Adapting to Wisconsin's Changing Climate

Tim Asplund, WDNR Water Resource Monitoring Section
Water Program Rep., WICCI Science Advisory Board
ILMA, February 20, 2015

115 million Americans in unison: 'It's too cold!'

Temperature is colder in Virginia than Alaska

Author: By Ed Payne CNN

Published On: Feb 19 2015 12:26:48 AM CST | Updated On: Feb 19 2015 12:33:47 PM CST

LOC

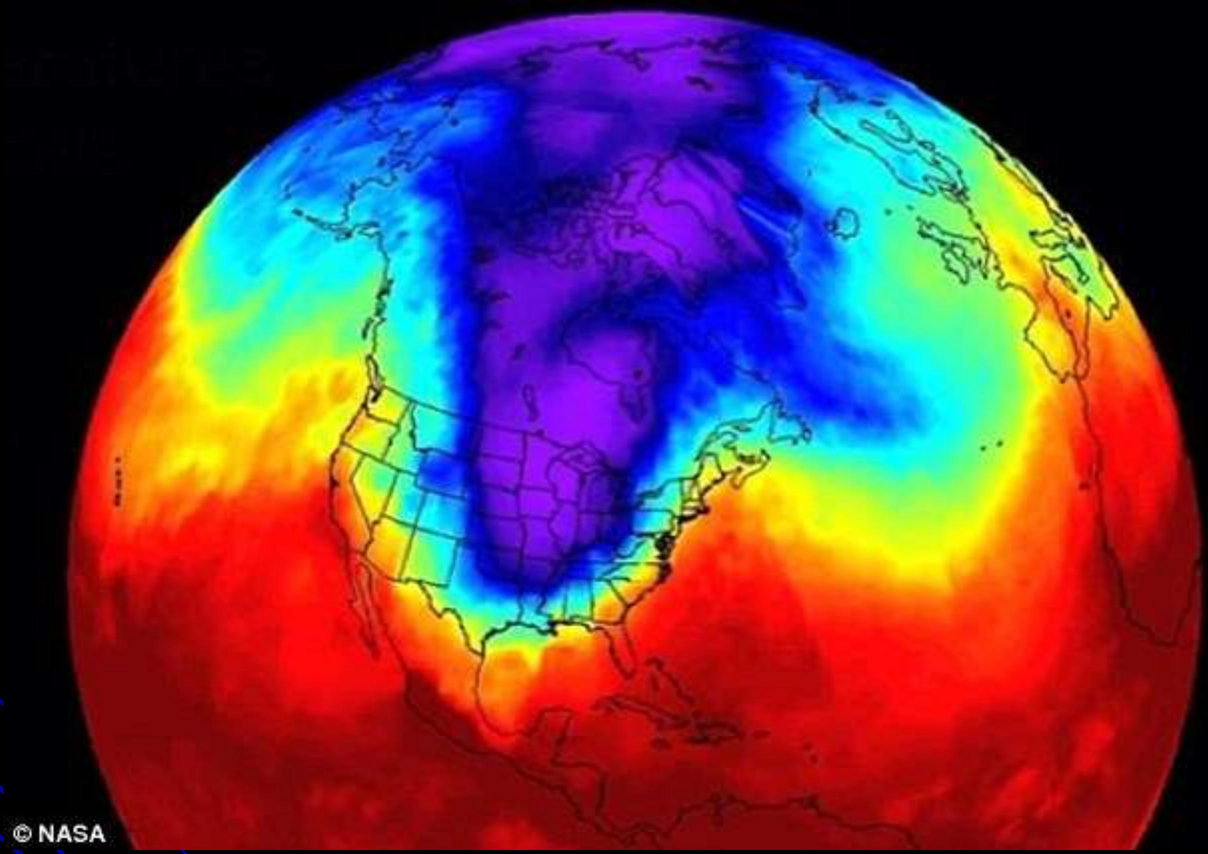
Unde
frostb

Man
find 1

Sena
sever

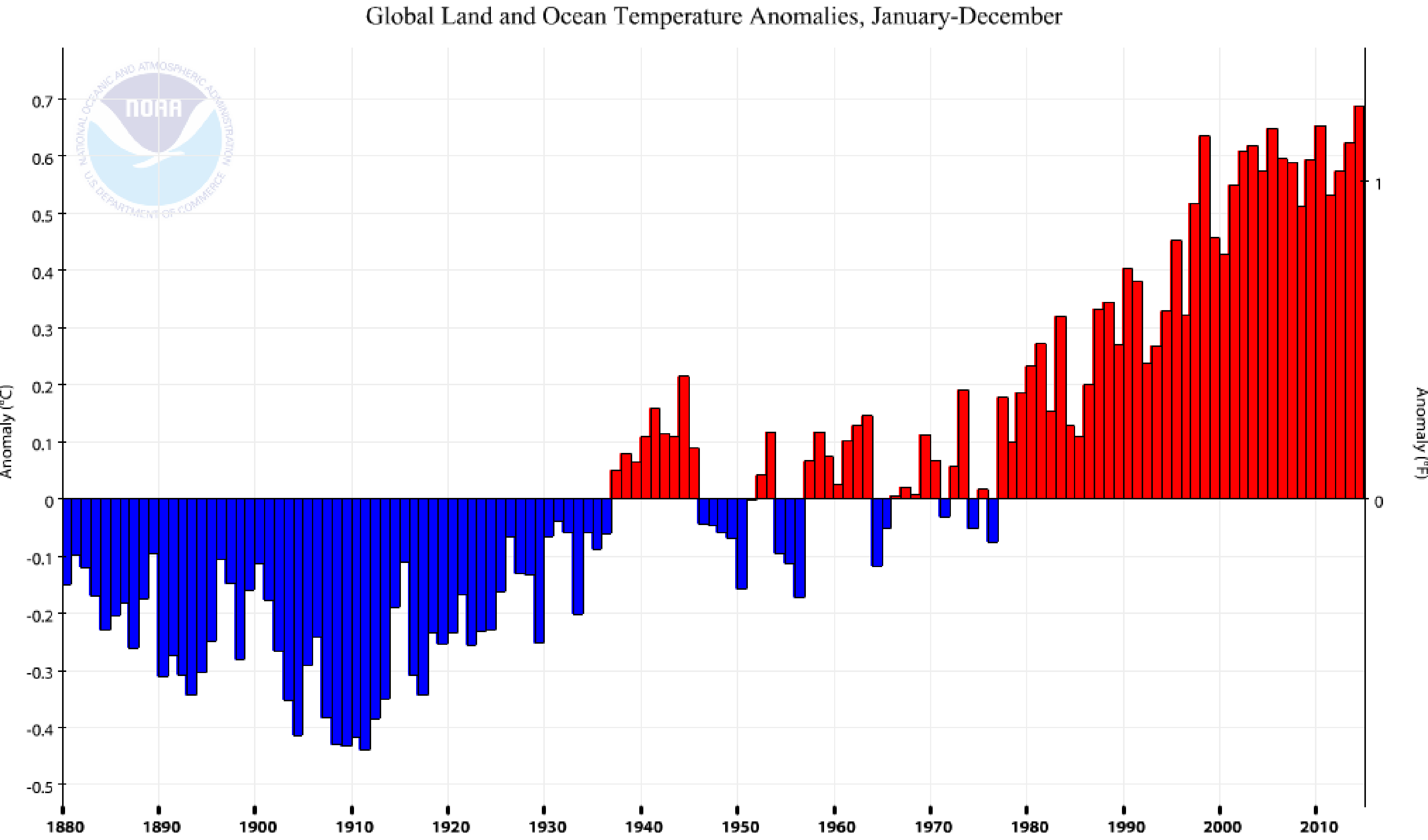
Paris

What about the Polar Vortex last winter?



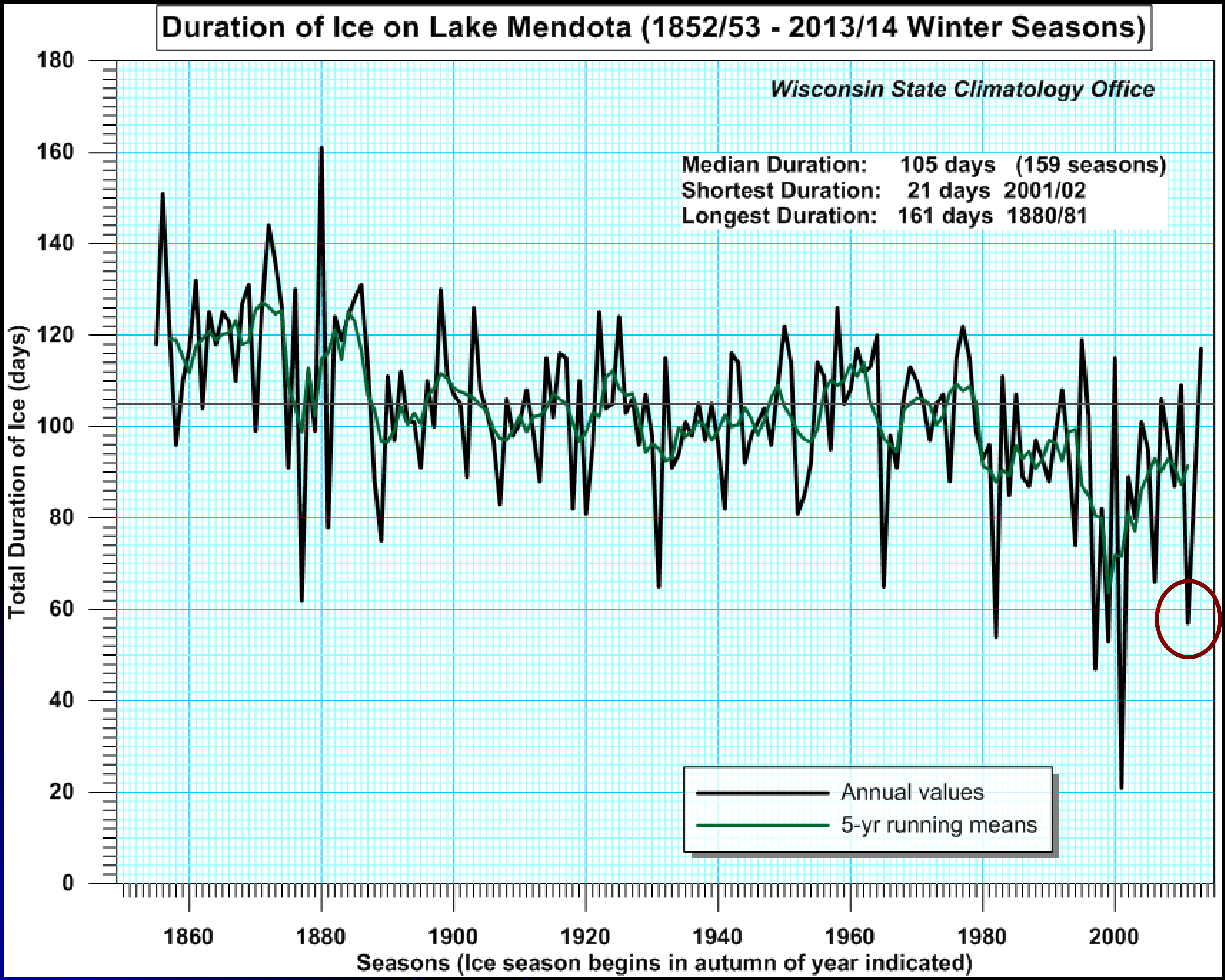
Out in the cold: The above heat map released by NASA shows how Arctic winds dipped south into the US this winter, causing unusually cold temperatures. *The rest of the world was unusually warm*

"The year 2014 was the warmest year across global land and ocean surfaces since records began in 1880."



http://www.ncdc.noaa.gov/cag/time-series/global/globe/land_ocean/ytd/12/1880-2014

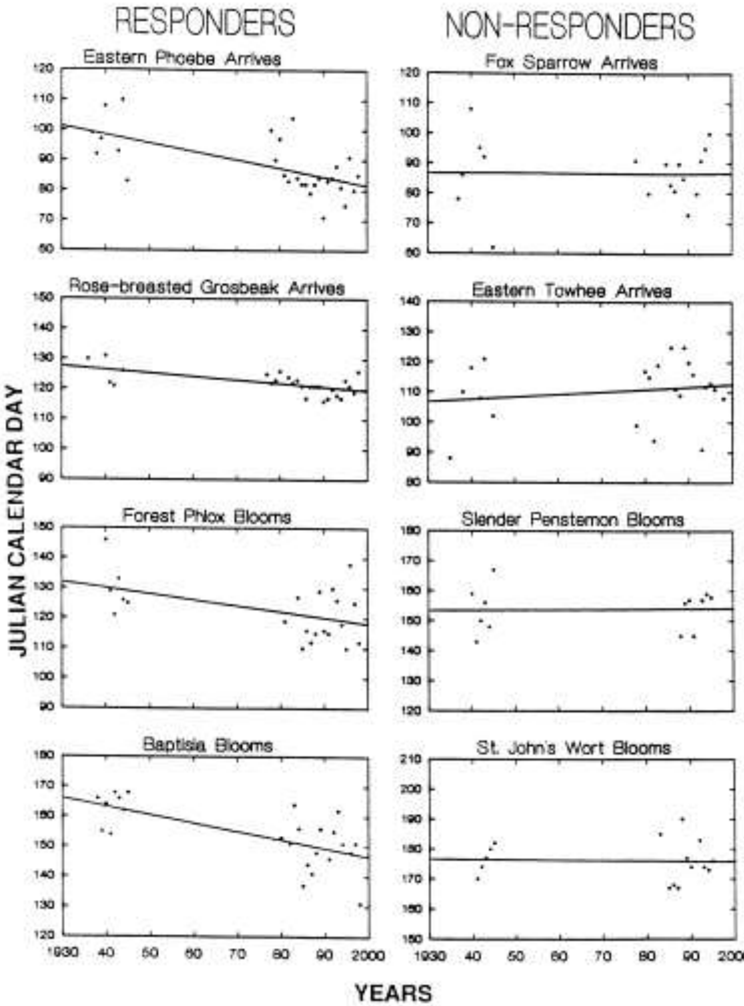
One of many signs of warming in Wisconsin...



2014:
118 days
13 days above median

2012:
57 days
5th shortest

On the left are regressions of four selected springtime phenophases that do show significant increases in earliness during the 61-year period of record….



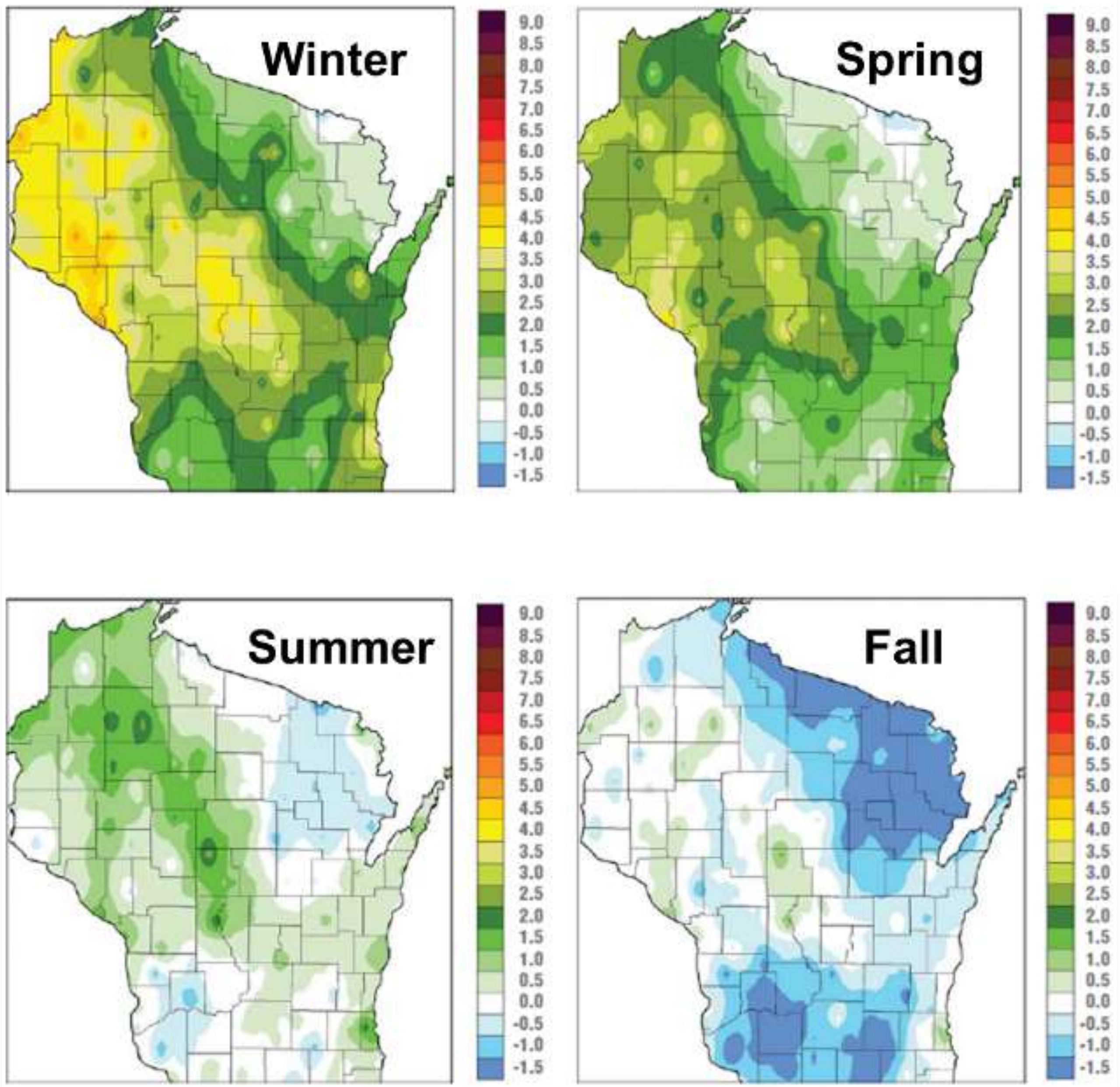
Bradley N L et al. PNAS 1999;96:9701-9704

Photos courtesy of Aldo Leopold Foundation website

http://www.aldoleopold.org

PNAS

Observed Change in Average Temperatures
°F from 1950 to 2006



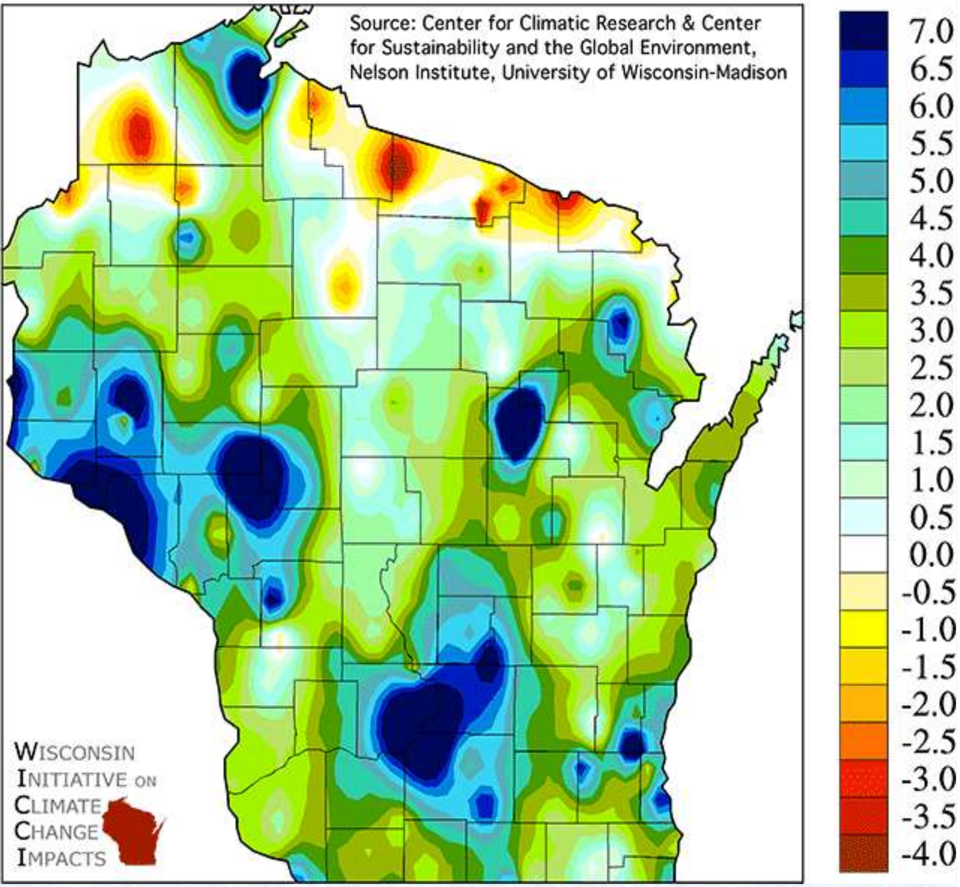
Winter temperatures have warmed more than any other season in recent decades, especially in northwestern Wisconsin.

(from Serbin and Kucharik 2009)

Summary of recent **historic** climate

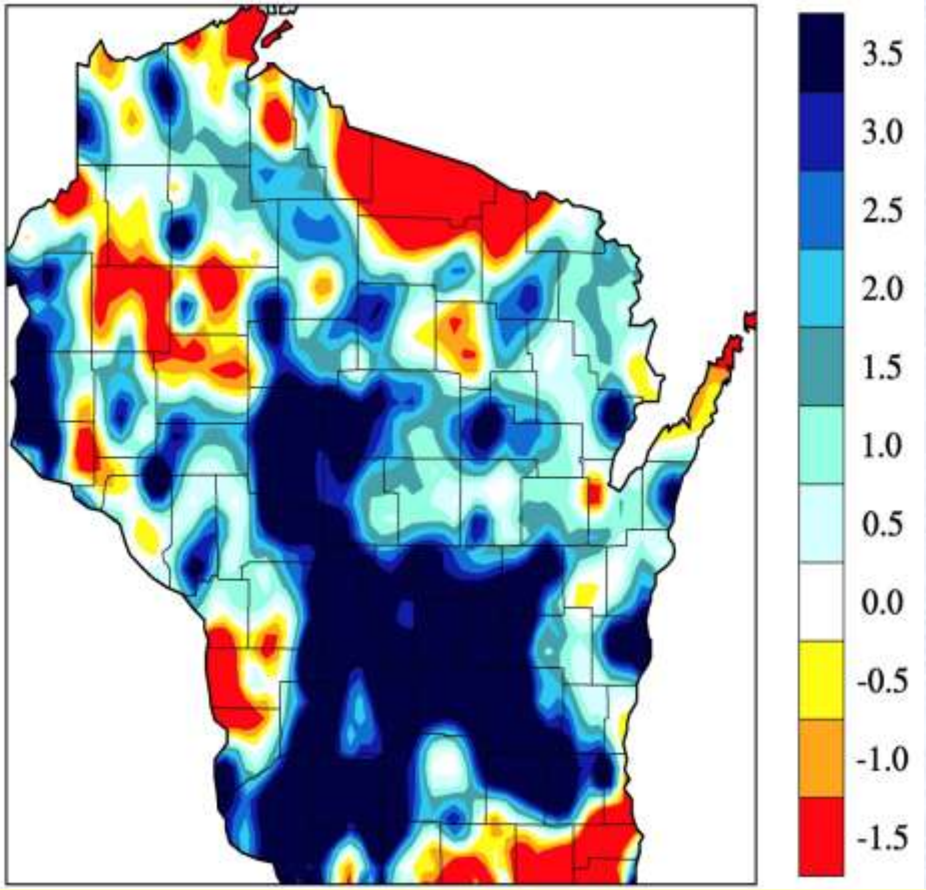
1950-2006 (based on NWS records)

Change in annual average precipitation (inches) 1950 to 2006



↑7” to ↓4” (drought)

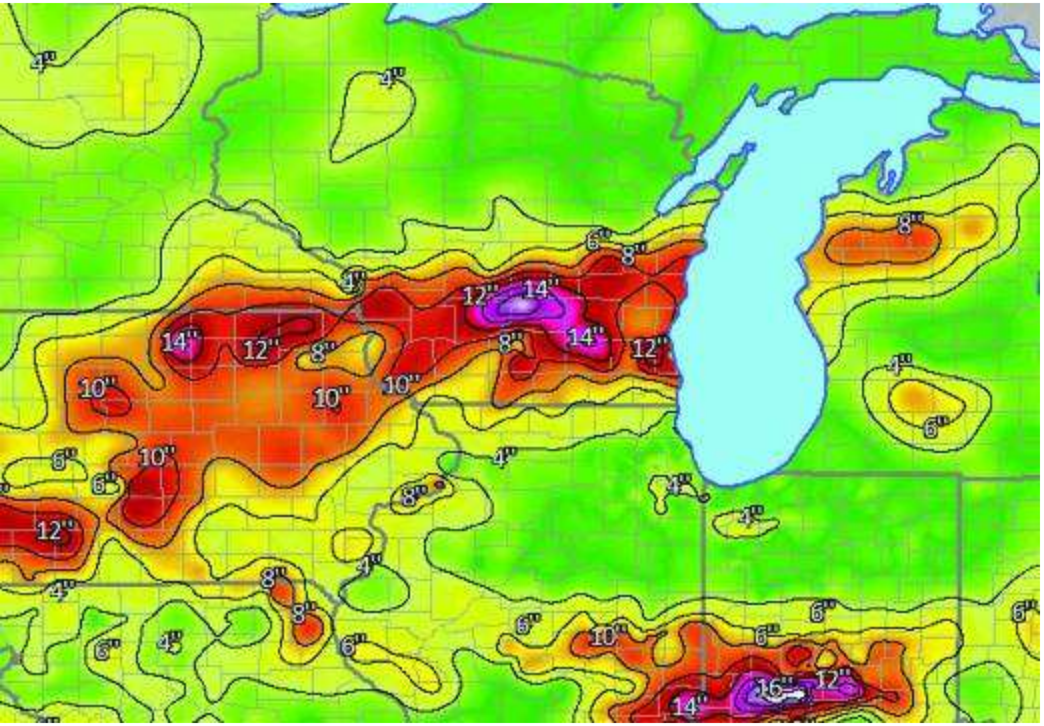
Increase in 2” rainfalls (days/decade) 1950 to 2006



↑3.5 days to ↓1.5 days (regionally variable)

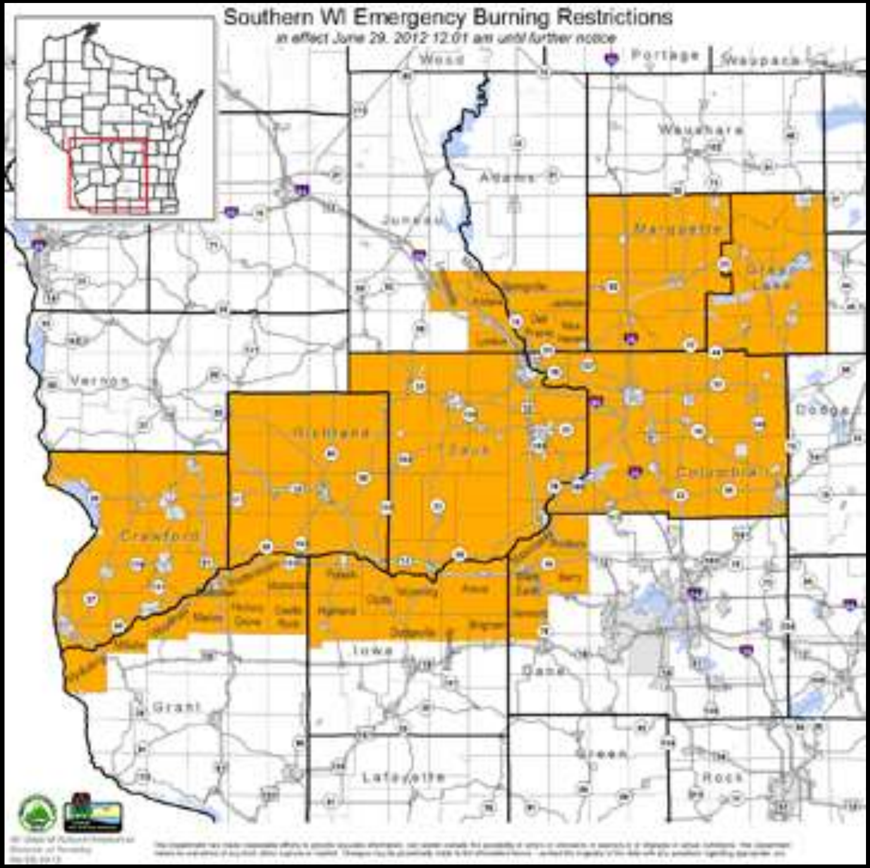
Extreme events: June 2008 storms

Total Precipitation (inches), June 1-15, 2008

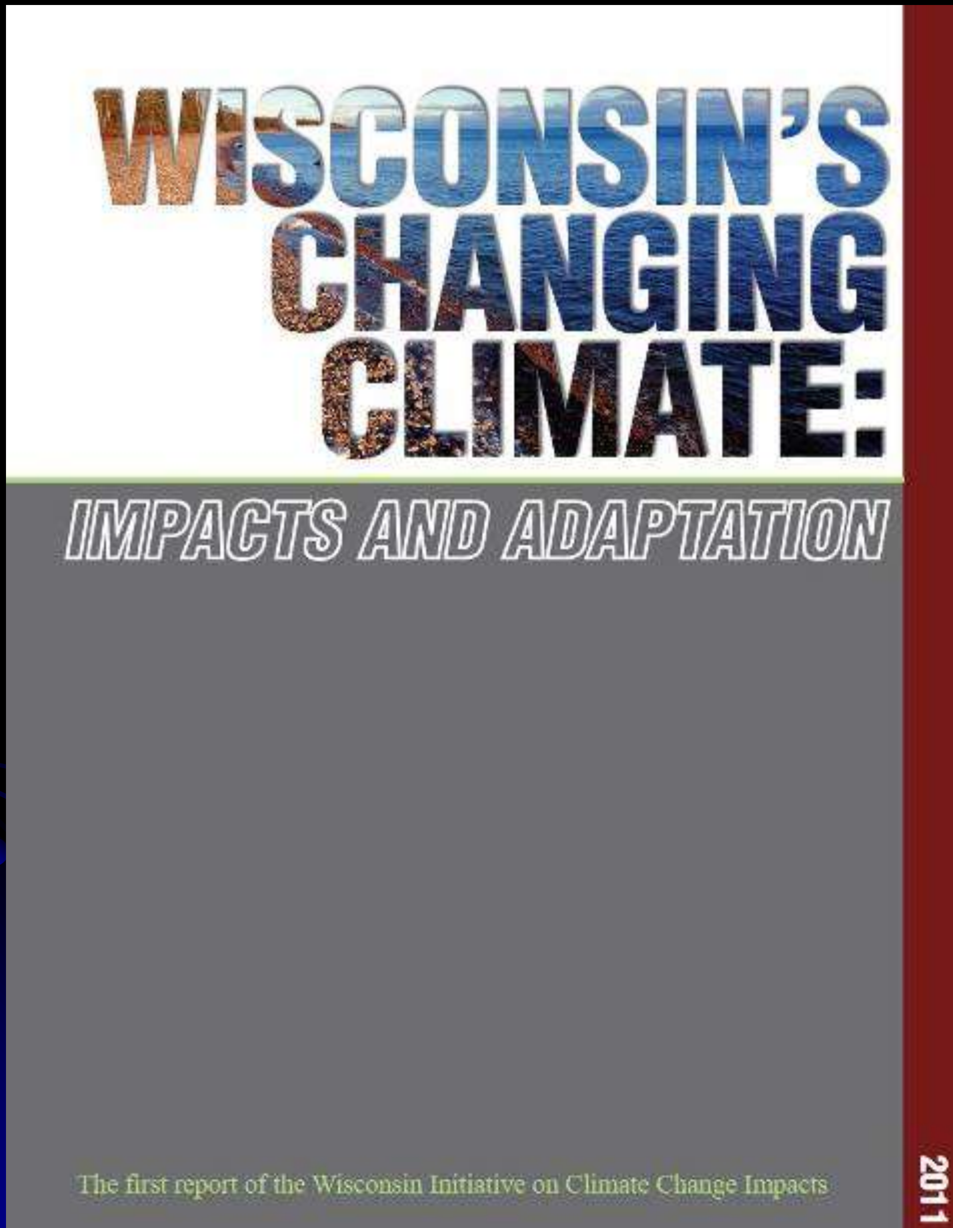


- **Stormwater infrastructure was overwhelmed**
- **Massive flooding (810 sq. mi)**
- **Water from private wells contaminated (28%)**
- **Raw sewage overflows (90 million gallons from 161 wastewater treatment plants)**
- **FEMA paid $34 million in flood damage claims**

Few communities even today can handle these kinds of extreme events!


Southern WI Emergency Burning Restrictions
in effect June 29, 2012 12:01 am until further notice
Wood
Portage
Waushara
Adams
Juneau
Marquette
Vernon
Richland
Sauk
Columbia
Dodge
Crawford
Iowa
Dane
Grant
Lafayette
Green
Rock

Wisconsin Initiative on Climate Change Impacts



WICCI's First Adaptive Assessment Report - released Feb 2011

30+ Authors

10 Editorial Team Members

22 Science Council Members

22 Chairs/Co-Chairs of 15 Working Groups

220 Working Group Members

http://wicci.wisc.edu

WICCI's Mission

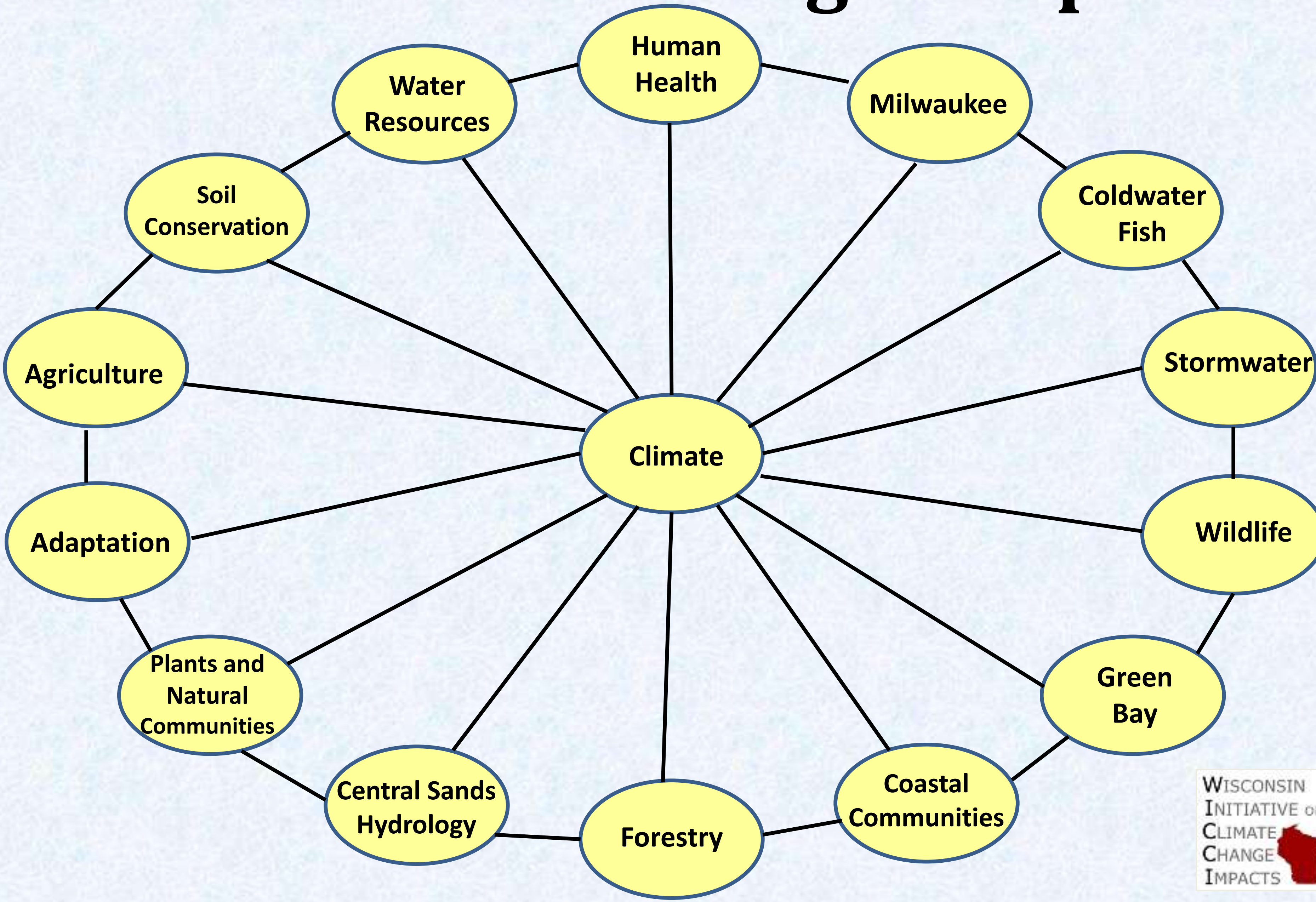
- Assess and anticipate climate change impacts on specific Wisconsin natural resources, ecosystems and regions

- Evaluate potential effects on industry, agriculture, tourism, and other human activities

- Develop and recommend adaptation strategies

WISCONSIN INITIATIVE ON CLIMATE CHANGE IMPACTS

WICCI Working Groups



Wisconsin Initiative on Climate Change Impacts

WICCI Climate Working Group

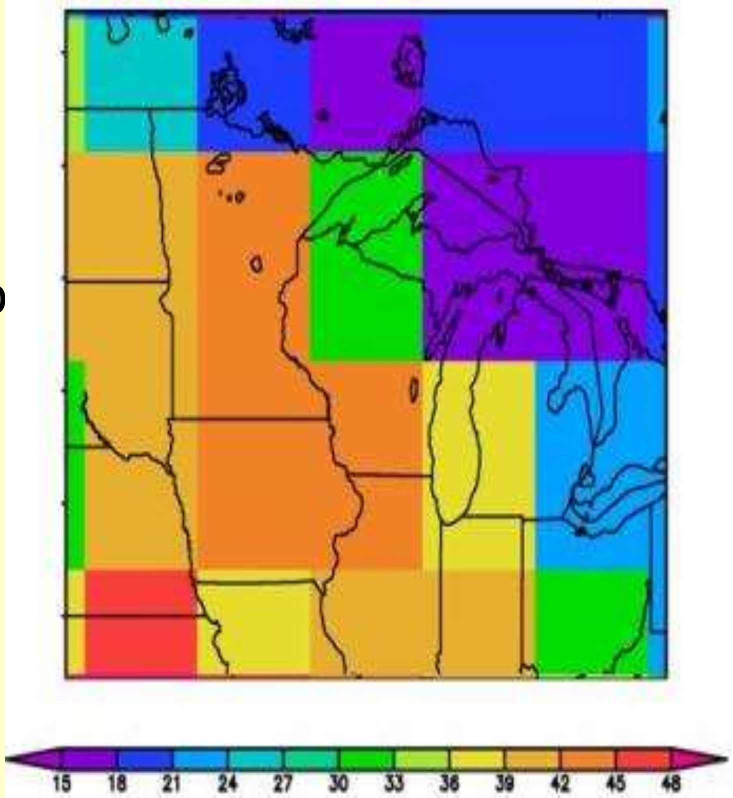
• Used 14 General Circulation Models (GCM's) from IPCC 2007 assessment

• Verified using historical Wisconsin weather station data

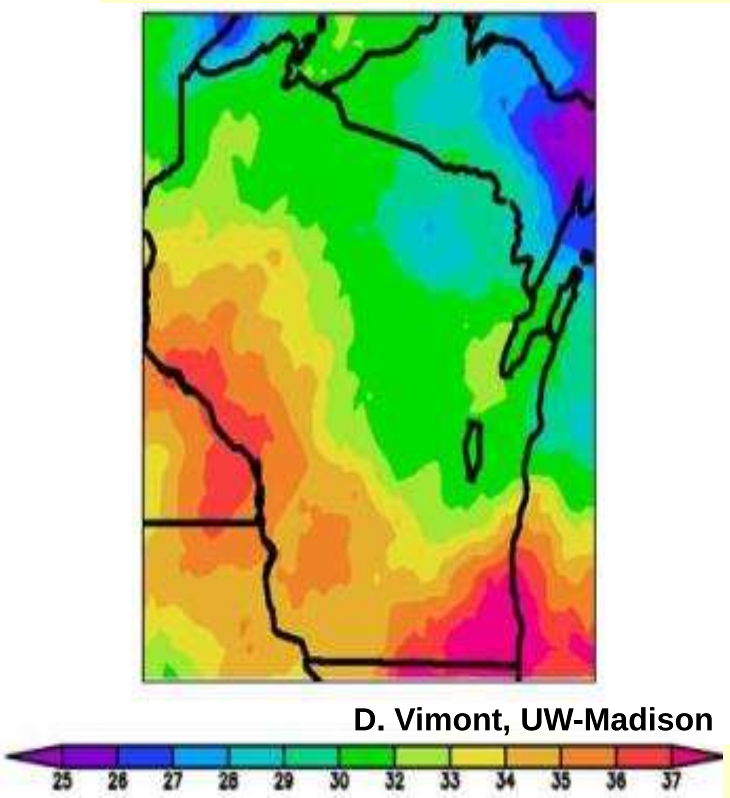
• Result: a statistical range of <u>probable</u> climate change

Downscaling: Focus global projections to a scale relevant to climate impacts in Wisconsin

GCM grid



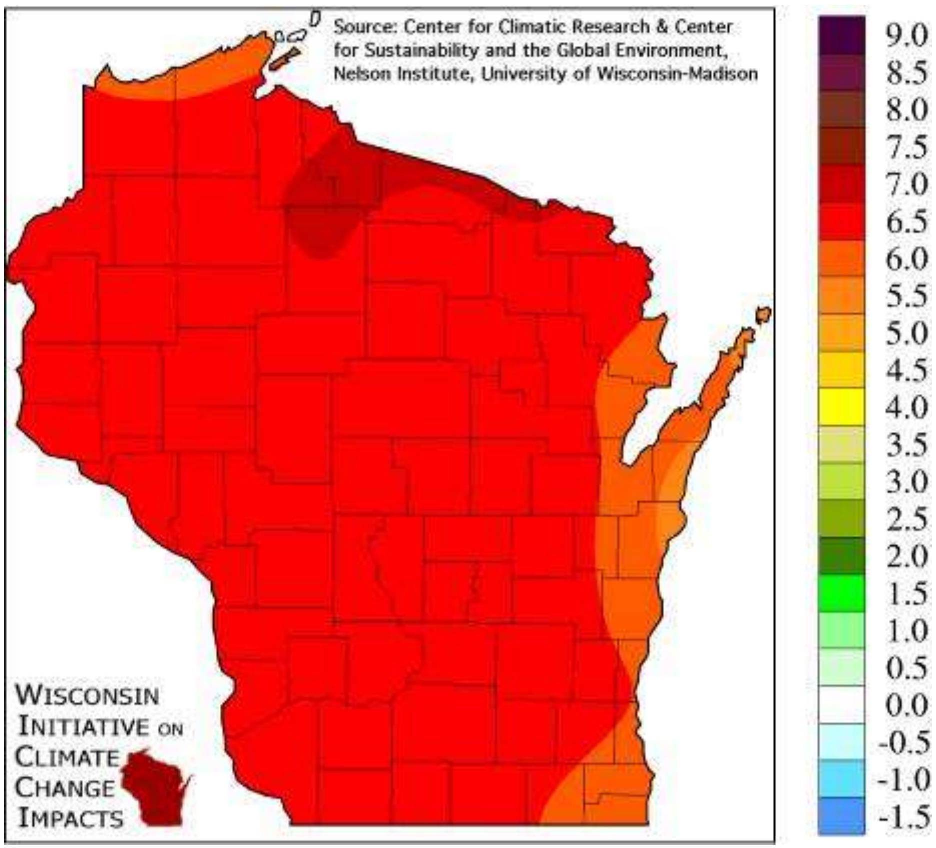
Downscaled (8x8 km) grid



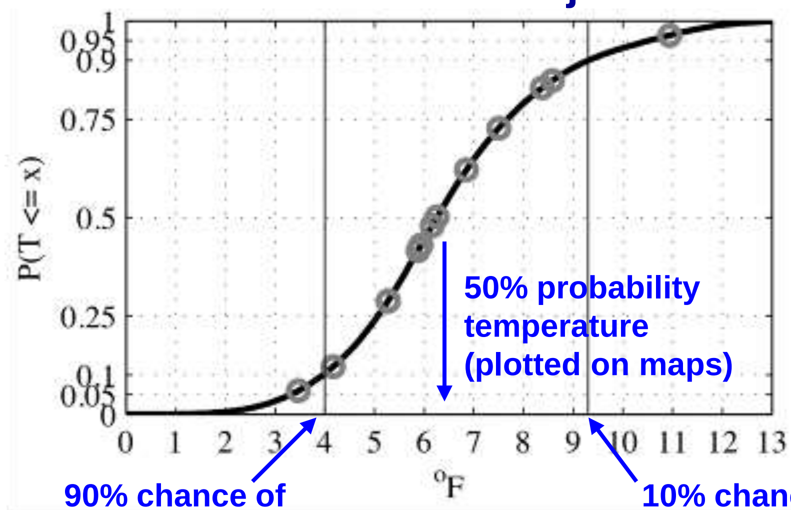
D. Vimont, UW-Madison

Annual Temperature Change

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



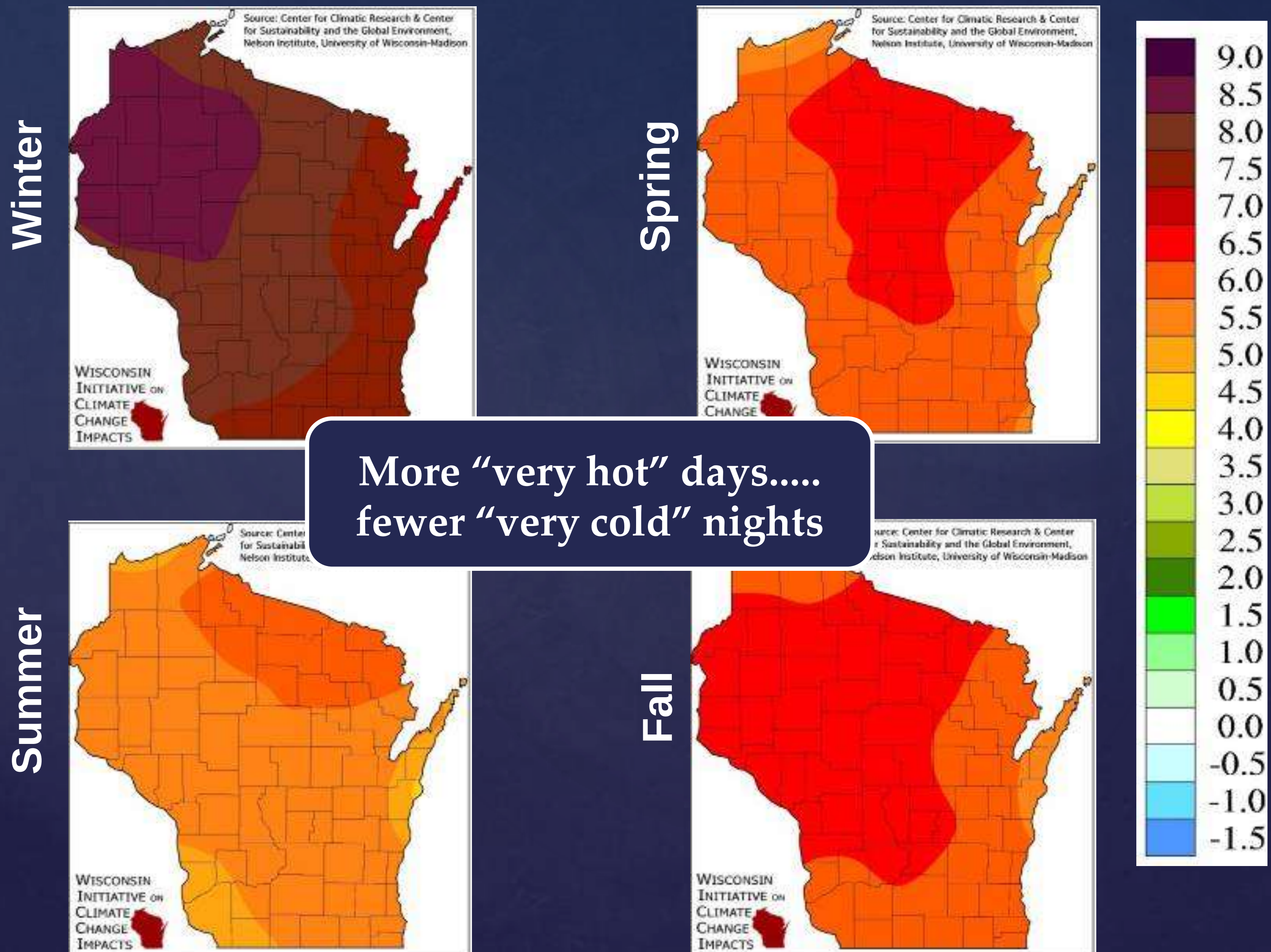
Probability Distribution of 14 Global Climate Model Projections



Wisconsin will warm by 4 – 9 °F by mid-21st Century

Source: Adapted from D. Vimont, UW-Madison

Projected Change in Seasonal Temperatures
1980 to 2055 (°F)

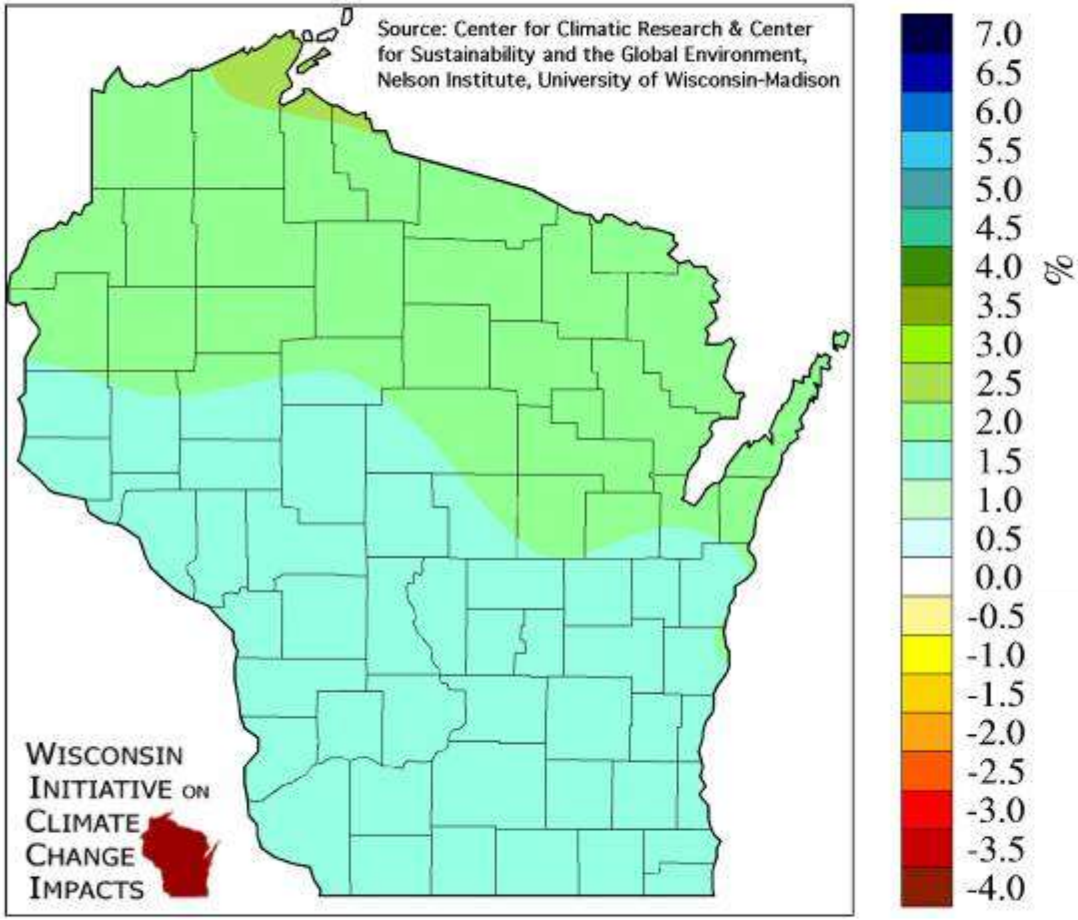


More "very hot" days..... fewer "very cold" nights

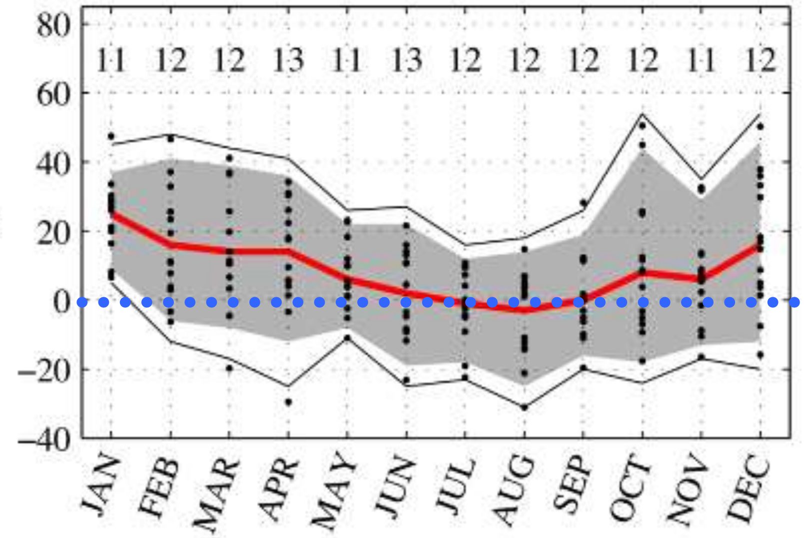
Wisconsin Initiative on Climate Change Impacts

Projected Change in Precipitation from 1980 to 2055

Change in Annual Average (inches)



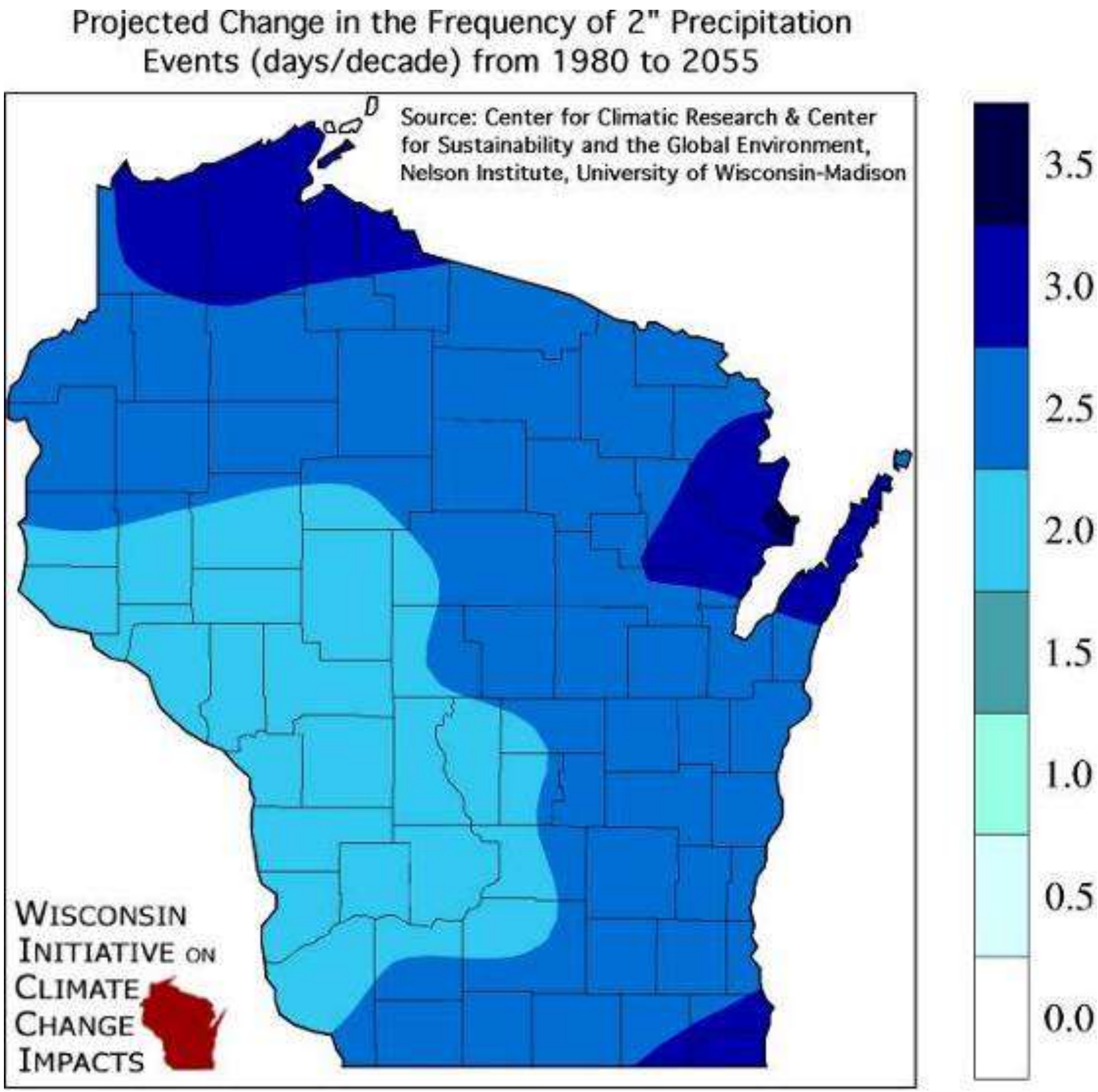
Probability Distributions of 14 Climate Model Projections by Month



Models predict winter and early spring will be wetter (0-40% increase).

Models uncertain about amount of summer rainfall

Number of days with intense precipitation is projected to increase across Wisconsin in 21st century.



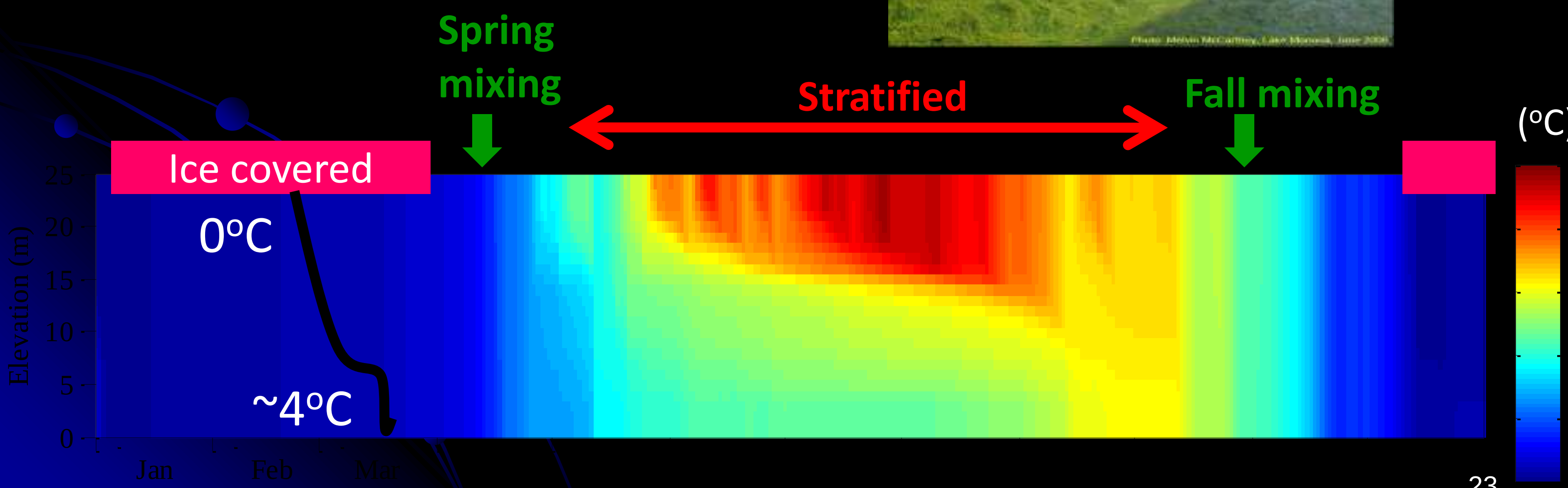
- Roughly a 25% increase in frequency.
- Recurrence intervals decrease from once every 10 months to once every 8 months in southern Wisconsin
- Once every 17 months to once every 14 months in northern Wisconsin.

Major Drivers of Climate Change Impacts on Water Resources

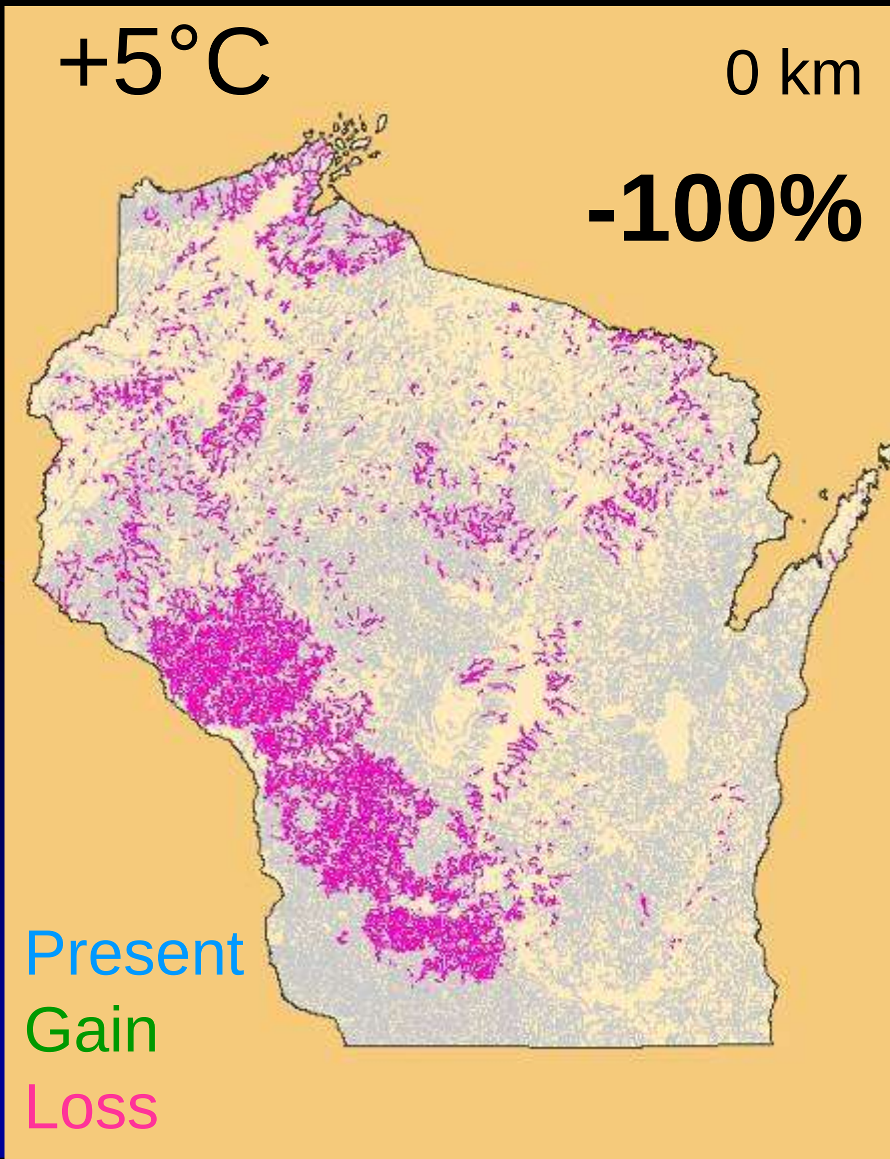
- Thermal Impacts (Increased air and water temps, longer ice-free period, more ET)
- Changing rainfall patterns (seasonal and spatial variability, + or – water, less precip in the form of snow)
- Increased storm intensity (more frequent large precipitation events)

Changing Thermal Structure

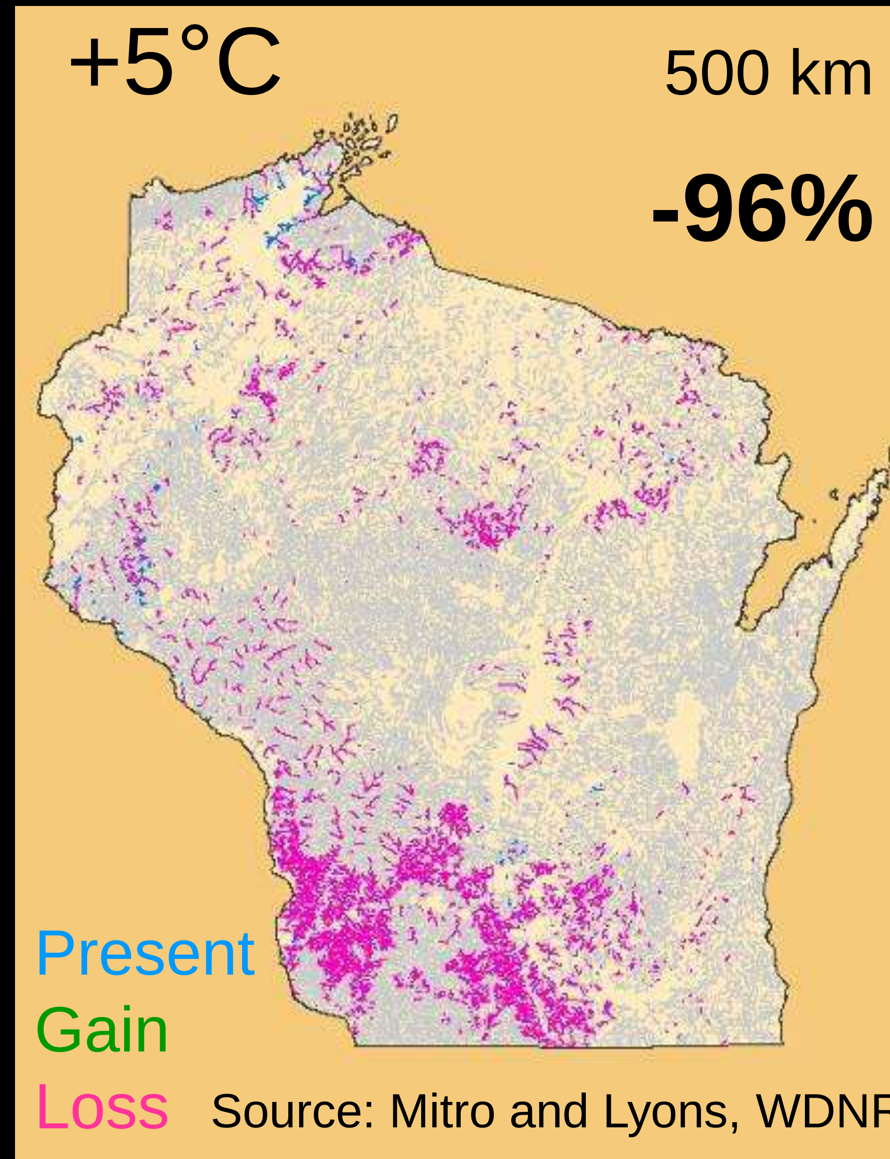
- ✓ **Earlier** thermocline onset
- ✓ **Warmer** surface temp
- ✓ **Greater** temp gradient across thermocline
- ✓ **Longer** stratified period



(from Chin Wu, UW Madison)



+5°C
0 km
-100%
Present
Gain
Loss

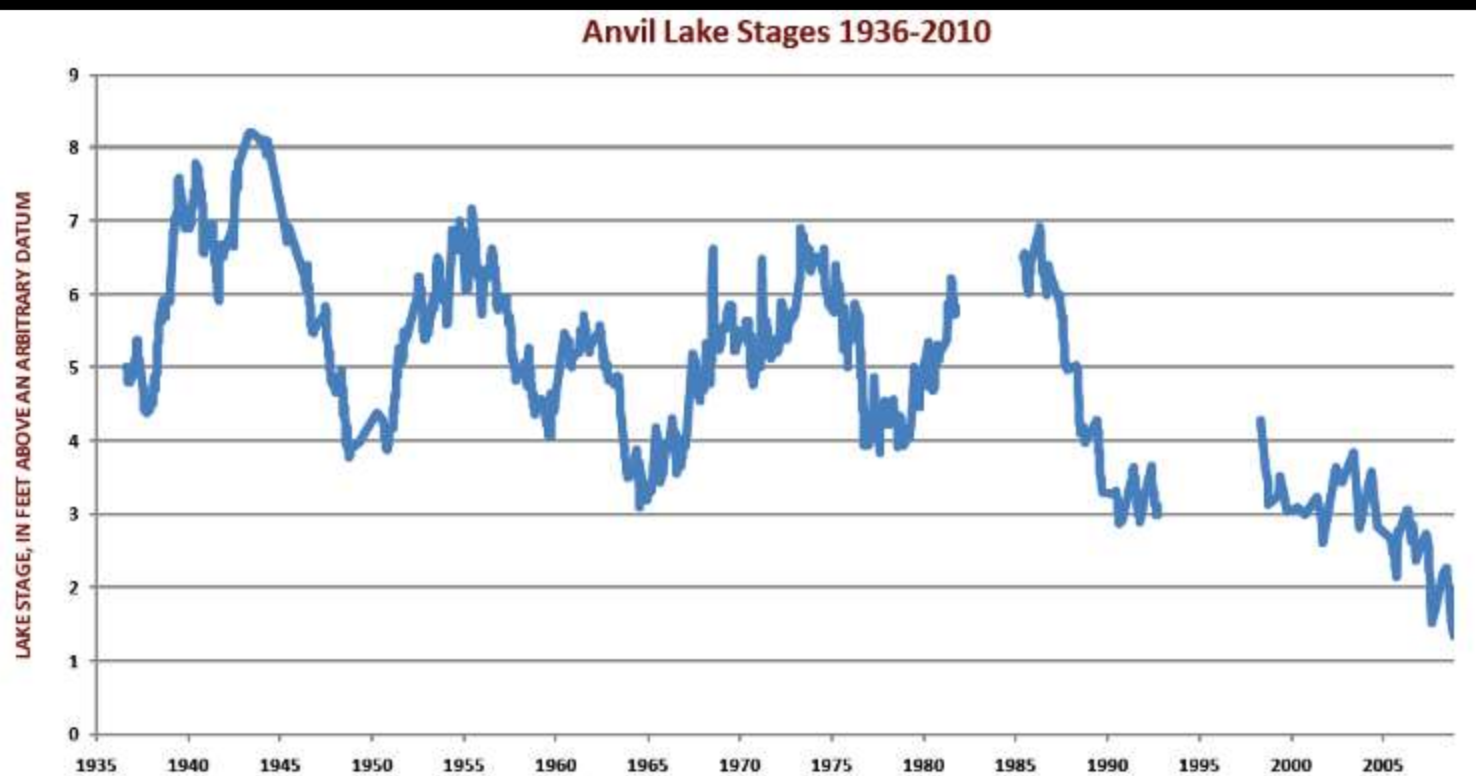


+5°C
500 km
-96%
Present
Gain
Loss
Source: Mitro and Lyons, WDNR


Pool 5 locations where water hyacinth and water lettuce were found during August to October 2011 based on surveys by the WDNR and USFWS
Prepared by: J. Sullivan WDNR-Lax
Belvidere Landing
Several areas in this backwater area
Buffalo City
Upper Spring Lake Landing


Water hyacinth removal
Mississippi River Pool 5 - 8/25/11
© Paul Skawinski

Water loss through evapo-transpiration associated with warmer temperatures could exacerbate recurring drought effects in the future, especially in lakes and wetland systems high in the landscape.



WICCI Water Resources Working Group

R. Lathrop

Fallison Lake, Vilas County

Warmer temperatures and increased runoff from large storm events causes water quality problems, blue-green toxins, eutrophication, etc

Photo: http://photogallery.nrcs.usda.gov/

Photo: R. Lathrop

Photo: R. Lathrop

Photo: Melvin McCartney, Lake Monona, June 2006

Buildings, roads and water/sewer systems are not currently designed for challenges from future climate changes.

WICCI Stormwater Working Group

Jamie McCartney
HWY 60 near Excelsior, WI
August 20, 2007

Photo: Michael Kienitz

Photo: Steve Zibell

Exacerbation of Existing Water Resource Problems

- Degradation of flood-absorbing capacity of wetlands, increased flooding and erosion
- Pressure to increase water extraction from the Great Lakes
- Mining of deep aquifers increases pressure on shallow groundwater
- ***More reliance on irrigation to grow crops***

Adaptation!

IPCC "… adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities."

WICCI: How humans will respond to climate change in a way that will make our natural and human systems more resilient.

So where do we go from here?

Adaptation – concepts

- Modify expectations
- Manage for extremes (plan and anticipate)
- Promote resilience, rather than resistance
- Incorporate dynamics and flexibility into decision-making (adaptive management)
- Improve capacity to detect trends and thresholds (leads to better decisions)
- Address impacts and adaptation at local levels as much as possible.

Impact: Water levels will change due to variable precipitation, recharge, and increased evaporation

Adaptation Strategies:

- Enhance and restore shoreline habitat to withstand variations in water levels
- Enhance infiltration by reducing impervious surfaces in urban/riparian areas and changing land management practices
- Build flexibility into planning and zoning for lakeshore and riparian development to account for changes in water levels
- Adjust and modify expectations – variability is the norm!

Photo - WDNR

Photo – Janesville Gazette

Impact: Harmful blue-green algal blooms will occur more frequently with increased summer temperatures

Adaptation Strategies:

- Identify ways in which climate change processes may increase the occurrence of exposures to HABs
- Create a HAB surveillance program to improve predictive capacity
- Develop statewide standards for blue-green algal toxins and take appropriate action to protect public health.

Anvil Lake Association

Carolyn Betz

Impact: Aquatic invasive species are likely to spread due to flooding and warmer temperatures

Adaptation Strategies:

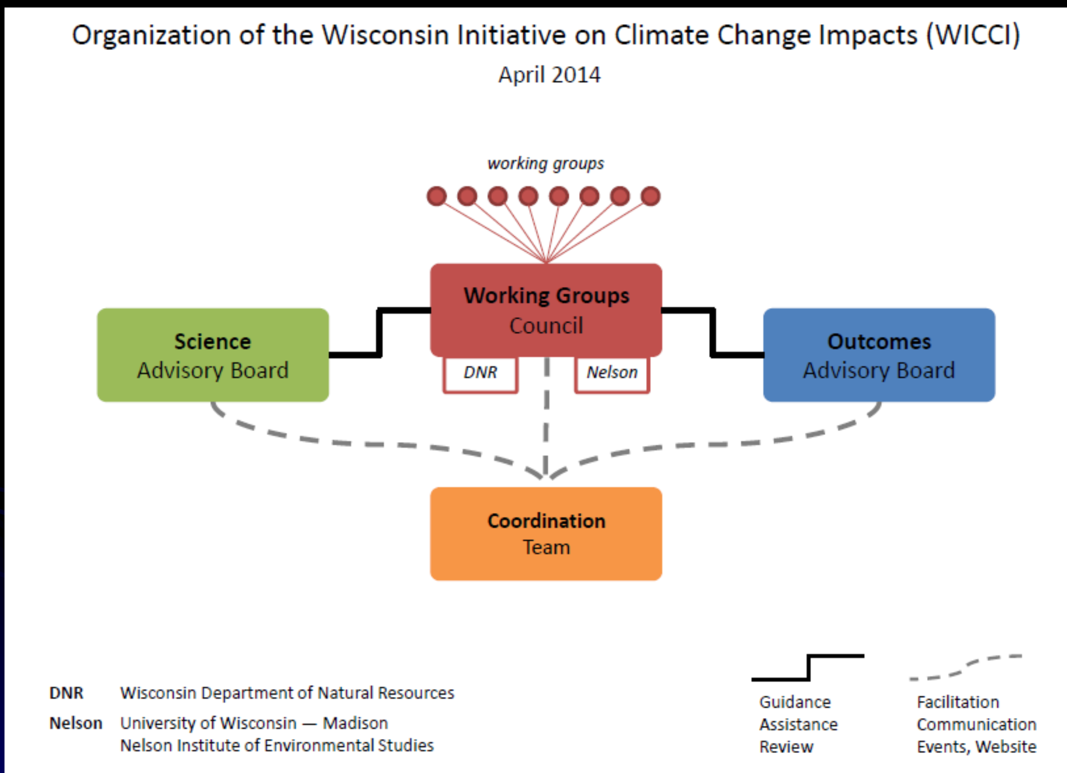
- Identify potential pathways for invasive species migrations and take preventive action
- Encourage regulatory activities aimed at preventing future invasions of exotic and invasive species
- Continue exotic and invasive species education/awareness programs for boaters, anglers, and others
- Develop rapid response planning and implementation methods to improve existing aquatic invasive species control programs

Photo – WDNR

Photo – Don Bush, WDNR

WICCI Phase 2

Wisconsin Initiative on Climate Change Impacts



Focus Areas:

Seepage Lakes
Thermal Impacts
Cold Water Fisheries
Biotic responses
Monitoring strategies
AIS distribution patterns

http://www.wicci.wisc.edu/