Tackling Goals, Supporting Partnerships, and Tracking Progress: Illinois' Role in Helping to Reduce Gulf Hypoxia

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Today we'll discuss:

- Nutrient Pollution in the U.S.
- A focus on the Mississippi River Basin and Gulf Hypoxia
- Hypoxia Task Force and Goals
- The HTF Collaborative, Science-Based Approach

Pressures to Act

- Nonpoint source (NPS) pollution is a significant problem for the US, with major water quality and economic impacts including significant HAB impacts
  - Cost to rectify is growing exponentially
  - Water quality/ecological consequences
    - Local water quality impairments
    - Far-field Eutrophication and Hypoxia
- Major Investment in Research and Science
- Commitment to Development of Guidance, Technical Assistance, and Information Transfer
- Number of State and Local Conservation Practice Pilots and Technology Demonstration Projects
- Continued State Innovation, Testing, and Exploration of Incentive, Cost-share, Limit of Technology, Trading, and Collaborative Approaches
- Variable State Strategies, Implementation, Programs, Priorities

Existing Data and Analysis

- EPA Science Advisory Board
  - Reactive Nitrogen in the United States (2009)
  - Hypoxia in the Northern Gulf of Mexico (2007)

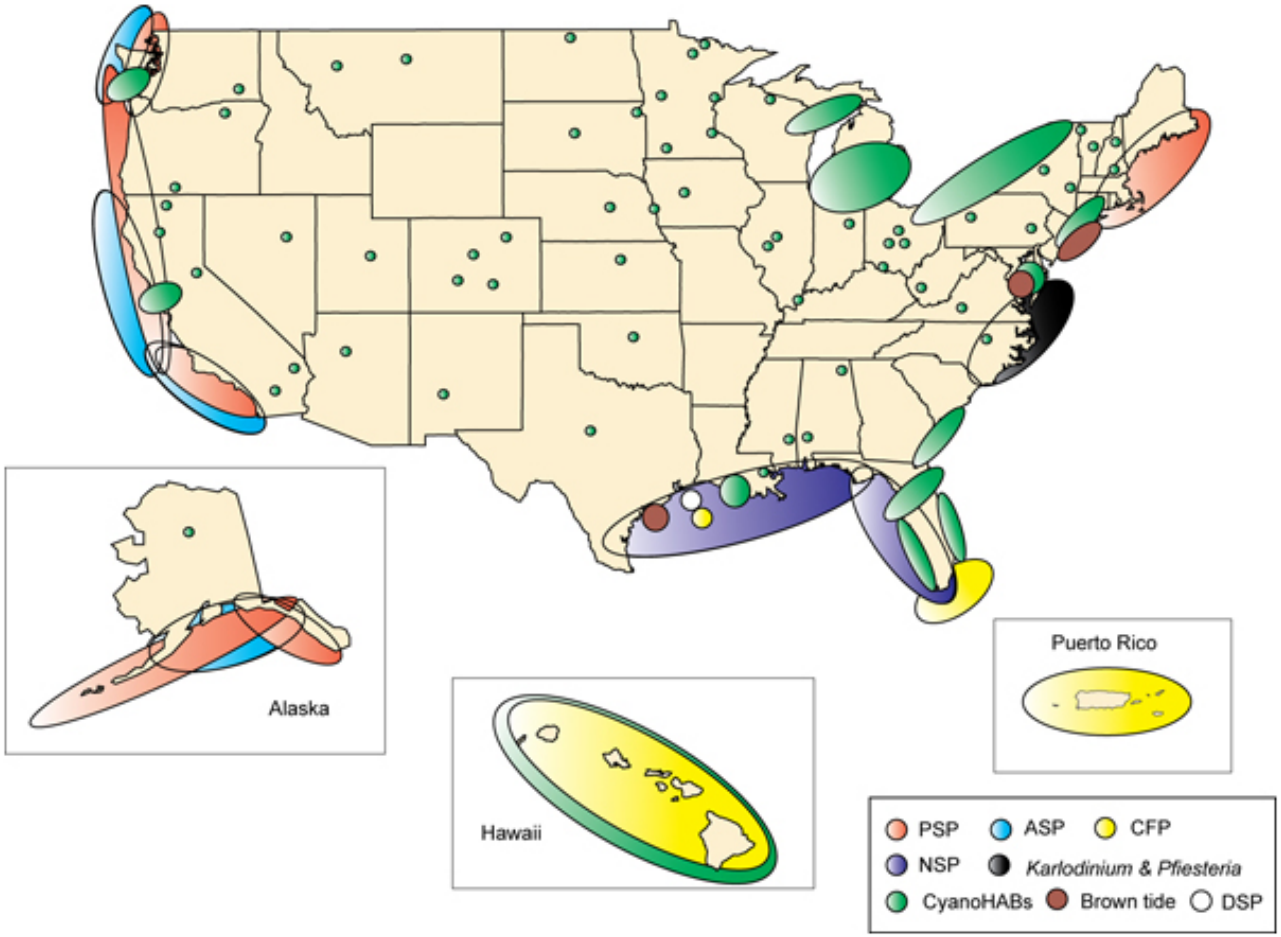
- USEPA
  - Wadeable Streams Assessment (2004)
  - National Lakes Assessment (2007, 2012)
  - National Rivers and Streams Assessment (2008-2009)
  - National Coastal Condition Assessment (2010)
  - National Wetlands Condition Assessment (2011)

- National Research Council
  - Mississippi River Water Quality . . . Challenges and Opportunities
  - Urban Stormwater Management

- Federal Agencies
  - NOAA: Effects of Nutrient Enrichment in the Nation's Estuaries
  - USGS: SPARRPOW Results
  - USDA: CEAP Results

- Numerous Published Articles, State Reports, and University Studies

Algal Bloom Occurrences in the United States (WHOI 2007)



Hypoxic Zone Locations

National Nutrient Problem Scope

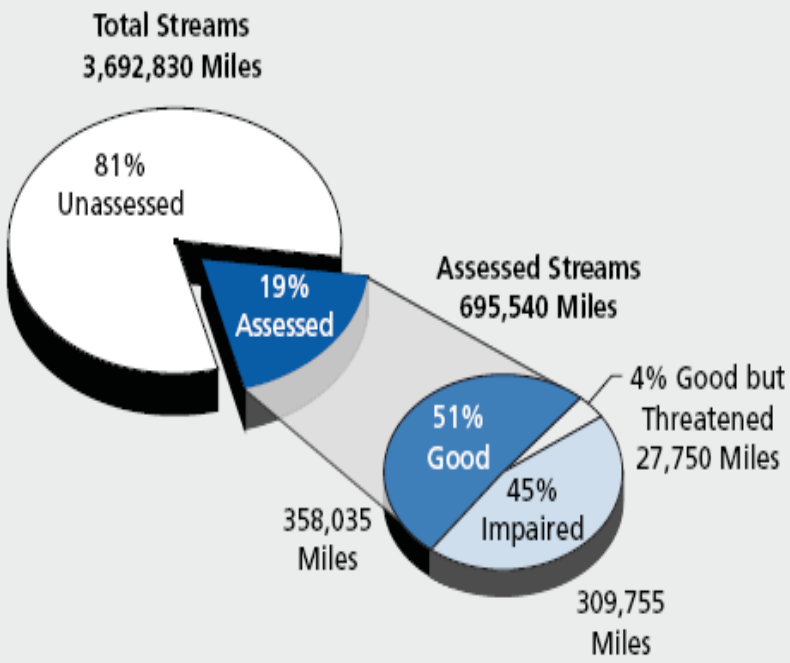
- 14,000 nutrient-related impairment listings in 49 states
  - And this is an underestimate . . .

- Over 47% of streams have Medium to High levels of phosphorus
- Over 53% of streams have Medium to High levels of nitrogen

- One third of U.S. estuaries are eutrophic

- 168 hypoxic zones in U.S. waters

Agricultural NPS is a Leading Source of Water Quality Impairment



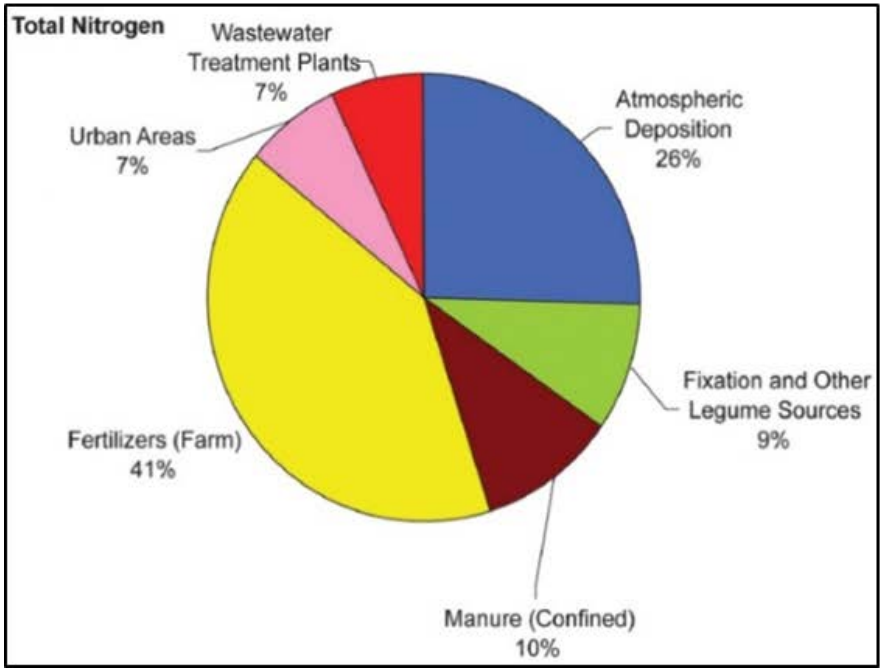
- Number one source for rivers and streams: 94,182 miles (33% of impaired miles)
- Number three source for lakes, ponds, and reservoirs: 1,670,513 acres (20% of impaired acres)
- Number nine source for estuaries: 792 square miles (8% of impaired area)

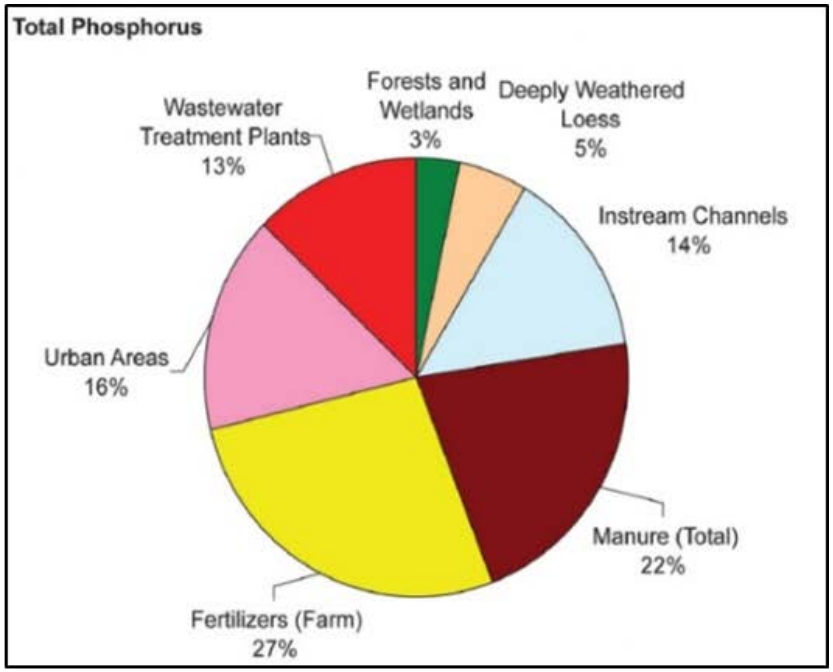
Illinois Water Quality Assessment Data for 2016 Reporting Cycle

Source: CWA 305(b) National Water Quality Inventory: Report to Congress, 2002 Reporting Cycle

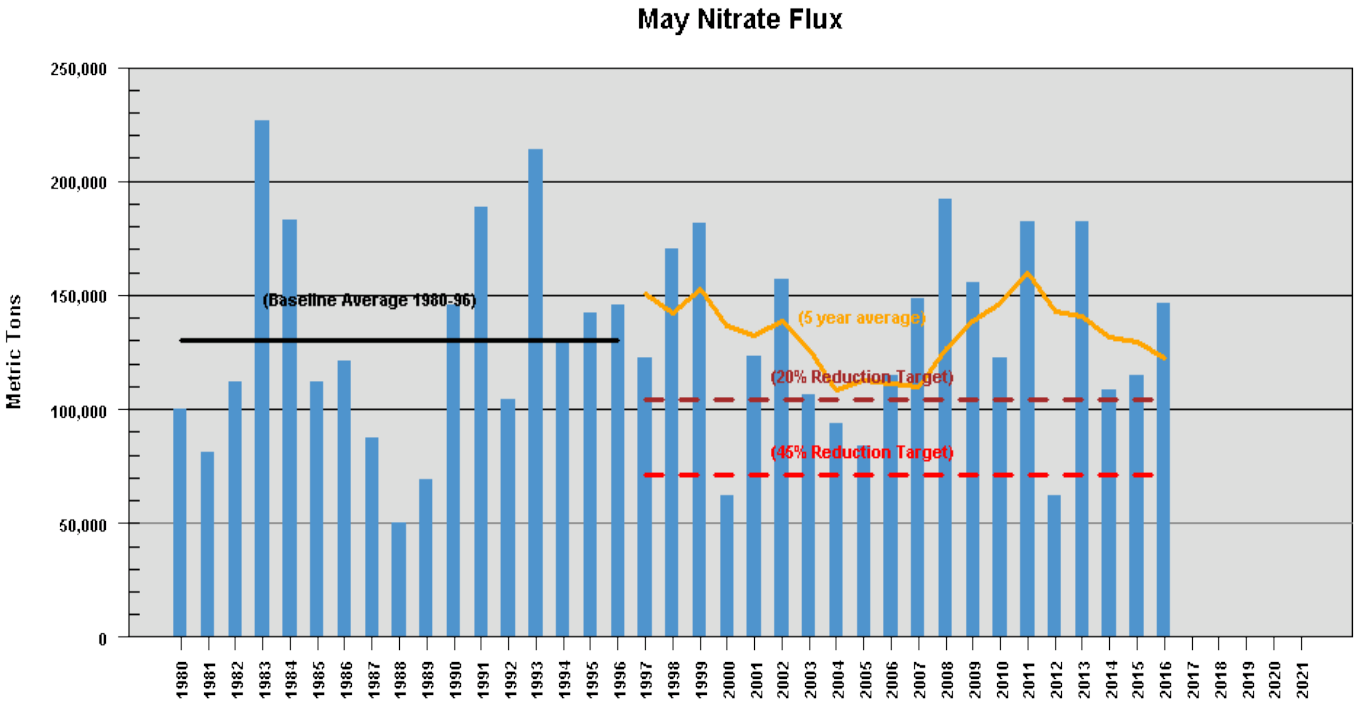
A focus in the Mississippi River Basin (MARB) and Gulf Hypoxia

Nitrogen and Phosphorus Loading Sources in the Mississippi and Atchafalaya River Basin (MARB)

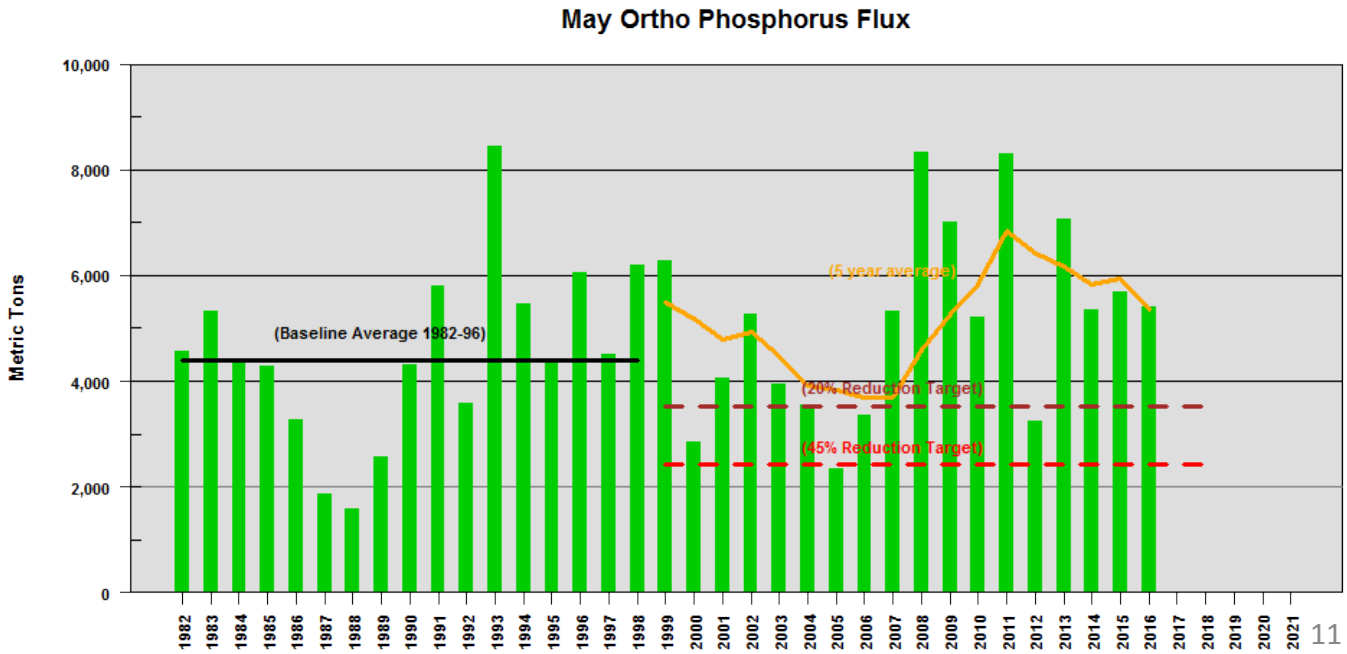


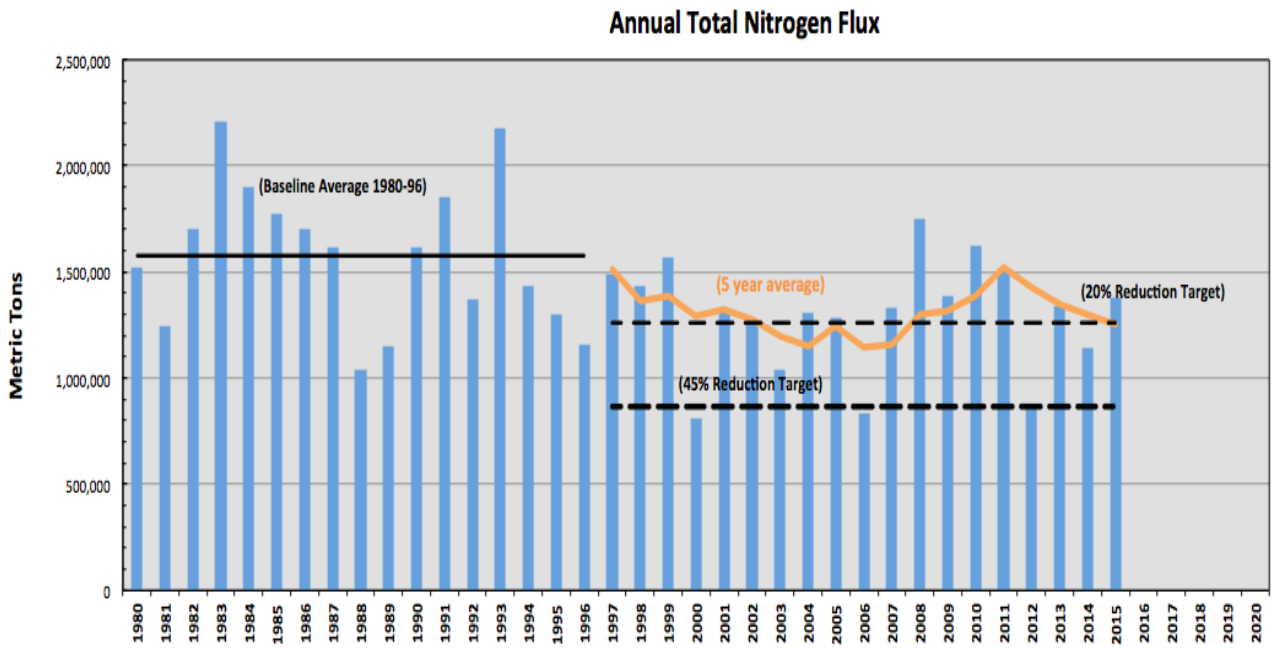


USGS SPARROW model estimates of sources of TN and TP transported from Mississippi River Basin to the Gulf of Mexico (Robertson and Saad 2013)

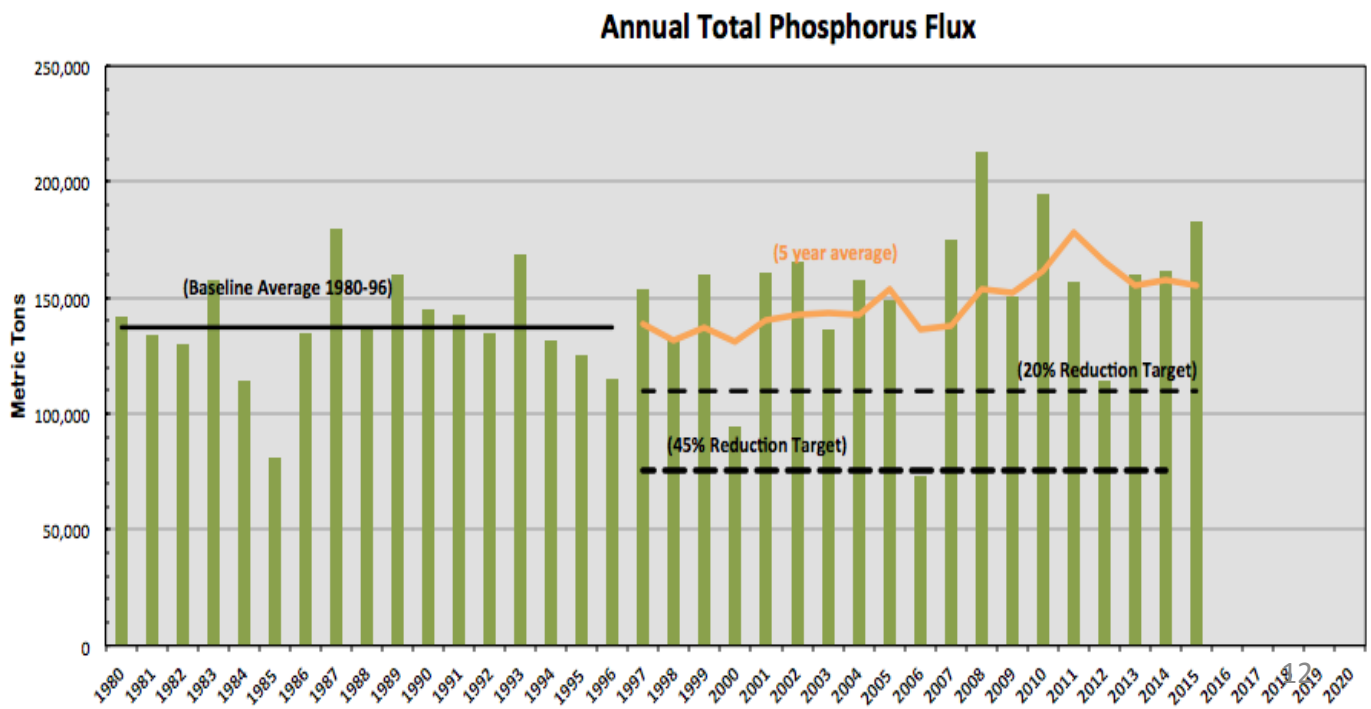


The 2012-2016 five-year average is about 10 percent below the 1980-1996 baseline period for nitrate and 22 percent above the baseline period for orthophosphorus (USGS 2014a).

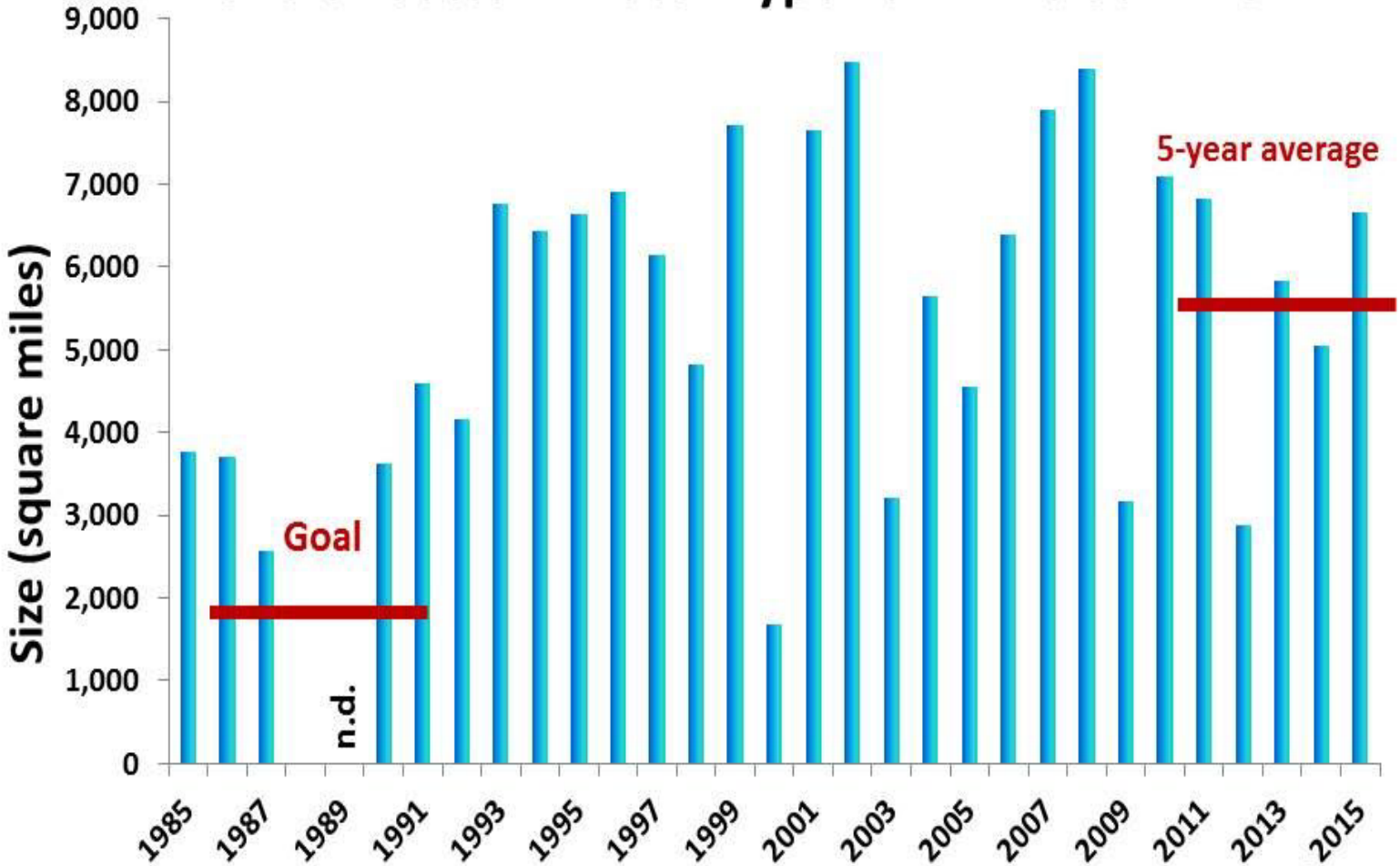




Annual TN and TP loads in the MARB transported to the Gulf of Mexico from 1980 to 2015 (USGS 2017)



Size of bottom-water hypoxia in mid-summer



Data source: Nancy N. Rabalais, LUMCON, and R. Eugene Turner, LSU

Funding sources: NOAA Center for Sponsored Coastal Ocean Research and U.S. EPA Gulf of Mexico Program

Hypoxia Task Force and Goals

Hypoxia Task Force Background

- Late 1990s: Formed based on the White House Committee on Environment and Natural Resources' "Integrated Assessment"
  - Scientific basis for 2001 Action Plan with goal to reduce the size of the Hypoxic Zone
  - Led to focus on reducing nitrogen loads to the gulf via the Mississippi River
- 2001 Action Plan called for Reassessment
  - 2004 white paper → Is phosphorus a co-driver of the hypoxic zone?
  - Convened four science symposia
  - EPA Science Advisory Board formed a panel, took symposia outcomes
- 2008 Action Plan
  - Calls for need for state strategies and dual N and P nutrient reduction effort
- 2015 reiterated the goal, adopted an interim target

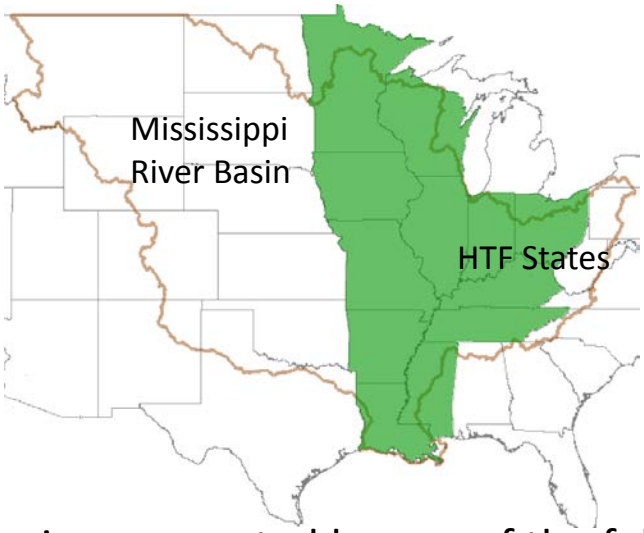
Hypoxia Task Force Members

5 Federal Agencies and Tribes:

- US Army Corps of Engineers
- US Environmental Protection Agency
- US Department of Agriculture
- US Geological Survey
- National Oceanic and Atmospheric Administration
- National Tribal Water Council

12 State Agencies:

- Arkansas
- Missouri
- Iowa
- Tennessee
- Minnesota
- Indiana
- Ohio
- Louisiana
- Illinois
- Mississippi
- Kentucky
- Wisconsin



Each state is represented by one of the following:

- Agriculture agency,
- Environmental Quality agency, or
- Natural Resources agency

HTF Focus

Nutrient Reduction Strategies

- All twelve states have developed strategies
- Implementation on the ground in state priority watersheds

Tracking progress towards the goal

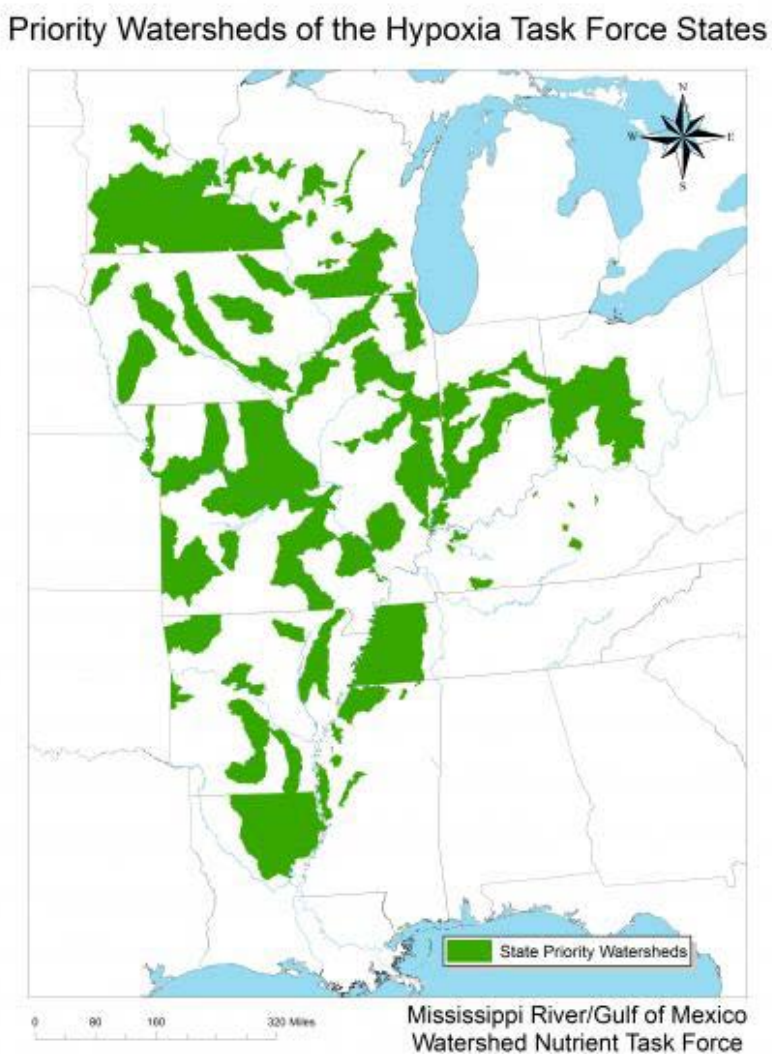
- Point Source Measures Report
- NPS Measures Report
- Federal Accomplishments and revise Federal Strategy, 2016

Continue to build and leverage partnerships

- SERA-46 Priorities for Collaboration

Communicating Success

- 2017 Report to Congress



Federal Agency Efforts to Support States

- Improving monitoring data and modeling approaches to help demonstrate progress
- Continuing research on the impacts and relationship between nutrients and hypoxia
- Support for targeting of conservation practices and watershed planning
- Develop and improve technical tools to help support state strategy implementation
- Expanding outreach and partnerships with organizations
- Support states in implementing their nutrient reduction strategies

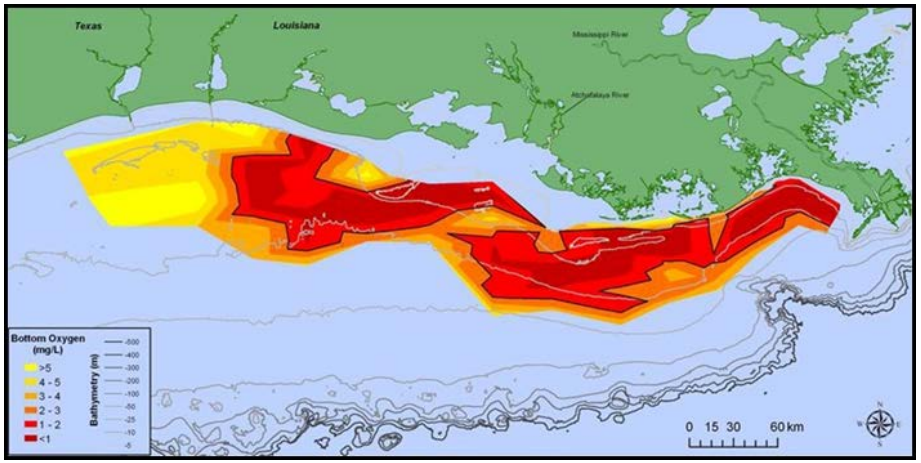
Science Based Goal

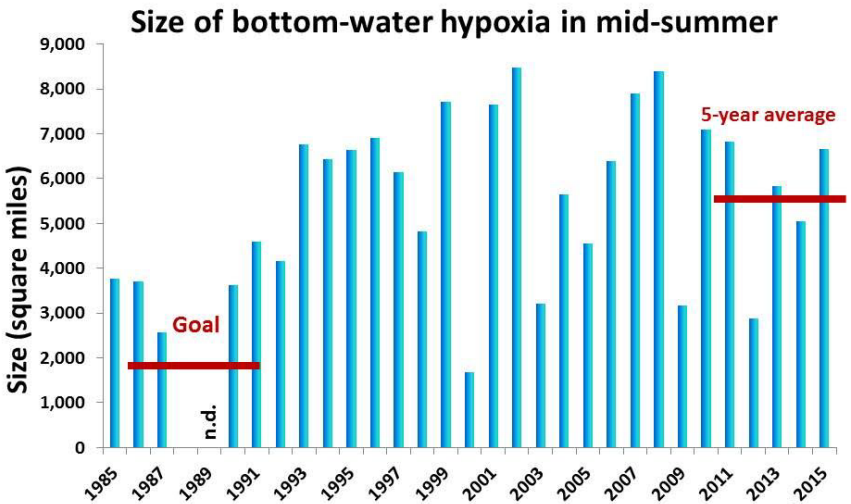
Coastal Goal:

By 2035, reduce 5-year running average size of the Gulf hypoxic zone to 5,000 km^2

Interim Target:

20% reduction of nitrogen and phosphorus loading by 2025

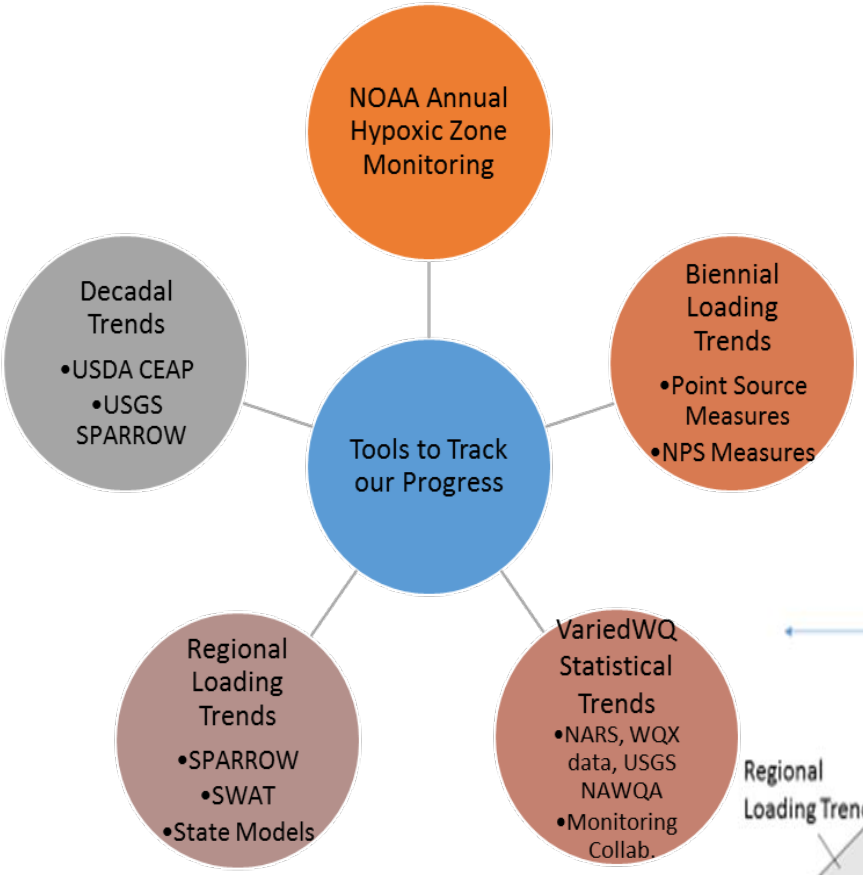


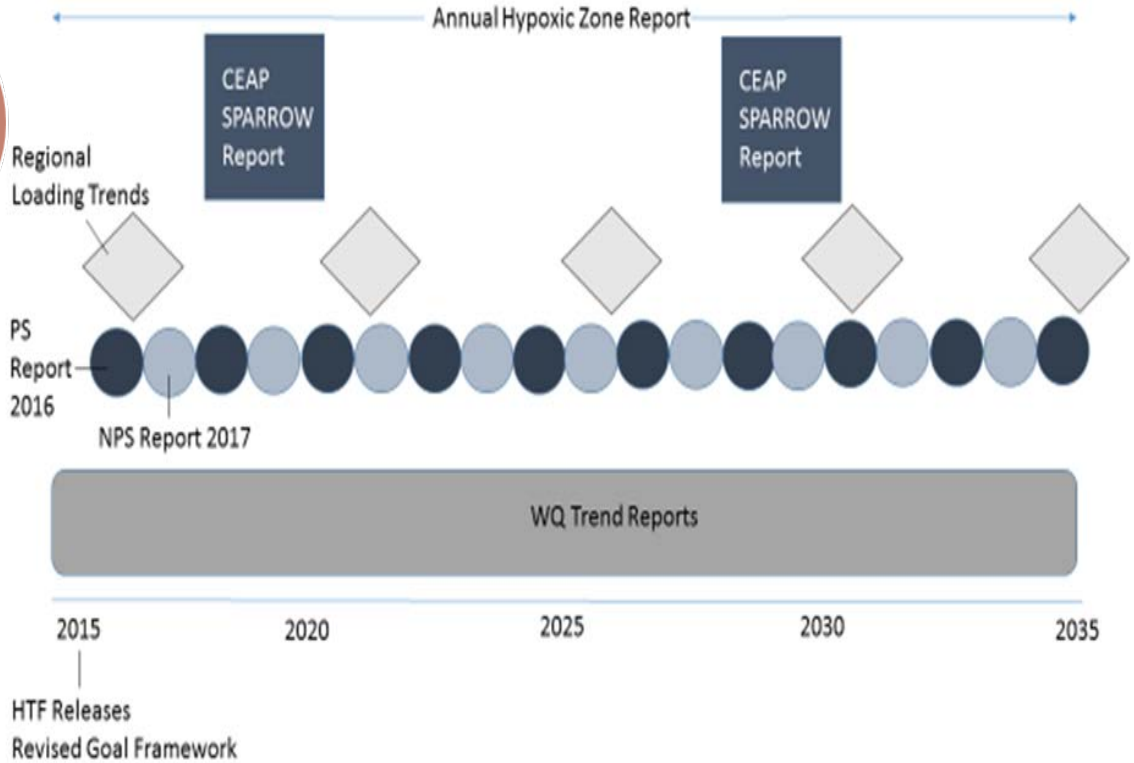


Data source: Nancy N. Rabalais, LUMCON, and R. Eugene Turner, LSU
Funding sources: NOAA Center for Sponsored Coastal Ocean Research and U.S. EPA Gulf of Mexico Program

Mississippi River Gulf of Mexico Watershed Nutrient Task Force

Tracking Progress Towards Our Goal





State Nonpoint Source Programs & Initiatives

Arkansas

- NRS focuses on outreach and grassroots implementation of nutrient reduction activities. Arkansas has invested significant effort to address point and nonpoint source nutrient loading through state, federal, and private partnerships.

Indiana

- Indiana Conservation Partnership uses EPA's Region 5 Nutrient Load Reduction model to determine the impact of assisted conservation efforts statewide on an annual basis.

Illinois

- Identified reduction goals to address hypoxia: 45 percent reduction in nitrate-nitrogen and total phosphorus; interim milestones of 15 percent reduction in nitrate-nitrogen, and 25 percent reduction in total phosphorus by 2025.
- The Illinois Nutrient Loss Reduction Strategy calls for five implementation working groups: 1) Policy Working Group, 2) Point Source Benchmarking Subwork Group, 3) Nutrient Monitoring Council, 4) Nutrient Science Advisory Committee, and 5) Agriculture Water Quality Partnership Forum

Iowa

- Outlines efforts to reduce nutrients in surface water from both point sources and nonpoint sources in a research-based, reasonable, and cost-effective manner. State initiatives involved include: 1) Iowa Nutrient Research Center, 2) Water Quality Initiative (WQI), 3) Iowa Agriculture Water Alliance (IAWA)

State Nonpoint Source Programs & Initiatives

Kentucky

- Strategy developed with input from stakeholders representing a broad perspective of interests: agriculture, industry, environmental advocacy, municipalities, conservation organizations, and federal and state partners. The strategy encompasses reduction from both point and nonpoint sources, as well as a variety of regulatory and cooperative approaches.

Louisiana

- Implementation of the strategy focuses on six key areas: (1) river diversions, (2) nonpoint source management, (3) point source management, (4) incentives, (5) leveraging opportunities, and (6) new science-based technologies/applications.

Minnesota

- Mandatory riparian buffer initiative, deadlines for establishment of buffers on public waters and public ditches are 2017 and 2018 respectively.
- River phosphorus/eutrophication standards established: has had longstanding phosphorus standards for discharges to lakes. Newly established eutrophication standards are designed to protect flowing water.
- Nitrogen fertilizer rule development for priority groundwater areas – fall fertilizer restrictions and (in some cases) required BMPs
- Wastewater nutrient treatment certainty: hold fixed total phosphorus and nitrogen limits for up to 20 years for wastewater facilities that voluntarily employ treatment options that remove and reduce those parameters according to permit limits from wastewater discharges.

Mississippi

- The approach involves increased coordination of MDEQ programs including Basin Management, Nonpoint Source, TMDLs, Water Quality Monitoring, Water Quality Assessment, Water Quality Standards, and NPDES Permitting.
- Eleven work groups formulated the details for 11 strategic elements: (1) stakeholder awareness, outreach, and education; (2) watershed characterization; (3) current status and historical trends; (4) analytical tools; (5) water management; (6) input management; (7) best management practices; (8) point source treatment; (9) monitoring; (10) economic incentives and funding sources; and (11) information management.

State Nonpoint Source Programs & Initiatives

Missouri

- In response to expressed interest in nutrient trading during the development of the Missouri Nutrient Loss Reduction Strategy, the department established a stakeholder work group in 2015 to examine water quality trading and develop a framework for interested stakeholders. Following a public comment period, the Missouri Clean Water Commission approved the framework in October 2016.

Ohio

- In 2014, Governor John Kasich signed into law Senate Bill 150, an update of Ohio's regulatory structure specifically geared to improving water quality. The bill requires fertilizer applicators to undergo education and certification by ODA, encourages producers to adopt nutrient management plans, allows ODA to better track the sales and distribution of fertilizer throughout the state, and provides the authority to repurpose existing funding for additional BMP installation.

Tennessee

- Tennessee has a distinct focus on soil health through the initiatives of the USDA Natural Resources Conservation Service and the Tennessee Department of Agriculture (TDA). Tennessee is third in the nation, behind Indiana and North Dakota in the number of acres of cover crops being planted.
- Supported in part by a grant from EPA, Tennessee has funded watershed modeling, using SWAT to determine the effects of installing conservation practices in a watershed in terms of nutrient flux.

Wisconsin

- Wisconsin permittees have the option of complying with new phosphorus permit limits through improved controls or through adaptive management or water quality trading. Both adaptive management and water quality trading offer the opportunity for point sources and non-point sources within a watershed to work together on actions that improve water quality.
- State's **nonpoint source performance standards and prohibitions** found in Chapter NR 151, Wisconsin Administrative Code and Chapter ATCP 50, Wisconsin Administrative Code. These include the cropland phosphorus index and requirements for nutrient management planning.

A Collaborative, Science-Based Approach

Priorities for Collaboration with SERA-46

- USDA-NIFA-supported m
  Southern Extension and
  Activities Committee nu

- The 12 Land Grant Unive
  are represented by one
  research scientist and
  one extension specialist

- HTF LGU Partnership

Hypoxia Task Force and LGU SERA-46
Priorities for Collaborative Work
Working DRAFT
May 2015

This document outlines emergent opportunities for potential short- and long-term collaborative work between the Hypoxia Task Force and LGU SERA-46. It is a work in progress, reflecting the most recent thinking of HTF and SERA-46 members about where collaboration will contribute most to state-level nutrient strategies and reducing the hypoxic zone in the Gulf of Mexico.

Each item in this summary can be tied to the three broad, proposed objectives:

Objective 1: Establish and strengthen relationships that can serve the missions of multiple organizations addressing nutrient movement and environmental quality.
Objective 2: Expand the knowledge base through the discovery of new tools and practices as well as the continual validation of recommended practices.
Objective 3: Improve the coordination and delivering of educational programming and increase the implementation effectiveness of nutrient management strategies that reduce nutrient movement for agricultural and non-agricultural audiences.

Additional information will be necessary to operationalize these ideas, such as:

- How will SERA-46 and HFT integrate these ideas with existing efforts?
- How will these ideas be resourced (e.g. funded, staffed)?

Answering these questions will be important next steps in moving priorities for land-grant HTF collaboration forward.

What is SERA-46 Doing For the HTF?

- **Refining and developing social and civic engagement indicators** to advance nutrient reduction efforts through an inclusive and consistent expansion of the use of SIPES/SIDMA tools throughout the MARB and to assess and encourage non-government stewardship of nutrient reduction strategies
- **Building capacity for watershed leadership and management** in HTF states through assessing existing watershed training programs that include farmers, hosting leadership summits of watershed practitioners, farmers, and farm advisors from MARB states, and developing training
- **Transforming drainage** (bringing in an additional state to an ongoing project) to educate the next generation of engineers and scientists to design drainage systems that include storage in the landscape
- **Cross-MARB communication of science** directly to state agencies for translation to policy
- **Develop a Nonpoint Source Reduction Measurement Framework** for tracking progress in the MARB

Collaboration with Walton Family Foundation

- WFF funded a nearly $300K three year grant to stand up a nonpoint source measurement framework to aggregate reductions in the landscape – just getting started

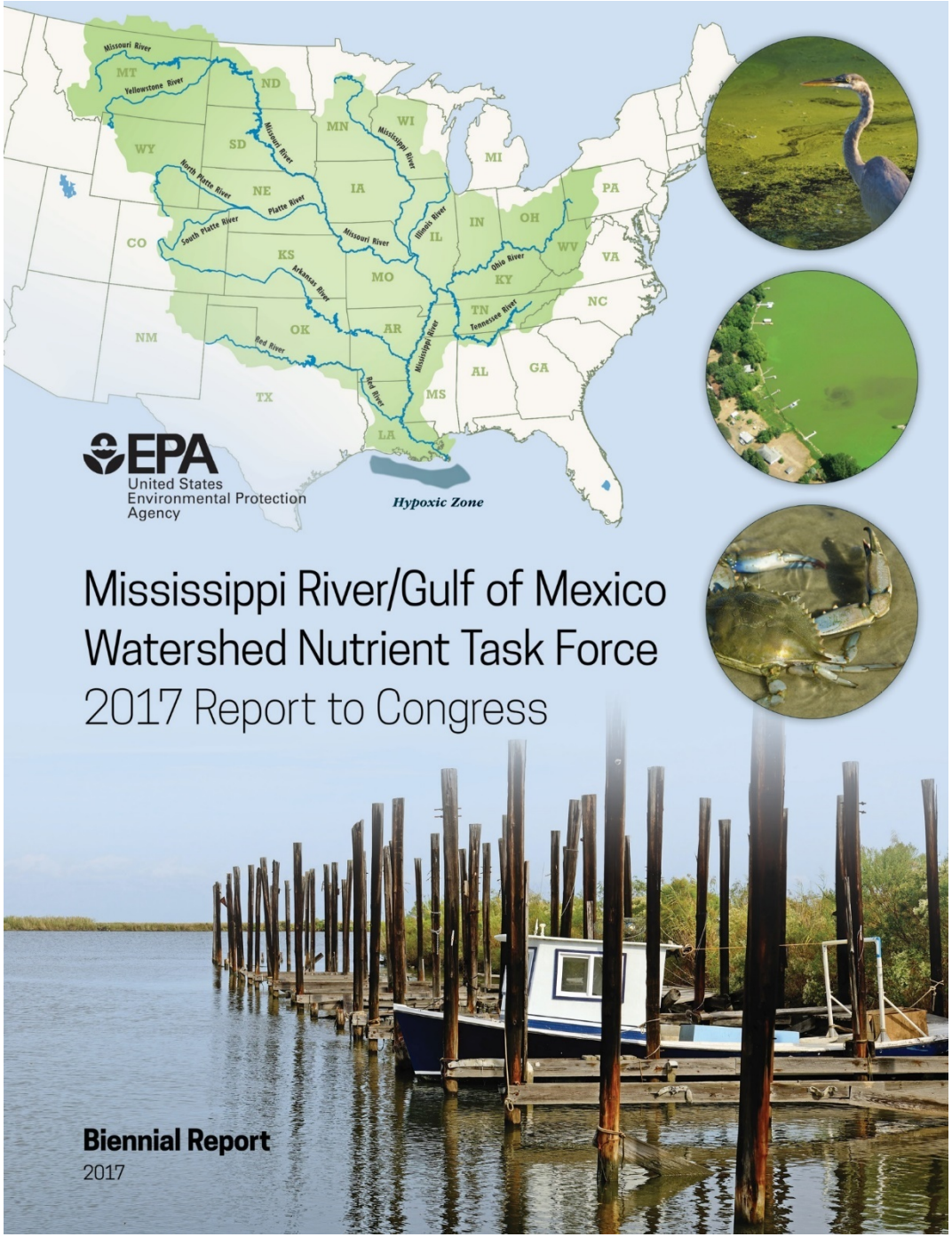
- WFF funds a significant amount of water quality focused work in the Midwest focused on state advocacy, nutrient reduction measurement and tracking, private corporation and organization engagement, water quality improvement, and sustainability work

2017 Report to Congress

- In 2015, HTF submitted our first report to congress, and we have one due biannually going forward

- Due in June, 2017
  - Present to Congress and interested parties the collaborative, partnership-based approach that states are taking to develop, implement and adaptively manage nutrient strategies
  - Highlight federal support, identify needed next steps

- Released November 2, 2017!



[2017 Report to Congress]

THANK YOU!

For more information visit:

www.epa.gov/ms-htf

HOW DOES THE ILLINOIS SCIENCE ASSESSMENT COMPARE TO OTHER STATES?

Reid Christianson and Laura Christianson

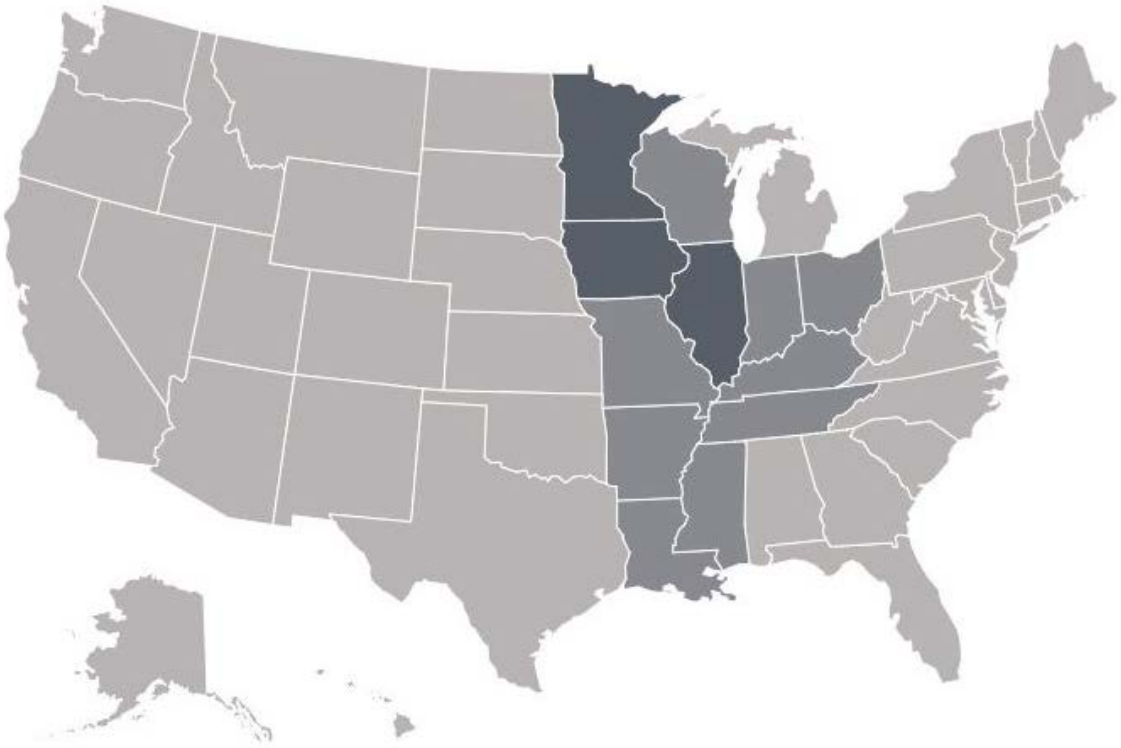
2017 Inaugural Illinois NLRS Workshop

Key Take-Aways

- The approach of doing a science assessment has been validated across the river basin.
- Aspects of the Illinois science assessment have been corroborated by the other science assessments.

Iowa, Illinois, & Minnesota Science Assessments

Comparison of the science surrounding the agricultural conservation practices



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Research article

Beyond the nutrient strategies: Common ground to accelerate agricultural water quality improvement in the upper Midwest

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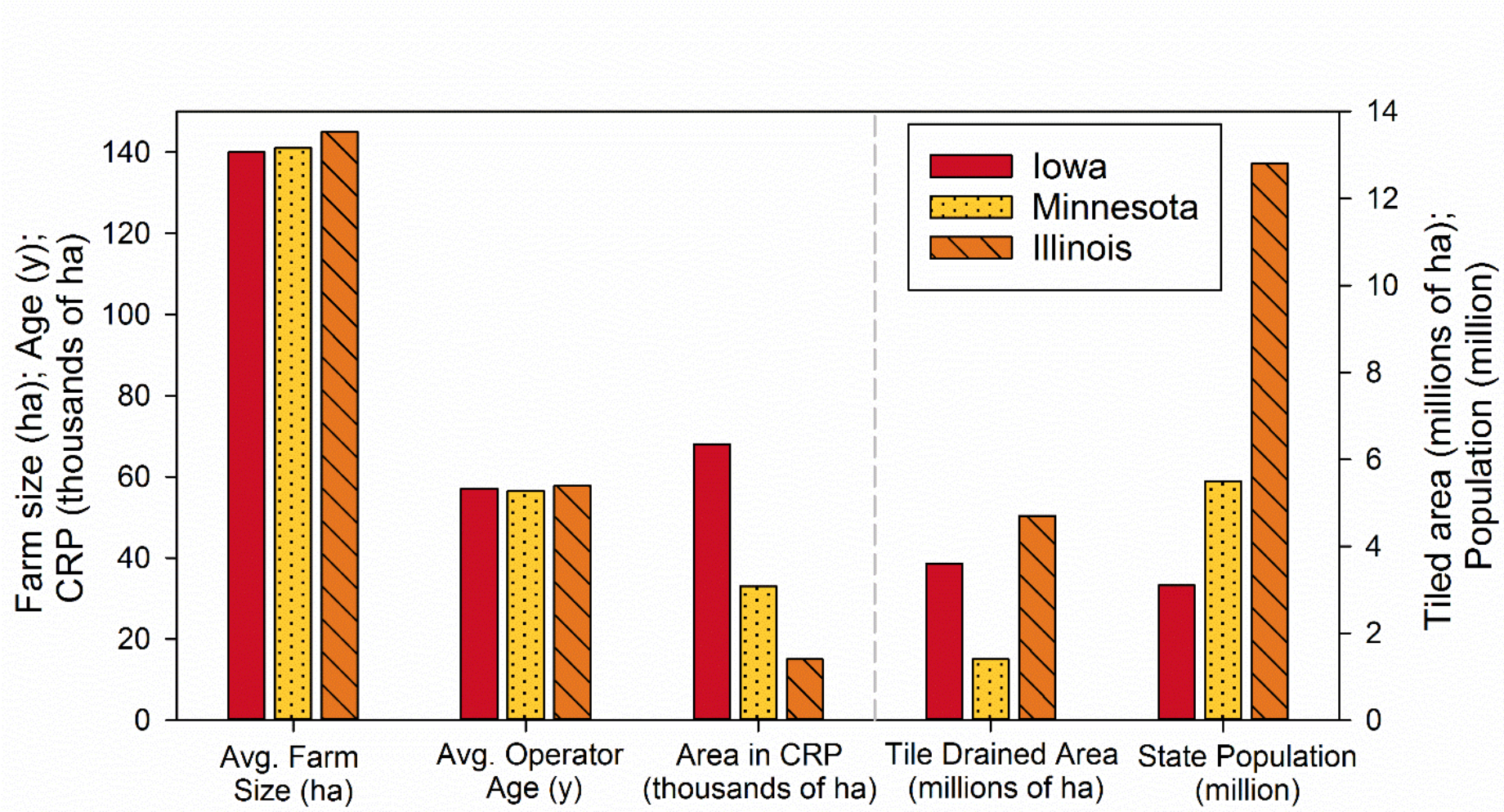
ABSTRACT

Nutrients in drainage waters from the Upper Mississippi River Basin states have been a well-documented contributor to the Gulf of Mexico hypoxic zone for decades, and in response, twelve states have developed strategies to address this issue, with Iowa, Minnesota, and Illinois performing rigorous science assessments which estimated nitrogen and phosphorus reduction effectiveness for numerous agricultural non-point source conservation practices. The practices identified in these strategies were compared to identify areas of consensus and

How does agriculture in the three states generally compare?



Christianson et al., In Press

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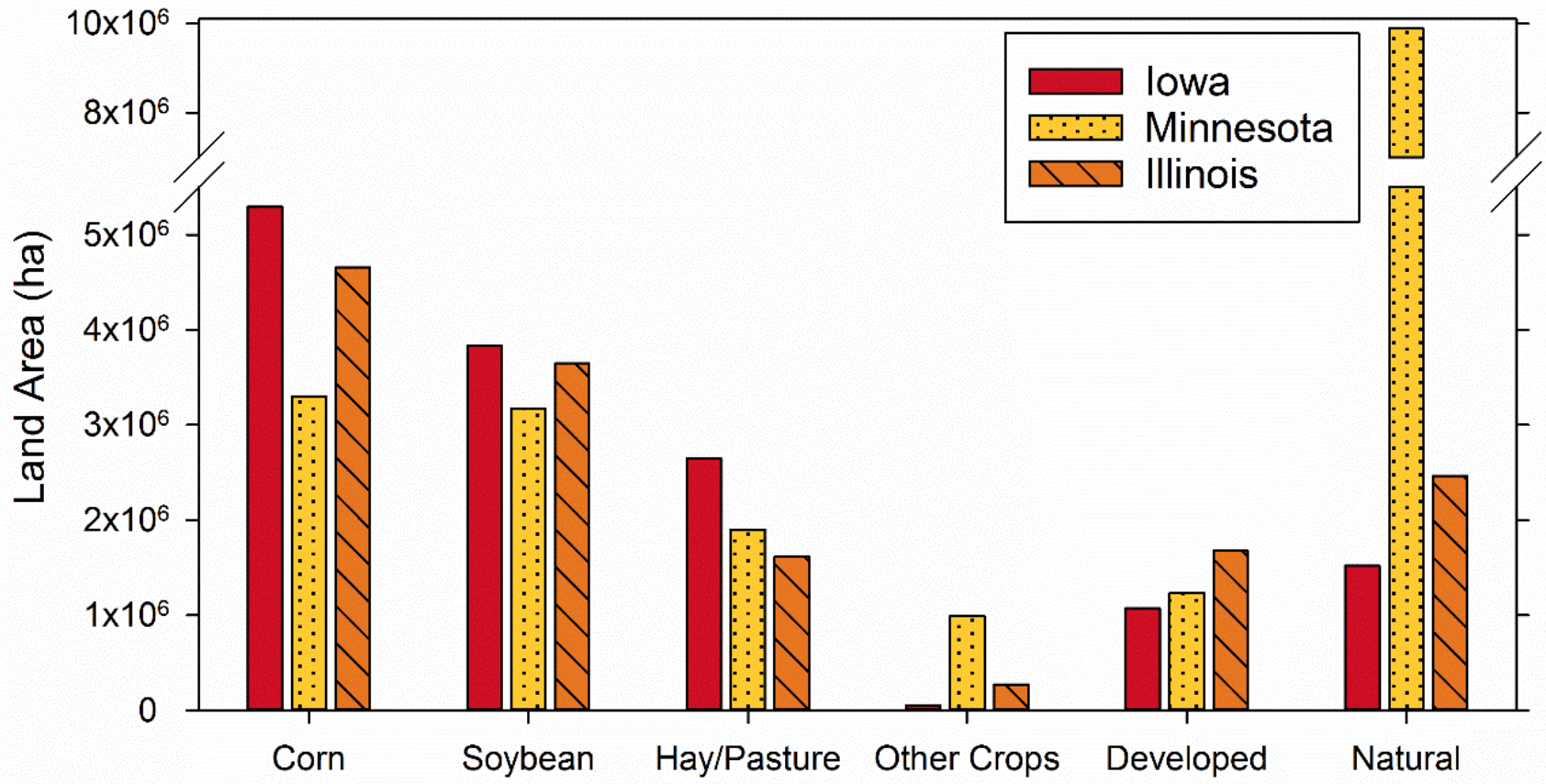
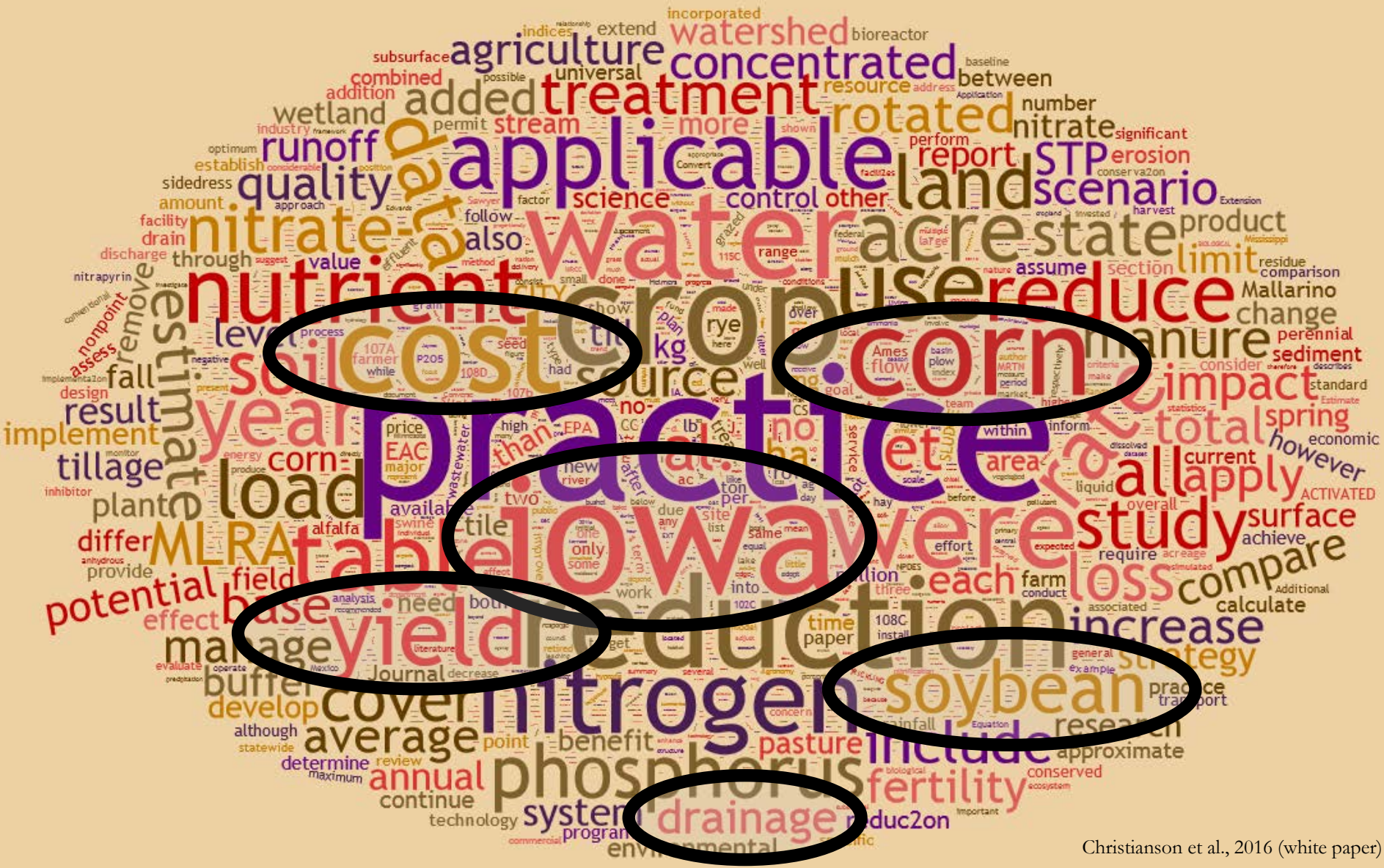


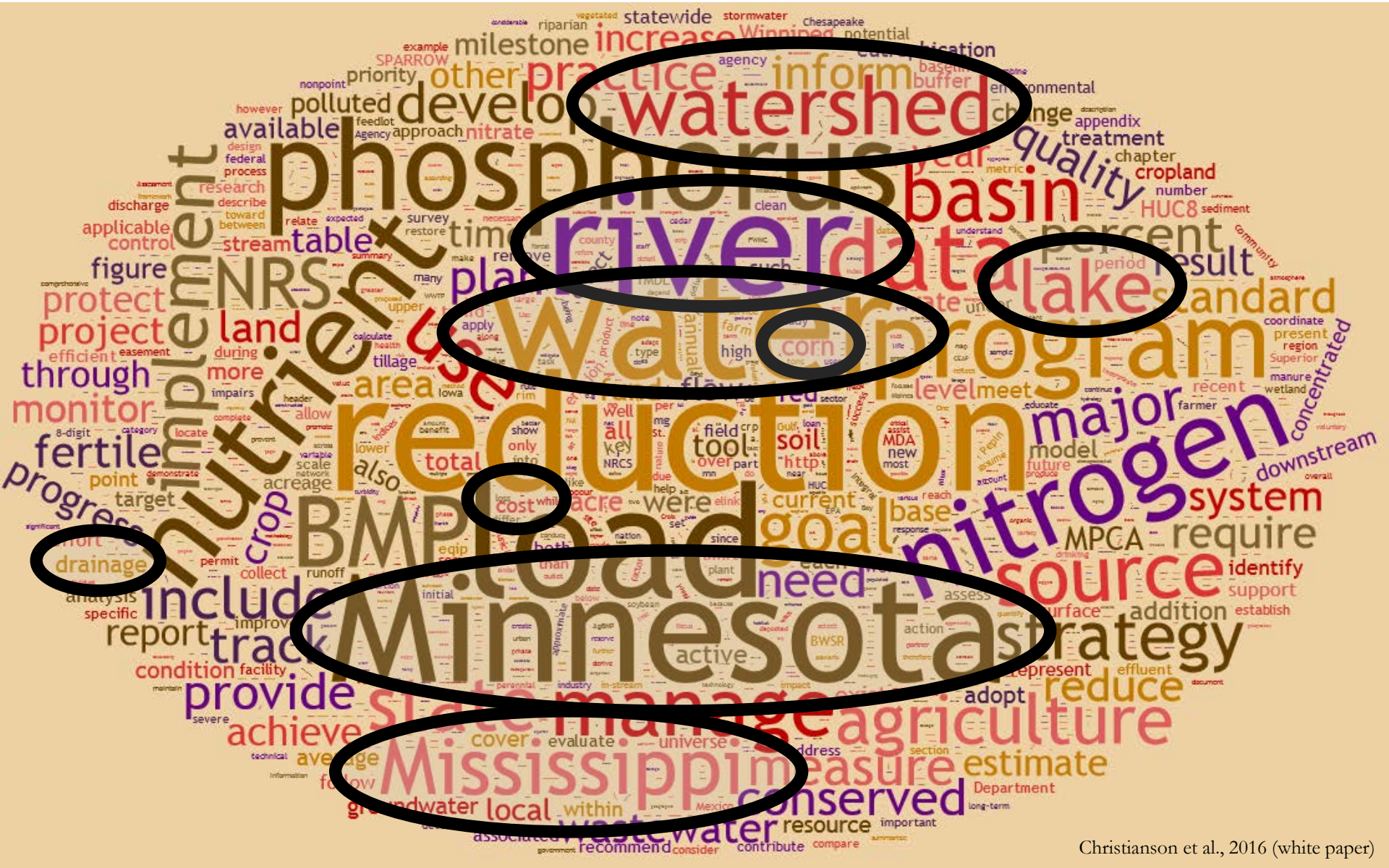
Christianson et al., In Press

Iowa



Christianson et al., 2016 (white paper)

Minnesota



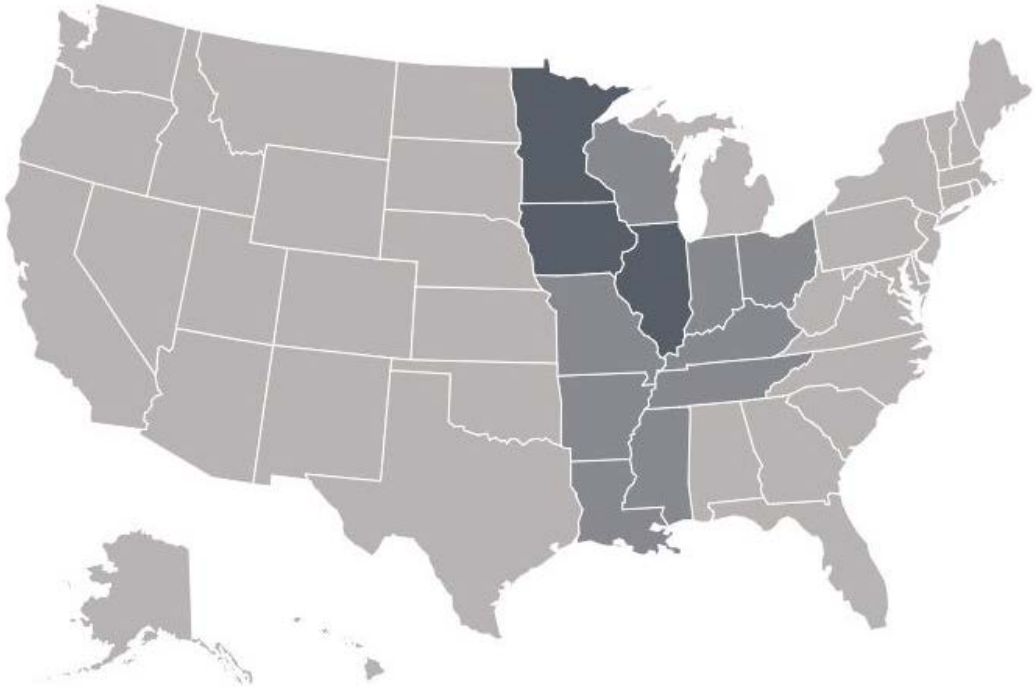
Christianson et al., 2016 (white paper)

Illinois

Christianson et al., 2016 (white paper)

Complexity of practice tracking

Given limited money to both implement practices and to track implementation, how can we effectively do both?



Complexity of practice tracking

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Analysis: review and compare the recommended practices in three nutrient strategies

In Field

- Maximum Return to N Application Rate (MRTN)
- Nitrification Inhibitor
- N Management
- Cover Crops
- Phosphorus Banding
- Conservation Tillage

Edge of Field

- Controlled Drainage (DWM)
- Bioreactors
- Constructed Wetlands
- Buffer

Land Use Change

- Grazed Pasture/ Hayland
- Perennial Energy Crops
- Land Retirement

In Field

- Maximum Return to N Application Rate (MRTN)
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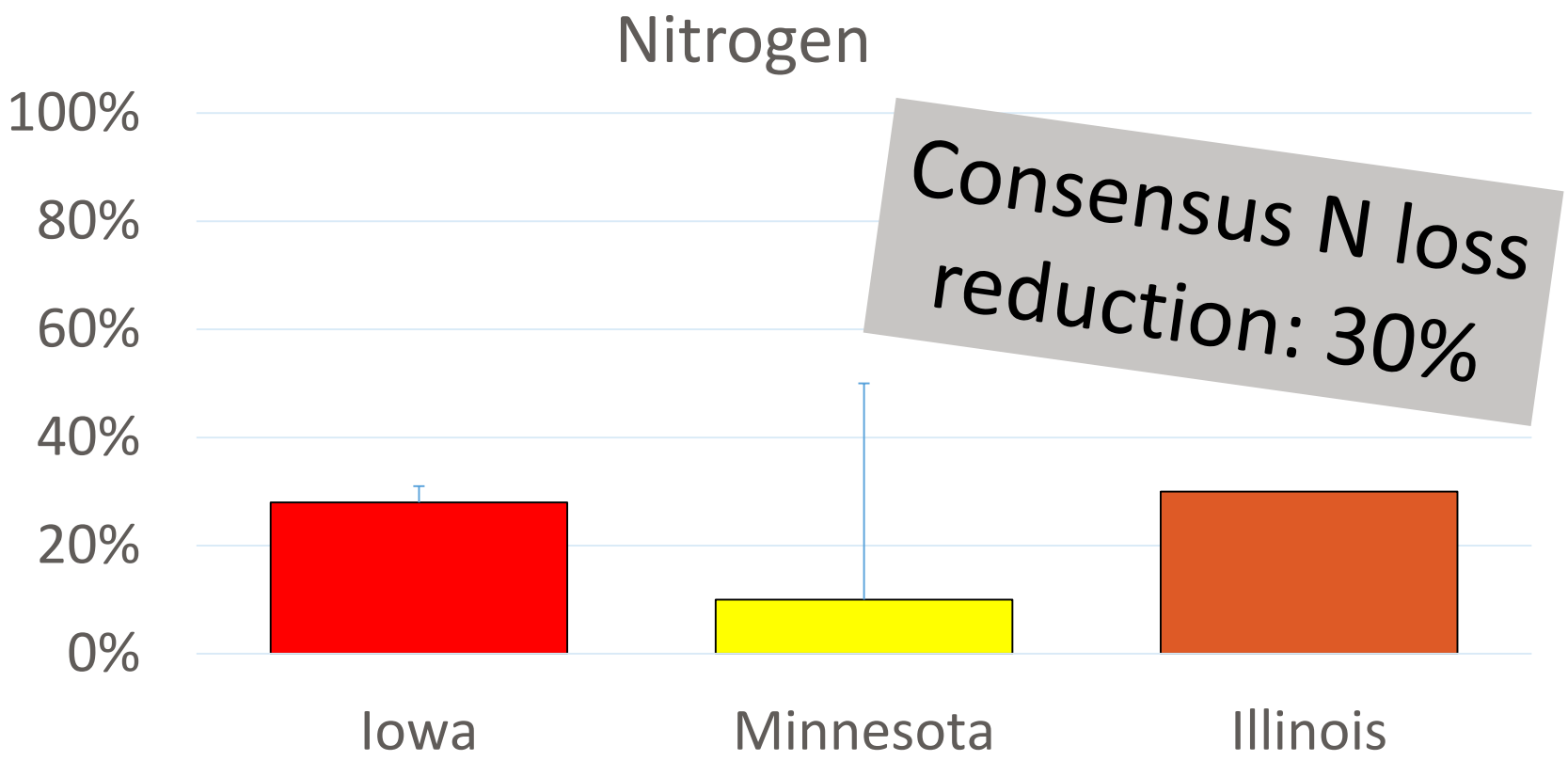
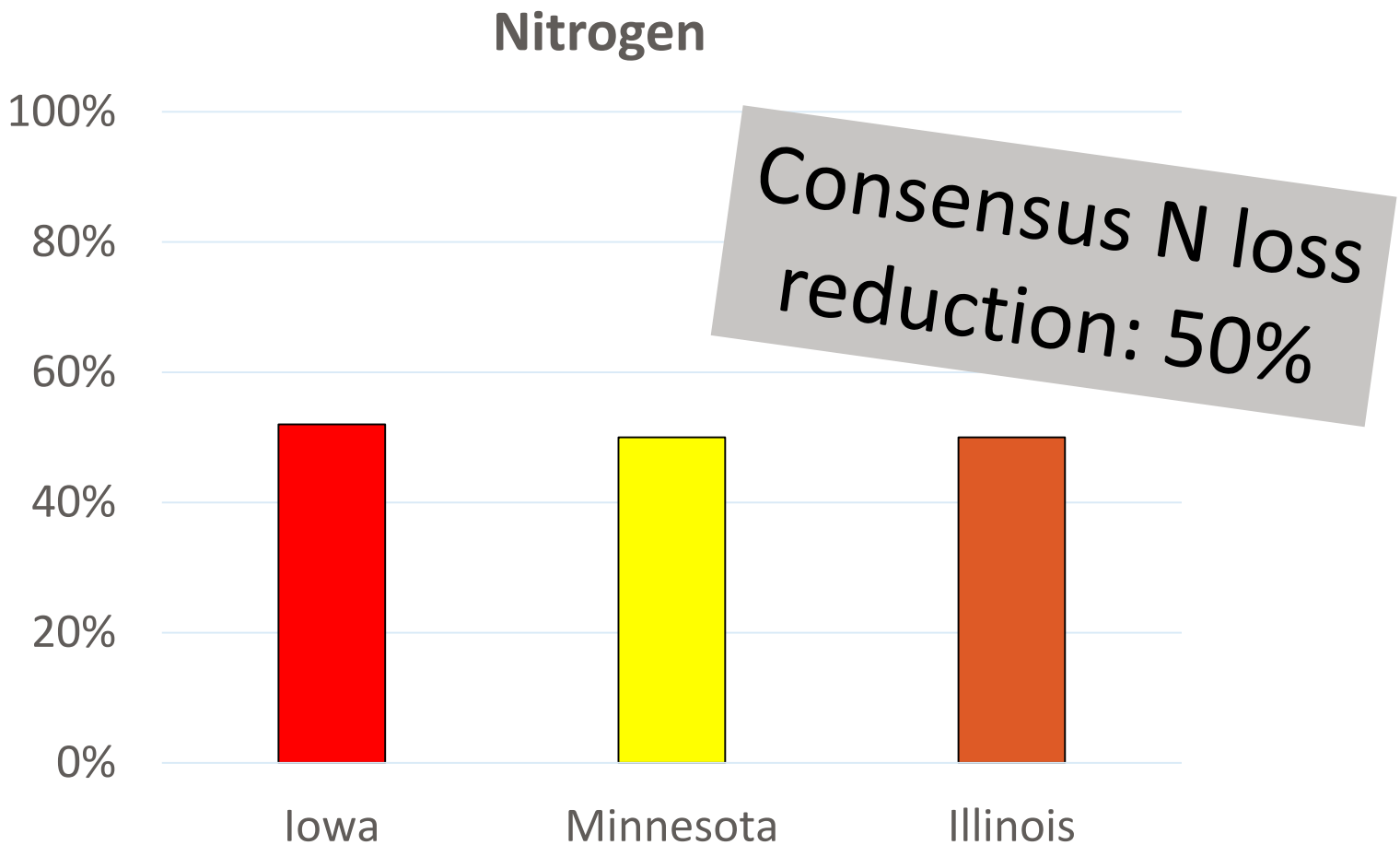
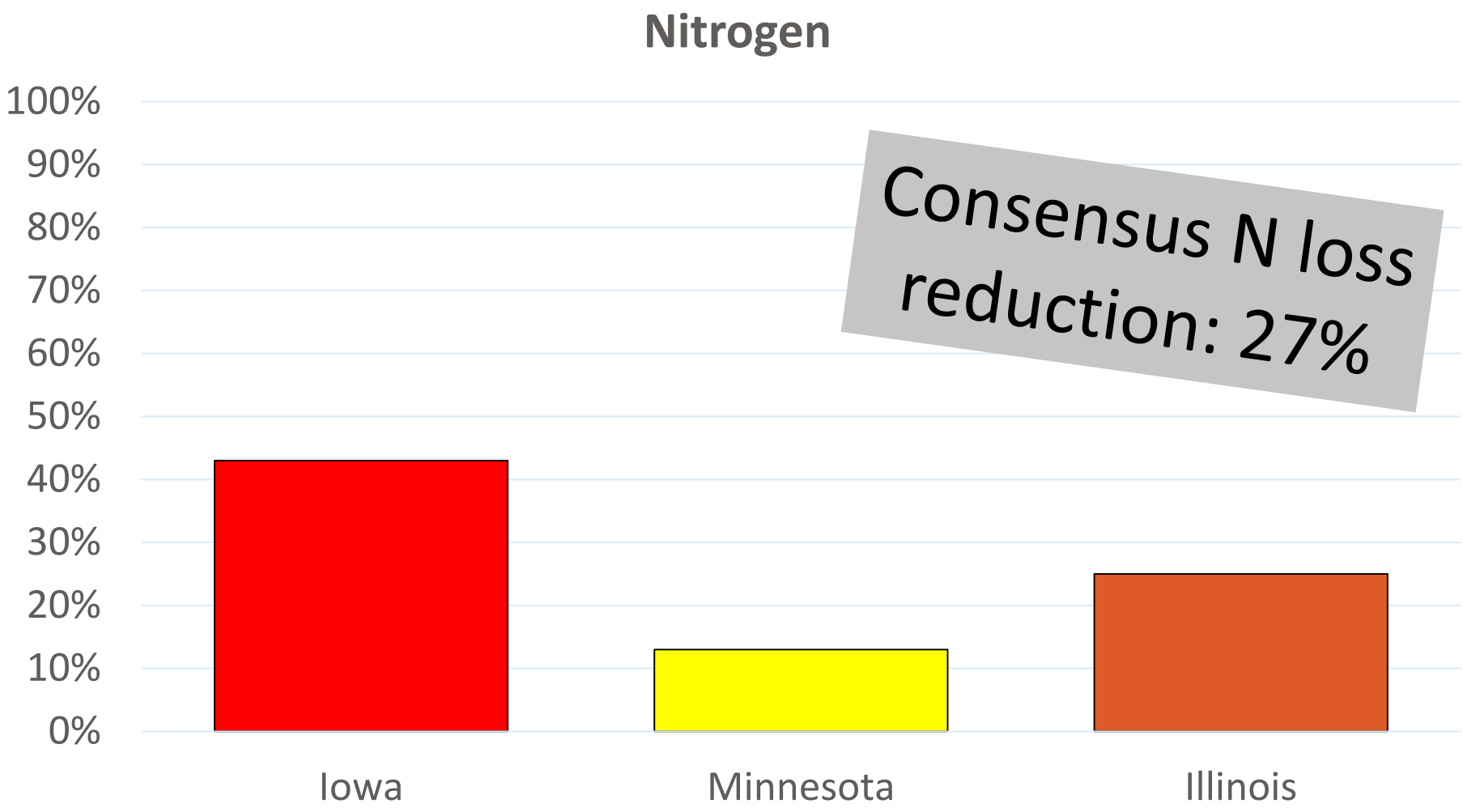
Cover Crops


Nitrogen
100%
80%
60%
40%
20%
0%
Iowa
Minnesota
Illinois
Consensus N loss reduction: 30%

Constructed Wetlands

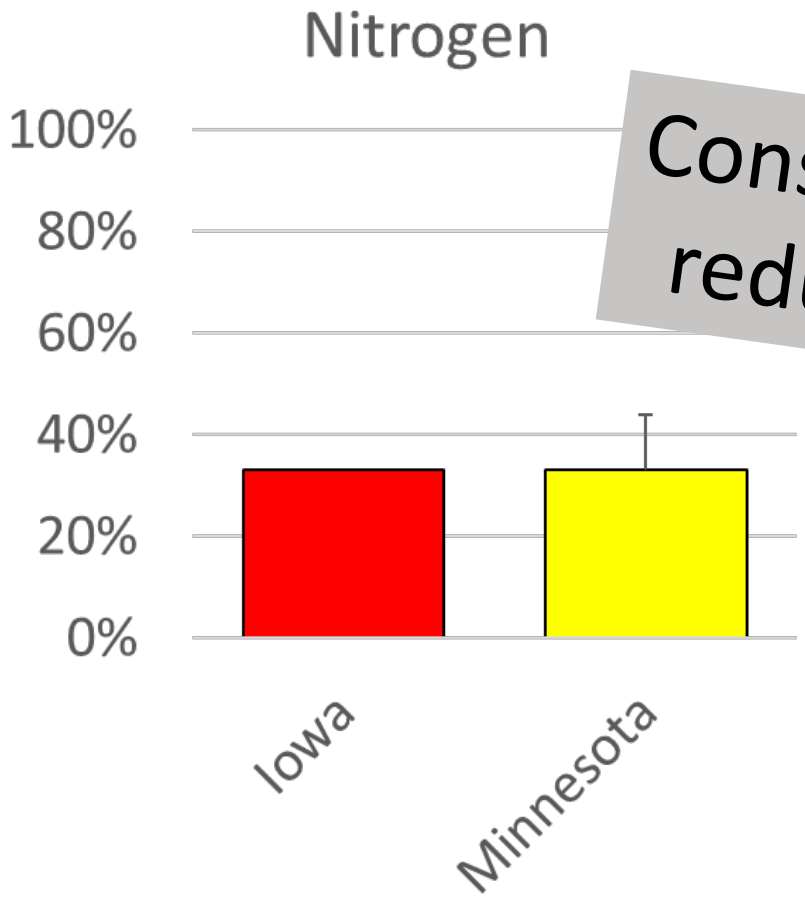


Bioreactors



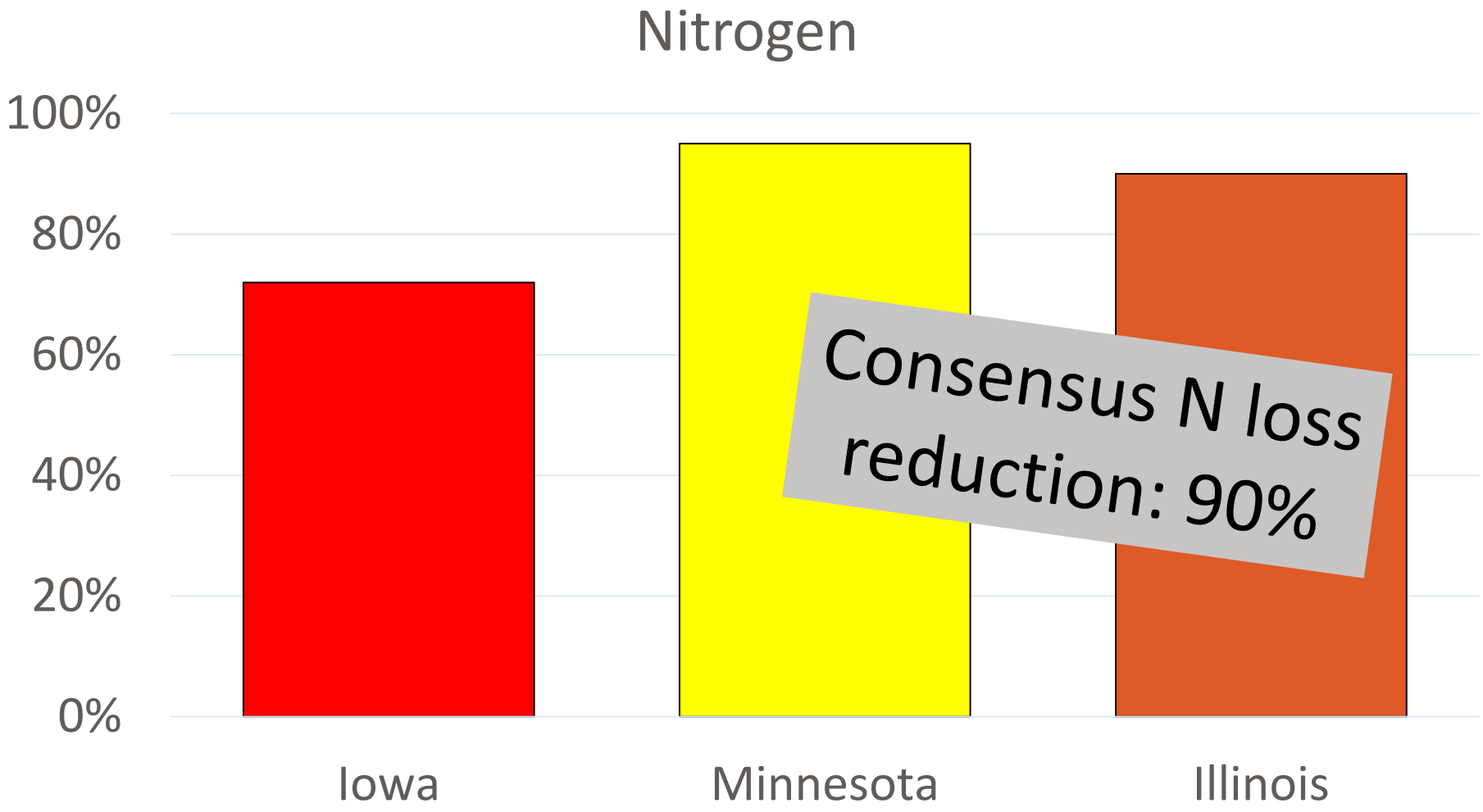
Consensus N loss reduction: 27%

Controlled Drainage



Consensus N loss reduction: 35%

Perennial Energy Crops



Complexity of practice tracking

Given limited money to both implement practices and to track implementation, how can we effectively do both?

There are differences between practices which make them:

- More/less effective for nutrient loss reduction
- More/less likely to be implemented
- Easier/harder to track their implementation

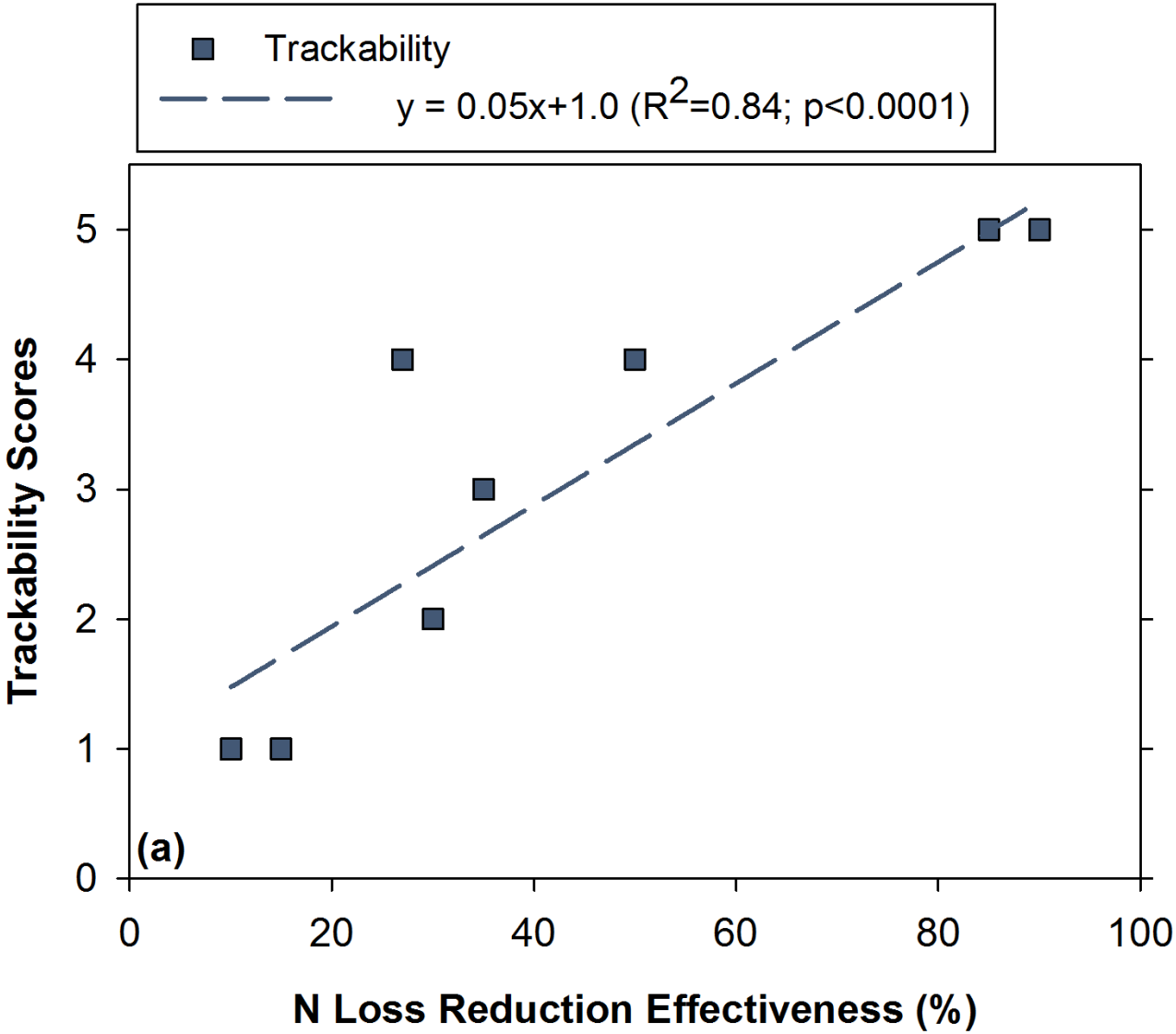
Complexity of practice tracking

State strategies assigned each practice:

- Efficiency: % N loss reduction
- Cost efficiency: $ per ha

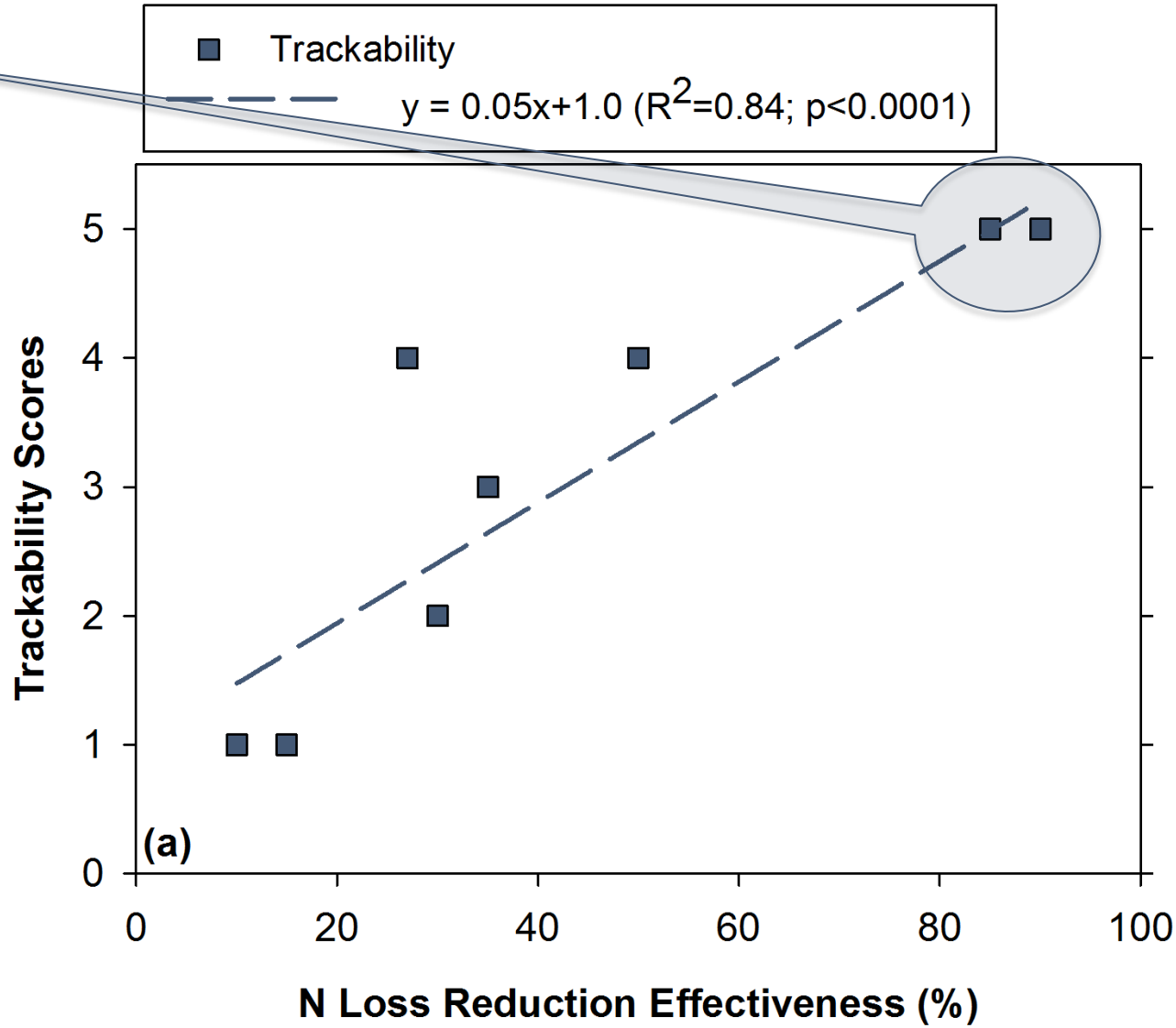
We ranked each practice in terms of:

- Trackability
- Stackability
- Production System Change



Christianson et al., In Press

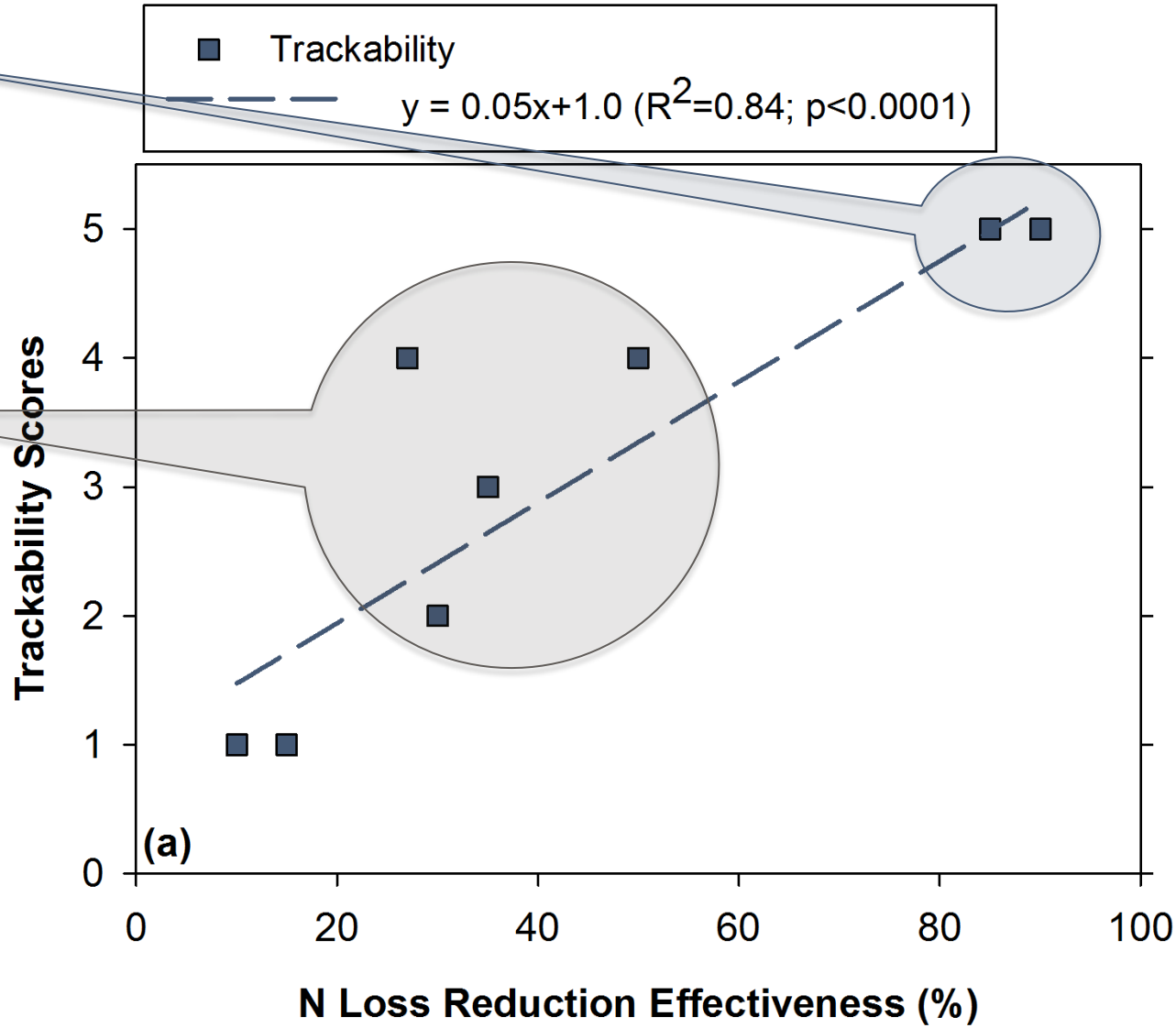
Land use change practices



Christianson et al., In Press

Land use change practices

Bioreactors, DWM, wetlands, cover crops



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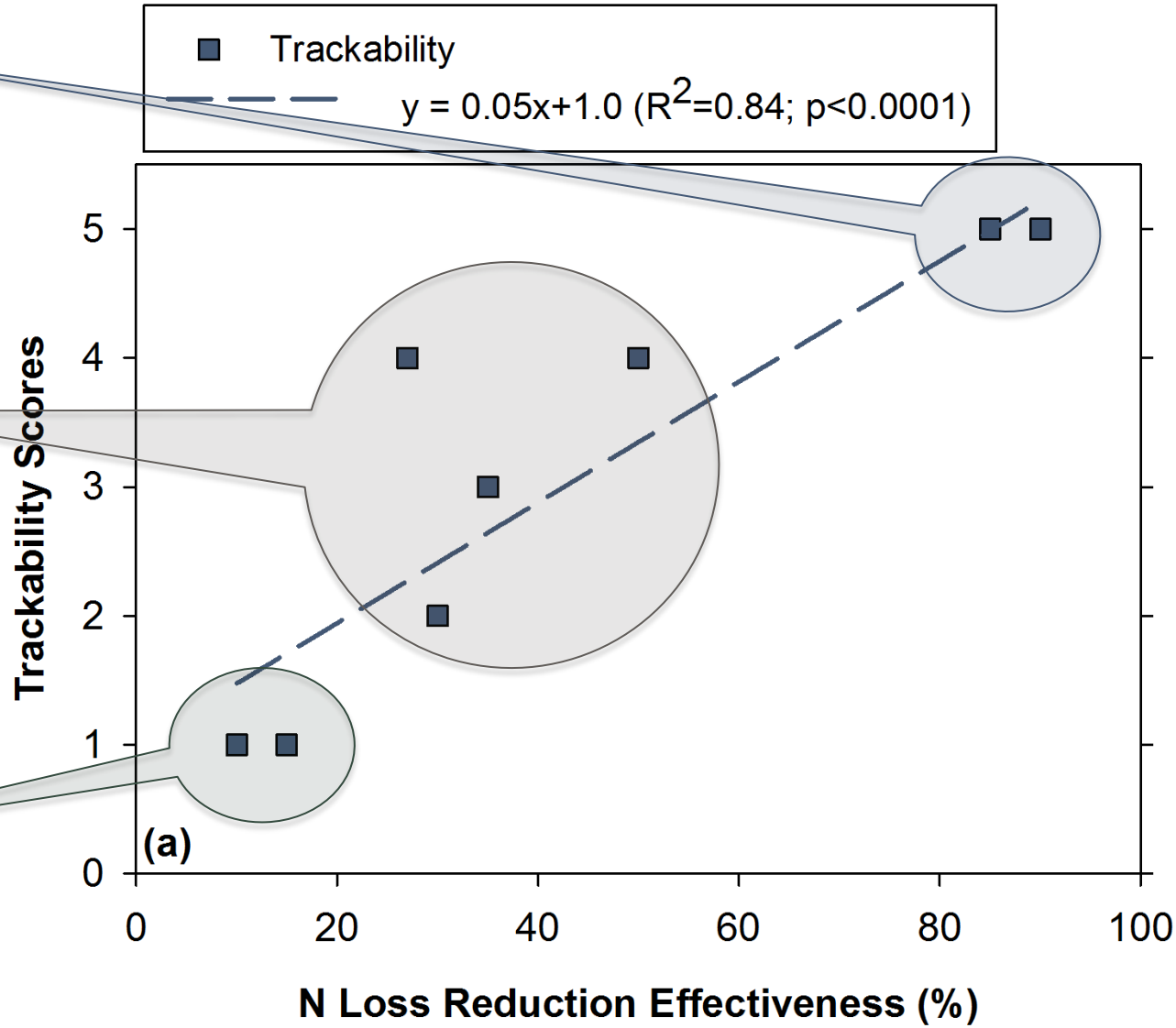
N management practices



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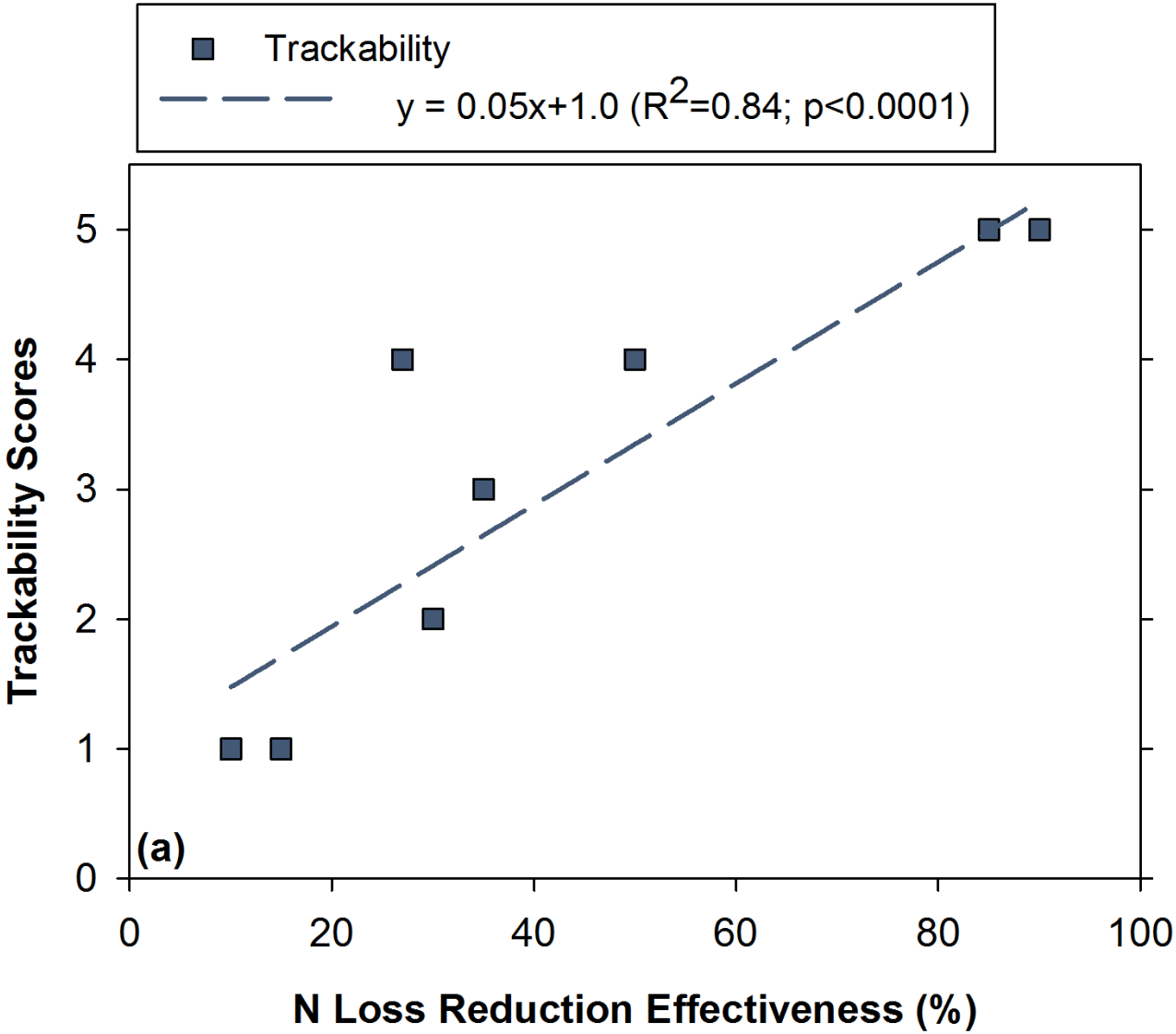

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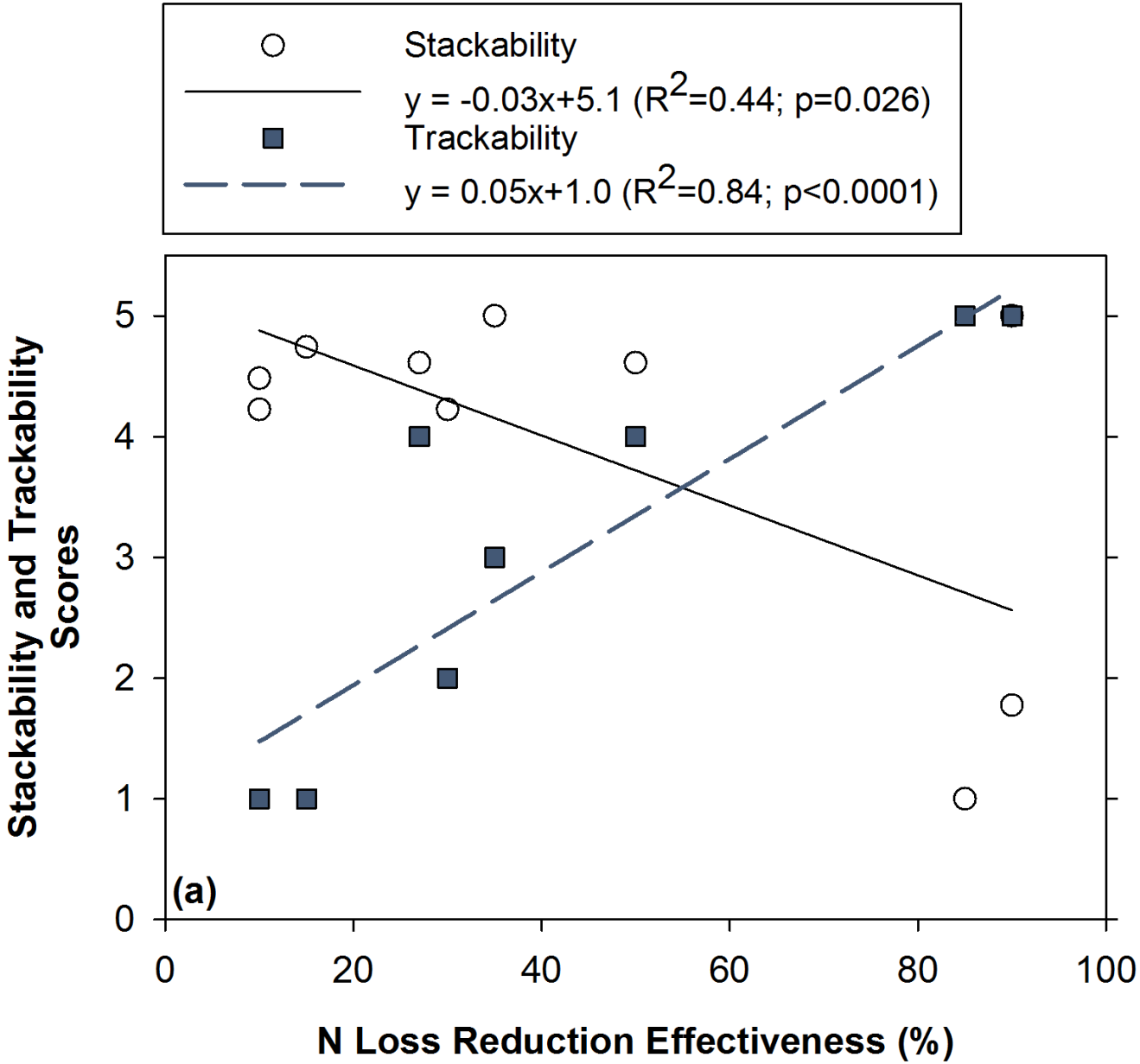

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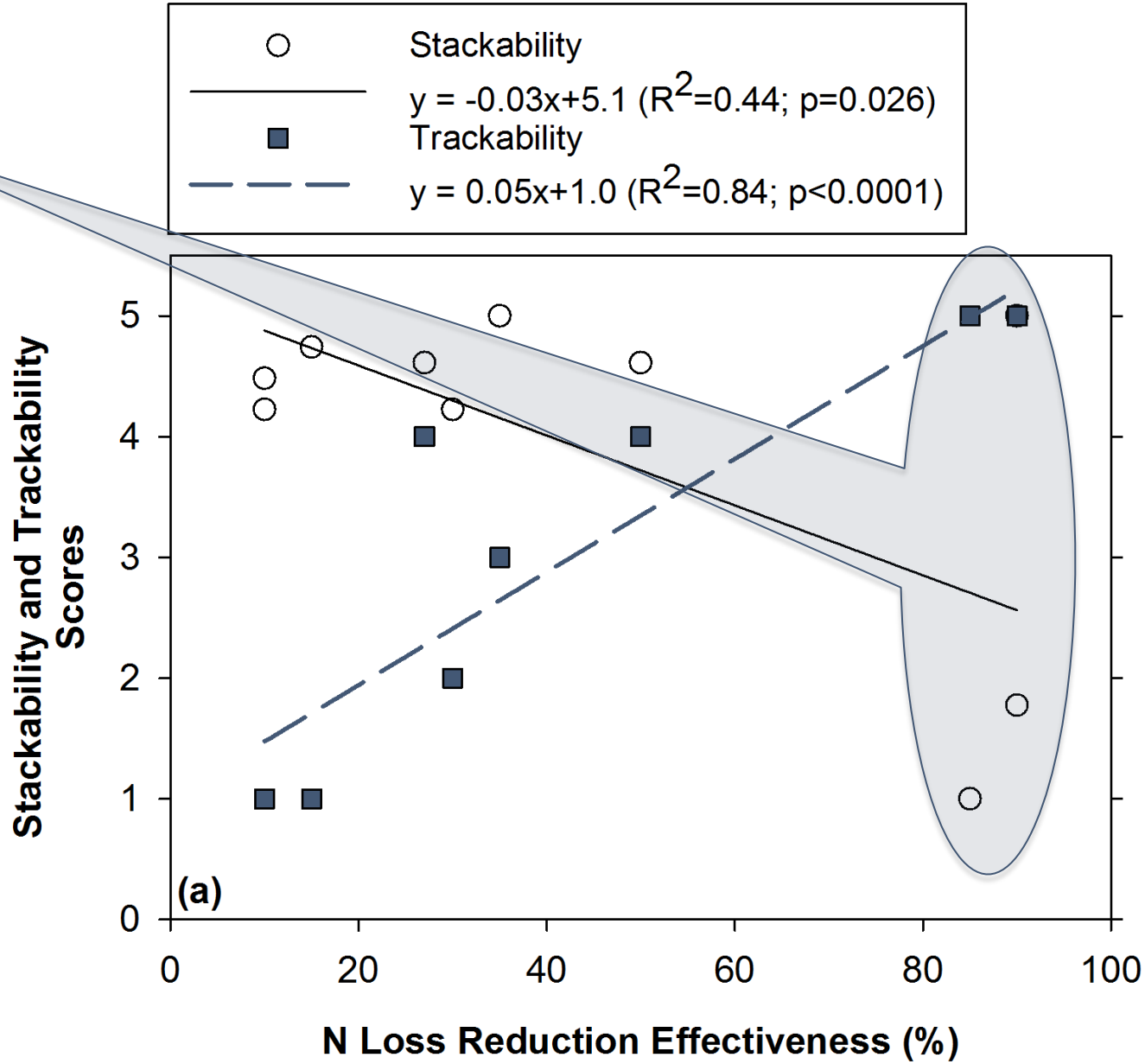

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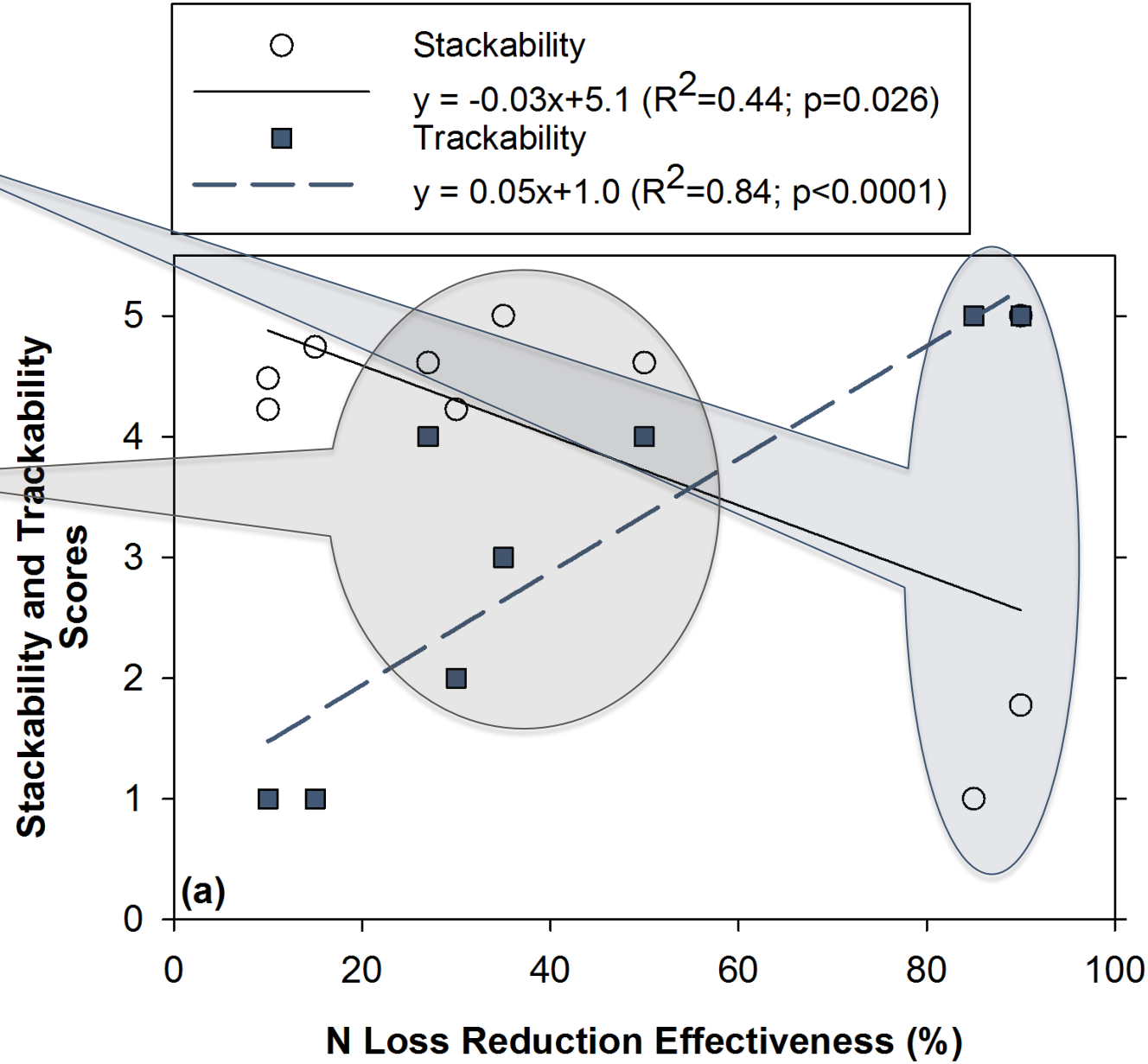

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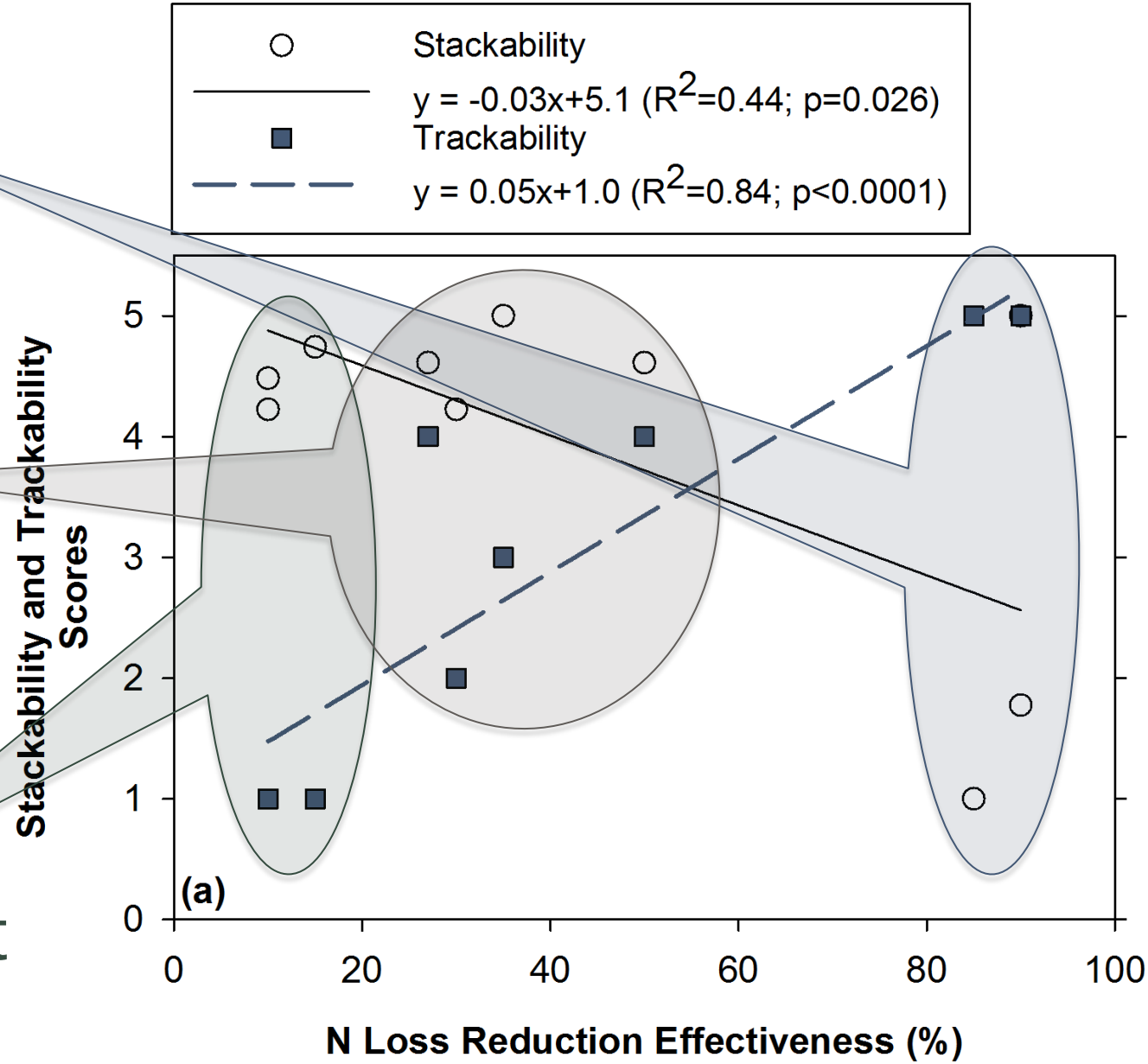

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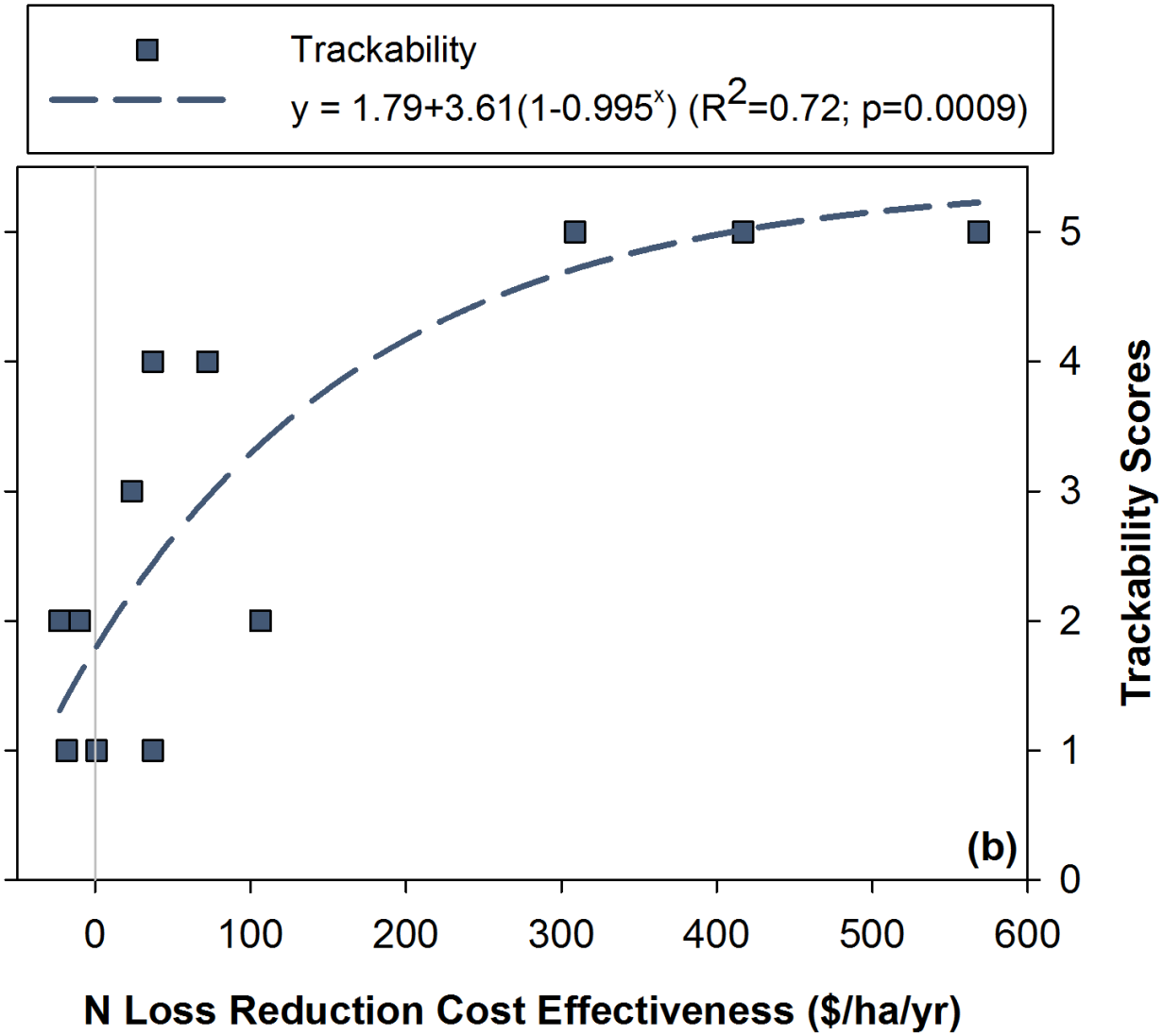

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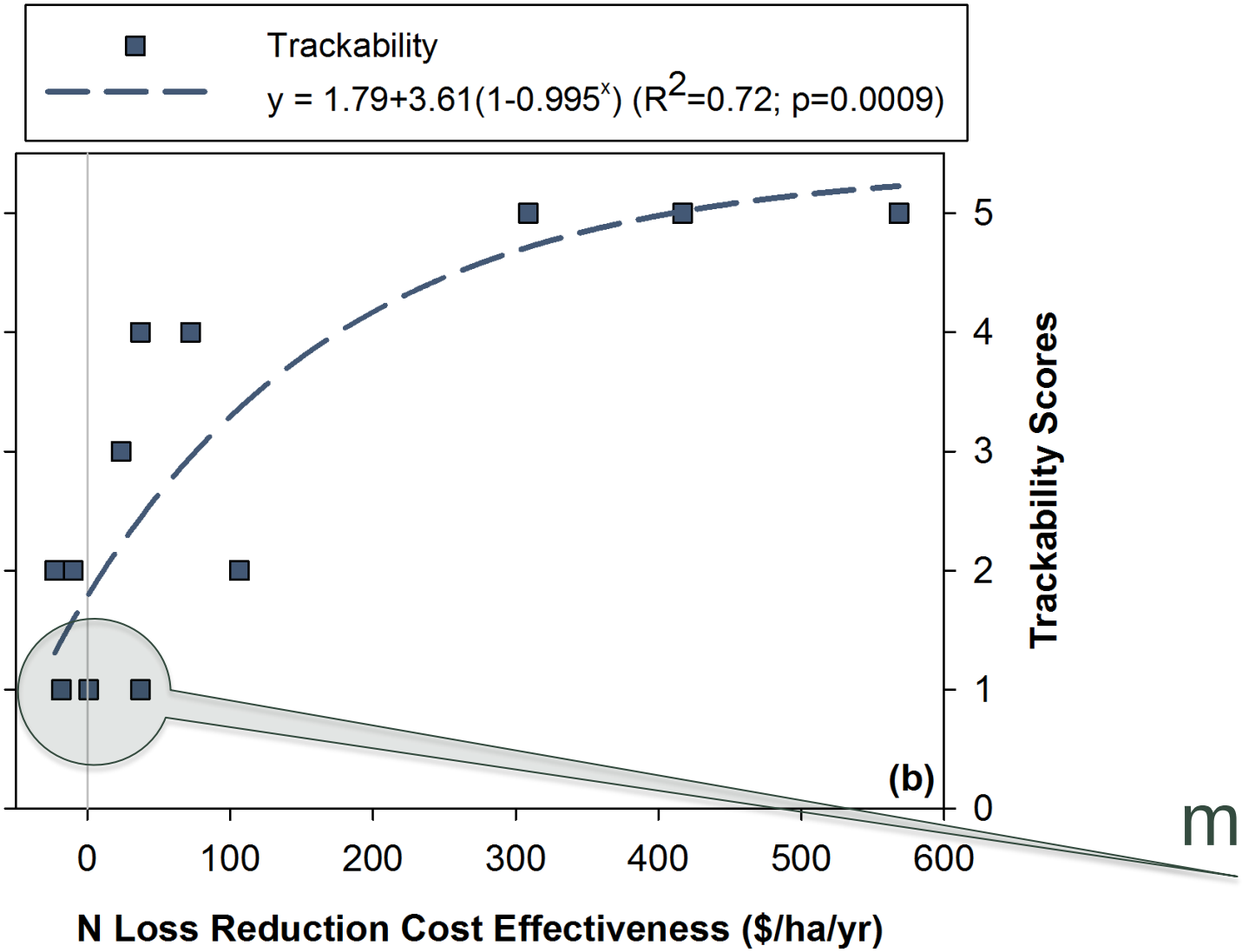

N management practices

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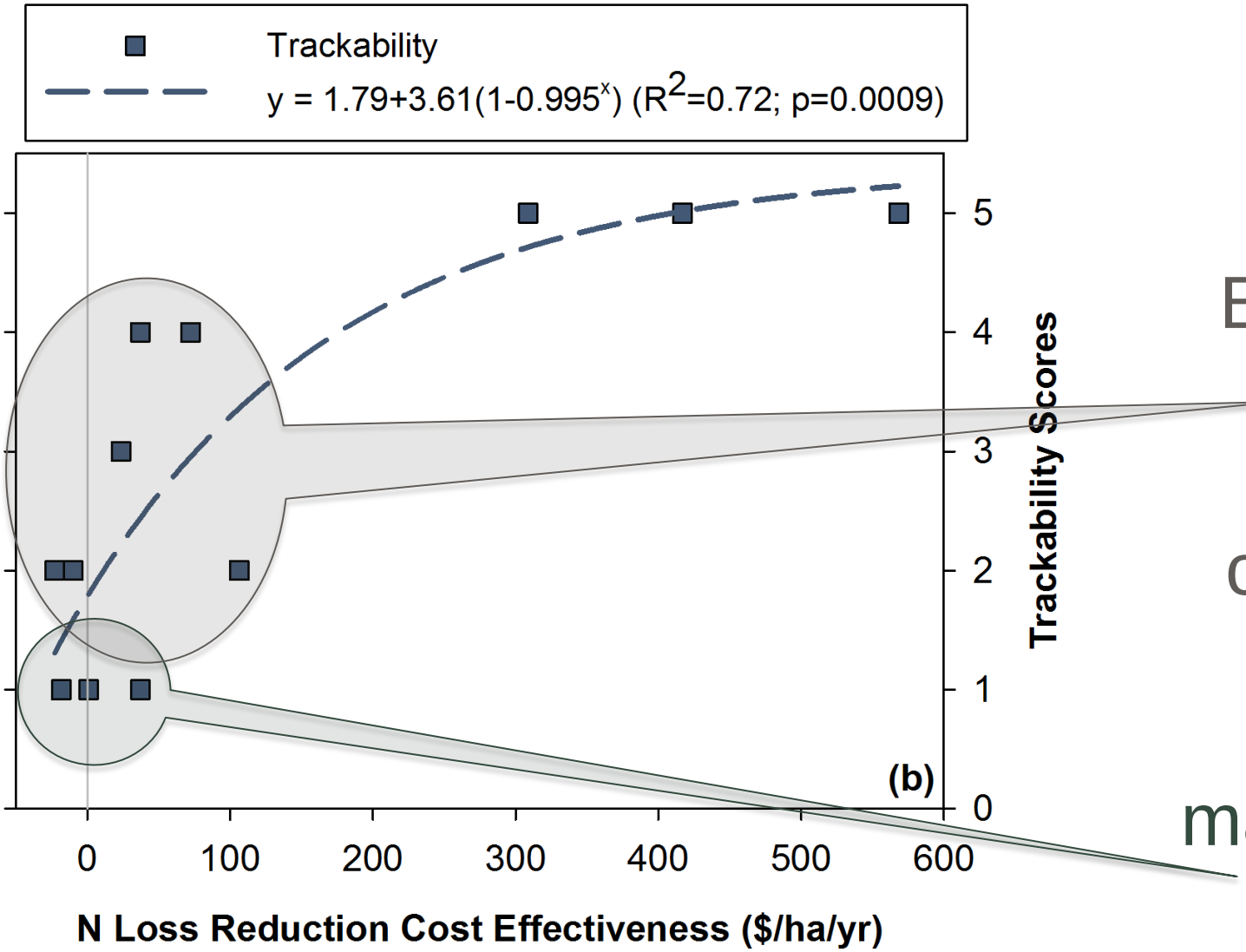

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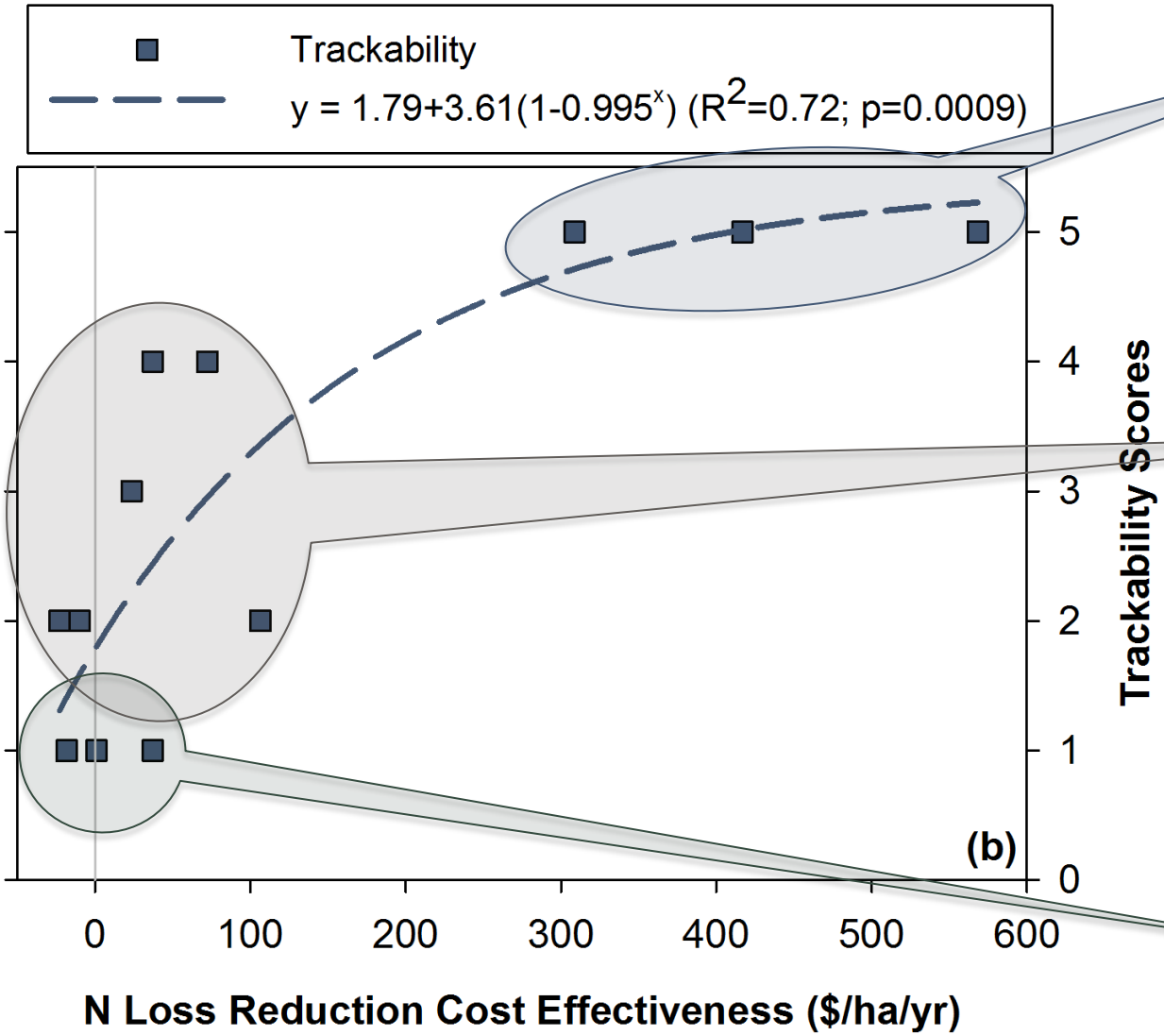

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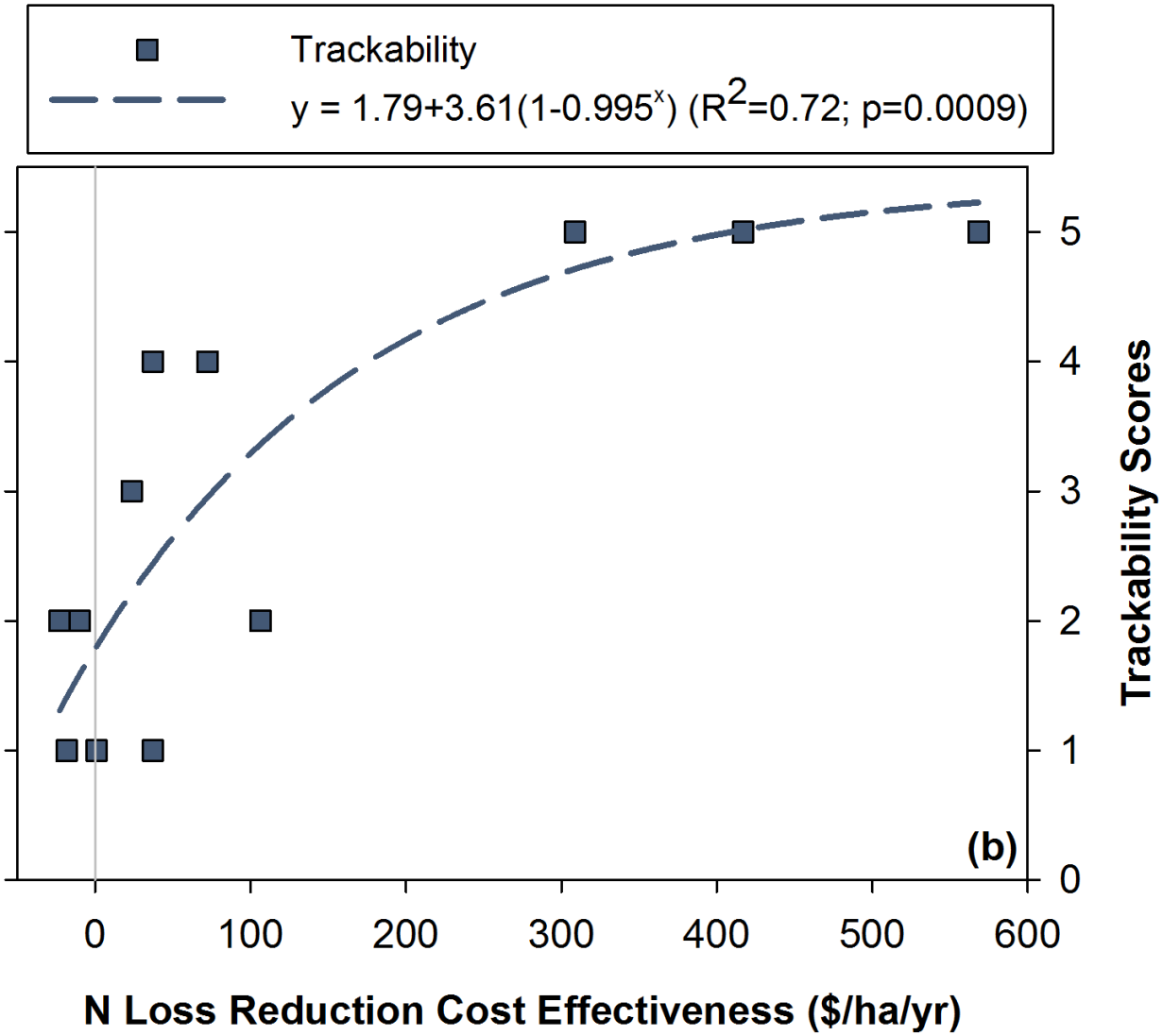

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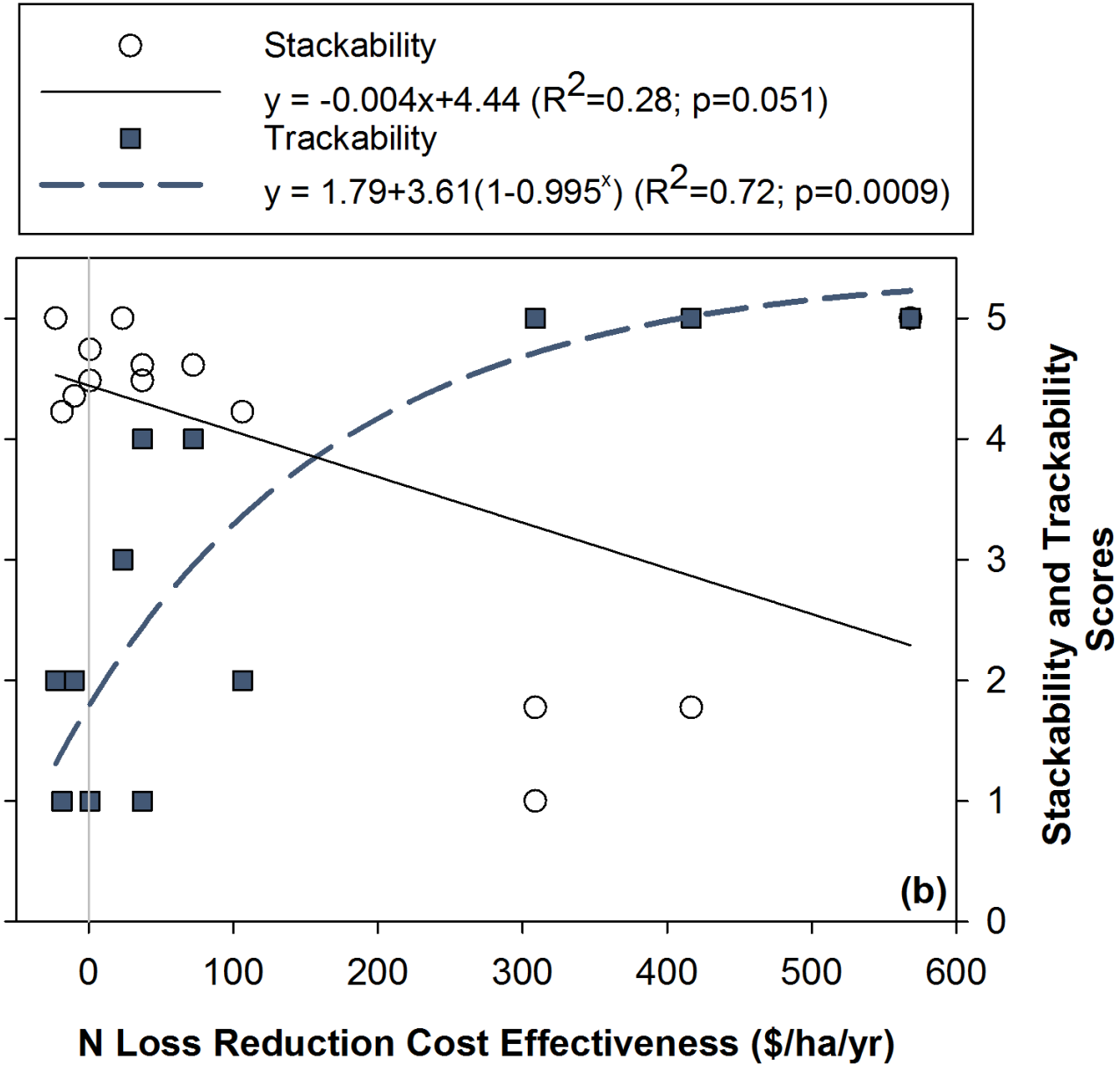

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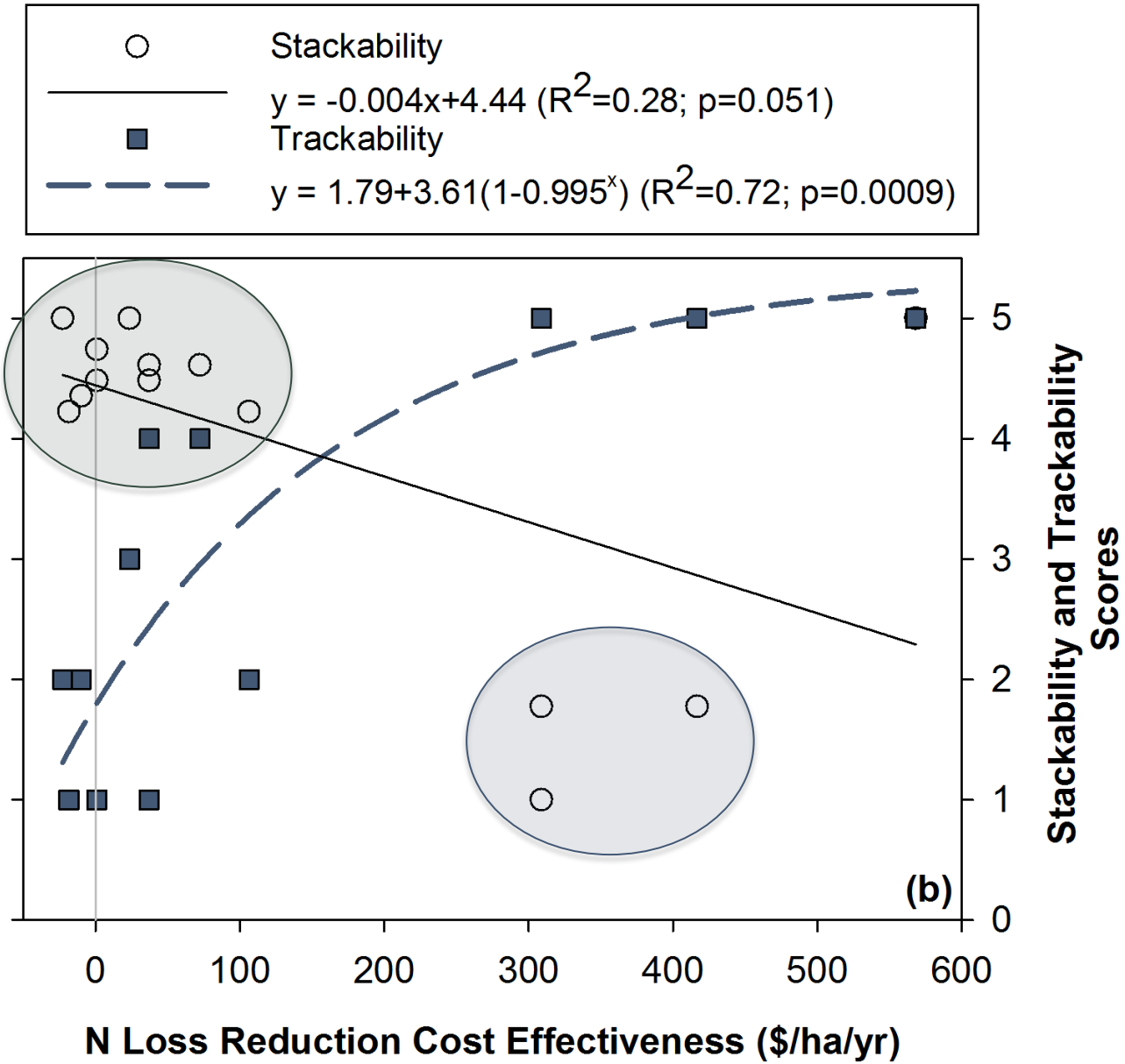

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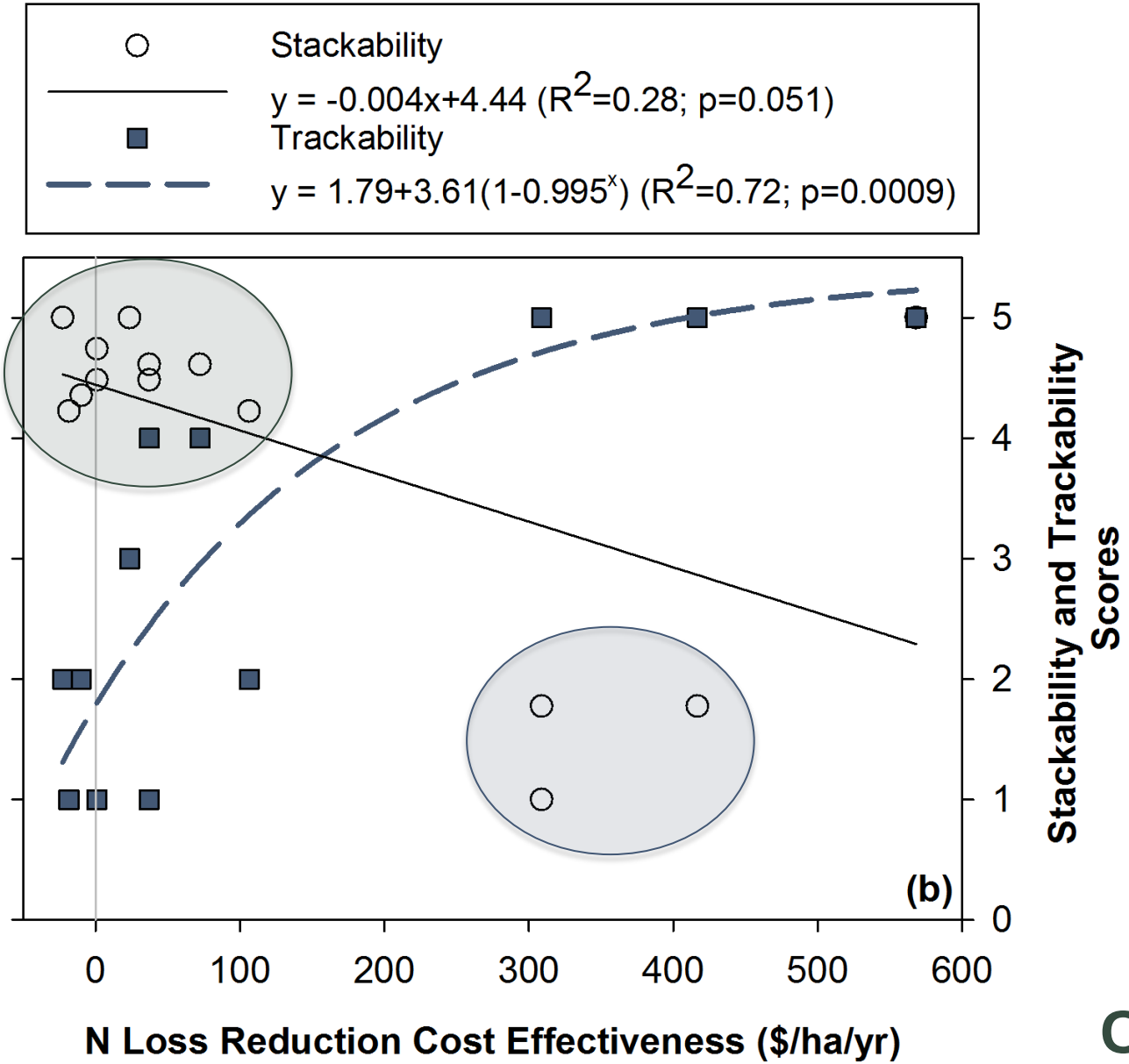

Land use change practices:
very effective, but high cost and not stackable

Can we stack
lower cost practices more cheaply and achieve similar loading reductions?

Can we track that?

Christianson et al., In Press

FOOD FOR THOUGHT

- Would stacking practices provide the most cost effective use of conservation dollars without difficult wholesale production system changes?
  - GAP: What are the trade-offs and/or synergies between stacked practices?
- The potential benefit of tracking relatively less effective practices accurately will need to outweigh the resources required to implement other practices.

Key Take-Aways

- The approach of doing a science assessment has been validated across the river basin.
- Aspects of the Illinois science assessment have been corroborated by the other science assessments.

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Research article

Beyond the nutrient strategies: Common ground to accelerate agricultural water quality improvement in the upper Midwest

Reid Christianson[a,*], Laura Christianson[b], Carol Wong[c], Matthew Helmers[d], Gregory McIsaac[e], David Mulla[f], Moira McDonald[g]

Practice	Trackability	Stackability	Production System Change
Maximum Return to N Application Rate	1.0	4.2	1.0
Nitrification Inhibitor	1.0	4.5	1.0
N Management	1.0	4.7	1.0
Phosphorus Banding	1.0	4.5	1.0
Conservation Tillage	2.0	4.4	3.0
Cover Crops	2.0	4.2	3.0
Soil Test P	2.0	5.0	1.0
Controlled Drainage	3.0	5.0	2.5
Bioreactor	4.0	4.6	2.0
Wetland	4.0	4.6	4.0
Buffer	5.0	5.0	3.5
Grazed Pasture/Hayland	5.0	1.8	4.5
Perennial Energy Crops	5.0	1.8	4.5
Land Retirement	5.0	1.0	5.0

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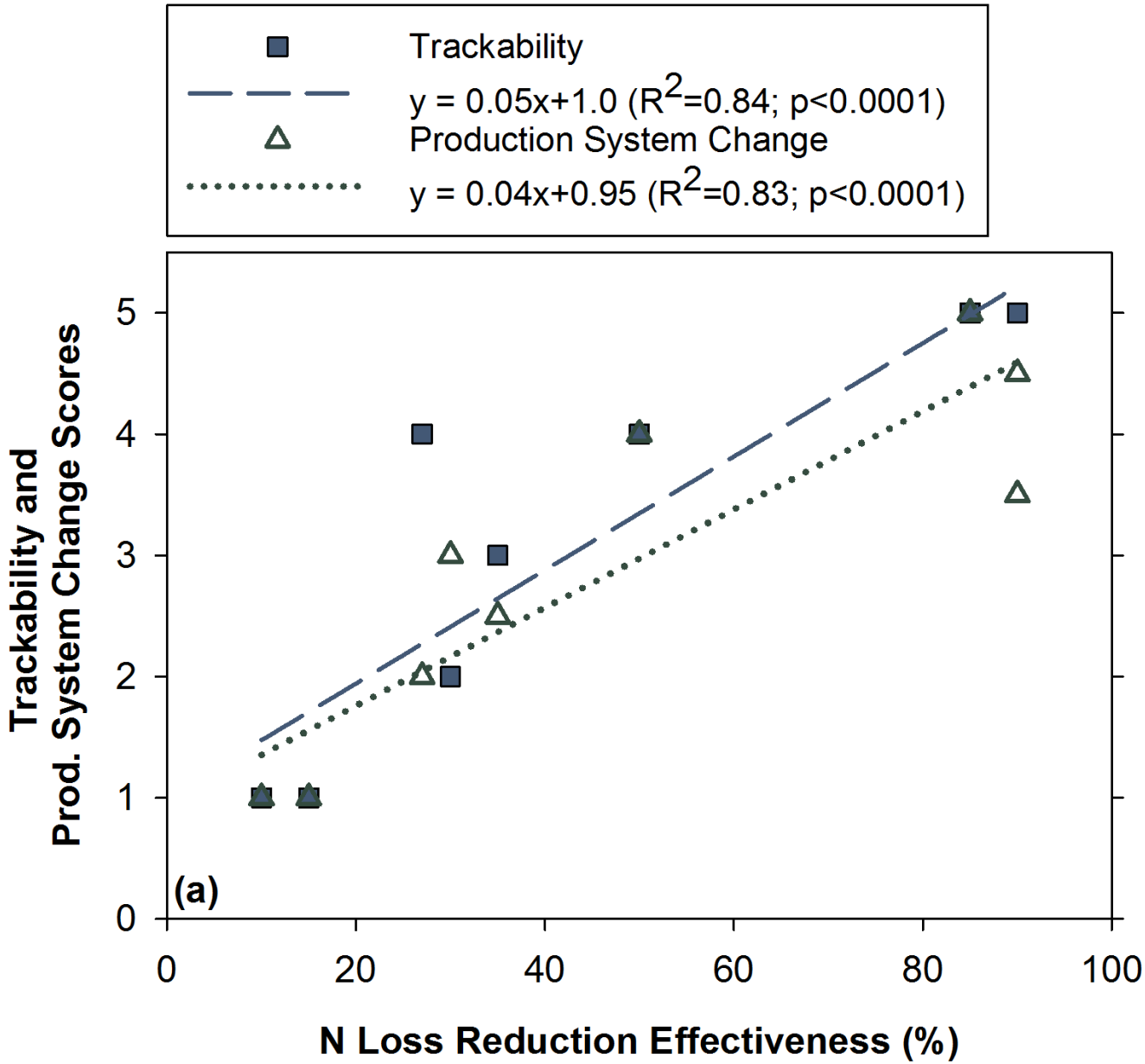

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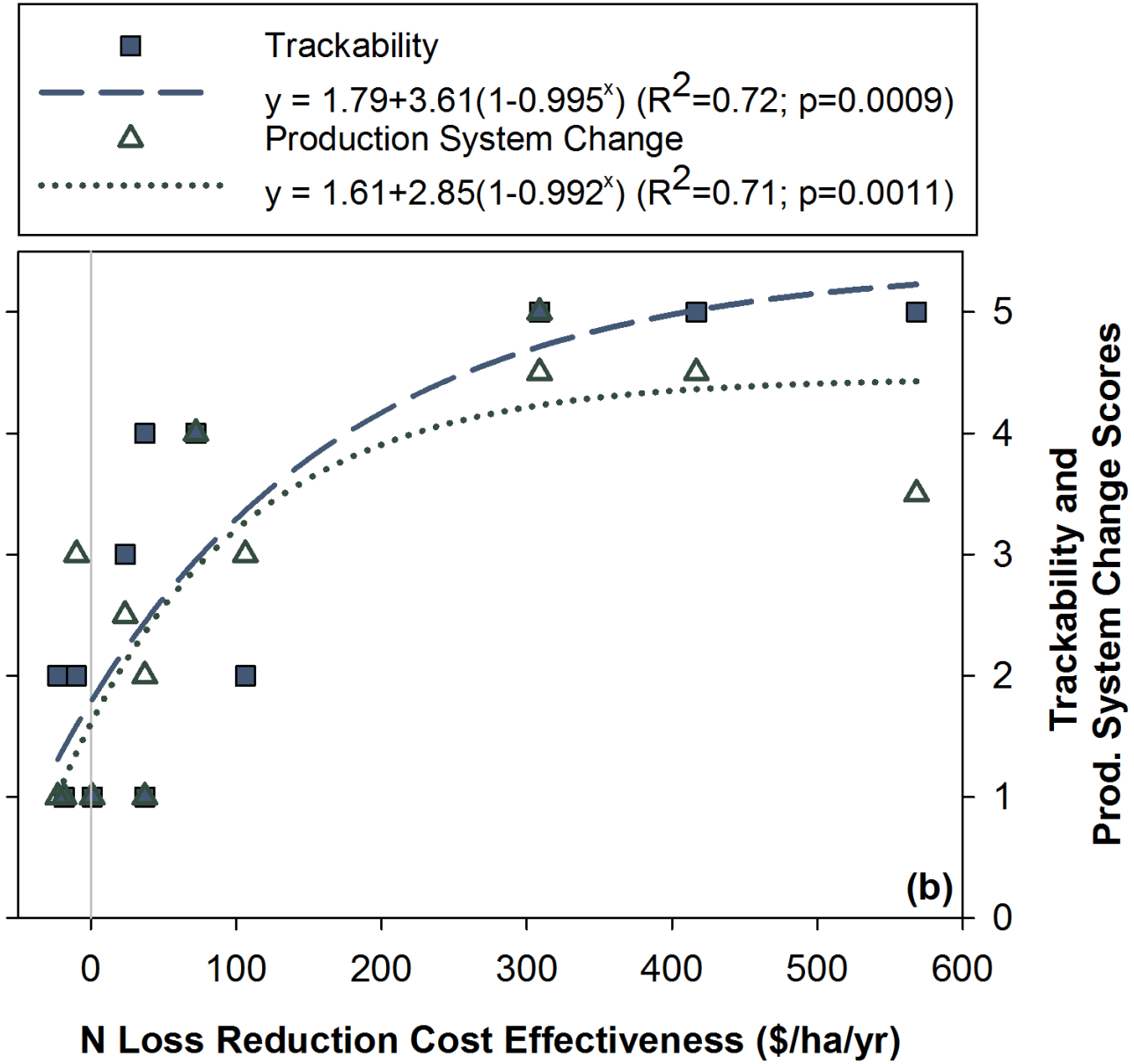

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SERA 46 Shared Priorities

State Nutrient Reduction Strategies

Wes Burger, Mississippi State University

MISSISSIPPI STATE UNIVERSITY
MS AGRICULTURAL AND FORESTRY EXPERIMENT STATION

Illinois Nutrient Loss Reduction Strategy Conference
Springfield IL – 11-27-2017

SERA 46 –*A Framework for Nutrient Reduction Strategy Collaboration: the Role for Land Grant Universities*

Who are we?

- Fall 2012 HTF meeting idea of HTF-LGU collaboration initiated
- Small working group assembled to more fully develop concept
- Spring 2013 HTF meeting idea of HTF-LGU collaboration articulated in white paper
- Summer 2013 non-funded cooperative agreement crafted
- Coordination needs identified at HTF Fall 2013 meeting and in follow-up conversations with HTF Coordinating Council members
- HTF-LGU Cooperative Agreement signed and executed
- Conference call Winter 2014 determined that Multistate Extension and Research Activity (ERA) appropriate organizational structure.

Extension Research Activity (ERA, SERA, NCERA)

- Formal USDA-NIFA multistate structure designed to promote multistate, integrated Research & Extension activities.
- Are intended to bring together researchers and extension specialists sharing a common problem, issue, or disciplinary interest.
- The general objective is to provide a functionally integrated forum to coordinate joint activities to address stakeholder needs.
- Approved by Experiment Station and Extension Directors and NIFA
- Overseen by Administrative Advisor
- Standardized reporting to USDA-NIFA

SERA Organizational Efforts

- 1/2014 – Southern and North Central leadership appoints SERA 46 leadership (Burger and Schmidt)
- Directors of Experiment Stations and Extension assign LGU participants
- 04/28/2014 – Inaugural organizational meeting, Atlanta Georgia
  - Attended by representatives from 10 LGUs, NC and S Regional directors, Administrative Advisors
  - Developed draft objectives and assigned writing teams
  - Timeline and assignments

SERA Goals/Objectives

1. **Establish and strengthen relationships that can serve the missions of multiple organizations addressing nutrient management and environmental quality.**
   a. Support regular communication and collaboration among LGUs, HTF members, and other partners to strengthen multi-state approaches regarding agricultural and environmental research and outreach
   b. Encourage intrastate interactions between state agencies, universities and others to meet state-level nutrient reduction goals
   c. Leverage the synergy of the HTF-LGU relationship to seek/secure funding to support multistate initiatives that address HTF goals

SERA Goals/Objectives

2. **Strengthen the knowledge base for discovery of new tools and practices as well as for the continual validation of recommended practices.**
   a. Strengthen the science base that informs our understanding of the costs, benefits, and efficacy of nutrient management strategies at multiple temporal and spatial scales.
   b. Develop and refine appropriate nutrient decision support tools for better decision-making
   c. Promote environmental assessment research to improve water and atmospheric quality

SERA Goals/Objectives

3. **Improve the coordination and delivery of educational programming and increase implementation effectiveness of nutrient management strategies that reduce nutrient movement for agricultural and non-agricultural audiences.**
   a. Exchange across states information about model education and outreach programs that improve adoption of conservation practices and enhance nutrient use efficiency.
   b. Within states, collaborate with HTF member agencies and other stakeholders to address outreach and education priorities
   c. Engage farmers in producer-led watershed projects and on-farm research and demonstration to increase the adoption and effectiveness of nutrient management strategies.
   d. Engage producer groups and Ag industry (CCAs, Trusted Advisors, Ag consultants) to develop and implement effective nutrient management strategies.

Priorities for Collaborative Work – May 2015

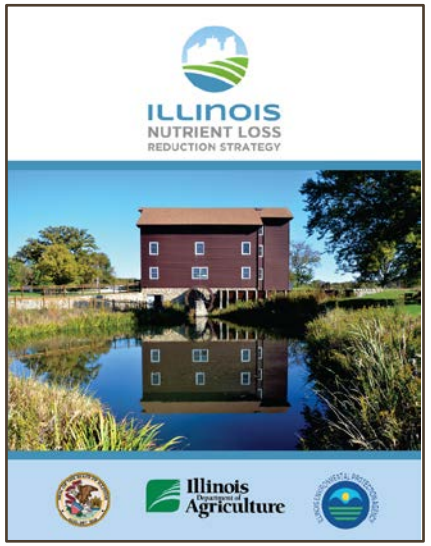
1. Strengthening Networks
2. Conservation Systems Research and Outreach
3. Monitoring, Calibration, and Validation

Strengthening Networks

1. …
2. …
3. …
4. …
5. ***Identify common attributes and gaps across state nutrient reduction strategies - Review the HTF states' nutrient reduction strategies to identify the state goals, approaches and common attributes. Highlight opportunities for cross state information sharing to enhance other HTF state strategies.***

State Nutrient Frameworks

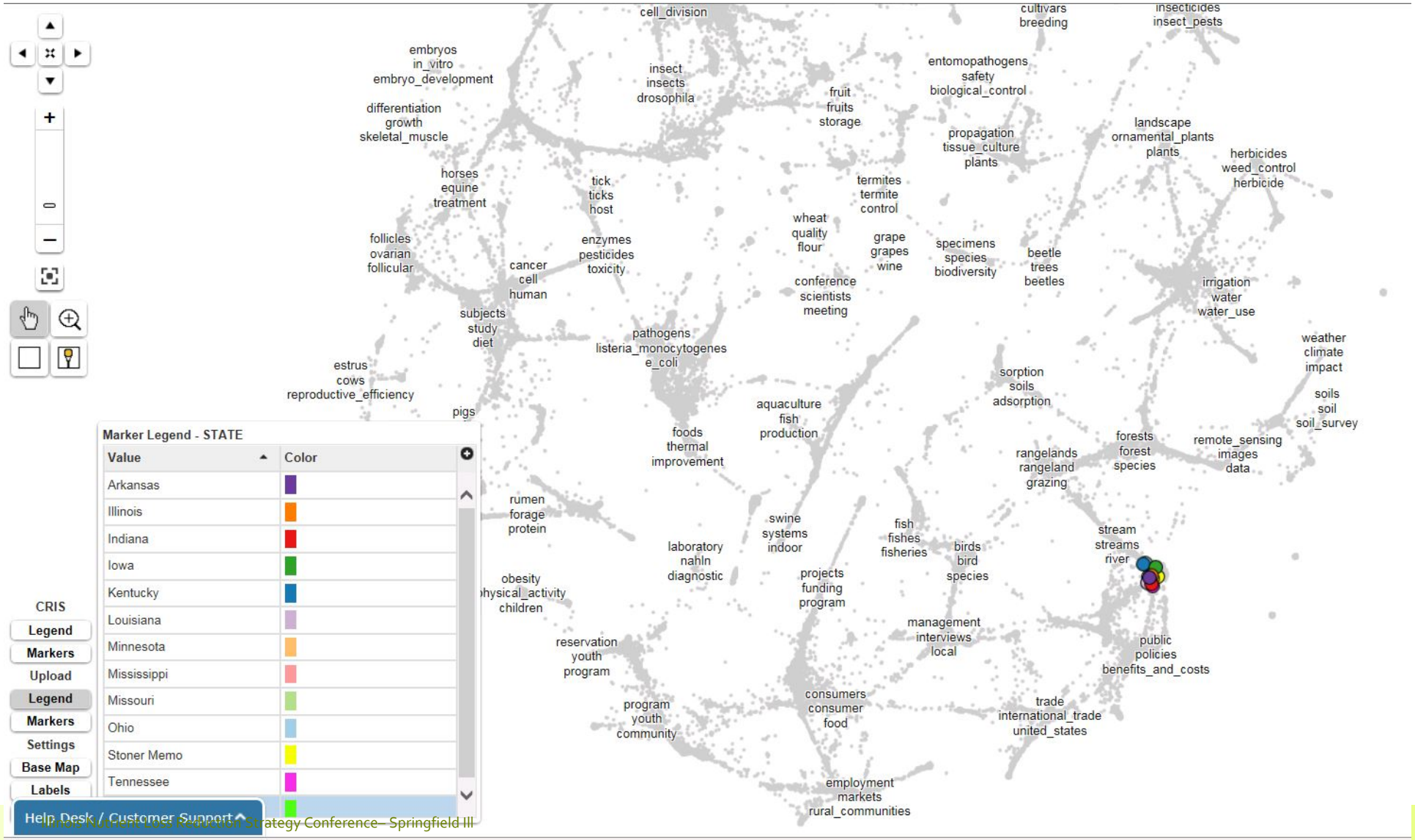
- Current Versions dated 2012 – 2015 (IL = 2015)
- Initial versions dated 2009 – 2015
- All states recognized frameworks as living documents to be periodically revised
- 4 states had released 1 or more revisions to initial framework
- Planned revision cycle varied from unstated to 5 years (IL = 5)



Ray Knighton, USDA-ARS Pushgraph Analysis of State Nutrient Strategies

State	Title	Top Concept #	% of Document Described by Concept Words	Top Concept Words	2nd Concept #	% of Document Described by Concept Words	2nd Concept Words	Third Concept #	% of Document Described by Concept Words	Third Concept Words
Indiana	INDIANA NUTRIENT REDUCTION STRATEGY	19	11.591	swcds swcd crep rule indiana directed tasks cwa board wabash	31	6.955	reduce water_quality monitoring epa nutrient watersheds develop specific address including	28	6.525	nutrients waters areas streams nutrient_management existing plans plan permit project
Kentucky	Kentucky Nutrient Management Strategy	21	13.922	kentucky reservoir wadeable macroinvertebrate usace highland atmosphere tactic ecoregion triennial	31	5.823	reduce water_quality monitoring epa nutrient watersheds develop specific address including	11	5.639	phosphorus practices sources include local loads goals efforts framework national
Arkansas	STATE OF ARKANSAS NUTRIENT REDUCTION STRATEGY	17	13.317	arkansas nutrient_impacts evaluated advanced understood reason treatment_systems creek remains expand	31	6.728	reduce water_quality monitoring epa nutrient watersheds develop specific address including	11	6.672	phosphorus practices sources include local loads goals efforts framework national
Wisconsin	Wisconsin's Nutrient Reduction Strategy	6	15.154	creek extrapolated fox apple honey yahara wpdes adm pine yellow	45	14.955	wisconsin cth pecatonica sth eau lake_michigan pigeon hwy decile headwaters	28	4.444	nutrients waters areas streams nutrient_management existing plans plan permit project
Ohio	Ohio Nutrient Reduction Strategy	2	11.04	ohio lake_erie trophic maumee odnr agri director cso ohios check	28	4.164	nutrients waters areas streams nutrient_management existing plans plan permit project	31	4.123	reduce water_quality monitoring epa nutrient watersheds develop specific address including
Tennessee	Tennessee Nutrient Reduction Framework	26	13.162	tennessee watersheds enrichment attachment precision_agriculture factor tdec ut_extension engage tda	31	5.294	reduce water_quality monitoring epa nutrient watersheds develop specific address including	28	4.702	nutrients waters areas streams nutrient_management existing plans plan permit project
Mississippi	Mississippis Strategies to Reduce Nutrients and Associated Pollutants	27	17.519	characterization mississippis responses growers mdeq federation sustainable case_studies assessing maintain	31	7.629	reduce water_quality monitoring epa nutrient watersheds develop specific address including	28	6.471	nutrients waters areas streams nutrient_management existing plans plan permit project
Louisiana	Louisiana Nutrient Management Strategy	22	8.733	ldeq efotg louisianas assimilation master_farmer lsu agcenter force practices ldnr	37	8.604	louisiana irrigation_water forests rouge master ouachita ldaf accessed milestones lpdes	23	5.611	coastal health_and crossing shade consultants continuing_education administration conveyance stabilize geosyntec
Minnesota	The Minnesota Nutrient Reduction Strategy	36	9.08	minnesota bwsr rim lake_superior winnipeg forage node metric chesapeakestat fwmc	13	4.255	nrs success mpca mda streambank_erosion populations feedlot mitigation barr web	9	3.888	chapter dnr geographic fertilizer_use programmatic cedar enable coordination files feedlots
Missouri	Missouri Nutrient Loss Reduction Strategy	42	6.913	grazing_management washington_dc csr omw bioretention bulletin senior springfield integrated_planning permeable_pavement	34	6.189	missouri nutrient_loss missouris swcp nutrient_monitoring precision environmental_engineering erosion agron pastureland	50	3.878	strips alexander smith forage brown supply documentation runoff_water revolving marb
Stoner Memo	Working in Partnership with States to Address Phosphorus and Nitrogen Pollution through Use of a Framework for State Nutrient Reductions	3	17.191	strategy reduction development programs agricultural usda management permits priority system	31	15.618	reduce water_quality monitoring epa nutrient watersheds develop specific address including	11	14.494	phosphorus practices sources include local loads goals efforts framework national
Illinois	Illinois Nutrient Loss Reduction Strategy	7	11.043	illinois nutrient_loss mlra rusle gentry chicago interpolation eroding pass lake	16	4.986	drained scenario nitrogen amount alfalfa annualized energy_crops price rotations mrtn	31	4.634	reduce water_quality monitoring epa nutrient watersheds develop specific address including
Iowa	IOWA NUTRIENT REDUCTION STRATEGY A science and technology-based framework to assess and reduce nutrients to Iowa waters and the Gulf of Mexico	46	10.589	science_and_technology treatments plots mallarino sawyer mlra rye rent activated_sludge p_index	16	6.676	drained scenario nitrogen amount alfalfa annualized energy_crops price rotations mrtn	10	6.168	stp assess in_field sharpley thesis terraces beef root_zone missouri schultz

Ray Knighton, USDA-ARS
Pushgraph Analysis State Nutrient Strategies
in the space of nutrient/water quality projects in CRIS database



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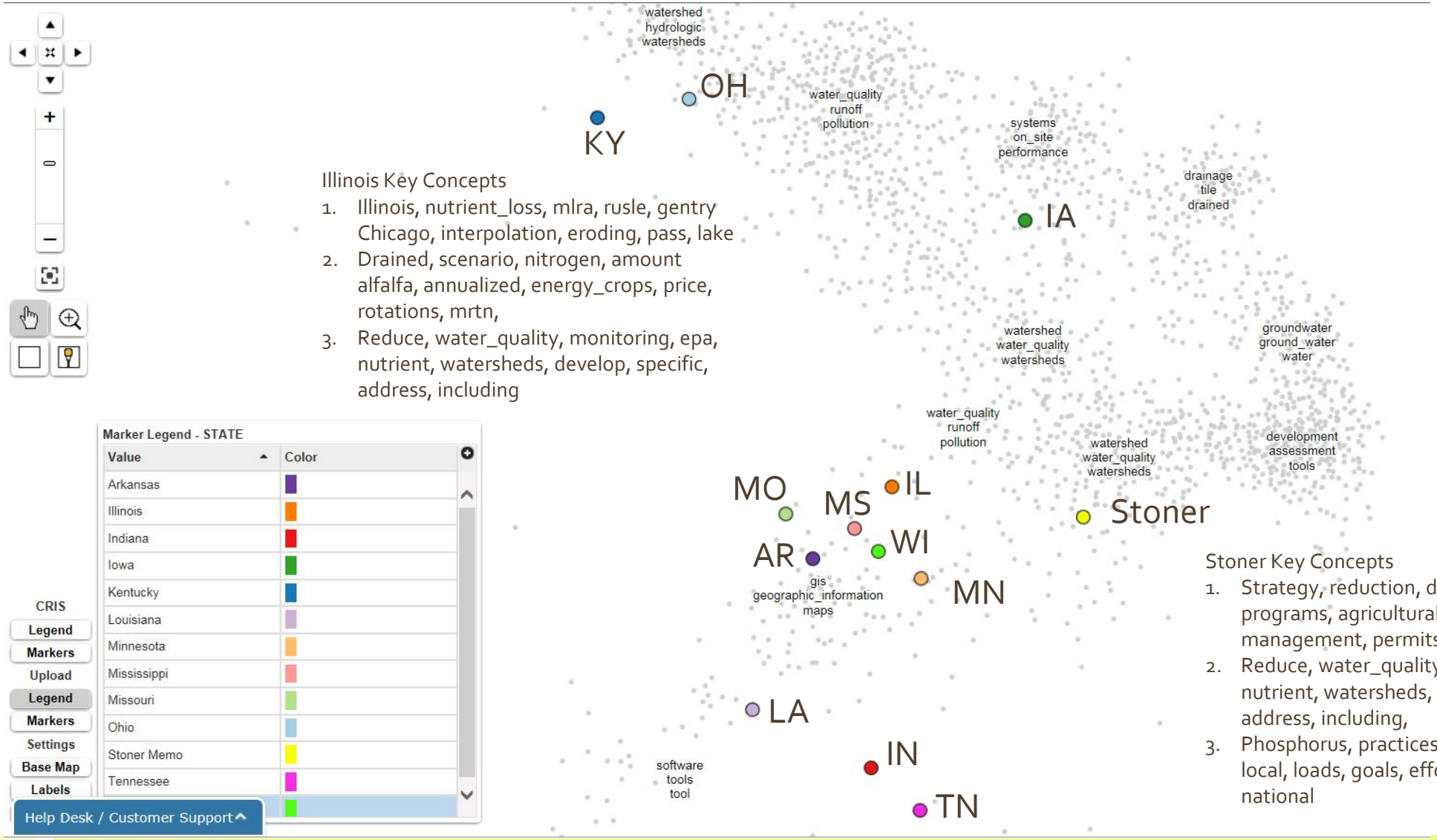


Illinois Key Concepts

1. Illinois, nutrient_loss, mlra, rusle, gentry Chicago, interpolation, eroding, pass, lake
2. Drained, scenario, nitrogen, amount alfalfa, annualized, energy_crops, price, rotations, mrtn,
3. Reduce, water_quality, monitoring, epa, nutrient, watersheds, develop, specific, address, including

Stoner Key Concepts

1. Strategy, reduction, development, programs, agricultural, usda, management, permits, priority system
2. Reduce, water_quality, monitoring, epa, nutrient, watersheds, develop, specific, address, including,
3. Phosphorus, practices, sources, include, local, loads, goals, efforts, framework, national

Stoner Memo – 8 Elements, 20 sub-elements

- **Prioritize watersheds on a statewide basis for nitrogen and phosphorus loading reductions**
  - Use best available information to estimate Nitrogen (N) & Phosphorus (P) loadings in all major watersheds at HUC 8 scale.
  - Identify major watersheds that individually or collectively account for a substantial portion of loads.
  - Within each major watershed that has been identified as accounting for the substantial portion of the load, identify targeted/priority sub-watersheds on a HUC 12 or similar scale to implement targeted N & P load reduction activities.
- **Set watershed load reduction goals based upon best available information.**
  - Establish numeric goals for loading reductions for each targeted/priority sub-watershed (HUC 12 or similar scale) that will collectively reduce the majority of N & P loads from the HUC 8 major watersheds.
- **Ensure effectiveness of point source permits in targeted/priority sub-watersheds for:**
  - Municipal and Industrial Wastewater Treatment Facilities that contribute to significant measurable N & P loadings;
  - All Concentrated Animal Feeding Operations (CAFOs) that discharge or propose to discharge; and/or
  - Urban Stormwater sources that discharge into N & P-impaired waters or are otherwise identified as a significant source.
- **Agricultural Areas**
  - In partnership with Federal and State Agricultural partners, NGOs, private sector partners, landowners, and other stakeholders, develop watershed-scale plans that target the most effective practices where they are needed most.
  - Look for opportunities to include innovative approaches, such as targeted stewardship incentives, certainty agreements, and N & P markets, to accelerate adoption of agricultural conservation practices.
  - Also, incorporate lessons learned from other successful agricultural initiatives in other parts of the country.
- **Storm water and Septic systems**
  - Identify how the State will use state, county and local government tools to assure N and P reductions from developed communities not covered by the Municipal Separate Storm Sewer Systems (MS4) program, including an evaluation of minimum criteria for septic systems, use of low impact development/ green infrastructure approaches, and/or limits on phosphorus in detergents and lawn fertilizers.
- **Accountability and verification measures**
  - Identify where and how each of the tools identified in sections 3, 4 and 5will be used within targeted/priority sub-watersheds to assure reductions will occur.
  - Verify that load reduction practices are in place.
  - To assess/demonstrate progress in implementing and maintaining management activities and achieving load reductions goals:
    - establish a baseline of existing N & P loads and current Best Management Practices (BMP) implementation in each targeted/priority sub-watershed,
    - conduct ongoing sampling and analysis to provide regular seasonal measurements of N & P loads leaving the watershed,
    - and provide a description and confirmation of the degree of additional BMP implementation and maintenance activities.
- **Annual public reporting of implementation activities and biannual reporting of load reductions and environmental impacts associated with each management activity in targeted watersheds**
  - Establish a process to annually report for each targeted/priority sub-watershed: status, challenges, and progress toward meeting N & P loading reduction goals, as well as specific activities the state has implemented to reduce N & P loads such as:
    - reducing identified practices that result in excess N & P runoff and documenting and verifying implementation
    - and maintenance of source-specific best management practices.
  - Share annual report publically on the state's website with request for comments and feedback for an adaptive management approach to improve implementation, strengthen collaborative local, county, state, and federal partnerships, and identify additional opportunities for accelerating cost effective N & P load reductions.
- **Develop work plan and schedule for numeric criteria development**
  - Establish a work plan and phased schedule for N and P criteria development for classes of waters (e.g., lakes and reservoirs, or rivers and streams).
    - The work plan and schedule should contain interim milestones including but not limited to data collection, data analysis, criteria proposal, and criteria adoption consistent with the Clean Water Act.
    - A reasonable timetable would include developing numeric N and P criteria for at least one class of waters within the state (e.g., lakes and reservoirs, or rivers and streams) within 3-5 years (reflecting water quality and permit review cycles), and completion of criteria development in accordance with a robust, state-specific workplan and phased schedule.

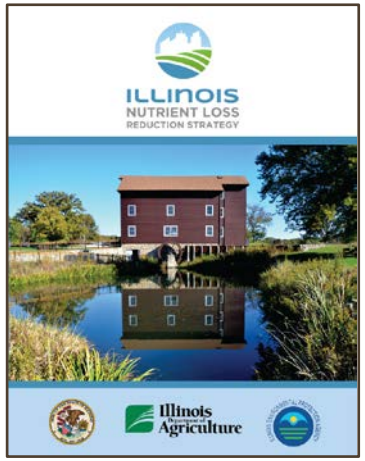
Guiding Principles

- Most plans referenced some set of guiding principles or values
- Ranged from 0 – 10, mean = 5 (IL = 6)
- 8 of 12 sets of overarching principles were some derivation of the HTF/GOMA principles:
  - Encourage voluntary, incentive-based, practical, cost effective actions.
  - Use existing programs.
  - Follow adaptive management.
  - Identify additional funds needed and sources.
  - Identify opportunities for innovative, market-based solutions.
  - Use collaborative teams of stakeholders, resource management agencies, regulatory agencies, NGOS, universities, etc
  - Emphasize local watershed nutrient reductions ad water quality improvements which provide cumulative regional benefits

Guiding Principles - Illinois

Six overarching principles as guidance for reaching these goals:

- Encourage actions that are voluntary, incentive-based, practical, and cost-effective.
- Use existing programs, including state and federal regulatory mechanisms.
- Follow adaptive management strategies.
- Identify additional funding needs and sources during the annual agency budget processes.
- Identify opportunities for and potential barriers to innovative and market-based solutions.
- Provide measurable outcomes.



Partnerships

- Lead agencies included:
  - State pollution control agencies (9 states) (ILL – Illinois EPA)
  - State Departments of Agriculture (2 states)
  - Coastal Protection and Restoration Authority (1 state)
- Mean number of partners = 14.8 (1 – 49)
  - Illinois – 22 Partners
    - Federal – 1
    - State – 7
    - University – 1
    - NGO - 14
- Partners included:
  - Other state agencies
  - Federal agencies
  - Universities
  - NGOs
  - Commodity groups
- Stakeholder engagement in process (11 of 12 states)

Science Assessments

- 6 of 12 states conducted detailed science assessments characterized by:
  - ✓ Statewide nutrient loading models (6 of 6)
  - ✓ BMP-specific opportunities and load reductions (3 of 6)
  - ✓ Representative alternative scenarios of BMP combinations (3 of 6)
  - ✓ Economic costs/benefits of BMPs and BMP combinations under alternative scenarios (3 of 6)

Framework Elements – Prioritize watersheds

- ✓ **Clear Process for prioritizing – (8 of 12 states)**
- ✓ **Scales**
  - **HUC 8 – (7 of 12 states)**
  - **HUC 8 and HUC 12 – (2 of 12 states)**
  - **HUC 8, HUC 10, and HUC 12 – (2 of 12 states)**
  - **HUC 10 – (1 of 12 States)**
- ✓ **Prioritization based on loadings – (12 of 12 states)**
- ✓ **Quantitative basis for ranking – (9 of 12 states)**
- ✓ **Programmatic opportunities included in ranking – (6 of 12 states)**
- ✓ **Number of Priority HUC 8s defined by 8 of 12 states, ranged from 6 – 20 (ILL = 18)**

Set watershed load reduction goals

- ✓ **Establish numeric goals for loading reductions for each targeted/priority sub-watershed (HUC 12 or similar scale) that will collectively reduce the majority of N & P loads from the HUC 8 major watersheds.**
- ✓ 9 of 12 states set numeric load reduction goals, but
  - Often simply 45%, or a stepped goal (e.g. 25% LR by 2025, 45% by 2060)
  - Except for those states that prioritized all HUC 12s within priority HUC 8s, it was not always clear if the HUC 12 load reduction goals would collectively achieve the HUC 8 reduction goal.

Ensure effectiveness of point source permits for:

- ✓ Municipal and industrial WWTF – (12 of 12 states)
- ✓ Concentrated Animal Feeding Operations (10 of 12 States)
- Urban storm water (10 of 12 states)
- Most states referenced an existing regulatory process for PS

Agricultural Areas – NPS

- ✓ Develop watershed plans that target the most effective practices where they are needed (11 of 12 states)
- ✓ Look for innovative opportunities (e.g. targeted incentives, nutrient trading, etc) to accelerate adoption (12 of 12 states).
- Lessons learned from other regions (7 of 12 states)

Storm water and septic systems

- ✓Identify how the State will use state, county and local government tools to assure N and P reductions from developed communities not covered by the Municipal Separate Storm Sewer Systems (MS4) program. (8 of 12 States)

Accountability and verification

- ✓Where and how will tools be used (9 of 12 states)
- ✓Verify that load reduction practices are in place (9 of 12 states)
- ✓Establish baseline of N&P loads and *current BMPs* in each priority watershed (12 of 12 states)
- ✓Conduct ongoing sampling and analysis to provide regular measurements of N&P leaving the watershed (12 of 12 states)
- ✓Additional BMP implementation and maintenance (8 of 12 states)

Annual reporting

- ✓All states had a plan for annual reporting
- ✓Varied substantively in depth and detail.
- ✓Web-based reporting (7 of 12 states)
- Few indicated that watershed scale spatial data would be available.

Numeric Nutrient Criteria

- ✓Work plan and schedule with interim milestones (8 of 12)
- ✓Reasonable timetable for development of N&P criteria for at least one class of waters (8 of 12)
- Responses on numeric criteria varied from:
  - "it can't be done"
  - "We ain't gonna do it"
  - "We have already done it"