Farmer-led Efforts to Improve Water Quality

Sean McMahon, Iowa Agriculture Water Alliance (IAWA)

Fluid Fertilizer Foundation

December 11, 2019

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Iowa Agriculture Water Alliance

- Mission
  - 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



Iowa Water Quality Initiative

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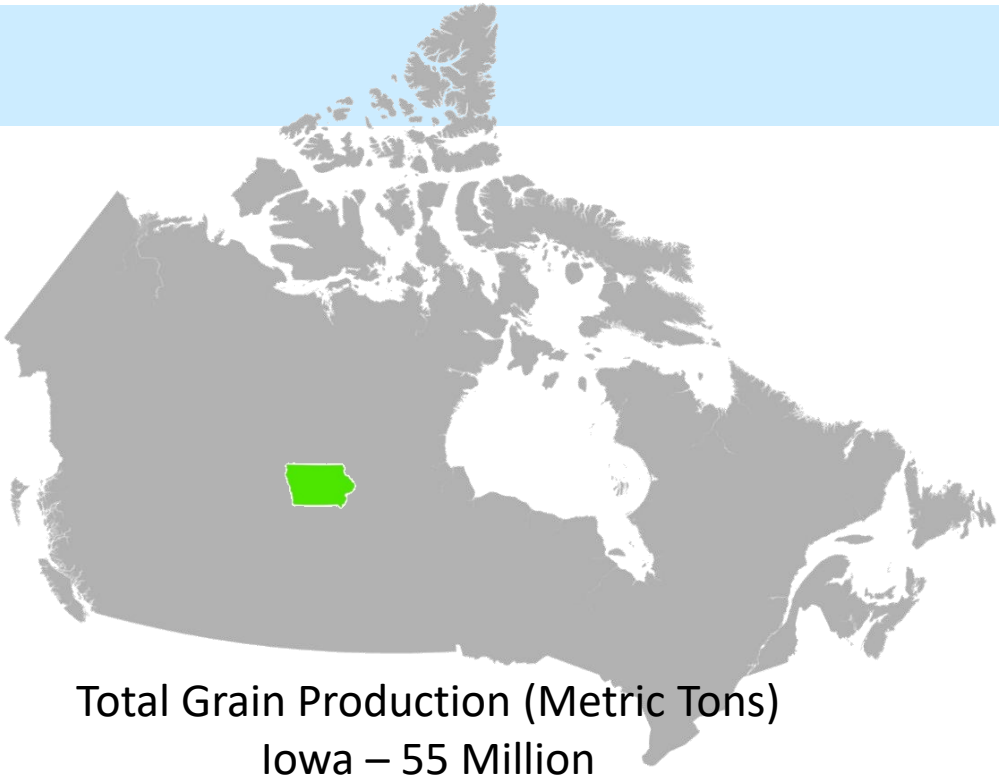


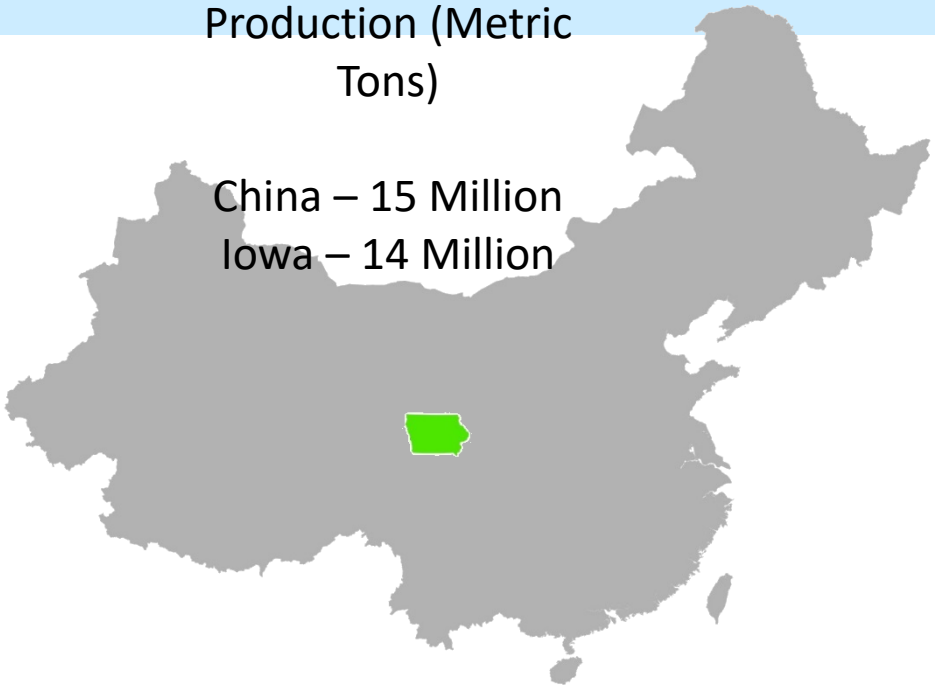
Total Grain Production (Metric Tons)

Iowa – 55 Million

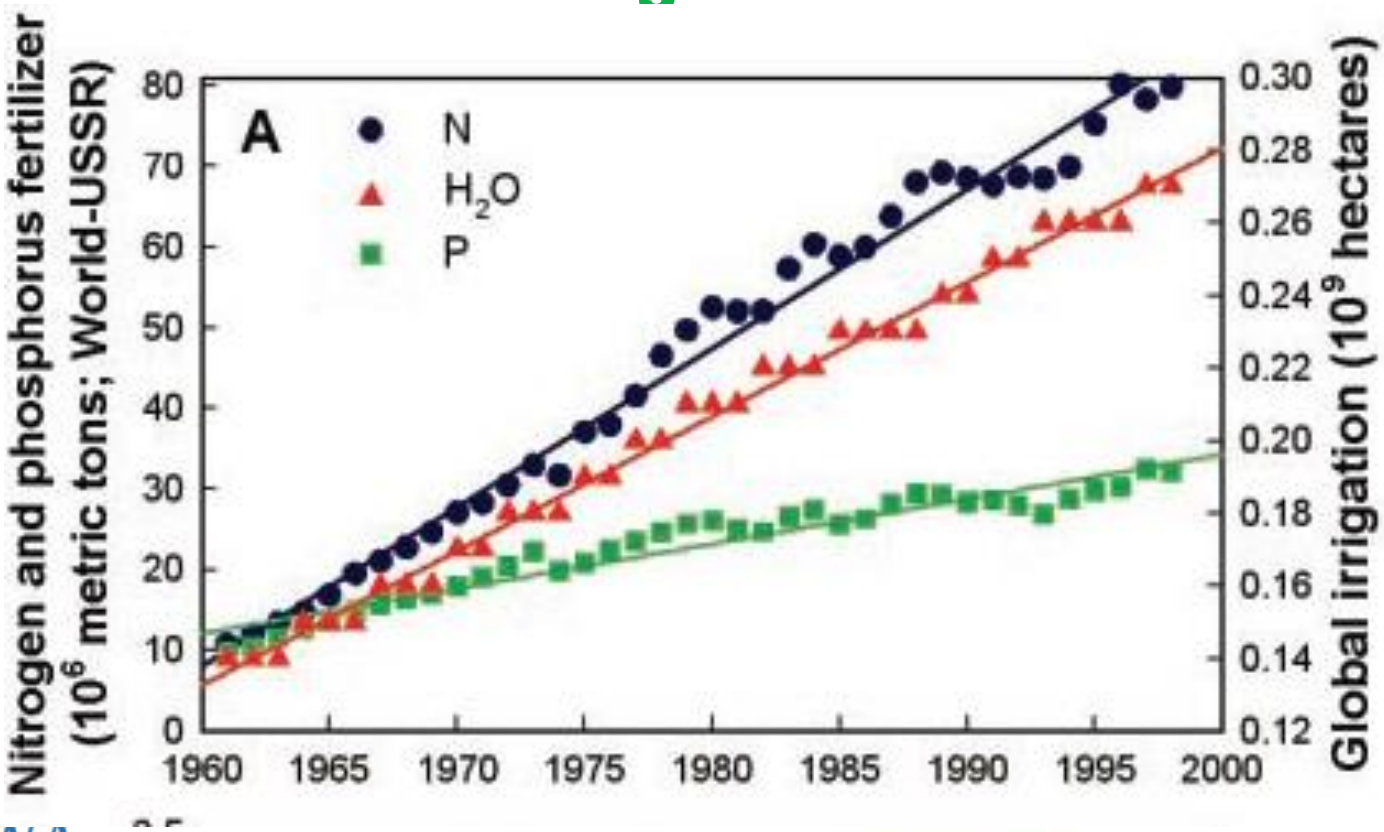
Canada – 45 Million

Total Soybean Production (Metric Tons)

China – 15 Million
Iowa – 14 Million



Global Nitrogen, Phosphorus and Irrigation Use



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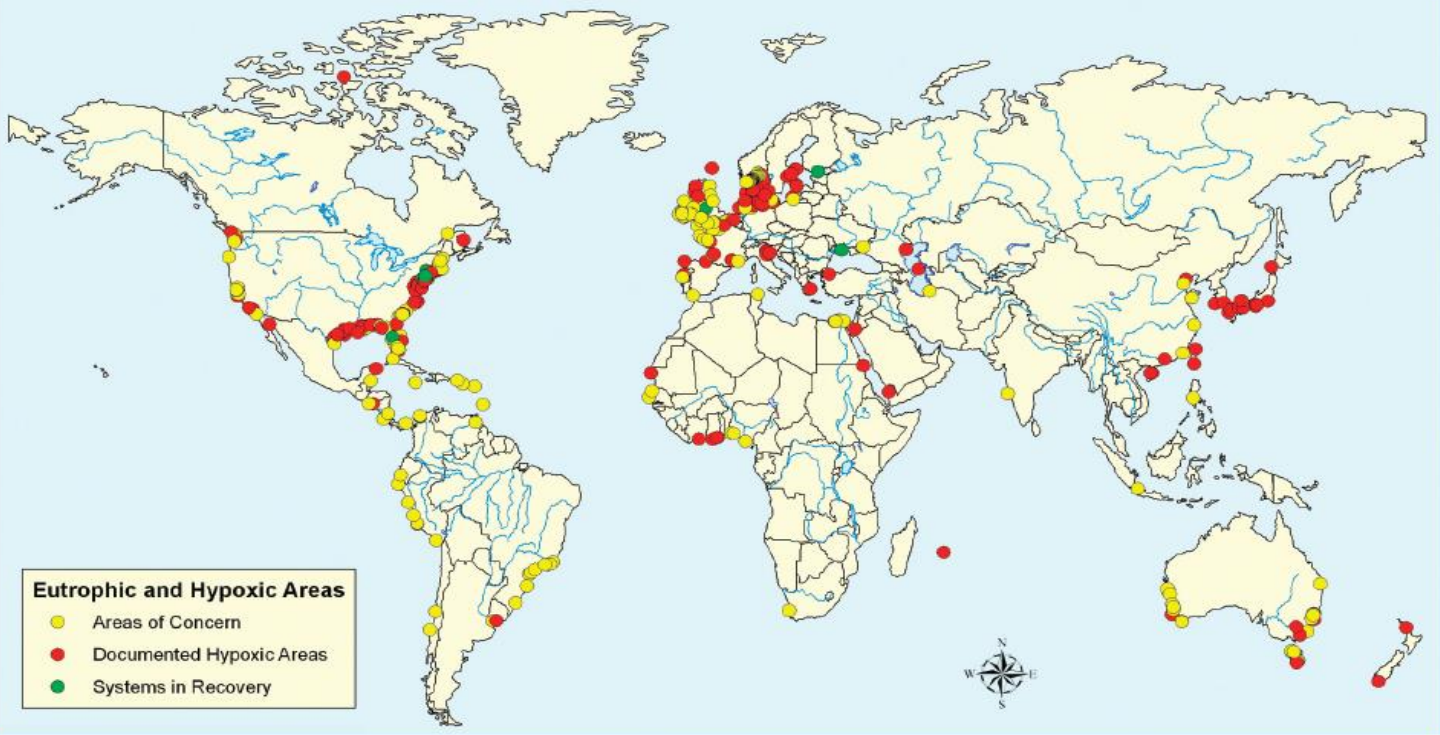
Hypoxic Zones of the World



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

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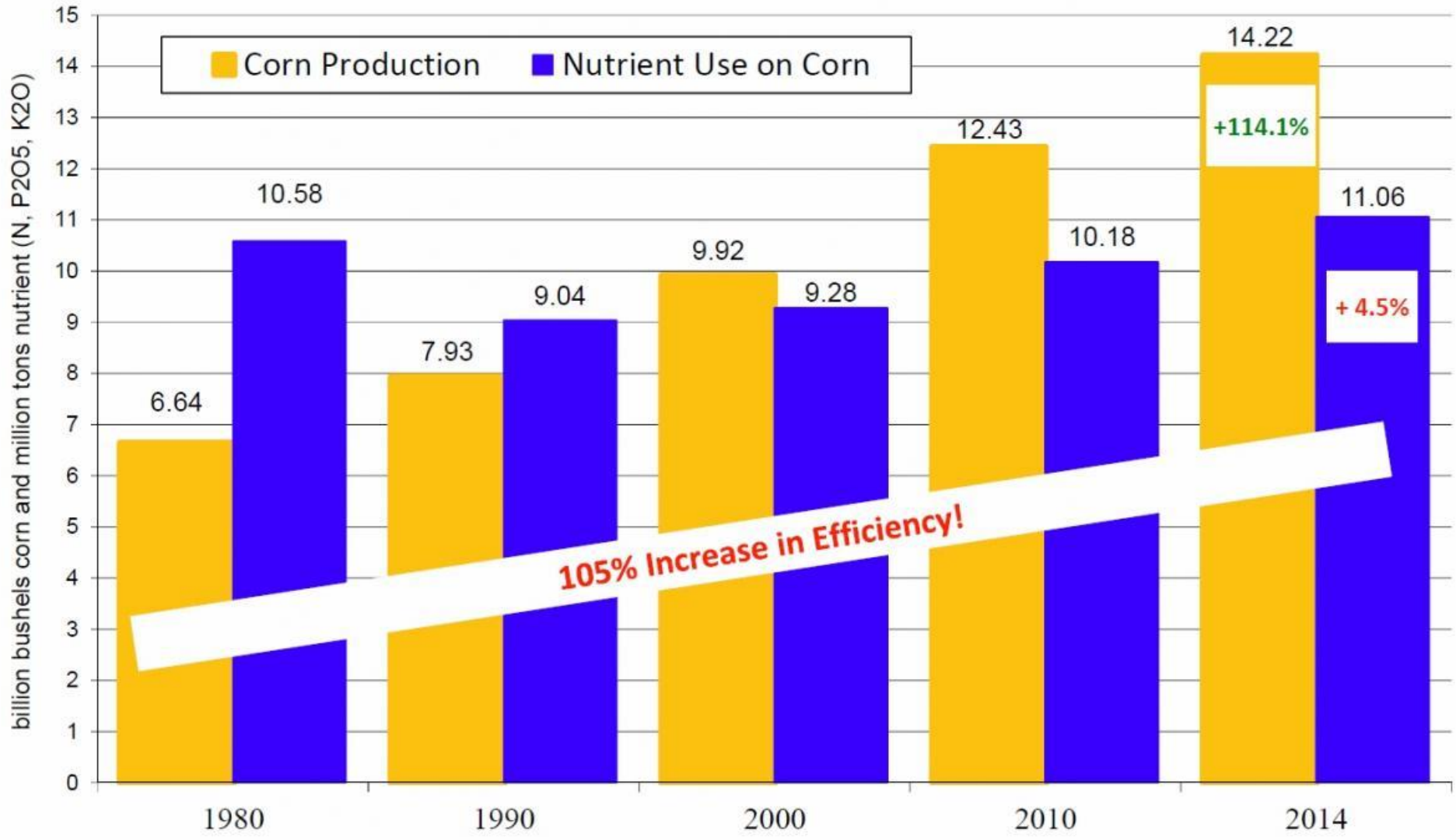
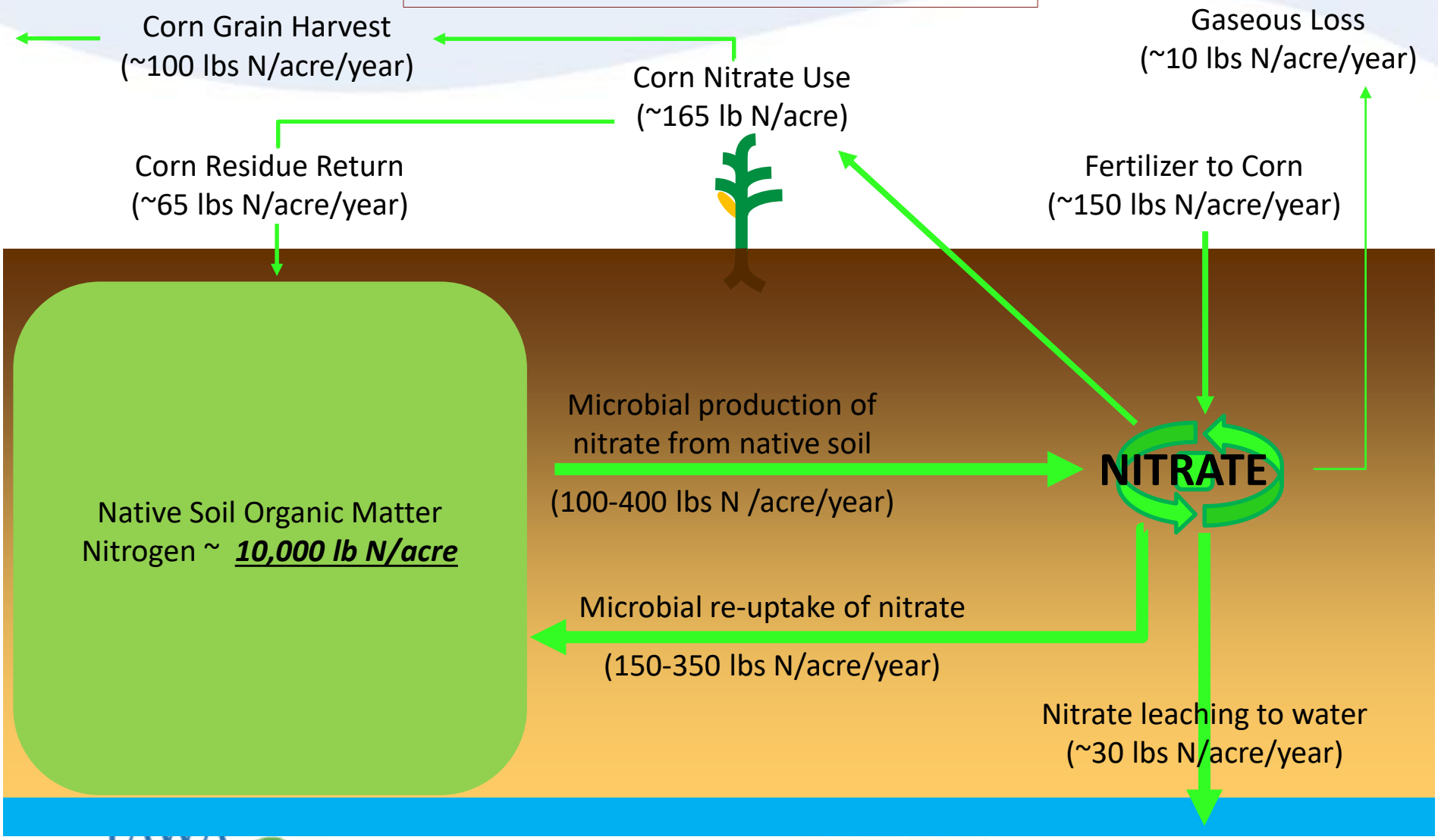
U.S. Corn Production and Nutrient Use on Corn

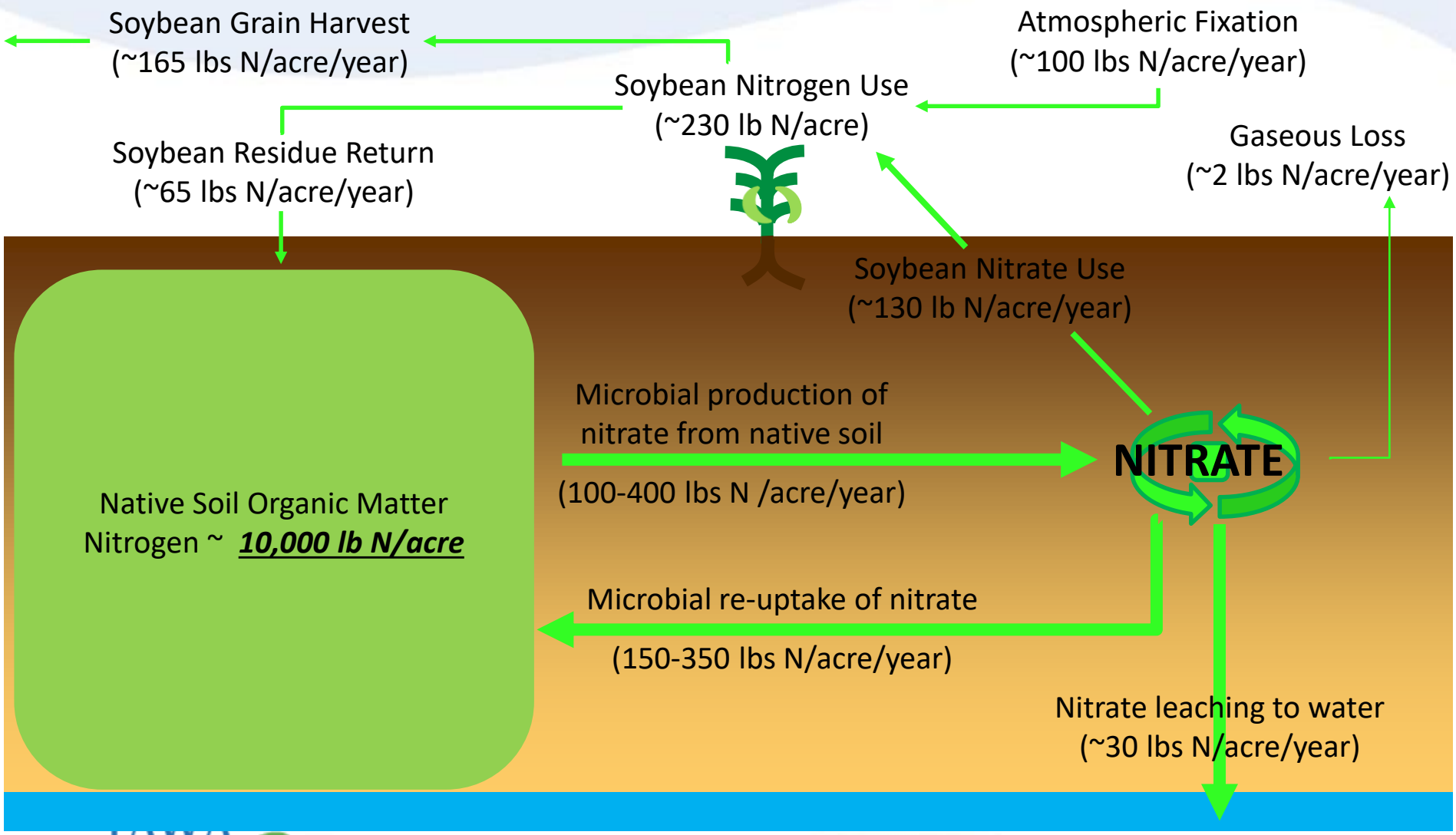


Source: Computed by The Fertilizer Institute from data reported by NASS, USDA.

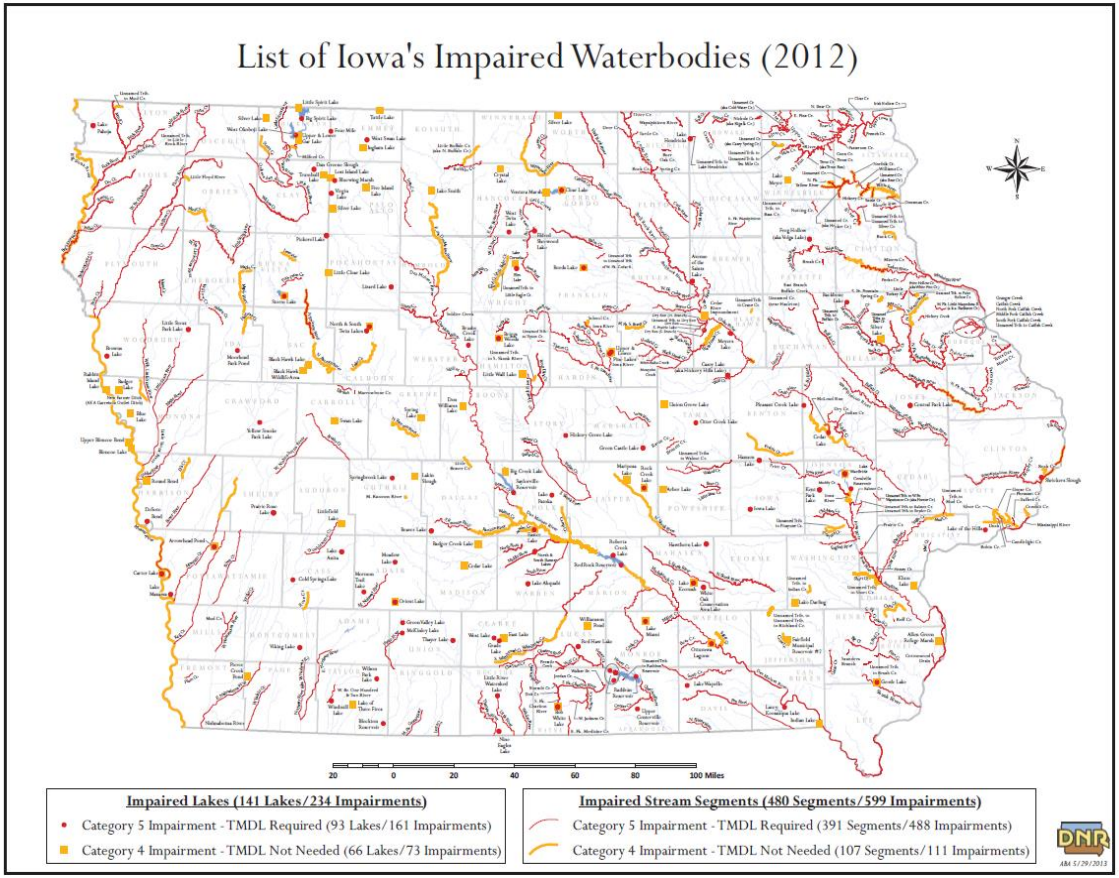
Corn Nitrogen Cycling & Budget



Soybean Nitrogen Cycling & Budget



Iowa Water Challenges and Opportunities



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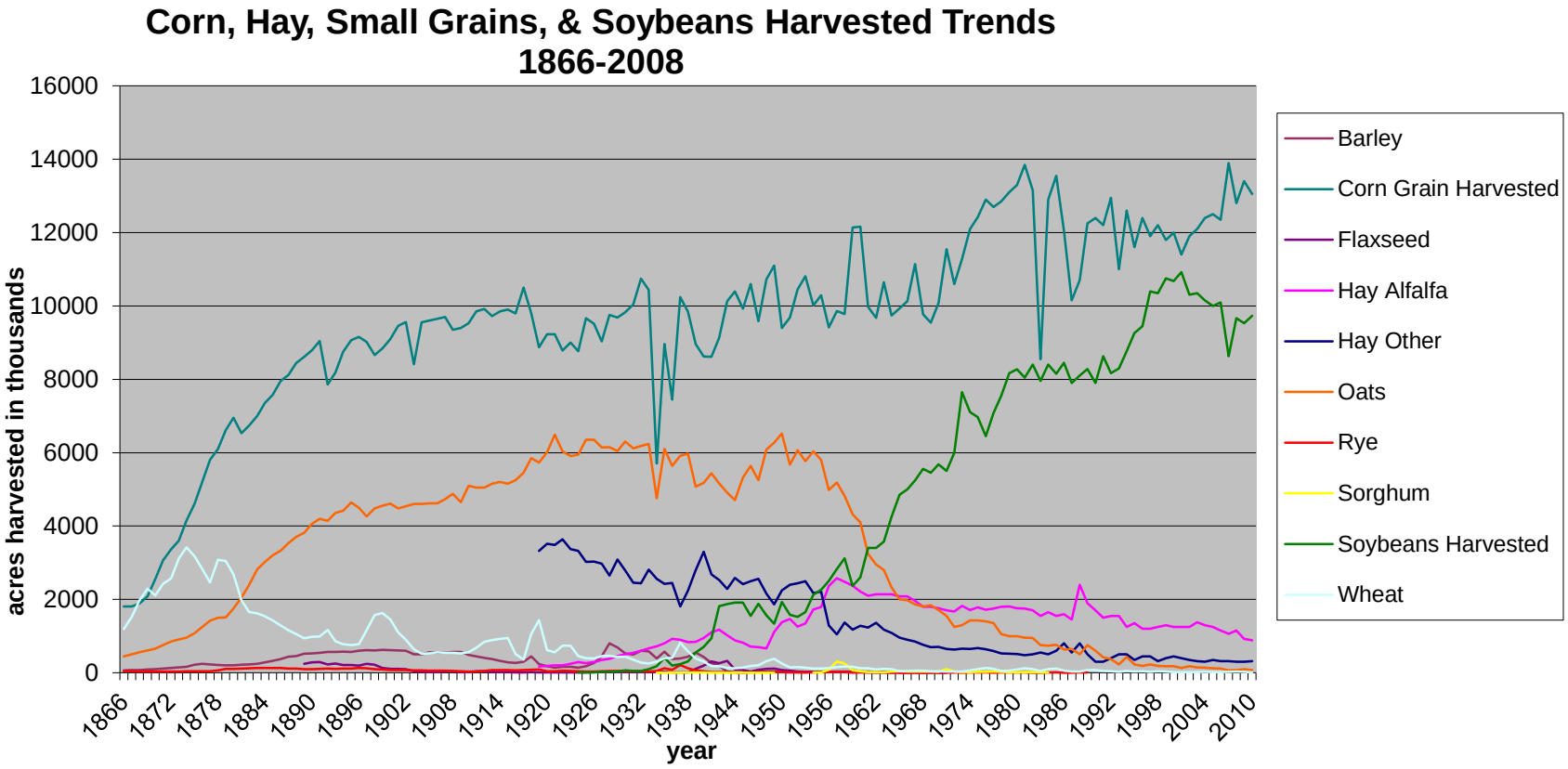
Changes in Land Use



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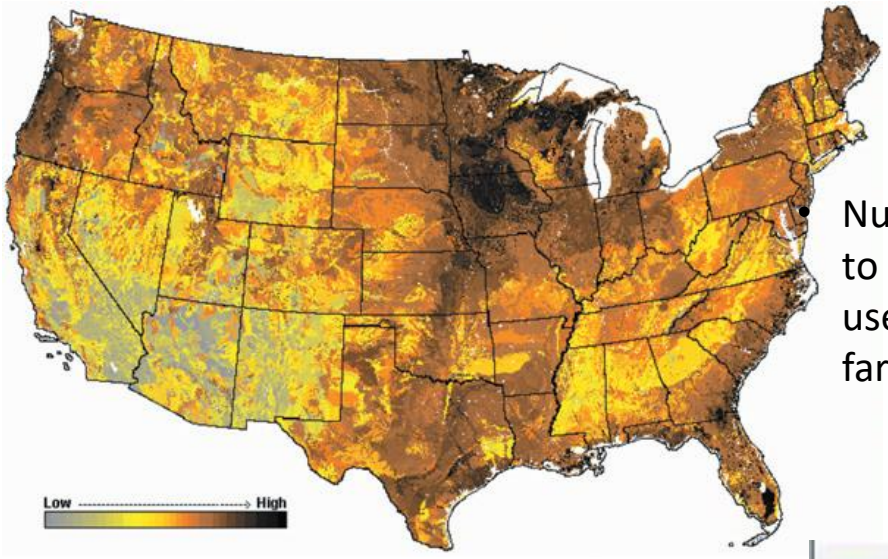
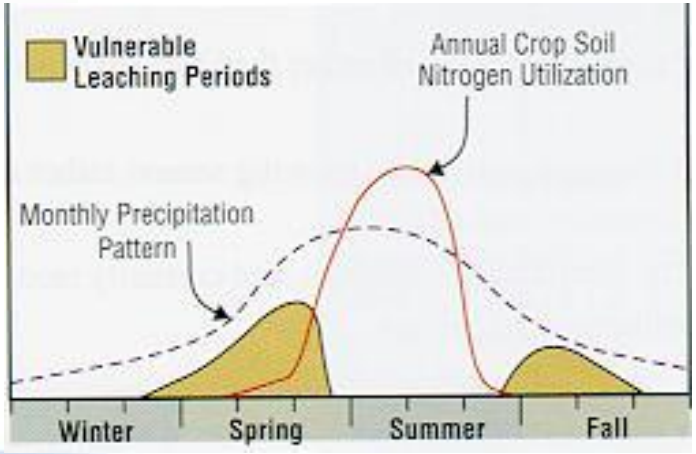
Soils Vulnerable to Leaching



- Nutrient content of water has more to do with historic changes in land use and hydrology than inputs by farmers.

Current major cropping system leaves soil vulnerable to erosion and nutrient leaching, especially in Spring and Fall.



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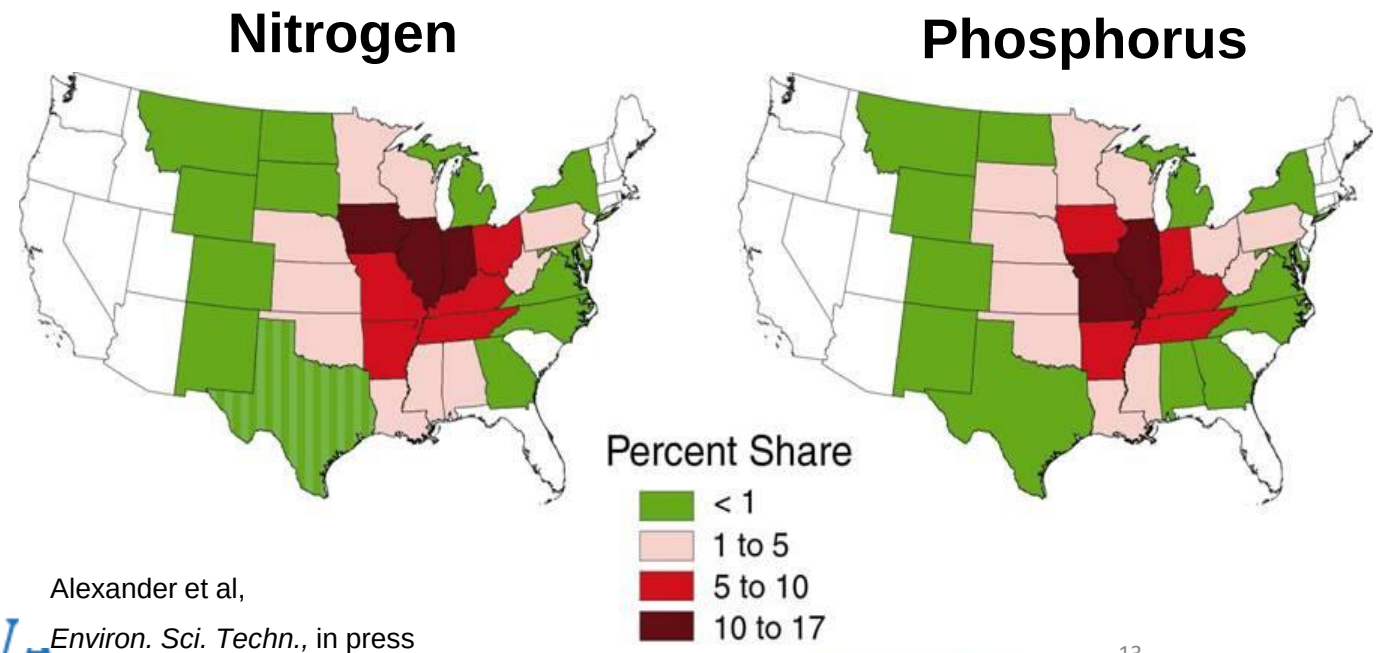
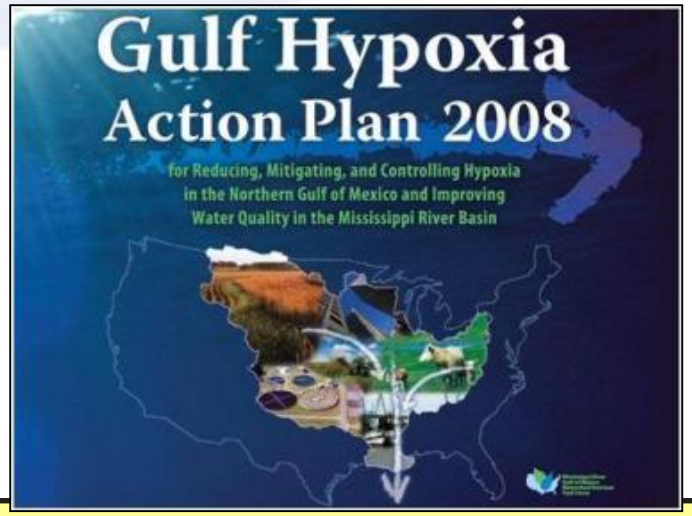
NUTRIENT DELIVERY TO THE GULF OF MEXICO

State shares of the total annual nutrient flux



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



EPA Hypoxia SAB report suggested

45% less total N

AND

45% less total P

discharge to the Gulf to reduce hypoxia

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Iowa Nutrient Reduction Strategy: 45% N and P Reduction Goals

Nitrogen Practices

Phosphorus 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	91 (20)	
	Saturated Buffers	Divert fraction of tile drainage into riparian buffer to remove Nitrate-N by denitrification.	50 (13)	

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	

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Iowa Nutrient Reduction Strategy

- *Transformational change* will be required to meet these targets, cost upwards of $4B
- No single practice will meet these reductions
- Current rate of adoption and investment – centuries; best case – decades

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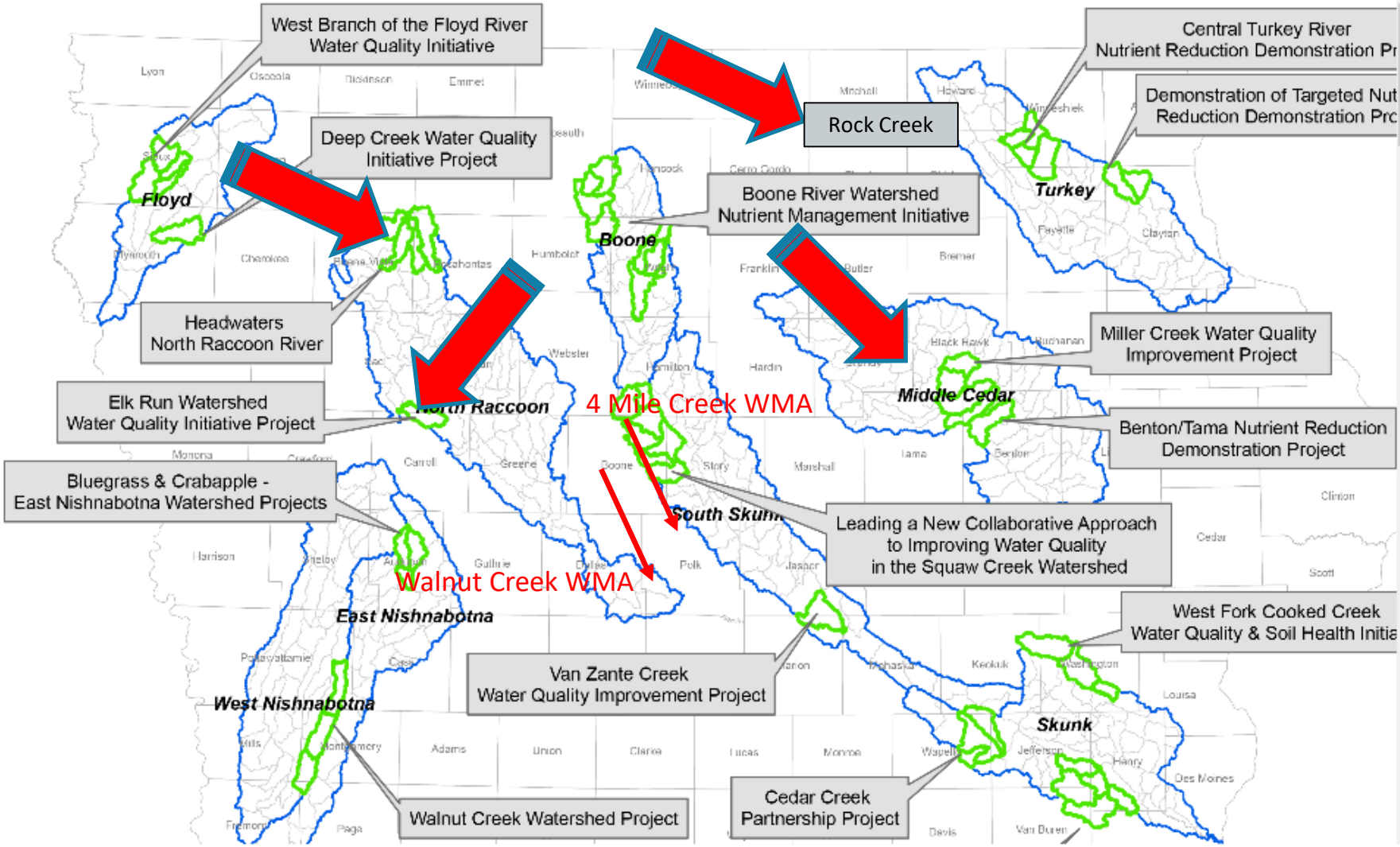
NRCS Photo

Watershed Approach



Conservation Infrastructure

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Opportunity for Economic Growth and Innovation

Cover Crops

- Now: ~880K-1.5M acres
- Need: 12-17 Million acres

Future Opportunities

- 300,000 acres of seed production
- 300 aerial seed applicators
- 1000's drills
- 100's-1000's seed cleaners
- 17,000 semis to transport seed
- and people…

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Opportunity for Economic Growth and Innovation

Bioreactors / Saturated Buffers

- Now: ~85 installed
- Need: 1000's more

Future Opportunities

- Engineering design
- Materials
- Construction
- Monitoring
- Maintenance

CI Vision and Definition of Succes

Economic development

Water Quality

VISION: We envision a prosperous, sustainable and resilient Iowa with HEALTHY SOIL AND WATER and ECONOMICALLY VIBRANT COMMUNITIES that is recognized as THE national leader in both agriculture and conservation.

DEFINITION OF SUCCESS: Conservation practices are economically compelling and easier for farmers and landowners to implement. Increased investments in conservation practices that lead to healthy soil and improved water quality for the benefits of all Iowans and downstream communities.

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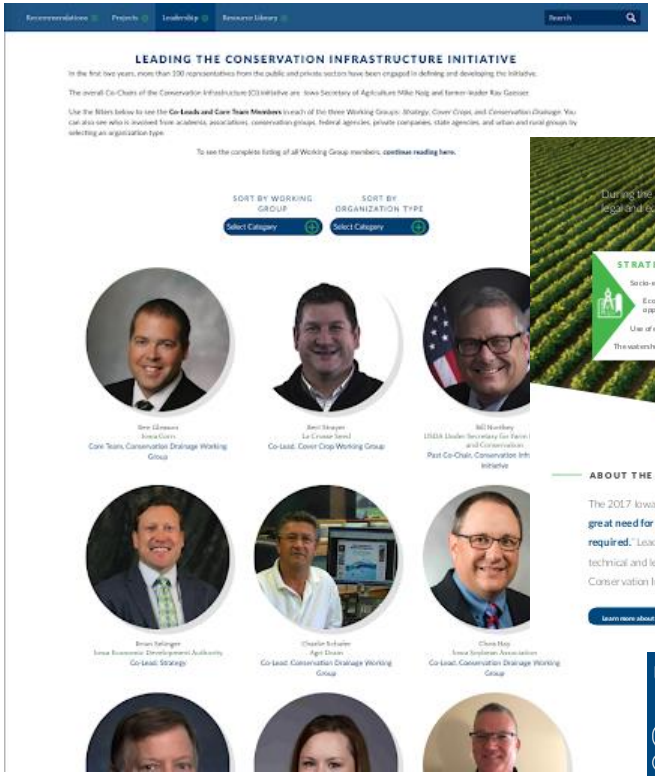
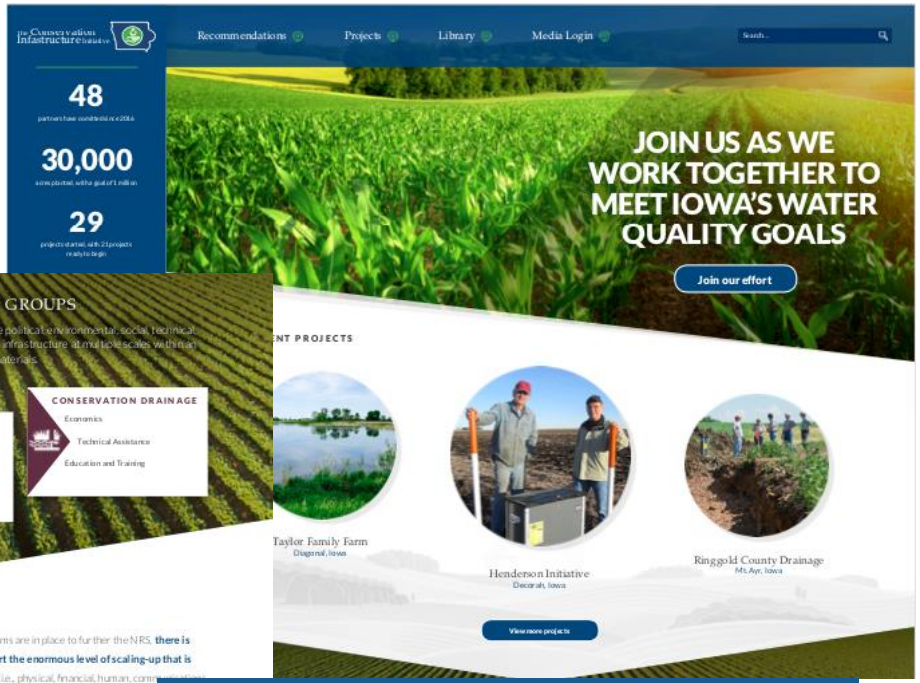
CI Update





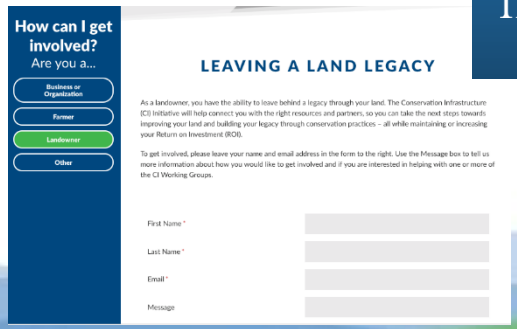
ABOUT THE CONSERVATION INFRASTRUCTURE INITIATIVE

The 2017 IowaNRS Progress Report sets the vision by saying, "While many programs are in place to further the NRS, **there is great need for developing other opportunities and investments that will support the enormous level of scaling-up that is required.**" Leaders in Iowa recognized the public and private infrastructure issues (i.e., physical, financial, human, communities, technical and leadership) required to increase the pace and scale of conservation practice adoption and other barriers. Conservation Infrastructure (CI) Initiative to address these and other infrastructure gaps and barriers.

Learn more about our leadership

The Conservation Infrastructure Initiative

www.**IowaCI**.org



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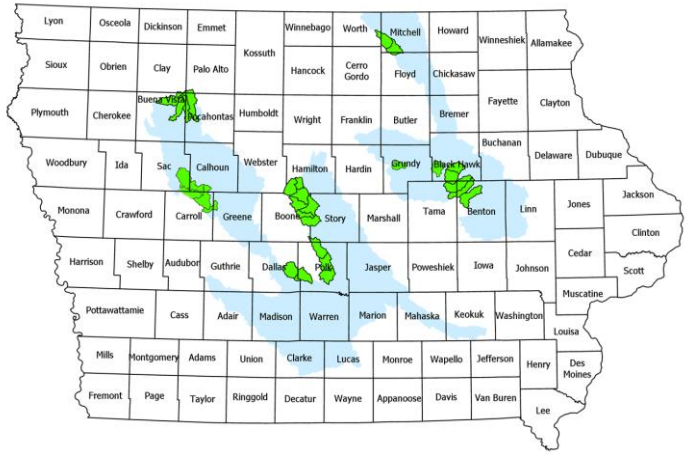
Midwest Agriculture Water Quality Partnership RCPP

$50M, 47 Partners

- 3.5M ac improved conservation in 3 years
- >90% original funding obligated
- ~99% of original 4:1 match requirement has been met



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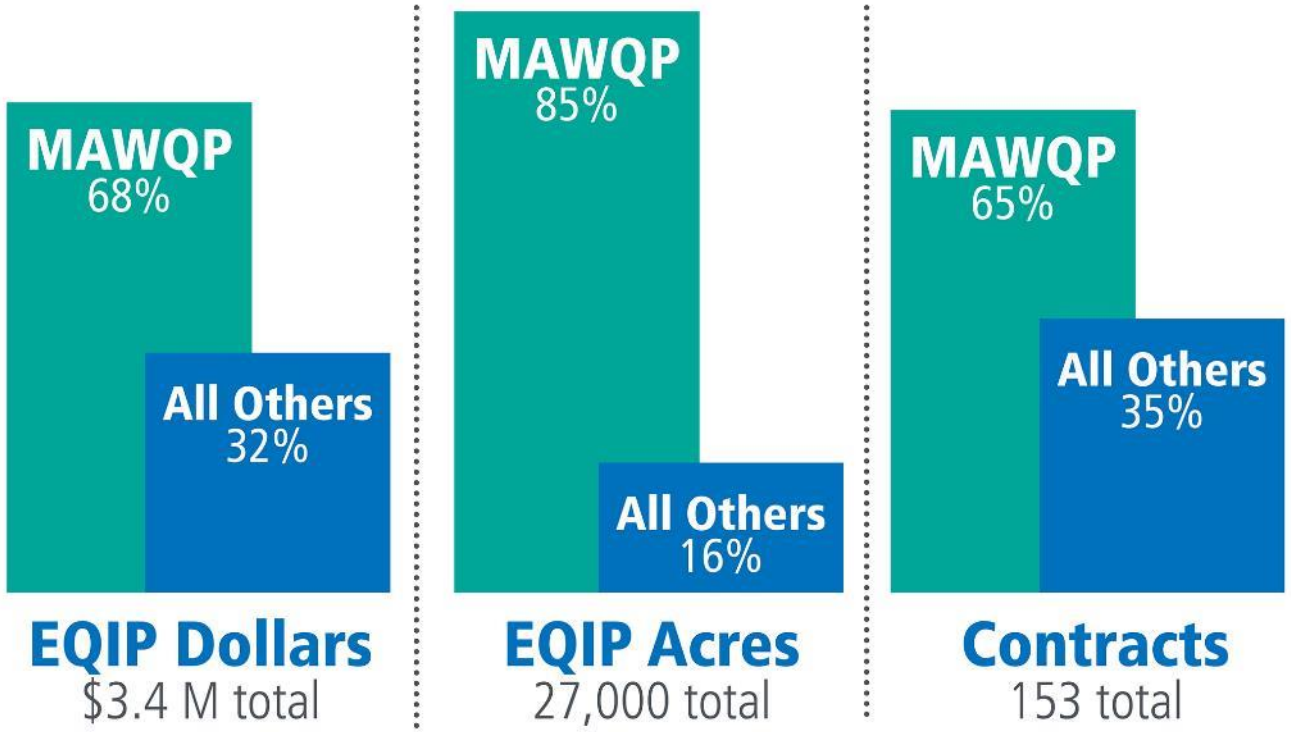
Eight RCPP Programs in Iowa



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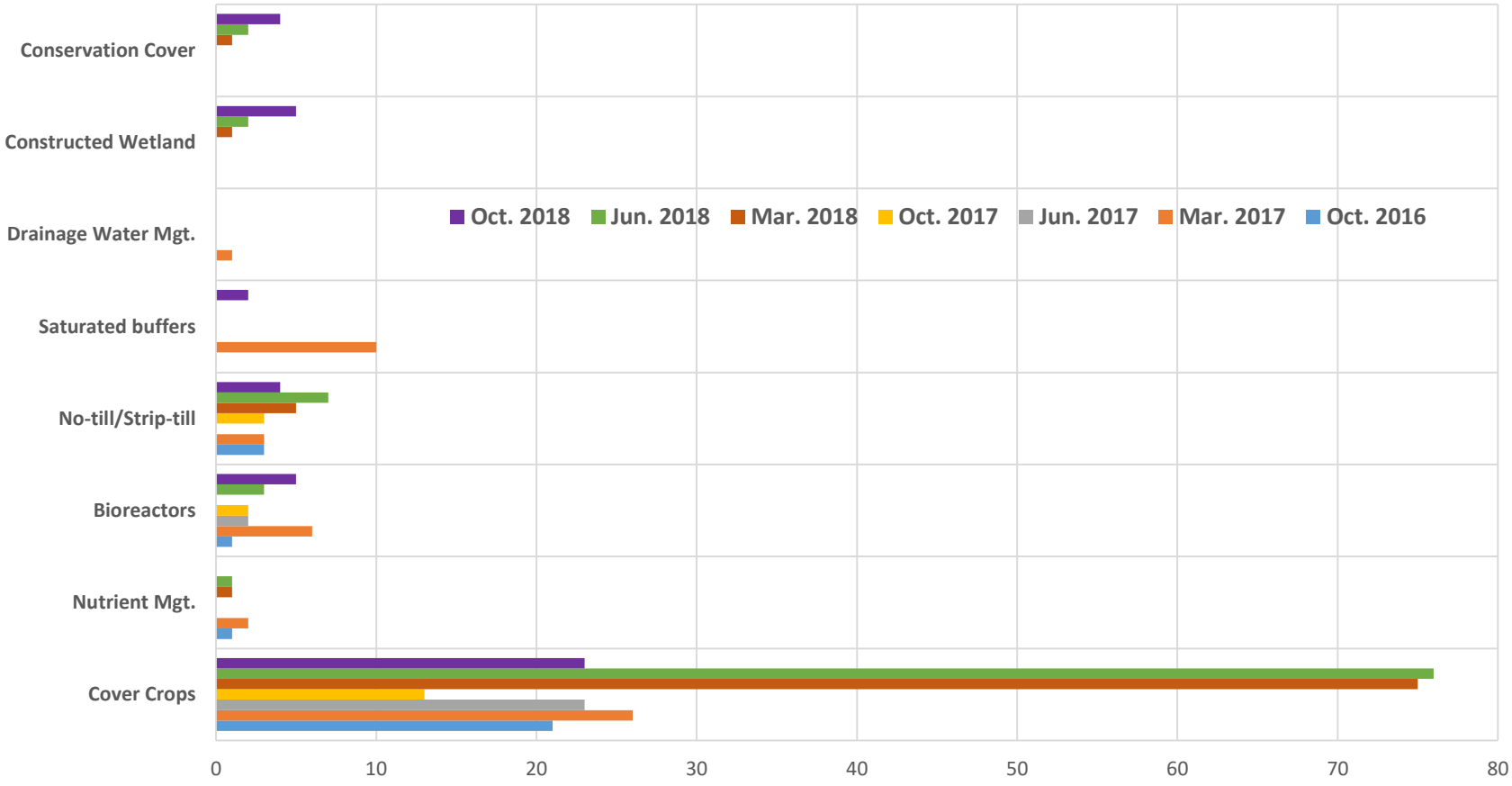
RCPP Practices by Signup

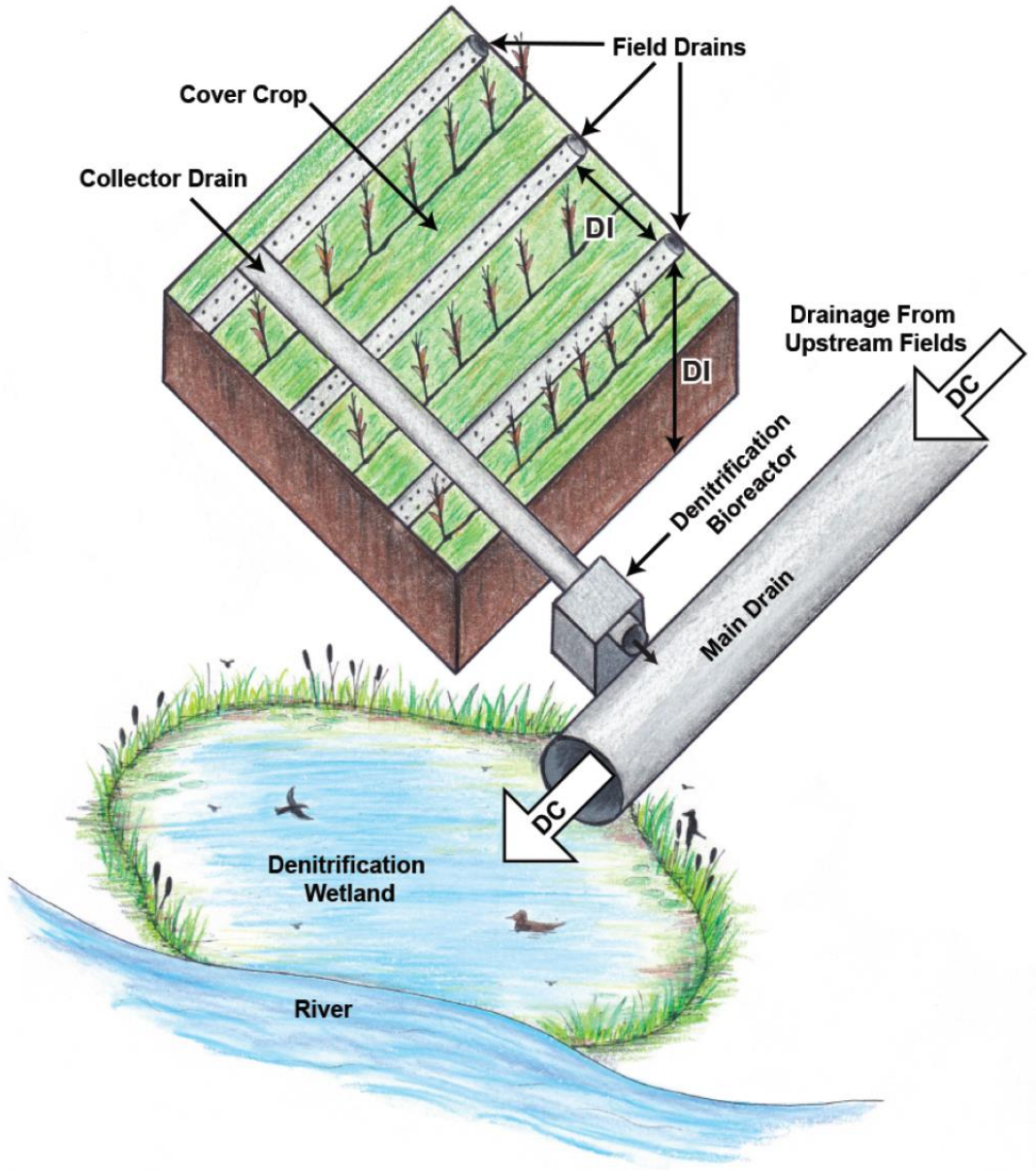


Future Fertilizer Management Sustainability Projects:

-Fertilizer Management payment flexibility in RCPP in exchange for new practices.
-Payments to Ag Retail for EQIP Contracts
-Supply Chain partnerships driven by consumers
-Payments for Ecosystem Services
-Systems Approach to Sustainable Intensification of ag drainage

Alternatives

- Wetlands
- Saturated buffers
- Shallow drainage
- Controlled drainage



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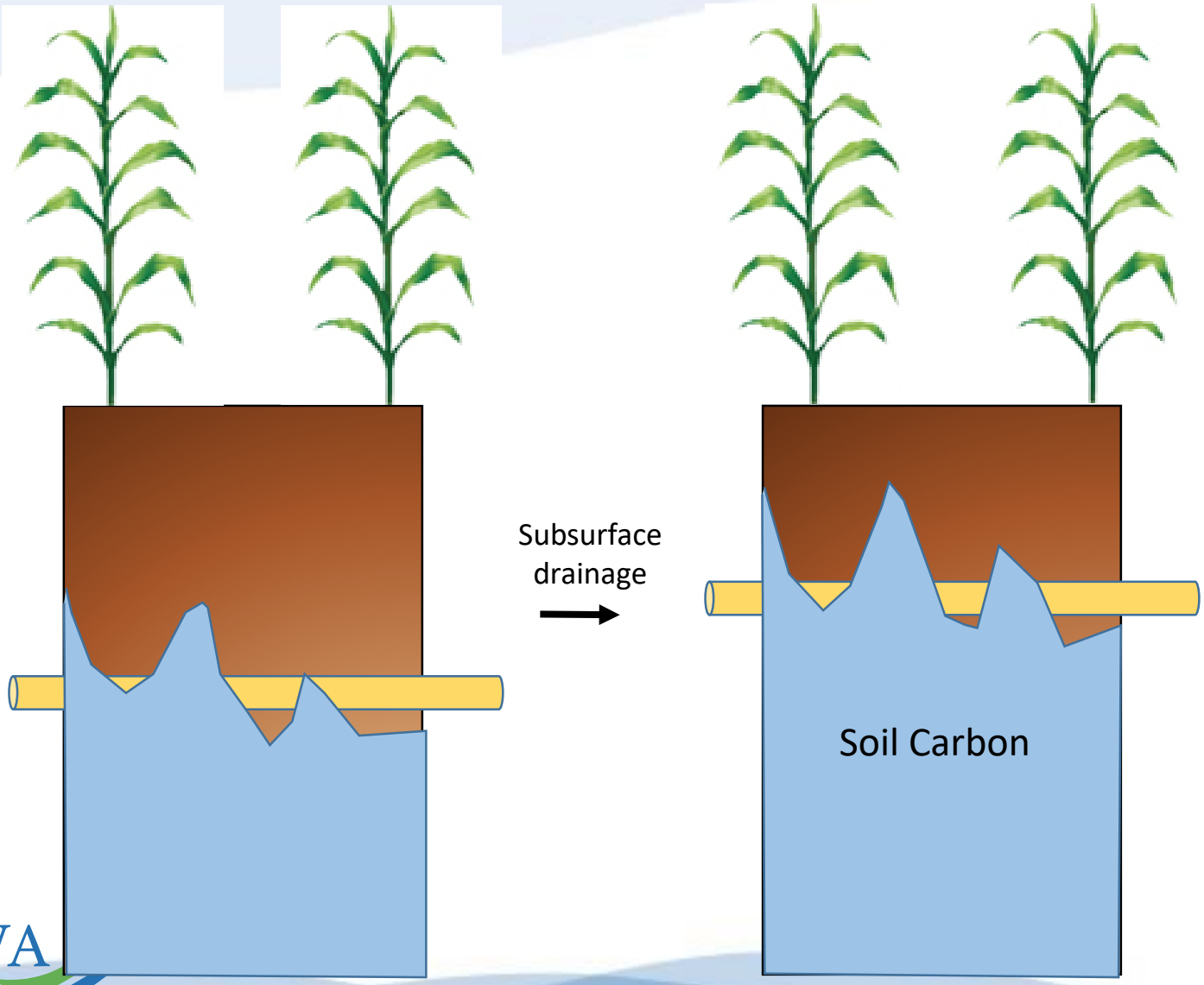
Shallow drainage: robust soil carbon sequestration



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NASDA National Public Private Partnerships Award – IAWA Business Council

Questions?

Get involved!

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