

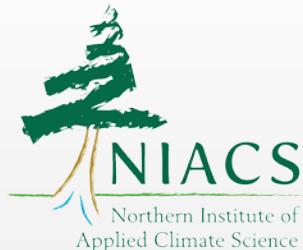


United States Department of Agriculture  
Northern Forests Climate Hub

# Adapting Forested Watersheds to Climate Change



Danielle Shannon  
May 24, 2017



Partners for Watershed Restoration  
*Alberta, MI*



# Agenda

- Big Question
- Intentionality
- Adaptation Resources for Forested Watersheds



**How do we pursue adaptation in the field of watershed management?**

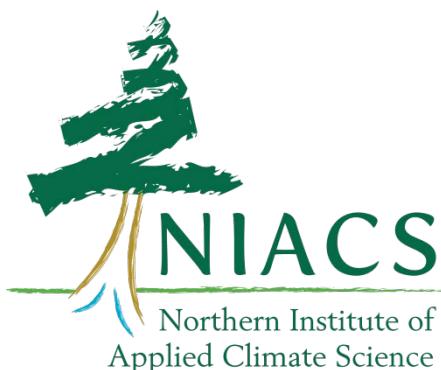




# Northern Institute of Applied Climate Science



Climate  
Carbon



Provides **practical** information, resources, and technical assistance related to forests and climate change

Regional multi-institutional partnership among:



Michigan  
Technological  
University



The  
UNIVERSITY  
of VERMONT

THE  
TRUST  
FOR  
PUBLIC  
LAND



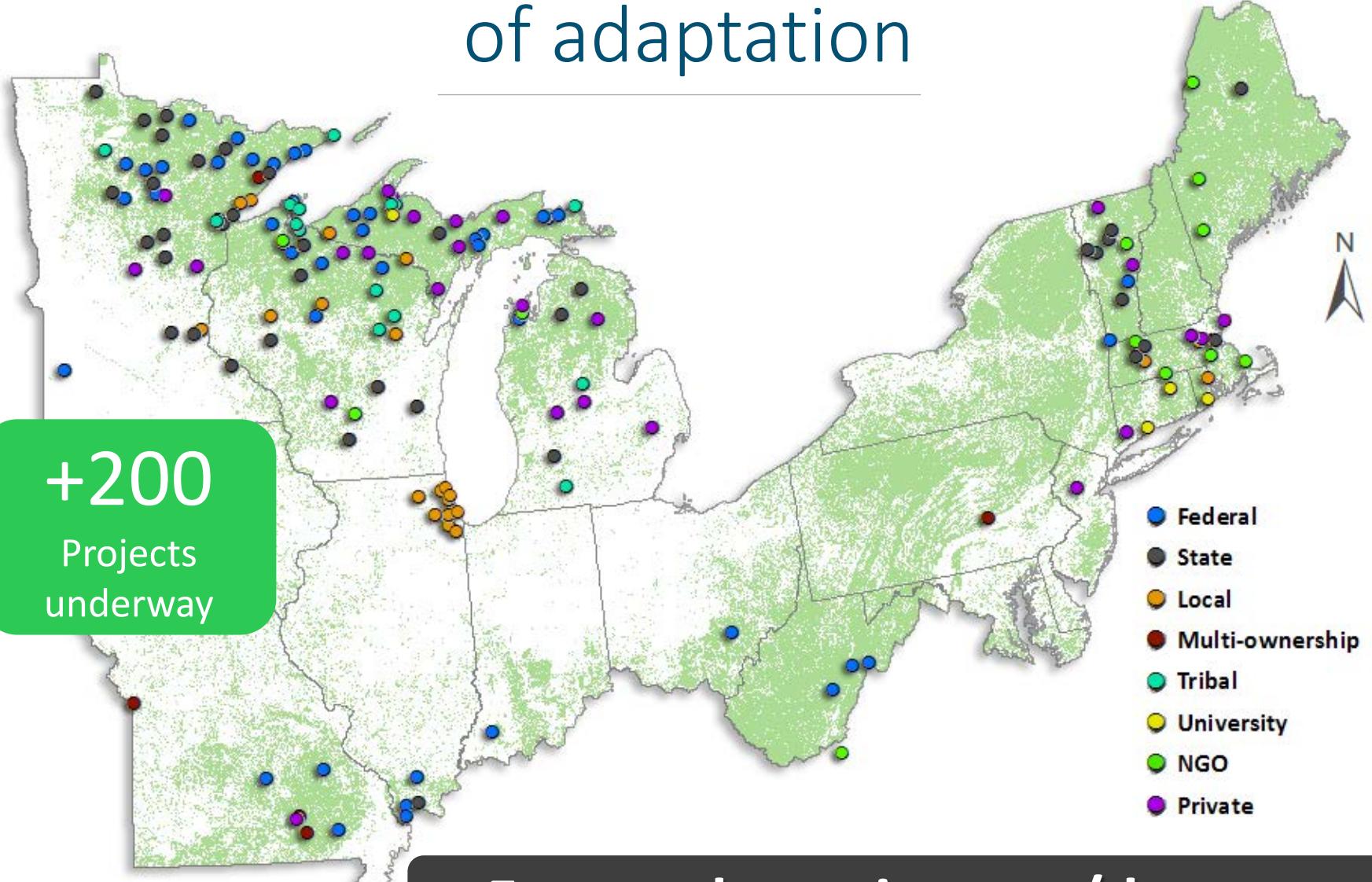
UNIVERSITY OF MINNESOTA



# Practical Resources & Technical Assistance

- USDA Forest Service Climate Change Resource Center
- USDA Climate Hub
- Forestadaptation.org
- AdaptationWorkbook.org

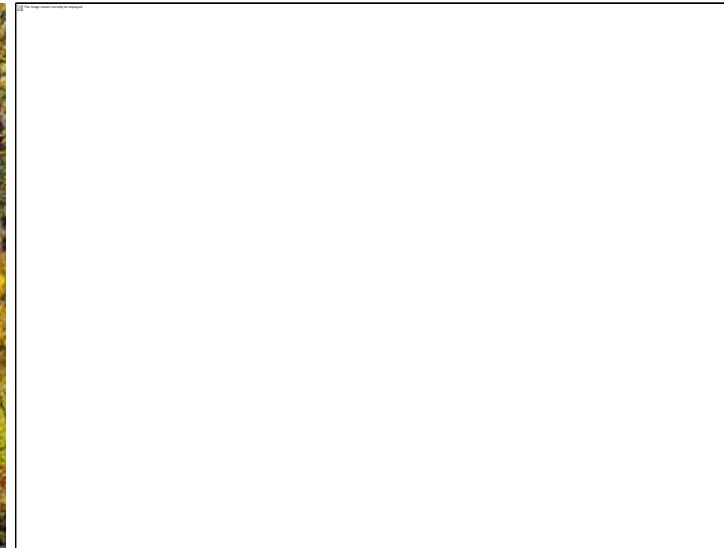
# Our goal: Develop local examples of adaptation



[Forestadaptation.org/demos](http://Forestadaptation.org/demos)



# Diverse Forest Values





Water flows from healthy,  
forested watersheds.

Furniss (2010), Sprague (2006)

Replenish & recharge groundwater



Protect and enhance downstream water supplies



Regulate stream flows and water quality



Provide habitat for native aquatic species



Control erosion and soil quality



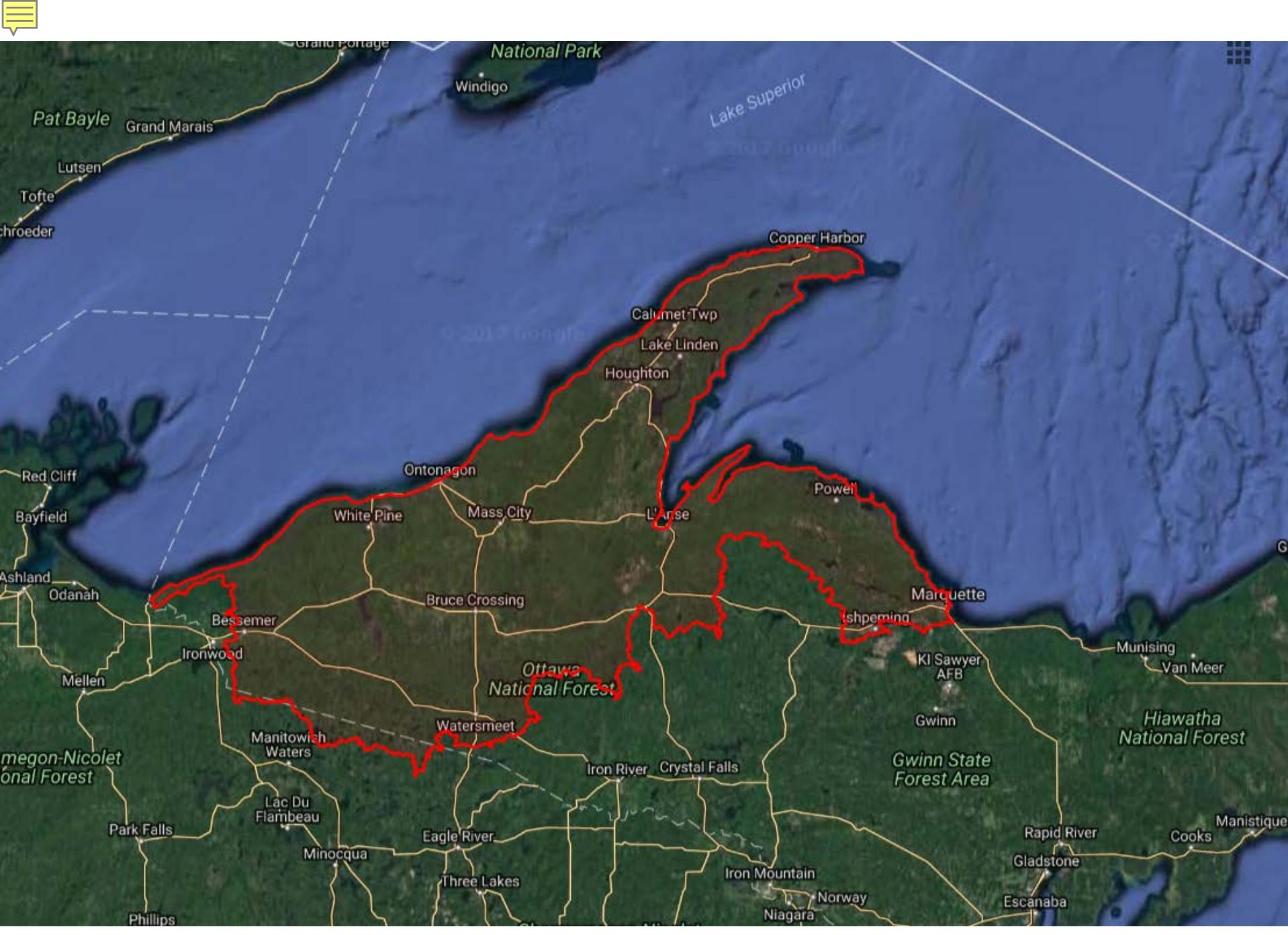
Capture and store water



Reduce flood and storm damage



... in addition the many cultural and spiritual benefits



# A changing climate...



**Annual  
Observed:**  
1895 – 2016  
 $+3.0^{\circ}\text{F}$



**Winter temp  
Observed:**  
1895 – 2016  
 $+4.3^{\circ}\text{F}$



**Precipitation  
Observed:**  
1895 – 2016  
2+ inches more  
annual precipitation



**Soil moisture  
Observed:**  
Drier than average,  
moderate drought  
during growing seasons



**Extreme events  
Observed:**  
More frequent  
extreme rain  
events ( $>3"$  over  
last 30yr)



**Climate change Ecosystem  
Vulnerability Assessment at**  
[forestadaptation.org/vulnerability-assessment](http://forestadaptation.org/vulnerability-assessment)

# Projected climate...



2 - 9 °F



- More rain in winter and spring (1"-3")
- Snow reduction 10–30%



Growing season lengthen by 1-2 months



Winters will become shorter



Earlier, more frequent extreme rain events + wind, followed by dry.

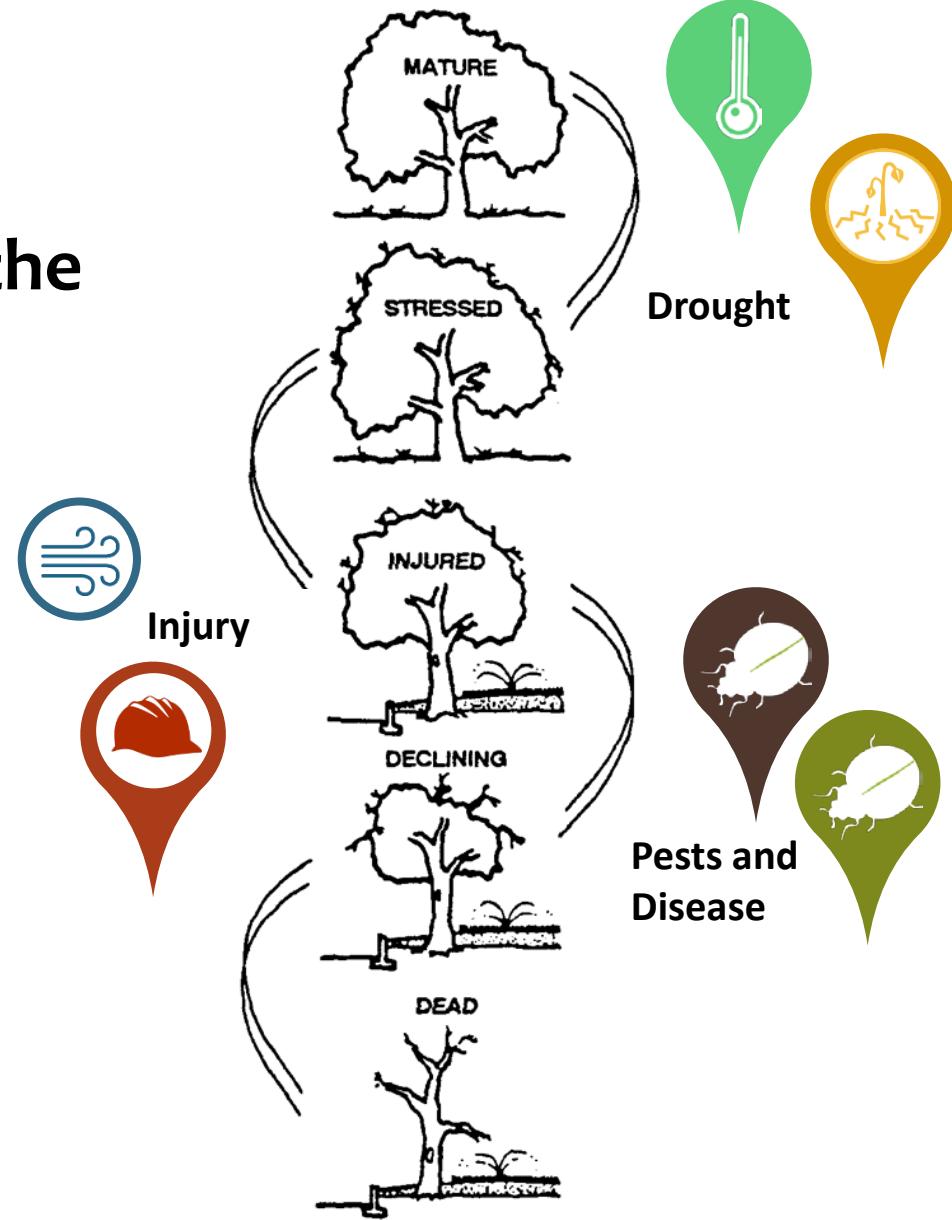
**Climate change Ecosystem Vulnerability Assessment at**  
[forestadaptation.org/vulnerability-assessment](http://forestadaptation.org/vulnerability-assessment)



# Threat multiplier

**Interactions make all the difference.**

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



# Adaptation...

the adjustment of systems in response to climate change.



**Taking action** to prepare for anticipated changes and risks, and responding to effects.



# Managing forested watersheds

## Goals...

- Water quality
- Water quantity
- Riparian buffers and corridors
- Forested Wetlands
- Infrastructure: culverts, transportation networks
- Other..



*Added considerations*



# Intentionality

- Explicitly consider and address climate change
- Sure we might get lucky...
- Intentionally assessing risk and vulnerabilities **makes our plans more robust!**



# Tools and resources

Adaptation resources to help you create **clear rationale** for your actions by connecting them to **broader adaptation ideas**.

***Does not make recommendations!***

## Customize adaptation plans

- Workshops
- Independent work

[Forestadaptation.org](http://Forestadaptation.org)



### Forest Adaptation Resources: Climate Change Tools and Approaches for Land Managers, 2nd edition

Forest Service  
Northern Research Station  
General Technical Report NRS-87-2  
Major Revision  
September 2016



USFS



Adaptation Workbook  
a climate change tool for land management and conservation

Use Workbook    About

FORESTS    URBAN FORESTS    AGRICULTURE

Tailored to your location

Peer-reviewed

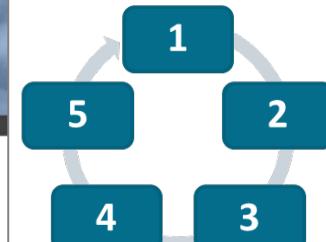
Structured process

Take it with you

Northern Institute of Applied Climate Science

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AdaptationWorkbook.org



# Project: Water Resources

## Project road map

- ✓ Network, reach out to the community
- ✓ Devise the tool
- ✓ Test the tool in workshops
- ✓ Review and refine**
- Publish
- Create demonstrations
- Training workshops



**Great Lakes RESTORATION**  
*supporting this work over 2 years*

*Beginning Fall 2016 -*

# Big ideas:

**Wetlands, floodplains** Restore and protect storage areas, reduce flood hazards, prolong seasonal flows.

**Riparian forests** Increase stream shading, diversify, protect the sponge.

**Aquatic Organism** Enhance habitat connectivity & habitat to help species adapt to changing conditions.

**Infrastructure** Incorporate climate considerations into design standards.

# What can you do...?

- Prioritize actions based on site vulnerability to enhance the ability to cope
- Reduce risks and plan ahead
- There is no single “right” way to respond
- Emphasize actions that maintain flexibility
- ACT! The time is now





Thank you!

Danielle Shannon  
[dshannon@mtu.edu](mailto:dshannon@mtu.edu)

# But how...?

- Assess future risk and vulnerabilities
- Design a response in line with your management goals and needs

Keep in mind....

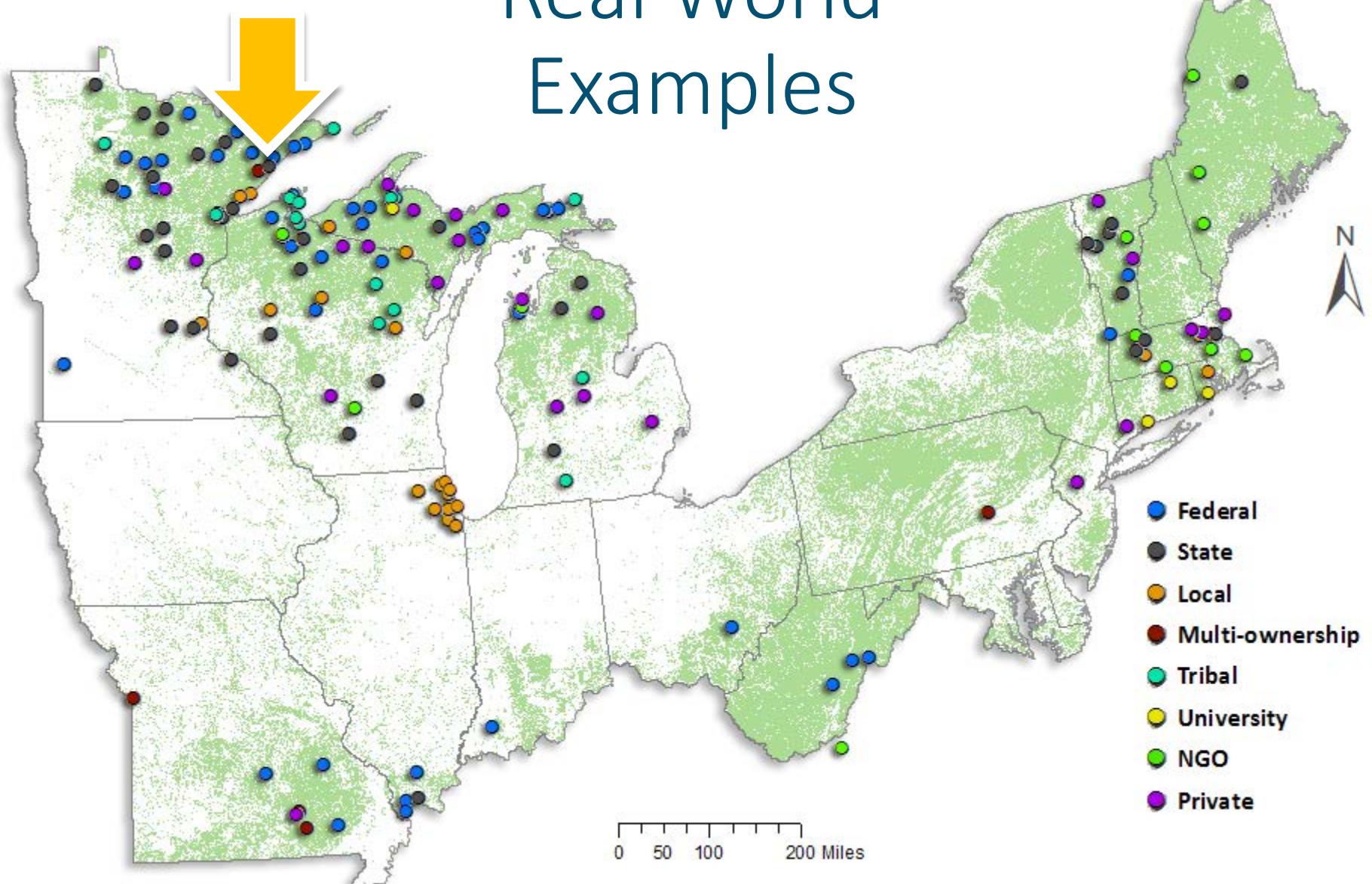
- There is no single “right” way to respond to climate change
- Activities can build upon and complement **sustainable management and conservation actions**



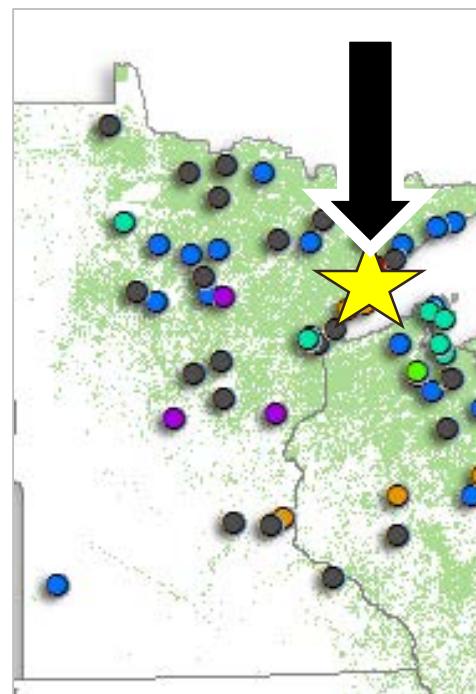
# A customized approach

Select approaches most applicable to your management goals.

# Real World Examples



# MN DNR: Knife River Project (MN)



## Goals

Maintain forest cover

Water quality

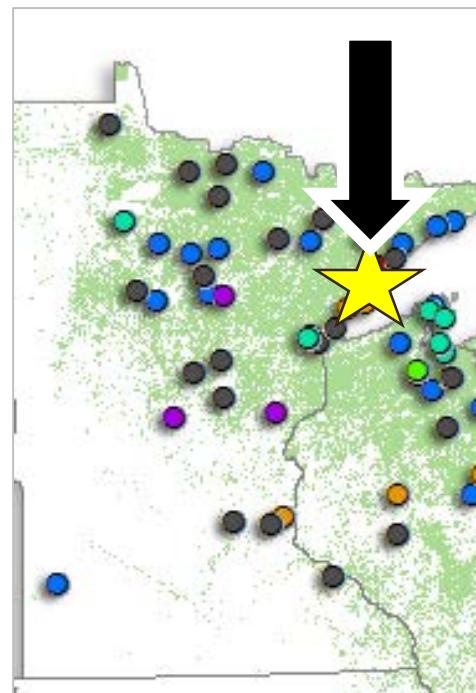
Timber

## Site Challenges

- Variable & extreme precipitation
- Warm temperatures
- Rapid snowmelt, and overland flows
- Erosion & soil disturbance
- Forest pests, and forest health decline
- Land use changes



# MN DNR: Knife River Project (MN)



## Goals

Maintain forest cover

Water quality

Timber

## Challenges

- Variable & extreme precipitation
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## Actions

### Project objective

**Forest cover**

**Reduce snowmelt w/ conifer shade**

**Reduce erosion & overland flow**

### Adaptation Approach

*Menu: 3.2, 4.1, 4.2*

*Menu: 3.1, 5.2*

*Menu: 2.3, 5.5*





# Adaptation Approaches

## Forest cover

Selectively harvest on-site timber.

Plant a mix of coniferous species, including future adapted native species.

- Revegetate areas impacted by disturbance (Approach 3.2)
- Favor native species expected to be adapted to future conditions (Approach 4.1)



# Adaptation Approaches

## **Reduce snowmelt with conifer shade**

Selectively reserve established conifers.

- Enhance forest and vegetative cover (Approach 3.1)
- Increase water retention and storage to recharge groundwater (Approach 5.2)



# Adaptation Approaches

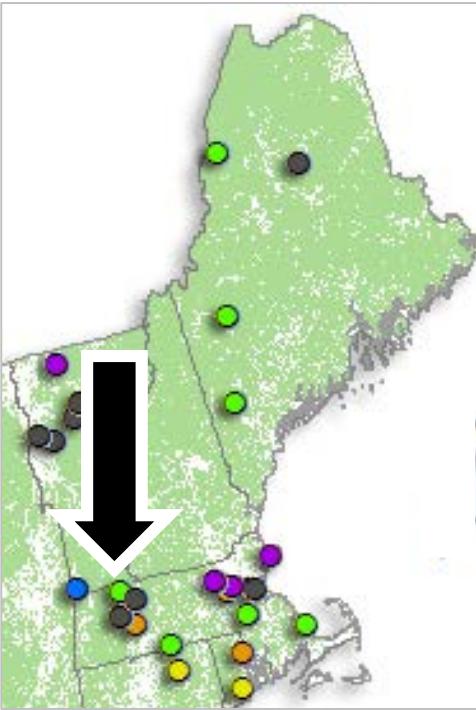
## Reduce erosion & overland flow

Leave coarse woody debris on-site post-harvest.

- Reduce soil erosion & sediment loading  
(Approach 2.3)
- Reduce overland flows  
(Approach 5.5)



# Trout Unlimited & Partners (VT/MA)



## Goals

Aquatic organism passage

Riparian forests

Stream morphology

## Challenges

- Variable & extreme precipitation
- Infrastructure washouts
- Erosion
- Forest pests in riparian area
- Warmer water temps



## Actions

Project objective

**Infrastructure & Connectivity**

Maintain shade in riparian area

Stabilize banks & fluvial processes

Adaptation Approach

Menu: 1.2, 1.4, 6.1, 6.2

Menu: 3.1, 4.3, 4.1

Menu: 1.3, 1.1, 1.5



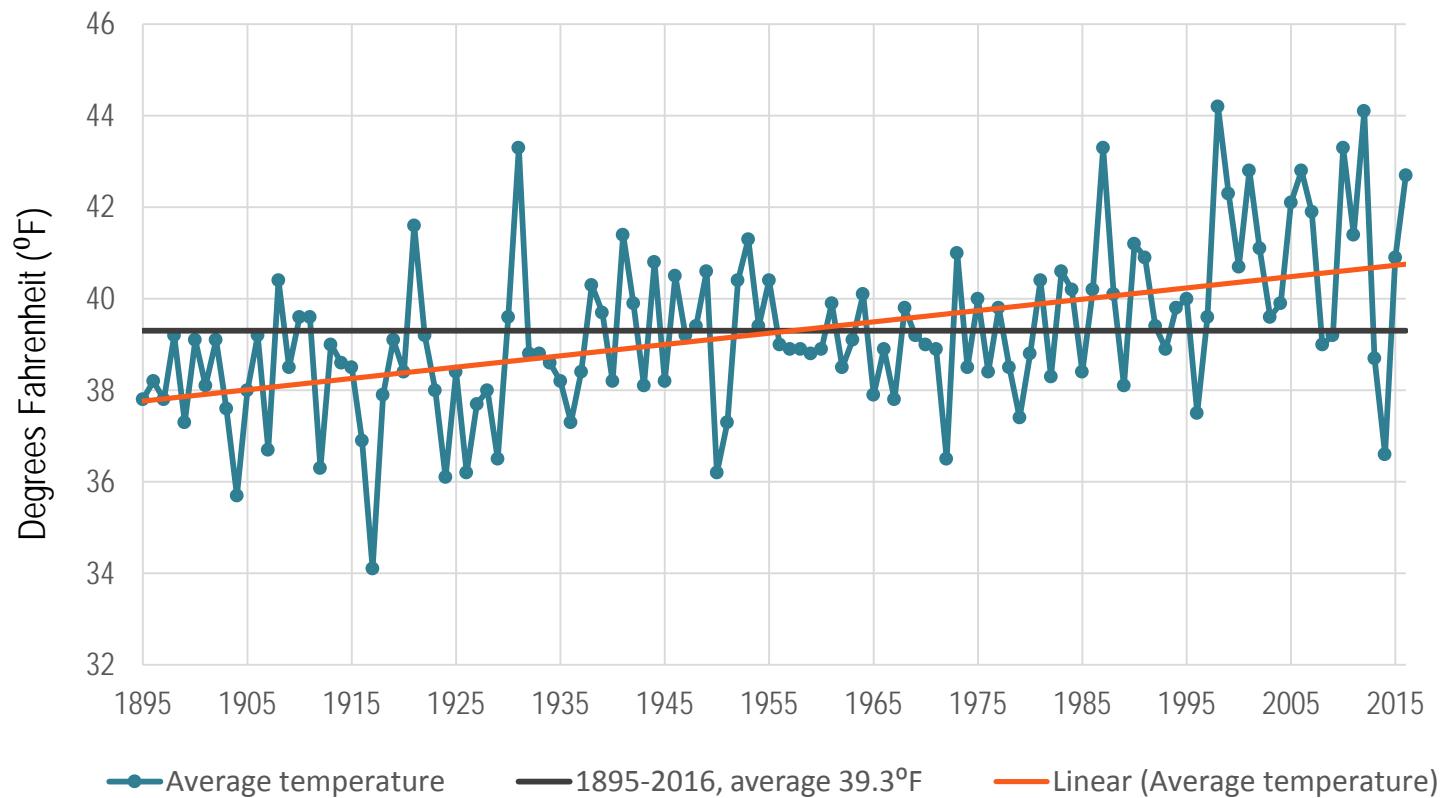


# It's getting warmer

## Observed:

- 1895 – 2016
- +3.0 °F

W. Upper Peninsula's Average Temperature (1895-2016)  
+0.2°F increase per decade



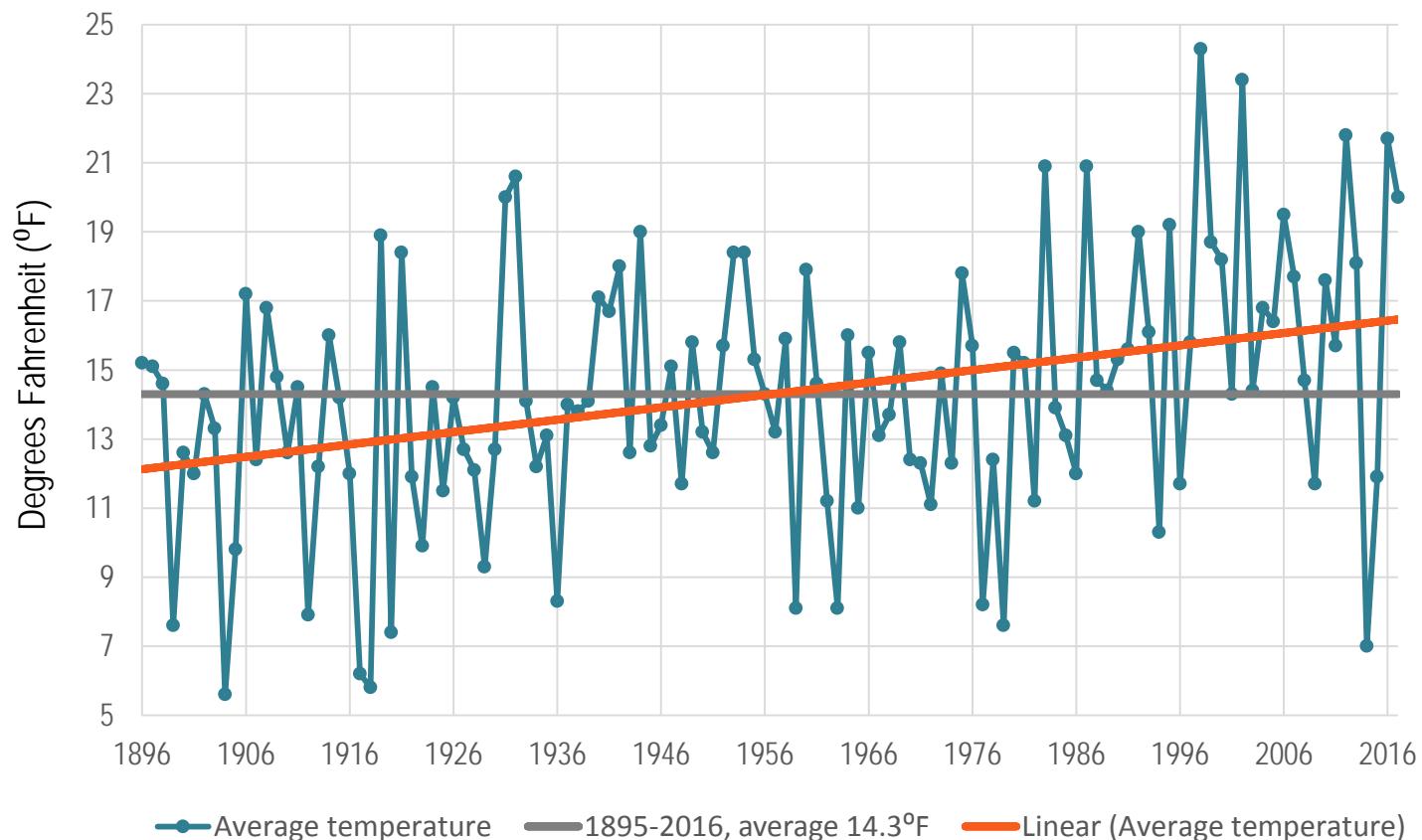


# It's getting warmer, especially in winter

## Observed:

- 1895 – 2016
- +4.3 °F

W. Upper Peninsula's Average Winter Temperature (1895-2016)  
+0.36°F increase per decade



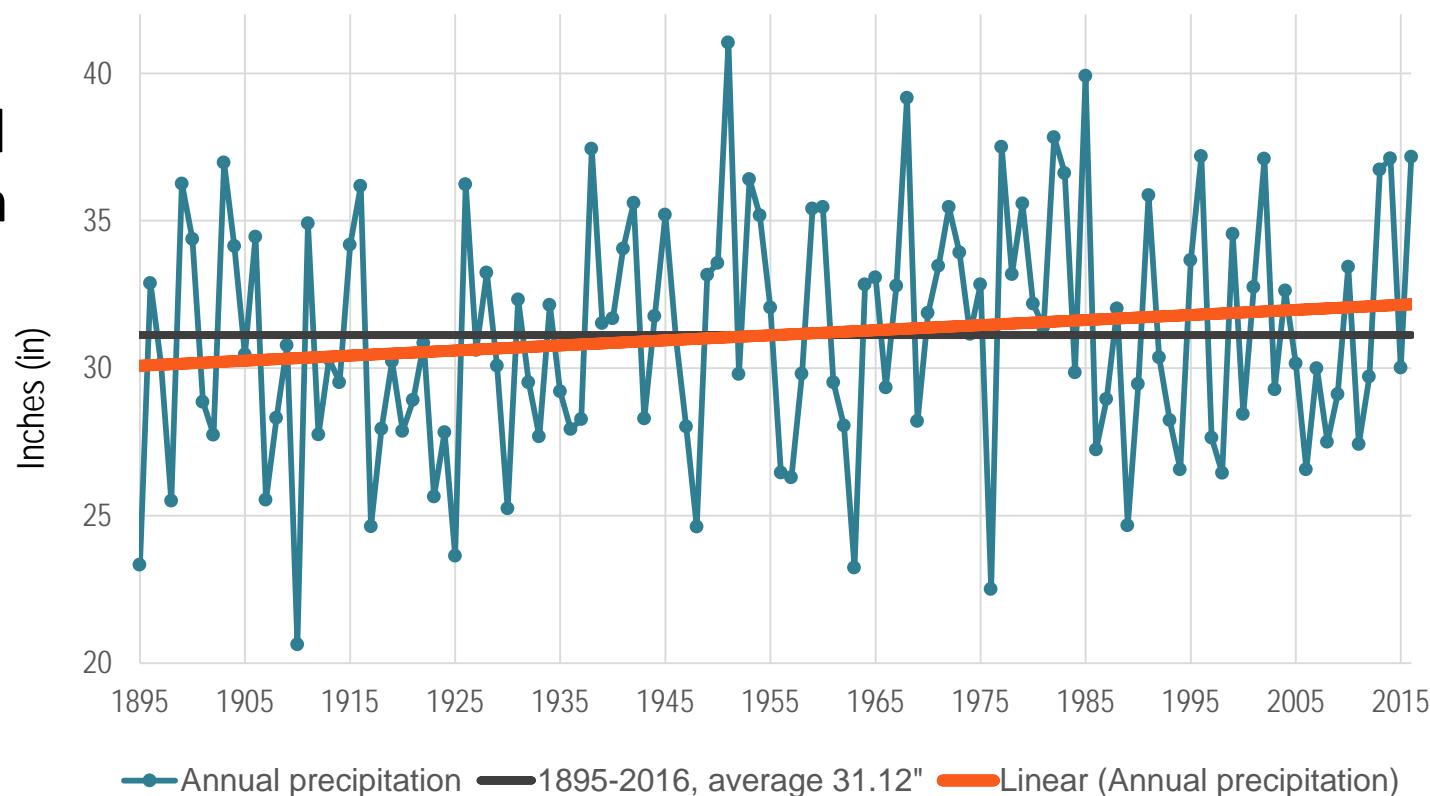


# Climate Change + Water = Wetter

## Observed:

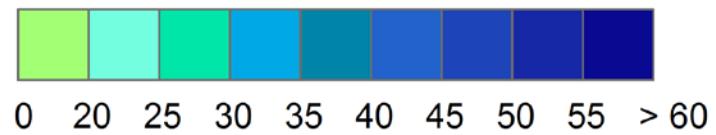
- 1895 – 2016
- 2+ inches more annual precipitation

W. Upper Peninsula's Average Precipitation (1895-2016)  
+0.17 inches increase per decade

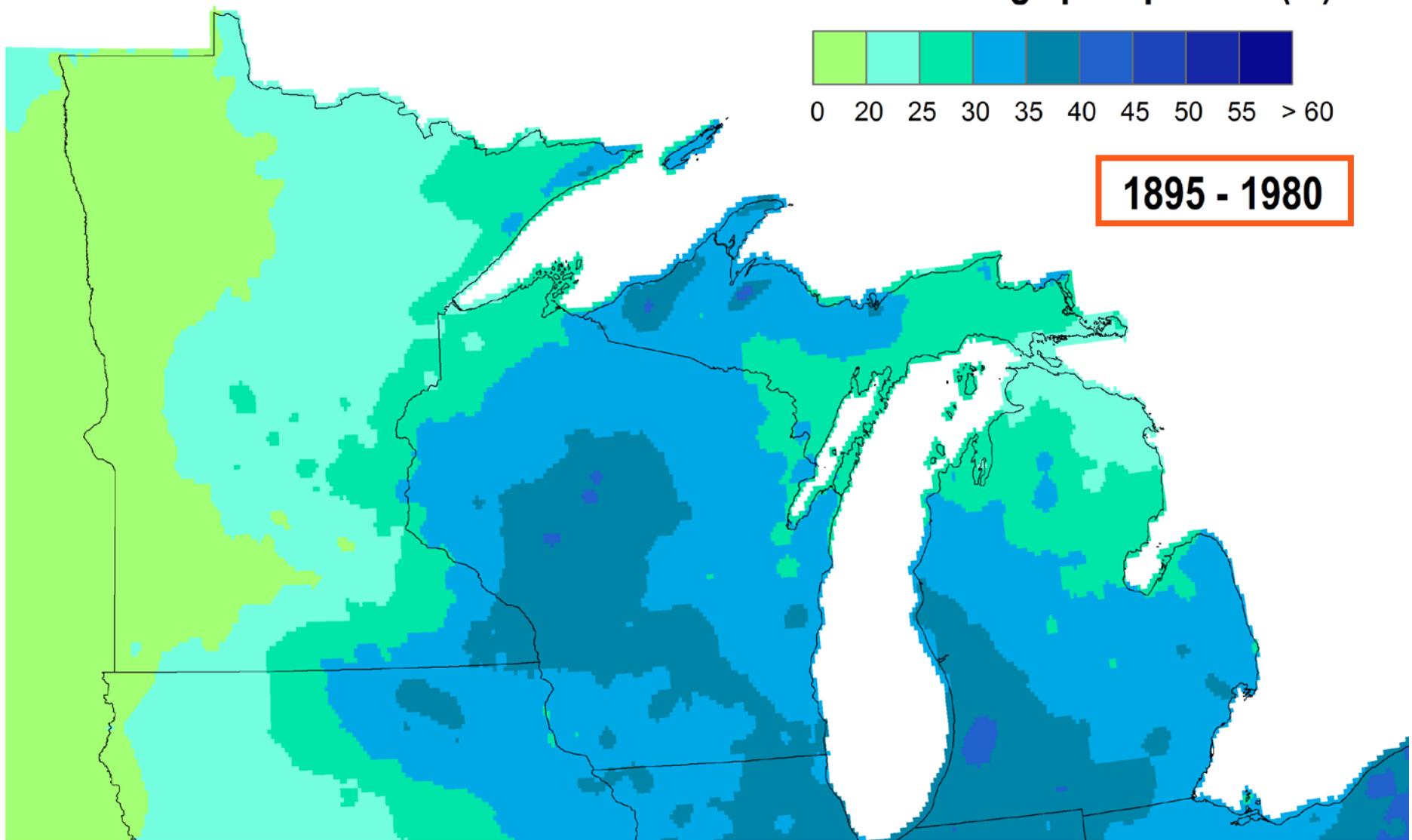




## Annual average precipitation (in)

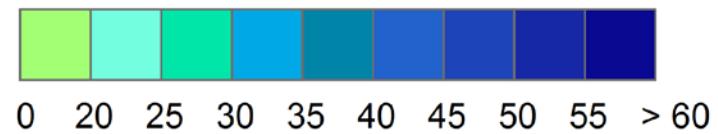


**1895 - 1980**

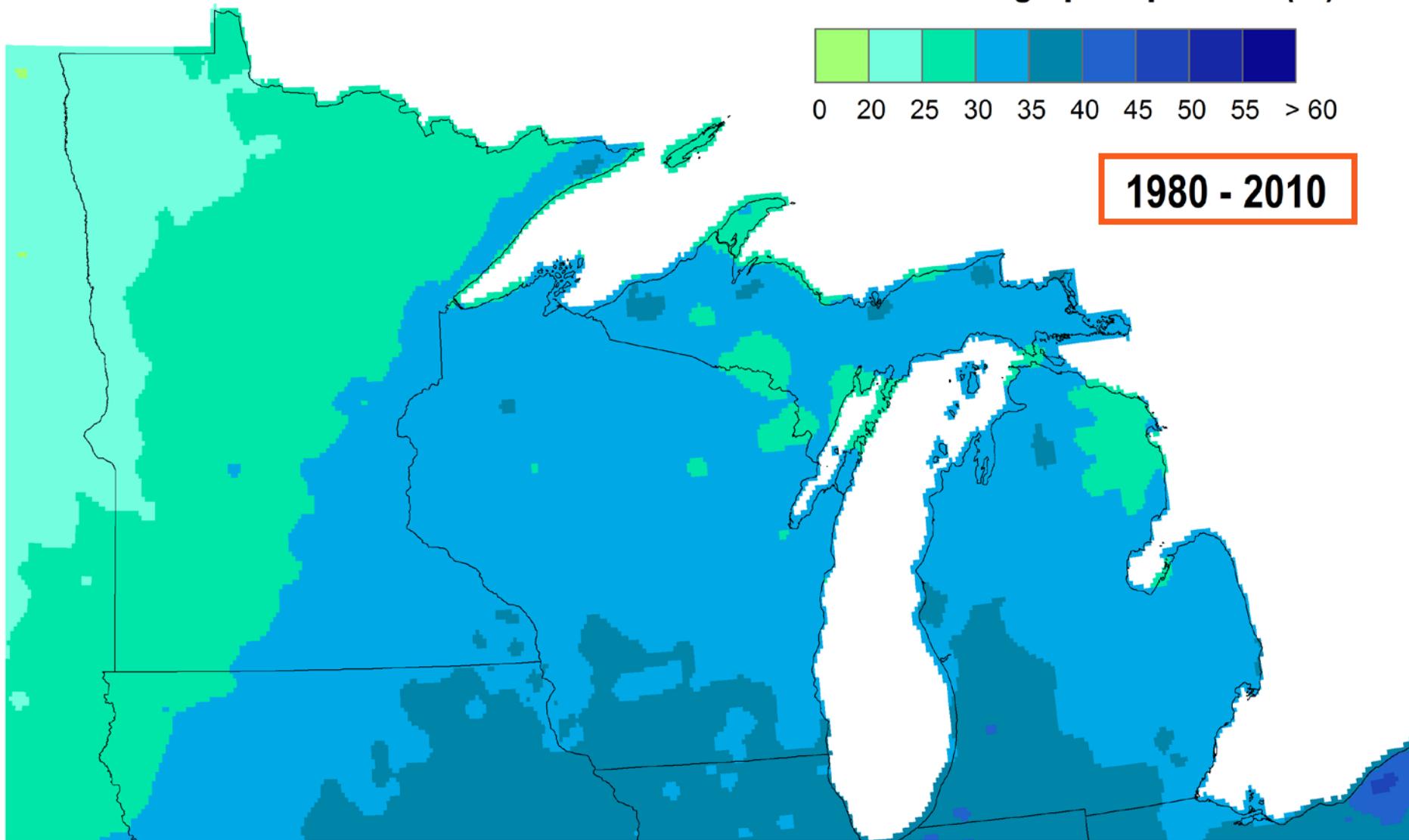




## Annual average precipitation (in)



1980 - 2010





# Forest Adaptation Resources

2<sup>nd</sup> edition released 2016!

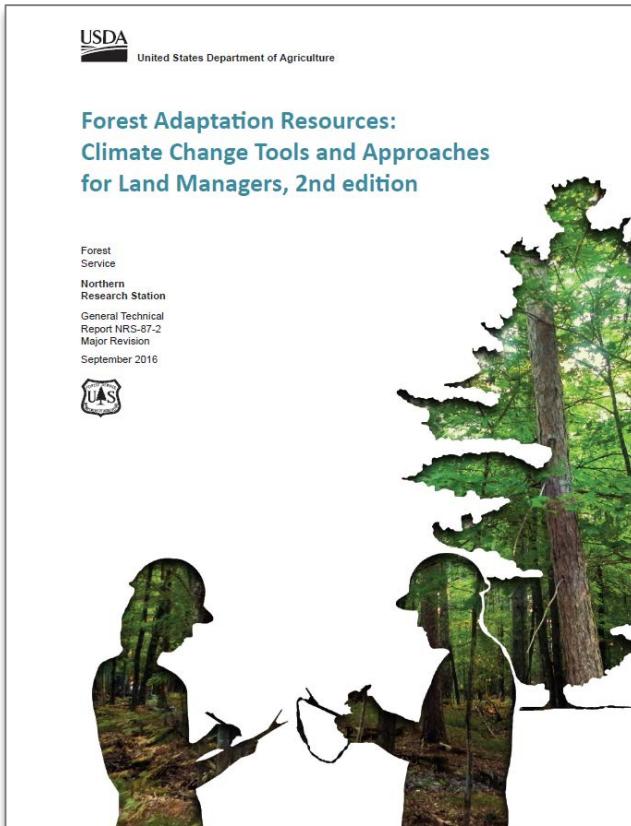
- Supports diverse goals and objectives
- Tailored to eastern forest types
- Menu of adaptation strategies and approaches for forest ecosystems
- Does not make recommendations

The image displays several components related to Forest Adaptation Resources:

- Report Cover:** Shows the USDA logo and the title "Forest Adaptation Resources: Climate Change Tools and Approaches for Land Managers, 2nd edition". It also includes the Forest Service Northern Research Station General Technical Report NRS-57-2 Major Revision September 2016.
- Adaptation Workbook Screenshot:** A screenshot of the "Adaptation Workbook" interface. It features a header with "Adaptation Workbook" and "a climate change tool for land management and conservation", with "Use Workbook" and "About" buttons. Below the header are three image cards: "FORESTS", "URBAN FORESTS", and "AGRICULTURE". The "FORESTS" card has sub-sections: "Tailored to your location", "Peer-reviewed", and "Take it with you!". The "Peer-reviewed" section notes that the tool is based on the best available science on climate change impacts and adaptation. The "Take it with you!" section notes that users can create a custom adaptation plan, access a library of information, and share their plans with colleagues.
- Process Diagram:** A circular flow diagram with five numbered boxes (1, 2, 3, 4, 5) connected by arrows forming a loop. Box 1 is at the top, Box 2 is to the right, Box 3 is at the bottom, Box 4 is to the left, and Box 5 is back at the top.

**AdaptationWorkbook.org**

# Forest Adaptation Resources



## Strategies & Approaches

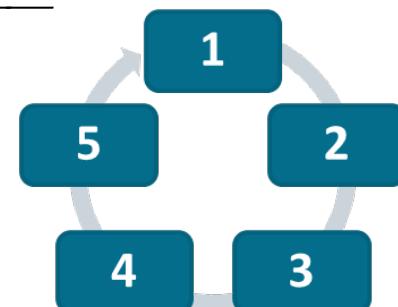
Menu of adaptation actions



## Adaptation Workbook

Structured process to integrate climate change considerations into management.

- Workbook approach



Also online: [AdaptationWorkbook.org](http://AdaptationWorkbook.org)



New!

# Forested Watershed Adaptation Resources

Translating **concepts** to **actions**



Adaptation options (concepts):

- Resistance, Resilience, Transition

Strategies:

- Regionally specific conditions

Approaches:

- Actions for a specific ecosystem or forest type

Tactics:

- Prescriptions for local conditions and mgmt. objectives



# Forest Adaptation Resources

Management Goals  
& Objectives

Menu + Workbook

Climate Change Impacts

Challenges & Opportunities

Intent of Adaptation (Option)

Make Idea Specific  
(Strategy, Approach)

Action to Implement  
(Tactic)

**Why it's important:**  
Helps connect the dots  
from broad concepts to  
specific actions for  
implementation.

# Regional Workshops (spring 2017)

*Two-day workshops!*

**17 Real-world projects**  
(Federal, State, Tribal, NGO, Private)

## Using Adaptation Workbook

Structured process to integrate climate change considerations into management.

- Workbook approach

