

# Climate Change Impact on Wisconsin Lakes

**Julia Noordyk**

Water Quality and  
Coastal Communities

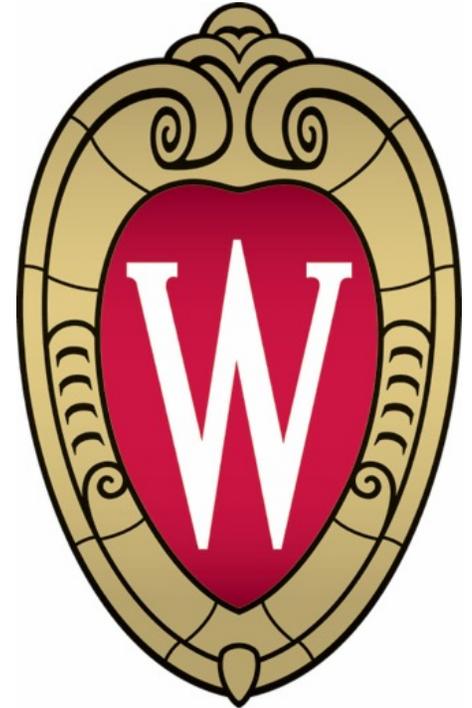
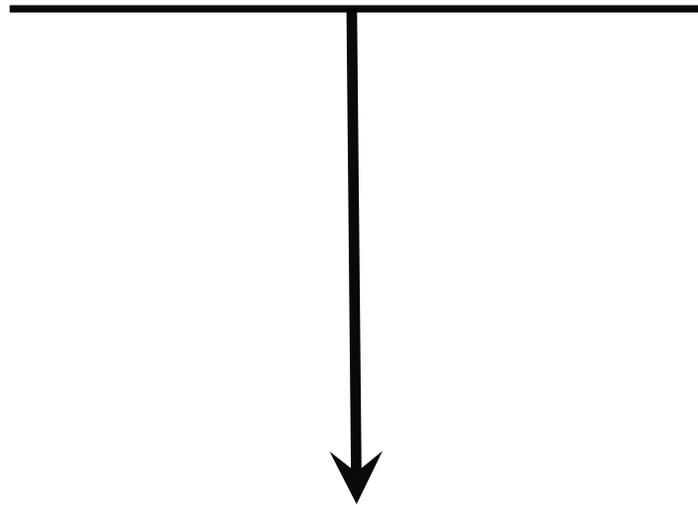
Outreach Specialist

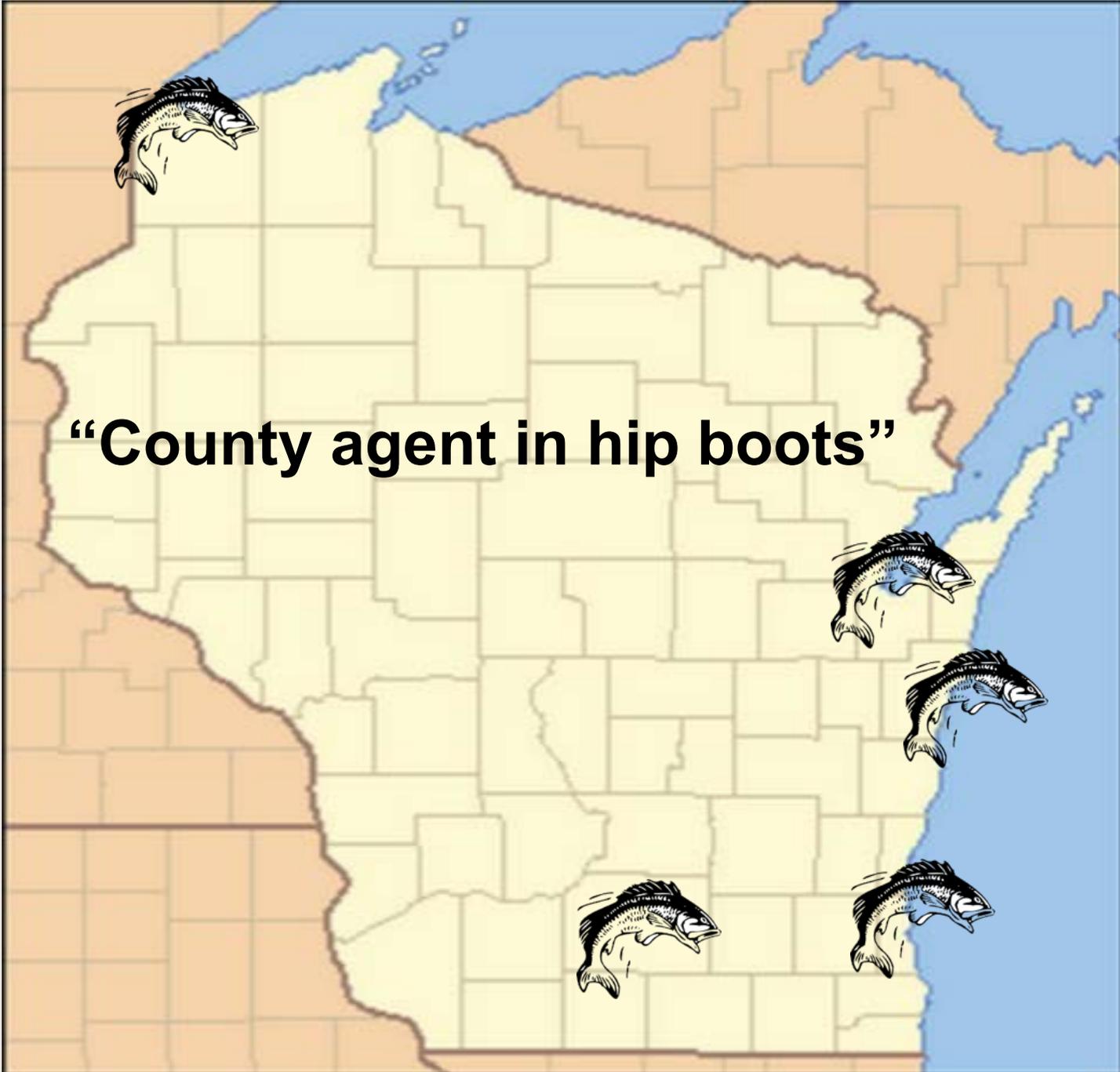
UW Sea Grant

@NoordCoast



# Sea Grant? In Wisconsin?





**“County agent in hip boots”**

# Climate vs Weather



# Climate vs Weather



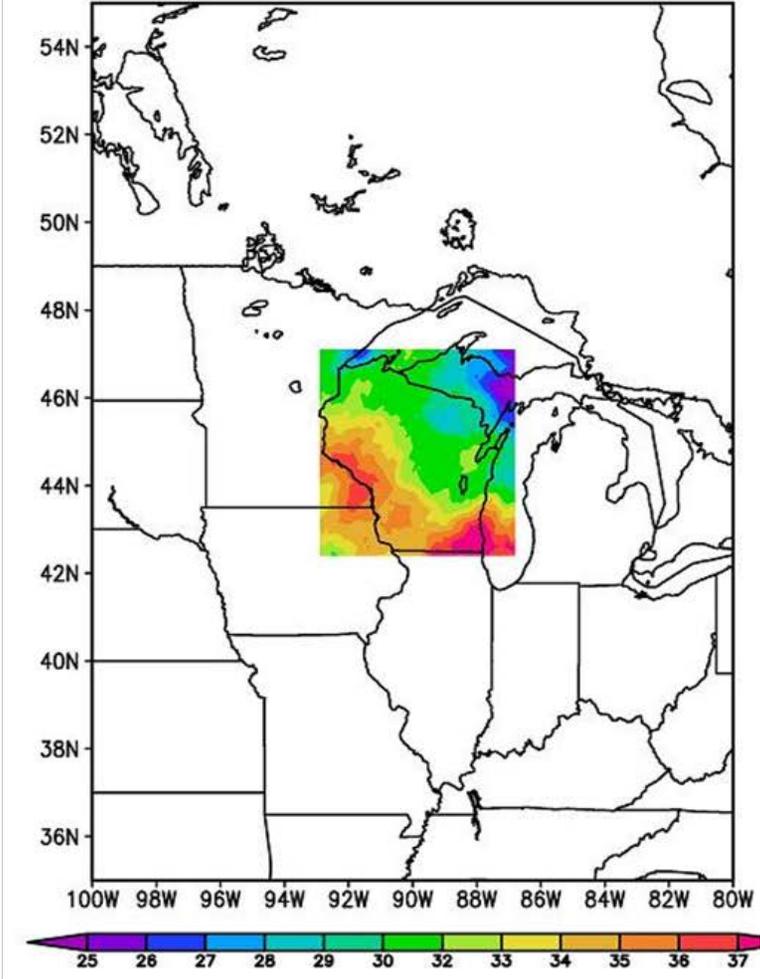
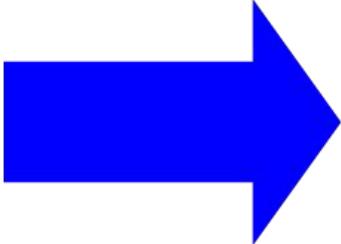
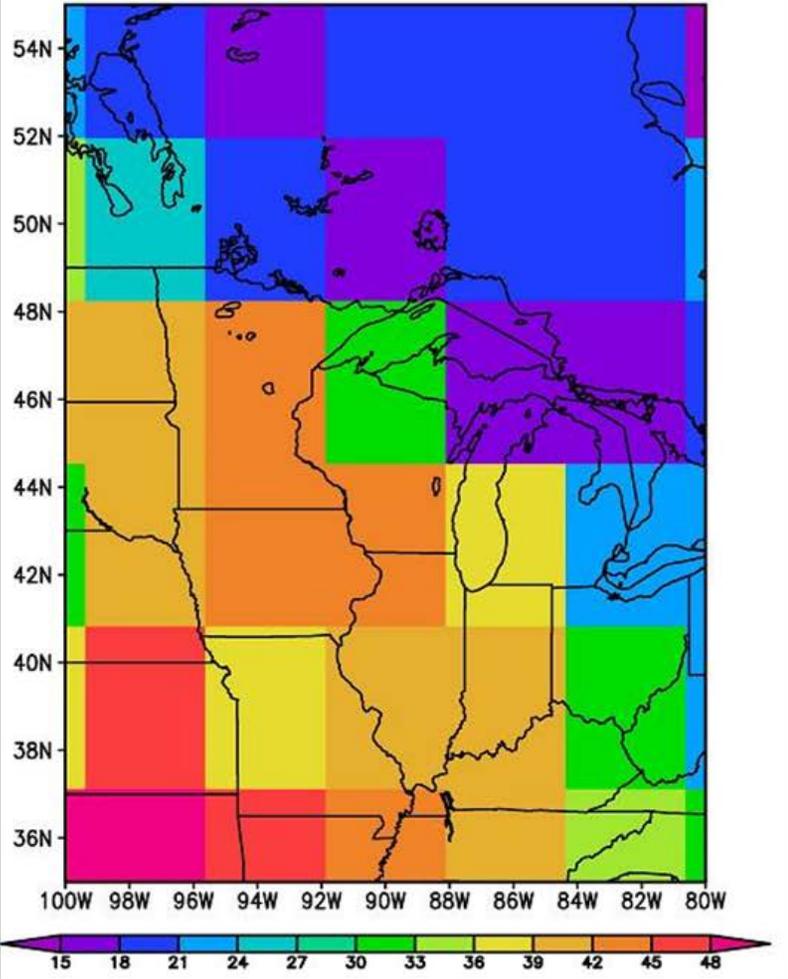
Climate is weather measured over a long period of time



WISCONSIN  
INITIATIVE ON  
CLIMATE  
CHANGE  
IMPACTS



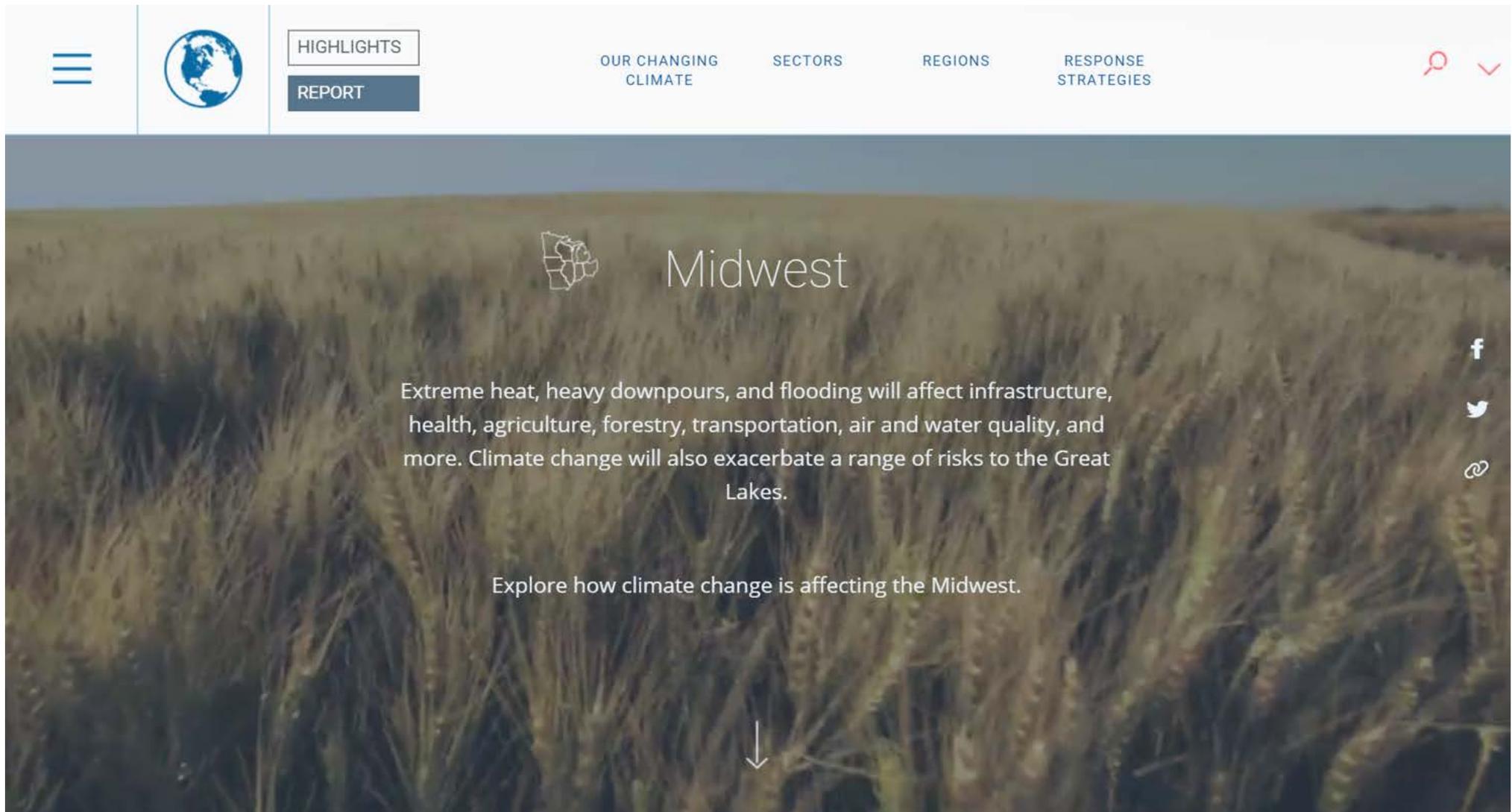
# Global projections on a scale relevant to Wisconsin



Global Climate Model

Downscaled

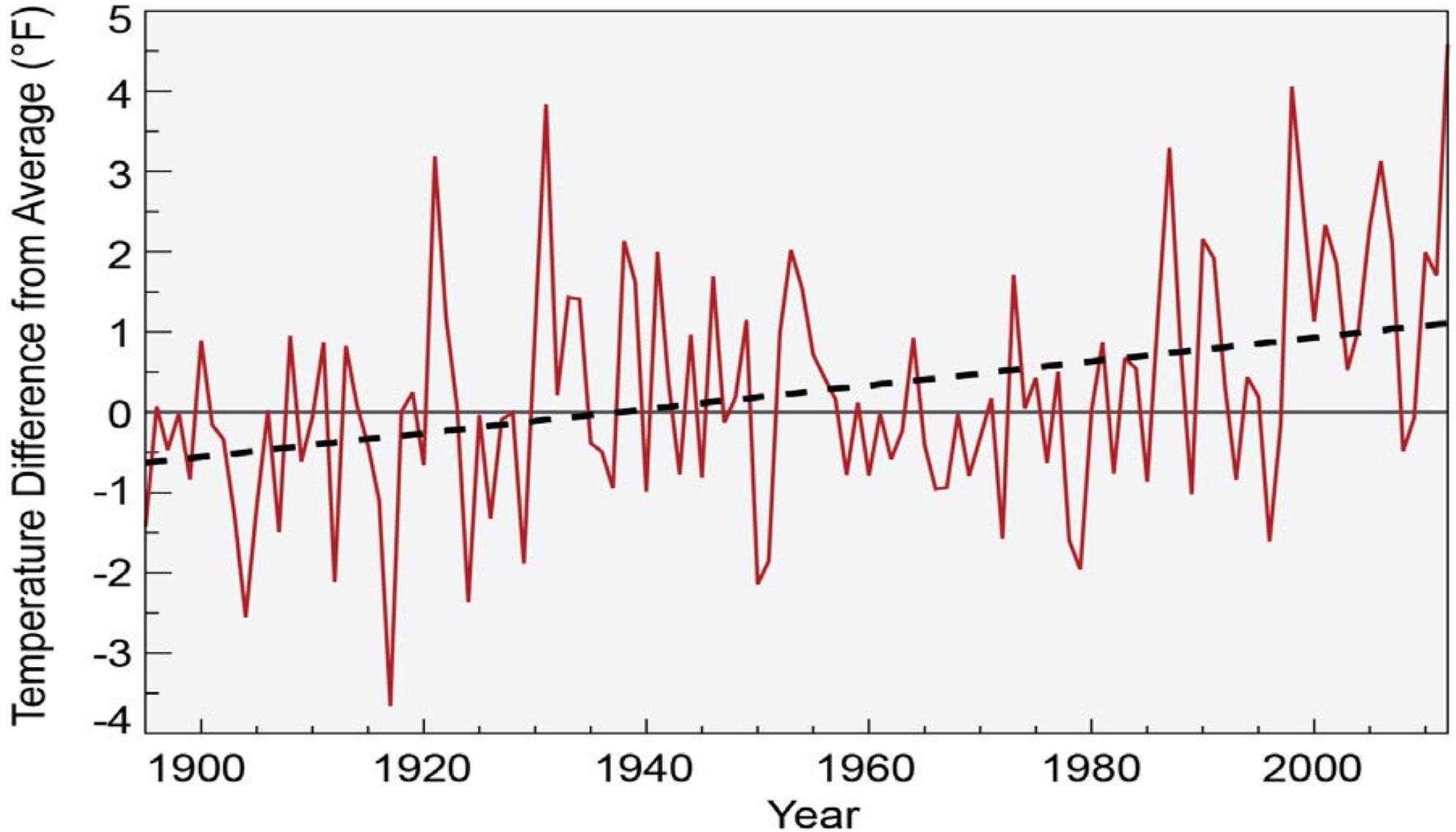
# National Climate Assessment



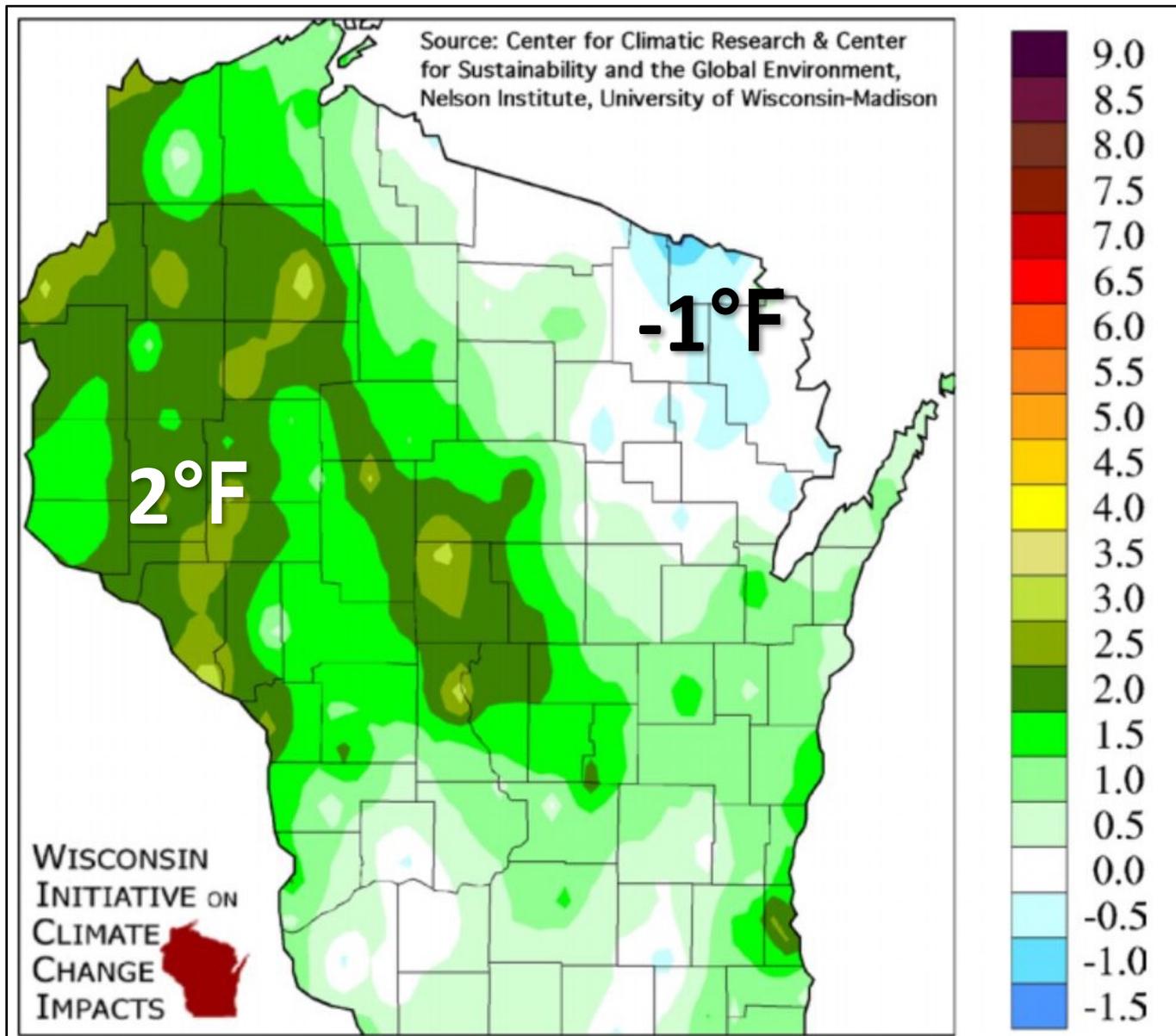
The screenshot shows the National Climate Assessment website interface. At the top, there is a navigation bar with a hamburger menu icon, a globe icon, and buttons for 'HIGHLIGHTS' and 'REPORT'. The main navigation includes 'OUR CHANGING CLIMATE', 'SECTORS', 'REGIONS', and 'RESPONSE STRATEGIES'. A search icon and a dropdown arrow are also present. The main content area features a large background image of a field of golden wheat. Overlaid on this image is a map of the Midwest region, the word 'Midwest', and a paragraph of text: 'Extreme heat, heavy downpours, and flooding will affect infrastructure, health, agriculture, forestry, transportation, air and water quality, and more. Climate change will also exacerbate a range of risks to the Great Lakes.' Below this text is a call to action: 'Explore how climate change is affecting the Midwest.' and a downward-pointing arrow. On the right side of the image, there are social media icons for Facebook, Twitter, and a link icon.

<http://nca2014.globalchange.gov/report/regions/midwest#intro-section>

# Temperatures are rising in the Midwest

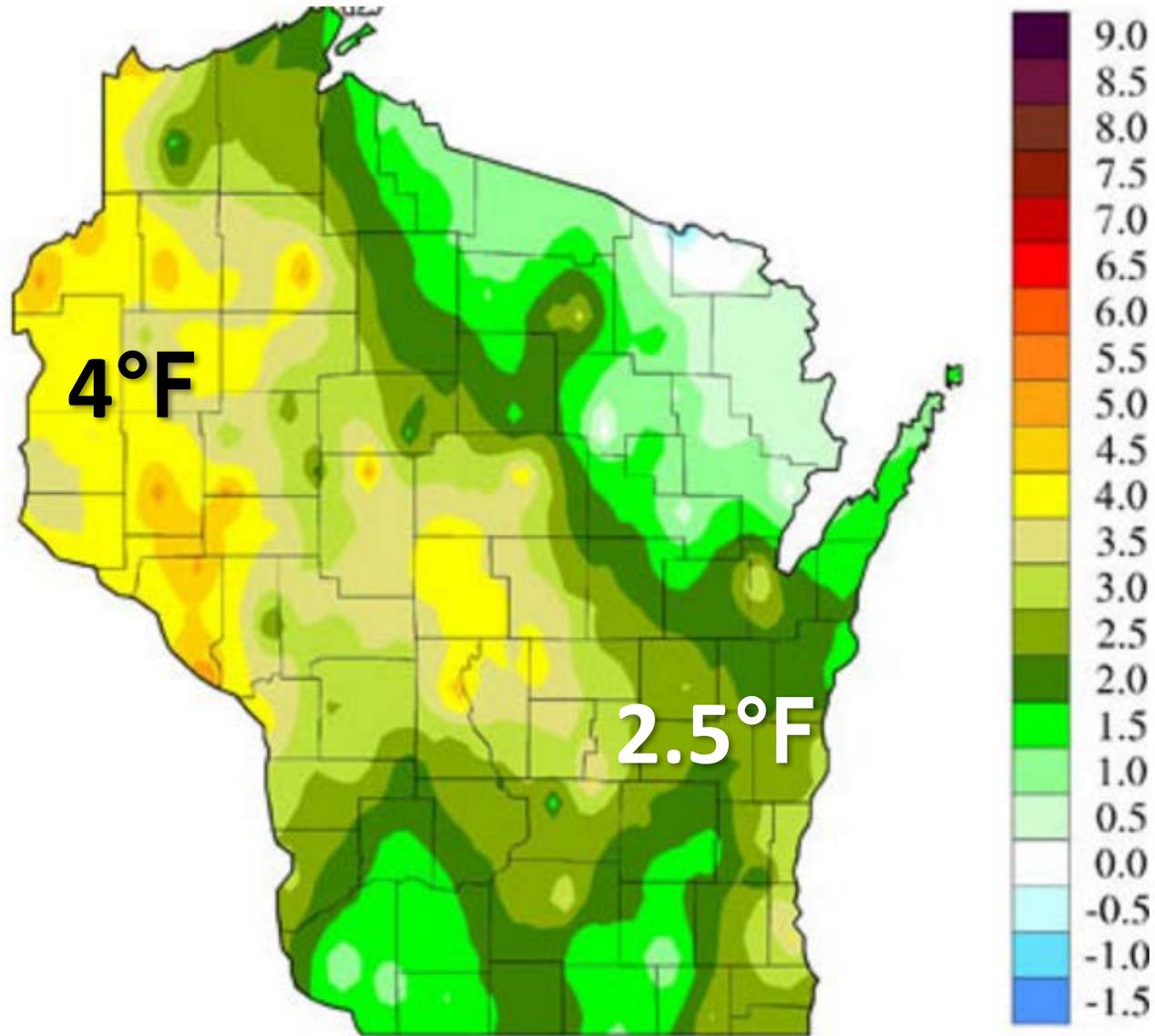


# Wisconsin's climate is changing...



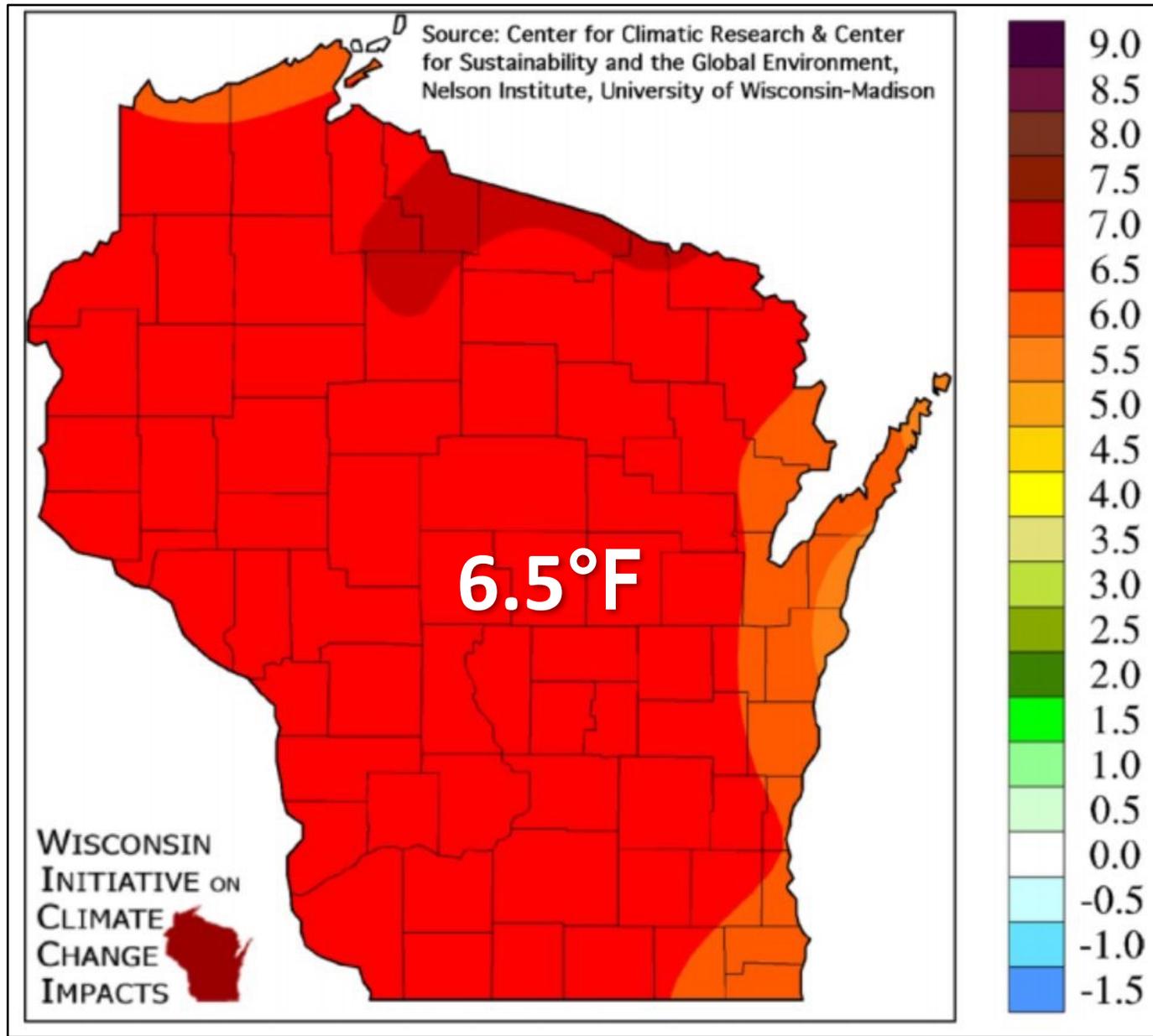
Observed Change in Annual Temperature (°F) 1950 - 2006

# Warming has been the greatest in winter



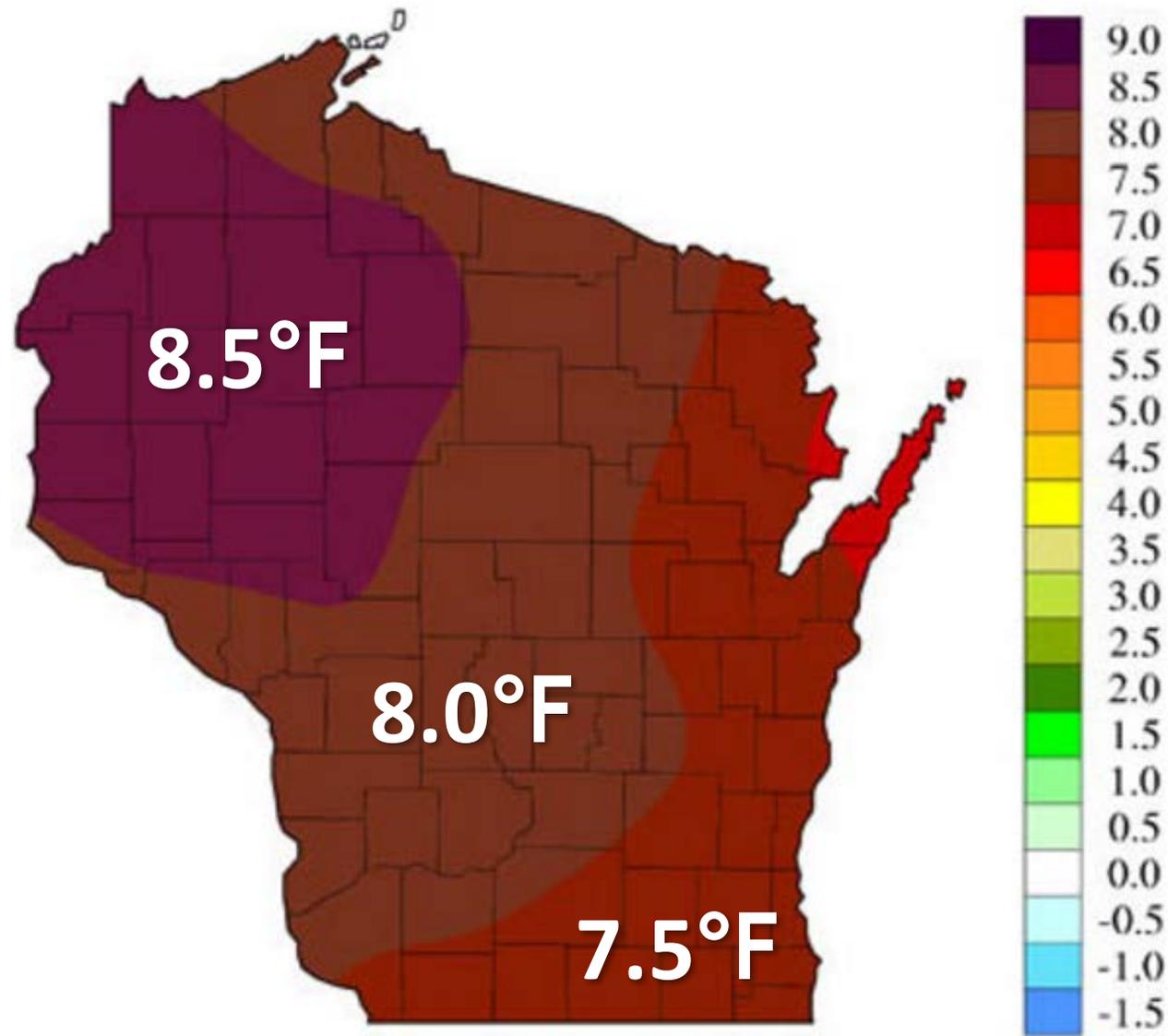
Change in Winter Average Temperature (°F) from 1950-2006

# Wisconsin's climate will continue changing...



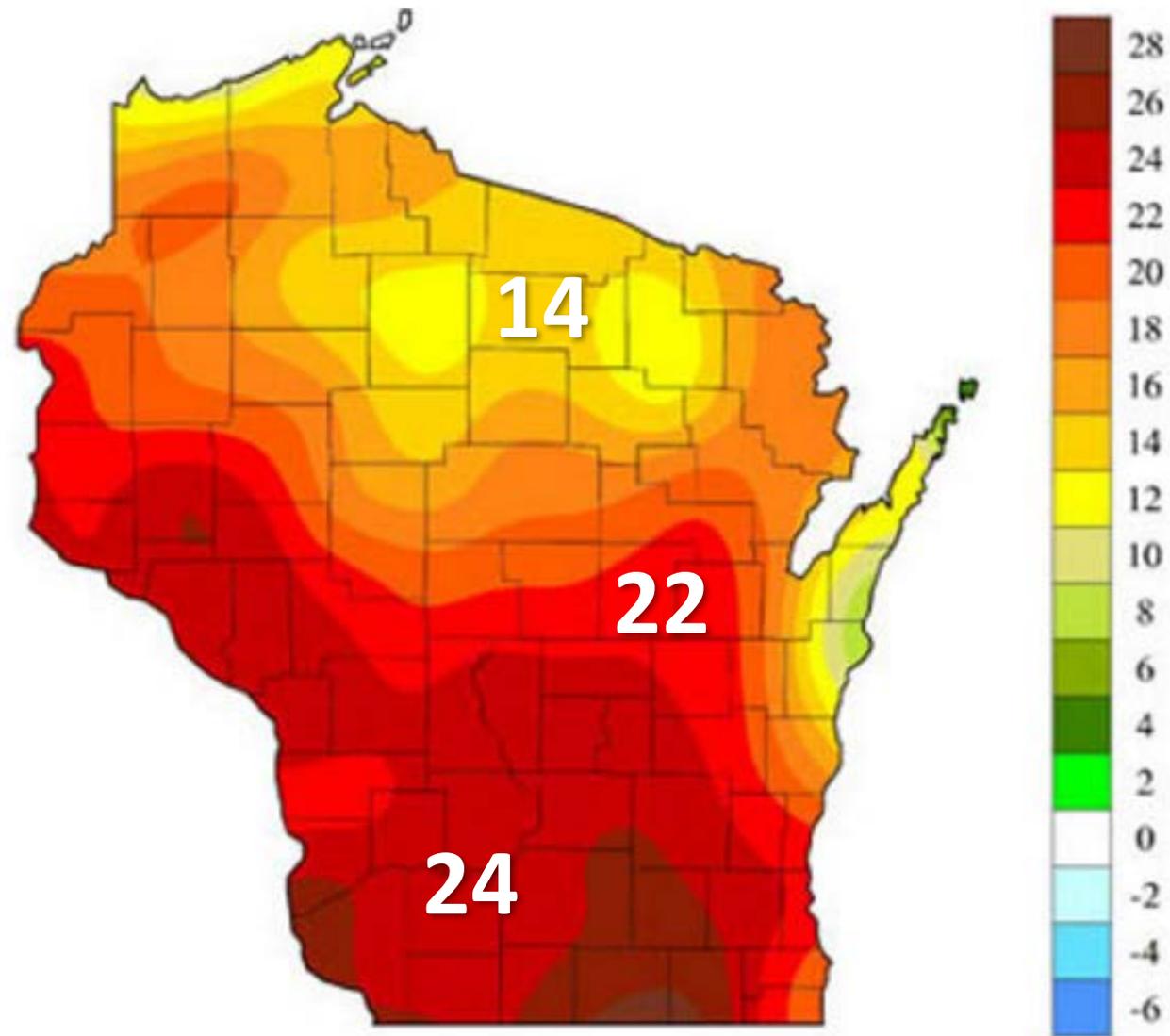
Projected Change in Annual Temperature (°F) 1980 - 2055

# Warming will be the largest in winter



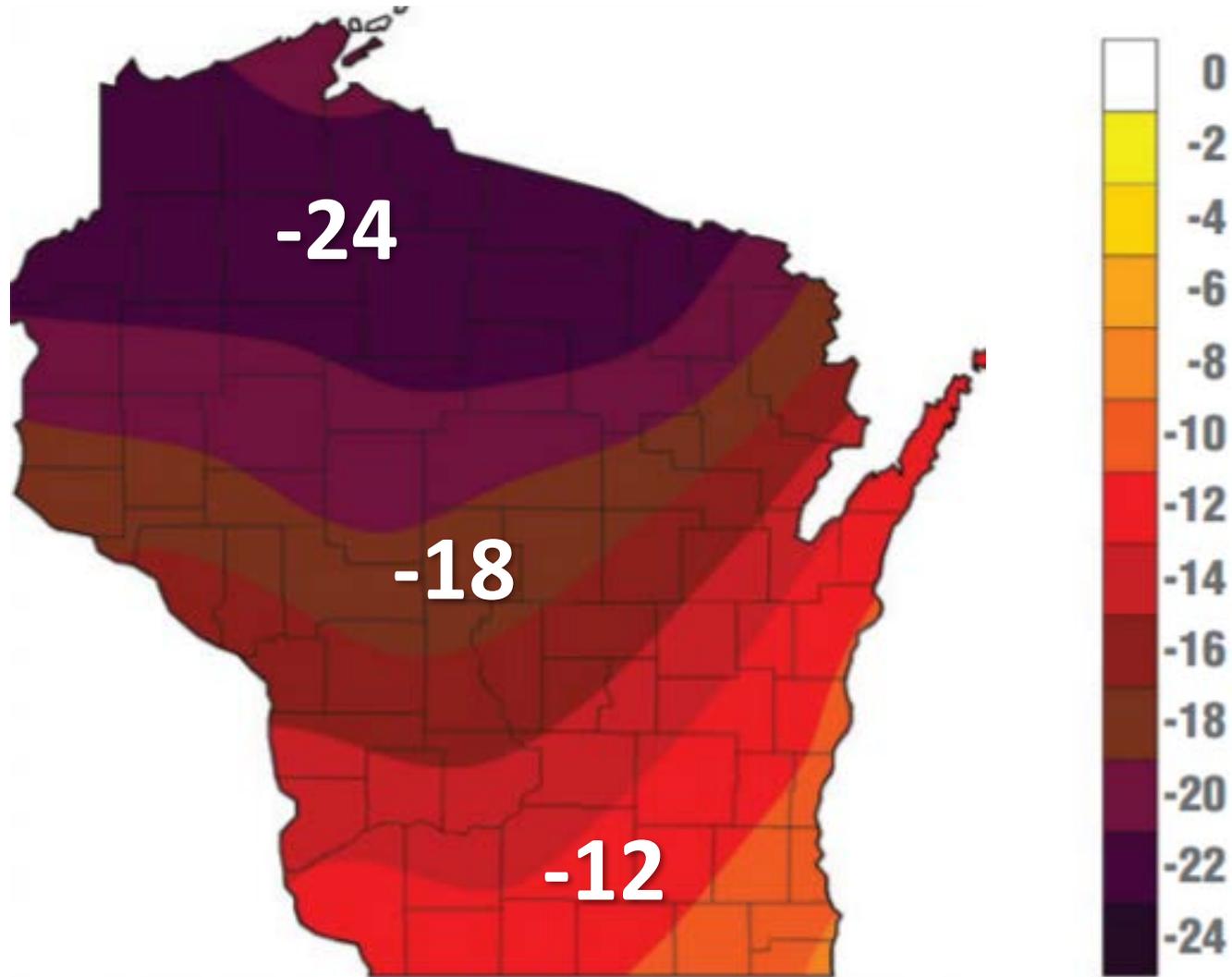
Projected Change in Winter Average Temperature (°F) from 1980 to 2055

# More hot days



Projected Change in the Frequency of 90°F Days Per Year from 1980-2055

# More warm nights

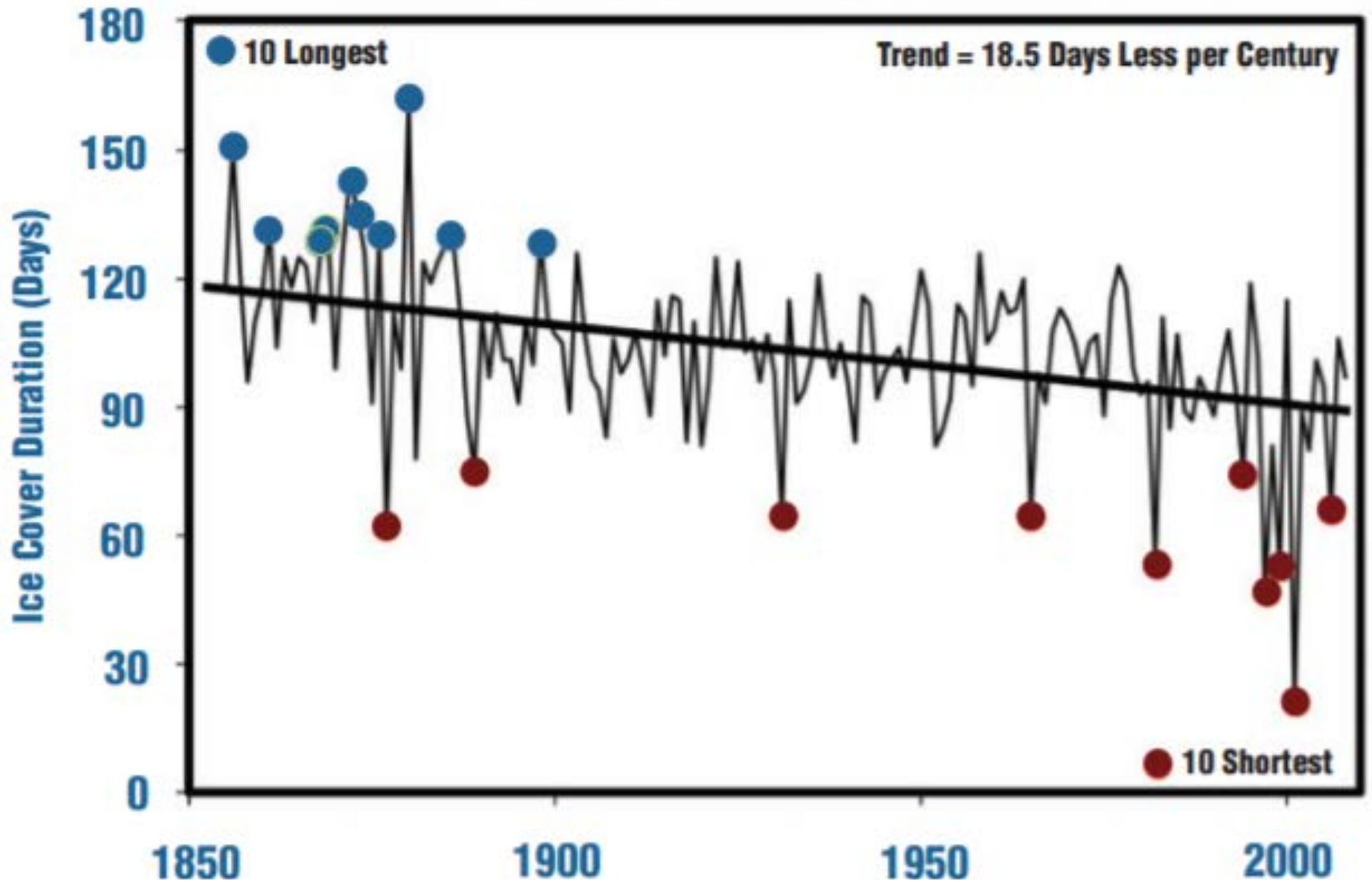


Projected change in the frequency of nights below 0°F days per year from 1980-2055

What does this mean for  
Wisconsin lakes?



# Lake Mendota ice duration



# Impact of drought on lakes

9 Feet



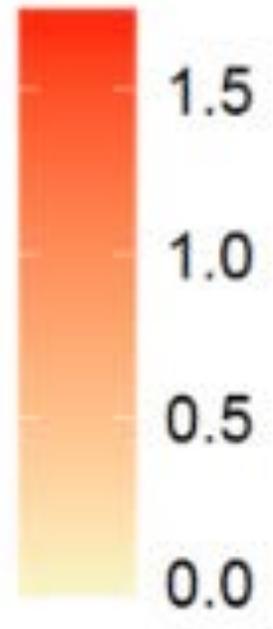
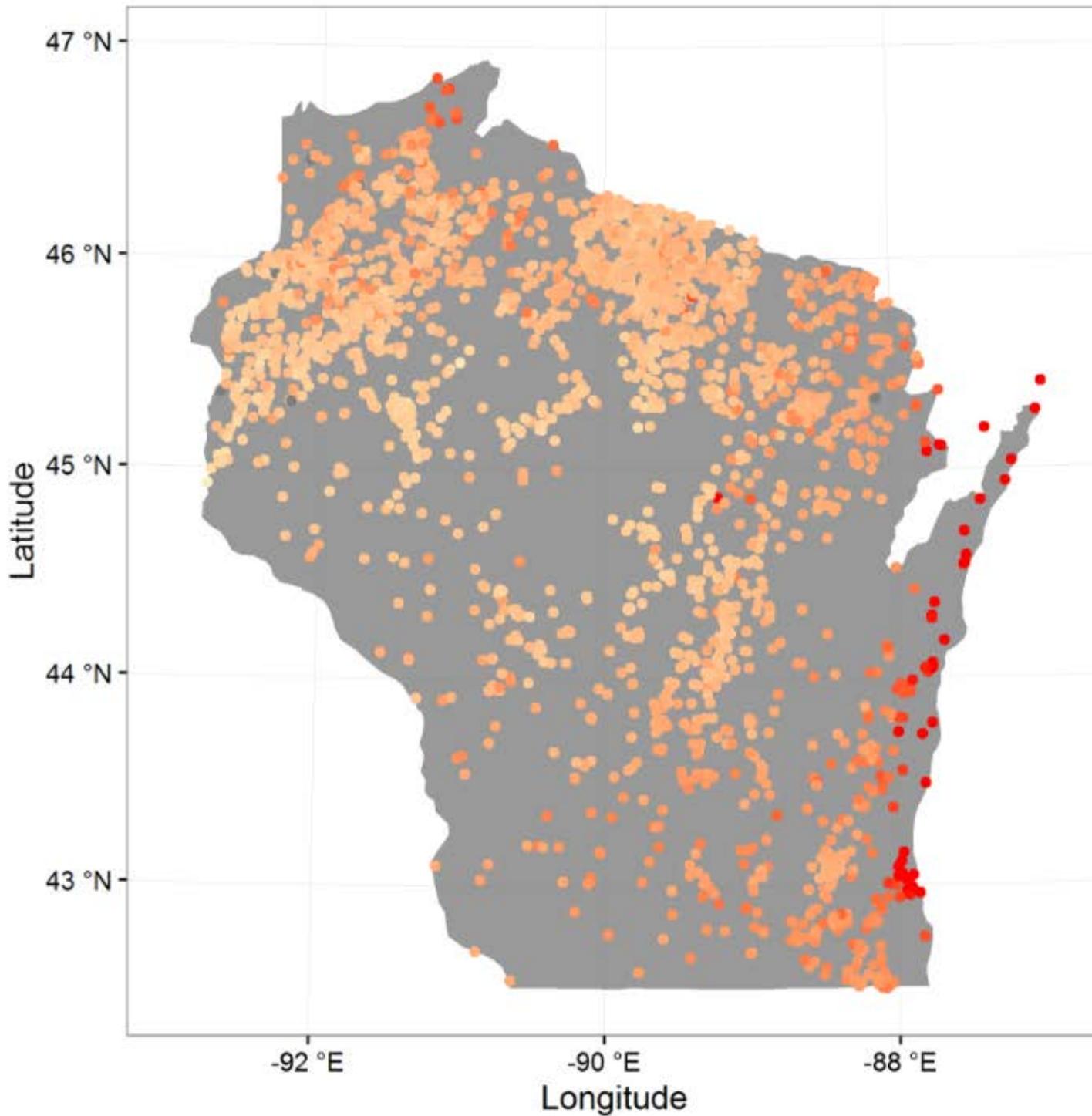
0 Feet

1936

2010

Anvil Lake, WI 1936-2010

# Lake warming since 1980 (°F)

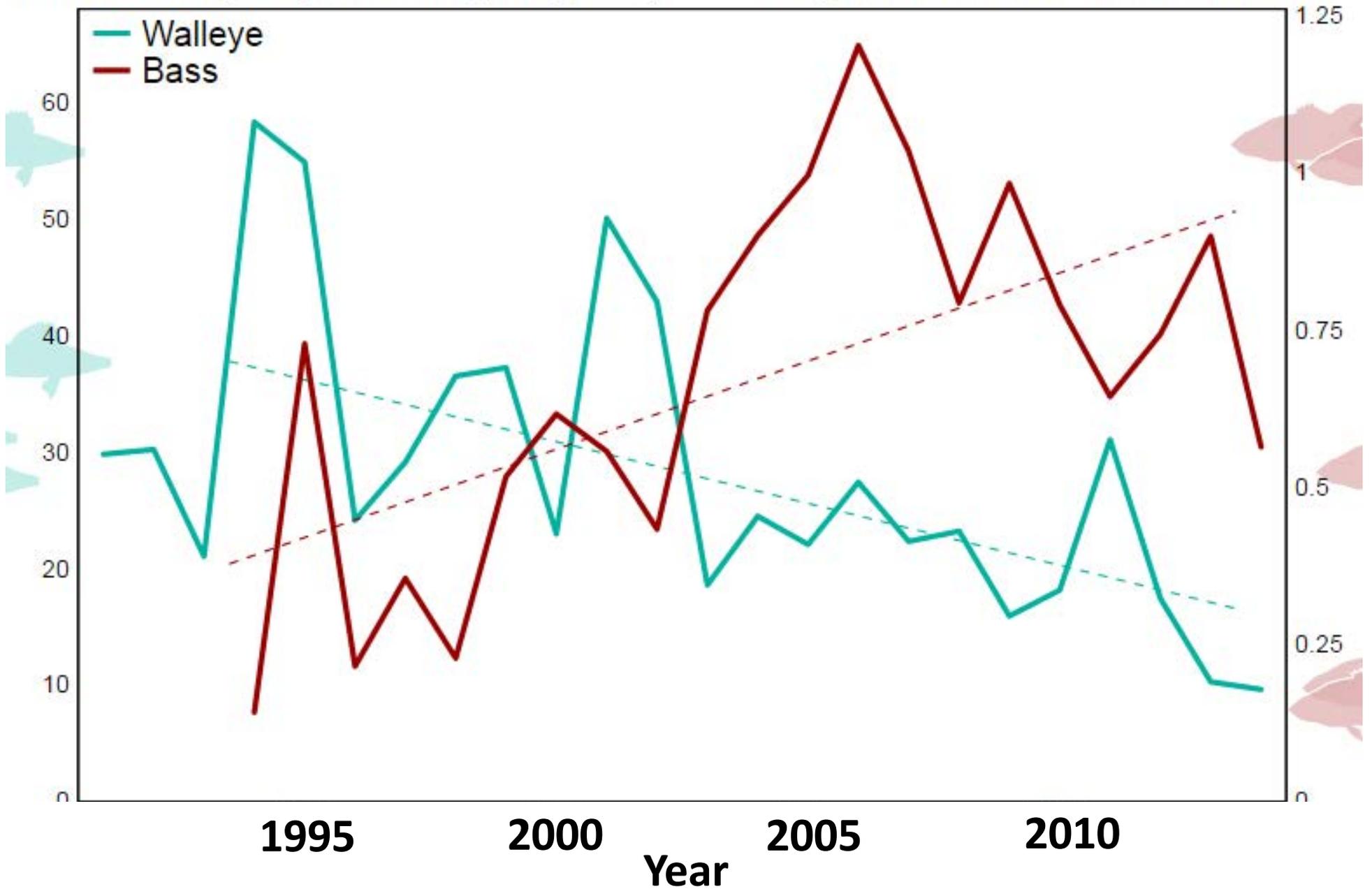


# Species composition?



# Natural walleye reproduction

# Largemouth bass relative abundance

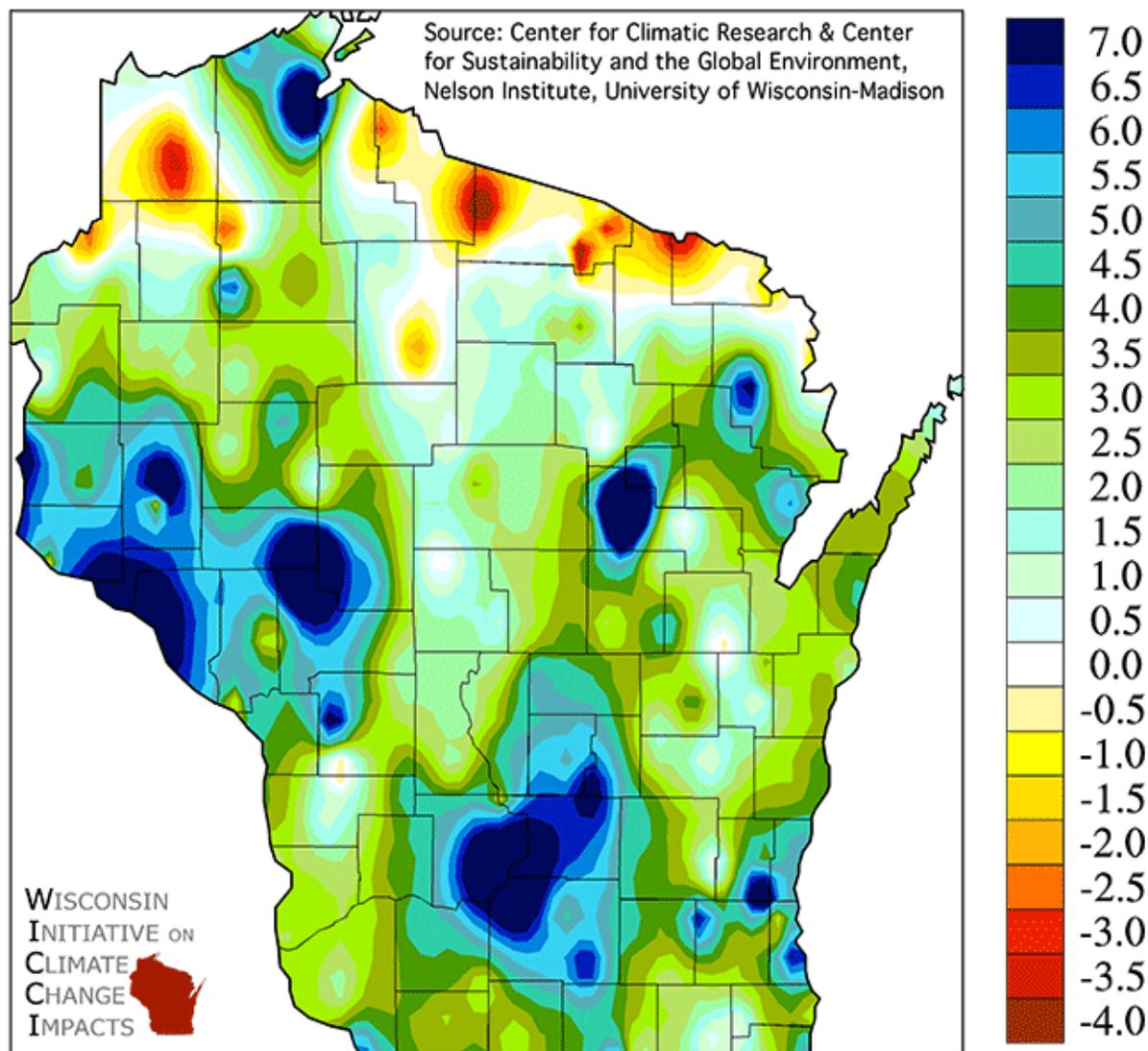


# Trout streams



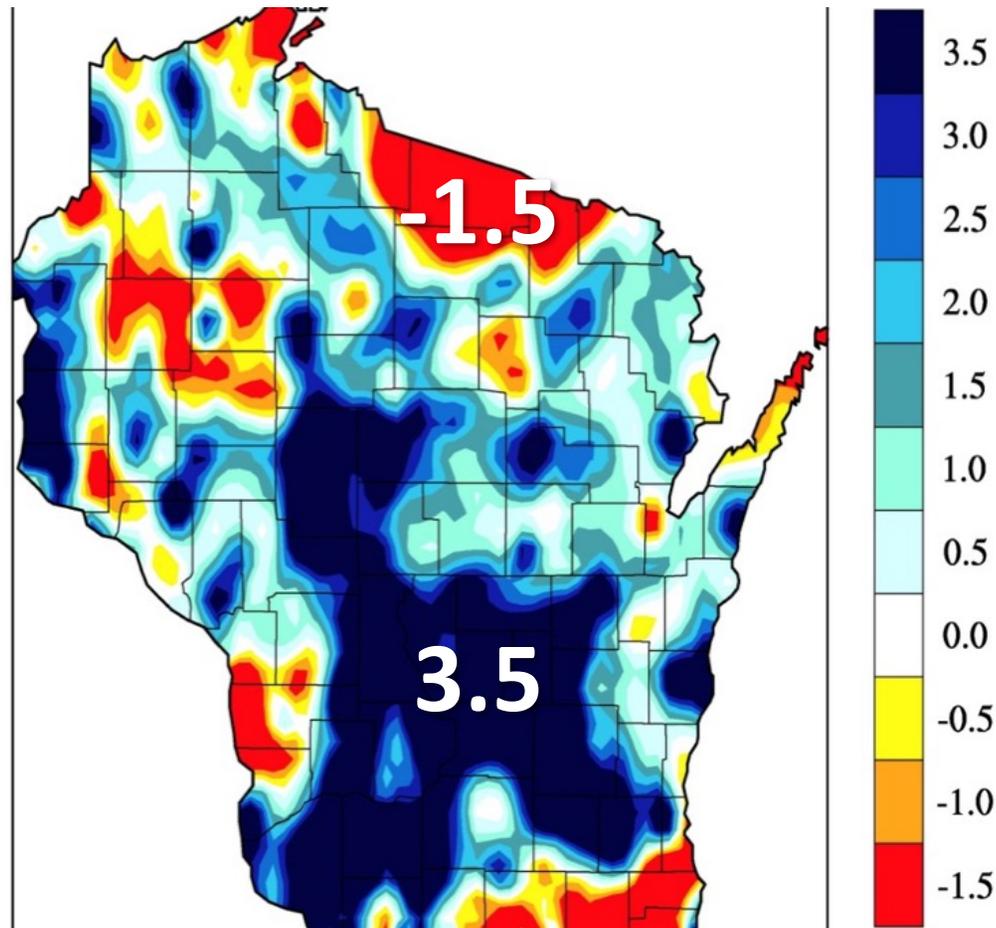
**Worst case  
+7.2°F = total loss**

# Wisconsin's Precipitation 1950-2006



**Change in annual average precipitation (inches)**

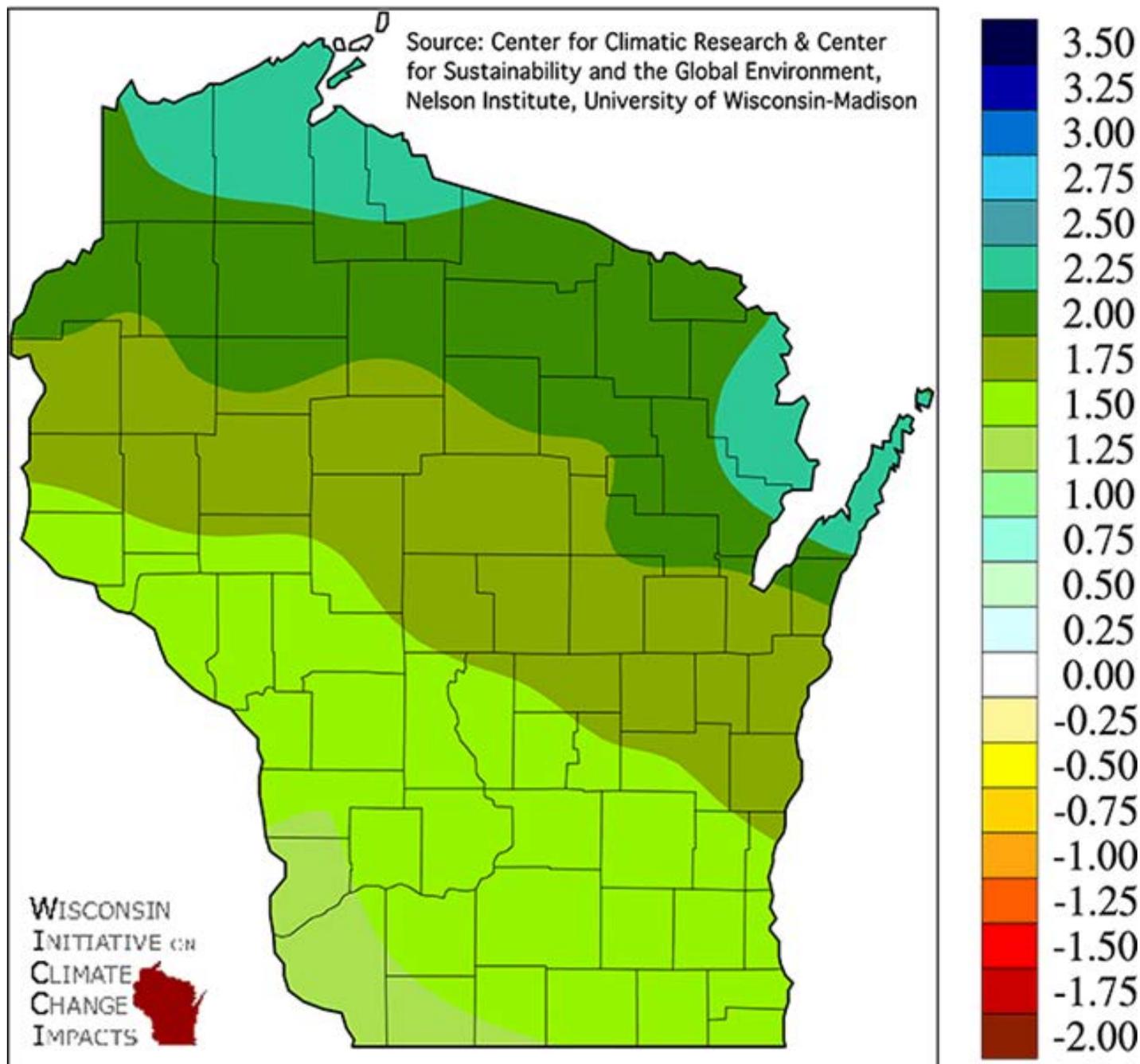
# Wisconsin's Precipitation 1950-2006



**Increase in 2" rainfalls**  
(days/decade)

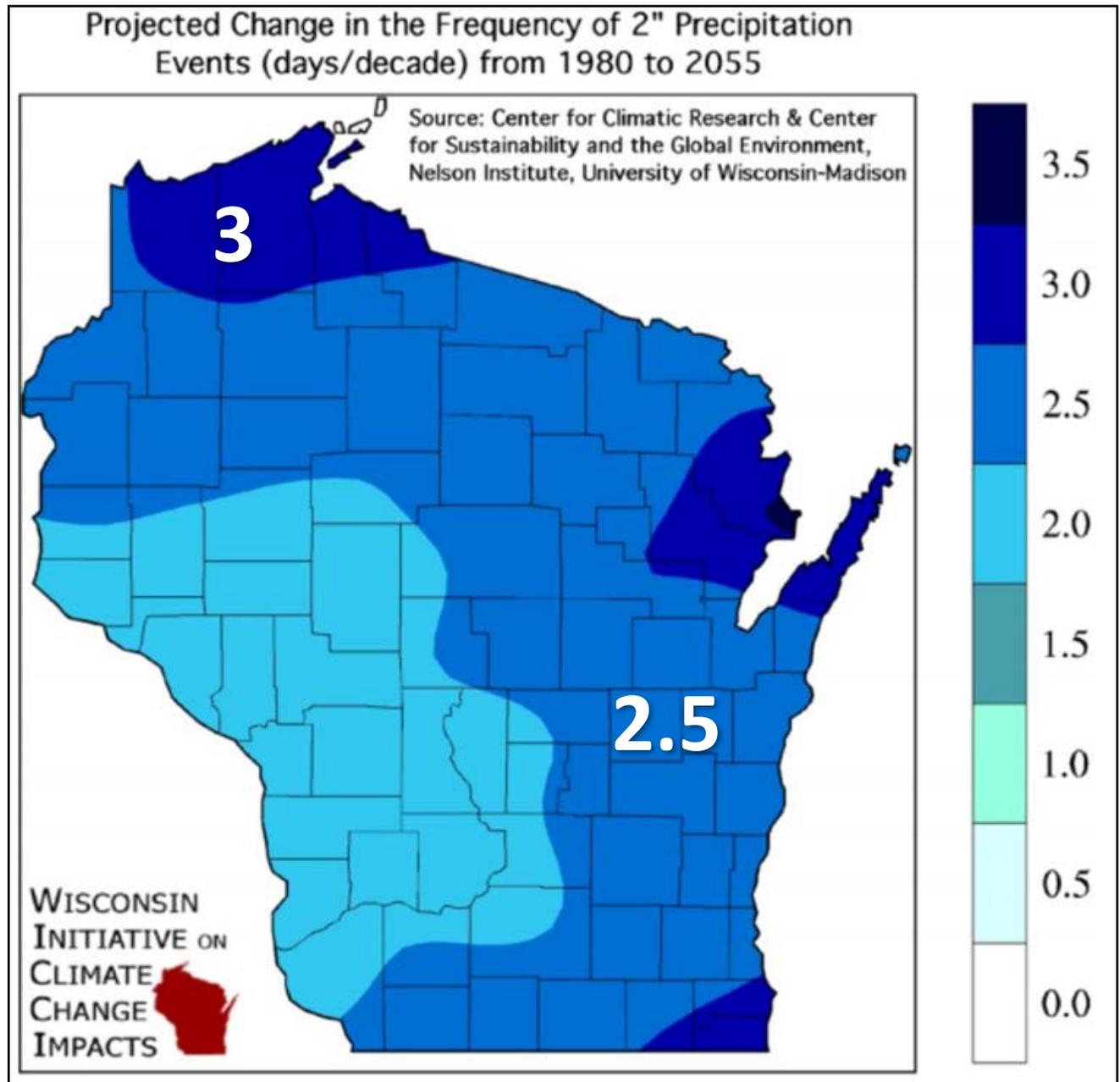
# Modest projected increase

1.25" to 2.25"  
annual increase

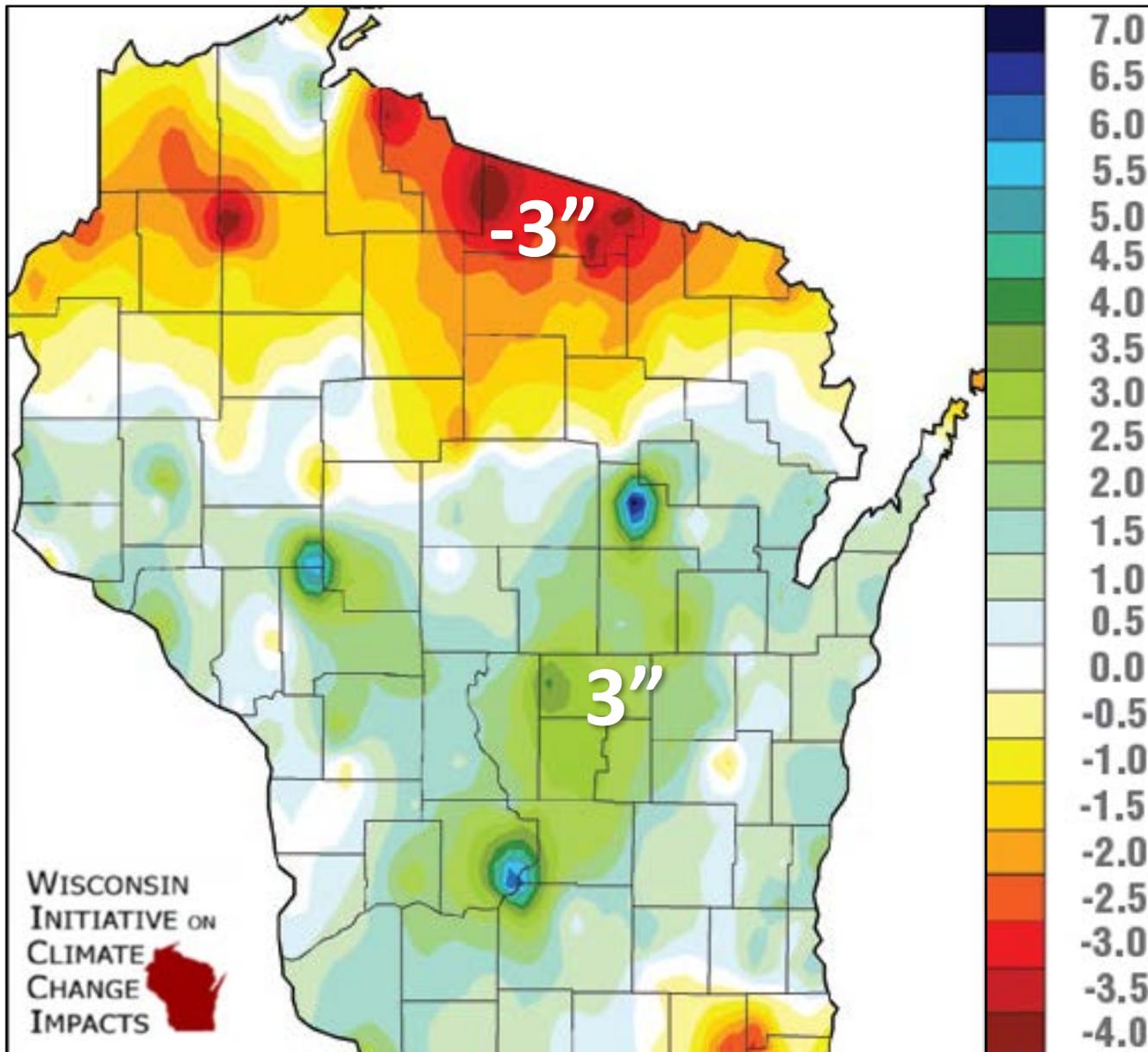


# More Large Storm Events

2-3 days more per decade of  $\geq 2''$  precipitation events



# Drier Summers



Change in Annual  
Summer  
Precipitation  
(inches)  
1950 - 2006

# Recent Significant Climate Trends in Western Great Lakes



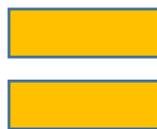
**Temperatures:** Warm winters and higher minimum temperatures



**Dewpoints:** Greater Frequency of Tropical-like atmospheric water vapor



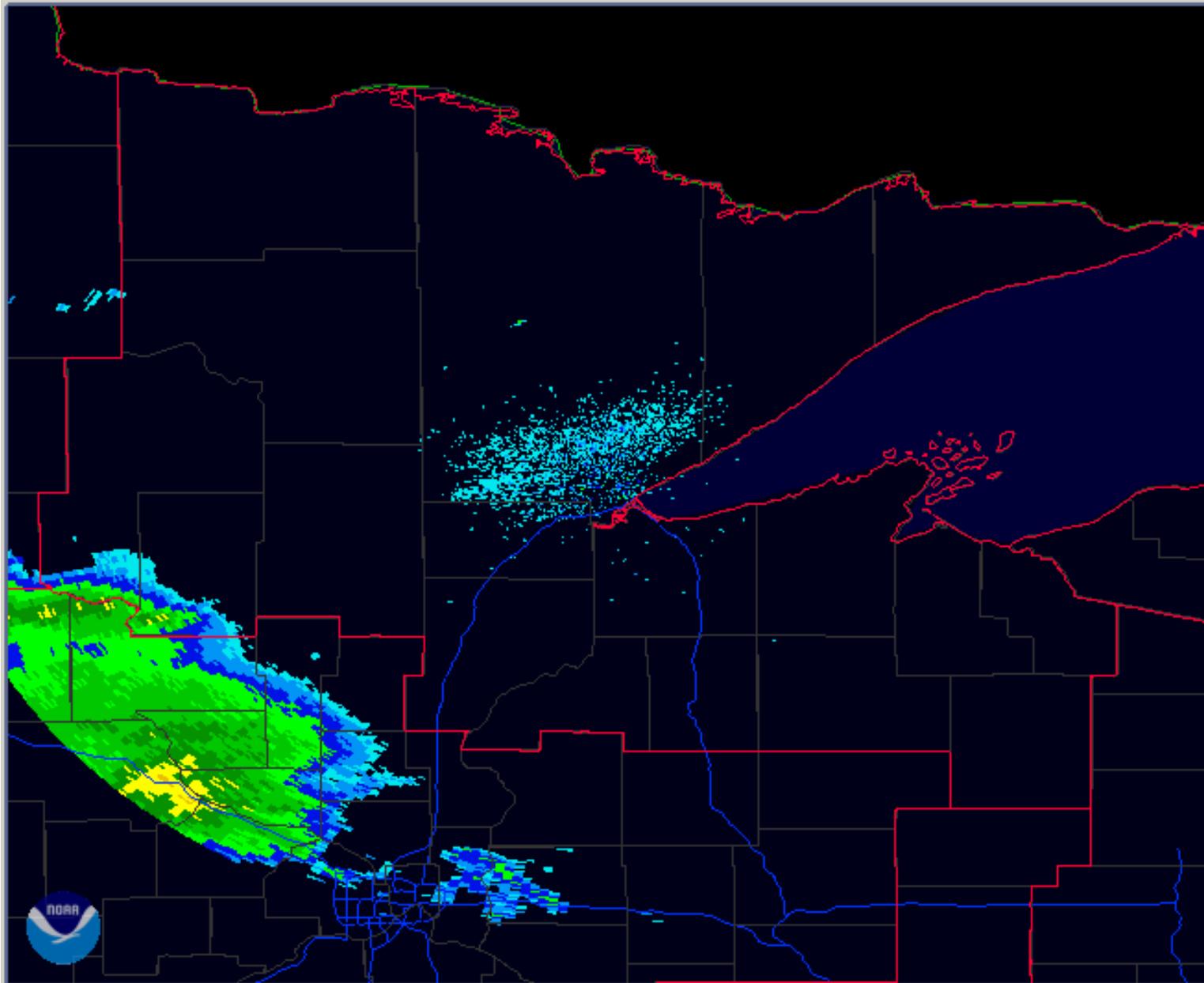
**Moisture:** Amplified precipitation signal, thunderstorm contribution



**Intense precipitation**

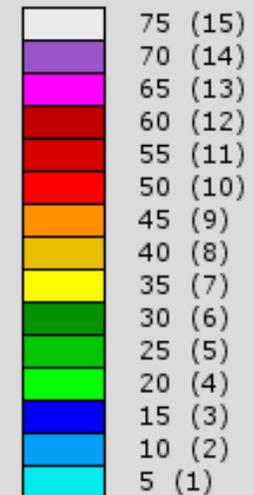
# Superior, WI

## June 19 – 20, 2012



NEXRAD LEVEL-III  
BASE REFLECTIVITY  
KDLH - DULUTH, MN  
06/19/2012 06:36:41 GMT  
LAT: 46/50/13 N  
LON: 92/12/35 W  
ELEV: 1542 FT  
MODE/VCP: A / 212  
  
ELEV ANGLE: 0.50 °  
MAX: 41 dBZ

Legend: dBZ (Category)







Hmmm...



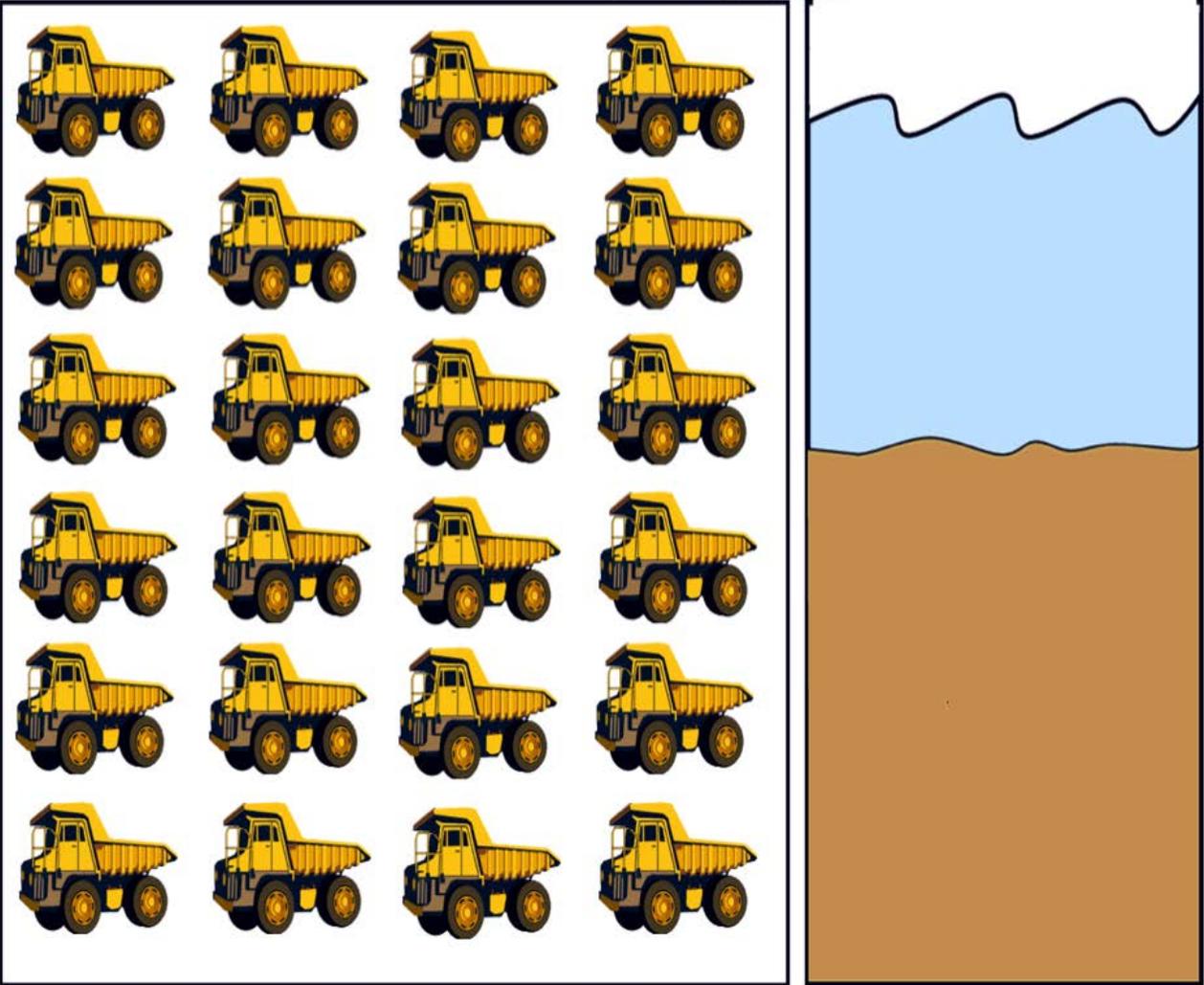
June 17<sup>th</sup>, 2012



June 24<sup>th</sup>, 2012



24 dump trucks of sediment are dumped into Green Bay per day



80% of all sediment delivered  
from the Lower Fox River  
watershed happens in 14 days



# Underwater video of an urban stormwater outfall

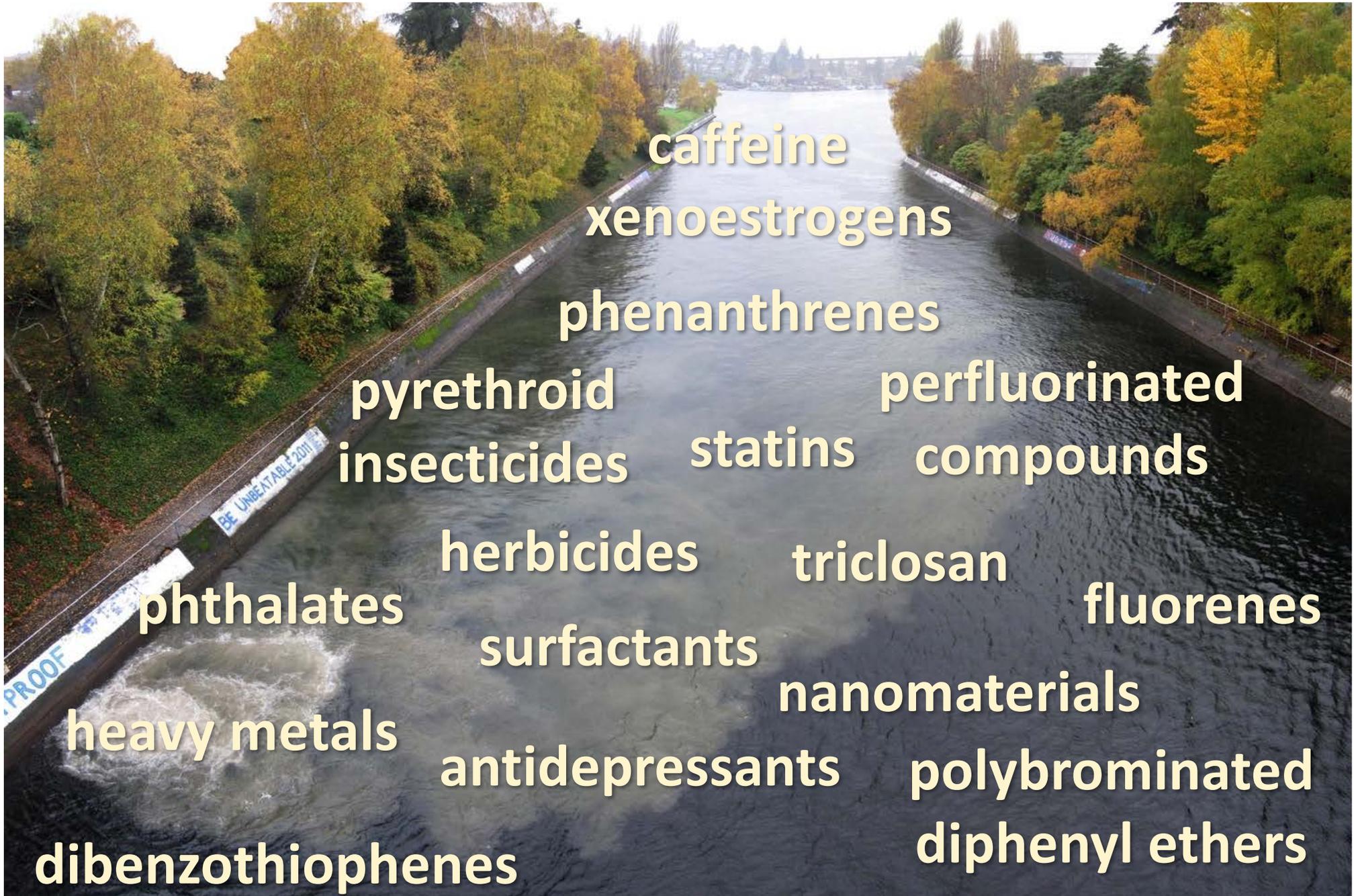


# The stormwater pollution you see...



*Photo by Blake Feist, NOAA Fisheries*

# ... and the pollution you don't see



caffeine

xenoestrogens

phenanthrenes

pyrethroid

perfluorinated

insecticides

statins

compounds

herbicides

triclosan

phthalates

fluorenes

surfactants

nanomaterials

heavy metals

antidepressants

polybrominated

dibenzothiophenes

diphenyl ethers

## THE QUESTION IS...

What do these changes mean for our communities when for decades we have been planning and making decisions, and building infrastructure based on a relatively stable climate?

# “Traditional” Gray Stormwater Infrastructure

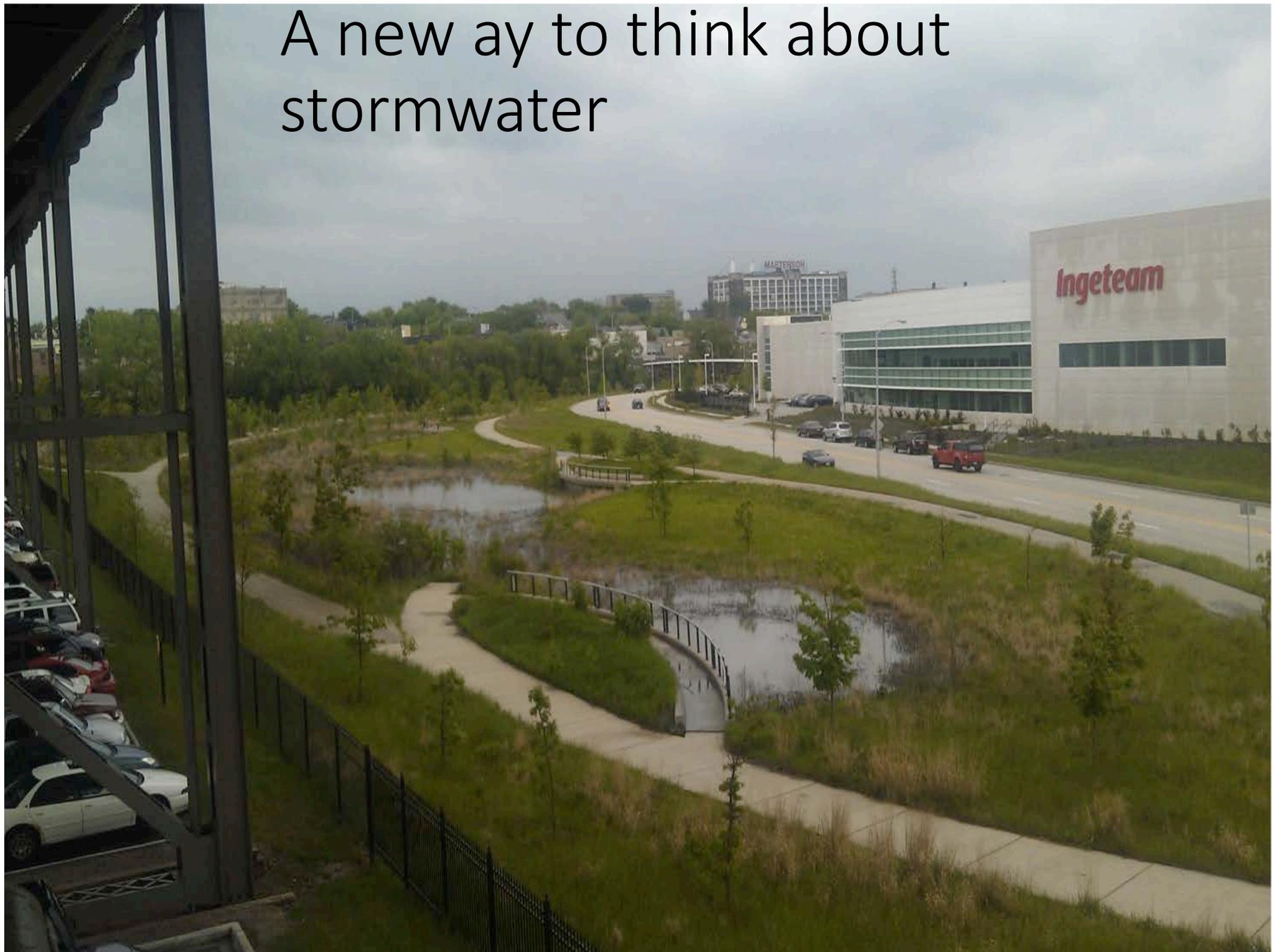


# “Traditional” Gray Stormwater Infrastructure





A new way to think about stormwater



**Bioswales** slow, infiltrate, and filter stormwater flows.





**Permeable Pavements** infiltrate, treat, and/or store rainwater where it falls

**Rain Gardens** collect and absorb runoff from rooftops, sidewalks, and streets



**Rainwater Harvesting** collects and store rainfall for later use



# Green Roofs





**Stormwater Trees**

# Stream restoration and buffers



# Floodplain Restoration



# What's the Impact: Permeable Alleyways



**63% runoff volume reduction**

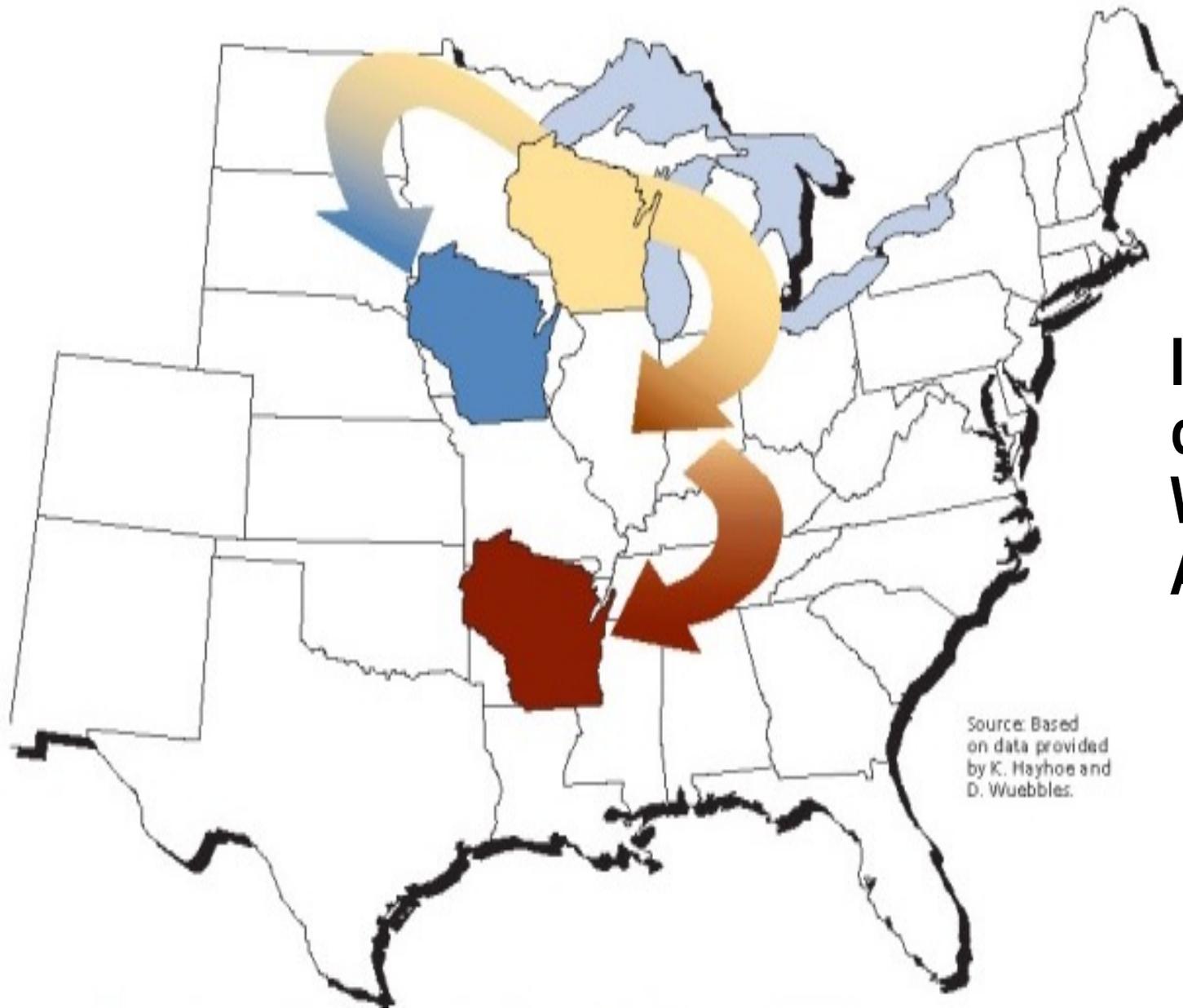
**63% total suspended solids reduction**

# What's the Impact: Substituting Native Vegetation for Turf Grass



**74% runoff volume reduction**

**64% total suspended solids reduction**



**Is climate  
change moving  
Wisconsin to  
Arkansas???**

Source: Based  
on data provided  
by K. Hayhoe and  
D. Wuebbles.

Summer  
by 2095

Winter  
by 2095

**Is this our destiny?**



Hopefully not yet!



Thank you!