Welcome!

Sustainable Phosphorus Alliance

Who We Are

The **Sustainable Phosphorus Alliance** is a members organization that serves as North America's central forum and advocate for the sustainable use, recovery, and recycling of phosphorus in the food system.

Members and Partners

OCP

NACWA

OSTARA

THE Water Research FOUNDATION

RENEWABLE NUTRIENTS

GreenEdge® GreenTechnologies, LLC

AQUASMART INC

Biochar Now

Nutrien

THE SUSTAINABILITY CONSORTIUM™

STEPS Science and Technologies for Phosphorus Sustainability

PHOSPHOLUTIONS

Strategic Partners

AgSTAR

Water Environment Federation the water quality people

nebra North East Biosolids & Residuals Association

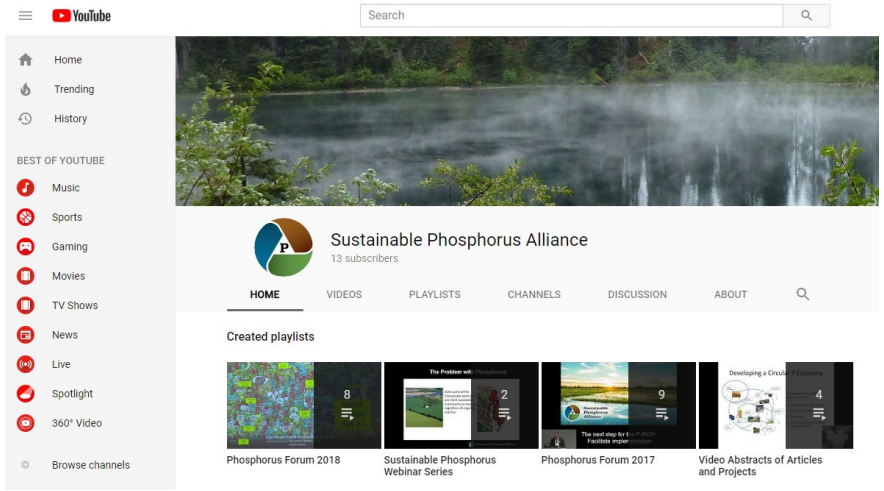
Foundational Supporters

A special thanks to Kerry McNamara and his team at OCP, North America

A Community Resource

YouTube.com/SustainablePhosphorusAlliance

>40 hours of video footage of P sustainability discussions available.



Also find us:

@SustainP

@SostenibleF (Spanish)

Sustainable Phosphorus Alliance

Join Our Network of Sustainability Leaders

Membership details for organizations are available here!

Special Thanks

Reception and Poster Session Sponsorship

VERDESIAN

THE NUTRIENT USE EFFICIENCY PEOPLE®

Sustainable Phosphorus Alliance

Agenda

Time (ET)	Session	Presenter(s)
07:00 – 08:00	Registration	
8:00 – 8:15	Welcome	Jim Elser, Sustainable Phosphorus Alliance
8:15 – 9:15	Farm Bill Food for Thought: Looking Ahead to 2023 Reauthorization	Jonathan Coppess, University of Illinois, Urbana-Champaign
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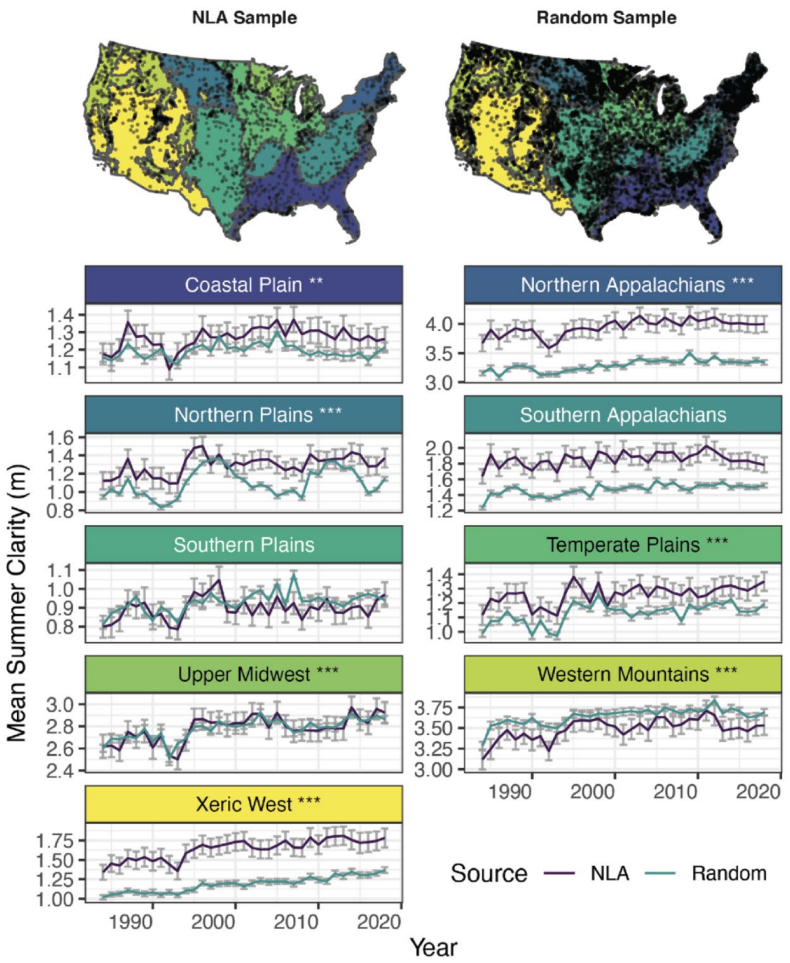
11:00 – 11:30	Not Slaughtering Sacred Cows: The Promise of Cellular Foods	Lejjy Gafour, CULT Food Science
11:30 – 12:30	Lunch	
12:30 – 1:00	P is for Planet: The Future of Sustainability in Phosphate	Maurício Fortuna, CRU
1:00 – 1:30	The Dichotomy in Sustainable Phosphorus Management: Why Do We Need a Convergence?	Kaushik Majumdar, Global Phosphorus Institute and African Plant Nutrition Institute
1:30 – 2:00	European Update	Ludwig Hermann, European Sustainable Phosphorus Platform (ESPP)
2:00 – 2:30	The Orthophosphate Paradox	Emily Remmel, National Association of Clean Water Agencies (NACWA)
2:30 – 3:00	Facilitated Policy Wrap-Up Discussion	Anna-Maria Marshall, University of Illinois, Urbana-Champaign

First, some good news

- “satellite remote sensing of over 14 000 lakes [shows] that **lake water clarity in the U.S. has increased** by an average of 0.52 cm yr−1 since 1984.”
- “largest increases occurred **prior to 2000** in densely populated catchments and within smaller waterbodies.”
- “consistent with observed improvements in water quality in U.S. streams and lakes stemming from **sweeping environmental reforms in the 1970s and 1980s that prioritized point-source pollution** in largely urban areas”
- “extensive U.S. freshwater pollution abatement measures have been **effective** and enduring, **at least for point-source pollution controls**”



PAPER • OPEN ACCESS

Multi-decadal improvement in US Lake water clarity

Simon N Topp[5,1], Tamlin M Pavelsky[1], Emily H Stanley[2], Xiao Yang[1], Claire G Griffin[3] and Matthew R V Ross[4]

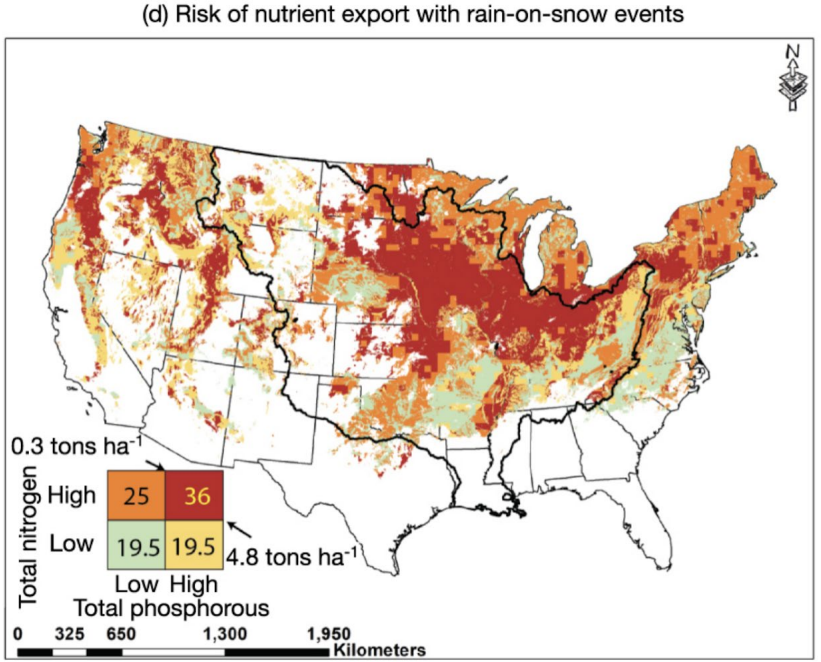
Published 10 May 2021 • © 2021 The Author(s). Published by IOP Publishing Ltd

Environmental Research Letters, Volume 16, Number 5

Citation Simon N Topp *et al* 2021 *Environ. Res. Lett.* **16** 055025

But not all is well, of course

"We show that rain-on-snow, a major flood-generating mechanism for large areas of the globe … affects 53% of the contiguous US and **puts 50% of US nitrogen and phosphorus pools** at risk of export to groundwater and surface water."



LETTER • OPEN ACCESS

Winter runoff events pose an unquantified continental-scale risk of high wintertime nutrient export

Erin C Seybold[1,2], Ravindra Dwivedi[2,3], Keith N Musselman[4], Dustin W Kincaid[2,5], Andrew W Schroth[2,6], Aimee T Classen[5,7,8], Julia N Perdrial[2,5,6] and E Carol Adair[9,2,5,8]

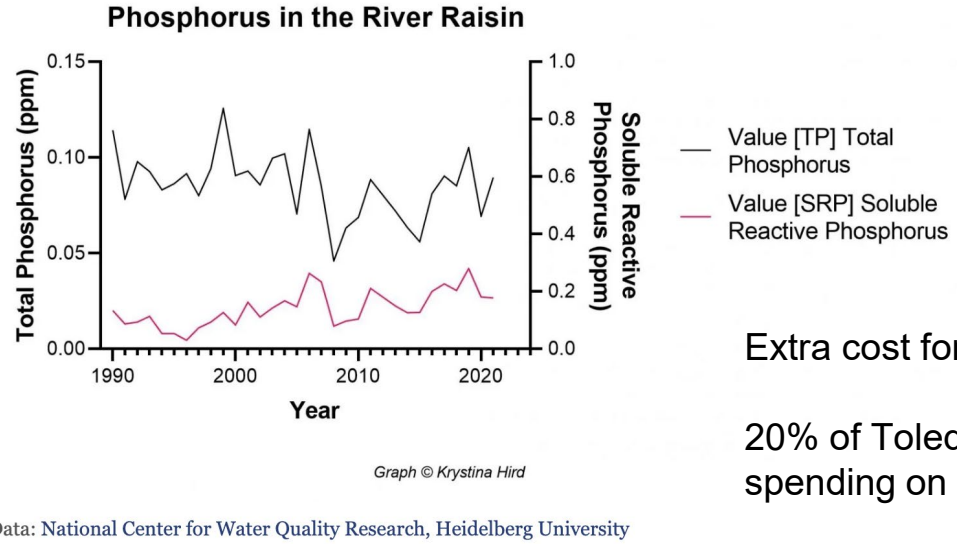
Published 6 October 2022 • © 2022 The Author(s). Published by IOP Publishing Ltd

Environmental Research Letters, Volume 17, Number 10

Citation Erin C Seybold *et al* 2022 *Environ. Res. Lett.* **17** 104044

Sustainable Phosphorus Alliance

But not all is well, of course



Data: National Center for Water Quality Research, Heidelberg University

Lake Erie's Failed Algae Strategy Hurts Poor Communities the Most

Algae blooms are hiking the cost of water for people already struggling to pay their bills.

By Laura Gersony, Circle of Blue

Costs to western basin treatment plants

- Monitoring for toxins: $21M
- Mitigating blooms: $21M
- Filtering: $220M
- Disposal: ($220M)

Extra cost for treating blooms: $100 per year for family of five.

20% of Toledo population "report "often" or "always" reducing their spending on basic needs to afford their water bill".

Also: Impacts on tourism, fishing permit sales, housing prices.

But not all is well, of course

“linking housing transactions in 2003 to 2015 from seven Ohio counties bordering Lake Erie with measures of water quality using remote-sensing images”

“For the average near lake homeowner, a **1 µg Chl /L** increase in algae concentrations is expected to **decrease property values by 1.7%** ($2205)”

“Fulfilling the Great Lakes Water Quality Agreement will provide a **yearly benefit of up to $42.9 million**, **fully covering the current annual expenditure** on water quality improvement”

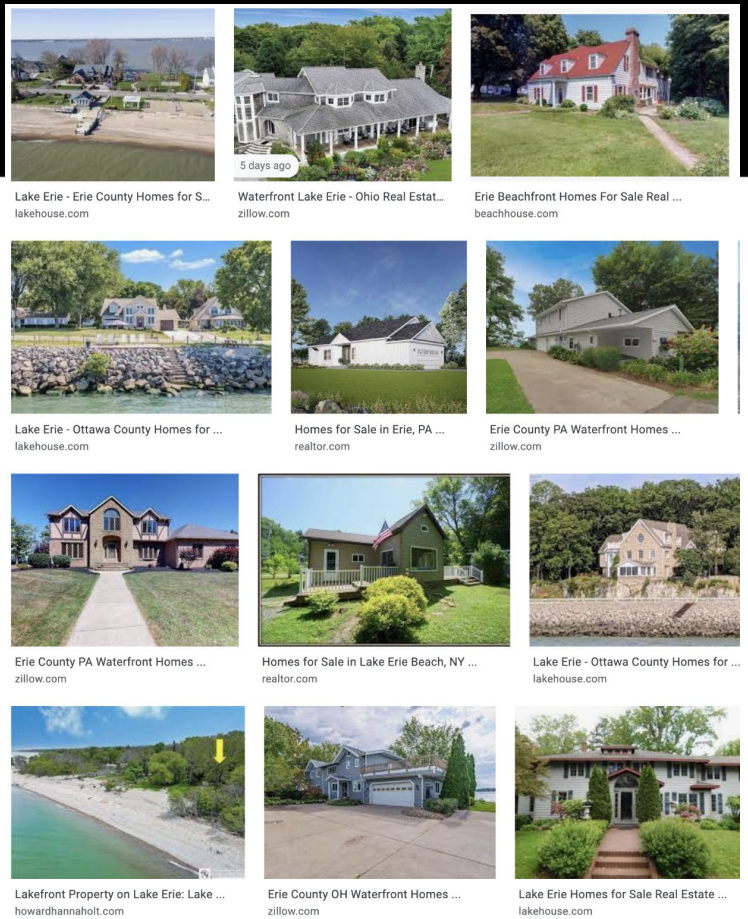
American Journal of Agricultural Economics

AAEA Agricultural & Applied Economics Association

Article | Full Access

Staying afloat: The effect of algae contamination on Lake Erie housing prices

David Wolf, Sathya Gopalakrishnan, H. Allen Klaiber



Sustainable Phosphorus Alliance

Reality check: Are we making progress at least?

Don Boesch @DonBoesch · Oct 6

EPA is ready to "recalibrate the timeline" by pushing back deadline for reducing nutrient pollution of Chesapeake Bay beyond 2025. This is not 15 years of learning, Adam, but 38 years, with missed deadlines in 2000 & 2010 to do essentially the same thing.
baltimoresun.com/news/environme...

1 3 4

Don Boesch @DonBoesch · Oct 6

Face facts, this failure is overwhelmingly due to the ineffectiveness of reducing nitrogen and phosphorus pollution from agriculture. It was fine to say this is "hard" in the 1990s, but that excuse wears old. Need to move from pay-the-polluter approaches and require performance.

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Let's go!

But first some suggested rules…

Trademark: S. Secchi

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Farm Bill Food for Thought: 2023

Phosphorus Week: November 1, 2022

Jonathan Coppess

ILLINOIS
Agricultural & Consumer Economics
COLLEGE OF AGRICULTURAL, CONSUMER
& ENVIRONMENTAL SCIENCES

Gardner
Agriculture
Policy
Program

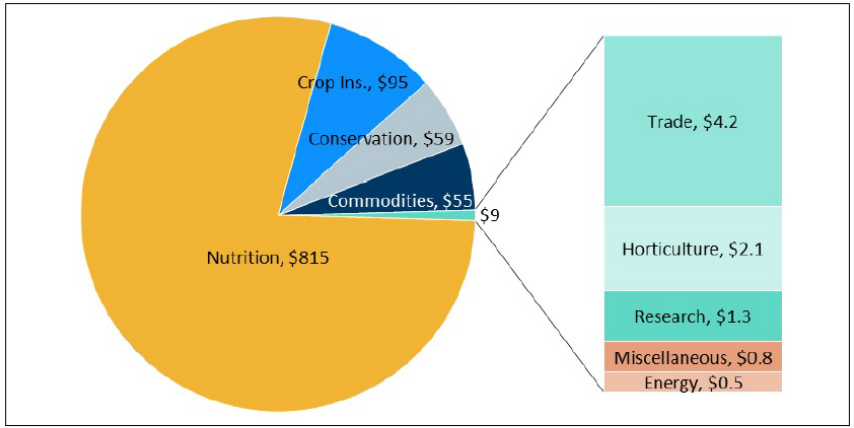
What is this "Farm Bill"??

Background

Multiyear → Omnibus → Authorizing

Figure 2. Baseline for Farm Bill Programs, by Title

($ billions; $1,033 billion over 10 years, FY2022-FY2031)



Source: Created by CRS using CBO, "Details About Baseline Projections for Selected Programs," July 2021 baselines (for the commodities, conservation, trade, nutrition, and crop insurance titles); and CRS Report R45425, *Budget Issues That Shaped the 2018 Farm Bill*; and amounts indicated in law for programs in other titles.

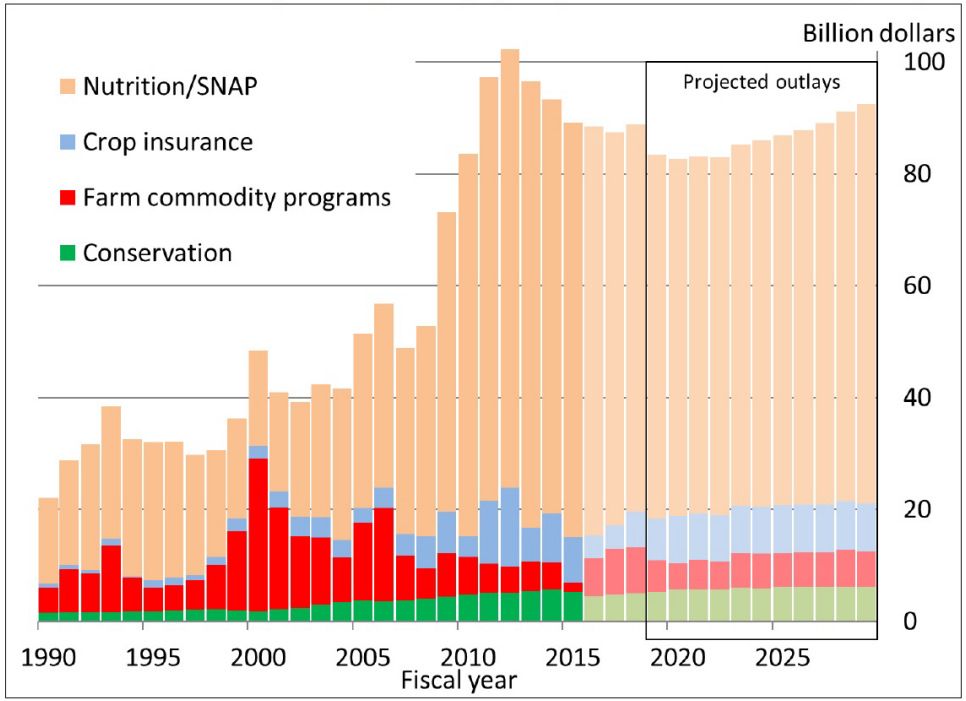
Notes: Excludes changes not yet incorporated, such as to the Thrifty Food Plan. Supplemental trade and pandemic assistance are not part of the baseline.

https://crsreports.congress.gov/product/pdf/download/RS/RS22131/RS22131.pdf/

We have to talk about budget 'baseline'…

What has been spent (and on what)…

Figure 3. Actual and Projected Spending by Major Farm Bill Mandatory Programs



Source: CRS using USDA and CBO data (through the May 2019 CBO baseline).

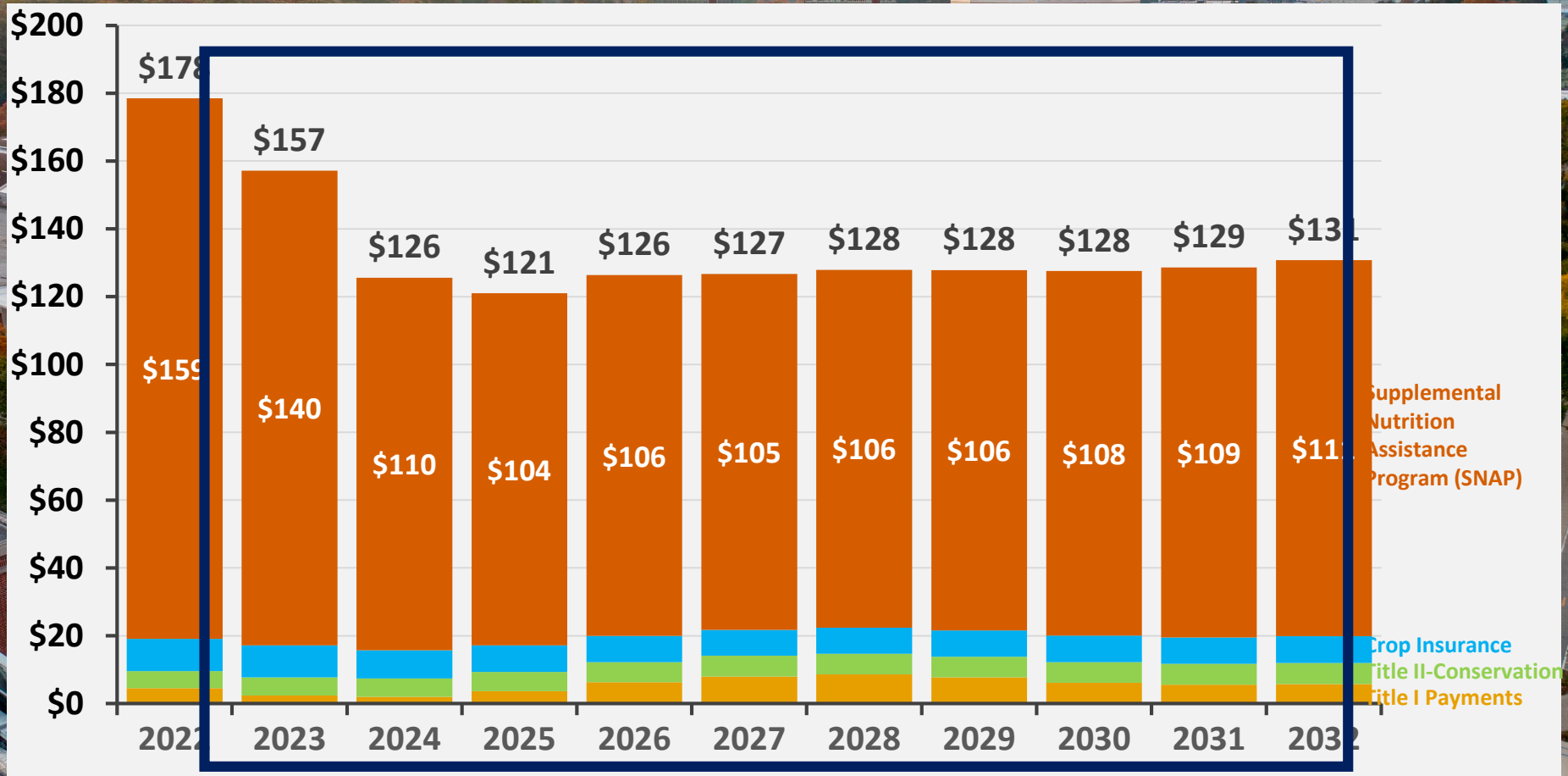
Notes: Darker shades of each color are actual outlays based on available USDA data; lighter shades are CBO data and projections. Excludes the Trade Aid Program announced in 2018-2019 and supplemental appropriations.

Forecast of spending is baseline.

https://crsreports.congress.gov/product/pdf/download/RS/RS22131/RS22131.pdf/

Farm Bill Baseline Overview in Billion Dollars

Congressional Budget Office (CBO) May 2022



Conservation Program Outlays by Fiscal Year in Million Dollars

Congressional Budget Office (CBO) May 2022

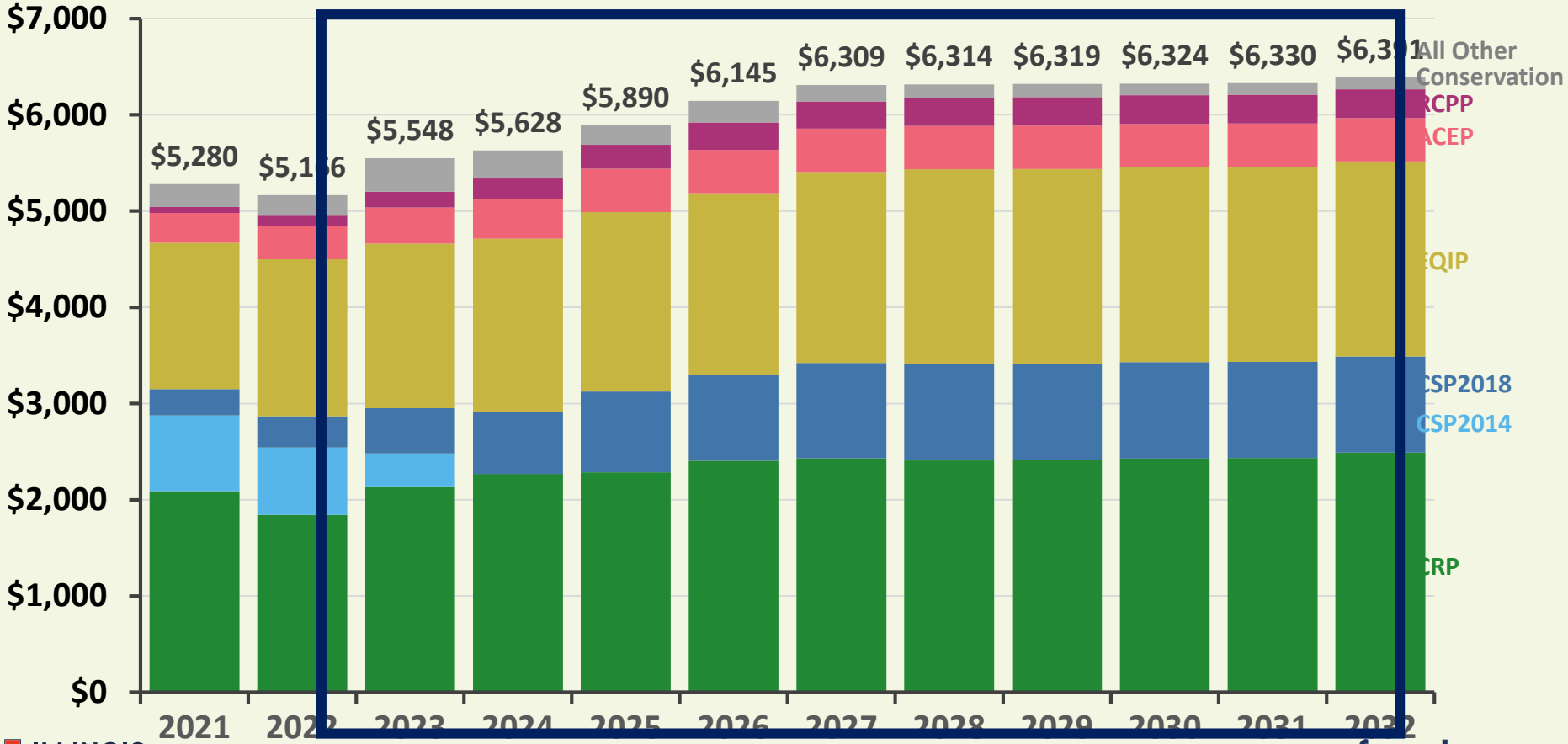
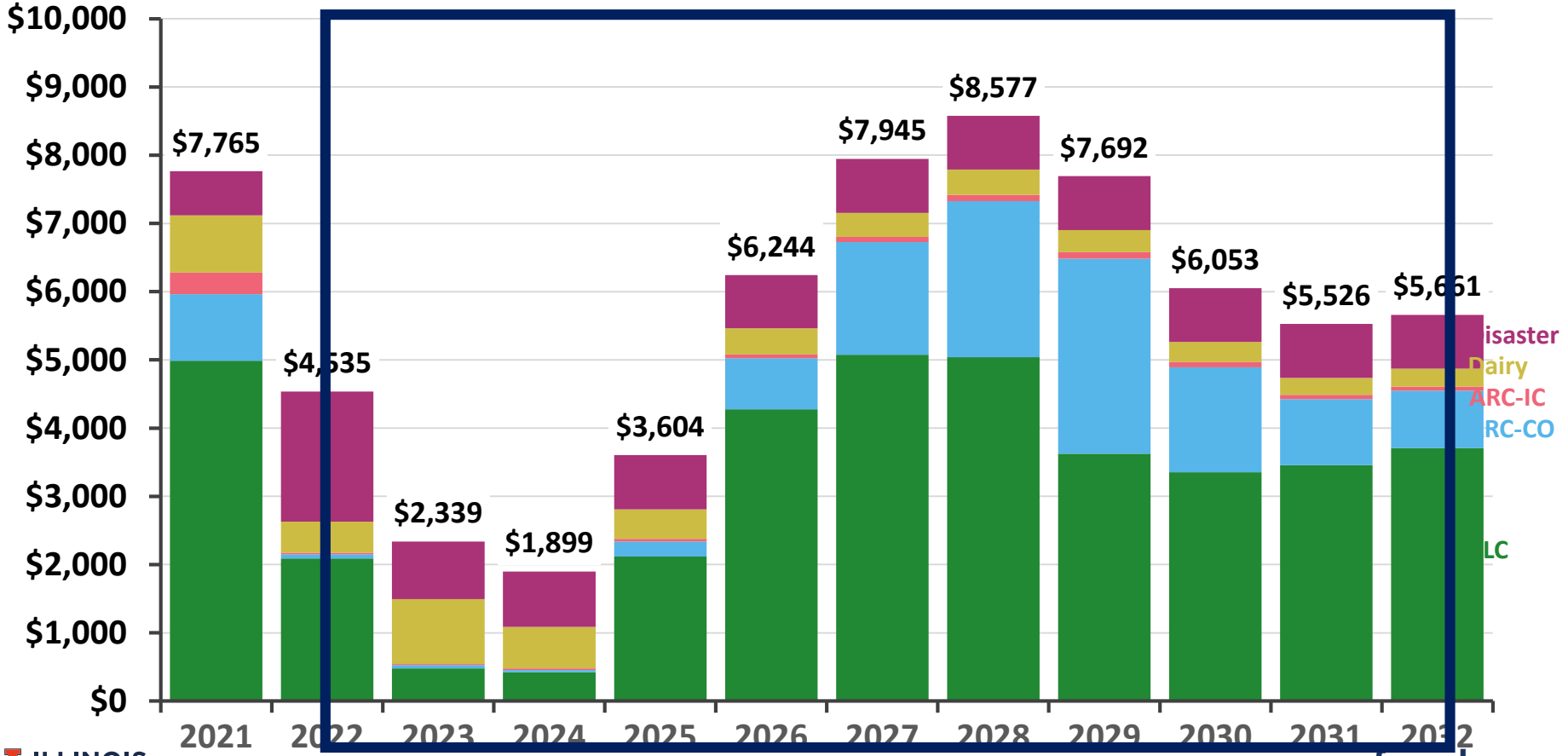


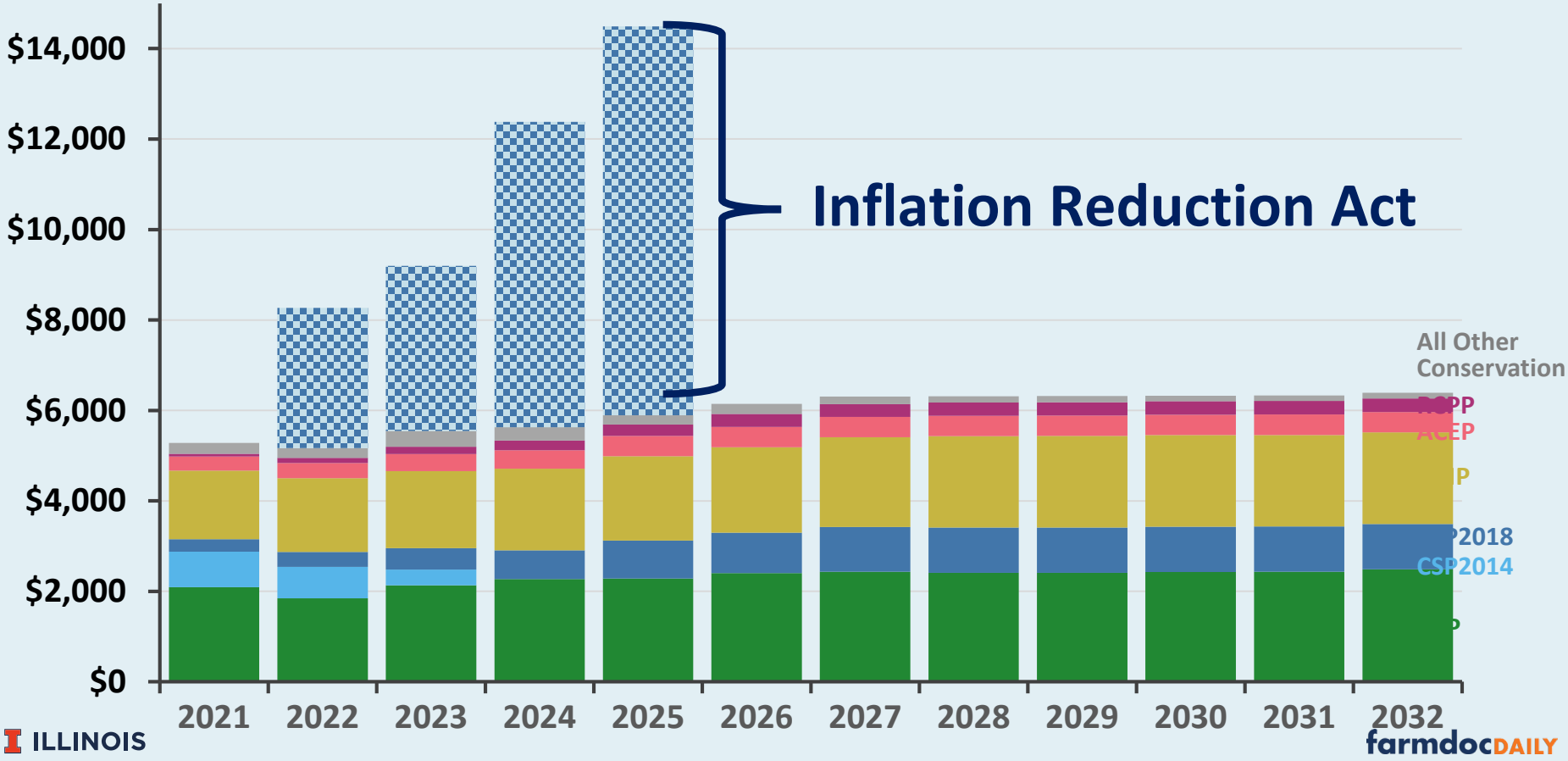
Figure 2. Commodities Programs Outlays by Fiscal Year in Million Dollars

Congressional Budget Office (CBO) May 2022

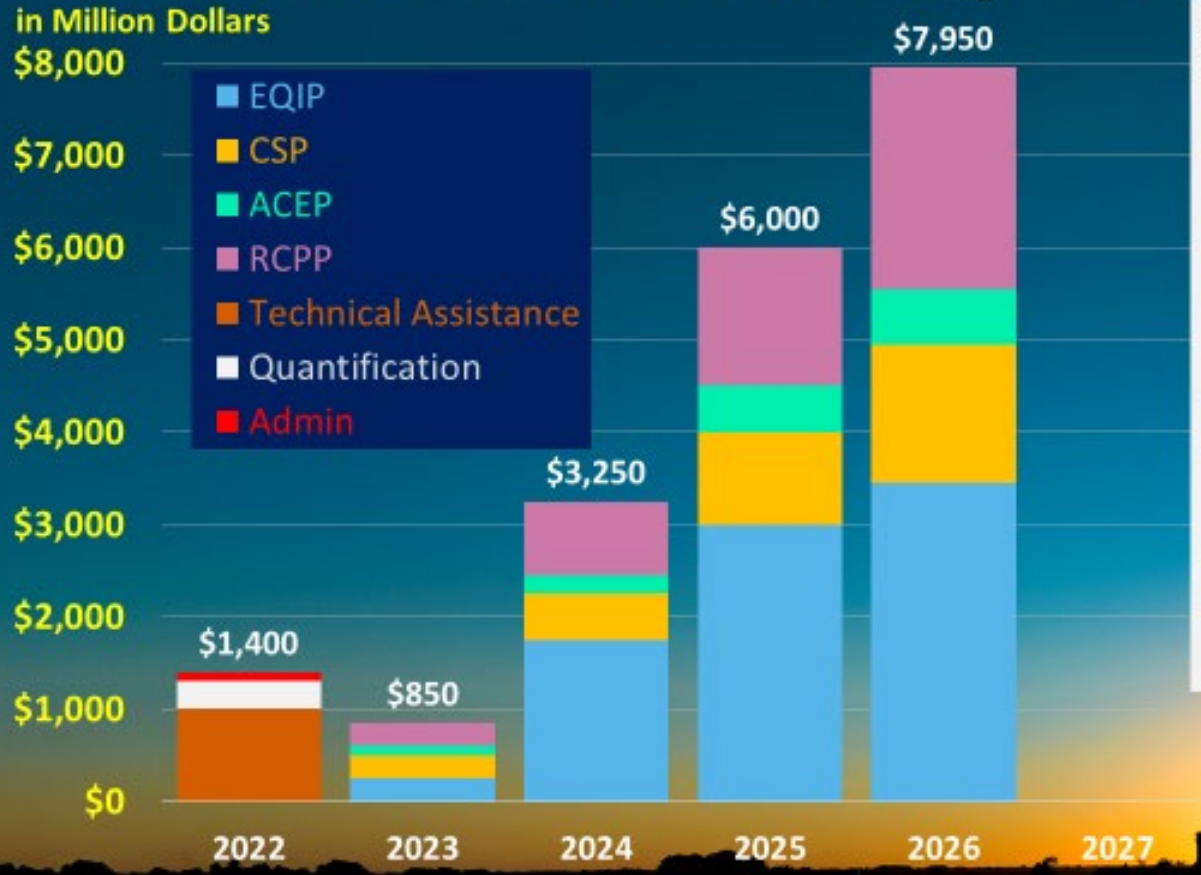


Conservation Program Outlays by Fiscal Year in Million Dollars

Congressional Budget Office (CBO) May 2022



Inflation Reduction Act: Agriculture



Authorization Extensions
from FY2023 to FY2031

16 U.S.C. §3839aa-2 and §3839aa-8
Environmental Quality Incentives Program (EQIP)

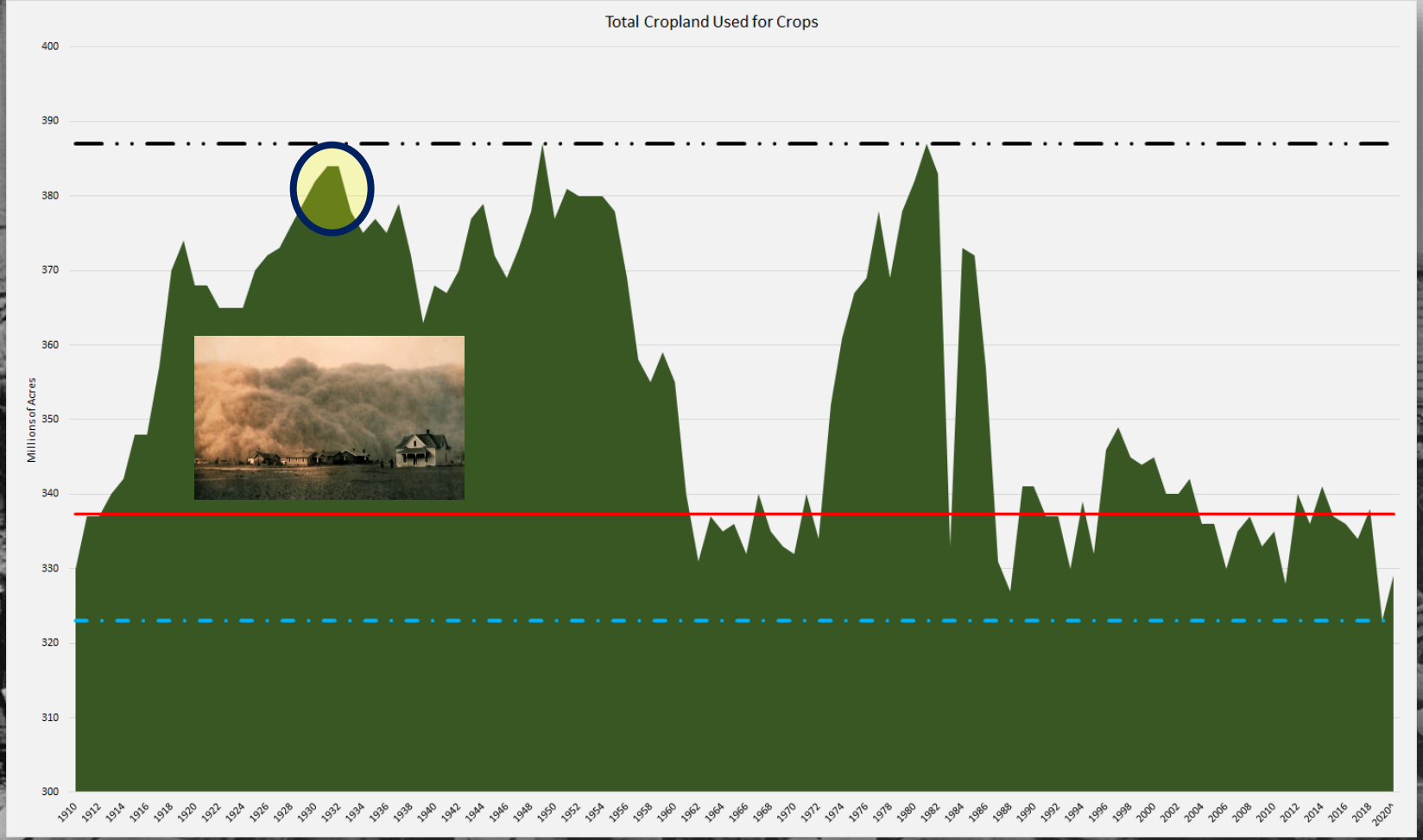
16 U.S.C. §3839aa-22 and §3839aa-24
Conservation Stewardship Program (CSP)

16 U.S.C. §3871d
Regional Conservation Partnership Program (RCPP)

16 U.S.C. §3841 and §3844
Facilities, Funding & Authorities of the Commodity Credit Corporation (CCC) for ALL Conservation Programs

Looking Back:

A Brief Review of Farm Bill History


Total Cropland Used for Crops
Millions of Acres
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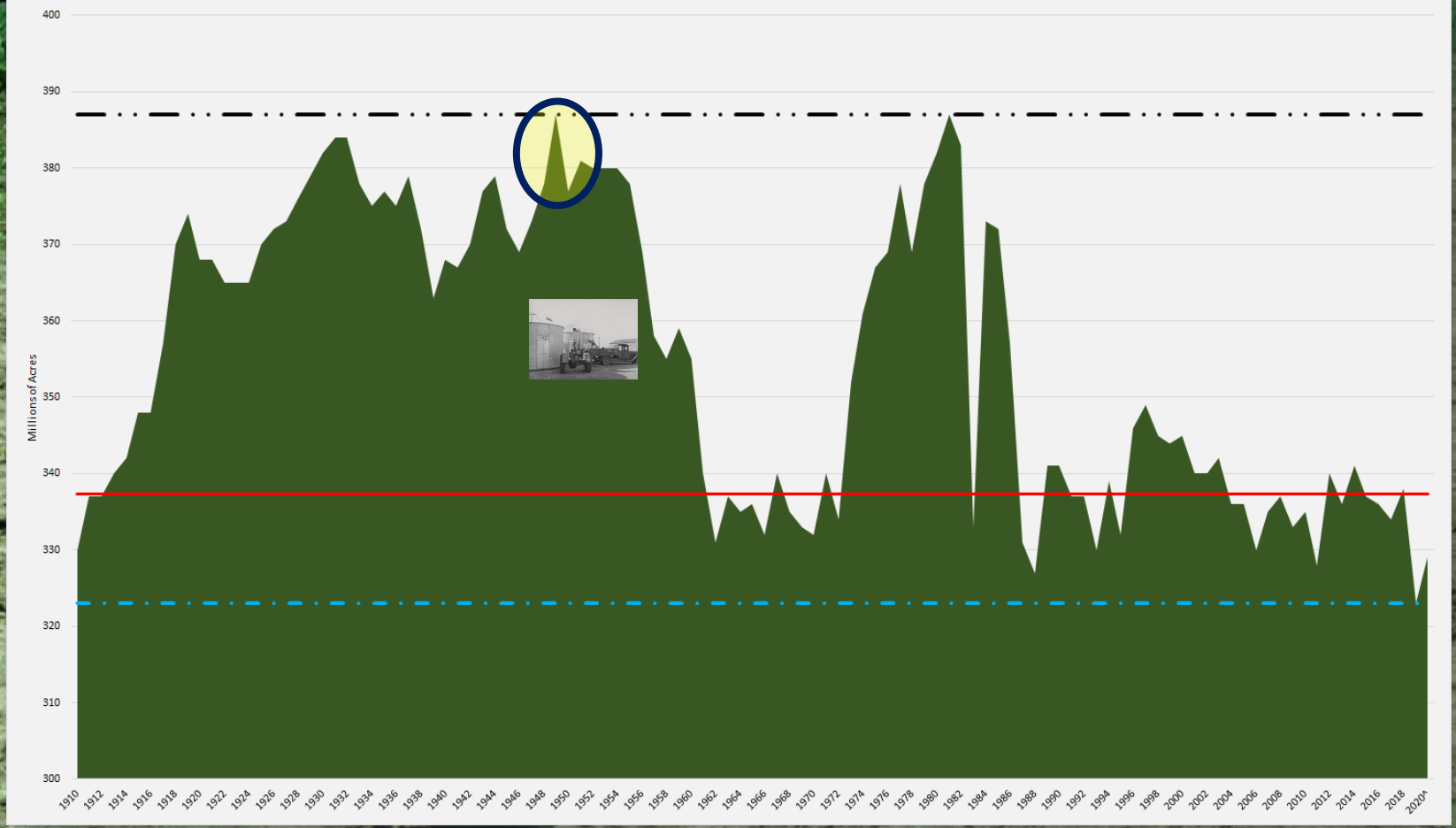
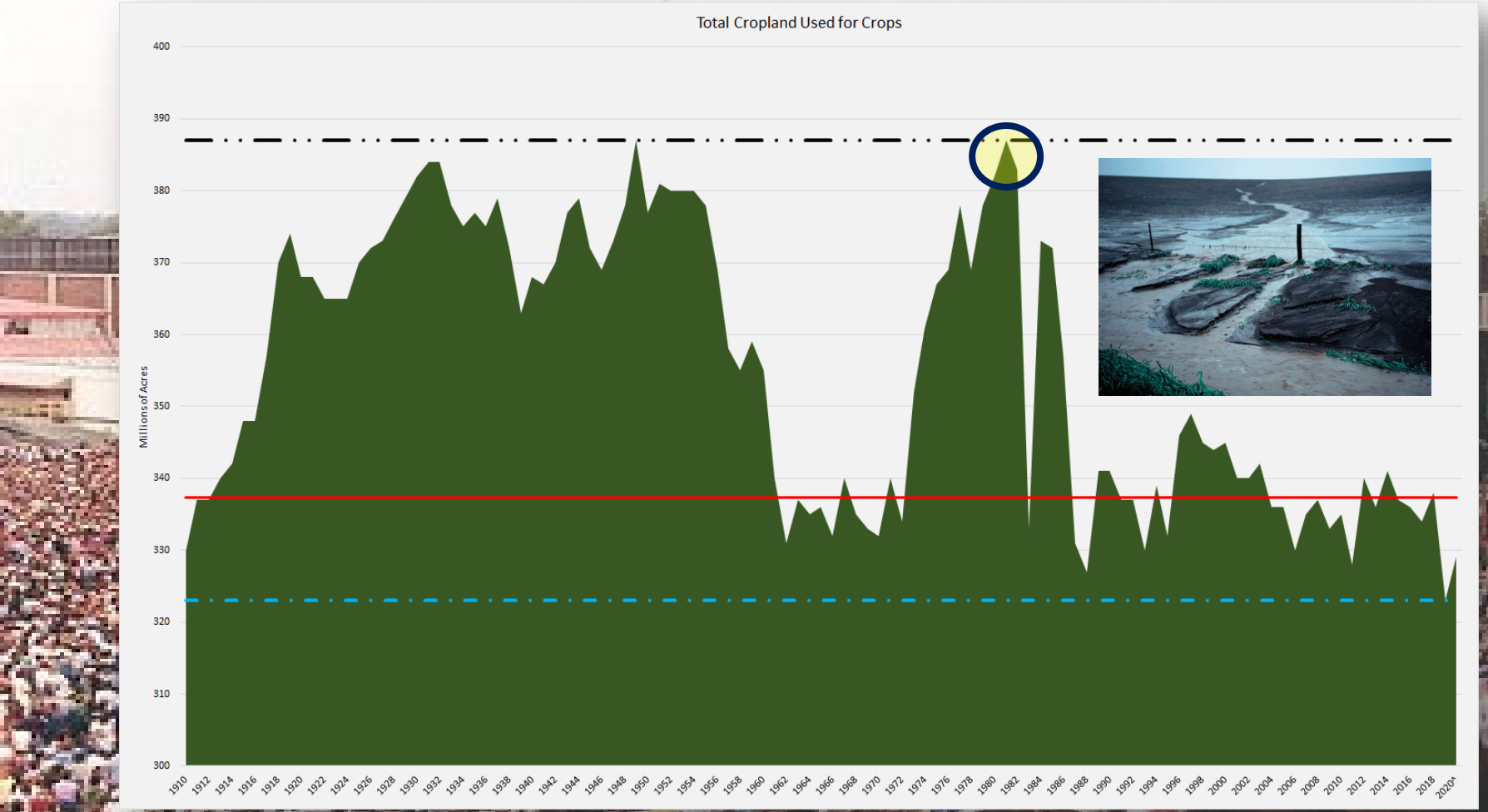
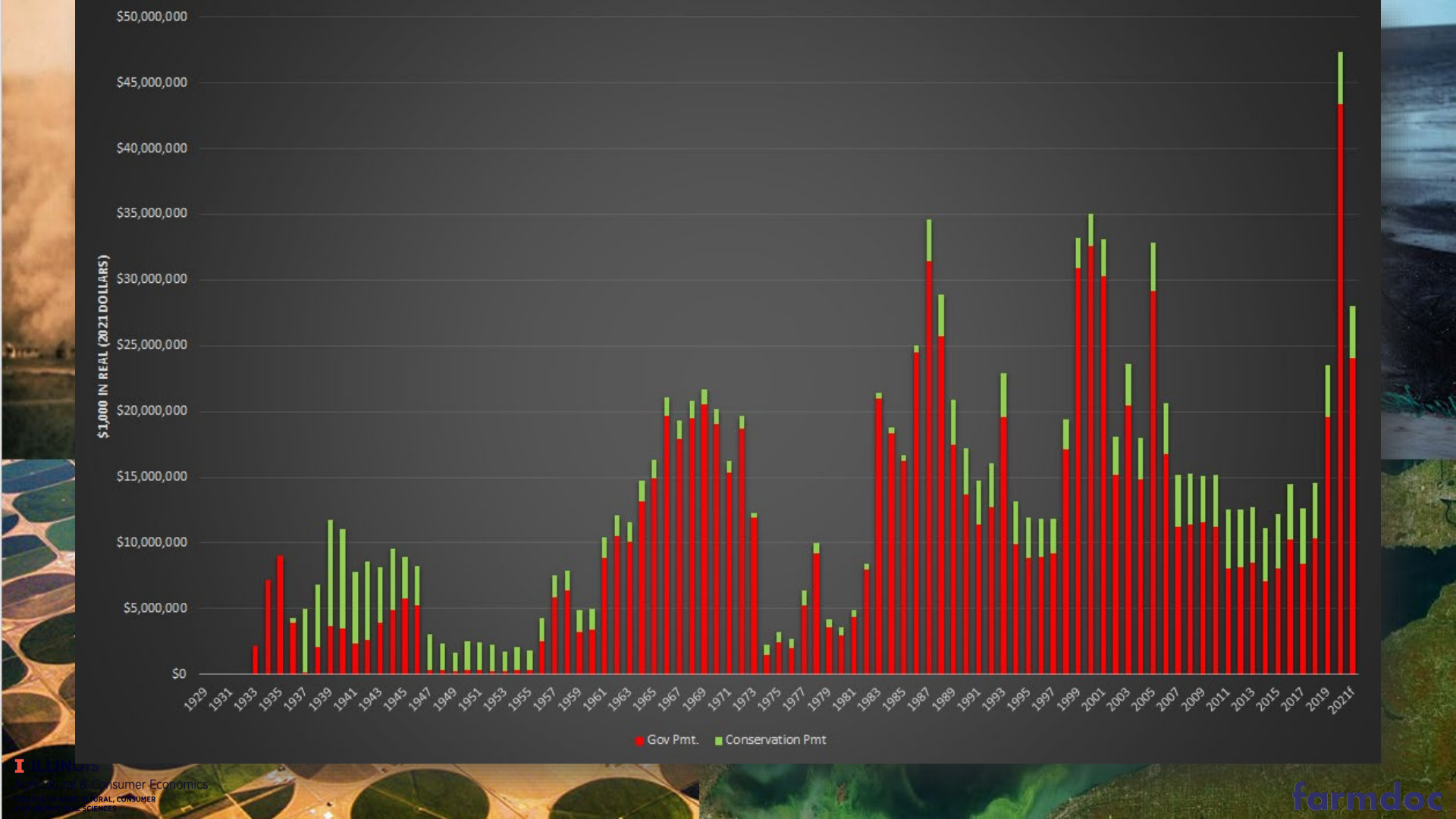
Total Cropland Used for Crops



Total Cropland Used for Crops

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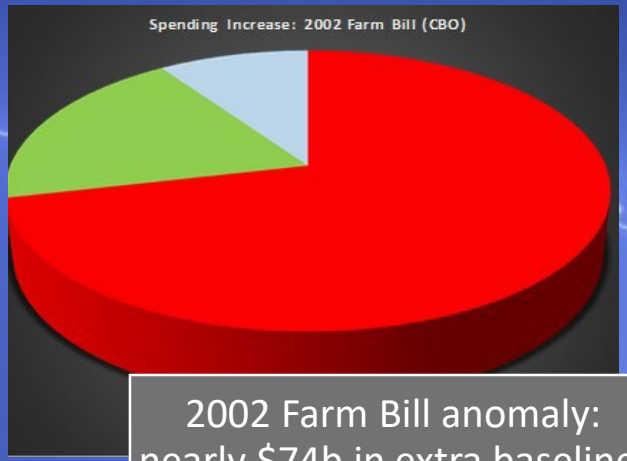
$45,000,000
$40,000,000
$35,000,000
$30,000,000
$25,000,000
$20,000,000
$15,000,000
$10,000,000
$5,000,000
$0
$1,000 IN REAL (2021 DOLLARS)
1929 1931 1933 1935 1937 1939 1941 1943 1945 1947 1949 1951 1953 1955 1957 1959 1961 1963 1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017 2019 2021f
Gov Pmt.
Conservation Pmt

2023 Farm Bill…?

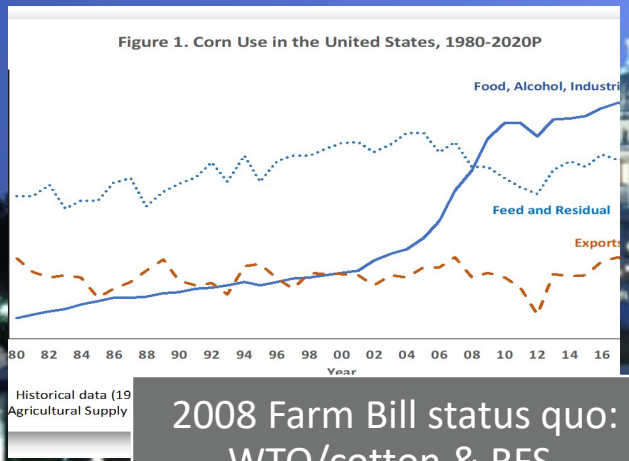
Portents & prognostications be damned.

Farm Bill:
Problems & Challenges.

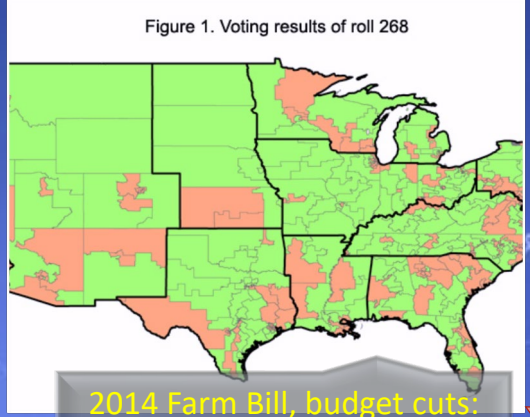
FAIR Act 1996: decoupling



2002 Farm Bill anomaly: nearly $74b in extra baseline.

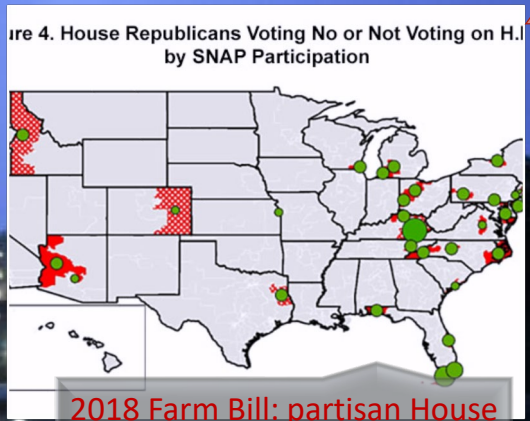


2008 Farm Bill status quo: WTO/cotton & RFS.



2014 Farm Bill, budget cuts: defeated on House floor over SNAP (2013).

2023 ????



2018 Farm Bill: partisan House fight over SNAP, another defeat on the floor.

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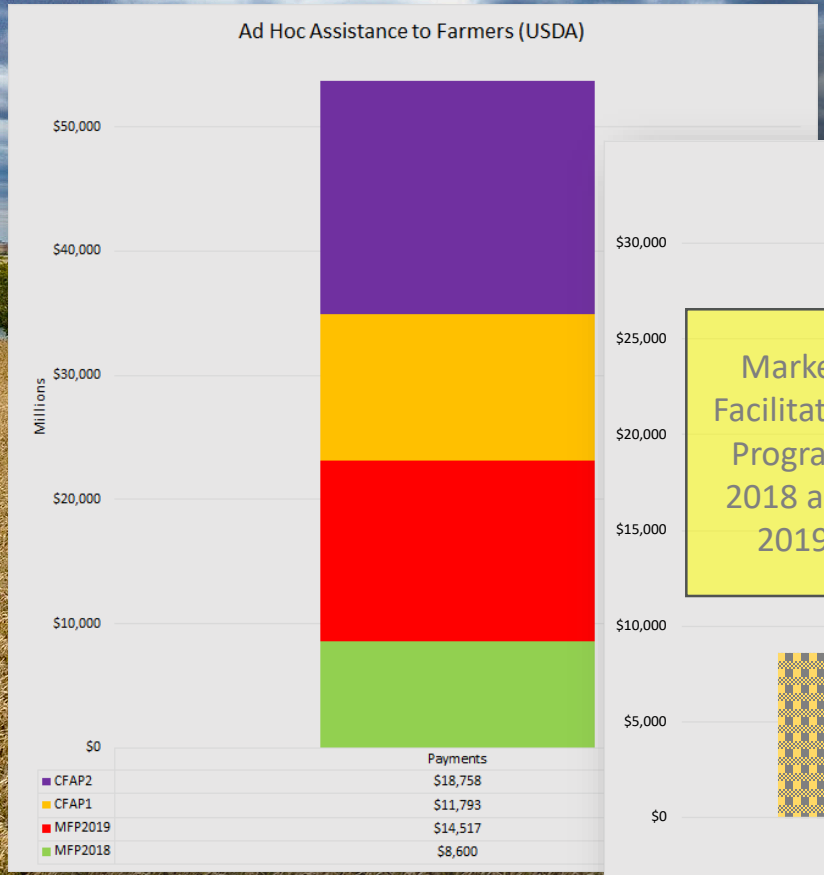
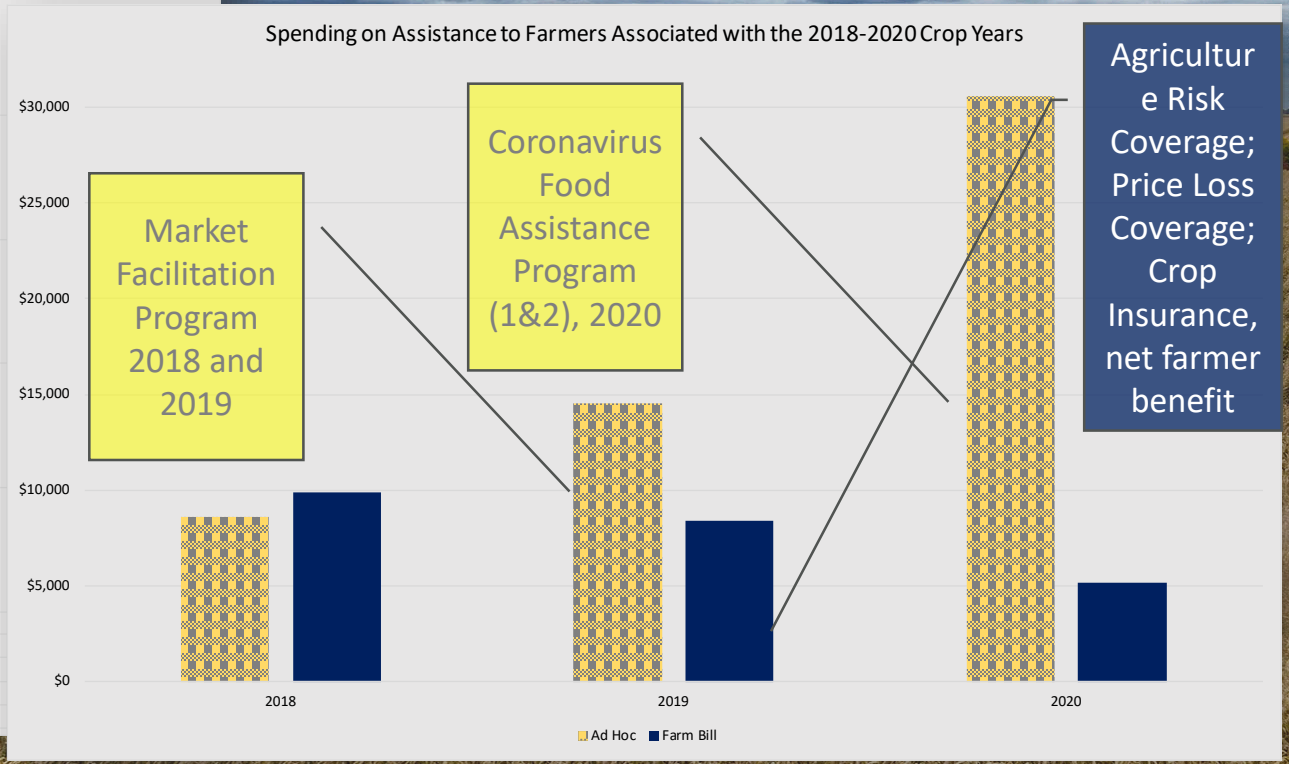
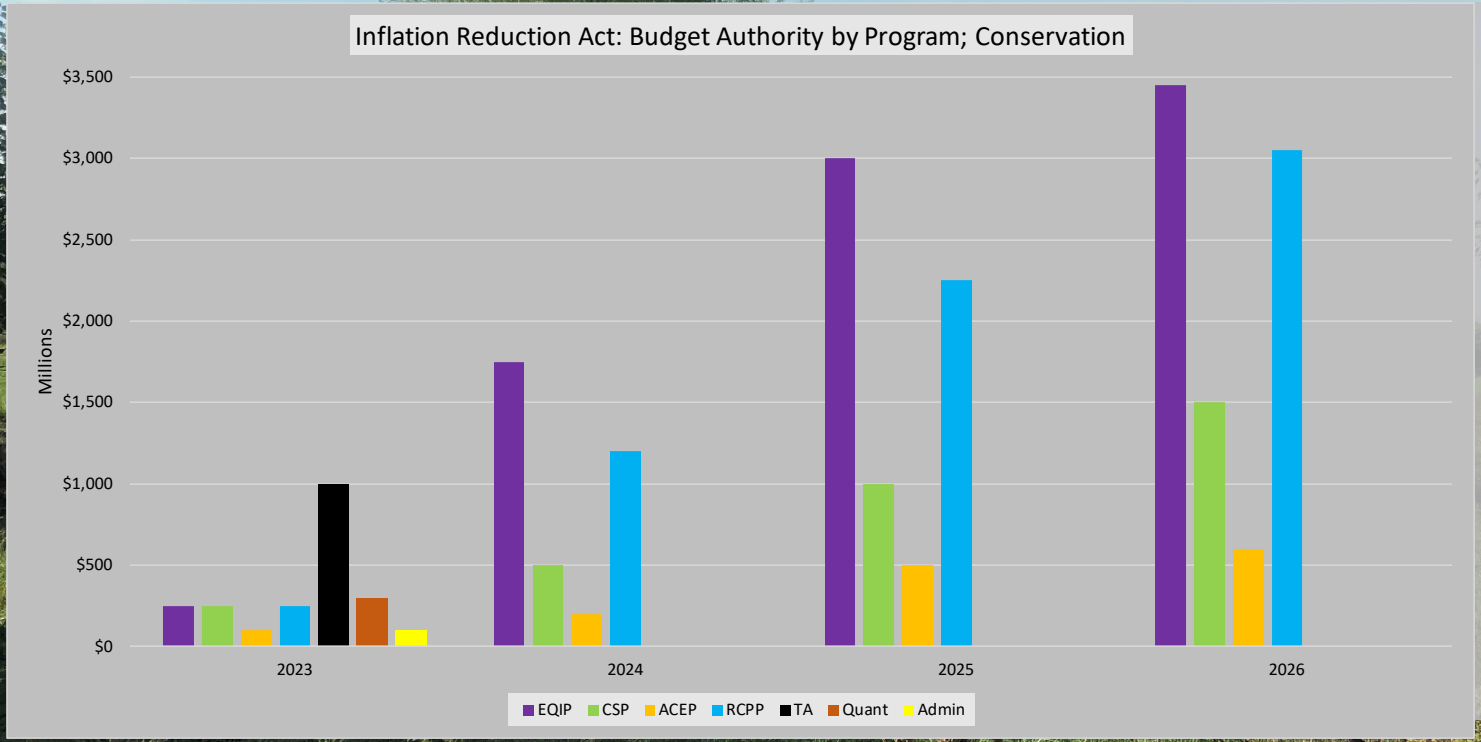
Unprecedented Payments.





Unprecedented Investment in Conservation & Climate



All of the conservation program spending in the IRA is for "**1 or more agricultural conservation practices or enhancements** that the Secretary determines directly improve soil carbon, reduce nitrogen losses, or reduce, capture, avoid, or sequester carbon dioxide, methane, or nitrous oxide emissions, associated with agricultural production"

Climate Change

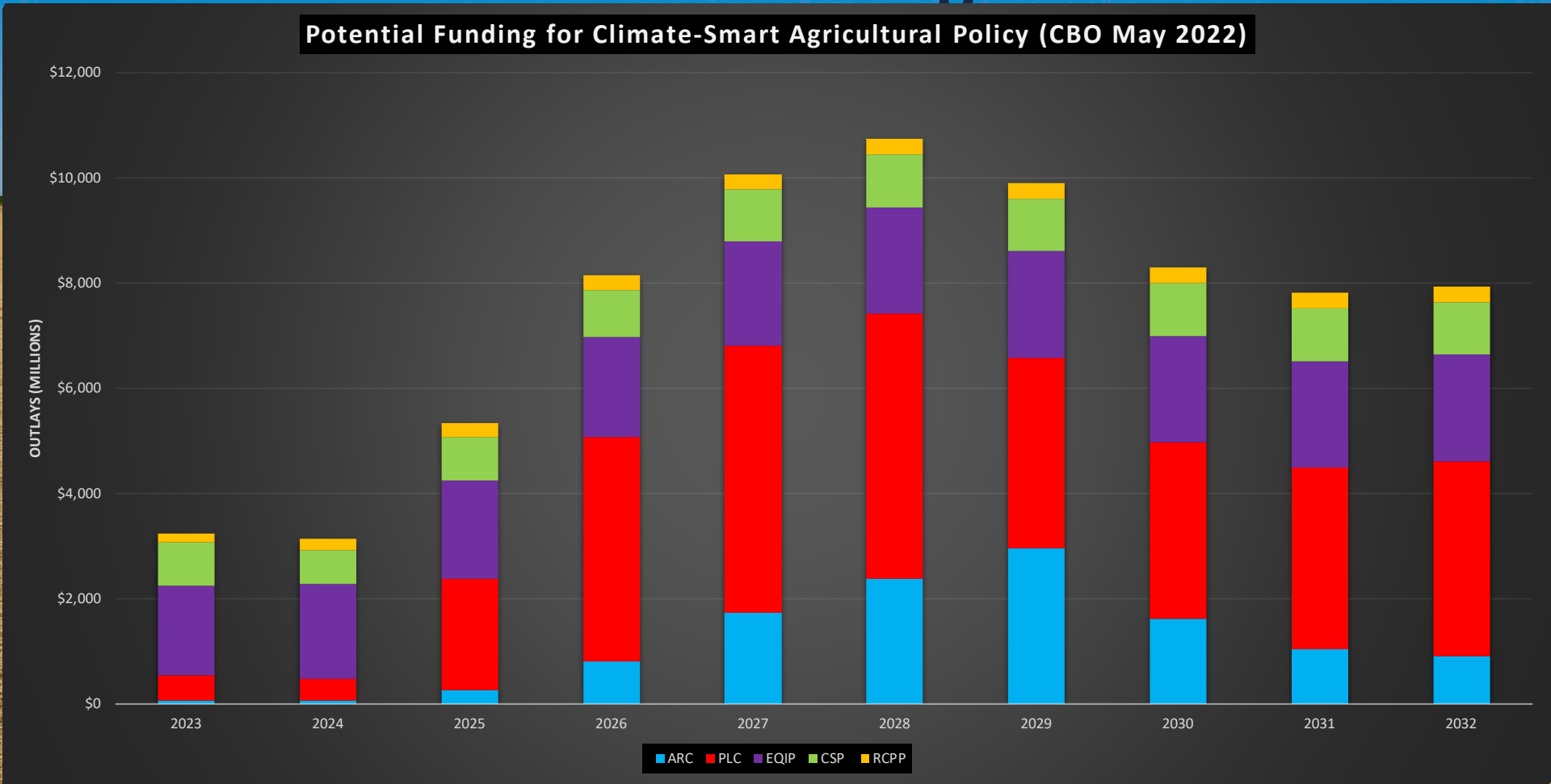
Markets & conflicts [China to Ukraine..]

Covid-19 pandemic & fallout

Political turbulence & worse.

https://canetalk.com/2009/10/1256906669.shtml

Food for Thought.



Thank you!

Questions?

Jonathan Coppess
University of Illinois
jwcoppes@Illinois.edu

Gardner Agriculture Policy Program

ILLINOIS

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Slaughtering Sacred Cows: Tech Fixes Won't Correct the Extractive Nature of US Agriculture

Silvia Secchi
Professor
Department of Geographical and Sustainability Sciences
University of Iowa
@ProfSecchi

Three ways to reduce pollution

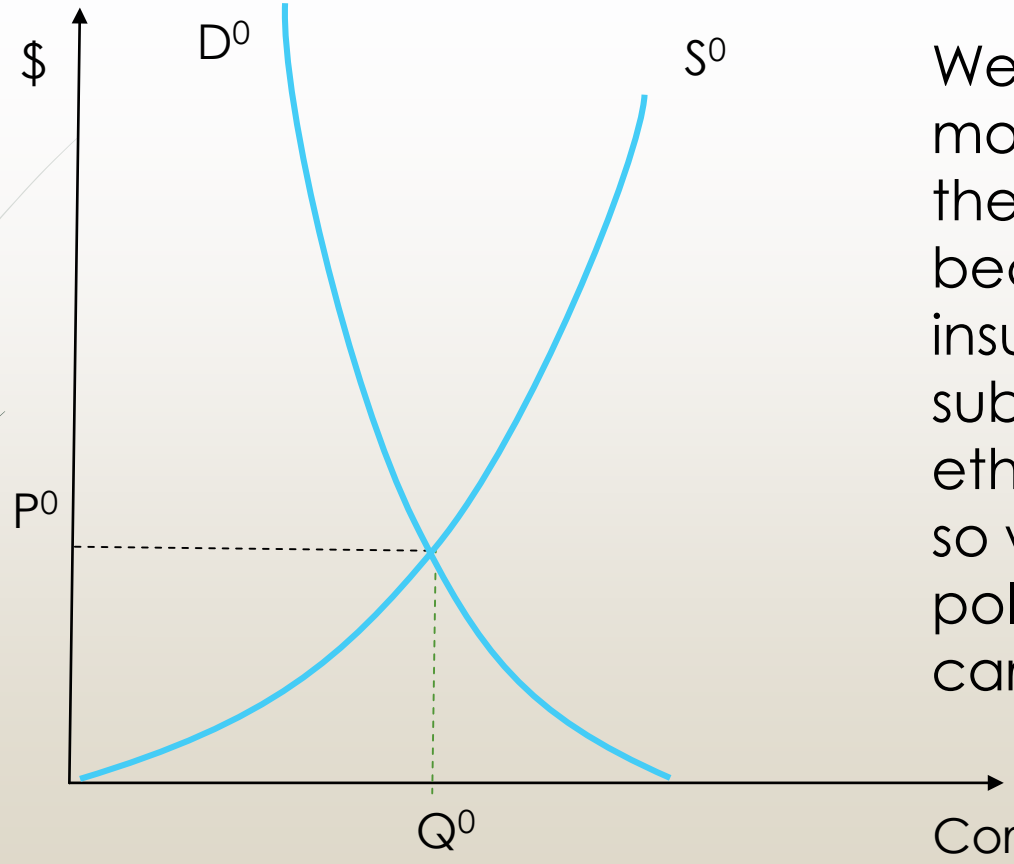
A. Reduce production of the good causing the pollution;

B. Change input mix to one less polluting;

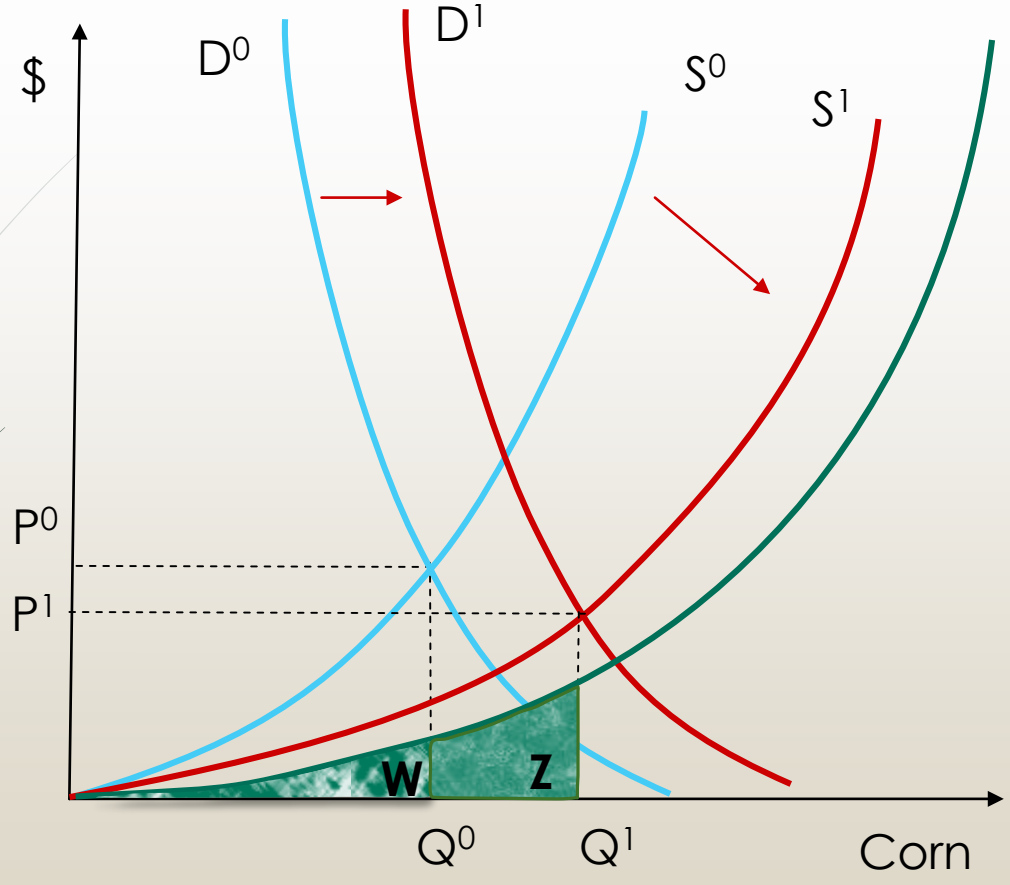
C. End of pipe treatment.

Three ways to reduce ag water pollution from P

A. Produce less of the crops (like corn) causing the pollution;
B. Use less fertilizer/slow release fertilizers/no fall applications;
C. Chemical treatment, grassed waterways, field borders.



We are producing more corn than the equilibrium because of the insurance subsidies & ethanol mandate, so we have MORE pollution to take care of.



The ethanol mandate increases demand

The crop insurance subsidies reduce the costs of production

Now consider the costs of pollution

Three ways to reduce ag water pollution from P

- Since A and many B options are not considered as large scale policies, we need to do more of B/C to address pollution than we would if we had all the options on the table.
- C and B options based on the voluntary approach.
- Unclear whether C options can be scaled up to address the problem.
- **The burden shifts to sectors that have already had to address their pollution.**

The voluntary approach problem

- Our current policy structure relies on farmers volunteering to reduce fertilizer rates, extend rotations, properly apply manure and so on.
- There is no balancing feedback loop between environmental conditions and the policy.

The accounting problem

- All changes in the agricultural system have to be accounted for – all other things are not remaining equal in agriculture.
- Counting BMPs number/acres of BMPs (worse: money spent) does not consider how they must offset impacts of livestock increases for example.

What matters are outcomes not (partial) inputs

Prepared for

IowaNREC.org
Agriculture. Science. Environment.

The Iowa Nutrient Research and Education Council
900 Des Moines Street
Des Moines, IA 50309

Quantification of Phosphorus Loss due to Structural Agricultural BMP Implementation

Final Report

Prepared by

Geosyntec consultants
engineers | scientists | innovators

920 SW Sixth Ave, Suite 600
Portland, OR 97204

Project Number PNW0443

Contacts:
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9 April 2021

Table 2
Iowa's contribution to TP export from the Mississippi River to the Gulf of Mexico.

Year	Iowa TP load (Mg)	Iowa mean TP Yield (kg/ha)	Miss. river water yield (mm)	Miss. river load (Mg)	Miss. river TP yield (kg/ha)	Iowa contribution to MR (%)
2000	7128	0.49	134	94,349	0.29	7.6%
2001	30,701	2.11	198	161,482	0.5	19.0%
2002	9232	0.63	211	166,925	0.52	5.5%
2003	10,744	0.74	195	136,080	0.42	7.9%
2004	29,065	1.99	231	158,760	0.49	18.3%
2005	9936	0.68	174	149,688	0.46	6.6%
2006	7576	0.52	137	73,483	0.23	10.3%
2007	51,211	3.51	180	175,997	0.55	29.1%
2008	72,182	4.95	255	212,285	0.66	34.0%
2009	19,415	1.33	256	150,595	0.47	12.9%
2010	50,929	3.49	226	195,048	0.61	26.1%
2011	19,015	1.30	243	157,853	0.49	12.0%
2012	5377	0.37	139	114,307	0.35	4.7%
2013	21,368	1.47	208	159,667	0.50	13.4%
2014	30,900	2.12	189	161,482	0.50	19.1%
2015	27,354	1.88	244	183,254	0.57	14.9%
2016	27,573	1.89	238	197,770	0.61	13.9%
2017	17,444	1.20	175	142,430	0.44	12.2%
Mean	24,842	1.70	202	155,081	0.48	14.9%

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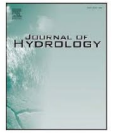


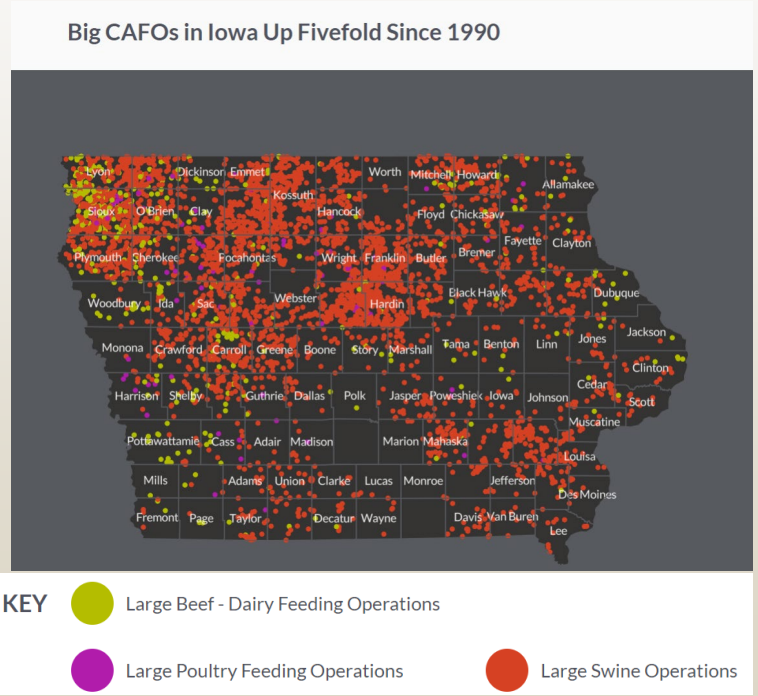
Research papers

Total phosphorus export from Iowa agricultural watersheds: Quantifying the scope and scale of a regional condition

Keith E. Schilling[a,*], Matthew T. Streeter[a], Anthony Seeman[b], Christopher S. Jones[c], Calvin F. Wolter[d]

The concentration problem

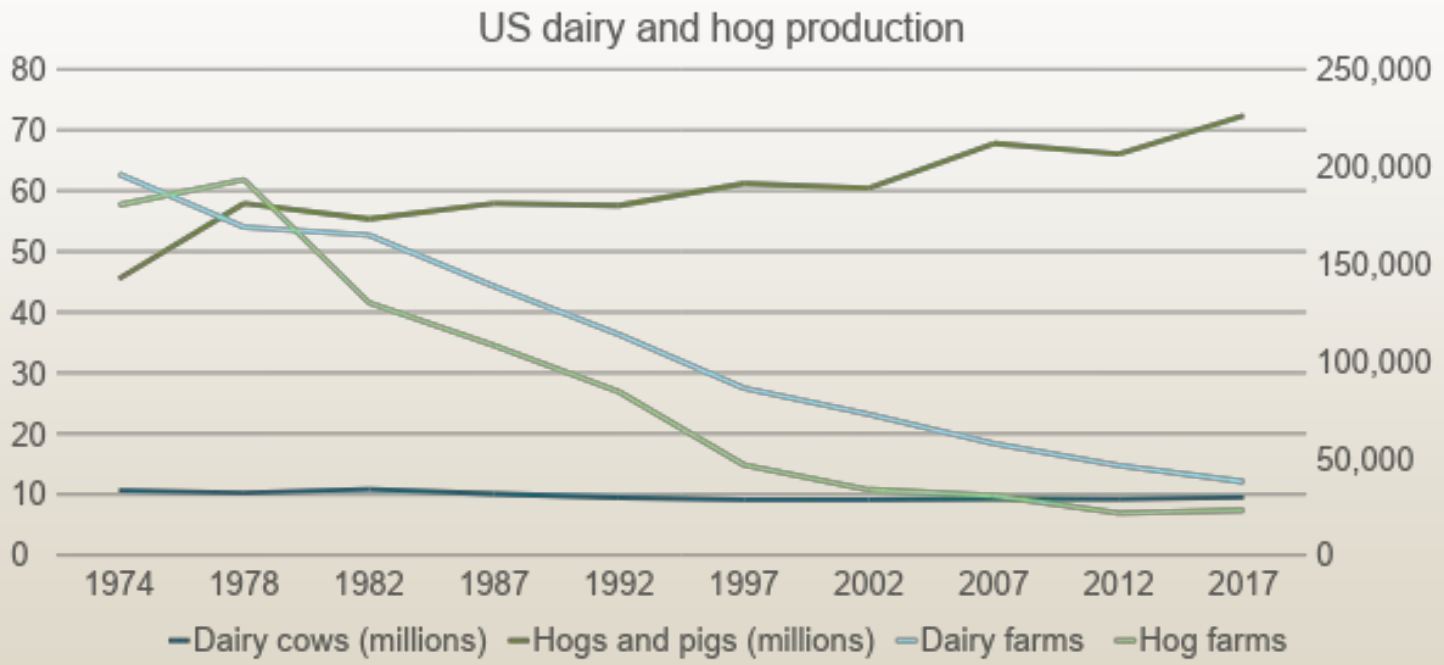
- The location and size of these operations means that manure is treated as a waste product not a substitute for commercial fertilizer.



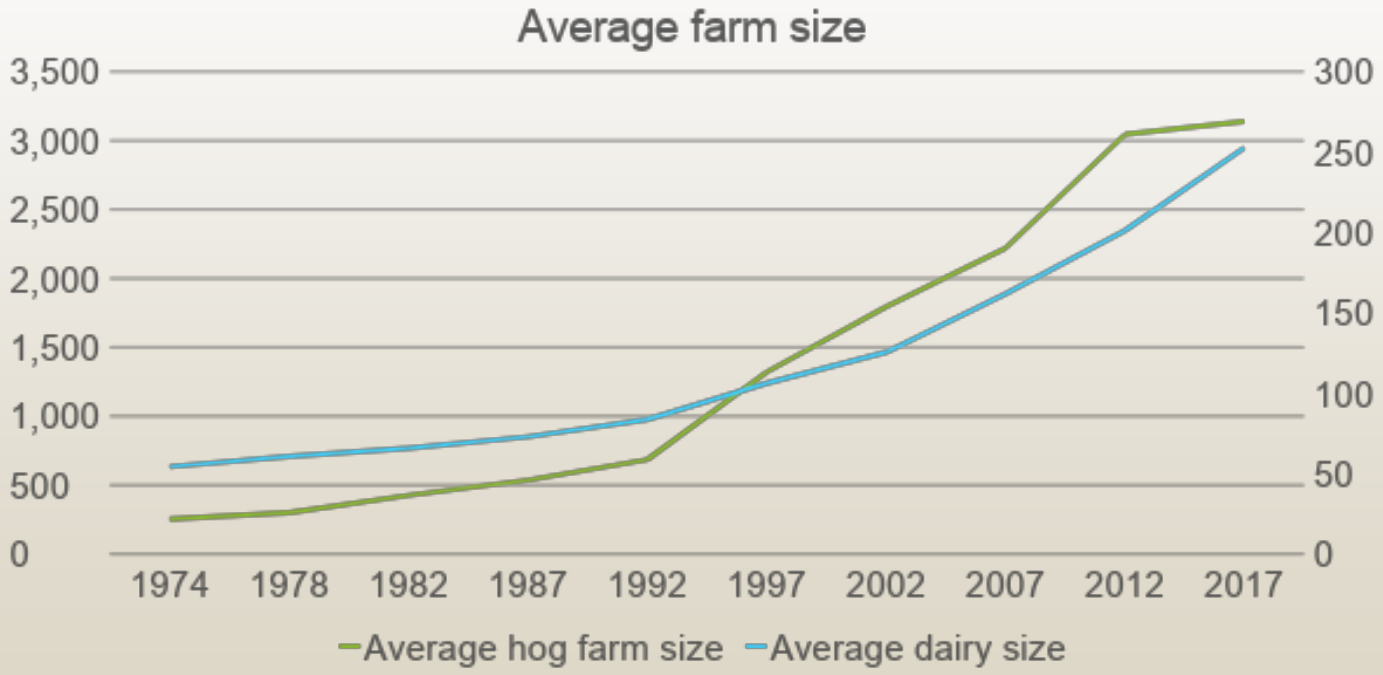
Iowa's hog industry form the ag census
Hogs and Pigs Herd Size by Inventory

Herd size	2017	2012	2007	2002	1997	1992	1987	1982	1978	1974
1 to 24	786	678	780	821	1,258	2,436	3,530		6,700	7,861
25 to 49	139	144	245	297	730	1,802		4,761	5,268	6,165
50 to 99	135	160	340	432	1,172	3,055	6,780	4,513	8,867	10,703
100 to 199	151	197	529	733	2,040	5,145	6,766	7,544	13,339	14,676
200 to 499	372	588	1,318	1,999	4,653	9,952	11,269	13,627	17,051	15,461
500 to 999	429	684	1,171	2,047	3,635	6,074	5,768	8,887	5,952	4,716
1,000 to 1,999	723	980	1,273	1,940	2,223	2,537	2,557	6,082	1,598	
2,000 to 4,999	1,794	1,795	1,866	1,449	1,224	692			329	
5,000 or more	1,131	1,040	808	487	308	97			30	
Total #	5,660	6,266	8,330	10,205	17,243	31,790	36,670	45,414	59,134	59,582
Million hogs	22.7	20.5	19.3	15.5	14.5	14.2	13.0	14.3	14.7	11.5

The concentration problem



The concentration problem



The efficiency argument

- The efficiency argument ignores the environmental costs, which are many, encompass different geographies, are location-specific and very hard to quantify.
- The US agricultural system has constantly ignored environmental costs and conservation programs have always been ancillary to production considerations.
- Further farm consolidation predicated on “efficiency” will create more social and environmental problems.

It's not just P!

- Solutions to the P (and N) problem have to also consider GHG emissions.
- At the same time, tech fixes such as biodigesters that allegedly reduce GHG emissions do not necessarily address nutrient pollution.
- Addressing agricultural pollution requires systemic changes not piecemeal tech-based non-scalable solutions paid for by taxpayers.

Conservation policy BMPs

- Conservation policy should not be ancillary to other policy goals.
- Counting practices is inferior to edge-of-field impacts which is inferior to watershed level analysis.
- Conservation policy must include consideration of livestock.

Conservation policy BMPs

- The costs and scalability of the programs should be considered:
  - In a voluntary setting that means considering how likely it is the BMPs will be adopted by large number of farmers;
  - There is no analysis of this kind in our current approach.

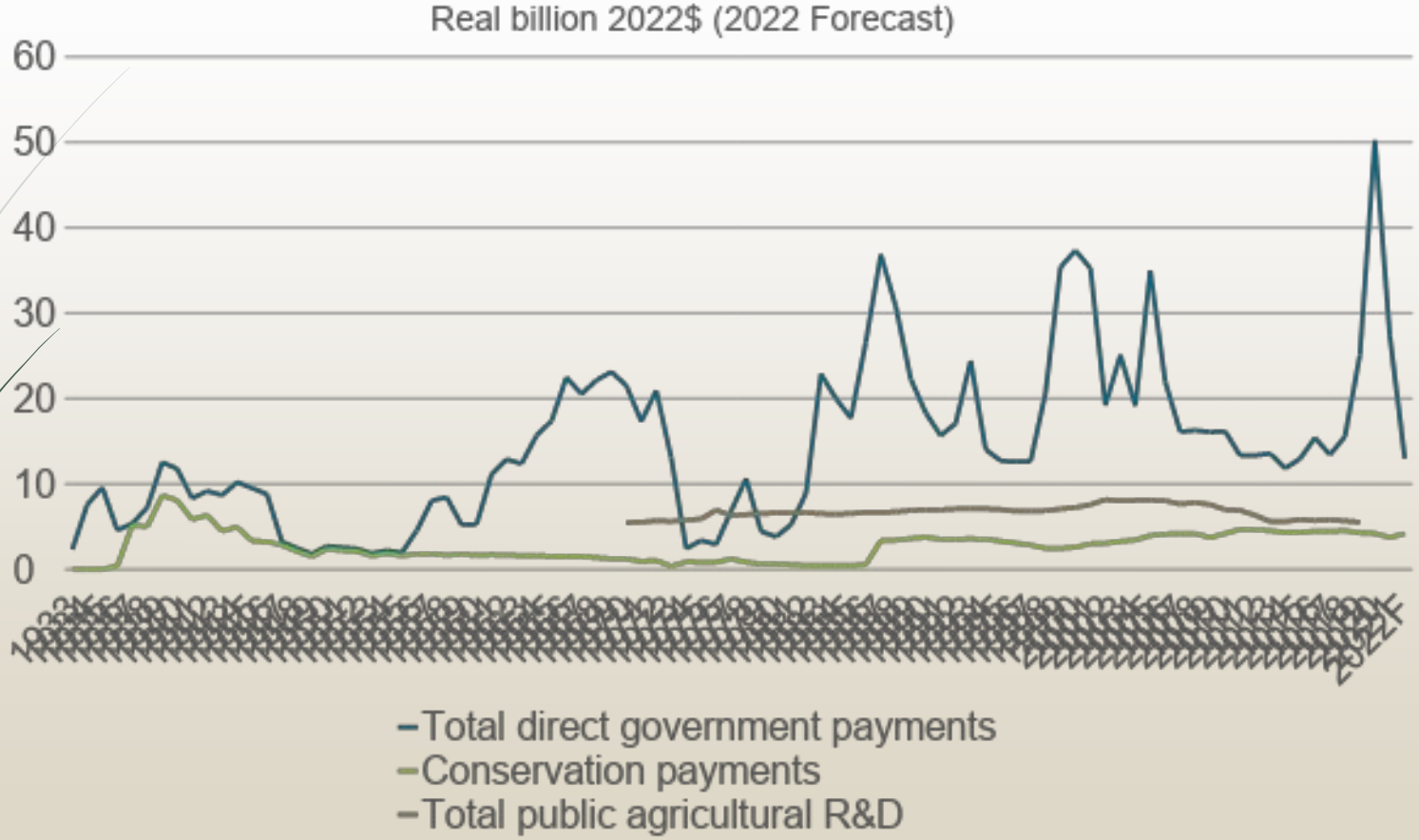
Conservation policy BMPs

- Spending money on treatment technologies to reduce emissions is generally less cost-effective than reducing (direct or indirect) subsidies for activities that cause the emissions to occur in the first place.
- We should not spend public money on activities that provide private benefits – beware of initiatives to fund upgrades in tile drainage for example.

Final thoughts

- We have artificially restricted the policy options on the table.
- Farm consolidation is a social and environmental problem of our own making.
- Livestock production is key to addressing the sustainability of US agriculture.

Federal Government direct farm program payments 1933-2022



Agenda

Time (ET)	Session	Presenter(s)
07:00 – 08:00	Registration	
8:00 – 8:15	Welcome	Jim Elser, Sustainable Phosphorus Alliance
8:15 – 9:15	Farm Bill Food for Thought: Looking Ahead to 2023 Reauthorization	Jonathan Coppess, University of Illinois, Urbana-Champaign
9:15 – 10:00	Keynote Panel– Are We Protecting Our Waters?	Dan Egan, Milwaukee Journal Sentinel JoAnn Burkholder, NC State University Laura Johnson, National Center for Water Quality Research at Heidelberg University Jim Elser, Sustainable Phosphorus Alliance
10:00 – 10:30	Coffee and Networking	
10:30 – 11:00	Slaughtering Sacred Cows: Tech Fixes Won't Correct the Extractive Nature of US Agriculture	Silvia Secchi, University of Iowa
11:00 – 11:30	Not Slaughtering Sacred Cows: The Promise of Cellular Foods	Lejjy Gafour, CULT Food Science
11:30 – 12:30	Lunch	

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VEVOLUTION
United Kingdom

CELL AG TECH
Toronto, Ontario

JELLATECH
Redwood City, California

COMPOUND
California

More than 80% of land use change and loss of biodiversity are said to be caused by system of agriculture.

Agriculture and food production may be responsible for up to a third of the effects of climate change.

https://pubmed.ncbi.nlm.nih.gov/33154139/

- **Producing 2.2 lb of beef requires, on average, 55 lb. of feed**
- **Pork uses 13 lb.–15 lb. of feed per 2.2 lb.**
- **Poultry 6.1 lb.**

https://ourworldindata.org/grapher/feed-required-to-produce-one-kilogram-of-meat-or-dairy-product

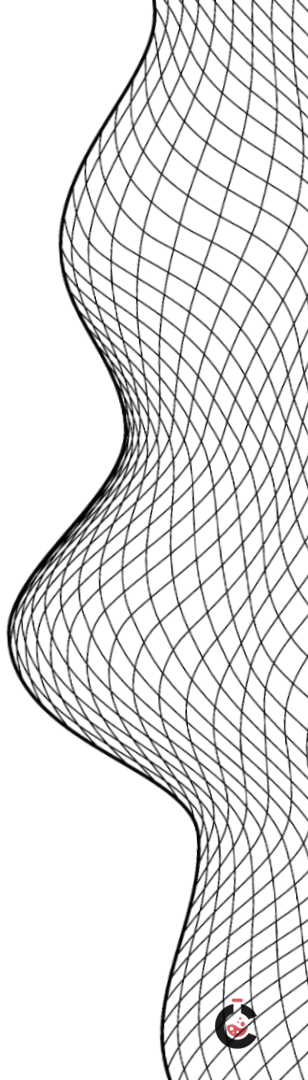
- Recycle of unused nutrients in the process
- Estimates show lower land area requirements
- With a likely reduced need for land, there is reduced use of fertilizer

https://cedelft.eu/wp-content/uploads/sites/2/2021/04/CE_Delft_190107_LCA_of_cultivated_meat_Def.pdf

Depending on how inputs are handled, it decouples agricultural practices from the land and water and forces it into a controlled system by design.

https://cedelft.eu/wp-content/uploads/sites/2/2021/04/CE_Delft_190107_LCA_of_cultivated_meat_Def.pdf

Is it easy? No.



FROM THE

Impossible

TO THE

Inevitable