Unpacking Conservation Agriculture

What about Economics?

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Division of Extension
University of Wisconsin-Madison

November 14, 2022 **Dodgeville, WI**

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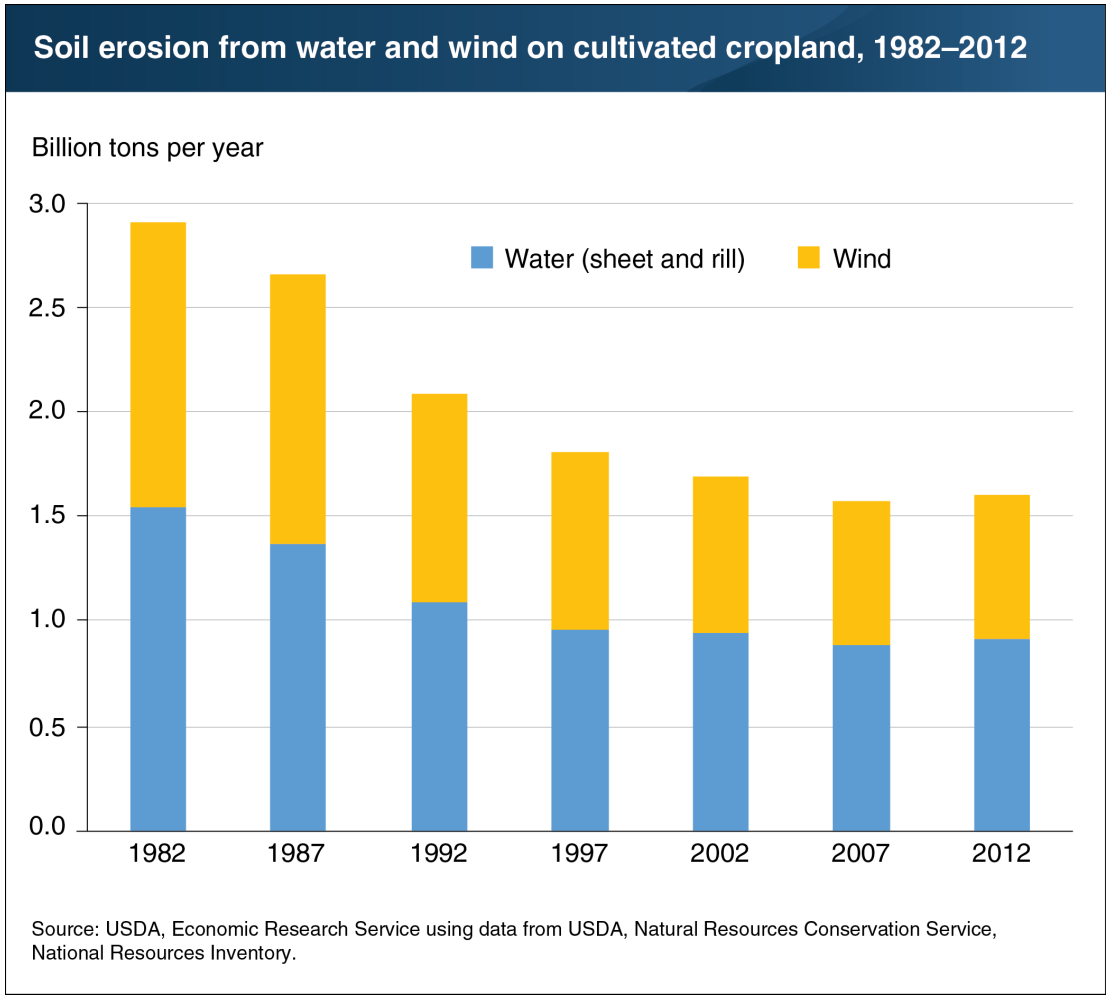
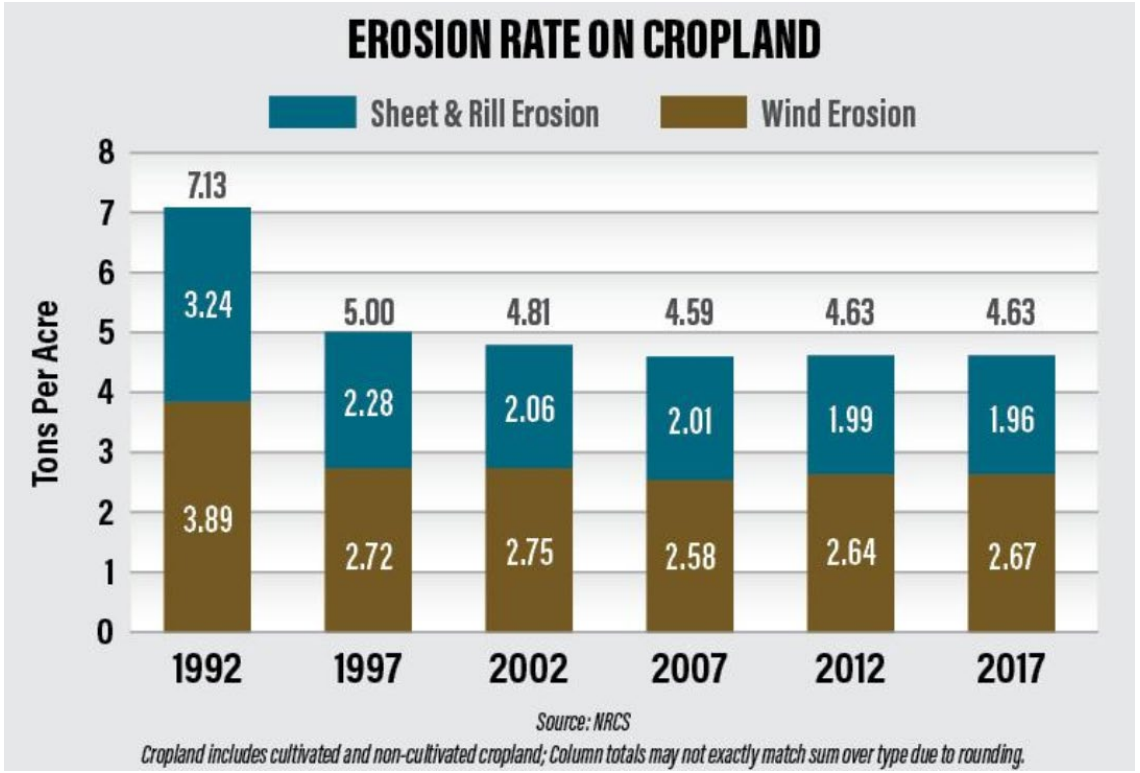
Goal Today

- Provide a practical perspective on the economics of conservation agriculture in southwestern Wisconsin
- Main Points
  - Conservation agriculture costs money and takes time
  - Economic benefits of conservation are uncertain
  - Weather uncertainty is increasing
  - Interest in conservation agriculture is increasing
- Managing nitrogen and soil erosion are now a cost of doing business, help your clients reduce their costs

Soil Erosion from US Cropland: We have stalled!

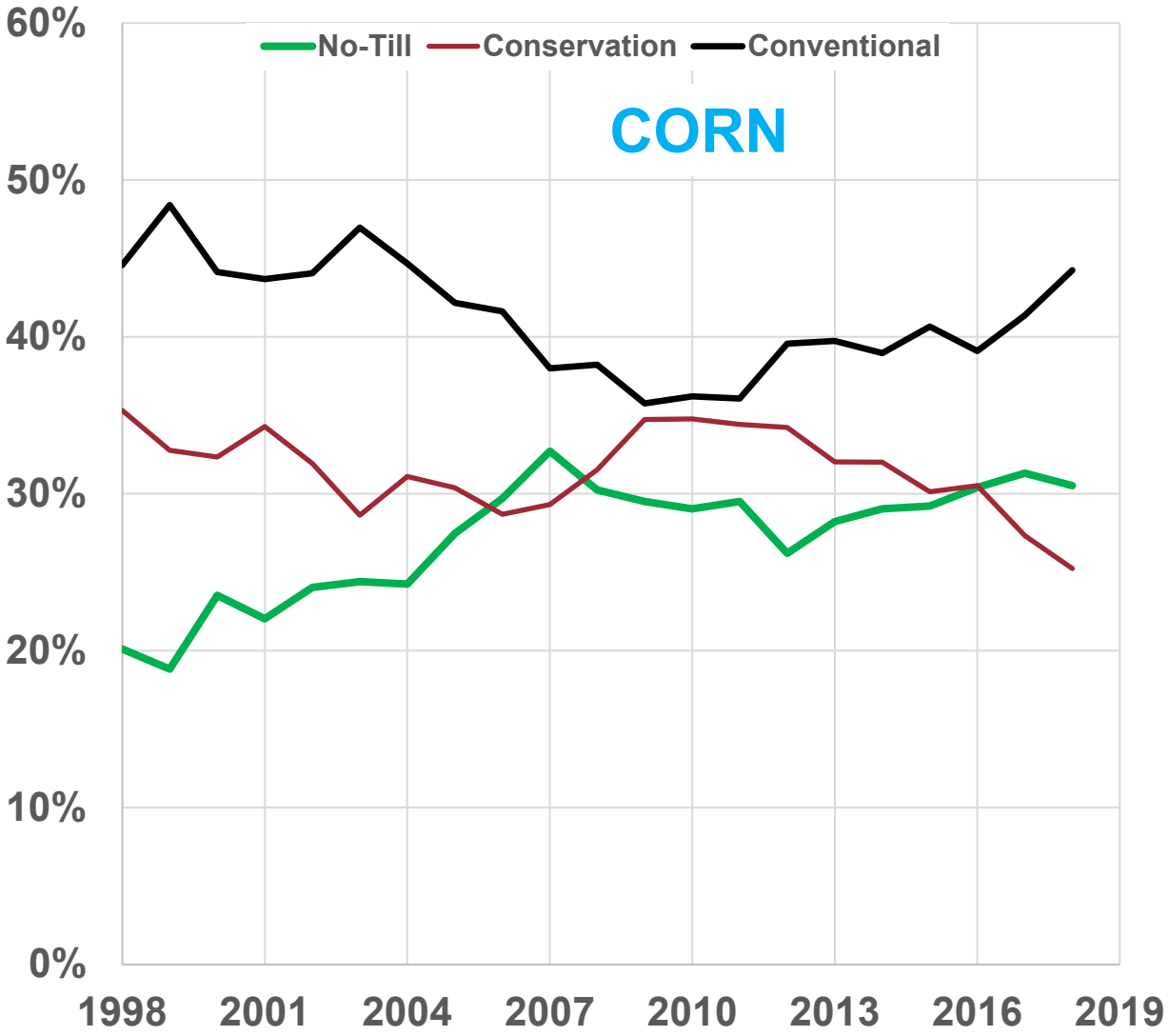


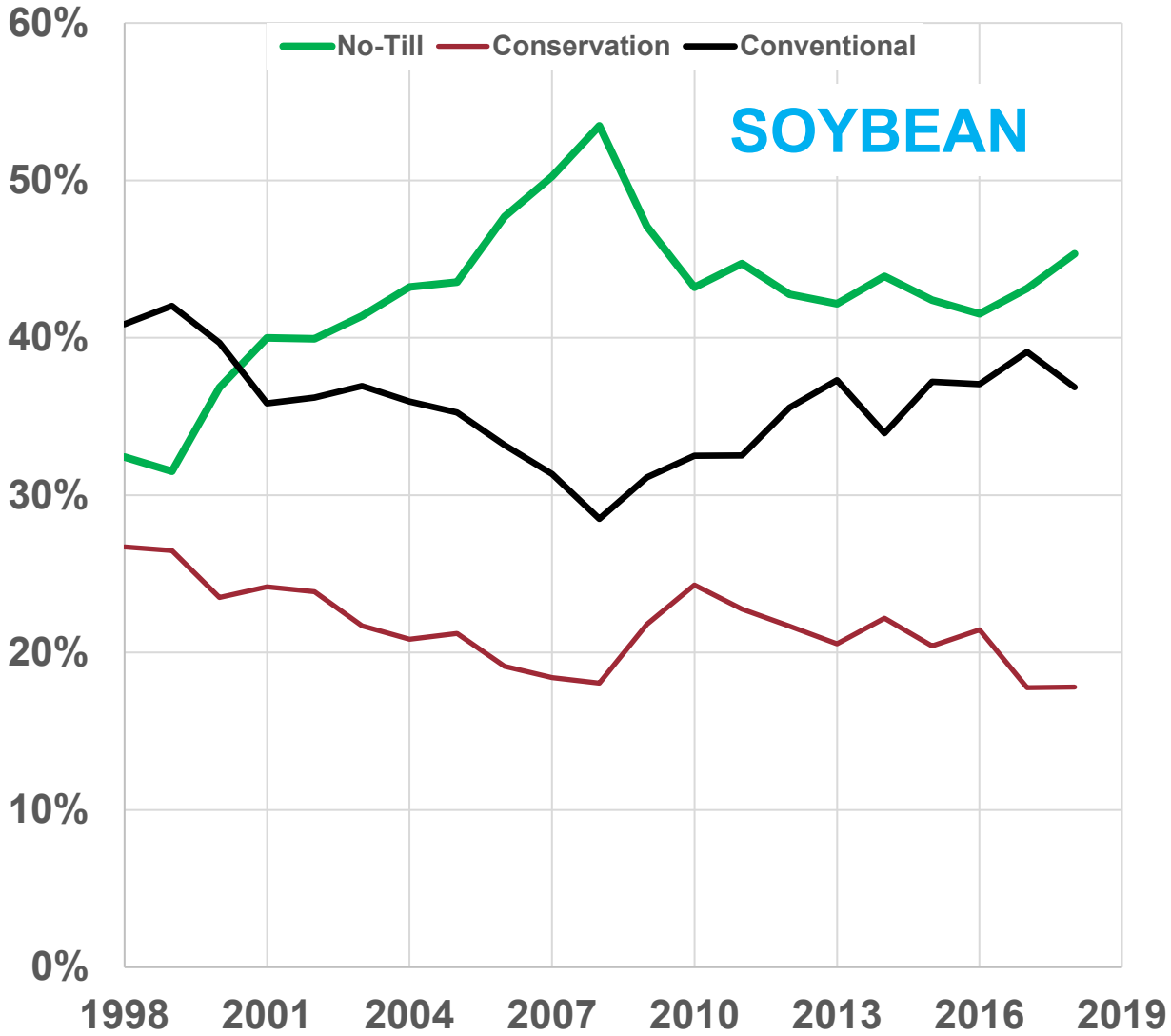
https://www.ers.usda.gov/data-products/charts-of-note/charts-of-note/?topicId=63d02a40-ccda-49ee-9799-76cbd1087e65



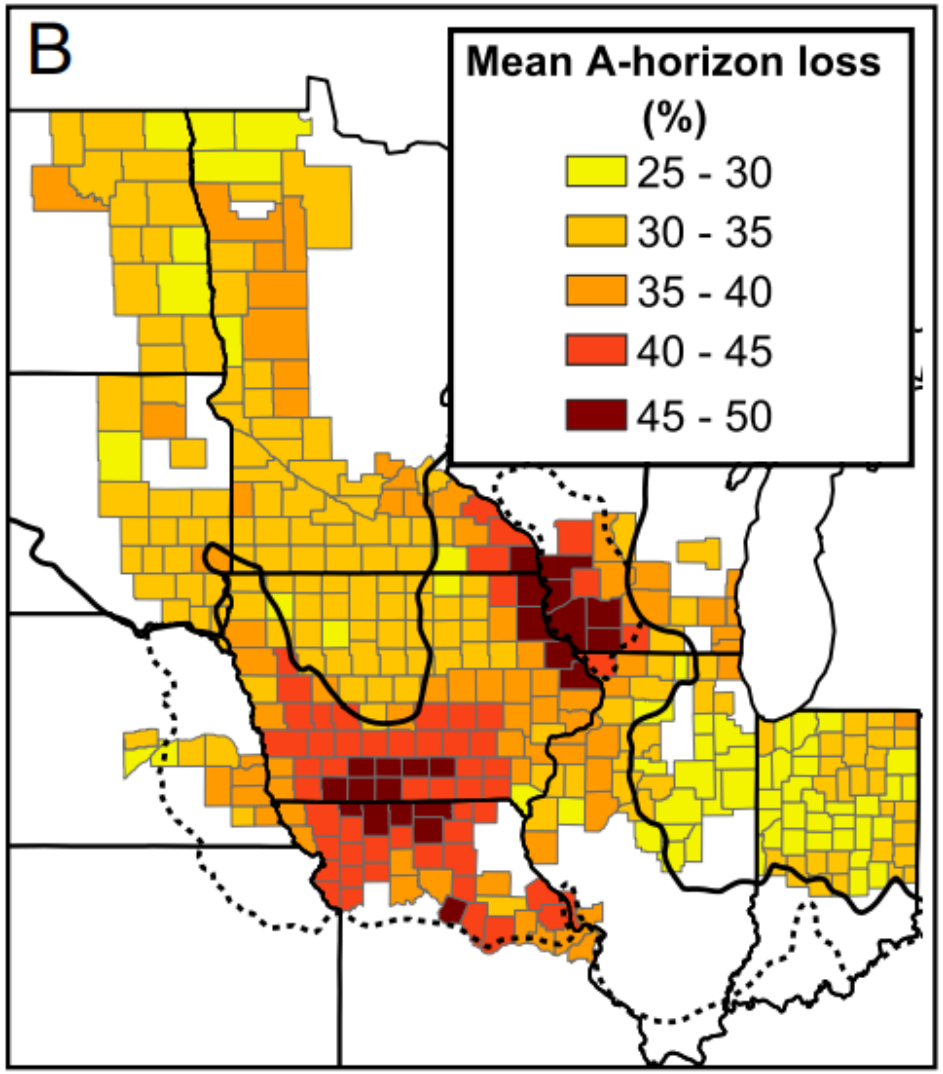
https://www.agweb.com/news/business/conservation/soil-erosion-trends-us

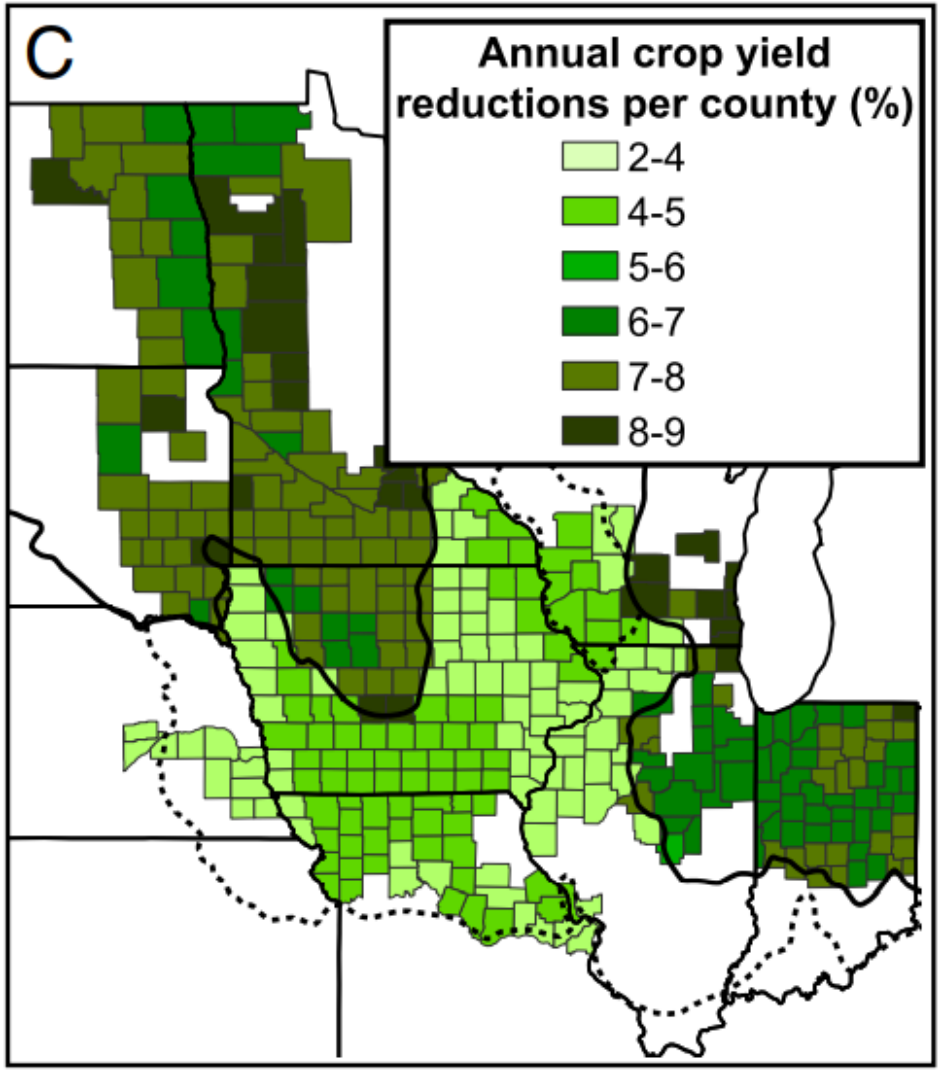
Tillage Practices for US Corn and Soybean Acres





Extent and Impact of Soil Erosion in the US Corn Belt





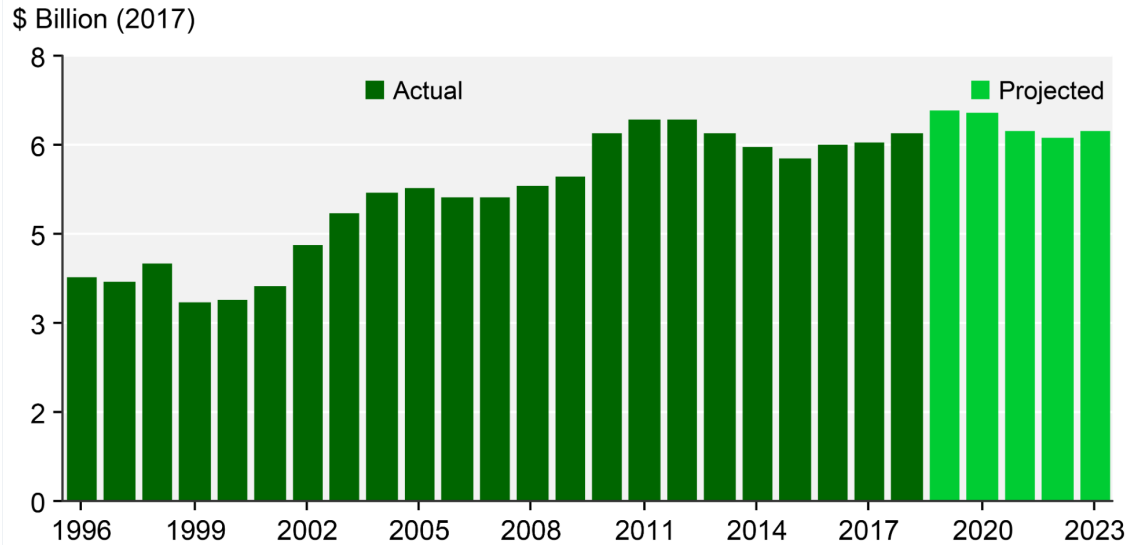
Thaler et al. 2021 PNAS: https://www.pnas.org/content/118/8/e1922375118

Conservation Costs Money and Takes Time

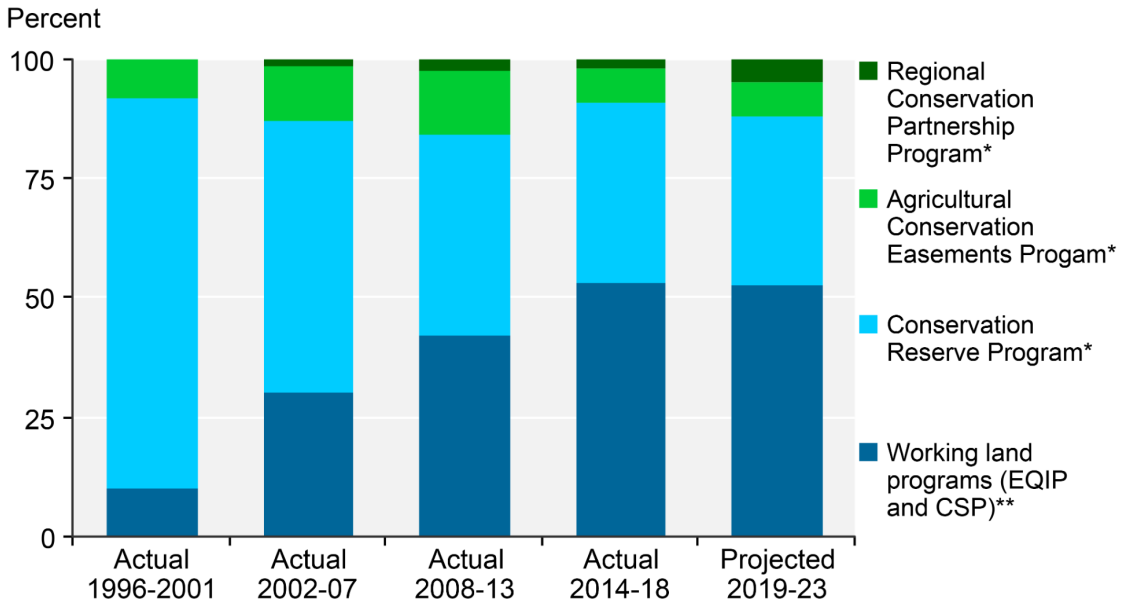
- Seems like common sense but many (non-ag) people think farmers purposely waste money on unnecessary inputs and activities
  - If conservation is a win-win or a sure bet, why are farmers slow to adopt?
- Prokopy et al. 2008: What drives Best Management Practices adoption?
  - Meta analysis of 55 papers, focused mostly on soil and nutrient management
- How many more studies found that monetary factors or labor availability measures increased BMP adoption compared to descreased adoption?
  - Farm size, income and capital: 2 times more studies (43 vs 21)
  - Labor: 5 times more studies (15 vs 3)
- Implication is that many BMPs will need to be incentivized
  - Common examples: Direct subsidy, Indirect subsidy, Regulations

USDA Conservation Spending

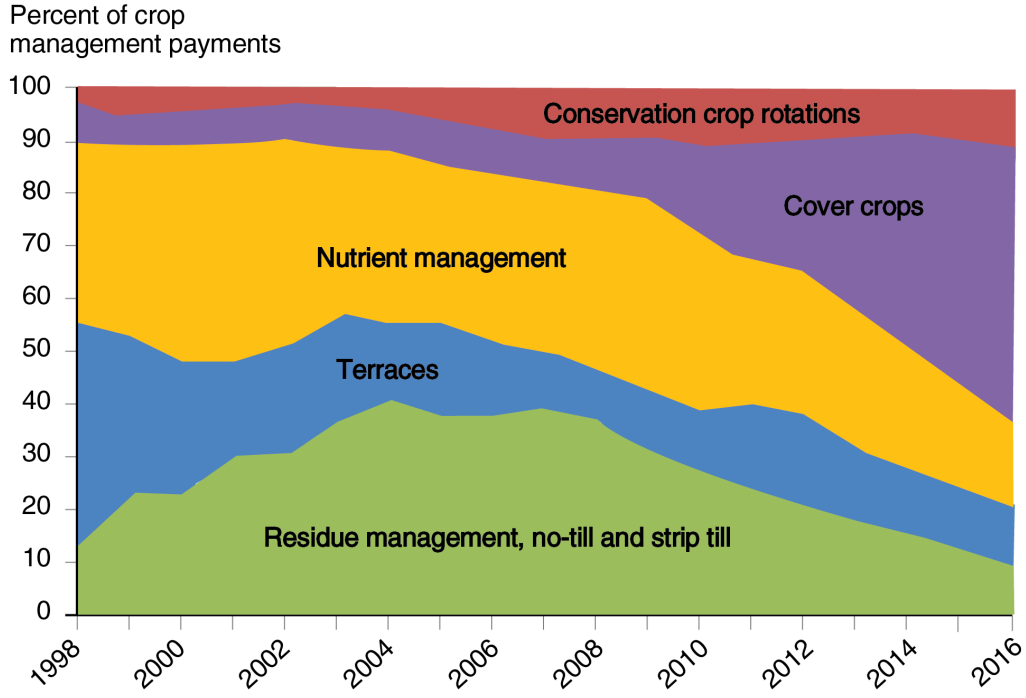
Inflation-adjusted annual spending for major USDA conservation programs, 1996-2018, with projections to 2023 1/



Share of conservation spending by major programs and predecessors in the 2018 and previous farm acts



Share of total Environmental Quality Incentives Program (EQIP) crop management payments by crop management practice, 1998–2016



Notes: Terraces are a structural practice designed to reduce runoff and soil erosion by constructing an earth embankment or ridge that is perpendicular to a field's slope. Between 1998 and 2016, the total payments for these five practices in inflation-adjusted 2016 dollars increased from less than $30 million per year to more than $100 million per year.

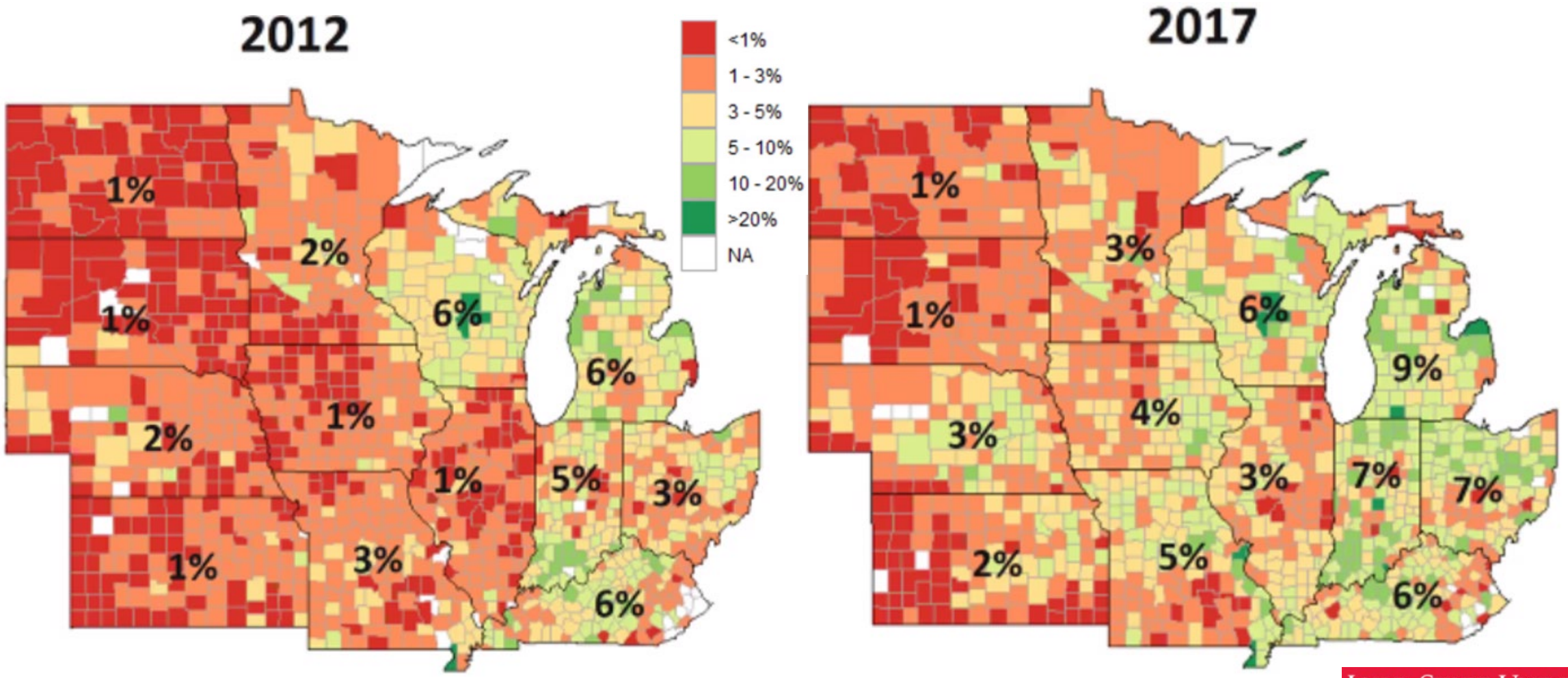
Source: USDA, Economic Research Service using data from USDA, Natural Resources Conservation Service, EQIP practice suite payments in the United States.

https://www.ers.usda.gov/topics/natural-resources-environment/conservation-programs/

https://www.ers.usda.gov/data-products/charts-of-note/charts-of-note/?topicId=63d02a40-ccda-49ee-9799-76cbd1087e65

What have we gotten for all this spending?

Cover crop adoption rates by county and state average

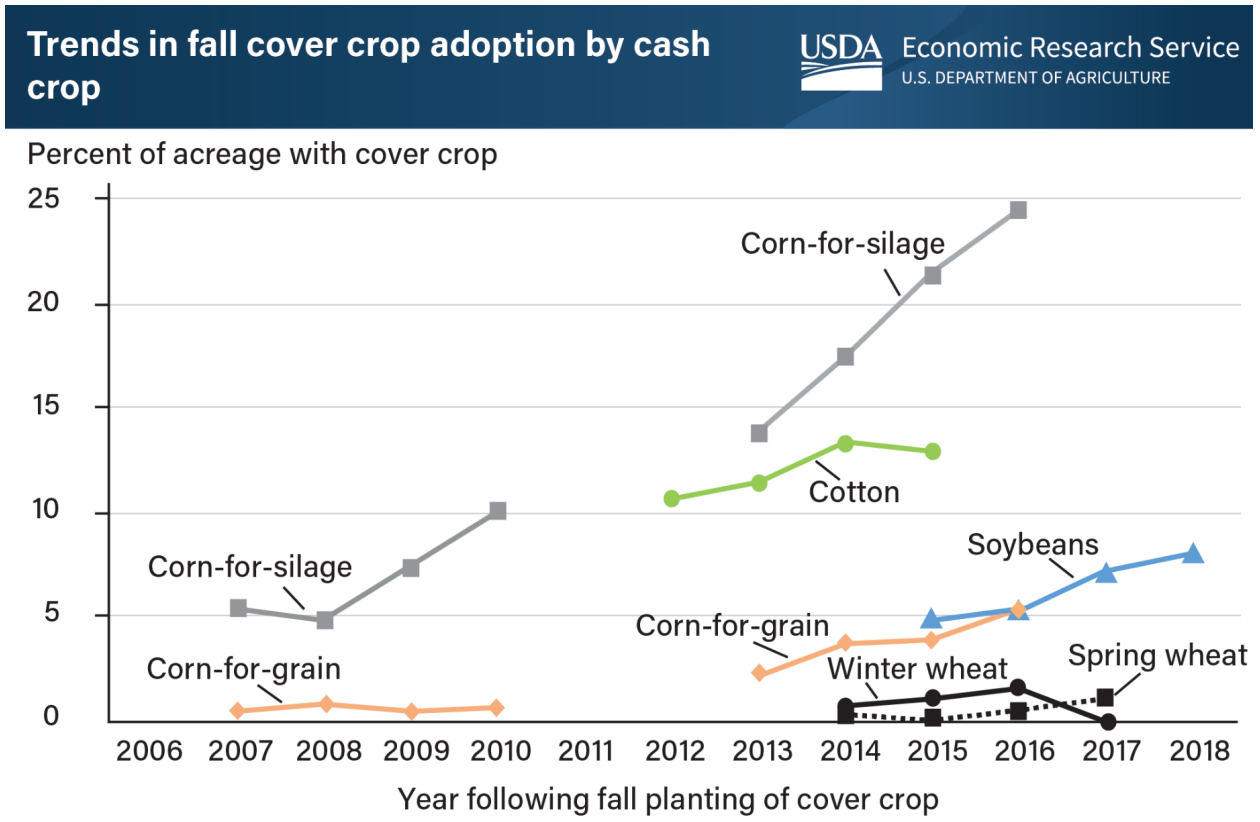


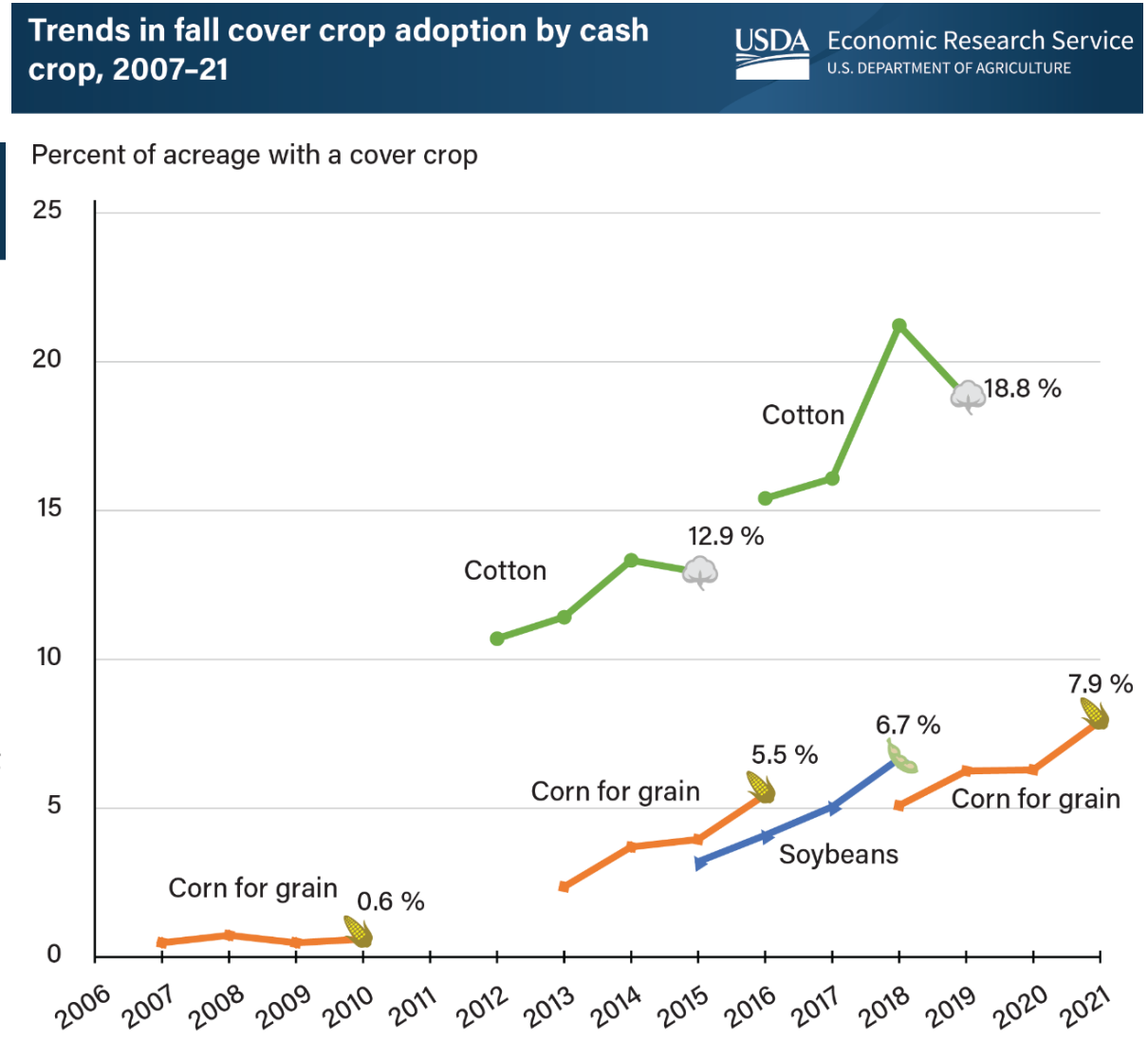
https://iowalearningfarms.wordpress.com/tag/cover-crops/

IOWA STATE UNIVERSITY
Extension and Outreach

What have we gotten for all this spending?

Cover Crop Adoption Rates by Crop



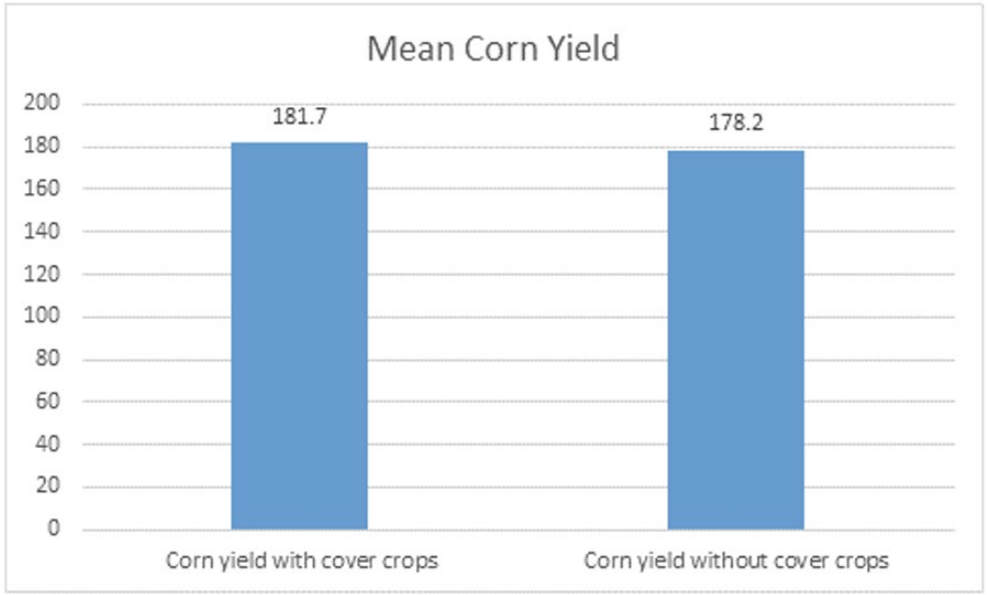


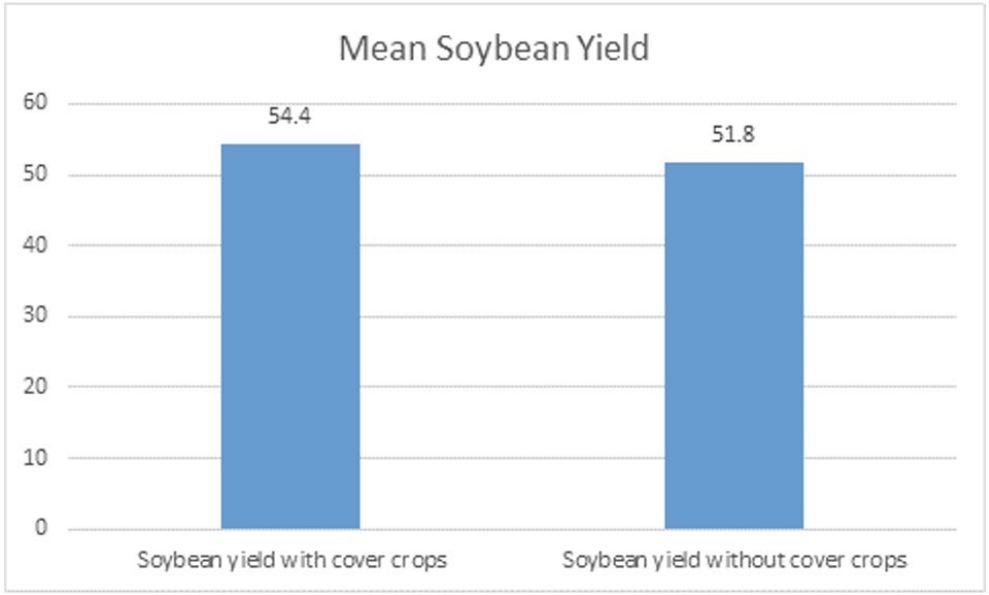
https://www.ers.usda.gov/data-products/charts-of-note/charts-of-note/?topicId=63d02a40-ccda-49ee-9799-76cbd1087e65

Cover Crops Cost Money, Give Uncertain Gains

- Bergtold et al. (2019): Kansas dryland corn: loss of $28/ac
  - Included a 10% yield advantage and a 10% nitrogen savings
- Plastina et al. (2020): Average loss $54/ac, median $64/ac (includes an average subsidy payment of $53/ac)
  - *“Despite farmers’ positive perceptions about cover crops and the availability of cost-share programs, calculated annual net returns to cover crops use were negative for most participants.”*
- Bowman et al. (2022): Costs were $40/ac, with wide ranging yield effects
  - ±$19/ac yield benefit for corn and ±$25/ac for soybean
  - Not enough to cover costs in most cases

Be wary of figures like this due to the possibility of Reverse Causality and Selection Bias

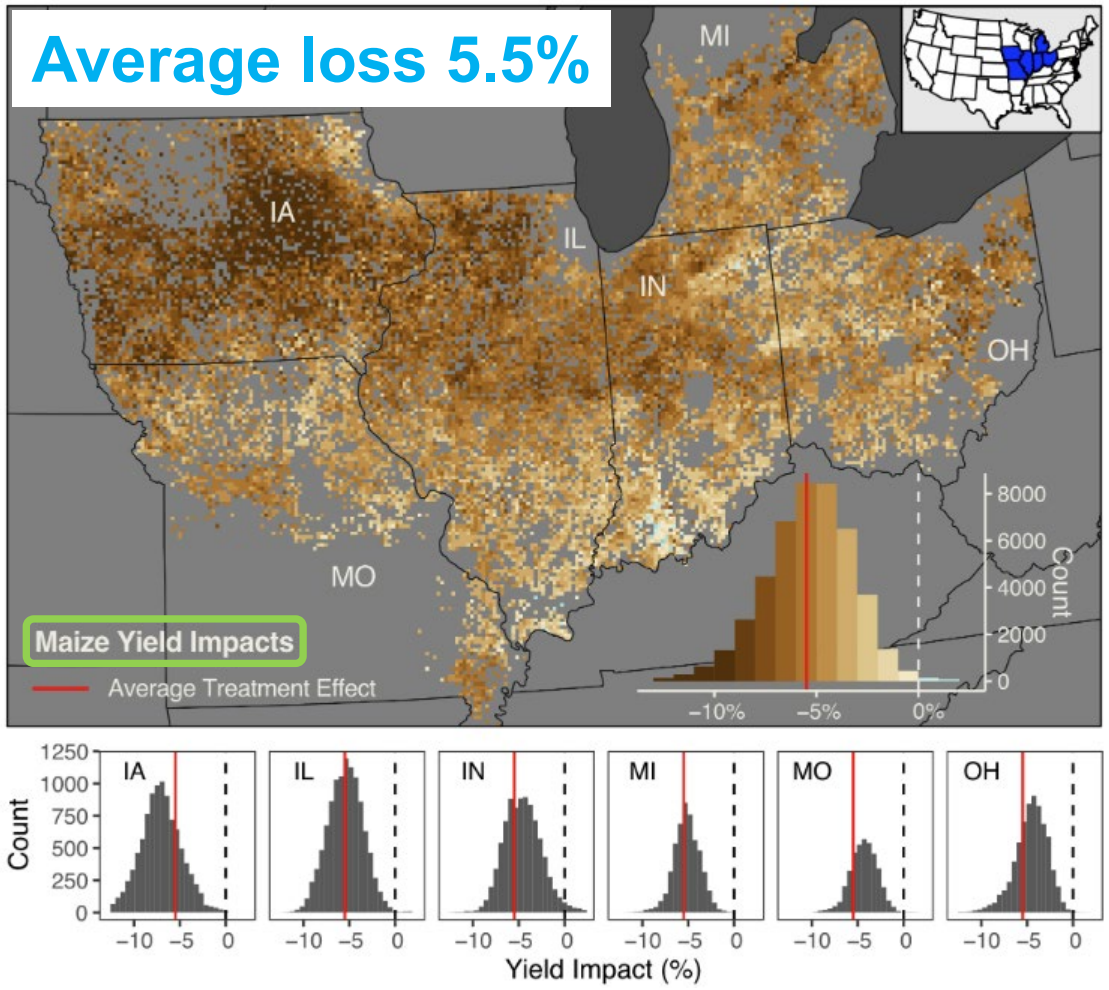


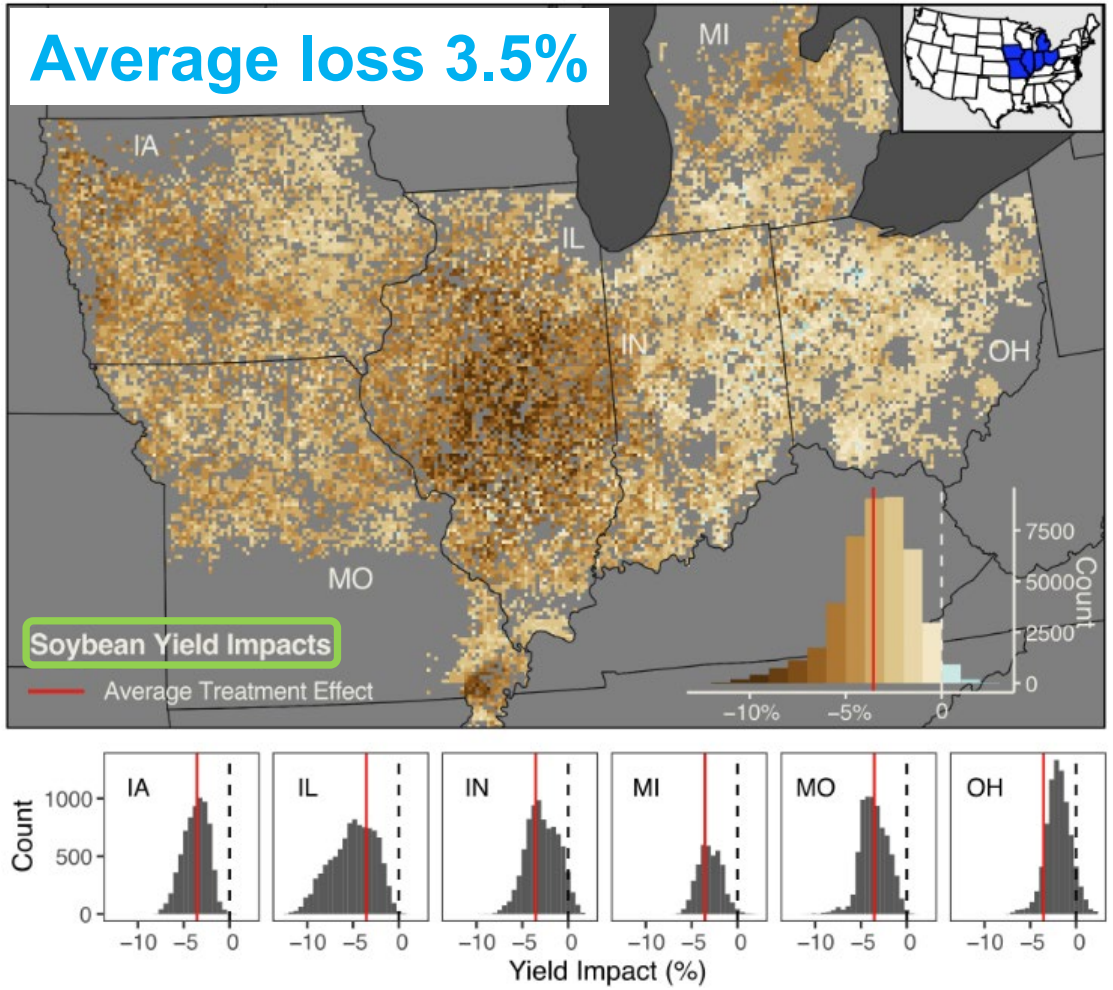


- Do cover crops increase yields?
- Maybe farms with higher yields can afford to plant cover crops
  - Higher yields may cause cover crops
- Maybe farms with higher yields are more likely selected for incentive programs
  - Higher yields may select for cover crop adoption

Remote sensing study controlling for reverse causality

Corn & soybean yield changes after 3+ years of cover cropping

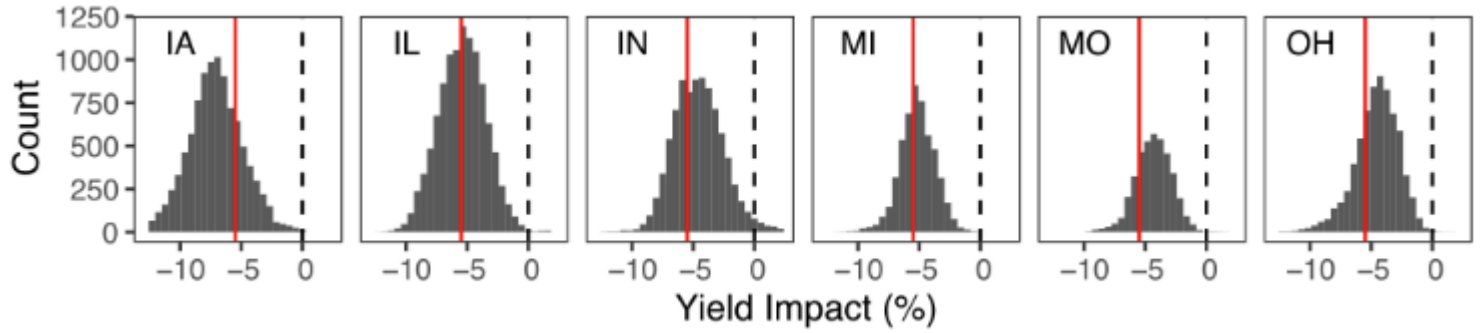




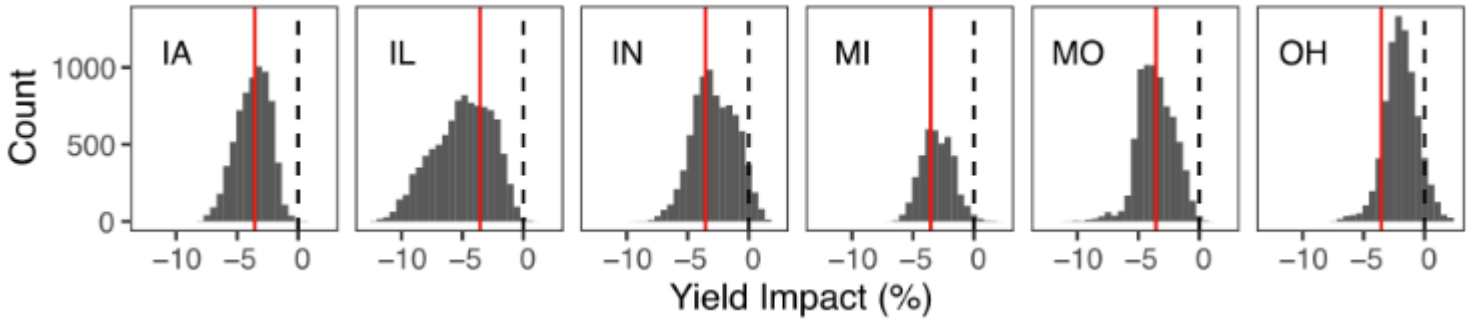
Deines et al. (2022) https://onlinelibrary.wiley.com/doi/epdf/10.1111/gcb.16489 published **Nov 8, 2022**

Yield Effects Vary a lot Around These Averages

CORN 5.5% x 172.3 bu/A x $6.80/bu = $64.44/A



SOYBEAN 3.5% x 50.2 bu/A x $14./bu = $24.60/A



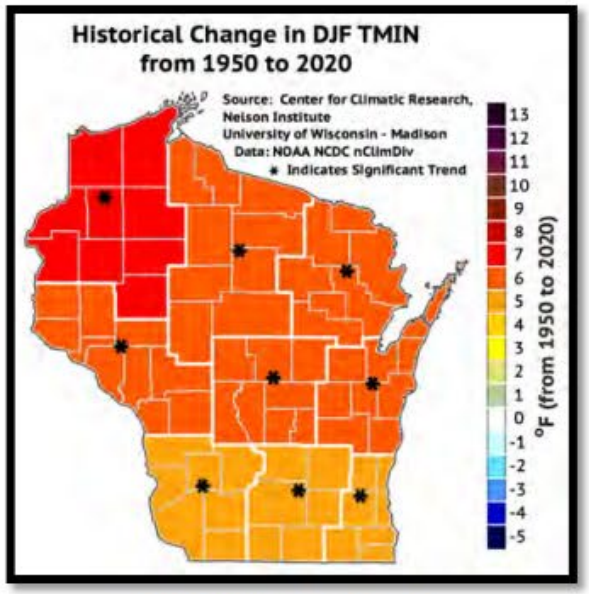
- Only a few cases of yield increases
- Hypotheses for losses

1. Cover crop residue immobilizes soil N
2. Cover crop competes for water
3. Soil O_2 depletion during wet springs

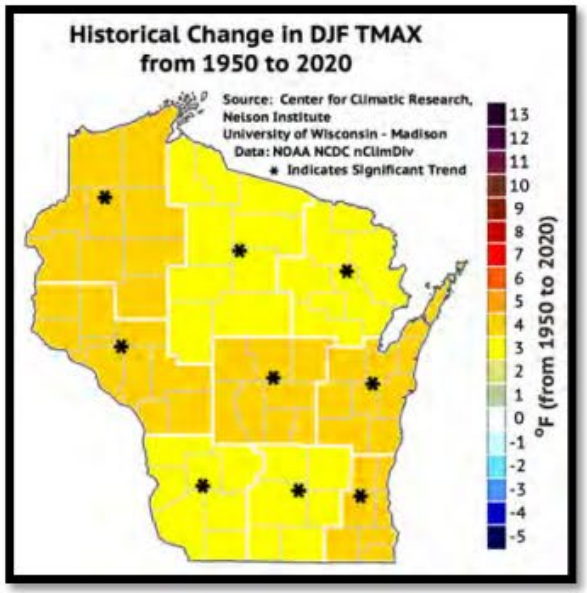
- Improved management may help reduce these losses longer-term

Deines et al. (2022) https://onlinelibrary.wiley.com/doi/epdf/10.1111/gcb.16489

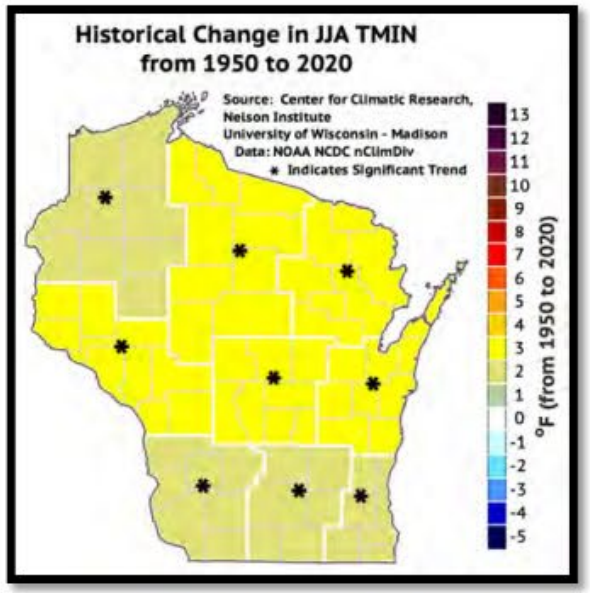
Weather Uncertainty is Increasing



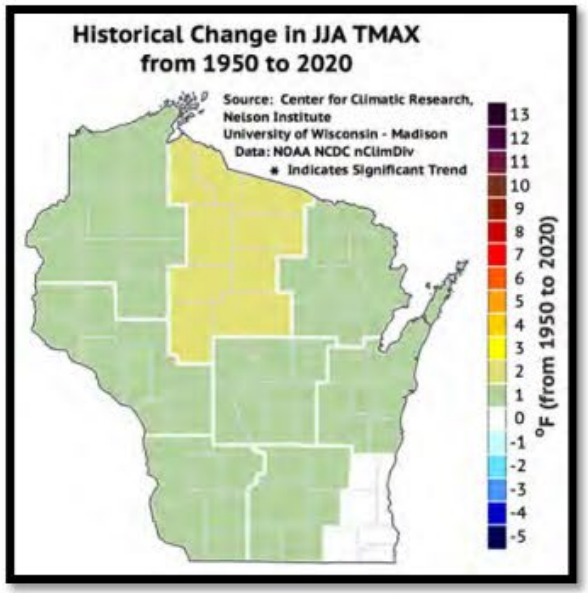
WINTER NIGHT
+5-7ºF



WINTER DAY
+3-4ºF



SUMMER NIGHT
+2-3ºF



SUMMER DAY
+1-2ºF

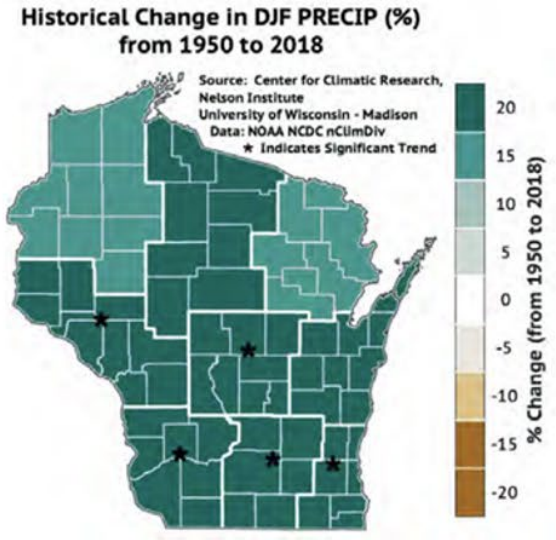
Chris Kucharik https://renk.aae.wisc.edu/wp-content/uploads/sites/2/2022/01/Kucharik_Chris.pdf

Night has warmed more than Day, Winter more than Summer

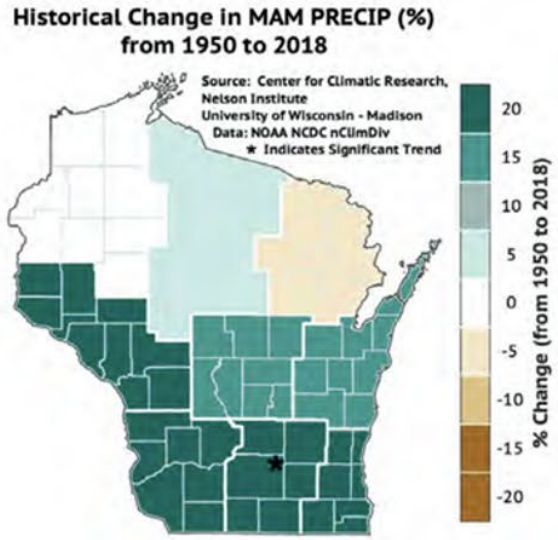
Seasonal Precipitation Trends 1950-2018

Chris Kucharik https://renk.aae.wisc.edu/wp-content/uploads/sites/2/2022/01/Kucharik_Chris.pdf

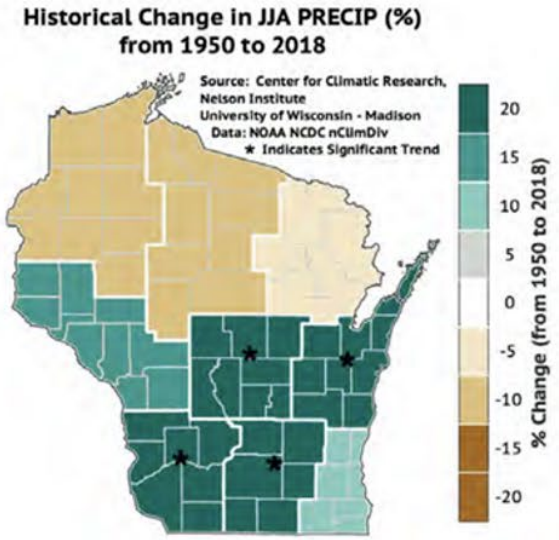
Substantial increased across southern WI for whole year



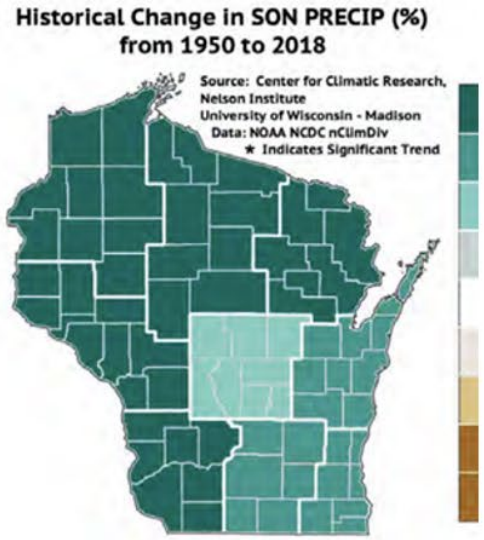
WINTER
+15-20%



SPRING
-5 to 20%



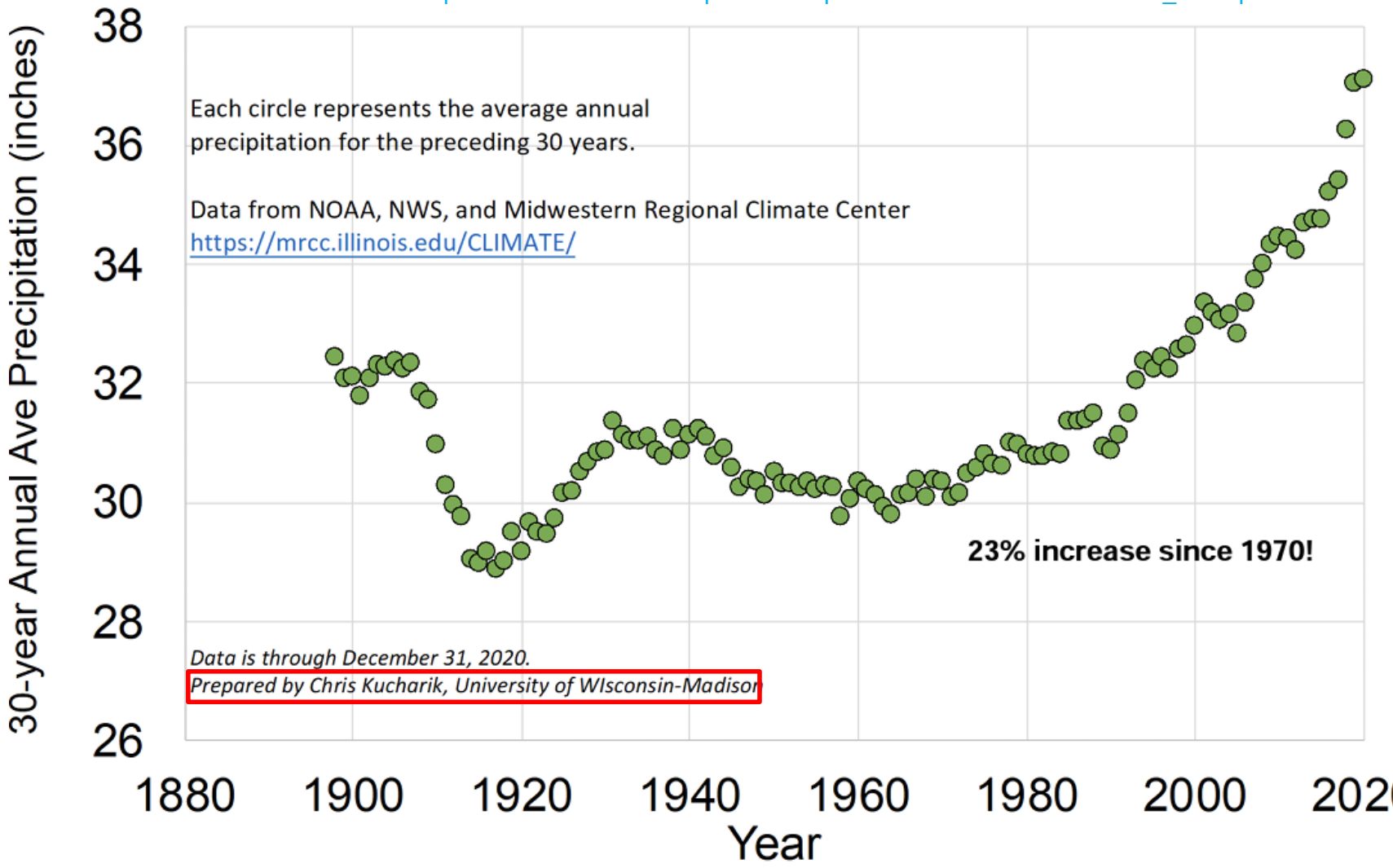
SUMMER
-10 to 20%

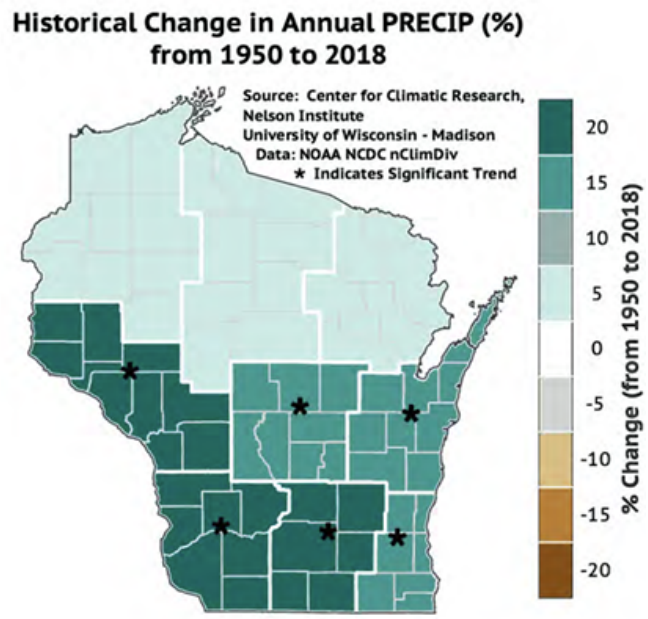


FALL
+10-20%

Madison Annual Precipitation Trend

Chris Kucharik https://renk.aae.wisc.edu/wp-content/uploads/sites/2/2022/01/Kucharik_Chris.pdf





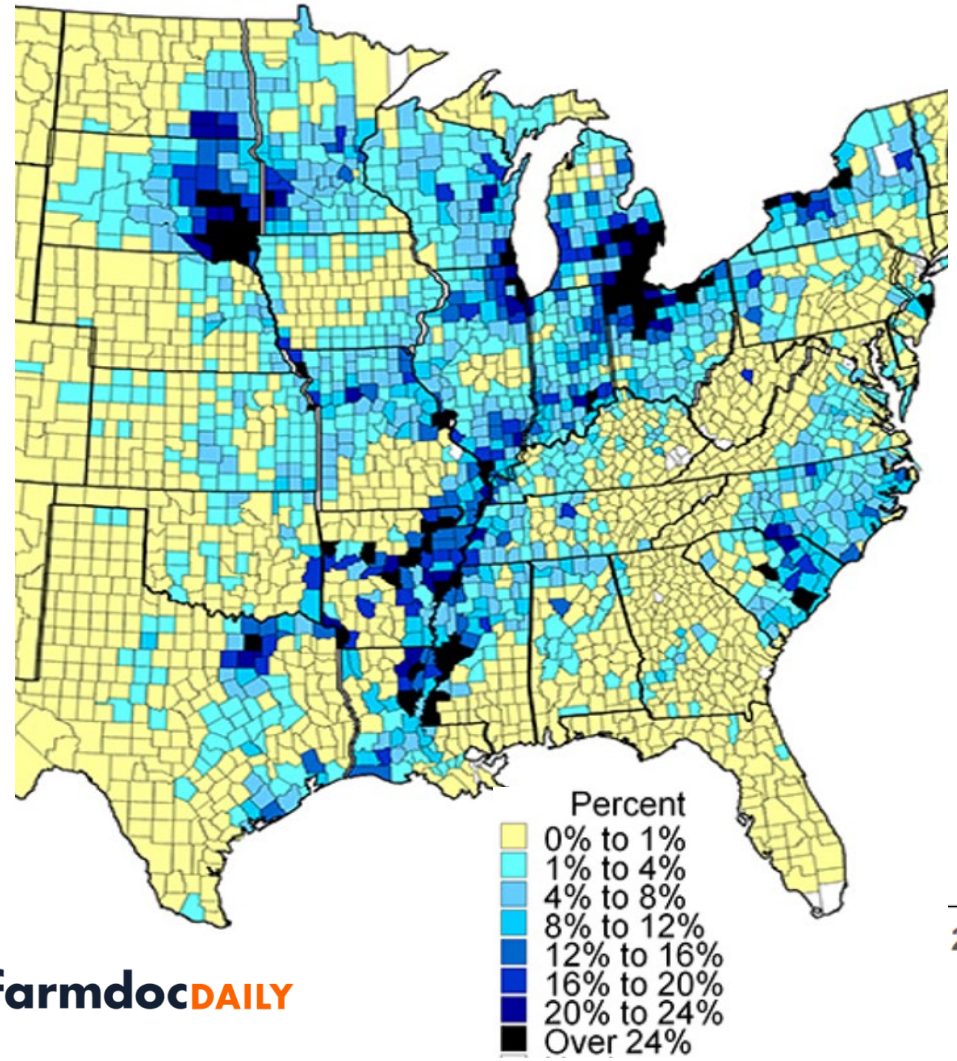
Top 10 wettest years
In Madison all-time

#2 – 2018 (50.64″)
#5 – 2019 (46.39″)
#6 – 2016 (45.56″)
#7 – 2013 (45.38″)
#8 – 2007 (44.41″)
#9 – 2008 (44.06″)
#10 – 1993 (43.34″)

2021: 22.82″, 13th driest ever since 1869

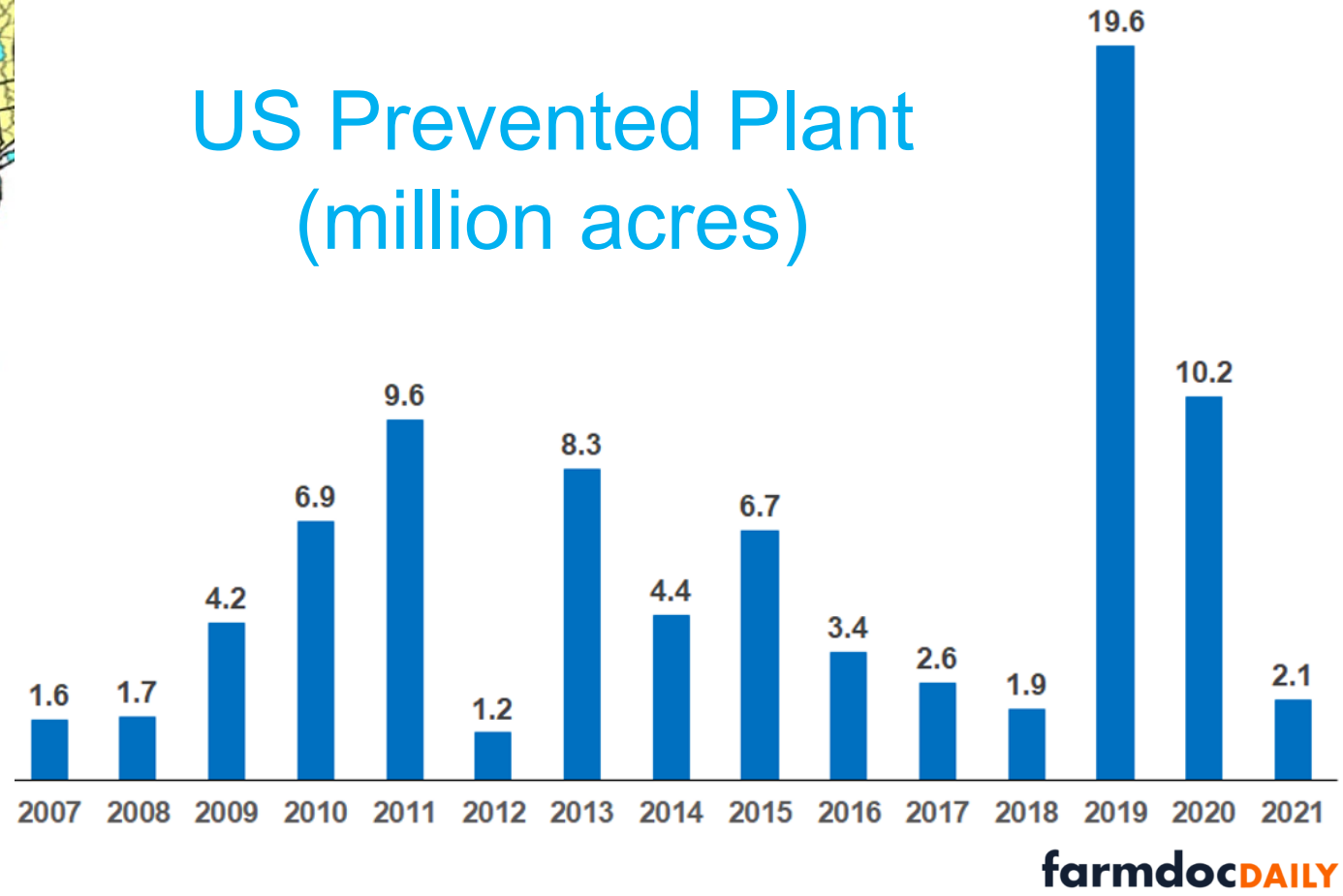
Wet springs are more common and increase prevented plant acres

2019 Prevented Plant



https://farmdocdaily.illinois.edu/2019/08/perspectives-on-2019-corn-and-soybean-acres-impact-of-prevent-plant.html

US Prevented Plant (million acres)

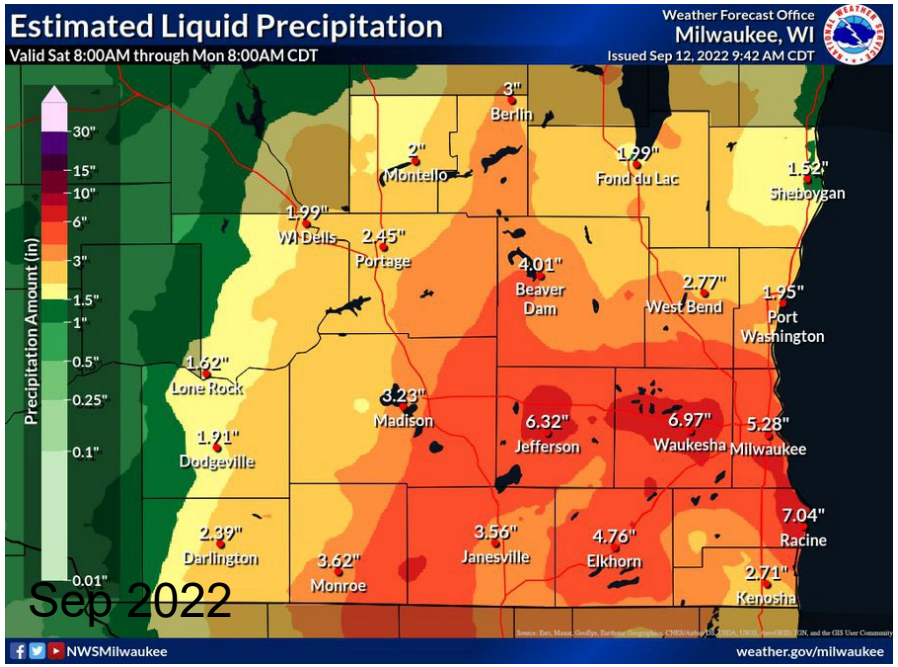


https://farmdocdaily.illinois.edu/2022/05/prevent-plant-and-2022-acres-a-looming-issue.html

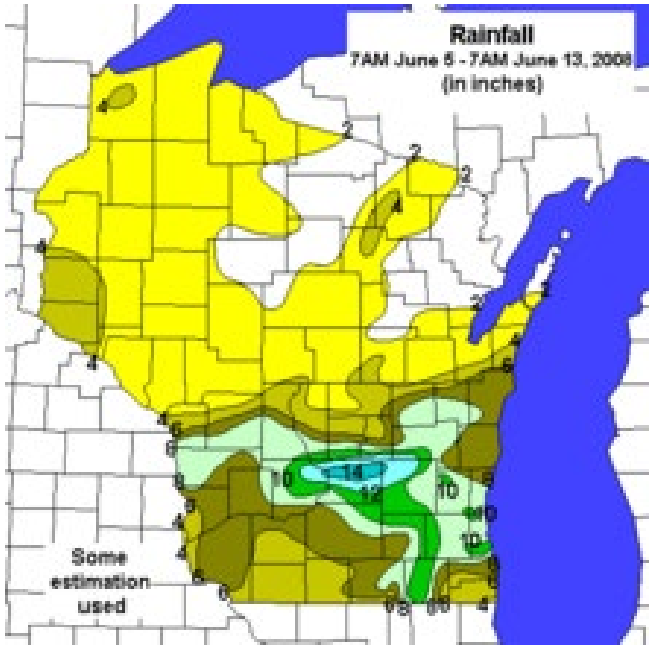
WI has a history of large rain events

One large rain event can undo years of conservation

Sep 2022 > 6in

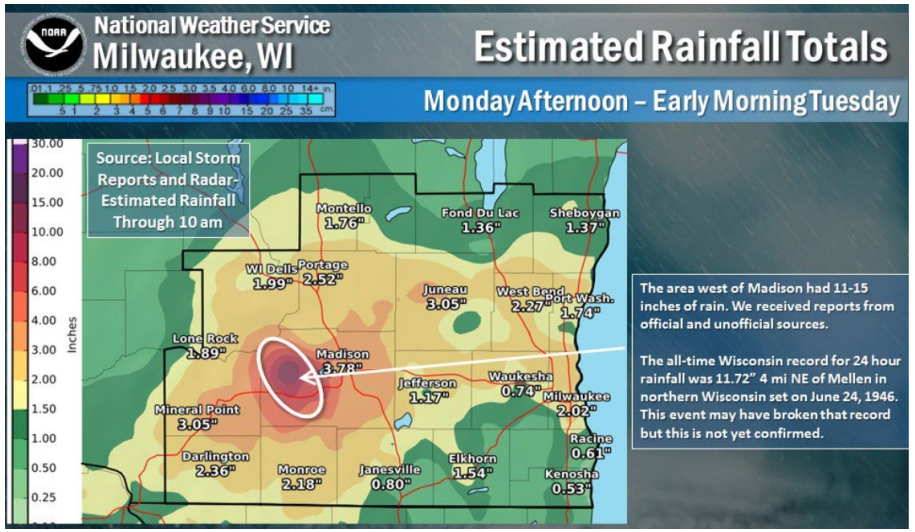


Jun 2008
>14 in



Dane Co. breaks state record for heaviest rainfall in 24 hours

Aug 2018
>14 in



Wisconsin Village Had 6.5 Inches Of Rain Thursday

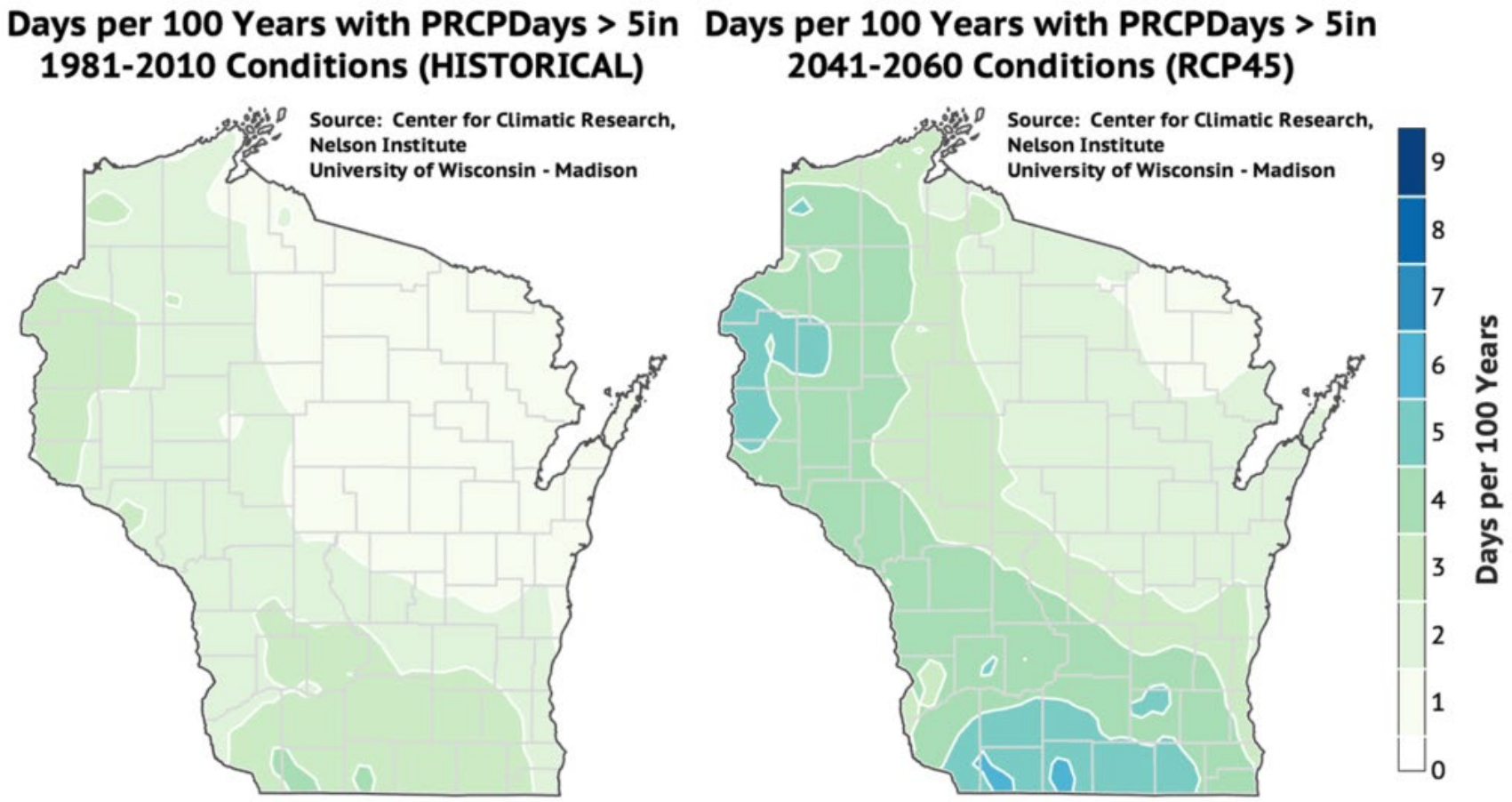
Northern Racine County was the hardest hit by rain and strong storms Thursday night, with several towns getting more than 5 inches of rain.

Scott Anderson, Patch Staff

Posted Fri, Jul 10, 2020 at 12:38 pm CT

July 2020
> 6 in

Large rain events likely to become even more common



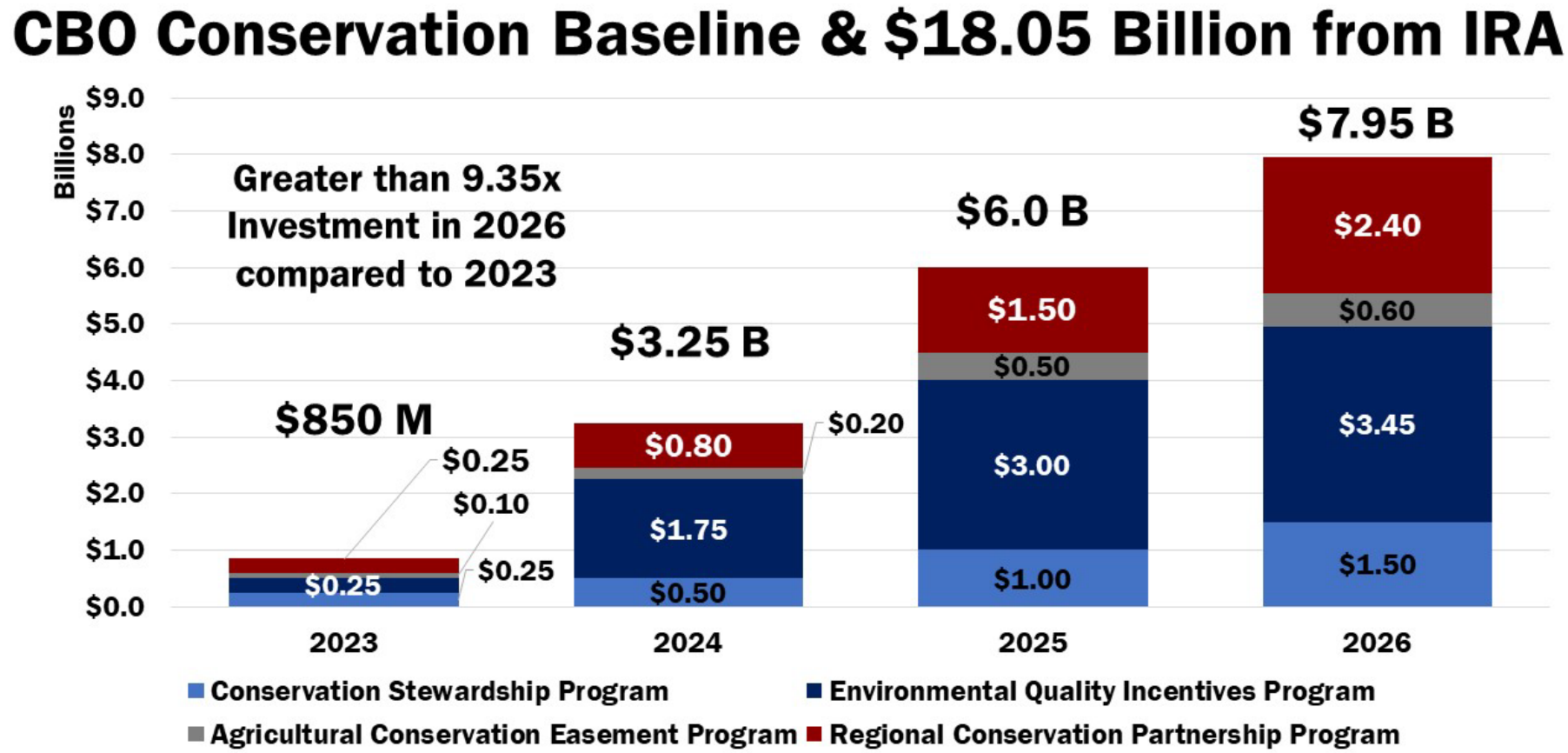
- We may need cover crops and grassed areas to prevent erosion disasters from large rain events
- Imagine the field erosion from a 5-inch rain in late May or early June in Iowa County

Wisconsin Initiative on Climate Change Impacts
Nelson Institute for Environmental Studies | Wisconsin Department of Natural Resources

https://wicci.wisc.edu/wisconsin-climate-trends-and-projections/

Interest in conservation agriculture is increasing

What's in the Inflation Reduction Act (IRA)?



+$1.4 Billion for technical assistance and admin

AMERICAN FARM BUREAU FEDERATION® www.fb.org

Source: Congressional Budget Office, HR 5376 EAS

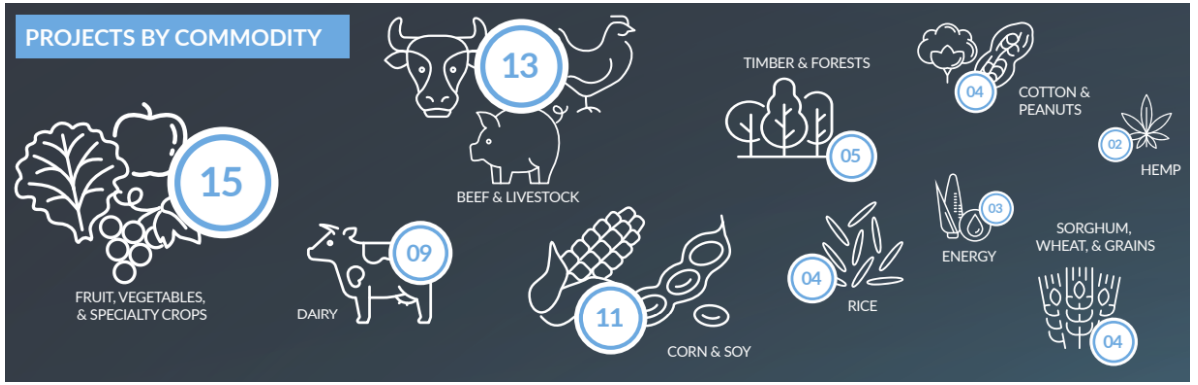
https://www.fb.org/market-intel/whats-in-the-inflation-reduction-act-for-agriculture

USDA Partnerships for Climate Smart Commodities

$2.8 Billion on 70 Projects

- Lots of them centered in WI, many others will be active in WI
- Edge Dairy Farmer Coop: $50 M
- The DeLong Co: $40 M
- Organic Valley: $25 M
- Carbon A List (Danone): $70 M
- Iowa Soybean Assoc: $95 M
- National Assoc Conservation Districts: $90 M
- National Fish & Wildlife Foundation $95 M

https://www.usda.gov/climate-solutions/climate-smart-commodities/projects



Vilsack Highlights USDA's Climate Initiatives and Investments at COP27

SHARM EL-SHEIKH, EGYPT, Nov. 12, 2022 – At the 2022 United Nations Climate Change Conference (COP27) this week, Secretary of Agriculture Tom Vilsack highlighted the U.S. Department of Agriculture's initiatives and investments in climate-smart agriculture and forestry, noting that global food security depends upon the ability of farmers and producers worldwide to increase their productivity while strengthening their climate resilience and minimizing their climate impacts.

Goals of the Climate Smart Partnerships

Support the production and marketing of climate-smart commodities through a set of pilot projects that provide voluntary incentives through partners to producers and landowners, including early adopters, to:

- Implement climate-smart production practices, activities, and systems on working lands,
- Measure/quantify, monitor and verify the carbon and greenhouse gas (GHG) benefits associated with those practices, and
- Develop markets and promote the resulting climate-smart commodities

- Morning: Situation and Outlook for Wisconsin agricultural industries: dairy, corn, soybeans, and livestock
- Afternoon: ***Climate Smart Dairy in WI***
- Union South on UW-Madison campus
- Tuesday, January 24, 2023
- Registration opens soon
- In-person: $50 for lunch and treats
- Livestream on YouTube: Free
- https://renk.aae.wisc.edu/2023-agricultural-outlook-forum/
- Jeremy Beach jpbeach@wisc.edu

SOUTHWEST WISCONSIN | TESTS OF WATER QUALITY

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

Assembly Speaker Robin Vos Forming Water Quality Task Force

Task Force Creation Follows Discovery Of Private Well Contamination In Southwest Wisconsin

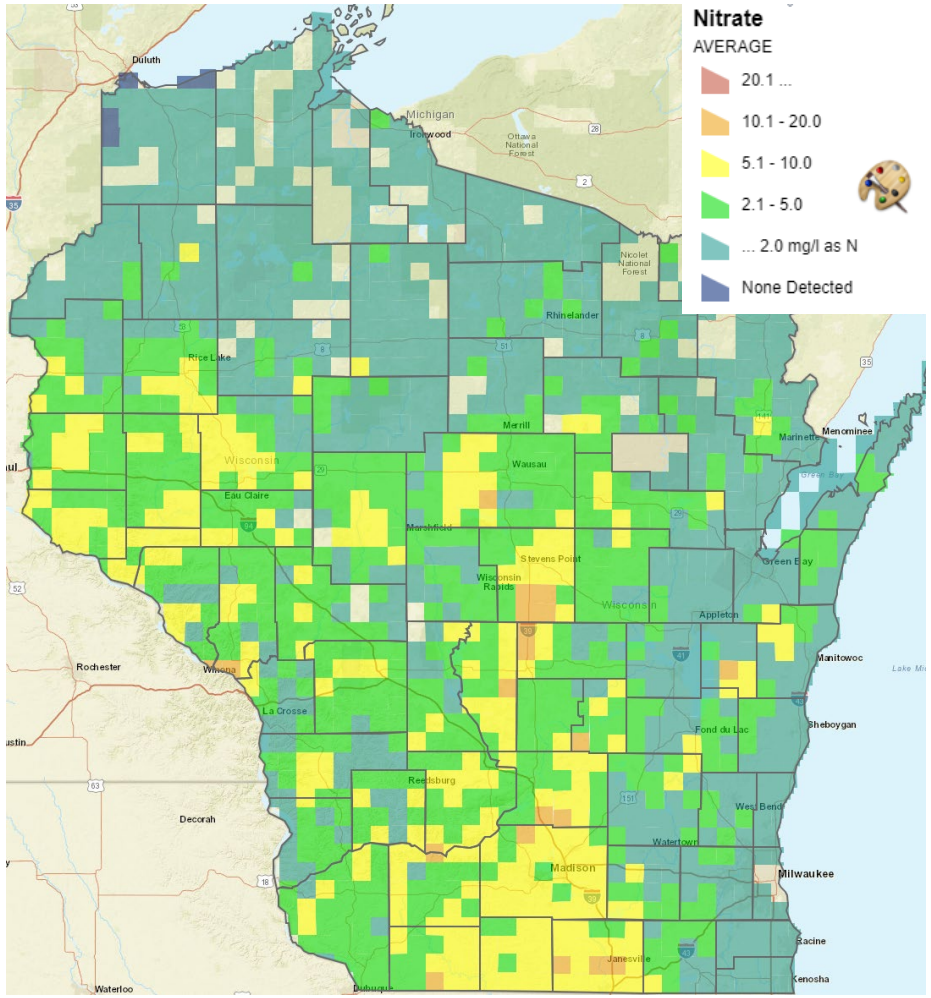
By Hope Kirwan and The Associated Press
Published: Thursday, January 3, 2019, 12:35pm

SOUTHWESTERN WISCONSIN | PRIVATE WELL WATER

Study of southwest Wisconsin well water continues to indicate contamination

Chris Rickert | Wisconsin State Journal Apr 19, 2020

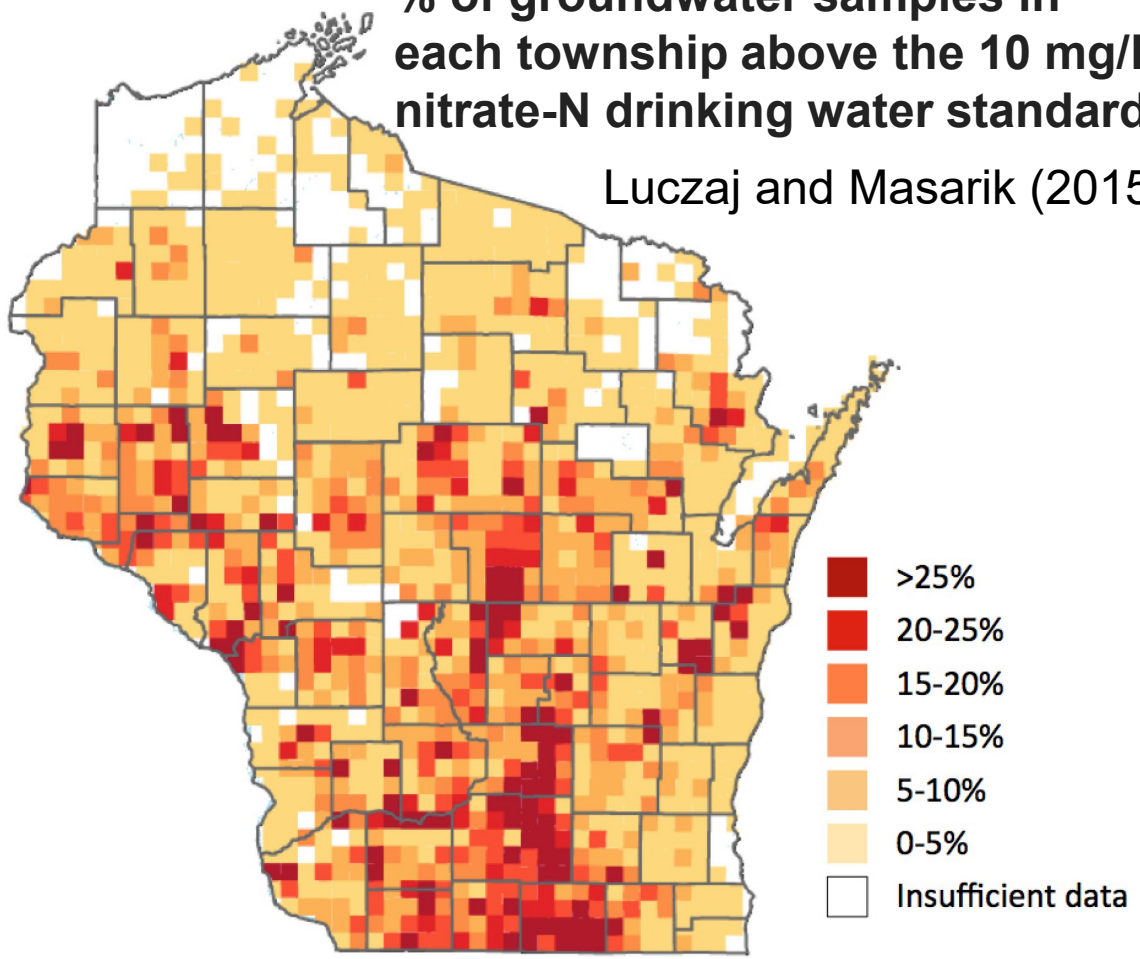
Nitrogen Contamination of Wisconsin's Groundwater



https://gissrv3.uwsp.edu/webapps/gwc/pri_wells/

% of groundwater samples in each township above the 10 mg/L nitrate-N drinking water standard

Luczaj and Masarik (2015)

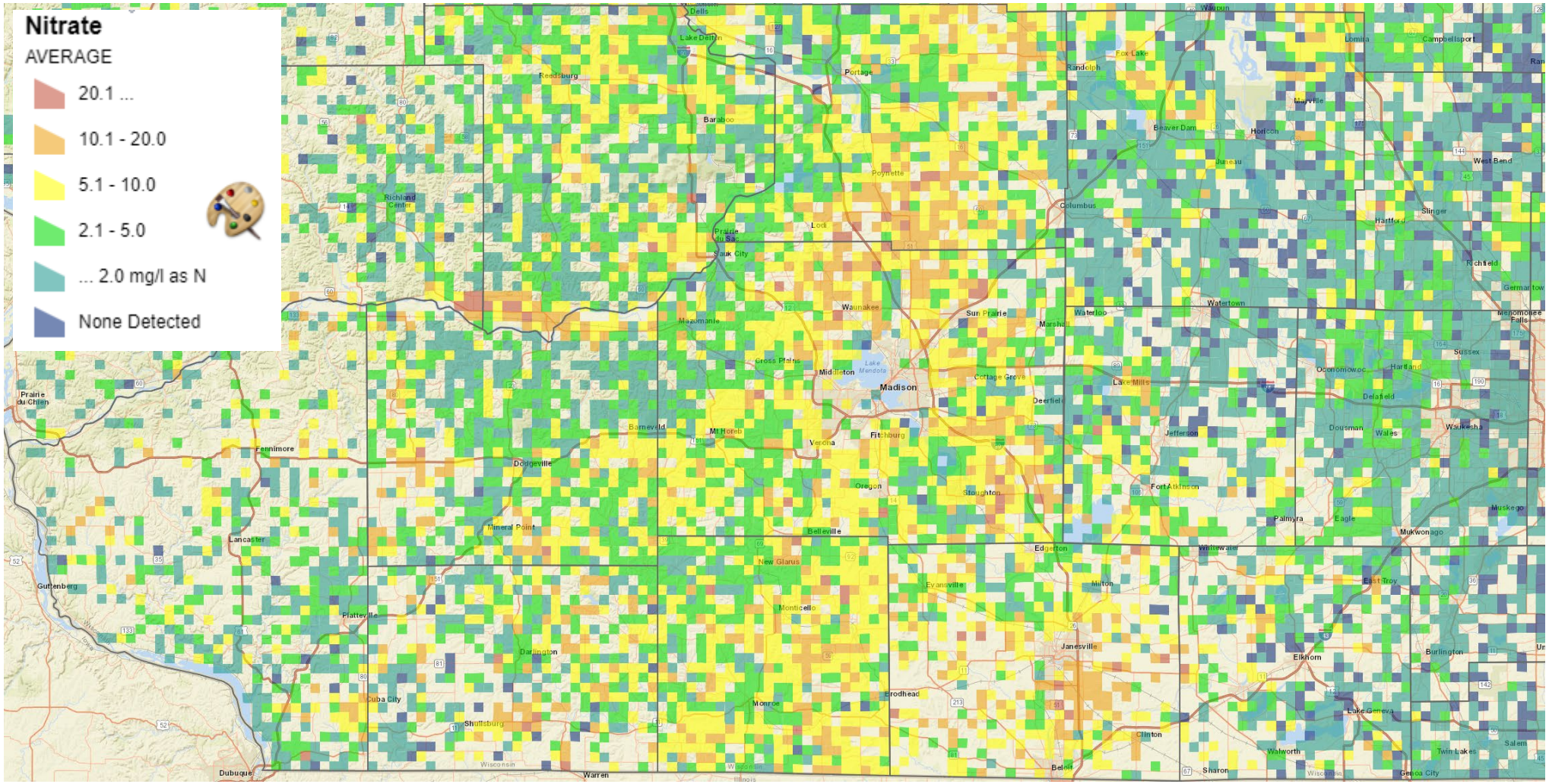


https://www.mdpi.com/2079-9276/4/2/323/htm

Center for Watershed Science and Education
College of Natural Resources
University of Wisconsin-Stevens Point

Extension
UNIVERSITY OF WISCONSIN-MADISON

Zooming in to the Section Level in Southwestern WI

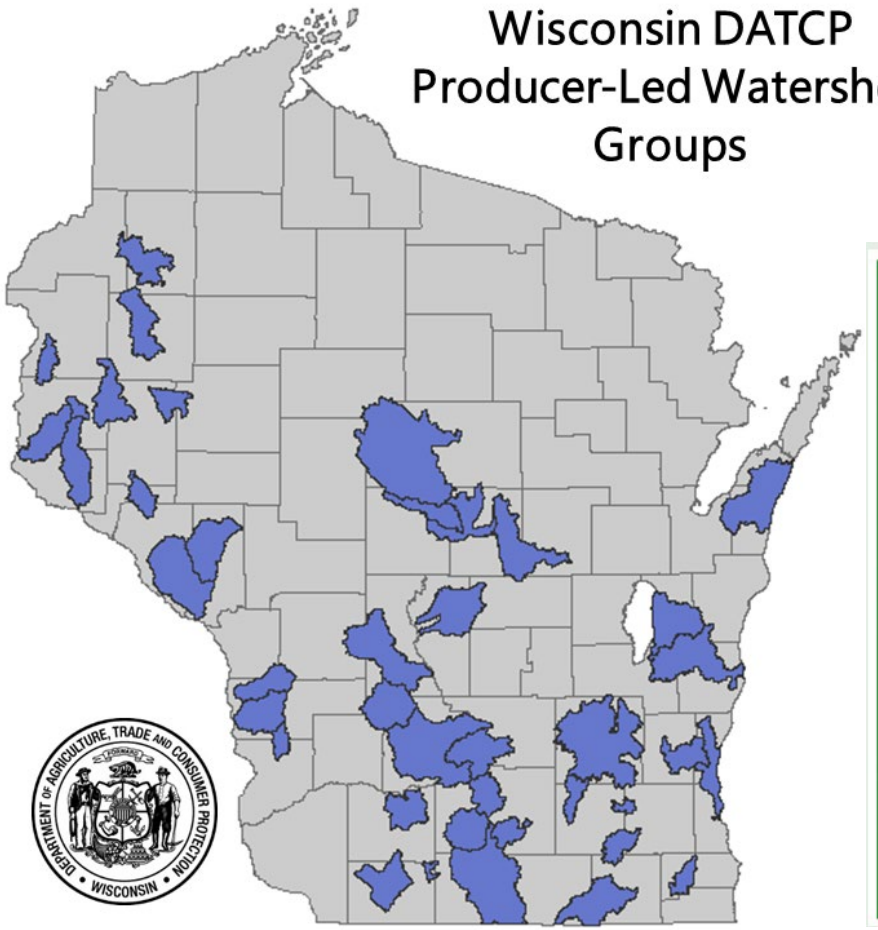


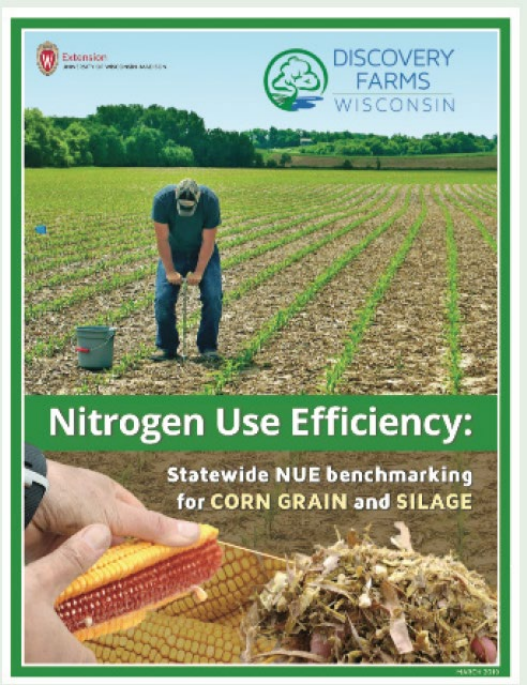
Center for Watershed Science and Education
College of Natural Resources
University of Wisconsin-Stevens Point

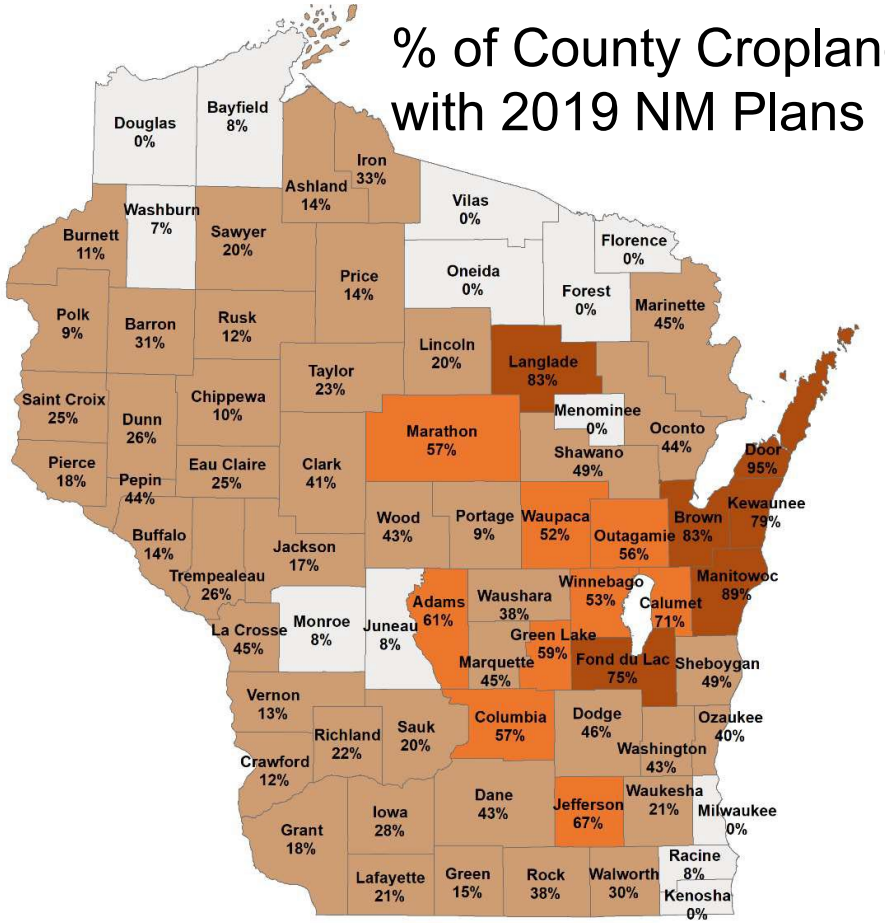
Extension
UNIVERSITY OF WISCONSIN-MADISON

https://gissrv3.uwsp.edu/webapps/gwc/pri_wells/

Wisconsin Farmers are Working on the Problem







WISCONSIN DEPARTMENT OF NATURAL RESOURCES

NR 151 RULE CHANGES FOR NITRATE

DRAFT EIA AND COMMENTS RECEIVED

Public comments were received for the draft economic impact analysis (EIA).

- All public comments received [PDF]

The public comment period was in effect March 8, 2021 - April 10, 2021 for the following documents.

- WT-19-19 Draft EIA [PDF]
- WT-19-19 Draft Rule [PDF]
- WT-19-19 EIA Solicitation Notice [PDF]

As part of the effort to address groundwater issues and protect drinking water and public health across Wisconsin, the Department of Natural Resources worked with key public and agriculture industry stakeholders, state agencies, the State Legislature, the governor and the general public to update ch. NR 151, Wis. Adm. Code [exit DNR].

Preliminary Assessment of the Potential Economic Impacts of Proposed Changes to

NR 151 for Agricultural Operations

https://go.wisc.edu/vcii7o

Lead Author:
Paul D. Mitchell

Report: Proposed Changes To DNR Rule Could Cost Farms Millions In Management Costs, Lower Yields

Researchers Say More Data On Fertilizer, Manure Management Needed To Understand Economic Impact Of Stricter Standards

By Hope Kirwan
Published: Wednesday, September 22, 2021, 5:25am

WISCONSIN PUBLIC RADIO
Wisconsin and the World. npr

What happened to Wisconsin's rules on nitrate contamination?

Nov 17, 2021 | Agriculture, Clean Water Now, Clear Water Farms, Drinking Water, Groundwater,

RIVER ALLIANCE of WISCONSIN

WISCONSIN DNR SCRAPS CLEAN WATER EFFORT

By Wisconsin Examiner
11/18/2021 *by Ruth Conniff*

SF Successful Farming

WFU: Abandoning NR-151 Is Backward Step

November 21, 2021

The Mid-West FARM REPORT

Concern about nitrogen and water quality remains

- Signed into law April 2022
  - Bipartisan, unanimous support
  - $1.7 million per year
- Grants up to $50,000 to help farmers come up with creative ways to optimize commercial nitrogen fertilizer
- $5/ac crop insurance premium rebate for planting cover crops
- Fund new position in UW System to monitor groundwater quality

WISCONSIN STATE JOURNAL

WEDNESDAY, FEBRUARY 23, 2022

LEGISLATURE | BUDGET COMMITTEE

Bills target water pollution

Help sought to keep nitrates out of nature

CHRIS HUBBUCH
chubbuch@madison.com

Even as attempts to regulate agricultural pollution have faltered, Wisconsin lawmakers have advanced rare bipartisan legislation aimed at improving water quality.

The Legislature's budget committee voted unanimously Tuesday to advance companion bills that would provide up to $1.4 million per year to help farmers keep fertilizer on their fields and out of lakes, rivers and groundwater, and fund a new position within the University of Wisconsin System to monitor groundwater quality.

Based on recommendations of a 2019 legislative water quality task force, the bills broadly target nitrate, Wisconsin's most prevalent groundwater contaminant and a contributor to toxic algae blooms that can kill fish and shut beaches.

Cowles

Shankland

A separate pair of bills would expand eligibility for well replacement grants to include wells contaminated with bacteria or nitrate.

"No single approach can solve our water pollution problems," said Sen. Rob Cowles, a Green Bay Republican who sponsored the Senate bills. "But concerted efforts such as these can make a noticeable impact for the state's agricultural producers, rural residents, and those who enjoy recreating on Wisconsin waters."

The bills are advancing even as the Department of Natural Resources recently scrapped a two-year effort to implement new regulations on manure and fertilizer in areas vulnerable to groundwater contamination. The agency announced in November that it could not complete the rulemaking process within the Legislature's timeframe.

About 1.7 million people in Wisconsin rely on private wells for drinking water, and the Department of Health Services estimates at least one in 10 Wisconsin wells has high levels of nitrate, which is considered hazardous, especially for pregnant women and infants.

Farm fertilizer and manure are the main sources of nitrate pollution, though faulty septic systems can also contribute to the problem.

Specifically, the bills would fund grants of up to $50,000 to help farmers come up with creative ways to "optimize the application" of commercial nitrogen fertilizer and create a $5 per acre crop insurance rebate to offset the cost of planting cover crops, which help hold soil and nutrients in place.

"The idea behind this bill is to reward farmers who want to experiment with nitrogen loading, while helping them absorb any risk attached with changing their commercial nitrogen application practices," said Rep. Katrina Shankland, D-Stevens Point.

Please see POLLUTION, Page A4

Pollution

From A3

The legislation has broad support from agriculture, conservation and public health groups, though some environmental advocates say they don't go far enough.

River Alliance executive director Allison Bender called them "a step in the right direction" but called on lawmakers to adopt the DNR's proposed performance standards.

"This collaborative and science-based process is almost complete," Bender testified. "The legislature should approve these rules if they are serious about reducing the impact of nitrate on our waters."

Wisconsin Manufacturers and Commerce, the state chamber of commerce, and the Wisconsin Dairy Alliance are wary of a provision that would fund a fourth hydrogeologist to help develop groundwater data for the Wisconsin Geological and Natural History Survey.

Craig Summerfield, director of environmental policy for WMC, warned that Gov. Tony Evers could use his broad veto powers to "radically" alter the bill and additional groundwater data could be used "as fresh justification" to push new regulations.

"While only one position might seem harmless enough," Summerfield testified, "the dairy industry and especially our members have already expended significant time and resources correcting the record to combat biased research."

Pause in NR 151 Rule Change Seems Temporary

- The social and political pressure to do something is just too great
- Most Wisconsin residents live in urban areas and think agriculture can easily fix its nitrogen and phosphorus problems and it should
  - The social footprint of agriculture continues to shrink, even in Wisconsin
- Voluntary farmer-led watershed groups, incentives for cover crops, money for research, water monitoring will only go so far, eventually regulations will come
- My opinion: We need to use this time to build partnerships, create tools, and collect data so we can contribute to practical and effective responses
- Recommendations from our report: Renew existing & build new partnerships to
- 1) Collect current data on farm nutrient and manure management practices
- 2) Create practical, science-based tools to calculate N losses from crops and how management practices change these losses

What else matters?

- Conservation is about more than just money and time
  - Who and what you know matters, What you think and believe matters
- Back to Prokopy et al. (2008): What drives conservation adoption?
- How many more studies found that a factor increased BMP adoption compared to descreased adoption?
  - Education, access to information: 4.1X (33 vs 8)
  - Network (government, business, social): 5.7X (17 vs 3)
  - Attitudes/Beliefs: 3.4X (17 vs 5)
- This is where you come in: You are in the information business, you are the network nodes, and know your clients' attitudes

My Opinions on Conservation

- Almost all farmers are interested in being good stewards of their land
- **Conservation has become a cost of doing business, not a profit center**
  - Money-making BMPs have mostly been adopted where they work
  - Technology changes and conditions evolve (markets, programs, climate), so returns from BMPs are always changing and need watching
- Crop Consultants & Extension are at ground zero for connecting farmers to latest information, what others are doing, and new technologies/opportunities
- My recommendations
  - Work on nitrogen management and soil erosion to reduce the costs, so you and your clients are a part of the solution
  - Get up to speed on climate smart opportunities as they emerge

Questions?
Comments?

Extension
UNIVERSITY OF WISCONSIN-MADISON

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