

Adapting to Climate Change – Extreme Water Levels, Invasive Species and Harmful Algal Blooms – Oh My!



Photo – Frank Koshere



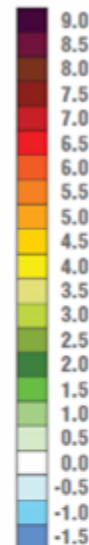
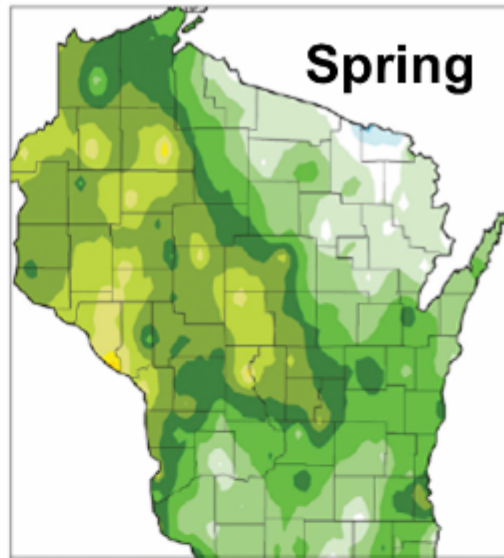
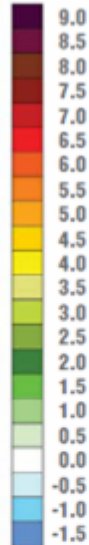
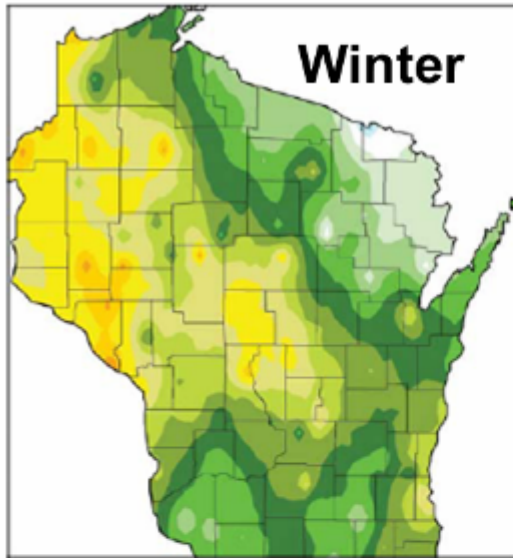
Photo – Frank Koshere



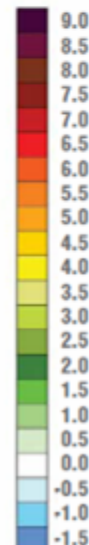
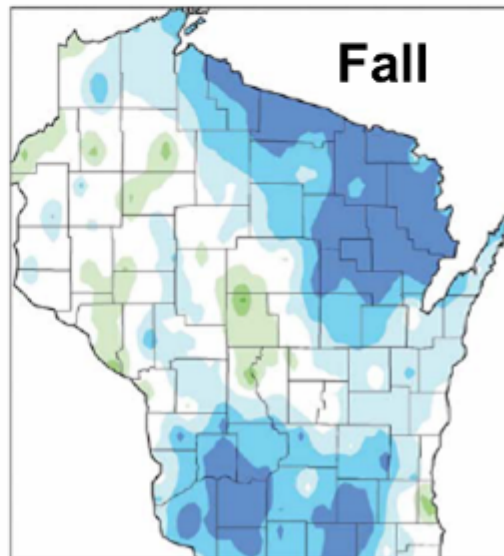
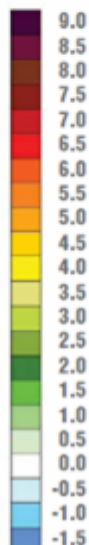
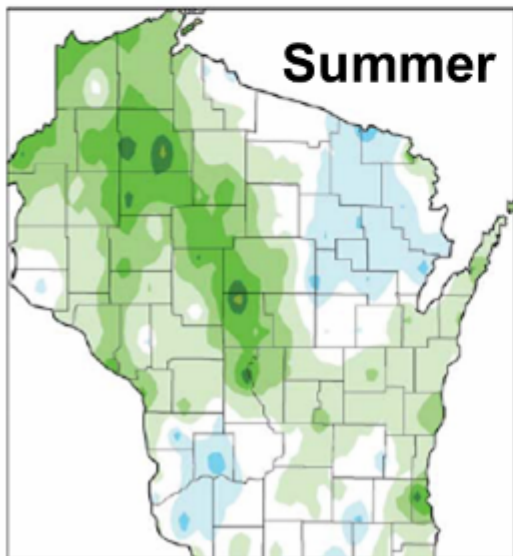
Photo – Anvil Lake Association

Tim Asplund, WDNR Lakes and Wetlands Section
Jim Hurley and Carolyn Betz, UW Madison
WI AWRA, March 4, 2011

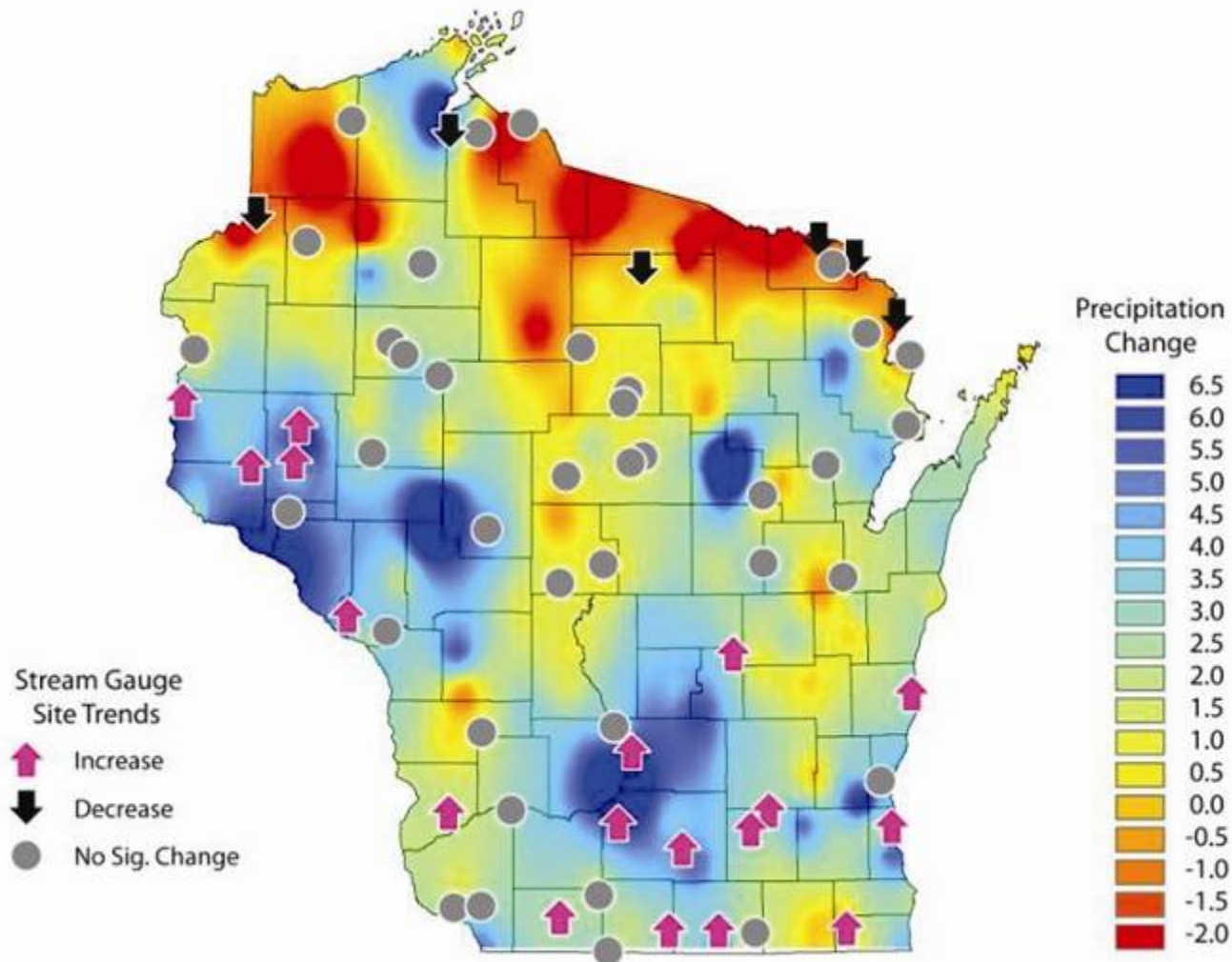
Observed Change in Average Temperatures °F from 1950 to 2006



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



Annual Stream Flow Trends and Precipitation Change from 1950 to 2006



Trends in observed stream flows generally corresponded to changes in precipitation across Wisconsin.



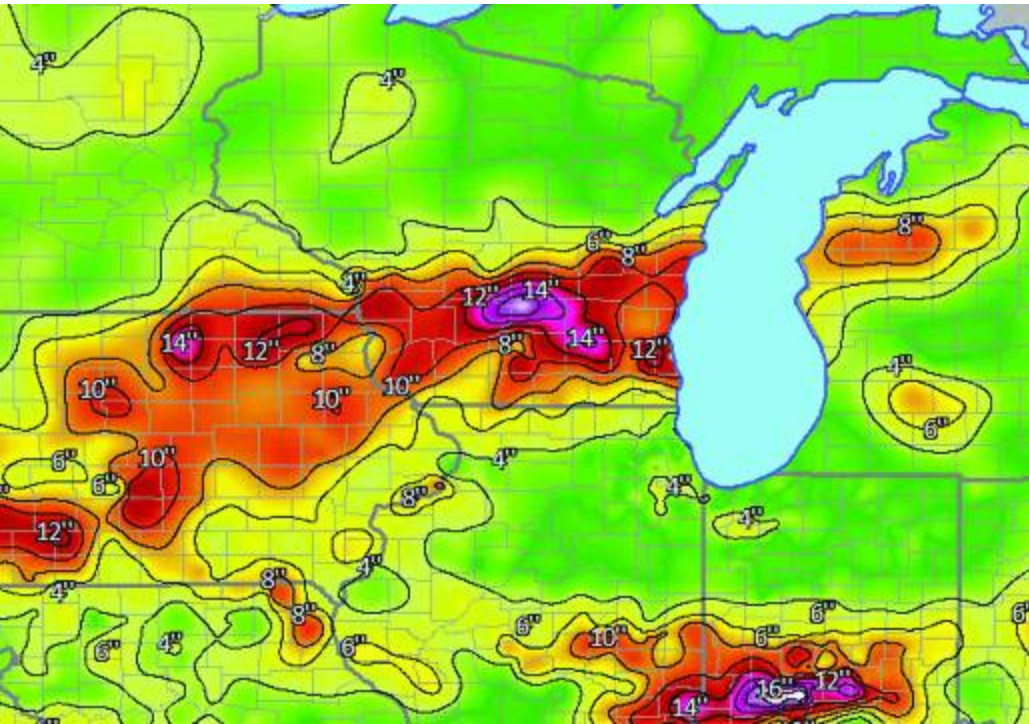
Fallison Lake, Vilas County

Crystal Lake groundwater flooding



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!

... and such events are projected to become more frequent in a warming climate.



Should we call it “Global Weirding”?

“I prefer the term 'global weirding,' coined by Hunter Lovins, co-founder of the Rocky Mountain Institute, because the rise in average global temperature is going to lead to all sorts of crazy things — from hotter heat spells and droughts in some places, to colder cold spells and more violent storms, more intense flooding, forest fires and species loss in other places.”

THOMAS L. FRIEDMAN – NY Times
Published: February 17, 2010

“Stationarity is dead.” Science 2008

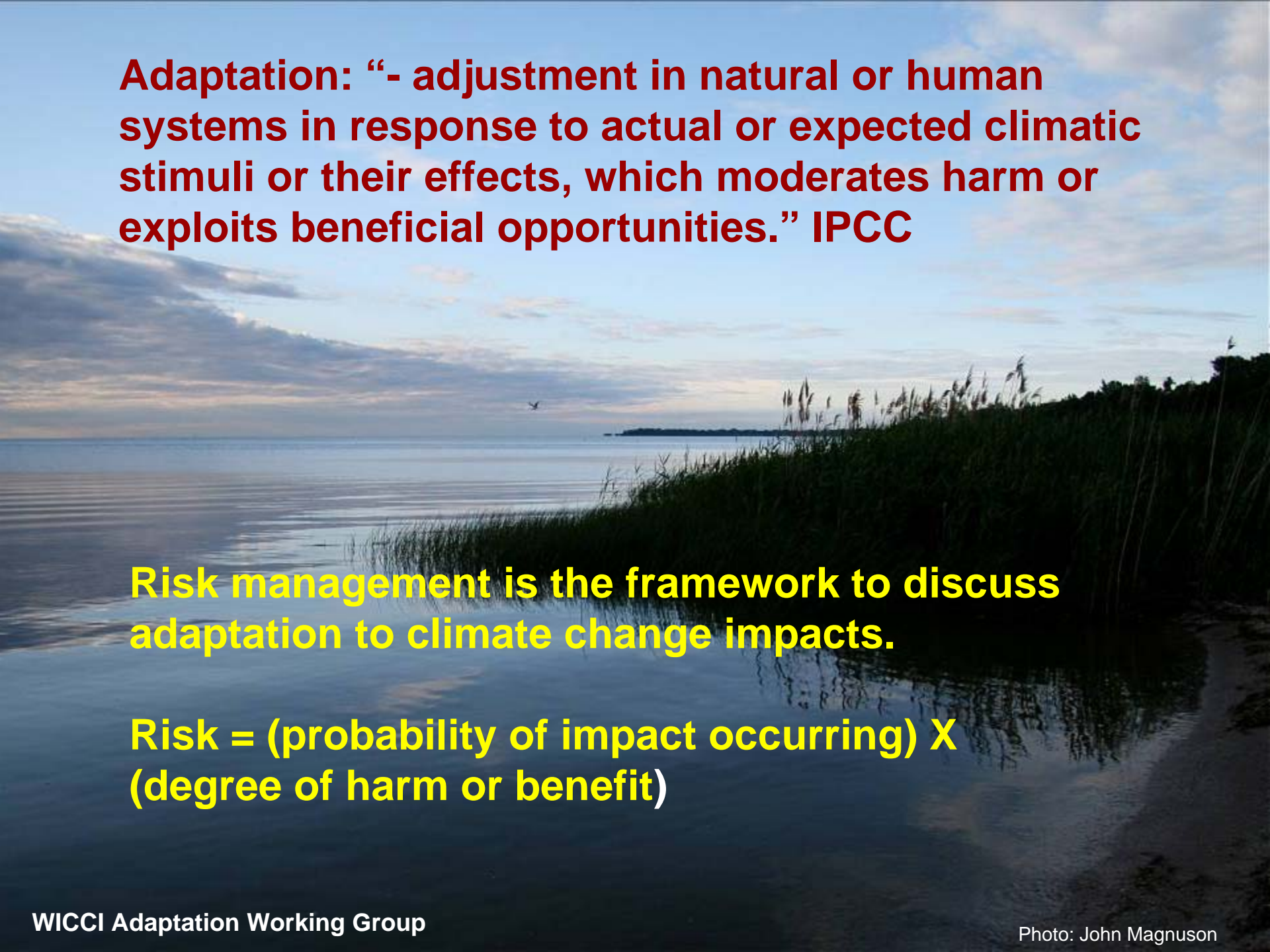
“Traditionally, hydrologic design rules have been based on the assumption of stationary hydrology, tantamount to the principle that the past is the key to the future...

...This assumption is no longer valid.”

Adaptation!



So where do we go from here?



Adaptation: “- adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.” IPCC

Risk management is the framework to discuss adaptation to climate change impacts.

**Risk = (probability of impact occurring) X
(degree of harm or benefit)**

WISCONSIN'S CHANGING CLIMATE:

IMPACTS AND ADAPTATION

The first report of the Wisconsin Initiative on Climate Change Impacts

2011

WICCI's First Adaptive Assessment Report - released Feb 2011

30+ Authors

10 Editorial Team Members

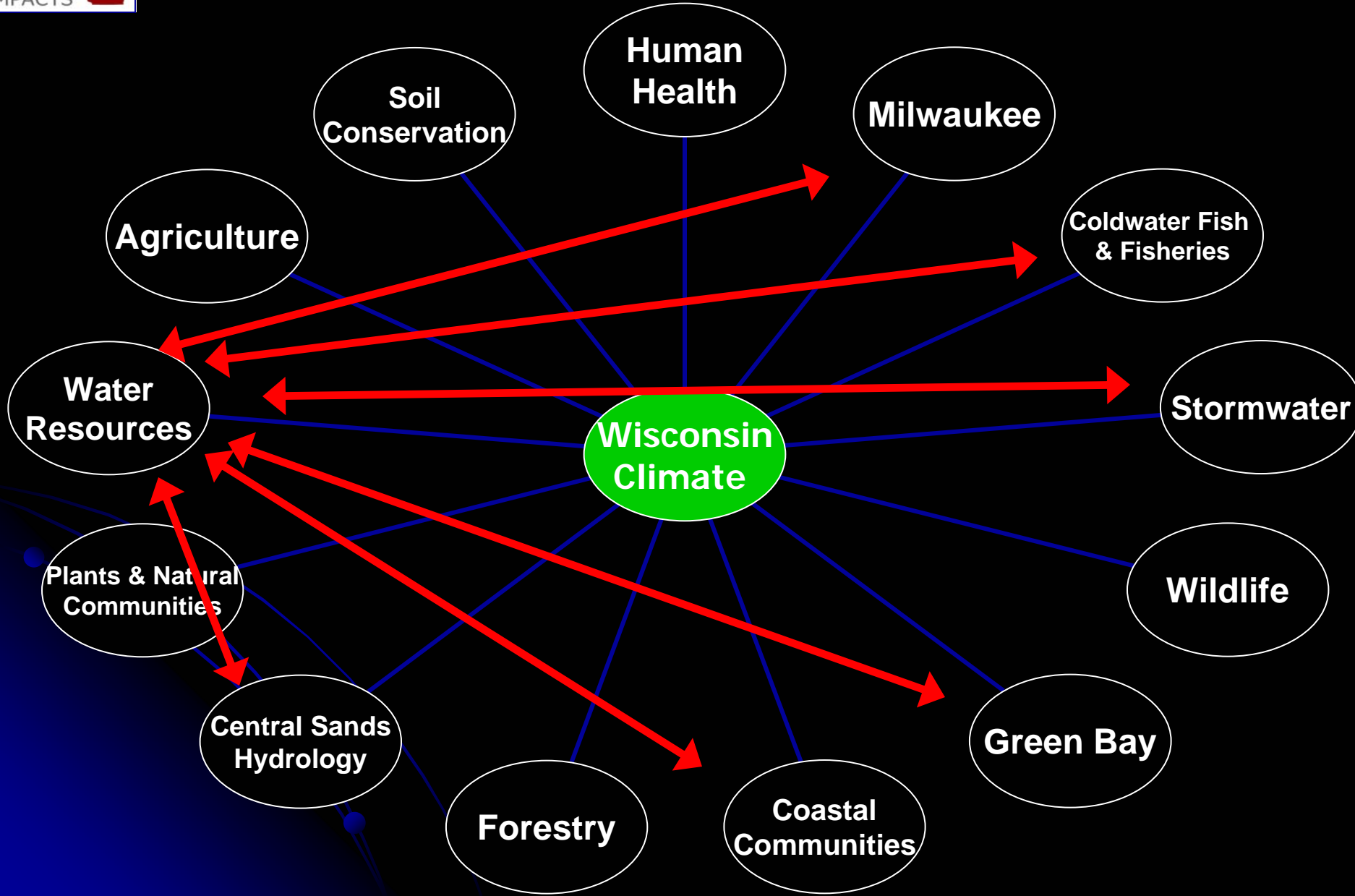
22 Science Council Members

22 Chairs/Co-Chairs of 15
Working Groups

220 Working Group Members

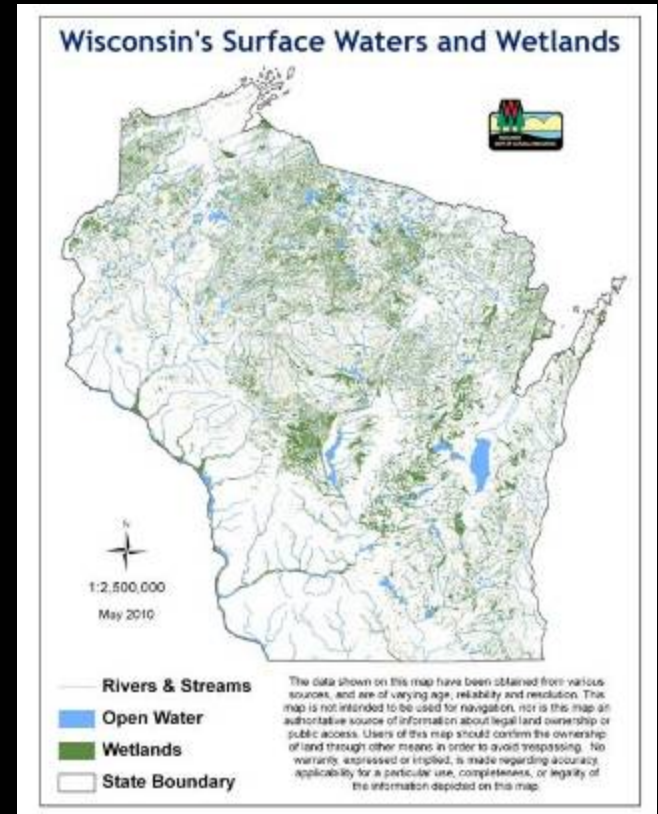
<http://wicci.wisc.edu>

Working Groups

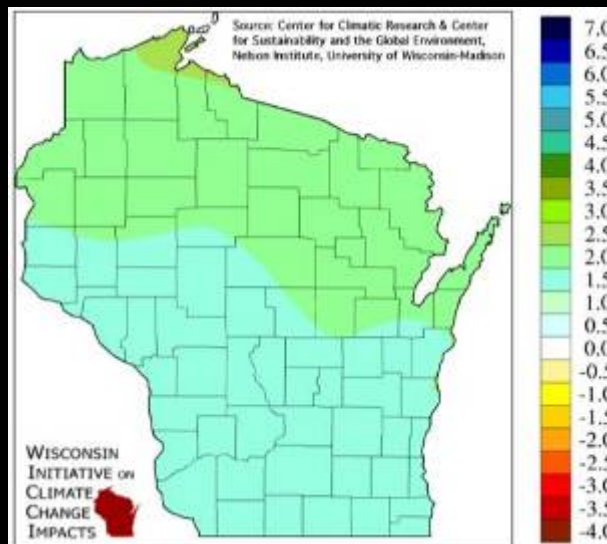
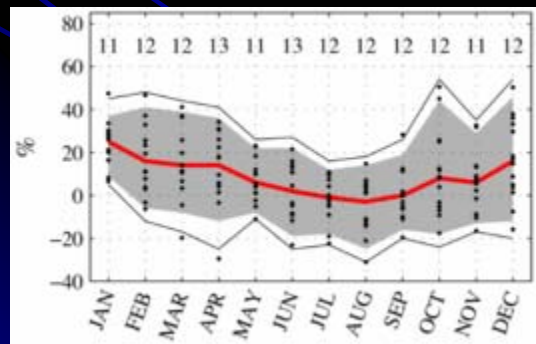
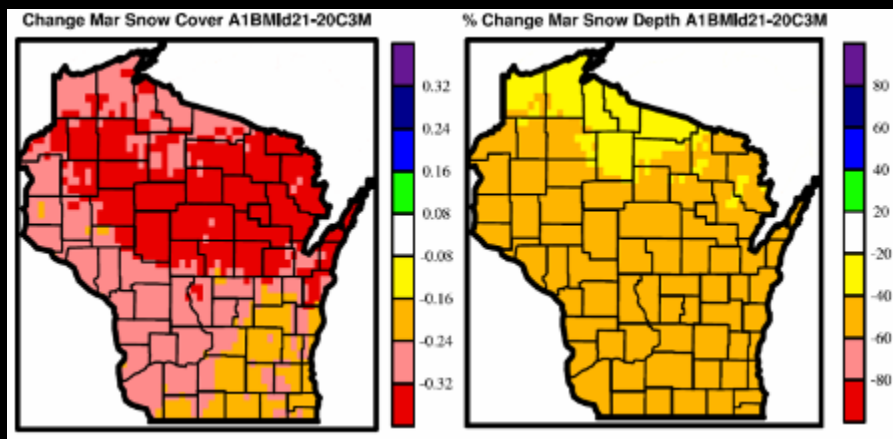
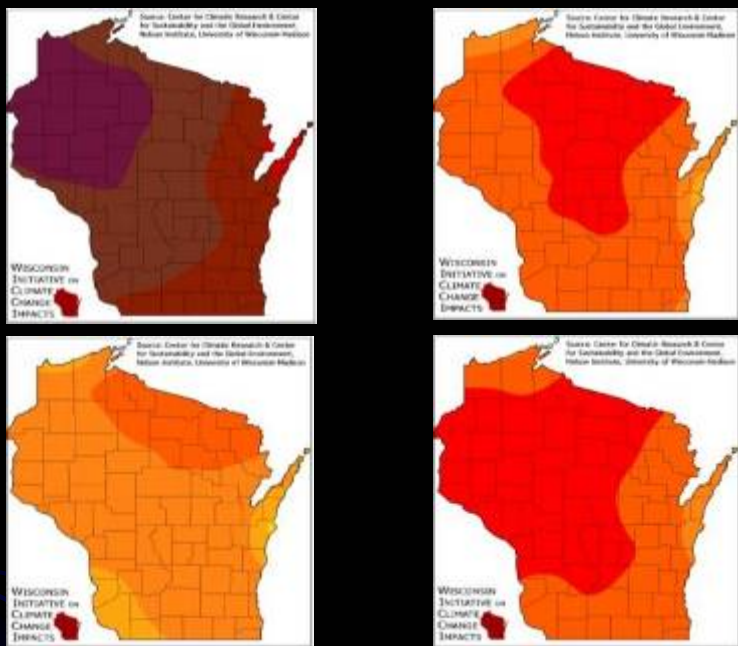


Water Resources Working Group Mission Statement

- The Water Resources Working Group will assess and synthesize climate change impacts to Wisconsin's water resources and assist in the development of adaptation strategies for dealing with those impacts.



WR Working Group Considered the Climate Group's Downscaled Projections



Brainstorm and Inventory Water Resource Impacts

Q - Based on the latest climate projections for Wisconsin, and your professional experience in your field of expertise, what are the most likely impacts to water resources and/or hydrologic processes that would be important to communicate to the people of Wisconsin at this time?

Resources :

- Lakes, Wetlands, Rivers/Streams, Groundwater

Hydrologic Processes:

- Infiltration and recharge, runoff and stormflow, baseflows, evapotranspiration, hydrodynamics

Consider impacts to:

- water quality (trophic status, sediments, DO, nutrients, chemistry, etc)
- water quantity (levels and flows)
- habitat (plants, substrate, wood)
- species (fish, macroinvertebrates, invasives)

Break down resource/process by geography or standard classification system if appropriate



Photos: Kyle Magyera

Key Water Resource Impacts

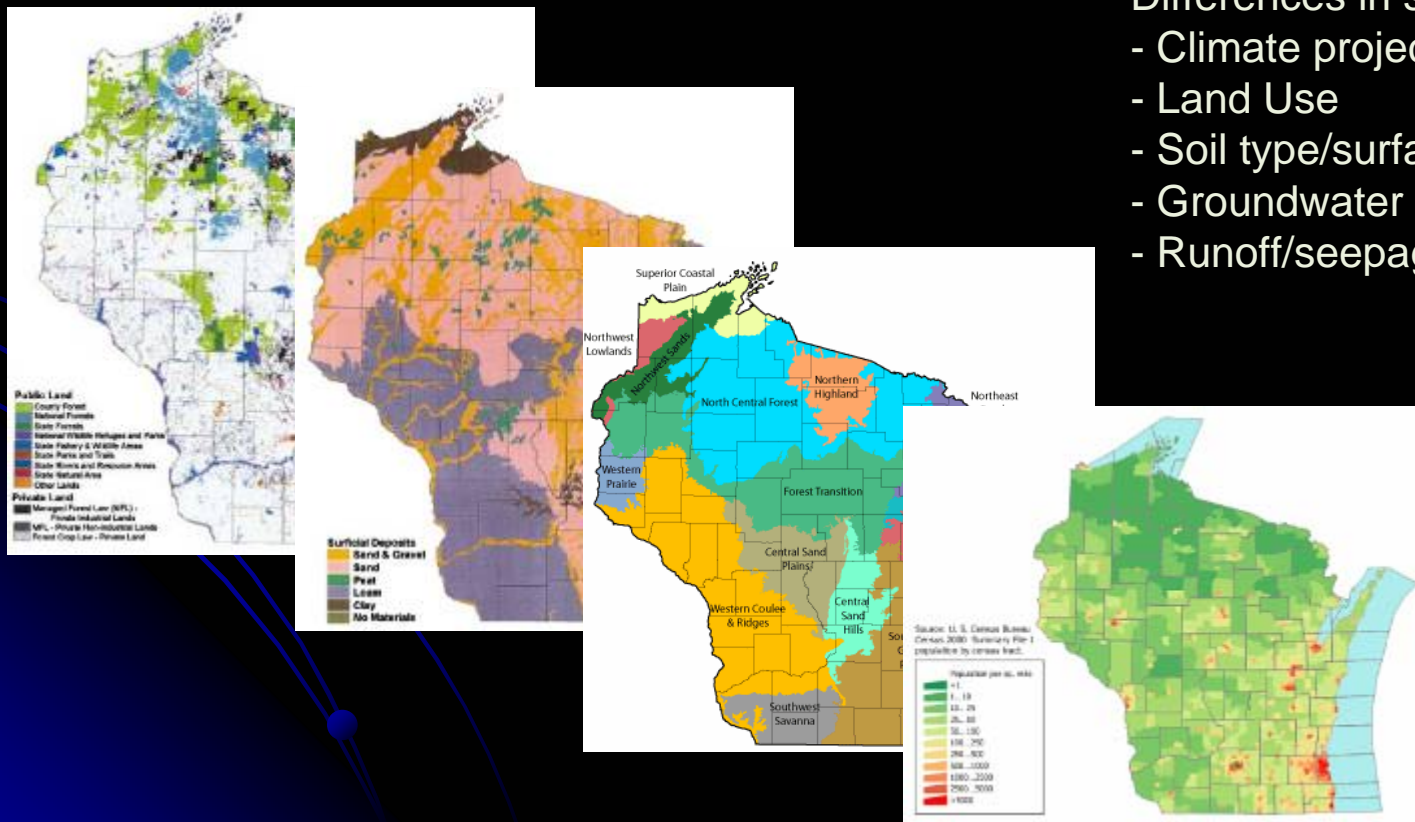
- ***Increased flooding***
- ***Increased frequency of harmful blue-green algal blooms***
- ***Conflicting water use concerns***
- ***Changes in water levels***
- ***Increased sediment and nutrient loading***
- ***Increased spread of aquatic invasive species***

Consensus Statement

“Our working group cautions that not all portions of Wisconsin are expected to respond in a similar manner in hydrologic responses to climate change.”

Differences in state:

- Climate projections
- Land Use
- Soil type/surface deposits
- Groundwater characteristics
- Runoff/seepage



Areas of uncertainty

- Timing, amount, and form of spring precipitation events relative to spring thaw
- Balance between increased precipitation and increased evapotranspiration on groundwater recharge, and subsequently lake levels and stream baseflows
- Short term (years to decades) vs long term (decades to century) processes

Adaptation Goals for Water Resource Management

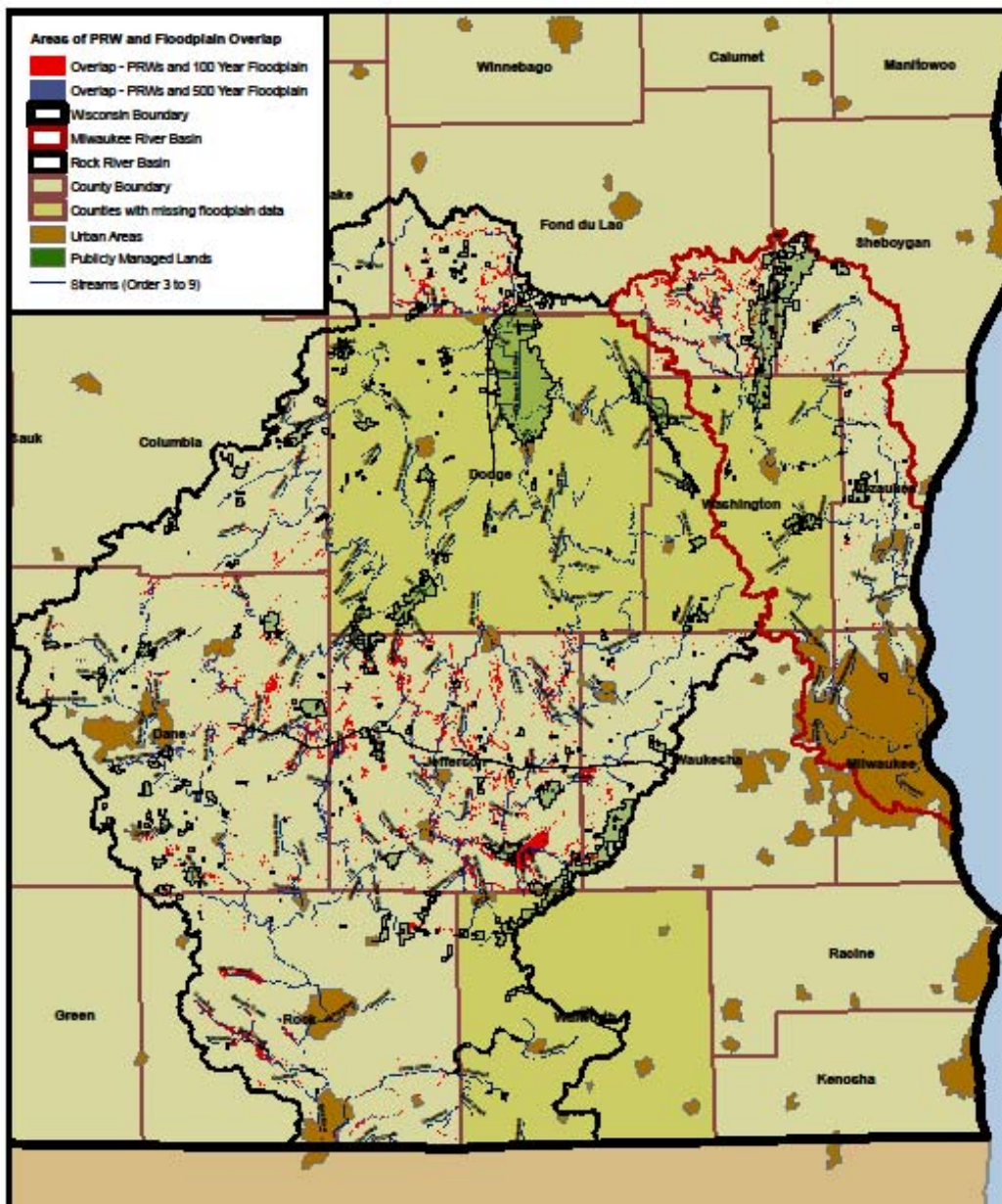
- Minimize threats to public health and safety by anticipating and managing for extreme events (floods and droughts)
- Increase resiliency of aquatic ecosystems to buffer the impacts of future climate changes
- Stabilize future variations in water quantity and availability by managing water as an integrated resource
- Maintain, improve, and restore water quality under a changing climate regime

Potential Adaptation Strategies

Strategy: Respond to increased flooding and impacts to infrastructure and agricultural land

- Identify and map and prioritize Potentially Restorable Wetlands (PRW's) in floodplain areas
- Reverse the loss of wetlands to mitigate storm flows and nutrient loading downstream
- Restore prior-converted wetlands in upland areas to provide storage and filtration





Areas in red show overlap between PRWs and 100 year floodplain

Note: floodplain delineations not complete for some counties.

Potential Adaptation Strategies

Strategy: Preventing increased sediment and nutrient loading during earlier and more intense spring runoff events

- Resize manure storage lagoons, wastewater facilities, storm sewers, etc to accommodate increased storm flows
- Restore prior-converted wetlands to provide storage and filtration and mitigate nutrient loading
- Protect recharge/infiltration areas, riparian buffers
- Incorporate resilient water management strategies into farm-based nutrient management plans



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

WICCI Stormwater Working Group



Potential Adaptation Strategies

Strategy: Response to changes in water levels due to variable precipitation, recharge, increased evaporation

- 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 – S. Ebben, Rhinelander, WI



Photo - WDNR



Photo – Janesville Gazette

Anvil Lake (Vilas Co.)



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.

Anvil Lake Stages 1936-2010



WICCI Water
Resources
Working Group

Potential Adaptation Strategies

Strategy: Response to increasing groundwater extraction and demand for water

- Encourage large water users to locate in areas with adequate (sustainable) water sources (e.g. large rivers/Great Lakes).
- Encourage water conservation (rural and urban) through incentives and regulation
- Promote Integrated Water Management: Planning water use based on long term projections of supply and demand

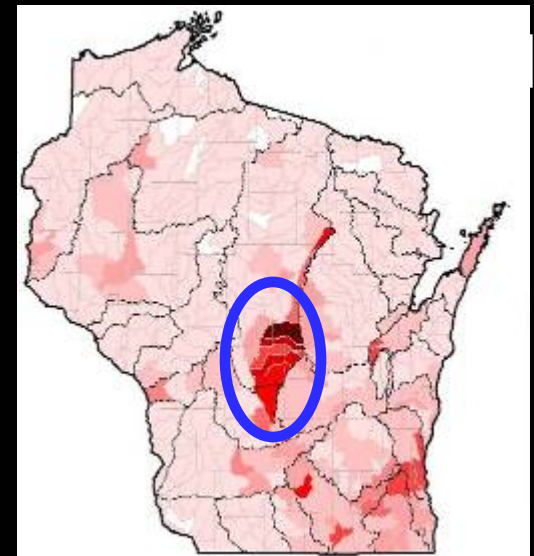
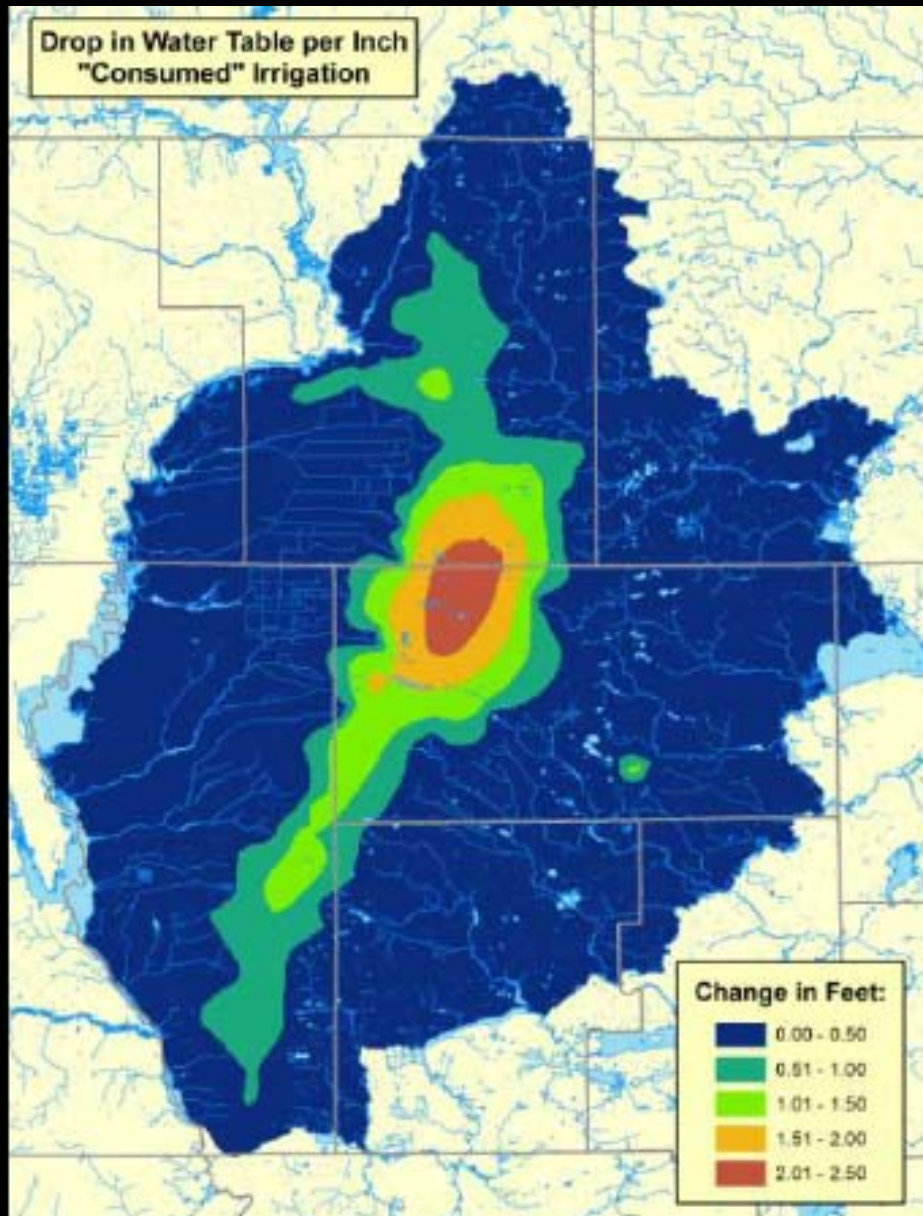


Photo - Mark Rozin/Capital Press



Quentin LaFond

Groundwater Management Areas!



Kraft & Mechenich, 2010

Potential Adaptation Strategies

Strategy: Prepare and respond to increased frequency of harmful blue-green algal blooms

- 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.



Photo – Anvil Lake Association



Photo - Petenwell and
Castle Rock Stewards

Potential Adaptation Strategies

Strategy: Reducing the potential for increased spread of aquatic invasive species

- 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, etc.
- Develop rapid response planning and implementation methods to improve existing aquatic invasive species control programs



Photo – WDNR



Photo – Don Bush, WDNR

Future Directions/Activities of WICCI Water Resources Working Group

- Identify and seek funding for Wisconsin research/outreach activities.
- Continue to synthesize existing knowledge and identify information gaps
- Propose new research and inform monitoring initiatives
- Continue to develop adaptation strategies and guidelines for managing watersheds, aquifers, and water-rich landscapes



WRI Call for Proposals



State of Wisconsin \ GROUNDWATER COORDINATING COUNCIL

Jim Doyle, Governor

101 South Webster Street
Box 7921
Madison, Wisconsin 53707
FAX 608-267-7650
TDD 608-267-6897

Joint Solicitation

**State of Wisconsin Groundwater Research and
Monitoring Proposals for State FY 2012**
(July 1, 2011 – June 30, 2012)

and

**University of Wisconsin Water Resources
Institute, USGS 104(B) Research Grants
Program for Federal FY 2011**
(Project period: March 1, 2011 - February 29, 2012)

Facilitated by:
Wisconsin Groundwater Coordinating Council
University of Wisconsin Water Resources Institute

Participating agencies:
University of Wisconsin System
Wisconsin Department of Natural Resources
Wisconsin Department of Agriculture, Trade & Consumer Protection
Wisconsin Department of Commerce

Proposal Submission Deadline: November 17, 2010

Contact James Hurley, Water Resources Institute (hurley@aqua.wisc.edu) or Jeff Helmuth, WDNR (jeffrey.helmuth@wisconsin.gov) if you have questions or wish to be removed from the mailing list for this annual solicitation.

Major research areas that should be explored ***using the new downscaled data:***

- Enhancing or refining existing hydrologic models
- Compiling and analyzing spatial/temporal trends in long-term hydrologic information
- Compiling and analyzing hydrologic parameters that are used by managers and regulators that may be affected by climate change
- Initial design of a climate response monitoring network
- Thermal impacts and the effects on biological communities and/or nutrient and carbon cycling

<http://wri.wisc.edu/>

How AWRA members can be involved

- Help get the word out! – <http://wicci.wisc.edu>
- Suggest information and research needs
- Join a working group or form new WICCI working groups around a topic or geographic region of WI
- Sponsor or lead adaptation workshops at community, watershed, or aquifer scale
- Help incorporate climate change adaptation into existing planning and decision-making efforts (e.g. water supply planning, TMDLs)

Water Resources and Climate Adaptation

WICCI's First Adaptation Report	Possible Water Resources Topics for Future Reports
Water Resources (General)	Seepage Lakes
Stormwater	Coastal Wetlands
Coldwater Fisheries	Groundwater Sustainability
Milwaukee	Great Lakes Water Levels
Green Bay	Aquatic Invasive Species
Central Sands	Northern Highlands or Driftless Area
Coastal Communities	Your topic here!

Working Group Participants

**Tim Asplund – WDNR, group
co-chair**

Tom Bernthal – WDNR

Carolyn Betz – UW-Madison

Ken Bradbury, UW-Extension
WGNHS

Esteban Chiriboga - GLIFWC

Alison Coulson – UW-
Madison/WDNR

Steve Elmore - WDNR

Andy Fayram – WDNR

Paul Garrison -- WDNR

Steve Greb – WDNR

Tim Grundl – UW-Milwaukee

Bob Hansis – WDNR

Jen Hauxwell – WDNR

Dale Higgins – US Forest Service

**Jim Hurley – UW-Madison,
group co-chair**

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Kevin Kirsch – WDNR

George Kraft – UW-Stevens Point

Dick Lathrop – WDNR

Steve Loheide – UW-Madison

John Magnuson – UW-Madison

Mike Miller – WDNR

Erin O'Brien – Wisconsin
Wetlands Association

Ken Potter – UW-Madison

Dale Robertson – USGS

John Walker - USGS

Steve Westenbroek – USGS

Chin Wu – UW-Madison