The Economics of Preventing and Mitigating Harmful Algal Blooms (HABs): Insights from Lake Erie and the Mississippi River Basin

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Landscape to Lake: A look at farming in the context of healthy watersheds

Lodi, NY March 23, 2023

Dyson
Cornell
SC Johnson College of Business

Cornell CALS
College of Agriculture and Life Sciences

Research & Extension Program Themes

- **Theme I: Agriculture & the Environment; Grower Decision Making**
- **Theme II: Land Value, Land Ownership, Land Tenure, Land Use**
- **Theme III: Chinese Agriculture & its Global Trade Implications**
- Other Useful information:

  Appointment: 50% Research & 50% Extension

  Joined Cornell Dyson School & Cornell Cooperative Extension in July 2022

  Faculty Affiliate, Cornell Institute for China Economic Research (CICER)

  Faculty Fellow, Cornell Atkinson Center for a Sustainable Future

  Led Iowa land value survey; co-founded the ISU China Ag Center

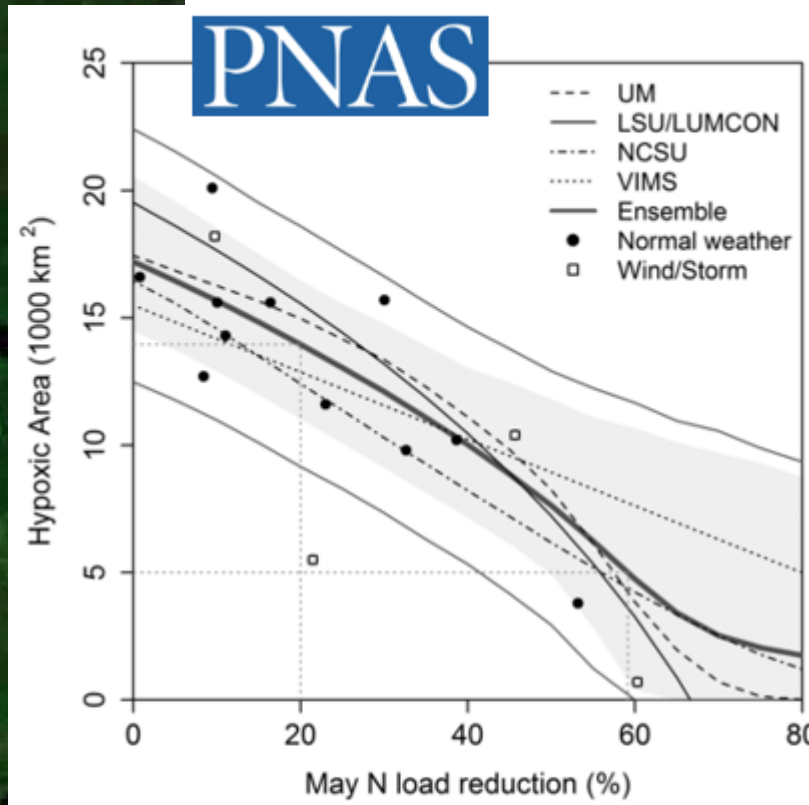
  New Projects in New York State

  - Ag & Solar; Agrivoltaics (joint with David Kay and Rich Stedman)
  - Floodplain paddy rice farming (joint with Jenny Kao-Kniffin and Susan McCouch)
  - Carbon credits for dairy farmers (joint with Chris Wolf)
  - US Northeast Land Value & Rent Trends (joint with ASFMRA Northeast Chapter)

Cities

Farms

[The Dead Zone https://youtu.be/a8ae2vq45eA](https://youtu.be/a8ae2vq45eA)



Ensemble modeling informs hypoxia management in the northern Gulf of Mexico

Donald Scavia, Isabella Bertani, Daniel R. Obenour, R. Eugene Turner, David R. Forrest, and Alexey Katin

PNAS first published July 31, 2017 https://doi.org/10.1073/pnas.1705293114

Nutrient reduction target for Western Lake Erie Basin

2016 Great Lakes Water Quality Agreement Protocol, Annex 4 **Spring** (March-July) Targets

Baseline Load Year: 2008	Maumee Watershed	Western Lake Erie
Dissolved Reactive P (**DRP**)	186 MT	**40% less**
Total P (**TP**)	860 MT	**40% less**

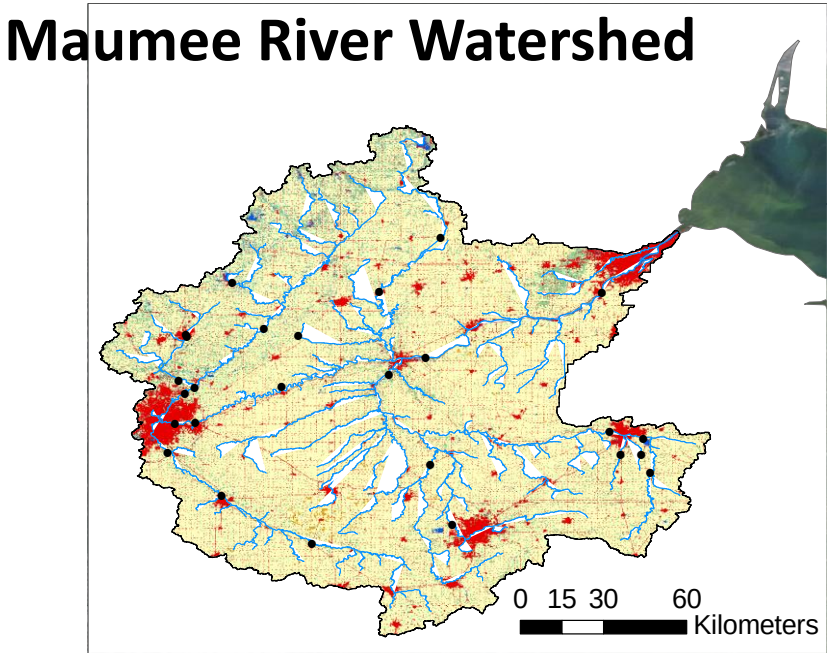


Figure 1. Map of the Maumee River watershed highlighting the per-acre phosphorus loading across subbasins.

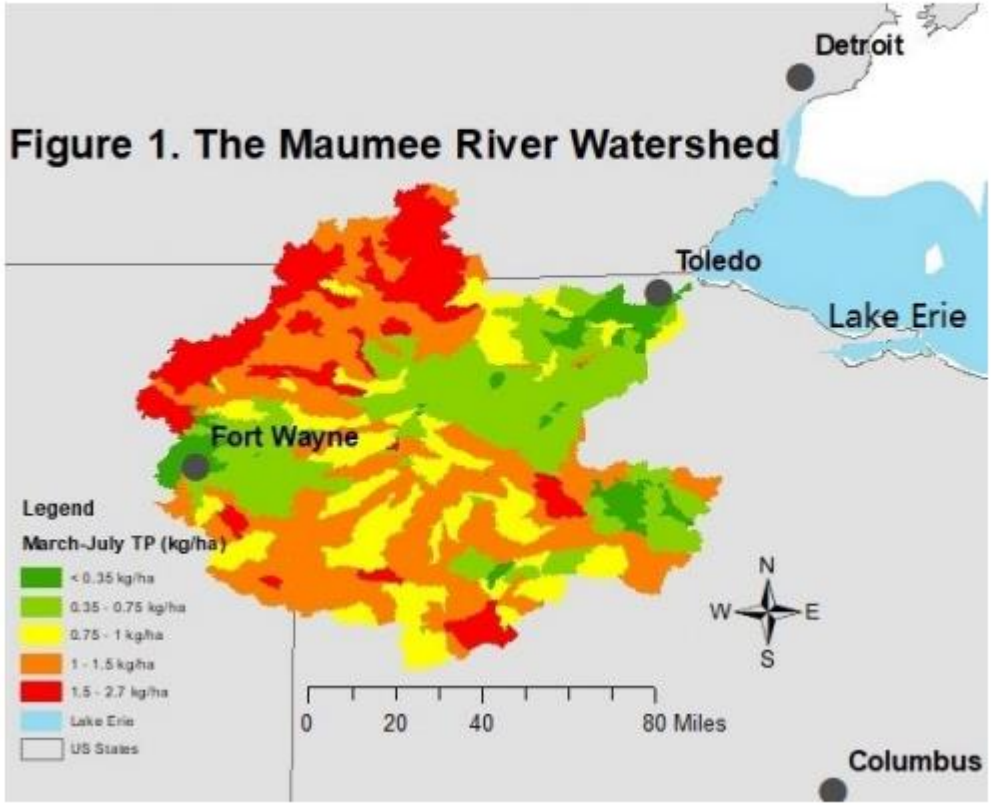
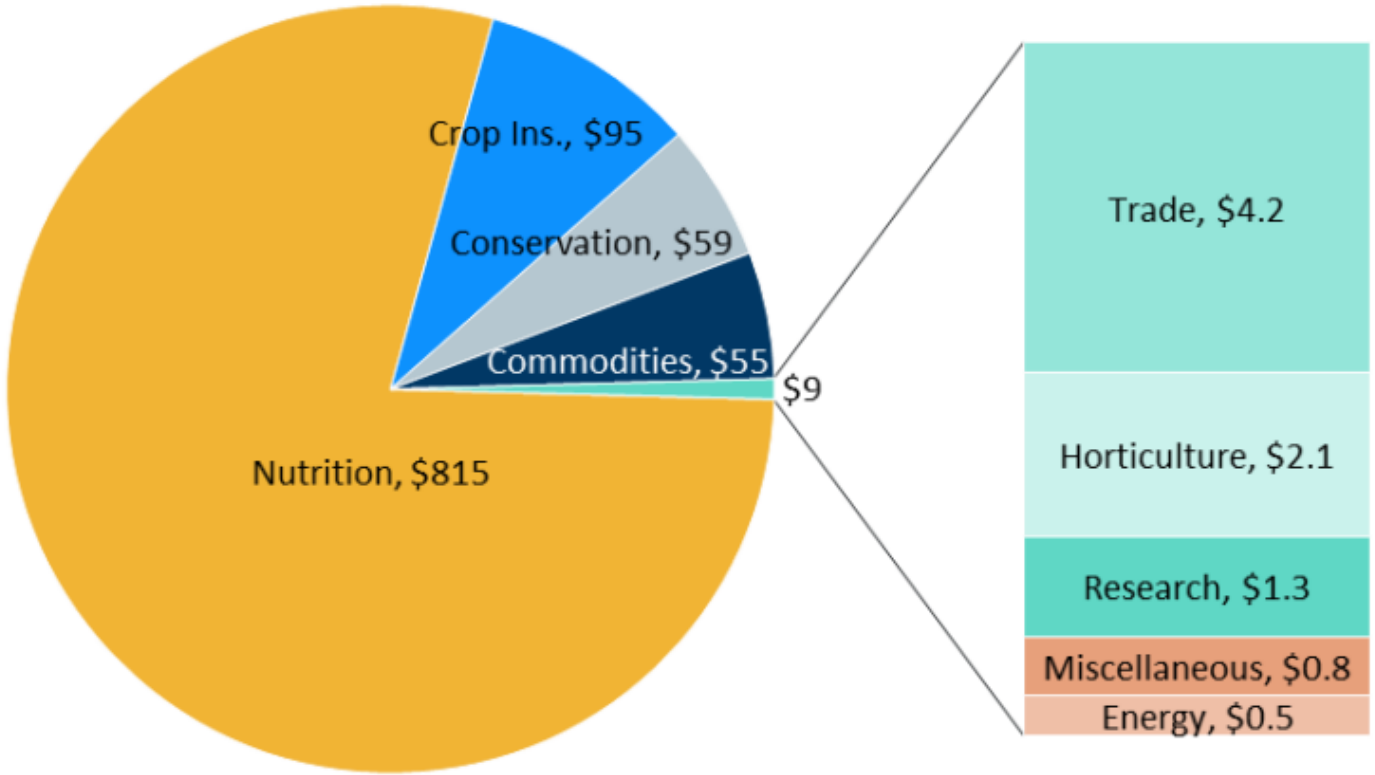


Figure 2. Baseline for Farm Bill Programs, by Title

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

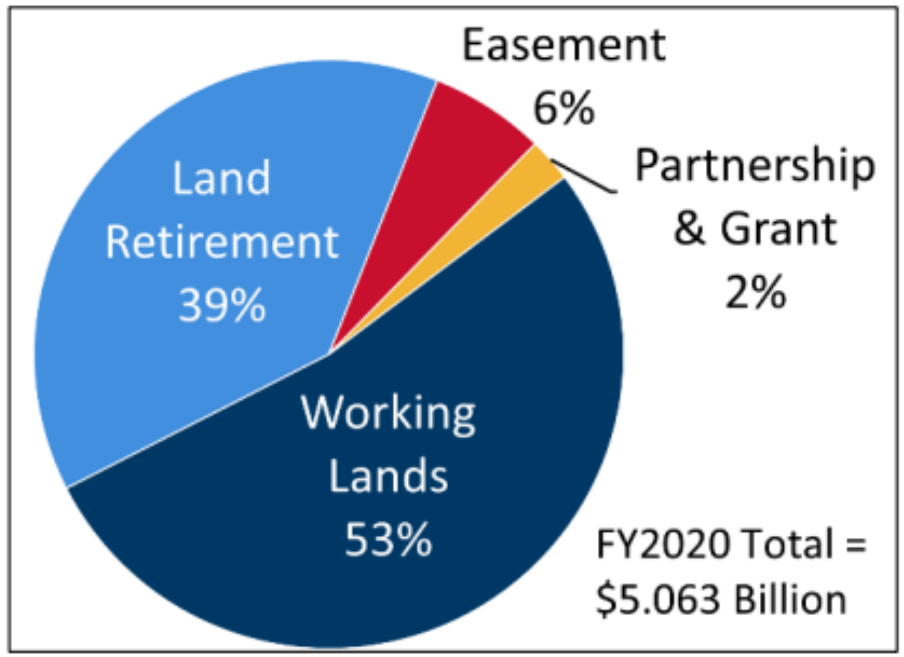


Source: Created by CRS using CBO, "Details About Baseline Projections for Selected Programs," July 2021 baselines (for the commodities, conservation, trade, nutrition, and crop insurance titles); and CRS Report R45425, *Budget Issues That Shaped the 2018 Farm Bill*; and amounts indicated in law for programs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

Figure 5. FY2020 Conservation Outlays

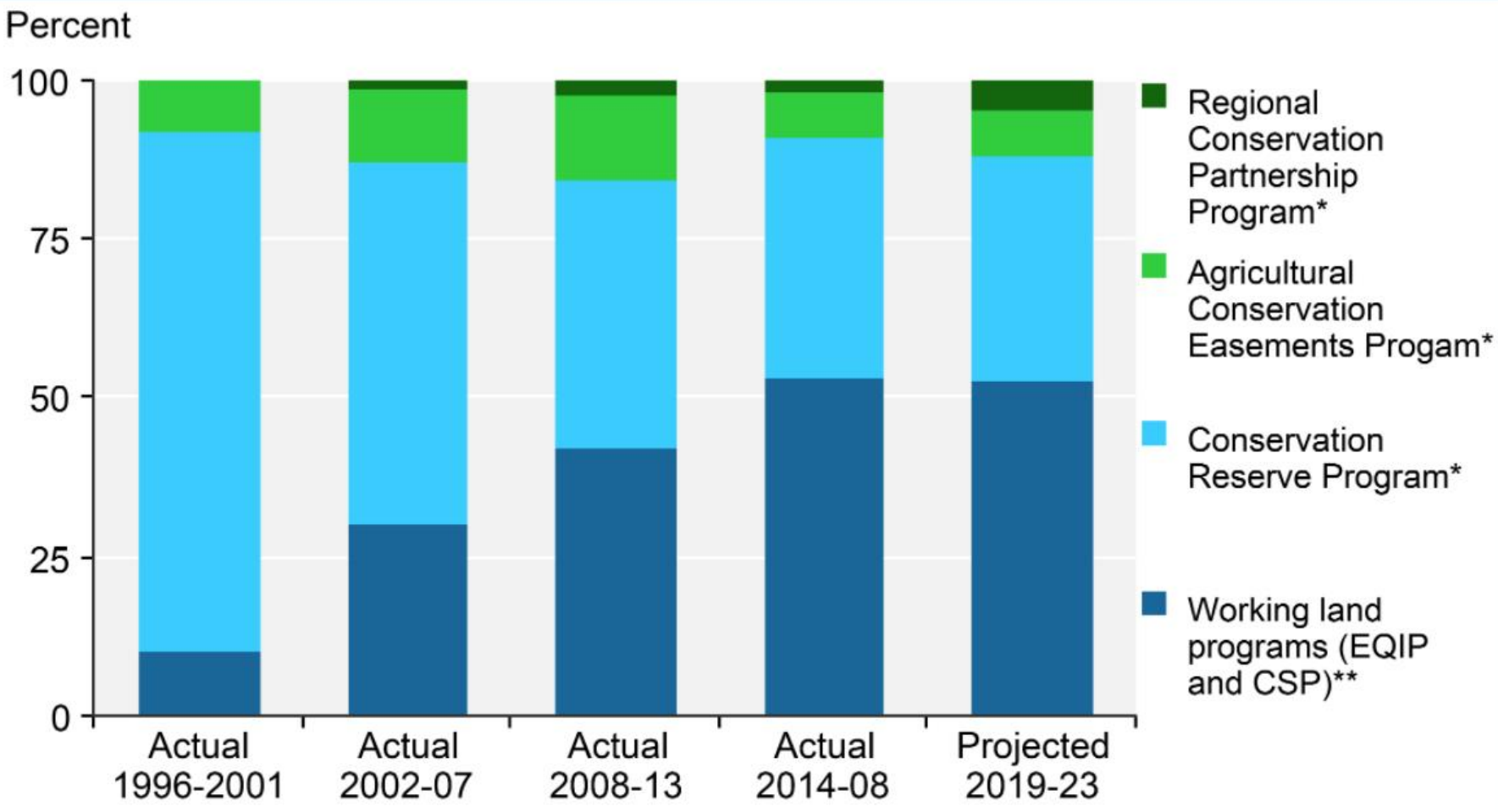
Total by program type



Source: Created by CRS using CBO, *Baseline Projections: USDA's Farm Programs*, July 2021.

https://crsreports.congress.gov/product/pdf/R/R47057

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



*Includes predecessor programs.
**Includes the Environmental Quality Incentives Program (EQIP), Conservation Stewardship Program (CSP), and predecessor programs (these are combined in the Congressional Budget Office estimates of spending under the 2018 Farm Act).
Sources: ERS analysis of Office of Budget and Policy Analysis data for 1996-2018 and Congressional Budget Office projections for 2019-23.

Voluntary cost-share subsidy payments is the mainstay ag conservation policy

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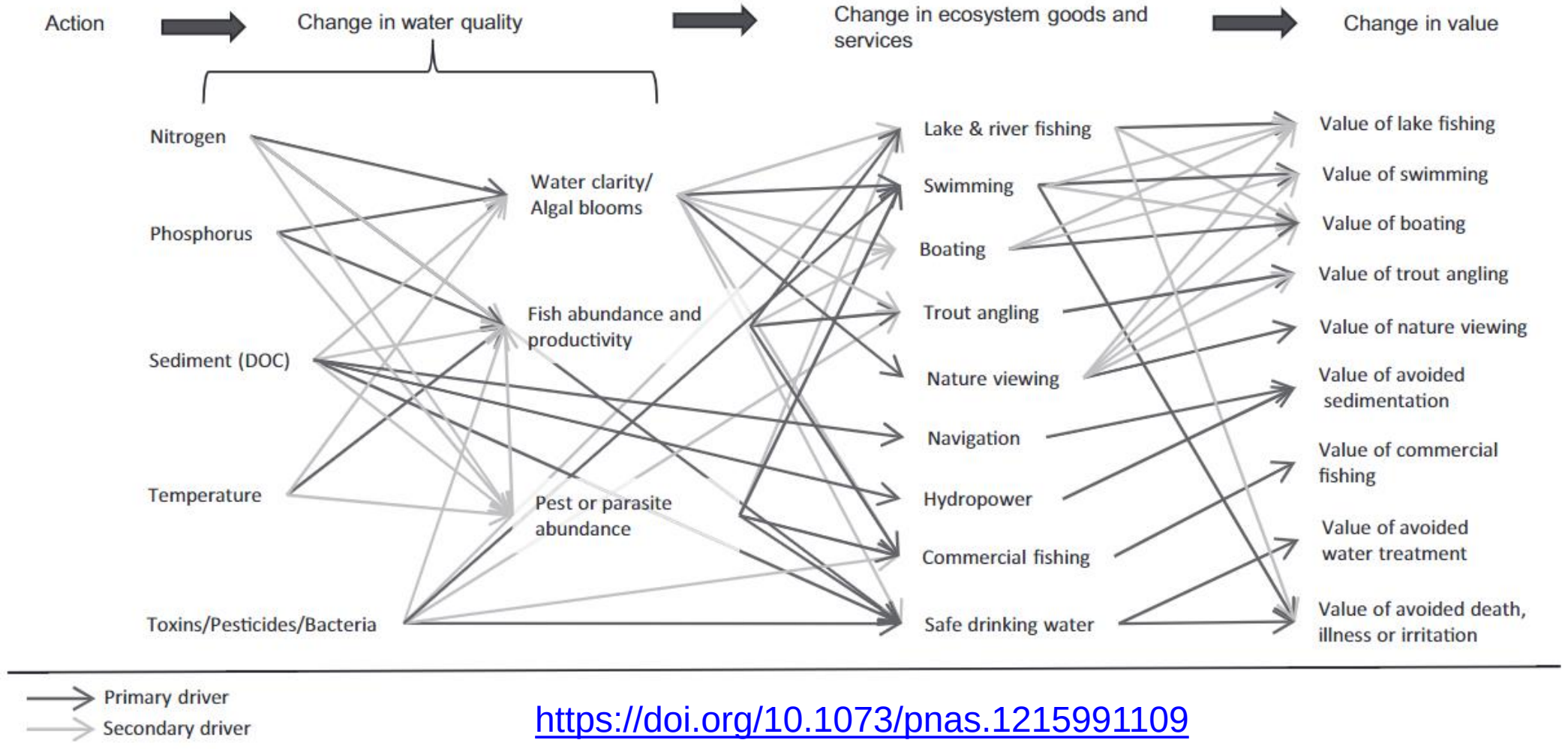
Costs and Benefits of Mitigating & Preventing HABs

- **Costs for farmers:** direct out of pocket expenses + lost yield + lower input costs + increased management time + increased risk + aesthetics
- **Costs for residents**: e.g., costs to change lawn fertilization practices
- **Government budget costs:** Cost share payments + monitoring & implementation costs
- **Benefit:** Value of recreational opportunities + value of waterfront property + Value of avoided drinking water / wastewater treatment costs + value of health benefits

Linking water quality and well-being for improved assessment and valuation of ecosystem services

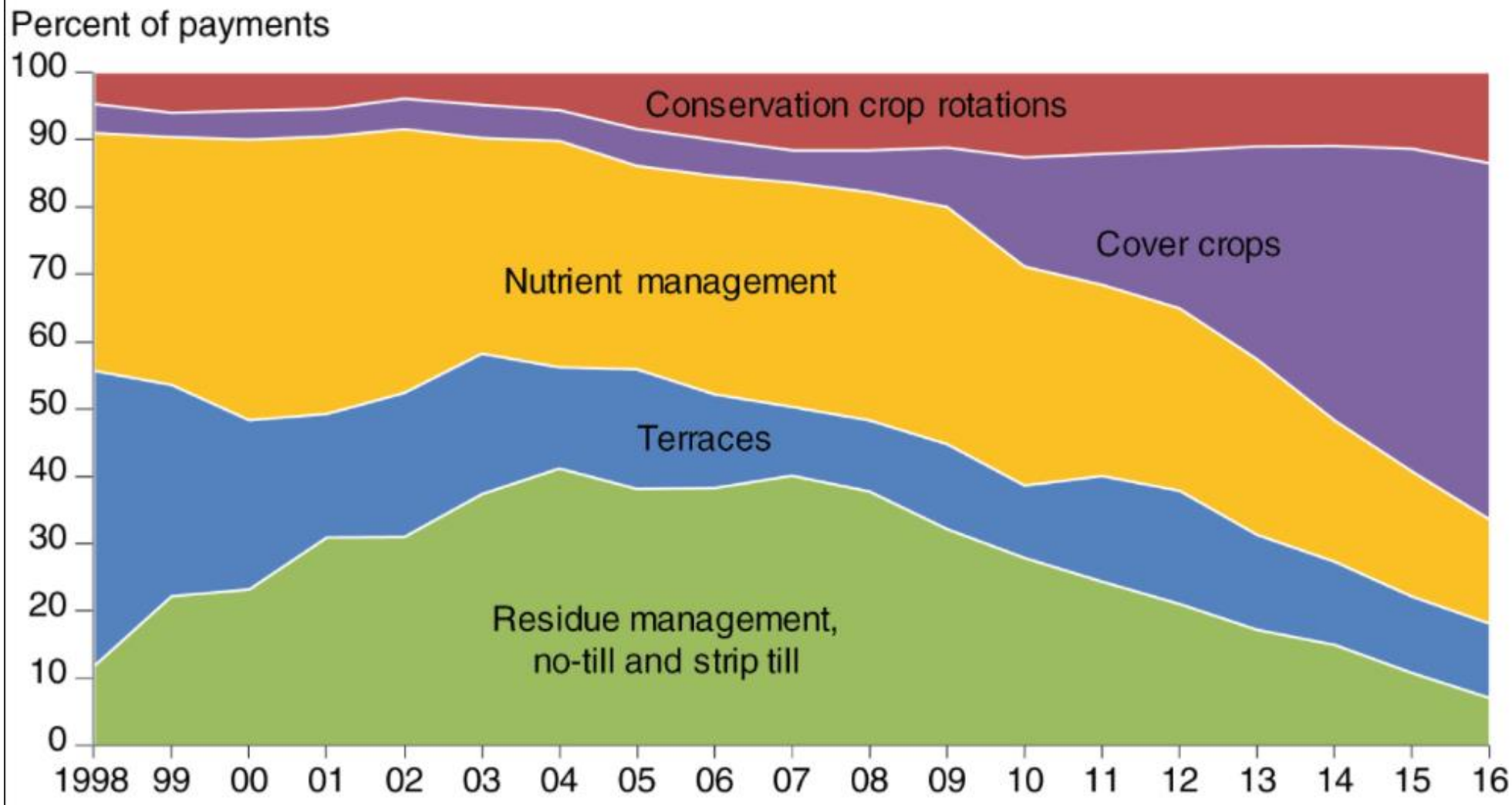
Bonnie L. Keeler[a,1], Stephen Polasky[a,b,c,1], Kate A. Brauman[a], Kris A. Johnson[d], Jacques C. Finlay[c], Ann O'Neill[e], Kent Kovacs[f], and Brent Dalzell[g]



https://doi.org/10.1073/pnas.1215991109

Fig. 2. Relationships between water quality change, multiple ecosystem goods and services, and associated changes in values. Actions considered in the far left column include changing land use or land management as well as other drivers of water quality change, such as climate change, invasive species, and atmospheric deposition. Connections between columns are classified as primary or secondary, according to expert opinion. Although not representative of all possible water quality changes, pathways, and effects on well-being, the figure highlights the most important and often-measured services.

Spending from the Environmental Quality Incentives Program (EQIP) focused on five different crop management practices between 1998 and 2016



Note: 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, total EQIP payments expanded from $18 million to $840 million.

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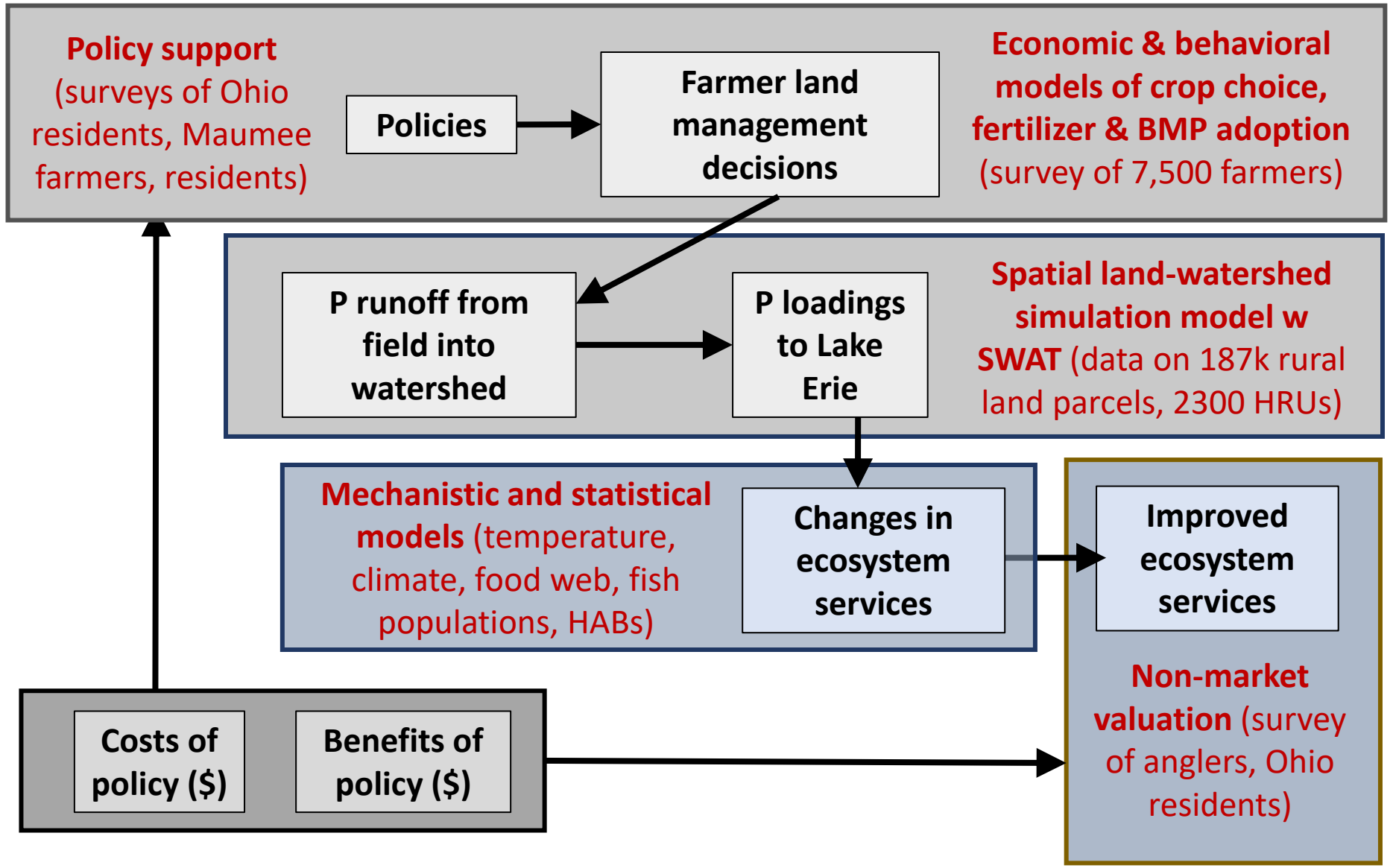
An example looking at the western Lake Erie Basin



Methods for Empirically Measuring the Value of Changes in Ecosystem Services (Less HABs)

1. Revealed Preference Studies
   - Look for behavior and changes in behavior that reveal tradeoffs
   - Recreation demand studies
   - House prices related to ecosystem amenities
   - Wage studies
   - Avoidance cost in wastewater treatment & water purifiers
2. Stated Preference Studies
   - Direct questioning about tradeoffs
   - Contingent Valuation
   - Choice Experiments

Do U.S. Anglers Care about Harmful Algal Blooms? A Discrete Choice Experiment of Lake Erie Recreational Anglers FREE

Wendong Zhang ✉, Brent Sohngen

American Journal of Agricultural Economics, Volume 100, Issue 3, April 2018, Pages 868–888, https://doi.org/10.1093/ajae/aay006

Abstract

Despite the growing awareness of harmful algal blooms (HABs) in the United States and abroad, estimates of welfare losses due to their presence are missing from the literature. Using a mail survey of 767 Ohio Lake Erie recreational angler respondents and a choice experiment, this study provides the first empirical quantification of the economic impacts of HABs on U.S. recreational anglers. Our results demonstrate a significant and substantial willingness to pay by anglers for reduction in HABs, beyond the benefits associated with conventional water quality measures such as catch rates and water clarity. For instance, we find that anglers are willing to pay $8 to $10 more per trip for one less mile of boating through HABs en route to a fishing site. This finding suggests that explicit measures of HABs need to be collected and considered when valuing water quality in nutrient-rich bodies of water. We evaluate the welfare improvements resulting from several nutrient reduction policies, and find that anglers are willing to pay on average $40 to $60 per trip for a policy that cuts upstream phosphorus loadings by 40%. The majority of welfare gains for anglers result from improving the non-catchable component of the fishing experience, notably water clarity and HAB reduction, as opposed to better chances of angler success.

Value of Reduced HABs to Anglers

Survey Design

(Zhang and Sohngen, 2014)

- Mailed to 3,000 randomly selected anglers based on ODNR fishing license database
  - 2500 to counties adjacent to Lake Erie, and 500 to other Ohio counties
  - January 2014 – April 2014
- Tailored Design Method (Dillman 2007)
- Pilot tested with anglers
- Response rate ≈ 25% (780 responses)
- Funded by Lake Erie Commission

Figure 2. One example of choice scenario in the choice experiment.

Scenario 1 (9):

In the following scenario, two potential sites for walleye fishing are presented. Please review the attribute levels for each site, and decide which site you would prefer. Check the box below the particular site for the one you would choose. You can choose neither by checking the box "Neither".

Attribute	**Site A**	**Site B**	**Neither**
Walleye catch rate at fishing site (# hours needed per fish caught per person)	6 hours	2 hours	
Miles of an algal bloom that you have to boat through before getting to the fishing site (0, 4, 8)	8	0	
Poor water clarity caused by sediments at fishing site (Very murky, somewhat murky, clear)	Very Clear	Very Murky	
Time in boat getting to fishing site (minutes)	30	45	
Distance from house to boat ramp (miles)	40	20	
Which Site do you MOST prefer (Please check the box for your preferred option)	**Site A** ☐	**Site B** ☐	**NEITHER** ☐

Welfare Estimates – Nutrient Reduction Scenarios for Lake Erie

Table 5. Welfare gain estimates from nutrient reduction scenarios ($/trip)

Nutrient Reduction Scenario	SP Only	RP data with SP coefficients		
	MXL with Interactions	MNL with Interactions	MXL with Interactions	MXL with Interactions and ASCs
10% less spring P loadings	**$10.34**	**$20.20**	**$7.98**	**$8.33**
from Maumee	(2.65)	(6.60)	(2.55)	(2.32)
20% less spring P loadings	**$24.66**	**$45.81**	**$19.31**	**$19.60**
from Maumee	(4.49)	(11.75)	(4.16)	(3.83)
40% less spring P loadings	**$71.91**	**$132.75**	**$57.30**	**$57.59**
from Maumee	(11.66)	(31.21)	(10.58)	(9.78)

American Journal of Agricultural Economics

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

David Wolf, Sathya Gopalakrishnan, H. Allen Klaiber

First published: 03 January 2022 | https://doi.org/10.1111/ajae.12285

Abstract

Lake Erie has experienced unprecedented harmful algal blooms since the early 2000s, prompting the 2012 Great Lakes Water Quality Agreement between the United States and Canada, which aims to reduce lake-wide phosphorous loadings by 40%. Little is known about the economic benefits from this agreement, especially to near lake homeowners. We provide key information on the benefits of harmful algal bloom cleanup by linking housing transactions in 2003 to 2015 from seven Ohio counties bordering Lake Erie with measures of water quality using remote-sensing images. We further control for endogenous algae production using instrumental variables derived from hydrological processes that link Maumee River runoff to nutrient concentrations in Lake Erie. Using a semiparametric approach, we find the impact of harmful algal blooms on housing prices is spatially limited to properties within 1.2 km of Lake Erie. For the average near lake homeowner, a 1 μg/L increase in algae concentrations is expected to decrease property values by 1.7% ($2205). In aggregate, 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.

EWG Analysis: Preventing and Treating Algae Blooms in U.S. Has Cost at Least $1.1 Billion Since 2010

- Communities whose drinking water comes from a source contaminated by an algae outbreak can install technology to remove bacteria and toxins. Granular activated carbon or powdered activated carbon are the most common. EWG found that 12 cities spent almost $289 million – 25 percent of the total costs we documented – on drinking water treatment. That includes the money communities like Toledo have invested in wholesale improvements to their drinking water systems.
- On smaller lakes, many communities treat algae outbreaks in the water instead of focusing on prevention. A common practice is to spray aluminum sulfate, or alum, onto the bloom, which causes the algae and phosphorus to sink to the bottom of the lake, although the phosphorus could be stirred up again by heavy rainfall from a big storm. Out of the 85 locations we examined, 18 used alum to treat an outbreak, at a total cost of about $9.4 million.

IWC Survey of Iowa Residents:
821 general public (2019) + 487 farmers (Boone, N. Raccoon; 2020)

	2019 Iowa general public survey	2020 Boone & N. Raccoon farmers
No. respondents	858	493
Response rate	28.7%	49.4%
Survey period	June – Dec' 19	July – Sept' 20
Age	59	64
% Male	57%	89%
Some college or higher	78%	76%
% Retired	38%	17%
HH income > $70k	48%	62%

Survey findings

- 32% Iowans & 55% farmers think Iowa's water quality to be good or very good
- 58% of Iowans are at least somewhat aware of algal blooms in Iowa's lakes
- Half of the general public & 30% farmers think algal blooms are very harmful
- 60% of Iowans have seen algal blooms in Iowa lakes at least once
- 60% of the general public & 32% of farmers think agriculture (manure + fertilizer) is the No.1 source of excessive nutrients in Iowa's lakes
- 65% of the general public & 20% of farmers are not at all familiar with the Iowa Nutrient Reduction Strategy; 4% of the general public and 23% of farmers are very or extremely familiar with INRS
- 52% of the general public & 22% of farmers chose fertilizer taxes (ag + lawn) as the best way to fund INRS; a recreational fee as the top choice by farmers (30%)
- 35% of Iowans & 26% of farmers are concerned about nitrates in drinking water in their neighbourhood
- Iowans are willing to pay $19 per household monthly on average for 25% less nitrate in source water; 50% less HABs related beach closure +10% less Gulf hypoxic zone

Costs of Reducing HABs & Conservation Practice Adoption Determinants

Best Management Practices and Nutrient Reduction: An Integrated Economic-Hydrologic Model of the Western Lake Erie Basin

Hongxing Liu, Wendong Zhang, Elena Irwin, Jeffery Kast, Noel Aloysius, Jay Martin, Margaret Kalcic

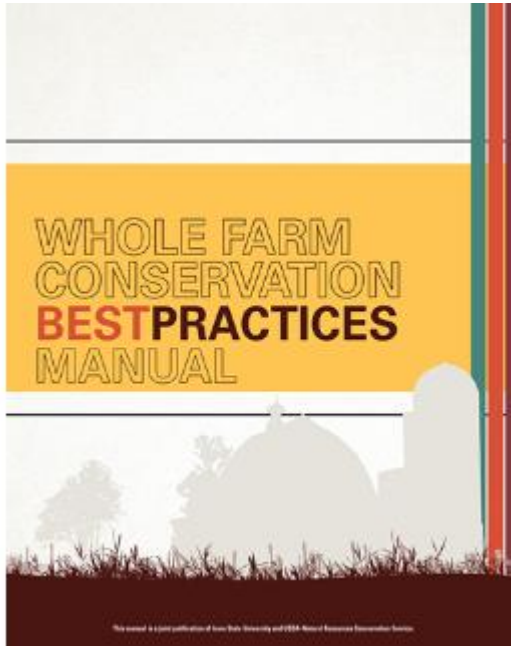
April 2020 [20-WP 601]

We develop the first spatially integrated economic-hydrological model of the western Lake Erie basin explicitly linking economic models of farmers' field-level Best Management Practice (BMP) adoption choices with the Soil and Water Assessment Tool (SWAT) model to evaluate nutrient management policy cost-effectiveness. We quantify tradeoffs among phosphorus reduction policies and find that a hybrid policy coupling a fertilizer tax with cost-share payments for subsurface placement is the most cost-effective, and when implemented with a 200% tax can achieve the stated policy goal of 40% reduction in nutrient loadings. We also find economic adoption models alone can overstate the potential for BMPs to reduce nutrient loadings by ignoring biophysical complexities.

Full Text 1.79 MB

https://www.card.iastate.edu/products/publications/synopsis/?p=1302

https://muse.jhu.edu/article/775584 (Published in Land Economics, Nov 2020)



— LEGEND —

Strong

Moderate

Weak

No Impact

✓ Anecdotal Evidence

✓✓ Multiple Studies

✓✓✓ Scientific Consensus

Practice	ABILITY TO ADDRESS RESOURCE CONCERN						
	Soil Health		Nutrient Loss Reduction			Habitat	
	Impact	Confidence	Nitrogen Impact	Phosphorus Impact	Confidence	Impact	Confidence
Cover Crops		✓✓✓			✓✓✓		✓✓
No-tillage		✓✓✓			✓✓		✓✓✓
Strip-tillage		✓✓✓			✓		✓✓✓
N Management		✓✓			✓✓✓		✓✓✓
P Management		✓✓			✓✓✓		✓✓✓
Diverse Rotations		✓✓			✓✓		✓✓✓
Wetlands		✓✓			✓✓✓		✓✓✓
Saturated Buffers	*	✓✓			✓✓✓		✓✓✓
Bioreactors	*	✓✓			✓✓✓	#	✓✓✓
Field Buffers	*	✓✓✓			✓✓		✓✓✓
Grassed Waterways	*	✓✓✓			✓✓		✓✓✓
Strategically Placed Perennials	*	✓✓			✓✓		✓✓✓
Prairie Strips	*	✓✓✓			✓✓		✓✓✓

Three BMPs we focused on

Subsurface placement of fertilizer
Current adoption rate: 47%

Cover crops
Current adoption rate: 21%

P rate reduction

ELSEVIER

Journal of Great Lakes Research
Volume 42, Issue 6, December 2016, Pages 1343-1356

What motivates farmers to apply phosphorus at the "right" time? Survey evidence from the Western Lake Erie Basin

Wendong Zhang [a], Robyn S. Wilson [b], Elizabeth Burnett [b], Elena G. Irwin [c], Jay F. Martin [d]

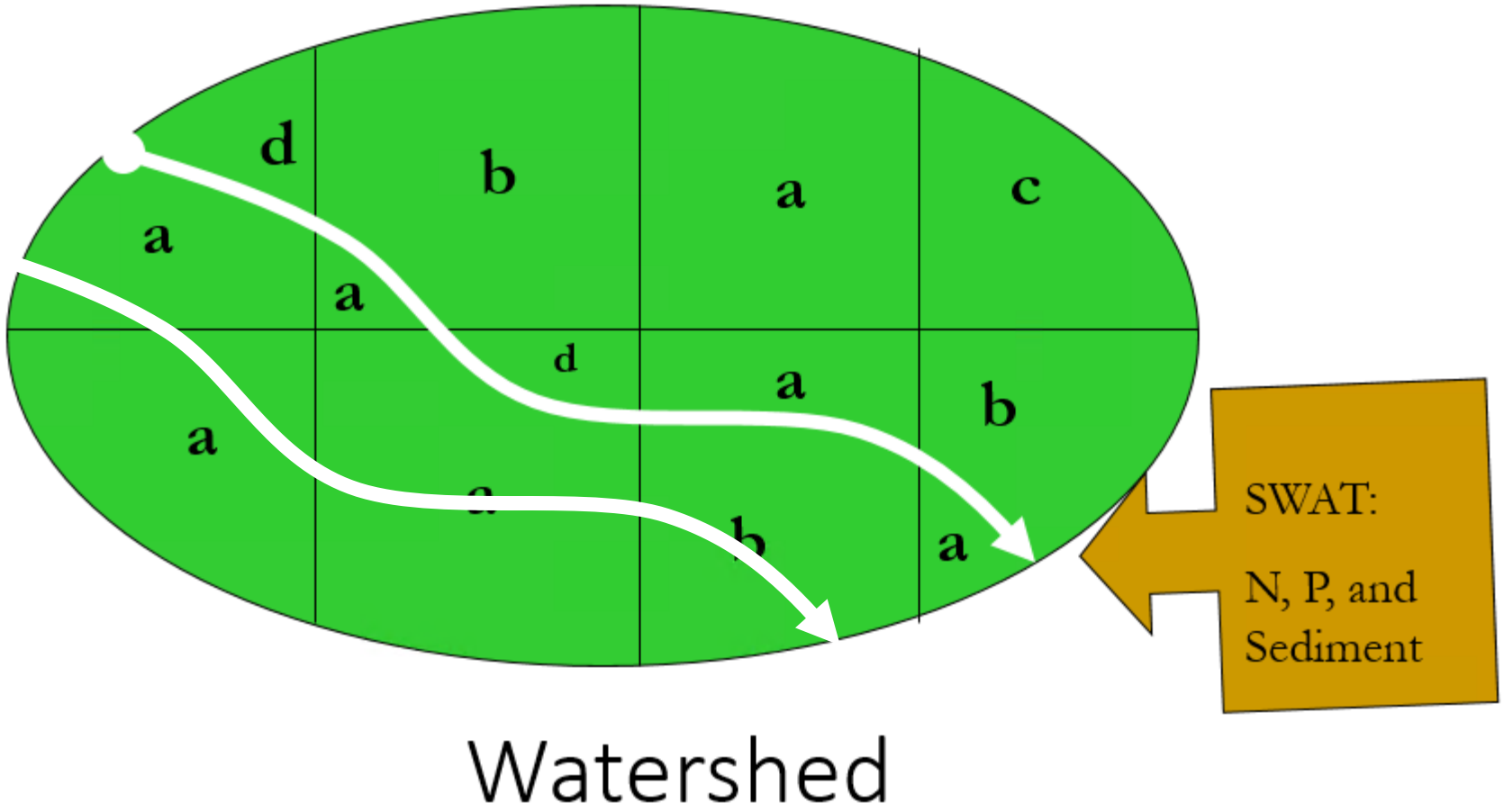
Policy simulation step 2:

Identify N reductions per acre from each practice using SWAT model

- Process-based Watershed-scale Ecohydrological simulation model developed by USDA - Agricultural Research Service

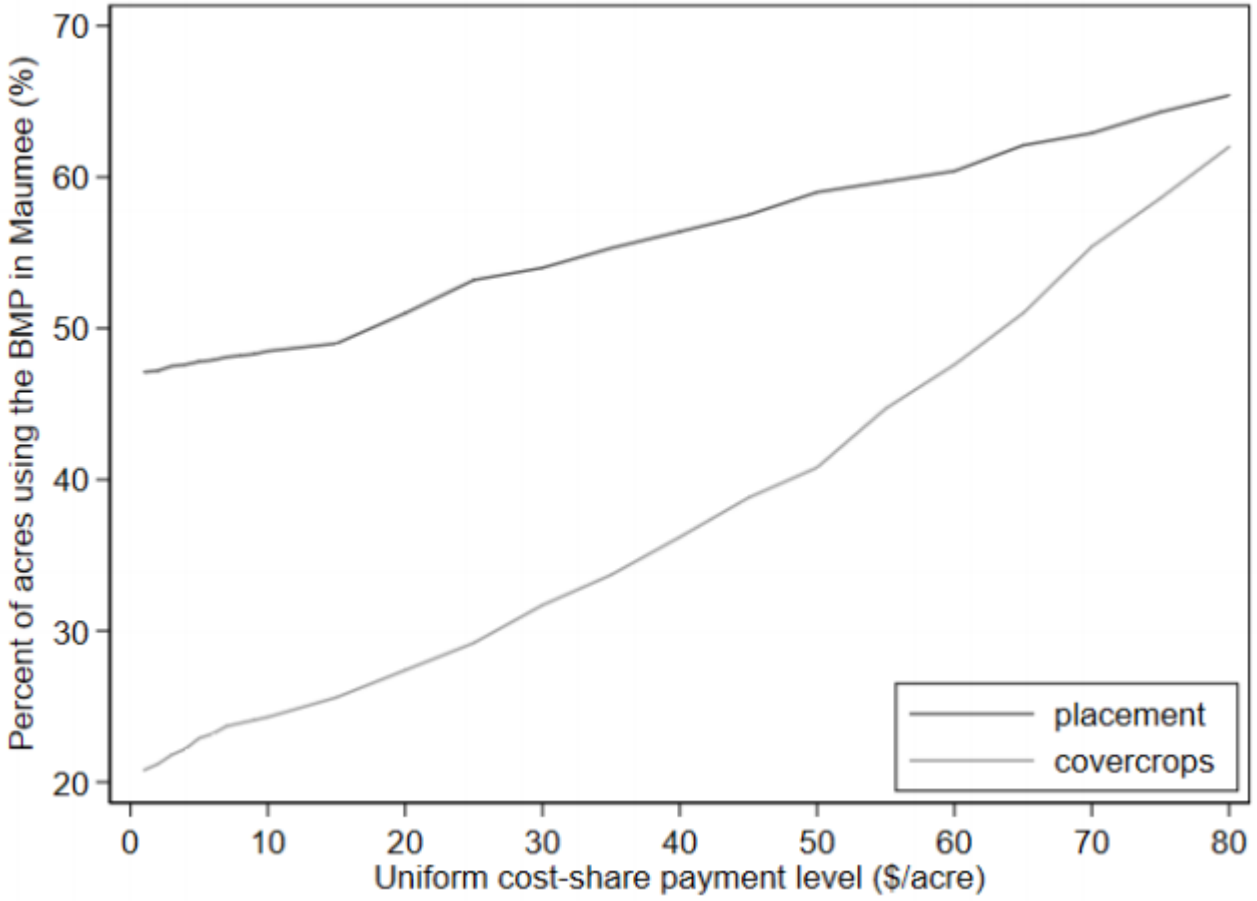
- Predicts ambient (instream) water quality associated with a spatially explicit set of land use/conservation practices

SWAT simulates water quality under any combination of landuse/abatement activities



Soil and Water Assessment Tool (SWAT)

Increase in BMP adoptions under cost share payments vs. fertilizer taxes



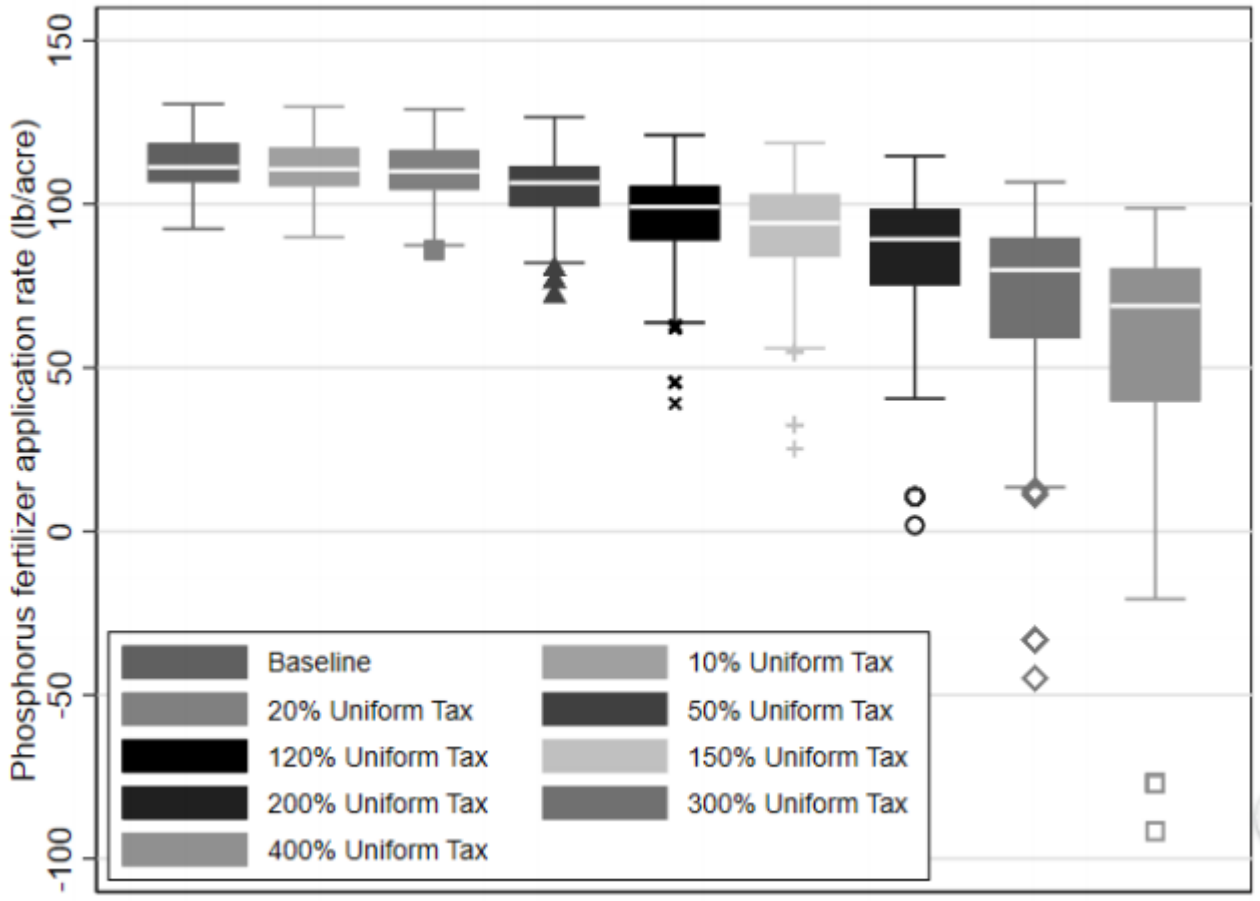


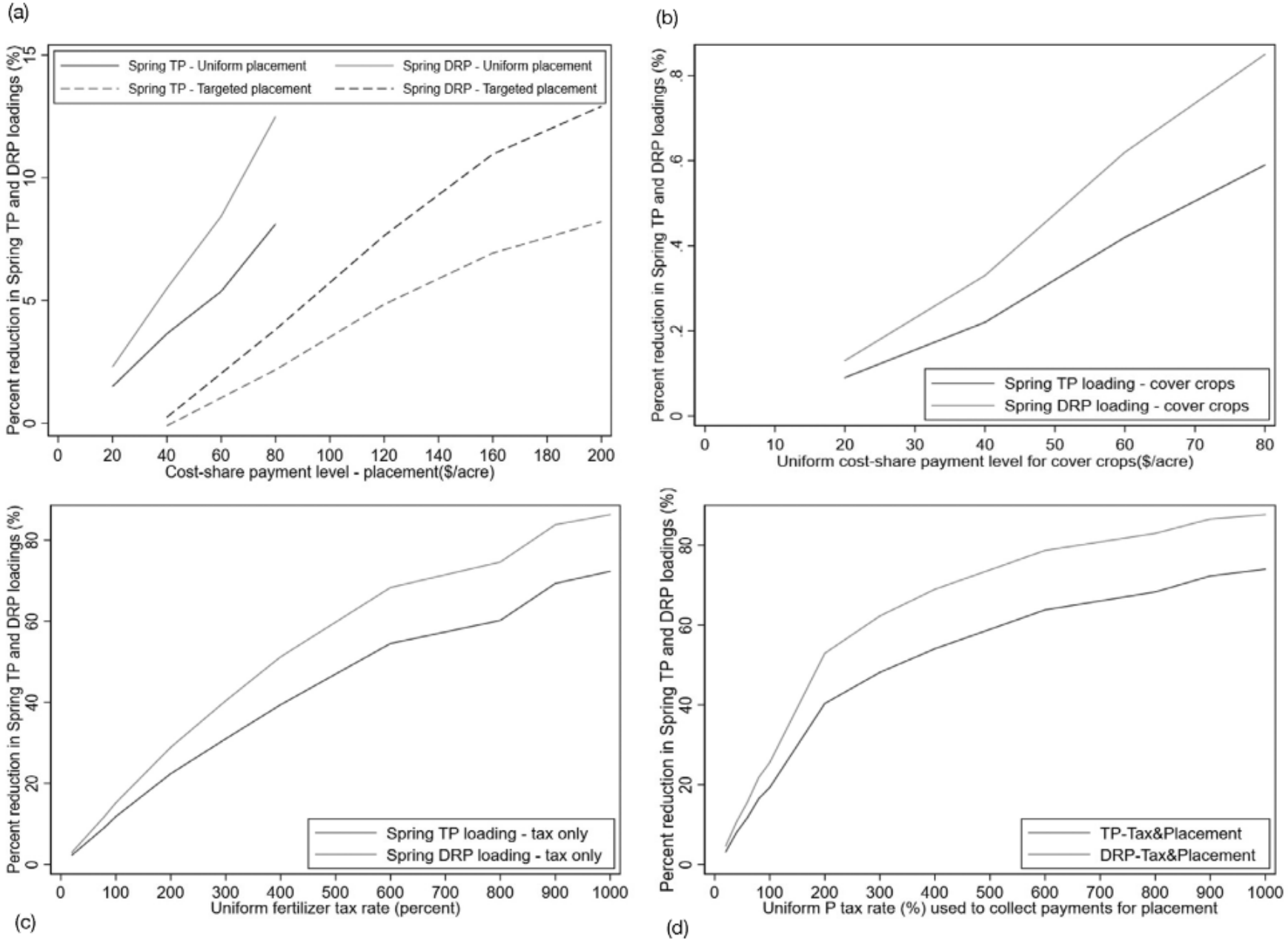
Figure 2

Increases in Best Management Practice (BMP) Adoptions under Different Nutrient Management Policy Scenarios

Reduction in total and DRP loadings under different nutrient management policy scenarios

Figure 3

Reduction in Total Phosphorus (TP) and Dissolved Reactive Phosphorus (DRP) Loadings under Different Nutrient Management Policy Scenarios



What Drives Landowners' Conservation Decisions? Evidence from Iowa

JOURNAL OF SOIL AND WATER CONSERVATION
The science and art of natural resource management for sustainability

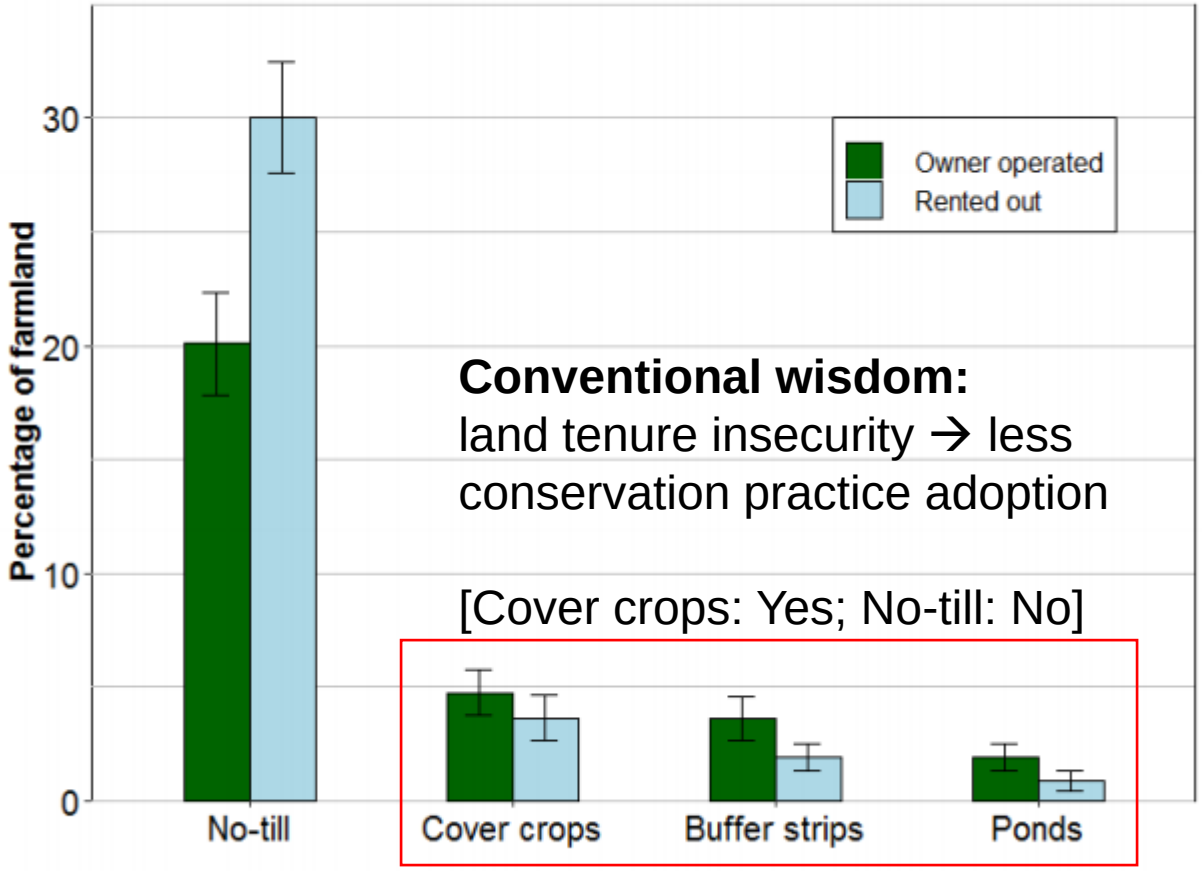
Wendiam Sawadgo, Wendong Zhang, Alejandro Plastina

September 2020 [20-WP 610]

	Owners	Acres
No till	21%	27%
Cover crops	5%	4%
Buffer strips	3%	3%
Ponds	1%	2%

Iowa Farmland Ownership and Tenure Survey, 1982-2017: **A Thirty-Five Year Perspective**

Figure 3
Iowa conservation practice farmland shares by land tenure and practice type.



Conventional wisdom:
land tenure insecurity → less conservation practice adoption

[Cover crops: Yes; No-till: No]

Bars reflect standard error of the mean.

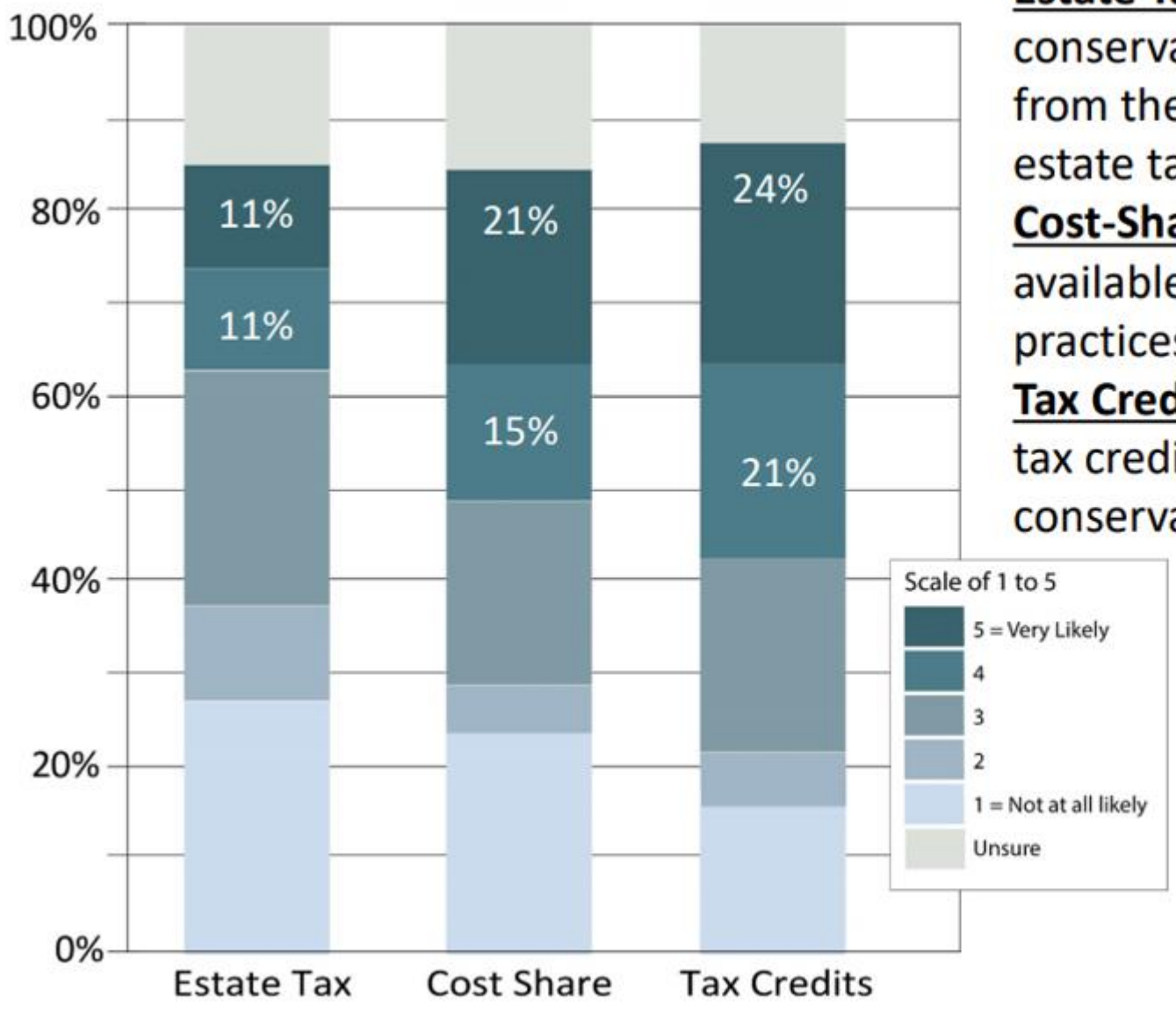
https://www.card.iastate.edu/products/publications/synopsis/?p=1312

Reasons for Not Using:

No-till				Cover crops			
	Operator	Non-operator	All		Operator	Non-operator	All
Not suitable for the land	12%	46%	21%	Tenant's decision	19%	36%	25%
Hurts crop yield	17%	22%	18%	Too costly to terminate	19%	27%	22%
Tenant's decision	15%	6%	13%	Requires too much labor/time or season is too short	16%	9%	14%

Top reason for not using buffer strips (84%) and ponds (88%) is that they were not needed on the land.

Landowners' Likelihood of Increasing BMPs under Alternative Policies



Estate Tax: land enrolled in conservation practices excluded from the value of the estate for estate tax purposes.

Cost-Share: tax-free cost sharing available for conservation practices.

Tax Credits: landowners to receive tax credits for implementation of conservation practices.

Annual Net Returns to Cover Crops in Iowa

Alejandro Plastina, *Iowa State University* Follow

We developed a series of partial budgets based on a statewide survey of Iowa farmers to evaluate the changes in net returns resulting from the incorporation of cover crops into a corn or soybean production system. **The average net returns to cover crop use for farmers** who did not use cover crops for grazing livestock or forage **were consistently negative** across different planting and termination methods, tillage practices, and experience levels. **Only farmers who used cover crops for grazing livestock or forage and received cost-share payments tended to derive net positive returns from cover crop use.** Our results can be used as benchmarks for current or potential cover croppers and for ground-truthing agricultural and conservation policy design.

https://docs.lib.purdue.edu/jafe/vol2/iss2/2/

When Do Cover Crops Pay Off?

June 19, 2019 | Posted in Soil Health, Economics

Source: USDA-SARE

A new report from USDA Sustainable Agriculture Research & Education explores cover crop profitability.

Farmers around the country are planting cover crops on millions of acres to protect and improve the soil, and the more that farmers use cover crops, the more they value this conservation practice. Cover Crop Economics, a new report published by USDA-SARE looks at the economics of cover crops to help farmers answer that big question: "When do cover crops pay?"

- After one year of cover crop use, corn yields increased 0.5% and soybean yields 2.1%
- After three years of cover crops, corn yields increased 1.8% and soybeans yields 3.5%
- After five years of cover crops, corn yields increased 3% and soybean yields 5%

https://www.covercropstrategies.com/articles/511-when-do-cover-crops-pay-off

Sources of changes in net profits	Mean	Median	Standard deviation	Range	Number of responses
	US$ ha^{-1}				
(A) Changes in revenues					
(1) Cost-share program	28.99	24.71	14.10	[0; 98.8]	15
(2) Value of change in following cash crop yield	22.14	0.00	18.34	[0; 156.6]	15
(3) Savings or extra revenue from grazing or harvesting cover crop for forage	1.65	0.00	2.58	[0; 24.7]	15
Subtotal A. Changes in revenue	***52.78***	***37.07***	***26.75***	***[0; 243.1]***	***15***
(B) Changes in costs					
(1) Cover crop planting					
(a) Seeds	50.41	44.48	9.52	[24.7; 108.7]	15
(b) Planting (excluding seeds)	50.08	49.42	5.10	[29.7; 77.1]	15
Subtotal B.1	*100.49*	*97.61*	*11.84*	*[66.7; 162.5]*	*15*
(2) Cover crop termination[a]					
(a) Extra expenses for farmers that applied herbicides to all acres (with and without cover crops)	1.57	0.00	5.70	[−24.7; 37.1]	11
(b) Extra expenses for farmers that did not apply herbicides before planting cash crop in acres without cover crops	38.36	38.36	2.38	[34.2; 42.5]	2
(c) Extra expenses for farmers that used winterkill or tillage to terminate cover crops	0.00	0.00	0.00	[0, 0]	2
Subtotal B.2	*6.27*	*0.00*	*7.17*	*[−24.7; 42.5]*	*15*
(3) Changes in other costs					
(a) Nitrogen costs	1.61	0.00	7.72	[−37.1; 61.3]	15
(b) Tillage costs	−0.74	0.00	2.35	[−20; 8.9]	15
(c) Costs to repair soil erosion	−2.72	0.00	3.23	[−30.9; 0]	15
(d) Opportunity cost of management time~	1.59	0.21	0.89	[0; 6.84]	15
Subtotal B.3	*−0.26*	*0.09*	*9.55*	*[−56.7; 61.3]*	*15*
Subtotal B. Changes in costs	***106.50***	***101.13***	***19.89***	***[17.4; 206.1]***	***15***
(C) Net change in profits (C = A−B)	***−53.72***	***−64.06***	***32.79***	***[−166.4; 163.3]***	***15***

Evaluating the tradeoff between cost effectiveness and participation in agricultural conservation programs

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Using a survey of 430 farmer respondents in the Boone and North Raccoon River watersheds in Iowa, we examine the impacts of three program innovations—reverse auctions, spatially targeted payments, and higher offered payments—on agricultural conservation program cost effectiveness and participation by farmers. We combine farmer responses to a discrete choice experiment offering voluntary conservation contracts with township-level estimates of per-acre nitrogen reductions from each practice derived from the process-based ecohydrological Soil and Water Assessment Tool model. Using a random-parameters logit model, we show that both cost-reducing and benefit-boosting interventions reduce budgetary costs per projected pound of nitrogen removed from the watershed for each practice and thus are more cost effective than the prevailing current cost-share programs. However, we find that these interventions can reduce participation by 30%–70%. Our policy simulations show that even with large budgets, the watershed-level nitrogen reduction from all policy interventions remains far below the policy targets set by the Iowa Nutrient Reduction Strategy. Furthermore, we find cover crop contracts are far more cost effective than no-till/strip-till split nitrogen application contracts.

Choice Experiment: Treatment

Random Assignment to either

1. Cost share contracts

Scenario 1

Please consider the terms of Programs A & B below for your field and answer the questions that follow as if a real conservation contract was being offered to you.

	Program A	Program B
Length of Contract	4 years (2021 - 2024)	4 years (2021 - 2024)
No-Till or Strip-Till (Leaving more than 90% residue)	Not Required	Must be used in 2021-24, ***not*** used in 2020
Cover Crops (Planting a crop after harvesting the main cash crop)	Must be used in 2021-24, ***not*** used in 2020	Not Required
Split Nitrogen application (Apply some N preplant/at-plant and the remainder sidedress)	Must be used in 2021-24, ***not*** used in 2020	Not Required
Annual Cost Share Payment to You	$10/acre	$100/acre

24. Which program do you prefer?

1 = Program A 2 = Program B 3 = Neither Program (If Neither, go to Page 7)

2. Reverse auction contracts with maximum cost share bids specified

Scenario 1

Please consider the terms of Programs A & B below for your field and answer the questions that follow as if a real conservation contract was being offered to you.

	Program A	Program B
Length of Contract	2 years (2021, 2022)	4 years (2021 - 2024)
No-Till or Strip-Till (Leaving more than 90% residue)	Not Required	Must be used in 2021-24, ***not*** used in 2020
Cover Crops (Planting a crop after harvesting the main cash crop)	Not Required	Must be used in 2021-24, ***not*** used in 2020
Split Nitrogen application (Apply some N preplant/at-plant and the remainder sidedress)	Must be used in 2021-22, ***not*** used in 2020	Must be used in 2021-24, ***not*** used in 2020
Maximum Cost Share Payments You Could Request	$100/acre	$130/acre

24. Which program do you prefer?

1 = Program A 2 = Program B 3 = Neither Program (If Neither, go to Page 7)

25. What is the **minimum** cost-share payment amount you would request for your preferred conservation program? (**Remember, lower cost share requests are more likely to be accepted and approved.**)

$ _____ / acre

Table 5b. Full Watersheds Policy Simulation Results: Cover Crops Contracts, Large Budget

Policy Scenarios	Total Budget Spent	Cost per Acre	Projected Farmers Enrolled	Acres Enrolled	Lbs. Reduced per Acre	Predicted N Reduction	Dollars per lb. Reduced	B/C Ratio
1. Cost Share $50	$3,076,350	$50	634	61,527 acres	6.95 lbs.	427,987 lbs.	$7.18	1.32
2. Cost Share $50, >= Median reduction fields	$2,073,300	$50	416	41,466 acres	7.38 lbs.	306,135 lbs.	$6.77	1.40
3. Reverse Auction $50	$2,500,623	$37.06	707	67,475 acres	6.39 lbs.	430,992 lbs.	$5.80	2.60
4. Reverse Auction $50, Accepting >= Median reduction fields	$1,305,736	$38.43	364	33,977 acres	7.37 lbs.	250,309 lbs.	$5.22	2.30
5. Reverse Auction $75, Accepting >= Median reduction fields	$2,087,893	$57.64	395	36,223 acres	7.34 lbs.	265,947 lbs.	$7.85	1.23

Notes: Benefit-cost ratios assume a value of $9.48 in benefits from a one-pound reduction of N (Ribaudo, Heimlich, and Peters 2005). According to SWAT modeling, the median field in our data set is projected to reduce N loadings by 6.5 lbs. per acre with the use of cover crops. Average N loading estimates from our SWAT modeling are 17.69 lbs. per acre for the two watersheds. The baseline N loading in the Boone and North Raccoon River watersheds are 12.42 and 27.24 million lbs. respectively (Gassman et al. 2017, Jones et al. 2017). Total budget allocated for each scenario is $3,145,000.

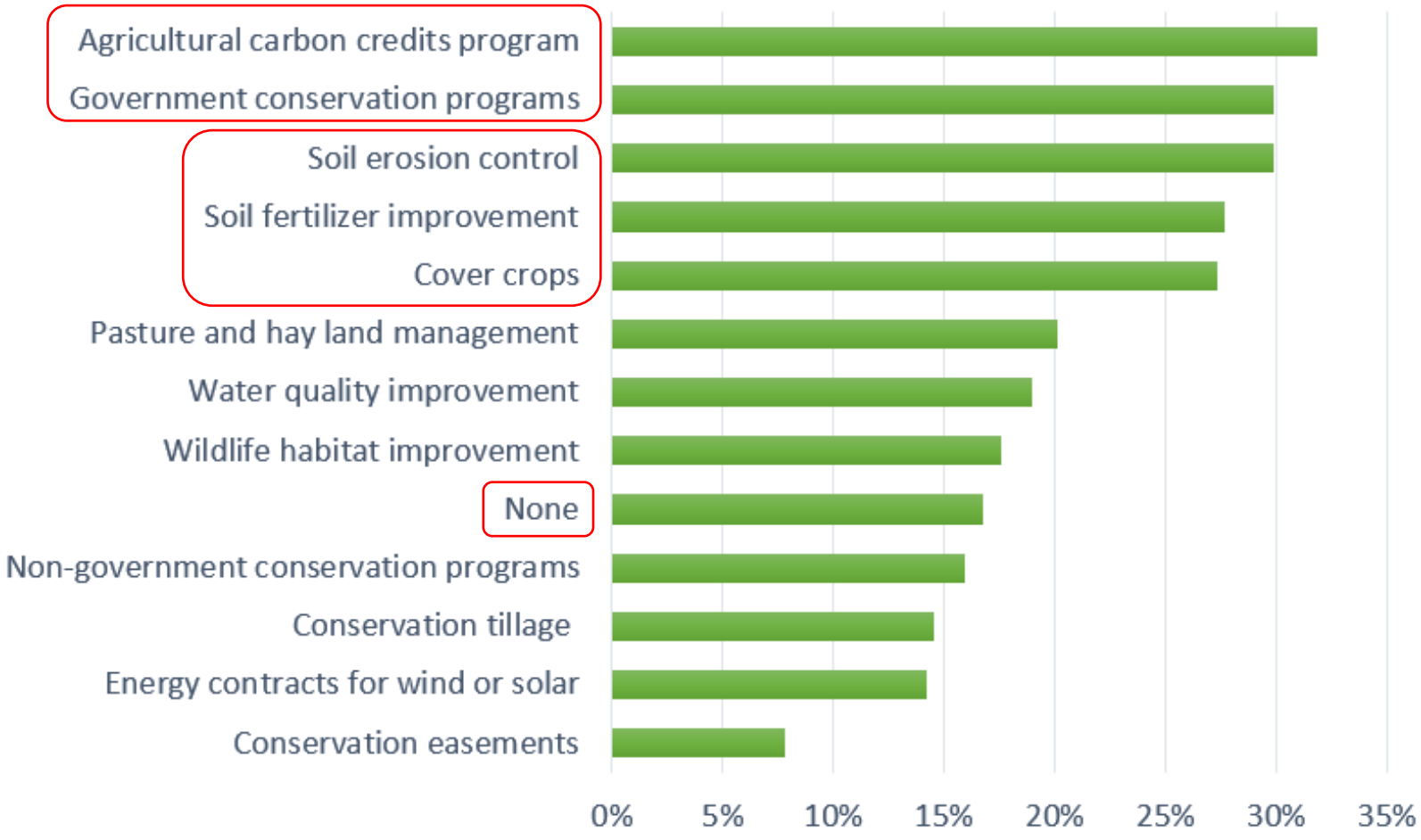
2021 Survey of Iowa Women Landowners

- 358 completed responses to the women landowner survey
  - web/mail survey from July 30 through October 20, 2021
  - response rate of 52.0% (358/688)
  - 135 (38%) are from ISU Extension and Outreach Women in Ag programs, 222 (62%) are from the Iowa Farmland Ownership and Tenure study

- Goal: offer information and resources to help women meet the challenges of implementing new conservation practices by studying their
  - interest in conservation topics
  - concerns on conservation issues
  - preferences for receiving educational programming

Policy brief available at
https://www.card.iastate.edu/products/publications/pdf/22wp633.pdf

Interest in Conservation Topics

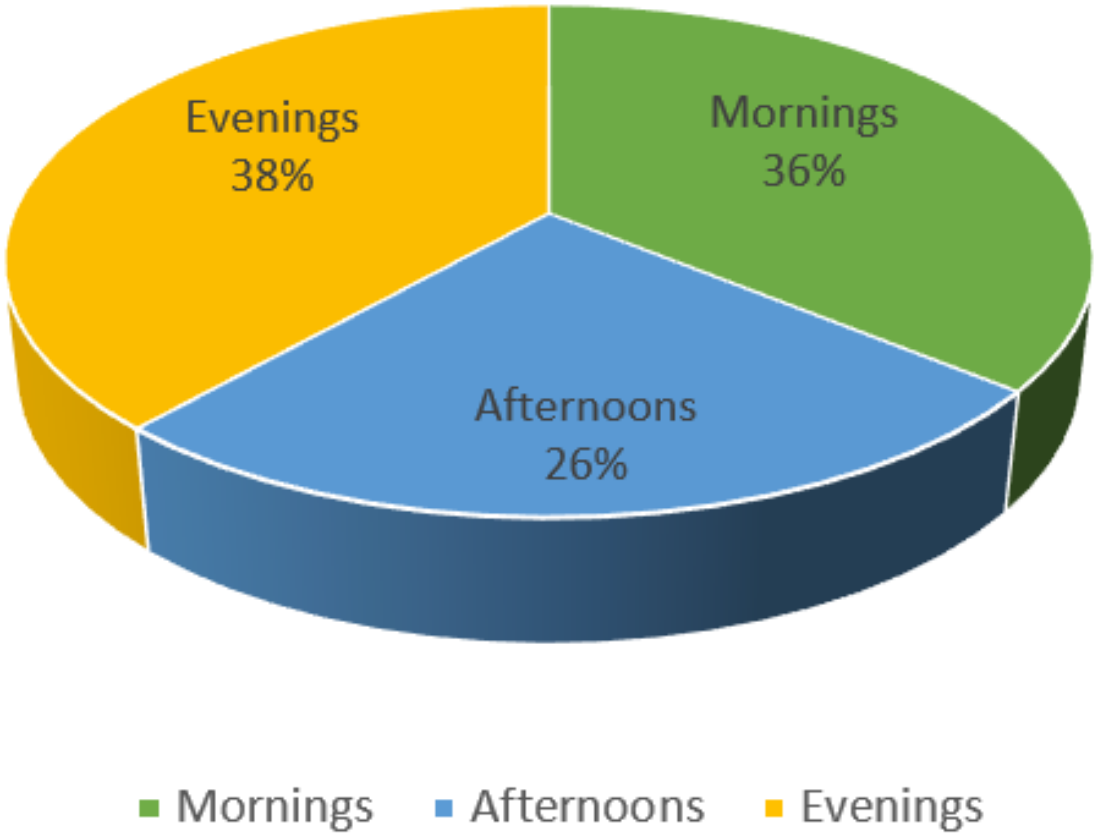


- Higher interest in the top 5 topics
  - Conservation programs
  - Soil conservation practices
- Disperse interest of women landowners in conservation topics

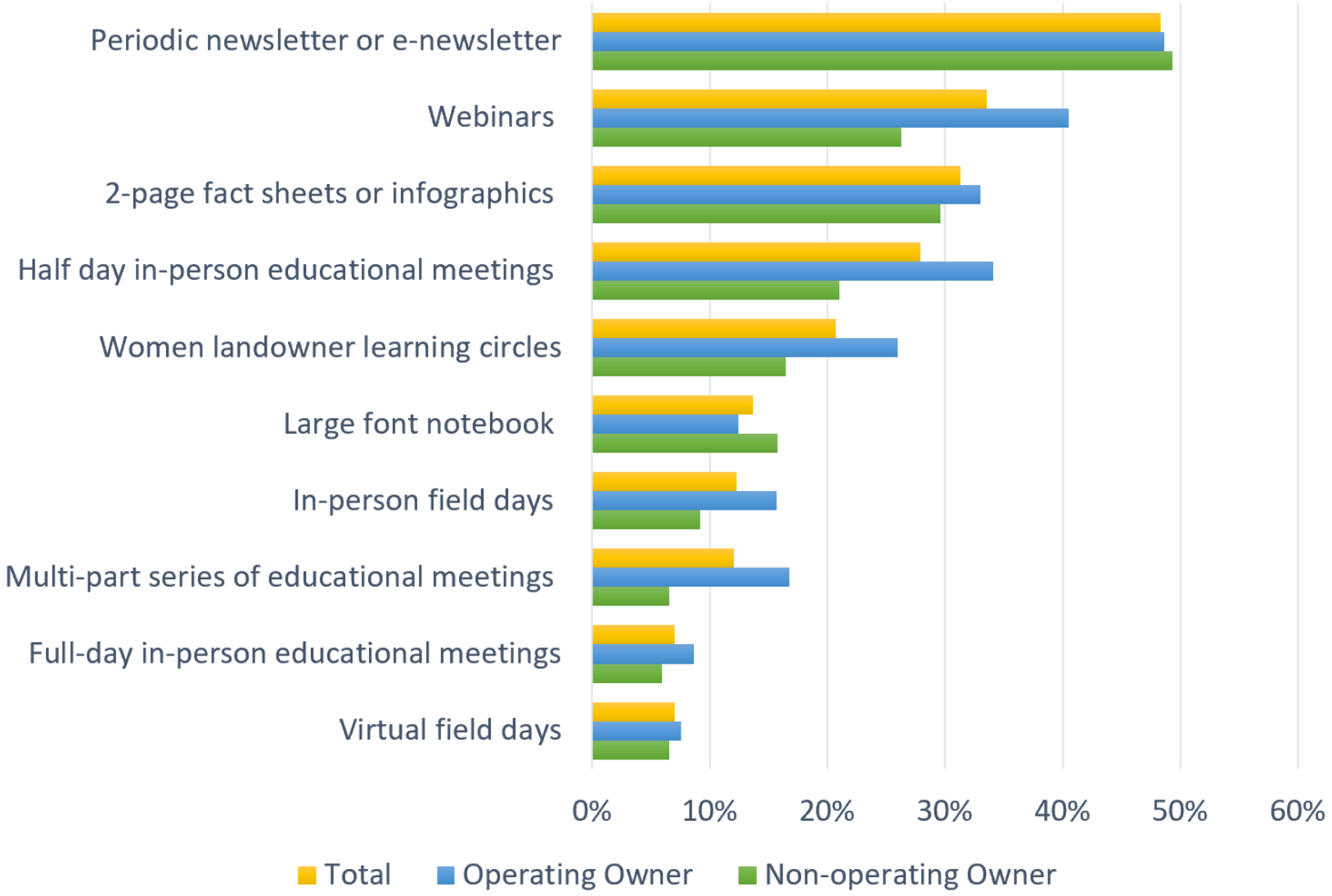
Concern on Conservation Issues

Conservation-related issues	Percent of respondents concerned or very concerned		
	Total	Operating owner	Non-operating owner
Too many requirements related to government programs	69%	76%	60%
Interference with the ability to change management practices	58%	67%	48%
Low cost-share payments	54%	62%	49%
Unsure of the true value of the practices to the environment	52%	54%	47%
Incorporating the practices into leases	45%	45%	46%
Hard to find information about state/federal programs	43%	45%	44%
Time consuming and laborious	43%	47%	40%
Access to conservation equipment needed	41%	45%	39%
Not familiar with conservation practices	33%	27%	39%
Communication with tenants	30%	28%	32%
Conservation practices may decrease the value of land	29%	26%	32%
Don't know anyone implementing the practices	26%	21%	30%
Discussion of the practices may upset family or co-owners	18%	17%	22%
Disapproval from neighbors	14%	15%	15%

Educational Preference - Time



Educational Preference – Delivery Mode

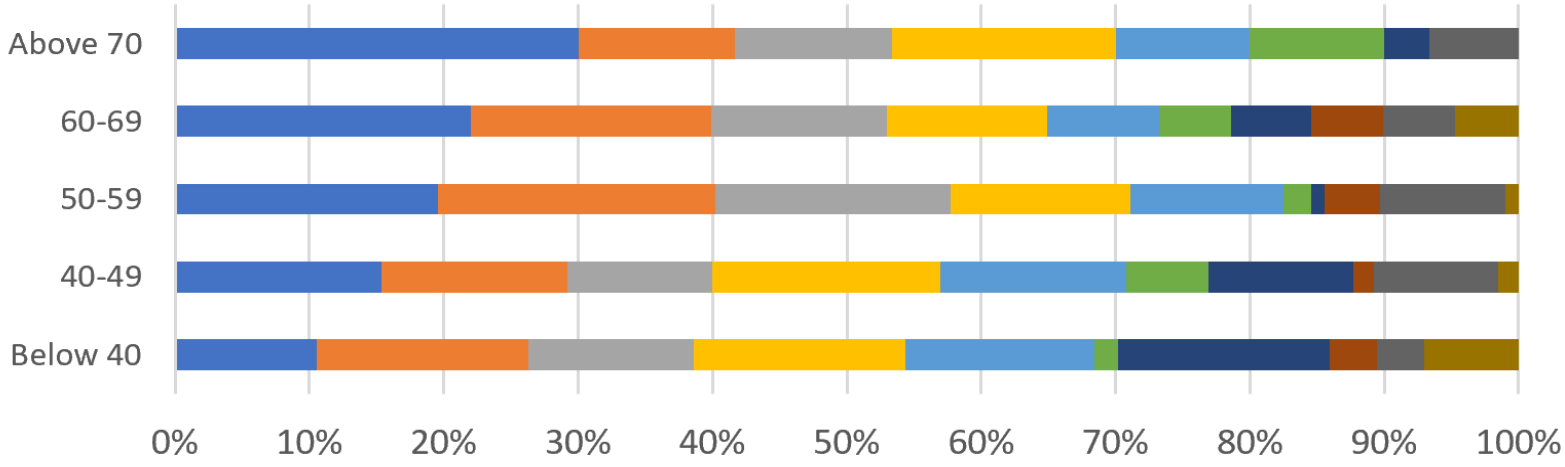


- Women prefer virtual delivery methods to in-person formats, while half-day in-person meetings are also welcome, ranking third for OLs and fourth for NOLs.
- OLs are more willing to receive educational information than NOLs
- Large gaps in webinars, half-day in-person meetings, women learning circles, and multi-part series of educational meetings

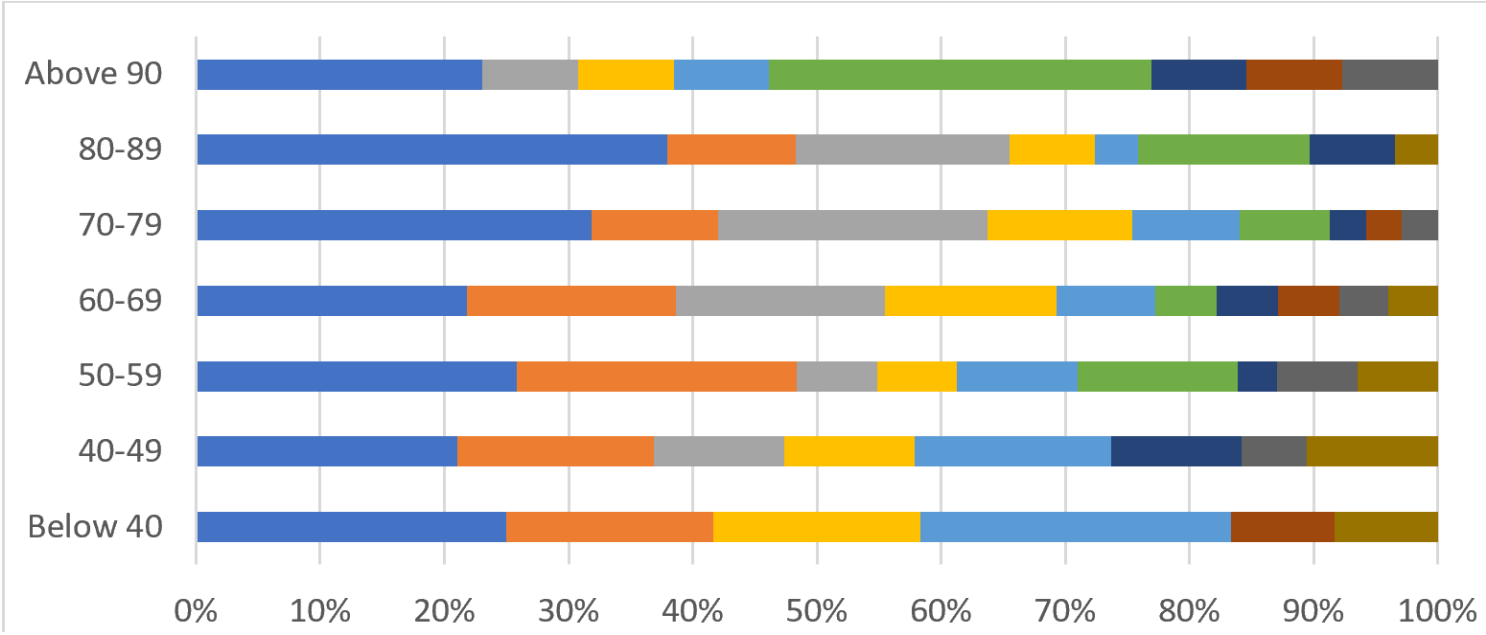
Educational Preference – by Age Groups and Operating Status

- Periodic newsletter or e-newsletter
- 2-page fact sheets or infographics
- Women landowner learning circles
- In-person field days
- Multi-part series of educational meetings
- Webinars
- Half day in-person educational meetings
- Large font notebook
- Full-day in-person educational meetings
- Virtual field days

(a) Operating owners' preferences by age groups



(b) Non-operating owners' preferences by age groups



Thank you!

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