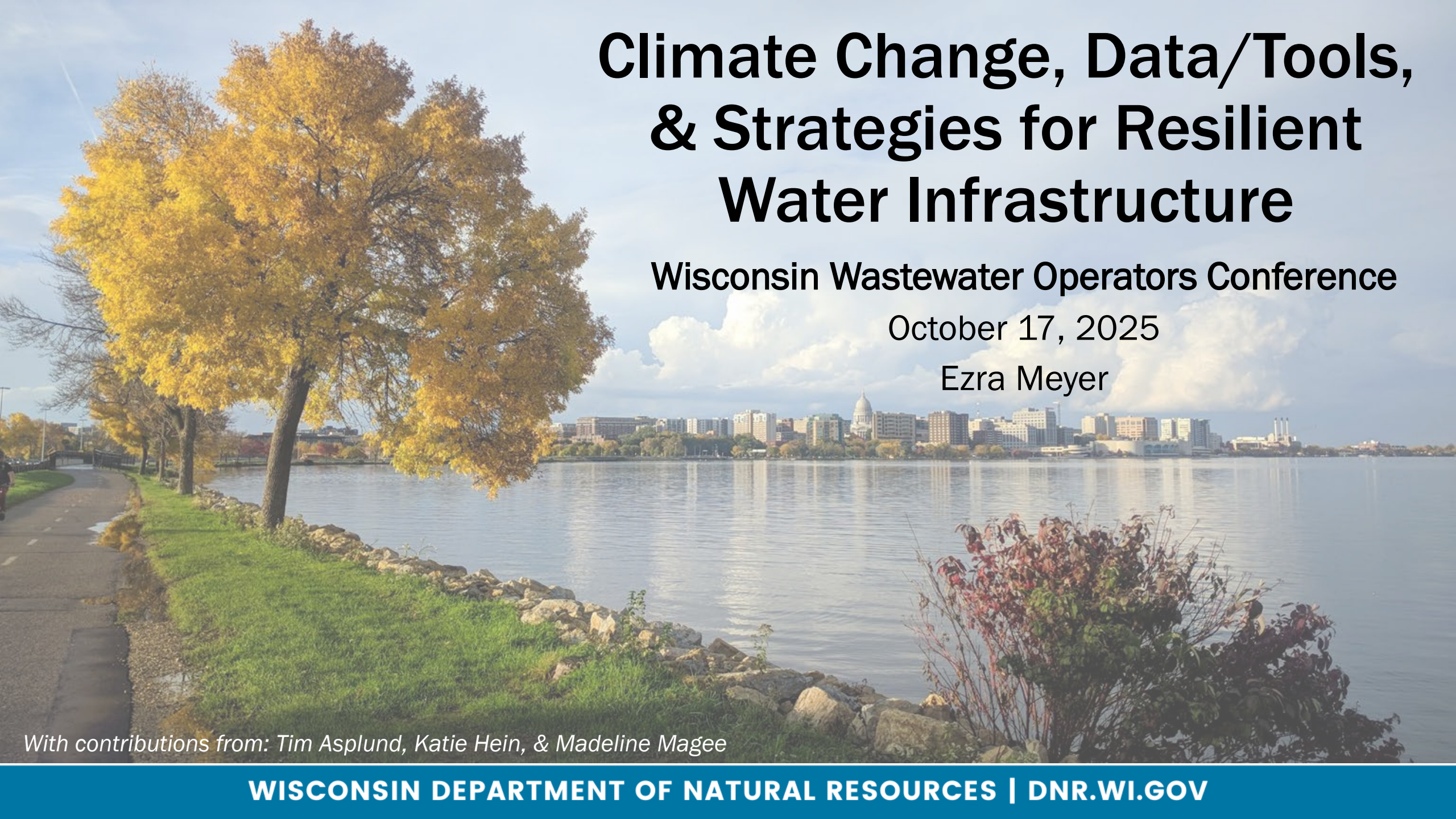


A scenic view of a lake with a city skyline in the background and a tree with yellow leaves in the foreground. The tree is on the left side of the frame, and the city skyline is visible across the water. The sky is blue with some clouds.

# Climate Change, Data/Tools, & Strategies for Resilient Water Infrastructure

Wisconsin Wastewater Operators Conference

October 17, 2025

Ezra Meyer

*With contributions from: Tim Asplund, Katie Hein, & Madeline Magee*

**WISCONSIN DEPARTMENT OF NATURAL RESOURCES | [DNR.WI.GOV](https://dnr.wi.gov)**

# Session Overview

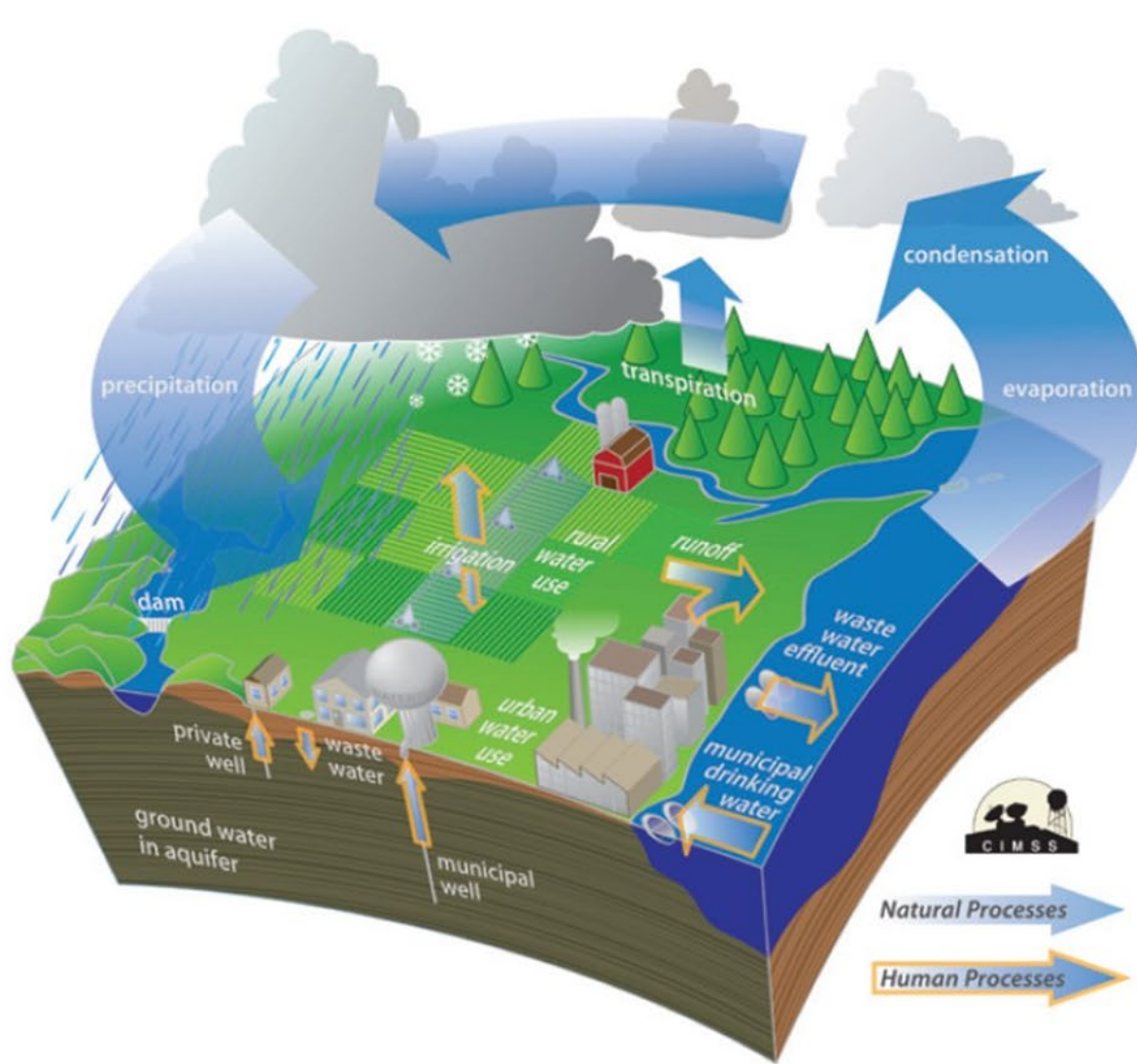
- Wisconsin Climate Change Overview
- Impacts to Water Resources
- Climate Change Data/Tools
- Climate Resilient Water Infrastructure
- Technical Assistance Opportunities



# Climate Change Overview

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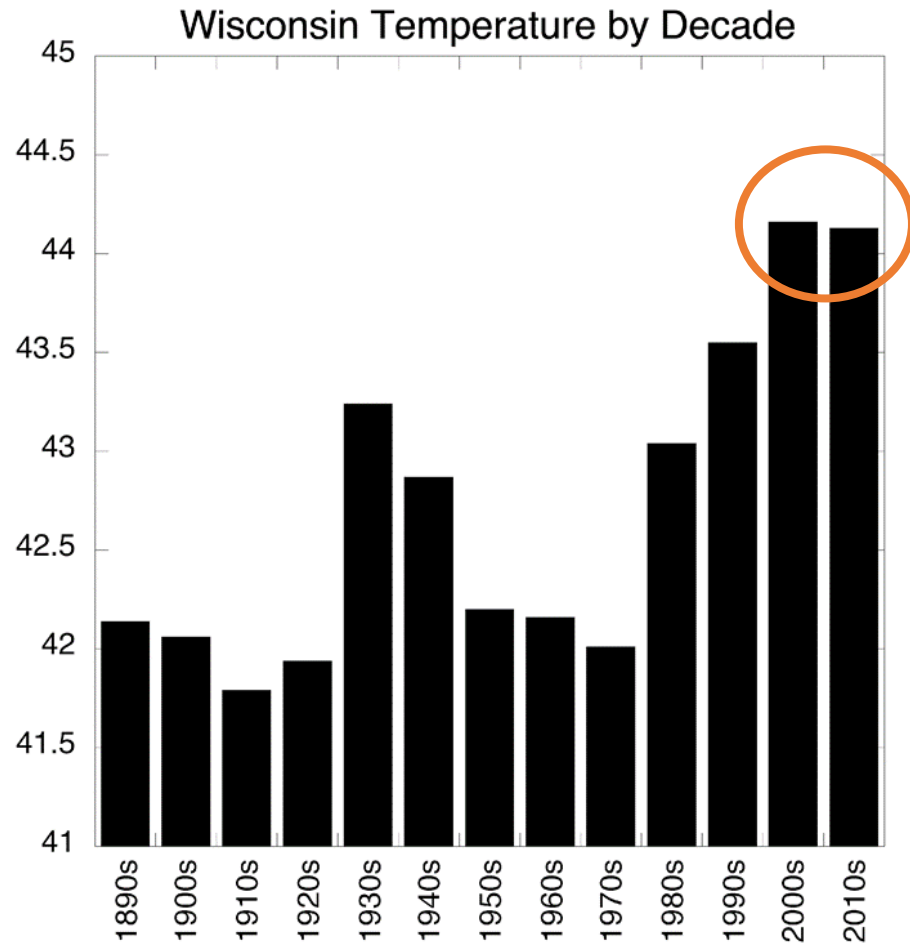
# Climate change will impact water cycles



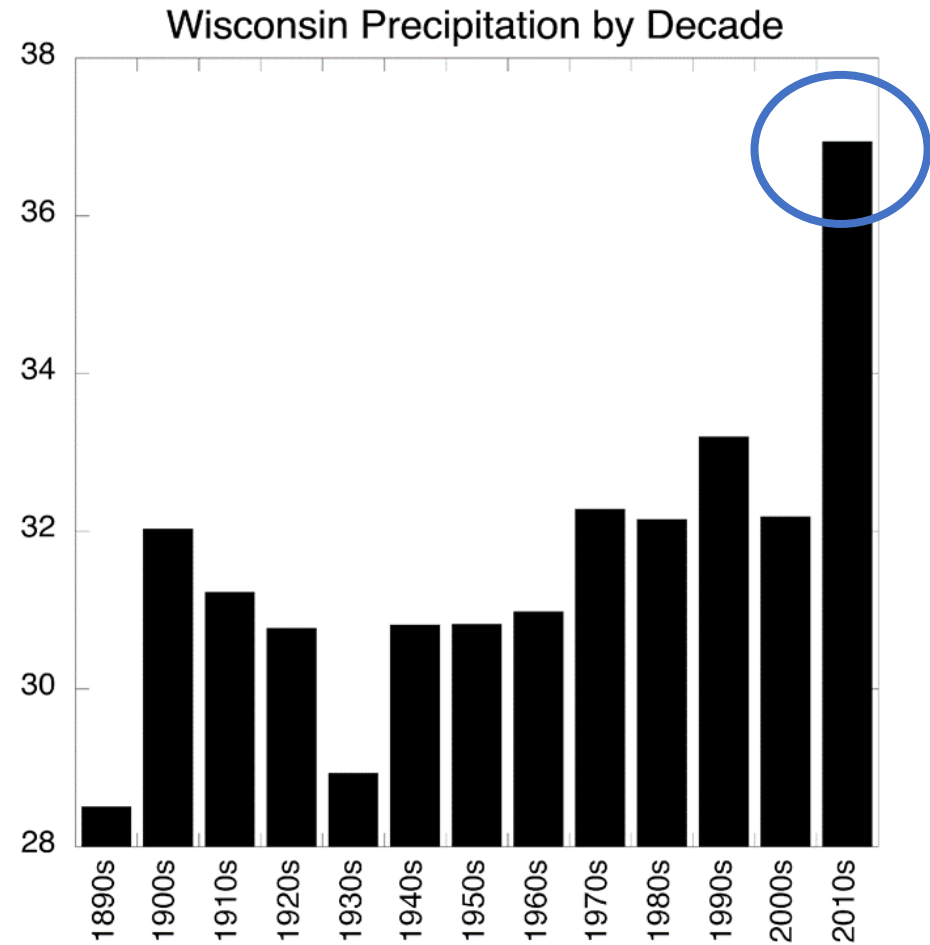
*“Climate change will affect how water moves through ecosystems in many ways, including more frequent heavy precipitation, a more variable snowpack, and changes in the timing of spring melt and runoff. These changes will have cascading effects on water quality and water availability.”*

*Tribal Climate Adaptation Menu*

# Wisconsin is getting warmer and wetter



*2000s and 2010s = warmest decades*

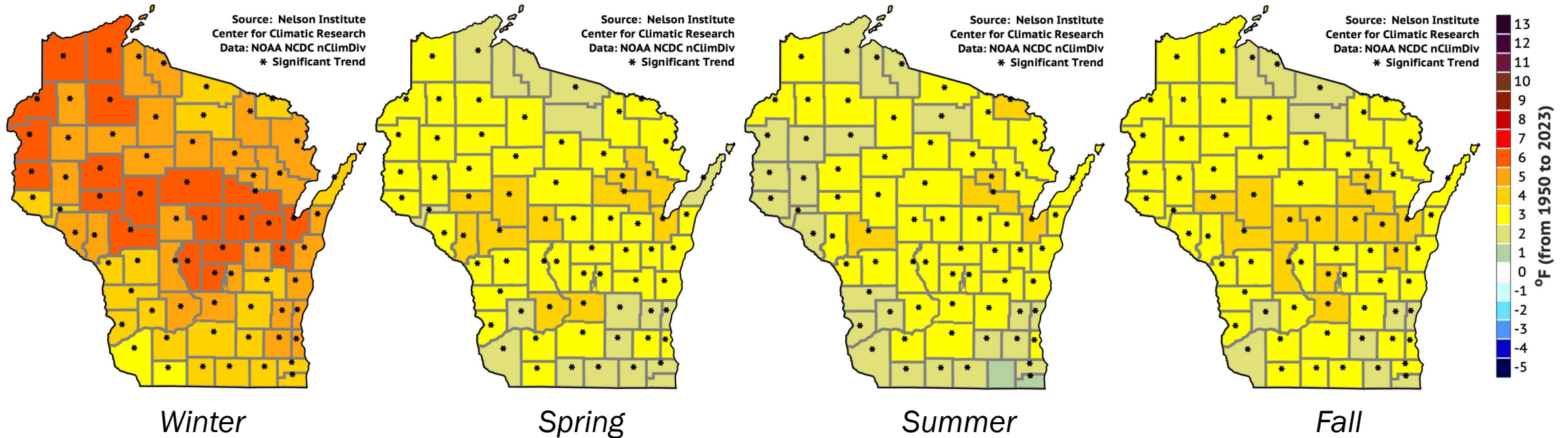


*2010s the wettest decade by far*

Source: WICCI

# Changes in climate have varied by season

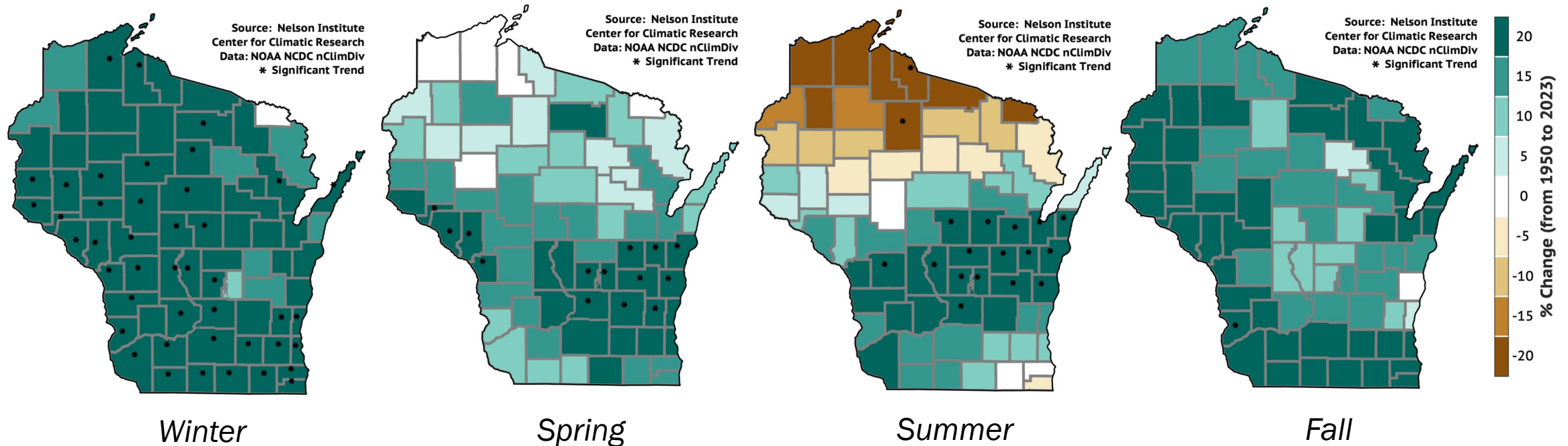
Change in annual mean temperature, 1950-2023



→ Winters have warmed more than other seasons

# Changes in climate have varied by season

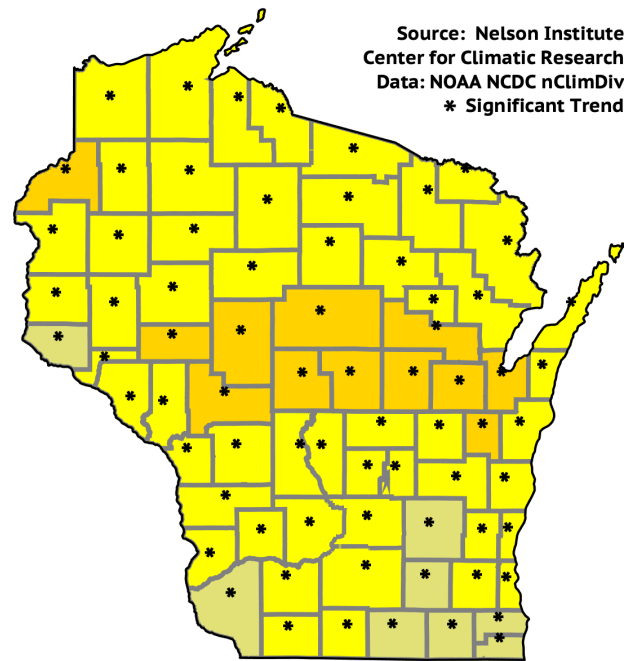
Change in annual precipitation, 1950-2023



- Most parts of the state have become **wetter** in winter, spring, and fall
- Some parts of the state have become **drier** in summer
- Precipitation has become more **variable**

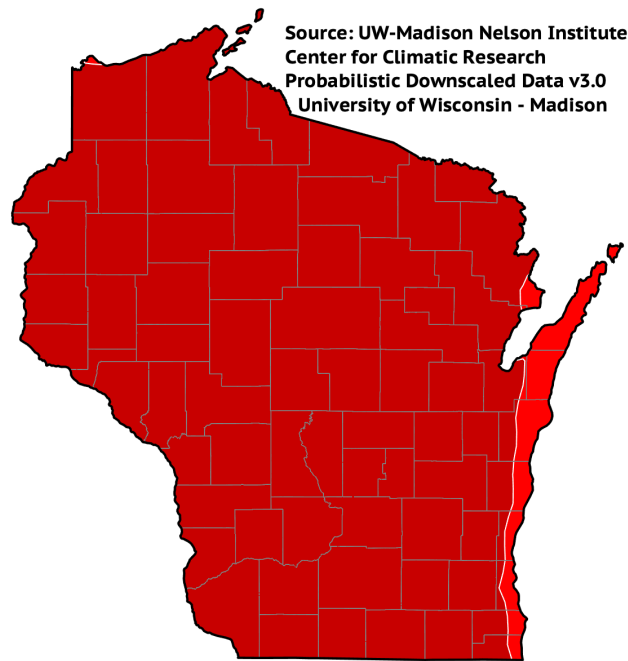
# Warmer and Wetter in the Future

Historical Change in Annual TMEAN  
from 1950 to 2023



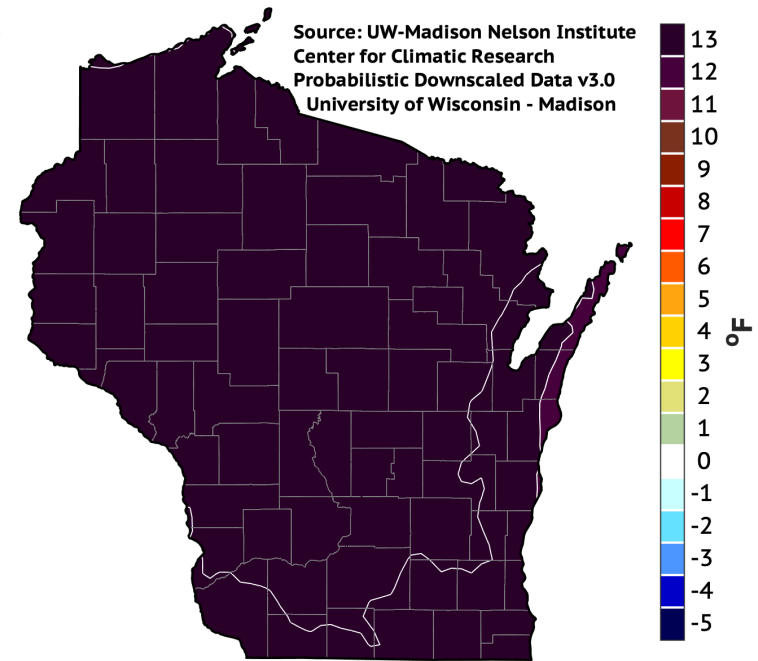
*2-4 °F warmer since 1950*

Change in Annual TMEAN, SSP245:  
2081-2100 minus 1981-2010



*If we reduce emissions =  
8°F warmer*

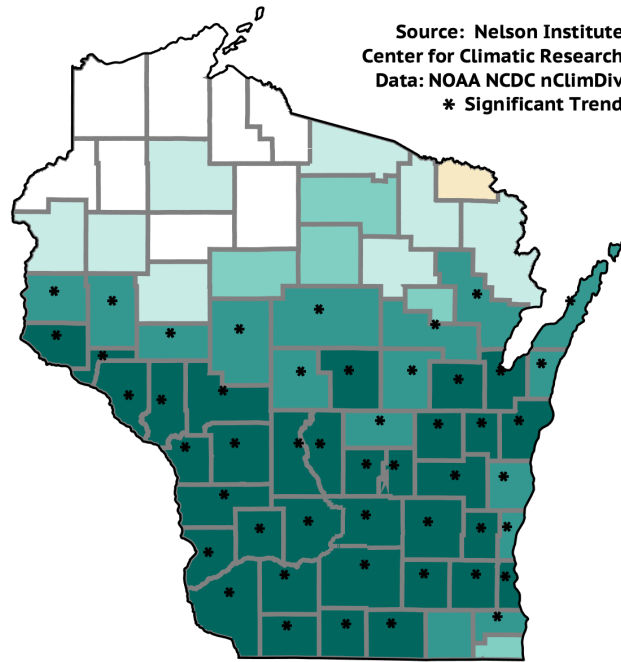
Change in Annual TMEAN, SSP585:  
2081-2100 minus 1981-2010



*Business-as-usual =  
13°F warmer*

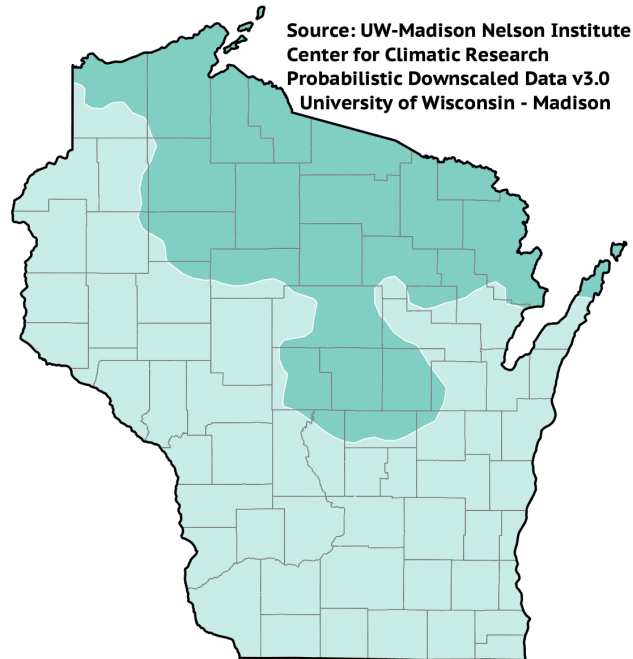
# Warmer and Wetter in the Future

Historical Change in Annual PRCP (%)  
from 1950 to 2023



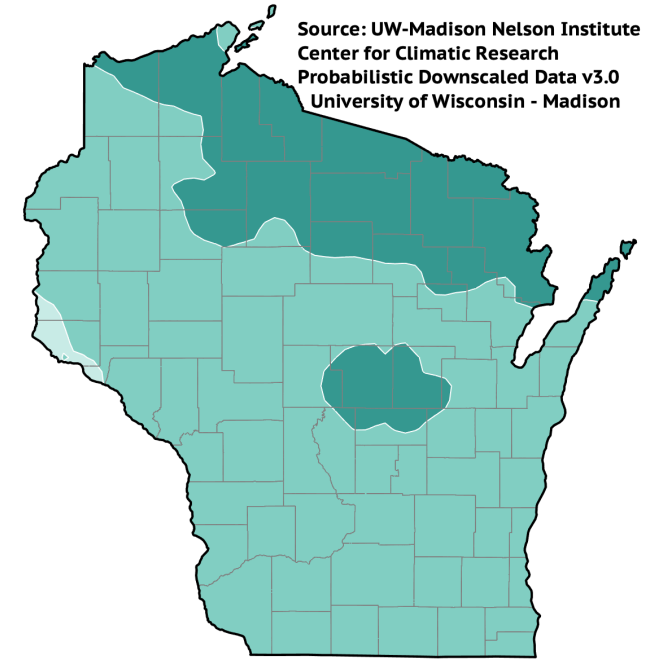
*Historical change since 1950*

Change in Annual PRCP (%), SSP245:  
2081-2100 minus 1981-2010

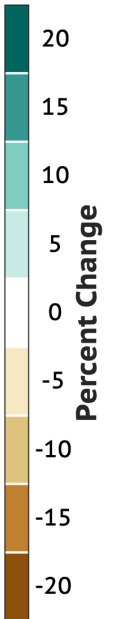


*If we reduce emissions*

Change in Annual PRCP (%), SSP585:  
2081-2100 minus 1981-2010



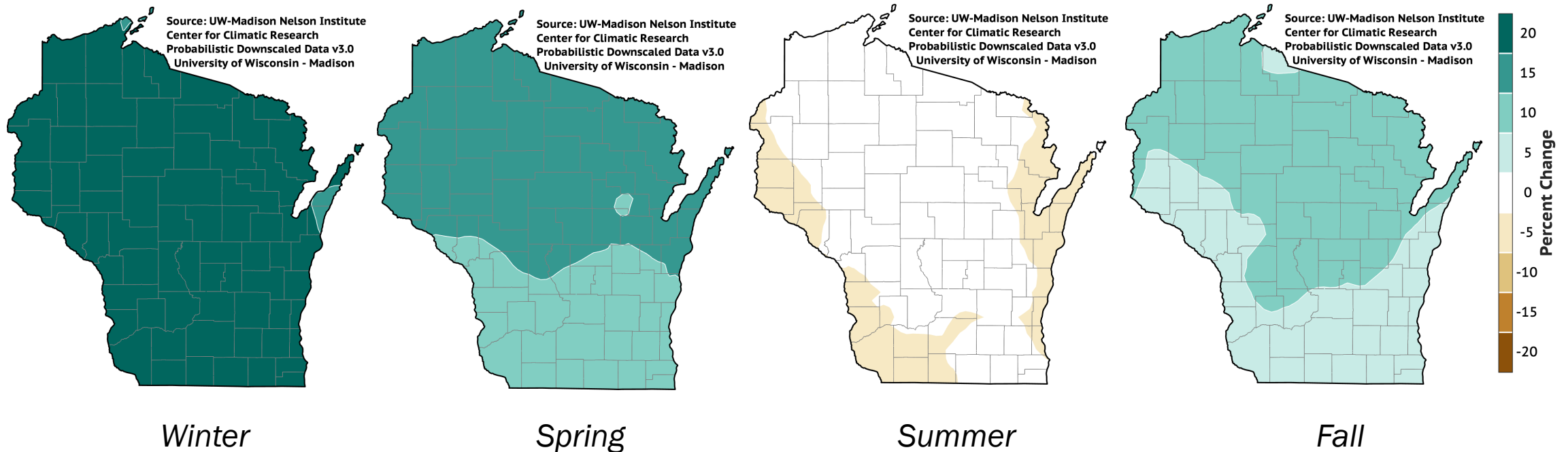
*Business-as-usual*



**Increase in annual precipitation**

# Precipitation Variability by Season

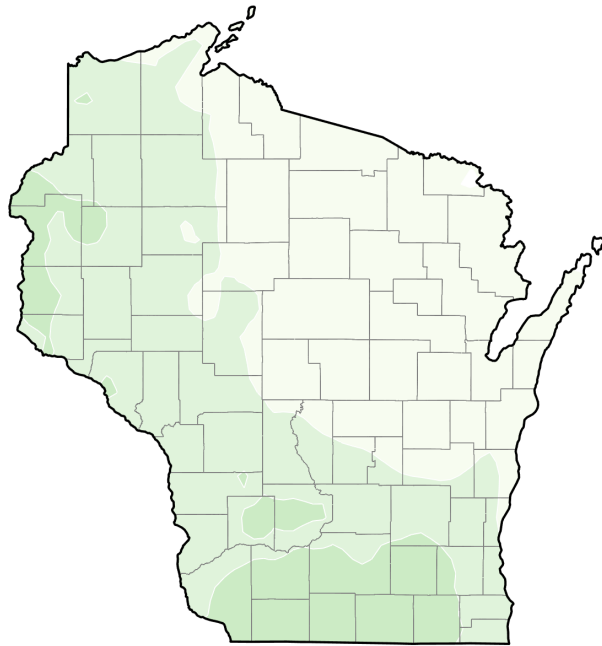
Change in precipitation, 2081-2100 minus 1981-2010 (SSP245 *emission reductions*)



- More precipitation in winter, spring, and fall
- More *variability* in summer

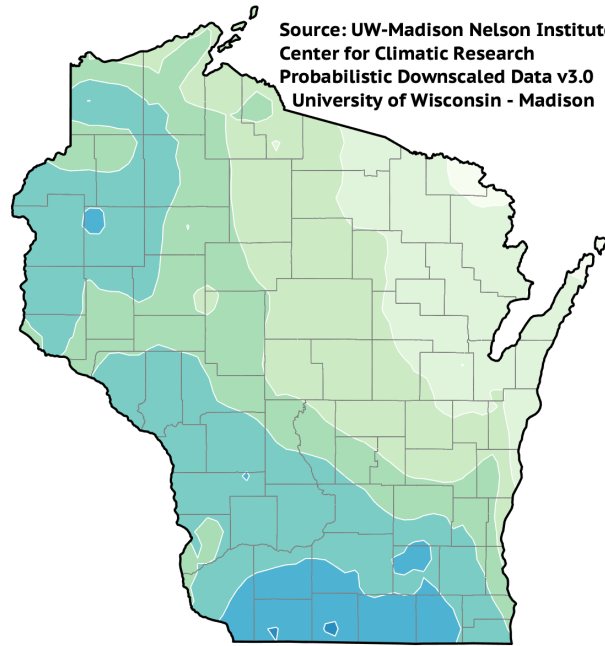
# Warmer and Wetter in the Future

Days per 100 Years with PRCP > 5in  
1981-2010 Conditions (HISTORICAL)



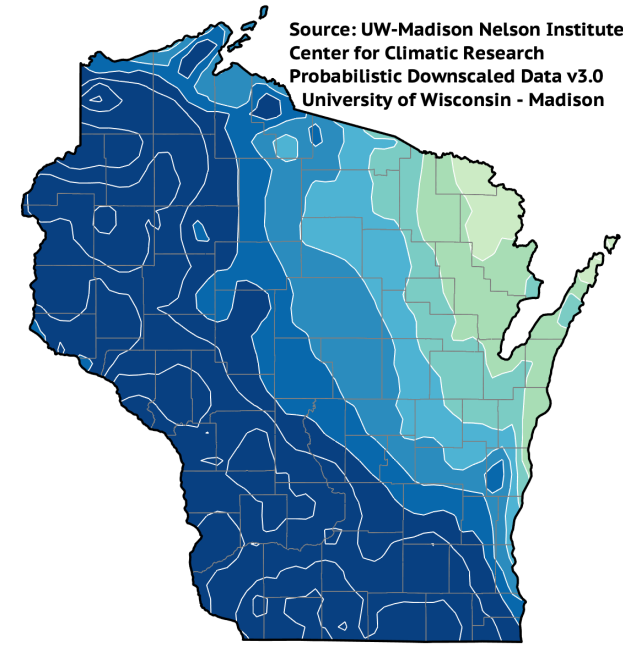
*Recent historical average*

Days per 100 Years with PRCP > 5in  
2081-2100 Conditions (SSP245)

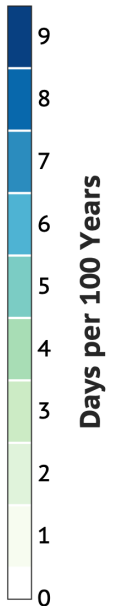


*If we reduce emissions*

Days per 100 Years with PRCP > 5in  
2081-2100 Conditions (SSP585)



*Business-as-usual*



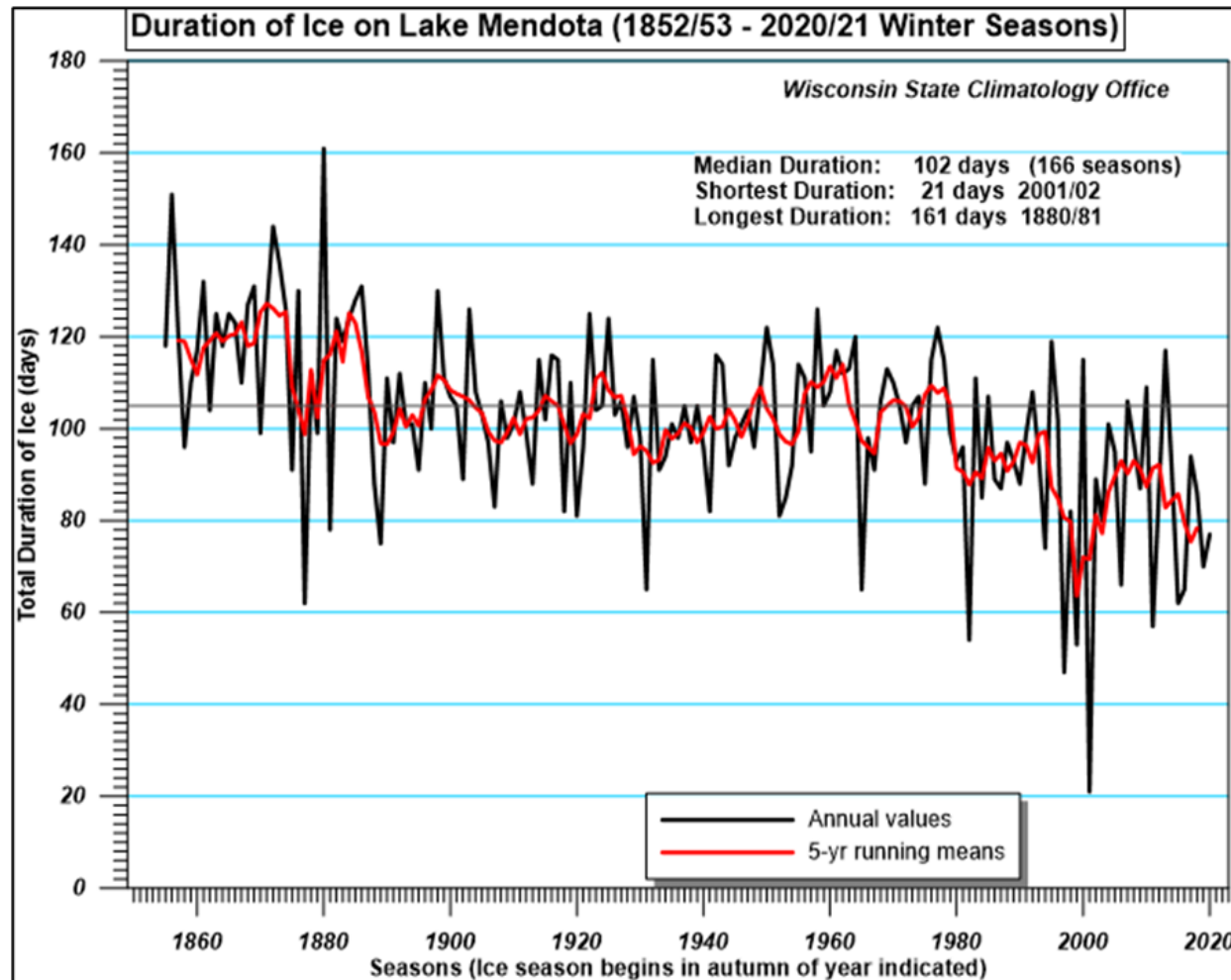
**Increase in extreme events**

# Impacts to Water Resources

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# Impacts of Increasing Temps. → Less Ice Cover

Winter ice cover lasts 4-5 weeks less than 150 years ago on Lake Mendota

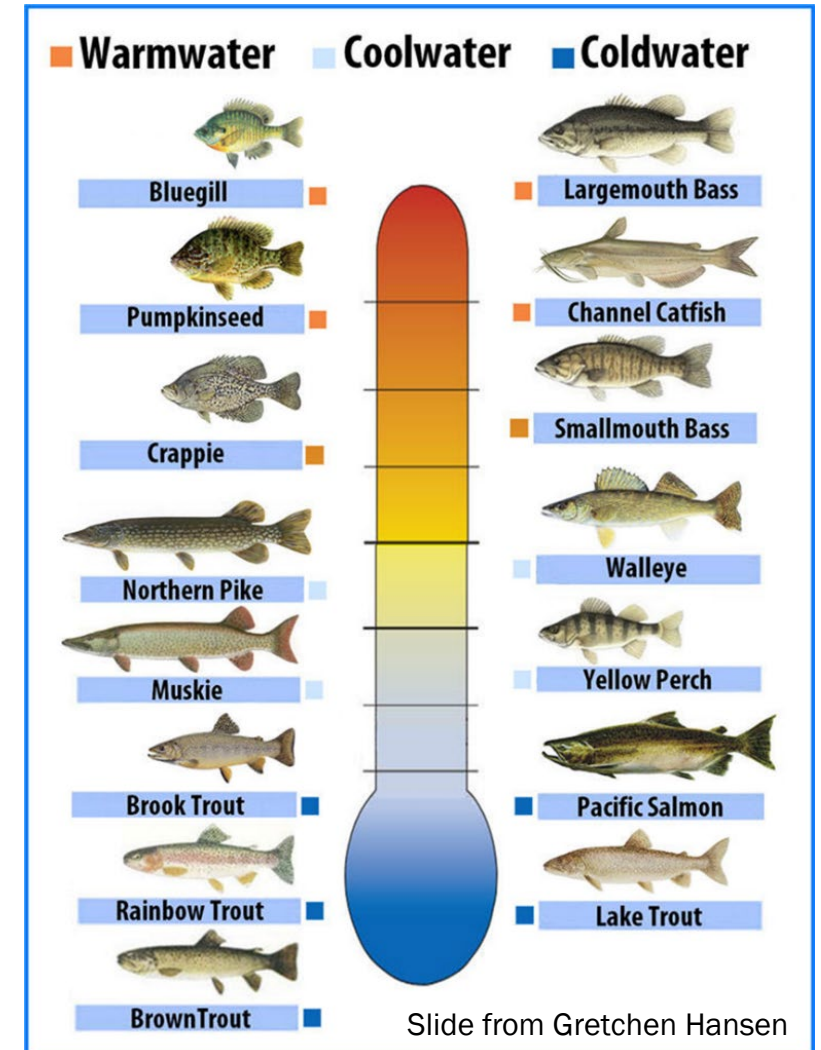
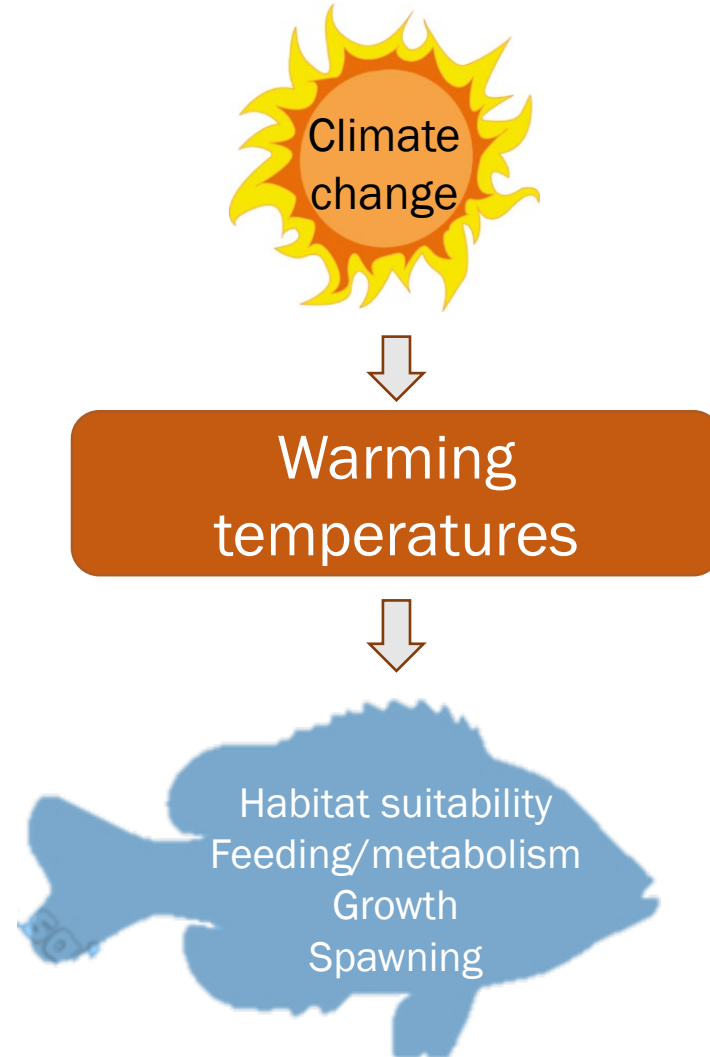


Experts predict ice-free winters for some southern Wisconsin lakes by 2050!

Sharma et al.

# Impacts of Increasing Temps. → Species Changes

Climate Change Favors  
Warmwater Fish



# Impacts of Increasing Temps. → More Algae

- More *harmful* algal blooms
- Cyanobacteria favored in warm water ( $>77^{\circ}\text{F}$ )
- Strong stratification favors buoyant cyanobacteria
- Outcompete plants and phytoplankton
- Toxins pose health risk



# Impacts of Changing Precipitation

Flooding



Drought



# Impacts of Changing Precipitation

## Flooding

- Compromised septic and sewage systems
- Contaminated drinking wells
- Harmed infrastructure
- Increased contaminant transport
- Increase erosion and runoff
- Reduced water quality

P. Skawinski

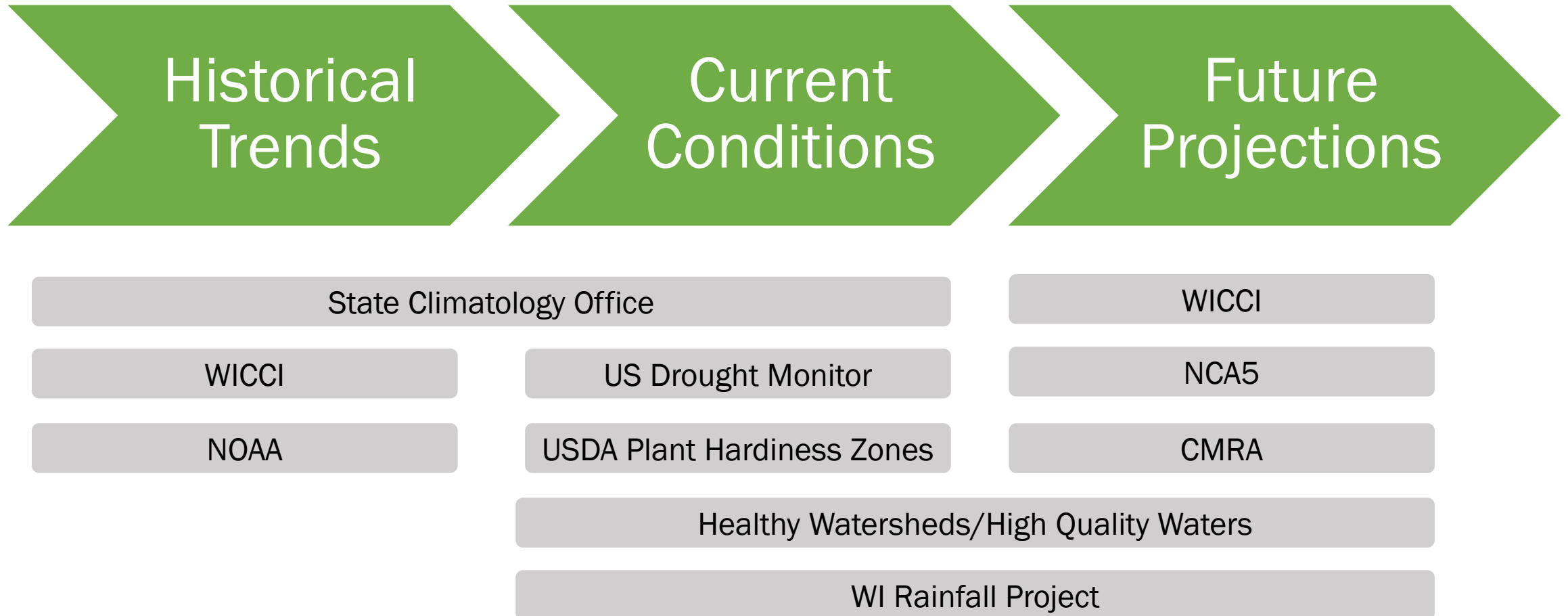
## Drought

- Reduced surface water volume
- Reduced groundwater discharge
- Dried drinking water wells
- Contaminated drinking water
- Dried streams & lakes
- Warmed surface waters
- Salinization
- More harmful algal blooms
- Stranded habitat

# Climate Data and Tools

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# Climate Data for Water Quality Planning



Past

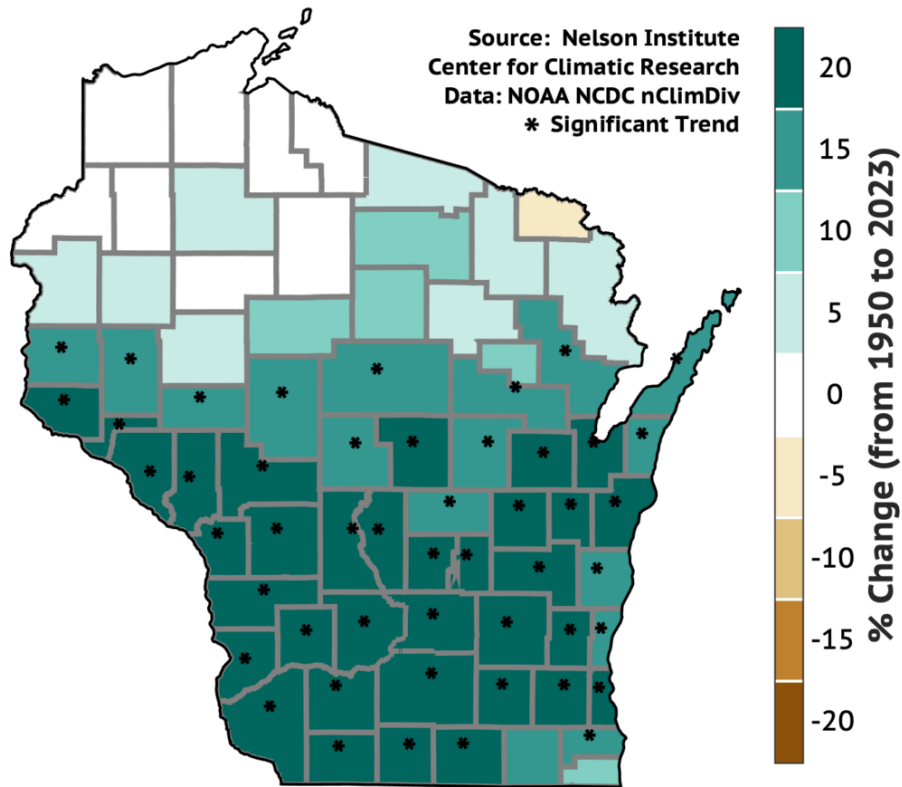
Present

Future

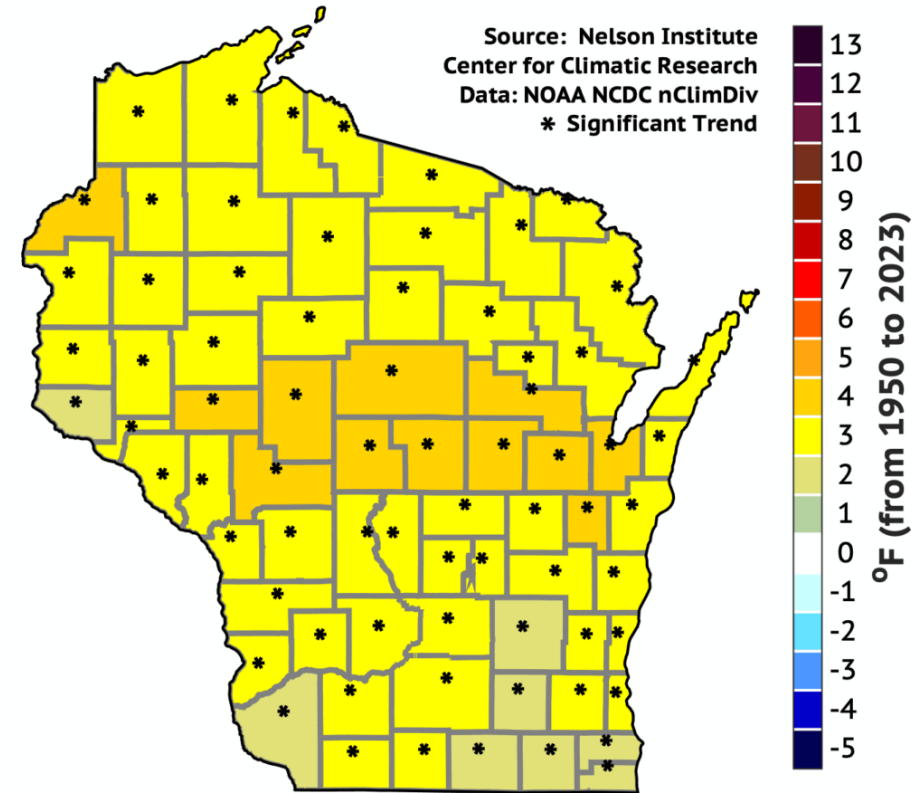
# Historical Climate Data – WICCI



Historical Change in Annual PRCP (%)  
from 1950 to 2023



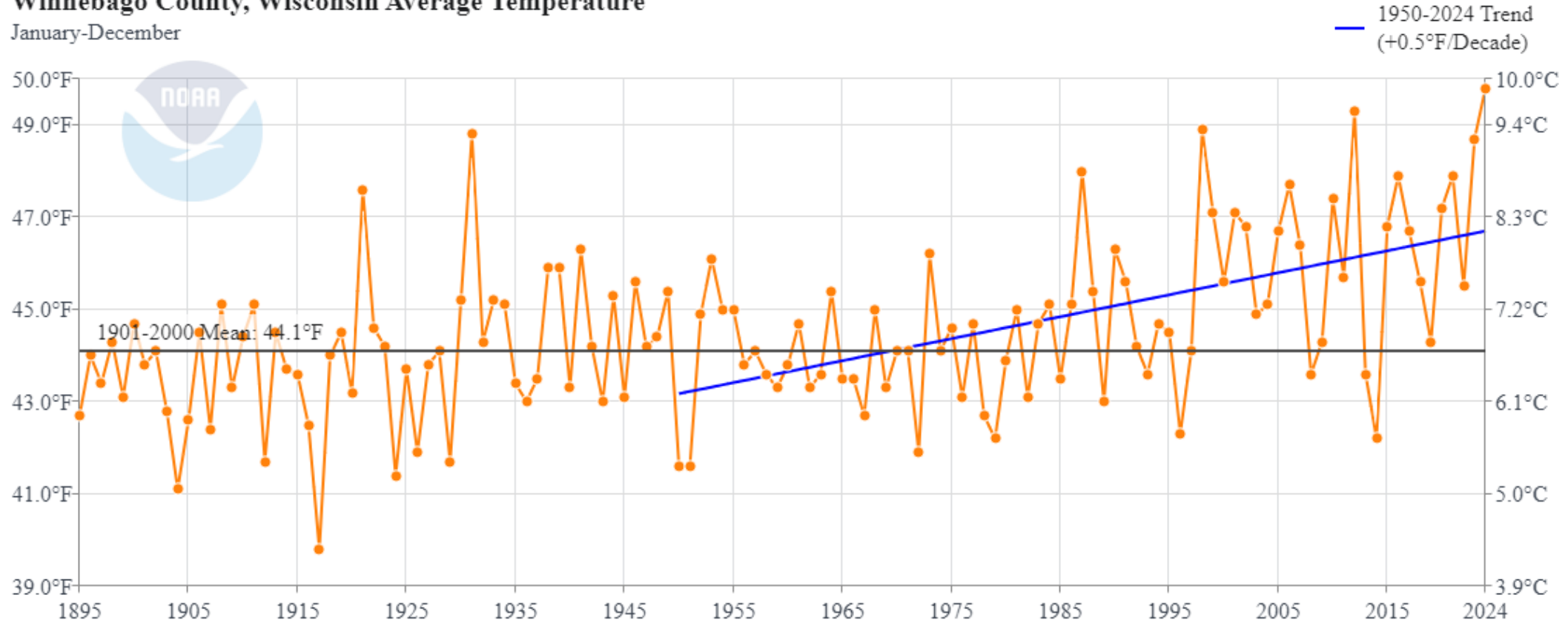
Historical Change in Annual TMEAN  
from 1950 to 2023



Maps recently updated in Fall 2024 with *county* level data. Provided by Dan Vimont, UW-Madison.  
[Trends and Projections | Wisconsin Initiative on Climate Change Impacts \(WICCI\)](#)

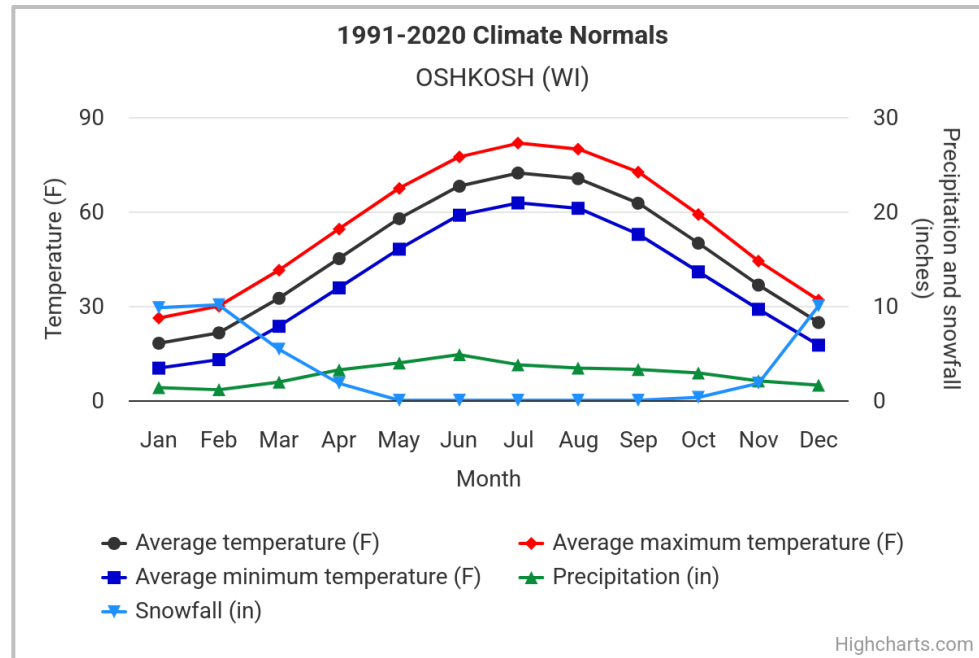
# Historical Climate Data – NOAA

Winnebago County, Wisconsin Average Temperature  
January-December

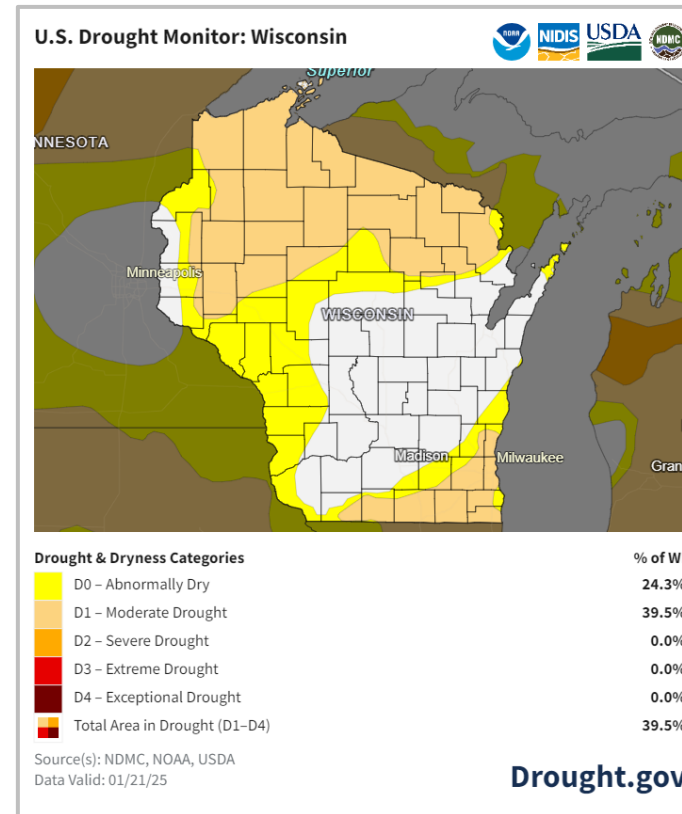


**County** level data from 1895-present, updated monthly. Available in chart or spreadsheet format and at different temporal scales. [NOAA Climate at a Glance – County Data](#)

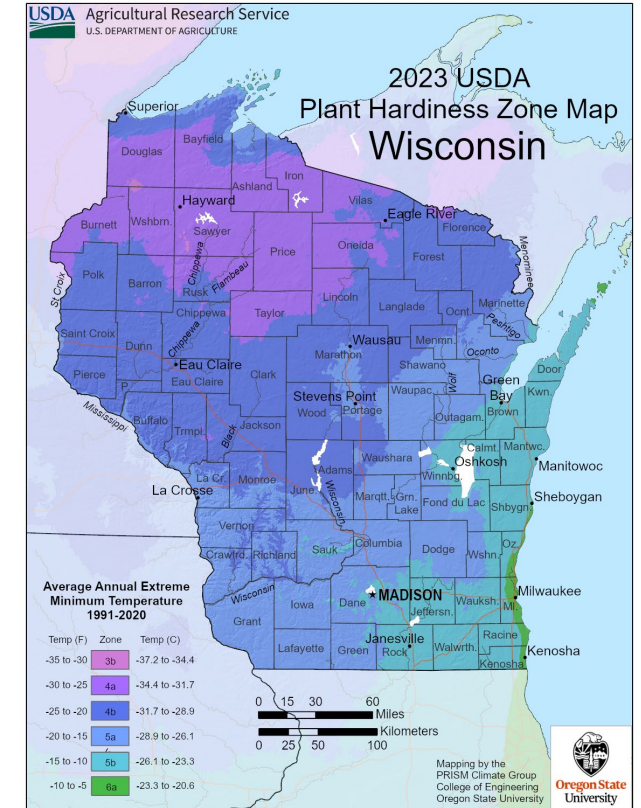
# Current/Recent Conditions



Climate Normals  
(State Climatology Office)



Drought Conditions  
(US Drought Monitor)



Plant Hardiness Zones  
(USDA)

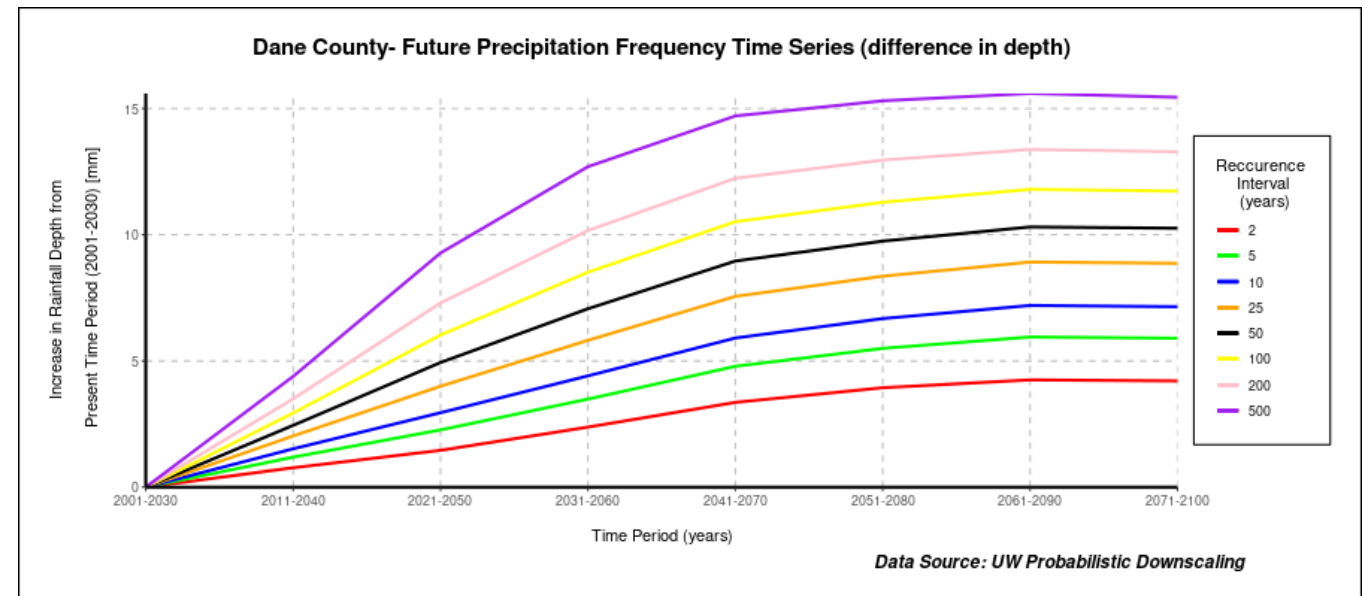
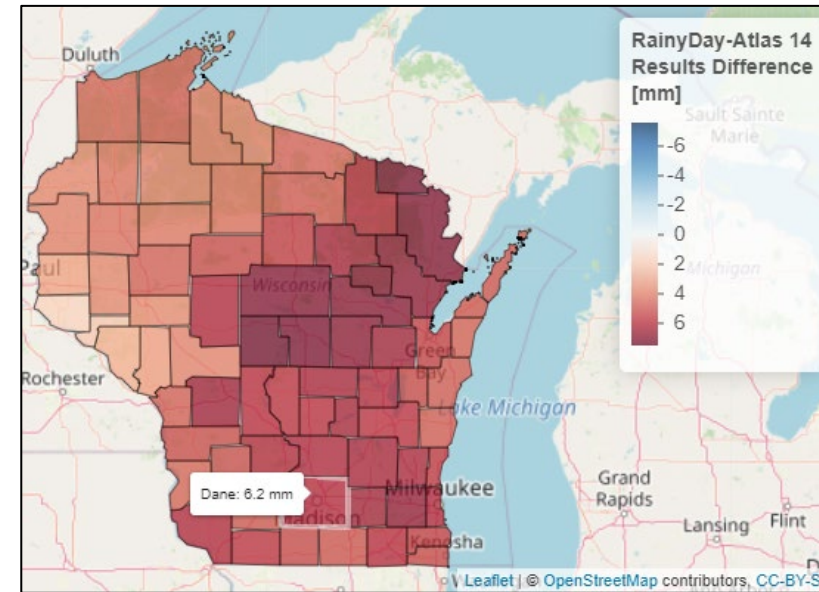
Past

Present

Future

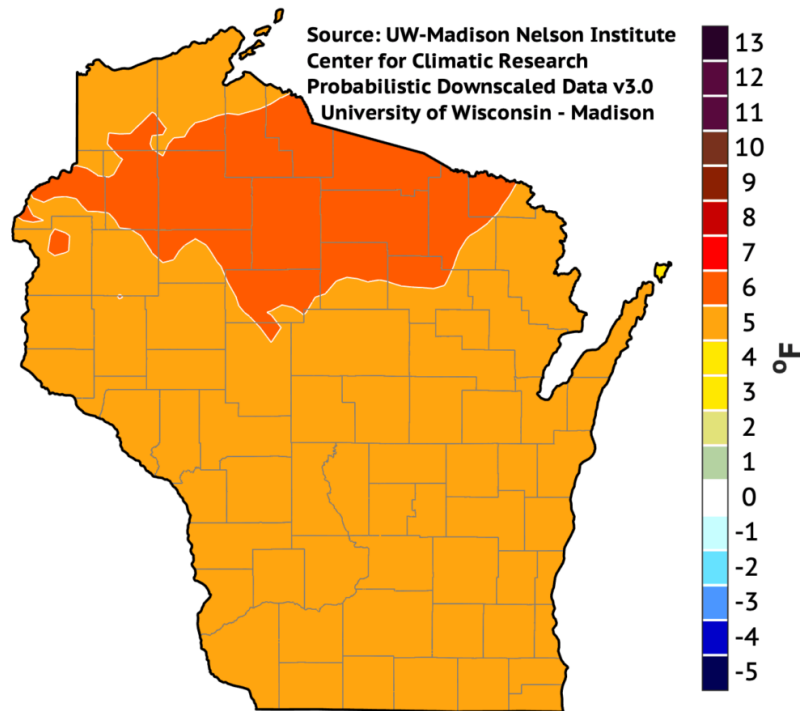
# WI Rainfall Project

- Updated present day rainfall statistics using recent storms and alternative methods.
  - Better reflect **recent** and **current** rainfall patterns
- Future** rainfall statistics using probabilistic climate model downscaling.
- Contact:** Daniel Wright,  
[DanielB.Wright@wisc.edu](mailto:DanielB.Wright@wisc.edu)

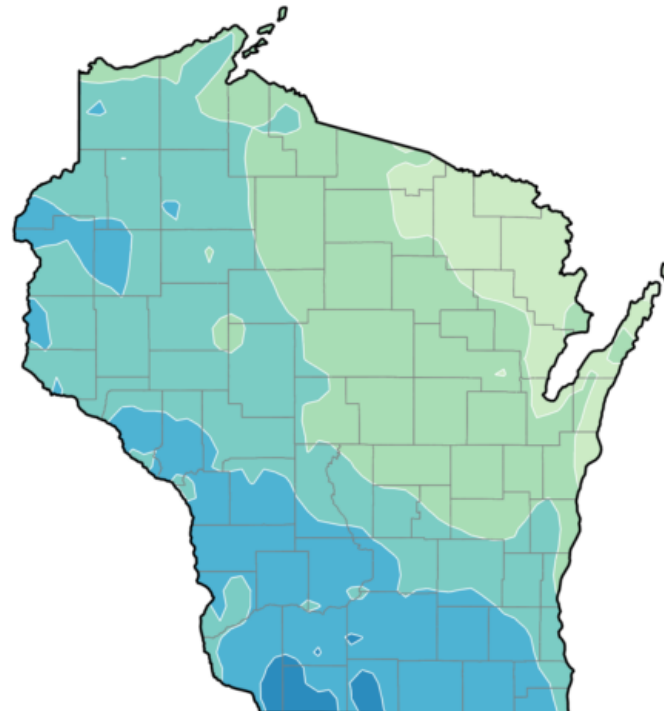


# Future Projections – WICCI

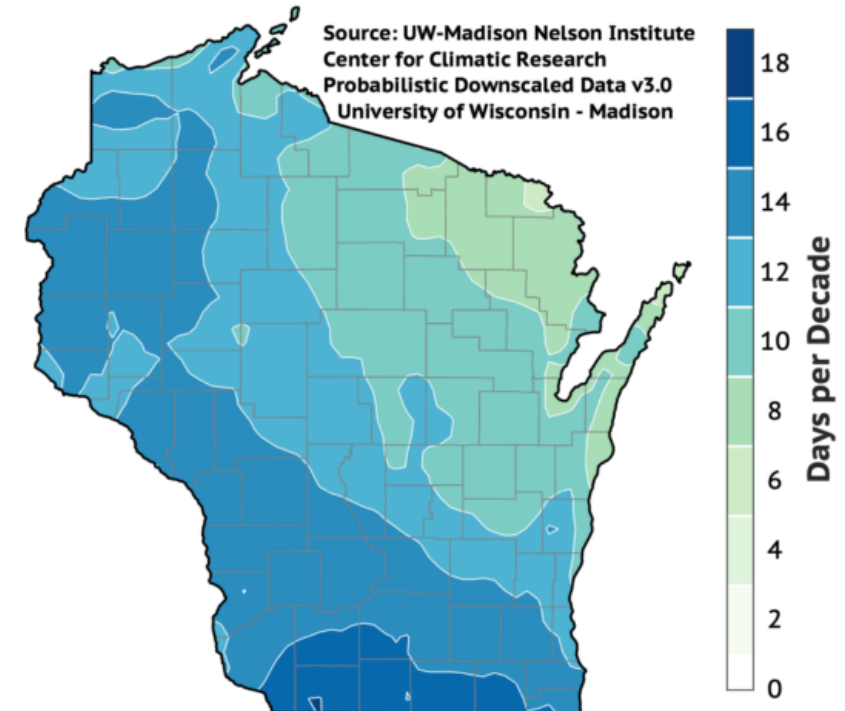
**Change in Annual TMEAN, SSP245:  
2041-2060 minus 1981-2010**



**Days per Decade with PRCP > 2in  
1981-2010 Conditions (HISTORICAL)**



**Days per Decade with PRCP > 2in  
2041-2060 Conditions (SSP245)**



Maps recently updated in Fall 2024 with CMIP6 climate projections. Provided by Dan Vimont, UW-Madison.

[Trends and Projections | Wisconsin Initiative on Climate Change Impacts \(WICCI\)](#)

Past

Present

Future

# Future Projections – WICCI



- GIS datasets currently available for last modeling update (2021)
- Updated GIS data for 2024 CMIP6 projections coming very soon!
- GIS datasets provided by Eric Compas, UW-Whitewater

GIS Data: [GeoData@Wisconsin](https://geodata.wisconsin.gov/)

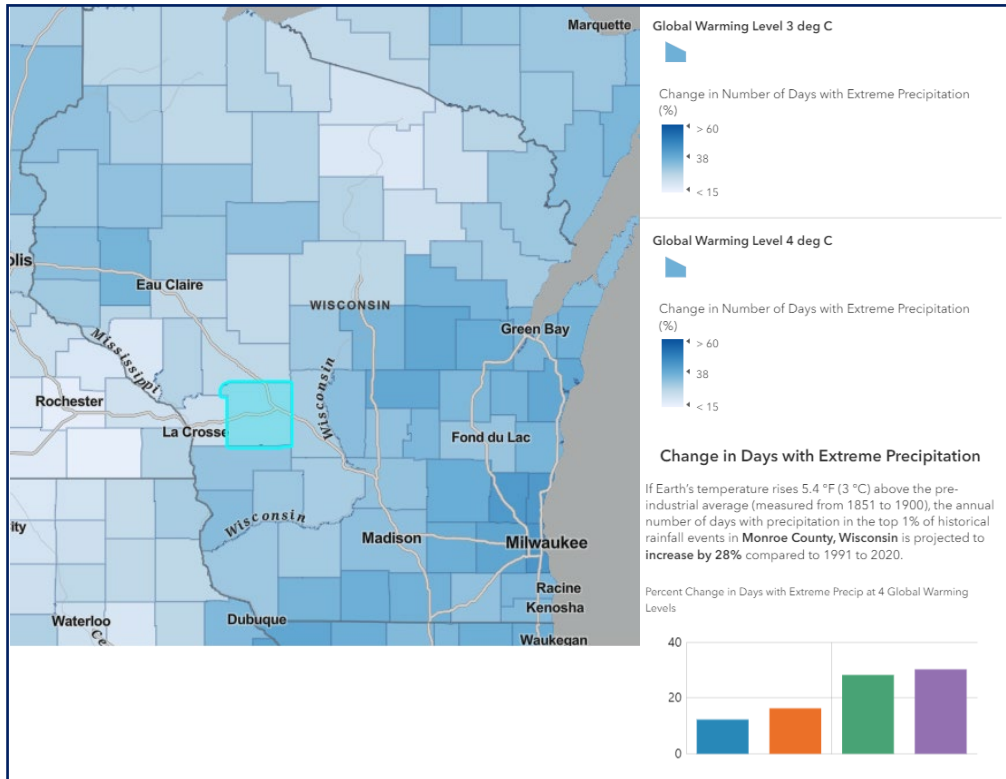
Tutorial: [State Cartographer's Office](https://statecartographer.wisconsin.gov/)

The screenshot shows the 'STATE CARTOGRAPHER'S OFFICE' website with the 'GeoData@Wisconsin' logo. A search bar is at the top. Below it, filters are applied: 'Collection > Climate' and 'Created By > Dr. Eric Compas, University of Wisconsin-Whitewater'. The 'Filter your search:' section shows 'Collection' with 'Climate' selected (18 results), 'Coastal' (18 results), and 'Statewide' (18 results). 'Created By' shows 'Dr. Eric Compas, University of Wisconsin-Whitewater' (18 results). 'Held By' shows 'UW-Madison Robinson Map Library' (18 results). The results list shows 1 - 18 of 18 items, with the first four items listed:

1. Modeled Historical Monthly Precipitation Metrics, Wisconsin 1981-2010. 1981-2010. Dr. Eric Compas, University of Wisconsin-Whitewater. This raster dataset contains a simp by the Wisconsin Initiative on Climate Change ...
2. Modeled Historical Monthly Temperature Metrics, Wisconsin 1981-2010. 1981-2010. Dr. Eric Compas, University of Wisconsin-Whitewater. This raster dataset contains a simp by the Wisconsin Initiative on Climate Change ...
3. Modeled Monthly Precipitation Metrics (RCP 4.5), Wisconsin 2021-2040. 2021-2040. Dr. Eric Compas, University of Wisconsin-Whitewater. This raster dataset contains a simp data produced by the Wisconsin Initiative on Cli...
4. Modeled Monthly Precipitation Metrics (RCP 4.5), Wisconsin 2041-2060. 2041-2060. Dr. Eric Compas, University of Wisconsin-Whitewater. This raster dataset contains a simp data produced by the Wisconsin Initiative on Cli...

# Future Projections – National Tools

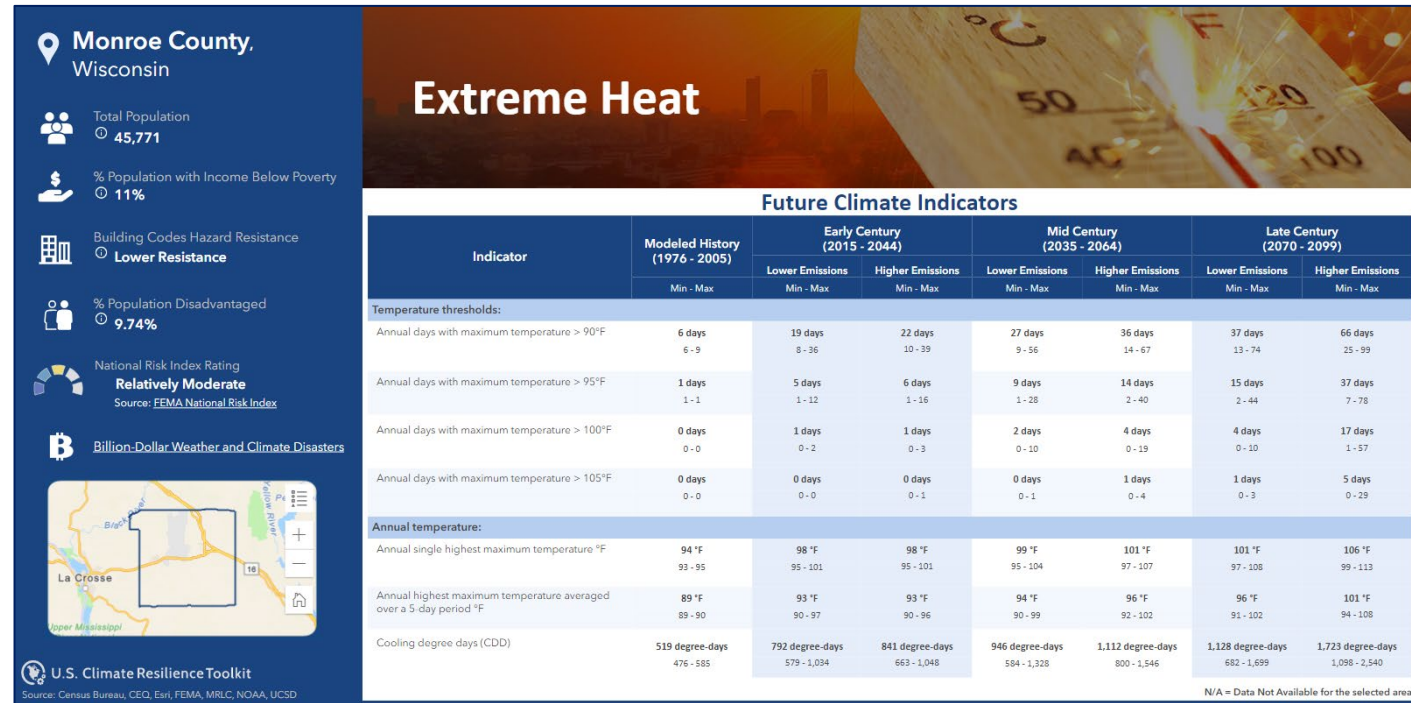
## 5<sup>th</sup> National Climate Assessment (NCA5)



Maps of 15 different climate indicators at different warming scenarios

[National Climate Assessment Interactive Atlas Explorer](#)

## Climate Mapping for Resilience & Adaptation (CMRA)



Five climate hazard categories: extreme heat, drought, wildfire, flooding, coastal inundation at low and high emissions scenarios

[CMRA - Climate Mapping For Resilience and Adaptation](#)

# **Planning, Designing, and Building Climate Resilient Water Infrastructure**

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# What do we mean by "climate resilience?"

*American Society of Civil Engineers:*

- Resilience is the “ability to plan, prepare for, mitigate, and adapt to changing conditions from hazards to enable rapid recovery of physical, social, economic, and ecological infrastructure.”

# What do we mean by "climate resilience?"

*Union of Concerned Scientists:*

- “...successfully coping with and managing the impacts of climate change while preventing those impacts from growing worse”

# What do we mean by "climate resilience?"

*Wisconsin DNR:*

- “Community resilience” refers to the ability of tribal nations, counties and municipalities to effectively respond to climate-driven disasters, anticipate climate change impacts, and adjust infrastructure investments and management approaches for future conditions.”

# Where local government & wastewater utilities can (and should!) consider climate resilience:

- Wastewater, drinking water, stormwater infrastructure:
  - Capital improvement plans
  - Facility plans / project plans & specifications
  - Operations plans
- Comprehensive / Development / Land use plans
- Hazard mitigation plans
- Climate action plans
- Transportation plans
- County Land & Water Resource Management Plans, etc.

# Climate Resilience and Water Infrastructure

## Some climate resilience options for water utilities:

- Watershed management to reduce soil & water runoff
- Land acquisition/easement to avoid future flooding
- Water conservation & efficiency measures
- Relocate treatment and/or collection/distribution assets to avoid hazards
- Redundancy/diversification (wells, pumps, etc.)
- Energy efficiency:
  - More efficient pumps, drives, and/or treatment processes
- Backup power supply for pumping stations & treatment plants
- Renewable electrical generation



# Climate Resilience and Water Infrastructure

## Resilience funding resources:

- WI water infrastructure funding ([dnr.wisconsin.gov/aid/EIF.html](https://dnr.wisconsin.gov/aid/EIF.html)):
  - *Clean Water Fund Program* (wastewater & stormwater)
  - *Safe Drinking Water Loan Program* (drinking water)
- ~~FEMA Building Resilient Infrastructure & Communities program:~~
  - ~~<https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities>~~
- WI's *Pre-Disaster Flood Resilience Grant Program*:
  - <https://wem.wi.gov/pre-disaster-flood-resilience-grant-fact-sheet/>
- WI's *Municipal Flood Control Grant Program*:
  - <https://dnr.wisconsin.gov/aid/MunFloodControl.html>

# Technical Assistance Opportunities

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# DNR Water Infrastructure Technical Assistance

## DNR Staff Technical Assistance Providers

- <https://dnr.wisconsin.gov/sites/default/files/topic/Aid/loans/BILfundingOutreachTAcontacts.pdf>
  - Wastewater – <position vacant>
  - Stormwater – Matt Kaelin
  - Agricultural Nonpoint Source Runoff – Laura James
  - Climate Resilience – Ezra Meyer
  - Healthy Watersheds/High Quality Waters – Lauren Haydon
  - Wastewater Plan Review – Ben Wacker, Sawyer Dobson, Santos Quispe
  - Drinking & Groundwater – Elaine Meier and Olivia Fronmueller
- Loan Support – Program Coordinators and Loan Project Managers
  - <https://dnr.wisconsin.gov/aid/documents/EIF/Guide/managers.html>

# EPA Water Infrastructure Technical Assistance

## Help for Your Community:

- Cybersecurity
- Climate Resilience
- Training
- Planning
- Decision Making
- Develop Funding Applications
- Address Capacity Needs
- Operator Certification



- Contact [WaterTA@epa.gov](mailto:WaterTA@epa.gov)
- Region 5 - Form

<https://www.epa.gov/water-infrastructure/water-technical-assistance-waterta>

# CONNECT WITH US

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Climate Resilience Outreach Specialist

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608-896-2456



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@WI\_DNR



/WIDNRTV



"WILD WISCONSIN:  
OFF THE RECORD"