

Drivers of Conservation Drainage Practice Implementation in the US Midwest

Jeppe Kjaersgaard
Minnesota Department of Agriculture

Gulf of Mexico Hypoxia





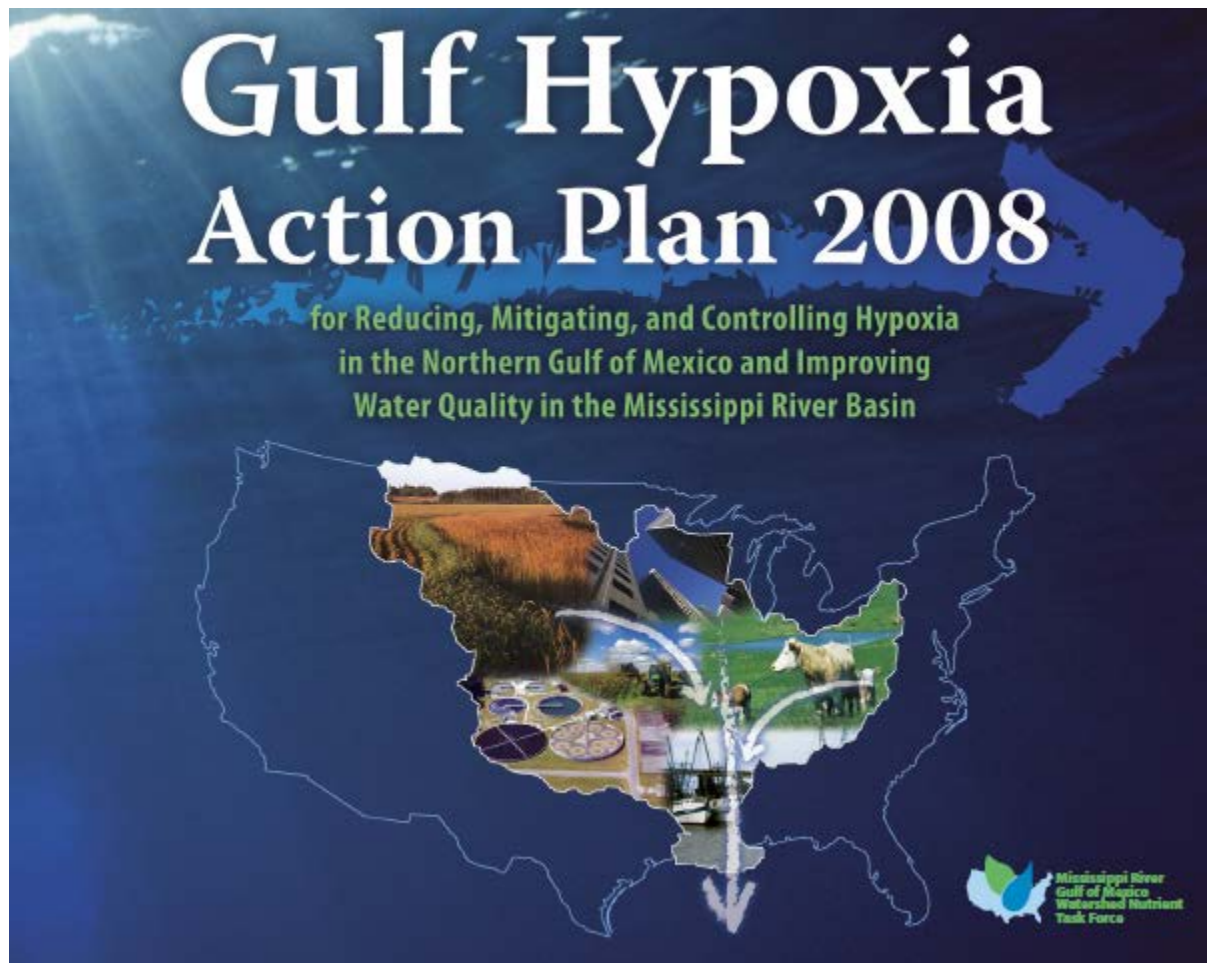
L O U I S I A N A

Mississippi River

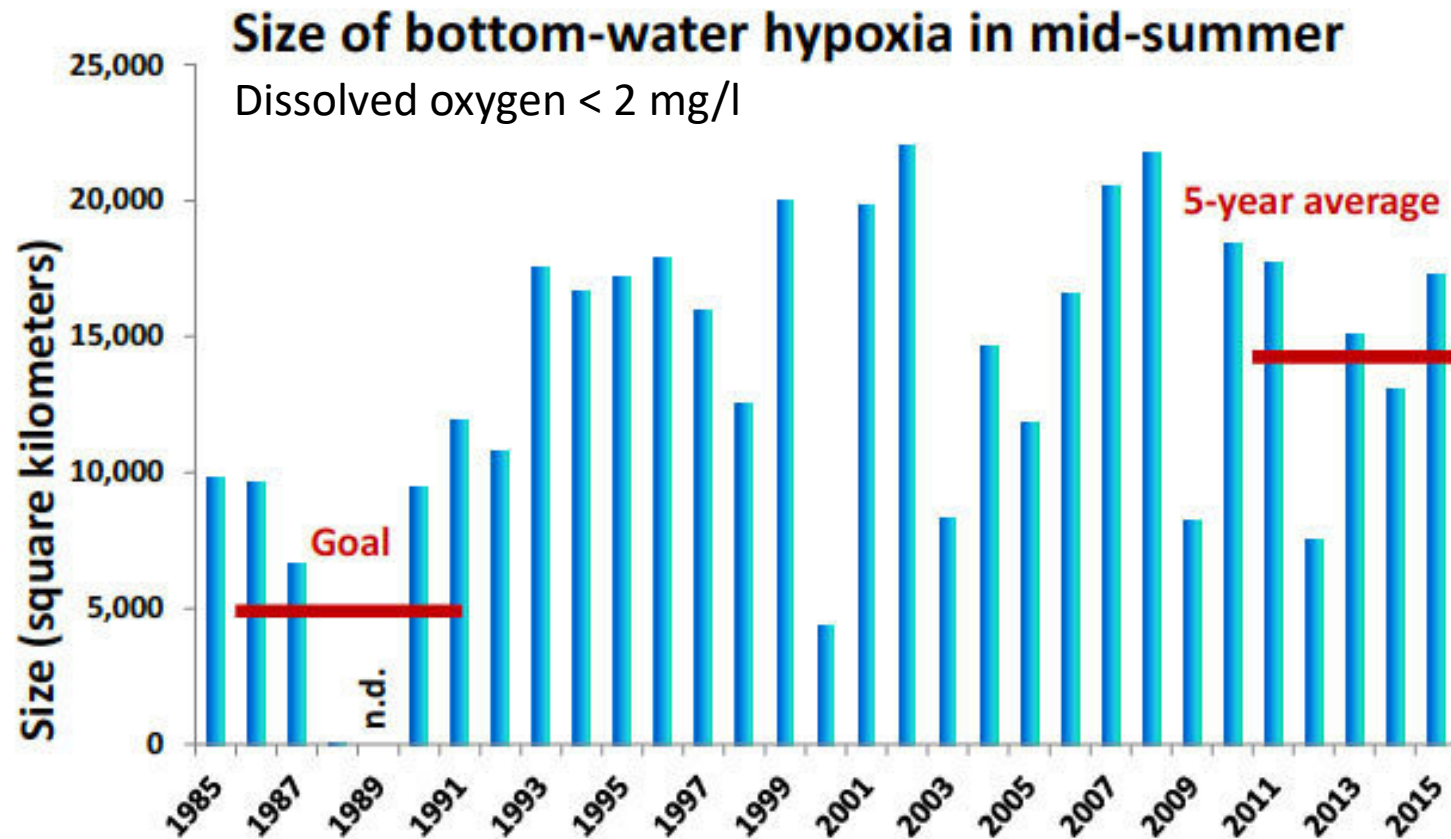
Atchafalaya
Bay

↑
Mississippi
"Bird Foot"
Delta

EPA-led Task Force Action Plan, 2008



Size of Hypoxic Zone is Large

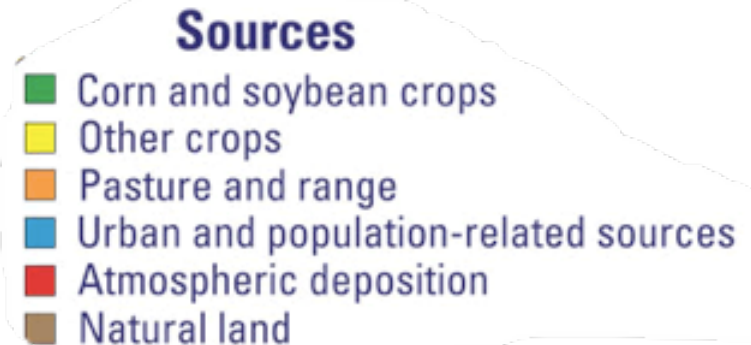
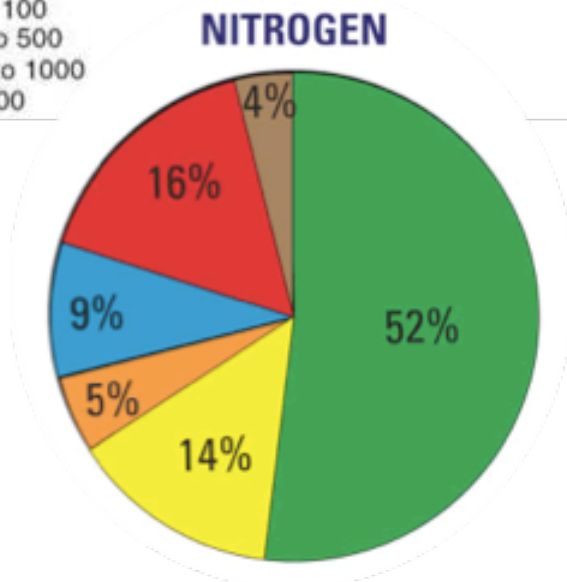
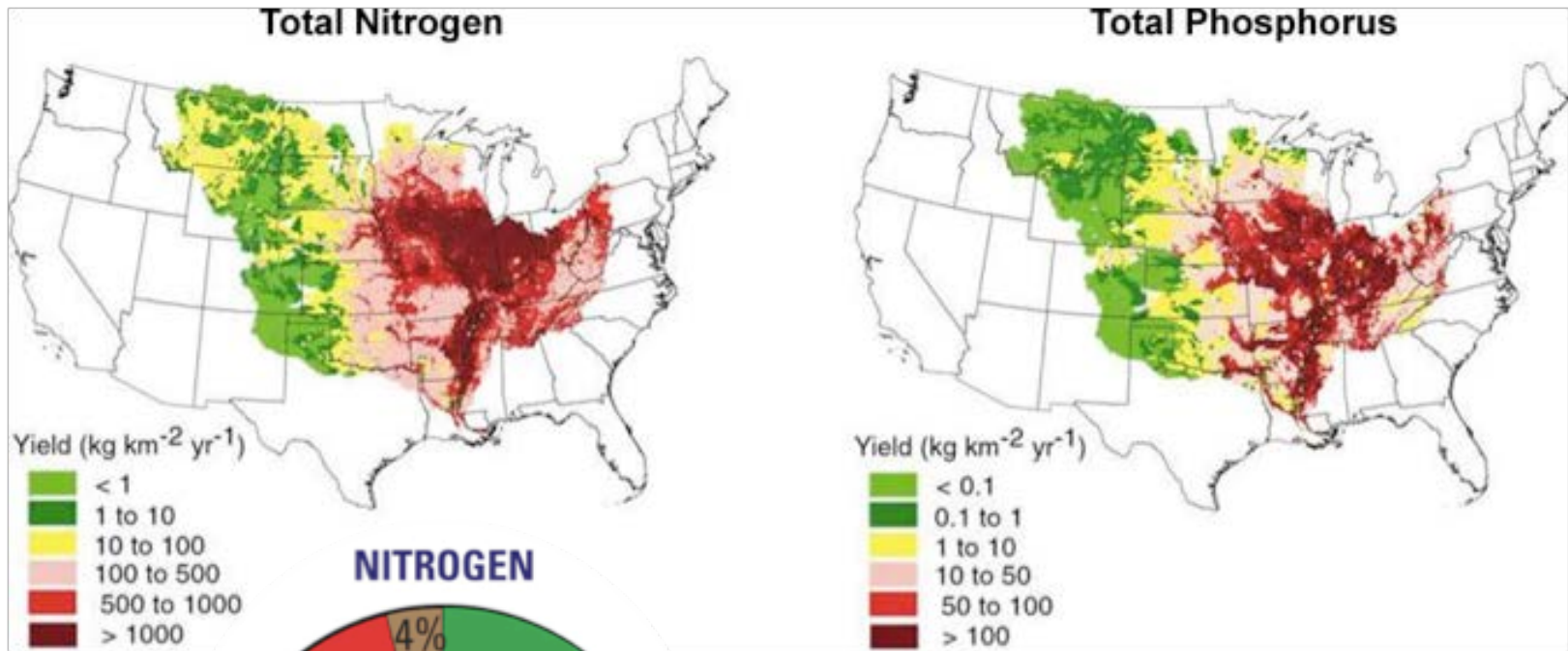


Data source: Nancy N. Rabalais, LUMCON, and R. Eugene Turner, LSU
Funding sources: NOAA Center for Sponsored Coastal Ocean Research
and U.S. EPA Gulf of Mexico Program



*Historic size of hypoxia from 1985 to 2015. The complete area was not mapped in 1989(n.d.).
The value for 1988 is 42 square kilometers and not visible on the scale.*

Nutrient deliveries to the Gulf

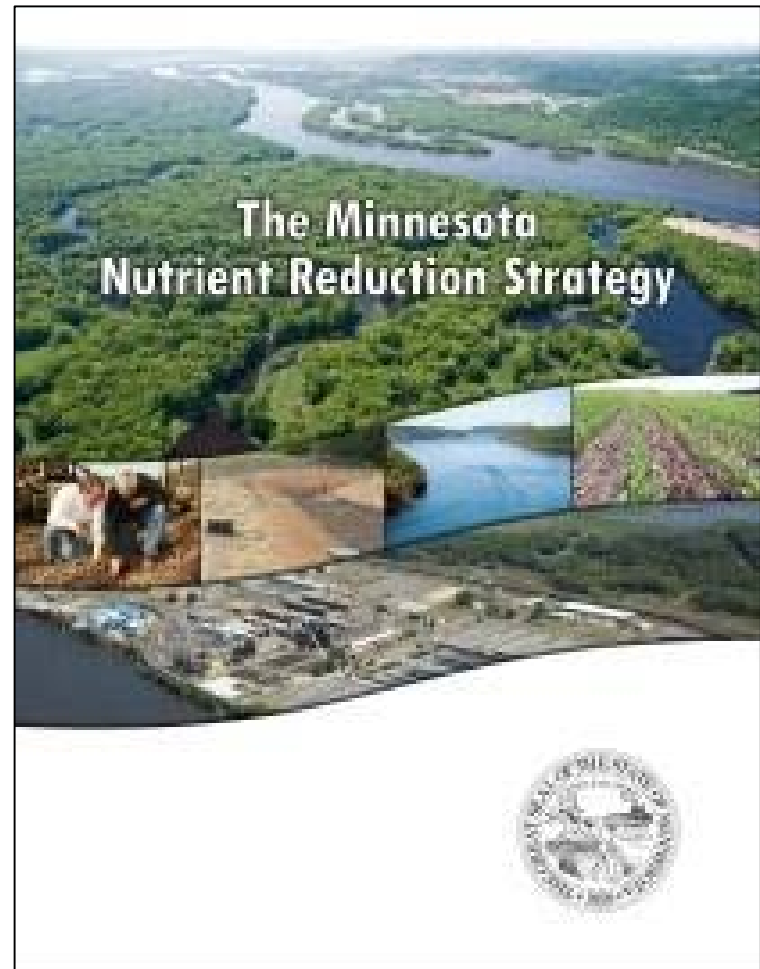


Nutrient Reduction Strategies

IOWA NUTRIENT REDUCTION STRATEGY
*A science and technology-based
framework to assess and reduce nutrients
to Iowa waters and the Gulf of Mexico*

Prepared by:
Iowa Department of Agriculture and Land Stewardship
Iowa Department of Natural Resources
Iowa State University College of Agriculture and Life Sciences

Updated September 2014



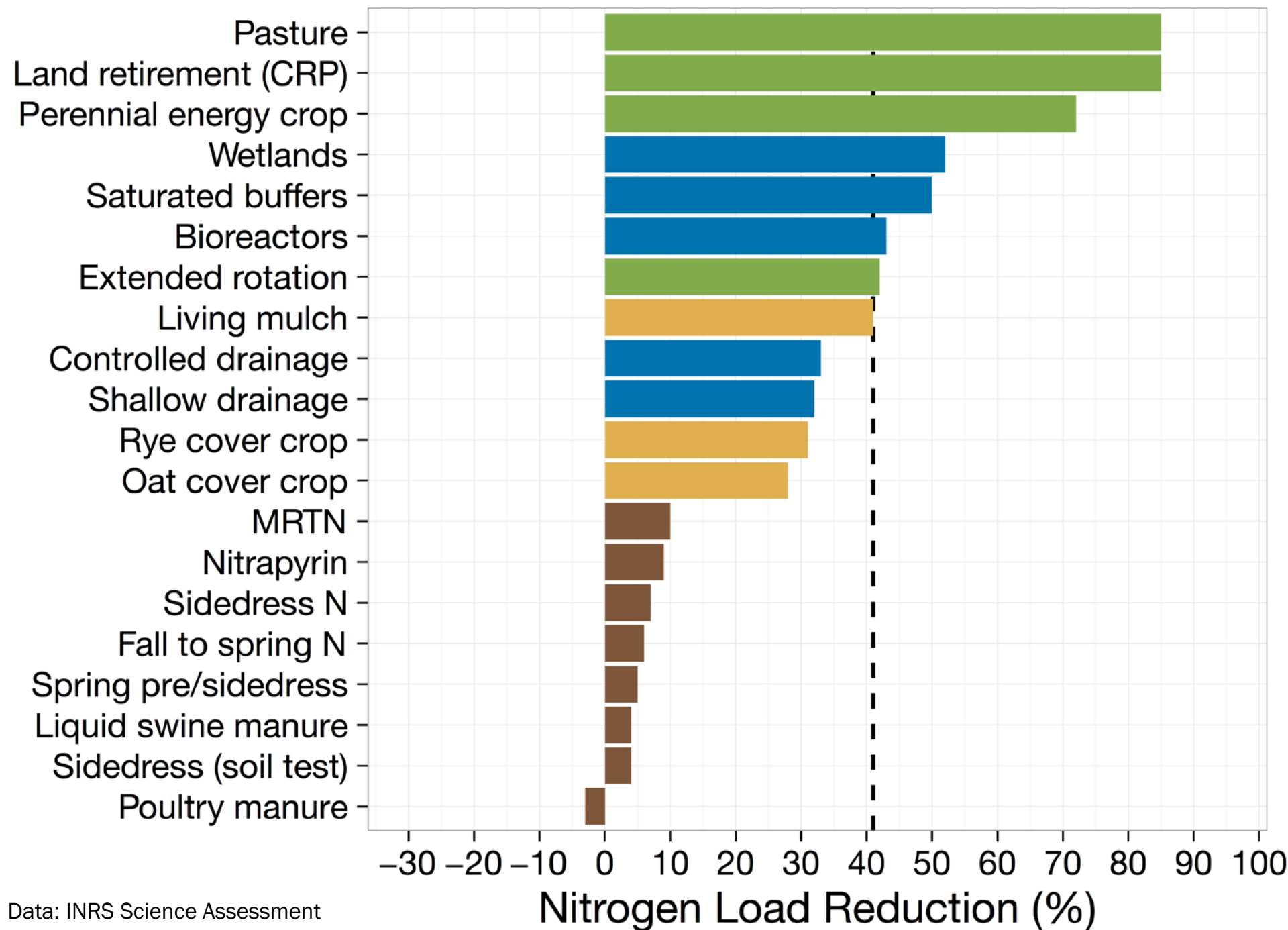
Practices to Reduce N Loss: Iowa

Table 2. Nitrogen reduction practices – potential impact on nitrate-N reduction and corn yield based on literature review.

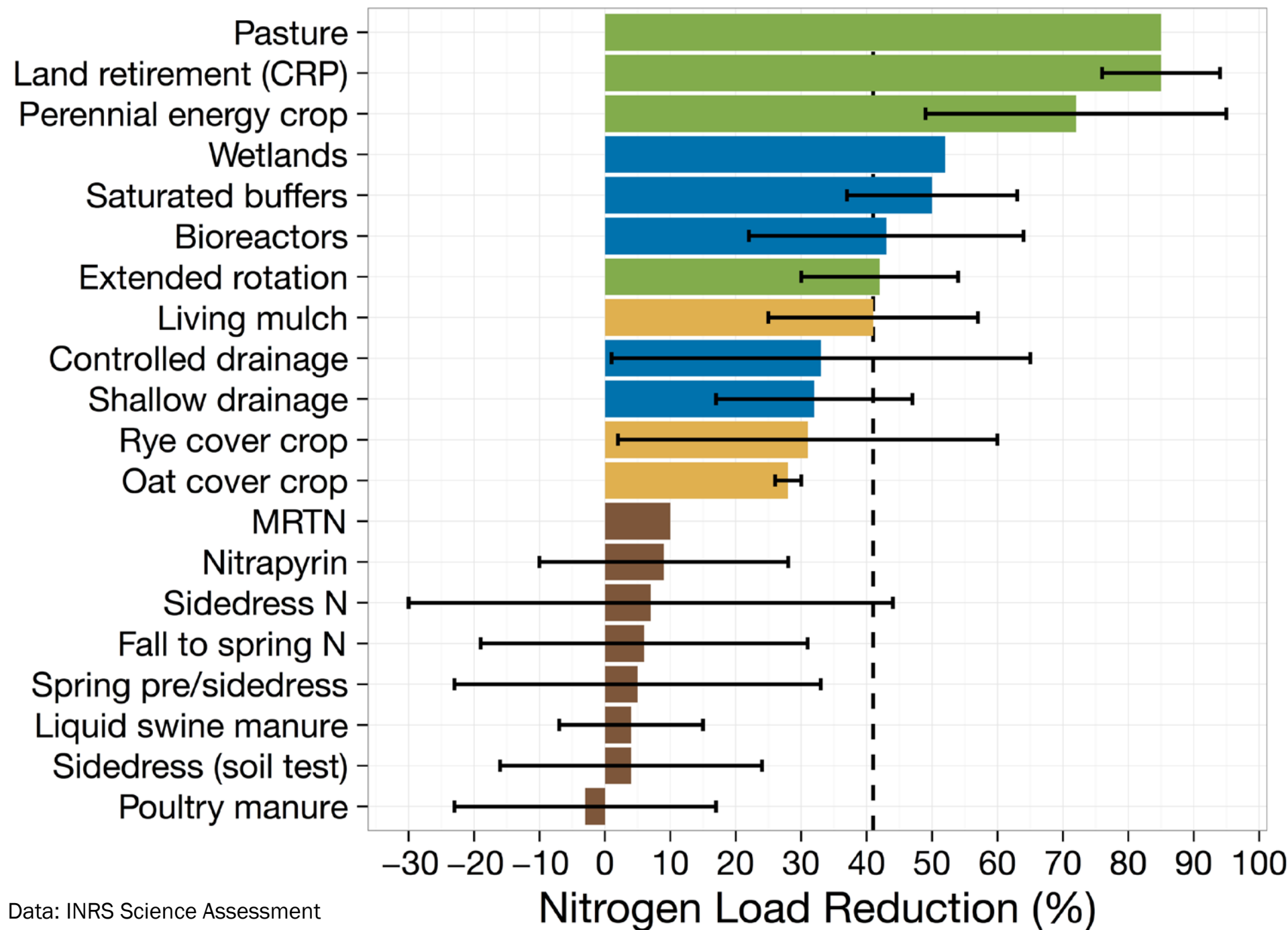
	Practice	Comments	% Nitrate-N Reduction ⁺	% Corn Yield Change ⁺⁺
			Average (SD*)	Average (SD*)
Nitrogen Management	Timing	Moving from Fall to Spring Pre-plant Application	6 (25)	4 (16)
		Spring pre-plant/sidedress 40-60 split Compared to Fall Applied	5 (28)	10 (7)
		Sidedress - Compared to Pre-plant 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	Reduce to Maximum Return to Nitrogen value 149 kg N/ha (133 lb N/ac) for CS and 213 kg N/ha (190 lb N/ac) for CC	10†	-1††
	Nitrification Inhibitor	Nitrapyrin – Fall - Compared to Fall-Applied without Nitrapyrin	9 (19)	6 (22)
...				
Edge-of-Field		Assume similar to CRP		
	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 active zone below the buffer - a small fraction of all water that makes it to a stream.	91 (20)	

+ A positive number is nitrate concentration or load reduction and a negative number is increased nitrate.

From:
<http://www.nutrientsstrategy.iastate.edu/>



Data: INRS Science Assessment
Slide courtesy of Chris Hay, Iowa Soybean Assoc.



Practice combination and cost: IA

Table 5. Example Statewide Combination Scenarios that Achieve Both the Targeted Nitrate-N and Phosphorous Reductions, Initial Investment and Estimated Equal Annualized Costs based on 21.009 Million Acres of Corn-Corn and Corn-Soybean Rotation.

Note: Research indicates large variation in reductions from practices that is not reflected in this table.

Additional costs could be incurred for some of these scenarios due to industry costs or market impacts.

		Nitrate-N	Phosphorus	Cost of N Reduction from baseline (\$/lb)	Initial Investment (million \$)	Total EAC* Cost (million \$/year)	Statewide Average EAC Costs (\$/acre)
Name	Practice/Scenario**	% Reduction from baseline ^{xx}					
NCS1	Combined Scenario (MRTN Rate, 60% Acreage with Cover Crop, 27% of ag land treated with wetland and 60% of drained land has bioreactor)	42	30	2.95	3,218	756	36
NCS3	Combined Scenario (MRTN Rate, 95% of acreage in all MLRAs with Cover Crops, 34% of ag land in MLRA 103 and 104 treated with wetland, and 5% land retirement in all MLRAs)	42	50	4.67	1,222	1,214	58
	Combined Scenario (MRTN Rate, Inhibitor						

From: <http://www.nutrientstrategy.iastate.edu/>

Des Moines Waterworks Lawsuit



Why is this Lawsuit Important?

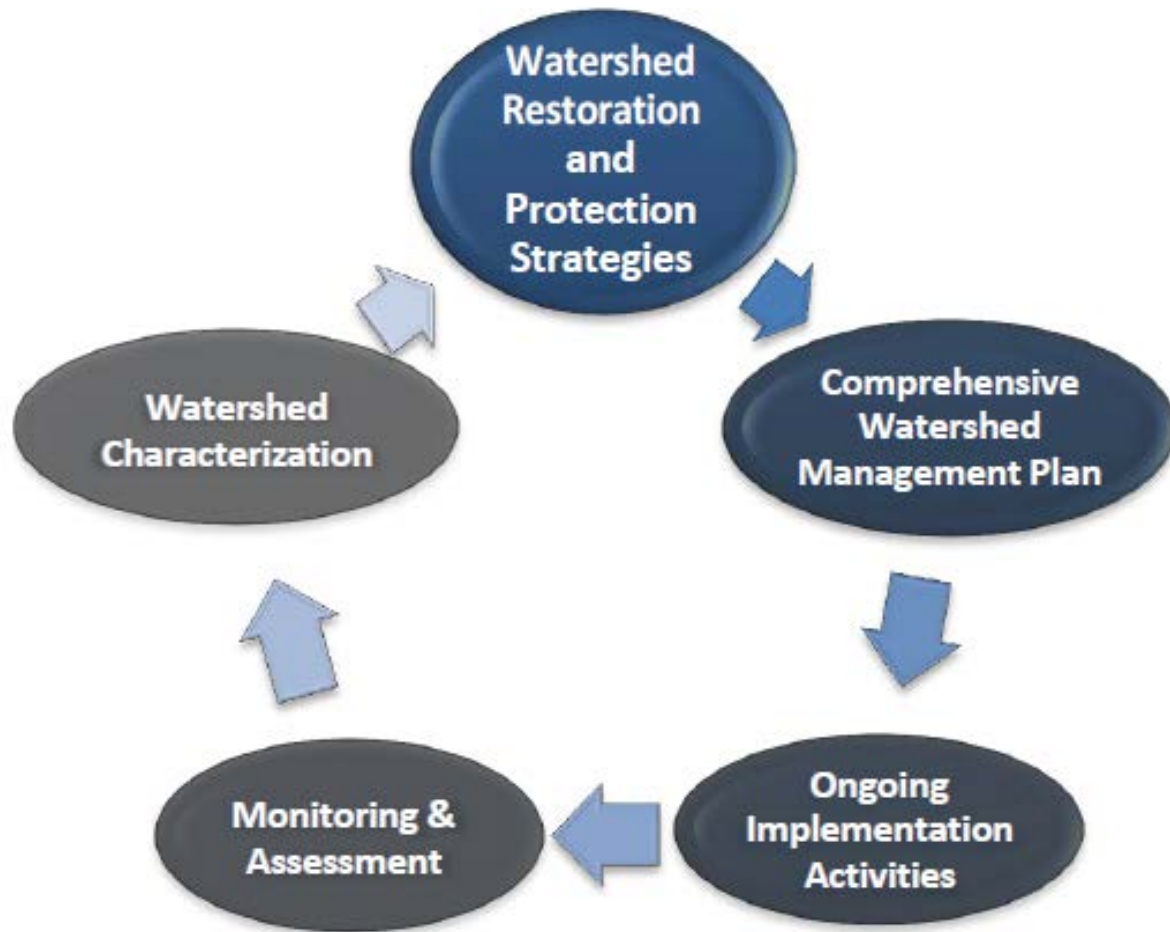
- In Federal court
- Water works alleges
 - voluntary approach to minimize nutrient losses is insufficient
 - It's costumers are subject to health risk and pays \$7,000/day to clean the water
- **Could require subsurface drainage to be regulated as a point source**
- Somewhat pits urban interests vs. rural interests
- May change how EPA regulates water from agriculture

Waters of the US (WOTUS)

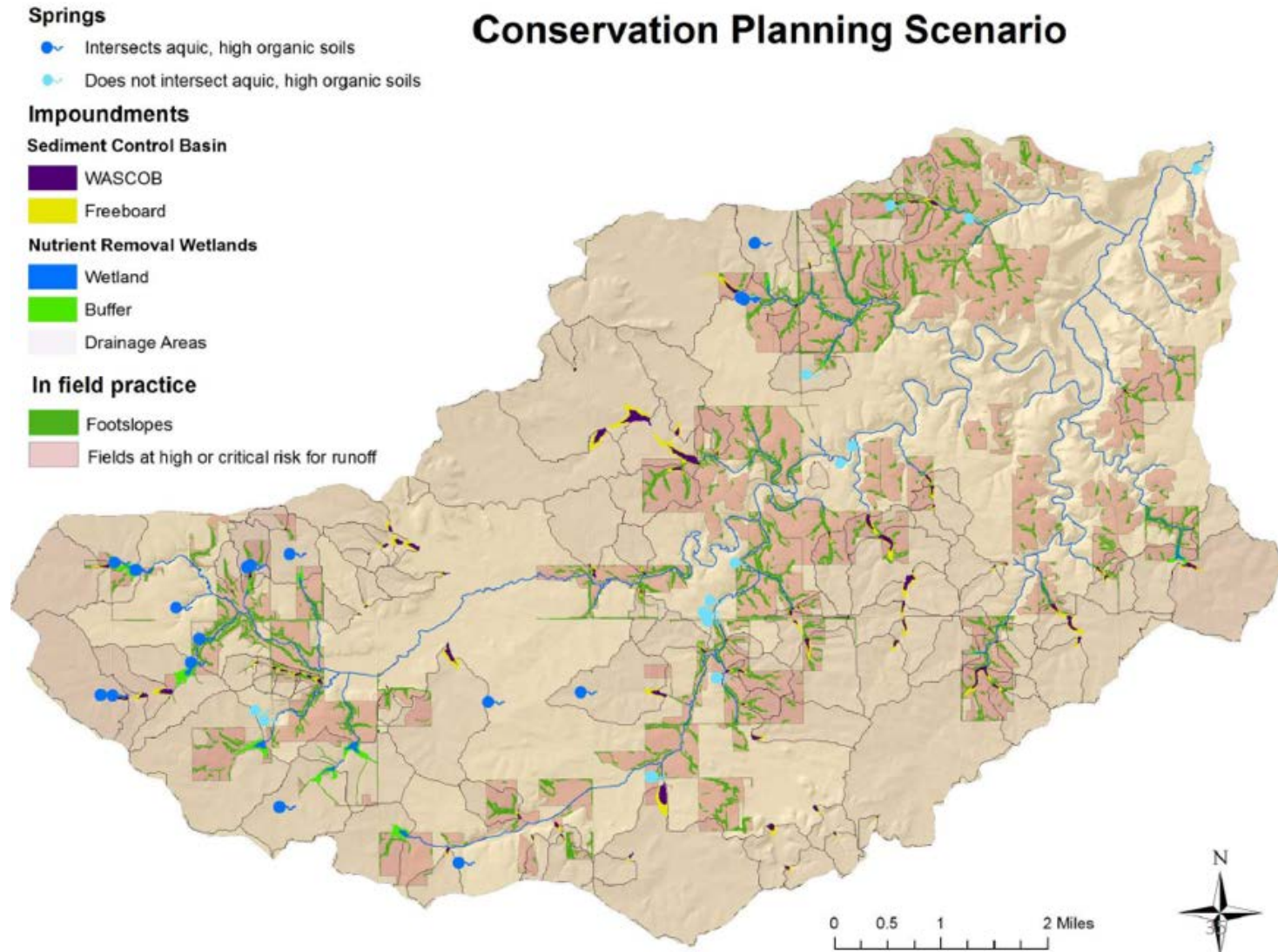
- Seeks to define who has jurisdiction over certain water bodies
- Relates to the Clean Water Act, where EPA and USACE are identified federal agencies with certain authorities and responsibilities
- Language referring to “Waters of the US” as ‘navigable waters’
- An issue is how to define ‘navigable water’
- Agricultural interests may be impacted, such as discharge from agricultural drainage

IMPLEMENTATION

Restoration Plan (Example)



Watershed Planning Tools



Implementation Approach

- Based on science
- Voluntary is preferred over regulatory
- Locally-driven, not one-size-fits-all
- Partnerships and collaborations
- Technical assistance
- Cost share available for many practices
- Attempt to minimize paperwork and red tape



Technical Assistance

- USDA Natural Resources Conservation Service (NRCS)
- State Agencies
- Local units of Government
- Researchers
- Agricultural Organizations
- NGOs



Standard Practices

To qualify for USDA cost share, the practices must follow USDA Practice Standards

- Bioreactors no 605
- Saturated Buffers no 604
- Controlled Drainage (DWM) no 554

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

DENITRIFYING BIOREACTOR

Code 605

(No.)

DEFINITION

A structure that uses a carbon source to reduce the concentration of nitrate nitrogen in subsurface agricultural drainage flow via enhanced denitrification.

PURPOSE

This practice is applied to achieve the following purpose:

- Improve water quality by reducing the nitrate nitrogen content of subsurface agricultural drainage flow.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to sites where there is a need to reduce nitrate nitrogen concentration in subsurface drainage flow.

This practice does not apply to underground outlets from practices, such as terraces, where the drainage source is primarily from surface inlets.

CRITERIA

General Criteria Applicable to All Purposes

Performance and Capacity. Design the capacity of the bioreactor based on one of the following:

- Treat peak flow from a 10-year, 24-hour drain flow event.
- Treat at least 15 percent of the peak flow from the drainage system.
- Treat at least 60 percent of the long-term average annual flow from the drainage system using locally proven criteria (e.g., drainage coefficient).

Disregard flow from surface inlets when calculating design subsurface drain flow for capacity purposes.

Design the bioreactor hydraulic retention time for a minimum of 3 hours at the peak flow capacity. Account for the porosity of the media and use the average depth of flow through the media. The effective volume of the reactor is calculated as:

$$V = L \times W \times (d_m + d_{mc}) / 2 \times P$$

Where:

V = effective volume of media (ft³)

NRCS reviews and periodically updates conservation practice standards. To obtain the current version of this standard, contact your Natural Resources Conservation Service [State office](#) or visit the [Field Office Technical Guide](#). USDA is an equal opportunity provider, employer, and lender.

NRCS, NHCP
September 2015

Cost share

- USDA-NRCS can often cost share 50-90% of practice cost
- Other examples:
 - Conserv. Reserve Prog.
 - Nutrient management
 - Cover crops
 - And 100+ more



A Case against Regulation



Your Soil Can't Hold All the N You Want to Apply

By Brian Hefty



...

If you don't think this is a big deal, let me tell you about Denmark. In 2011, Darren and I toured a few farms in over there. Did you know that Danish farmers are limited on how much nitrogen they can use on their farms? It's true, and it's now adversely affecting their yields. The problem started just like ours here in the U.S. Farmers were over-applying nitrogen ***BECAUSE THEY DIDN'T KNOW THEIR CECs***. In addition to nitrogen limitations, Danish farmers are required to turn in an extensive and complete report each year to the government about ***EVERYTHING*** they plan to do on the farm, from tillage, to which crops they'll plant, to their herbicide and fertilizer plan, and a whole lot more. We have a copy of a 25-page report that a 400-acre farm had to turn in prior to being allowed to do anything on their farm in 2011.

If we're not careful, we're going to end up in the same position as the Danish farmers, so here's what I'm asking you to do ***TODAY***:

A Case against Regulation

Continued...

1. **Know your cation exchange capacity in every single field.** It's cheap and easy to test, and it doesn't change much from year to year, so testing even once every 4 or 5 years is more than sufficient.
2. **Don't over-apply your nitrogen in any form, including manure.** If your soil can only hold 150 pounds of nitrogen, subtract the amount that your soil already contains and only apply the difference.
3. **If your crop needs more nitrogen, split-apply it.** Put some on at sidedress, foliar, or some other way once your crop has used some of the early-applied N.
4. **Use a nitrogen stabilizer like NutriSphere-N.** Our studies have shown that nitrogen stabilizers help prevent loss and keep N in the ammonium (more stable) form longer. However, nitrogen stabilizers are not miracle products. If your soil can only hold 150 pounds of N, just because you add a nitrogen stabilizer doesn't mean you can now apply 300 pounds of N safely.

In Denmark, it doesn't matter now if a farmer wants to use a nitrogen stabilizer or split-apply nitrogen or any other method to reduce nitrate in the water. It's too late. The law is in place, and a farmer simply cannot use more nitrogen. The same thing will happen here **UNLESS** we're proactive, so please, get your Cation Exchange Capacity tests run now and follow the steps I've listed above! If our nitrogen use gets limited someday, it could be pretty tough to turn a profit on the farm.

Excerpt from: Ag PhD newsletter, February 2, 2013

From: <http://www.agphd.com/uncategorized/2013/02/08/your-soil-cant-hold-all-the-n-you-want-to-apply/>

Jeppe Kjaersgaard

Minnesota Department of Agriculture

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605-201-6149

Minnesota Agricultural Water Quality Certification Program

*Certifying that Minnesota's farms
and waters can prosper together*



Brad Jordahl Redlin
Peter Gillitzer

Certification is a Contract

- Contract between the State of Minnesota and certified producer
- Agreement good for 10 years
- Outlines obligations of producer and responsibilities of the State
- Defines certainty and grants it to producer
- Field assessment records attached as appendix to contract

Certification Number _____



STATE OF MINNESOTA
AGRICULTURAL WATER QUALITY CERTIFICATION AGREEMENT

This agreement is between _____ ("Producer") and the Minnesota Department of Agriculture ("MDA"), which is authorized to sign on behalf of the Minnesota Pollution Control Agency, Minnesota Department of Natural Resources, and the Board of Water and Soil Resources pursuant to Minnesota Governor's Executive Order 14-09.

This contract is governed by Minnesota Statutes Sections 17.9891-17.993 which outline procedures for implementing the Minnesota Agricultural Water Quality Certification Program. All parties agree that the Minnesota Agricultural Water Quality Certification Program is in the public interest as it enhances the water quality of Minnesota's rivers, lakes, streams, wetlands and groundwater, as well as promotes and accelerates environmental stewardship by Minnesota's farmers.

A. TERMS OF AGREEMENT:


Agreement start date is _____ and expires on _____

Assessment Process: Step 1

- Application establishes **eligibility** for program resources
- Ensures **compliance** with existing water quality regulations

		Circle One	
1	Are you in compliance with Minnesota Administrative Rules Chapter 7020 – Animal Feedlots and, if applicable, do you have a valid National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) permit for your feedlot operation?	Yes	N/A
2	Are you in compliance with (not cited with any unresolved violations of) the Minnesota Wetlands Conservation Act (Minnesota Statutes Section 103G.221- 103G.2375)?	Yes	N/A
3	Do you have a Subsurface Sewage Treatment System (septic system) that is deemed an Imminent Threat to Public Health and/or have been cited in violation of local ordinance thus requiring an immediate upgrade?	No	N/A
4	Are you in compliance with the Federal Insecticide, Fungicide, and Rodenticide Act and Minnesota statutes (18B, 18C, 18D, 103H) regarding pesticide and fertilizer distribution, use, storage, handling and disposal?	Yes	N/A
5	Are you in compliance with current State rules and statutes pertaining to shoreland and riparian protection?	Yes	N/A

If you are not in compliance and free of any violations per the above questions, your MAWQCP representative can assist you with information on technical and financial assistance to resolve eligibility.

 Minnesota Department of Agriculture		625 Robert Street North, St. Paul, MN 55155-2538 www.mda.state.mn.us																			
Pesticide and Fertilizer Management, Ph: 651-201-6489																					
Minnesota Agricultural Water Quality Certification Program Application																					
<p>This serves as formal application to participate in, and formal declaration of intent to achieve certification by the Minnesota Agricultural Water Quality Certification Program (MAWQCP). Formal application for certification may provide priority attention and consideration for state and federal agency decisions involving technical and financial assistance to obtain certification. Completion of this application by the Applicant constitutes eligibility for any priority status provided in support of the Minnesota Agricultural Water Quality Certification Program.</p> <p>The data collected during your participation in the Minnesota Agricultural Water Quality Certification Program will only be used in support of the program. You are not required to provide MDA with this data; however, failure to do so will result in your removal from the Agricultural Water Quality Certification Program. Only people with a need to access your data in support of the Agricultural Water Quality Certification Program will have the authority to access your data unless you provide MDA with informed consent to release the data, a court orders the release of the data, or upon request of a legislative auditor to review the data.</p>																					
Applicant Full Name (Print)		Phone																			
		State	Zip																		
<p>Agricultural Water Quality Certified producers must be in compliance with all existing applicable state water protection regulations at the time of Certification. Producers seeking certification must confirm compliance with the following existing:</p> <table border="1"><thead><tr><th></th><th>Yes</th><th>N/A</th></tr></thead><tbody><tr><td>Are you in compliance with Minnesota Administrative Rules Chapter 7020 – Animal Feedlots and, if applicable, do you have a valid National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) permit for your feedlot operation?</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr><tr><td>Are you in compliance with the Minnesota Wetlands Conservation Act (Minnesota Statutes Section 103G.221- 103G.2375)?</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr><tr><td>Are you in compliance with Subsurface Sewage Treatment Systems (septic system) requirements (Minnesota Statutes 115.55 and 115.56)?</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr><tr><td>Are you in compliance with the Federal Insecticide, Fungicide, and Rodenticide Act and Minnesota statutes (18B, 18C, 18D, 103H) regarding pesticide and fertilizer distribution, use, storage, handling and disposal?</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr><tr><td>Are you in compliance with the local shore land management ordinance?</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr></tbody></table>					Yes	N/A	Are you in compliance with Minnesota Administrative Rules Chapter 7020 – Animal Feedlots and, if applicable, do you have a valid National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) permit for your feedlot operation?	<input type="checkbox"/>	<input type="checkbox"/>	Are you in compliance with the Minnesota Wetlands Conservation Act (Minnesota Statutes Section 103G.221- 103G.2375)?	<input type="checkbox"/>	<input type="checkbox"/>	Are you in compliance with Subsurface Sewage Treatment Systems (septic system) requirements (Minnesota Statutes 115.55 and 115.56)?	<input type="checkbox"/>	<input type="checkbox"/>	Are you in compliance with the Federal Insecticide, Fungicide, and Rodenticide Act and Minnesota statutes (18B, 18C, 18D, 103H) regarding pesticide and fertilizer distribution, use, storage, handling and disposal?	<input type="checkbox"/>	<input type="checkbox"/>	Are you in compliance with the local shore land management ordinance?	<input type="checkbox"/>	<input type="checkbox"/>
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Are you in compliance with the local shore land management ordinance?	<input type="checkbox"/>	<input type="checkbox"/>																			
<p>If you are not in compliance with any of the above questions, your MAWQCP representative can assist you with information on technical and financial assistance to resolve eligibility.</p> <p>If you are able to answer Yes or N/A to each of the above questions, you are eligible for MAWQCP certification. MAWQCP-certified parties are subject to audit of compliance with the terms of your MAWQCP certification.</p> <p>I understand that at the time of certification I must be in compliance with existing applicable state water protection rules and regulations and that I have priority status for technical and financial assistance to reach certification.</p>																					
Applicant Signature		Date																			
<p>In accordance with the Americans with Disabilities Act, this information is available in alternative forms of communication upon request by calling 651-201-6000. TTY users can call the Minnesota Relay Service at 711 or 1-800-627-3529. The MDA is an equal opportunity employer and provider.</p>																					
			AG-03247 11/14																		

Step 2

Minnesota Agricultural Water Quality Certification Program

Nutrient Management **Certification Eligible**

	Field	Nutr. Mgmt	Tillage	Pest Mgmt	Base Score	Irr/Dmg Adjust	Final
	(6.69)	(9.49)	(9.00)	(10.00)	8.74	7.68	8.73

Risk index score

Nitrogen application rate	MN BMP recommendation	10.00
Phosphorus application rate	1-10% over the UMN recommen...	9.00
Commercial fertilizer timing	Recommended	10.00
Commercial fertilizer source	Acceptable with Risk	6.00
Commercial fertilizer placement	Recommended	10.00
Manure application timing & placement	Incorporated / Injected Fall ST <...	10.00

Site Information | Field Physical Factors | **Nutrient Management** | Tillage & Pest Management | Irrigation/Tile Drainage | Conservation Practices



Unitless **risk-assessment index** for each parcel and crop, scoring between 0 - 10 based on site-specific criteria with site inspection for eligible scores ≥ 8.5



assessment tool online at:

<https://mnwatercertify.mda.state.mn.us/wqcpapp/>

Assessment Process: Step 3



- Whole farm conservation planning
- Site-specific treatments supported by NRCS field office technical guide
- Boots-on-the-ground conservation delivery

Field verification covers:

- * Cropland/hayland
- * Pasture
- * Water features
- * Wildlife/forest/headquarters

