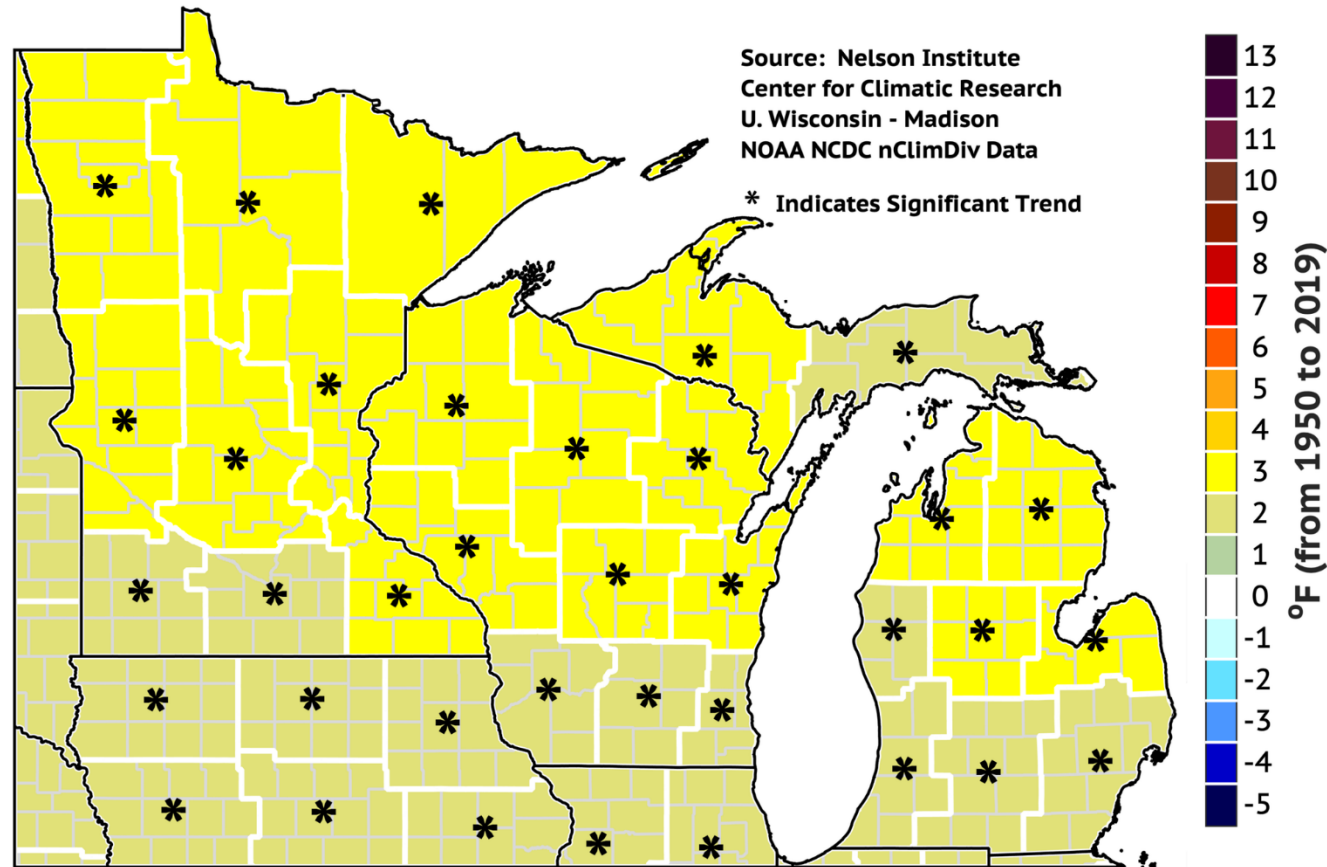
Climate –
What you expect.
Long term trends.

Weather –
What you get!
Day to day.



Our climate is already changing

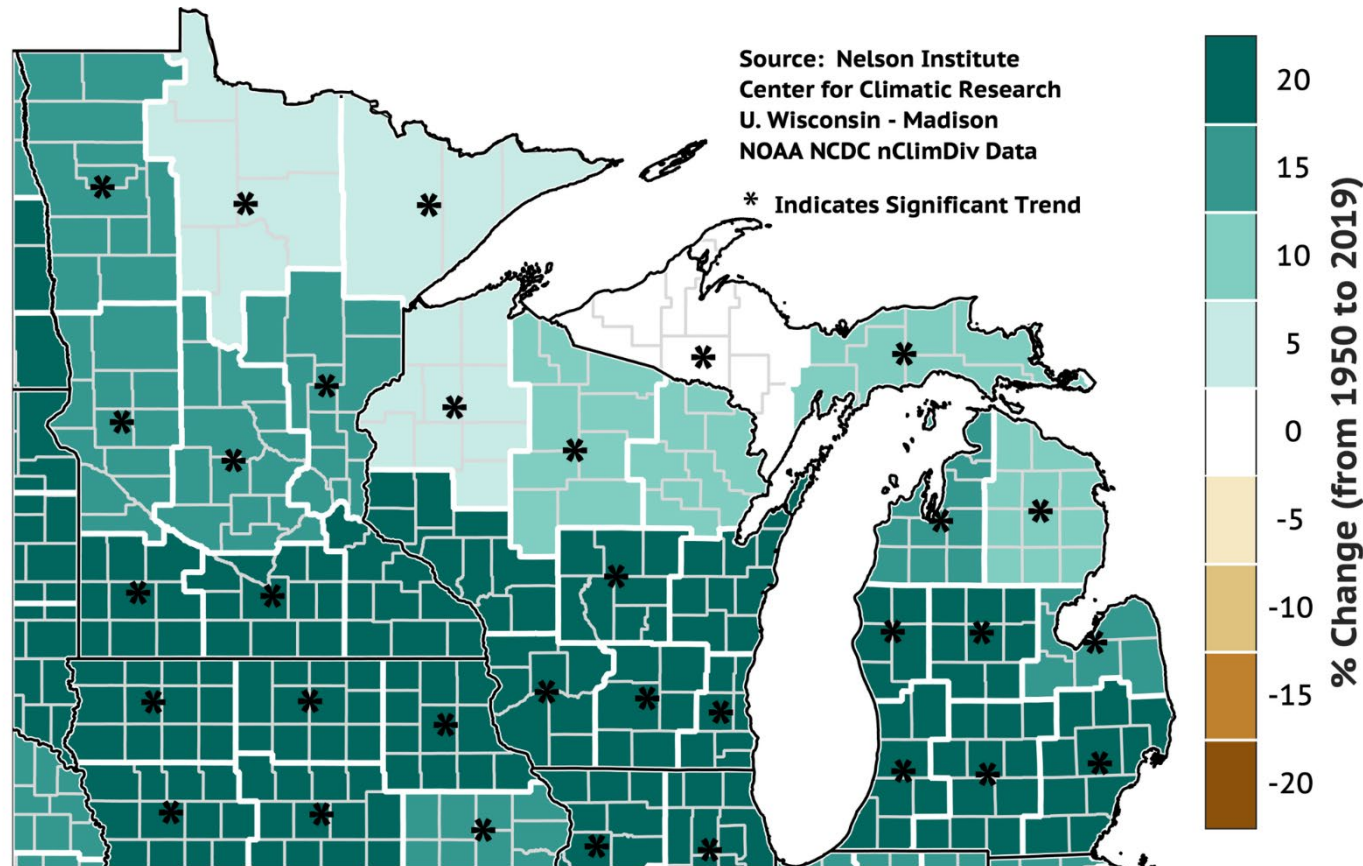
Historic Change in **Average Annual Temperature** from 1950-2019: **2-3 degrees F**



Find more at WICCI (UW Nelson Institute Center for Climatic Research, WICCI 2020):
wicci.wisc.edu/wisconsin-climate-trends-and-projections/

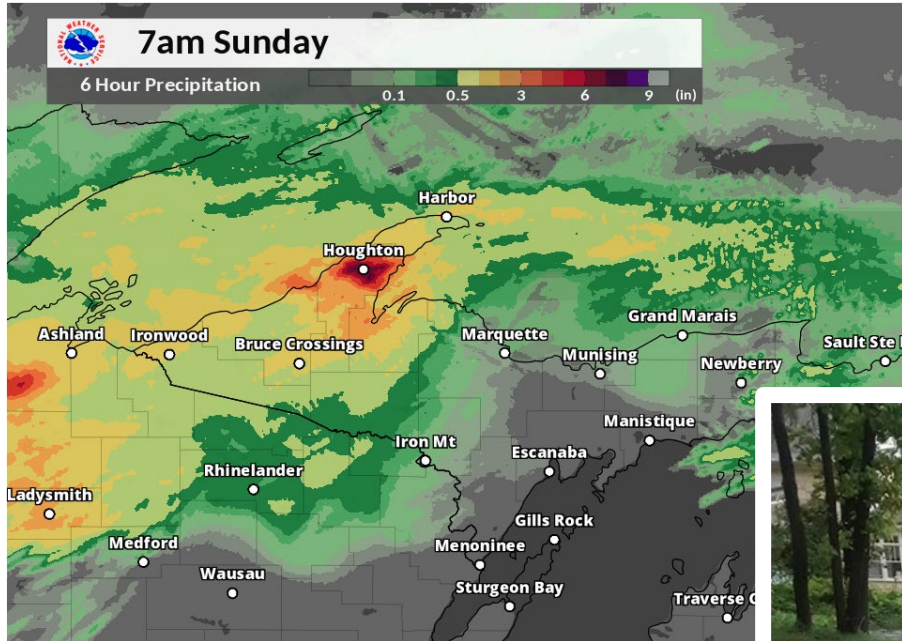
Our climate is already changing

Historic Change in **Average Annual Precipitation** from 1950-2019: **5-20% change**



Find more at WICCI (UW Nelson Institute Center for Climatic Research, WICCI 2020):
wicci.wisc.edu/wisconsin-climate-trends-and-projections/

It's been "different" lately



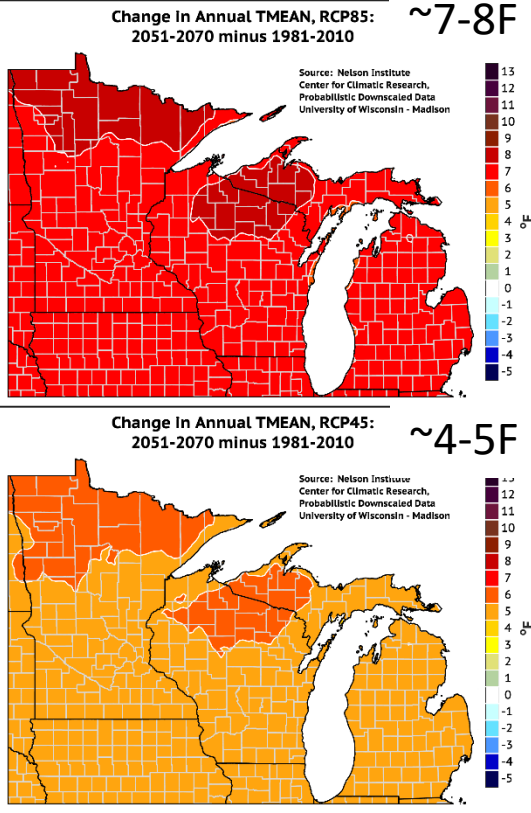
Houghton, Michigan
Father's day Flood, June 17, 2018



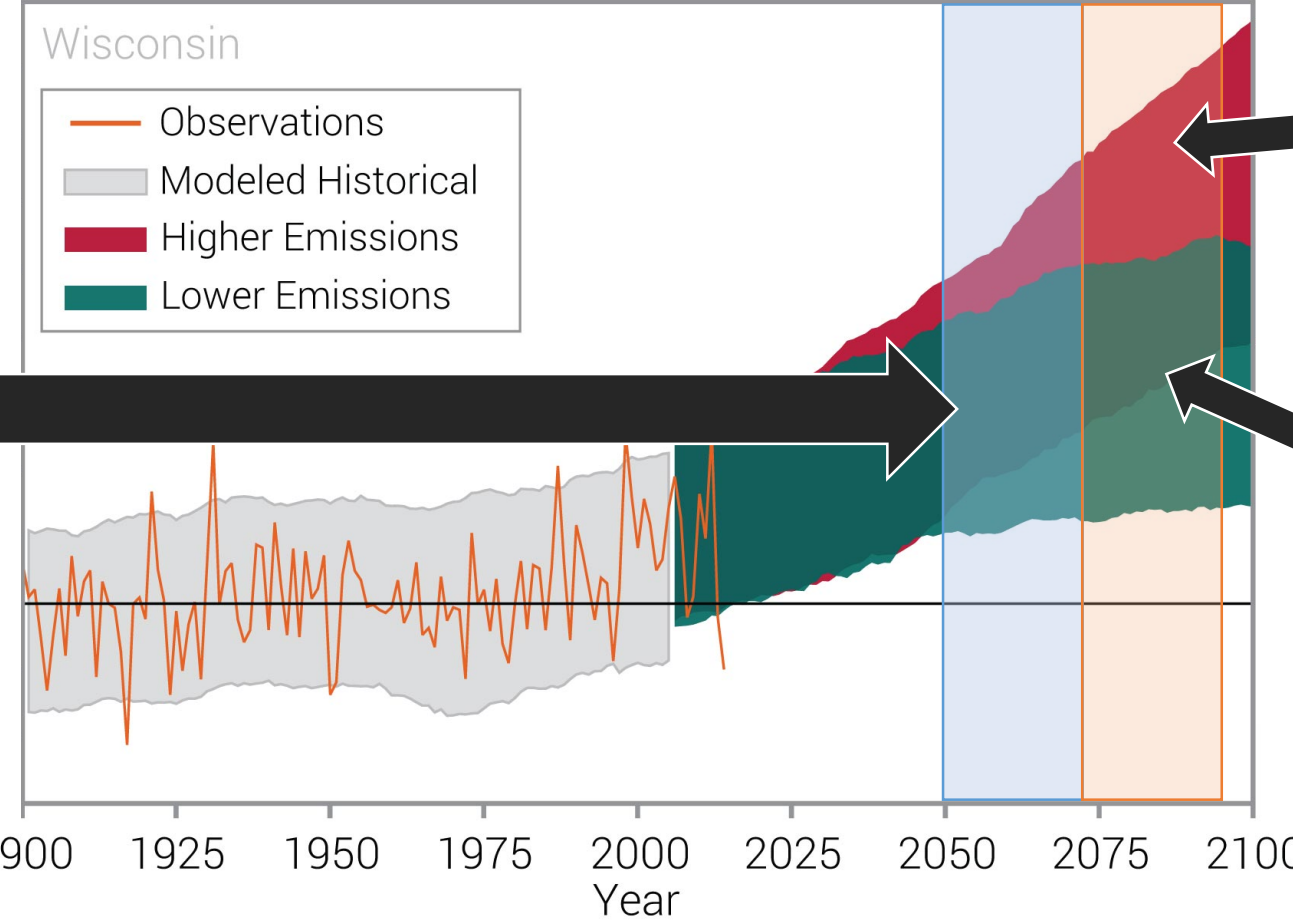
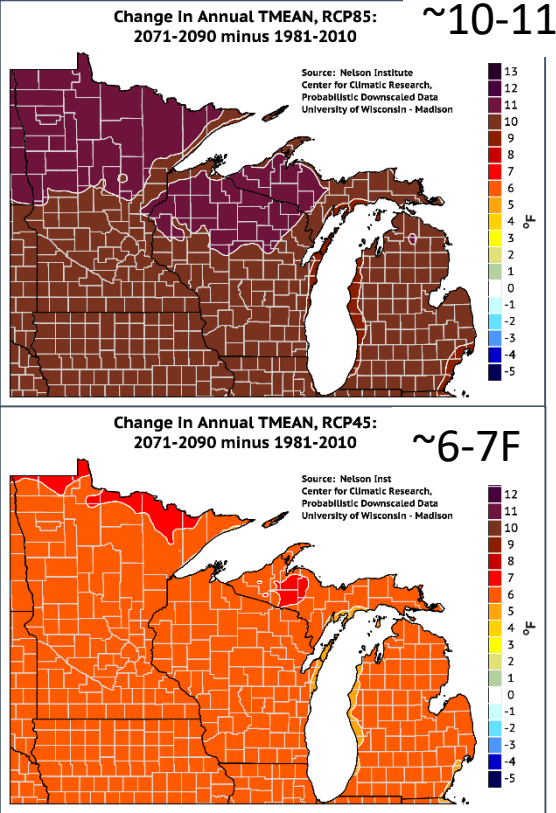
Weather.gov

Future climate: Temperature will increase

Mid-Century 2051-2070



End of Century 2071-2090



Key Climate Change Impacts ...

1. Less cold / more heat
2. Longer growing season
3. More rain in winter/spring
4. Less snow
5. More extreme rainfall
6. More Flooding
7. Reduced Water quality
8. More drought stress
9. Species may shift
10. Cumulative stressors can affect habitat quality

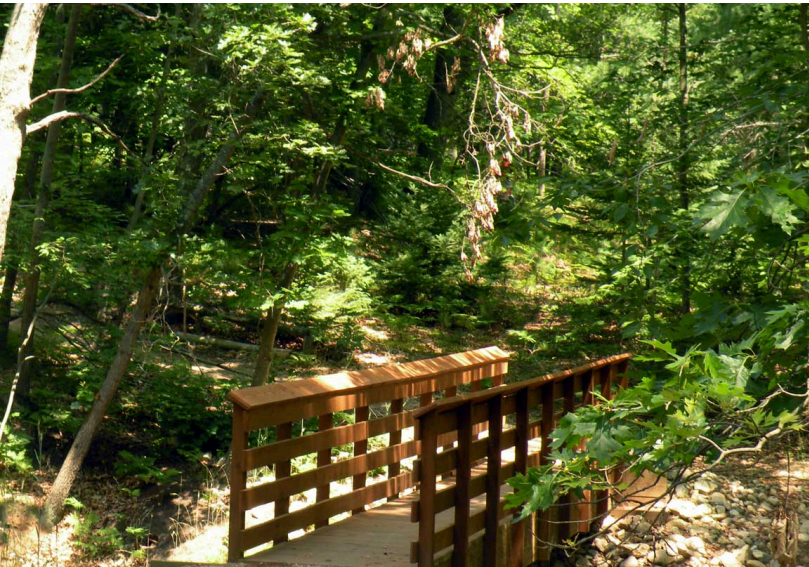


Photos: Aaron Carlson

Why Should I Care?



*What does it mean for our forests and **trees**?*



Huron-Mainstee National Forest



Hiawatha National Forest

Ecosystem Composition will change

Many northern/boreal species are projected to **decline** in the region— contract to more northerly and higher-elevation locations

Many species common farther south are expected to see **increased** and new habitat within the region.

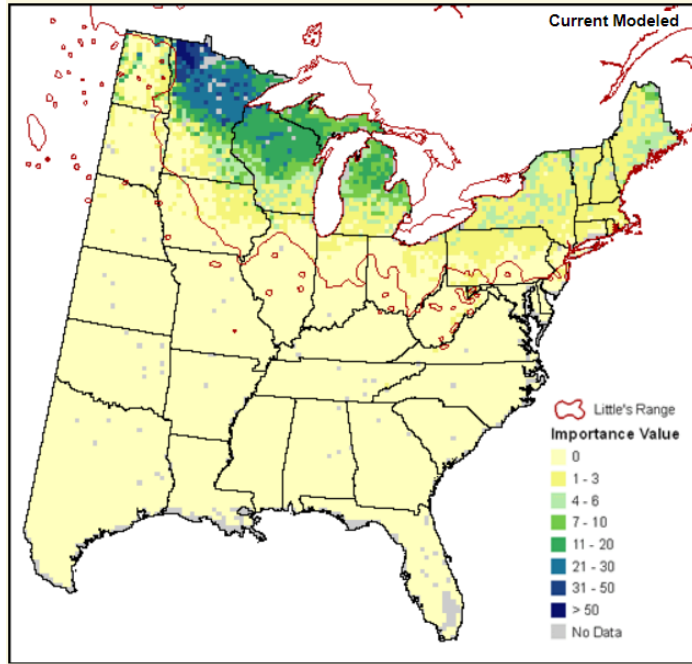


Tree habitat is expected to shift

Quaking Aspen habitat

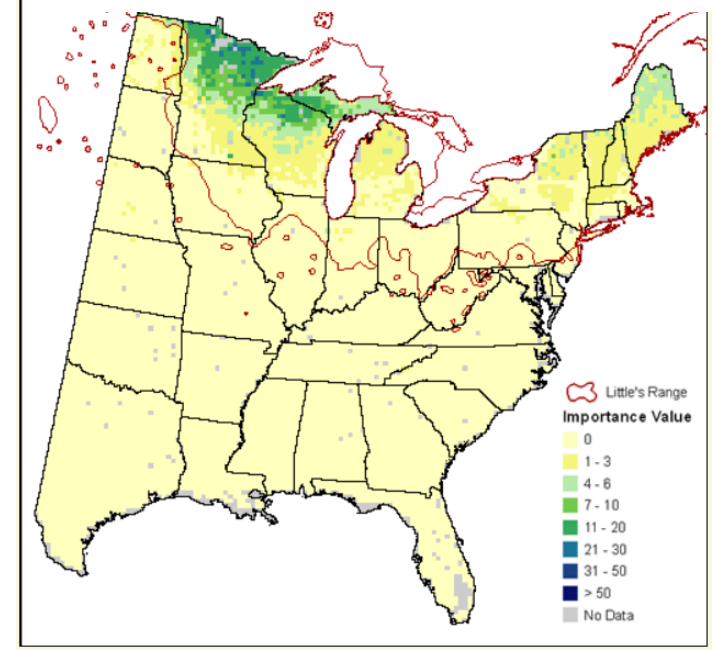
Current (present day, based on USFS FIA)

Importance Value
Low
High



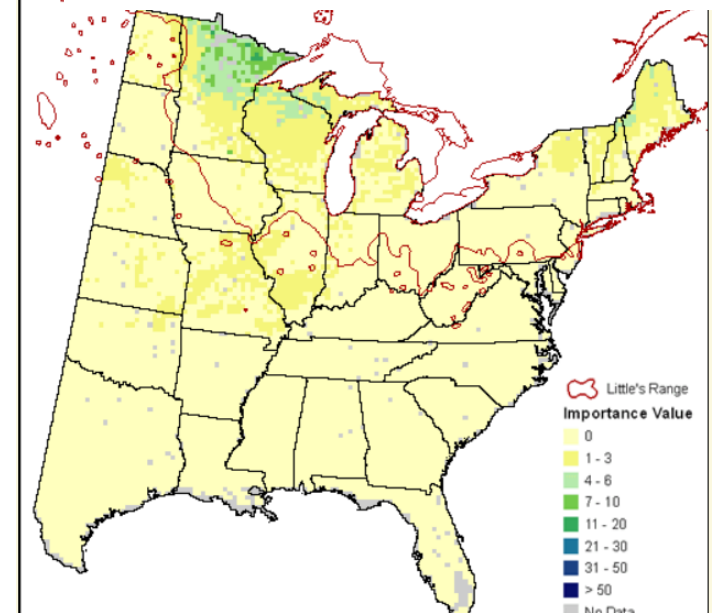
Low emissions (less warming)

2070-2100 Low (less warming)



High emissions (very warm)

2070-2100 High (very warm)



Future Tree Species Range Shifts: N. Wisconsin



Likely to Decrease

- Balsam fir
- Black ash
- Black spruce
- Northern white-cedar
- Paper birch
- Quaking aspen
- White Spruce
- Yellow birch

May decline

- Balsam poplar
- Eastern white pine
- Jack pine
- Sugar Maple
- Tamarack

Mixed Results

- Bigtooth aspen
- Eastern hemlock
- Green ash
- Red maple

Potential “Winners”

- American basswood
- American elm
- Ironwood
- Black cherry
- Black & Bur oak
- American honrbeam
- Northern red & pin oak
- Silver maple
- Swamp oak
- White ash
- White oak

Learn more at: www.forestadaptation.org/Northwoods_treehandouts

Changes in forests

Migration may not be easy for all species

- Less able to migrate if habitats are fragmented
- Some species are confined to particular habitats on the landscape
 - hydrologic regimes, soil types, or other reasons



Ex: Sugar maple (WI state tree)

- Limited to soils that are rich in nutrients like calcium.
- **May have less available suitable habitat** than might be projected solely from temperature and precipitation patterns.

Changes in forests

Some are just more tolerant than others

Forest systems that are **more tolerant of drought, flooding, or fire** are expected to be better able to withstand climate-driven disturbances...

.... *Up to a certain point*



Dry-Mesic Woods. Image: Mywisconsinwoods.org

Ex: **Dry pine forests and woodlands**

- Might benefit from drier conditions with more frequent fire
- However, these systems might also convert to savannas or open grasslands if fire becomes too frequent or drought becomes too severe

Nowacki and Abrams, 2008, Gustafson and Sturtevant, 2013.

Changes in forests

Diverse ecosystems = good!

- Greater resilience to extreme conditions
- Better recovery from disturbance
- Genetic diversity within a species: may hedge risks over time



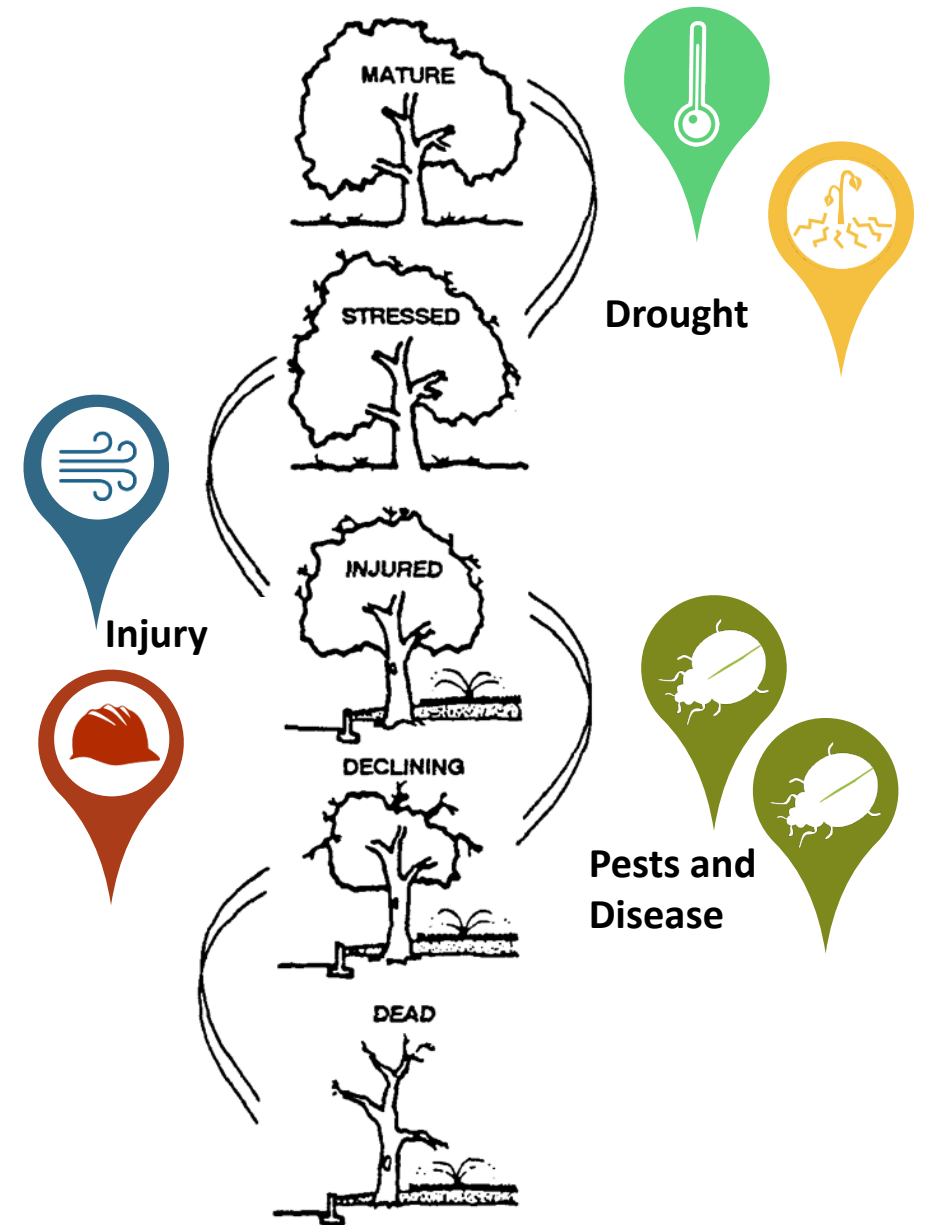
Image: www.stateforesters.org/districts/wisconsin/

Changes in forests

Interactions make all the difference

Challenge: could make systems more susceptible to existing or new stressors

- Chronic stress
- Disturbances
- Invasive species
- Insect pests
- Forest diseases



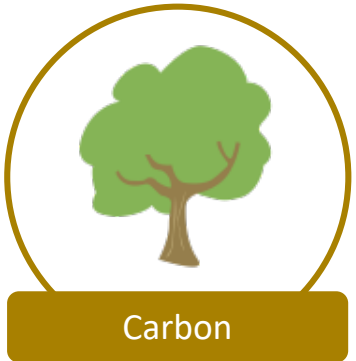
What can I do?



Who, me?

Adaptating to climate change: There is no single answer

Every landowner is different



Each decision is unique and will vary based upon:

People: Values, Culture, & Resources

Place: Location & Site Conditions

Purpose: Goals & Objectives

Practices: Equipment, Procedures, & Methods

Adaptation in the wild

- Loss of urban forest canopy due to Emerald Ash Borer.
- Increased frequency of drought and flooding.



Riverside, IL



Reforestation of site considering climate change

Plant native species, understory and shrub layers to buffer climate extremes.

- Replace 11% canopy due to EAB
- Increase species diversity, adaptability, insect resistance
- Mulch and water mature trees
- Disfavor maladapted species (various maples)

More info at: forestadaptation.org/riverside-reforestation

Adaptation in the wild

Too wet, Too dry - May inhibit plant establishment and persistence

- Flooding (earlier)
- Increased frequency, duration, and magnitude of storms (winter-spring)
- Reduced soil moisture and dry and droughty conditions may affect plant establishment.



Restoration of site considering climate change

Plant diverse species that can tolerate a broad range of moisture regimes (including inundation and drought)

- Seed broadly across gradients to allow plants to occupy species according to moisture and nutrient tolerances

More info at: forestadaptation.org/BohnFarms

What can I do? Chart a path forward.

Use the Wisconsin “Woods Health” Scorecard to

- Asses the condition of your forest
- Take Action to improve forest resilience

Take home messages:

- 1. Keep Forests as Forests**
- 2. Reduce Stressors**
- 3. Address Vulnerabilities**



Whether you spend time outside in your woods or just enjoy the beauty of your trees and wildlife from the window, you likely love your woods and want to keep it healthy.

Forests are always changing and adapting to new conditions. Some changes, like the progression of green summer leaves to bright red and gold fall foliage, or the annual return of migratory songbirds, are expected.

Other shifts, such as earlier spring leaf-out or an increase in nuisance plants such as buckthorn, are only visible when comparing differences in woodlands across many years or decades.

Our climate is changing, resulting in altered weather patterns, rising temperatures and shifts in seasonal precipitation patterns. Actions you take today can help

your forest be resilient, healthy and productive in the face of future climate changes.



This publication can serve as a tool to help you assess the resilience of your woods in a quick and easy manner. It contains background information on the important characteristics of resilient and healthy forests and provides examples of potential adaptation strategies. The included scorecards can be used in the field to evaluate the resilience of your woods, which you can use on your own or to start a conversation with a forester.

Forest Resilience: The capacity of a forest to respond to a disturbance by resisting damage or stress and recovering quickly.

Forestadaptation.org/climate-scorecard-Wisconsin

What can I do? Read more.

Climate Change Field Guide for Northern Wisconsin Forests: Site-level considerations and adaptation





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Frozen Ground Duration

Over the 20th century, frozen ground conditions declined by 12 to 24 days per winter across north Minnesota. Frozen ground is necessary to conduct management in much of northern Minnesota to protect sensitive soils, cross wet areas, and haul on unpaved roads. As winter temperatures have increased, snow conditions have also become more variable. Some places have seen an increase in snowfall (such as lake-effect snow belt) while warm periods also lead to more melting between snowfalls. Snow acts as an insulator and protector for the soil during winter, so a change in snow levels has consequences for management and the duration and depth of frozen ground.

Frozen ground duration is expected to shrink by another 30 days per winter by the end of the century. Minnesota is also expected to receive less snow and winter rain.




Charlie Blinn, UAS

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Climate Change Vulnerability

Overall Vulnerability:  Moderate


Confidence:  Medium evidence Medium agreement

Climate Change Impacts: Negative

- Greater wildfire activity could be a benefit, but much fire could hamper regeneration.
 - Wildfires may burn larger areas in northern Minnesota under climate change.
 - The fire season could shift later into the growing season with warmer, drier summers. Early-season fires could also become more common with earlier snowmelt.
 - Severe wind events or pest and disease outbreaks could create more fuel for large fires.
- Insect pests and diseases may become more damaging under a warmer climate. New pests arrive in northern Minnesota, such as western beetles.
- Broadleaf species are increasing within Fire-Dependent Forests and may be further encouraged by climate change.
- Deer populations are expected to increase with warmer winters, which may increase herbivory on preferred species.

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212T Northern Green Bay Lobe



- Lake Michigan affects local climate (mild temperatures, more precipitation and snow)
- Ground moraines and areas of lake plains, sand dunes, glacial outwash to the west
- Local cities: Shawano, Florence, Marinette

Species	Adapt	LOW CHANGE		HIGH CHANGE	
		Habitat Change Class	Species Capability	Habitat Change Class	Species Capability
American basswood	-	▲	▲	●	○
American beech	-	▲	▲	▲	▲
American elm	-	▲	▲	▲	▲
Balsam fir	-	▼	▼	▼	▼
Balsam poplar	-	▼	▼	▼	▼
Bigtooth aspen	-	▲	▲	●	○
Black ash	-	▼	▼	▼	▼
Black cherry	-	▲	▲	▲	▲
Black oak	-	▲	▲	▲	▲
Black spruce	-	▼	▼	▼	▼
Black walnut	-	*	*	*	*
Boxelder	+	●	▲	●	▲

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TREE SPECIES PROJECTIONS

What can I do? Learn from the community.

CLIMATE CHANGE RESPONSE FRAMEWORK

Who we are ▾ Assess ▾ Adapt ▾ Learn ▾ Focus ▾ Contact

Adaptation Demonstrations

Home >> Adapt >> Demonstrations

Map Satellite

◆ Start-Up ◆ Planning ◆ Action ◆ Evaluation

Click for case study info!

[Forestadaptation.org/demos](https://forestadaptation.org/demos)

What can I do? Make a plan!

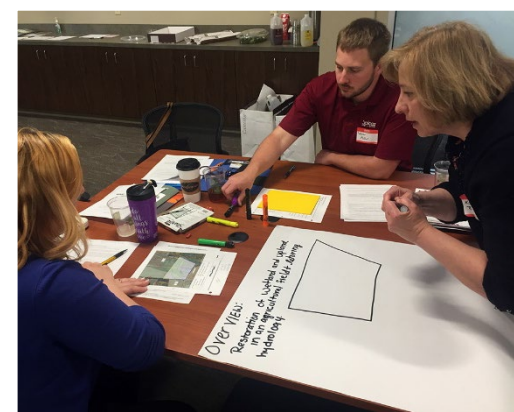
- Create custom adaptation plans using Adaptation Workbook

In-person - 1-2 day interactive workshop

Online – Free

- Distance learning course
- 8 weeks – 1 session/week
- Access to adaptation coaching

Upcoming
Course:
Fall 2020!



[Forestadaptation.org/training](https://forestadaptation.org/training)

Don't take your forests for granted

What you can do:

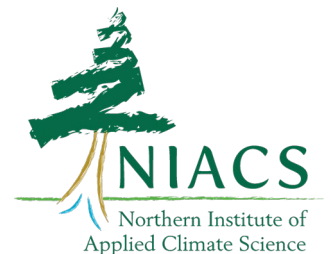
- Diagnose site vulnerabilities.
- Prioritize critical areas in planning.
- Intentionally take actions to respond to climate change.
- Make a plan!

Contact me!

Danielle Shannon
(dshannon@mtu.edu)

www.ForestAdaptation.org

Thank you!



Links from this presentation

- wicci.wisc.edu/wisconsin-climate-trends-and-projections/
- [Forestadaptation.org/Northwoods treehandouts](http://Forestadaptation.org/Northwoods_treehandouts)
- Forestadaptation.org/climate-scorecard-Wisconsin
- Forestadaptation.org/northwoods
- Forestadaptation.org/demos
- Forestadaptation.org/training