Water Summit – March 21, 2015

Farmer-led Efforts to Improve Water Quality

Presented by Sean McMahon

IAWA
IOWA AGRICULTURE
WATER ALLIANCE

Iowa Agriculture Water Alliance

Mission

- To increase the pace and scale of farmer-led efforts to improve water quality.

Founding Organizations

- Iowa Corn Growers Association
- Iowa Pork Producers Association
- Iowa Soybean Association

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Overview

- Global state of water quality and footprint of Ag.
- Iowa's importance to global food production
  - Soil fertility plays a major role
  - Population, consumer demand drive land use changes
  - Avoided conversion of natural areas
- Water quality challenges in Iowa, U.S., Gulf of Mexico
- **We didn't get here overnight – won't solve it overnight**
- Conservation practices proven to improve water quality

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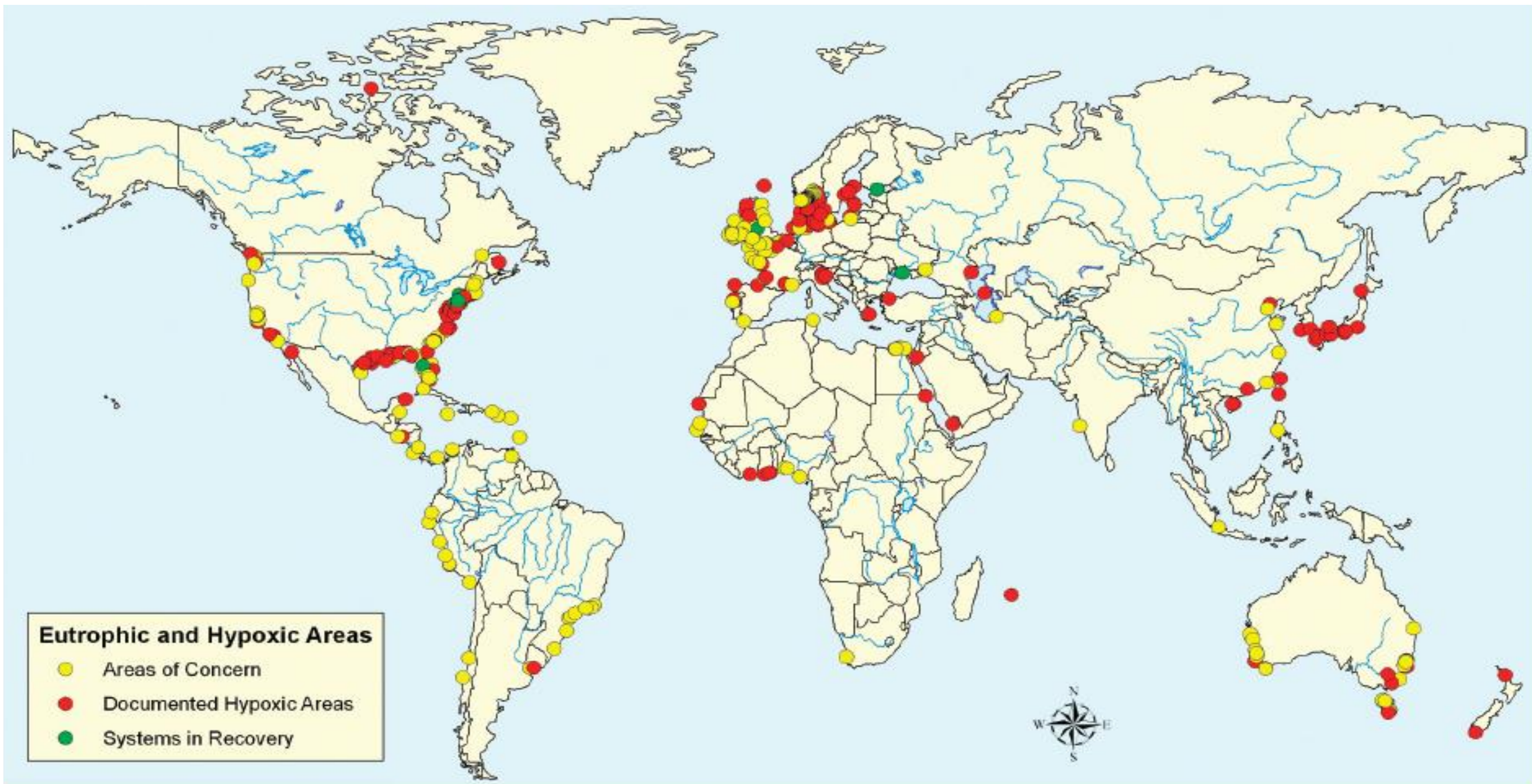
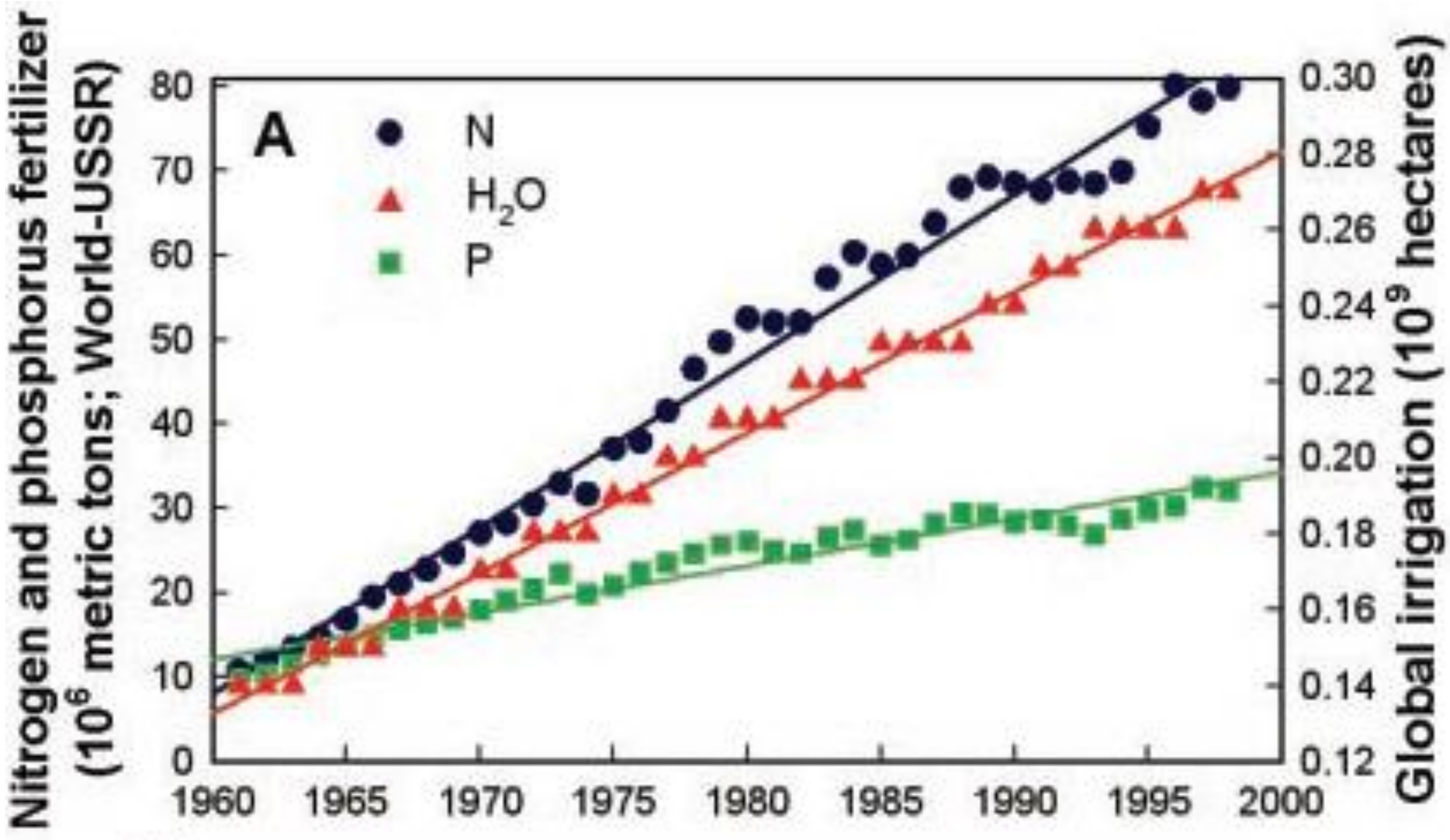
Dead Zones of the World

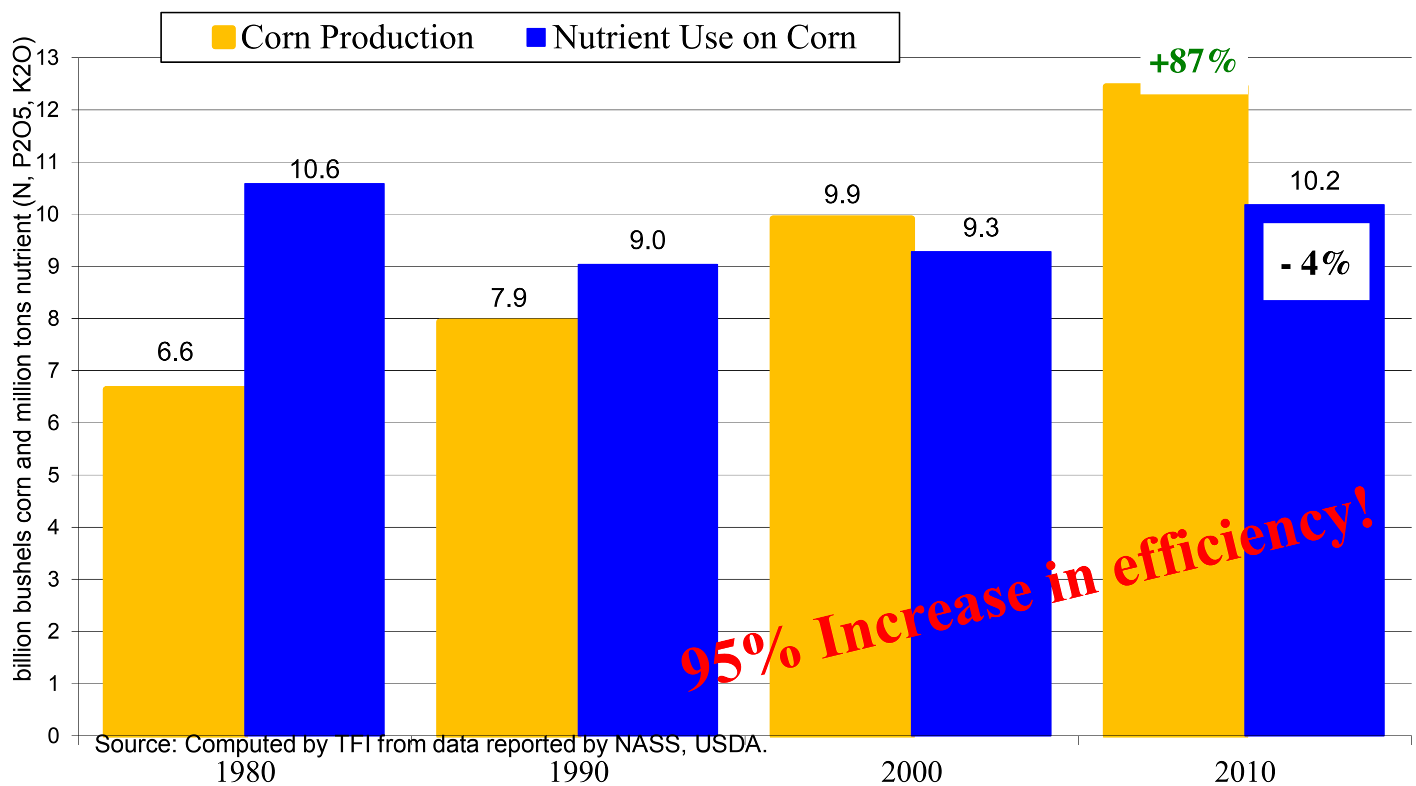


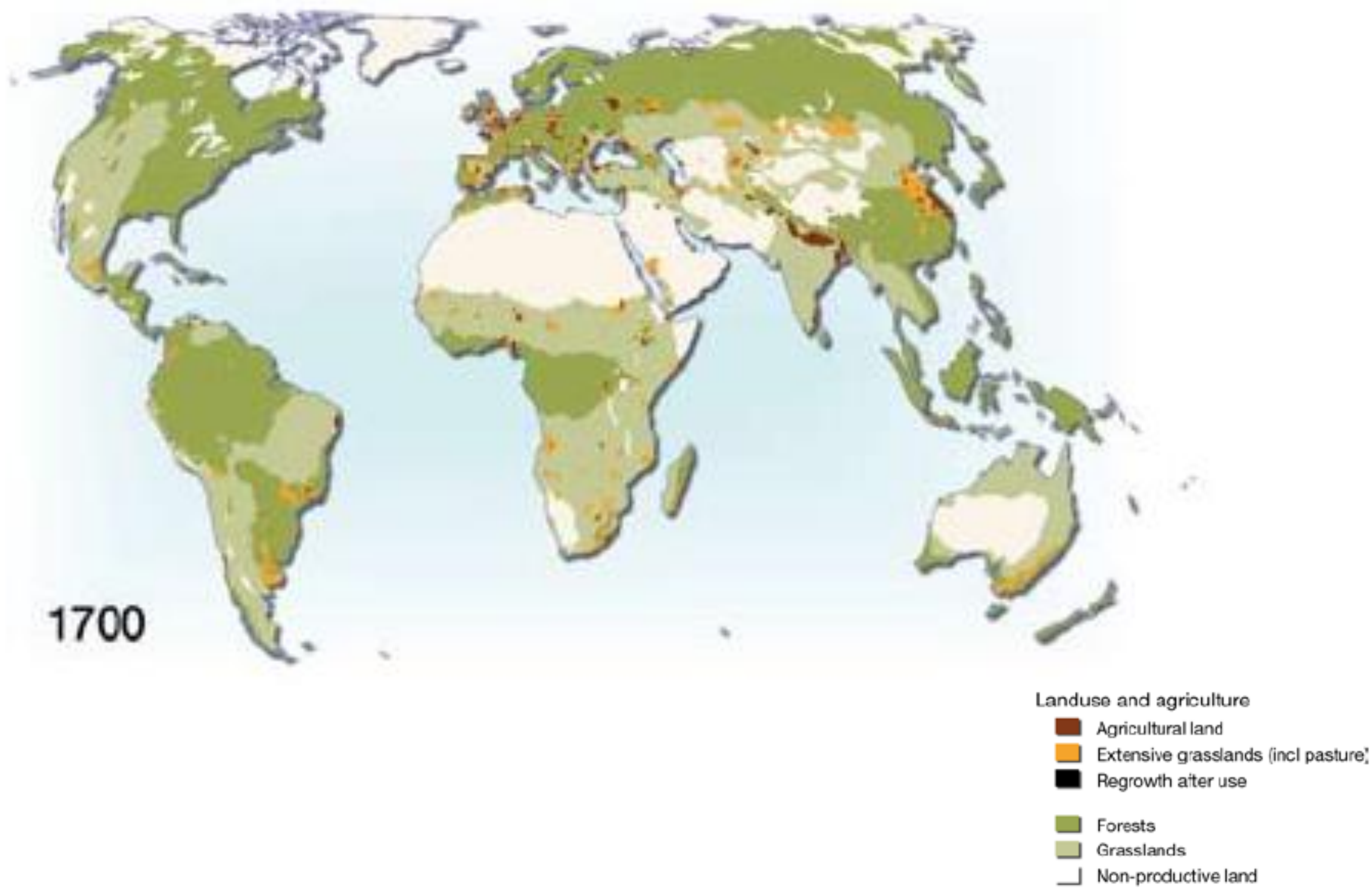
Major known eutrophic and hypoxic areas. Reprinted from Selman et al

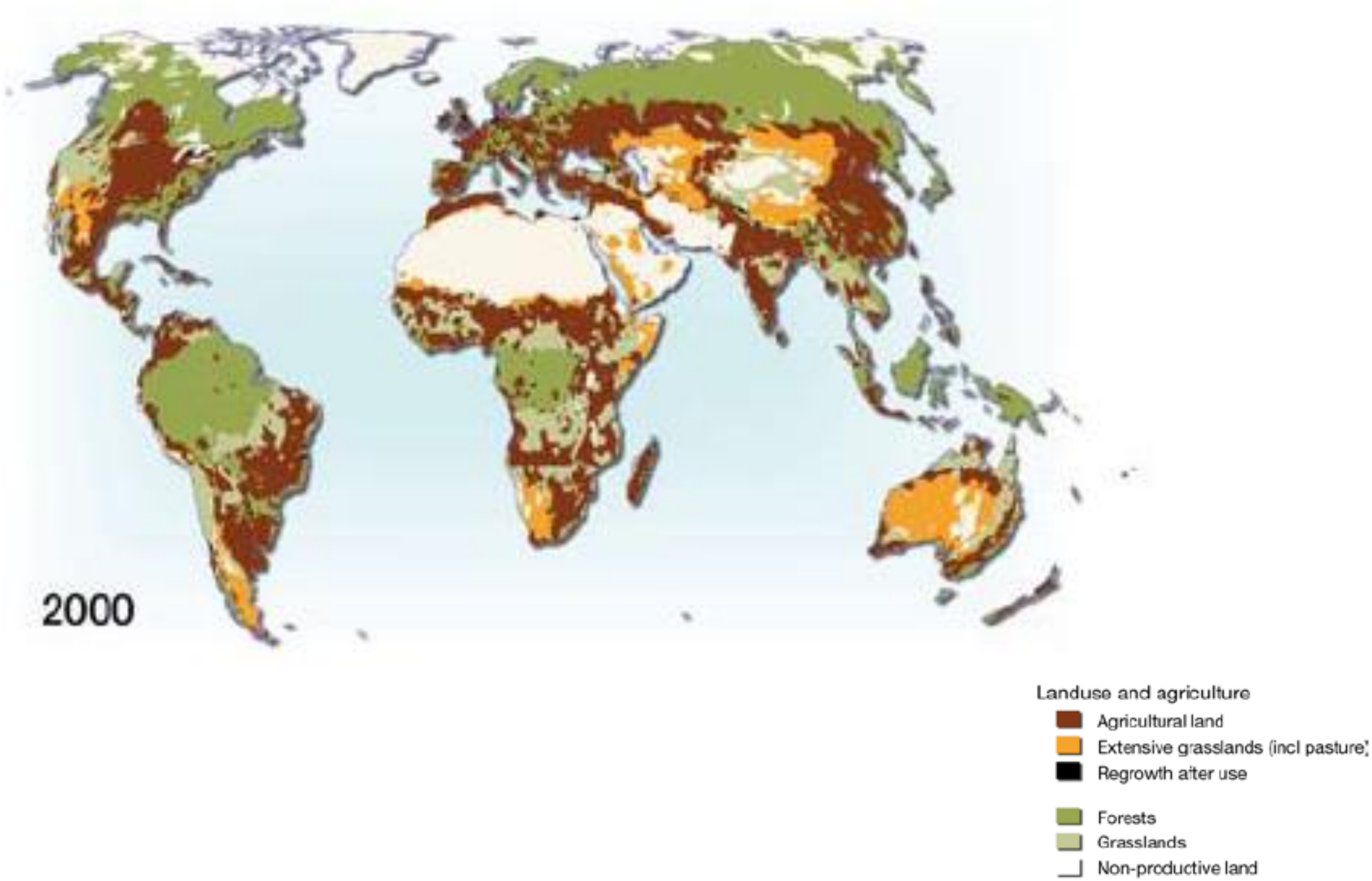
Global Nitrogen, Phosphorus and Irrigation Use

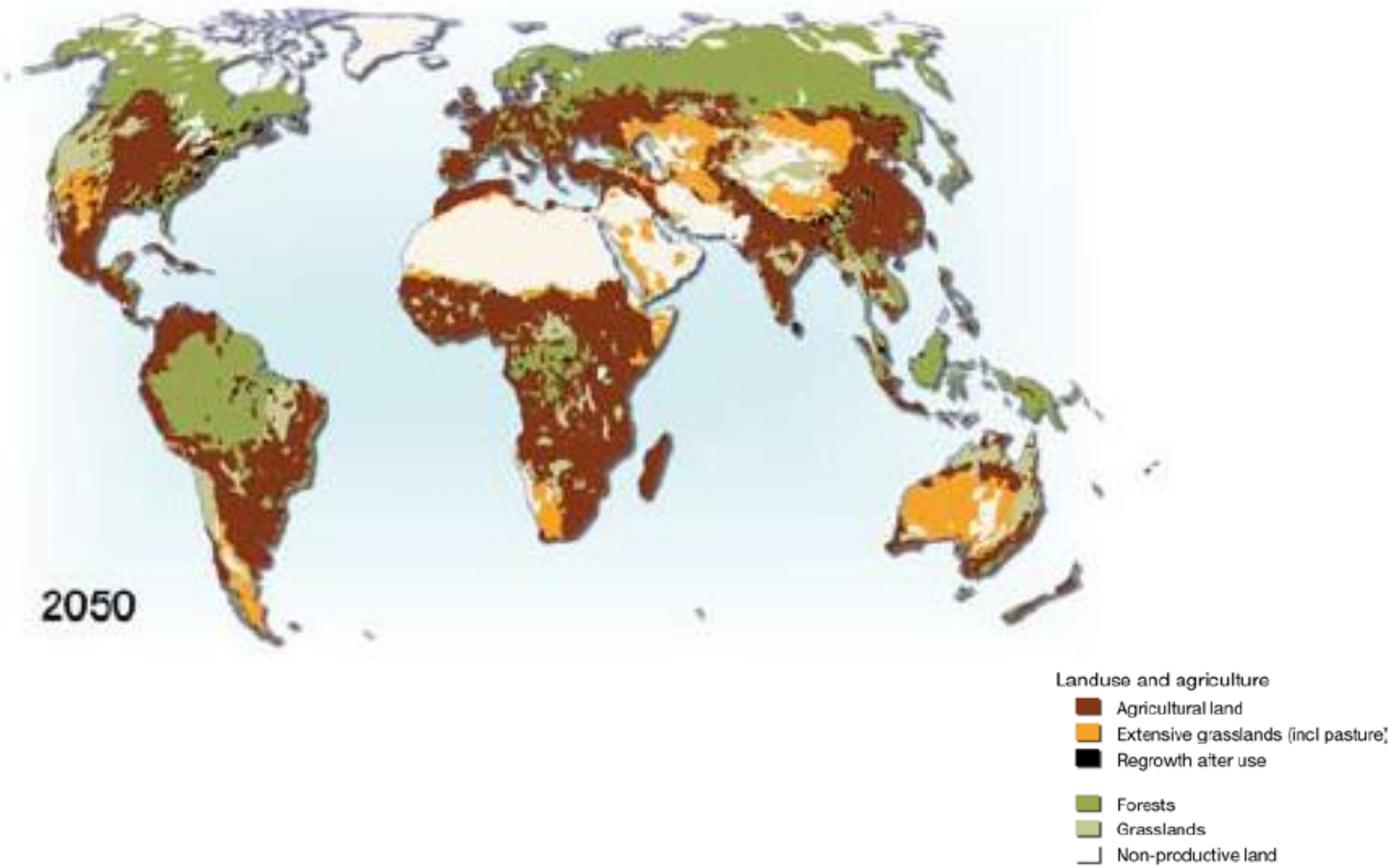


U.S. Corn Production and Nutrient Use




1700
Landuse and agriculture
Agricultural land
Extensive grasslands (incl pasture)
Regrowth after use
Forests
Grasslands
Non-productive land


2000
Landuse and agriculture
Agricultural land
Extensive grasslands (incl pasture)
Regrowth after use
Forests
Grasslands
Non-productive land

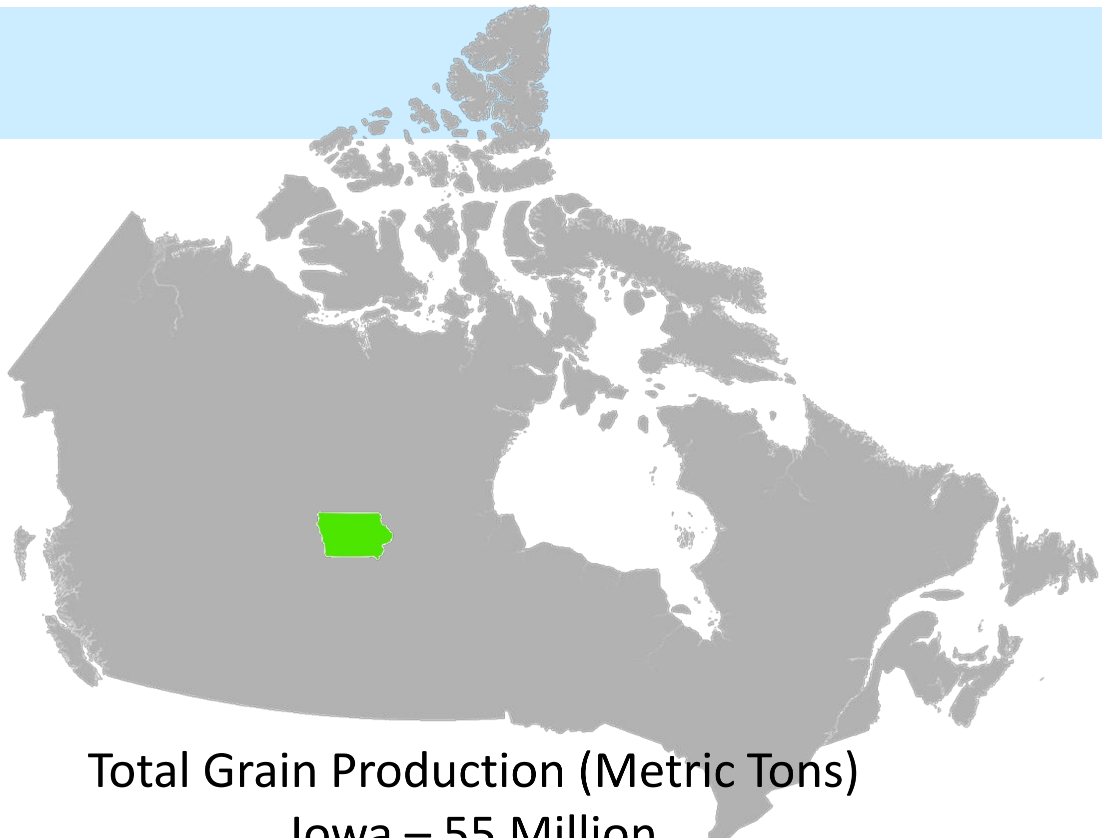

2050
Landuse and agriculture
Agricultural land
Extensive grasslands (incl pasture)
Regrowth after use
Forests
Grasslands
Non-productive land


Sustainable Intensification of Agriculture
The agricultural challenge: Feeding humanity while protecting nature

Iowa Water Quality Initiative

IOWA DEPARTMENT OF AGRICULTURE & LAND STEWARDSHIP

CLEANWATERIOWA.ORG



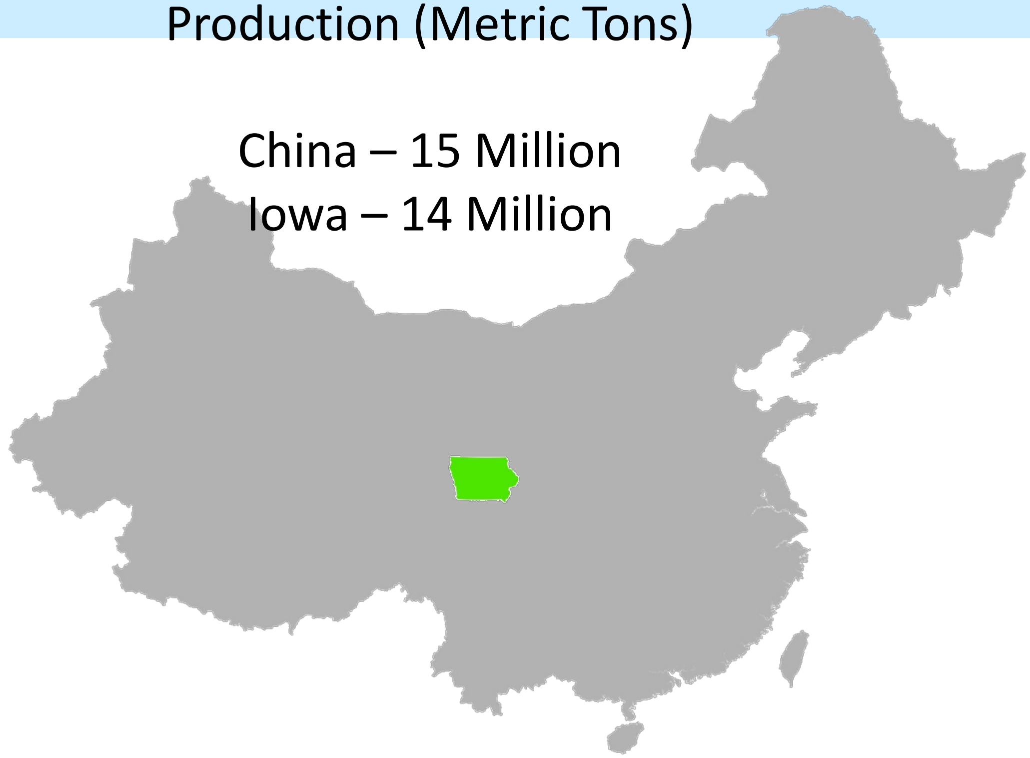
Total Grain Production (Metric Tons)

Iowa – 55 Million

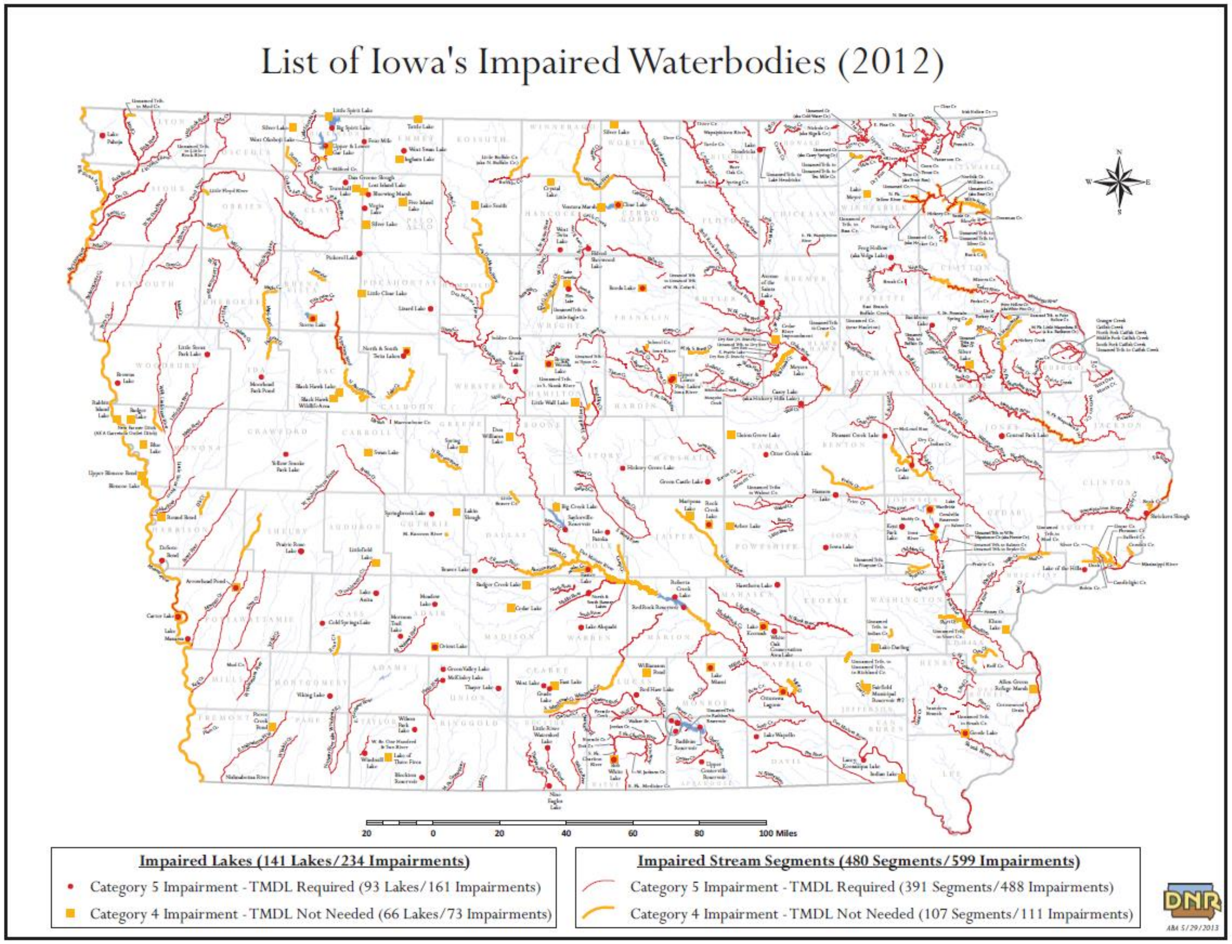
Canada – 45 Million

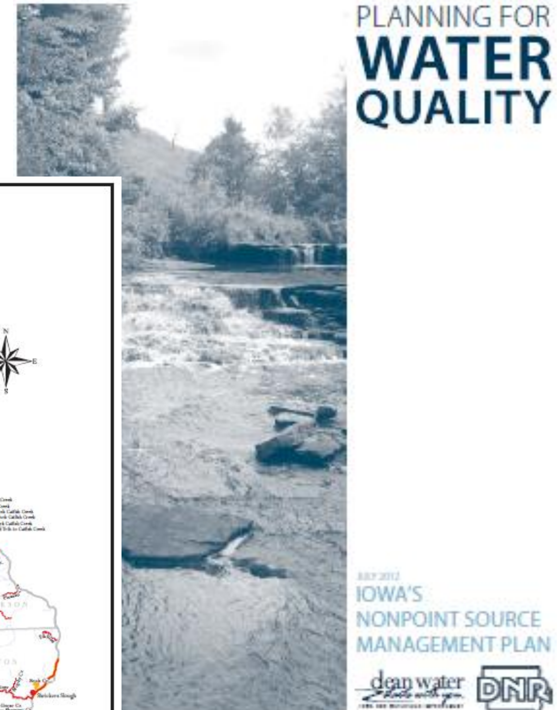
Total Soybean Production (Metric Tons)

China – 15 Million
Iowa – 14 Million



Iowa Water Challenges



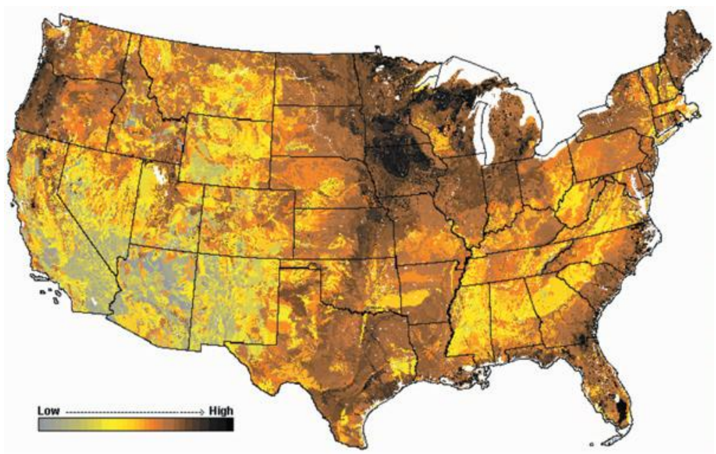


Nutrients Causing WQ Impairments

- **>100,000 miles of rivers and streams,**
- **Approx. 2.5 million acres of lakes, reservoirs and ponds,**
- **> 800 square miles of bays and estuaries in the U.S.**
- **166 coastal hypoxic areas or "dead zones" nationwide**
- **"nutrient pollution is widespread": 27% river and stream miles have high N, 40% have high P**
- **Stream biological condition:**
  - **55% poor, 23% fair;**
  - **9% more "good" N condition, 19% fewer "good" P condition**

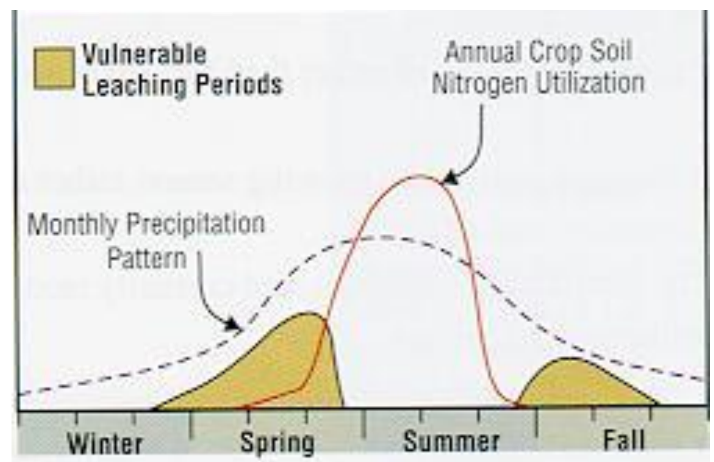
Source: 2013 EPA website: http://water.epa.gov/type/rsl/monitoring/riverssurvey/index.cfm , http://www2.epa.gov/nutrientpollution/effects-environment , http://www2.epa.gov/nutrientpollution/where-occurs-lakes-and-rivers

Soils Vulnerable to Leaching



- Current major cropping system leaves soil vulnerable to erosion and nutrient leaching.
- Markets and Technological Advances have shifted cropping patterns and increased productivity.
- **Have the most tools available to date and will still continue to develop and adopt new technologies**

- Nutrient impairment is beyond the usual culprit of mismanagement of fertilizers and manures, but more to historic changes in land use and hydrology.



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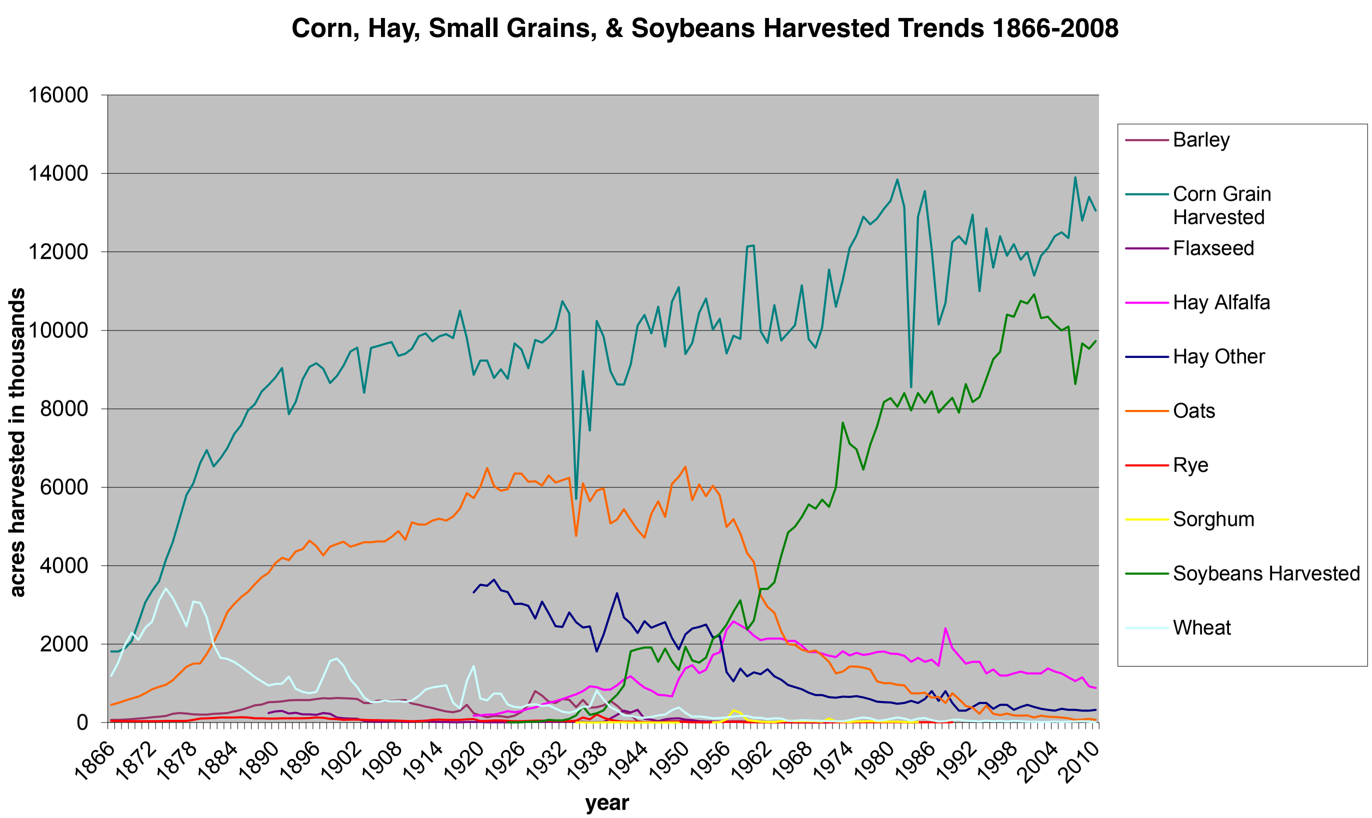
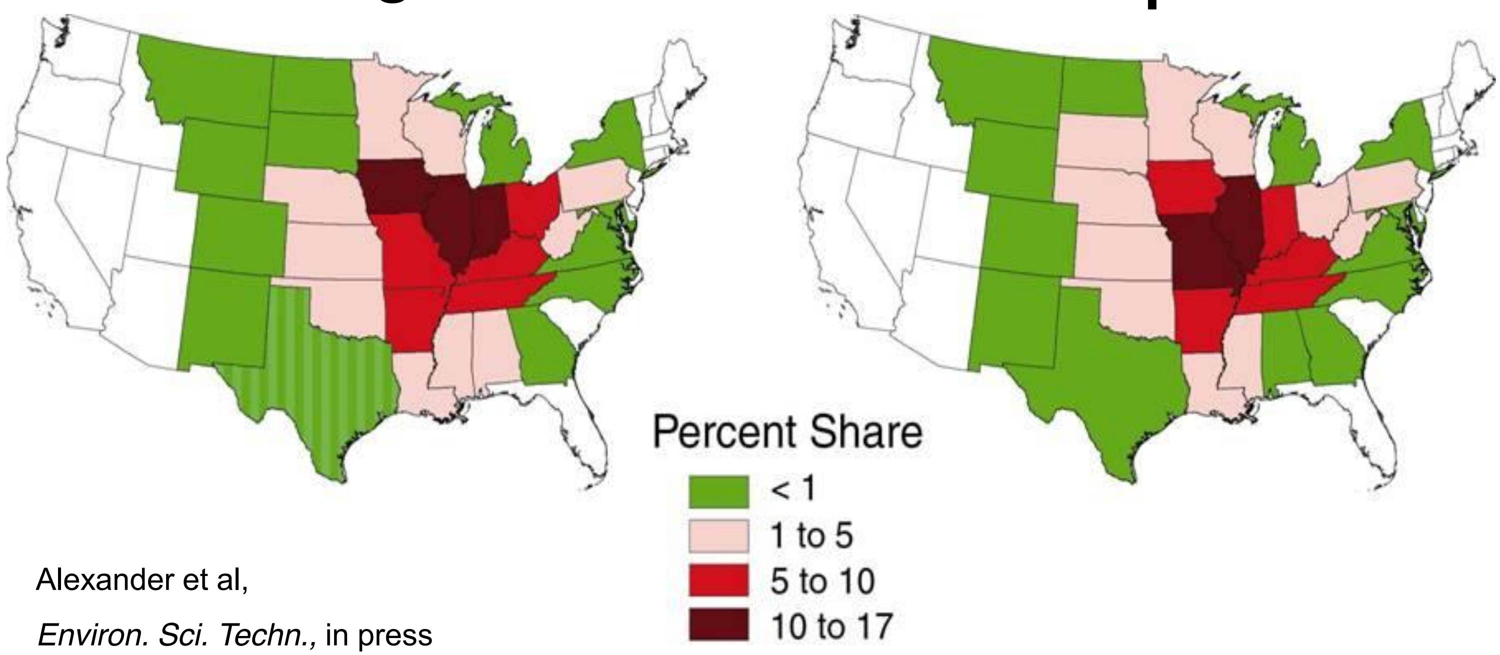
Changes in Land Use



Nutrient Delivery to Gulf of Mexico

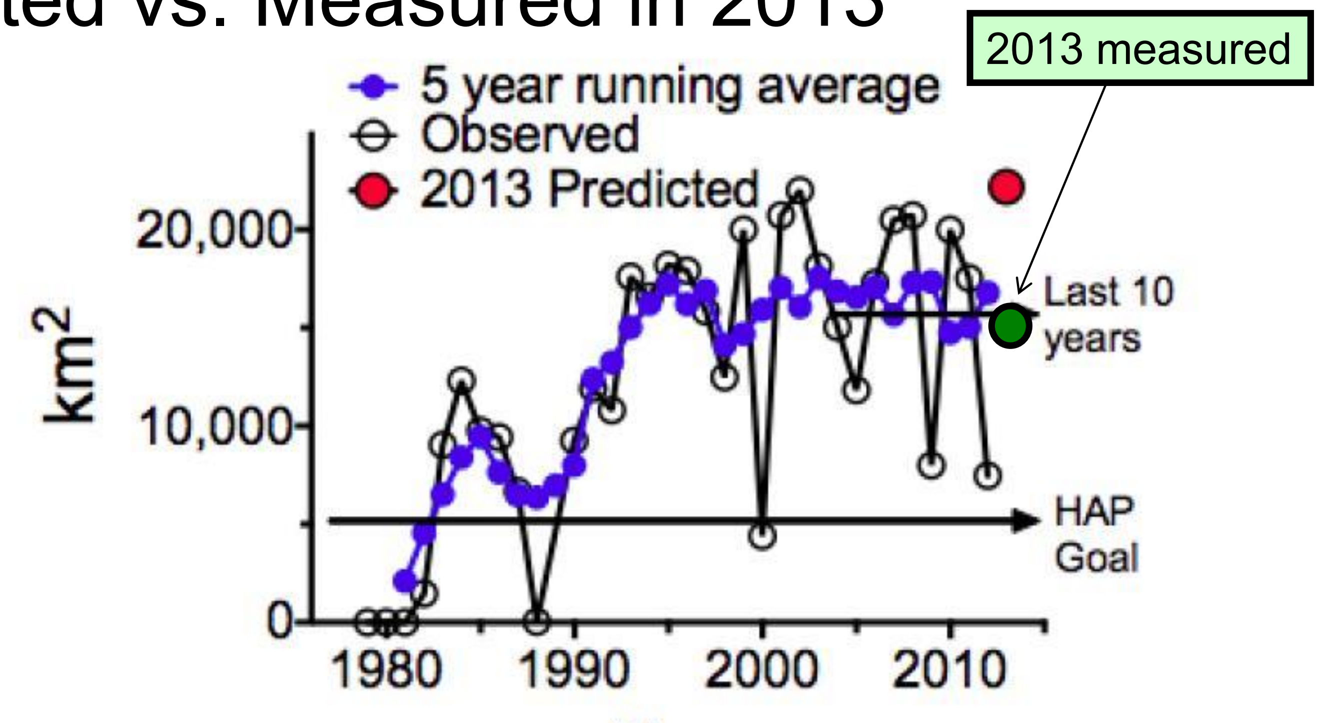
State shares of the total annual nutrient flux

Nitrogen **Phosphorus**



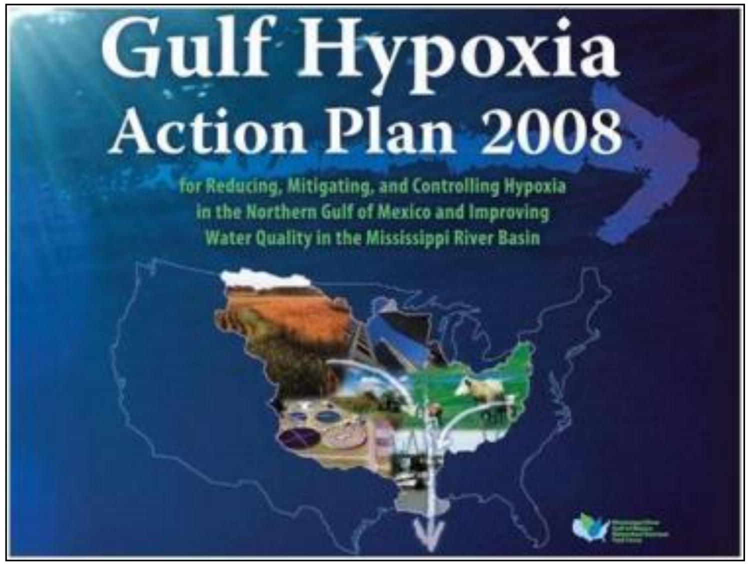
Alexander et al,
Environ. Sci. Techn., in press

Gulf of Mexico Hypoxia - Historic and Predicted vs. Measured in 2013



Can we connect in-field practices with downstream impacts?

Rabalais & Turner, 6/18/2013



EPA Hypoxia SAB report suggested

45% less total N

AND

45% less total P

discharge to the Gulf to reduce hypoxia

IOWA WATER QUALITY INITIATIVE

Moving From Strategy to Implementation

Nutrient Reduction Strategy

Leads

- Iowa Department of Ag and Land Stewardship
- Iowa Department of Natural Resources
- Iowa State University

- Released May 2013, after public comment period
- Living document meant to be adjusted as technologies are developed and understanding of these systems/practices improves.
- **Goal of 45% reductions in Total N and P**

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Nitrogen Practices

Nitrogen moves primarily as nitrate-N with water

	Practice	Comments	% Nitrate-N Reduction+	% Corn Yield Change++
			Average (SD*)	Average (SD*)
Nitrogen Management	Timing	Moving from fall to spring pre-plant application	6 (25)	4 (16)
		Spring pre-plant/sidedress 40-60 split Compared to fall-applied	5 (28)	10 (7)
		Sidedress – Compared to pre-plant application	7 (37)	0 (3)
		Sidedress – Soil test based compared to pre-plant	4 (20)	13 (22)**
	Source	Liquid swine manure compared to spring-applied fertilizer	4 (11)	0 (13)
		Poultry manure compared to spring-applied fertilizer	-3 (20)	-2 (14)
	Nitrogen Application Rate	Nitrogen rate at the MRTN (0.10 N:corn price ratio) compared to current estimated application rate. (ISU Corn Nitrogen Rate Calculator – http://extension.agron.iastate.edu/soilfertility/nrate.aspx can be used to estimate MRTN but this would change Nitrate-N concentration reduction)	10	-1
	Nitrification Inhibitor	Nitrapyrin in fall – Compared to fall-applied without Nitrapyrin	9 (19)	6 (22)
	Cover Crops	Rye	31 (29)	-6 (7)
		Oat	28 (2)	-5 (1)
	Living Mulches	e.g. Kura clover – Nitrate-N reduction from one site	41 (16)	-9 (32)
Land Use	Perennial	Energy Crops – Compared to spring-applied fertilizer	72 (23)	
		Land Retirement (CRP) – Compared to spring-applied fertilizer	85 (9)	
	Extended Rotations	At least 2 years of alfalfa in a 4 or 5 year rotation	42 (12)	7 (7)
	Grazed Pastures	No pertinent information from Iowa – assume similar to CRP	85	
Edge-of-Field	Drainage Water Mgmt.	No impact on concentration	33 (32)	
	Shallow Drainage	No impact on concentration	32 (15)	
	Wetlands	Targeted water quality	52	
	Bioreactors		43 (21)	
	Buffers	Only for water that interacts with the active zone below the buffer. This would only be a fraction of all water that makes it to a stream.	91 (20)	
	Saturated Buffers	Divert fraction of tile drainage into riparian buffer to remove Nitrate-N by denitrification.	50 (13)	

Phosphorus Practices

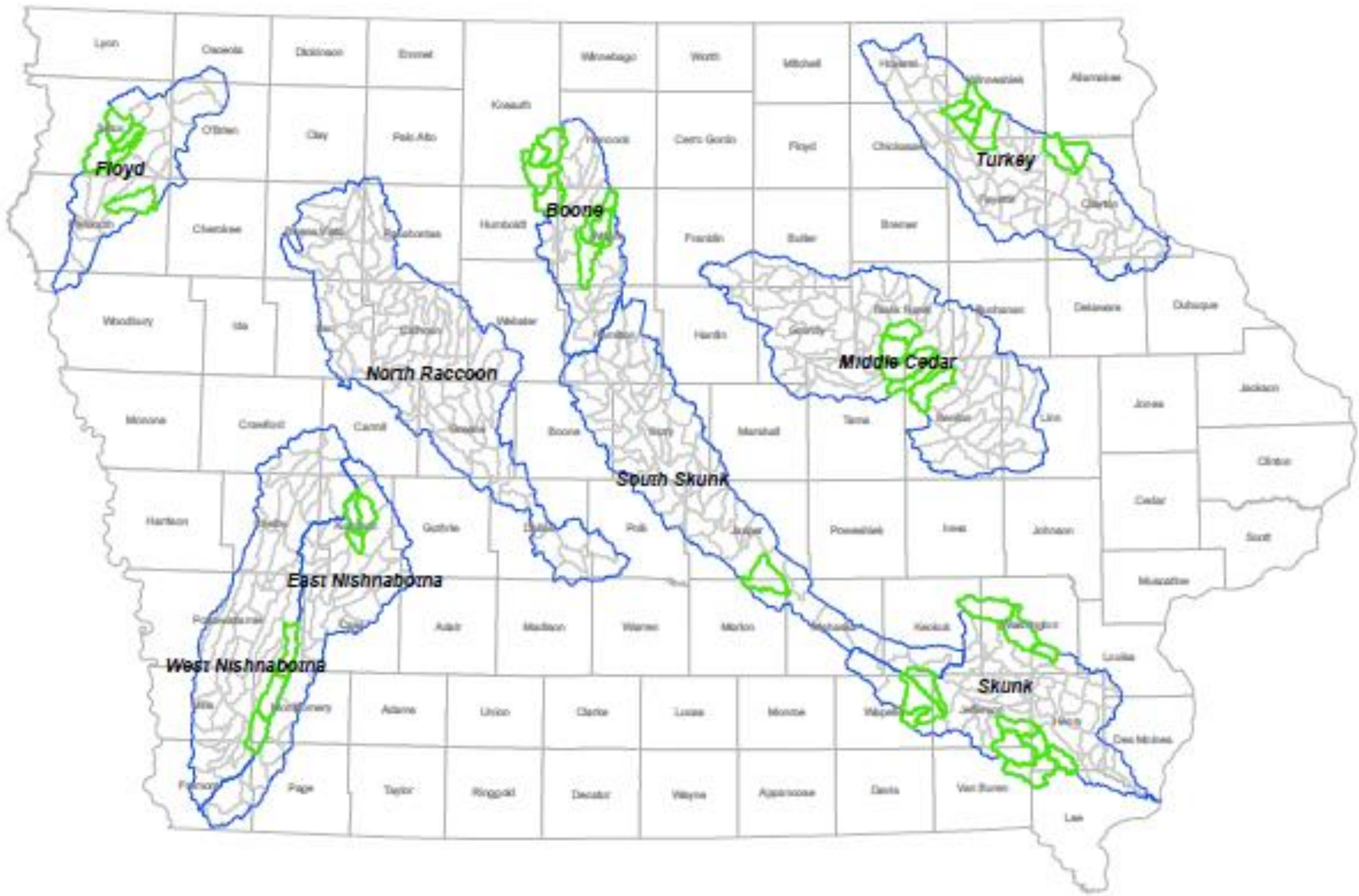
Phosphorus moves primarily with eroded soil

	Practice	Comments	% P Load Reduction[a]	% Corn Yield Change[b]
			Average (SD[c])	Average (SD[c])
Phosphorus Management Practices	Phosphorus Application	Applying P based on crop removal – Assuming optimal STP level and P incorporation	0.6[d]	0
		Soil-Test P – No P applied until STP drops to optimum	17[e]	0
	Source of Phosphorus	Liquid swine, dairy, and poultry manure compared to commercial fertilizer – Runoff shortly after application	46 (45)	-1 (13)
		Beef manure compared to commercial fertilizer – Runoff shortly after application	46 (96)	
	Placement of Phosphorus	Broadcast incorporated within 1 week compared to no incorporation, same tillage	36 (27)	0
		With seed or knifed bands compared to surface application, no incorporation	24 (46)	0
	Cover Crops	Winter rye	29 (37	-6 (7)
	Tillage	Conservation till – chisel plowing compared to moldboard plowing	33 (49)	0 (6)
		No till compared to chisel plowing	90 (17)	-6 (8)
Land Use Change	Perennial Vegetation	Energy Crops	34 (34)	
		Land Retirement (CRP)	75	
		Grazed pastures	59 (42)	
Erosion Control and Edge-of-Field Practices	Terraces		77 (19)	
	Buffers		58 (32)	
	Control	Sedimentation basins or ponds	85	

WQI Demonstration Watershed Projects

- Targeted to Priority Watersheds to Provide:
  - Demonstration of practices and technologies outlined in science assessment
  - Foster partnerships with wide range of project stakeholders to leverage resources and expand audience.
  - Strong outreach/education components to provide information on practices and adoption of available practices detailed in the Science Assessment
  - Local/regional hubs for demonstrating practices and providing practice information to farmers, landowners, farm managers, peer networks, etc.

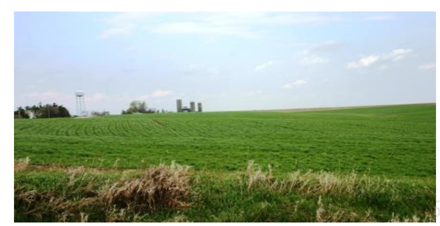
WQI Projects



Statewide Efforts

- Statewide efforts
  - Offer incentives to try a new practice from NRS Science Assessment
  - Follow-up efforts to offer the information necessary to improve chances of successful implementation
    - Any new practice adds complexity to already complex weather and management related variables
  - Recruit the help of experienced farmers in providing assistance to new users.



Conservation Practices

- Cover Crops
- Nutrient Management
- Conservation Tillage
- Nutrient Treatment Wetlands
- Bioreactors
- Saturated Buffers
- Drainage Water Management
- Buffers, Grass Waterways, Terraces

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Summary

- Water quality challenges in Iowa
- Iowa's contributions to global food production are largely due to fertile soils
- Soil fertility also poses challenges for water quality
- **We didn't get here overnight – won't solve it overnight**
- Voluntary practices are working

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Acknowledgements for slides, data, research

- Cliff Snyder, International Plant Nutrition Institute
- Harry Vroomen, The Fertilizer Institute
- Matt Lechtenberg, Shawn Richmond, Iowa Department of Agriculture and Land Stewardship
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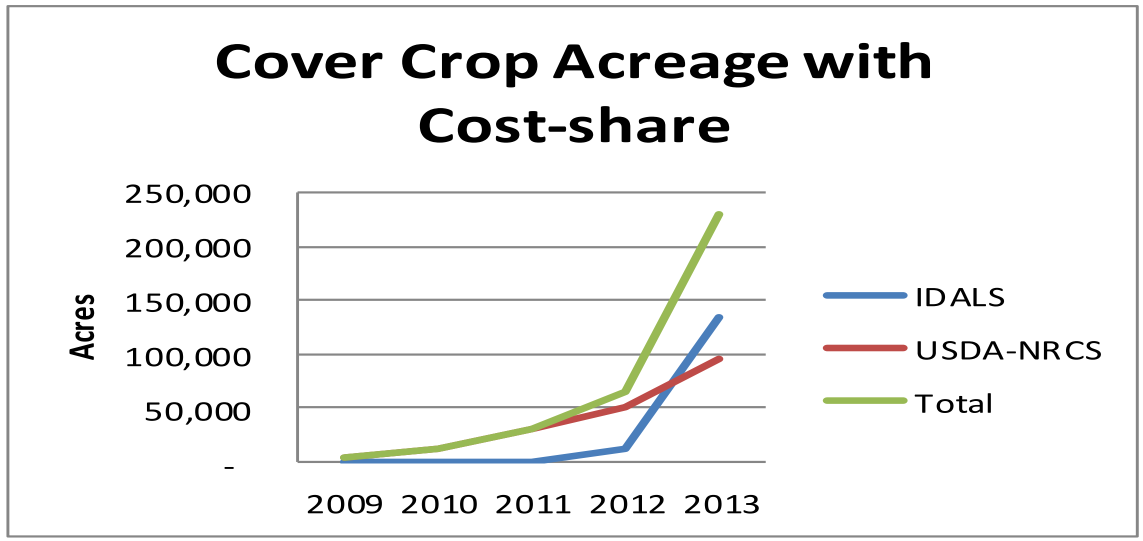
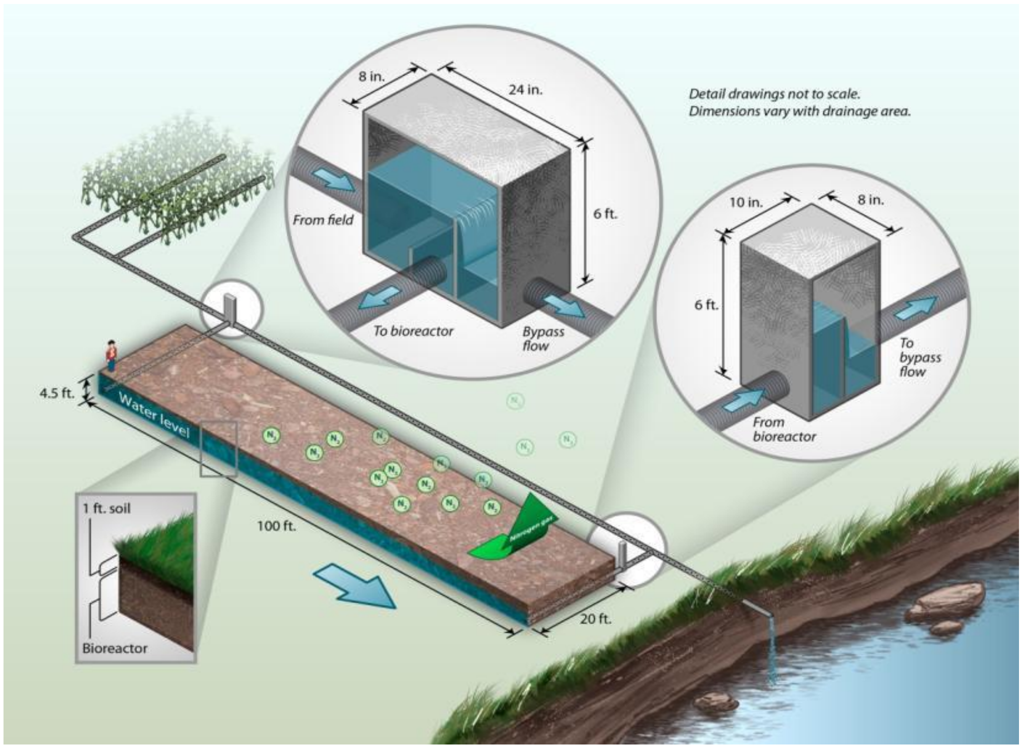
STATEWIDE EFFORTS

Interest is growing…



*Does not account for acres of Cover Crops done privately or through Conservation Stewardship Program contracts.

Drainage Water Treatment
Woodchip Bioreactor

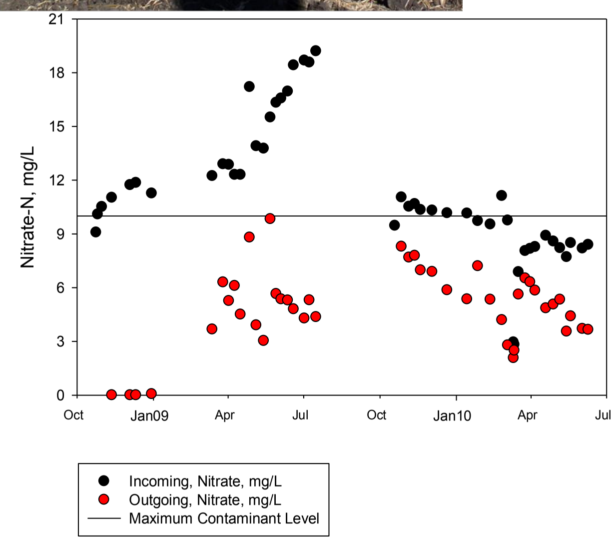


ISA EPS – 22 Bioreactors

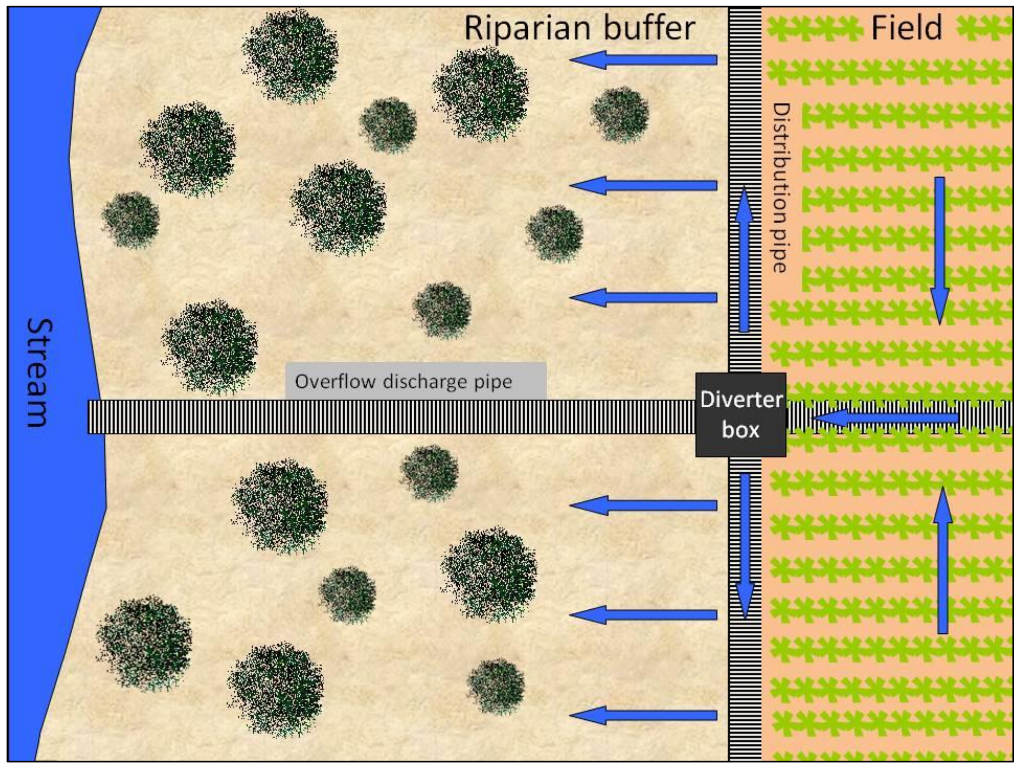
- 12 actively monitoring
- Project with Iowa Nutrient Research Center

Drainage Water Treatment
Woodchip Bioreactor

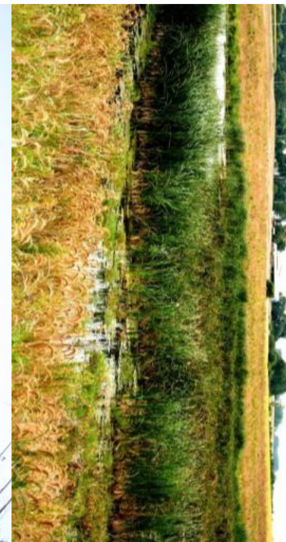
Woodchip Bioreactors for N removal. An innovative practice being applied in watersheds with nitrogen resource concerns. Water monitoring data to validate performance.

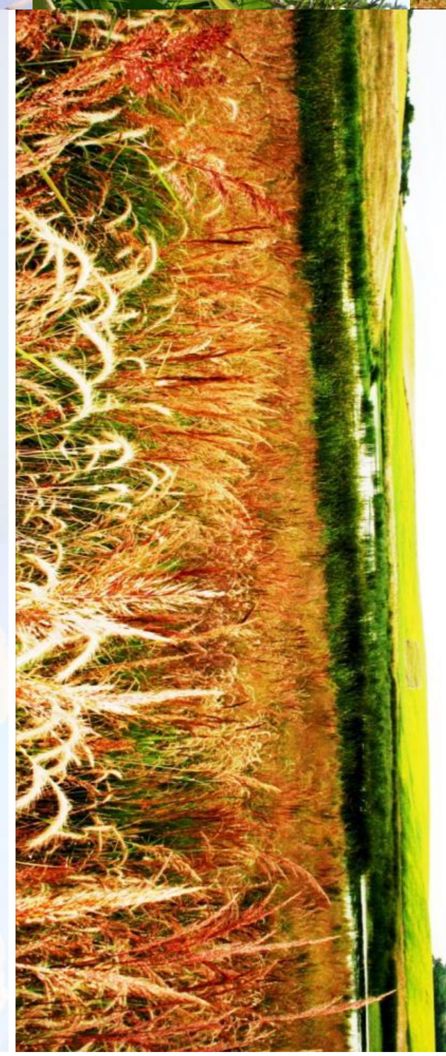
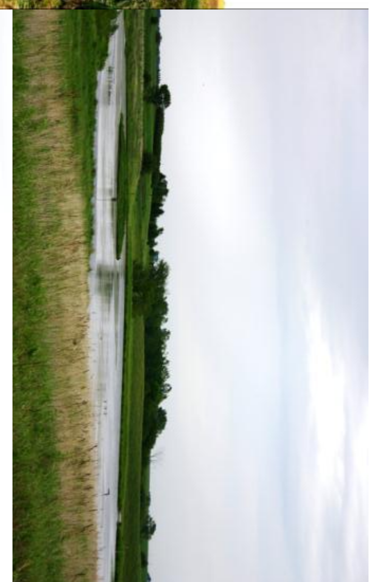


Re-saturated Riparian Buffers



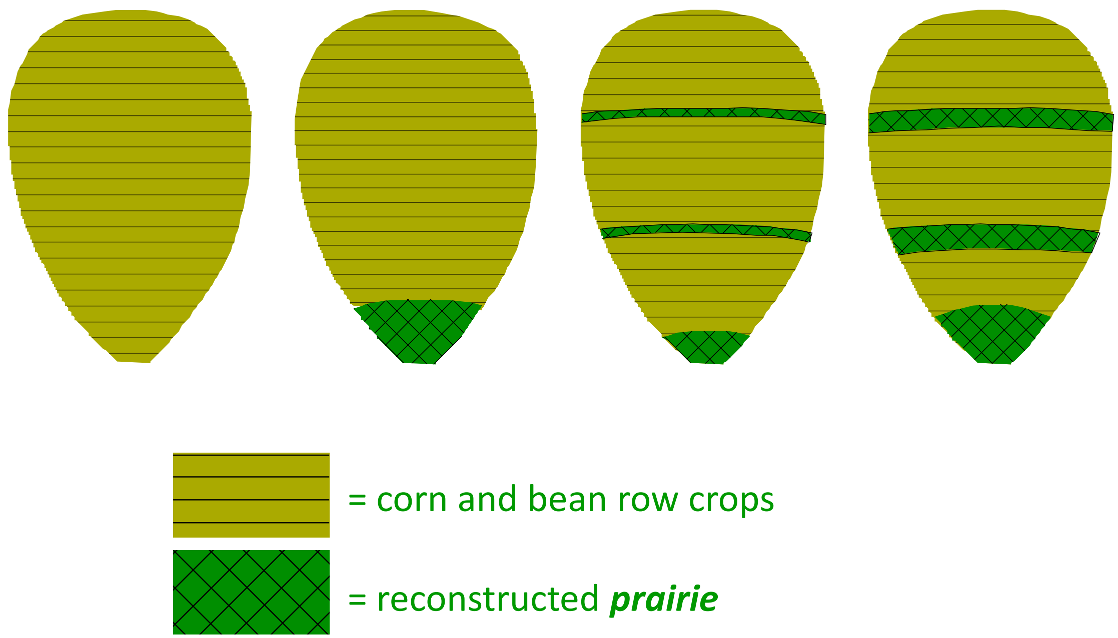




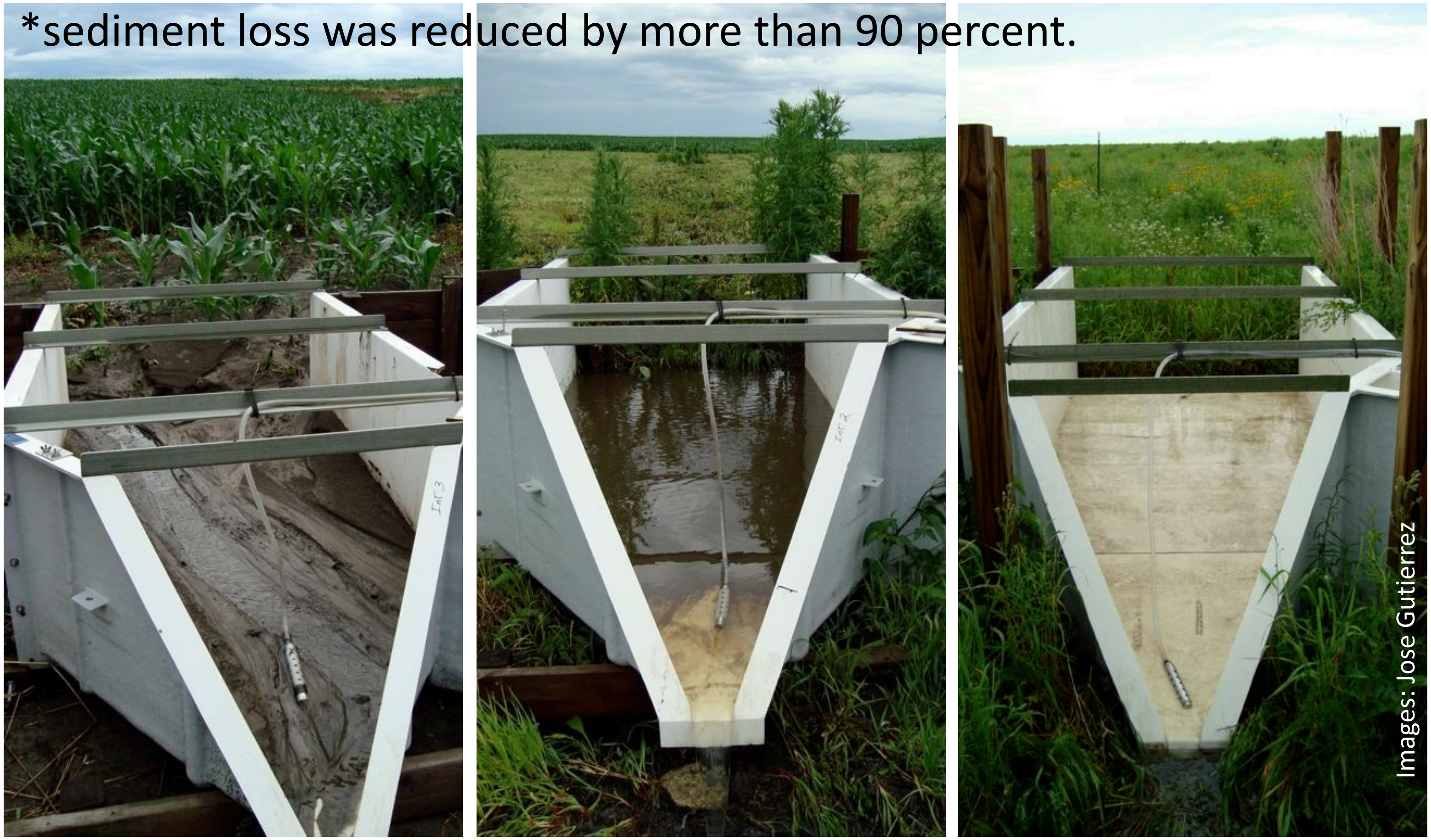

Prairie STRIPS

12 small watersheds – 1-8 ac:
Random Incomplete Block Design:
3 reps X 4 treatments X 3 blocks



*60% reduction in water runoff; *88% reduction in N;*89% reduction in P with just 10-20% of watershed converted to prairie.

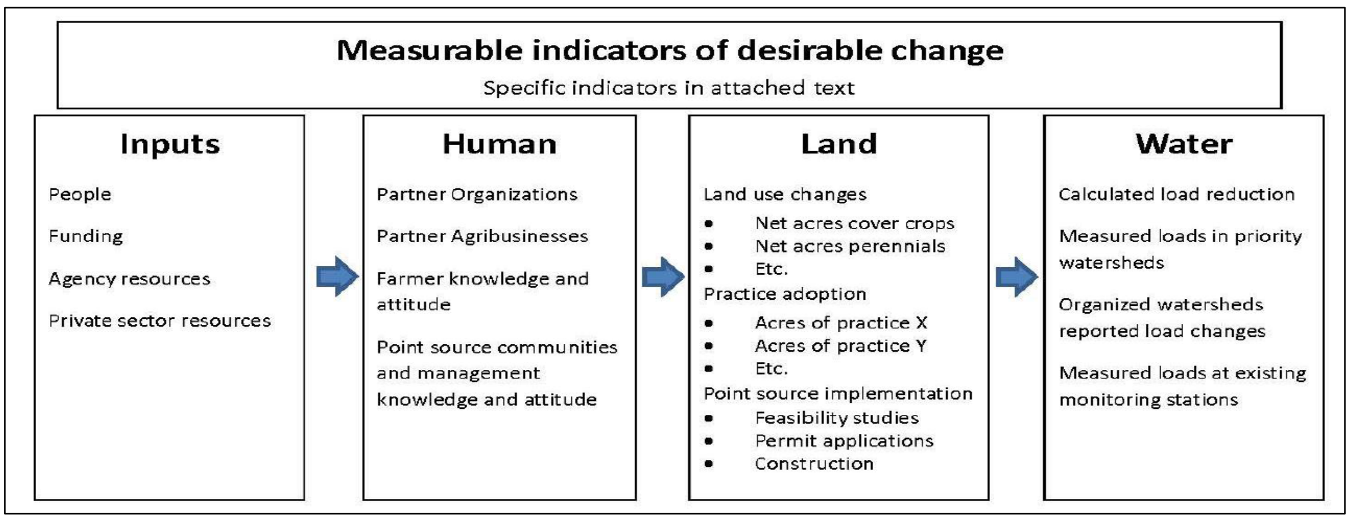
*sediment loss was reduced by more than 90 percent.



Images: Jose Gutierrez

ONGOING EFFORTS

- Measures of Success:
  - Develop new and expanded frameworks to track progress, beyond ambient water quality monitoring
  - Public/private template for gathering better baseline data and tracking load reductions resulting from conservation practice adoption
  - Track aggregate practice adoption levels
  - Report calculated/modeled load reductions from practice adoption



FUTURE EFFORTS

- Continue to support and build on statewide efforts
- RCPP funding build upon Targeted Demo Projects
  - Other RCPP opportunities
- RFA currently open for Urban Conservation projects
- RFA for additional Targeted Demonstration Watershed Projects
- Expand funding into other practices detailed in the Iowa NRS
- Sec. Northey's budget request for FY2016 for WQI at $7.5M

Partnerships

NCGA www.ncga.com
The Nature Conservancy Protecting nature. Preserving life.
American Farm Bureau Federation
Bayer CropScience
syngenta
General Mills
John Deere
MARS incorporated
The Fertilizer Institute Nourish, Replenish, Grow
National Alfalfa & Forage Alliance NAFA
WWF
CropLife America
DuPont The miracles of science
Fleishman Hillard International Communications
Farm Press
College of Agricultural & Life Sciences University of Wisconsin-Madison
Cargill
CTIC
National Cotton Council of America
Field to Market The Keystone Alliance for Sustainable Agriculture
Innovation Center for U.S. Dairy
National Potato Council
Bunge
ASA American Soybean Association If you believe, belong.
National Association of Wheat Growers
UofA University of Arkansas Division of Agriculture
Environmental Defense Fund finding the ways that work
National Association of Conservation Districts conserving natural resources for our future
Kellogg's
CropLife International
BASF The Chemical Company
Coca-Cola Live Positively
Indiana Soybean Alliance
USDA NRCS United States Department of Agriculture Natural Resources Conservation Service
Manomet Center for Conservation Sciences
cotton
Our soybean checkoff. Effective. Efficient. Farmer-Driven.
Land O'Lakes, Inc.
IPNI International Plant Nutrition Institute
USA Rice Federation
Darden Restaurants
World Resources Institute
GMA The Association of Food, Beverage and Consumer Products Companies
Monsanto imagine

Regulation vs Freedom to Operate

Water Works votes to sue 3 counties over nitrates
-Des Moines Register

Battle Lines Drawn On EPA's Chesapeake Bay TMDL Authority

21 State Attorneys General's amicus brief, filed in February, also challenged EPA's authority over state authority.

IJC Report

Acknowledgements for slides, data, research

- Cliff Snyder, International Plant Nutrition Institute
- Harry Vroomen, The Fertilizer Institute
- Matt Lechtenberg, Shawn Richmond, Iowa Department of Agriculture and Land Stewardship
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Wadeable Streams with High Nutrients

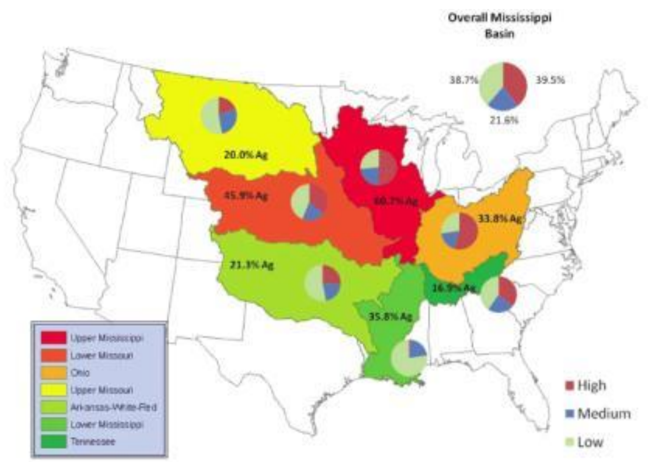


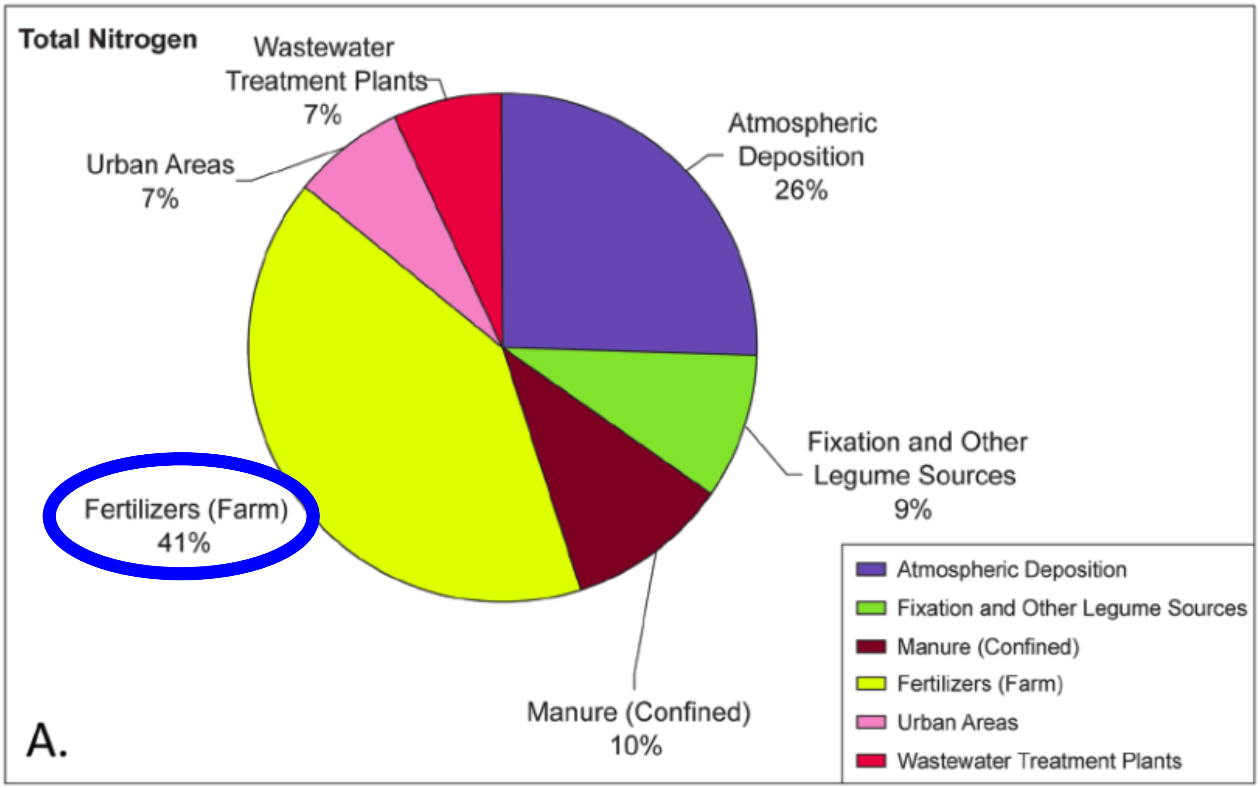
Figure 2. Percent of streams with high, medium and low levels of nitrogen and percent of land area in agricultural use (Source: WSA)

	Phosphorus	Nitrogen
Total U.S. (lower 48)	30.9%	31.8%
Total MS River Basin	32.5%	39.5%
Upper Mississippi	23.4%	50.4%
Ohio	43.2%	54.6%
Tennessee*	18.1%	36.3%
Upper Missouri	22.4%	18.6%
Lower Missouri	27.7%	34.9%
Arkansas	41.2%	25.9%
Lower Mississippi*	38.6%	1.6%

***** *Small sample sizes in these sub-basins result in lower statistical significance*

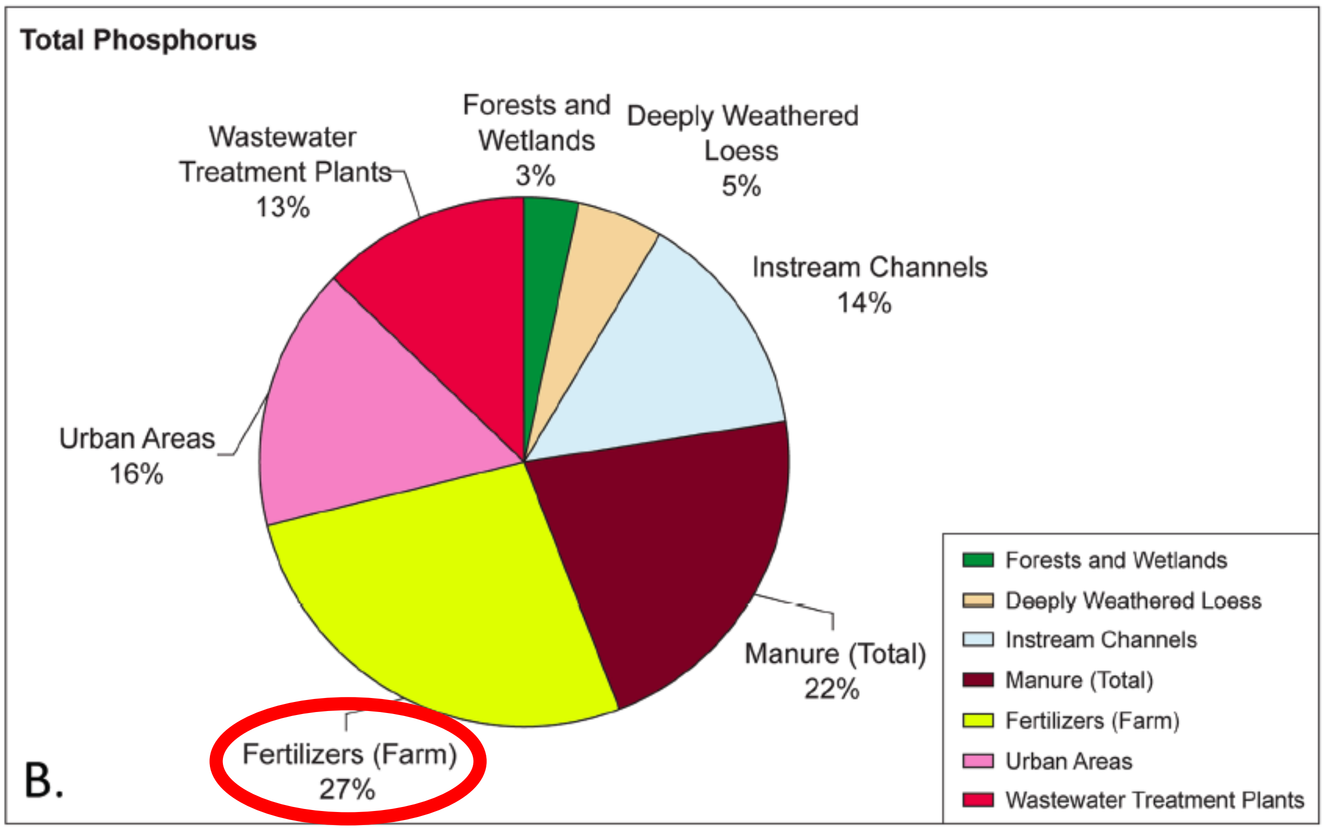
http://water.epa.gov/type/rsl/monitoring/upload/EPA-MARB-Fact-Sheet-112911_508.pdf

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



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

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



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


Sustainable Intensification of Agriculture
The agricultural challenge: Feeding humanity while protecting nature