February 2020
Public Hypoxia Task Force Meeting
Washington DC

Tuesday, February 4, 2020
EPA WJC East, Building Entrance is at 1201 Constitution Ave, NW
***See map on final page of this agenda**

8:30 AM **Welcome (1153 EPA East)**
Rules of Engagement and Other Administrative Items
Adam R. Saslow, Senior Facilitator (Kearns & West)

Welcome and Introductions
David P. Ross (Task Force Federal Co-Chair), United States Environmental Protection Agency
Mike Naig (Task Force State Co-Chair), Iowa Department of Agriculture and Land Stewardship

Public Meeting Goals

- USDA and others to provide programmatic and communications updates to the HTF and the public;
- The Water Quality Trends Working Group will note progress with regard to identifying options for a basin-wide metric that tracks regional water quality trends; and,
- States present on activities and actions that will help to meet in-basin and Gulf goals

8:50 AM **Communications Update**
Anna Wildeman, Principal Deputy Assistant Administrator, U.S. EPA Office of Water
Objective: This is an information sharing session with some facilitated interaction
Ms. Wildeman will discuss new efforts underway at US EPA that better communicate the scale, efforts and progress of nutrient management in the Mississippi River Basin and the Gulf of Mexico. HTF members will have the opportunity to briefly expand upon their own outreach efforts in facilitated exchanges.

9:00 AM **USDA Update**
Matt Lohr, Chief, USDA Natural Resources Conservation Service
Objective: This is an information sharing session with some facilitated interaction
Mr. Lohr will discuss the Mississippi River Basin Initiative, National Water Quality Initiative and other Farm Bill programs that can help meet Task Force Goals, CART and other tools. A brief facilitated Q&A session amongst HTF members will follow.

9:15 AM **Water Quality Trends Working Group Update**
Water Quality Trends Workgroup Co-Chairs, Lori Sprague, USGS and Meg Wiitala, US EPA
Objective: This is an information sharing session with some facilitated interaction
In this session, the presenters will provide insight and background on recommendations from the Water Quality Trends for a common approach to tracking within-basin water quality and loading trends. A facilitated Q&A session amongst HTF members will follow.

9:30 AM **Break**

9:45 AM **Actions and Outcomes in Implementing State Nutrient Reduction Strategies**

In five different sessions, multistate groups will describe strategies undertaken and results realized within specific themes, recognizing that each state has employed various additional actions in implementing strategies. A portion of this time will be dedicated to formal and informal presentations as well as Q&A from HTF members.

- Indiana, Kentucky, Mississippi: State Science Assessment (15 min)
- Arkansas and Ohio: Goal setting to ensure implementation efforts are targeted and tracked by developing milestones/interim goals (state- or watershed-wide) (10 min)
- Iowa and Illinois: Deployment of staff to plan, prioritize, engage partners and stakeholders in priority watersheds, and manage progress tracking mechanisms (10 min)
- Louisiana, Minnesota, Tennessee: Assessing progress: Develop and deploy a system for tracking and reporting progress (15 min)
- Missouri and Wisconsin: Market-Based Approaches (10 min)

11:15 AM **Public Comment**

Observers and members of the public may provide comments to HTF members. Those wishing to speak will need to check in and be recognized by the facilitation team and will be limited to no more than five minutes (and perhaps less, depending upon the volume of speaker requests) at the microphone.

11:45 AM **Wrap up and Next Steps**

David P. Ross (Task Force Federal Co-Chair), United States Environmental Protection Agency
Mike Naig (Task Force State Co-Chair), Iowa Department of Agriculture and Land Stewardship

Noon to 1:00 PM **HTF Networking Session with the Public**

Objective: Relationship building between HTF members and observers and the public.
Light refreshments will be served. This is an opportunity to mix, mingle and build bridges between and among interested parties.

Map of EPA Federal Triangle Complex

If you think you are lost, call 703-835-5523

USDA
United States Department of Agriculture

Natural Resources
Conservation Service

Hypoxia Task Force Meeting

Matthew Lohr
Chief, NRCS

February 4, 2019

USDA
United States Department of Agriculture

Valley Pike Farm, Inc.

nrcs.usda.gov/

USDA United States Department of Agriculture

Announcing USDA investments totaling $56.4 M available to producers for improving water quality

This year NRCS is continuing landscape level efforts through the Mississippi River Basin Healthy Water Initiative (MRBI) and the National Water Quality Initiative (NWQI).

Natural Resources Conservation Service

nrcs.usda.gov/

USDA United States Department of Agriculture

MRBI investments

- $17.5 M to producers in 13 states:
  Arkansas, Illinois, Indiana, Iowa, Kentucky, Louisiana, Minnesota, Mississippi, Missouri, Ohio, South Dakota, Tennessee, Wisconsin
- Utilizes Farm Bill programs such as EQIP and ACEP
- Specifically supports nutrient loss reduction strategies of HTF member states.
- Since its launch, MRBI has:
  - ✓ 2010-2019, $307 M obligated to MRBI projects through contracts
  - ✓ Helped producers implement conservation on nearly 1.5 million acres
  - ✓ Reduced sediment loss by 2.1 million tons
  - ✓ Reduced phosphorous loss by 4.1 million pounds
  - ✓ Reduced nitrogen loss by 16 million pounds.

Natural Resources Conservation Service

nrcs.usda.gov/

USDA United States Department of Agriculture

Iowa working lands benefit from federal and state partnership investments

- MRBI and Iowa Water Quality Initiative (WQI) – one year initiative
- $2 M in MRBI funding made available to support eight WQI identified watersheds.
- Conservation practices focused on water quality in these watersheds included:
  - ✓ Cover crops
  - ✓ Grassed waterways
  - ✓ Terraces
  - ✓ Prescribed grazing
- Outcomes and metrics are being assessed

Natural Resources Conservation Service

nrcs.usda.gov/

USDA United States Department of Agriculture

NWQI Investments

- NRCS will make available $38.9 M to producers across the nation
- Partnership with NRCS, EPA and state water quality agencies to address impaired water bodies
- Targeted funding for financial and technical assistance in small watersheds
- Also targets ground and surface sources of drinking water

- Since its launch 8 years ago, NWQI has:

  - ✓ Invested $64 M to implement conservation practices within HTF states.

  - ✓ Helped producers implement conservation on 825,000 acres.
  - ✓ Reduced sediment loss by 850,000 tons.
  - ✓ Reduced phosphorous loss by 2 million pounds.
  - ✓ Reduced nitrogen loss by 9.6 million pounds.

Natural Resources Conservation Service

nrcs.usda.gov/

USDA United States Department of Agriculture

NWQI Success Stories

- ✓ A 2019 *Vermont Clean Water Initiative* report revealed promising phosphorus reductions in Vermont's impaired Lake Champlain.
- ✓ Working with NRCS and the partners of Vermont's Agricultural Water Quality Partnership, farmers in that state have installed conservation practices which are making a positive impact on water quality.
- ✓ **Agricultural improvements overall are responsible for 97% of the total phosphorus reductions to Lake Champlain** that were reported in fiscal year 2019, and **VT NRCS efforts contributed to 66% of that work.**
- ✓ As a result of the outstanding work by the Vermont Ag Water Quality Partnership, and the farmers themselves, agriculture has already reduced agricultural phosphorus by 11% of the total required by the Lake Champlain TMDL by 2038 (**15.89 metric tons)**.

Natural Resources Conservation Service

nrcs.usda.gov/

USDA United States Department of Agriculture

2018 Farm Bill
NRCS Conservation Programs

- Demonstrates strong congressional support
- $4.3 Billion annually for CTA and FB programs
- EQIP, CSP, ACEP, RCPP
- Helps streamline, target and simplify NRCS programs
- Developing rules that will be ready for FY20 signups
- 10% source water protection

Natural Resources Conservation Service

nrcs.usda.gov/

USDA United States Department of Agriculture

Conservation Assessment Ranking Tool (CART)

- NRCS recently deployed a new conservation planning tool CART.
- CART assists conservation planners as they assess site vulnerability, existing conditions, and potential resource concerns.
- CART will rank/score farmer needs against all potential funding sources
- CART will improve customer services.
- CART integrates closely with the Conservation Desktop (CD) tool.
- CART training session are ongoing with agency employees across the U.S.

Natural Resources Conservation Service
nrcs.usda.gov/

USDA United States Department of Agriculture

Thank You

Contact: Matthew Lohr, Chief, NRCS at Matthew.Lohr@usda.gov

Natural Resources Conservation Service
nrcs.usda.gov/

Water Quality Trends Workgroup

Lori Sprague, U.S. Geological Survey (co-chair)
Meg Wiitala, U.S. Environmental Protection Agency (co-chair)
Breegan Andersen, Arkansas Natural Resources Commission
Julie Harrold, Indiana State Department of Agriculture
Adam Schnieders, Iowa Department of Natural Resources
Dave Wall, Minnesota Pollution Control Agency
Lee Ganske, Minnesota Pollution Control Agency
Natalie Segrest, Mississippi Department of Environmental Quality
Kurt Boeckmann, Missouri Department of Natural Resources
Sally Zemmer, Missouri Department of Natural Resources

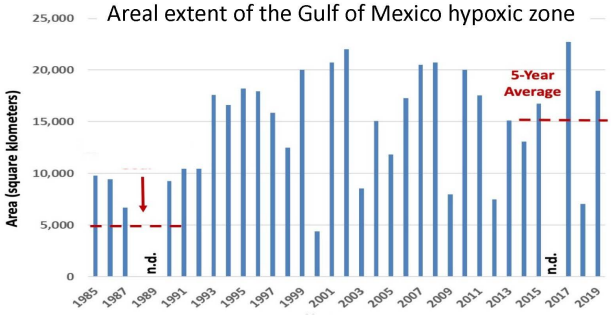
John Mathews, Ohio Environmental Protection Agency
Adrian Stocks, Wisconsin Department of Natural Resources
Marcia Wilhite, Wisconsin Department of Natural Resources
Doug Daigle, Lower Mississippi River Sub-basin Committee
Richard Mitchell, U.S. Environmental Protection Agency
Katie Flahive, U.S. Environmental Protection Agency
Tom Wall, U.S. Environmental Protection Agency

Lori Sprague, U.S. Geological Survey
Mississippi River/Gulf of Mexico Hypoxia Task Force Meeting
February 2020

Mississippi River Gulf of Mexico Watershed Nutrient Task Force

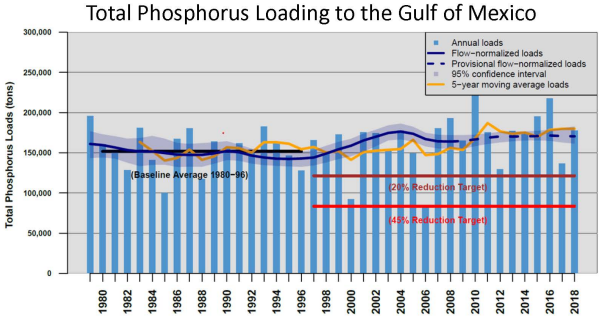
Current Metrics Used by the Hypoxia Task Force (HTF)

Areal extent of the Gulf of Mexico hypoxic zone



Bottom area of dissolved oxygen ≤ 2 mg/L. Source: Dr. Nancy Rabalais (Louisiana Universities Marine Consortium) and Dr. Eugene Turner (Louisiana State University). https://gulfhypoxia.net/research/shelfwide-cruises/

Total Phosphorus Loading to the Gulf of Mexico



Source: U.S. Geological Survey. http://kswsc.cr.usgs.gov/~cjlee/mississippi_loads_trend2020all/#/GULF

New HTF metrics

To increase awareness of nutrient reduction efforts upstream in the Mississippi River Basin, the HTF is considering new metrics to complement current metrics

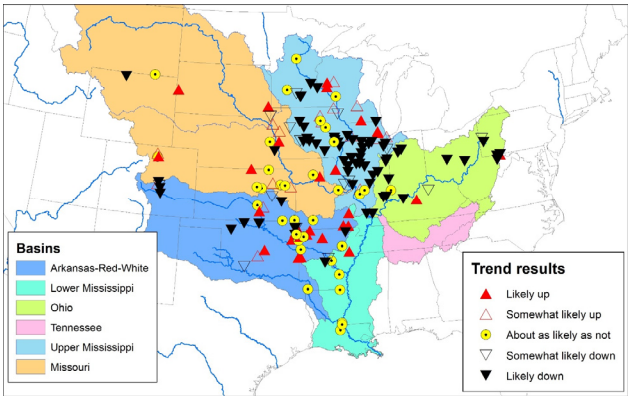
1. Point source reduction efforts
2. Nonpoint source reduction efforts
3. Water quality trends within the basin

Recommendations for within-basin water quality trends

What metrics?	When?	Across what time period?	Which water quality parameters*?	How?
• Load • Concentration	• Annually • Spring	Multiple periods: • HTF Baseline (1985-1996) to 2017 • 10 year: 2007-2017 • 20 or 30 year: 1987- 2017 or 1992-2017	• Nitrate • Total Nitrogen • Total Phosphorus • Dissolved Phosphorous • Orthophosphate • Sediment • Turbidity	WRTDS: Weighted Regressions on Time, Discharge, and Season
* Not all sites will have data for all water quality parameters	Note: The choice of trend method reflects the workgroup's decision to account for streamflow/precipitation changes and to evaluate significance and uncertainty. Trends will be parsed into the amount of change attributed to trends in streamflow versus changes in watershed management, such as changes in point or non-point sources.			

Case study illustration

Trends in annual flow-normalized nitrate loads between 2002 and 2012 at 166 sites in the Mississippi-Atchafalaya River Basin



Source: Network Controls on Mean and Variance of Nitrate Loads from the Mississippi River to the Gulf of Mexico, Crawford et al., https://doi.org/10.2134/jeq2018.12.0435

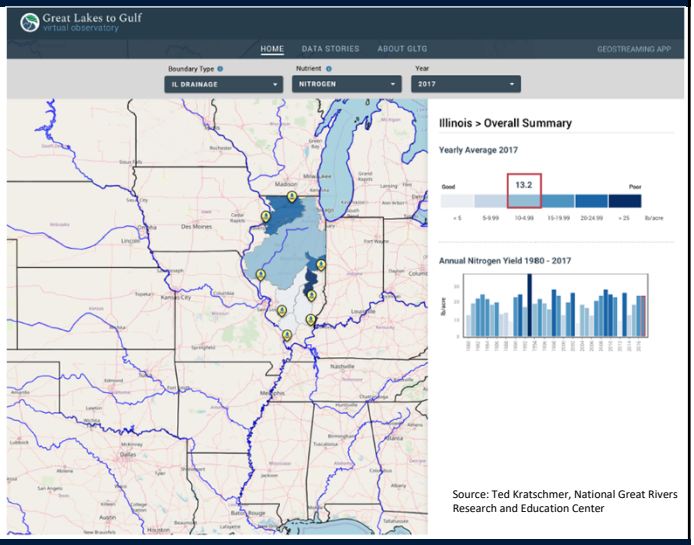
- Widespread decreases from 2002-2012
  - Largest decreases occurred at sites with the highest loads in 2002
- Despite these reductions, little change occurred downstream where the Mississippi River enters the Gulf
  - To meet HTF nutrient reduction targets, larger and/or more widespread decreases are needed upstream in the basin
  - Legacy nutrient accumulation may be delaying the response to nutrient management
- An updated analysis may have different results and/or different sites

Within-basin results offer an opportunity for the HTF to highlight success stories and gain important insight into where additional management could be most helpful

Partnership with the National Great Rivers Research and Education Center

Recommended next steps:

- Identify monitoring sites with required data
- Discuss the list of available sites; consider using a subset based on priority information needs
- Consider options for visuals, storyline, and dashboard for displaying results
- Evaluate any differences with trend analyses done within state agencies



Source: Ted Kratschmer, National Great Rivers Research and Education Center

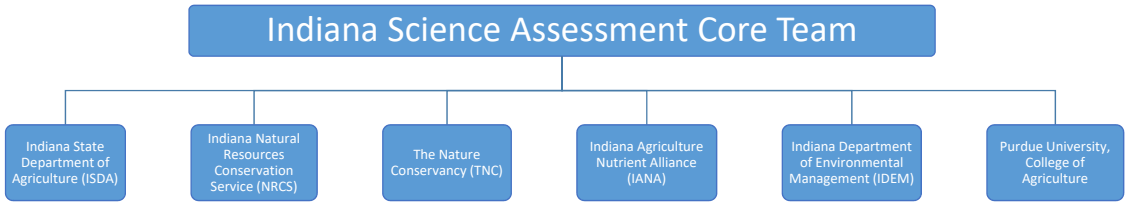
Indiana Science Assessment

Gulf of Mexico Hypoxia Task Force Meeting

Washington, D.C.
February 4, 2020

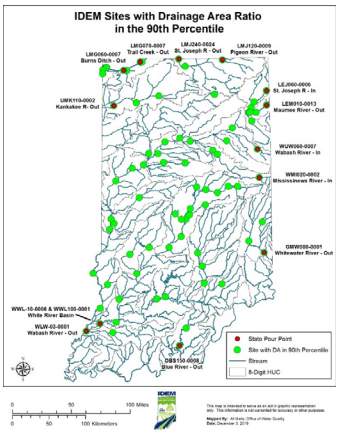
Julie Harrold, Indiana State Department of Agriculture (ISDA)
Jordan Seger, Indiana State Department of Agriculture (ISDA)

- The Indiana Science Assessment was born out of the desire of the Indiana Conservation Partnership (ICP) and other conservation partners wanting to improve and strengthen the existing method of capturing sediment and nutrient load reductions from the implementation of conservation practices, including adding the component of dissolved nutrients.



▪ Component #1: Determine historic and ongoing nutrient loads leaving the state, and also by basins used in the State Nutrient Reduction Strategy.

- Component #1 is being carried out internally among the partners; ISDA, IDEM and USGS.
- Goal is to determine baseline load of nutrients leaving the state (Baseline period will be 1980-1996).
- Have analyzed existing IDEM and USGS data at 7 pour points along state borders, and at pour points within Indiana's major basins
- We will utilize the USGS Weighted Regressions on Time, Discharge, and Season (WRTDS) model to determine loads.
- The Science Assessment underpins the SNRS by helping to determine loads and concentrations in each of the basins in the state, which further helps in prioritizing HUC 12 watersheds for more targeted conservation efforts in the future. (Section 3 of the SNRS).



INDIANA STATE DEPARTMENT OF AGRICULTURE

▪ Component #2: Improve method to quantify nutrient reductions from conservation practices, including dissolved nutrients, and determine efficiency of practices in reducing loads.

- EPA funds for Hypoxia Task Force States will be used to help carry out Component #2, to hire a research associate who will conduct research on:
  - Identifying and/or developing a standard tool and procedures for estimating nutrient load reductions from conservation practices (first step is for 10 practices) (second step is for at least 25 more practices)
  - Determining the percent efficiency of conservation practices on reducing nitrogen and phosphorus loads.
- The research associate will work at Purdue University, under Dr. Jane Frankenberger with direction provided by the Science Assessment Core Team and a team of cooperating researchers.
- Includes having a collective list of and consistent definitions of best management practices.
- A Tangible result will be a table showing percent efficiencies of conservation practices.

INDIANA STATE DEPARTMENT OF AGRICULTURE

- Through the development of the Indiana Science Assessment, public-private partnerships will benefit by working together to improve water quality from non-point source pollution.

- The work of the Indiana Science Assessment to improve the method of determining nutrient load reductions could in-turn provide assistance/information to the other Hypoxia Task Force states who are working on how to gather conservation practice implementation data, and moving toward determining nutrient load reductions.

INDIANA
STATE DEPARTMENT OF AGRICULTURE

Kentucky's Science Assessment

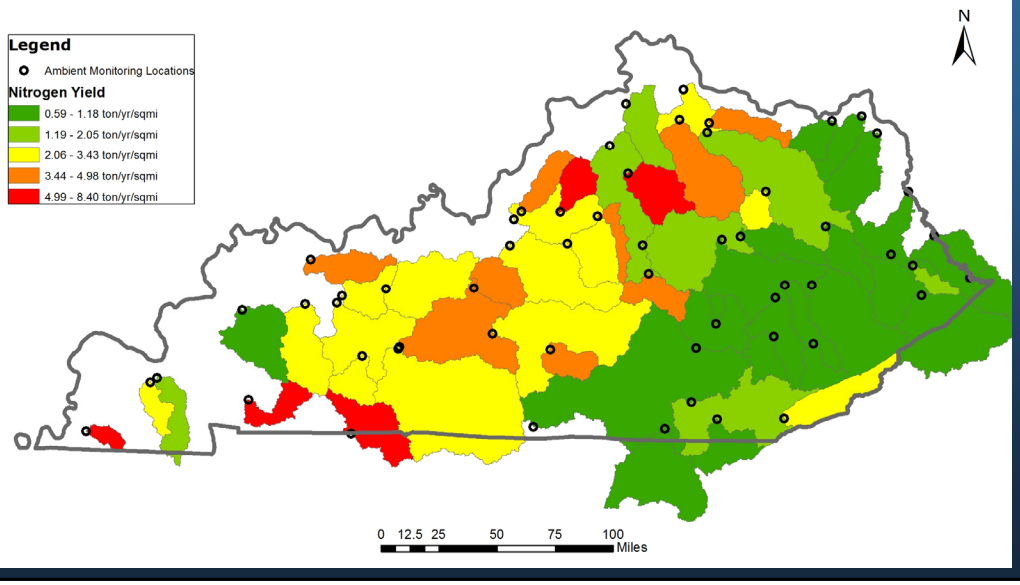
Data Driven Implementation

Hypoxia Task Force Meeting – February 4, 2020

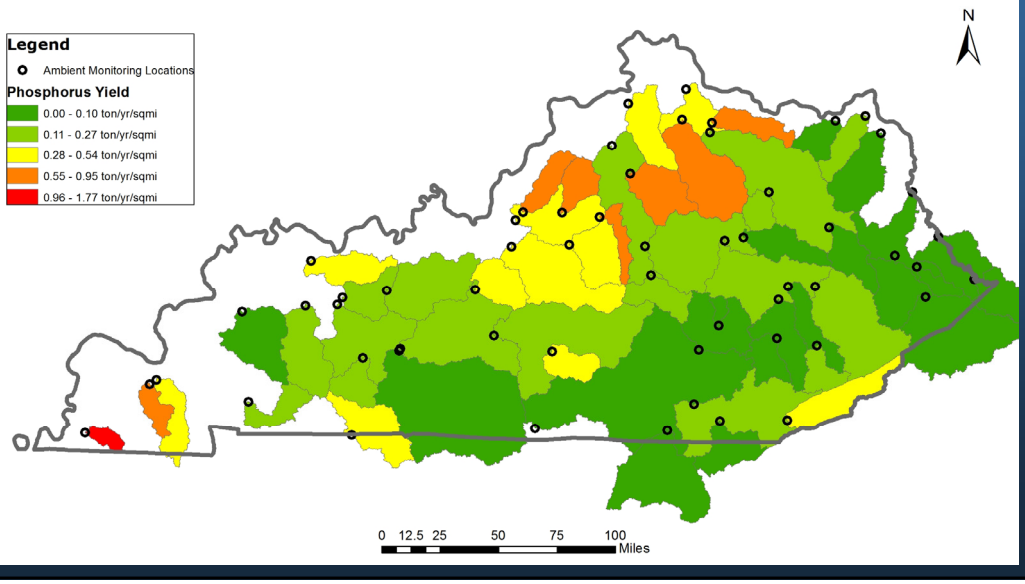
John Webb, Josiah Frey – KY Division of Water
Paulette Akers – KY Division of Conservation

State Science Assessment Goal – "Determine KY-specific nutrient efficiencies for BMPs to deliver best bang/buck"

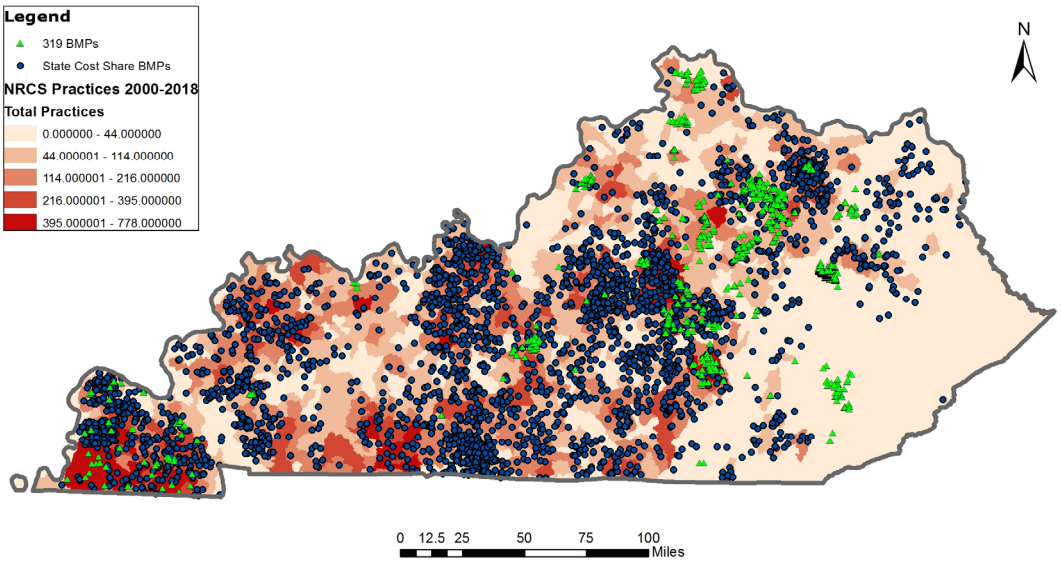
Kentucky Nutrient Reduction Strategy
Mean Annual Nitrogen Yield (2005-2017)



Kentucky Nutrient Reduction Strategy
Mean Annual Phosphorus Yield (2005-2017)



Kentucky Nutrient Reduction Strategy
Best Management Practices (BMP) Progress



Kicking Off Mississippi's Science Assessment

Gulf of Mexico Hypoxia Task Force Meeting

February 4, 2020 Washington D.C.

Natalie Segrest, Mississippi Department of Environmental Quality

Mississippi's Approach: Nutrient Trends and Reductions from Conservation

- Undertaking two separate analysis efforts in the next 12-24 months
- Analyze existing water quality and stream flow data to establish nutrient loads, yields, and concentrations
- Identify core conservation practices and use conservation tracking framework to determine Nitrogen and Phosphorus loss reduction practice efficiencies that are appropriate for use in Mississippi and calculate reductions achieved for those practices

Trends Analysis: Concentrations, yields, and Loads for TN and TP

- Work collaboratively with the USGS to perform analysis
- Utilize a combination of ambient monitoring data collected monthly by MDEQ from 20 locations statewide in combination with 2 USGS stations
- All stations have flow data in addition to WQ data
- Analysis covers a 12 year period (2007-2018). The dataset will be split between 2 periods: 2007-2013 as older record and 2014-2018 to represent current condition
- Loads, yields and concentrations will be summarized by site, major basin, and landuse category
- Results will be made available via data visualization tools

Capturing Conservation Efforts

- Mississippi ranks in the top 5 states in the nation for the amount of conservation dollars put into practice
- Building on the work of the Task Force an other states, MDEQ will work with MSU to implement the Conservation Tracking Framework in MS
- Identify core practices (used in MS) that reduce nitrogen and phosphorus inputs into receiving streams
- Update reduction efficiencies for those practices as needed to represent conditions in MS
- Using established efficiencies calculate nitrogen and phosphorus reductions achieved through implementation of those practices

Future of Science Assessments

- Build on what works and what other states have produced
- By using the same methodologies and metrics, we can build tools that are comparable
- By building on the work of other states and researchers working with the HTF, analyses can be expanded and strengthened
- Develop tools and metrics that better track nutrient reduction efforts on multiple fronts (point source and nonpoint source, concentrations and loads)
- Cooperation, collaboration, and partnerships are critical

ARKANSAS NUTRIENT REDUCTION STRATEGY GOAL SETTING AND TARGETING

Presented to the Hypoxia Task Force in Washington D.C. on February 3, 2020

J. Ryan Benefield, P.E.
Deputy Director

Overarching goals

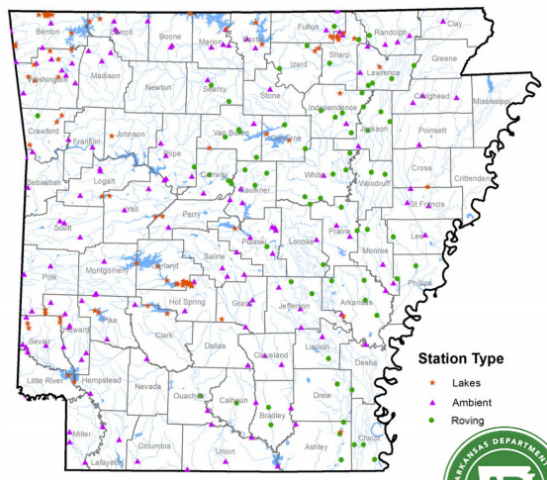
- Reduce nutrient concentrations and subsequent loading
- Improve water quality for the benefit of Arkansans
- Provide guidance/information to organizations about activities related to nutrient management and reduction

Arkansas Nutrient Reduction Strategy Update

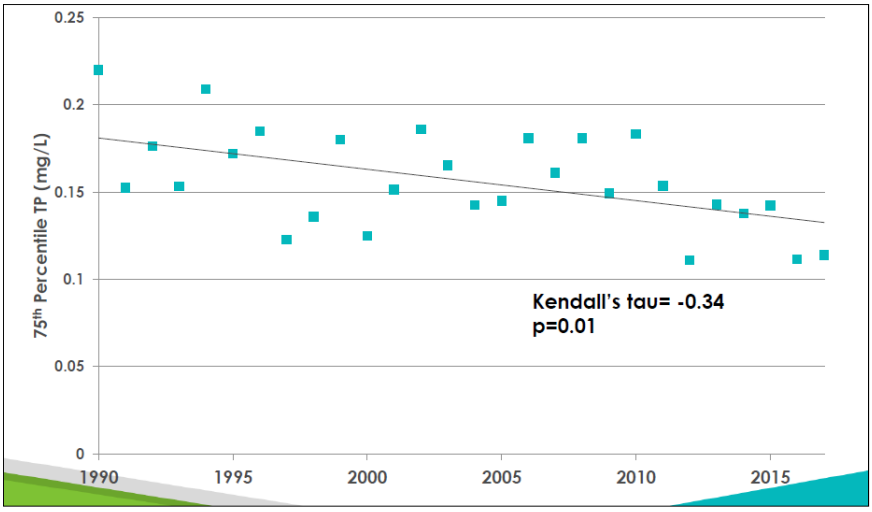
- Stakeholder Meetings (2018-2019)
- Method to Measure Success
- Targeted Nutrient Focus Watersheds
- Concentrate/Reallocate Resources
- Tool to Report NPS Nutrient Reductions

Measuring Success

- Arkansas will measure progress/success by analyzing the directional change of the 75% of all total nitrogen and total phosphorus concentration data within each 8-Digit HUC from 1990 to present



HUC-08020303 Lower White

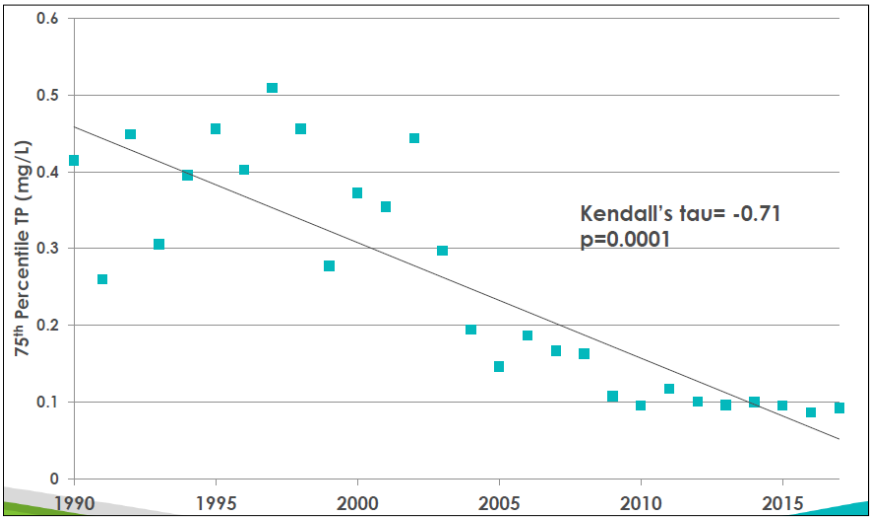


HUC-08020303 Lower White

- In 13 of 27 years (48), TP was lower than the previous year.
- Only, 11 of 27 (41%) years were lower than 1990
- Significant reduction from 1990 to present
- Overall Reduction

Year	75th Percentile (mg/L)	% Change in 75th Percentile
1990-1995	0.180	
1995-2000	0.161	-10.29
2000-2005	0.158	-2.36
2005-2010	0.177	12.57
2010-2015	0.151	-15.12
90-95:10-15	-	-19.47

HUC – 11110103 Illinois



Review of the Significant Trends for all 51 HUC-8 Watersheds

- 17 (33%) had significant ($p<0.01$) decreases of total phosphorus since 1990
- 23 (45%) indicated a negative, non-significant trend
  Kendall tau values ranged from 0.28 to -0.01
- 10 (20%) indicated a positive, non-significant trend
  Kendal tau values ranged from 0.03 to 0.21
- 1 (2%) indicated a steady increase since 1990
  Kendall tau (0.3), p=0.04

Targeted Nutrient Focus Watersheds

- Target based on site specific trends using ambient monitoring data/ flow data
  - Log-transform data
  - Flow adjust concentrations using locally weighted regression(LOESS)
  - Evaluate the flow adjusted using various statistical tests
- Four targeting categories
  - Nutrient Reduction Focus Watershed
  - Insufficient Data – High Priority Watershed
  - Insufficient Data – Low Priority Watershed
  - Nutrient Reduction Low Potential Watershed

Implementation Strategy

- 319 Priority Watershed Designations
- Watershed Based Plans
- Water Quality Technicians – NMP Adoption
- CW RLF Nutrient Reduction Incentives
- NRCS NWQI Projects and Designations
- NRCS RCPP, CSP, AWEP,EQIP, WRE Projects
- Nutrient Surplus Area Designations
- Point Source Monitoring and Reporting of Nutrients/Limits
- Sceptic Tank Replacement Grant/Loan Program
- Discovery Farm/Watershed
- Watershed Group Establishment and Support


Questions?

Ohio – Monitoring and Movement on Nutrient Reduction

John Mathews

Ohio EPA

February 3, 2020

Ohio Environmental Protection Agency

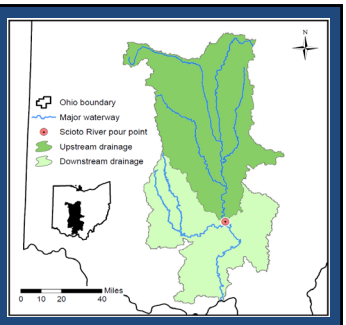
Ohio Nutrient Mass Balance Report

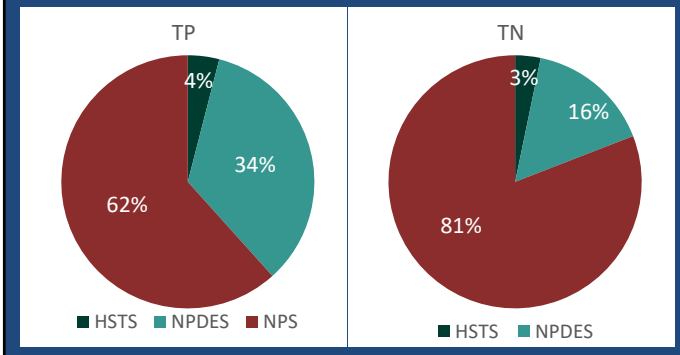
- Reports total load & load sources Every 2 years
- Lake Erie Nutrient Reduction (Annex 4)
- Gulf of Mexico Hypoxia Task Force

Ohio Environmental Protection Agency

Example Reporting Info: Loading Breakdown - Scioto

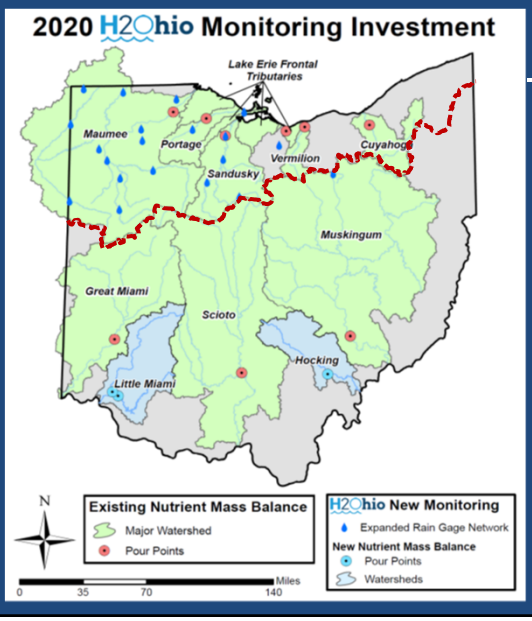
Proportions of Total P and Total N
Average of 5 years





Ohio Environmental Protection Agency

New: Expand Monitoring Network



Lake Erie Basin

Ohio River Basin

Currently:

- 8 watersheds
- 29,600 mi^2 (in Ohio)
- 66% Ohio's land area

Ohio Environmental Protection Agency

Staged launch of H2Ohio Funding

$172 M

2020: Maumee

14 counties

2021: Western Lake Erie Basin

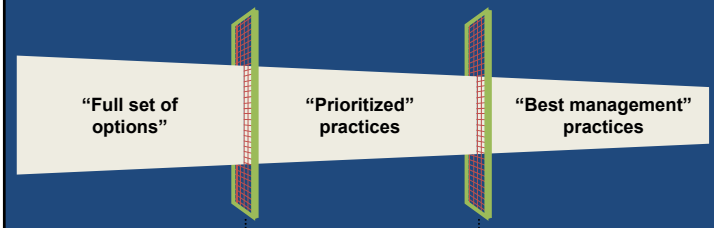
22 counties

2022: All of Ohio

88 counties

Ohio Environmental Protection Agency

H2Ohio Funding: Prioritize Practices That Achieve Phosphorus Reduction



100+

of phosphorus reduction practices based on agronomic & scientific research

30+

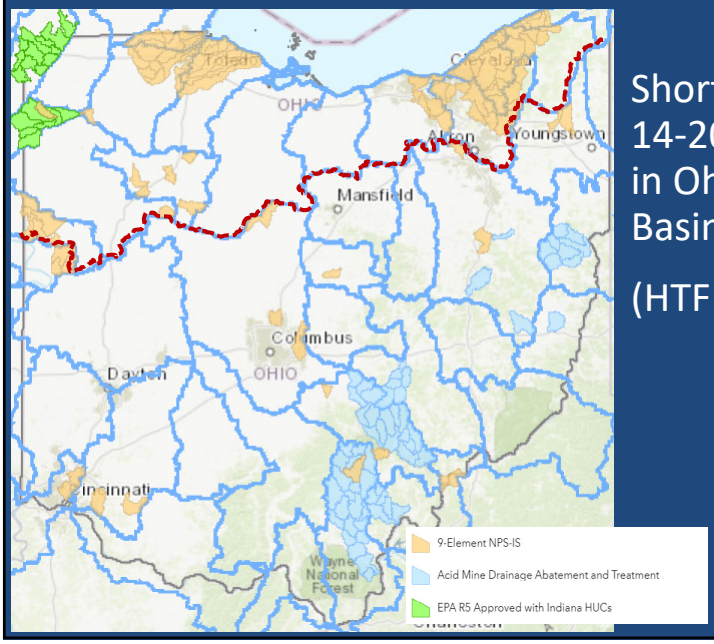
Management practices chosen for impact potential based research, interviews, & quantitative modeling

10

Best management practices that will play a major role in reducing phosphorus runoff by 40%

Ohio Environmental Protection Agency

Increase Ohio's 9-Element Watershed Plans

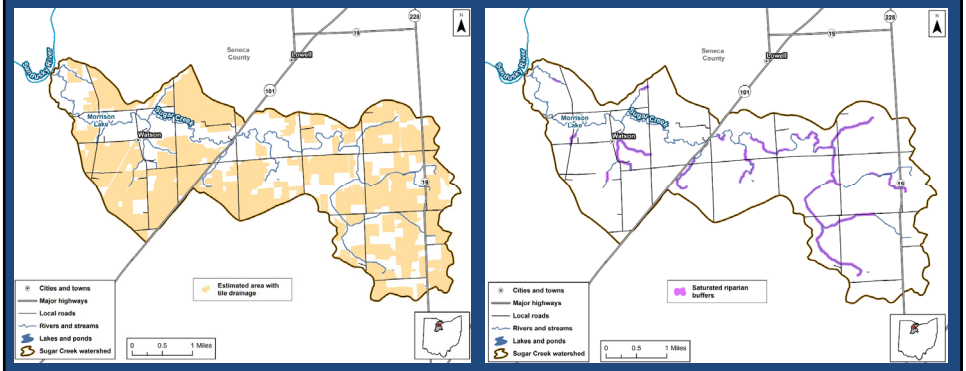


Short Term Goal: 14-20 New Plans in Ohio River Basin (HTF) Area

(HTF Asst Grant)

Ohio Environmental Protection Agency

Watershed Plans: Use Agricultural Conservation Planning Framework (ACPF) & Similar Tools for Siting Practices



Courtesy of USDA ARS Agricultural Conservation Planning Framework (ACPF) and Tetra Tech

(HTF Asst Grant)

Ohio Environmental Protection Agency

Additional Steps:

- Update Ohio's Nutrient Strategy (now that Ohio has H2Ohio funding has been initiated)
- Continue to work to reduce point sources loads from WWTP based on technical improvements and as able nutrient load limits
- Home septic treatment systems grants and loans

Ohio Environmental Protection Agency

Illinois Nutrient Loss Reduction Strategy Watershed Coordinators

Hypoxia Task Force Meeting
February 4, 2020

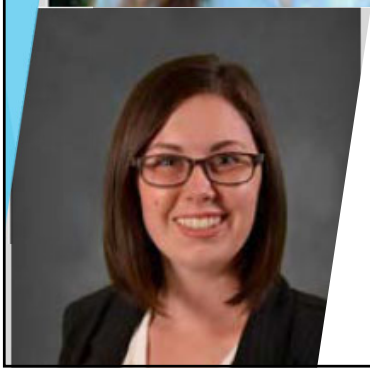
ILLINOIS NUTRIENT LOSS REDUCTION STRATEGY

Improving our water resources with collaboration and innovation

Trevor Sample, Illinois EPA

University of Illinois Extension Watershed Coordinators

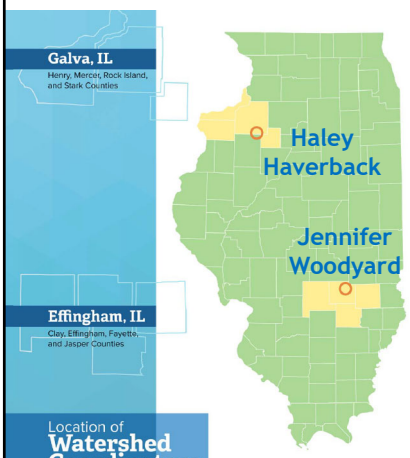
- Illinois EPA has partnered with University of Illinois Extension to hire two watershed coordinators to work in priority watersheds.
- Provide education, outreach and technical assistance related to implementing the Illinois Nutrient Loss Reduction Strategy
- Assist local stakeholders in:
  - Watershed Planning
  - Implementation of Watershed Plans
- Coordinate local initiatives, collaborate with other organizations in their watersheds, grant writing.
- Hired in Spring of 2018.

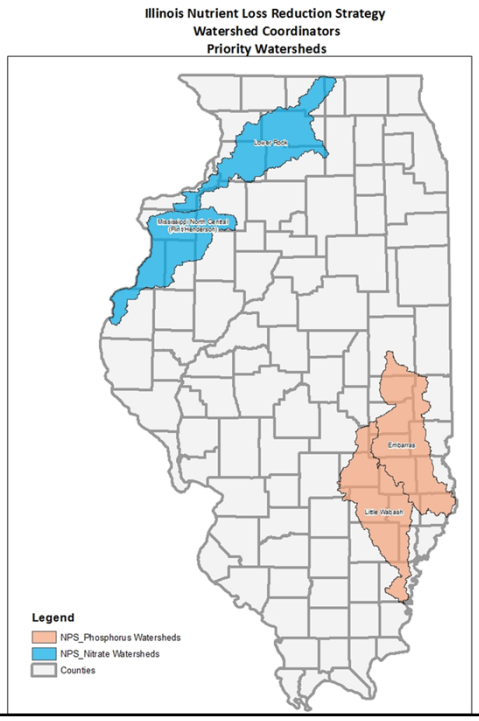


University of Illinois Extension Watershed Outreach Associates

- **Jennifer Woodyard**
  - Embarras River watershed
  - Little Wabash River watershed
- **Haley Haverback**
  - Mississippi North Central watershed
  - Lower Rock River watershed

University of Illinois Extension Watershed Coordinators

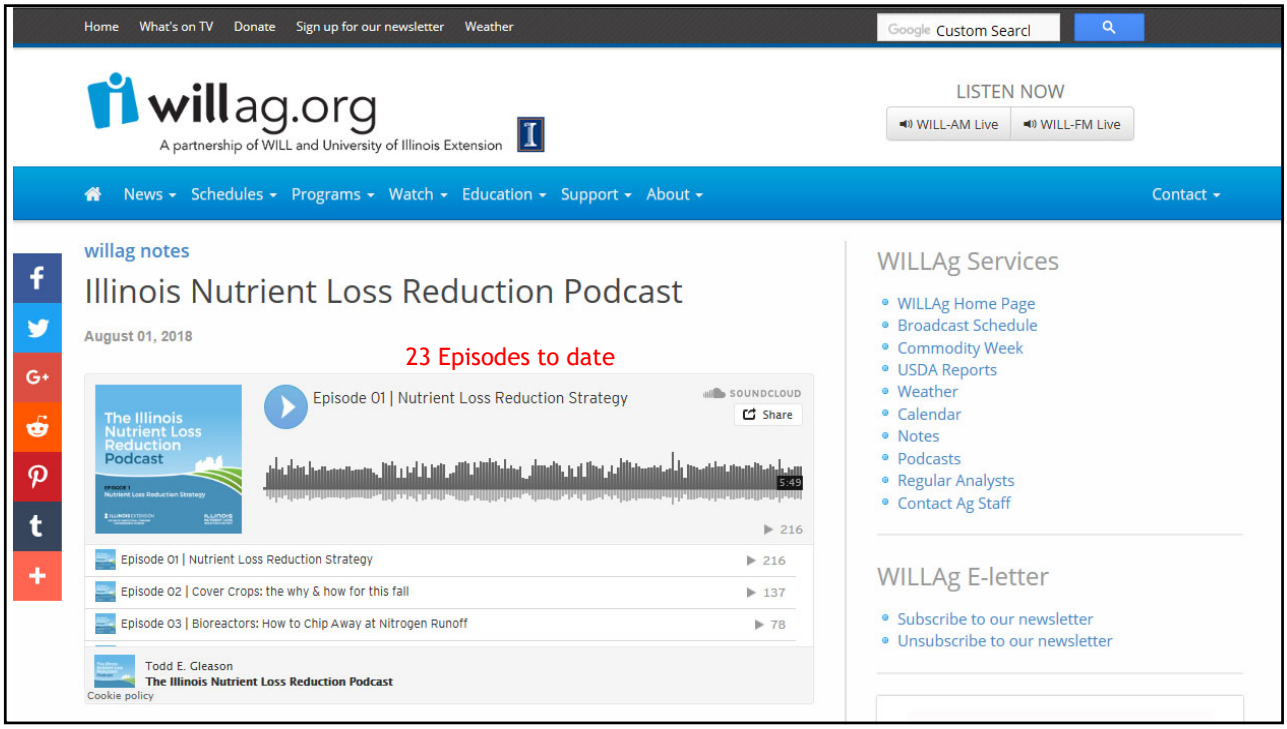




University of Illinois Extension NLRS Ag Science Team

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

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



Current Activities:

- Watershed Planning
  - Embarrass River Watershed
  - Salt Creek Watershed (Little Wabash)
  - Mill Creek (Mississippi River North Central)
- Collaborate with the Soil Health Partnership
- Give presentations to local organizations on the NLRS and local nutrient loss issues
- Assist with nutrient research grants with funding from the Nutrient Research and Education Council
- Provide support to local Illinois Farm Bureau Nutrient Stewardship Grants
- Contribute articles to agriculture publications

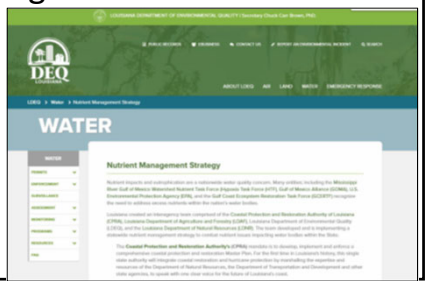
ILLINOIS
NUTRIENT LOSS
REDUCTION STRATEGY

LOUISIANA STATEWIDE NUTRIENT REDUCTION AND MANAGEMENT STRATEGY ASSESSING PROGRESS

February 4, 2020

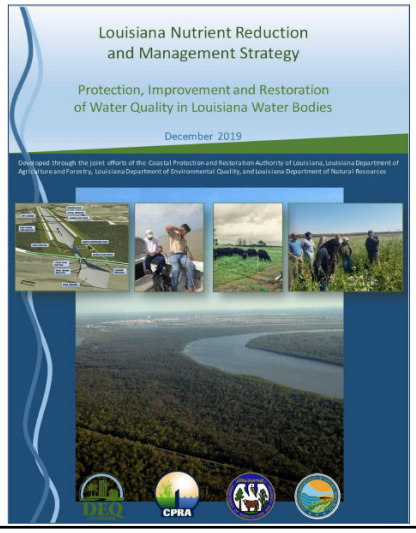
Tracking and Reporting on Progress

- Website developed with the help of EPA funds
- Stakeholders can learn about
  - Current and planned activities
  - Current relevant tools
  - Regulations, policies and programs
- Access documents
  - Strategy
  - Annual Reports



https://www.deq.louisiana.gov/page/nutrient-management-strategy

Louisiana Nutrient Reduction and Management Strategy

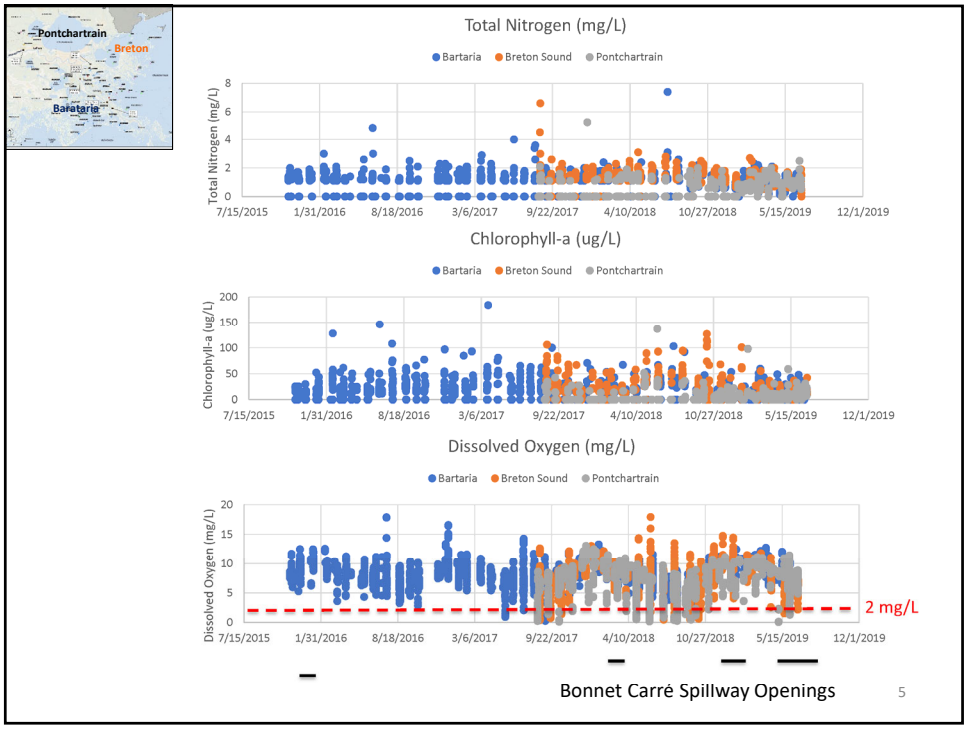


- https://edms.deq.louisiana.gov/app/doc/view.aspx?doc=11972009&ob=yes&child=yes
- https://www.epa.gov/ms-htf/hypoxia-task-force-nutrient-reduction-strategies

- Finalized 2019 update (5 year revision)
- Annual Reports

Coordination with Louisiana Agencies

- Coastal Protection and Restoration Authority
  - *Created after Hurricanes Katrina and Rita (2005) to **integrate storm protection with coastal ecosystem restoration***
- Department of Agriculture and Forestry
  - *Created to promote, protect and advance **agriculture and forestry, and soil and water resources***
- Department of Environmental Quality
  - *Created to provide comprehensive **environmental protection** for Louisiana*
- Department of Natural Resources
  - *Created to ensure and **promote sustainable and responsible use** of the natural resources of our state*



Effective Approaches for Tracking and Communicating Progress

- Tracking **stakeholder engagement** events
- Easier and more efficient **online** permit reporting and tracking
- Nutrient monitoring implemented for various **permits**
- **Cooperative efforts** for nonpoint source reduction
- **Identifying high priority watersheds** for BMP implementation
- River Diversion **planning and permitting**
- Best Management Practices **training**
- **Voluntary approach** for participation of watershed community
- **Annual reports** for State Nutrient Strategy

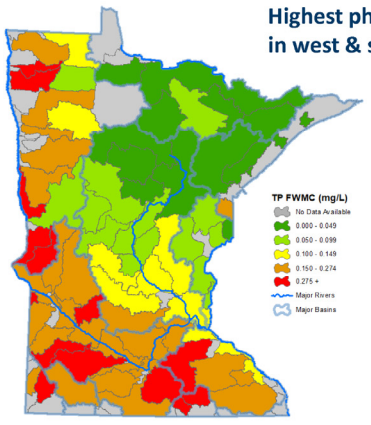
Minnesota's Nutrient Reduction Strategy

Tracking progress toward milestone goals

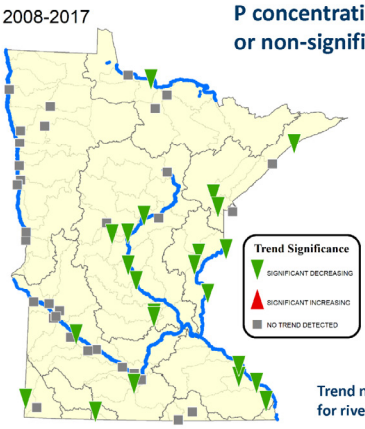
Katrina Kessler, P.E. |Assistant Commissioner

MINNESOTA POLLUTION CONTROL AGENCY

River condition, trends - phosphorus



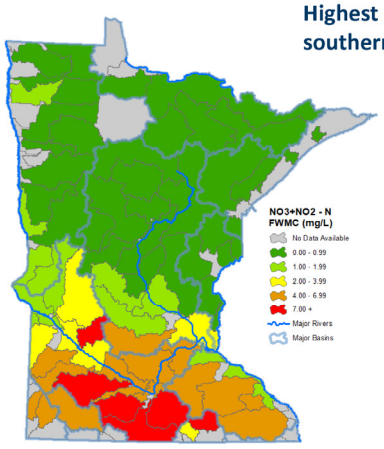
Highest phosphorus in west & south



P concentrations decreasing or non-significant trend

Trend methods correct for river flow variability

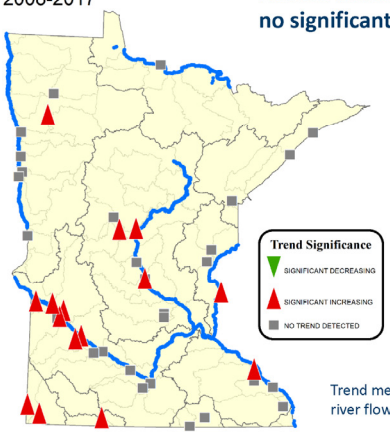
River condition, trends - nitrate



Highest nitrate in southern MN

2008-2017

Nitrate increasing or no significant trend

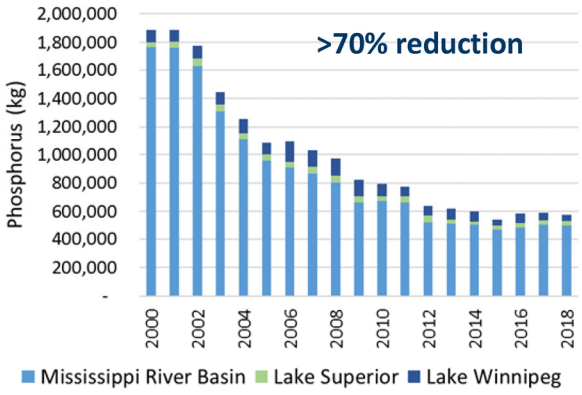


Trend methods correct for river flow variability

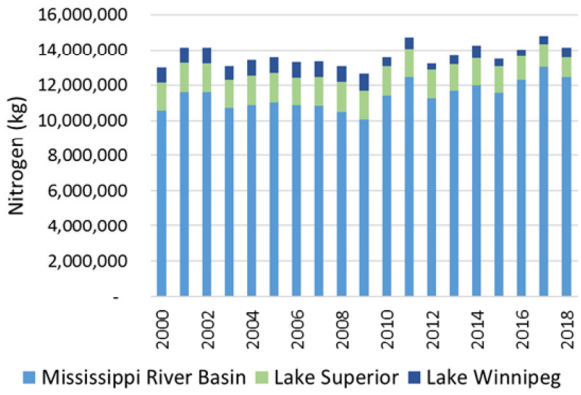
Wastewater nutrient discharges

2000-2018

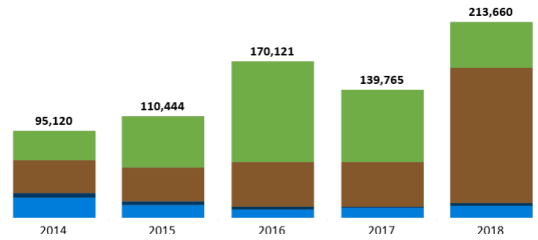
Phosphorus



Nitrogen



Tracking BMP adoption, Government Programs Statewide



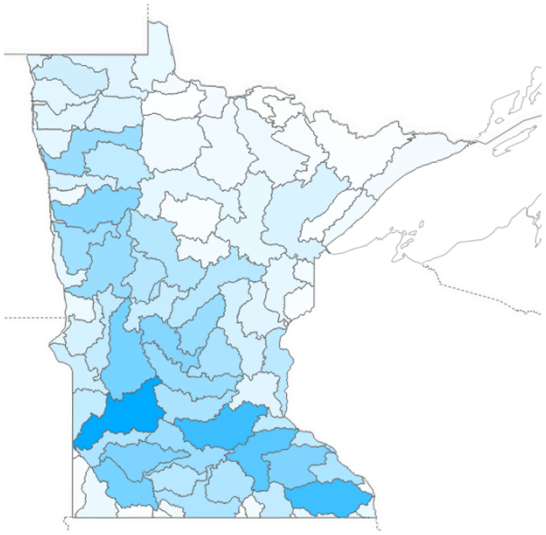
Living Cover (326,657 acres total)
Practices that reduce nutrient and soil loss by keeping plants growing continuously, including the Fall and Spring months. Common practices include cover crops and conservation cover.

Cropland Erosion Control (317,642 acres total)
Designed to reduce runoff and soil losses. This group consists primarily of farming practices that leave crop residue on the surface or structural practices that reduce or capture runoff and eroded soil.

Drainage Water Retention and Treatment (15,678 acres total)
Practices designed to slow down waters leaving tile-drained landscapes or otherwise treat tile-waters for nutrient removal prior to entering streams. Wetland restoration and controlled drainage management are the most common practices, but other emerging practices include saturated buffers and bioreactors.

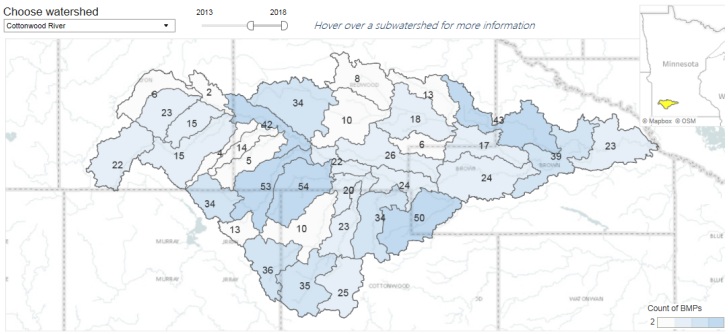
Nutrient Management (69,134 acres total)
Managing the amount, form, placement, and timing of nutrient and soil amendments such that nutrients are used most efficiently by the crops, at the same time minimizing leaching and runoff to surface and ground water.

Tracking BMP adoption, Government programs (HUC8 watershed scale)



BMPs Installed 2004-2018	BMP Count
Tillage/residue management	11,382
Designed erosion control & trapping	10,236
Nutrient management (cropland)	9,992
Septic System Improvements	7,874
Converting land to perennials	7,696
Open tile inlet & side inlet improvements	7,136
Stream banks, bluffs & ravines protected/restored	6,073
Buffers and filters - field edge	5,348
Add living cover to annual crops in fall/spring	4,508
Habitat & stream connectivity management	4,026
Pasture management	3,087
Drainage ditch modifications	2,715
Agricultural tile drainage water treatment/storage	1,184
Urban Stormwater Runoff Control	1,114
Changing rotations to less erosive crops	455
Feedlot runoff controls	173
Forestry Management	138
Wetland restoration/creation	104
In Lake Management	4
Other	51,878
Grand Total	135,123

Tracking BMP adoption, government programs (HUC12 subwatershed scale)



Cottonwood Watershed 2013-18 BMP #s

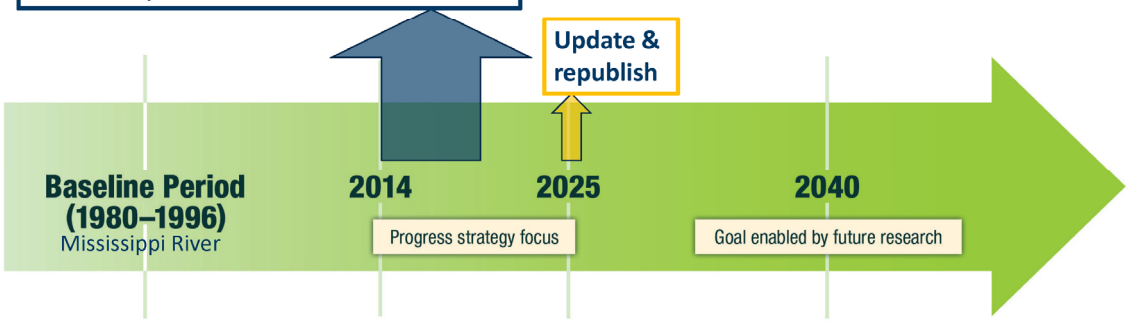
Cottonwood River watershed

Strategy	Practice Description	Total BMPs	Number of BMPs (by unit)	Installed Amount (by unit)	Units
Designed erosion control	Water & Sediment Control Basins	100	2	1,001	Feet
			98	1,450	Count
	Grassed Waterway	43	43	113	Acres
	Terrace	14	3	7,057	Feet
			11	3	Acres
	Sediment Basin	1	1	2	Count
Stream banks, bluffs & ravines	Grade Stabilization Structure	43	43	43	Count
	Streambank and Shoreline Protection	24	24	5,560	Feet
	Structure for Water Control	2	2	7	Count
Buffers and filters - field edge	Conservation Cover	33	33	487	Acres
	Filter Strip	40	40	286	Acres
Living cover to crops in fall/spri...	Cover Crop	75	75	13,002	Acres
Converting land to perennials	Conservation Cover	33	33	487	Acres
	Critical Area Planting	24	24	60	Acres

https://www.pca.state.mn.us/water/healthier-watersheds

Five-year Progress Evaluation – Spring 2020

1. Are NRS strategies/programs in place?
2. How much progress with BMP adoption?
3. Can we see improvements in water?
4. Next steps for 2020-25?



https://www.pca.state.mn.us/water/nutrient-reduction-strategy

Thank You!

MINNESOTA POLLUTION CONTROL AGENCY

Tennessee's Nutrient Framework Implementation
HTF
February 4, 2020

TN Department of Agriculture

TN Department of Environment & Conservation

Tennessee's Nutrient Framework Implementation

- All about DATA
- Establishing a Baseline
- Establishing Tracking and Reporting Mechanisms

TN Department of Agriculture

TN Department of Environment & Conservation

Tennessee's Nutrient Framework Implementation

- Point Source Progress
- https://www.tn.gov/environment/program-areas/wr-water-resources/tn-plant-optimization-programs/tnpop.html

Department of Agriculture

Department of Environment & Conservation

Tennessee's Nutrient Framework Implementation

- State-Level Nutrient Taskforce Established
- 50 members, federal, state, local nonprofit, public utilities, higher education, policy groups
- Working groups formed and working

Department of Agriculture

Department of Environment & Conservation

Tennessee's Nutrient Framework Implementation

HTF Grant from EPA

- Retrieve chemical data from WQX and TDEC internal database (for older data)--Analyze data by trend analysis
- Use trend analysis data and ongoing activities to create outreach materials for each sector (point source, agriculture, stormwater, general public
- Work with media experts to design and distribute educational materials
- Provide input on building effective web page that links to social media--fine-tune the messages to each sector
- Establish fifteen soil health partnerships
- Conduct plant optimization at least two new facilities

TN Department of Agriculture

TN Department of Environment & Conservation

Tennessee's Nutrient Framework Implementation

- Evaluate Water Quality Data Trends for Nutrients
- Gather data on accomplishments from all sectors
- Develop Website to Communicate progress to public
- Continue to evaluate and target for optimum outcomes.

- Use adaptive management to adjust as needed.

TN Department of Agriculture

TN Department of Environment & Conservation

Missouri Nutrient Loss Reduction Strategy

Hypoxia Task Force 2020

MISSOURI DEPARTMENT OF NATURAL RESOURCES

MISSOURI dept. of Agriculture

1

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Market Based Approach - Why in Missouri?

News Releases

February 2019 - EPA Announces New Water Quality Trading Policy Memorandum

September 2019
EPA Seeks Comment on New Policy Proposals to Facilitate Market-Based Opportunities to Improve Water Quality

"EPA is proposing updates to our water quality trading policy that would help state and local partners take advantage of new technologies or develop market-based programs for improving water quality. Building on efforts already underway at the state, local, and tribal level, EPA is helping facilitate the use of innovative tools and technologies that will deliver critical water quality improvements at a lower cost." ~EPA Administrator Andrew Wheeler

2

Soil and Water Conservation Program (SWCP)

Funded through Parks, Soils and Water Sales Tax

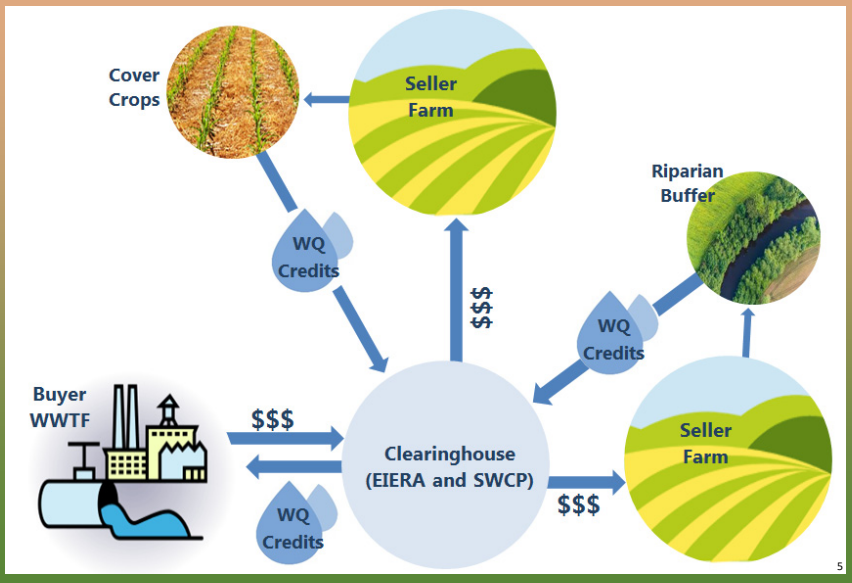
- 1/10 of one percent of state sales tax
- First approved by voters in 1984
- Renewed in 1988, 1996, 2006 and 2016
- Half goes to Division of State Parks
- Half goes to SWCP

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Soil and Water Conservation Program

Why in Missouri?

MISSOURI DEPARTMENT OF NATURAL RESOURCES



5

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Nutrient Trading

Current Framework

- Water Protection (permitting) and Soil and Water Programs will manage trading using information on agriculture practices gathered through SWCP.

- The Clearinghouse (EIERA) will serve as a broker between trading partners to collect funds from credit buyers and track trades to ensure that the buyer has sufficient credits to fulfill regulatory requirements.

6

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Moving Forward

News Releases from Headquarters

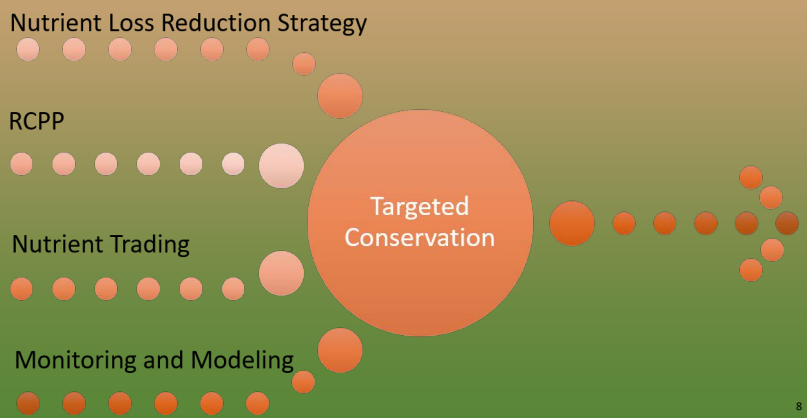
EPA Provides $1.2 Million to Hypoxia Task Force States and Continues to Promote National Dialogue to Reduce Excess Nutrients and Enhance the Nation's Waters

Dec 2019 – March 2020

1. Evaluate and quantify nutrient (N and P) reduction potential of individual and combined BMPs
2. Develop and quantify scientifically proven procedures and methodology of calculating nutrient reduction metrics

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Nutrient Trading and other efforts continue working together!



MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

Questions?

Kurt Boeckmann, Agriculture and Rural Policy
Missouri Department of Natural Resources
(573) 751-8424, Kurt.Boeckmann@dnr.mo.gov

Water Quality Trading
A Market-Based Approach in Wisconsin

Hypoxia Task Force Meeting
February 4, 2020

Jim Zellmer, Department of Natural Resources

Phosphorus Implementation

- Trading program began in 2013, after P WQS established
- Water quality based effluent limits are the main driver for water quality trading.
- Trading is not a silver bullet to address NPS; it is a compliance strategy for point sources.

Wisconsin's Existing Framework

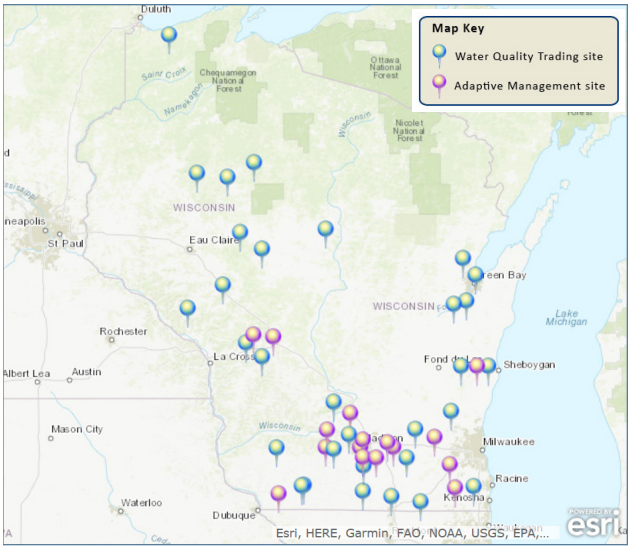
- Water quality trading is an offset of an end of pipe discharge—requires an improvement in water quality.
- Wisconsin utilizes a trade ratio to add flexibility, encourage prioritization of effective management practices, and ensure that trades result in an improvement in WQ.
- Geographic extent of trades exist because a water quality trade is an offset of an end of pipe effluent limit; however, we do allow for both upstream and downstream trades occur.
- Wisconsin allows interim (currently 5 year) credits to provide temporary credits for reductions below current practice but above the long-term credit threshold

Current WQ Trading in Wisconsin

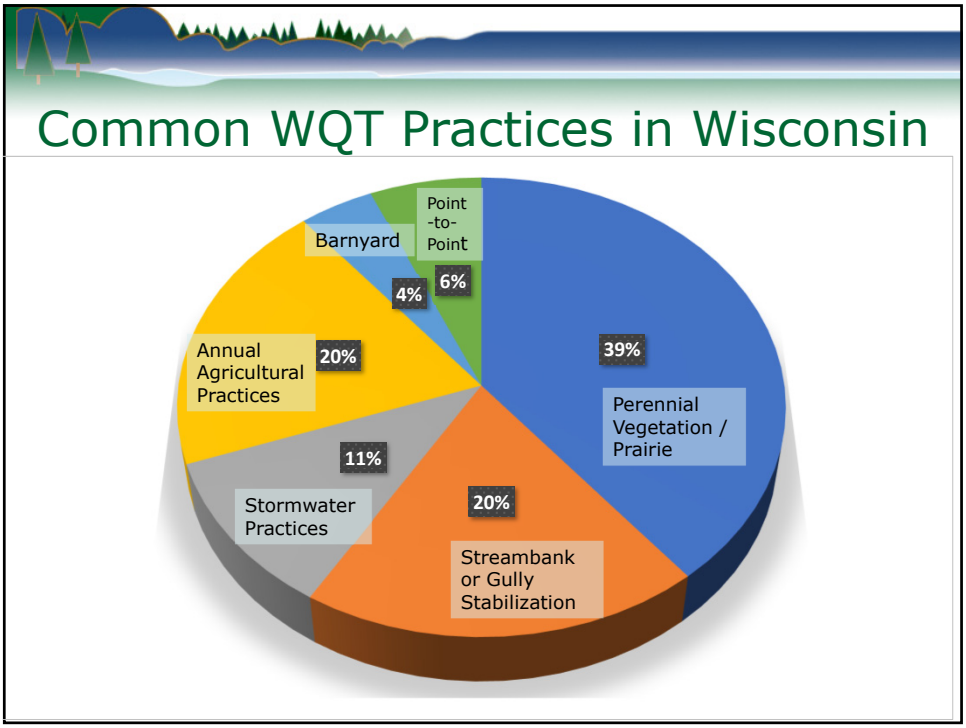
18 Implemented
26 Approved
13 Under Development

Phosphorus limits are phased in over 5-year permit term and facilities typically have compliance schedule of 7 to 9 years to fully implement.

Average trade ratio 1.8:1



Common WQT Practices in Wisconsin



USDA NRCS PHOTO

JULY 2019

Soil Health Case Study

Eric Niemeyer, MadMax Farms, OH

Introduction

Eric Niemeyer's MadMax Farms lies in the middle of the Upper Scioto Watershed in Ohio. Eric is a first-generation farmer in his 15th farming season producing corn and soybeans. He has learned many lessons the hard way by trying different ideas and learning what practices work best on his 1,250-acre operation.

His soils are mainly silt and clay loams. Although many of his fields have flat or slightly rolling terrain, Eric saw the impact of erosion when gullies formed in low areas or where soil washed away in areas of concentrated water flow. More importantly, he recognized that using conventional tillage practices made it difficult to consistently grow a profitable crop.

Consequently, Eric spent time educating himself at workshops, field days, and conferences, and by reading about soil health practices. When Eric decided he needed to change how he farmed, he sought the help of Charlie Walker, his right-hand man and a longtime no-till innovator. Following Charlie's advice, Eric converted his cropland to no-till and adopted variable rate fertilizer application technology (VRT) in 2011. To address surface or sub-surface drainage issues, Eric repaired sub-surface drainage tile, gullies, and eroded areas. He also began taking soil tests every two years instead of every four.

In 2014, he started planting cover crops on his entire farm. Eric prefers using multi-species mixes and customizes them based on whether he is planting corn or soybeans. In addition, he fine-tunes his cover crop recipe based on what soil health outcomes he is trying to achieve. These include breaking up compaction layers, increasing water infiltration, increasing organic matter, and improving nutrient availability. Eric became such a believer in cover crops that he started a cover crop consulting business in 2014. He also seeds cover crops for other farmers using his customized, high clearance seeder during the growing season. Eric continues educating himself about soil health practices for his farm and for his consulting businesses. Half of Eric's significant learning costs have been attributed to his farm operation and included in this study.

Soil Health, Economic, Water Quality, and Climate Benefits

Combining cover cropping, no-till, and VRT has produced many benefits. Eric can *see* and *smell* the improvements in soil health, which he believes have led in part to increased yields. Since 2014, his per acre yields have gone from 165 to 195 bushels for corn and from 45 to 65 bushels for soybeans. He estimates at least half of these improvements are the result of his soil health management system and attributes the rest to good weather and better varieties.

Better soil health has also led to better nutrient cycling, improved weed management, and less disease and insect pressure. These changes, along with more precise nitrogen (N) applications allowed Eric to cut N for corn by over 5%. More importantly, he has been able to cut phosphorus (P) and potassium applications by 50% for both corn and soybeans. As a result, he is saving almost $18 per acre each year on fertilizer. Better soil health has allowed Eric to reduce his soybean seeding rate, saving $5 per acre. Similarly, he has nearly eliminated the need for residual herbicides

Farm at a Glance

COUNTY: Marion & Delaware Counties, OH

WATERSHED: Upper Scioto Watershed

CROPS: Corn & soybeans

FARM SIZE: 1,250 acres

SOILS: Silt loam & clay loam soils, flat to slightly rolling terrain with slopes from 0 to 10%

SOIL HEALTH PRACTICES: No-till, cover crops, nutrient management

USDA
United States Department of Agriculture
Natural Resources Conservation Service

American Farmland Trust

by planting "green" into growing cover crops, terminating them with a roller crimper. This saves him over $18 per acre. His fungicide costs have decreased as well, reducing soybean seed treatment cost by $6 per acre.

Eric believes the use of biological amendments have also contributed to his success by enhancing soil health and nutrient availability. He spends about $30 per acre for the biologicals.

Eric's no-till system has lowered labor and machinery expenses by $35 per acre. Cost savings from eliminating his tillage equipment allowed Eric to upgrade and increase the size of his planter. This led to more timely planting and helped Eric increase his farming operation from 500 acres in 2011 to 1,250 acres today.

Reduced no-till expenses are offset by increased costs for one additional fertilizer pass and cover crop planting and termination costs. Nevertheless, the benefits of using all three soil health practices have increased the overall profitability of the farm.

To estimate the water quality and climate benefits experienced on one of Eric's 110-acre fields, USDA's Nutrient Tracking Tool was used and found Eric's use of no-till, cover crops, and variable rate applications reduced his N, P, and sediment losses by 58, 74, and 88%, respectively. On the same field, USDA's COMET-Farm Tool estimates that Eric's soil health practices resulted in a 494% reduction in total greenhouse gas emissions which corresponds to taking 17 cars off the road.

Partial budgeting analysis was used to estimate the benefits and costs of adopting no-till, cover crops, and variable rate fertilizer applications on MadMax Farms. The study limited its focus to variables affected by the adoption of these soil health practices. The table presents a summary of these economic effects. Eric improved his bottom line by $38 per acre and by $47,569 on the 1,250 acres in the study area by adopting the soil health practices.

Closing Thoughts

Eric's motivation for adopting soil health practices has been to "make dead soil alive again." He also enjoys the challenges of understanding management nuances needed to be successful. For example, Eric loves fine-tuning cover crop recipes to achieve desired outcomes for every field, tweaking the planter setup, timing cover crop termination to successfully "plant green," and understanding herbicide chemistries and other inputs to lessen negative impacts on cover crops and soil health. Eric also relishes the fact that "cover crops are like miracle workers holding the soil in place," and he credits all three soil health practices with now being able to reliably raise a profitable crop on marginal soils where profitability was not always guaranteed before.

Economic Effects of Soil Health Practices on MadMax Farms (2018)

Increases in Net Income

Increase in Income

ITEM	PER ACRE	ACRES	TOTAL
Yield Impact Due to Soil Health Practices	$69.00	1,250	$86,250
Total Increased Income			**$86,250**

Decrease in Cost

ITEM	PER ACRE	ACRES	TOTAL
Nutrient Savings due to Soil Health Practices	$17.51	1,250	$21,881
Reduced Seeding Rate for Soybeans	$5.00	625	$3,125
Pesticide Savings due to Soil Health Practices	$18.75	1,250	$23,438
50% Reduction in Treated Soybean Seed	$6.00	625	$3,750
Reduced Machinery Costs Due to Reduced Tillage	$35.45	1,250	$44,317
Field Repair Savings due to Soil Health Practices	$1.00	1,250	$1,250
Total Decreased Cost			**$97,761**
Annual Total Increased Net Income			$184,011
Total Acres in this Study Area			1,250
Annual Per Acre Increased Net Income			$147

Decreases in Net Income

Decrease in Income

ITEM	PER ACRE	ACRES	TOTAL
None Identified			$0
Total Decreased Income			**$0**

Increase in Cost

ITEM	PER ACRE	ACRES	TOTAL
Variable Rate Application Cost	$3.00	1,250	$3,750
Increased Soil Testing Every Two Years	$10.00	1,250	$12,500
Residue and Tillage Mgt. Learning Activities	$1.17	1,250	$1,465
Cover Crops Learning Activities	$5.86	1,250	$7,326
Nutrient Management Learning Activities	$3.32	1,250	$4,151
Using Biologicals in Furrow	$30.00	1,250	$37,500
Increased Machinery Costs due to Change in Nutrient Management	$6.30	1,250	$7,875
Cover Crop Costs	$49.50	1,250	$61,875
Total Increased Cost			**$136,442**
Annual Total Decreased Net Income			$136,442
Total Acres in this Study Area			1,250
Annual Per Acre Decreased Net Income			$109

Annual Change in Total Net Income = $47,569

Annual Change in Per Acre Net Income = $38

This table represents costs and benefits over the entire study area (1,250 acres) as reported by the farmer. • All values are in 2018 dollars. • Crop prices used in the analysis: Corn: $3.55/Bu, Soybeans: $8.60/Bu. Source: Crop Values 2018 Summary, USDA, NASS. • Fertilizer prices used in the analysis: Nitrogen: $.30/LB, Phosphate: $.39/LB, Potash: $.27/LB. Source: Estimated Costs of Crop Production in Iowa—2018. • For information about study methodology, see http://farmland.org/soilhealthcasestudies. For information about USDA's Nutrient Tracking Tool, see https://www.oem.usda.gov/nutrient-tracking-tool-ntt. For information about USDA's COMET-Farm Tool, see http://cometfarm.nrel.colostate.edu/. This material is based on work supported by a USDA NRCS CIG grant: NR183A750008G008. • Eric is receiving technical and financial assistance through a Conservation Stewardship Program (CSP) contract (2016-2020). This support allowed Eric to conduct tissue testing and Haney soil testing on 300 of his acres. The CSP income is not included in the analysis given the mismatch in years and acres between the contract and the study. Readers can assume that during the contract years, Eric received additional net income from CSP.

For more information about this study or to discuss soil health practices, please contact

- Brian Brandt, American Farmland Trust, Agriculture Conservation Innovations Director, bbrandt@farmland.org, 614-430-8130
- Denise Shafer, Delaware County NRCS, District Conservationist, 557 Sunbury Rd # A, Delaware, OH 43015, 740-362-4011

Seeding soybeans into cereal rye

Seeding cereal rye into corn

Soil Health Case Study

Larry, Adam, and Beth Thorndyke, Thorndyke Farms, IL

JULY 2019

Introduction

Larry Thorndyke started growing crops over 40 years ago and currently farms with his wife, Beth, and son, Adam. The family grows corn and soybeans on 2,600 acres across several counties in North Central Illinois, leasing all but 230 acres. Roughly half the fields are flat with silty clay soils while the rest have clay and silt loam soils with 2 to 3% slopes. Faced with extremely tight margins, including rising rents and fertilizer costs, the Thorndykes wanted to reduce their inputs without hurting yield. Ten years ago, Larry began attending conferences and field days where he learned about the importance of soil biology and function, which motivated him to improve the health of his soils.

Adam Thorndyke started farming with his father in 2001, and together they started their soil health journey in 2008 by transitioning from conventional tillage to strip-till on a 200-acre bean field going into corn. Prior to this change, they would make two or more tillage passes across the field. When soil washed away, additional passes were needed to level up the field and fill in gullies.

While Larry said the transition to strip-till was painless, transitioning their soybean fields to no-till on their rented ground was a challenge. They saw some fields taking longer to transition than others due to the management by previous tenants and landowner preference. Because of this, the study only includes 1,400 acres because these acres are successfully under conservation tillage (700 acres of strip-till corn and 700 acres no-till soybeans).

Larry and Adam's first attempt in 2011 at cover crops was discouraging. The aerial seeding application method missed places along roadsides and turn rows and did not allow for good seed to soil contact. Adam now seeds cereal rye with a Hagie sprayer, and they currently plant rye on about 700 acres after corn and soybeans.

In 2015, the Thorndykes refined their nutrient management by purchasing a fertilizer buggy that allows them to apply phosphorus (P) and potassium (K) directly into the strips after soybean harvest. This allowed them to cut P and K in half (now only applying 100 pounds each) and to stop applying anhydrous ammonia in the fall. By applying all their nitrogen (N) in the spring (via pre-plant and Y-drop), Larry and Adam can time nutrient applications to match their crop needs.

Soil Health, Economic, Water Quality, and Climate Benefits

When comparing their five-year yield averages before and after implementing soil health practices, the Thorndykes observed yield increases of over 15% on both corn and soybean fields. Though Larry and Adam recognize the role that changes in seed hybrids and seeding rates play in improved yields, they still believe some of their yield gains are due to soil health practices.

This study chose to include a conservative yield gain attributable solely to cover crops—a 4% increase for soybean yields and a 2% increase for

Farm at a Glance

COUNTY: Ford County, IL

WATERSHED: Vermilion Headwaters

CROPS: Corn & soybeans

FARM SIZE: 2,600 acres cropland

SOILS: Silty clay loam soils, 50% flat fields & 50% rolling with 2–3% slopes

SOIL HEALTH PRACTICES: Cover crops, strip-till & no-till, nutrient management

Seeding cereal rye into corn

USDA United States Department of Agriculture
Natural Resources Conservation Service

American Farmland Trust

corn yields—and ignore the yield benefits of strip-till, no-till, and nutrient management. This information is based off the last four years of data from the 2016–17 National Cover Crop Survey by CTIC.* Thus, the Thorndyke's yield bump from a consistent use of covers over the last three years led to a $16 per acre increase in net income for soybeans and $10 per acre increase for corn, or an average net income increase of about $13 per acre.

Additional benefits come in the form of lower machinery costs due to less fuel and labor needed with less tillage and using one less fertilizer pass thanks to application of P and K into the strips. This is in addition to the fertilizer savings described earlier. Fewer tillage and fertilizer passes, lower nutrient applications, and use of cover crops all translate to less sediment and nutrient loss.

In fact, USDA's Nutrient Tracking Tool (NTT) estimates that Larry reduced his N, P, and sediment losses by 45, 89, and 76%, respectively, by instituting strip-till and no-till, nutrient management, and cover crops on a 70-acre field selected for the NTT analysis. USDA's COMET-Farm Tool estimates that Larry's soil health practices resulted in a 192% reduction in total greenhouse gas emissions from this same field. This corresponds to taking 14 cars off the road.

Achieving their soil health goals hasn't come without costs. They report about 100 hours each year or nearly $2 per acre in increased cost due to learning activities. In addition, they spend $39 per acre to grow cover crops and have increased their use of herbicide for weed control since they no longer plow or cultivate.

Partial budgeting was used to analyze the benefits and costs of adopting conservation tillage, nutrient management, and cover crops on the Thorndyke Farm. The study limited its focus to variables affected by the adoption of these soil health practices.

The table below presents a summary of these economic effects showing Larry improved his bottom line by $34 per acre and by $47,086 on the 1,400 acres in this study by adopting the soil health practices.

Closing Thoughts

Larry compares soils to the human body with the motto, "what you put in is what you get out." By putting in practices to improve soil health such as nutrient management, conservation tillage, and cover crops, Larry and Adam believe they have increased the water holding capacity, organic matter content, aggregate stability, and earthworm activity of their soil resources. Though adopting cover crops presented some initial challenges, the Thorndykes have succeeded in implementing a system of changes over time that have proven to be successful in reducing their inputs while increasing their yields.

Economic Effects of Soil Health Practices on Thorndyke Farms (2018)

Increases in Net Income

Increase in Income

ITEM	PER ACRE	ACRES	TOTAL
Yield Impacts due to Cover Crops	$12.95	700	$9,067
Total Increased Income			**$9,067**

Decrease in Cost

ITEM	PER ACRE	ACRES	TOTAL
Nutrient Savings Due to Nutrient Management	$66.00	700	$46,200
Reduced Machinery Cost due to Reduced Tillage	$17.68	1,400	$24,746
Reduced Machinery Cost due to Nutrient Mgt.	$2.73	1,400	$3,815
Total Decreased Cost			**$74,761**
Annual Total Increased Net Income			$83,828
Total Acres in this Study Area			1,400
Annual Per Acre Increased Net Income			$60

Decreases in Net Income

Decrease in Income

ITEM	PER ACRE	ACRES	TOTAL
None Identified			$0
Total Decreased Income			**$0**

Increase in Cost

ITEM	PER ACRE	ACRES	TOTAL
Nutrient Management Learning Activities	$0.87	1,400	$1,221
Cover Crops Learning Activities	$1.74	700	$1,221
Cover Crop Costs	$39.00	700	$27,300
Increased Pesticide Cost due to Reduced Tillage	$5.00	1,400	$7,000
Total Increased Cost			**$36,742**
Annual Total Decreased Net Income			$36,742
Total Acres in this Study Area			1,400
Annual Per Acre Decreased Net Income			$26

Annual Change in Total Net Income = $47,086

Annual Change in Per Acre Net Income = $34

This table represents costs and benefits over the entire study area (1,400 acres) as reported by the farmer.
All values are in 2018 dollars.
Crop prices used in the analysis: Corn: $3.55/Bu, Soybeans: $8.60/Bu. Source: Crop Values 2018 Summary, USDA, NASS
Fertilizer prices used in the analysis: Phosphate: $.39/LB, Potash: $.27/LB. Source: Estimated Costs of Crop Production in Iowa—2018
For information about study methodology, see http://farmland.org/soilhealthcasestudies. For information about USDA's Nutrient Tracking Tool, see https://www.oem.usda.gov/nutrient-tracking-tool-ntt. For information about USDA's COMET-Farm Tool, see http://cometfarm.nrel.colostate.edu/. This material is based on work supported by a USDA NRCS CIG grant: NR183A750008G008.
*CTIC is the Conservation Technology Information Center.
The Thorndykes are receiving technical and financial assistance through the federal Conservation Stewardship Program. Due to insufficient information about the contract, the study does not include the CSP income.

For more information about this study or to discuss soil health practices, please contact
- Dr. Emily Bruner, American Farmland Trust, Midwest Conservation & Stewardship Program Manager, ebruner@farmland.org
- Ford County Soil & Water Conservation District, 217-349-4388 ext. 3 and NRCS Paxton Field Office, 217 379-2371 ext. 3.

Both are at: 1380 West Ottawa, P.O. Box 232, Paxton, IL 60957.