**SAES-422 NC-1190**

**Format for Multistate Research Activity Accomplishments Report**

**Basic information**

* Project No. and Title: NC 1190 : Catalysts for Water Resources Protection and Restoration: Applied Social Science Research (/project/17900)
* Period Covered: July 2018-June 2019
* Date of Report: September 15, 2019
* Annual Meeting Dates June 25-27, 2019 Wooster, OH

**Participants**

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**Tuesday, June 25th**

7:00 pm: Informal dinner in Wooster

**Wednesday, June 26th**

7:00 am**: Breakfast at hotel**

8:00 **Convene in Research Services 130 – OARDC campus, Welcome & quick introductions**

8:30 **State Updates (each individual gave a brief introduction and update on activities in the past year related to NC 1190 - 5-10 minutes/state)**

**Idaho – U of Idaho -- Chloe Wardropper –** University of Idaho

 Project on cover crops – wheat land NW Idaho

 Cover Crops as a

USGS Powell Center project -- SUCCINCT Like – visualizing streamflow depletion to better understand water quality issues across the USA –

Aquifer depletion – Water quantity…

**Indiana** - Purdue University - Linda Prokopy – Talked about the forthcoming Special issue of Journal of Contemporary Research and Education; On a project Crop Insurance as a limiter for BMP adoption – Beginning farmers yes – but standard farmer say yes, but actually don’t; Longterm conservation adoption – Why continue use or not;

**Indiana**- Purdue University -- Pranay Ranjan –

Farmer perception of conservation – mid-term report

 On-line focus groups and work that they are doing….

Work with non-operating landowners – Barriers to adoption of conservation practices see paper in Land Use Management

Ag Conservation Planning Toolbox – HUC 12 scale conservation opportunities…

See 2 papers – One in Journal of Soil and Water Conservation – that address these issues and use of decision support tools…

**Iowa** – Iowa State University -- J. Arbuckle– still working on the Iowa Farm and Rural Life Poll. Was formerly associated with ERS but have pulled out. Research interests include -- working on groundwater use in agriculture; increased use of anaerobic digesters on Iowa farmers

**Michigan - Michigan State University** -- Stephen Gasteyer

Working on: water and sanitation in rural communities and its implications for water quality – specifically onsite wastewater management; farmer led conservation and water quality, specifically in the Western Lake Erie Basin; understanding drainage and water management; an integrated approach to understanding the social factors behind algae blooms; groundwater management and irrigation – comparing across state context.

**Minnesota** -- Jeffrey Peterson – we went through mid-term review – positively reviewed

Announced upcoming proposals… NIFA - AFRI – Foundation RFP is out…Noted that NIFA will relocate to Kansas City along with ERS and this may disrupt timing of future grants. This is also creating a number of position vacancies.

Funding at NSF – INFEWS – being phased out… One more round…

 New Funding at NSF – 1. Coastlines and People –

2. Sustainable Urban Systems -- includes surrounding landscapes

 UCOWR conference – 2020 – Twin Cities – Call for special sessions…Deadline mid-September

 June 9-11, 2020

**Minnesota** -- Adam Wilke– will be program director for UCOWR –would like some discussion of upper Midwest water issues at the conference. He is interested in questions related to water data. Collaborating with University of Illinois (among others) who have established the Midwest big data hub.

**Minnesota -- University of Minnesota** -- Mae Davenport -- Projects: 1) working with J. Arbuckle on how to build relationships with farmers – focus on Practices, behaviors, etc., focused on: Building capacity to address changing water; Subgroup comparisons on water values; Gender differences and water values; **Risk perception** and water behaviors; Social norms of conservation – science communication; 2) **Understanding and Protecting the Harvest –** Policy and law… Tribal directed research – Survey of state permitted wild rice Mennomin - (Wild Rice) – Sulfate standard for wild rice…work in particular with tribal resource managers; 3) **Narratives of Urban Waters;** 4) **Papers –** Outcomes of practices **–** What is the social and ecological feedback that is important?

**Minnesota – UM --** Sarah Fellows – has been continuing work in the **Root River watershed – asking:** What are the drivers and barriers to adoption; also the Sand Creek Watershed – asking: What are the attitudes and values that have changed; also working on Shifting efforts to social norms – capacity and capacity needs to protect soil and water quality – and focusing on contextual capacity development to address particular water issues. Targeting capacity…

**Montana State University** - Sarah Church – working on:

1. Successful watershed management 🡪 practitioners guides – successful watershed management;
2. Case studies of How to make a successful project – flooding – education and extension;
3. Paper for issues of hydro-sciences – what should we be funding research for – socio-hydrology framework – See Matt Sanderson’s email about call for papers
4. System’s thinking – Talk to farmers about decision making – farmers as system’s thinking – have we plateaued in adoption because we talk in a systems we don’t message to non-systems thinkers – Getting farmers to draw out thinking
5. Developing a Film on watersheds and BMP implementation – from multiple stakeholder perspective… hoped to use for a social learning approach… Title: “Common Ground, Common Water”

**Nebraska – University of Nebraska-Lincoln - Mark Burbach** –

Working on: Ag Participation in water quality efforts; Nebraska Ag leadership program – evaluation leadership programming; USDA NIFA grant work with herders on management practices – discovered that most ranchers manage to the middle to make landscape to more homogeneous, and thus less resilient to climate variation in weather patterns – has led to work with NRCS and Coop Extension recognizing that some of their programs have in fact created barriers to heterogeneity – specifically prairie dog eradication programs.

**Ohio -- Ohio State University -- Doug Jackson-Smith**

Working on project exploring soil balancing (with organic farmers) to get a better sense of how this alternative practice fits into holistic approach to soil health management under organic systems. Also submitting proposal to identify the impacts of re-integration of livestock back into crop production systems in the Corn Belt. Fully integrating livestock could help identify ways to optimize nutrient cycling and close nutrient loops. Also, using livestock opens up viable pathways diversity cropping systems. Continuing work on NSF-INFEWS grant on effects of ‘deglobalization’ on eastern corn belt/upper Midwest. Integrated regional economic model will be coupled with SWAT Model to simulate impacts of economic changes associated with changes in trade and access to global markets on water quality in the region. Colleague, Robyn Wilson, is conducting a survey of farmers and non-operating landowners to capture information on how do farmers respond to changed economic conditions through land use and enterprise changes.

More broadly, Doug is continuing research on participatory approaches to both research and modeling. On the NSF-INFEWS project we are bringing in farmers and stakeholders to unpack model assumptions and demystify the black box of SWAT and regional economic models. Ideally, feedback will lead to better science and better models that are more accurate and more impactful on the world. Also interested in leading a group effort to document impacts of various approaches to doing on-farm research. One example that is being explored in OH is to develop Discovery watersheds – like Discovery Farms, but expanded to include observations that connect edge of field to mainstream rivers and terminal lakes. Still serving on the NASEM Board of Agriculture and Natural Resources. Also collaborating with group of social scientists in an NSF-SESYNC pursuit to develop synthetic conceptual model that explains private lands conservation behavior by integrated sociology, psychology, decision-science and economics theory and methods. Goal is to find a couple of case studies to do empirical test of model. As sociologist – one key issue that is being highlighted is role of structure and Macro Decision Making Context in shaping individual decisions and behaviors?

Doug – Bringing in a postdoc this fall (Andrea Rissing) who did her PhD at Emory University with Peggy Barlett (who in turn wrote great book on the farm crisis, and showed how farmers who ignored the advice of experts to expand and take on debt in the 1970s made it through the farm crisis best in the 1980s). Andrea will be helping design and implement a statewide Ohio farm survey this winter.

**Ohio State --** Lourdes Arrueta (student of Doug Jackson-Smith) – working on working on disproportionality – pattern of actual fertilizer application -- development of perceptions of watershed function among farmers and scientists

**Ohio State --** Caroline Brock **--** works with Doug in Wooster and has taken the lead on the Soil Balancing/Nutrient Mgt project listed above. Also working with colleagues at OSU on a study of antibiotic resistance and herd health management on Ohio cattle/dairy farms (including a focused set of organic dairies, as well as typical conventional herds).

Anil – is working on a lit review that will bring in the multiple factors will share with us…

**Pennsylvania** -- Wes Eaton – working on: 1) Participation in water for agriculture – (Kathy Brasier PI), Issues of interest include -- mix-methods, case comparisons, application of social learning theory, Leadership – scales of learning and change. Two papers out of the work are under development: Paper on conceptual model; Paper on what does a participatory framework look like? 2) Also working on understanding sense of place and measures of working landscapes – including a paper in *Society and Natural Resources on “*sense of loss and working landscapes…”

**Penn State** -- Anil Chaudhary– working on: How are networks addressing water issues?; Water quality and BMPs among farmers and how to move beyond piece meal approaches to addressing water quality – toward an interdisciplinary and system wide approach to adoption of water quality policy; working on a drinking water quality study, specifically groundwater concerns and how does GW quality impact human and animal health?

**Penn State** -- Kathy Brasier– Working with Wes – also working on Energy – Marcellus Shale.

**Virginia Tech -- Kurt Stephenson** – Working on meeting Chesapeake Bay water quality goals….

 Scramble to meet the TMDL by 2025

Has a Grant to look at **legacy N** – in springs – what might be treatments – bioreactors…

 Pay for performance – contracts to remove pounds

 The more water treated, the more land one treated

 VA – has very stringent WW release – Urban spending $500/lb

 Regulatory risk – in working with farmer…

Technical Advisory for Chesapeake Bay Initiative – Scientific Gap analysis

 What was tried versus outcomes – disconnect

 Prime suspects is agriculture

 Doing a **stack workshop** – how do we better target BMPs

**Virginia Tech -- Eric Kauffman** – Working on Educational Leadership; Sustainable unsustainability; adaptive leadership; Leadership among individuals…

**Wisconsin- UW Madison** -- Adina Rissman

 Have two – small and medium sized farms – how new landowners understand their land.

 Parcel data to understand parcel rates – conservation rates

 How are new landowners acculturated to conservation

 2 teams – Grasslands 2.0 – looking at grassland management

 INFEWS grant around upper Mississippi basin – will look at governance networks

 See – Adaptation paper – among County Conservationists – more common than planning

 Staffing was not associated was not associated – Still working on Nutrient

**Wisconsin – UW Madison Ken Genskow** –

Working on:

1. Collaborative approaches… Interest in Farmer-Led watershed council… Tracking longterm progress in Farmer-led Watershed councils
2. Looking at water quality issues in water sands part of Wisconsin – Stakeholder participatory modeling on watershed management in high conflict
3. Developing NSF – Socio-hydrologic framework – on multi-stakeholder initiative on longterm water issues.
4. NCRWN – supporting small initiatives
5. SARE 46 group – Hypoxia Task Force – Linda is on…Big focus on soil health
6. Phosphorous trading in Wisconsin – Law that created numeric P standard to provide for cap that could be traded

**Wisconsin** – UW Madison - Zhixuan Wu -- P Trading in Wisconsin – 50 trading cases – gap between practice and theory

Problem of nonrecognition of transaction cost… -- who are participants and how do they make their decisions… How do Point and non-point sources interact… Problem of possible competition between NRCS and trading –

9:30        **Review of work on 6 priority tasks from last year**

10:30     **Break**

11:00     **Election of new secretary**

 Stephen Gasteyer, Doug Jackson-Smith and Mark Burbach outlined the job…

Mae Davenport was nominated, and accepted the nomination to be the incoming secretary. A key caveat is that that she and Gasteyer will switch the roles in hosting meetings 2020 and 2021. Davenport will host the 2020 meeting in Minneapolis, MN to coincide with the UCOWR meetings, where there will be an NC1190 panel, and Gasteyer will host in 2021 in East Lansing, MI

**Brainstorm plans/priority projects for 2019/20**

A brainstorming exercise was developed by Doug Jackson-Smith to identify the priority projects for 2019/2020. Exercise involved people nominating potential topics and projects, then rearranging these on the wall to identify priorities and clusters of similar ideas. Based on this activity, we identified the following activities.

Report outs included interest in:

Wardropper – 1. The development of a Multi-Site Workshop on Participatory modeling; 2. Role of crop insurance in farmer conservation; 3. Comparative Studies of Hypoxia Outbreaks (e.g. Great Lakes, Mississippi-Gulf; Chesapeake Bay)

Reismann – 1. Urban Rural conservation paper; 2. Multi-state participatory modeling – Literature review on Decision making and adoption of BMPs

Ranjan – 1. Excess moisture – role collective action theory in agricultural drainage – in other words, excess water management; 2. What is the typology of agricultural operational relationships? 3. Non-operating land owner and operating land owner relationships

Gasteyer – 1. Connecting urban and rural water quality mobilization; 2. Drainage; 3. Onsite Sanitation and water quality

Burbach -- Engagement workshop; Farmer research fatigue

Prokopy – BMPs, adoption, and effectiveness.

Stephenson – 1. adoption; effectiveness – 2. next generation incentive programming

Wu – 1. Content analysis of media to discover local perceptions of water quality issues; 2. Public perception and TMDLs;

Genskow– 1. Addressing policy options for achieving water quality (regulatory, etc.); 2. competing versus complimentary conservation; 3) Ten-year post Stoner memo analysis of impact.

Church – 1. Paper on urban-rural impacts of conservation; 2. Maladapatation to issues like climate change and moving beyond; 3. Limits to engagement

Kaufmann – Work on grant writing …

Frock– Farmer to farmer TA and conservation (farmer led conservation)

Wilke – 1. Generational Difference; 2. Non-Adoption – what is our role to engage; 3. Impacts and trajectory of the Hypoxia task force and state level response…

Arrueta – Participatory modeling workshop – how to and when to engage stakeholders

Kathy Brasier – 1. Performance and BMPs – individual performance and landscape level impacts… individual vs. collective action in a particular perspective

Chaudary – 1) BMP adoption – How do different factors that impact different farmers impact adoption…; 2) How do community based participatory approaches – community based social marketing…

Eaton – 1. interdisciplinary team science; 2. workshop and book

Arbuckle – 1. Proposing increased collaboration across NC-1190; 2. inform better questions,

Jackson-Smith – 1. coordinate data collection across states… 2. replicate Assessment of onfarm research --- 3. Urban water narratives – cross-culture water issues… 4. Conservation programs – water leadership programs

Davenport – 1. Why do participants participate in programs… ; 2) getting the social science applied by U of Minnesota Extension – Is our social science used and how is it used? Especially in Agriculture; 3) Participation/engagement – empowering feedback loops for self-efficacy

12:30     **Lunch**

1:00       **Prep for phone call with Allison Thompson, Field-to-Market**

1:15       **Zoom call w/ Allison Thompson**

Allison Thomson Discussed the Field to Market initiative – an initiative to work with industry to incentivize farmers to move toward sustainability. The call discussed how the initiative is organized, the partners and numbers of farmer participants (about 30,000). NC 1190 participants discussed the possibilities of collaboration, specifically thinking about data collection, evaluation, the issues tipping and saturation points, voluntary vs. regulatory approaches, compliance concerns, participatory research design, and how to build on existing knowledge related to farmer and community motivations for implementing conservation measures.

2:00-3:00 **Presentation about Alpine Nutrient Trading Program, Sugar Creek Projects (R. Moore)**

**Richard Moore and Michelle Wood (Holmes Soil and Water Conservation) – presented on the Sugar Creek – Incredible improvement of water quality –**

**Project has received lots of awards…**

The group heard a presentation on the Sugar Creek – Alpine Dairy Nutrient Trading Program – considered one of the most successful nutrient trading programs in the US. Presenters highlighted the importance of the modeling the system to understand the contributors to poor water quality and the role of the Alpine Dairy in adding nutrients to the watershed, followed the calculations of what percent of the problem could be offset through paying for farmers to implement Best Management Practices for livestock and crop management to minimize runoff. Alpine Cheese makes Jaarslberg cheese – producing lots of Phosphorous. After EPA identify high nutrient levels in the watershed, issued requirements for a significant reduction through plant upgrades. Alpine Cheese factory was to be closed for excess emissions, EPA and factory came to OSU (Moore). EPA happened to be interested Environmental Services Trading – and inaugurated the first Water Quality Trading project to achieve water quality through trading emissions in the Sugar Creek watershed. The Dairy ultimately did commit to Partial facility upgrade, but then with SWCS as the intermediary, traded for the rest of the nutrient reduction. Worked with 25 farmers to install 91 practices, creating 7,133 credits, needed 5,500 by 2011. In just three years achieved goals in nutrient reduction remediating twice as much N as P – because of the BMPs implements. Created 12 jobs, at the cheese factory, and improved milk by improving cow health. The project worked because it was implemented in an area with a small enough watershed that there was a high level of trust between farmers and dairy and the existence of trusted brokers (SWCS, OSU Extension). From a watershed perspective, the project started in the headwaters and then moved into secondary and tertiary watersheds, which allowed for built-in synergies. RESEARCH CHALLENGES for future research and application to other cases: How to Lower Transaction costs; How to include carbon trading with P and N trading?; How to give incentives for upstream conservation?; How to create synergy between multiple PS? How to include local economic development? Critical source area modeling? Ingredients of success included -- Structured to be farmer friendly and flexible… 2 page contract – knew exactly how much money they would receive based on credits. Farmers were directly related to dairy – so there was a sense of community benefit to implementation. Relationships – Ag Extension Agents – worked with community – HHs, community meetings. SWAG to pay for each credit -- $30 per practice, about perfect…WHY NOT MORE of these kinds of initiatives. Aside from the problem of trust, it is not always financially the best option. For instance, WW treatment plants can treat with chemicals which is less expensive. trusted interlocutor

3:00       **The Group departed on field trip of the Alpine Dairy and the Sugar Creek Watershed**

7:30       **Return to Wooster from field trip**

7:45       **Group dinner downtown Wooster (City Square Steakhouse patio)**

**Thursday, June 27th**

7:00 am **breakfast at hotel**

8:00       **Convene in Research Services 130 / OARDC**

**Decide on topics for focused subgroup work/discussion/planning for 2019/20**

9:00       **Work on special topics**

Grouping of projects

Super spicy – (Lots of interest for the coming year)

a. Hypoxia Task Force and Nutrient Reduction Plans – cluster –

1) 10 Year Anniversary of Stoner Memo;

2) Comparative Hypoxia initiatives -- Mississippi River, Chesapeake Bay, Puget Sound, etc. What are trends and what have been actions.

b. Engaging Farmers –

1. Workshop;

2. Joint volume (special issue; compendium);

3. Course

c. Finalizing the Urban- Rural Relationships paper --

d. Drainage –

1. Understanding trends;

2. Maladaptation;

3. Perspective

e. BMP adoption -- Social science on adoption;

1. Factors leading to adoption;

2. How is it sustained over time;

3. Adoption under different conditions – conservation plan – State regulations/NRCS regulations…who are the programs and actors;

4. Policy adoption strategies

f. Use and practice of social science –

Details of activities

Participation and Engagement

1. Workshop; bringing together (see Wes’ proposals)
	1. Who would be involved? -- Scholars/researchers/practitioners/program directors
	2. Solicit USDA conference grant
	3. Timing – tentative 2020
	4. Maybe special session at UCOWR --
2. Maybe develop a white paper…
3. Focus on public participation and working landscapes and water…part of the issues
4. Multi-campus Course? – A) Working Title: Stakeholder Engagement and Participatory Research;
	1. Stakeholder engagement
		1. Watershed planning
		2. Program design and implementation
	2. Participation research/modeling
		1. farmer
	3. Class – could be a class to engage people in engagement with the community – Giving communities planning tools and strategies… structure and deadlines
	4. Use to coordinate literature review
	5. Methods training
	6. Graduate and Undergraduate training…
	7. Paper outputs? Authorship?
	8. Lit review / end product goal
	9. Online

Adoption, dead option, factors of participation – in what ways does participation contribution

1. Holistic synthesis
	1. Literature review
	2. Methods
	3. Empirical data
	4. Adoption/Implementation and de-adoption; how to deal with the full suite of variables; factors; methods; gaps
2. How build off literature review effort from last few years.

Hypoxia and Nutrient Reduction strategies

1. Stoner Memo as Catalyst – Mississippi Basin – impact and variance across states…
	1. Coordination with SARE46
2. Comparative case paper on hypoxia cases – Chesapeake, MRB, GLB - issues and catalysts Institutional and system work –

Conservation Adoption Process

* Holistic synthesis
	+ Lit reviews on social science on WQ/behaviors
	+ Methods
	+ Empirical data
	+ Adoption/implementation and de-adoption; how to deal with the full suite of variables; factors; methods; gaps
	+ Coordinating instruments
* How to build off the literature review effort
* See “Inspiring Action for Nonpoint Source Pollution Control” university of Minnesota
* Mapping of conceptual models… by discipline…
* Use that to guide a comparative case study
* Proposal
	+ Convening to synthesize/integrate conceptual models
	+ Use model to guide comparative case study assessment of ag watershed conservation projects across states – perhaps focus on one or more of the big basins (Chesapeake, Mississippi, Great Lakes)
	+ Funding Sources?
		- Foundations (Walton,…)
		- Nonprofits (TNC, NFWF, AFT)
		- Fed Agencies (USDA?, NSF)

Create pooled database of empirical studies of BMP adoption (actual data instruments)

 Fund a Research Coordination Network

Adoption pathways, sustainability

 Persistence, de-adoption

 Social drivers –

 Intergeneration ties, family dynamics, gender

 Behavior heterogeneity, disproportionality

 Landlord/tenant

 Policy Issues / Institutions

 (RMA; incentives/performance)

 Governance structures

 Economic / market condition (sweet spot, driver, excuse…)

**Accomplishments**

* Through surveys and interviews led by Dr. Church, we are increasing our understanding of the role of systems thinking in conservation behaviors. We found that farmers who adopt conservation practices are more likely to be systems thinkers than non-adopters. We are using this preliminary data to develop a more robust set of systems thinking measurements and to understand any messaging gaps that occur between conservation staff and farmers due to the use of a systems approach to conservation. Our results will be discussed with our NRCS partners to help inform their communication strategies with farmers.
* Program evaluation of the Nebraska Water Leaders Academy by Dr. Burbach showed that Academy alumni have emerged as leaders in their communities and with the knowledge and skills to drive innovative approaches to water management in Nebraska. Research by Dr. Burbach and colleagues found that partnerships with NGOs, research universities, and public agencies are critical to progressive ranchers successful operations. Furthermore, Dr. Burbach and colleagues determined that managing for vegetation heterogeneity in grasslands is compatible with cattle production. The role of boundary spanner, individuals within an organization who can reach across organizational borders to build relationships, interconnections, and interdependencies in order to manage complex problems, is important to establishing trust between stakeholders in integrated water resource management.
* Wardropper: 1)Outreach materials about soil health and water quality were sent to over 30,000 landowners of farmland in IL, IN, IA as part of a Purdue and TNC-led project; 2) 2 workshops conducted with farmers and other agricultural stakeholders in Idaho and Washington on barriers and opportunities to implementing erosion-control measures including no-till and cover crops; 3) Increased knowledge of water quality perceptions and health behaviors related to lead-contaminated waterways in northern Idaho through a survey; 4) Co-developed computer game for middle and high school students that educates kids about metals contamination in waterways in mining-impacted regions; 5) greater realization of the value of including social science researchers/research in interdisciplinary/transdisciplinary projects addressing soil and water conservation in SD for Dr. Schad’s project
* Jackson-Smith: OSU-CFAES WQ Task Force developed a strategic plan and is implementing it to expand access to and impact of water quality related research by non-academic partners. State water quality policy discussions increasingly grounded in science (which originated from or is organized by OSU faculty).
* Gramig’s project increased understanding of farmer willingness to adopt and resistance to adopting nutrient loss reduction practices in central Illinois. A key constraint identified is the large share of high cash rent land being farmed and the perceived requirement that landlords accept lower rents if farmers are required to adopt certain practices.
* Margerum’s project led to two products that have been shared with practitioners: (1) Funding and compensation report for councils and coordinators to share information about resource stability and compensation levels for coordinators; (2) metrics on council utilization of resources, training along with a needs assessment of training and resources for councils which will be used by the Oregon Network of Watershed Councils to support their strategic planning, training and outreach.
* In 2018-2019, Iowa NC1190-related projects employed qualitative and quantitative research methods to collect and analyze social science data from Iowa farmers to inform water quality improvement activities. Research findings are helping agencies (e.g., Iowa Department of Agriculture and Land Stewardship, Iowa Department of Natural Resources) and NGOs (e.g., Iowa Soybean Association, Iowa Clean Water Alliance), and private sector stakeholders to more effectively work with farmers to implement soil and water conservation practices in support of the Iowa Nutrient Reduction Strategy, a statewide initiative to reduce nutrient loss.
* PI Arbuckle collaborated on three grants with NC1190 participants in other states. Products of research have been disseminated through journal articles published or forthcoming, extension and technical reports,) presentations to academic and stakeholder audiences, and multiple articles referencing NC1190-related research in mainstream news outlets (e.g., New York Times, Des Moines Register) and agricultural press (e.g., Wallaces Farmer, Iowa Farmer Today).
* Rissman realized that county conservationists are more aware of adaptation options for extreme storm events. Additionally, Watershed partners are beginning to integrate climate change projections into models of future water quality, such as Yahara CLEAN 3.0

 **Output (websites)**

<https://iwrrc.org/commongroundcommonwater/>

Nebraska Water Leaders Academy, <http://waterleadersacademy.org/>

<https://chloewardropper.weebly.com/>

waterquality@osu.edu

<https://wsc.limnology.wisc.edu/yahara2070>

<http://clean-water.uwex.edu/partners.html>

**Output (Presentations)**

1. Arbuckle, J.G., S. Church, F. Eanes, K. Floress, Y. Gao, B. Gramig, L. Prokopy, P. Ranjan, A. Singh. Why farmers adopt (or do not adopt) soil and water conservation practices: Results from a meta-analysis of adoption research from 1982-2017. Rural Sociological Society Annual Meeting, Portland, OR, July 24, 2018.
2. Arbuckle, J.G. Rented farmland: Are Landlords from Mars and Tenants from Venus? Evidence from an Iowa Landowner Survey. ISU ANR Extension Crops Team Spring In-Service. Boone, IA, April 2, 2019
3. Arbuckle, J.G. A Brief History of Adoption Research: From Hybrid Corn to Cover Crops. Iowa Water Conference. Ames, IA, March 12, 2019
4. Arbuckle, J.G. Rented farmland: Are Landlords from Mars and Tenants from Venus? Evidence from an Iowa Landowner Survey. Iowa Water Conference. Ames, IA, March 12, 2019
5. Arbuckle, J.G. Land Tenure and Soil Health. ISU Soil Health Conference. Ames, IA, February 4, 2019
6. Arbuckle, J.G. Monarch butterflies and Iowa agriculture: What do farmers think? Environmental Defense Fund/ISU Monarch Conservation Workshop, Ames, IA, November 27, 2018
7. Arbuckle, J.G. Why do farmers adopt (or not adopt) soil and water conservation practices? The Nature Conservancy Iowa Board of Trustees Meeting. Marion, IA, July 20, 2018.
8. Bielicki, J.M., E. Irwin, L. Arrueta Antequera, B. Bakshi, M.A. Beetstra, C. Brock, Y. Cai, B. Cultice, M. Doidge, D. Jackson-Smith, J. Kast, J. Martin, A. Randall, I. Sheldon, S. Tang, Y. Wang and R.S. Wilson. The Dynamic Regional Food, Energy, Water Systems Framework for Investigating Effects of Deglobalization, Presentation at American Geophysical Union Meetings. Washington, DC December 10-14, 2018.
9. Burbach, M.E. Great Plains ranchers management for vegetation heterogeneity: The need for partnerships. ISSRM, Oshkosh, WI, June 4, 2019.
10. Burbach, M.E. Water for agriculture and local leadership teams. Central Platte Region Local Leadership Team meeting, February 5, Wood River, NE, 2019.
11. Burbach, M.E. Full Range Leadership for leaders in the water arena. Nebraska State Irrigation Association, Nebraska Water Leaders Academy, Lincoln, NE, January 24, 2019.
12. Burbach, M.E. Tapping into your motivation to serve and inspiring others in their service. Nebraska State Irrigation Association, Nebraska Water Leaders Academy, November 15, Nebraska City, NE, 2018.
13. Burbach, M.E. Personal empowerment “ Continuing to develop your leadership capacity. Nebraska State Irrigation Association, Nebraska Water Leaders Academy, November 15, Nebraska City, NE, 2018.
14. Burbach, M.E. creating an engaged approach to water for & from agriculture. Nebraska Water Center Advisory Board Meeting, November 5, Lincoln, NE, 2018.
15. Burbach, M.E. Catalysts of change: An evaluation of the Nebraska Water Leaders Academy. ISSRM, June 20, Snowbird, UT, 2018.
16. Church, S.P., J. Lu, L.S. Prokopy. "The role of systems thinking in early adopter conservation behaviors: Implications for middle adopters." Oral. 25th International Symposium on Society and Resource Management, Oshkosh, WI. June 2-7, 2019.
17. Church, S.P., J. Lu, L.S. Prokopy. "The role of systems thinking in early adopter conservation behaviors: Implications for middle adopters." Oral. 74th Soil and Water Conservation Society International Annual Conference. Pittsburgh, PA. July 28-31, 2019.
18. Church, S.P. "Common Ground Common Water: Film as a tool for shared understanding of water resource protection." Poster. 74th Soil and Water Conservation Society International Annual Conference. Pittsburgh, PA. July 28-31, 2019.
19. Delozier, J., & Burbach, M.E. Boundary Spanners: A key resource in developing trust between stakeholders in integrated water resource management. ISSRM, Oshkosh, WI, June 4, 2019.
20. Eanes, Francis Weston M. Eaton, Jessica D. Ulrich-Schad Sarah P. Church, Morey Burnham, and J. Arbuckle. 2019. Sense of Place in Working Landscapes: Troubles and Opportunities. International Symposium on Society and Research Management; Oshkosh, WI.
21. Kolady, Deepthi, Tong Wang, and Jessica D. Ulrich-Schad. Adoption of diverse crop rotation: Drivers and implications. Southern Agricultural Economics Association Annual Meeting; Birmingham, AL.
22. Morris, C. and J.G. Arbuckle. Do conservation plans make a difference in practice adoption? Evidence from Iowa farmers. Iowa Water Conference. Ames, IA, March 12, 2019
23. Norton, M. and J. Arbuckle. Livestock Production, Water Scarcity, and Potential for Collaborative Water Governance in Northwest Iowa. Agriculture, Food, and Human Values Society & Association for the Study of Food and Society. Madison, Wisconsin, June 15, 2018.
24. Norton, M. and J.G. Arbuckle. Livestock production, water scarcity and potential for collaborative water governance in northwest Iowa. Iowa Water Conference. Ames, IA, March 13, 2019
25. Prokopy, L., S Church, B Gramig, P Ranjan. Meta-Review of Barriers and Motivations for Farmers to Adopt Conservation Practices, 2018 SWCS, Albuquerque, NM. July 30, 2018.
26. Ranjan P. and J.G. Arbuckle. Meta-Review of Barriers and Motivations for Farmers to Adopt Conservation Practices. Iowa Water Conference. Ames, IA, March 12, 2019
27. Rissman, Adena R. Adapting conservation policy and management to ecosystem dynamics and no-analog futures. Colorado State University. April, 2019
28. Rissman, Adena R. Using social sciences to inform lake management. Lake Leaders. Kemp Station, WI. September, 2018. [training with local lake association leaders and volunteers]
29. Rissman, Adena R. Organized and presented at a public forum, Tackling Environmental Problems: the Wisdom of Science and Lived Experience. Madison, WI. November, 2018. Speakers at the event included: Connie Blau, landowner and citizen scientist, Tim Van Deelan and Chris Kucharik from UW Madison, Alison Duff from USDA Dairy Forage Research Center, Heidi Johnson from Dane County UW-Extension, Mary Kolar from Dane County Board of Supervisors, Curt Meine from Aldo Leopold Foundation and the Center for Humans and Nature.
30. Rissman, Adena R. Panelist, Science and the Public: Apocalypse Wow, Madison Children's Museum Adult Swim. March 8, 2019. [public panel on environmental and social futures for adult night at the museum]
31. Rissman, Adena R. Love and land: managing private lands for public good. Baraboo Range Preservation Association. Baraboo, WI. February, 2019.
32. Rissman, Adena R. Governing agricultural water quality: spatial, temporal, and functional dimensions of ecohydrologic institutional fit. Workshop on the Ostrom Workshop. June, 2019. Bloomington, IN.
33. Rissman, Adena R. Adaptations to extreme storms by county conservationists. Water@UW. May, 2019. Madison, WI.
34. Rissman, Adena R. October, 2018. UW Agroecology graduate seminar, Farm Bill Conservation Title.
35. Saak, Alexander, Tong Wang, Deepthi Kolady, Jessica D. Ulrich-Schad, David Clay, Abdelrahim Abulbasher. (Poster) Economic and environmental benefits of conservation tillage: perceptions of farmers in South Dakota. Soil Health Institute Annual Meeting; Albuquerque, NM.
36. Schaad, J. Adaptations to extreme storm events by conservation organizations. International Symposium on Society and Resource Management. Oshkosh, Wis. June 2-6, 2019.
37. Schaad, J. Tailoring messages to promote conservation on U.S. rented cropland. International Symposium on Society and Resource Management. Snowbird, Utah. June 17-21, 2018.
38. Schaad, 2019 (Invited) South Dakota Farmers: Usage and Determinants of Conservation Best Management Practices Webinar. South Dakota Regional Carbon Group.
39. Schaad, 2018 (Invited) Utilizing the Social Indicator Planning & Evaluation System (SIPES) to Assess Conservation Outreach and Practices (Webinar). The Nature Conservancy.
40. Sun, S, M Delgado and BM Gramig. Cost-effectiveness of Nutrient Loss Reduction from Working Lands Agricultural Conservation Expenditures, 2018 AAEA, Washington, DC.
41. Wall, N. & Burbach, M.E. maximizing your civic capacity by engaging in water issues.Nebraska Association of County Officials (NACO), Institute of Excellence, Lincoln, NE, September 7, 2018.
42. Wang, Y, M. Delgado, JP Sesmero, BM Gramig. Impact of Ethanol Plant Spatial Competition on Local Corn Supply: A Spatially Explicit Analysis, Southern Economic Association 2018 Annual Meeting, Washington, DC.
43. Yun, SD and BM Gramig. Agro-Climatic Data by County (ACDC): Methods and Data Generating Processes. 2018 North American Regional Science Conclave (NARSC), San Antonio, TX. November 10, 2018.

**Activities**

* Dr. Flores collaborated with Dr. Prokopy and Dr. Burbach to edit a special issue of the Journal of Contemporary Water Resources and Education, along with publishing papers in the issue. The issue is a direct output from NC1190 - the papers are all co-authored by our team members and we have been working on it for 2 years. Issue: "Catalyzing Change: Social Science for Water Resources Management" <https://onlinelibrary.wiley.com/toc/1936704x/2019/167/1>
* Dr. Church collaborated on a research note with several members of NC1190 (Eaton, Ulrich-Schaad, Church, Arbuckle) that proposed a new set of survey questions to understand how sense of place and a conservation ethic situated specifically in working landscapes contributes to conservation behaviors: She also published a case study about the use of social science data in watershed planning and management. This is part of a special issue specific to research and collaborations with NC1190 members (Church, Ulrich-Scahd, Ranjan, Prokopy). Church, S.P., Babin, N., Bentlage, B., Dunn, M., Ulrich Schad, J.D., Ranjan, P., Magner, J., McLellan, E., Stephan, S., Tomer, M.D. and Prokopy, L.S., 2019. The Beargrass Story: Utilizing Social Science to Evaluate and Learn from the â€œWatershed Approach. Journal of Contemporary Water Research & Education, 167(1), pp.78-96. 3) Completed and published two literature synthesis projects looking at determinants of farmers' conservation behaviors with several NC1190 members (Arbuckle, Church, Floress, Gramig, Prokopy, Ranjan).Ranjan, P., Church, S.P., Floress, K. and Prokopy, L.S., 2019. Synthesizing Conservation Motivations and Barriers: What Have We Learned from Qualitative Studies of Farmersâ€™ Behaviors in the United States?. Society & Natural Resources, pp.1-29. Prokopy, L.S., Floress, K., Arbuckle, J.G., Church, S.P., Eanes, F.R., Gao, Y., Gramig, B.M., Ranjan, P. and Singh, A.S., 2019. Adoption of agricultural conservation practices in the United States: Evidence from 35 years of quantitative literature. Journal of Soil and Water Conservation, 74(5), pp.520-534. She engaged in research and outreach on climate change impacts to water quality, including the responses of county land and water conservation departments/districts to extreme storm events. This included a research survey of county conservationists, research brief, and talks at conferences and the Wisconsin county conservationist association. She also did a research on water quality trading and trading-like mechanisms. Wisconsin's water quality trading programs are growing rapidly, and I have conducted research and assisted students on understanding the dynamics of these programs.
* Dr. Burbach evaluated the effect of the Nebraska Water Leaders Academy in producing catalysts of change in water issues. He investigated predictors of ranchers' attitudes toward heterogeneous landscape--scale management. He also investigated the role of boundary spanners in developing trust between stakeholders in integrated water resource management.
* Dr. Kaufman co-chaired an Extension program team in the area of Leadership, Volunteerism, and Civic Engagement.
* Dr. Wardropper did two conferences presentations on related topics. She was awarded 5 Grants on related topics. She did 4 publications on related topics
* Dr. Schad received the 2019 Journal of Soil and Water Conservation, Best Research Paper Award (Dunn et al. 2016). She presented Utilizing the Social Indicator Planning & Evaluation System (SIPES) to Assess Conservation Outreach and Practices (via Webinar) to The Nature Conservancy. She also presented on South Dakota Farmers: Usage and Determinants of Conservation Best Management Practices (via Webinar) to the South Dakota Regional Carbon Group. She conducted a mail/online survey of South Dakota corn, soybean, and wheat producers regarding nutrient management; included questions to test the theory of planned behavior as part of a grant received from the Nutrient Research and Education Council of South Dakota. She also conducted a mail/online survey of livestock producers in South Dakota who graze their cattle to learn about their parasiticide usage, their knowledge about dung beetle populations (and relationship with parasiticide use), and attitudes regarding soil health; included questions to study sense of place and relationship to conservation behavior; part of a 3 year grant received from USDA-NIFA with rangeland ecologists and entomologists to study dewormers and dung beetle populations. Within 3 different farmer surveys, she conducted survey experiments to document best practices for survey research with farmers including the usage of incentives, institutional affiliations (NRCS), and multiple simultaneous response options. She also conducted about 40 interviews with farmers in SD who have diversified on-farm (including into wind farming) regarding the drivers, challenges, and benefits to diversification as well as the impact on their identity as farmers
* Dr Jackson-Smith contributed to an NSF funded survey of farmers and nonoperating landowners in 5-state region to identify likely land use changes made in response to markets and policy shocks. Work will help inform development of coupled systems model to simulate effects of 'deglobalization' and environmental policies on food, energy and water system in eastern corn belt/Great Lakes region. He chaired Water Quality Task Force for College of Food, Agriculture and Environmental Sciences at The Ohio State University. Developed recommendations for expanding and improving impact of CFAES faculty research, outreach, and teaching on water quality. Facilitated update of white paper on scientific knowledge about drivers of algal blooms in Western Lake Erie Basin.
* Dr. Gramig: 1) Worked extensively throughout the entire year with multi-state team that included NC-1190 members Arbuckle (IA State), Floress (USDA-FS), and Prokopy (Purdue) funded by the Walton Family Foundation to complete a meta-review of the literature on adoption of agricultural conservation practices in the US. 2) Presented research at the Illinois Nutrient Loss Reduction Strategy annual workshop and Research Showcase in fall 2018. 3) Worked with Extension, NGO and private sector interests on agricultural sustainability issues in Illinois through the informal "Alphabet Soup" group/network convened by The Nature Conservancy that includes farm organizations, environmental NGOs working on agriculture, SWCDs and federal agencies
* Dr. Arbuckle collaborated on three grants with NC1190 participants in other states. Products of research have been disseminated through journal articles published or forthcoming, extension and technical reports)
* Dr. Arbuckle is conducting a 5-year (2015-2019) survey research project sponsored by the Iowa Department of Agriculture and Land Stewardship and Iowa State University Extension. The survey objectives are to measure change in awareness, attitudes, and actions related to nutrient loss reduction among Iowa farmers, and to identify barriers to action. Results have been disseminated through technical reports, targeted presentations, and the farm press.
* Dr. Arbuckle is a collaborating researcher on NC1190 member Linda Prokopy (Purdue University) grant from the Walton Family Foundation ($100,000) called Assessing the strengths and limitations of voluntary conservation to modify agricultural practices. The project is conducting focus groups in Iowa, Illinois, and Indiana with farmers who do not use recommended BMPs and non-operator landowners. We also continue to work on papers stemming from our 2016-17 Walton Family Foundation grant Assessing Barriers to Adopting Conservation Practices.
* Dr. Arbuckle is conducting a 5-year (2015-2019) survey research project sponsored by the Iowa Department of Agriculture and Land Stewardship and Iowa State University Extension. The survey objectives are to measure change in awareness, attitudes, and actions related to nutrient loss reduction among Iowa farmers, and to identify barriers to action. Results have been disseminated through technical reports, targeted presentations, and the farm press. Stakeholders have used results to help refine outreach programs for farmers and agricultural advisers.
* Dr. Arbuckle is co-PI with fellow NC1190 member and lead PI Mae Davenport (University of Minnesota) on a NIFA AFRI grant called Understanding and Building Capacity to Address Changing Water Availability in the Upper Corn Belt. This three-year multistate project (ISU and UMN) seeks to improve understanding of how planners, policy makers, and agricultural producers anticipate, respond, and adapt to changing water availability in four sites in Iowa and Minnesota. Iowa research has conducted in-depth interviews with rural water systems, livestock groups, government agencies, and other key stakeholders to evaluate perspectives on water availability and water quality issues in the region. In spring 2019 the project conducted a survey of farmers in both states to collect data on water availability and management perspectives and practices.
* In 2018 Dr. Arbuckle annual survey of Iowa farmers, the Iowa Farm and Rural Life Poll, examined several NC1190-relavent issues, including current and potential future use of key agricultural BMPs and current participation in watershed management activities. Just 30% of farmers indicated that there was an active watershed management group in their watershed, and only 15% percent reported that they themselves are involved in watershed management activities.
* Dr. Arbuckle is co-PI on an internal Iowa State University Presidential Interdisciplinary Research Initiative (PIRI) Program grant (3 years, $741,480) called Initiative for Cultivating Human And Naturally reGenerative Enterprises (CHANGE).â€ The primary objectives of the grant are to conduct research and engagement that leads to increased integration of perennial crops into Iowa agricultural landscapes and development of anaerobic digesters/biogas and bioproduct supply chains that improve agriculture environmental and economic outcomes.
* Dr. Rissman: 1) Research and outreach on climate change impacts to water quality, including the responses of county land and water conservation departments/districts to extreme storm events. This included a research survey of county conservationists, research brief, and talks at conferences and the Wisconsin county conservationist association. 2) Research on water quality trading and trading-like mechanisms. Wisconsin's water quality trading programs are growing rapidly, and I have conducted research and assisted students on understanding the dynamics of these programs.
* Dr. Margerum conducted a study of Oregon watershed council capacity, stability and management in relation to nonprofit status. Study included a survey of 60+ watershed council coordinators in collaboration with the Network of Oregon Watershed Councils. The survey has been followed up by approximately 20 interviews with coordinators.

**Impacts**

1. The Nebraska Water Leaders Academy is producing catalysts of change in water issues at local, state, regional, national, and international levels.
2. Partnerships are critical to progressive ranchers environmental stewardship.
3. Managing for vegetation heterogeneity in grasslands is compatible with cattle production.
4. Boundary spanning behaviors are important to developing trust between stakeholders in integrated water resource management.
5. Agricultural stakeholders attending soil health workshops in Washington described increased understanding of implementation options
6. Increased awareness of lead contamination in waterways among residents of three communities in northern Idaho
7. Identification of training and support needs for watershed councils
8. Status of coordinator compensation and benefits to help stabilize coordinator turnover
9. The Iowa Nutrient Reduction Strategy (NRS) Farmer Survey has informed outreach strategies and helped to track progress toward NRS goals.
10. The Iowa Farm and Rural Life Poll survey results have informed outreach strategies around water quality-related soil and water conservation practice promotion.
11. Improved responses to storm events help landowners and conservationists.

**Publications**

***Peer Reviewed Journal Articles (published)***

1. Brock, Caroline, Jessica D. Ulrich-Schad, and Linda S. Prokopy. 2018. " Bridging the Divide: Challenges and Opportunities for Public Sector Agricultural Professionals Working with Amish and Mennonite Producers on Conservation." Environmental Management. 61(5): 756-771.
2. Burbach, M.E., Floress, K., Prokopy, L.S. (2019). Introduction to Special Issue: Catalyzing Change. Journal of Contemporary Water Research and Education, 161 (1).
3. Byrd, ES\*, NJO Widmar, BM Gramig. "Presentation Matters: Number of Attributes Presented Impacts Estimated Preferences." Agribusiness: an International Journal 34(2):377-389, 2018. (Grad student co-author\*)
4. Church, Sarah P., Nick Babin, Belyna Bentlage, Michael Dunn, Jessica D. Ulrich-Schad, Pranay Ranjan, Joe Magner, Eileen McLellan, Susi Stephan, Mark Tomer, Linda S. Prokopy. 2019. The Beargrass Story: Utilizing social science to evaluate and learn from the watershed approach. Journal of Contemporary Water Resources and Education (167):78-96.
5. Czap, N.V., Czap, H.J., Banerjee, S., & Burbach, M. (2019). Encouraging farmers participation in the Conservation Stewardship Program: A field experiment. Ecological Economics, 161, 130-143.
6. Doering, O, B Gramig and Jeong\*. Economic and Policy Implications of Nitrogen Management. Soil Nitrogen Uses and Environmental Impacts, Advances in Soil Science: Soil Nitrogen volume, eds. R. Lal and B.A. Stewart. CRC Press, Taylor & Francis Group: 2018 (Grad student co-author\*)
7. Eaton, W. M., F. R., Eanes, J. D., Ulrich-Schad, M., Burnham, S. P., Church, J. Arbuckle, J. Cross. 2019. Trouble with Sense of Place in Working Landscapes. Society & Natural Resources, 32(7), 827-840. https://doi.org/10.1080/08941920.2019.1568653
8. Floress, K., Thompson, A.W., & Fisher, C.L. (2019). Assessing principles of good governance: The case of Lake Wausau, Wisconsin. Journal of Contemporary Water Research and Education, 161(1).
9. Gardezi, M. and J.G. Arbuckle. 2019. The influence of objective and perceived adaptive capacities on Midwestern farmers use of cover crops. Weather, Climate, and Society. <https://doi.org/10.1175/WCAS-D-18-0086.1>.
10. Gardezi, M. and J.G. Arbuckle. 2019. Techno-optimism and farmers attitudes toward climate change adaptation. Environment and Behavior. <https://doi.org/10.1177/0013916518793482>.
11. Gardezi, M. and J.G. Arbuckle. 2019. Spatially Representing Vulnerability to Extreme Rain Events Using Midwestern Farmers' Objective and Perceived Attributes of Adaptive Capacity. Risk Analysis. 39(1):17-34 DOI: 10.1111/risa.12943
12. Gramig, BM and NJO Widmar. "Farmer Preferences for Agricultural Soil Carbon Sequestration Schemes." Applied Economic Perspectives and Policy 40(3):502-521, 2018.
13. Haigh, T., Schacht, W., Knutson, C.L., Smart, A.J., Volesky, J., Allen, C., Hayes, M., & Burbach, M. (2019). Socioecological determinants of drought impacts and coping strategies for ranching operations in the Great Plains. Rangeland Ecology & Management, 72, 561-571.
14. Jackson-Smith, D., S. Ewing, A. Sigler, C. Jones, and A. Armstrong\*. 2018. The road less travelled: assessing the impacts of farmer and stakeholder participation in groundwater nitrate pollution research. Journal of Soil and Water Conservation 73(6):610-622. <https://doi.org/10.2489/jswc.73.6.610>
15. Kaufman, E. K., Kennedy, R. E., & Cletzer, D. A. (2019). Understanding the Nature of EcoLeadership: A Mixed Methods Study of Leadership in Community Organizations. Journal of Contemporary Water Research & Education, 167(1), 33-49. [https://doi.org/10.1111/j.1936-704X.2019.03310.x+D4+D5](https://doi.org/10.1111/j.1936-704X.2019.03310.x%2BD4%2BD5)
16. Lee, D., J.G. Arbuckle, Z. Zhu, and \*L. Nowatzke. 2019. Conditional Causal Mediation Analysis of Factors Associated with Cover Crop Adoption in Iowa, USA. Water Resources Research. 54(11):9566-9584 https://doi.org/10.1029/2017WR022385
17. Owley, Jessica, Federico Cheever, Adena R. Rissman, M. Rebecca Shaw, Barton H. Thompson, Jr., and W. William Weeks. 2018. Climate change challenges for land conservation: rethinking conservation easements, strategies & tools. Denver University Law Review. 95:727-780
18. Prokopy, L. S., Floress, K., Arbuckle, J. G., Church, S. P., Eanes, F. R., Gao, Y., & Singh, A. S. (2019). Adoption of agricultural conservation practices in the United States: Evidence from 35 years of quantitative literature. Journal of Soil and Water Conservation, 74(5), 520+D4+D5
19. Ranjan, P., C.B. Wardropper, F. Eanes, S. Reddy, Y. Masuda, L. Prokopy. 2019. Understanding barriers and opportunities for adoption of conservation practices on rented cropland. Land Use Policy. 80, 214-223. doi: 10.1016/j.landusepol.2018.09.039
20. Roesch-McNally, G., J.G. Arbuckle, J. Benning, L.W. Morton and A. Wilke. 2019. University extension communities of practice: Learning, communicating, and engaging on climate change adaptation and mitigation in the United States Corn Belt. Pp. 180-193, In: Lachapelle, P., & D. Albrecht. (Eds.), Addressing Climate Change at the Community Level in the United States. New York: Routledge.
21. Singh, Ajay S., Brian MacGowan, Jessica D. Ulrich-Schad, Michael O Donnell, Heidi Klotz, and Linda S. Prokopy. 2018. The influence of demonstration sites and field days on conservation practices adoption. Journal of Soil and Water Conservation 73(3): 274-281.
22. Sliwinski, M., Burbach, M.E., Powell, L., & Schacht, W. (2018). Factors influencing ranchers intentions to manage for vegetation heterogeneity and promote cross-boundary management in the northern Great Plains. Ecology & Society, 23 (4):45.
23. Sliwinski, M., Burbach, M.E., Powell, L., & Schacht, W. (2018). Ranchers’ perceptions of vegetation heterogeneity in the Northern Great Plains. Great Plains Research, 28, 185-197.
24. Wardropper, C.B., A. R. Rissman. 2019. Adaptations to extreme storm events by conservation organizations. Climatic Change, 152(1), 85-101. doi: 10.1007/s10584-018-2342-8
25. Wardropper, C.B., S. Gillon, A.R. Rissman. 2018. Innovation in outcomes-based water quality policy: A case study from the Yahara Watershed, Wisconsin, USA. Case Studies in the Environment, doi: 10.1525/cse.2018.001222
26. Wardropper, C.B. 2018. Environmental performance information use by conservation agency staff. Environmental Management, 61 (4), 563-576. doi: 10.1007/s00267-017-0990-5
27. Yun, SD and BM Gramig. "Agro-Climatic Data by County: A Spatially and Temporally Consistent U.S. Dataset for Agricultural Yields, Weather and Soils." Data 4(2):66, 2019.

**Technical Reports**

1. Arbuckle, J. Gordon Jr. 2019. Iowa Farm and Rural Life Poll: 2018 Summary Report. Extension Report SOC3090. Ames, IA: Iowa State University Extension.
2. Nowatzke, Laurie and J. Gordon Arbuckle Jr. 2018. Iowa Farmers and the Iowa Nutrient Reduction Strategy: Survey Results from the Missouri-Little Sioux Watershed. SOC 3087. Department of Sociology, Iowa State University, Ames, Iowa.