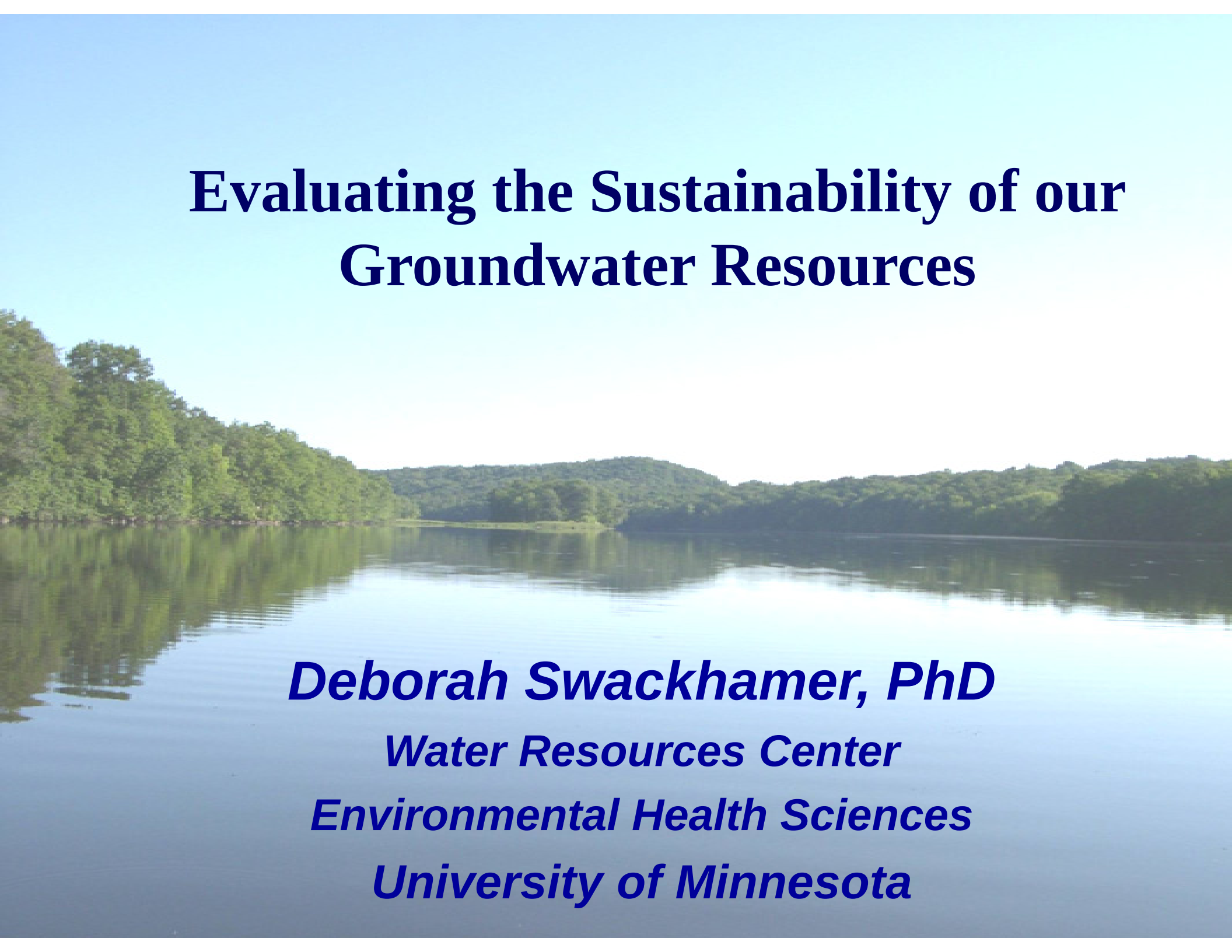




Evaluating the Sustainability of our Groundwater Resources

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Overview

- Two Groundwater Workshops
 - ◆ Purpose
 - ◆ Who participated
 - ◆ Process
 - ◆ Outcome
 - ◆ Next steps



What was the motivation?

- Lack of clear consensus of adequacy of supply
- DNR Report (2005):
 - ◆ *Sustainability of Minnesota's Ground Water: A Statement of Issues and Needs*
- EQB/DNR Report (2008):
 - ◆ *Use of Minnesota's Renewable Water Resources: Moving Toward Sustainability*
- Groundwater managed for different uses



DNR Report, 2005

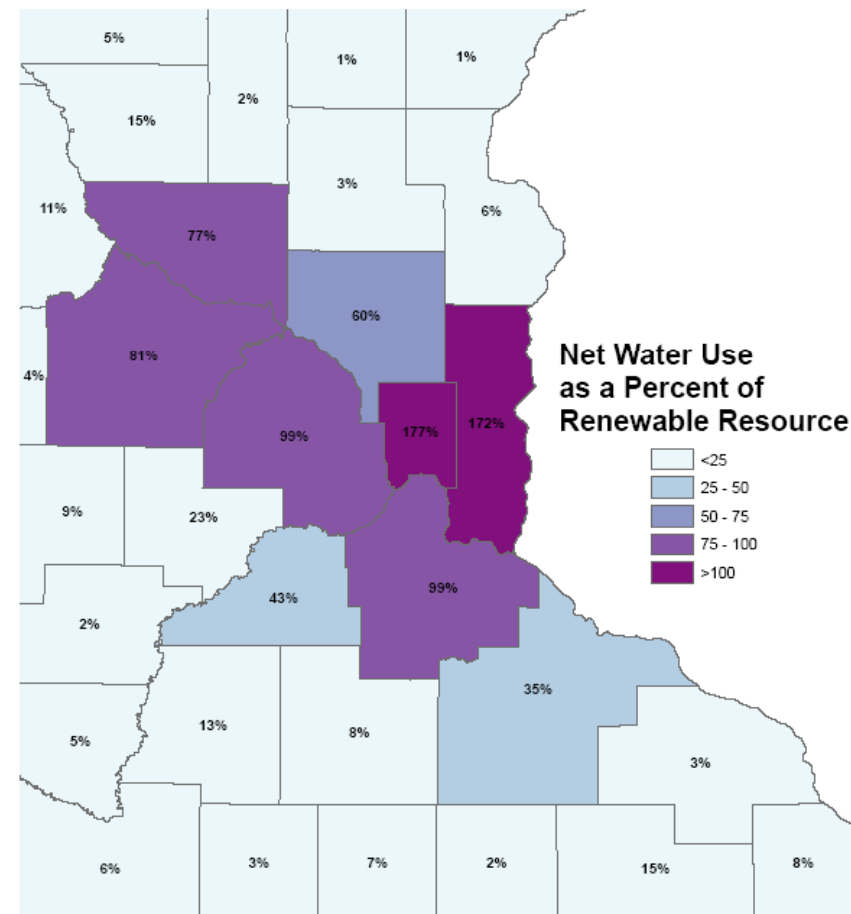
- ***“Sustainable use of ground water is the use of water to provide for the needs of society, now and in the future, without unacceptable social, economic, or environmental consequences.”***
- **Identified Needs:**
 - ◆ Technical
 - ◆ Planning
 - ◆ Monitoring
 - ◆ Regulatory

EQB & DNR, 2007

Moving Towards Sustainability

- Evaluated current and future (2030) demand by County
- Provided recommendations for needed research
- Provided recommendations for future assessments

2030 Net Water Use as a Percent of the Renewable Resource





EQB Water Availability Project, 2008

- Recommendations for:
 - 1: Achieving protective standards
 - 2: Planning for water sustainability
 - 3: Defining water information needs



Unanswered Questions:

- Do we know how much groundwater we have?
- Do we know how much we are using or replacing?
- What is needed to answer these questions?



Ad hoc Steering Committee

Convened by WRC and Freshwater Society
Deb Swackhamer, Faye Sleeper,
Gene Merriam, Joan Nephew

Members:

- Laurel Reeves – DNR
- Chris Elvrum – Met Council
- Bruce Olsen – MDH
- Dale Setterholm – MGS
- Scott Alexander – MGWA
- Jim Stark - USGS
- John Wells – EQB
- John Neiber - UM



What are “Sustainable Waters”?

Those that meet people's needs,
safeguards ecosystem functions,
preserves water quality,
and provides adequate water for
future generations.

- (EQB, 2008)



Workshop: Nov 2008

- Invited participants – limited to 50
- Technical people only
- Policy discussion discouraged
- Plenary and facilitated breakout sessions



Plenary Speakers

- Dr. Bruce Wilson, UM
 - ◆ Framing the Groundwater System: The Hydrologic Cycle

- Dr. Ray Wuolo, Barr Engr
 - ◆ What Tools, Models and Data are Available?



Bruce Wilson

- Must consider mass balance of water
 - ◆ Water balance, not just depth
- Ground water watershed $\neq$ surface water watershed
- Scale of watershed greatly influenced recharge



Ray Wuolo

- Developed 2050 ground water Metro model
- Raised issues of
 - ◆ preserving available drawdown for future users
 - ◆ aquifer 'mining' (removal of stored water)
 - ◆ Drawdown below confining layer
 - ◆ Surface water-ground water interactions
- Pumping affects surface water – need models that predict water balance to assess sustainability



National Case Studies

- Howard Reeves, USGS

- ◆ Michigan

- Ken Bradbury, U of WI

- ◆ Wisconsin

- Virginia McGuire, USGS

- ◆ Ogallala Aquifer



Howard Reeves, PhD

- New permit regulations motivated by Great Lakes Compact
 - ◆ Formed Water Resources Advisory Council, with Technical Subcommittee
- Created on-line Water Withdrawal and Assessment Tool
- Assesses adverse ecological impacts



Ken Bradbury, PhD

- Drawdown not most important indicator, water balance is
 - ◆ Water balance not as easy to get at
- Ground water – surface water interactions
 - ◆ Trout streams dry from GW withdrawals
- 2003 GW Quantity Law
 - ◆ Did not link withdrawals to ecological impacts
 - ◆ Process a bit bogged down



Virginia McGuire, MS

- High Plains Aquifer
 - ◆ 8 states
 - ◆ Ogallala largest unit
 - ◆ Not managed sustainably
 - ◆ Unacceptable recharge – water contamination
- Sustainability system is function of quantity & quality, legal framework, socio-economics and social choices



Breakout Groups

- What is needed to understand the system: Identify gaps in monitoring and modeling
- What scaling issues should be considered (esp. modeling)
- What are the knowledge and research gaps?
- What are the significant human impacts on the system?



Findings

- We do not know the 3-D extent of our groundwater
- Need better understanding of all components of hydrologic cycle
- Monitoring data are insufficient
- Scaling issues are critical
- Understanding the interaction of groundwater and surface water is critical
- Complete geological atlas project



Monitoring Needs

- Quantifying recharge is difficult, esp evapo-transpiration
- Need base-flow stream data
- Need times series data, e.g. GW levels
- Should use systems approach
- Need good use data



Monitoring Needs

- Aquifer geometry data
- Water balance –
 - ◆ amt exported in food and products
 - ◆ tile drainage impacts
- Recharge water quality
- Surface water – ground water relationship, effect on ecology
- Access/management of databases



Modeling Needs

- Scale needed depends on question being asked
- Need to address time and space
- Understanding limitations of models and error propagation
- Scenarios of land use
- Should integrate hydrologic, biological, chemical, geomorphic (& human) systems
- Incorporate remote sensing data
- Scaling changes impact model parameters



Human Impacts

- Land use
- Cropping systems
- Tile drainage
- Waste disposal practices
- Positive feedback effects
- Geothermal heating and cooling
- Use of water for aesthetics
- Demographic change
- Climate change and warming!



Next Steps

Workshop: May 2009

- Build on Nov 2008 results
- Align with DNR study



Workshop: May 2009

- Purpose: to develop a comprehensive framework and guidance document that:
 - ◆ Can be used for assessing Minnesota's groundwater resources that is scientifically based
 - ◆ That accounts for the diversity of geological and hydrological conditions found in the state
 - ◆ That can be used for the different management questions asked



Workshop: May 2009

- Different management considerations include the following:
 - ◆ Permitting of water withdrawals
 - ◆ Protection of drinking water sources
 - ◆ Community-wide planning, including long-term and land-use planning
 - ◆ Protection of ecosystem services



DNR Charge

- Evaluate models, tools and information relevant to water management, availability, and sustainability decisions
- 2009-2010



Need Collaborative Approach to address Water Sustainability



Thank You!

Water Resources Center

UNIVERSITY OF MINNESOTA

Driven to DiscoverSM