Illinois Nutrient Loss Reduction Strategy Nutrient Monitoring Council

11th Meeting, August 29, 2018, Urbana, IL





Welcome/Housekeeping

- Important Stuff bathrooms, lunch, other
- Member Introductions
- Newsworthy Notes:
 - Amy Walkenbach Retirement
 - Hold the Date NLRS Annual Workshop 11/13/18
 - NOAA Dead Zone Forecast
 - Others?





Nutrient Monitoring Council Members (3/15/18)

Illinois EPA Gregg Good, Rick Cobb

Illinois State Water Survey Laura Keefer

Aqua Illinois Kevin Culver

Illinois Natural History Survey Andrew Casper (Need Replacement?)

Illinois Dept. of Natural Resources Ann Holtrop

Univ. of IL – Dept. of Ag and Bio Eng. Paul Davidson

Sierra Club Cindy Skrukrud MWRDGC Justin Vick

Illinois Corn Growers Association Laura Gentry

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

U.S. Geological Survey Kelly Warner

National Center for Supercomputing Apps Jong Lee

Univ. of IL – Dept. of Nat. Res. & Bio. Studies Greg McIsaac

NLRS Coordinator – Illinois EPA Trevor Sample



Ida and Jove Vick...New Members?





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 <u>leaving the state of Illinois</u> compared to 1980-1996 baseline conditions; and



- b. Generate estimations of Nitrate-Nitrogen and Total Phosphorus loads <u>leaving selected NLRS</u> <u>identified priority watersheds</u> 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.

ILLINOIS Improving our water resources with collaboration and innovation

March 15, 2018, NMC #10 Meeting

- Review of Meeting
- Minutes (review and approve)





Trevor Sample, Illinois EPA NLRS Coordinator

- NLRS Watershed Coordinators Update
- NLRS Science Team and Science Assessment Update
- Future opportunities for communication and collaboration with NLRS Watershed Coordinators, Science Team, and NMC???



University of Illinois Extension Watershed Coordinators





University of Illinois Extension Watershed Coordinators

PODCASTS

- Watershed Coordinators are producing podcasts covering NLRS topics
- Hosted on WILL website
- Three podcasts have be created to date.
- A subscription service is being developed
- https://will.illinois.edu/agriculture/note/50107



University of Illinois Extension Science Team

- Laura Christianson Crop Science
- Jonathan Coppess Ag Econ
- Paul Davidson Ag and bio engineering
- Cameron Pittelkow Crop Science
- Maria Villamil Crop Science
- Suzanne Bissonnette Assistant Dean, Extension
- Reid Christianson Crop Science

- Provide technical support from research to Watershed Coordinator.
- Update conservation practice performance in NLRS updates.
- Approve of new conservation practices to be included in the NLRS.

Science Assessment Update

- Dr. Greg McIsaac will update statewide nutrient loads
- HUC 8 loads and yields
- Compare point versus nonpoint source contributions
- Compare to baseline
- Complete by March 2018.



Figure 2.2. Nitrate-N reduction goal in pounds per year by source.



Figure 2.3. Total phosphorus reduction goal in pounds per year by source.

Table 3.4. Water, nitrate-nitrogen, total nitrogen, DRP, and total phosphorus loads for Illinois for 1980-1996 and 1997-2011, along with David and Gentry (2000) estimates as a comparison. Point source loads are also shown as well as point sources as a percent of the recent loads.

	Water	Nitrate-N	Total N	DRP	Total P
	1012 ft3 yr-1		million	lb yr¹	
David and Gentry (2000)	1.6		538		31.3
1980-1996	1.7	404	527	15.4	34
1997-2011	1.72	410	536	18.5	37.5
Urban runoff		6	8.3		1.5
Point sources		75.2	87.3		18.1
Point source percent of 1997-2011 load		18.4	16.3		48
David and Gentry (2000) point source percent of load			16		47



Figure 3.2. Nutrient sources in Illinois contributing to riverine nutrient export from the state.



Figure 3.3. Annual water flows from Illinois for the 1980-2011 water years. The LOESS trend fit is shown in red.



Figure 3.4. Annual nitrate-nitrogen and total phosphorus loads from Illinois for the 1980-2011 water years. The LOESS trend fit is shown in red.



Figure 3.5. Riverine loads of nitrate-nitrogen and total phosphorus averaged for 1980-1996 and 1997-2011.



Figure 3.13. Point and non-point source nitrate-nitrogen yields by HUC8 in Illinois.

Figure 3.15. Point and non-point source total phosphorus yields by HUC8 in Illinois.



USGS Happenings and Updates Kelly Warner and Paul Terrio

- USGS 2nd Year Super Gage Results Report Results through Water Year 2017
- Super Gage Stations Update
- AWQMN Trends/Loads Computations
- Other USGS Stuff





NLRS Nutrient Science Advisory Committee (NSAC) Update Paul Terrio, Committee Member

- Progress to Date
- Projected Release Date
- Next Steps After Release





Updates on IL NLRS Data Portal

August 29, 2018 @ Nutrient Monitoring Council



Updates Summary

• Deployed the site

- <u>https://ilnlrs.ncsa.illinois.edu/</u>
- Based on feedback from IEPA
 - Customized About/Welcome page
 - Updated the accordions
 - Updated naming of EPA sites and Supergages
 - Updated phosphorous data
 - Updated parser to get additional data
- New capabilities from GLTG
- Version 3 is coming soon



Customized Welcome/About Page





Customized Categories



Illinois Nutrient Loss Reduction Strategy Data Portal

Explore Layers





Illinois Nutrient Loss Reduction Strategy Data Portal

WELCOME

Explore Layers		+
Explore Data by Source		Waterloo
 Station Legend 	wa	Ceo
Great Rivers Ecological Observation Network (GREON)	(i) Vo	ines Io
0713		
IEPA Ambient Water Quality Monitoring Network (ILLINOIS-EPA)	1	
0714		Kirksville
lowa Water Quality Information System	1	my m
0706 🛥 🛥	-	-Sedalia Jefferson
Fox River Study Group (SIERRA- CLUB)	1	1 - co
0712 Show more (160 more sensors)	5	Rolla
Upper Mississippi River Restoration (UMRR LTRM)	1	XAX
0708 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	S	ringfield
	1	the state



Updated Predefined Area

 In Download page, predefined area has been configured for search/filter sites





Updated Naming of EPA and USGS Sites



Illinois Nutrient Loss Reduction Strategy

Data Portal





USGS and USGS Supergauges

 Created Separate Group for USGS Supergages and others





Updated Phosphorous Data

- USGS
 - Phosphorous in Situ Orthophosphate as P (mg/L)
- IEPA Ambient Water Quality Network
 - Phosphorous Dissolved as P (mg/L)
 - Phosphorous Total as P (mg/L)
- Sierra Club Fox River Study Group
 - Phosphorous Dissolved as P (mg/L)
 - Phosphorous Total Bottom Deposit Dry Weight (Mg/kg)
 - Phosphorous Total as P (mg/L)
 - Phosphorus, SED, BOT, <63, Wet Sieve, Field, Total (mg/L)



New Sites

 Sites from Iowa Water Quality Information Systems



♦ Iowa Water Quality Infor > WQ\$0020				
Time Series				
	Date 6/23/2014 - 6/6/2018 Averaged by month	Download Data 🕶		
Selected Parameters (j)	Time Series	Box and Whisker (i)		
Discharge (ft3/s)	Discharge (ft3/s) Source: [1]			
Dissolved Oxygen (mg/L)	12000.00	•		
Nitrate and Nitrite as N (mg/L)	89900.00	73541.04 61536.74 51972.23 42633.15		
Specific Conductivity (USCM)	4000.00			
☐ Water Temperature (C)	000 - , 48 0,000 48 48 48 50 000 48 48 48 50 000 48 50 000 48 50 000 48 50 000			
Colors Bapids Iown Cry Durynon	Nitrate and Nitrite as N (mg/L) Sources (1)	3.38 0.458 1.46 0.42		
	200			



V3 Search Page





Grouping Map Layers

Explore Layers		
 SPARROW 2002 Nutrient Model Results 		
Select All		
SPARROW 2002 Nitrogen Load		
► Legend		
SPARROW 2002 Phosphorus Load		
► Legend		





Legend for Map Layer







New GIS Layers

• SPARROW 2002 Model Results for Nutrients

- Nitrogen Load
- Phosphorus Load
- Gulf Hypoxia (2005 2017)
- NOAA annual precipitation (2017)



Geostreaming Data Framework V3

- New Frontend
 - Up-to-date technology (React.js/Redux/OpenLayers v3)
 - Improvements to user interface
 - Easier to add/configure new visualizations
- New Backend
 - New binning technology
 - Daily/Monthly/Yearly/Seasonal Bins stored in PostgreSQL
 - Individual Bins stored separate
 - maintaining bins easier and cheaper over time
 - Signup/Login for users
 - Track downloads
- Tentative release in the fall
 - Some features available now (new search page)



V3 Design – Explore Page





V3 Design – Detail Page





V3 Alpha - Detail Page





V3 Alpha - User Login / Track Downloads

Great Lakes Moni X Sign in X C Great Lakes to G X G GLM Explore Inite X Pull Request #211 X Home X UPpl Great Lakes Moni X Sign in X G Great Lakes to G X G GLM Explore Inite X Pull Request #211 X Home X UPpl Great Lakes Moni X Sign in X G Great Lakes to G X G GLM Explore Inite X Pull Request #211 X Home X UPpl Great Lakes Moni X Sign in X G Great Lakes to G X G GLM Explore Inite X G GLM Explore Ini					
Illinois-Indiana Sea Grant	ip Sign in Sig				
Sign in with your credentials					
]marini@illinois.edu					
Remember me					
Sign in	C Oreat Lakes Monix X Download X Oreat Lakes to GL X Oreat Lakes t				
Have you forgot your password? Reset it now	Illinois-Indiana Sea Grant				
	Reasons for Downloading How do you intend to use this data				
	Download				



3 Categories of Value Streams





Models and Analyses

- The data repository and visualization capacity to describe the Best Management Practices (BMPs) for each of the 12 states that relate to the HTF.
 - This is a SERA-46 effort in conjunction with the HTF led by Dr. Reid Christianson at the University of Illinois (e.g., the initial work will describe the 80+ BMPs at HUC 8 watershed scales as reported by the NRCS since 2008)

• Illinois Nutrient Trend Analyses

- Nitrate-Nitrogen: Linear interpolation method (by Prof. Greg McIsaac)
 - Original code in Excel. Implemented in Python
 - User can choose different sensors sites and percentage to contribute
- Working on WRTDS model

Great Lakes to Gulf Virtual Observatory https://greatlakestogulf.org



Water Quality Monitoring in Groundwater near Havana, Illinois

Lance Gruhn and Bill Morrow Central Midwest Water Science Center

U.S. Department of the Interior U.S. Geological Survey

Well data since March 8, 2017

- HACH NITRATAX plus sc
 - Nitrate
- In-Situ Aqua TROLL 600
 - pH
 - Specific Conductivity
 - Water Temperature
 - Dissolved Oxygen
 - Water Level
- 3 discrete water quality samples





*Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government

Nitrate (Blue) and Water Levels (Brown)





Quiver Creek Data since April 11, 2017

- HACH NITRATAX plus sc
 - 20 discreet nitrate measurements _____
 - Longitudinal Survey
- Manta 35 (6 readings)
 - pH
 - Specific Conductivity
 - Water Temperature
 - Dissolved Oxygen
- Water Levels





*Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government

Quiver Creek piezometer data since April 4, 2018

- HACH NITRATAX plus sc
 6 discrete nitrate measurements
- Manta measurements
 - pH
 - Specific Conductivity
 - Water Temperature
 - Dissolved Oxygen
- Water Levels





*Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government



Piezometer Nitrate Concentrations (mg/L)









Lunch Time!





NUTRIENT LOSS REDUCTION STRATEGY | Improving our water resources with collaboration and innovation

Potential P Load Reductions from Recovering Wastewater P in the Upper Sangamon HUC 8

Gregory McIsaac, PhD

Associate Professor Emeritus,

U of IL at Urbana Champaign

Research Scientist

Agricultural Watershed Institute



http://www.epa.illinois.gov/Assets/iepa/water-quality/watershed-management/tmdls/2016/303-d-list/appendix-a5.pdf

Advancing Food-Energy-Water (FEW) System Resilience in the Corn Belt by Integrated Technology-Environment-Economics Modeling of Nutrient Cycling

National Science Foundation funded project 2017-2021

Ximing Cai, Civil & Environmental Engineering Roland Cusick, Civil & Environmental Engineering Vijay Singh, Agricultural & Biological Engineering Ben Gramig, Agricultural & Consumer Economics

Steve John, Ag Watershed Institute Gregory McIsaac, Ag Watershed Inst.





Figure 3.15. Point and non-point source total phosphorus yields by HUC8 in Illinois.

Nutrient Loss Reduction Strategy (2015)

Avg Precipitation = ~40 inches Water Yield = ~12 inches

Major Point Source 2009-2016 water years: Sanitary District of Decatur (SDD) Discharge: ~700 Ton P/yr Population of 90,000 plus two wet mill ethanol facilities processing about 500,000 bu/day

> 2009-2016 avg. Export Yield: 2.1 lb P/ac-yr Load: 1,100 Ton P/yr

Data sources: USGS, IEPA & SDD



http://www.epa.illinois.gov/Assets/iepa/water-quality/watershed-management/tmdls/2016/303-d-list/appendix-a5.pdf

Water Yield and TP loads in the Sangamon River at Riverton minus TP load in the South Fork of the Sangamon at Rochester, and estimated TP discharge from the Sanitary District of Decatur (SDD)



Data sources: River flow and River TP concentrations from USGS; SDD TP discharge estimated from concentration and discharge data provided by the Sanitary District of Decatur.

600 Mg/yr increase = 1.3 million lb P/yr = 22% of the Statewide P load increase of 5.8 Million lb P/yr



2017 Biennial Report

If SDD were to meet the 1.0 mg P/L effluent target, P discharge could be reduced by ~1.7 million lb P/yr, = ~8% of the 21 million lb/yr reduction needed to achieve 45% goal.

Sangamon at Monticello



Agricultural Phosphorus Inputs, Harvest and Net P Input for Upper Sangamon River Basin, 8 Counties, 1987-2006



Data: USDA-NASS, USGS and Sanitary District of Decatur (SDD)

Quantifying P legacies and lag times



1. Conceptual representation of natural, managed, soil, and best management practice (BMP) processes influencing the lag time for system response.

Watershed modeling using SWAT (K. Wallington, S. Niroula, X. Cai, G. McIsaac, J. Arnold)

Economic Analysis & Public Engagement

- Engage stakeholders
- Survey Farmer/landowner willingness to adopt conservation practices
- Understand economic tradeoffs of both non-point source and point source options
- Estimate non-market benefits and social preferences
- Communicate findings
- Develop practical implications & next steps

Ben Gramig, Steve John in collaboration with the whole team

Point source P reduction options:

Struvite precipitation reactors are a reasonably well developed (but costly) option that enable P removal and recovery of slow release fertilizers



Ostara.com

R. Cusick

Corn ethanol process streams have phosphorus concentrations much, much higher than in municipal wastewaters. So less costly P removal and recovery methods are possible, but these processes and markets need to be evaluated and developed.



^{1.} Noureddini, H., M. Malik, J. Byun, and A. J. Ankeny. *Bioresour. Tech.* 2009

(R. Cusick & V. Singh)

76

Regional Collaborators and Workshops

- Andrew Sharpley, U of Arkansas
- Indrajeet Chaubey, Purdue U
- Rebecca Logsdon Muenich, U of Arizona
- Donald Scavia, U of Michigan
- Keith Schilling, Iowa DNR and U of Iowa
- Matthew Helmers, Iowa State U
- Thomas Franti, U of Nebraska
- Jeff Arnold, USDA-ARS
- Wayne Anderson, Minnesota Pollution Control Agency

Summary

- Over the next 3 to 4 years, our team hopes to provide analysis and recommendations for P recovery and P discharge reduction relevant to the Upper Sangamon and the Corn Belt in general
- We hope this informs decision making and future research

Thank you!



NMC Member Updates Exciting or Boring News to Share?





"Next Steps" Summary (NMC August 29, 2018)

Today's Action Items?

≻A.

≻ B.

≻ C.

Topics/Presentations for Next Meeting?

> Other (TBD)





Next NMC Meetings

March 14, 2017 (#8)
 September 6, 2017 (#9)
 March 15, 2018 (#10)
 August 29, 2018 (#11)
 ???





>???



