# Nitrogen in Agriculture

# Let's Talk About It!

AAE 320

# Articles/Videos

- 1. Ecosystems: Down on the Farm (*Environmental Defense Fund Video*)
- 2. A Brief History of Our Deadly Addiction to Nitrogen Fertilizer (*Mother Jones*)
- **3**. Nutrient Pollution: The Sources and Solutions: Agriculture (*US EPA and USDA NRCS*)
- 4. Taking a Stand Against Those Who Pollute Drinking Water (*Environmental Working Group*)
- 5. Update on DMWW Lawsuit (*FarmDOC*)

# **Questions to Consider**

- What grabbed your attention when reading the article/watching the video?
- What does the author want <u>farmers</u> to do?
- How do we solve this problem?

# Dead Zones are a Global Problem

#### **World Hypoxic and Eutrophic Coastal Areas**



Google "dead zones map" to see the many maps and data



### Iowa Nutrient Reduction Strategy

http://www.nutrientstrategy.iastate.edu/

# Image: Description of the second of the s

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The Iowa Nutrient Reduction Strategy was developed by:

IOWA DEPARTMENT OF

IOWA STATE UNIVERSITY

IOWA DEPARTMENT OF AGRICULTURE &

LAND STEWARDSHIP

#### Iowa Nutrient Reduction Strategy

The lowa Nutrient Reduction Strategy is a science and technology-based framework to assess and reduce nutrients to lowa waters and the Gulf of Mexico. It is designed to direct efforts to reduce nutrients in surface water from both point and nonpoint sources in a scientific, reasonable and cost effective manner.

The Mississippi River/Gulf of Mexico Watershed Nutrient Task Force was established in 1997 to coordinate activities to reduce the size, severity and duration of hypoxia in the Gulf. Hypoxia is a large area of low oxygen that can't sustain marine life. Nutrients that lead to algae growth are the main culprit.

In its 2008 Action Plan, the task force called upon each of the 12 states along the Mississippi River to develop its own nutrient reduction strategy.

Working together, the Iowa Department of Agriculture and Land Stewardship, the Iowa Department of Natural Resources, and the Iowa State University College of Agriculture and Life Sciences developed this proposed strategy.

The lowa strategy outlines a pragmatic approach for reducing nutrient loads discharged from the state's largest wastewater treatment plants, in combination with targeted practices designed to reduce loads from nonpoint sources such as farm fields. This is the first time such an integrated approach involving both point sources and nonpoint sources has been attempted.

This proposed strategy is the beginning. Public input will be considered before the strategy is finalized and as operational plans are developed. This is a dynamic document that will evolve over time as new information, data and science is discovered and adopted.

https://www.cals.iastate.edu/files/misc/183758/reducing-nutrient-loss-science-shows-what-works.pdf

#### **Iowa Strategy to Reduce Nutrient Loss: Nitrogen Practices**

This table lists practices with the largest potential impact on nitrate-N concentration reduction (except where noted). Corn yield impacts associated with each practice also are shown as some practices may be detrimental to corn production. If using a combination of practices, the reductions are not additive. Reductions are field level results that may be expected where practice is applicable and implemented.

	Practice	Comments	% Nitrate-N Reduction*	% Corn Yield Change**	
			Average (SD <sup>†</sup> )	Average (SD <sup>†</sup> )	
		Moving from fall to spring pre-plant application	6 (25)	4 (16)	
	Timing	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)**	
Ŧ	Source	Liquid swine manure compared to spring-applied fertilizer	4 (11)	0 (13)	
a me	Source	Poultry manure compared to spring-applied fertilizer	-3 (20)	-2 (14)	
Nitrogen Manage	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 – <u>http://cnrc.agron.iastate.edu</u> 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)	
	Course Course	Rye	31 (29)	-6 (7)	
	Cover Crops	Oat	28 (2)	-5 (1)	
	Living Mulches	e.g. Kura clover – Nitrate-N reduction from one site	41 (16)	-9 (32)	
	Perennial	Energy Crops – Compared to spring-applied fertilizer	72 (23)		
ŝ	rerennia	Land Retirement (CRP) – Compared to spring-applied fertilizer	85 (9)		
and	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		
	Drainage Water Mgmt.	No impact on concentration	33 (32)		
_	Shallow Drainage	No impact on concentration	32 (15)		
ield	Wetlands	Targeted water quality	52		
붛	Bioreactors		43 (21)		
Edge-	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)		

## WI Private Well Survey Data

https://gissrv3.uwsp.edu/webapps/gwc/pri\_wells/

#### NITRATE (mg/l as N) for Dane County

Range	Number Pe	ercent	Summary
None Detected	687	8%	Minimum: No Detect
2.0	1,808	20%	
2.1 - 5.0	1,889	21%	Median: 5.1
5.1 - 10.0	2,623	29%	Average: 6.4
10.1 - 20.0	1,606	18%	
20.1	288	3%	Maximum: 138
<b>Total Samples:</b>	8,901		
> 10mg/l N	1,894	21%	Exceeds Health Standard

#### NITRATE (mg/l as N) for Rock County

Range	Number Pe	ercent	Summary
None Detected	176	8%	Minimum: No Detect
2.0	289	14%	
2.1 - 5.0	432	21%	Median: 6
5.1 - 10.0	634	31%	Average: 7
10.1 - 20.0	472	23%	
20.1	72	3%	Maximum: 64.4
Total Samples:	2,075		
> 10mg/l N	544	26%	Exceeds Health Standard



#### Groundwater Quantity and Quality Issues in a Water-Rich Region: Examples from Wisconsin, USA

Resources 2015, 4(2), 323-357; https://doi.org/10.3390/resources4020323

https://www.mdpi.com/2079-9276/4/2/323/htm

Figure 8. Map of Wisconsin showing the percentage of groundwater samples in each township above the 10 mg/L nitrate-N drinking water standard

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# Hazardous drinking water found in 42% of southwest Wisconsin wells

Steven Verburg | Wisconsin State Journal Jan 2, 2019

### Most Nitrate, Coliform In Kewaunee County Wells Tied To Animal Waste

Study Shows Cow Manure Stored Or Spread On Farm Fields Poses Highest Risk For Certain Contaminants

By Sarah Whites-Koditschek and Coburn Dukehart | WPR and Wisconsin Center for Investigative Journalism Published: Wednesday, February 27, 2019, 5:35pm



Manure-laden tap water in Wisconsin has led to calls for stronger controls on agricultural pollution, which is responsible for less visible nitrate pollution. Kewaunee County conservation officer Davina Bonness collected this tap water from a homeowner in 2016. It contained animal waste that matched manure spread on a nearby farm field.

KEWAUNEE COUNTY LAND AND WATER CONSERVATION DEPARTMENT ARCHIVES

#### SOUTHWESTERN WISCONSIN | PRIVATE WELL WATER

# Study of southwest Wisconsin well water continues to indicate contamination

# WATER QUALITY TASK FORCE

OUR MISSION:

# TO PROTECT A HEALTHY AND STABLE SUPPLY OF WATER FOR RESIDENTS AND INDUSTRY

Home

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News

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Legislature Home

Speaker Robin Vos outlined five specific areas to examine:

Comment

1. Identifying best practices for testing and data collection, measuring water quality in different parts of the state, and types of soil

Where We're Headed

Video

Task Force Report

2. Determining the sources and causes of contaminants impacting water quality

Our Mission

- 3. Consulting with stakeholders to assess current practices to manage runoff as well as suggestions to improve these efforts
- 4. Investigating remedies that will protect a healthy and stable supply of water for residents and industry

Reference Materials

5. Studying best practices for designing and constructing wells and septic systems to safeguard a healthy water supply

## Producer-Led Watershed Protection Grants

https://datcp.wi.gov/Pages/Programs Services/ProducerLedProjects.aspx

Program Goal: To improve Wisconsin's soil and water quality by supporting and advancing producer-led conservation solutions by increasing on the ground practices and farmer participation in these efforts.

Each application must come from a group of at least 5 farm ers in the same watershed, collaborating with conservation agencies, institutions or nonprofit organizations. The maximum grant award per group will be \$40,000, with a total of \$750,000 available funding each fiscal year. There are 31 total projects that have been funded since the

program's inception.

Map ID	Producer-Led Group	Map ID	Producer-Led Group
	Bear Creek/Chippewa Farmer Groundwater		Milwaukee River Watershed Clean Farm Families
1	Group*	17	(CFF)
2	Buffalo-Trempealeau Farmer Network	18	Pecatonia Pride
	Calumet County Agricultural Stewardship		
3	Alliance*	19	Peninsula Pride Farms (PPF)
	Cedar Creek Farmers - Improving Land for		
4	Cleaner Waters	20	Producers of Lake Redstone
	Dodge County Farmers for Healthy Soil & Healthy		
5	Water	21	Red Cedar Conservation Farmers
6	Dry Run Creek Farmer-Led Council	22	Sauk Soil and Water Improvement Group*
	Eau Pleine Partnership for Integrated		
7	Conservation (EPPIC)	23	Sheboygan River Progressive Farmers
8	Farmers for Lake Country	24	South Kinni Farmer-Led Watershed Council
9	Farmers for the Upper Sugar River	25	Tainter Creek Farmer-Led Watershed Council
			The Shell Lake- Yellow River Farmer-Led
10	Farmers for Tomorrow	26	Watershed Council
11	Farmers of Barron County	27	Uplands Watershed Group
			Watershed Protection Committee of Racine
12	Farmers of Mill Creek	28	County
13	Farmers of the Sugar River	29	Waumanee Watershed
14	Hay River Farmer-Led Watershed Council	30	Western Wisconsin Conservation Council
15	Horse Creek Farmer-Led Watershed Council	31	Yahara Pride Farms
		Bolded	groups received 2020 grant funding, an * indicates
16	Lafayette Ag Stewardship Alliance (LASA)		new groups



# Agricultural Use of Nitrogen & Phosphorous in WI

- As long as it does not cause damage, no laws regulate how much fertilizer a farmer can use (rate, timing)
  - If a farmer spreads manure on frozen ground and it kills fish, the farmer can be fined
- Several triggers exist that require a farmer to have a Nutrient Management Plan for the farm
- UW NPM "What is a Farm Nutrient Management Plan?" https://ipcm.wisc.edu/download/pubsNM/what is NMP.pdf
- DATCP "Wisconsin Nutrient Management Basics"
   <u>https://datcp.wi.gov/Documents/NMBrochure.pdf</u>

# What is a Farm Nutrient Management Plan?

- A strategy for obtaining the <u>maximum return</u> from on-farm and commercial fertilizer resources in a way that <u>protects water quality</u>
   Soil Test Reports
  - O Inventory of On-farm Nutrient Resources
  - Nutrient Crediting
  - Farm Conservation Plan (i.e. meets "T")
  - Manure Spreading Plan with map showing restricted areas
     Meets the USDA-NRCS 590 Nutrient Mgmt Standard
     Annual Updates

UW Soil & Plar 8452 Mineral F Verona, WI 53 (608) 262-436	Ilyzed By: Int Analysis La Point Road 3593 4	SOIL TEST The "Crop Nutrient Need" section is the field's autrient recommendations based on your soil test results and crop to be			REPORT The "Fertilizer Credit" section is based on the numbers entered on your soil test information form. If you dida't put them on the form but do have credits, you can				Thi infi The you P_O	This is the most important information on the entire report! The "Nutrients to Apply" section tells you the actual pounds per acre of N, P_O, and K_O to apply. This recom-			
LAB #:		been adjusted	for any fertili	ns nave inor nar cradite.	subtra	ct them from	the "Crop	Nutrient	mer	mendation has been adjust		adjusted to r	eflect
County: Washington	Account No.				Need"	to get the "N	lutrients to	ants to Apply."		any fertilizer credits you indicated.			ed.
Date Received	Date Processed			NU		TRIENT RECOMMENDATIONS				Richards In Anni-			
6/26/2007	6/26/2007	Cropping Sequence	Yield Goa	N	P <sub>1</sub> O <sub>5</sub>	K <sub>2</sub> O	Legume N	Manure N	P.O. K	0 N	P.C	K_O	
Slope Acres 1% 15	Plow Depth 8"	Com antis	151,170 bu		bsia-	0	Ibs/a	60	60 14	1	lbs/a -	0	
Soil Name		Sm grain silage walf sdg	2.3.5 ton	20	0	0	0	20	10 11	5 0	0	0	
Sisson		Alfalfa established	56-65 ton	0	0	90	0	10	5 9	0	0	90	
1		Alfalfa, established	5.6-6.5 ton	0	0	90	0	0	0 0	0	0	90	
Previous Crop		There is no lime recommen	ndation		-					1.	-		
Com		SUCCESTED N APPLIC	ATION RATES F	R CORN (GRAI	AT DIFF	FRENT N'COR	N PRICE RA	DOS					1
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		5		0.05	(	0.10		0.15			0.20		
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Corn, Forage	legumes, Le	guminous vegetables,			1	lb N/a	(Total to Ap	iply)2		1			
Green manur	res <sup>3</sup>		165	135-190	135	120-15	5 1	20 10	0-135	105		90-120	<u></u>
Soybean, Sm	nall grains4		140	110-160	115	100-130	1	00 85	-115	90		70-100	
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unur unikely is shown and interpreted as H (high). The others are left blank because they were not tested.

#### Worksheet for a Step-by-Step Guide to Nutrient Management on Your Farm Complete One Form Per Field

1. Field Info	ormation				_
a) Field ID	3	c) Acres	15	e) Soil name	Sisson silt loam
b) Year		d) Crop to be gro	ownCorn	f) Previous cr	opCorn
2 Nutrient	Need				
2. Nutrent	liccu		м	R.O.	KO
a) Nutrient read	ormondations	15	(bs/acre)	(lbs/acre)	(lbs/acre)
a) Nutrient rec	ommendations	(from soil test report)			
b) Special nut	rient need				
					[]
c) Total nutrie	nt need				
2 Nutriant	Credit				
3. Nutrient	Great				
a) Manure					
b) Legume					
c) Residual nit	rate (if test was no	t conducted enter 0)			
d) Other sourc	es (whey, sludge, e	etc., must have sample analy	/sis)		
ө) Total nutrie	nt credit				
-					
4. Adjusted	Nutrient Ne	ed			
(Total nutrie	nt need - Total	nutrient credit)			

http://corn.agronomy.wisc.edu/Management/pdfs/L025\_SoilTestBasis.pdf

# What Triggers Needing to File a Nutrient Management Plan in Wisconsin?

- Participate in USDA-NRCS Programs
- Permitted Livestock Operations (NR243)
- Wisconsin's Livestock Siting Ordinance (ATCP51)
  - o County & Local Zoning
- County Programs
  - Priority Watersheds & Outstanding/Exceptional Resource Water Protection Areas (NR 151)
  - Land & Water Conservation Plans (NR 151)
  - Working Lands (Farmland Preservation) Tax Credit
  - If accept cost-share to create a plan (ATCP 50)



- Learning Goals
- To become aware of some of the issues surrounding the use of nitrogen in agriculture
- To become aware that Wisconsin has problems with nitrogen in groundwater and drinking water
  - Also phosphorus in surface waters and manure contamination
- To become aware of some of the activities in Wisconsin to help address these problems and what more agriculture and famers can expect