4R Stewardship Research Initiative

Fluid Forum, February 17, 2015

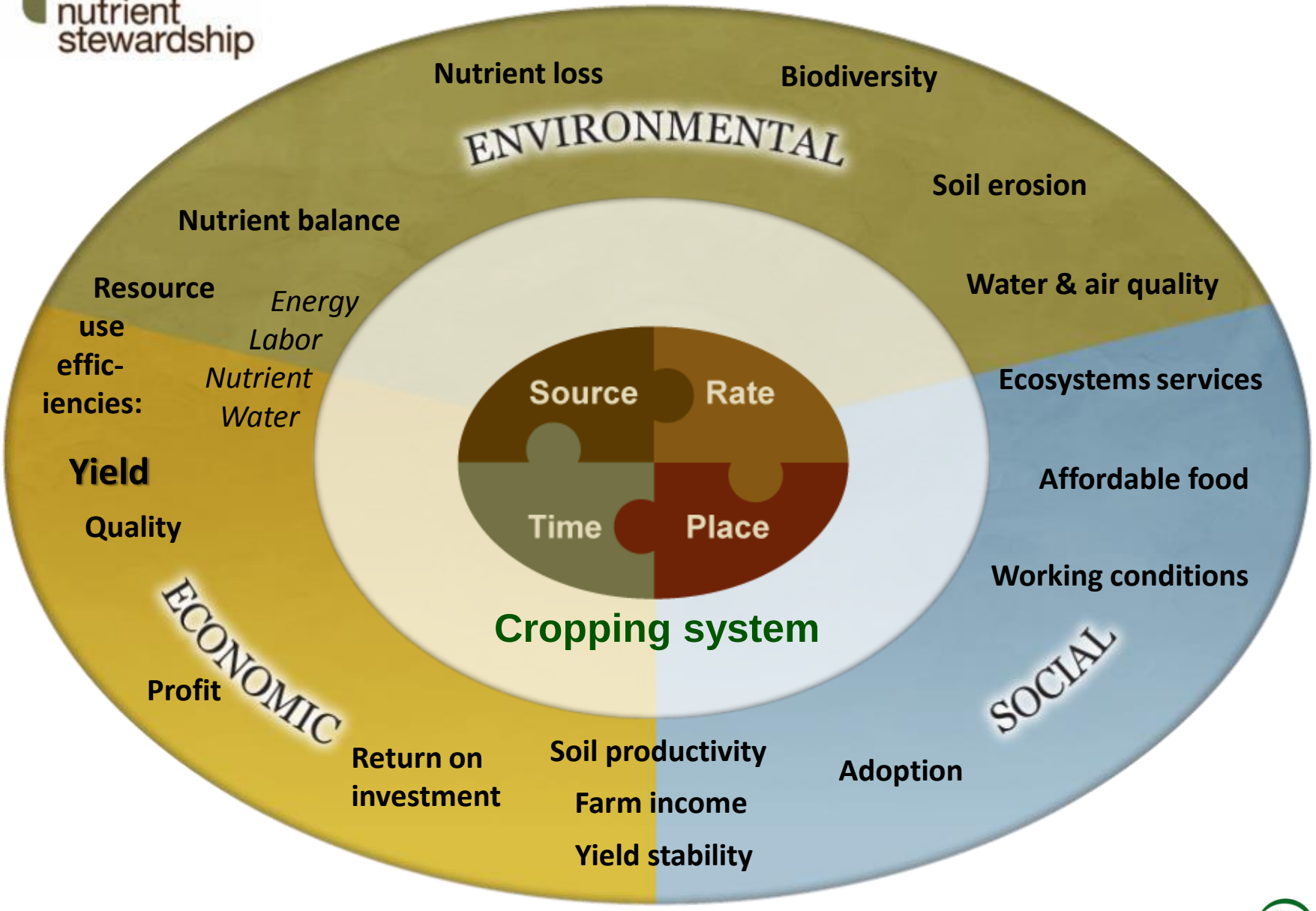
Scottsdale, AZ

Paul Fixen,
International Plant Nutrition Institute

NUTRIENT STEWARDSHIP CERTIFICATION

IPNI

Performance Indicators



Right Source **at** ***Right Rate, Right Time, Right Place***

http://www.nutrientstewardship.com/funding

Purpose of the 4R Research Fund: To help develop data on the economic, environmental and social impact of 4R Nutrient Stewardship across North America

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TFI, CFI and IPNI Member Contributors

Agricen
AGRIServices of Brunswick, LLC
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Wilson Industrial Sales Co., Inc.
Wolf Trax Inc.
Yara North America, Inc.

Friends of the Industry Contributors

Environmental Defense Fund
John Deere
Fluid Fertilizer Foundation
Micronutrient Manufacturers Association
MFA Incorporated

- NA fertilizer industry pledged $7 M over 5 yrs
- To date: $2,494,000 has been collected

Technical Advisory Group (Chair: Paul Fixen)

Industry

Melissa Bauer, Service Provider
Greg Binford, Wilbur-Ellis
Howard Brown, Growmark
Kyle Freeman, The Mosaic Company
Rigas Karamanos, Viterra/Koch
Alexandre Mailloux, La Coop Fédérée
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Lara Moody, TFI *(Ex-Officio)*
Dave DeGeus, Nature Conservancy
Cliff Snyder, IPNI
Scott Murrell, IPNI,
Clyde Graham, CFI *(Ex-Officio)*

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Fund Management Committee (Chair: Lara Moody)

Voting Members

Doug Beever, Agrium
Steve Biggar, Richardsons
Jeff Carr, United Suppliers
Jeff Holzman, Potash Corp
Bill Jackson, AgriServices of Brunswick
Michael Johnson, CHS
John Malinowski, J. R. Simplot
Mark Kaplan, The Mosaic Company
Rosemary O'Brien, CF Industries
Billy Willard, Willard Ag

Non-Voting Members

Terry Roberts, IPNI
Tom Christianson, USDA NRCS
Clyde Graham, CFI
Mark Walbridge, USDA ARS

Project Oversight

- Funding for the projects goes through the Foundation for Agronomic Research (FAR)
- An IPNI scientist over sees each project … visits the research sites, work with the researchers, collect the reports, help disseminate information, etc.

Reviews and Meta-analyses Funded to Date ($273,000)

1. **Nutrient Stewardship on Drained Land** - Laura Christianson, The Conservation Fund
2. **Enhanced Efficiency Fertilizers in Corn Systems** - Rachel Cook, Southern Illinois U.
3. **Effects of Conservation & Fertilizer Application Methods on N & P Loss** - Song Qian, U. of Toledo
4. **P Placement & Tillage Interaction for Corn & Soybean** - Dorivar Ruiz Diaz, KSU
5. **4R Fertilizer Management to Address Nitrous Oxide and Nitrate Losses in U.S. Corn-based Systems** - Alison Eagle, Duke U.

Progress or final reports due end of February

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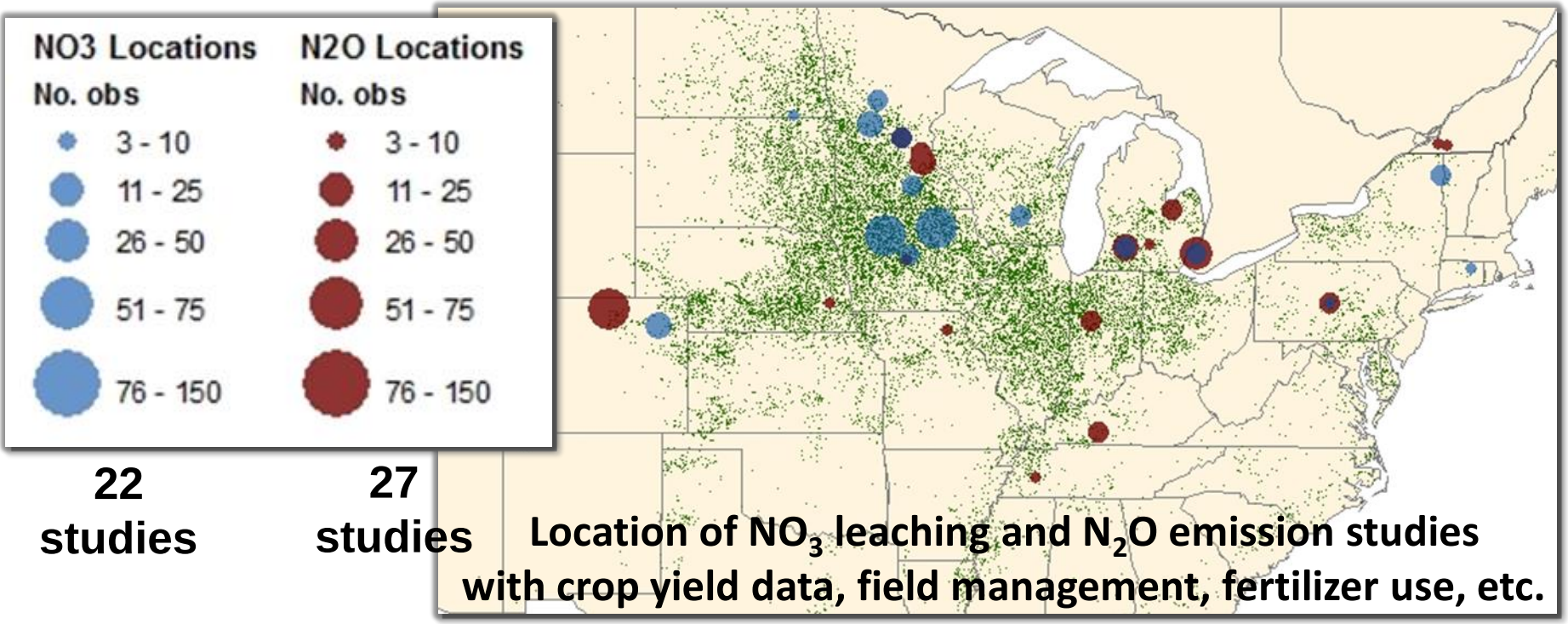
Example of results from "4R Fertilizer Management to Address Nitrous Oxide and Nitrate Losses in U.S. Corn-based Systems" - Alison Eagle, Duke University



- Very few studies report yield and both NO_3^- and N_2O losses
- Source comparisons in ½ the N_2O studies but only 1 NO_3^- study
- Placement or timing compared in 15-19% of cases

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Meta-Analysis: Decock (2014)

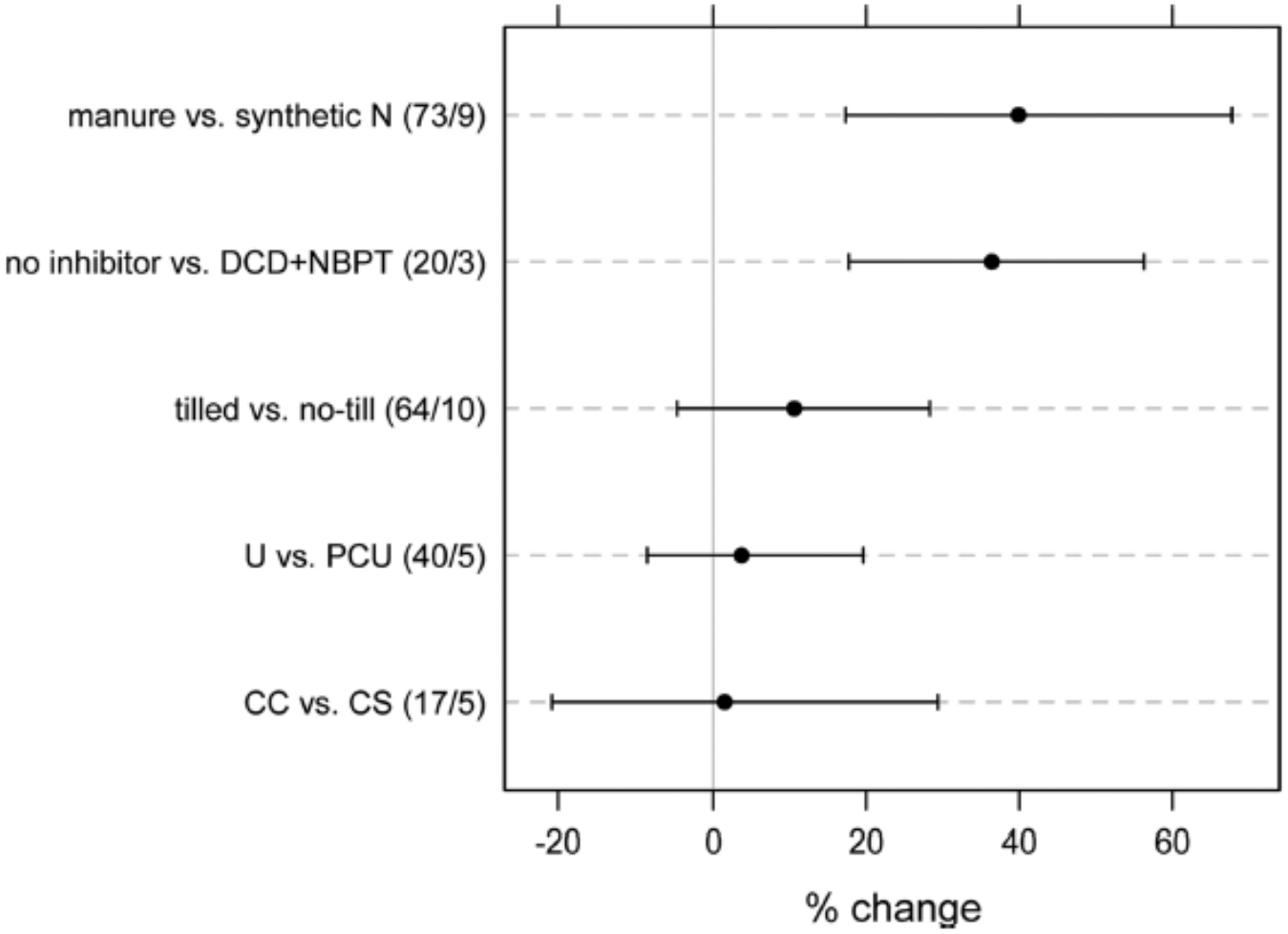

Figure 3. Results from meta-analyses for side-by-side comparisons of N_2O emissions following various N and cropping system management practices. Numbers in parentheses indicate the number of observations on which the analysis was based, and the number of different field sites from which the observations originated. Error bars denote 95% confidence intervals. Figure was created in R-project version 3.0.2.

Field Projects Funded to Date – U.S. ($2.1 mil over 5 yrs)

1. **Evaluating 4R Nutrient Stewardship & Certification in the W. Lake Erie Basin** – Kevin King, USDA-ARS
2. **Impacts of 4R on Crop Production** & **Nitrate Loss in Tile Drainage** – Matt Helmers, ISU
3. **Late-vegetative N App. for High-yield Corn: Hybrid Implications** – Tony Vyn, Purdue
4. **Minimizing P Loss with 4R Stewardship & Cover Crops** – Nathan Nelson, KSU

KSU P Study (Nathan Nelson)
18 small watersheds

Plot 101 (1.2 ac)
Plot 102 (1.18 ac)
Plot 103 (1.21 ac)
Plot 104 (1.26 ac)
Plot 106 (1.15 ac)
Plot 201 (1.16 ac)
Plot 203 (1.21 ac)
Plot 204 (1.22 ac)
Plot 206 (1.17 ac)
Plot 301 (1.25 ac)
Plot 303 (1.34 ac)

H-flume instrumented for continuous measurement of runoff and automated collection of water samples

(1.2 ac)

Watershed Outlets

Treatment

- Fall broadcast P fertilizer, no cover crop
- Fall broadcast P fertilizer, with cover crop
- No P fertilizer applied, no cover crop
- No P fertilizer applied, with cover crop
- Spring injected P fertilizer, no cover crop
- Spring injected P fertilizer, with cover crop

0 55 110 220 330 440 550
Feet

North

Field Projects Funded in Canada

($150,000 as Canadian bridge funding in 2014)

1. **N stabilizers to enhance NUE and reduce GHG emissions** – Dr. Linda Hall, U of A
2. **Coordinated N and S management** in **Sulfur-deficient soils** – Dr. Miles Dyck, U of A
3. **Effect of broadcast vs banded P on fate of applied P in soil and in snowmelt water flow** – Dr. Jeff Schoenau, U of S
4. **Limiting loss of fall applied N fertilizer using EEFs** – Dr. Mario Tenuta, U of M

Progress summaries due end of February

1. **Improving N management tools for reduced environmental losses from corn production** – Dr. Claudia Wagner-Riddle, U. of Guelph
2. **Improved N application methods and N sources for corn in SW ON** – Dr. Craig Drury, AAFC in Harrow, ON
3. **Optimization of N fertilization in response to production uncertainties under 4R Nutrient Stewardship** – Dr. Nicolas Tremblay, AAFC in St-Jean-sur-Richelieu, QC
4. **Can the use of in-season foliar urea increase NUE and reduce N losses in potato production in Atlantic Canada** – Dr. David Burton, Dalhousie U

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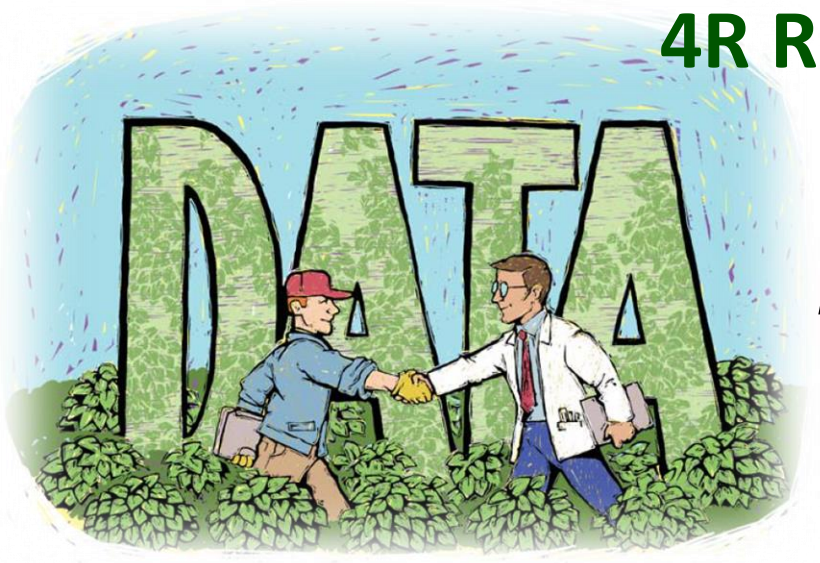
4R Research Fund Data Repository



Stated in Fund RFPs and project agreements: *"Data generated by 4R Fund projects must be submitted for inclusion in an open access 4R Fund project database, in a format that will be subsequently determined and prescribed."*

Making the Case for

Evidence-based Agriculture

by Madeline Fisher

CSA News, May 2014

- Strives to round up and evaluate all high quality **data** on the efficacy of practices and apply the **synthesized findings** to crop care
- Systematic reviews of literature and meta-analyses
- Publishing and curating high quality, open-access data sets

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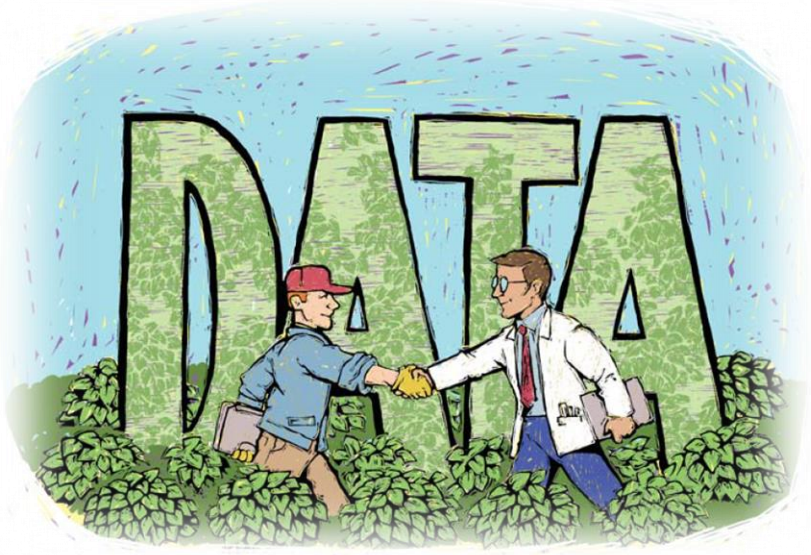

Status of 4R Research Fund Data Repository

- Proposal in late stages of development
  - Dr. Sylvie Brouder, Purdue U.
  - A standard data repository and preservation framework for 4R Fund projects
  - Assistance to funded projects with data submission
- Housed within the Purdue University Research Repository (PURR) managed by Purdue Libraries
  - Budget remains in preparation
  - Project duration of 18 months

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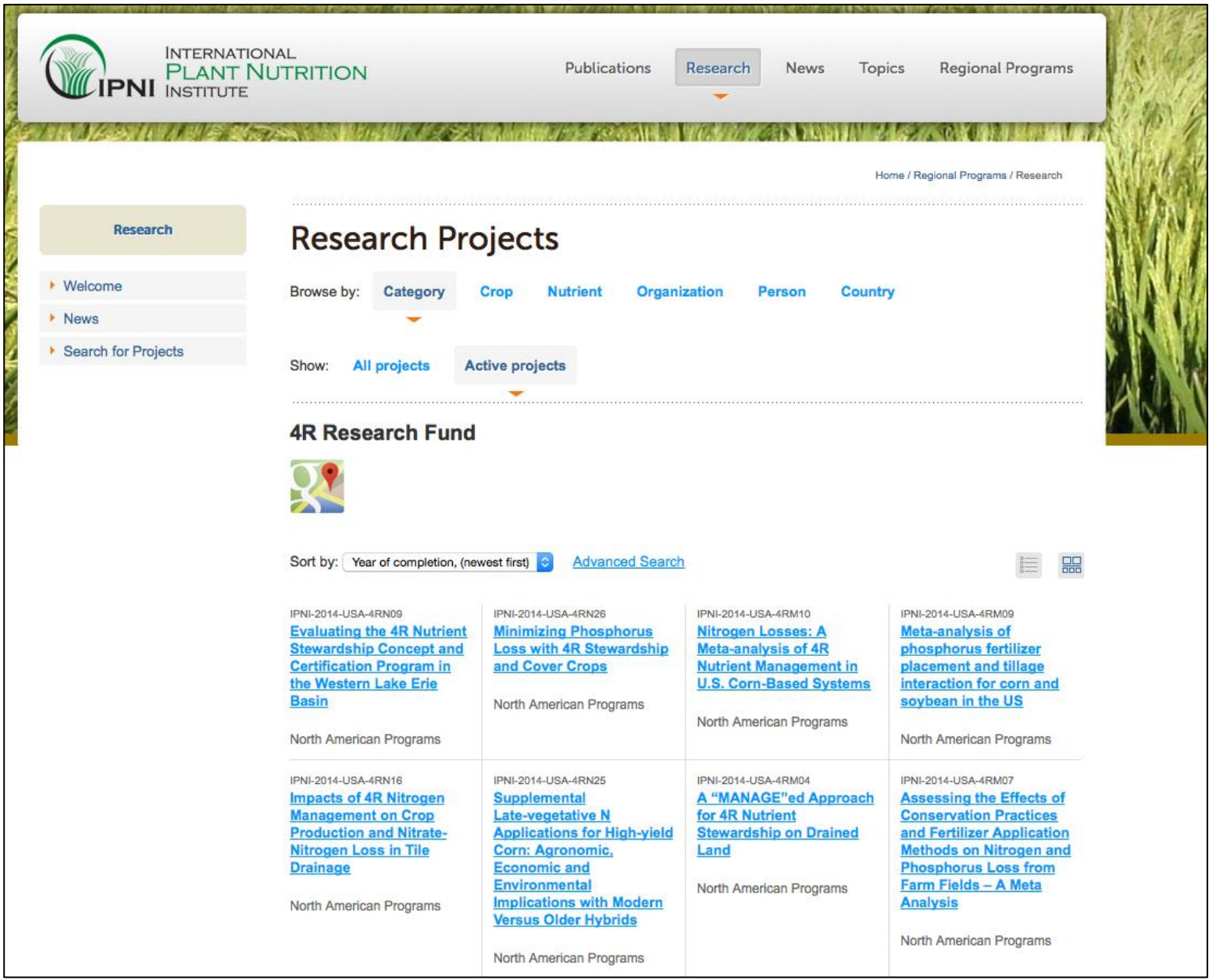
http://research.ipni.net/toc/category/4r_research_fund



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Evaluating 4R Nutrient Stewardship & Certification in the W. Lake Erie Basin – Dr. Kevin King, USDA-ARS

($1.2 M from 4R Fund + $3.2 M in external funding)

- **Collaborators:**
  - 11 principal/co-principal investigators
  - 6 Institutions: USDA-ARS, Ohio State U., Heidelberg U., LimnoTech, The Nature Conservancy, IPNI
- **Goal:** evaluate impacts of the adoption of 4R practices and the 4R Certification Program on crop productivity and profitability, water quality, and perceptions of growers, nutrient service providers, and residents of the Basin

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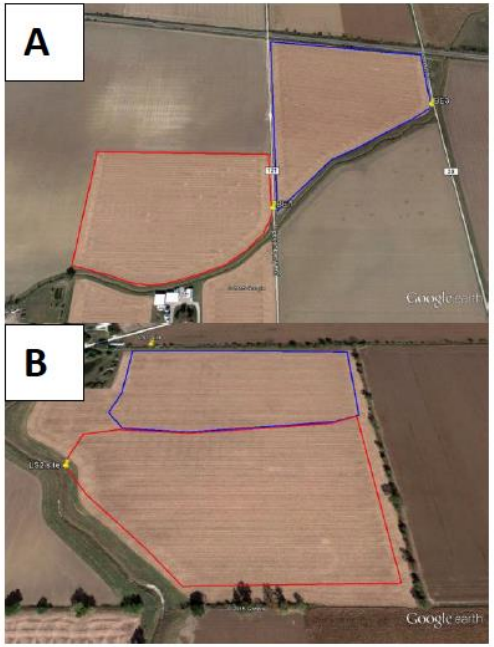
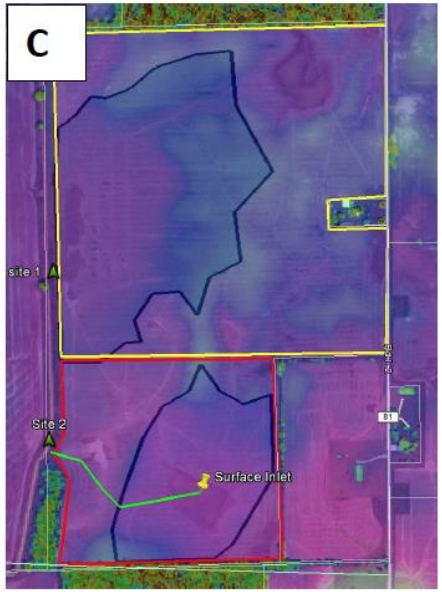
- Data collection from edge-of-field scale
- Date collection from watershed scale
- Watershed and in-lake modeling





Outline of fields in Ohio (A and B) and Indiana (C) to be used for edge-of-field monitoring

Evaluating 4R Nutrient Stewardship & Certification in the W. Lake Erie Basin – Dr. Kevin King, USDA-ARS

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- Status: Instrumentation of the edge-of-field sites is well underway. Watershed water quality data is being collected.

Loss via tile

Loss via runoff

- Previous producer surveys are being evaluated and additional surveys for both producers and retailers are being developed.
- Outreach and promotion of the 4R program have occurred at multiple meetings and venues.

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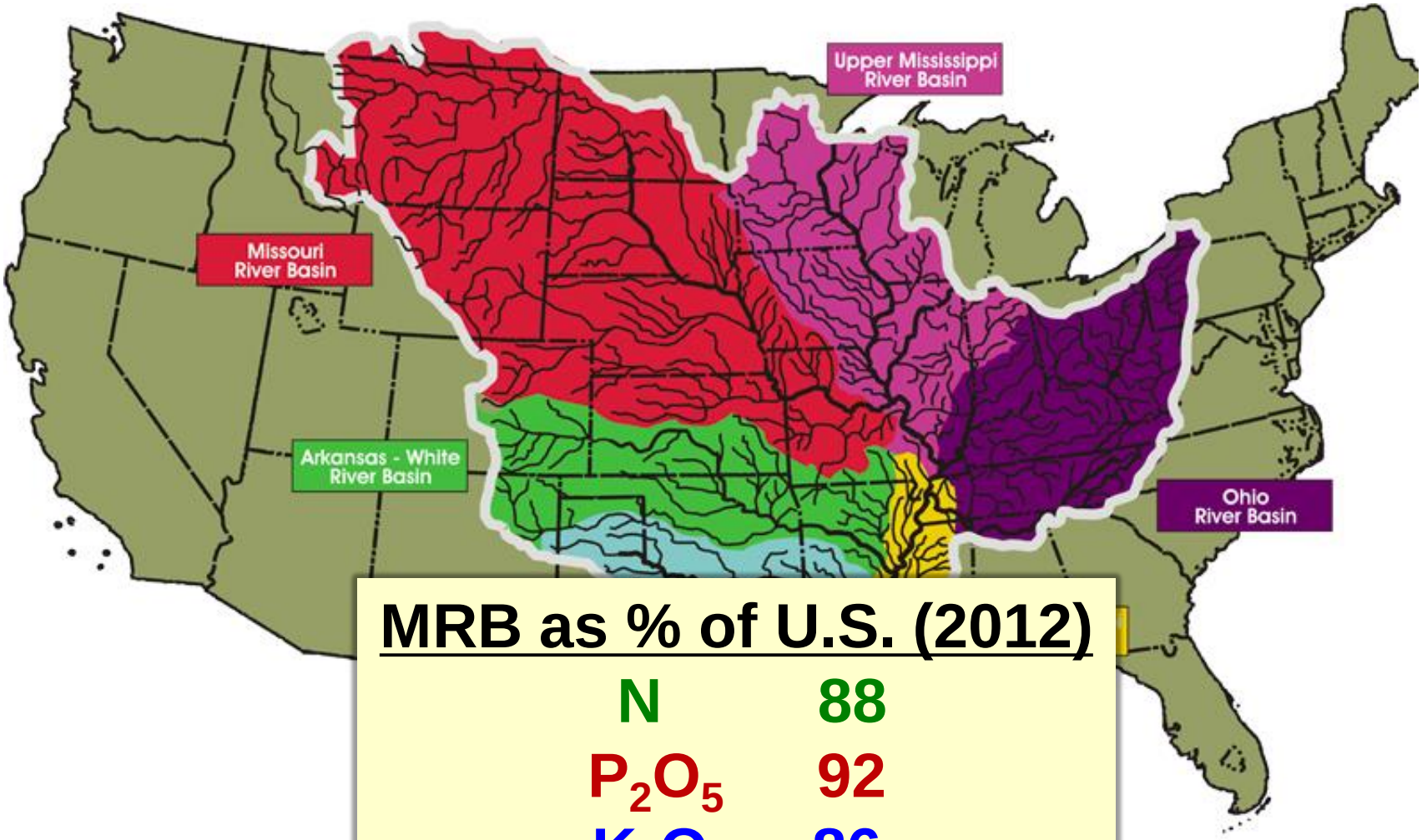
What's next?

- Establishment of the 4R data repository
- Planning a 4R summit with researchers who conducted the reviews/meta-analysis the week of May 11, 2015 to
  - Present their findings and gaps identified
  - Provide an opportunity to leverage funds … states with tonnage taxes, crop commodity groups with check off dollars, EPA, ARS, and NIFA will be invited
- Additional call for projects once priority gaps are identified

The 4R Fund and supported projects continue to be relevant and important to the fertilizer industry …

Mississippi River Basin – All or Parts of 30 States

Major U.S. Fertilizer Consumption



MRB as % of U.S. (2012)

N	88
P_2O_5	92
K_2O	86

Graphic Source: NOAA

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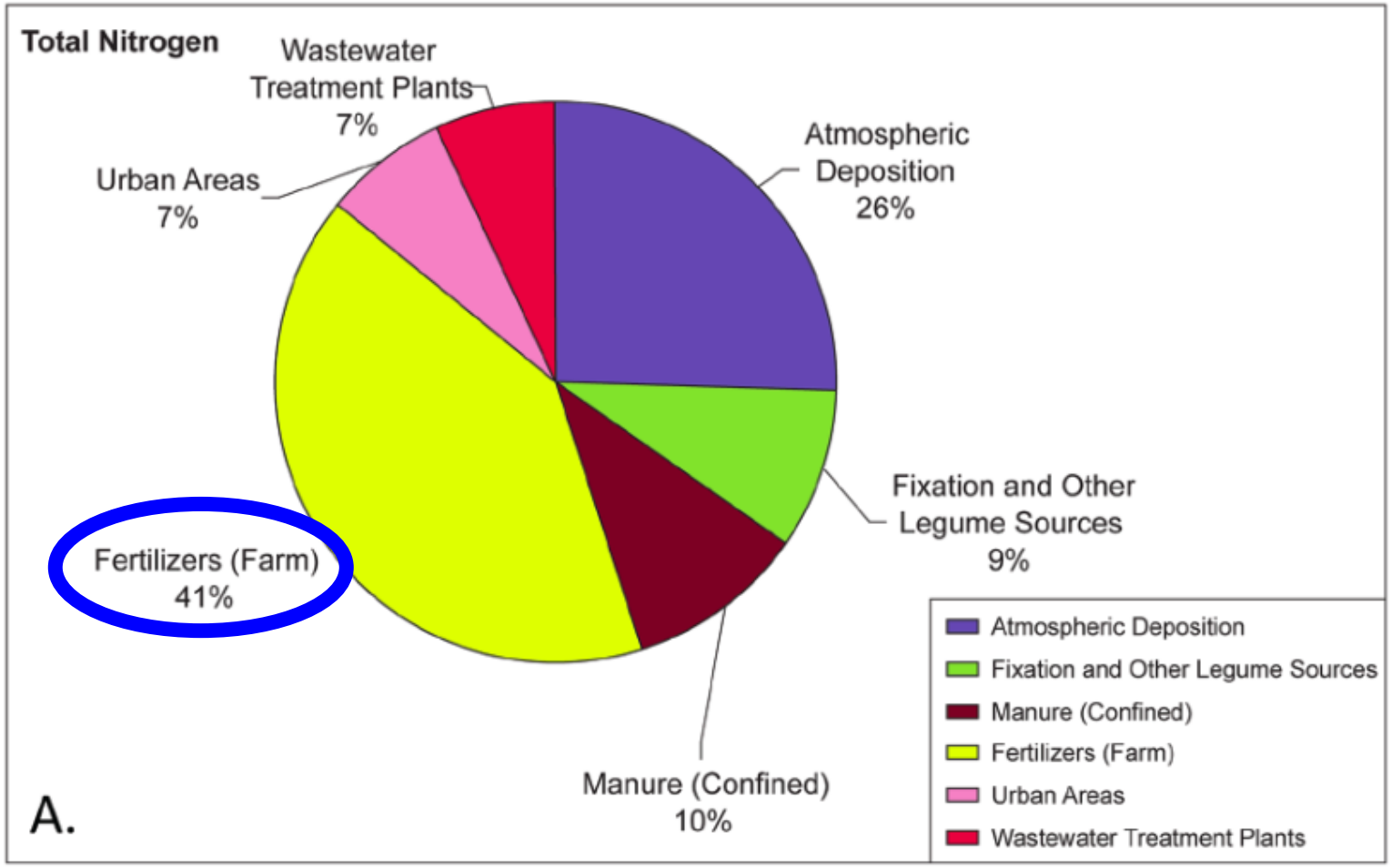
USGS SPARROW Modeled Sources of Annual N Load to Gulf of Mexico



Robertson and Saad. 2013. J. Environ. Qual. 42:1422–1440

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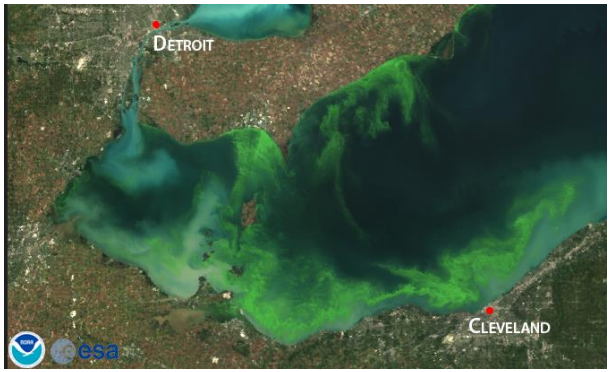
- Des Moines Water Works sues 3 counties over high nitrate levels in the Raccoon River
  - Filed in federal court under the U.S. Clean Water Act, which grants regulatory exemptions to nonpoint source discharges, including field tile systems
  - Waterworks officials say organized drainage districts shouldn't be exempt from regulations
- Adds to relevance of "Impacts of 4R on Crop Production & Nitrate Loss in Tile Drainage – Matt Helmers, ISU"

Mississippi River Basin States with Nutrient Loss Reduction Strategies

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



- Tennessee (coming soon)

http://water.epa.gov/type/watersheds/named/msbasin/nutrient_strategies.cfm

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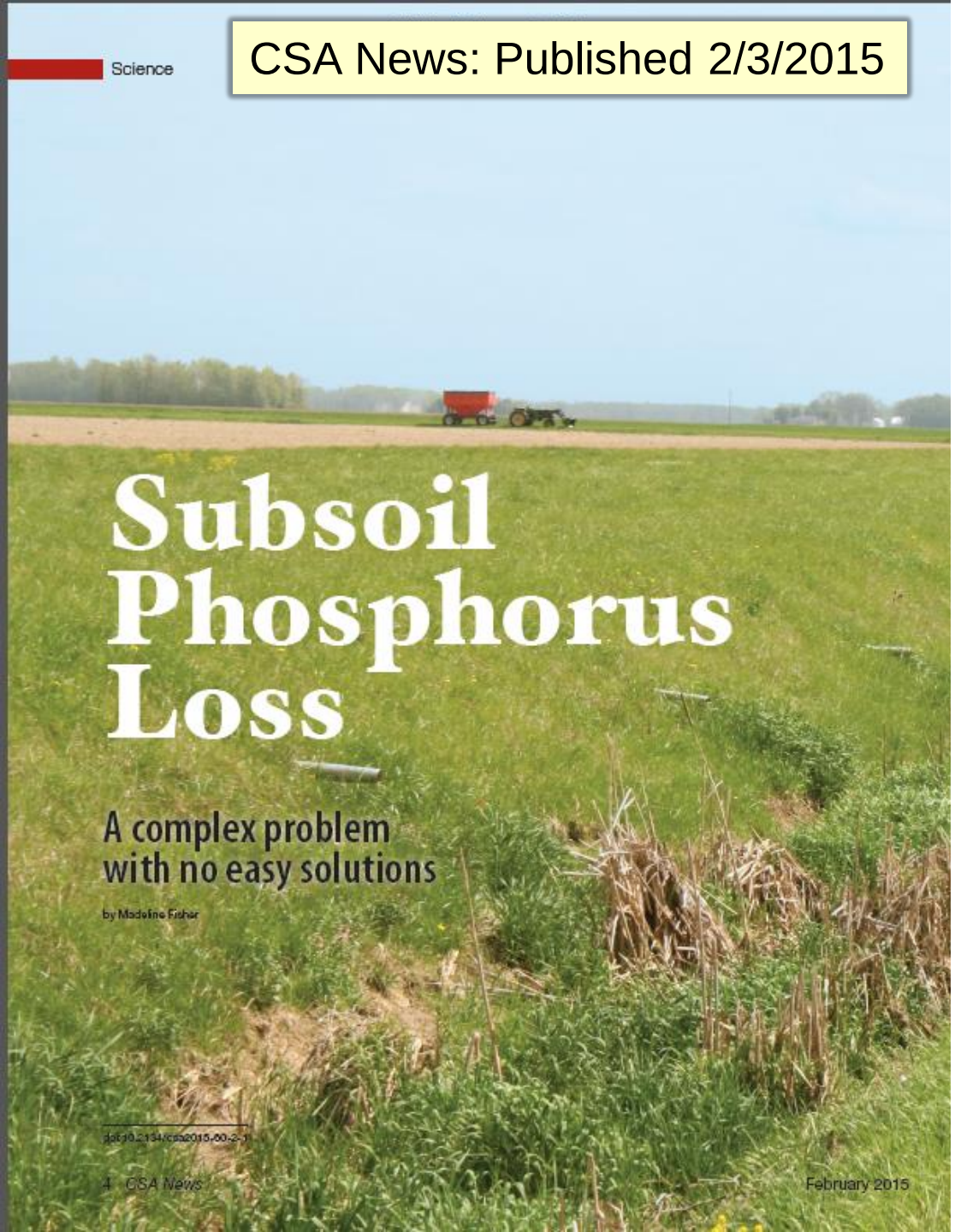


- Included Lake Erie problems
- P loss via tile drains a significant contributor
- 4R project should offer import science-based guidance

nutrient stewardship

ABOUT CALENDAR FUNDING PARTNERS CONTACT 4R ADVOCATE

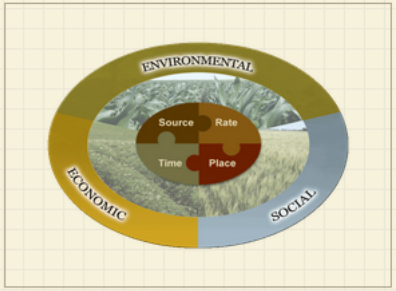
Search... GO

WHAT ARE THE 4RS | IMPLEMENT THE 4RS | 4R TRAINING | 4R NEWS

4R RESEARCH FUND

BACKGROUND

The 4R Research Fund was established by the fertilizer industry to help establish sustainability indicators and environmental impact data for implementation of 4R nutrient stewardship across North America. It provides needed resource support with a focus on measuring and documenting the economic, social and environmental impacts of 4R nutrient stewardship. This effort will help expand the 4Rs beyond being solely an industry effort and towards becoming a viable strategy embraced by other important stakeholders to address cropping system productivity and concerns for nutrient losses into the environment. Further information on 4R Nutrient Stewardship can be found on



Thanks for your support of the 4R Fund

Research fund contributors are listed below, if you would like to contribute to this effort please contact Lara Moody, Director of Stewardship Programs for TFI (lmoody@tfi.org).

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