Welcome to *The Current*, the North Central Region Water Network's Speed Networking Webinar Series

Groundwater Quality and Nitrate: 2PM CT

1. Submit your questions for presenters via the chat box. The chat box is accessible via the purple collaborate panel in the lower right corner of the webinar screen.
2. There will be a dedicated Q & A session following the last presentation.
3. A phone-in option can be accessed by opening the Session menu in the upper left area of the webinar screen and selecting "Use your phone for audio".

This session will be recorded and available at northcentralwater.org and learn.extension.org.

Today's Presenters:

- **Troy Gilmore**, Assistant Professor in the Conservation and Survey Division in the School of Natural Resources, University of Nebraska-Lincoln
- **Vasudha Sharma**, Assistant Extension Professor and Irrigation Specialist, University of Minnesota
- **Kevin Masarik**, Groundwater Education Specialist, University of Wisconsin-Madison Division of Extension and University of Wisconsin-Stevens Point

Troy Gilmore

Troy Gilmore is an Assistant Professor in the Conservation and Survey Division – School of Natural Resources with a joint appointment in the Department of Biological Systems Engineering. He earned his PhD in 2015 at North Carolina State University, in the Biological and Agricultural Engineering Department. His undergraduate degree is in Civil Engineering, also at North Carolina State University.

Groundwater Age: A Tool for Understanding Aquifer Impacts on Stream Water Quality

Troy E. Gilmore, Assistant Professor
Conservation and Survey Division – School of Natural Resources
Biological Systems Engineering
University of Nebraska – Lincoln
October 9, 2019

Water for Food
DAUGHERTY GLOBAL INSTITUTE
at the University of Nebraska

SCHOOL OF NATURAL RESOURCES

126 YRS
CSD
1893-2019

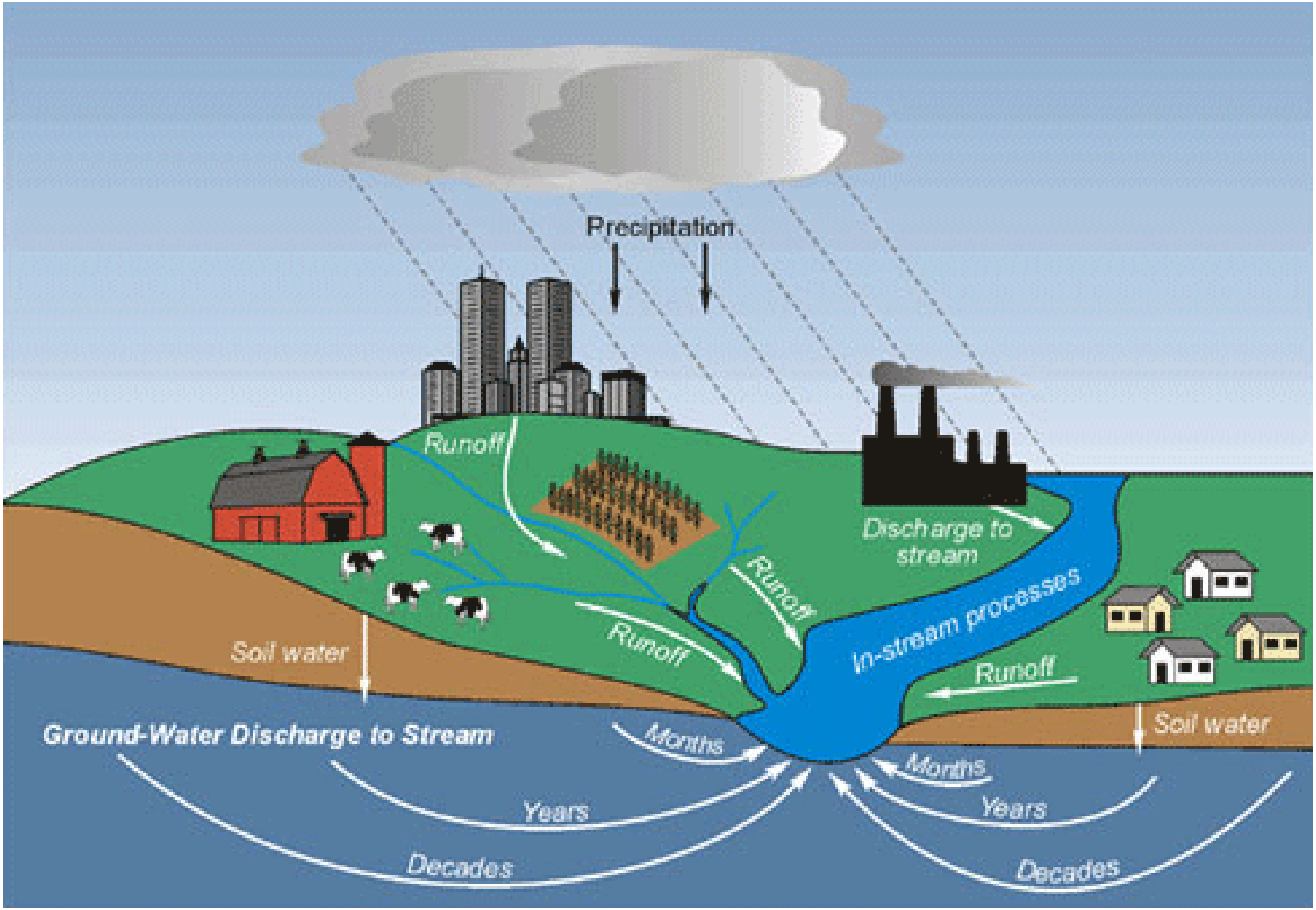
Acknowledgements

- Students
  - Mason Johnson (MS)
  - Marty Wells (MS)
  - Sydney Corcoran (UG)
  - Caner Zeyrek (PhD)
  - Mikaela Cherry (PhD)
  - Joshua Johnson (UG)
- Collaborators
  - North Carolina State Univ.
  - University of Utah
- Funding

National Science Foundation (EAR-1744719)

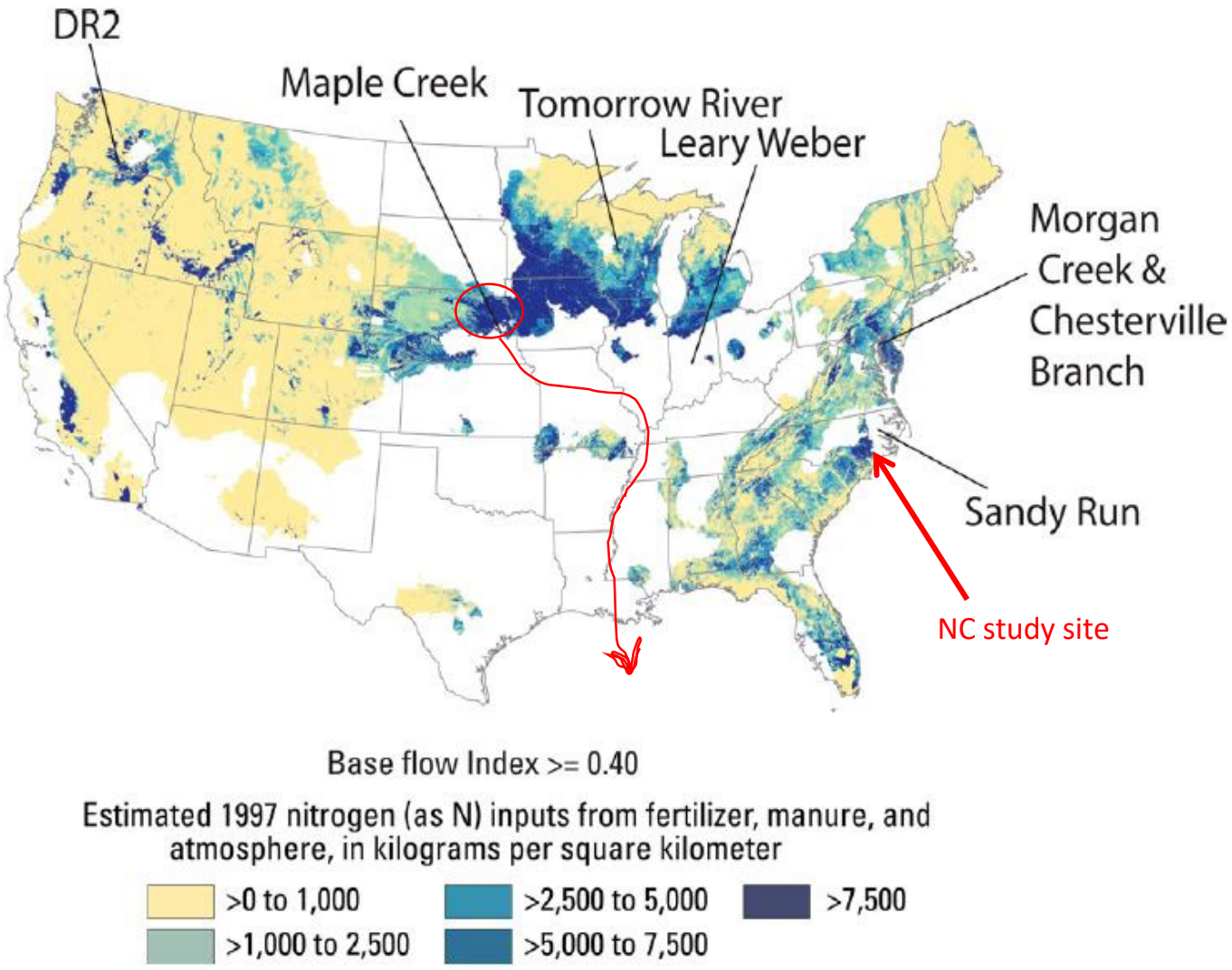
USDA NIFA - Hatch project NEB-21-177

Groundwater Flowlines and Discharge at a Streambed



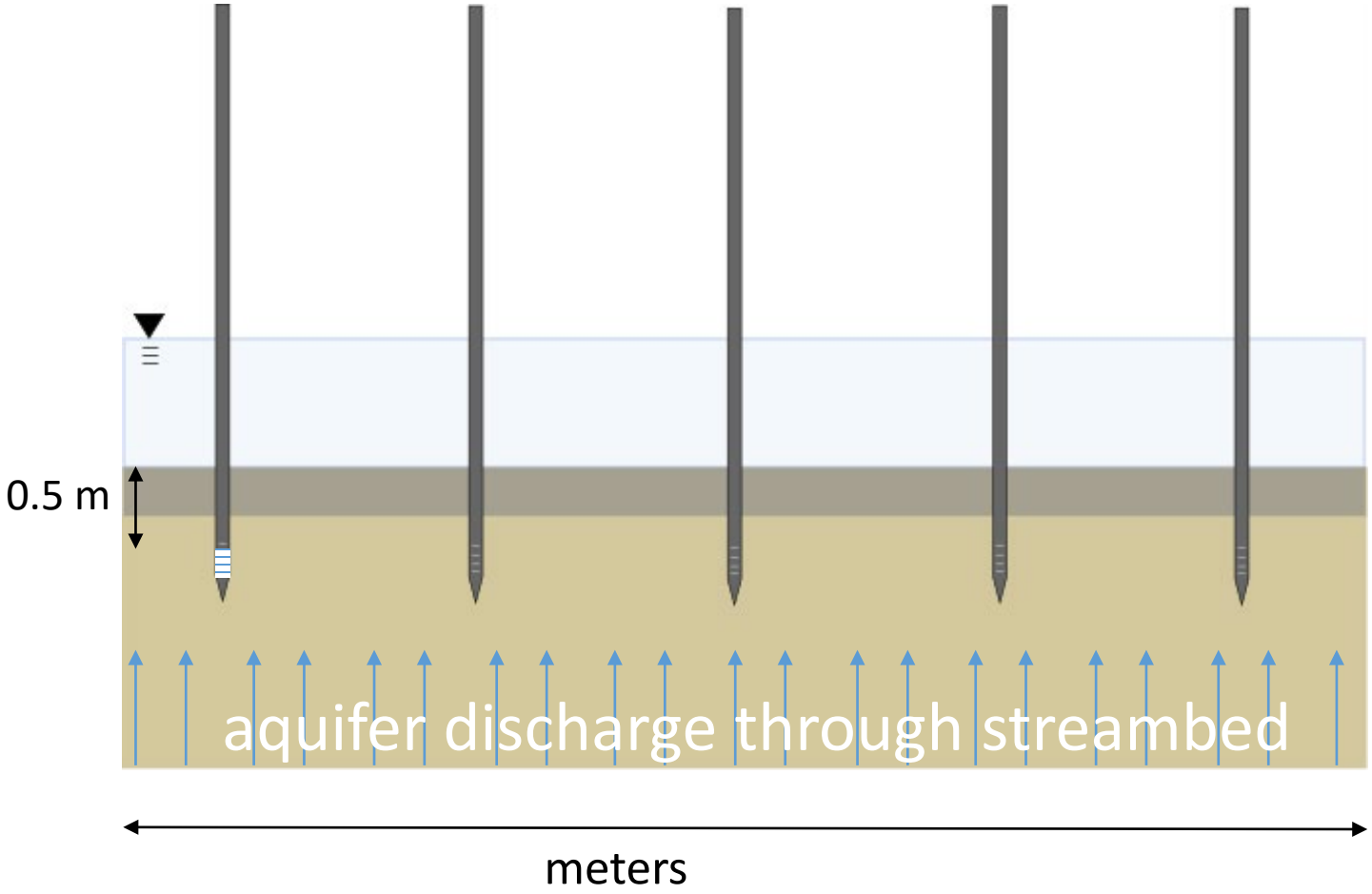
http://www.chesapeakebay.net/issues/issue/groundwater

Stream vulnerability to GW contamination

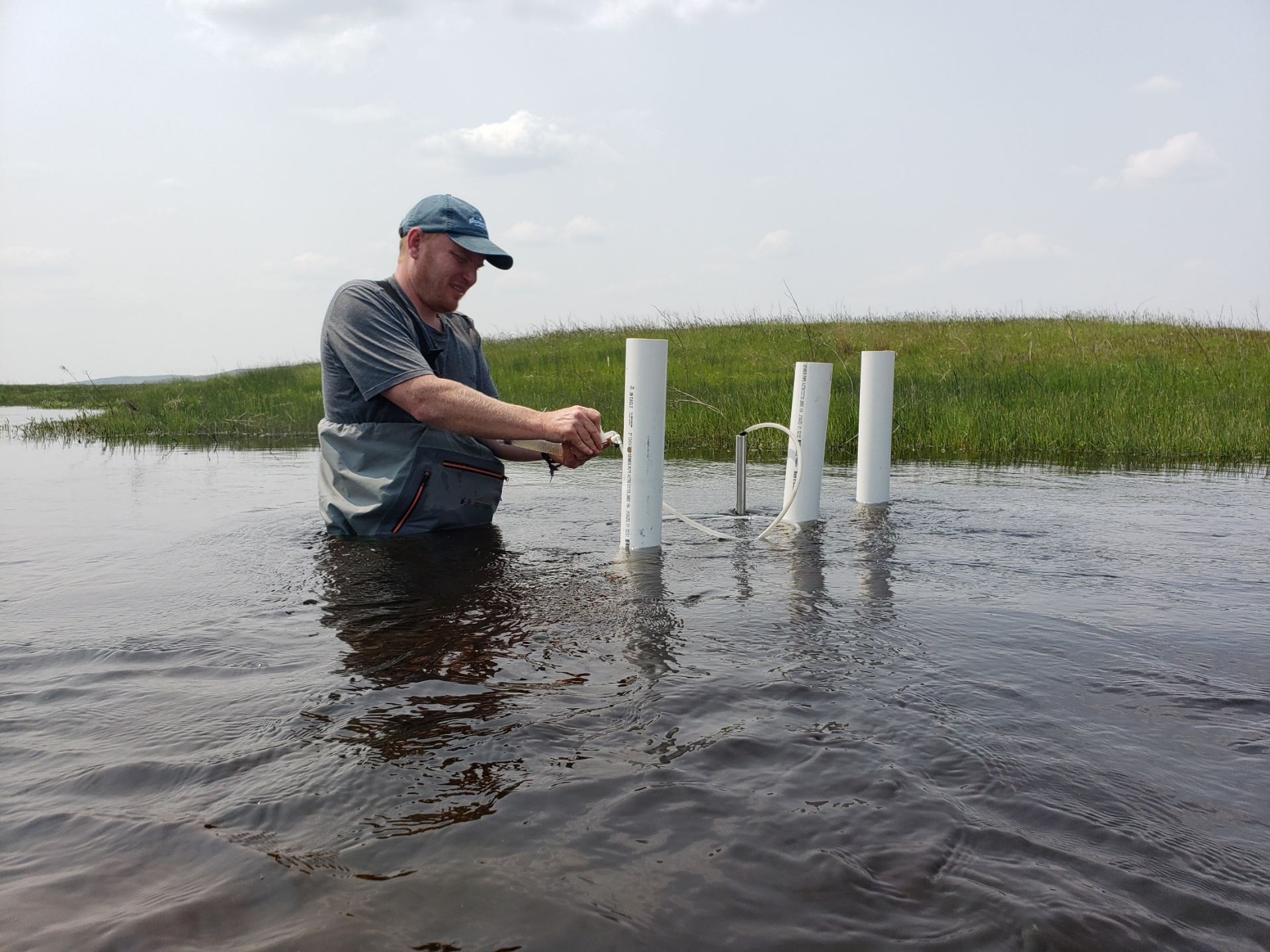


Tesoriero et al. (2013)

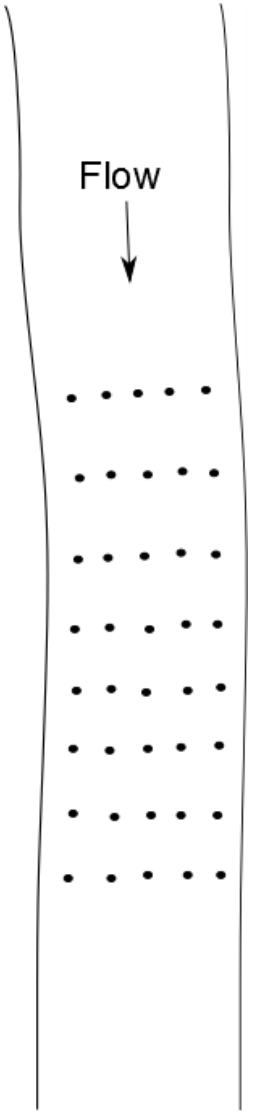
Groundwater sampling in streambeds

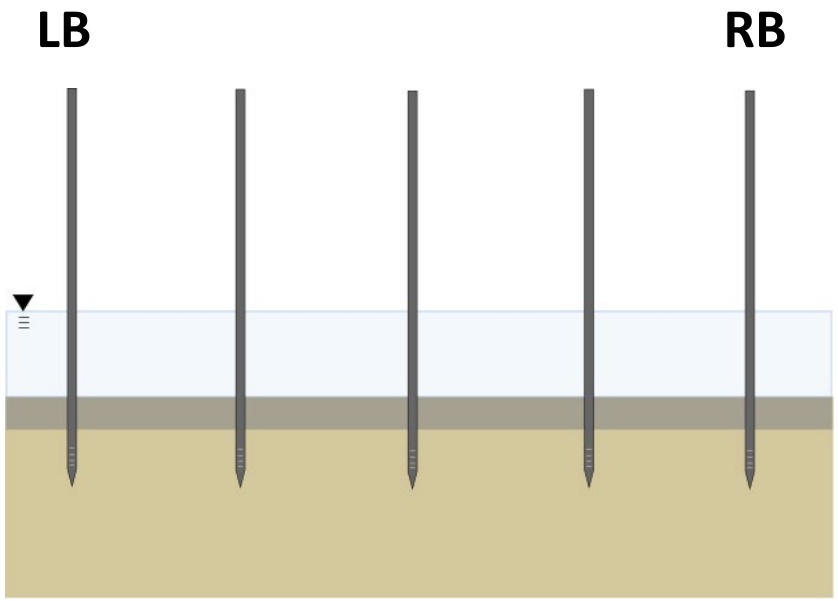


Browne and Guldan 2005; Kennedy et al. 2007, 2009; Genereux et al. 2008; Gilmore et al. 2016



Data collection: point scale

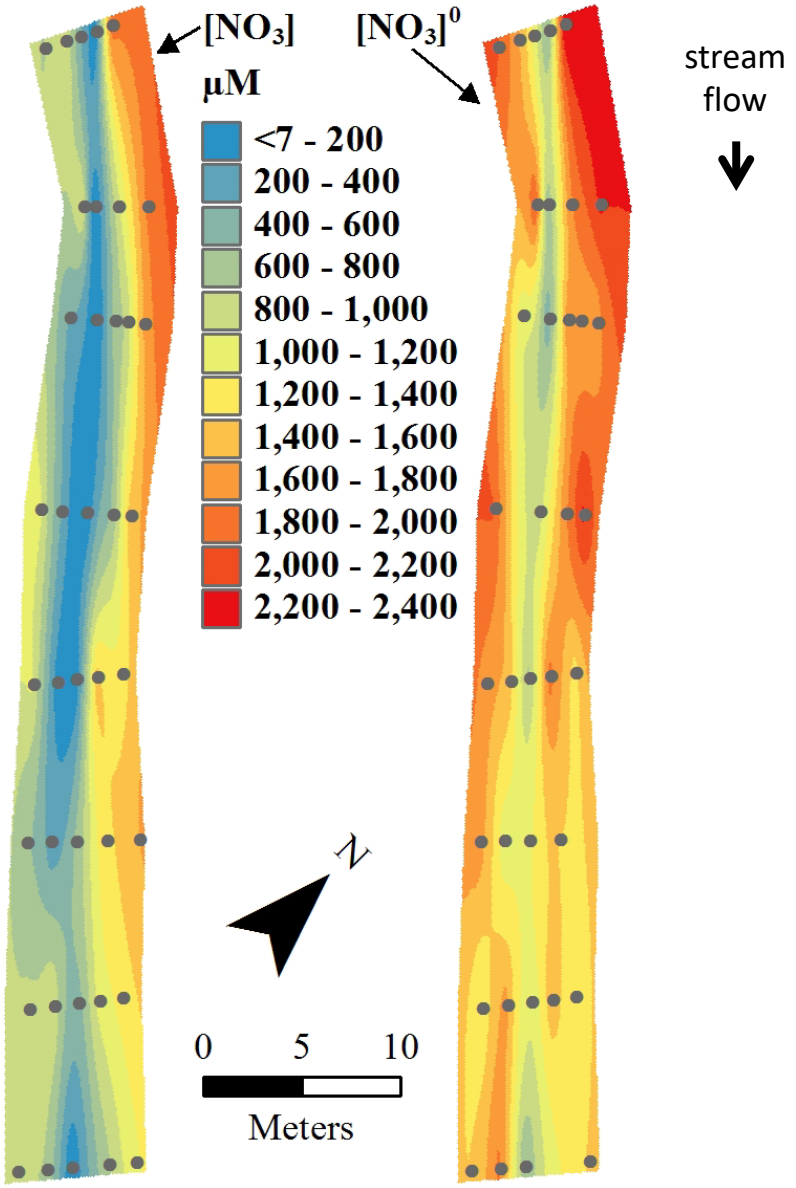




Kennedy et al. 2007, 2009; Genereux et al. 2008

Visualizing NO_3

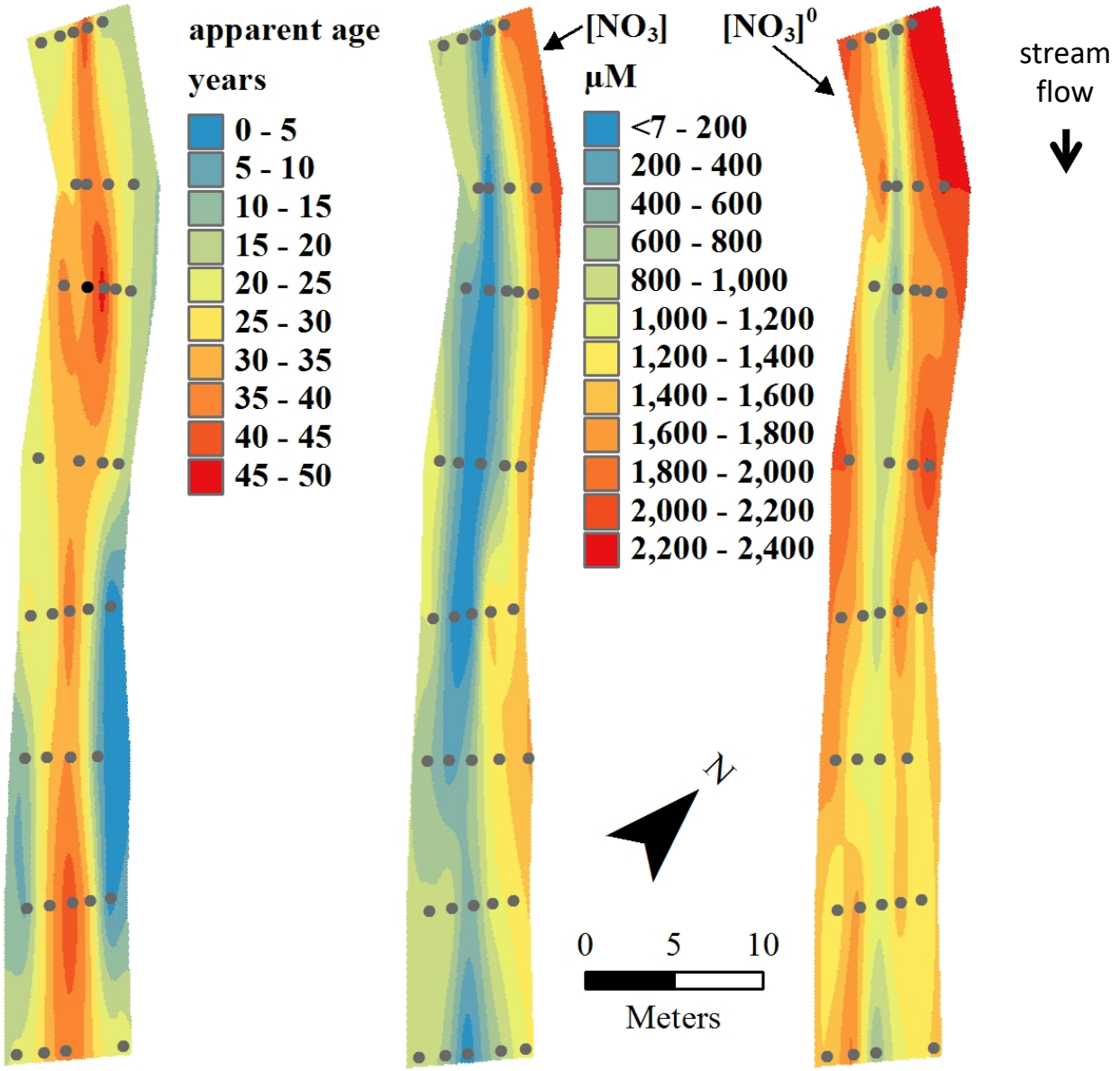
July
2012



Gilmore et al. 2016

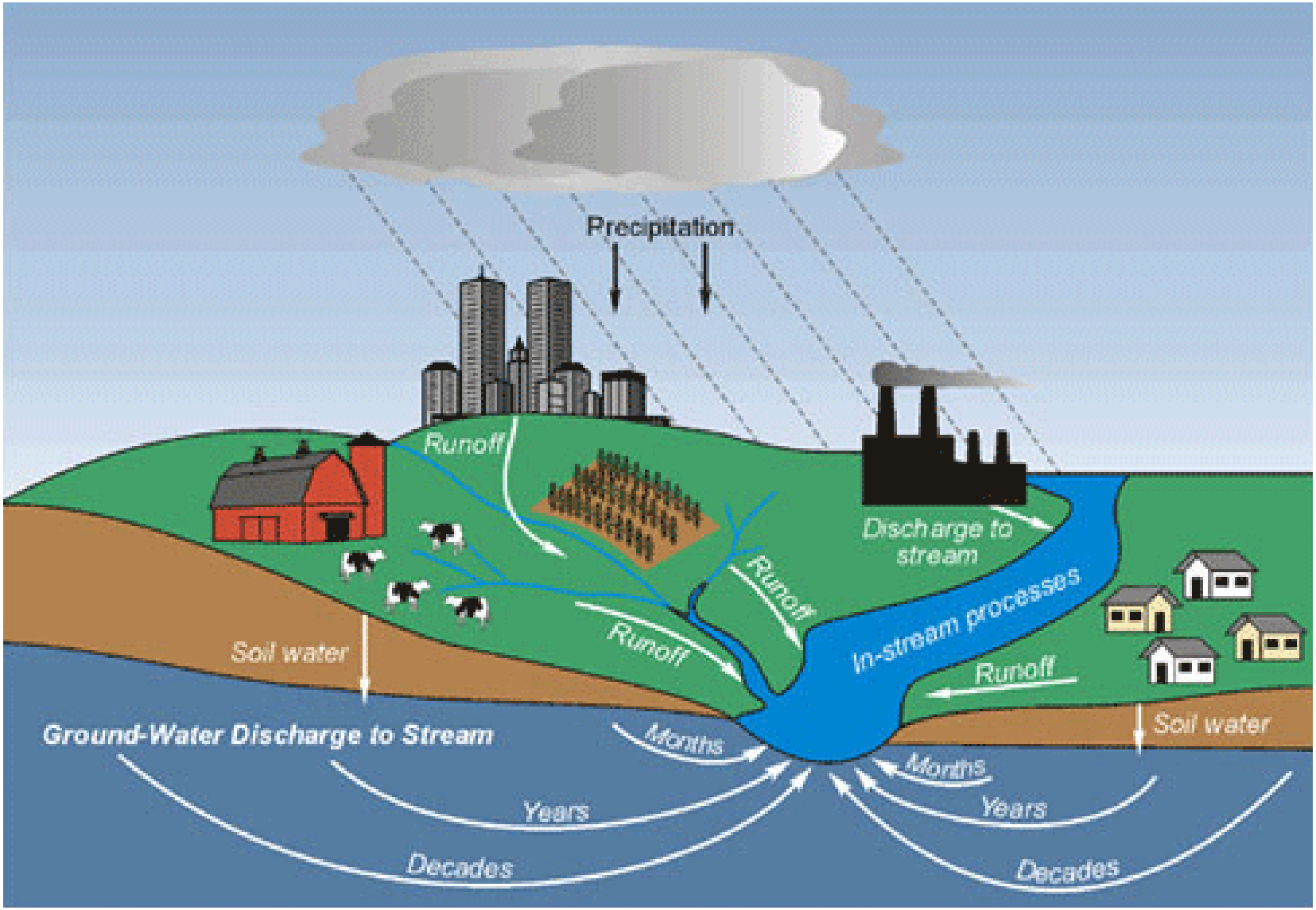
Visualizing NO_3 and age linkage

July
2012



Gilmore et al. 2016

Groundwater Flowlines and Discharge at a Streambed



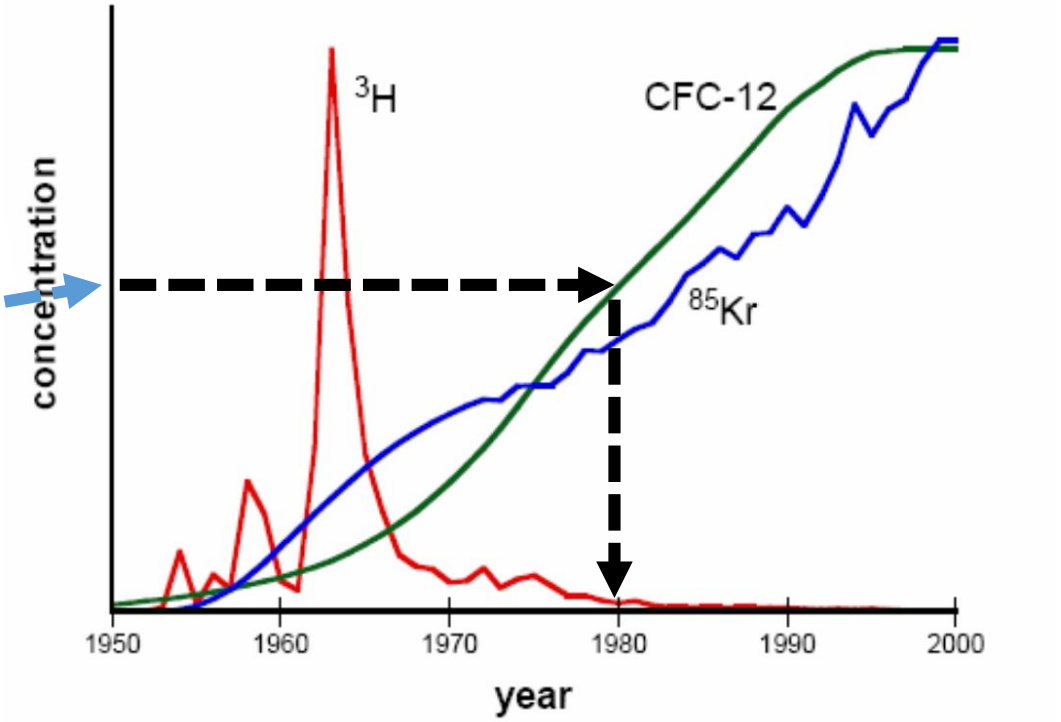
http://www.chesapeakebay.net/issues/issue/groundwater

Principle of age-dating with tracers

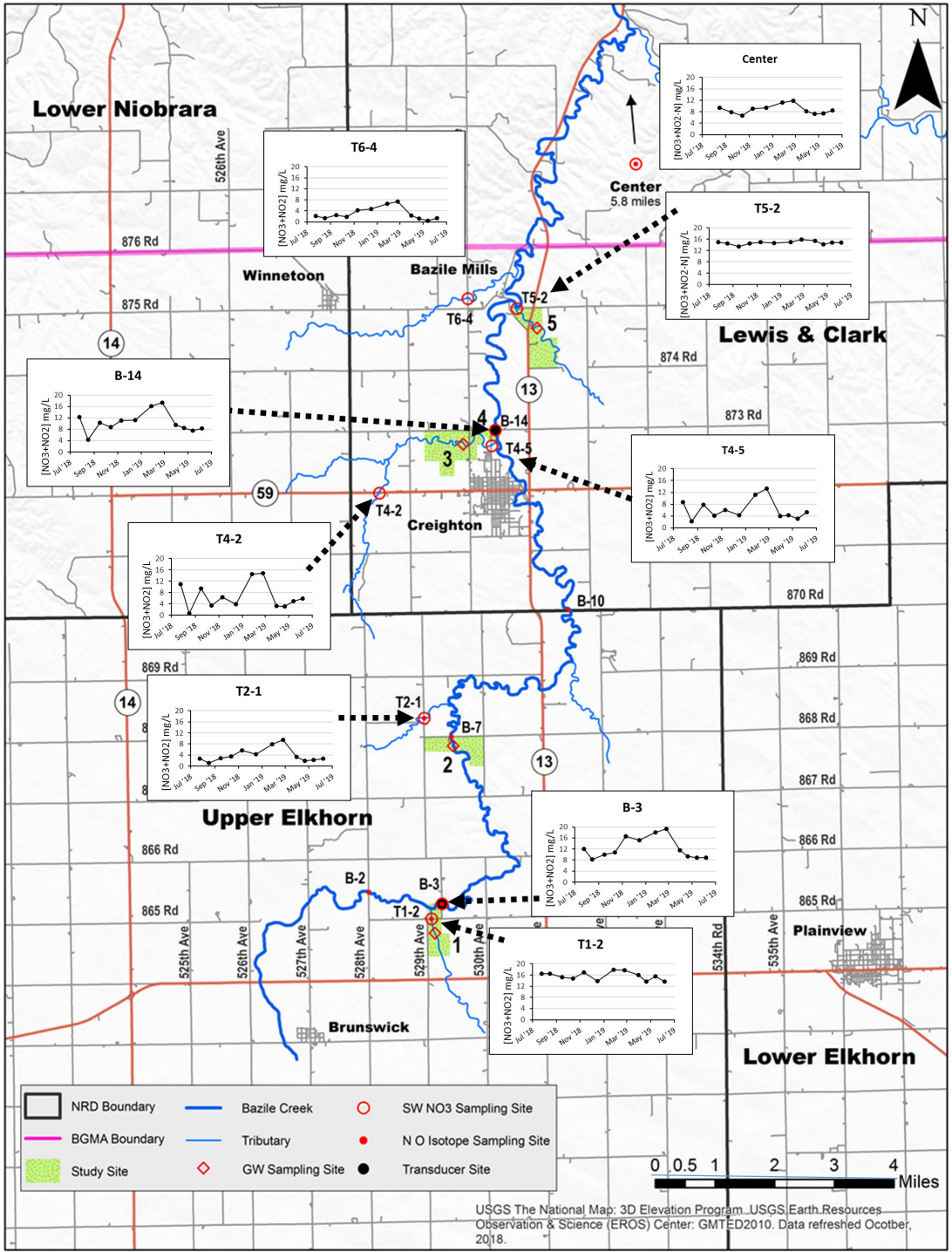
measure CFCs in GW

"do some calculations"

concentrations in the atmosphere



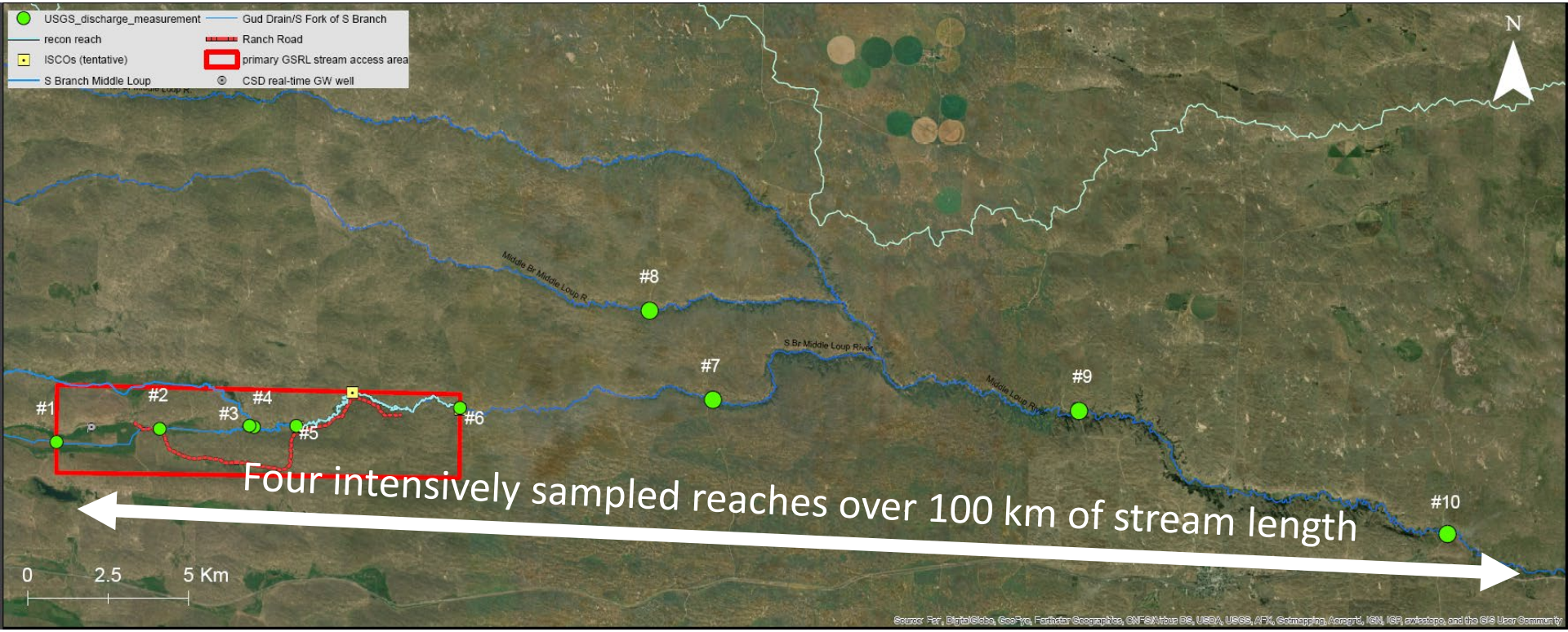
http://www.iup.uni-heidelberg.de/institut/forschung/groups/aquasys/WAH/lehre/material/Chap1%20Introduction.pdf



Upscaling

- ~30 km scale
- baseflow [NO_3^-] in SW
- "survey" of GW age using $^3H/^3He$

Upscaling and integrating GW age in numerical models

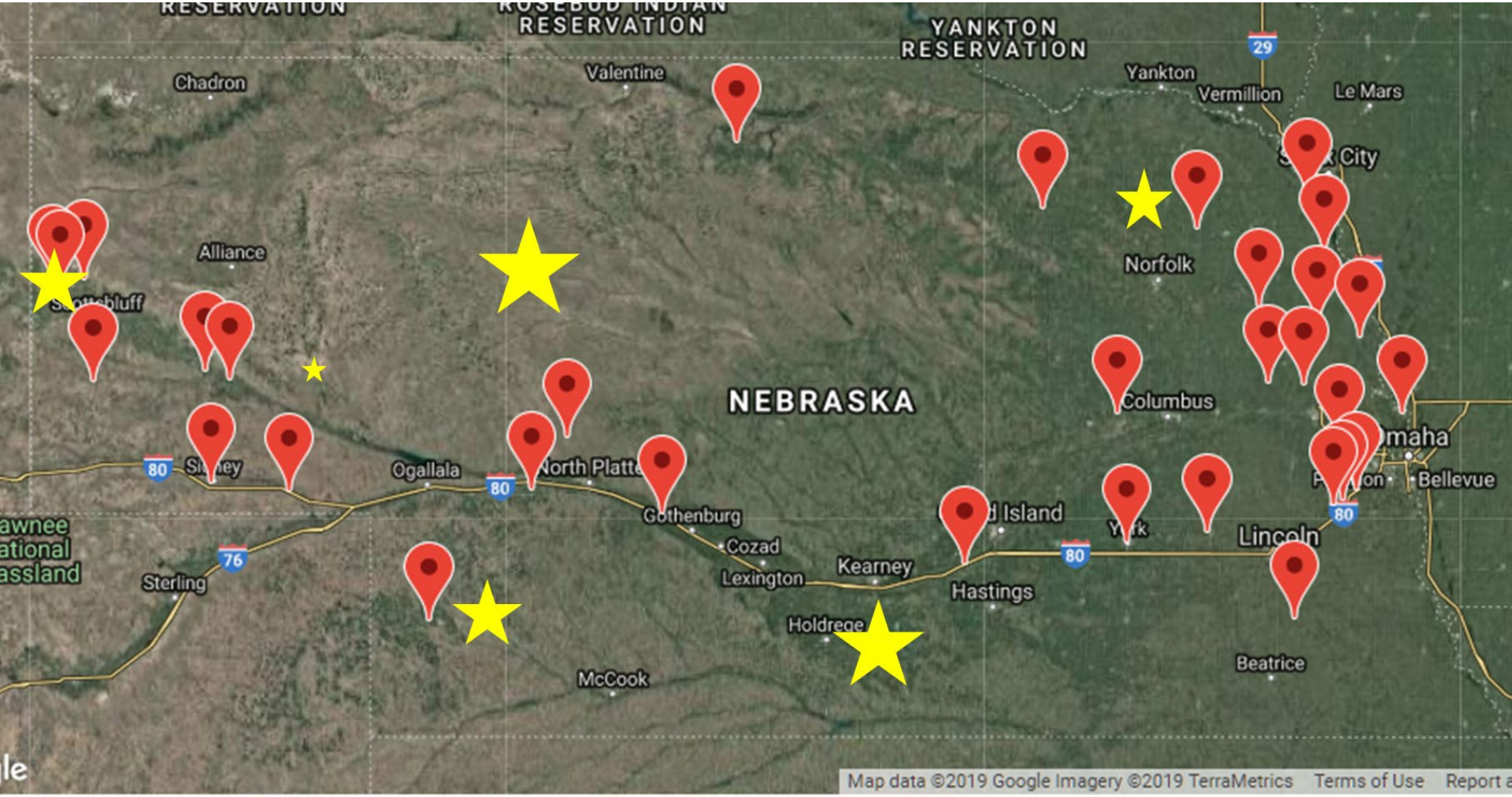


- Collaborators
  - North Carolina State Univ.
  - University of Utah

National Science Foundation (EAR-1744719)

Thank you!

SCHOOL OF NATURAL RESOURCES



https://go.unl.edu/gwage

gilmore@unl.edu
@gilmore_unl

Vasudha Sharma

Vasudha Sharma is Assistant Extension Professor-Irrigation Specialist in the Department of Soil, Water and Climate and Department of Bioproducts and Biosystems Engineering at the University of Minnesota. She earned her M.S. and Ph.D. degrees in Biological and Agricultural Engineering from the University of Nebraska-Lincoln in 2014 and 2018, respectively. Her current research and extension activities include soil water monitoring, evapotranspiration (ET) measurements, soil-crop water dynamic, and irrigation scheduling and management to reduce irrigation-induced environmental pollution in Minnesota.

Irrigation Management Impacts on Corn Yield and Nitrate Leaching in Minnesota Central Sands

Vasudha Sharma, Irrigation Specialist
Departments of Soil, Water and Climate and Bioproducts and Biosystems Engineering
University of Minnesota

Outline

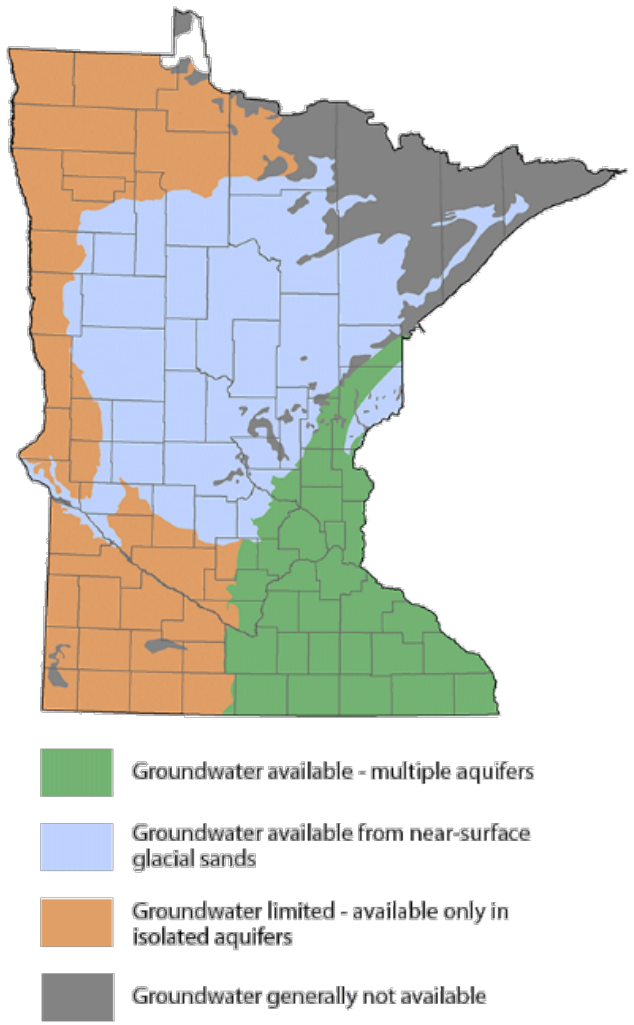
- Background
- Irrigation in Minnesota
- Ongoing Research Projects

Background

- **Assistant Extension Professor-Irrigation Specialist**: University of Minnesota (2018-present)
- **Ph.D.**: University of Nebraska-Lincoln, Biological Systems Engineering Department (2014-2018)
- **Masters**: University of Nebraska-Lincoln, Biological Systems Engineering Department (2012-2014)
- **Undergraduate**: Agricultural Engineering from Punjab Agricultural University, Ludhiana, Punjab in 2012

Groundwater in Minnesota

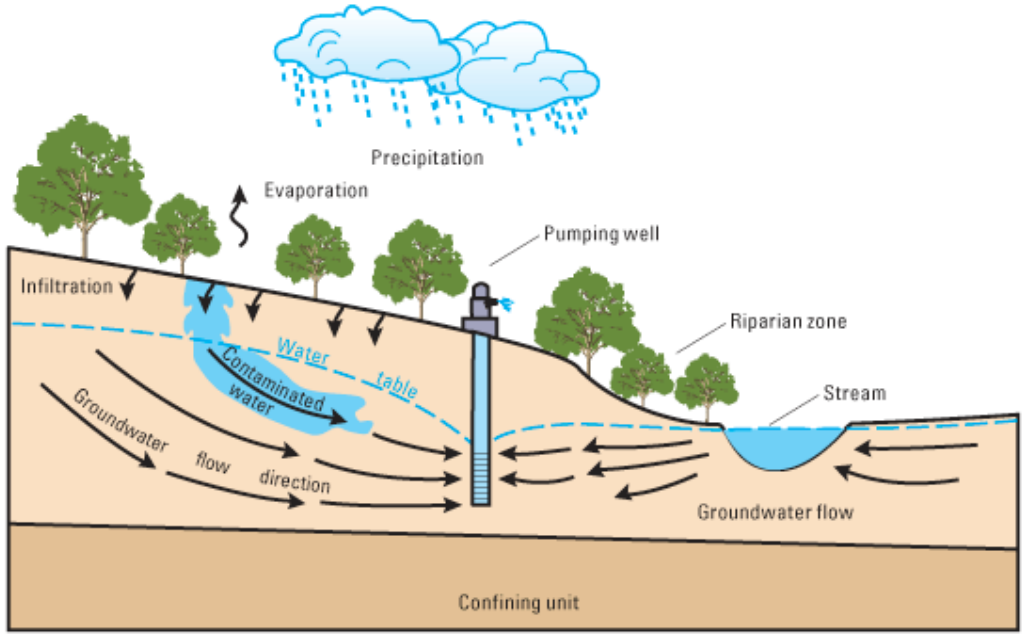
- Groundwater is the primary source of drinking water for about 75% of all Minnesotans
- It provides almost all of the water used to irrigate crops
- Availability varies throughout the state
- The central region of the state is characterized by coarse textured soils formed from glacial outwash
- Groundwater and surface water are interconnected



Picture: https://www.pca.state.mn.us

Groundwater Contamination

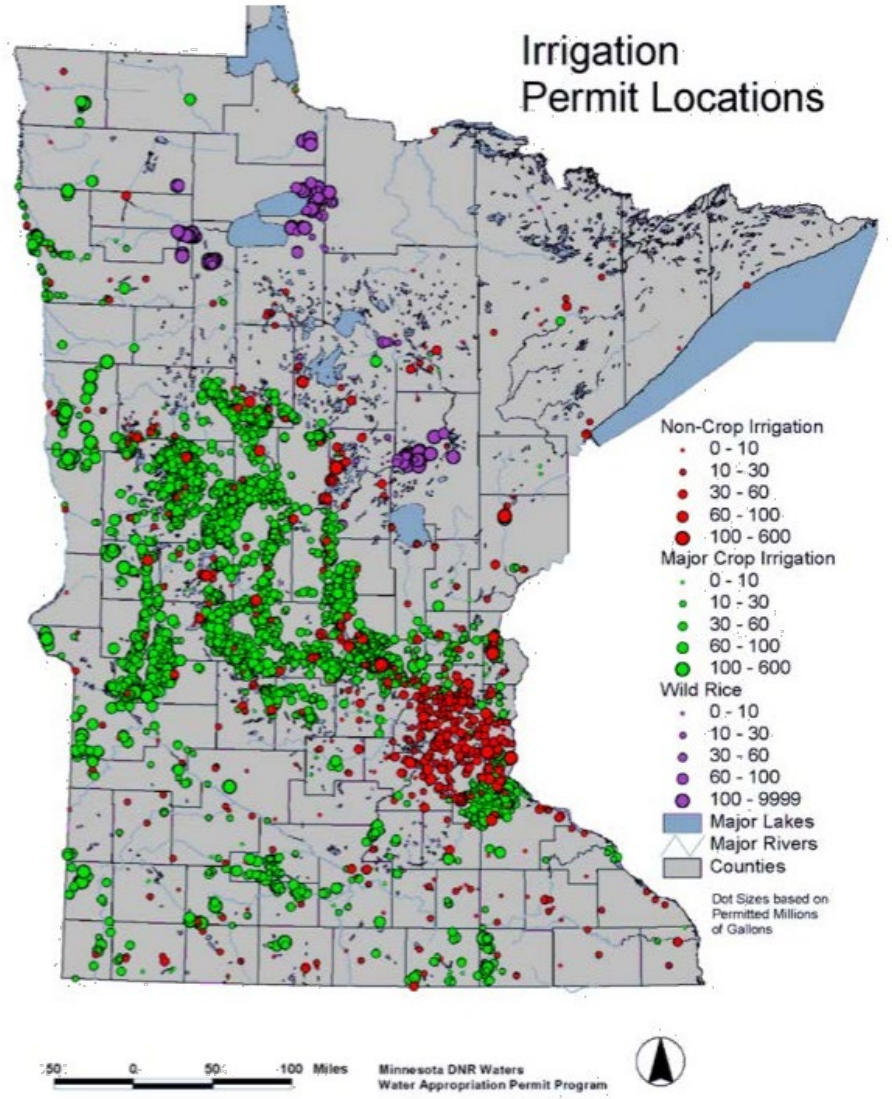
- In central region of the state, only 37% of the streams meet water quality standards for aquatic life (MPCA).
- About 40 percent of the shallow wells (less than 30 feet deep) have higher nitrate concentrations for drinking water (MPCA).



Picture: Domagalski et al. 2012

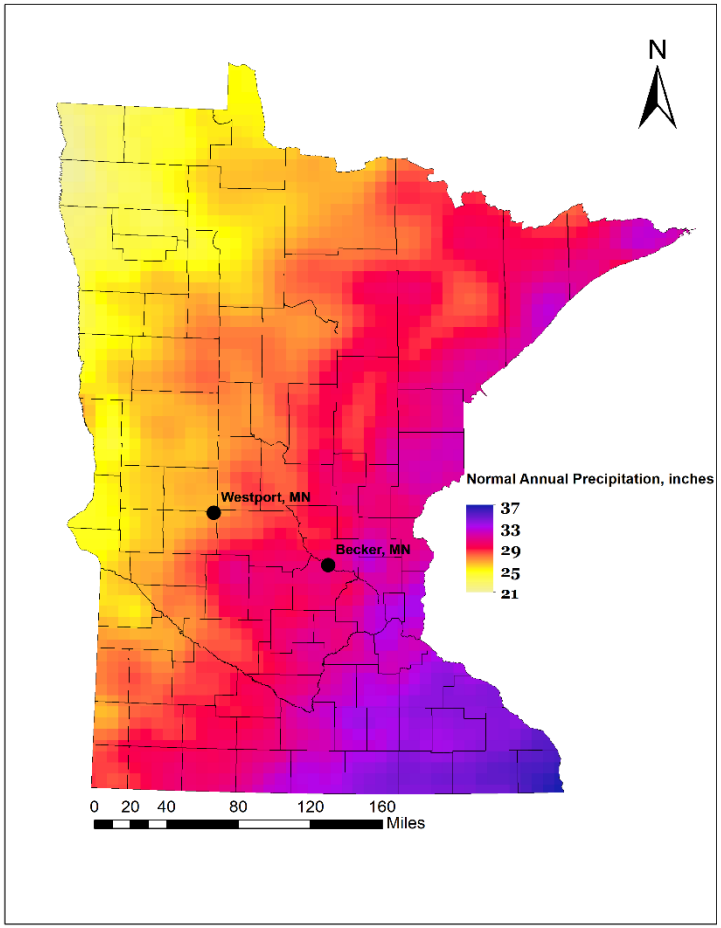
Irrigation in Minnesota

- Supplemental Irrigation is essential for crop production in central sands region: coarse textured soils and not enough precipitation in the growing season
- Extensive agricultural production with crops such as corn, soybean, wheat, potato, dry edible beans etc.
- Enhanced the stability of many local communities



Picture: https://files.dnr.state.mn.us/waters/gwmp/thresholds/gw-thresholds-project_groundwater-reviews.pdf

Irrigation Research In Minnesota



Irrigation and Nitrogen interaction study

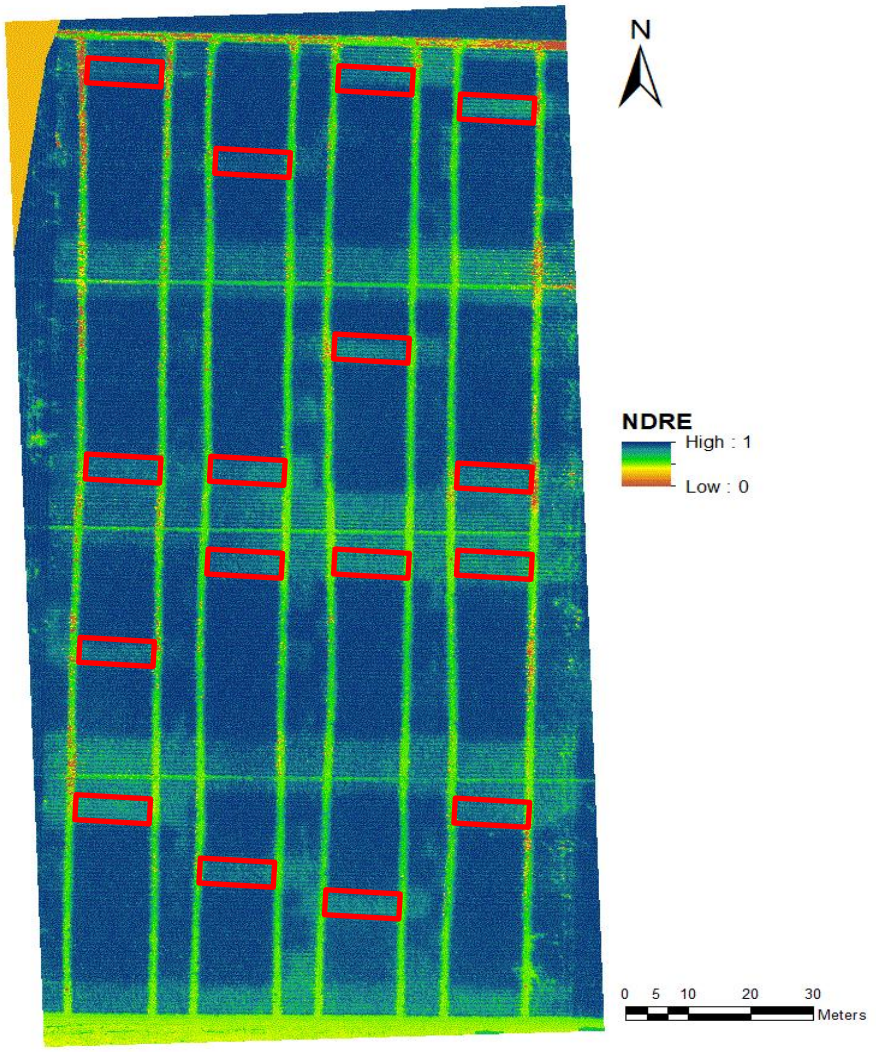
- Irrigation and N combination BMPs
- Nitrate leaching under different irrigations
- N- and Water-use efficiency
- Evapotranspiration and crop coefficients

Comparison of different Irrigation methods

- Impact of irrigation management strategies on total irrigation amount, crop yield and nitrate leaching.

Irrigation and Nitrogen Interaction 2019

- Main plots (4) are irrigation levels --100%, 75%, 50% irrigation and rainfed
- Subplots (6) are nitrogen rates -- 0, 70, 140, 210, 280 and 350 lb/ac N



DEPARTMENT OF AGRICULTURE

Irrigation and Nitrogen Interaction 2019

- Measurements

Neutron Probe

Weather station

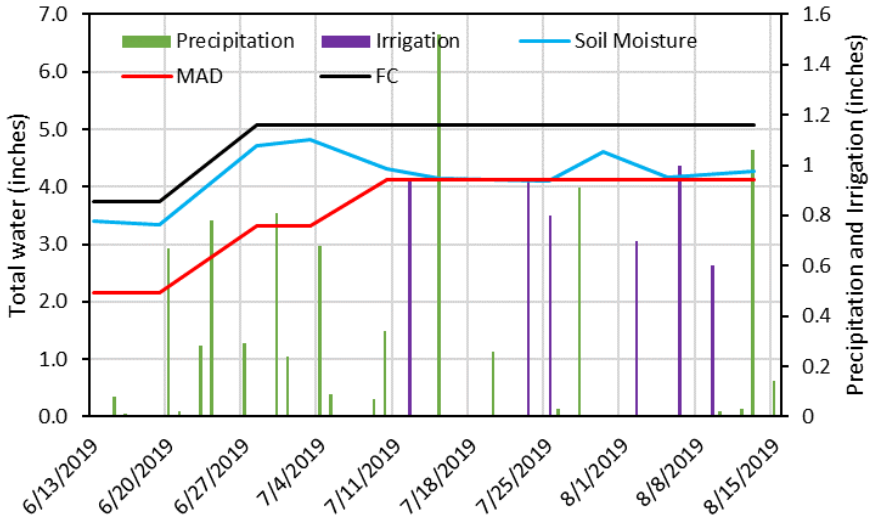
Lysimeter

Plant and soil sampling

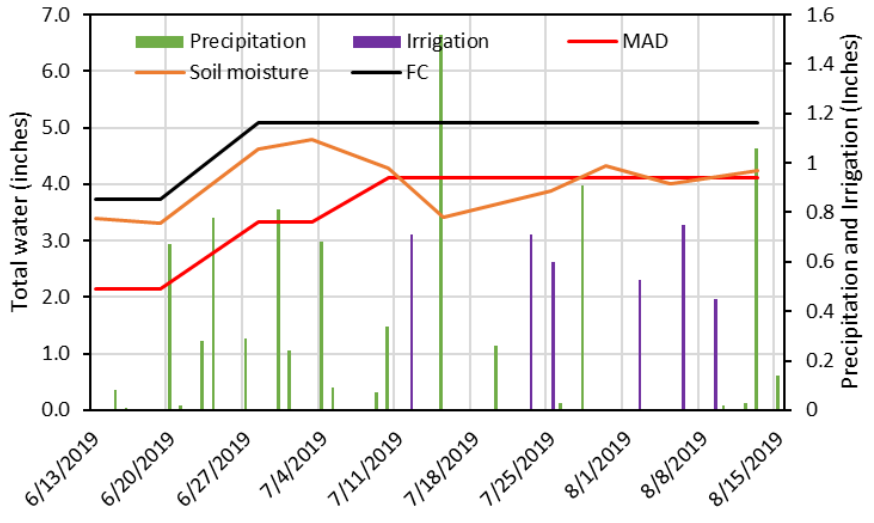
Irrigation and Nitrogen Interaction 2019

- Soil moisture in the root zone

100% irrigation



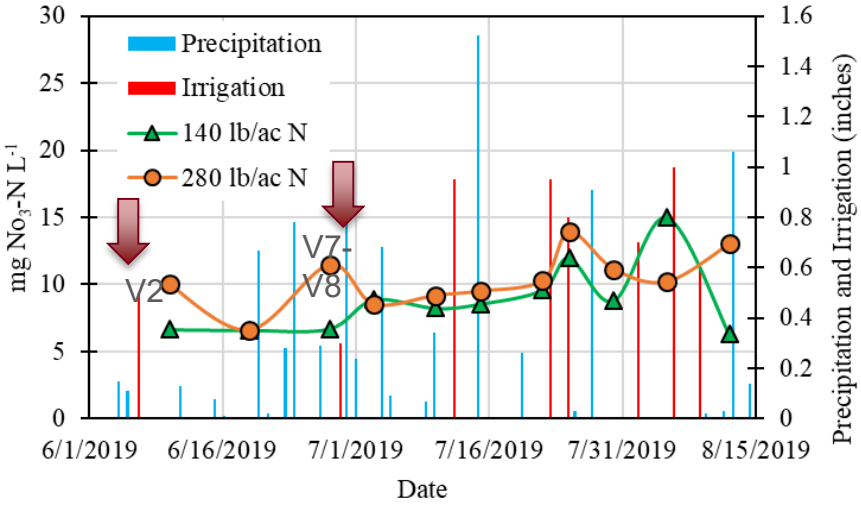
75% irrigation



Irrigation and Nitrogen Interaction 2019

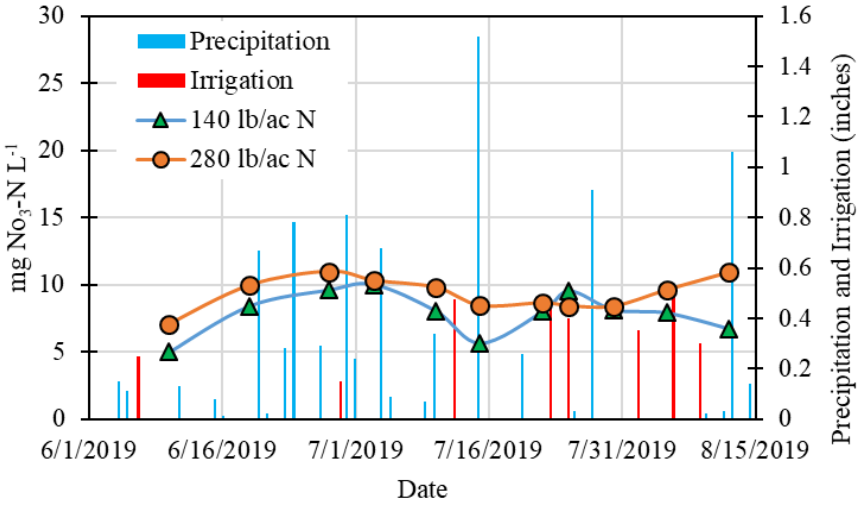
- No_3-N concentration in soil-water

100% irrigation



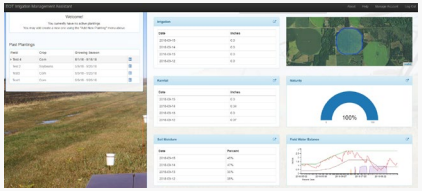
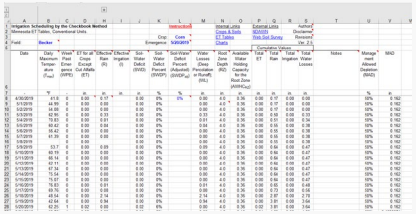
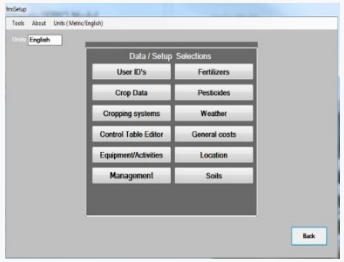
Average No_3-N = 10mg L^{-1}

50% irrigation



Average No_3-N = 8mg L^{-1}

Comparison of Irrigation Methods

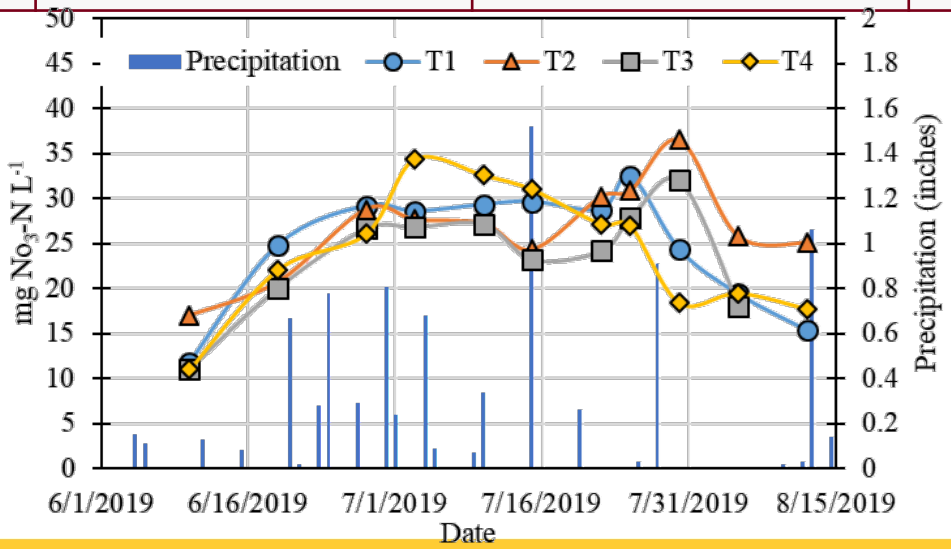
Soil moisture monitoring using soil moisture sensors	Irrigation Management Assistant (IMA): 100% Crop Evapotranspiration (ETa) replacement	University of Minnesota Checkbook Method	EPIC Crop Growth Model
			

MinnesotaCorn RESEARCH & PROMOTION COUNCIL

DEPARTMENT OF AGRICULTURE

Comparison of Irrigation Methods 2019

Soil moisture monitoring using soil moisture sensors (T1)	University of Minnesota Checkbook Method (T2)	Irrigation Management Assistant (IMA): 100% Crop Evapotranspiration (ETa) replacement (T3)	EPIC Crop Growth Model (T4)
Total Irrigation amount (inches)			
5.7 inches	5.05 inches	1.6 inches	3.66 inches



MinnesotaCorn RESEARCH & PROMOTION COUNCIL

DEPARTMENT OF AGRICULTURE

Thank you!

vasudha@umn.edu

MinnesotaCorn RESEARCH & PROMOTION COUNCIL

DEPARTMENT OF AGRICULTURE

NORTH CENTRAL REGION WATER NETWORK

Kevin Masarik

Kevin Masarik is a groundwater education specialist with the University of Wisconsin-Extension and University of Wisconsin-Stevens Point. His research and outreach activities focus on assisting private well owners with management and assessment of water quality, quantifying the impacts of agricultural activities and other land-use on groundwater quality, and educating citizens and local officials about groundwater.

Using well water data for outreach to communities about nitrate and groundwater

Kevin Masarik
Center for Watershed Science and Education

Center for Watershed Science and Education
College of Natural Resources
University of Wisconsin-Stevens Point

Extension
UNIVERSITY OF WISCONSIN–MADISON

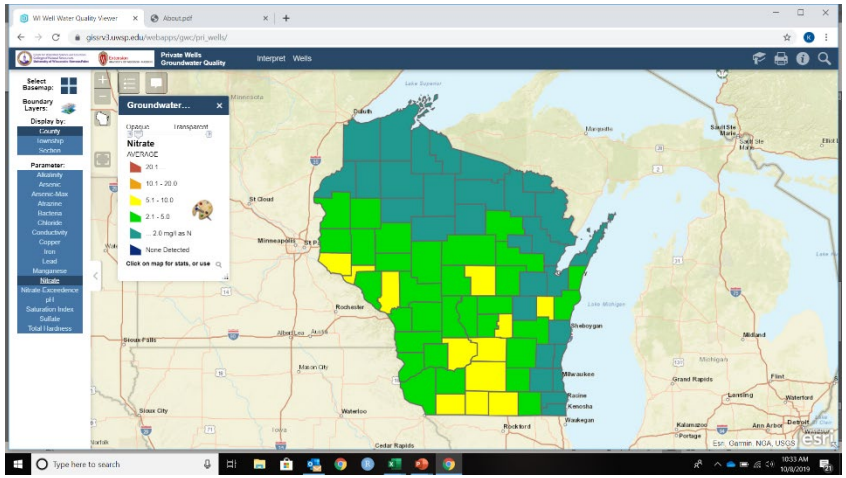
Nitrate data for Wisconsin's private wells

- University of Wisconsin-Stevens Point & UW-Extension, Private Wells Database contributed **105,381** samples
- The WI Dept of Agriculture, Trade, and Consumer Protection provided **8,236** samples
- The WI Dept of Natural Resources GRN system added **44,985**
- New WI Department of Natural Resources requirements of NR812 as of 2014 provided **59,677** additional samples
- The Eau Claire City-County Health Dept provided **2,189** analyses
- The La Crosse County Health Department provided **5,381** analyses

WI Well Water Viewer

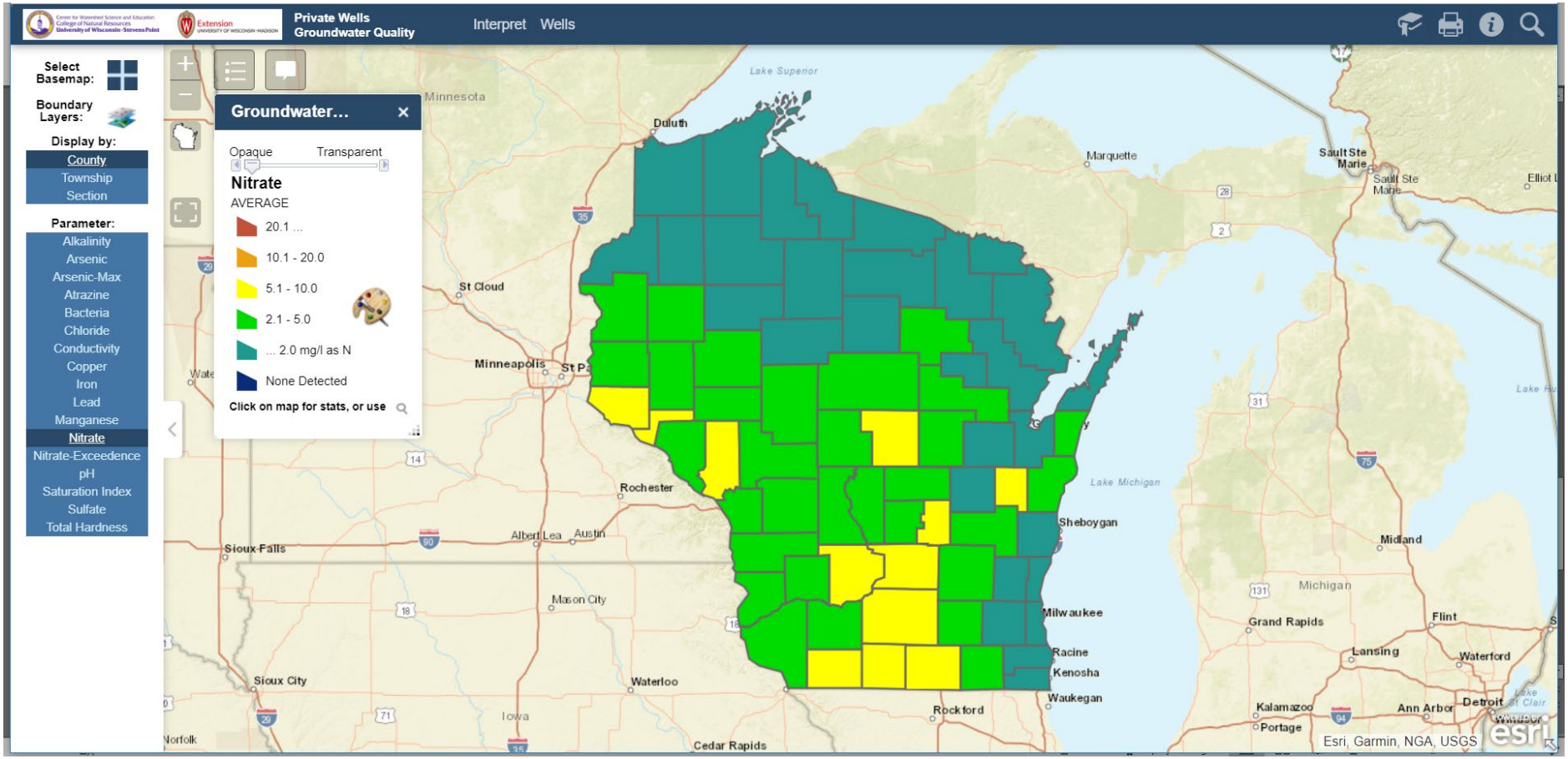
Homeowners and local units of government can use this tool to:

- Learn about general well water quality in Wisconsin
- Compare water quality to nearby towns or counties
- Raise awareness of local groundwater quality issues
- Promote testing and outreach efforts
- Encourage well testing in areas where little data exists
- Highlight the value of baseline data

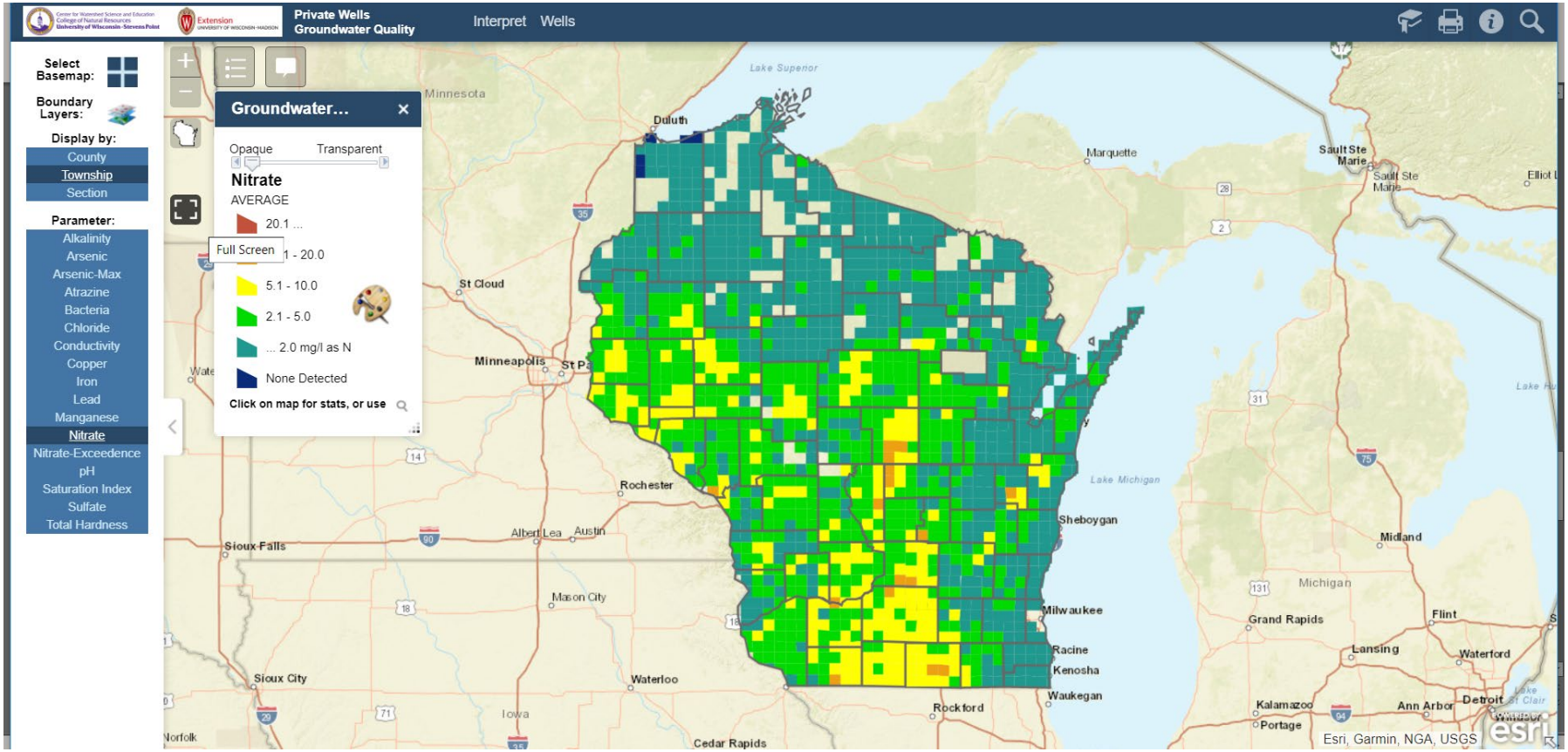


https://www.uwsp.edu/cnr-ap/watershed/Pages/WellWaterViewer.aspx

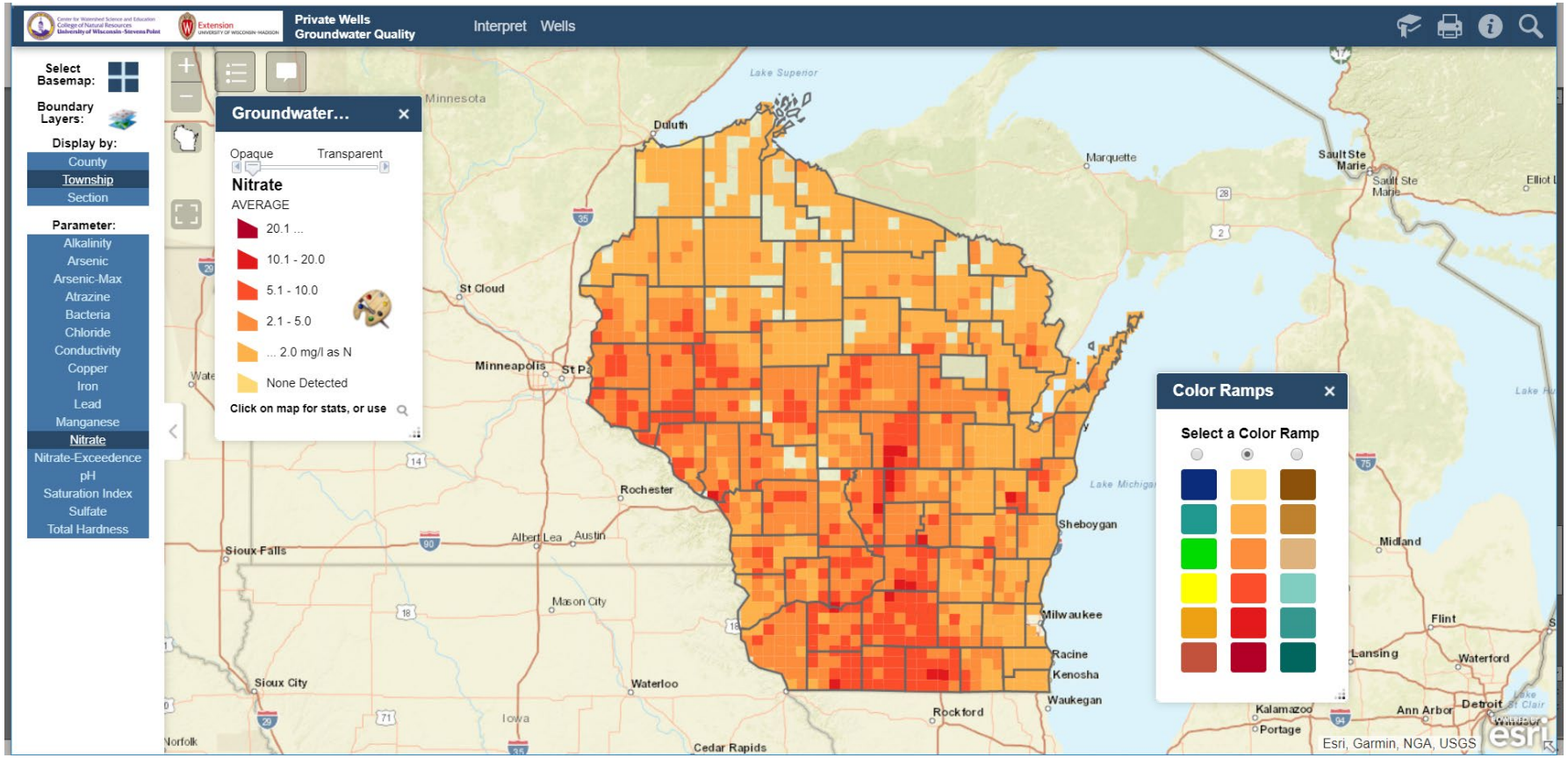
WI Well Water Viewer



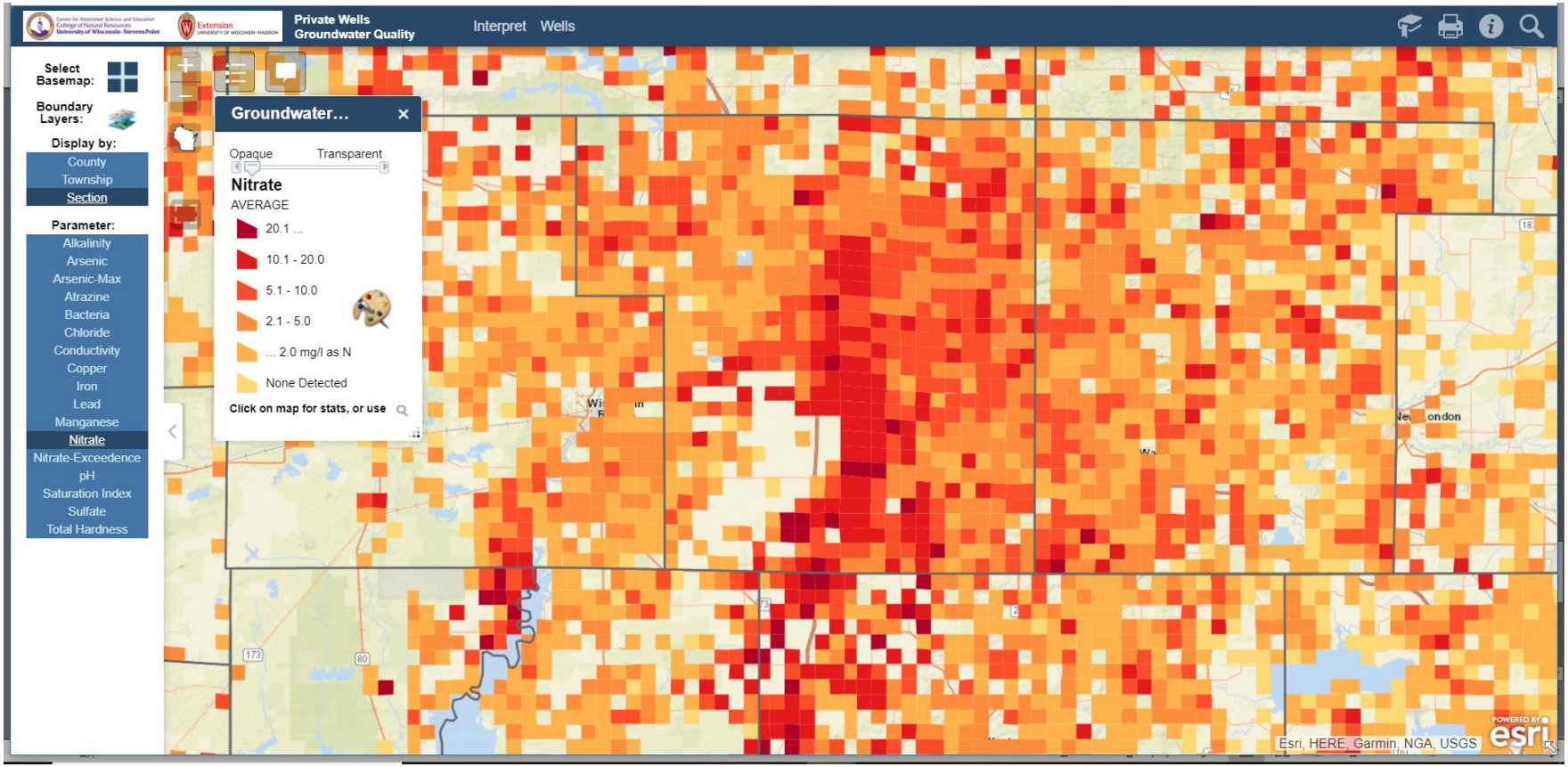
WI Well Water Viewer



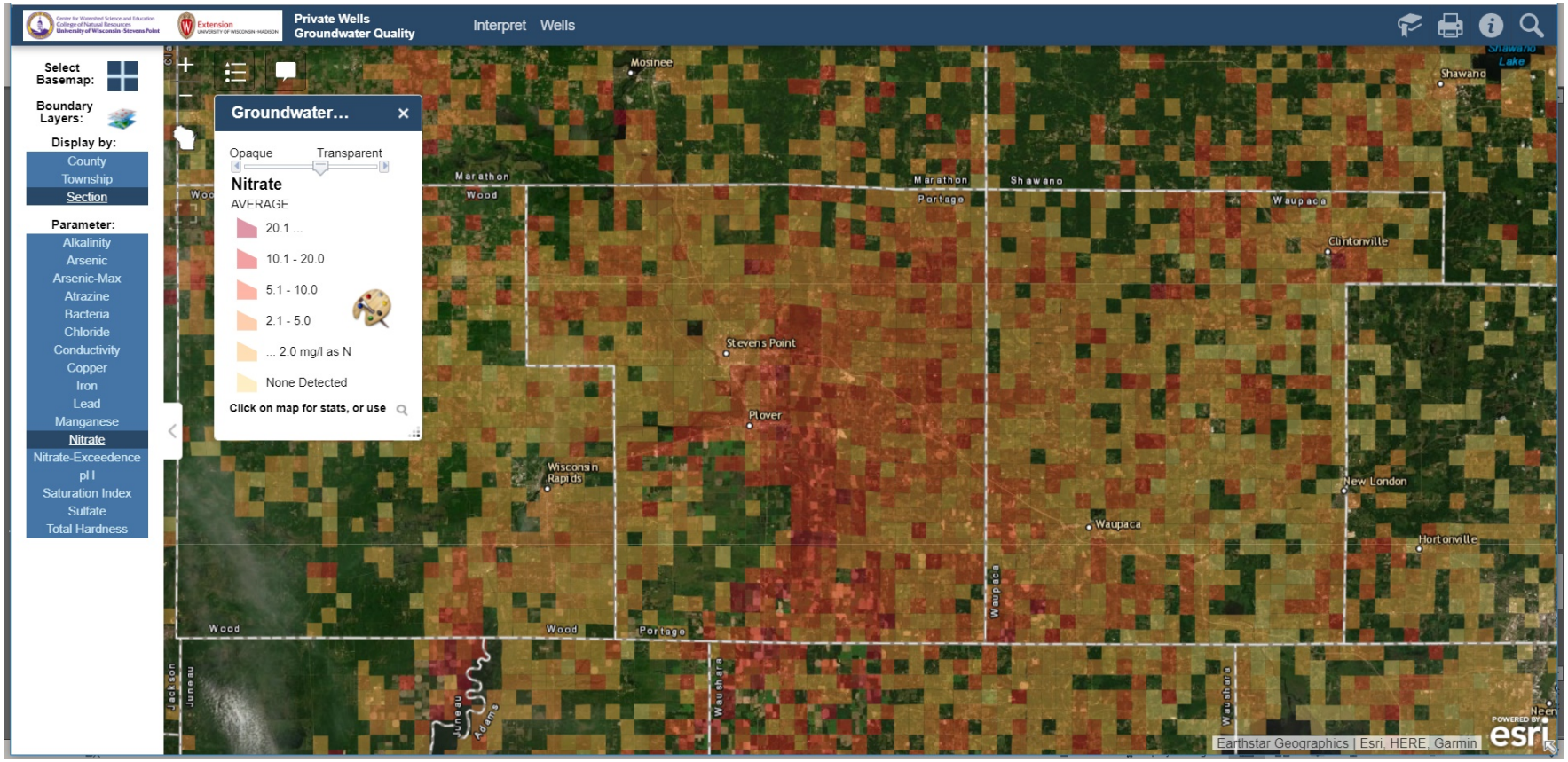
WI Well Water Viewer



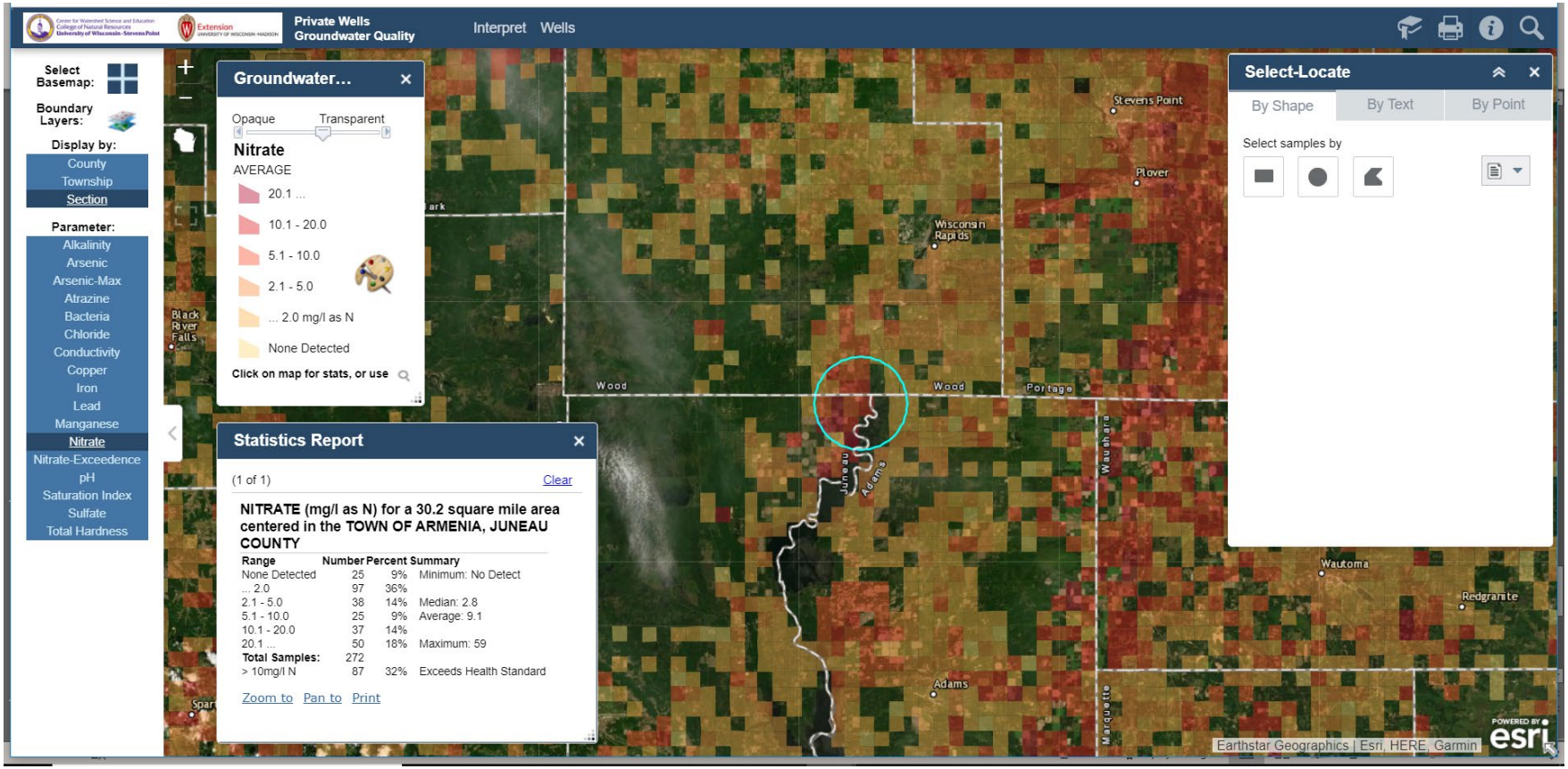
WI Well Water Viewer



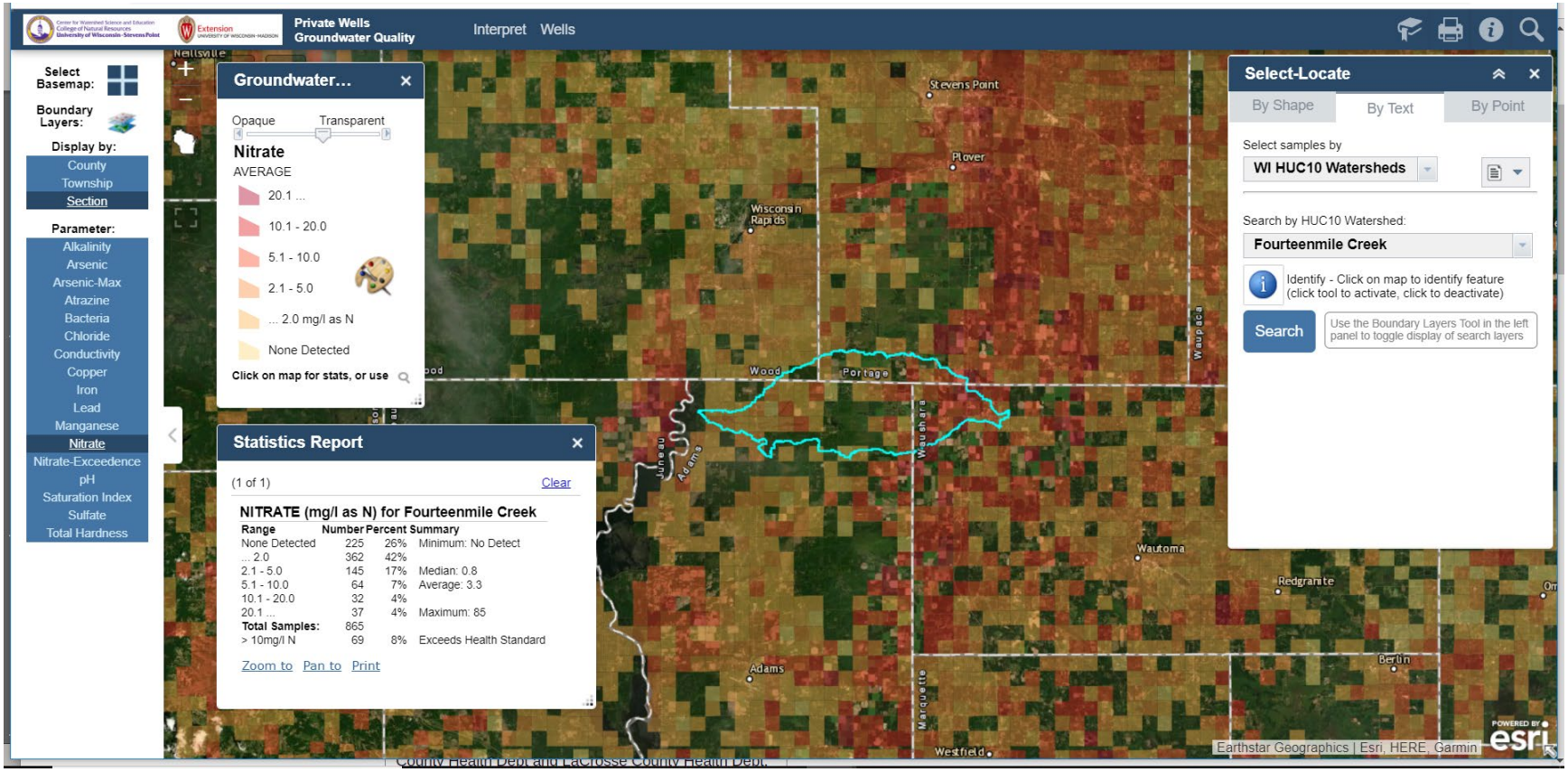
WI Well Water Viewer



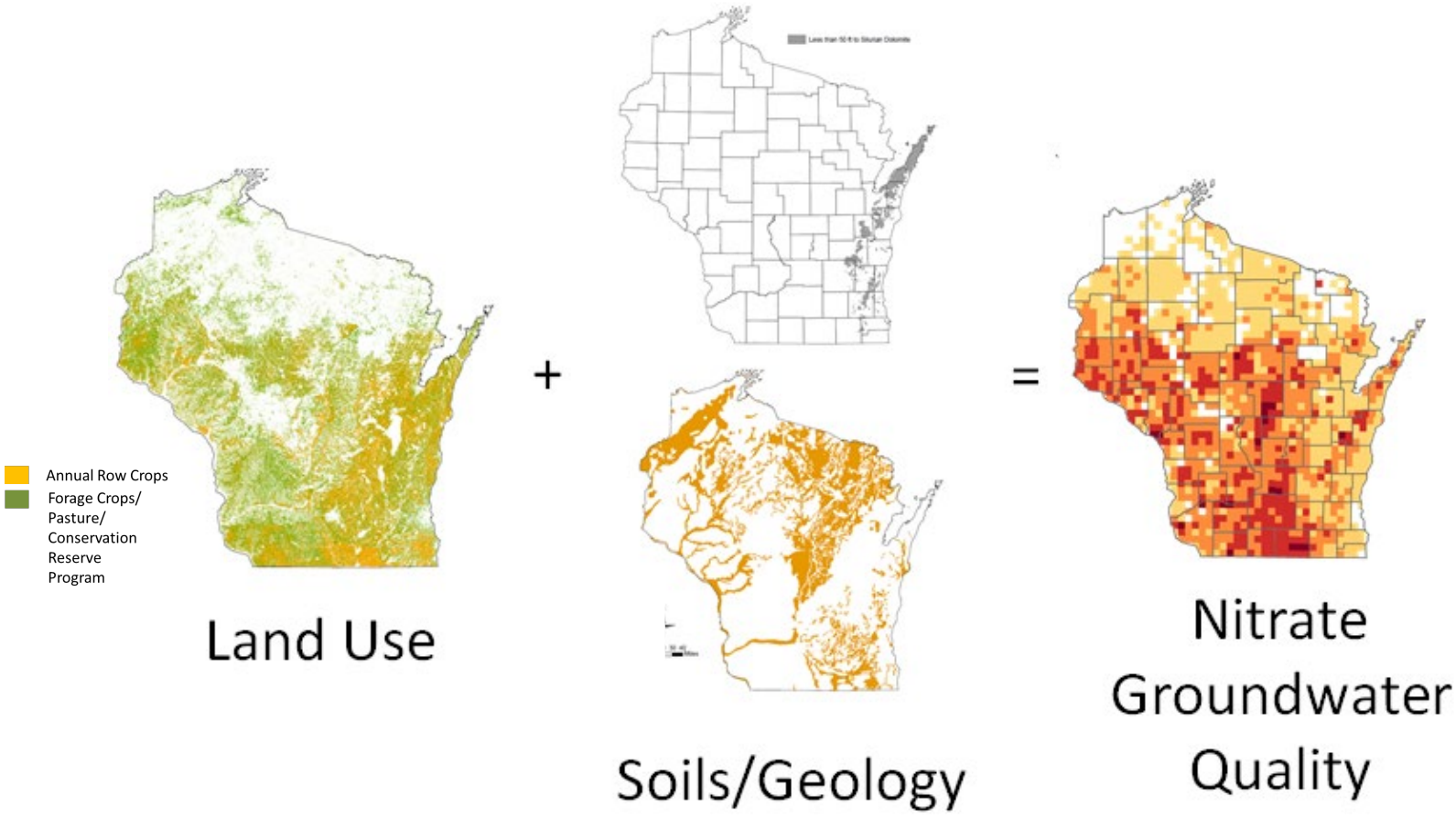
WI Well Water Viewer



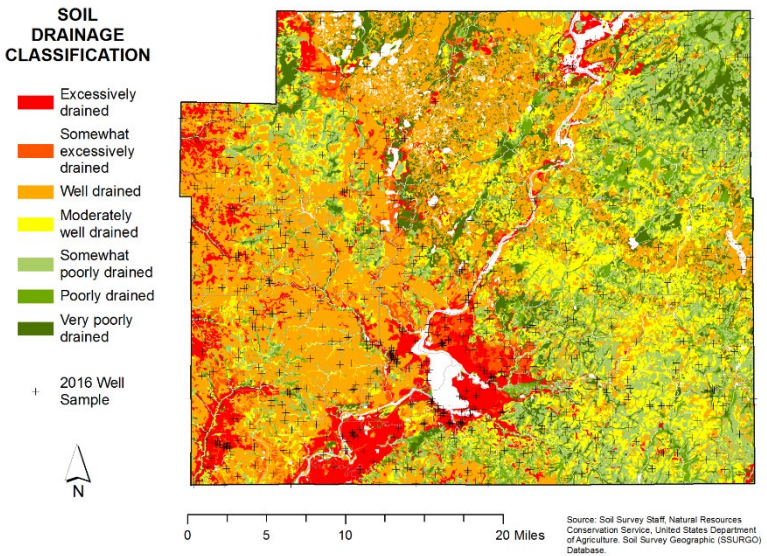
WI Well Water Viewer

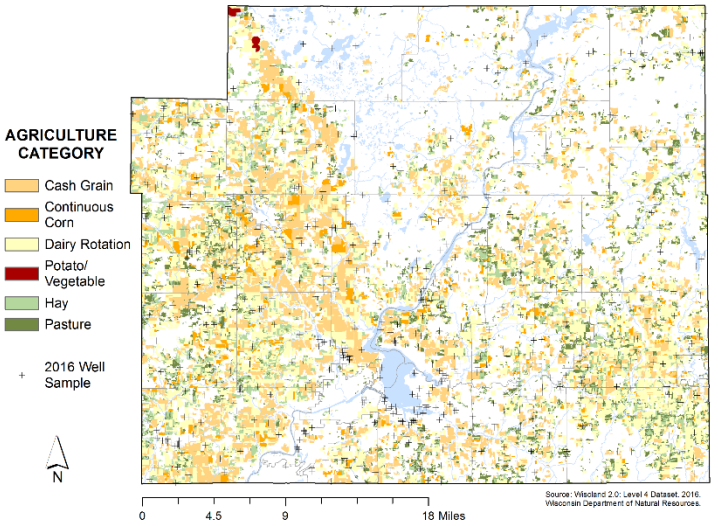


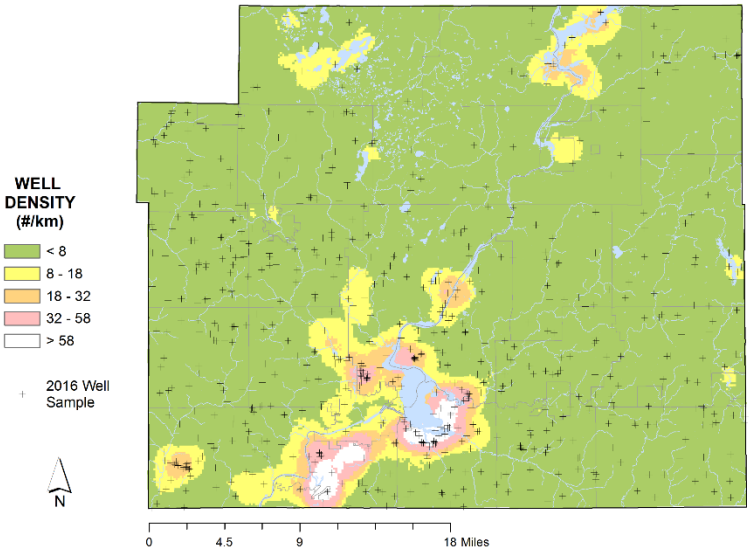
Nitrate in Wisconsin's Groundwater

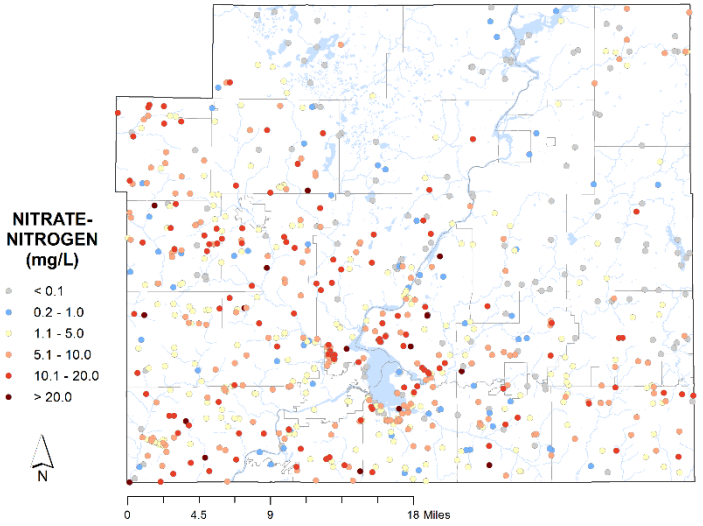


Developing Statistical Models utilizing the data

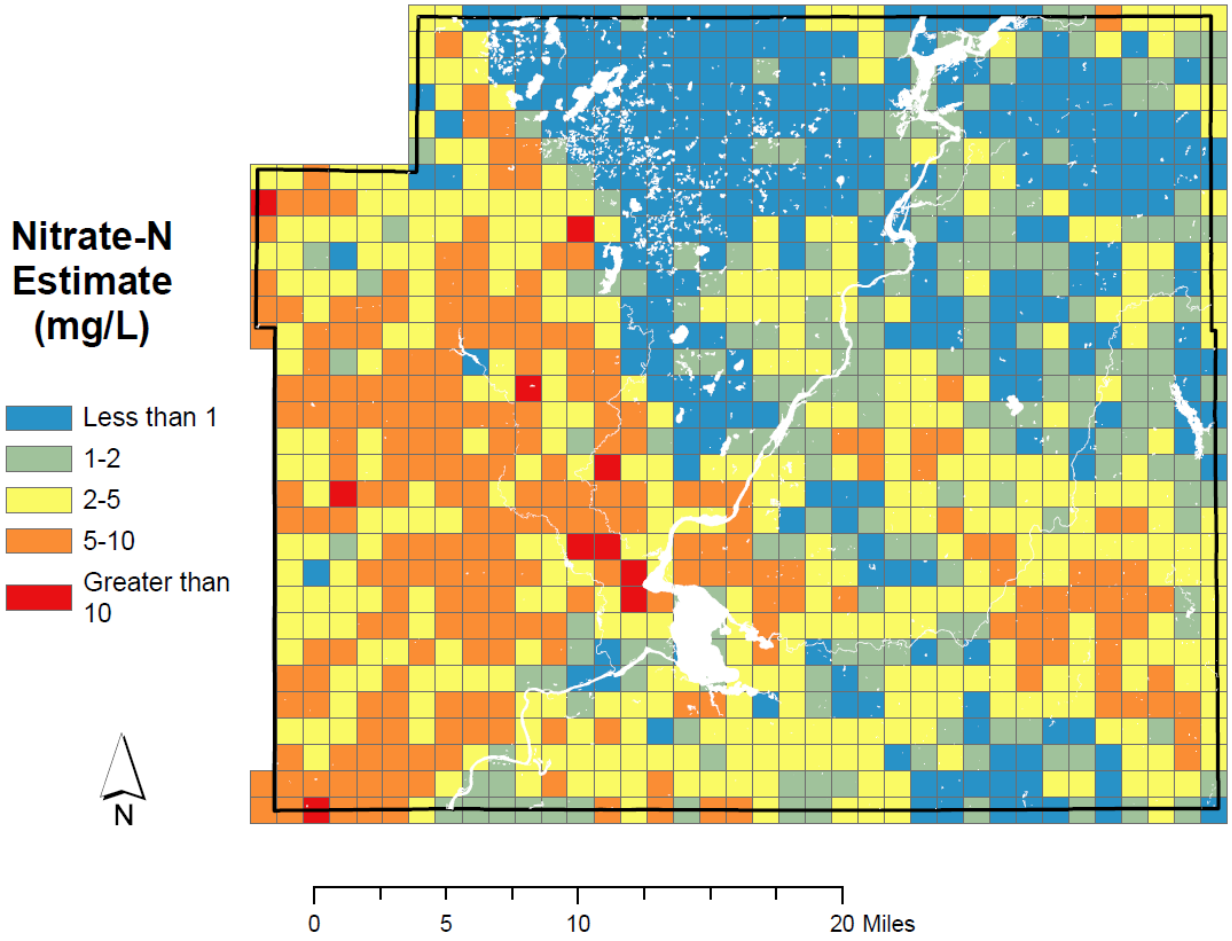




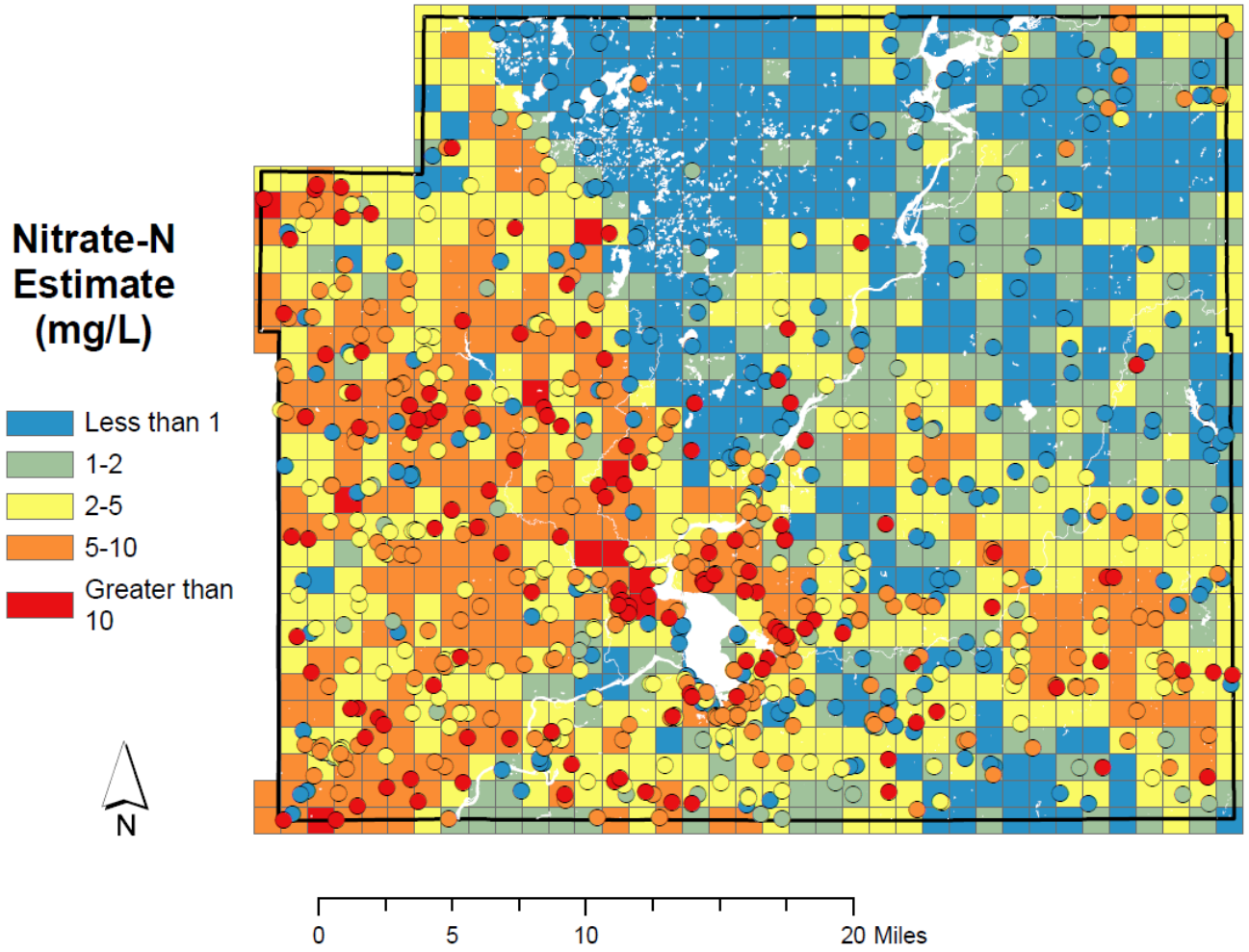




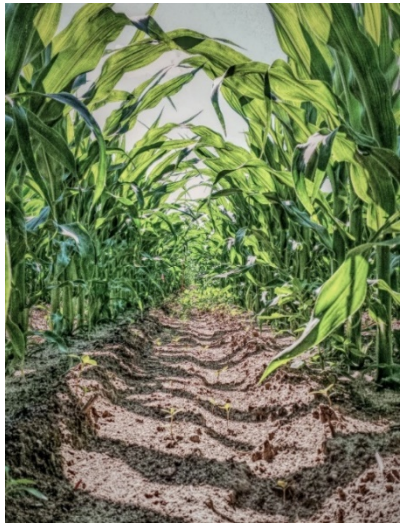
Chippewa Predicted Nitrate-N Concentration



Chippewa Predicted Nitrate-N Concentration with 2016 Well Sample Results



Contact Info:
Kevin Masarik
Groundwater Specialist
Center for Watershed Science and Education
800 Reserve St.
Stevens Point, WI 54481
715-346-4276
kmasarik@uwsp.edu



Center for Watershed Science and Education
College of Natural Resources
University of Wisconsin-Stevens Point

Extension
UNIVERSITY OF WISCONSIN-MADISON

Question and Answer Session

We will draw initial questions and comments from those submitted via the chat box during the presentations.

Today's Speakers

Troy Gilmore – gilmore@unl.edu
Vasudha Sharma – vasudha@umn.edu
Kevin Masarik – kmasarik@uwsp.edu

Thank you for participating in today's *The Current*!

Visit our website, northcentralwater.org, to access the recording and our webinar archive!

Next webinar
Climate Change's Affect on Field Crop Diseases
Monday, October 28th at 1pm CT
https://northcentralclimate.org/webinars/