Illinois Nutrient Loss Reduction Strategy

Nutrient Monitoring Council

15th Meeting/Zoom Conference Call, June 18, 2020

Illinois EPA Lake Monitoring….During COVID-19

Welcome/Housekeeping

- Important Stuff – ~~bathrooms~~, ~~lunch~~, other
- Member and Guest Introductions
- Newsworthy Notes:
  - Originally Scheduled March 31, 2020
  - Have you heard? COVID-19 ☹

Nutrient Monitoring Council Members

Illinois EPA
Gregg Good, Rick Cobb

Illinois State Water Survey
Laura Keefer

Illinois Natural History Survey
James Lamer

Illinois Dept. of Natural Resources
Brian Metzke

Univ. of IL – Dept. of Agriculture and Biological Engineering
Paul Davidson

Sierra Club
Cindy Skrukrud

MWRDGC
Justin Vick

Illinois Corn Growers Association
Laura Gentry

U.S. Army Corp of Engineers-Rock Island
Nicole Manasco

U.S. Geological Survey
Kelly Warner

National Center for Supercomputing Apps
Jong Lee

Univ. of IL – Dept. of Natural Resources and Environmental Sciences (Emeritus)
Greg McIsaac

NLRS Coordinator – Illinois EPA
Trevor Sample

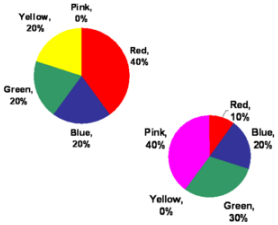
NMC Charges *(Revised 10/26/15)*

1. Coordinate the development and implementation of monitoring activities (e.g., collection, analysis, assessment) that provide the information necessary to:

   a. Generate estimations of 5-year running average loads of Nitrate-Nitrogen and Total Phosphorus *leaving the state of Illinois* compared to 1980-1996 baseline conditions; and
   b. Generate estimations of Nitrate-Nitrogen and Total Phosphorus loads *leaving selected NLRS identified priority watersheds* compared to 1997-2011 baseline conditions; and
   c. Identify Statewide and NLRS priority watershed *trends in loading over time* using NMC developed evaluation criteria.

2. Document *local water quality outcomes* in selected NLRS identified priority watersheds, or smaller watersheds nested within, where future nutrient reduction efforts are being implemented (e.g., increase in fish or aquatic invertebrate population counts or diversity, fewer documented water quality standards violations, fewer algal blooms or offensive conditions, decline in nutrient concentrations in groundwater).

3. Develop a *prioritized list of nutrient monitoring activities and associated funding* needed to accomplish the charges/goals in (1) and (2) above.



September 10 and October 22, 2019, NMC Meetings

- Review of Meetings
- Minutes (review and approve)

Statewide and Major River Total Phosphorus (TP) and Nitrate-N Loads Through the 2019 Water Year

Gregory McIsaac, Associate Professor Emeritus
University of Illinois at Urbana Champaign

Adjunct Research Scientist
Agricultural Watershed Institute

River Load Calculation Methods

Load (lb/yr) = water flow (volume/time) x concentration (mass/volume)

Yield (lb/ac-yr) = Load/drainage area

USGS provides daily water flow

IEPA and USGS provide sample concentrations approximately monthly

Daily Load = daily water flow x estimated daily concentration

Daily concentrations estimation methods

Nitrate: Linear Interpolation over time between measured samples

Phosphorus: Weighted Regressions on Time, Discharge and Seasonality (WRTDS)

Statewide Results: Riverine Flow and Loads

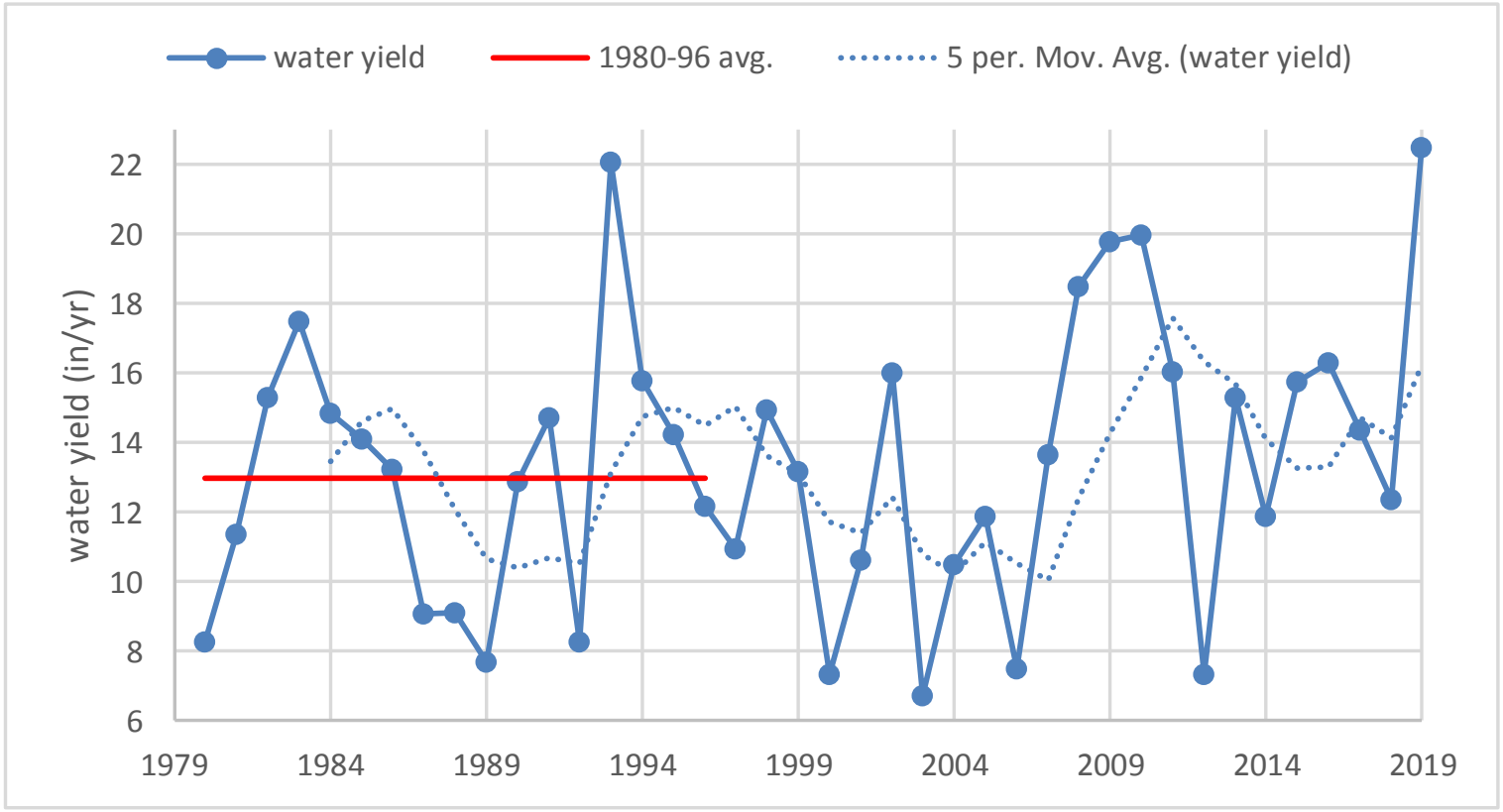
New update

	1980-1996 baseline Avg. value	2013-17 (Biennial Report)		2014-18		2015-19	
		Avg. value	% change from 1980-1996	Avg. value	% change from 1980-1996	Avg. value	% change from 1980-1996
Water Yield (in/yr)	13.0	14.7	+13%	14.1	+9%	16.3	+25%
Nitrate-N Load (Million lb N/yr)	397	425	+7%	380	-4.4%	448	+13%
Total P Load (Million lb P/yr)	33.7	42.2	+25%	40.8	+21%	46.2	+37%

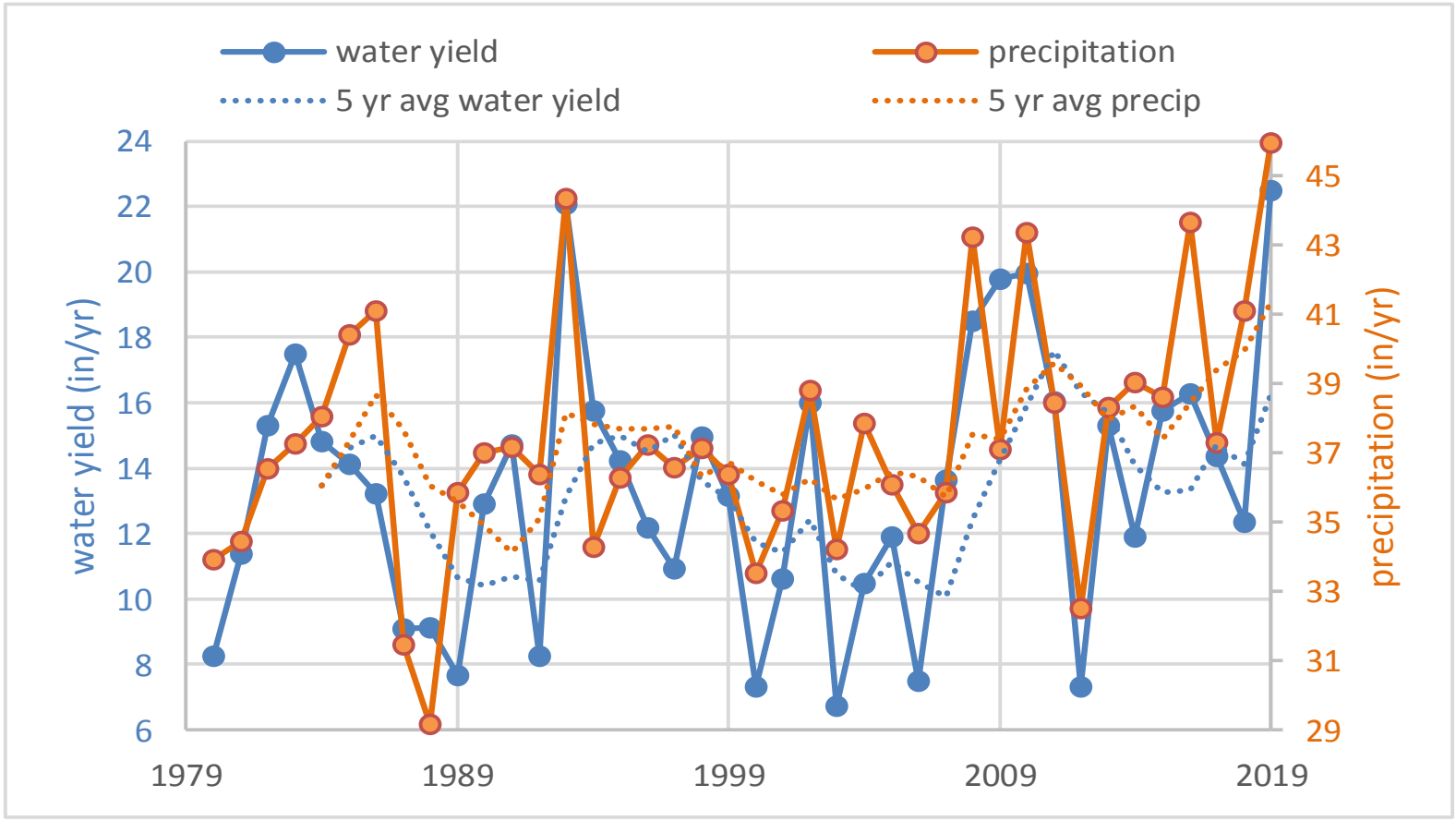
2013-17 TP loads are slightly lower here than in the 2019 Biennial Report because WRTDS calculates loads based on relationships over a 7 year window. Adding new observations can shift these relationships.

Statewide annual water yield

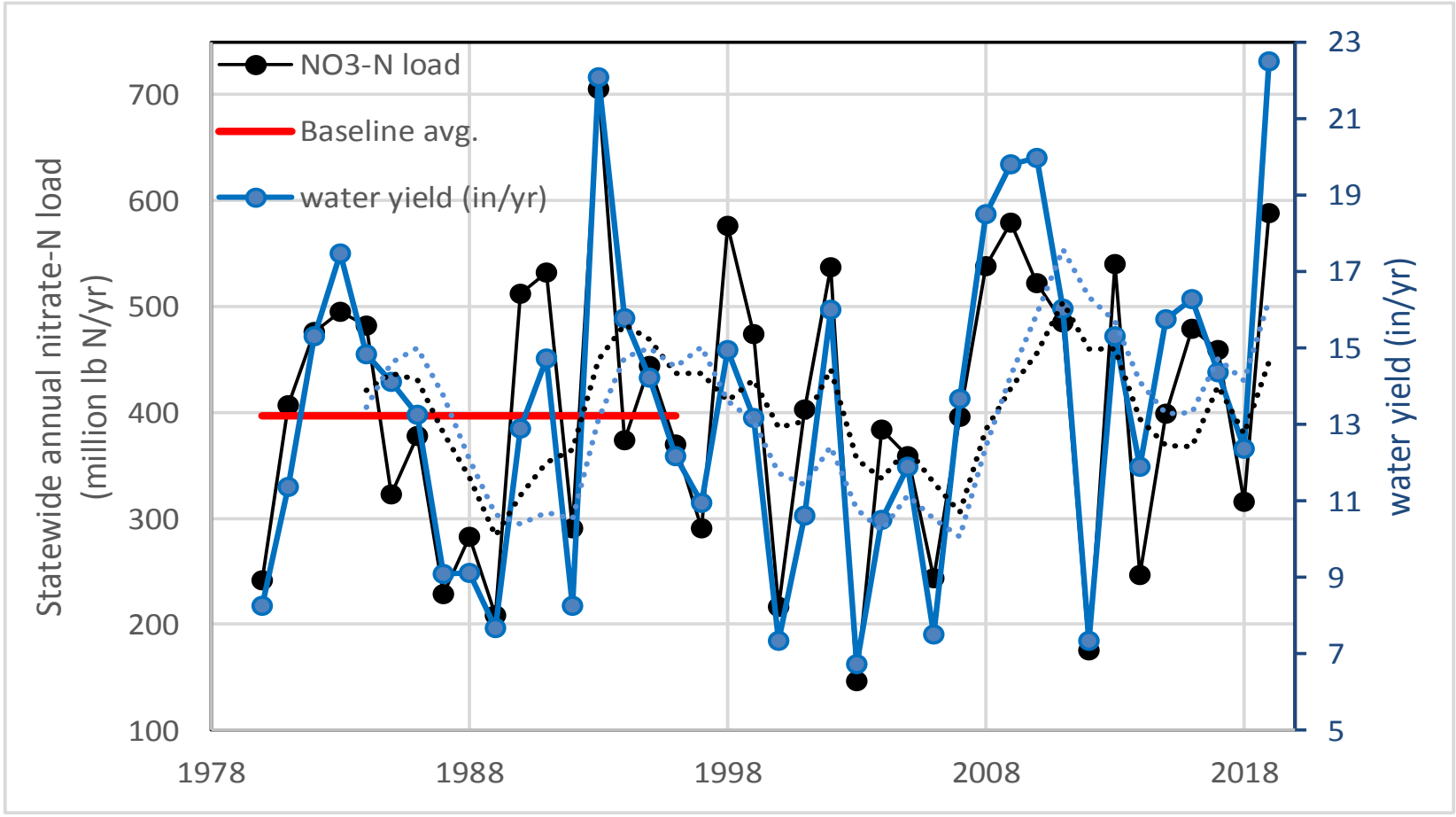
annual, 5 year moving average, and 1980-96 average



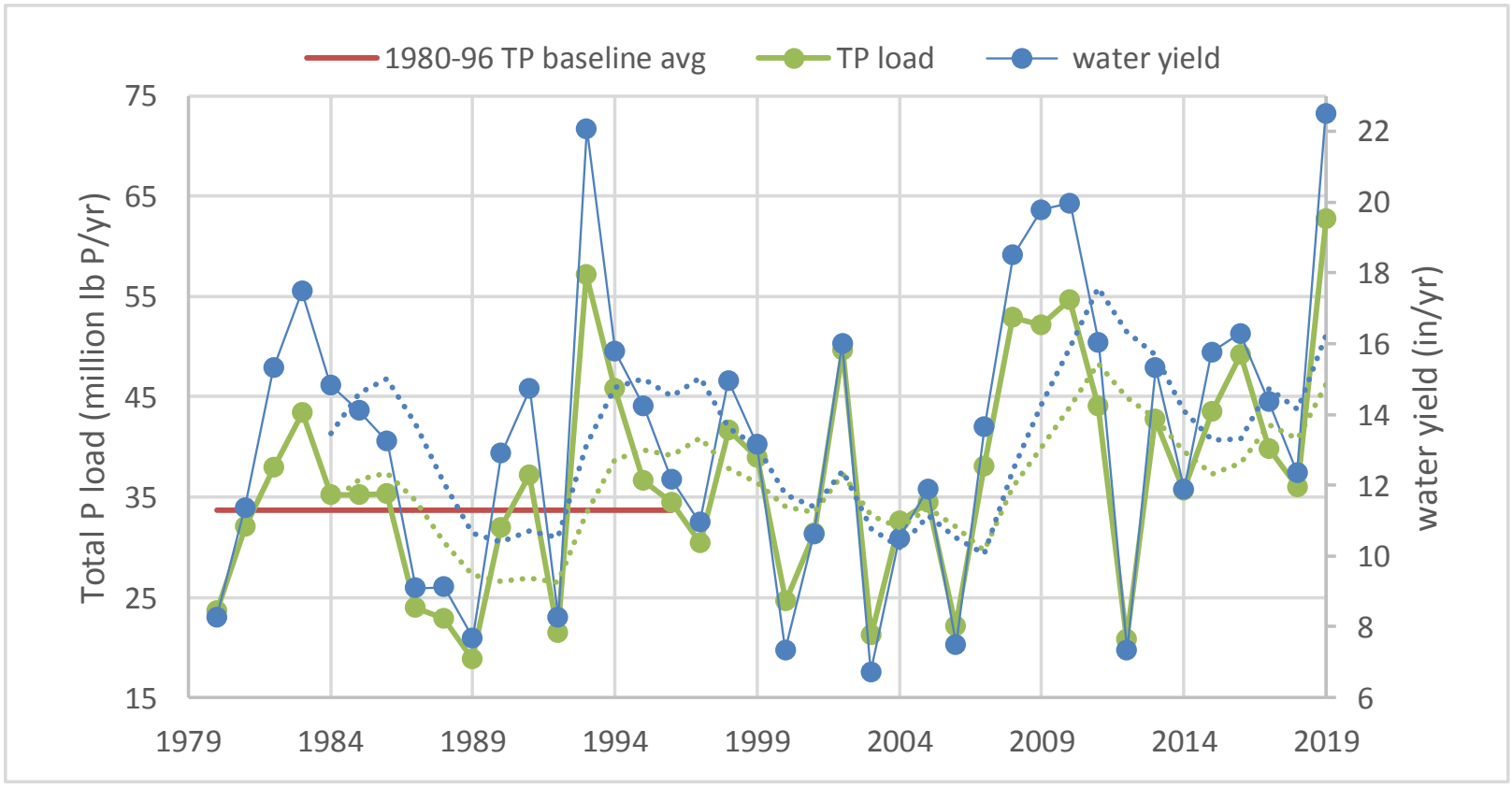
Statewide average precipitation and water yield 1980-2019



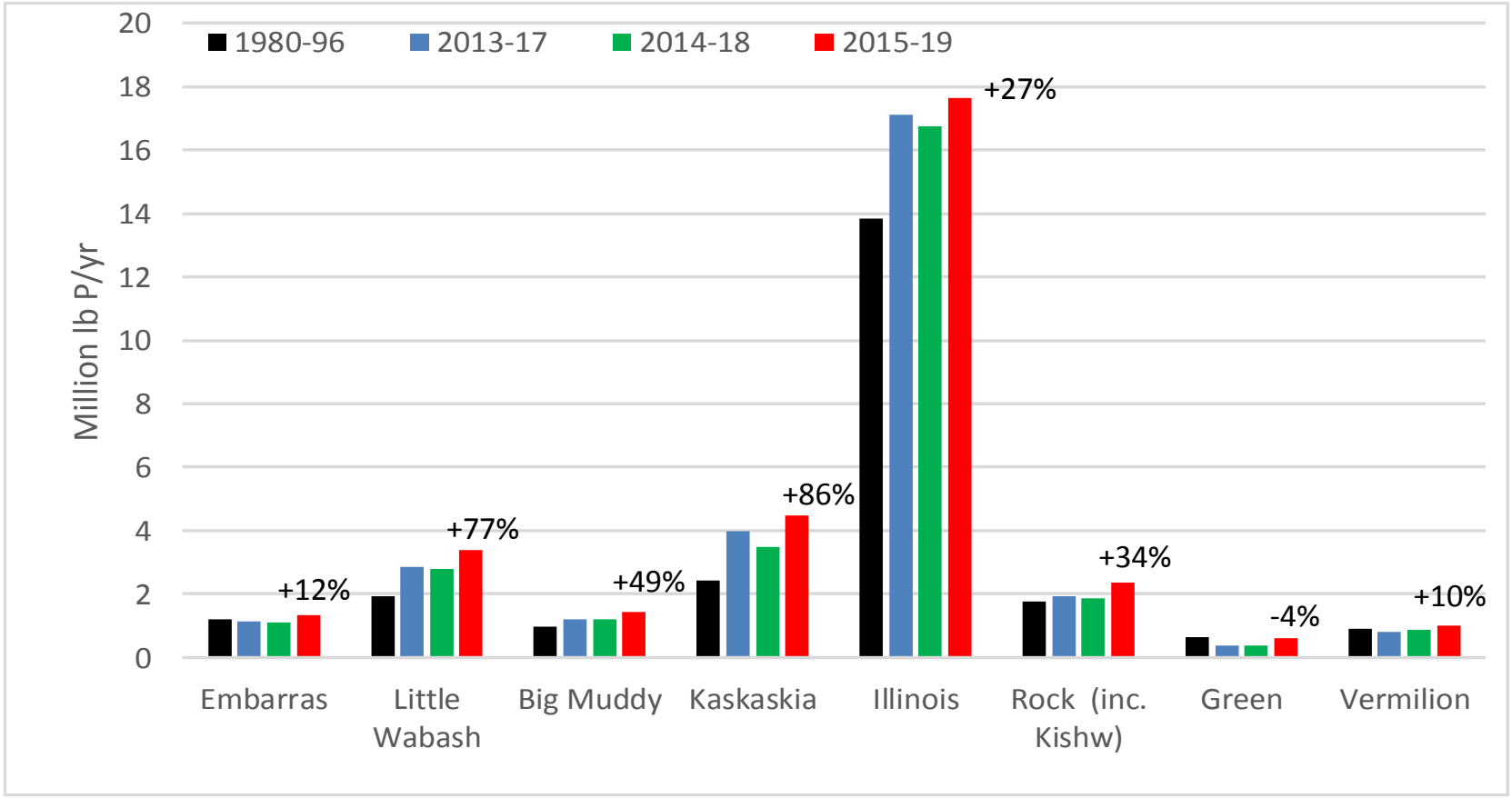
Statewide estimates of annual nitrate loads (black), water yield (blue),
1980-96 baseline average (solid red line), and five year moving average values (dashed lines)



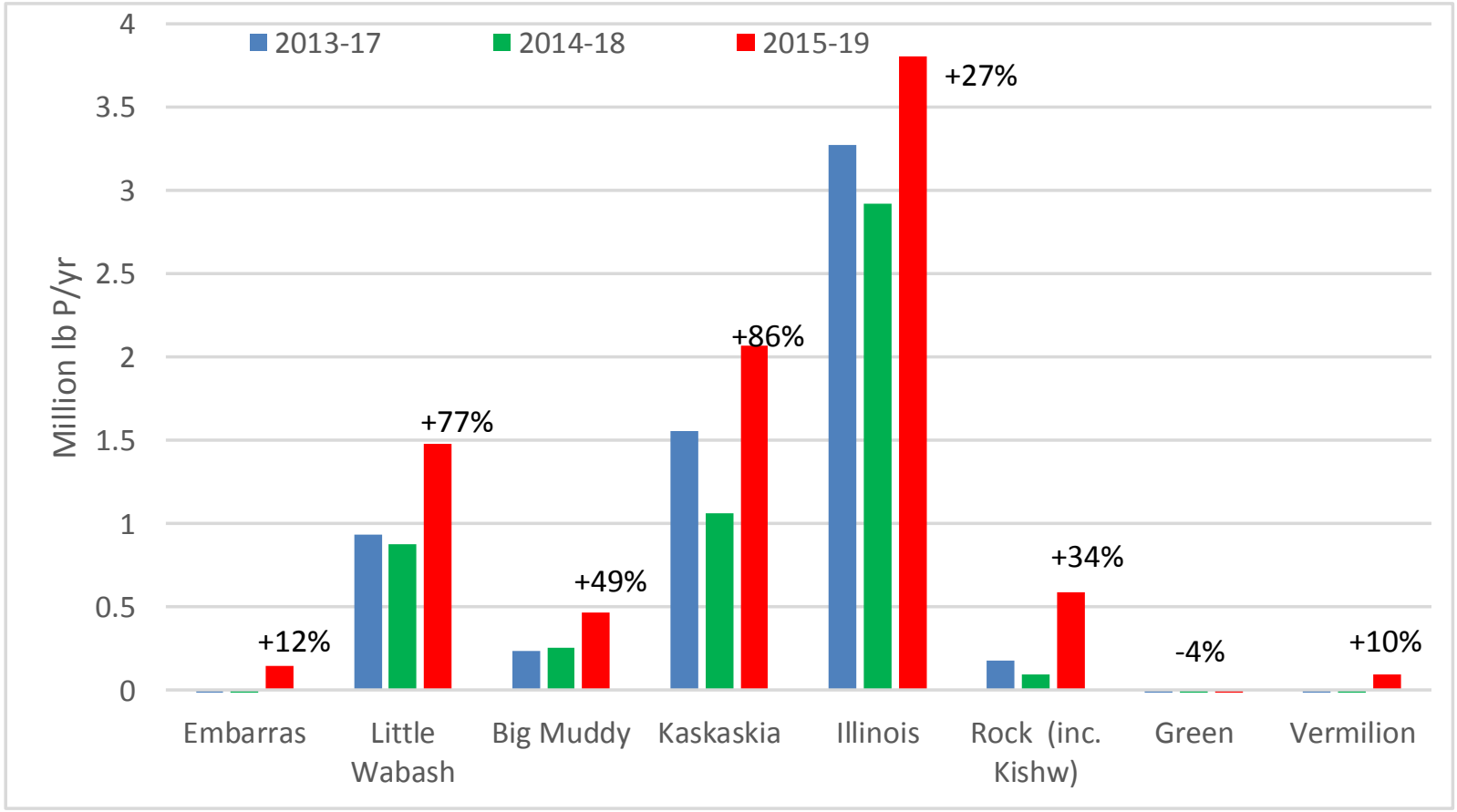
Statewide estimates of annual TP loads (green), water yield (blue),
1980-96 baseline average (solid red line),
five year moving average values (dashed lines)



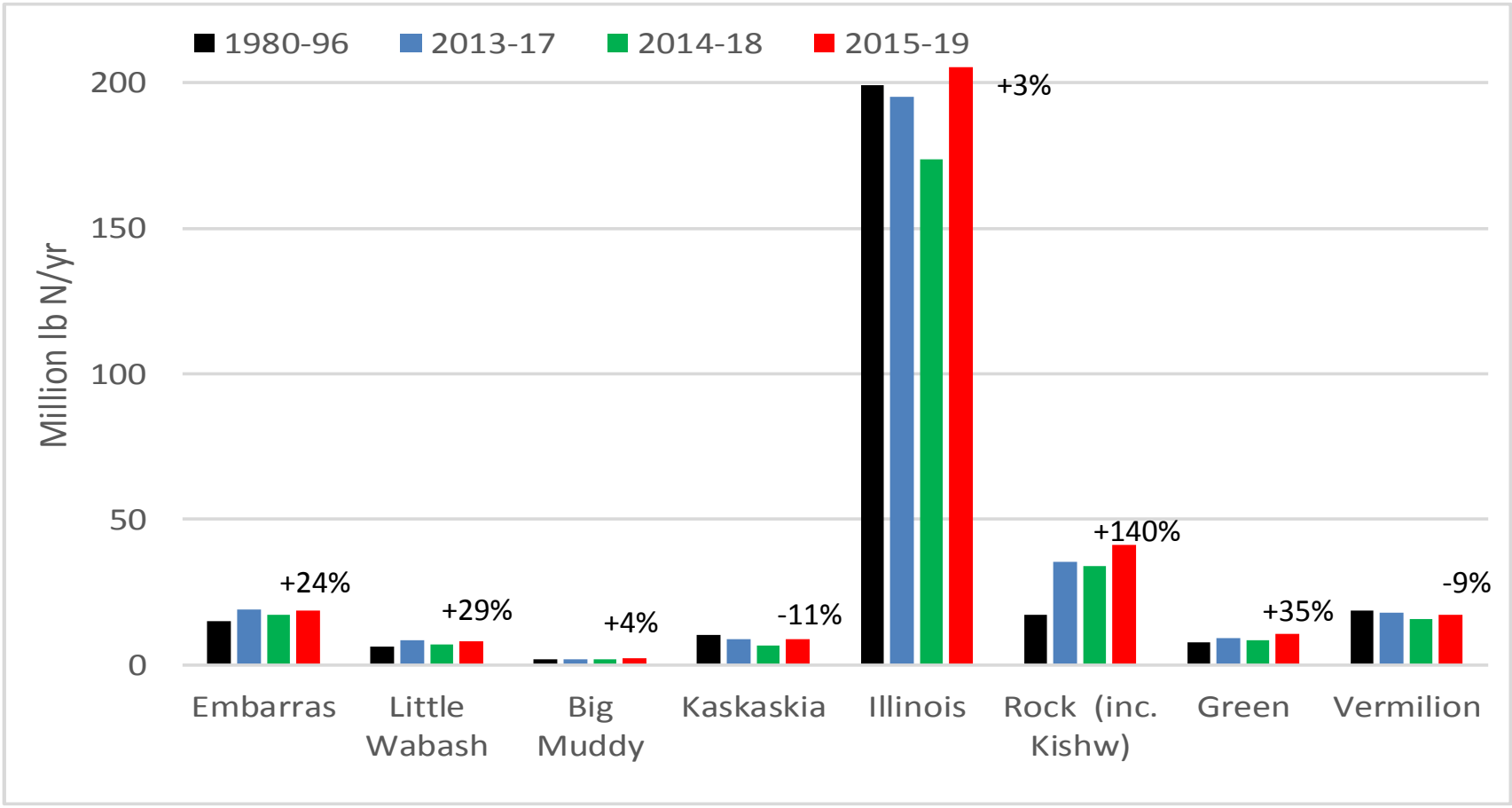
TP Load Estimates for Major Rivers in Illinois 1980-96, 2013-17, 2014-18 and 2015-19



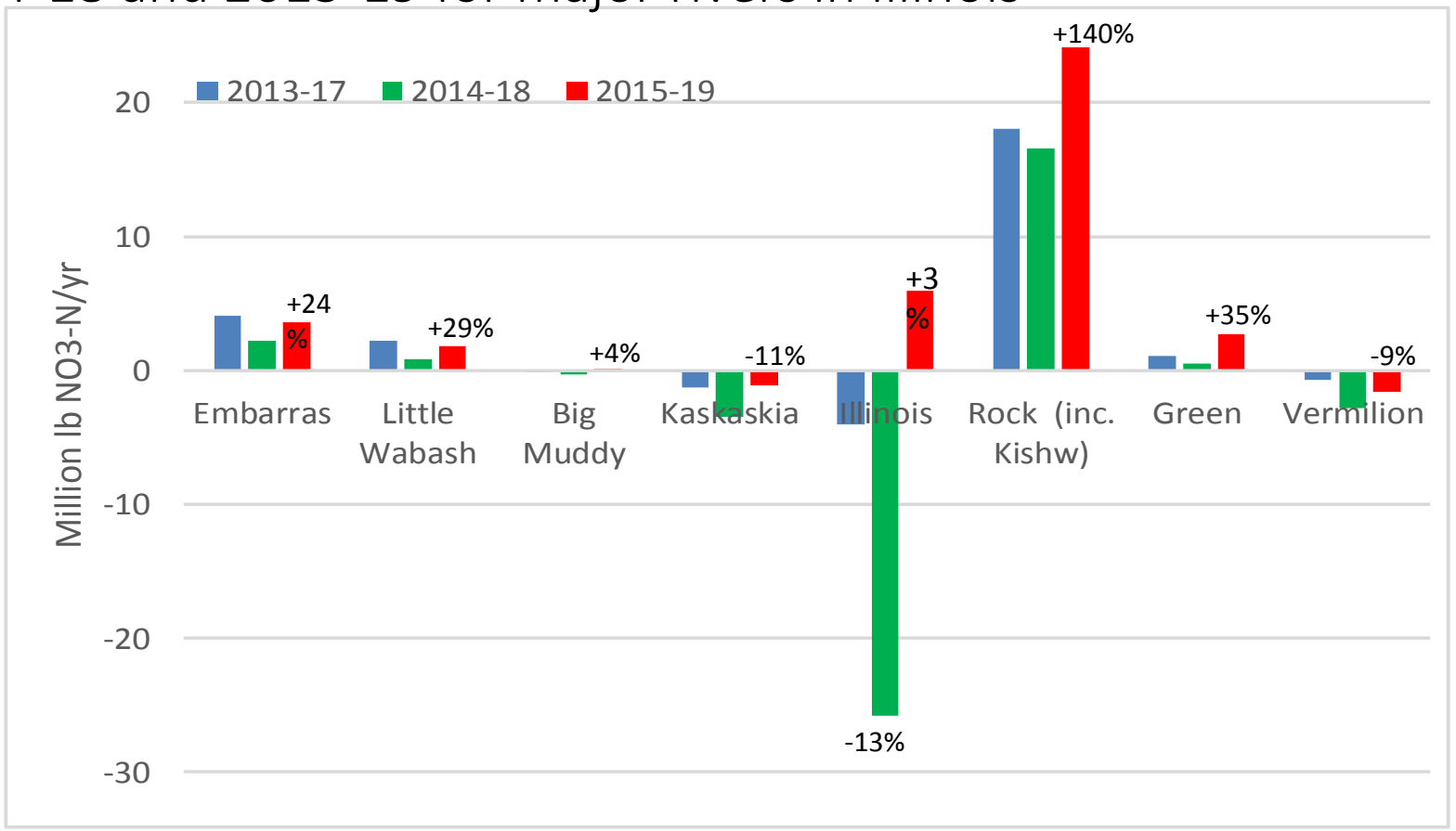
Changes in Riverine TP Loads from 1980-96 to 2013-17 and 2014-18 for major rivers draining Illinois



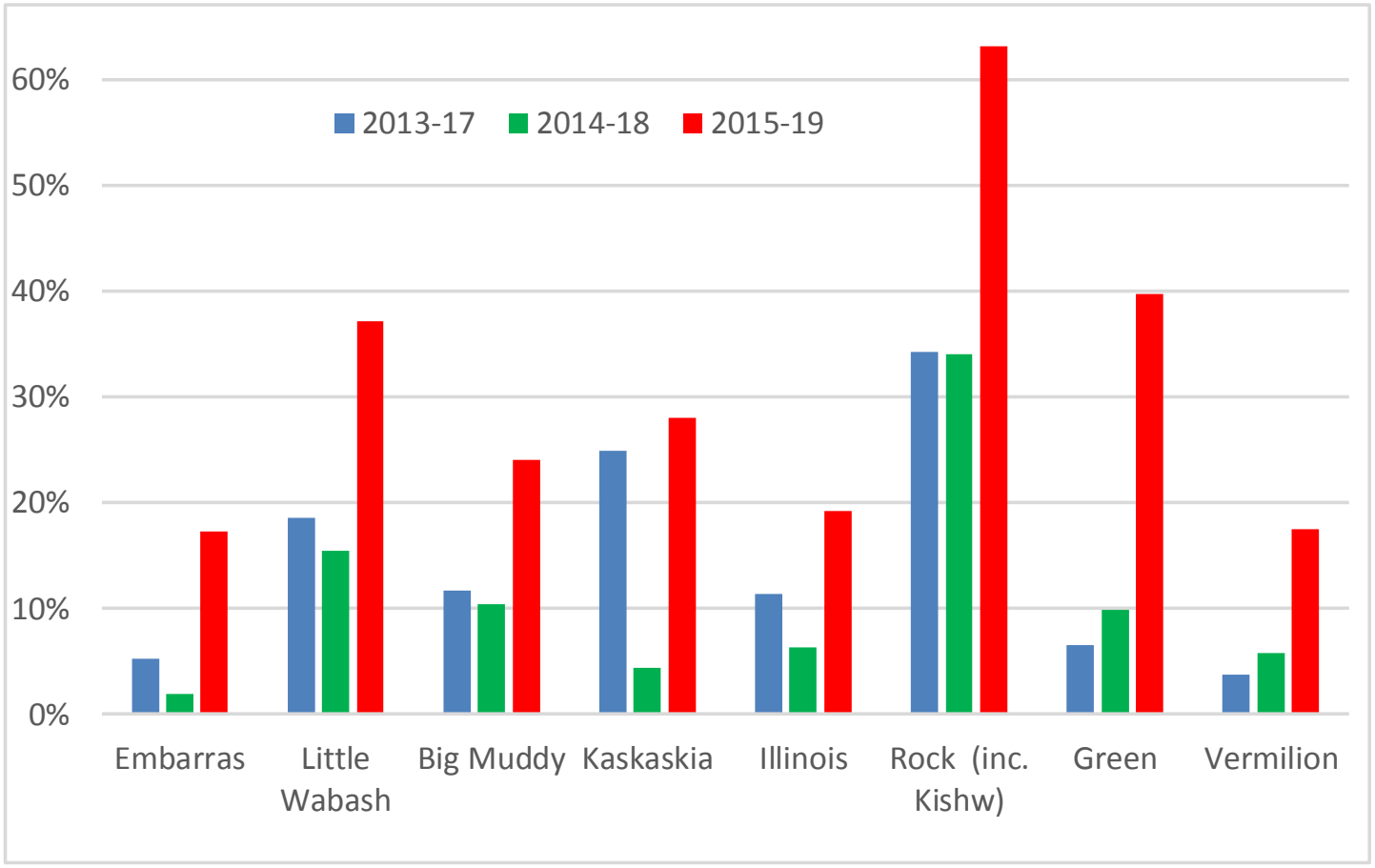
Nitrate-N Load Estimates for Major Rivers in Illinois 1980-96, 2013-17, 2014-18 and 2015-19



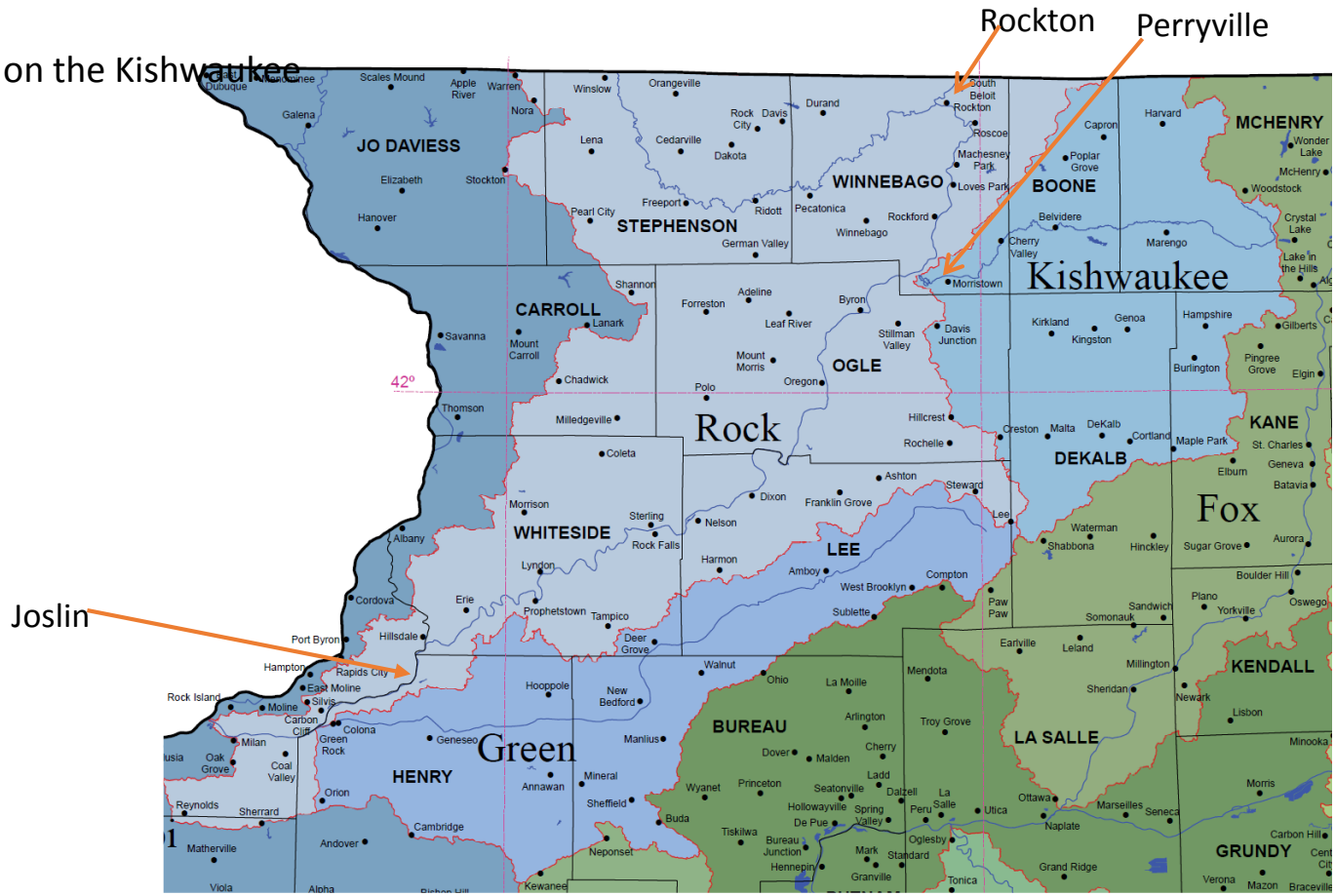
Changes in Riverine Nitrate-N Loads from 1980-96 to 2013-17, 2014-18 and 2015-19 for major rivers in Illinois



Changes in water yield from the 1980-96 baseline

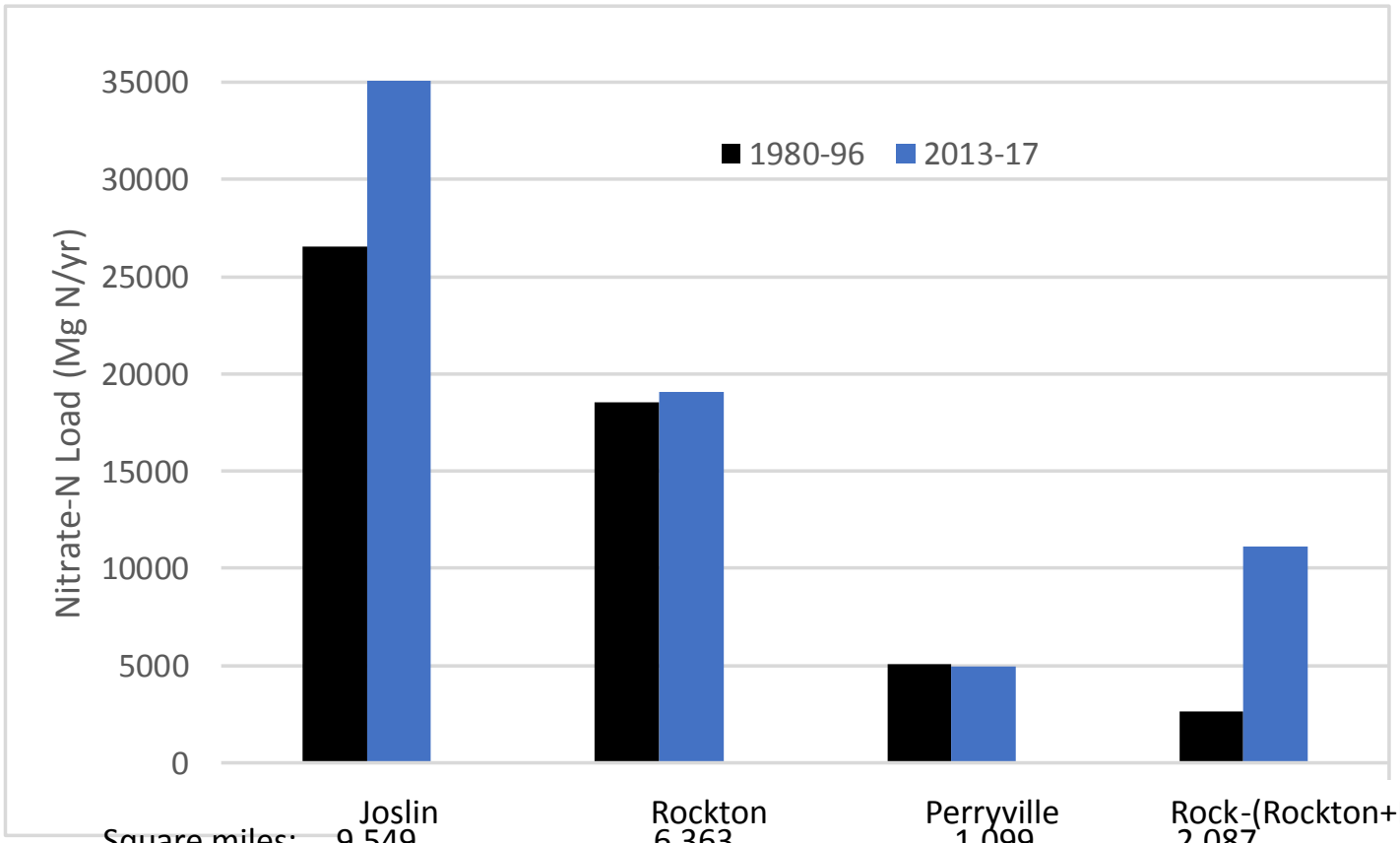


Illinois portion of the Rock River Watershed
USGS and IEPA monitoring locations at Rockton and Joslin
and Perryville on the Kishwaukee



Modified from ISWS

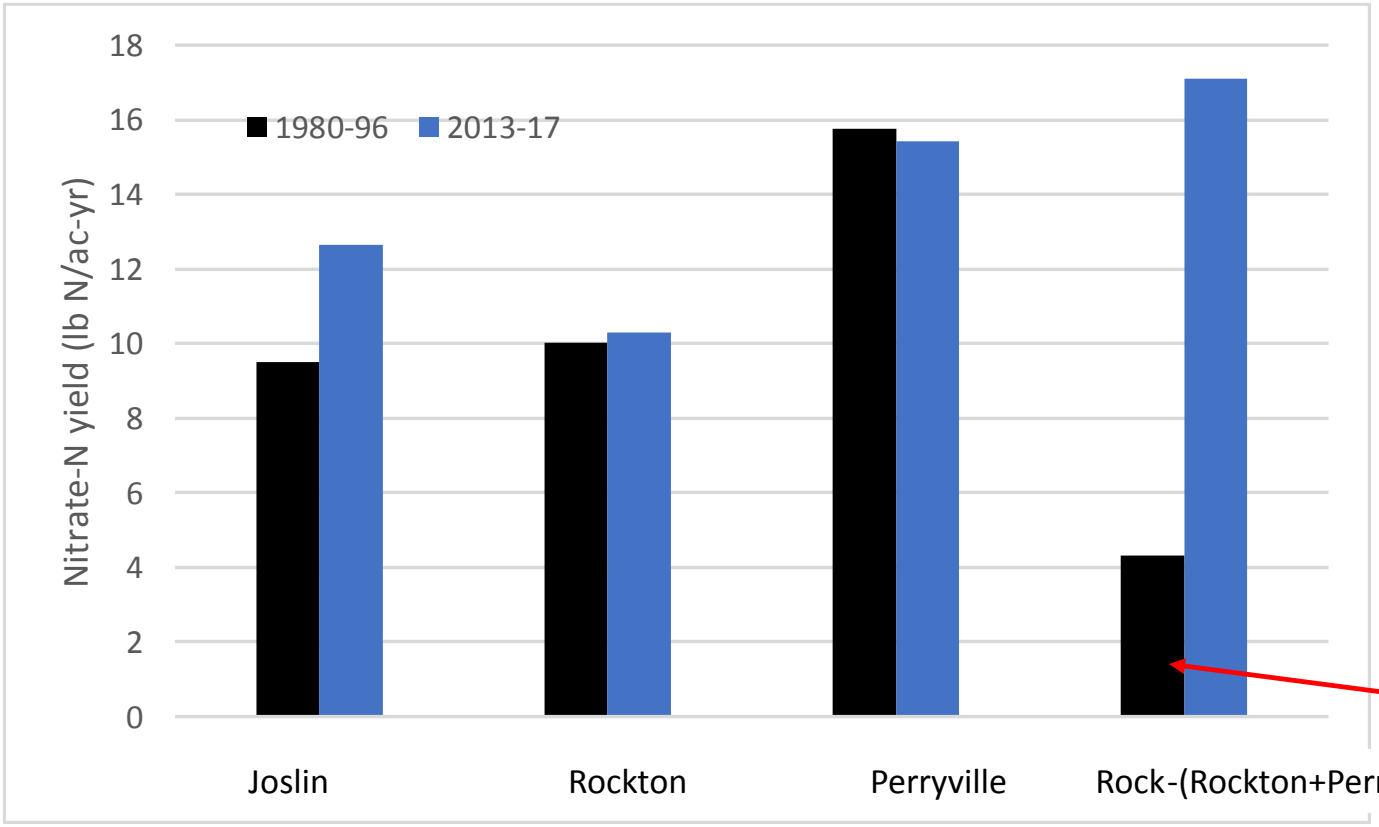
Nitrate-N loads 1980-96 (excluding 1993-4) and 2013-2017 Rock River and subbasins



1993-4 were excluded from all sites because of concentration gaps at Perryville and Rockton

8,500 Mg N/yr = 19 million lb N/yr

Nitrate-N yield 1980-96 (excluding 1993-4) and 2013-2017 Rock River and subbasins



	Joslin	Rockton	Perryville	Rock-(Rockton+Perryville)
Square miles:	9,549	6,363	1,099	2,087

1993-4 were excluded from all sites because of concentration gaps at Perryville and Rockton

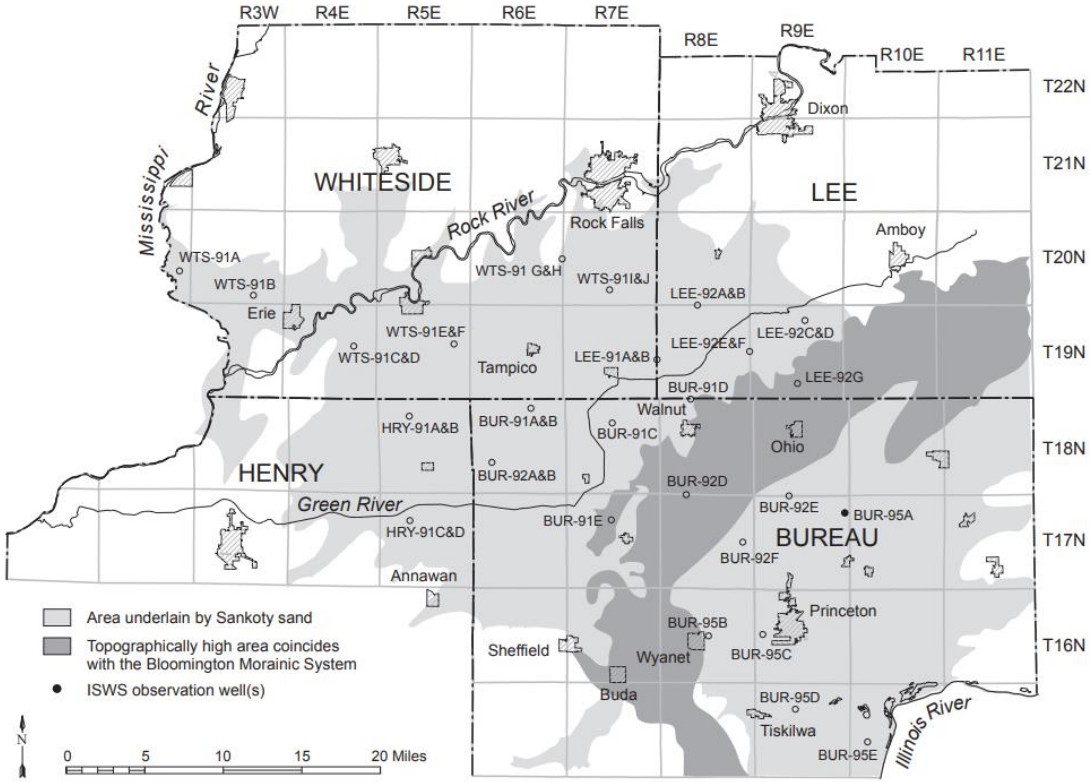
Green River
1980-96: 11.3
2013-17: 13.9

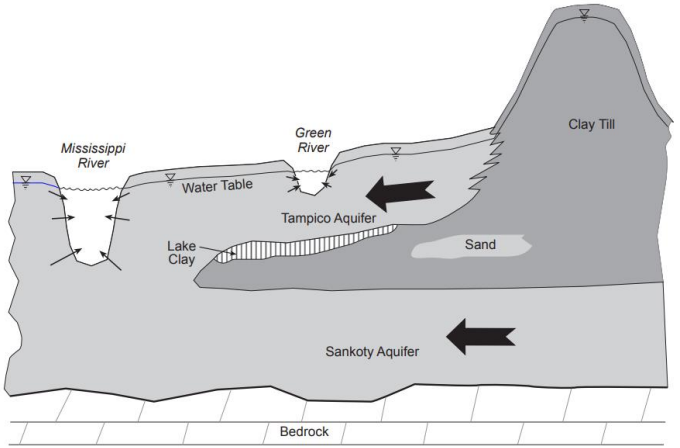
Why so low?

Why was the nitrate-N yield from the section of the Rock downstream of Rockton and Perryville so low in 1980-96? Potential answers:

- Delayed arrival of nitrate leaching from previous decades through a long groundwater flow pathway?
- High in-stream denitrification that was later reduced due to higher flows, especially in June and July?
- Changes in ag practices? (Irrigated acres increased by 50,000 acres between 1978 and 2017 in Whiteside and Ogle Counties)
- Lack of tile drainage that was later added, especially in conjunction with irrigation

Green River Lowlands





https://www.isws.illinois.edu/groundwater-science/groundwater-monitoring-well-networks/green-river-lowlands-monitoring

ISWS Map Series 2015-03
Published November 2015

Center Pivot Irrigation in Illinois
2012 and 2014

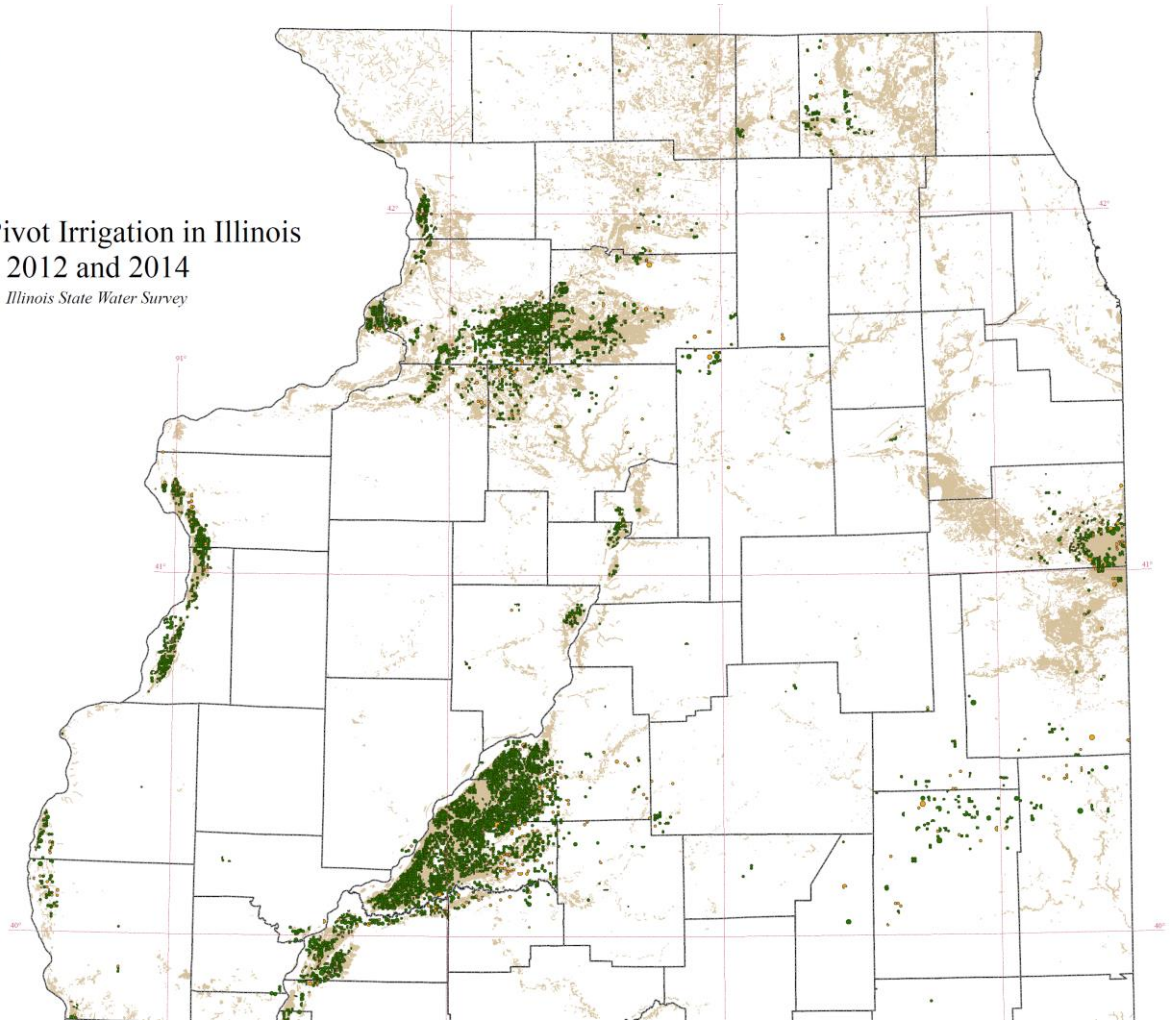
Illinois State Water Survey

Center Pivot Irrigated Field 2012

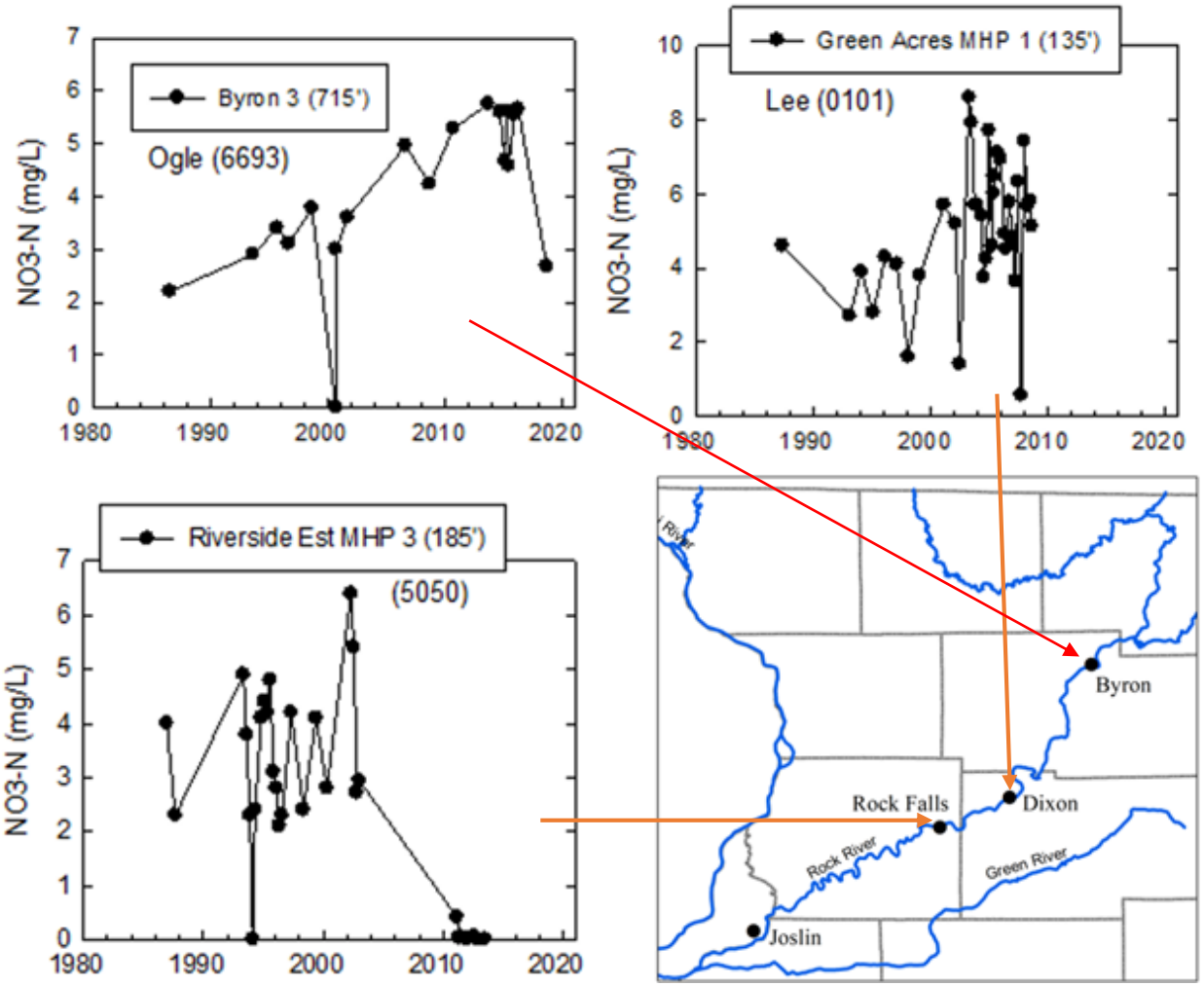
Center Pivot Irrigated Field Added
Between 2012 and 2014 Growing Seasons

Saturated Hydraulic Conductivity (≥3.6 cm/hr)

N
W E
S

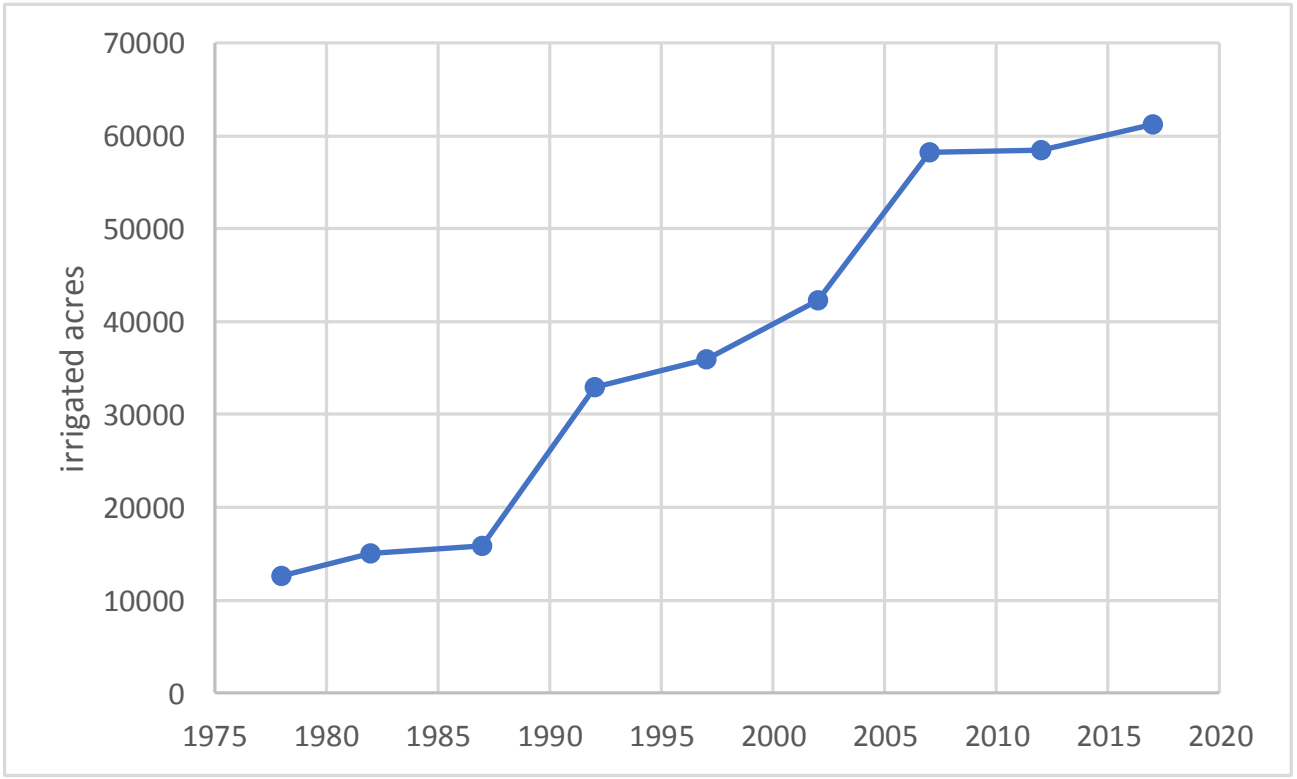


Nitrate-N concentrations in public water supply wells located near the Rock River



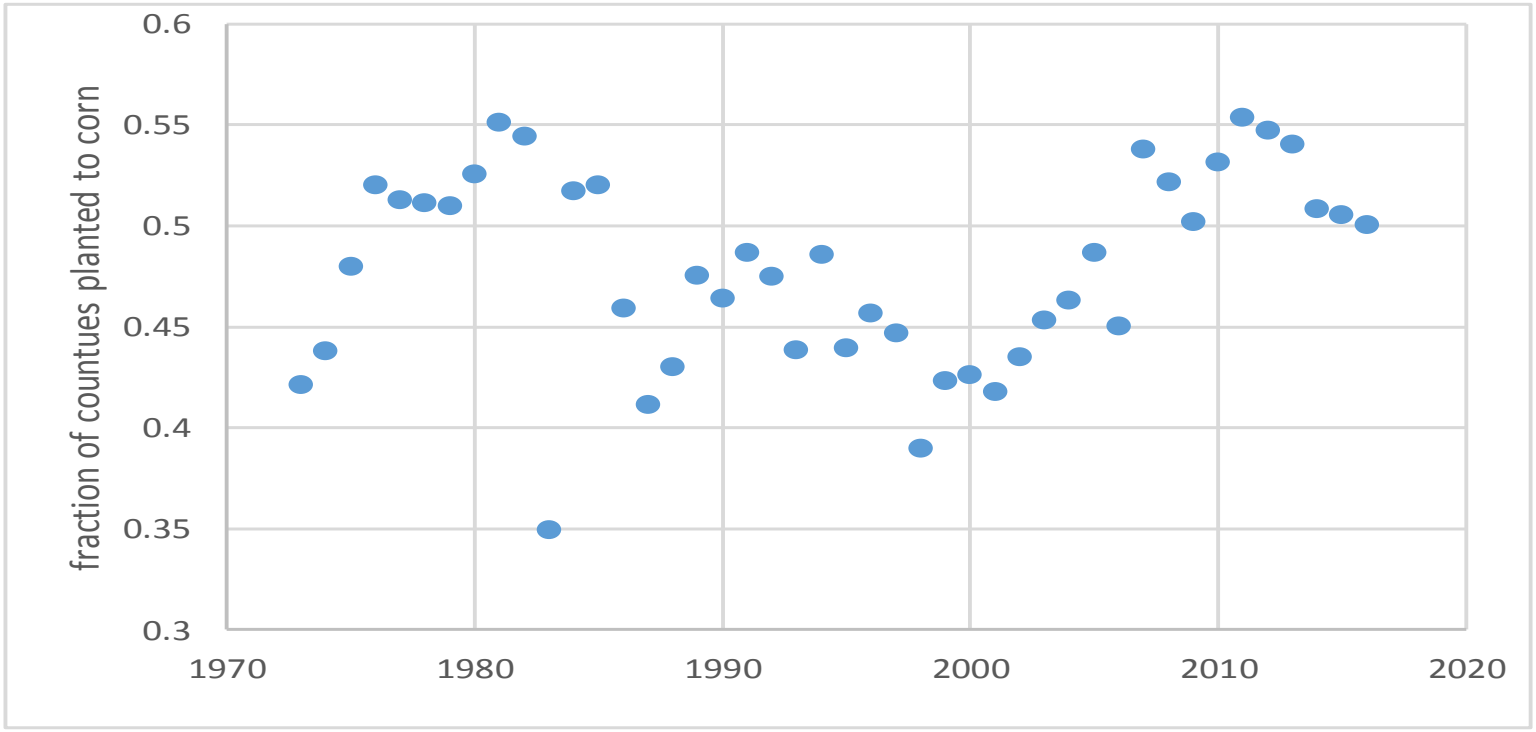
From Daniel Abrams, Walton Kelly, Vlad Iordache and my proposal to NREC; data from ISWS Community Water Supply database.

Irrigated acres in Whiteside + Ogle Counties



USDA Census of Agriculture data

Fraction of Whiteside plus Ogle Counties planted to corn



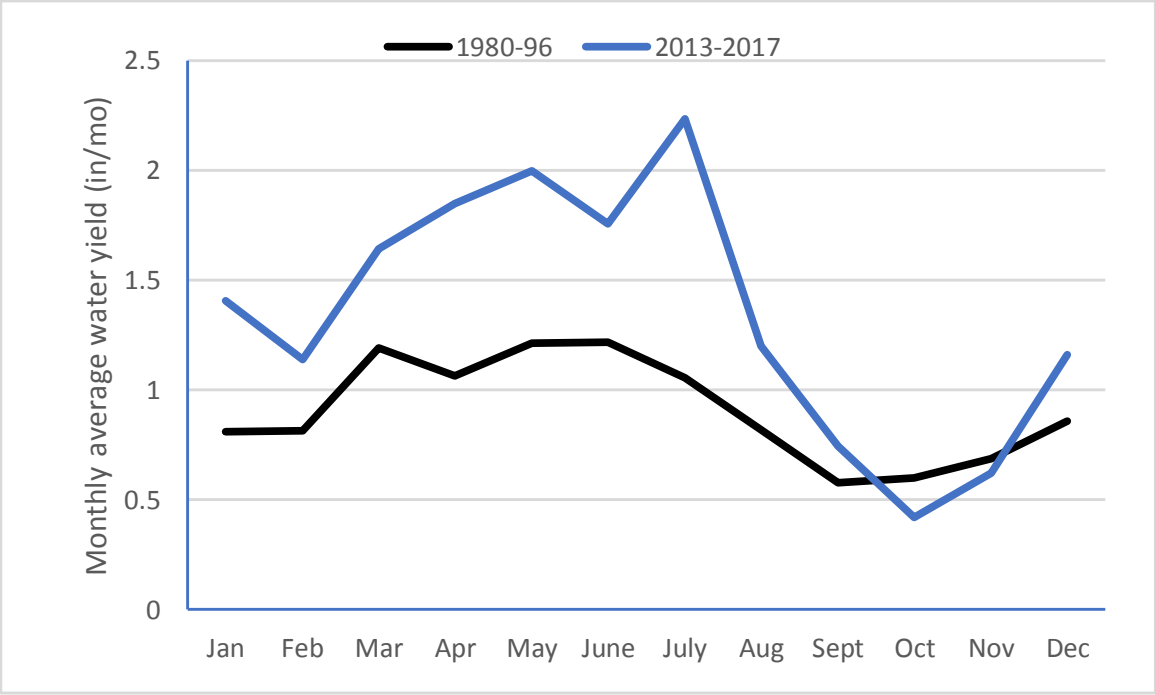
USDA National Agricultural Statistics Service

1979-95 avg: 0.47; 2012-16 avg: 0.53 increase of 41,500 acres of corn

Potential impact of new irrigated acres and increased corn acres

- Assuming no overlap in new irrigated acres and increased corn acres:
- ~100,000 acres * 30 lb N/ac = 3 million lb N/yr
- This is small compared to the 19 million lb N/yr increase in river load

Rock-(Rockton+Perryville) average monthly water yield (48% increase in annual average water flow)



High flows in the growing season promote leaching losses;

Higher flows in warmer months (May, June, and July) probably reduce in-stream denitrification losses and thereby increase riverine loads;

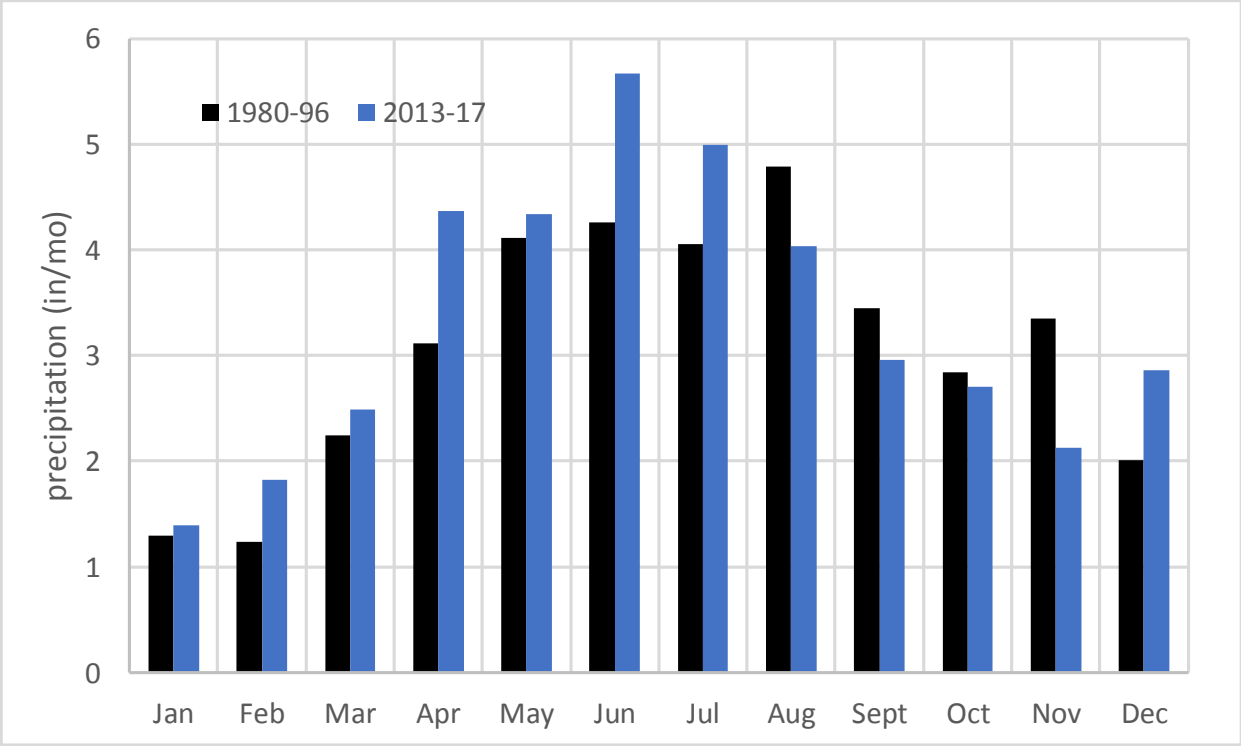
A similar pattern can be seen at other locations, but the Lower Rock may be more suitable to denitrification at low flows.

April through July water yield increased 80% (3.5 in/yr) July water yield doubled

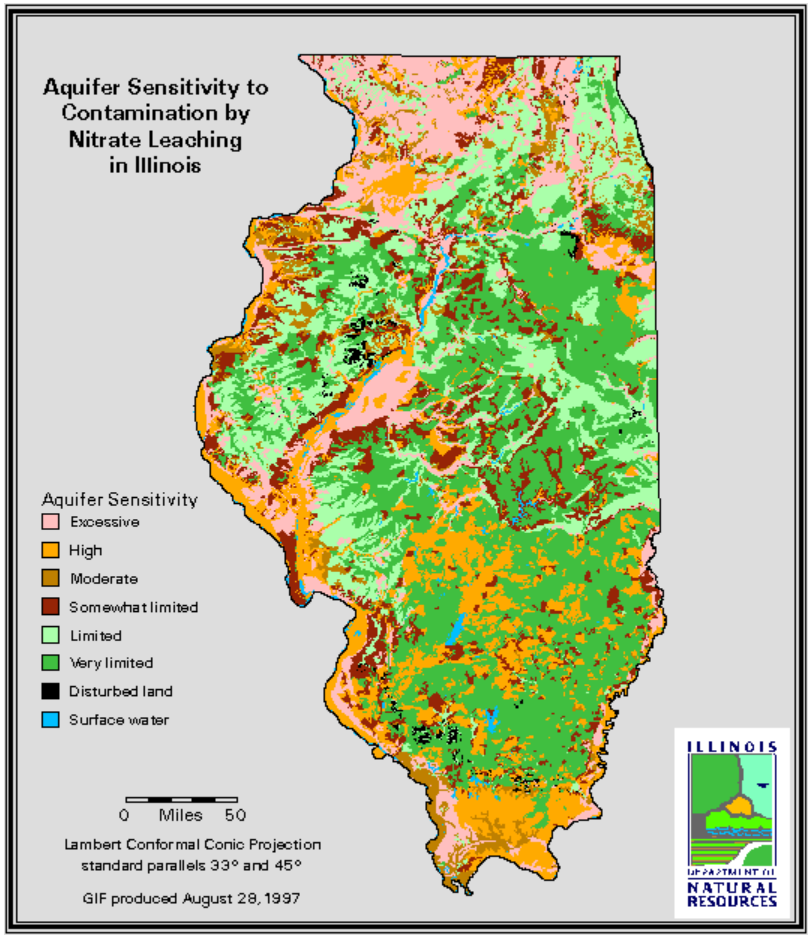
Jan and Feb. 2017 average flows estimated at Perryville and Rockton due to some missing daily data

Monthly average precipitation in Rock River Basin between Rockton and Joslin

(avg of Dekalb, Dixon, Morrison, Mount Carrol, Rockford and Rochelle)



Average April through July precipitation increased 3.8 inches


Aquifer Sensitivity to Contamination by Nitrate Leaching in Illinois
Aquifer Sensitivity
Excessive
High
Moderate
Somewhat limited
Limited
Very limited
Disturbed land
Surface water
0 Miles 50
Lambert Conformal Conic Projection
standard parallels 33° and 45°
GIF produced August 28, 1997
ILLINOIS
NATURAL RESOURCES

Concluding Thoughts about the Rock River Nitrate-N Loads

If there is a large reservoir of groundwater nitrate discharging into the Rock River, there will probably be long lag times between reductions in leaching losses from cropland and reduced loads in the river.

Practices that reduce nitrate concentrations in the river (e.g., side channel wetlands) may reduce loads more quickly.

Irrigation water management efficiency is critical to efficient use of N fertilizer under irrigation.

USGS Super Gage Network

One Year Extension(?) and Contingency Planning if the Network Can't be Continued Long-Term

Gregg Good and Trevor Sample

Hypoxia Task Force

Water Quality Monitoring Workgroup

Trevor Sample

HTF Water Quality Monitoring Workgroup

- In 2019 the twelve Hypoxia Task Force states sent a letter the Federal Water Sub-Cabinet detailing a list of items for federal agencies to address to assist states in implementing their state nutrient strategies.
- The letter was discussed at the Hypoxia Task Force meeting held February 3-5, 2020 in Washington D.C.
- The outcome of the discussion led to the formation of several working groups to address certain issues outlined in the states' letter.

Hypoxia Task Force Work Groups

- Water Quality Monitoring
- Ecosystem/Social Metrics
- Adoption of Innovative BMPs
- Research
- Communications
- Funding, Traditional and Non-Traditional
- Challenges Face on Mitigation

Water Quality Monitoring Work Group

- Chair-Casey Lee, United States Geological Survey, National Water Quality Network Coordinator—Lawrence, Kansas
  - Co-Chair Trevor Sample, Illinois EPA
- GOAL: Write a pre-proposal and subsequent business case for establishing a Mississippi River Basin monitoring network that would capture annual nutrient loads from each HTF state.
- Three calls have been held so far. Calls are held monthly.

Water Quality Monitoring Work Group

- Currently working with National Great Rivers Research and Education Center and Tetra Tech to determine existing water quality stations and to identify sites where new stations could be added.
  - USGS gages, state monitoring stations in WQX portal, other
- Some of this work has already been completed by NGRREC for the HTF Trends Working Group. Tetra Tech will review and compile the NGRREC data and identify sites for new stations.
- States will be surveyed to obtain data that may not be housed in federal databases.
- Preproposal is due this fall before the next HTF meeting (date not set).

UPPER MISSISSIPPI RIVER (UMR) BASIN ASSOCIATION

UMR Water Quality Improvement Act (Gregg Good)

and

Nutrient Strategy Progress Tracking Summit (Trevor Sample)

UMR WQ Improvement Act

- UMRBA – Regional Interstate Organization formed in 1981 by Govs. of MN, WI, IL, IA, and MO. Facilitate dialogue and cooperative action regarding water/land resource issues (i.e., clean water, ecosystem health, commercial navigation, hazardous spills, flooding, and aquatic nuisance species).

- UMRBA Board – IDNR-DWR (Loren Wobig, Rick Pohlman); WQEC – IEPA (Gregg Good); WQTF – IEPA (Gregg Good)

- UMR Watershed "Nutrient Reduction Challenges":
  - Differences in State Monitoring Programs
  - Data systems incompatibilities
  - Spatial gaps
  - Estimating costs of conservation practices
  - Lack of major investment in reduction

UMR WQ Improvement Act (continued)

- Federal and state investment must be substantially increased to meet nutrient reduction and resource monitoring goals!
- Solutions:
  - Creation of an (Upper?) Mississippi River Program Office administered by NRCS and USEPA (much like GLNPO)
  - Big dollars for implementing state nutrient reduction strategies – primarily Ag and Urban NPS components
  - More comprehensive and coordinated monitoring, modeling, and research (i.e., CWA coordinated 305(b) assessment of the UMR)
  - Better communication between parties via development of a communication strategy (i.e., status and trends, success stories, research, condition assessments)
  - Go big or go home – hundreds of millions to be requested!

- Bill Sponsors:
  - House of Representatives: Rodney Davis (R-IL), Angie Craig (D-MN)
  - US Senate: Roy Blunt (R-MO), Amy Klobuchar (D-MN)

UMRBA Nutrient Strategy Progress Tracking Summit

- UMRBA reached out to their member states (Illinois, Iowa, Minnesota, Missouri, Wisconsin) to discuss holding a summit for states to gather to discuss successes and challenges in tracking progress of implementing state nutrient reduction strategies.
- A planning committee was formed to set the agenda and determine who should attend. Between 3-6 members from each state will be allowed, along with staff from USEPA and NRCS.
- Event was originally scheduled for July 22-23 in Dubuque, Iowa but has been postponed to 2021 due to COVID-19 concerns
- In the meantime, UMRBA is planning to offer a few webinars in 2020 with priority topics chosen by the planning committee.

Current and H2NOW

Svetlana Taylor, Current Innovation, NFP

Current

Real-Time Water Quality Monitoring: H2NOW Chicago

Nutrient Monitoring Council Meeting
June 18, 2020


Mission

Current's mission is to grow Chicago and Illinois' blue economy – the companies developing innovative water technologies and industries that use them – to build solutions that will solve the world's water challenges.

Who We Are

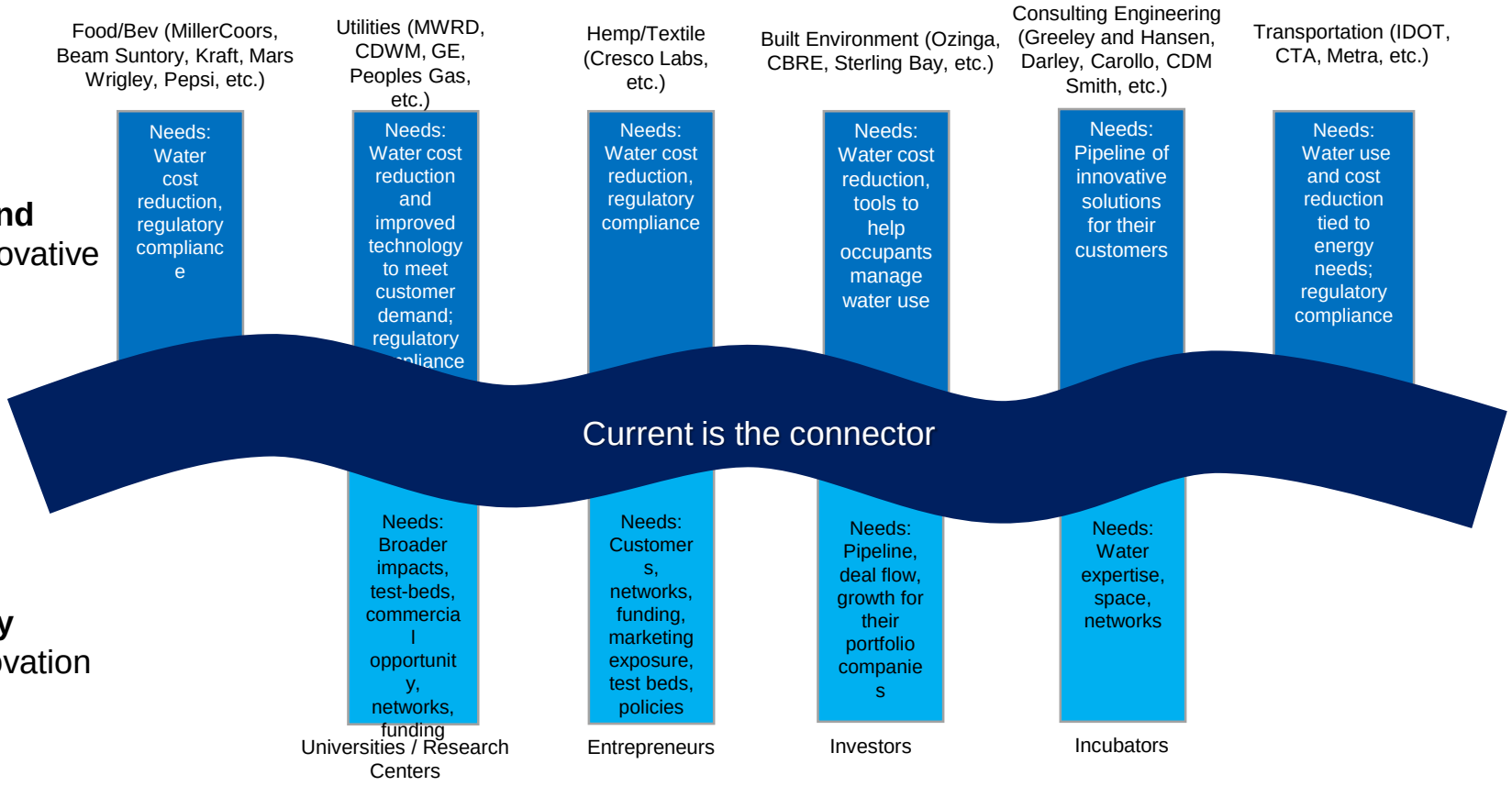
Launched in 2016 as a nonprofit water innovation hub, Current is headquartered in Chicago, IL. We're a collaborative that leverages partnerships with the state's world class utilities, research institutions, industries and innovation community for global environmental and economic impacts

How We Work

As a cross-sector connector of local and global water sector stakeholders, we build networks, organize events and convenings, and help develop pilot projects in real-world settings to solve persistent local water challenges.

Building Illinois' Blue Economy

The "Blue Economy" describes industries with *demand* for technology to manage water in some way, and the industries and sectors *supplying* those technologies. Current connects stakeholders with distinct but common interests in water innovation.



Illinois is a Global Water Hub

Pillar 1

Technology deployed to solve local and regional water needs

Pillar 2

New technologies and solutions generated and exported; companies, jobs and GRP grow

Pillar 3

Educational pipeline for skilled and diverse workforce is established

Pillar 4

Governing and regulatory bodies support innovation in water and respond to the sector needs

Pillar 5

Thriving ecosystem: supply/demand connected; stakeholders collaborate to establish business relationships and develop solutions

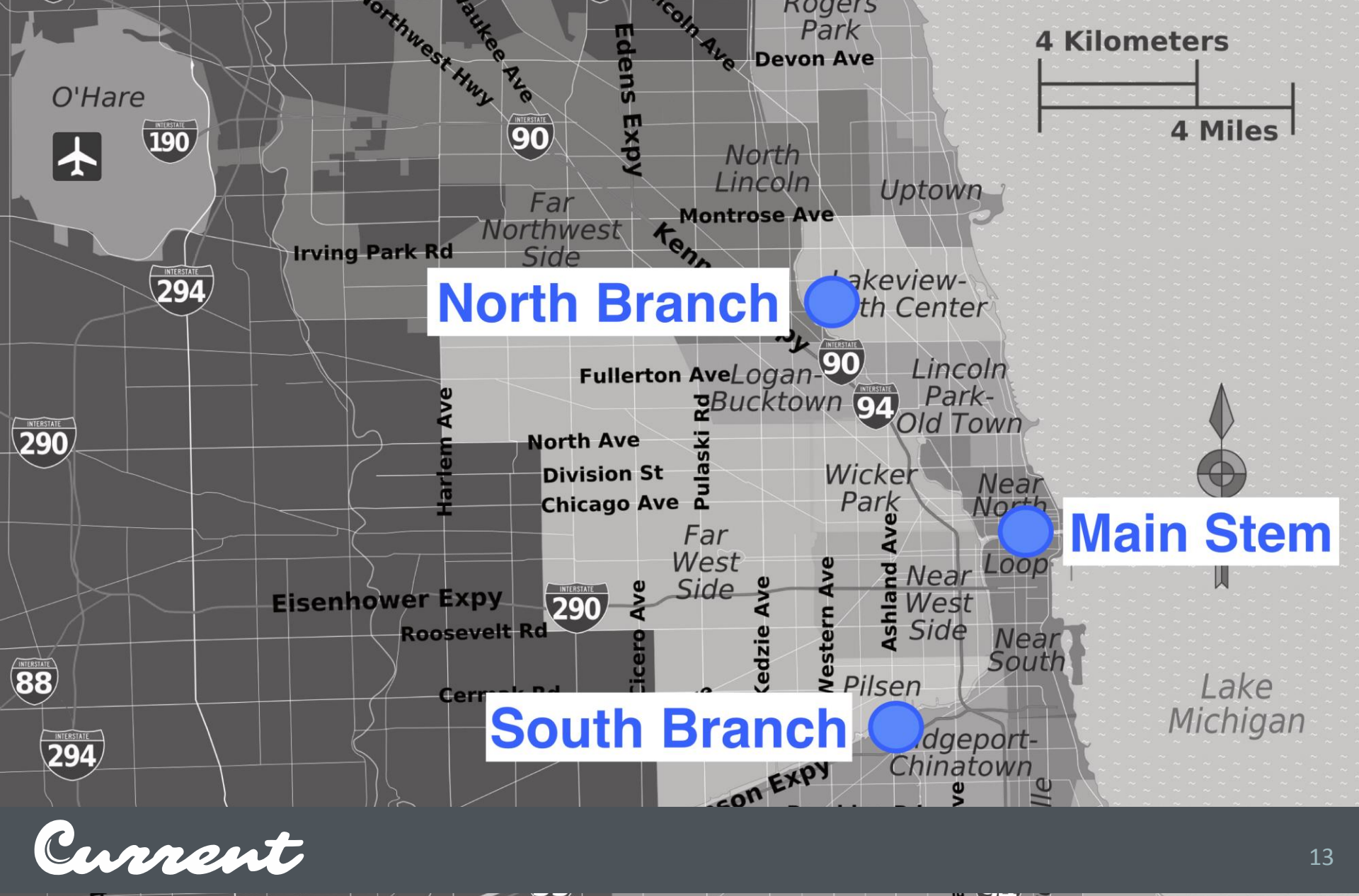
Foundation: understanding needs of stakeholders on both supply/demand sides of local water cluster, identifying persistent local and regional water issues, technological and commercialization gaps, regulatory environment as it pertains to innovation, and brokering resources to fill the gaps

H2NOW CHICAGO

WATERWAY MONITORING

Goals

- Obtain **near real-time information** about the microbial quality of the Chicago River
- **Educate and engage the public** about improvements to river health and water quality
- **Observe how river water quality changes** in response to conditions and events (CSOs)
- **Evaluate novel technologies** for real-time microbial water quality assessment


4 Kilometers
4 Miles
North Branch
Main Stem
South Branch
O'Hare
Rogers Park
Devon Ave
Northwest Hwy
Milwaukee Ave
Edens Expy
Lincoln Ave
North Lincoln
Uptown
Montrose Ave
Far Northwest Side
Irving Park Rd
Lakeview-
Center
Fullerton Ave
Logan-Bucktown
Lincoln Park-Old Town
Harlem Ave
Pulaski Rd
North Ave
Division St
Chicago Ave
Wicker Park
Near North
Loop
Far West Side
Ashland Ave
Near West Side
Eisenhower Expy
Roosevelt Rd
Cicero Ave
Kedzie Ave
Western Ave
Near South
Pilsen
Lake Michigan
Bridgeport-Chinatown
55th St
Garfield Blvd
Midway
Southwest Side
Hyde Park
INTERSTATE 190
INTERSTATE 90
INTERSTATE 294
INTERSTATE 290
INTERSTATE 94
INTERSTATE 88

Sensing and Testing Technologies

PROTEUS

- Real-time estimate of fecal coliform concentrations
- Sensor detects tryptophan fluorescence
- Algorithm adjusts the signal to account for temperature
- Algorithm **estimates microbial levels** based on the temperature correlated tryptophan reading and turbidity
- Results are statistically correlated to test results obtained with a traditional method

TECTA - PDS

- 2-16 hours, typically 6-10 hours for river water
- Sensor monitors response in fluorescence and registers time-to-detection (TTD)
- There is linear correlation between TTD and log-transformed microbial count - this correlation can be developed by conducting traditional lab testing in parallel

Communication Technologies

Cellular network

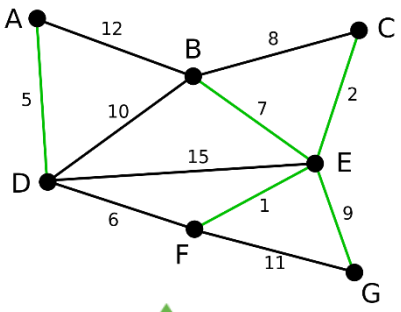
- **Pick up data from the sensors**

Low power wide area network (LPWAN) supplemented by cellular

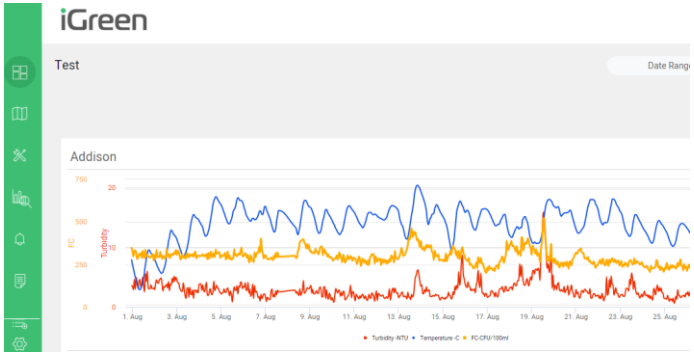
- **Transmit data to visualization platforms**
- **Visualize the raw data**

Data Analysis and User Experience

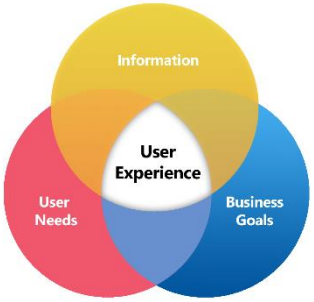
IOSight



- Data standardization
- Data validation
- Data processing for assessment purposes
- Correlations to other data (rainfall, DO, conductivity, flow, CSOs, etc.)
- Data visualization and sharing platform

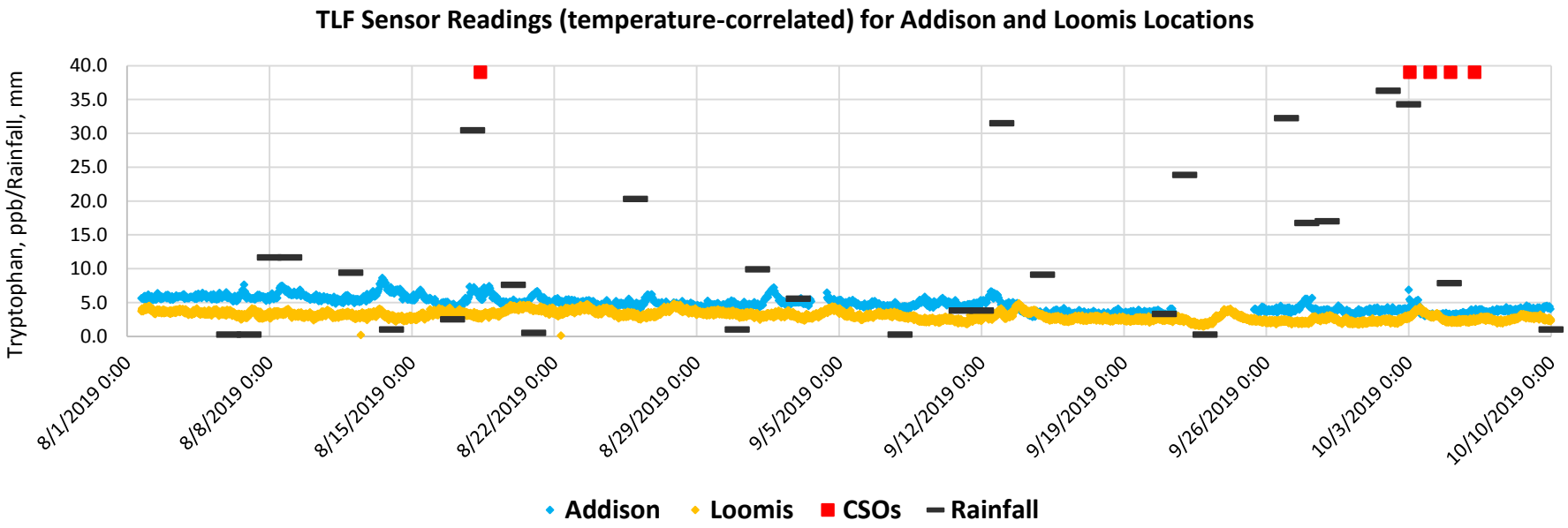


Green Diamond
SUSTAINABLE PERFORMANCE



- Best practices in data collection and presentation
- User-centered design and data presentation
- Website and data visualization tools

What do we know so far? *2019 data



2020 Goals

- Improve **data availability** (consistent power source, reliable communication network)
- Achieve **higher accuracy and precision** (additional sampling)
- Understand and **communicate the limitations of data** in terms of accuracy and inference on the entire river
- **Streamline data collection and integration** from other sources to build a more comprehensive picture of water quality
- Continue to **engage volunteer network** in collecting river samples for improved calibration accuracy

Partners

Data Analysis

MEKOROT Israel National Water Co.

IOSight

Sensing

PROTEUS

TECTA - PDS

Data Visualization / Transfer

Green Diamond SUSTAINABLE PERFORMANCE

esri

AYYEKA

Community Engagemen

NORTH RIVER COMMISSION

URBAN RIVERS

SIERRA CLUB ILLINOIS CHAPTER

Friends of the Chicago River

SOUTH LOOP Chamber of Commerce

FOREST PRESERVES of Cook County

Shedd AQUARIUM

Funding

THE CHICAGO COMMUNITY TRUST AND AFFILIATES

COMCAST

Research

ILLINOIS

Utilities

Department of Water Management

Metropolitan Water Reclamation District of Greater Chicago

How You Can Engage!

- **Survey – Scan the QR Code!**
- **Volunteer to collect water samples and survey community members**
- **Follow and promote the project on social media (@CurrentWater)**
- **Join the H2NOW Chicago Advisory Committee**
- **Become a partner or sponsor**

Other Projects

Nutrients

- Came out of the effort to establish a phosphorus trading program in Illinois
- Producing a white paper/report with learnings and recommendations
- Identifying a technology-related project for monitoring and/or reduction of nutrient concentrations in the Illinois River Basin (workshop is coming in July)

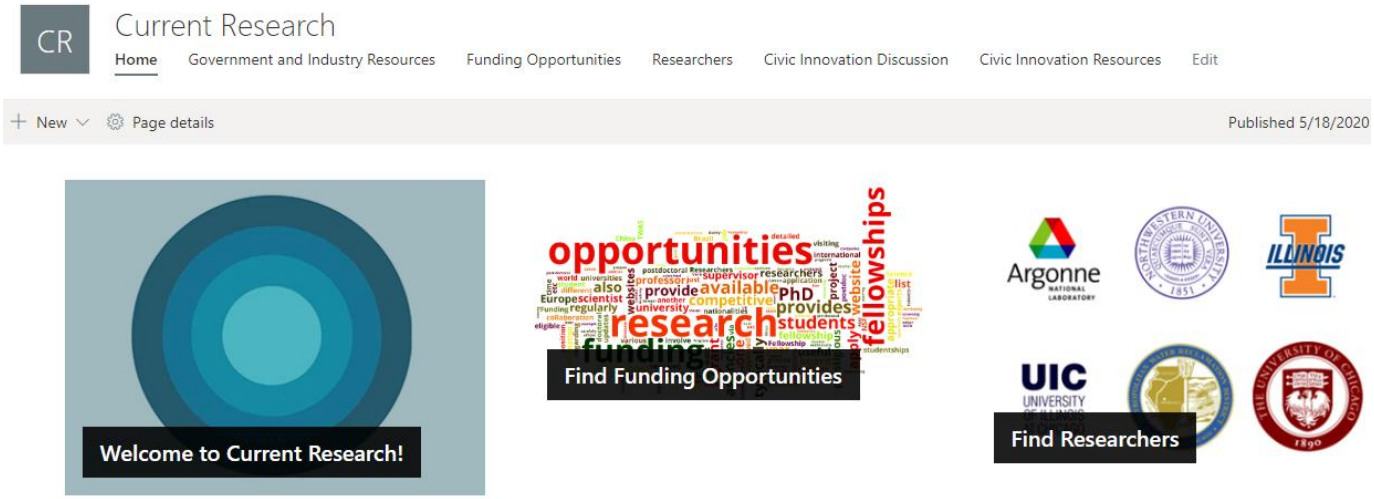
CoWERC

- International (Israel) industry and research collaboration on the topics of emerging contaminants, energy efficiency, and water reuse
- Current is playing a role of convener and supporter

Ongoing Events

- Brave Blue World Screening
- Innovator Showcases and Focused Workshops

Current Research SharePoint Site



- Database of researchers
- Database of funding opportunities
- Regional news and events
- Resources on the topics of regional importance

Questions?

Thank You!

currentwater.org

Alaina Harkness: Aharkness@currentwater.org **- @harknessa**

Svetlana Taylor: Staylor@currentwater.org

George Brigandi: Gbrigandi@currentwater.org


Great Lakes to Gulf
VIRTUAL OBSERVATORY

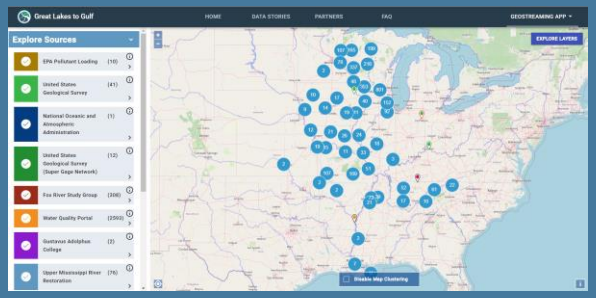
Great Lakes to Gulf
Updates on the Data Portal and Work with additional Hypoxia Task Force States

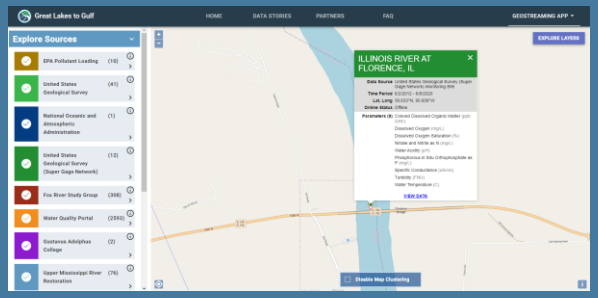
Ted Kratschmer
NGRREC

Great Lakes to Gulf
VIRTUAL OBSERVATORY

What is the Great Lakes to Gulf Virtual Observatory?

- The GLTG Virtual Observatory is a web-based geospatial application that integrates water quality data and analytical tools from multiple sources allowing a user to visualize and understand nutrient pollution and water quality conditions in the Mississippi River watershed.
- The online interactive application provides users with tools to explore, analyze and compare water quality data from the Mississippi River and its tributaries.





Great Lakes to Gulf
VIRTUAL OBSERVATORY

Data to Decision Support

- Support states and other stakeholders “where they are” through narratives, visual tools, and analyses

Nutrient Reduction Progress Tracking Journey

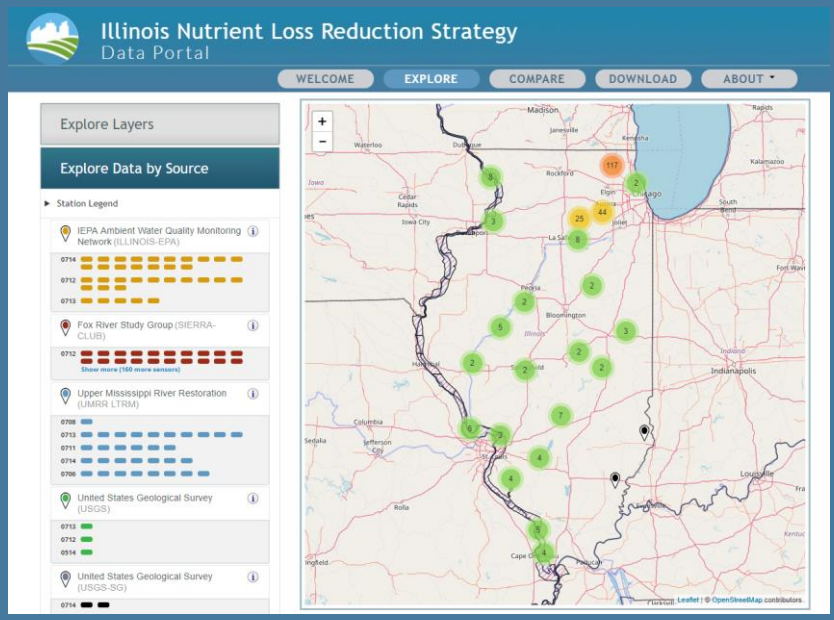
Monitoring, land use, cover crops, etc. etc.

Choosing models, trend analysis etc.

Great Lakes to Gulf
VIRTUAL OBSERVATORY

Illinois Nutrient Loss Reduction Strategy Data Portal

- Based on GLTG application our team provides interactive data portal for IL NLRS
- Always looking for additional data for this and the main GLTG site

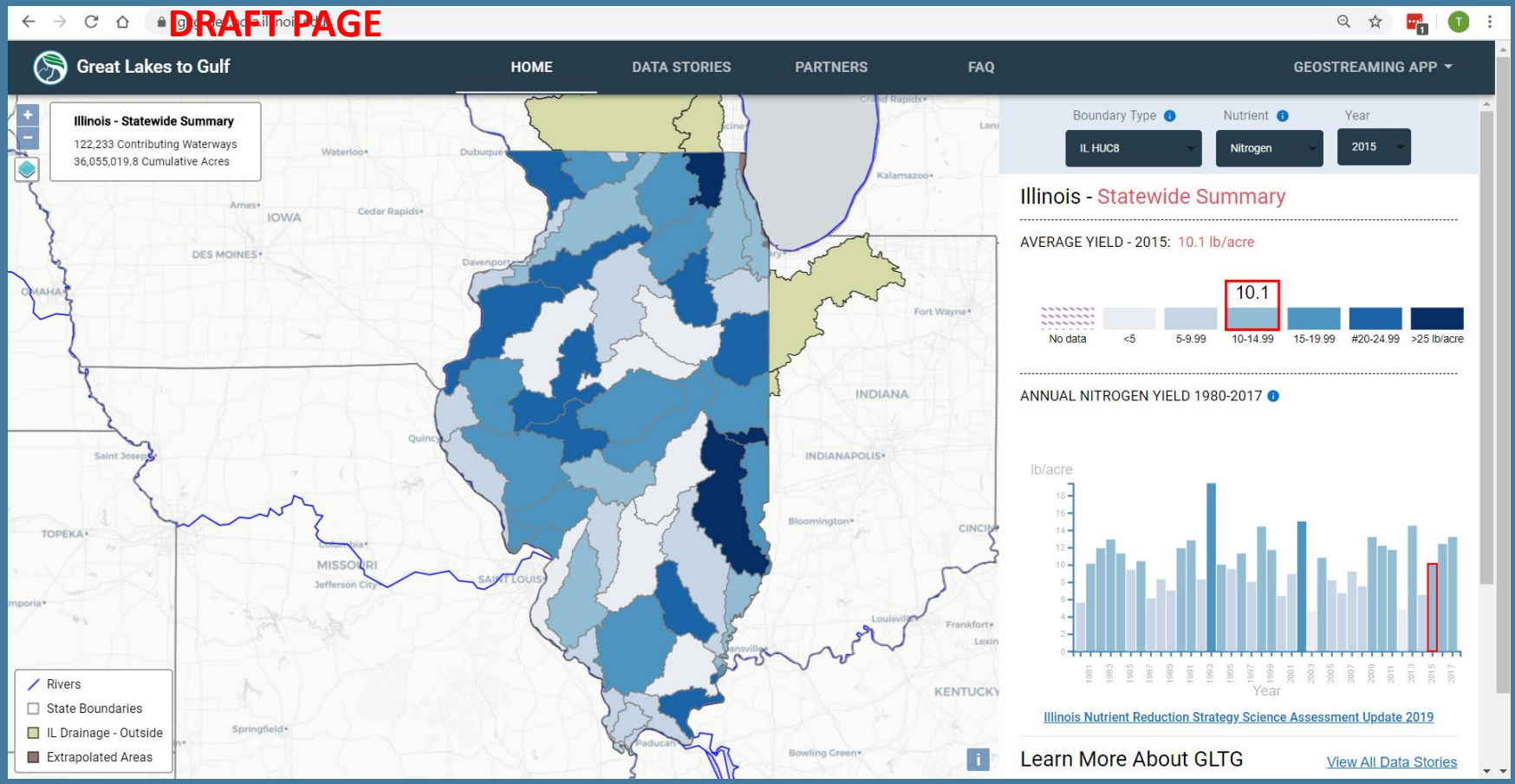


Illinois Nutrient Loss Reduction Strategy

- Data portal enhancements
  - ilnlrs.ncsa.Illinois.edu
  - New interface to explore raw data
    - Ambient & Supergage data
    - Other data sources
  - Additional visualization and interactive exploration of data outputs from the Biennial Report
    - Yearly Statewide Loads at a glance
    - HUC-8 summary by year
    - Illinois major watershed basins
  - Narrative Storyboards

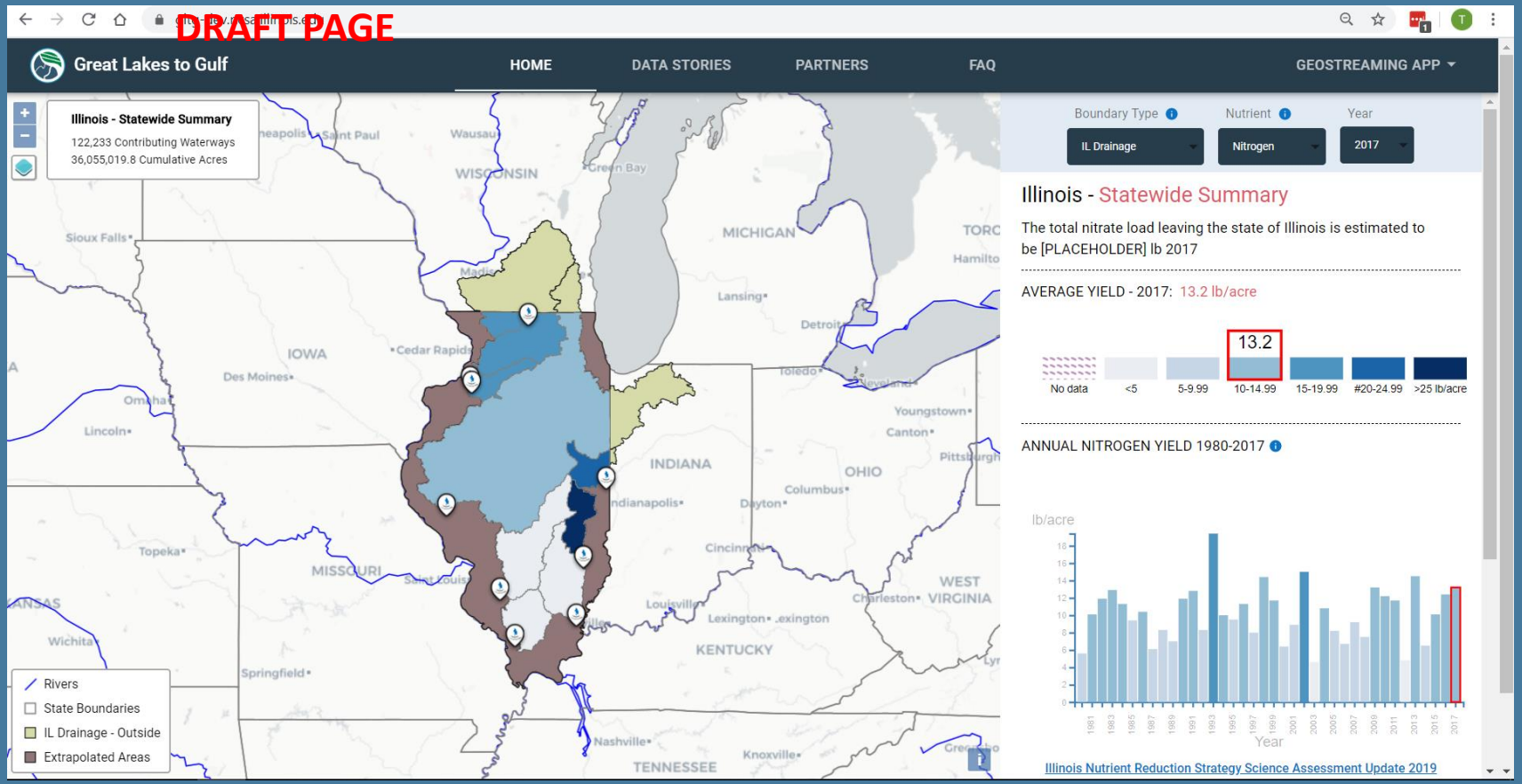
Great Lakes to Gulf
VIRTUAL OBSERVATORY

Visualizing Illinois NLRS Data



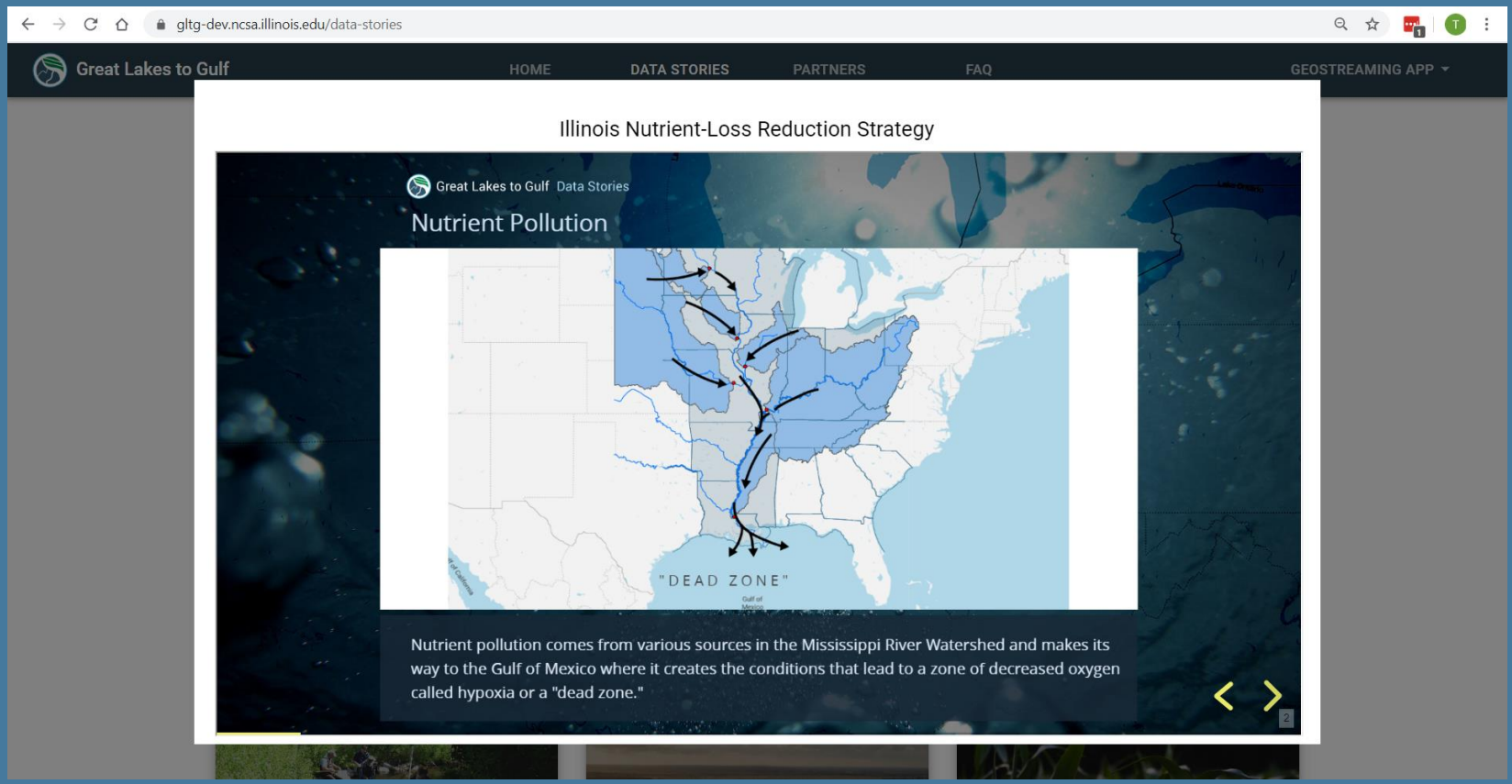
Great Lakes to Gulf
VIRTUAL OBSERVATORY

Visualizing Illinois NLRS Data



Great Lakes to Gulf
VIRTUAL OBSERVATORY

Explaining NLRS Data - Storyboards



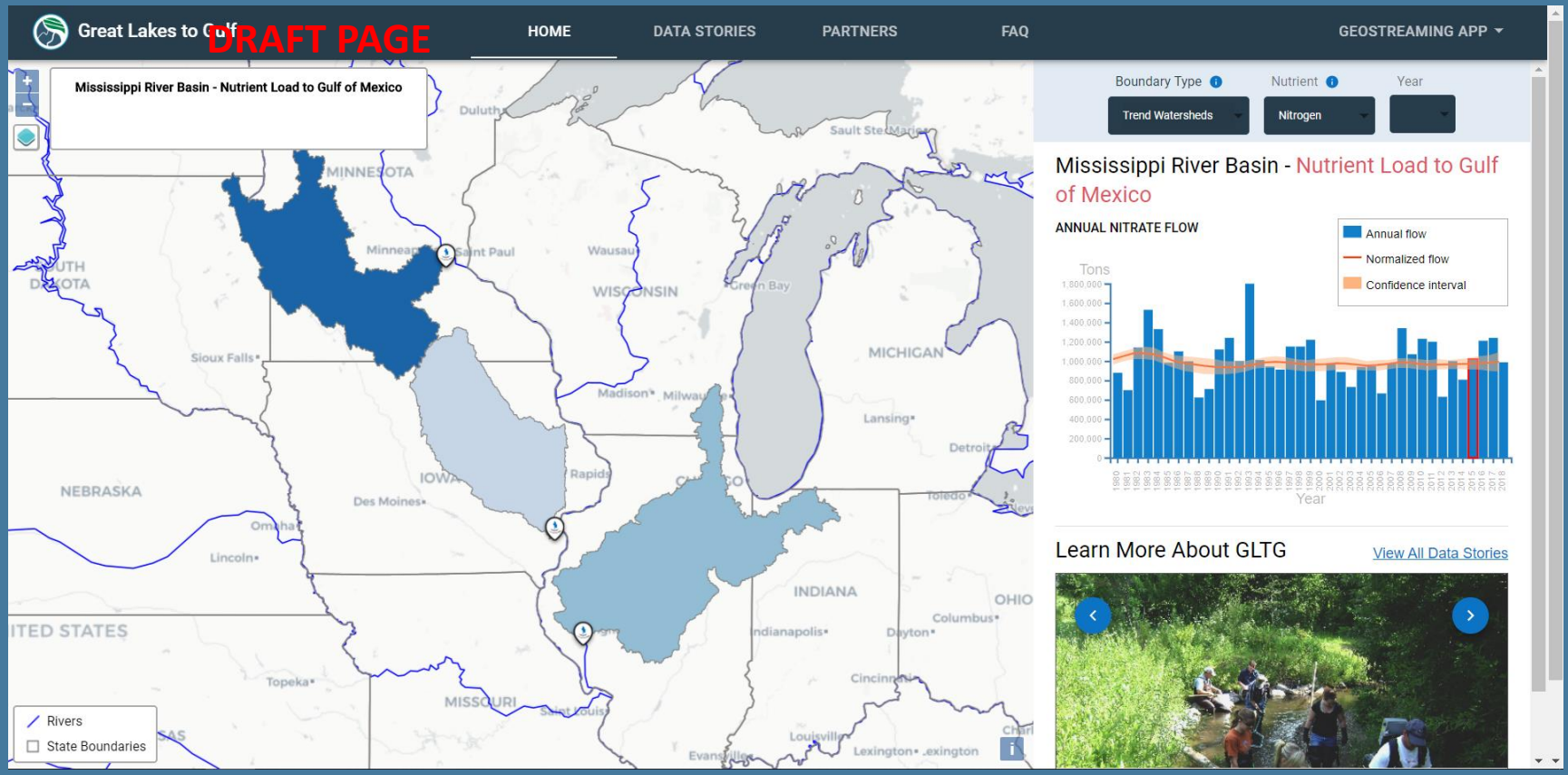
New Initiative

Tracking States' Progress in context of basin

- Progress Tracking through Visualization/interpretation of water quality trends by watershed, state or for the entire MRB
  - Flow-Normalized Loads
  - Includes concentrations and loads for nitrogen and phosphorus
  - New effort with HTF to establish MRB Trend Sites to better show progress on nutrient reductions
- Data repository and visualization capacity to describe inventory of ag best management practices for each of the 12 MRB mainstem states in the Mississippi River Basin (Reid Christianson – UIUC)
- Innovative remote monitoring of cover crops and relationship to water quality (Kaiyu Guan - UIUC)

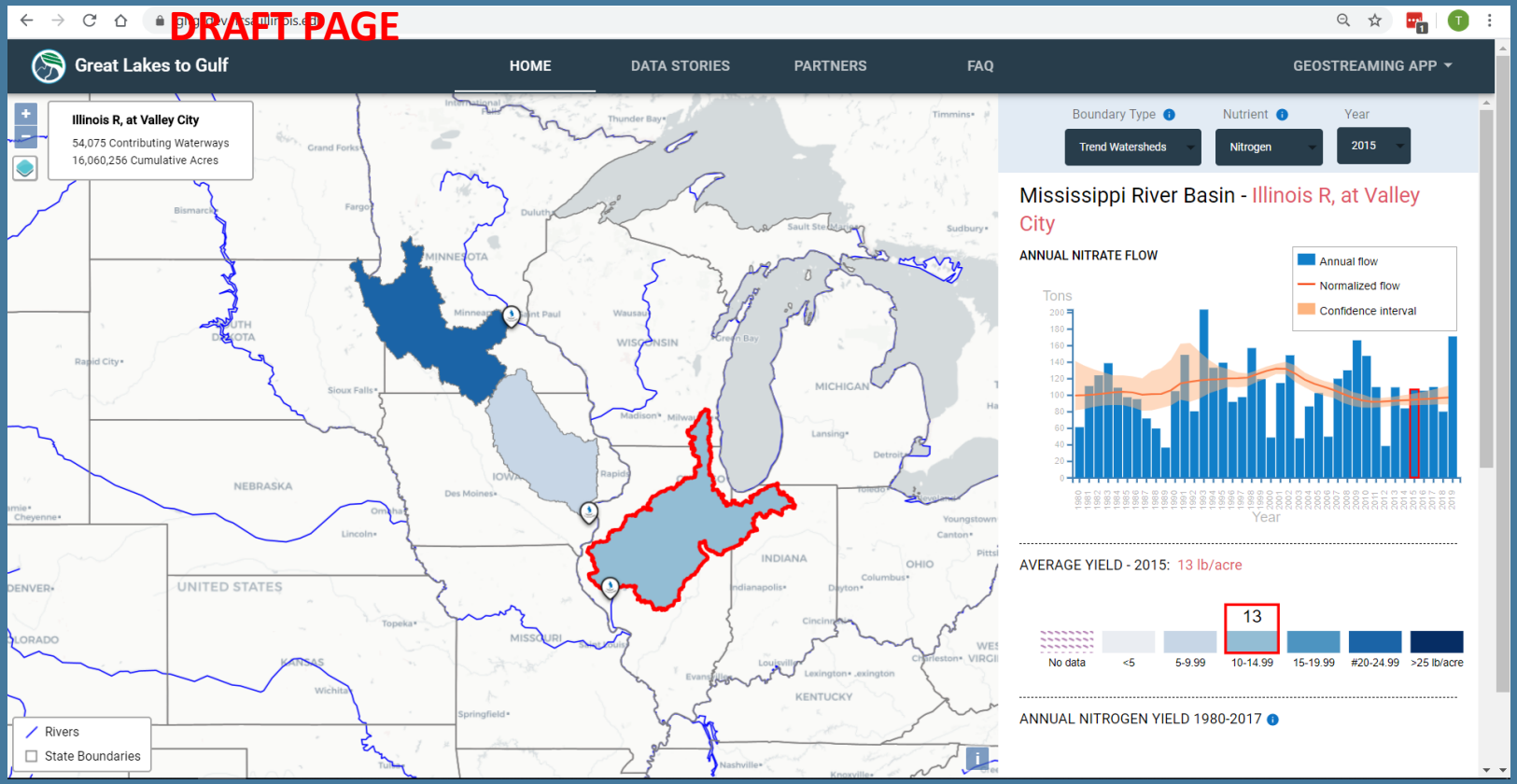
Great Lakes to Gulf
VIRTUAL OBSERVATORY

Overall Trend in the Basin



Great Lakes to Gulf
VIRTUAL OBSERVATORY

Watershed Trends in the Basin



Future Enhancements

- Progress Tracking through Visualization/interpretation of water quality trends by watershed, state or for the entire MRB
- Data repository and visualization capacity to describe inventory of ag best management practices for each of the 12 MRB mainstem states in the Mississippi River Basin (Reid Christianson)
- Innovative remote monitoring of cover crops and relationship to water quality (Kaiyu Guan)
- Side Project – Water Quality Data Inventory of Lower Mississippi River Main Stem

Great Lakes to Gulf
VIRTUAL OBSERVATORY

Funding from:

"Next Steps" Summary

- Today's Action Items?
  - A.
  - B.
  - C.
- Topics/Presentations for Next Meeting?
- Next Meetings – Sept/Oct 2020, March 2021 – Look for the Doodle
- And finally……..

.....New Chair Extraordinaire!

GOOD

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