Proceedings of the 2nd Annual Nitrogen: Minnesota's' Grand Challenge & Compelling Opportunity Conference

Nitrate in Our Drinking Water---

What 10,000 Wells Are Telling Us

NITROGEN: MN's Grand Challenge and Compelling Opportunity Conference

February 23, 2016
Rochester, Minnesota

Bruce Montgomery
MN Department of Agriculture

Huge holiday savings inside

StarTribune

21°/12°
Snow won't melt
Cold and a bit dreary. B12

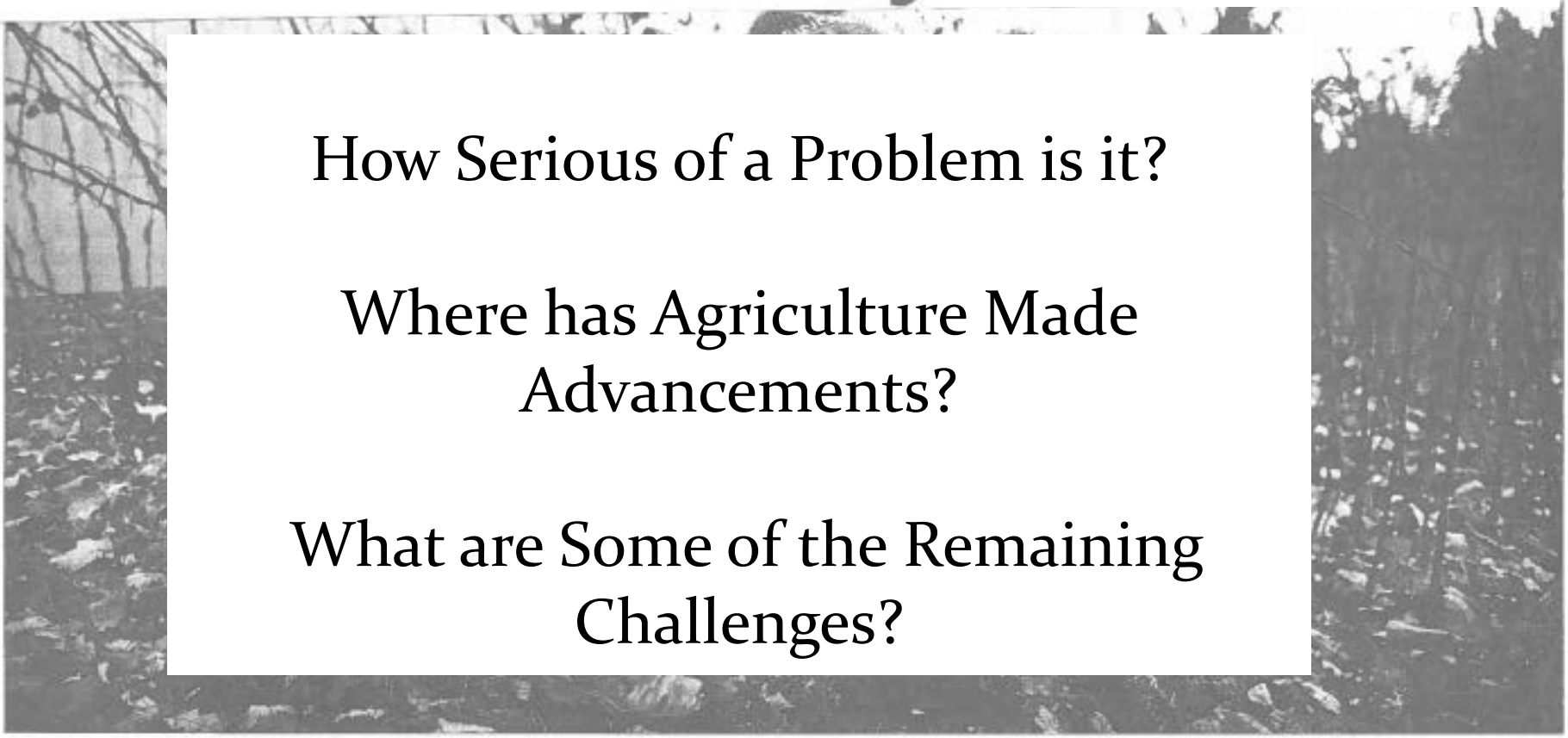
DECEMBER 23, 2012 Sunday

December 23, 2012

How Serious of a Problem is it?

Where has Agriculture Made Advancements?

What are Some of the Remaining Challenges?



RENÉE JONES SCHNEIDER • reneejones@startribune.com

Debbie Carlson filled a bottle of water on one of her properties near Red Wing to bring back to her Hastings home for drinking and cooking. She has high nitrate levels in her well water at home.

◂ WATER FROM A1

PAYING A PRICE FOR FERTILIZER AT FAUCET

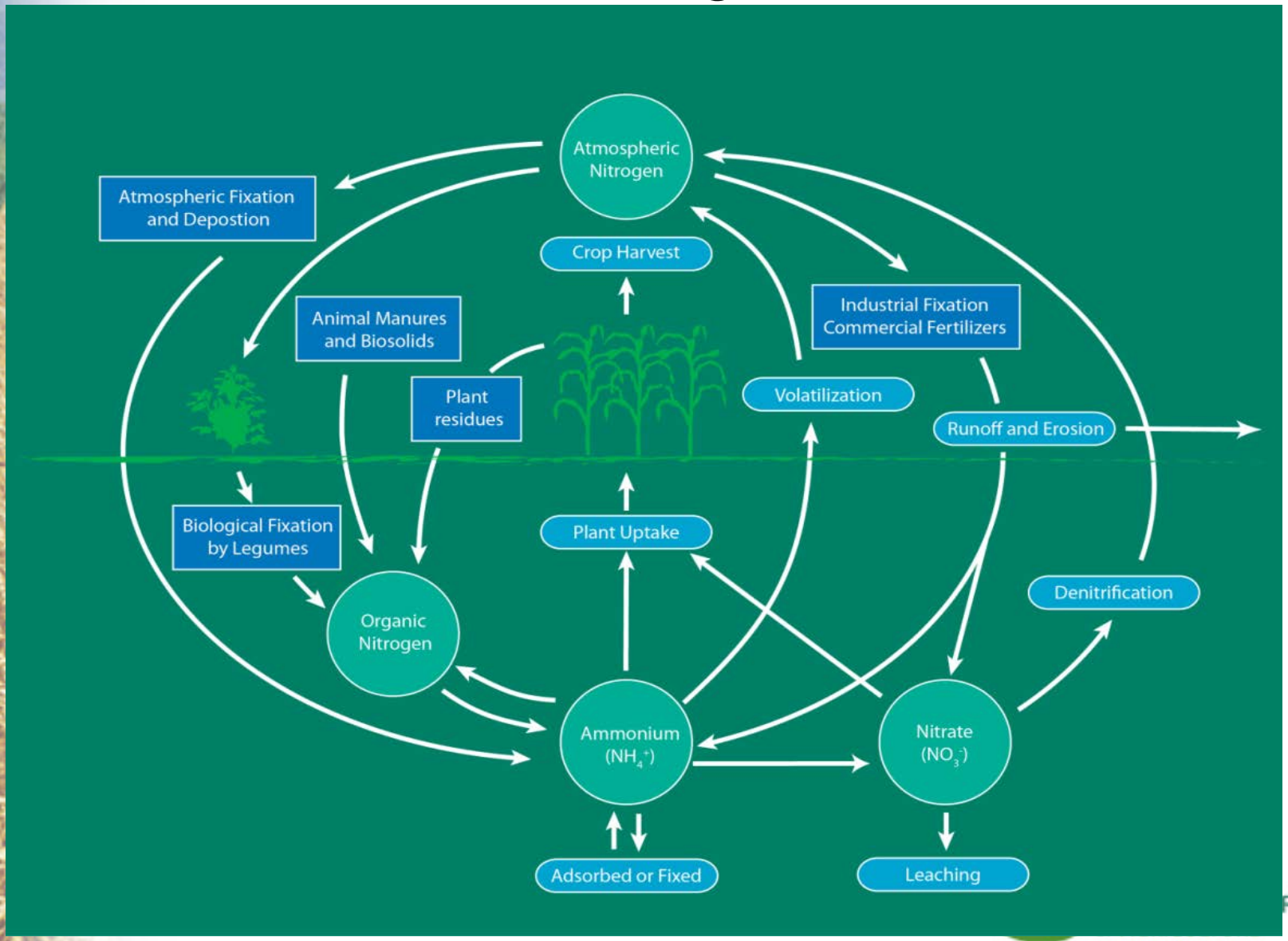
Now, through an encouraging statewide strategy, the Minnesota Department of Agriculture is devising a range of fixes, includ-

"It's a pain," she said. "I don't know what I'm going to do."

Regulation?

...innesota came up with its

The Nitrogen Cycle is a Highly Complex Set of Chemical and Biological Processes

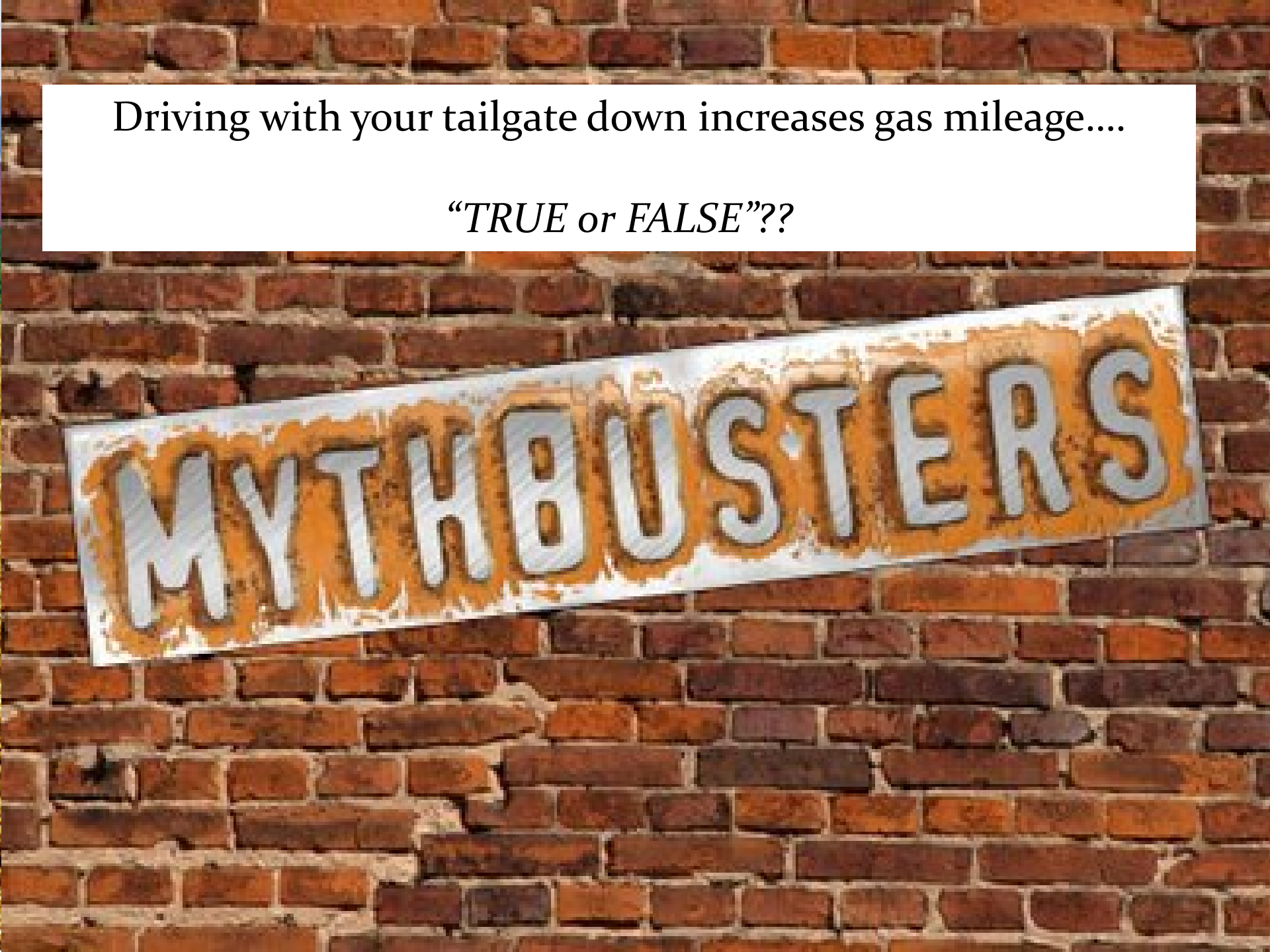


Mythbusters

MINNESOTA DEPARTMENT OF AGRICULTURE

Driving with your tailgate down increases gas mileage….

“TRUE or FALSE”??



Driving with your tailgate down increases your gas mileage?
Correct Answer---FALSE (BUSTED)

Sorry, You're Incorrect

A. True

The correct answer is:

B. False

go. But when MythBusters Jamie Hyneman and Adam Savage drove identical trucks under the same conditions across the desert — one with the tailgate up and the other with it down — Jamie's tailgate-closed pickup outlasted Adam's by more than 30 miles.

Closing the tailgate actually improves fuel efficiency because it creates a type of airflow called a separated bubble within the bed of the truck. As wind rushes over the moving truck, that bubble of slow-moving air deflects it over the raised tailgate. By guiding surrounding air over and across the truck bed, that vortex effect prevents added drag.

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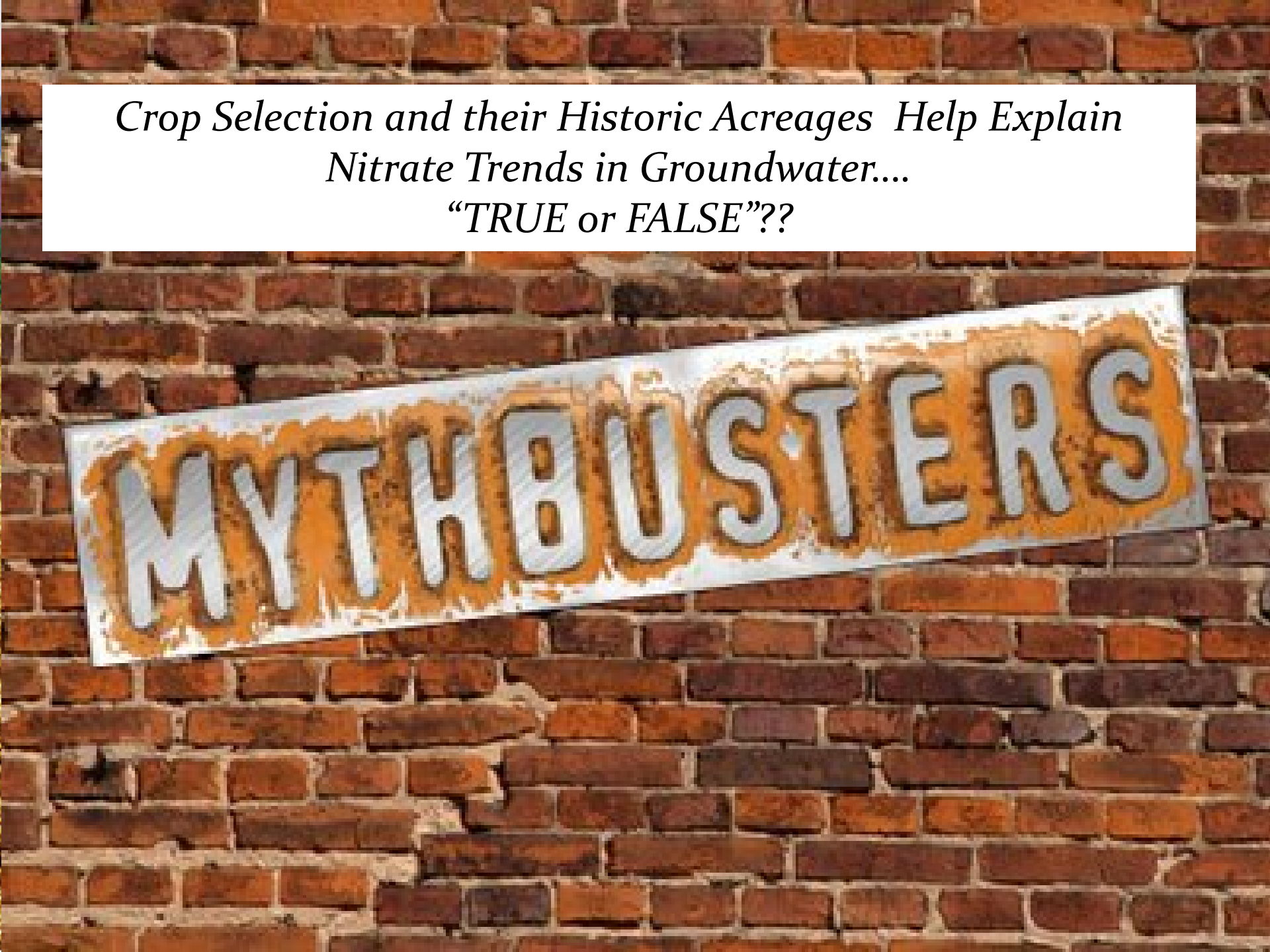
Crop Selection and their Historic Acreages Help Explain Nitrate Trends in Groundwater….
"TRUE or FALSE"??

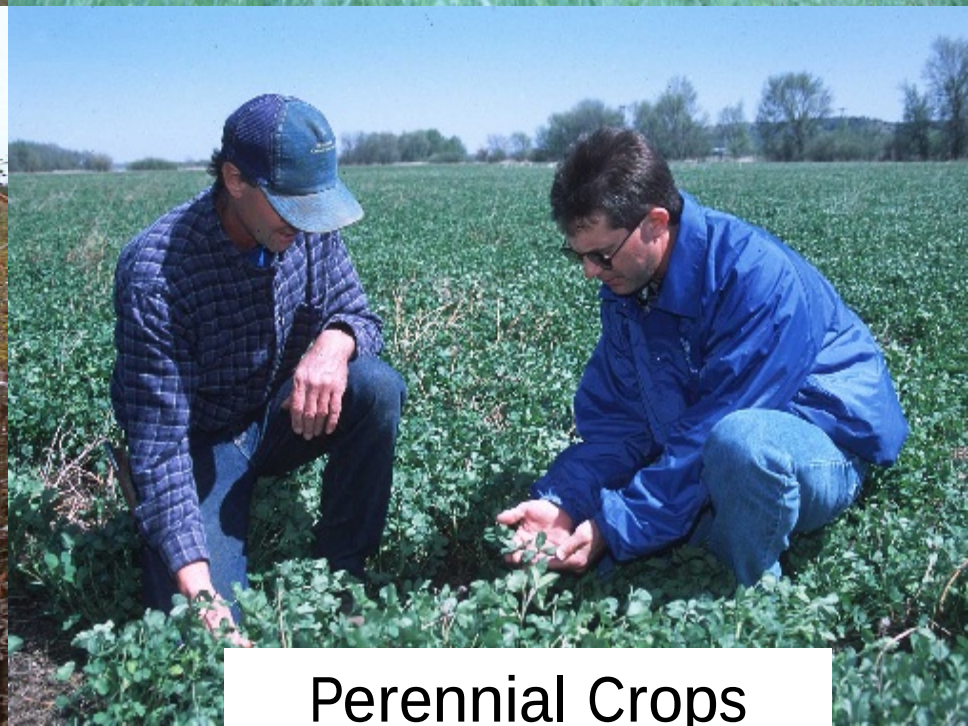


Crops with Low N Loss Leaching Potential

Alfalfa and Clover

Vegetated Pasture

Native Prairie/CRP Plantings



Perennial Crops

Alfalfa, Clovers, Orchard Grass, and Other Perennials Are Excellent Nitrogen Scavengers

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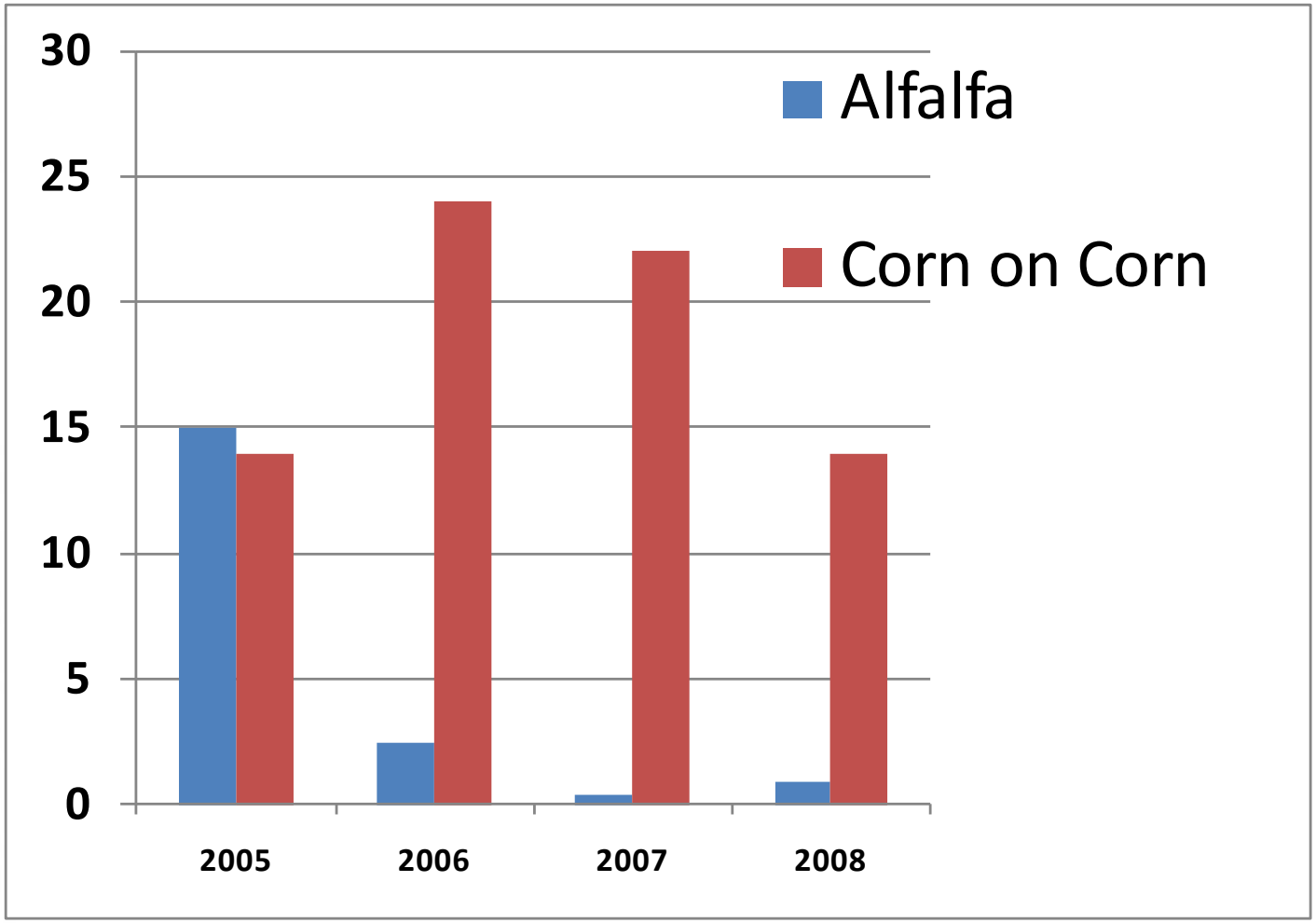
Annual Nitrogen Losses Under Corn vs. Alfalfa
Red Top Farm Demonstration Site



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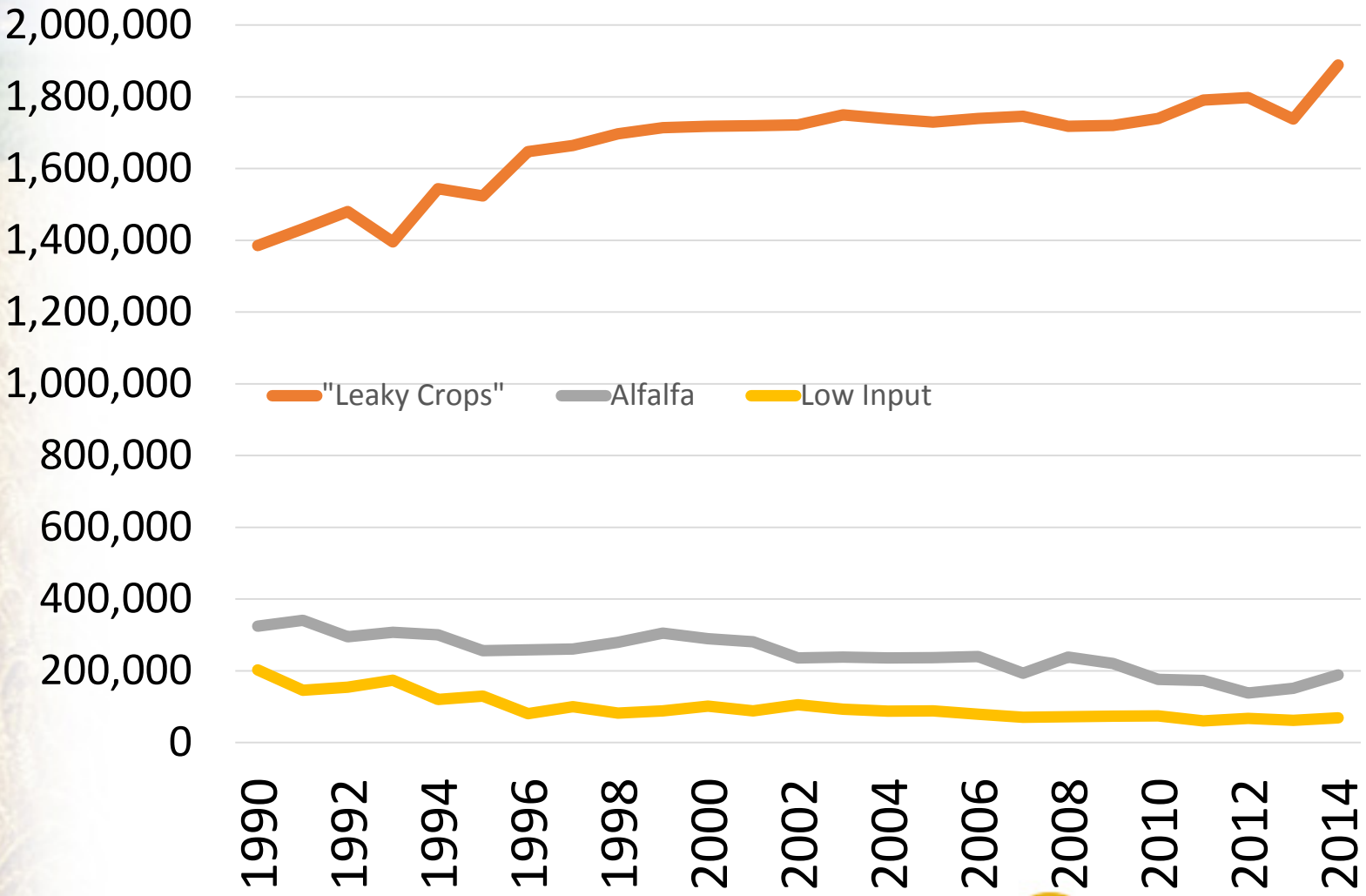
South East MN's Cropping Trends
1990-2014



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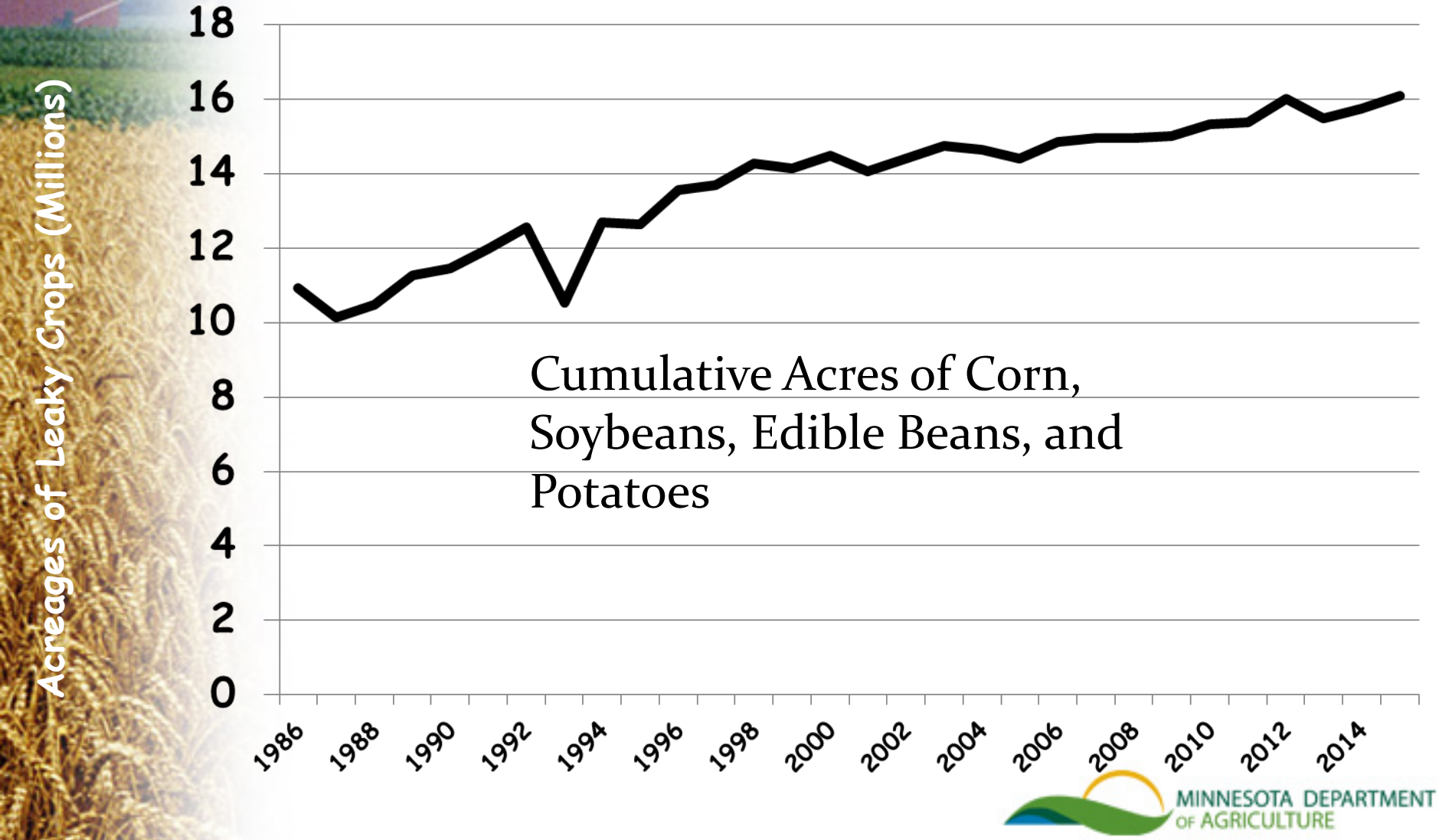
Trends in "Leaky" Crop Acreage in Minnesota

1986-2015



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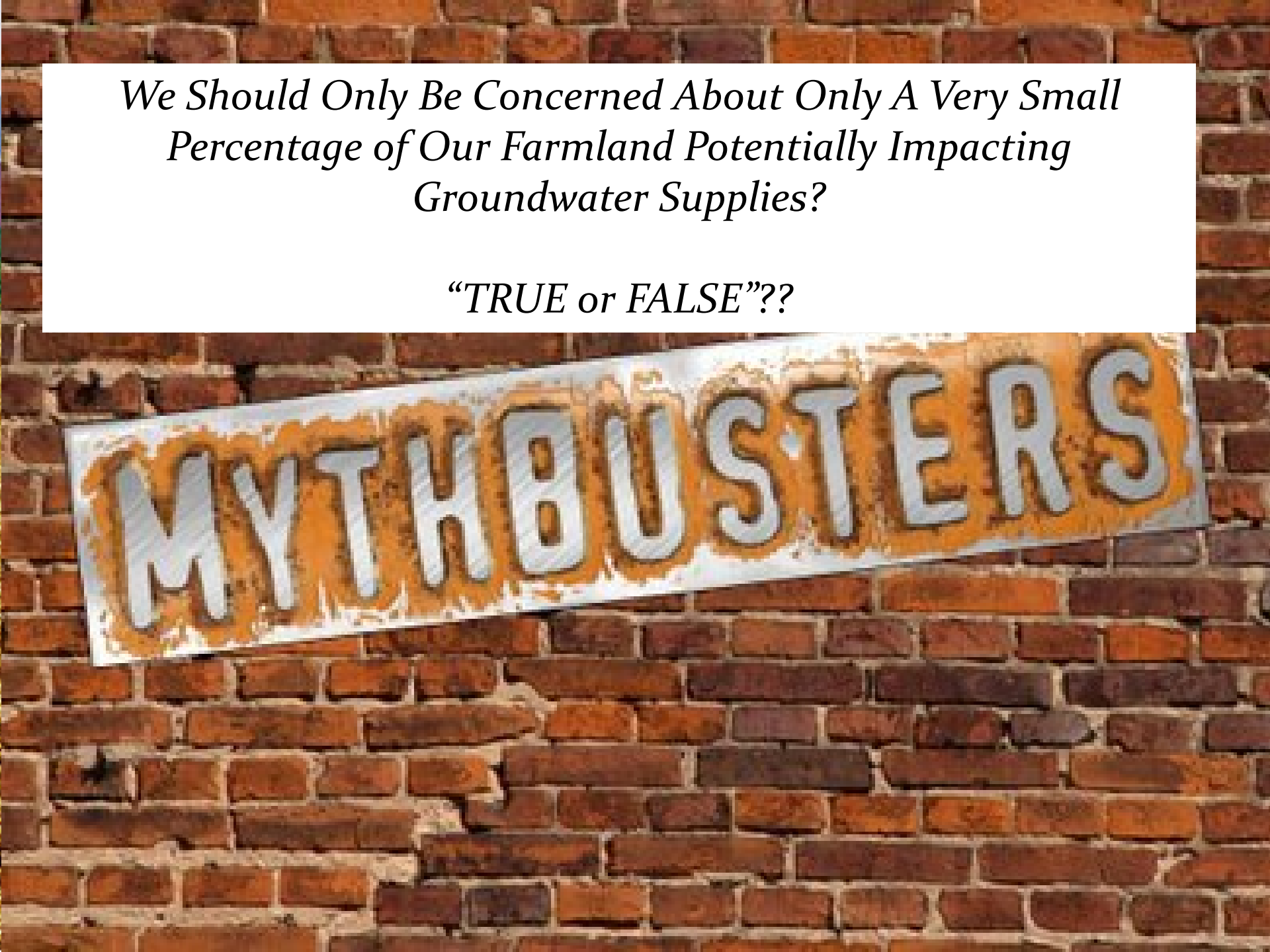
Crop Selection and their Historic Acreages Help Explain Nitrate Trends in Groundwater....
"TRUE or FALSE"??

Plausible

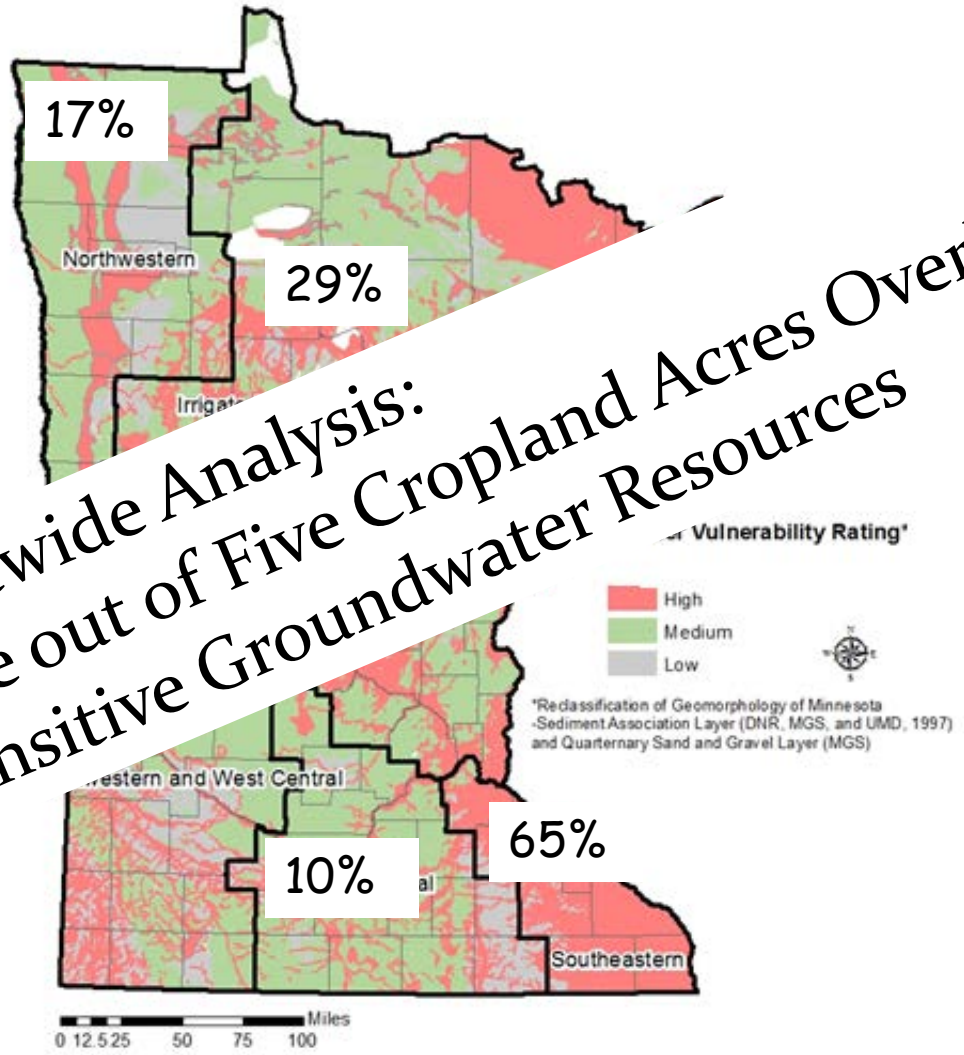
We Should Only Be Concerned About Only A Very Small Percentage of Our Farmland Potentially Impacting Groundwater Supplies?

"TRUE or FALSE"??



One Huge Challenge is the Sheer Size:

Minnesota Has Over 4 Million Acres of Cropland Overlying Vulnerable Groundwater Supplies



Statewide Analysis:
One out of Five Cropland Acres Overlies Highly Sensitive Groundwater Resources

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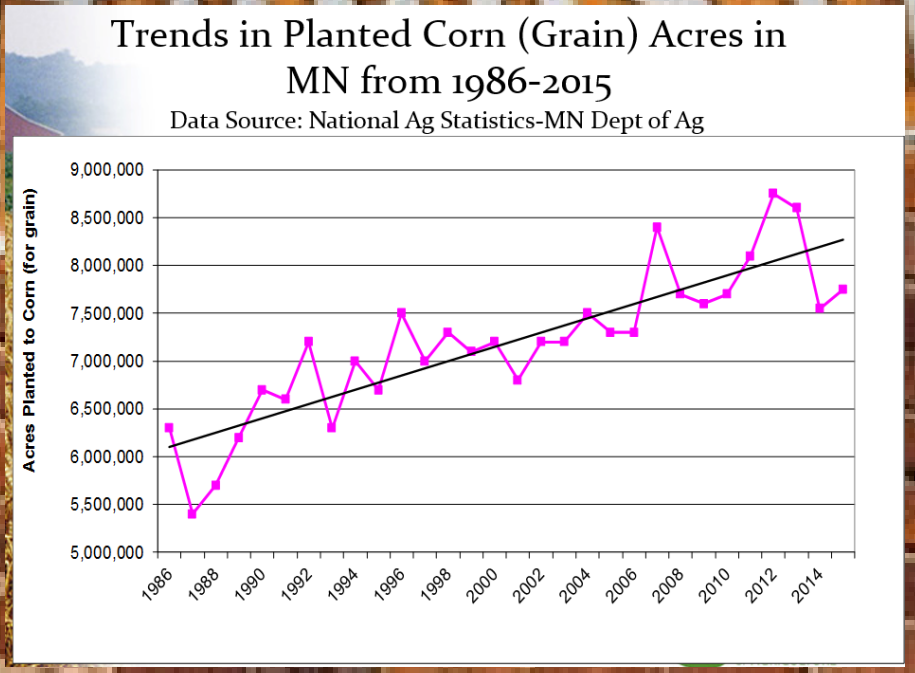
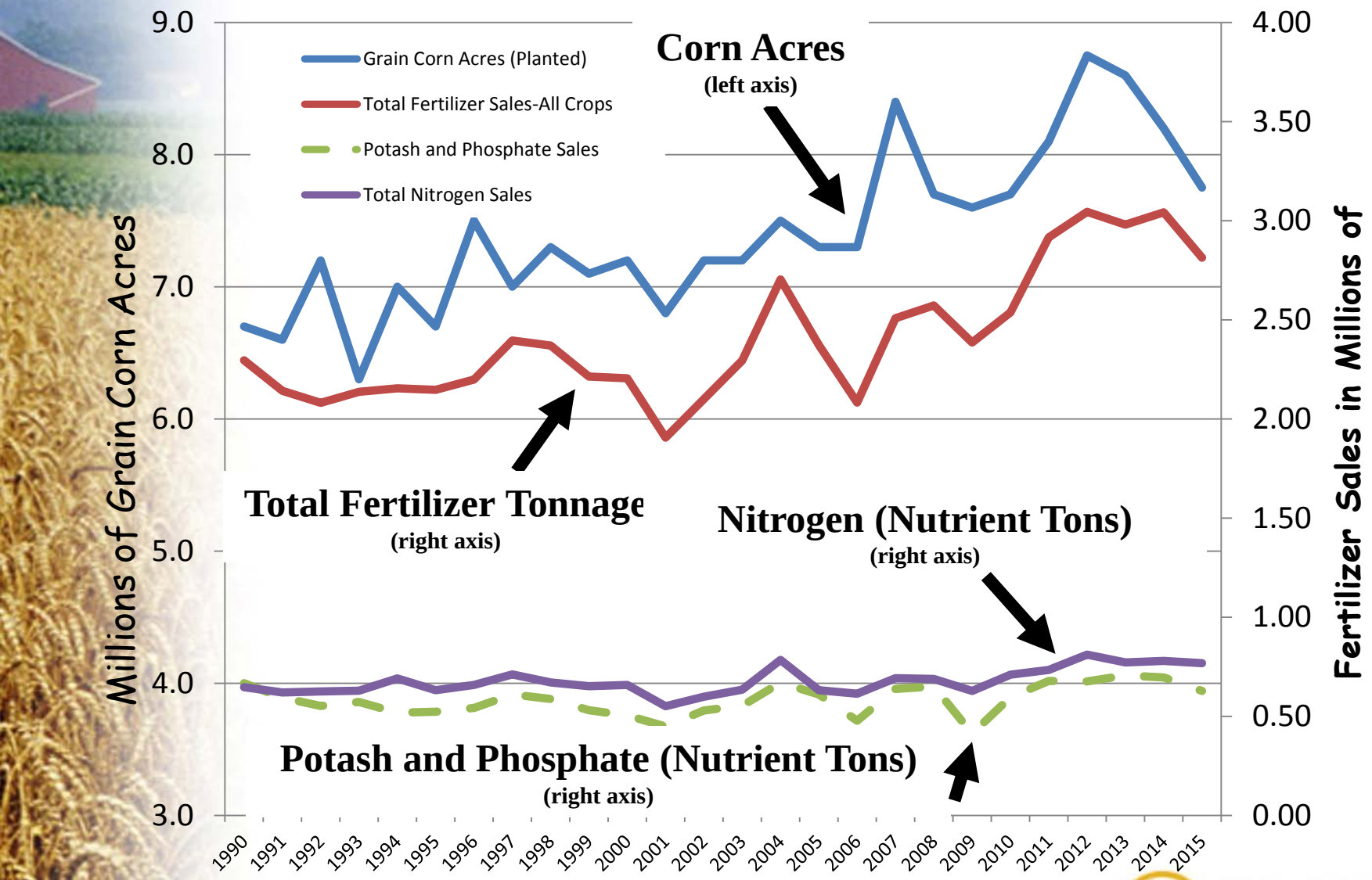
Nitrogen fertilizer sales have sky-rocketed to support the record corn production….
"TRUE or FALSE"??



Trends in Minnesota's Corn Acreage and Fertilizer Sales: 1990-2015



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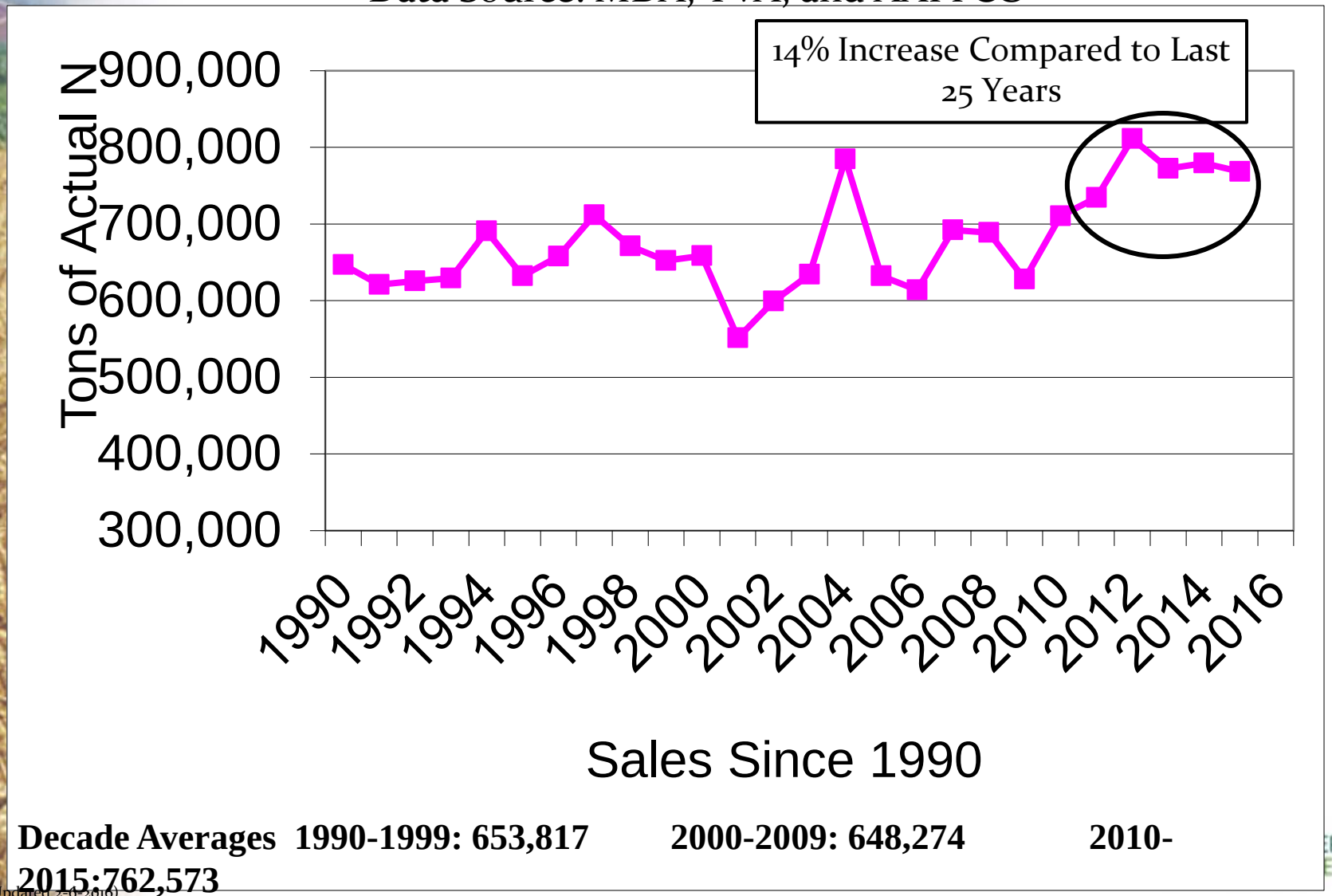
(Updated 2-6-2016)

Commercial Nitrogen Fertilizer Sales Trends in Minnesota: 1990-2015

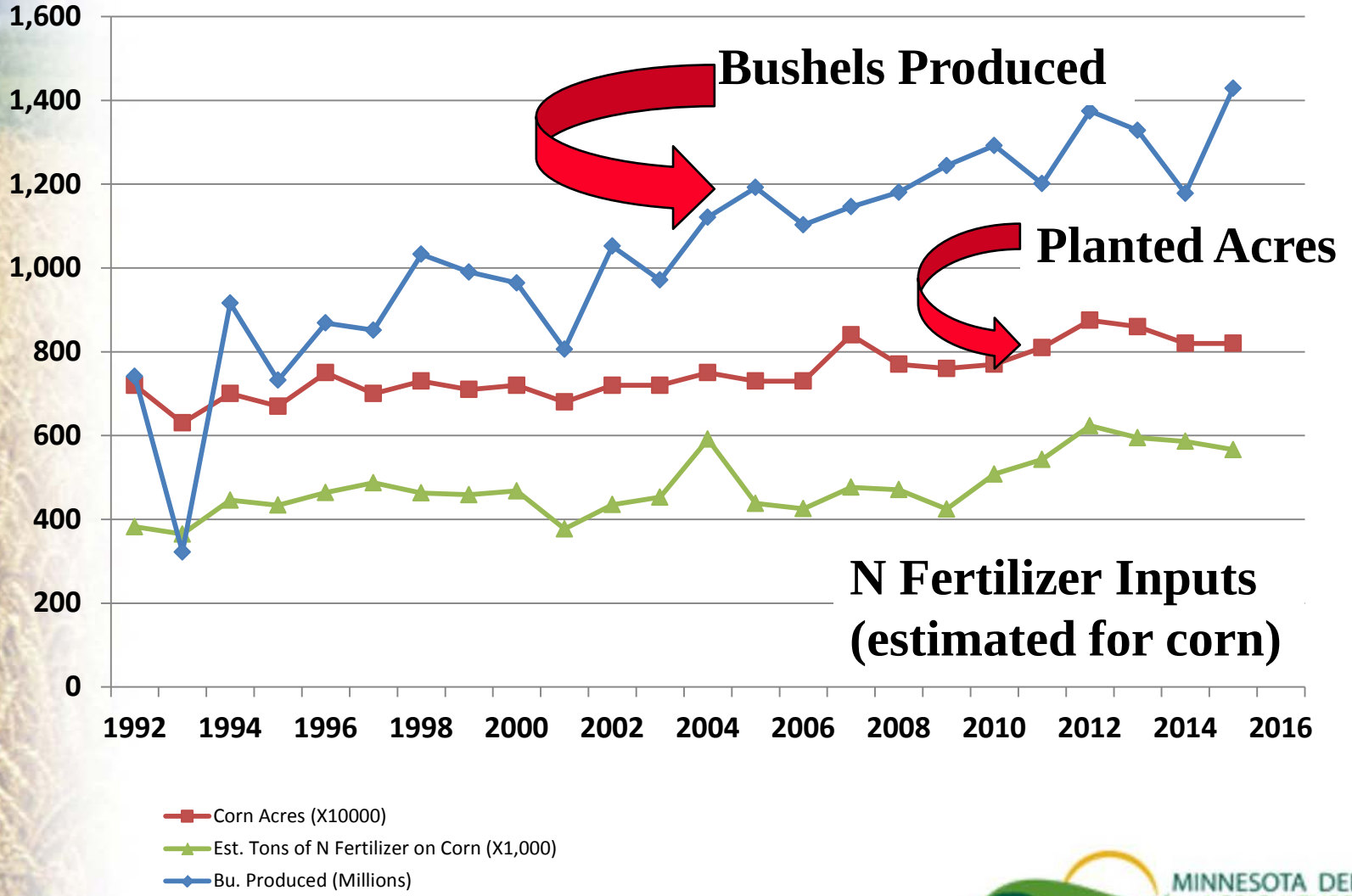
Data Source: MDA, TVA, and AAPFCO



Decade Averages 1990-1999: 653,817 2000-2009: 648,274 2010-2015:762,573

(Updated 2-6-2016)

Relationship Between Production and N Fertilizer Inputs on MN Corn (1992-2015)



(Updated 2-6-2016)

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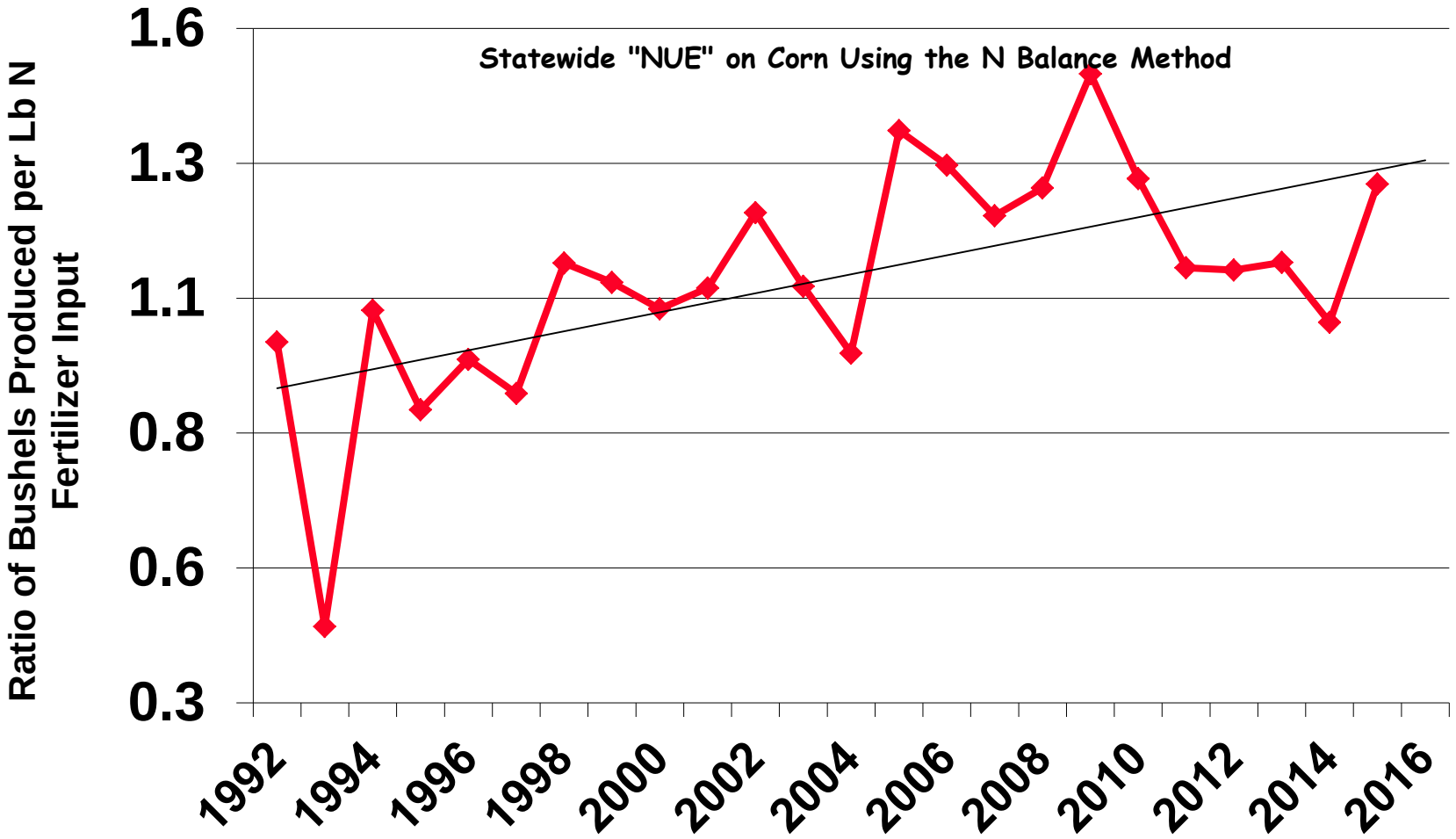
“Nitrogen Use Efficiency” for Minnesota Corn Production

1992 to 2015



(Updated 2-6-2016)

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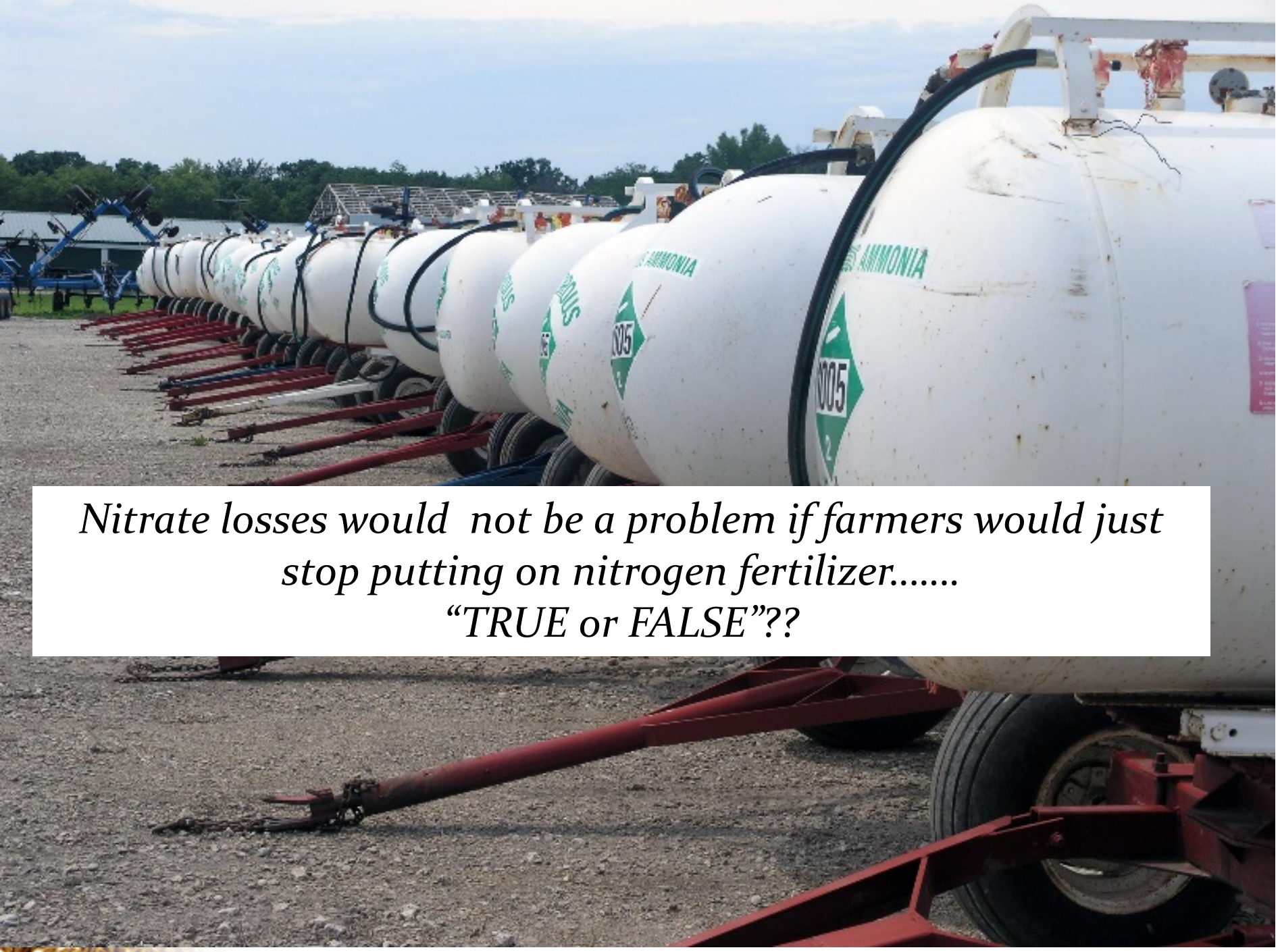
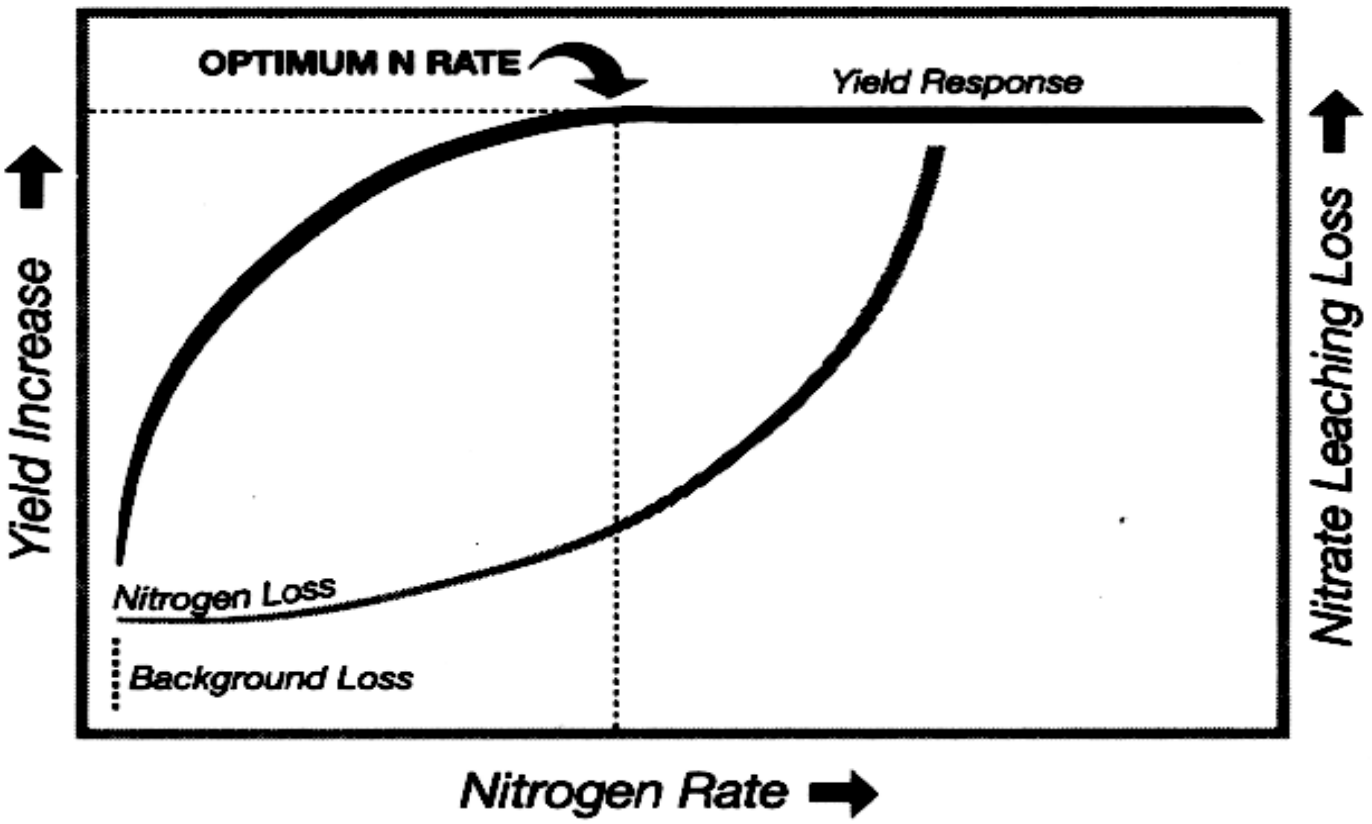
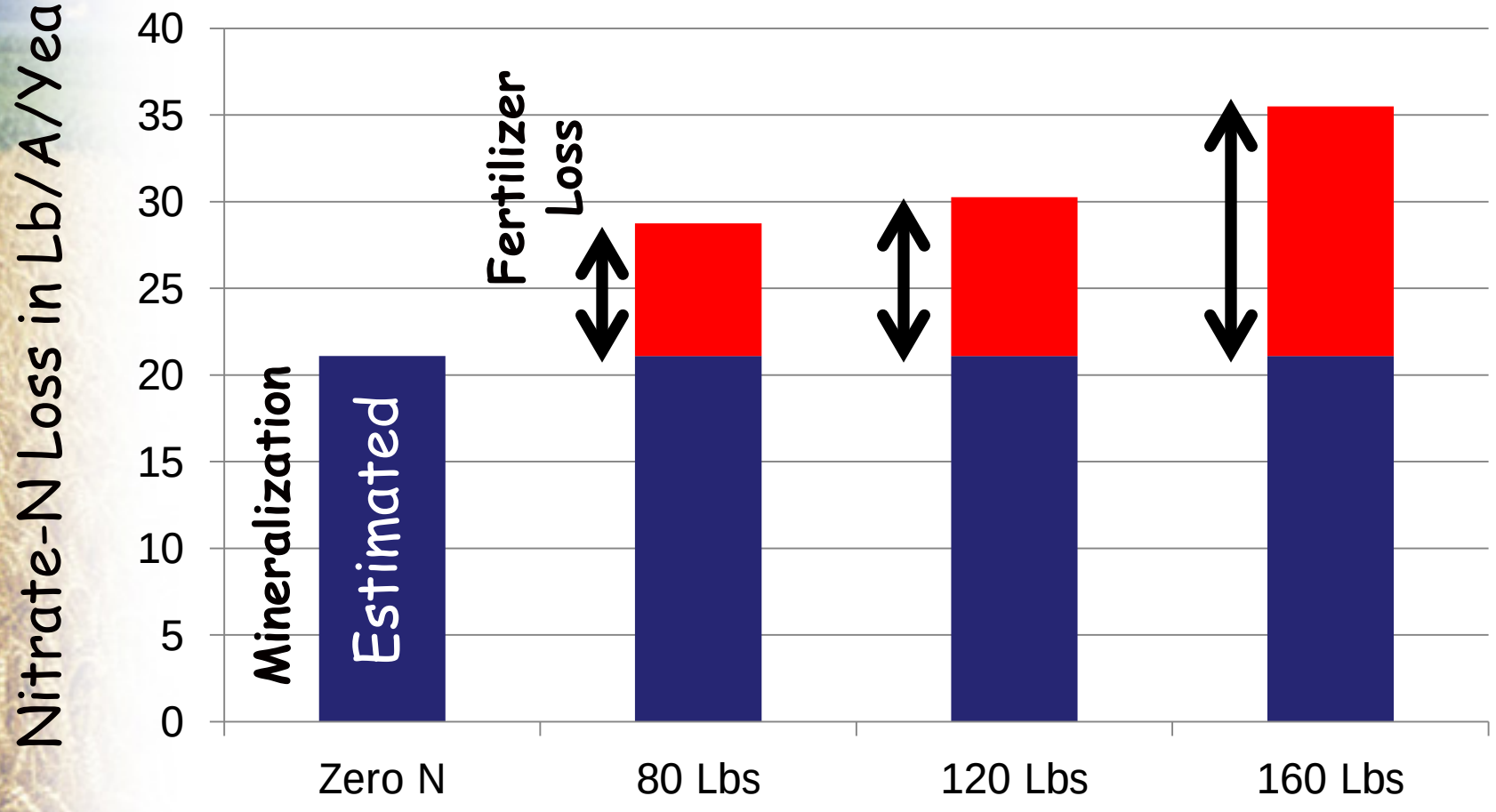


Nitrate losses would not be a problem if farmers would just stop putting on nitrogen fertilizer.....
"TRUE or FALSE"??


OPTIMUM N RATE
Yield Response
Yield Increase
Nitrate Leaching Loss
Nitrogen Loss
Background Loss
Nitrogen Rate

Partitioning Nitrate-N Losses from Mineralization and Fertilizer Applications

(SROC Waseca, 2000-2003 Wetter than normal years)



Data Source: Randall and Vetch, SROC

Estimated Check using 10 ml/L, 9.3 inches of drainage which is one inch higher due to poorer water use efficiency)

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Nitrate losses would not be a problem if farmers stopped putting on nitrogen fertilizer…….
"TRUE or FALSE"??

False. There will always be some losses under row crop production. However, using recommended rates that optimize yields can significantly reduce unnecessary nitrate loading to our water resources

UNIVERSITY OF MINNESOTA
EXTENSION

AGRICULTURAL DRAINAGE

Nitrates in Drainage Water in Minnesota

Brad Carlson, Extension Educator, University of Minnesota Extension
Jeff Vetsch, Assistant Scientist, University of Minnesota SROC
Gyles Randall, Soil Scientist and Professor Emeritus, University of Minnesota SROC

New Products Intended to Help Producers Increase Fertilizer Efficiencies Have Flooded the Market in Recent Years

"TRUE or FALSE"??

N-Serve
NITROGEN STABILIZER

eNhance

NutriSphere-N

MYTHBUSTERS

AVAIL® Phosphorus Fertilizer Enhancer

AGROTAIN

NZONE™
Nitrogen Management Aid

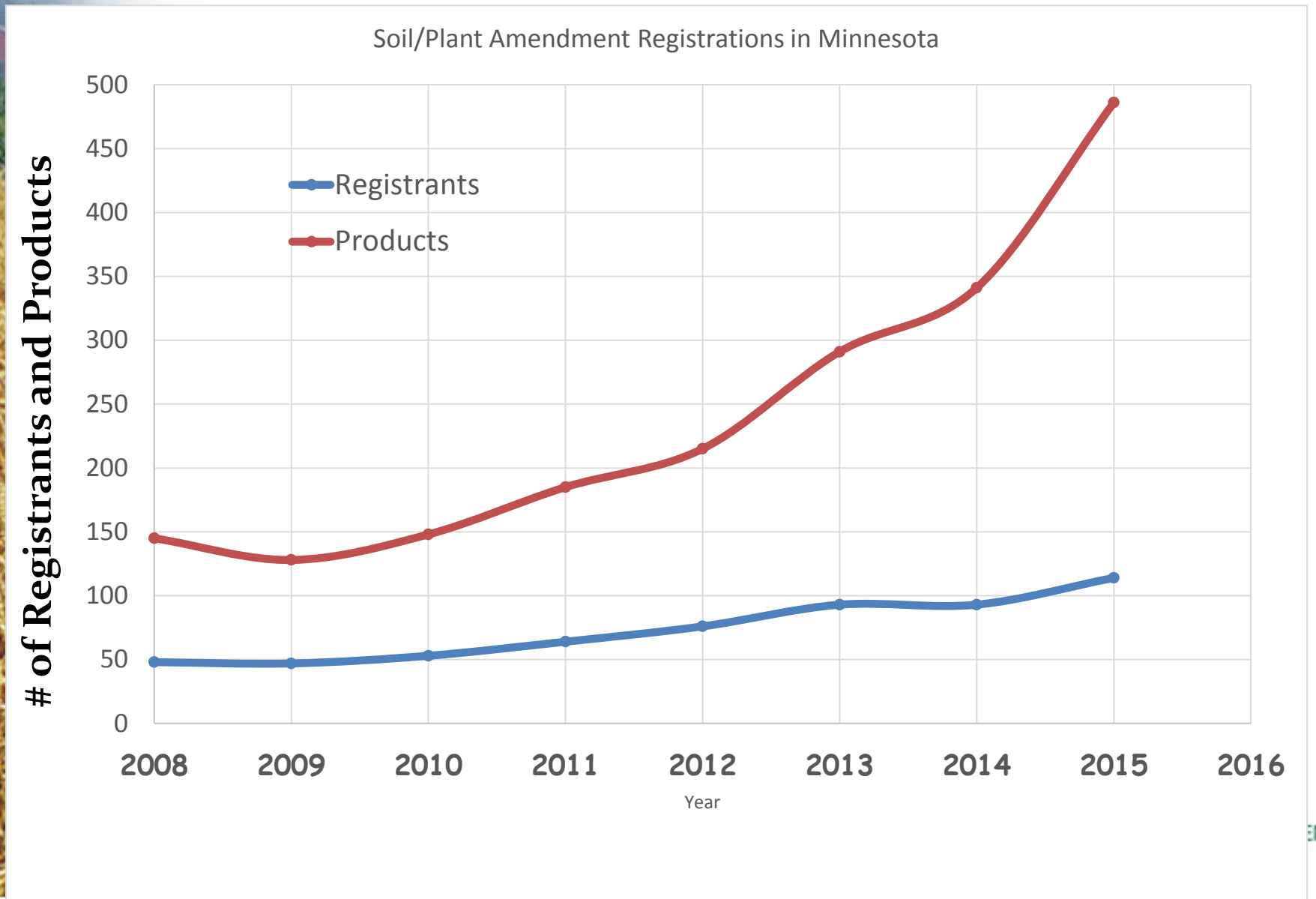
Instinct II
NITROGEN STABILIZER

NH_4^+ —Nitrosomonas→ NO_2^-

NO_2^- —Nitrobacter / Nitrosolobus→ NO_3^-

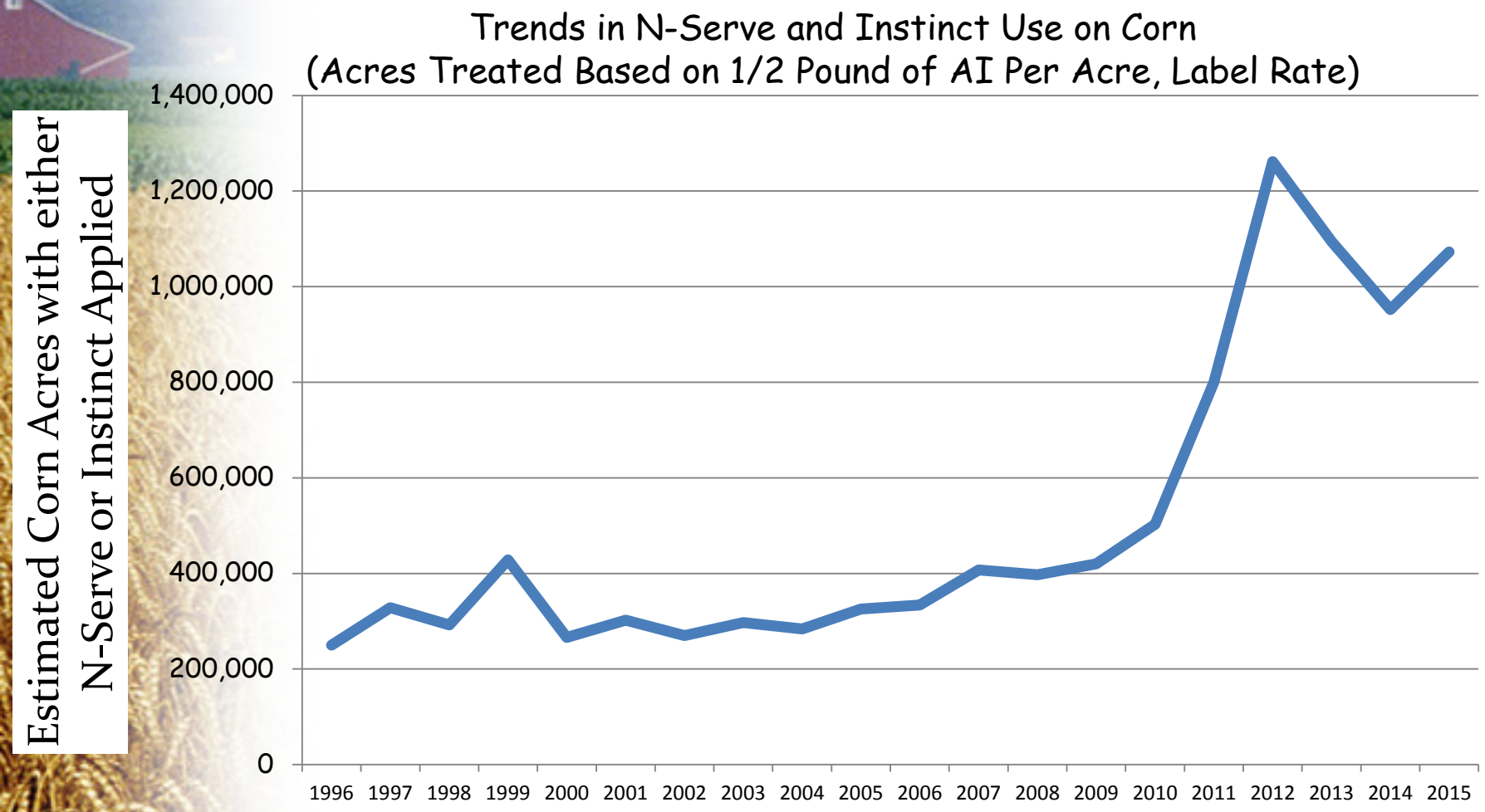
Soil and Plant Amendment Registration Trends 2008-2015

Data Source: MDA



Nitrapyrin Sales: 1996-2015

Data Source: MDA



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SF-1581

Nitrogen Extenders and Additives

FOR FIELD CROPS

D.W. Franzen
NDSU Extension Soil Specialist

NCERA-103 Committee
North Dakota State University

In winter wheat, very low levels of N are required for overwintering. However, once wheat breaks dormancy, a large proportion of N is required during the next few weeks. In spring wheat, a small of amount of N is

showed that nitrapyrin was active as a nitrification inhibitor and that the degree of nitrification was influenced by the nitrapyrin rate as a ratio of nitrapyrin to anhydrous ammonia. Greater N recovery

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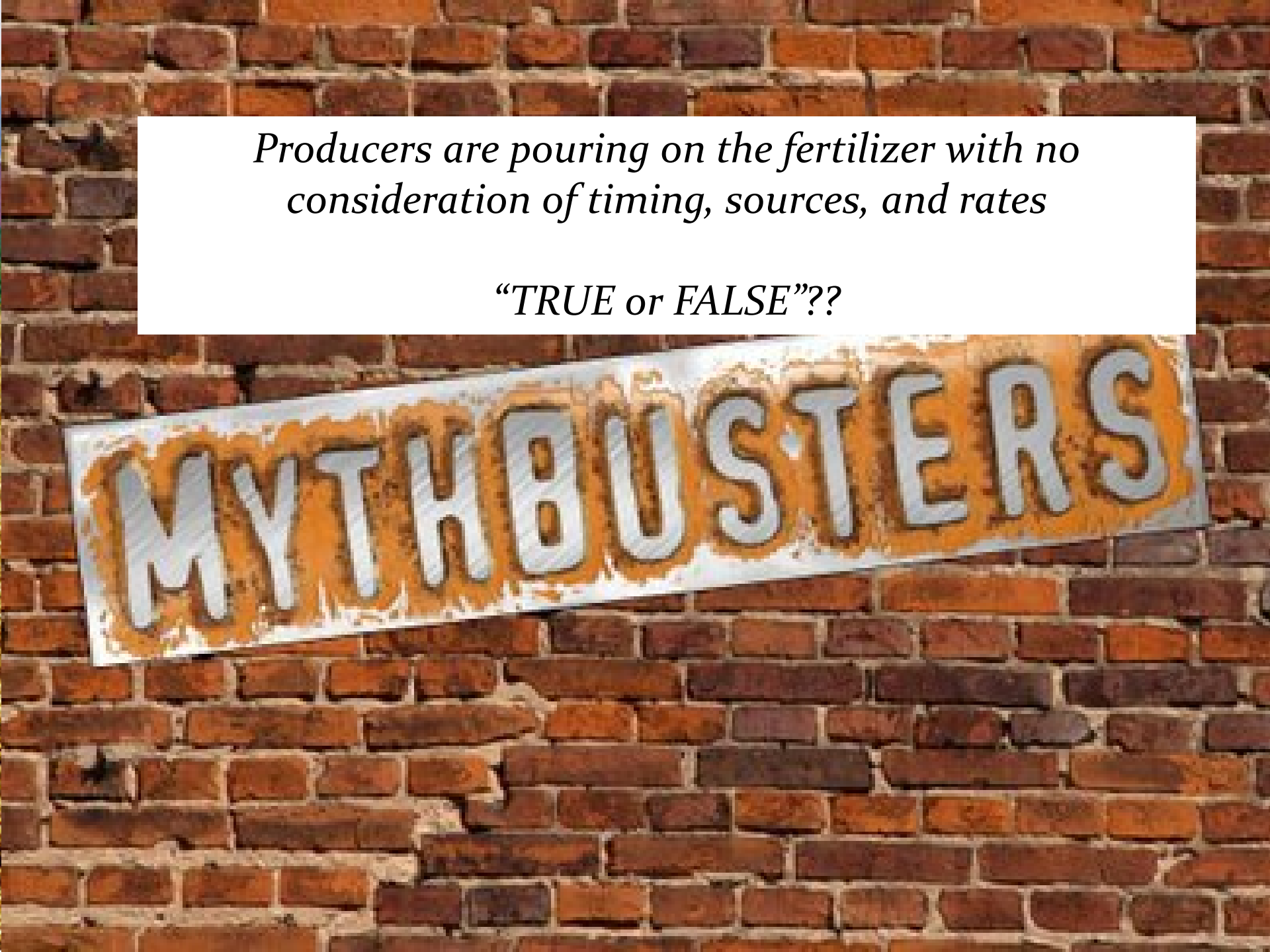
Producers are pouring on the fertilizer with no consideration of timing, sources, and rates

"TRUE or FALSE"??



Characterizing Regional and Statewide Fertilizer Practices

Survey of Nitrogen Fertilizer Use on Corn in Minnesota

Peter Bierman[1], Carl Rosen[1], Rod Venterea[1,2], John Lamb[1]

[1]University of Minnesota – Department of Soil, Water, and Climate
[2]United States Department of Agriculture – Agricultural Research Service

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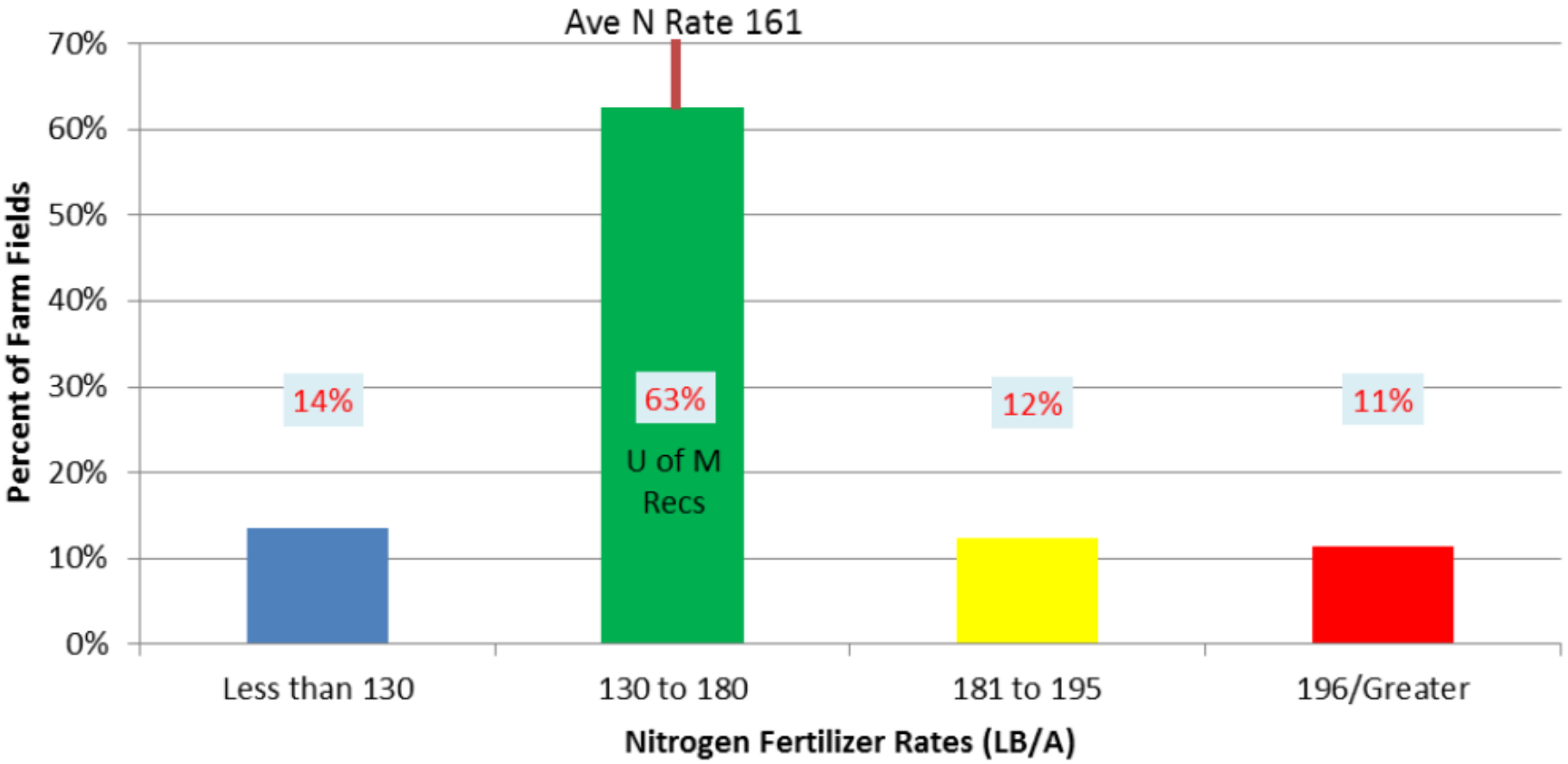
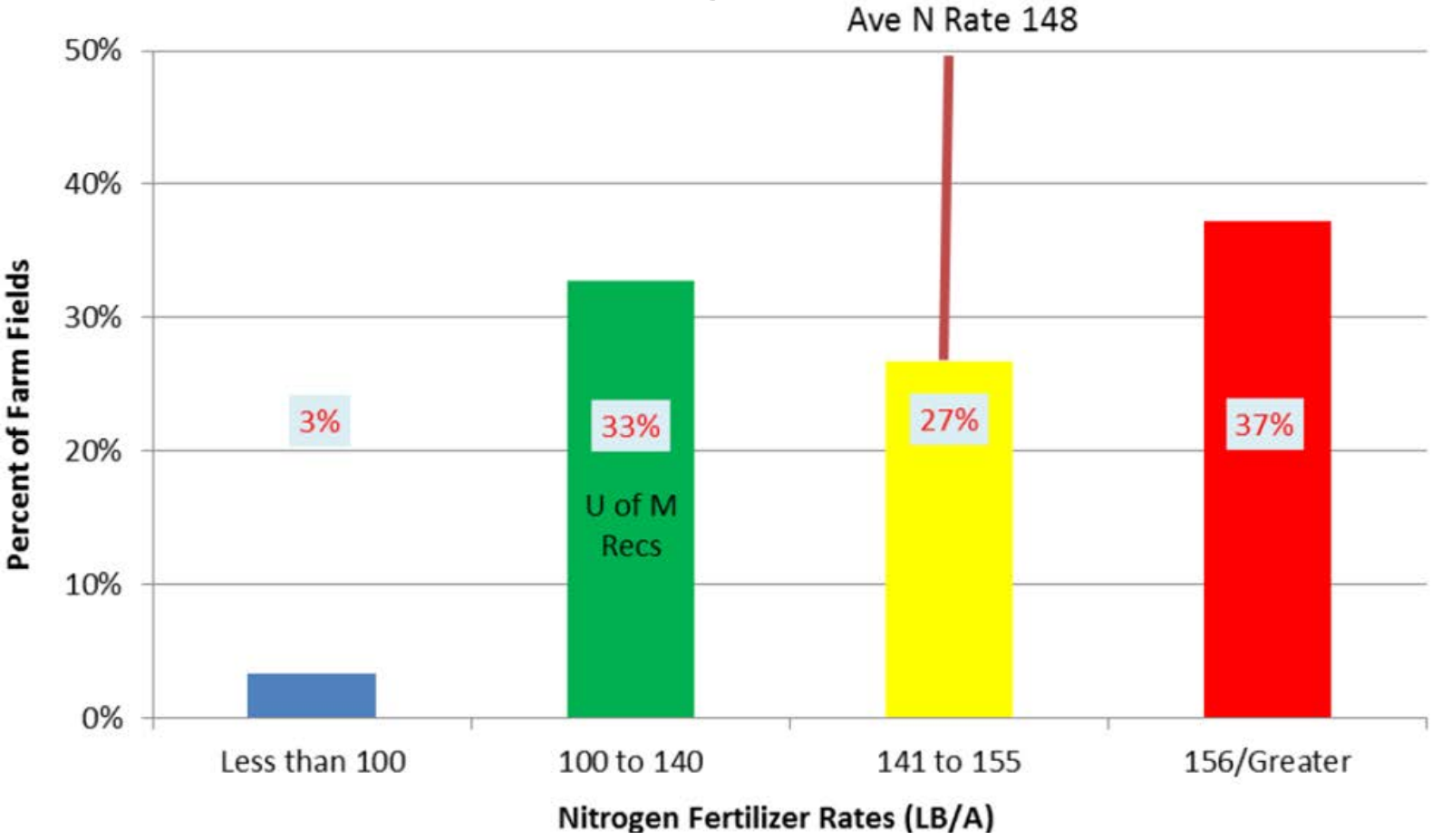
NASS Corn Grower N Survey-2010

% of Fields Within UM Recommended N Ranges for Corn Following Corn---Statewide



Details: Analysis included 665 fields. Analysis uses “Nitrogen to corn price ratio” of 0.05 UM Recs at 0.10: 120-165 (140) Manured fields not included in this scenario.

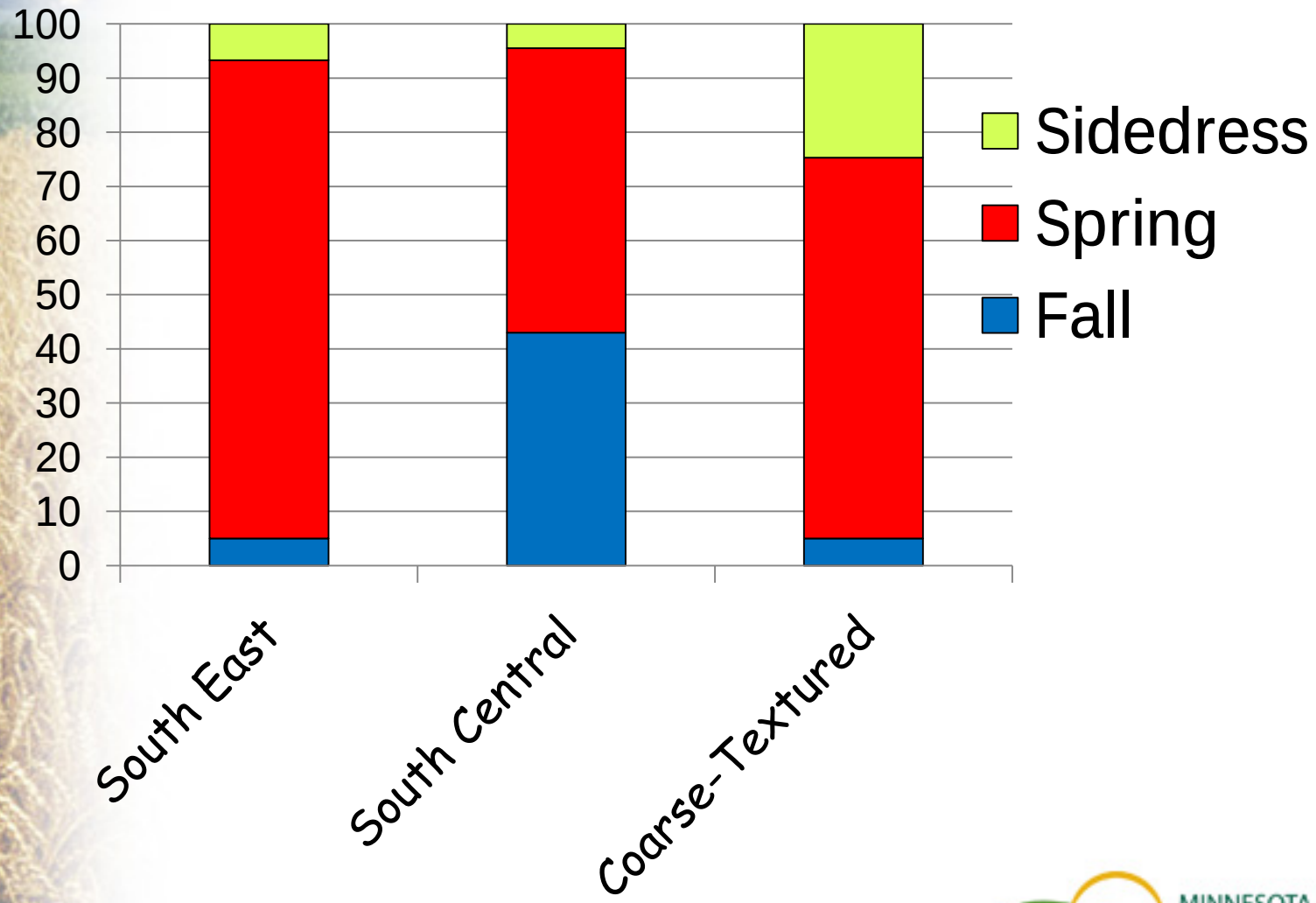
NASS Corn Grower N Survey-2010
% of Fields Within UM Recommended N Ranges for Corn Following Soybeans---Statewide



Details: Analysis included 2,222 fields. Analysis uses “Nitrogen to corn price ratio” 0.05. UM Recs at 0.10: 90-125 (110)
Manured fields not included in this scenario.

NASS Corn Grower N Survey-2010

Timing of the Major N Source on Corn



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Producers are pouring on the fertilizer "TRUE or FALSE"??

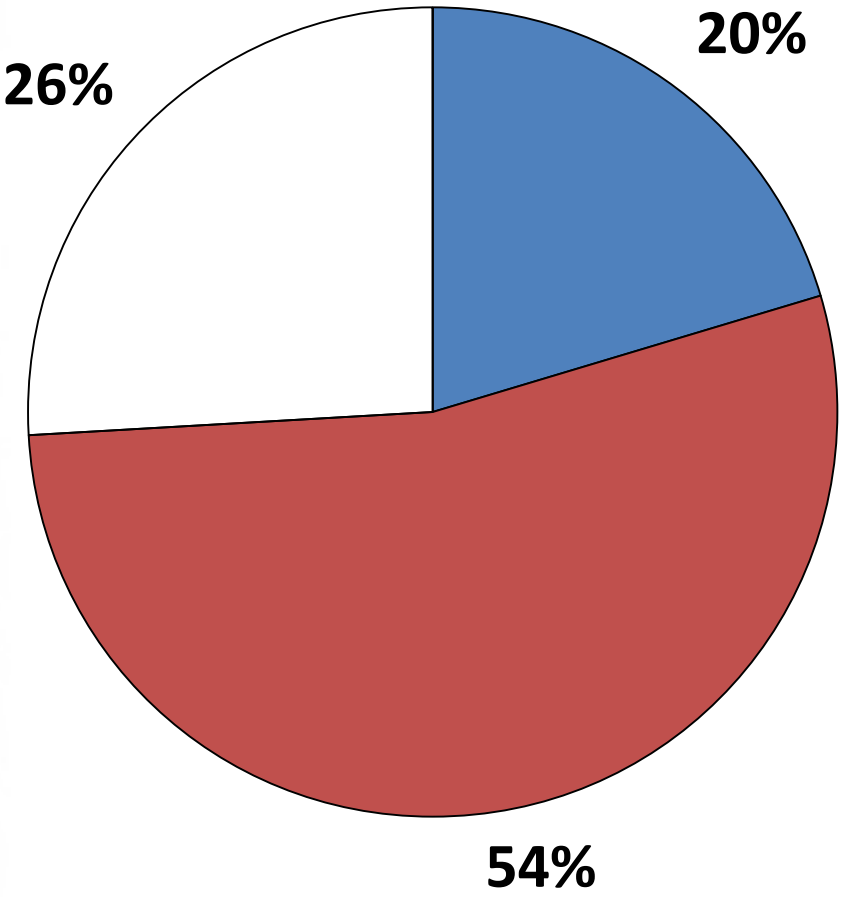
In general, MN producers do good to great jobs at using the right source, timing and placement;

Producers in many cases fail to take full advantage of soybean credits;

Producers have made significant gains in manure crediting and management

Nitrate in Our Drinking Water---What 10,000 Wells Are Telling Us

3 out of 4 Minnesotans get their drinking water from GROUNDWATER



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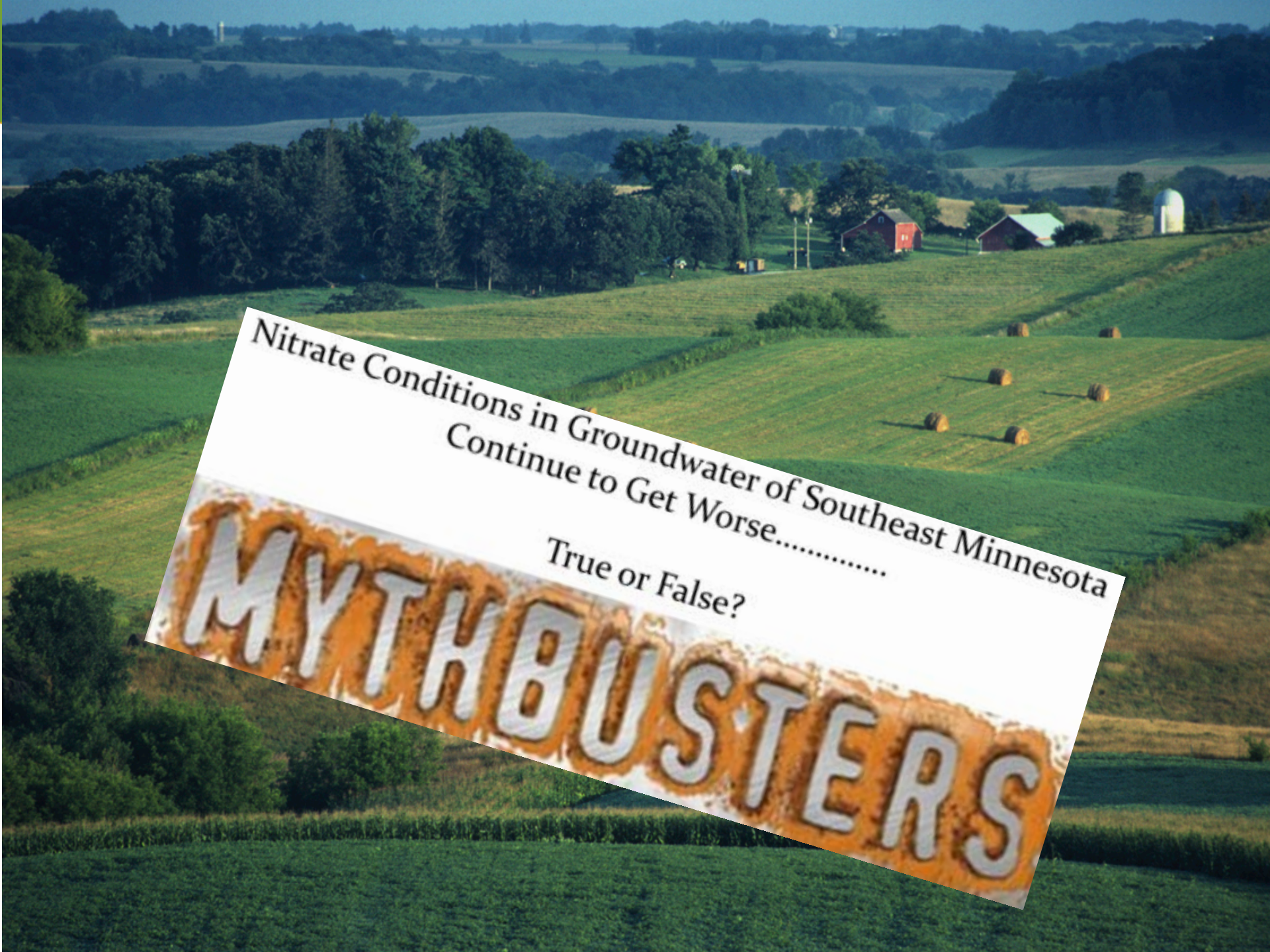
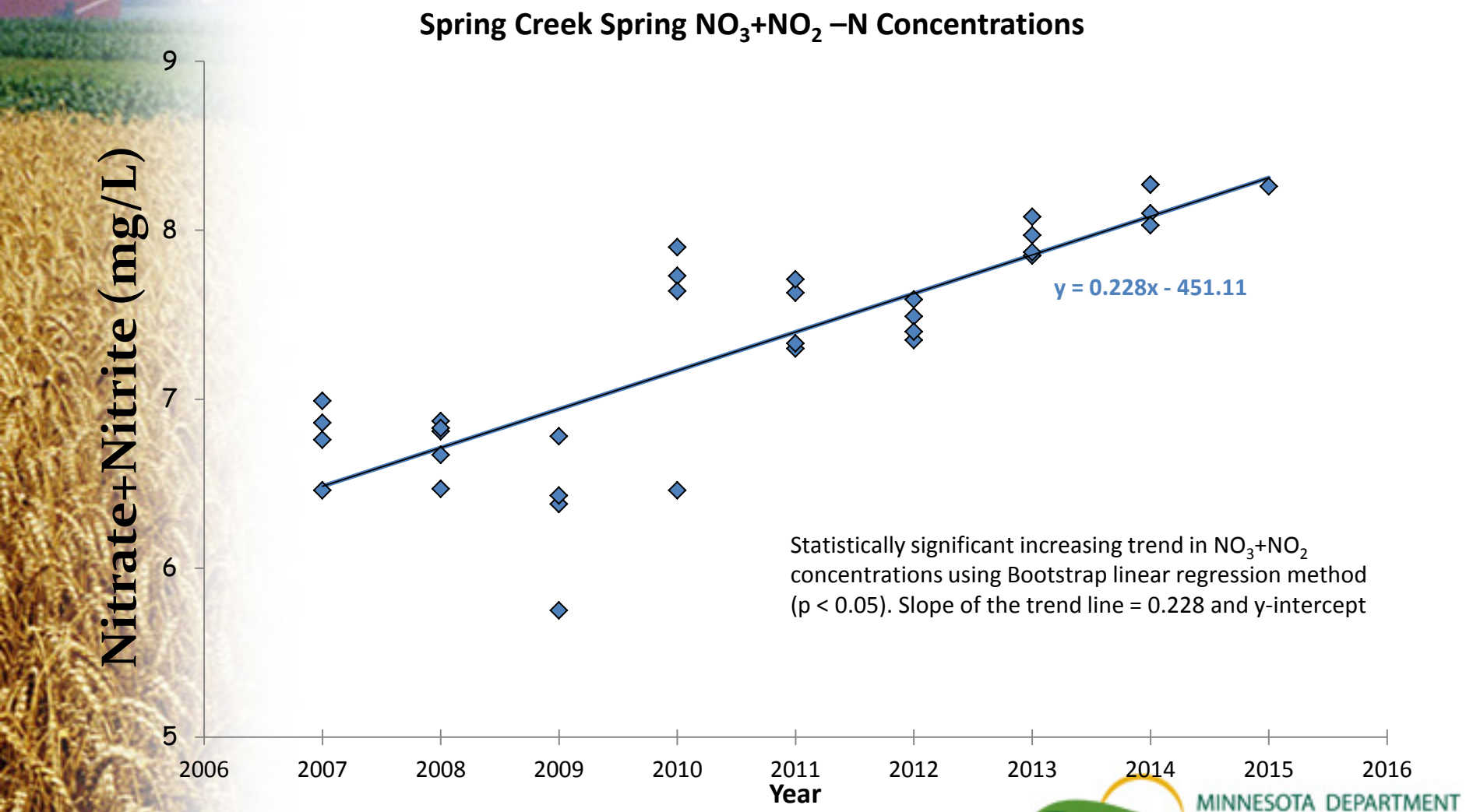

Nitrate Conditions in Groundwater of Southeast Minnesota
Continue to Get Worse.....
True or False?
MYTHBUSTERS

Hydrologists Use Diverse Approaches in the Karst:

- Streams/Rivers
- Springs
- Wells
- Edge of field (vadose)

Spring Creek Spring Nitrate Trend Analysis
Goodhue County 2006-2015



Statistically significant increasing trend in NO_3+NO_2 concentrations using Bootstrap linear regression method ($p < 0.05$). Slope of the trend line = 0.228 and y-intercept

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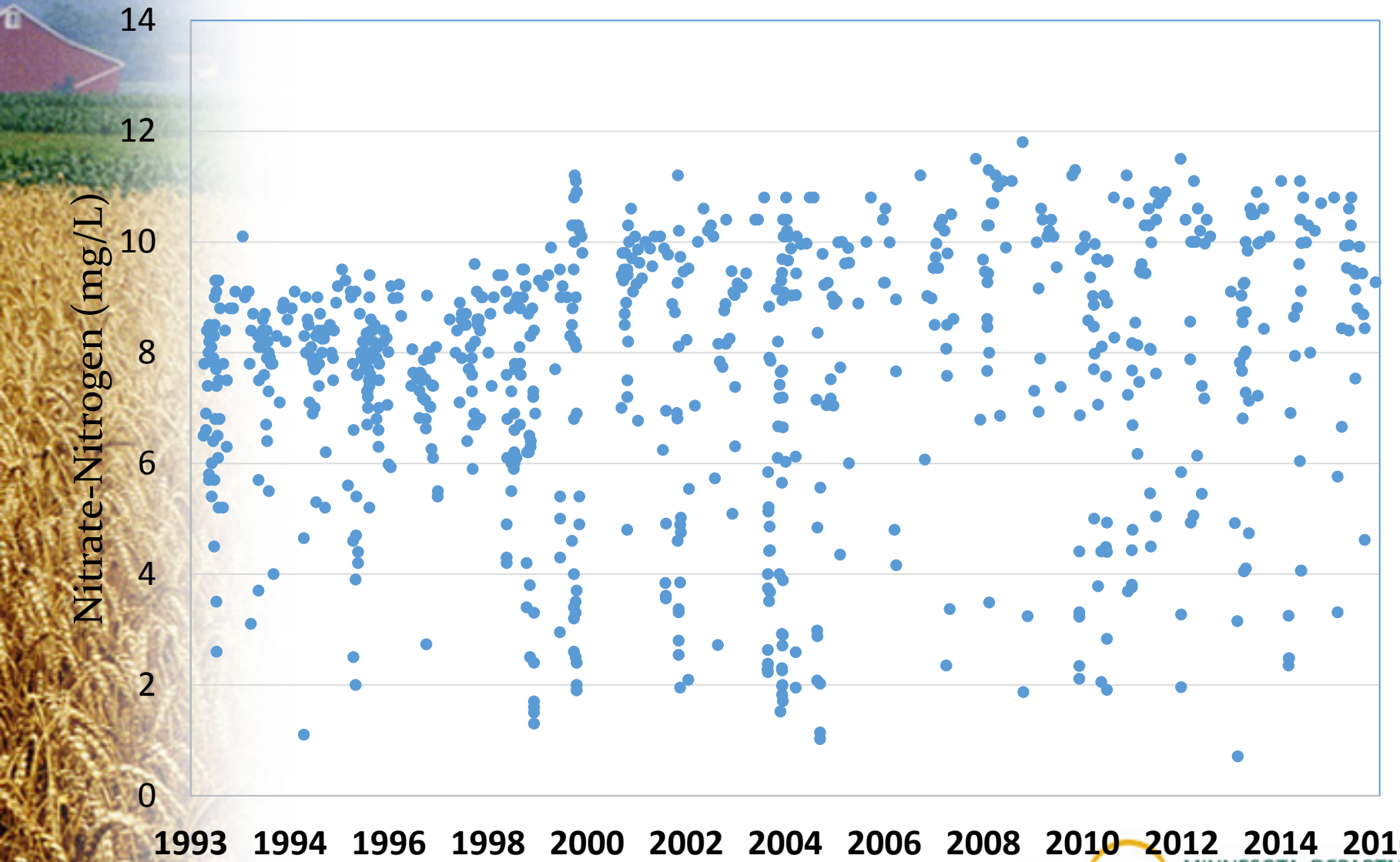
Middle Branch Whitewater River Nitrate-Nitrogen 1993-2015



MDA Data

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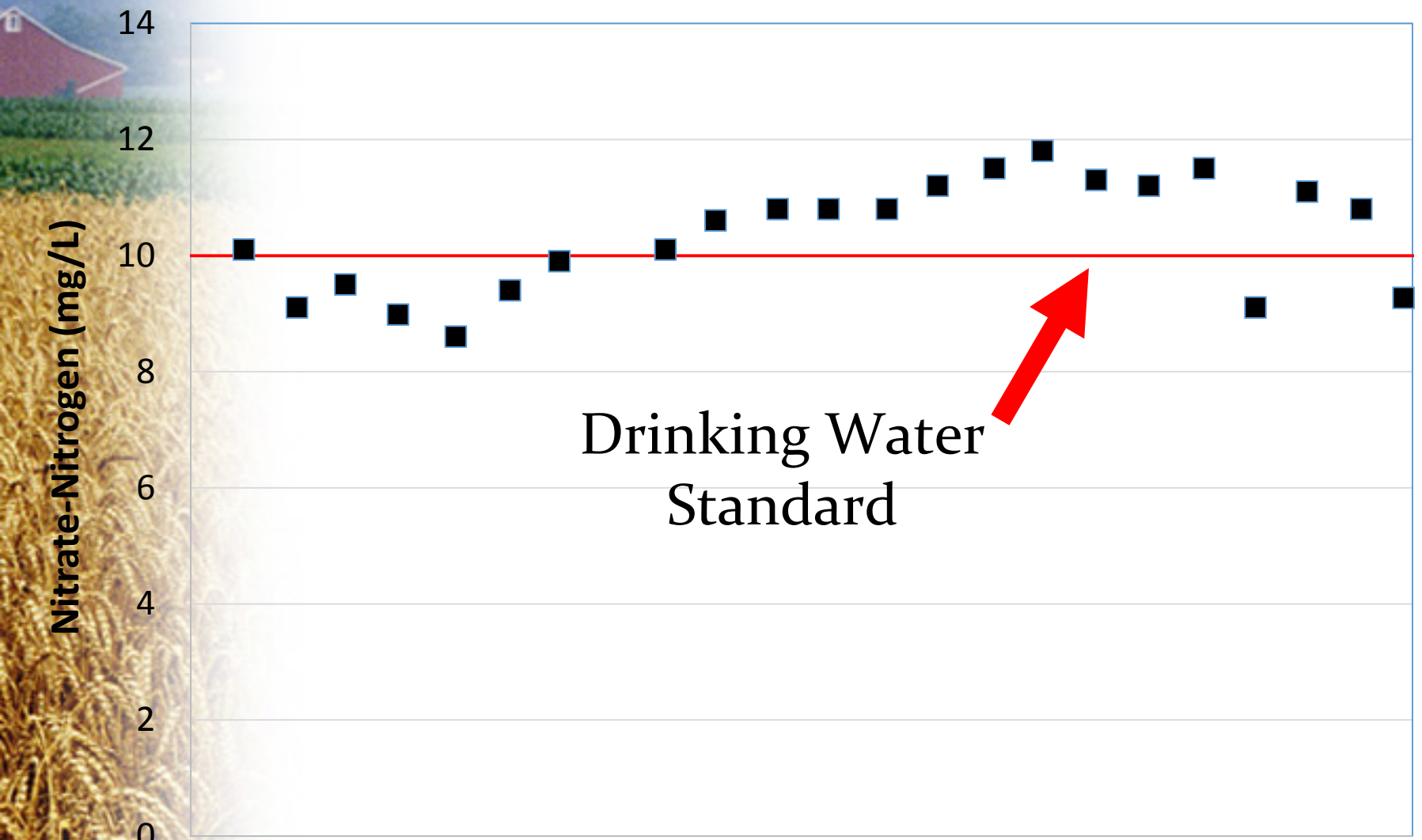
Middle Branch Whitewater River Nitrate-Nitrogen 1993-2015



MDA Data

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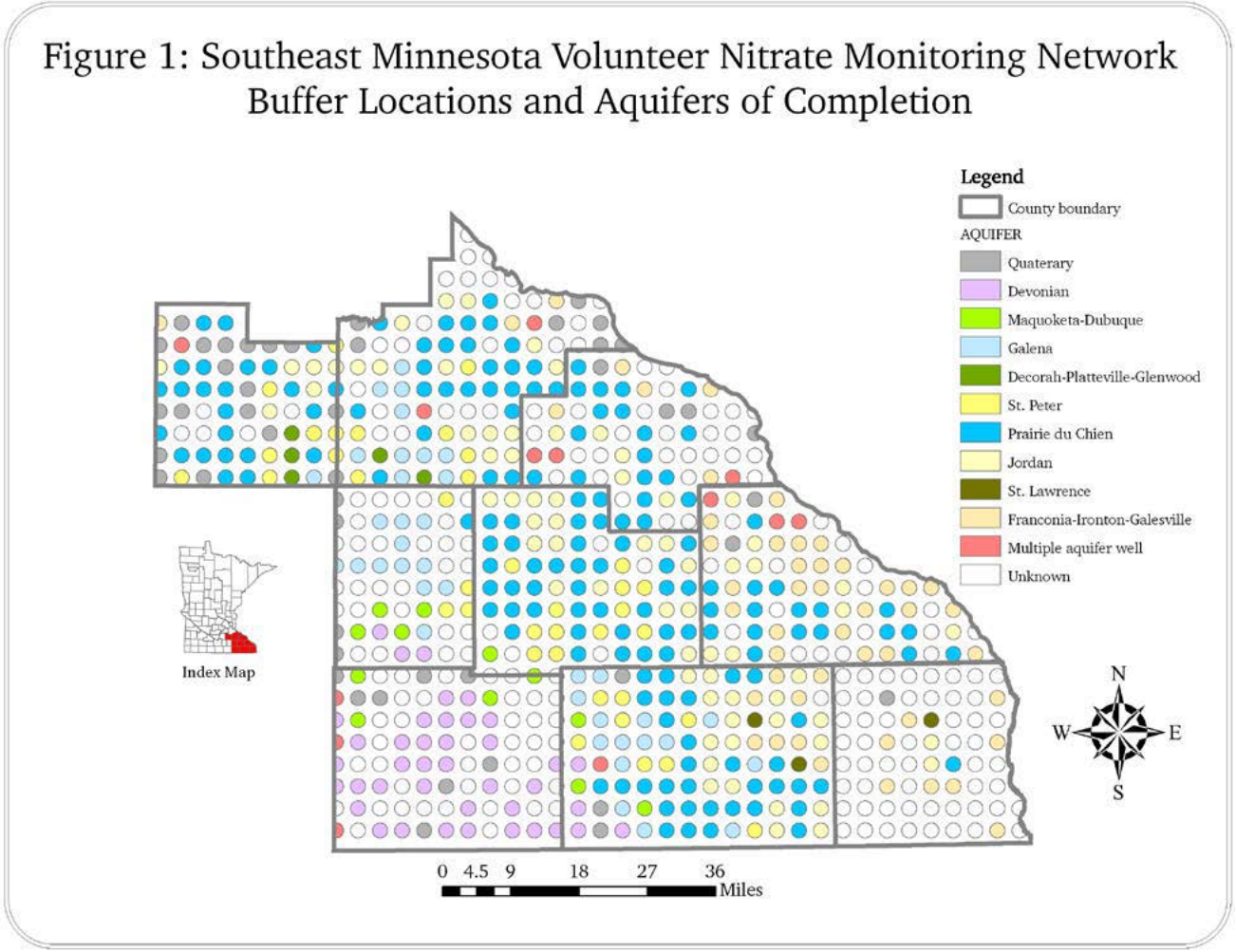
Southeast Nitrate Monitoring Network



Data Source: MDH/MDA

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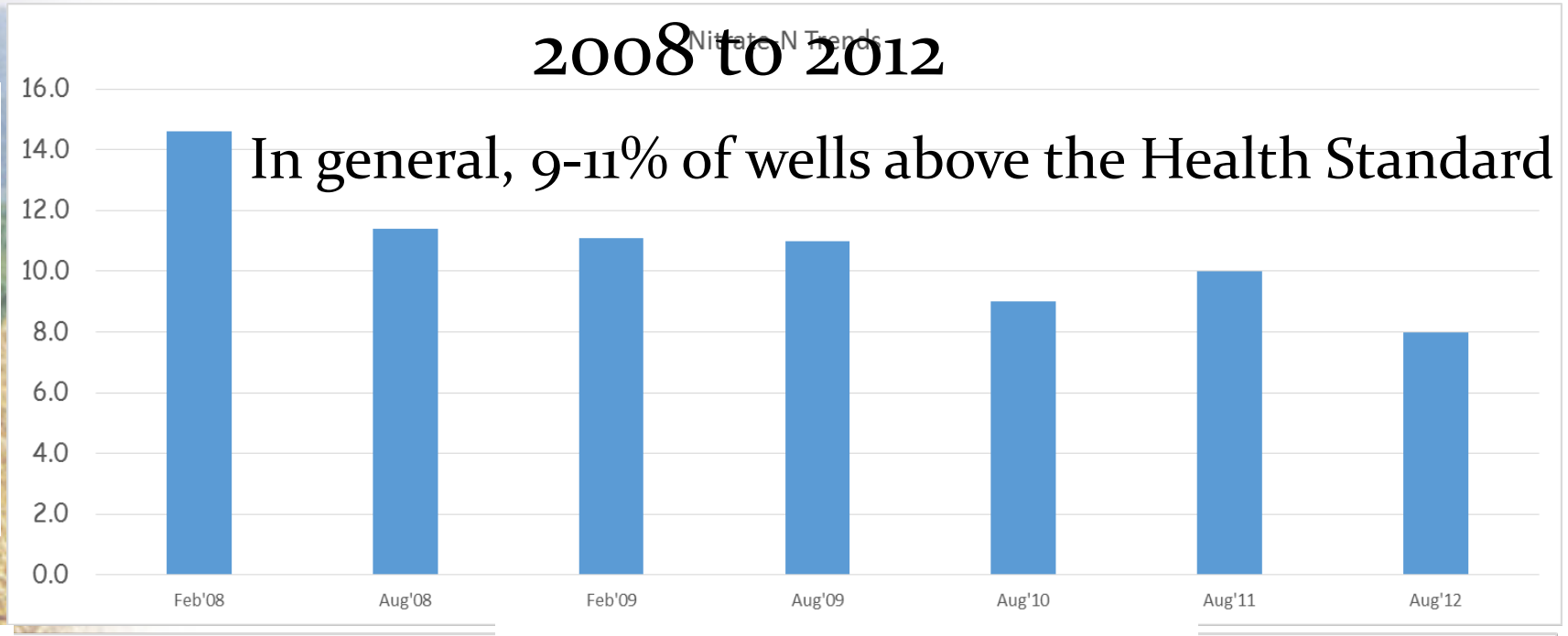
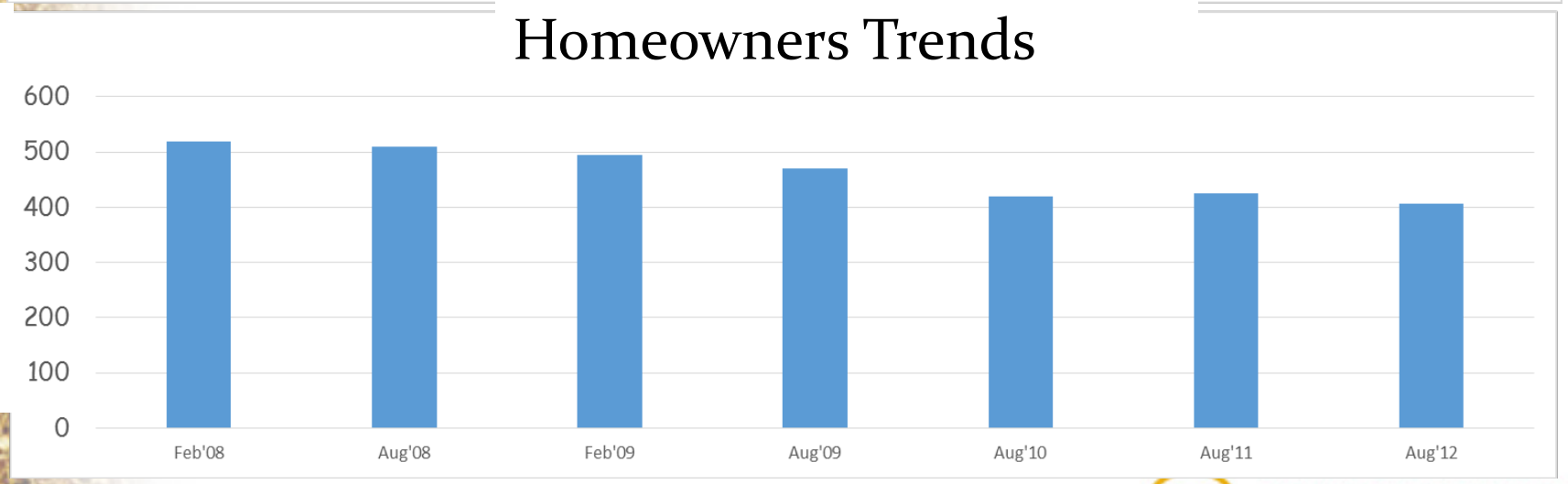
Southeast Private Well Monitoring Network 2008 to 2012



In general, 9-11% of wells above the Health Standard



Data Source: MDH and MDA

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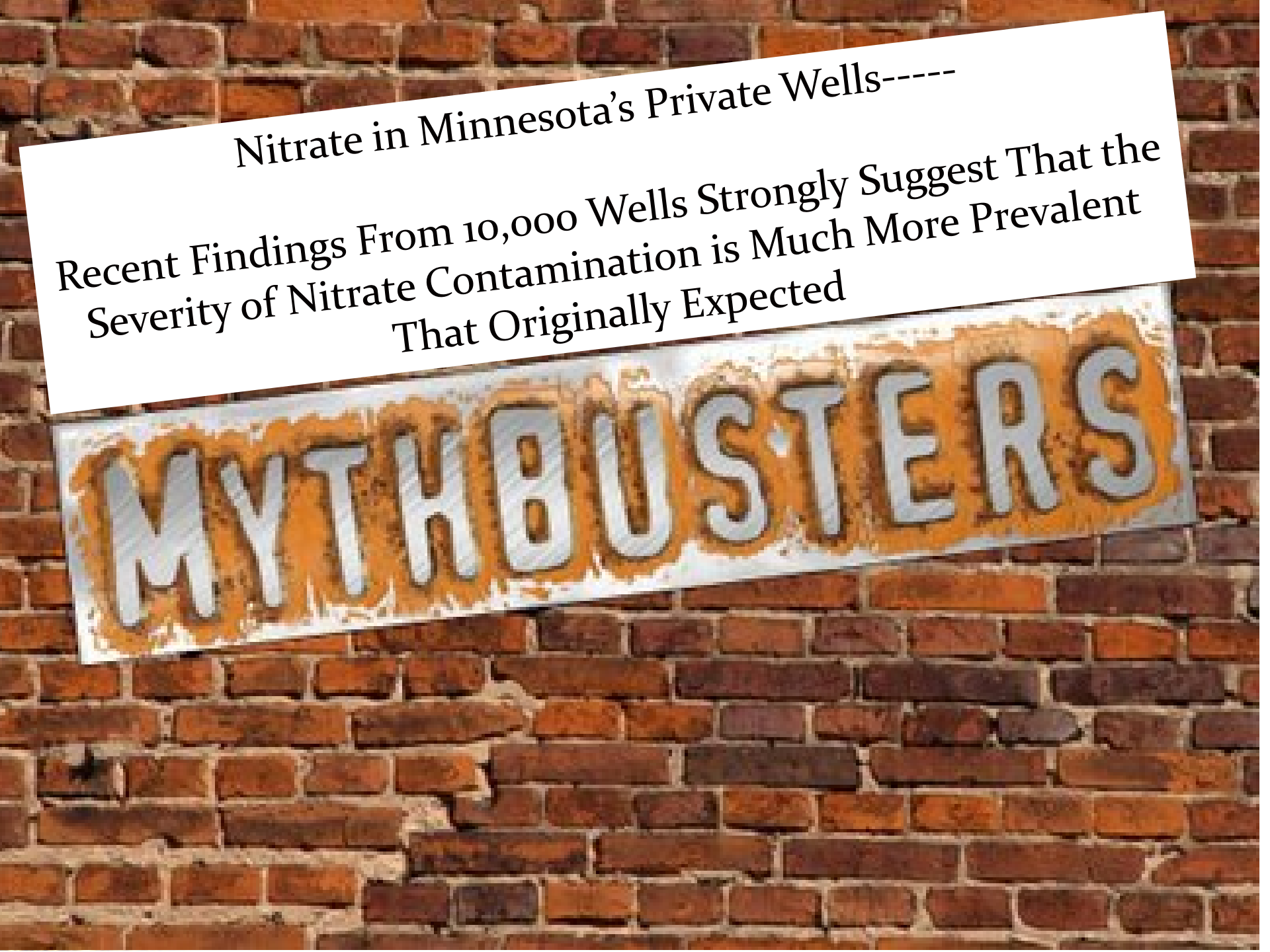
Nitrate in Minnesota's Private Wells-----

Recent Findings From 10,000 Wells Strongly Suggest That the Severity of Nitrate Contamination is Much More Prevalent That Originally Expected



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ASSESS TE

CLEAN WATER LAND & LEGACY AMENDMENT

MINNESOTA DEPARTMENT OF AGRICULTURE

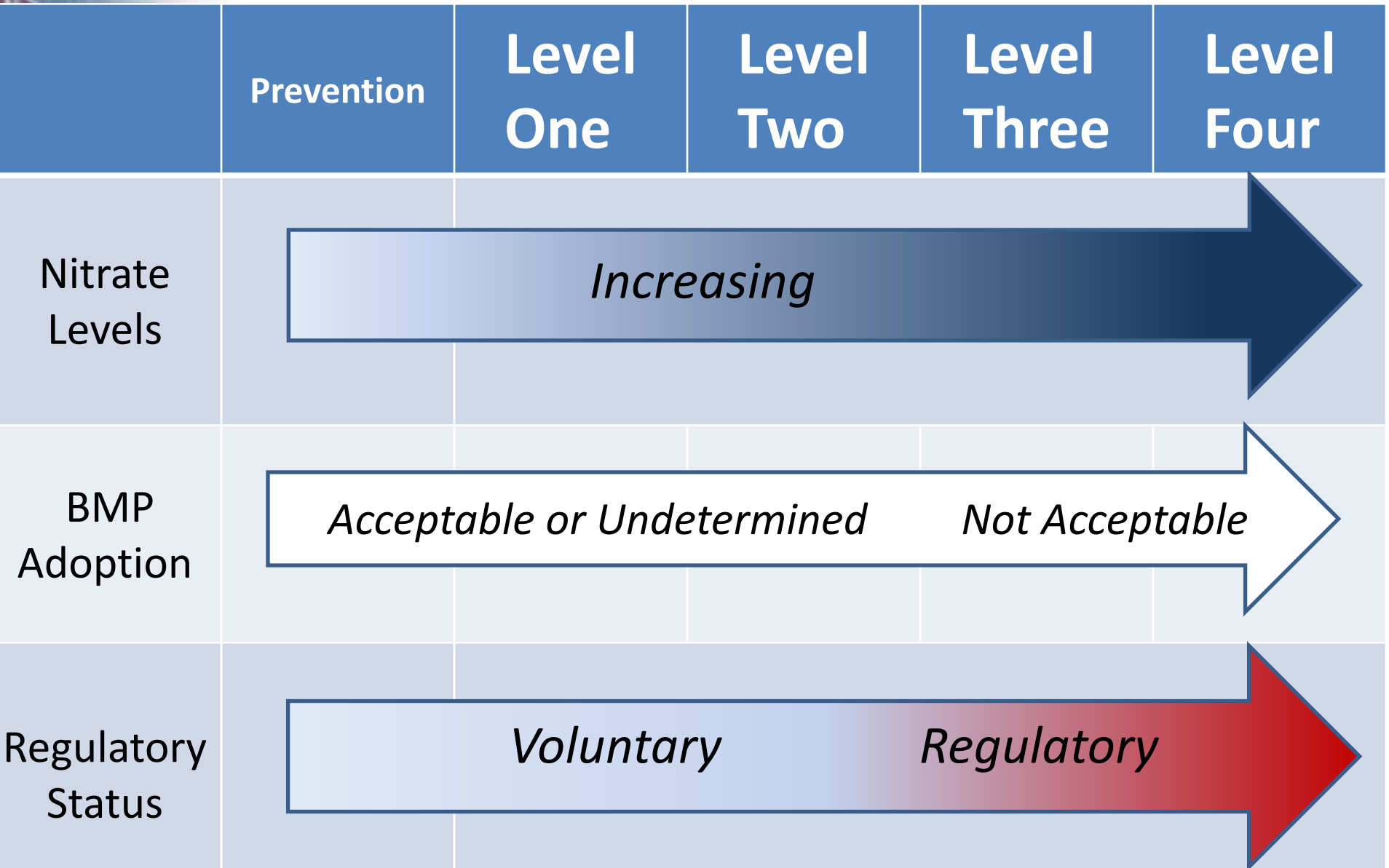
An Outcome of the 1989 Groundwater Protection Act-

Nitrogen Fertilizer Management Plan (NFMP)

The NFMP is the state's blueprint for minimizing groundwater impacts from the use of nitrogen fertilizer

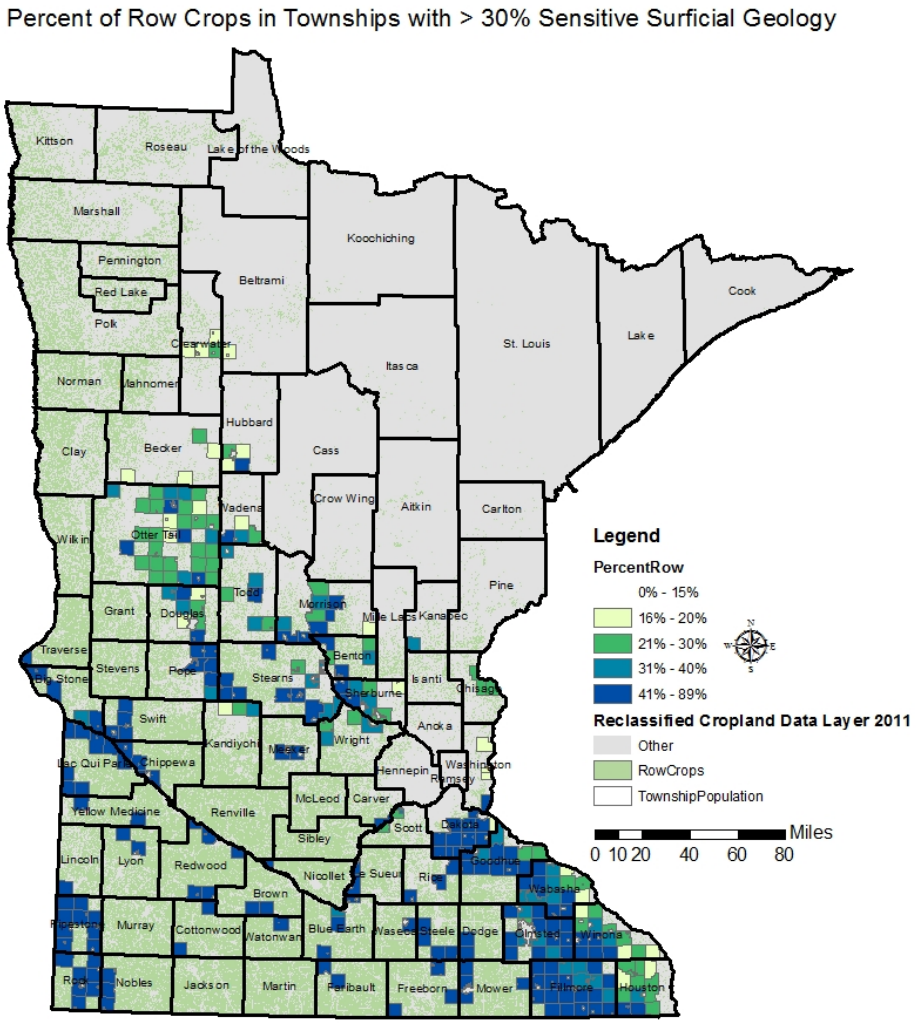
MINNESOTA DEPARTMENT OF AGRICULTURE

The Revised NFMP must Consider Water Quality and BMP Adoption to make Decisions on a Township Level



Long Term Goal

Characterize Nitrate Conditions in 250-300 Vulnerable Townships by 2018



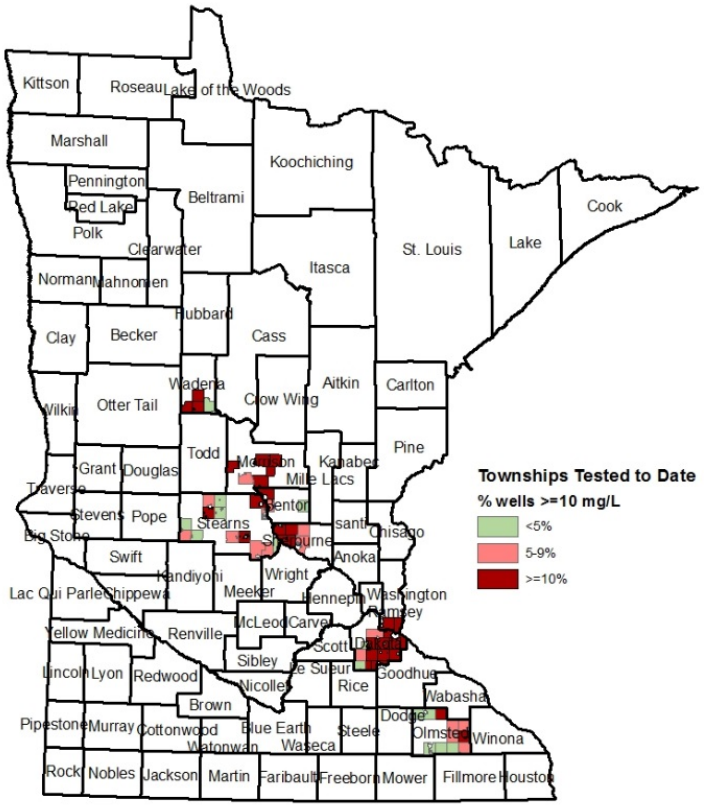
Prepared by the Minnesota Department of Agriculture 2013

MINNESOTA DEPARTMENT OF AGRICULTURE

In a Nutshell, What Did We Find?

Based Upon the First 60 Townships Tested (7,342 Wells)

- Within some of the worst case scenarios, 14% of the private wells exceeded the 10 PPM Health Standard;
- In Dakota County, 7 of the 15 townships tested were found to have 30% or more above the Health Standard;
- Conversely, results in other locations were surprisingly better than anticipated.



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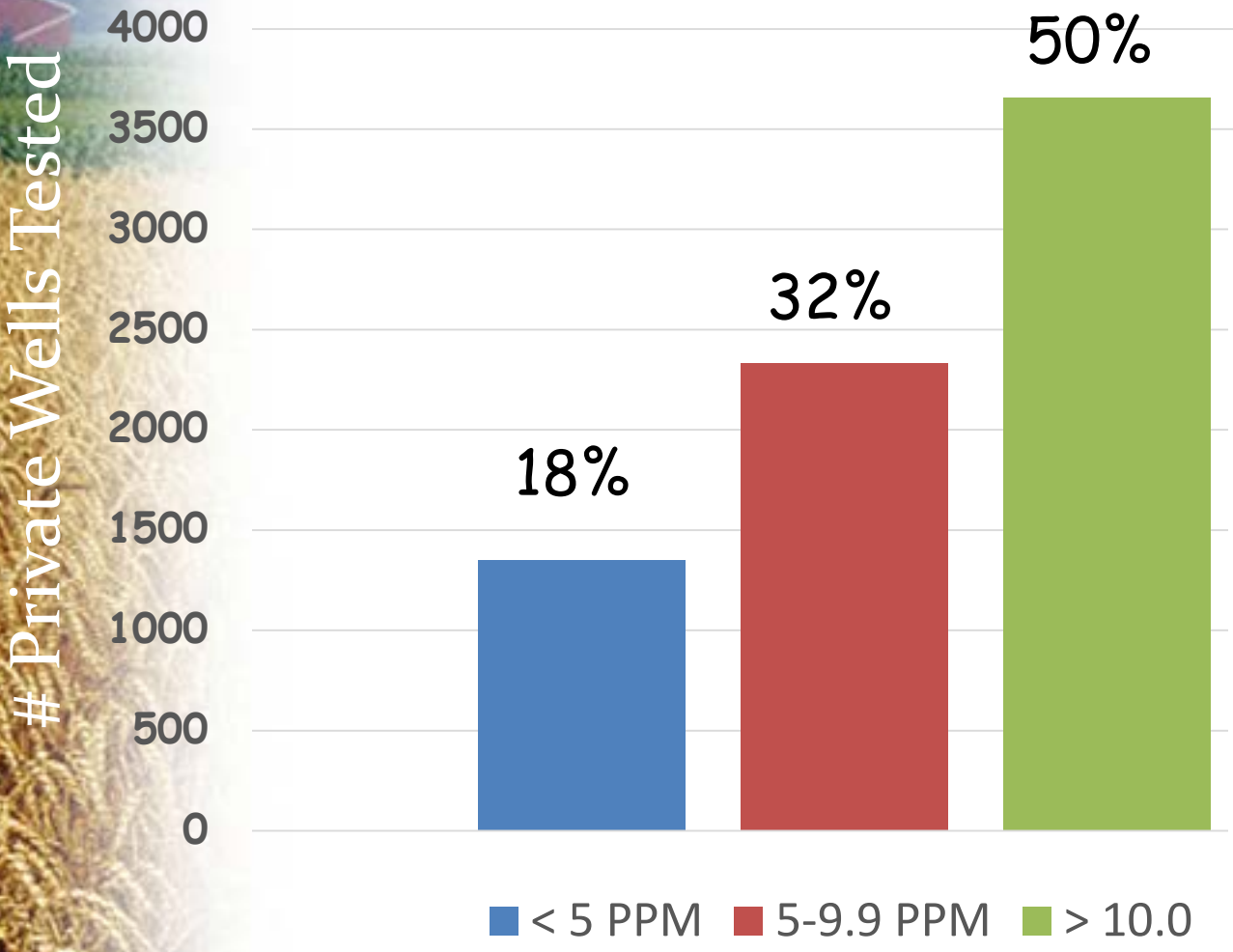
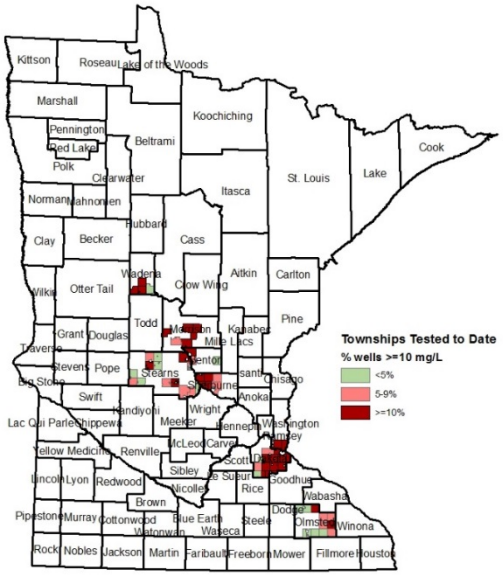
% Townships with 10%+ Wells Exceeding Health Standard

First 60 Townships Tested (7,342 Wells)





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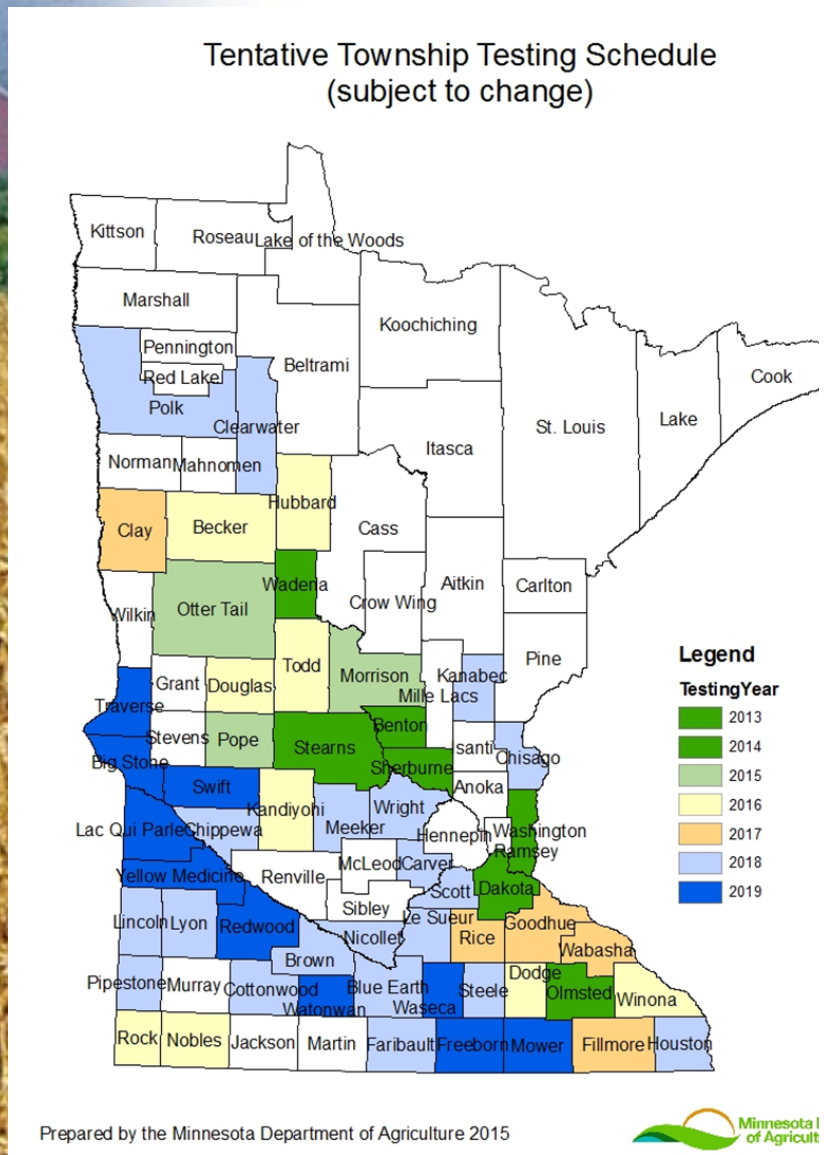
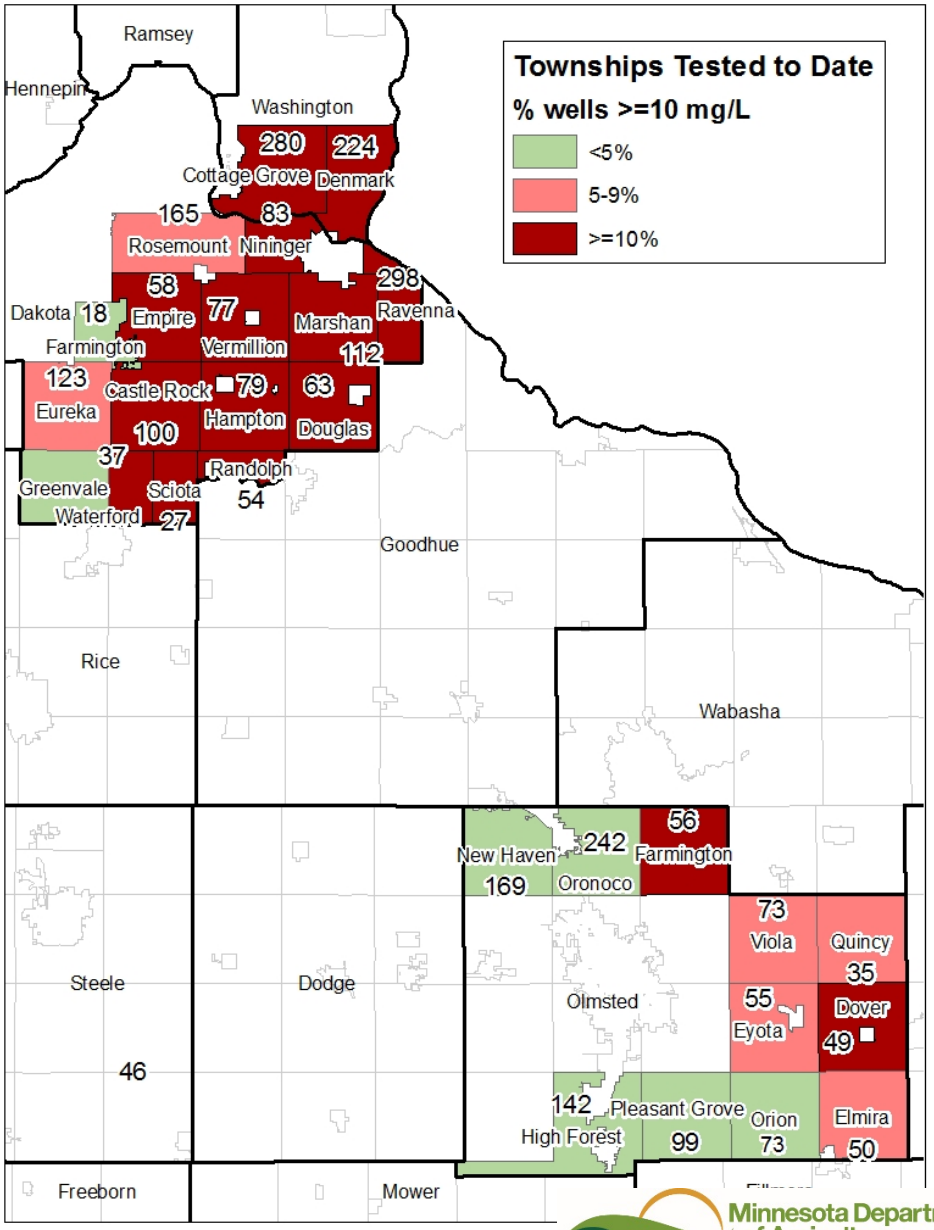
Status of the Township Testing Program in SE MN

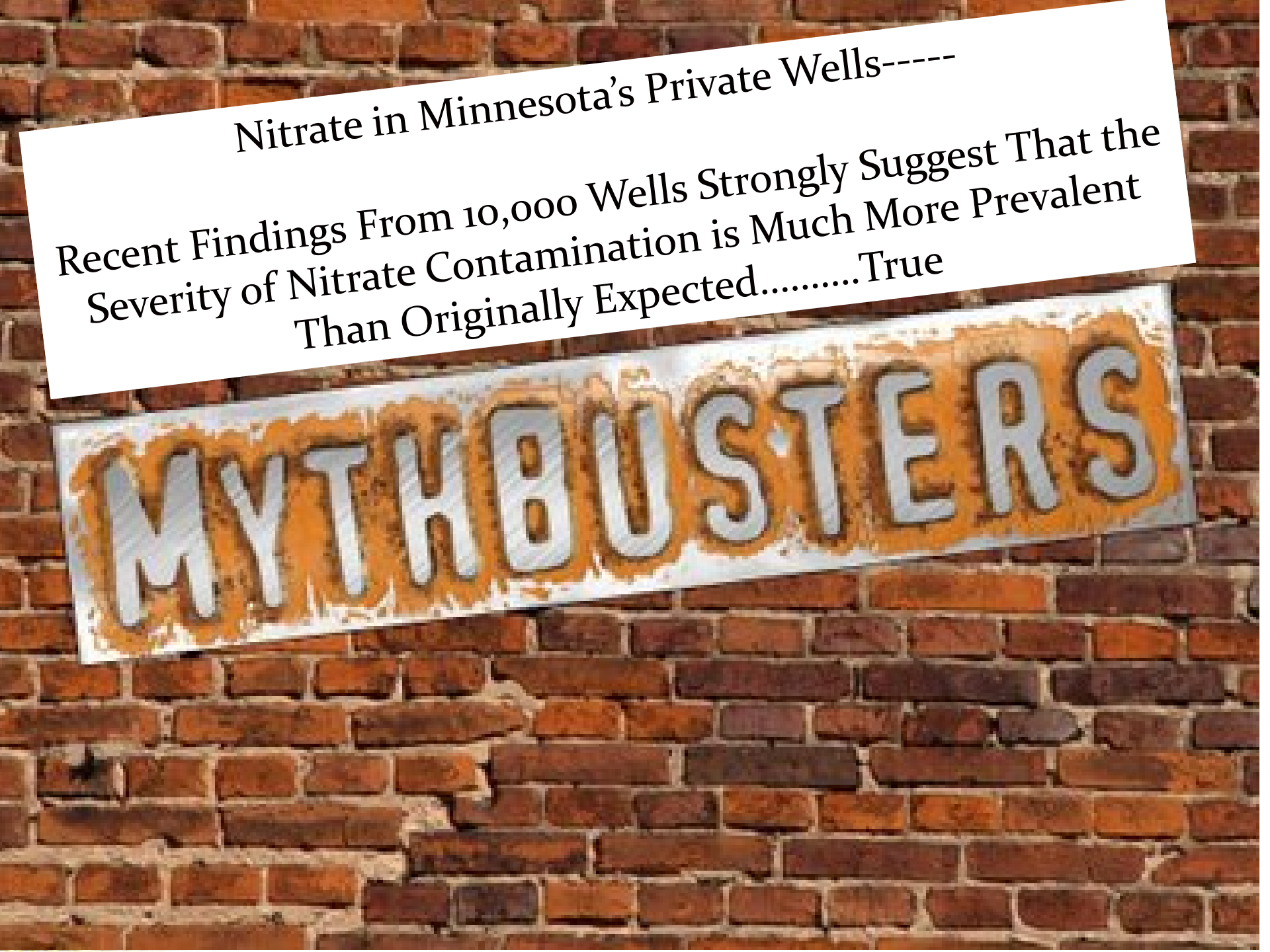




Minnesota Department of Agriculture

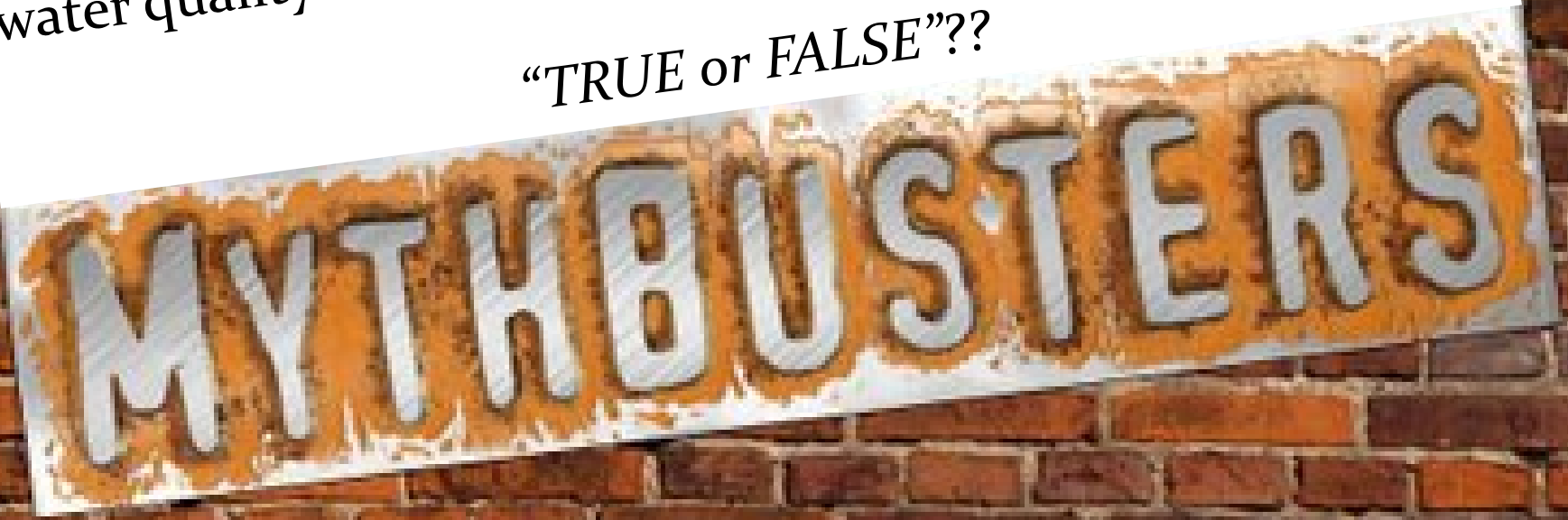
Nitrate in Minnesota's Private Wells-----

Recent Findings From 10,000 Wells Strongly Suggest That the Severity of Nitrate Contamination is Much More Prevalent Than Originally Expected.....True



There is very strong public perception that restrictions or banning on Nitrogen fertilizers must be achieved to protect water quality

"TRUE or FALSE"??



Proposed Rules Restricting Timing of Nitrogen Fertilizer Applications

The MDA has started the process for developing rules for new regulations following the completion of the final NFMP. The rule development process will include additional opportunities for public comment. These rules will include two parts.

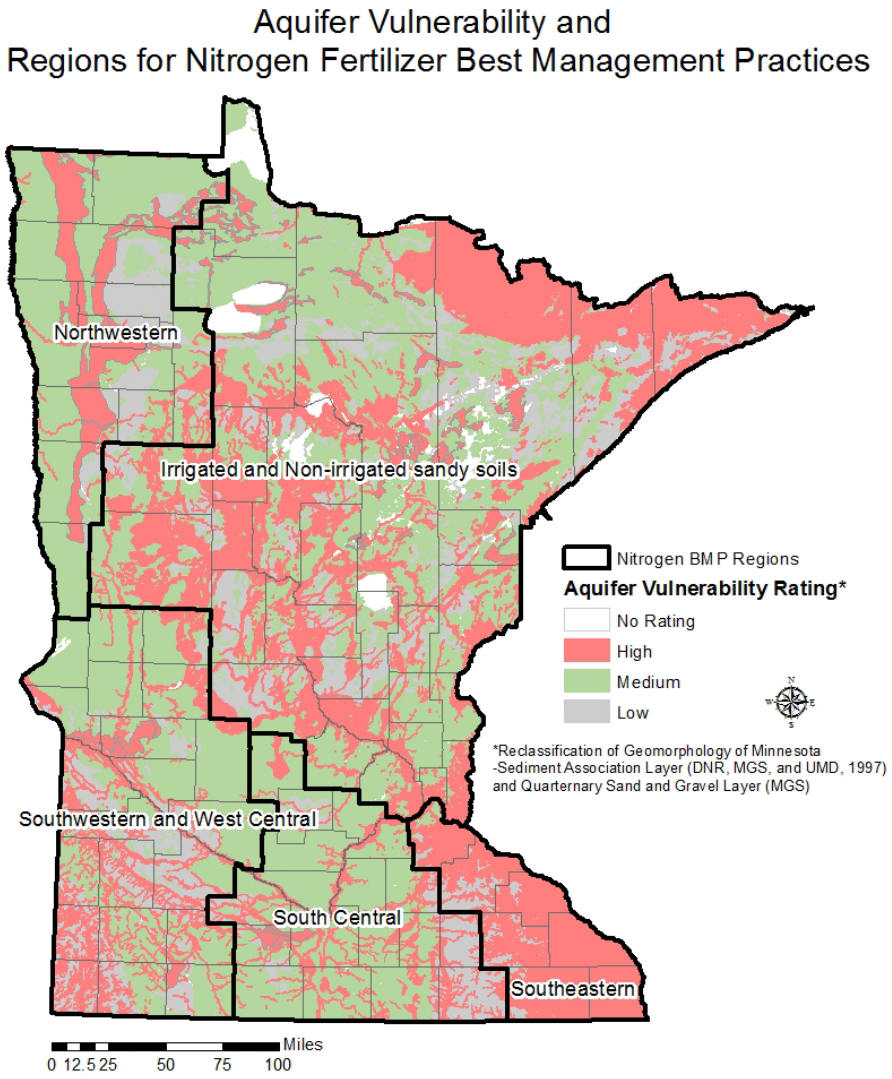
Part One—Proposed rules will restrict the fall application and application to frozen ground of nitrogen fertilizer in areas that are vulnerable to groundwater contamination.

MINNESOTA DEPARTMENT OF AGRICULTURE

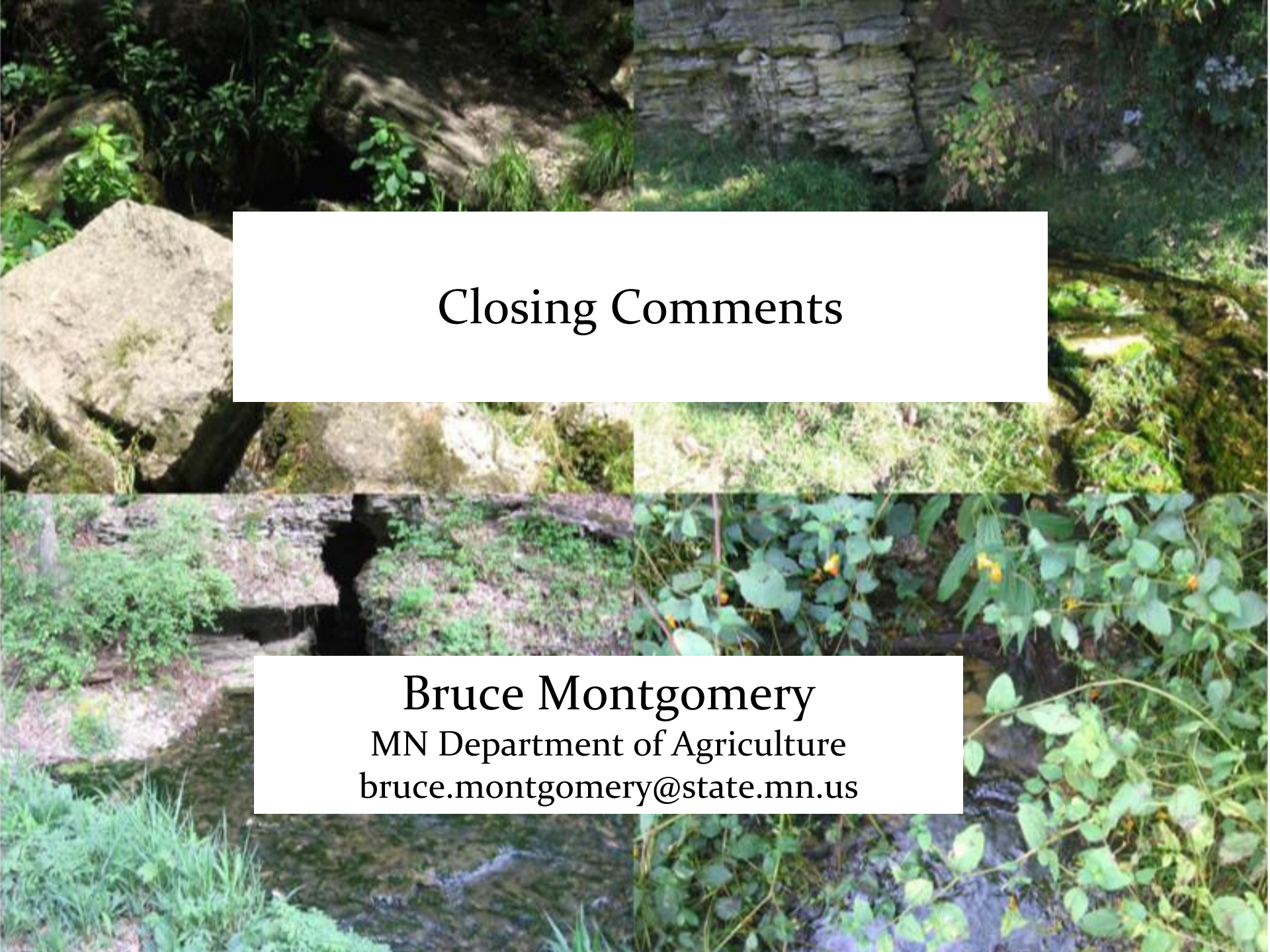
Proposed Rules Restricting Timing of Fertilizer Application

Where?

In areas with vulnerable groundwater. Restrictions vary by N BMP Region



NNESOTA DEPARTMENT AGRICULTURE



Closing Comments

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