Cover sheet

Theme: Environmental Dynamics and Food Systems

Pursuit: Soil as a social ecological feedback: Mapping the social and ecological processes for agroecosystem resilience in the era of climate change

Short-title: Soil as SES feedback

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Project summary: Social science research indicates that soil health can act as a "social-ecological feedback" which is a result of direct producer experiences managing for weather variability and extremes and their impact to their soil resources. The observation of these changing soil conditions can result in land managers' re-evaluation of their soil resources and drive them towards more sustainable management that builds soil health and enhances climate resilience. Given the projected impacts of climate change and limited adoption of soil improving approaches among many large-scale agricultural producers in the U.S., new tools for understanding how and why certain soil conservation practices are implemented across the landscape are urgently needed. *The goal of this pursuit is to bring together a diverse team of collaborators to examine how soil health can act as a social-ecological feedback at the level of individual farmers, agencies and policy makers' decisions to use or encourage soil enhancing practices through a transdisciplinary integration of biophysical, climatic and social science data at multiple scales (spatial and human-institutional).* Further, this pursuit would enable the enhancement of soil health, through the development of data mining and geospatial analysis techniques, integrated into a distributable library in R and developed into visual aids via an online Story Map format. This proposed output could be used to facilitate the development of diagnostic and educational tools to understand the social, biophysical, as well as policy-level, factors that influence the adoption of soil health improving practices.

Resubmission: See Addendum for response to reviewers at the end of this document (pg. 14-15)

Keywords: Soil health; farmer decision making; climate change; conservation practices; social-ecological systems

Proposed Start Date: February 2018

Three meetings proposed with tentative timing: Meeting 1 (Summer 2018); Meeting 2 (Winter 2019); Meeting 3 (Fall 2019)

No known Conflicts of Interest

Problem Statement

Preserving soil resources and enhancing soil health is critical to reducing agricultural systems' social and ecological vulnerability, particularly in the context of more frequent extreme and variable weather associated with climate change (Cruse et al. 2013; Melillo et al. 2014). The Natural Resource Conservation Service defines soil health as "the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans" so that they are "sustainable for future generations"[1]. Healthier soils that improve the adaptive capacity of agricultural systems allow for the agroecosystem[2] and the farmers working within it to "cope with or adjust to climate effects, moderate potential damages [associated with more extreme and variable weather] and take advantage of opportunities created by climate change" (Lengnick 2015:96). Although there are numerous farm-level practices known to improve soil health, such as conservation tillage or no-till farming, crop diversification, cover crops and crop and livestock integration, there is limited adoption of these practices across a range of cropping systems within the United States. *Without wider use of soil health practices, the United States agricultural sector is at risk of degrading its rich natural resource based upon which agricultural production relies.*

Conceptual Framework

In linked social-ecological systems, such as agriculture, people and nature interact "reciprocally and form complex feedback loops" which can be an effective source of learning and innovation in the system (Liu et al. 2007:1513). Recent work by Roesch-McNally et al. (2017) suggests that the social-ecological feedback between farmers and their soil resources activates a soil stewardship ethic that encourages farmers to adopt, maintain and enhance their use of conservation practices. Some farmers in these situations commit to building healthier soil resources over the long-term, thus reconciling short term productivity goals with longer term stewardship aims. For example, a healthy soil has the capacity to buffer the negative effects on farm performance of both flooding and drought by capturing and storing more water during intense rain events. Farmers observe these adaptive benefits of healthy soil, along with many other co-benefits such as less soil erosion and lower production costs. These easy to recognize benefits of soil health that flow from the use of conservation practices can provide the feedback needed to encourage farmers to manage their soil resources differently, which will in turn influence their future experiences during climate change related shifts or extreme events.

There is a need to further explore how soil might act as a social-ecological feedback not only in the context of farmer decision making around soil health, but also in the context of agency response (e.g., NRCS programing, which includes incentives designed to encourage soil health improvements) and policy prescription (e.g., the role of crop insurance to reduce weather risks, as prescribed in the Farm Bill). While much research has been conducted on drivers of conservation practice adoption, no synthesis has been conducted to operationalize this notion of soil acting as a social-ecological feedback using social, policy, biophysical and climatic factors at multiple scales, which might explain soil health stewardship at a landscape scale. Further investigation using SESYNC's socio-ecological synthesis approach would deepen our

[1] NRCS Soil Health website: https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/

[2] We define agroecosystem as the food production system as a whole, including the integrated region of agricultural production as well as the connected social components (Gliessman 2015).

understanding of how this feedback works and would provide an opportunity to operationalize these ideas at a landscape scale.

Considering this need, we propose a SESYNC Pursuit that supports the development of research synthesis products to answer the following questions. First, given the preliminary research evidence that soil health can act as a social-ecological feedback loop, what additional social, economic, biophysical/climatic and policy-level drivers (e.g., changes to crop insurance or conservation reserve program payments) foster the adoption of farm management practices that achieve the goal of resilient soils? Further, how can this soil adaptation feedback loop be leveraged to encourage greater stewardship amongst U.S. farmers, to preserve and enhance soil resources for climate resilience?

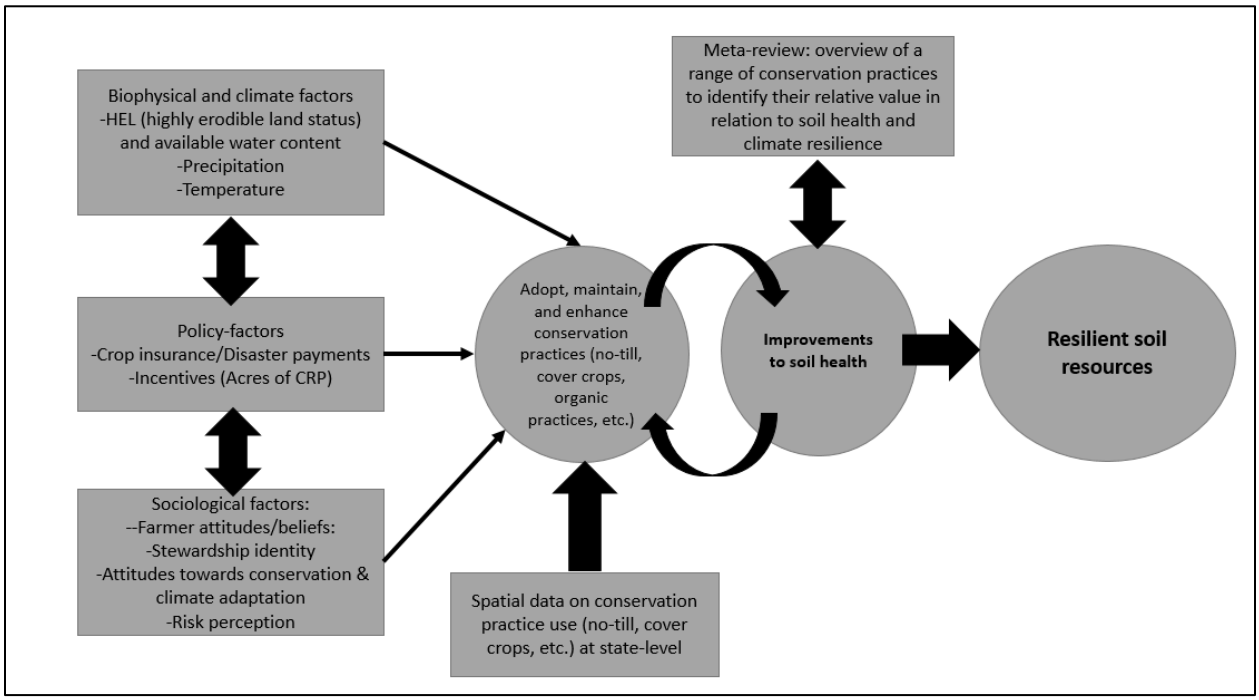

Figure 1. Conceptual mapping of proposed modeling effort illustrating linkages between key sociological, policy-level and biophysical/climatic factors (and subsequent data sources) and actions taken to adopt, maintain and enhance soil conservation practices that may lead to soil health improvements and resilience over time. Square boxes describe factors, that are linked to data sources (Table 1) and their expected relationships to the broader conceptual framework (circles), building off of work developed in Roesch-McNally et al. 2017.

Proposed Activities

We propose a pursuit that brings together a group of scholars and practitioners with the disciplinary, methodological, experiential, and regional diversity required to synthesize existing biophysical and social science data underpinning relationships of farmer behavior, policy drivers, conservation practices and environmental outcomes to the soil adaptation feedback loop. The proposed activities and products include:

1. Prior to the first workshop, participants will begin populating a database[3] which will include multiple sources of data that will be used to explore this soil adaptation feedback via social, policy, and biophysical/climatic factors that explain the relative benefits,

[3] For the purposes of this Pursuit, we define database as a loosely coupled, organized grouping of related datasets, used for integrated analysis.

adoption, maintenance and enhancement of soil conservation practices (See further description in Data and Data Analysis section).
2. At the workshops, participants will continue populating the databases and begin conducting analyses that integrate multiple data types exploring the drivers of the use of soil conservation practices among farmers, and will be driven by hypotheses developed by the team of collaborators that explicate social, biophysical/climatic, economic, and policy-level drivers that may be facilitating or hindering the use of these practices (See Figure 1).

This work would lead to the following products:

1. A series of peer-reviewed publications that would include at minimum: 1. A meta-review linking soil health outcomes to conservation practices and 2. A summary of the structural equation modeling and spatial analysis based on an integration of multiple factors outlined above.
2. The primary publicly facing presentation of the results will be developed using a Story Map framework which would be used as an online educational and visualization tool. The Story Map also allows for the integration of regional case studies already developed via various conservation networks (e.g., National Association of Conservation District Soil Health Champions and NRCS Soil Health leaders). The draft Story Map would be reviewed by relevant stakeholders before being finalized.[4] Feedback will also be used to further refine the final products and identify research gaps that could be used to formulate future grant proposals.
3. This Story Map tool will also be used to develop short (1-2 page) educational briefs based on the synthesis results that provide insight into how policy incentives could be modified to better encourage soil conservation practices and would be informed by and distributed via our network of policy-oriented organizations (e.g., National Farmers Union, National Sustainable Agriculture Coalition and Union of Concerned Scientists).
4. A "how to" document geared toward teams of scientists interested in following a similar protocol to integrate diverse data, that would include sample R code and step by step instructions for downloading and processing the same datasets.

To accomplish these objectives, we propose meeting three times over the course of two years. The meetings would be co-facilitated by the PI's as well as by collaborators with relevant skills depending on the overarching foci of the discussion. Participants will be encouraged to participate in preparatory activities prior to the meetings, including populating the database described above with relevant content.

Data and Data Analysis

The primary synthesis from this project would occur using publicly available state-level data (e.g., HUC-6 or county-level data aggregated at the state level), and would include data on biophysical factors, conservation practice use, and sociological factors (including variables measuring attitudes towards conservation practice adoption and risk perception) (See Table 1). Relationships will be explored primarily through structural equation modeling following a

[4] E.g., Practical Farmers of Iowa, National Farmers Union, regional Conservation District partners (e.g., Latah Soil and Water Conservation District in Idaho and Benton Soil and Water Conservation District in Oregon), the Stockholm Resilience Center and the North American Climate Smart Agricultural Alliance. PI's and pursuit collaborators have relationships with these organizations as well as other pertinent organizations that arise during workshop discussions.

similar method as Williams et al. (2016) or via other statistical multilevel modeling tools that take advantage of the spatial nature of these data to determine the most important factors governing the relationships driving the adoption, maintenance and increased use of soil health conservation practices. The datasets utilized in this work will include:

- Results from a meta-review of meta-analyses (~25 meta-analyses have been preliminarily identified) related to well-established aspects of conservation management (including but not limited to no-till, cover crops, and organic systems) and their known impacts on indicators of soil health (including soil carbon, runoff, nitrate loss and crop yields).
- Policy and economic data describing the current use of key agricultural conservation practices being implemented at a landscape scale, which include factors such as conservation incentives (Conservation Reserve Program acreage and crop insurance payouts).
- Social science datasets are available from peer reviewed meta-analyses which have identified a set of key variables that help explain conservation practice adoption (e.g., Knowler and Duncan 2007; Prokopy et al. 2008; Baumgart-Getz et al. 2012) and relevant case studies on soil health stewards (i.e., soil stewards highlighted via National Association of Conservation Districts and Natural Resource Conservation Service). Additionally, PI's and collaborators have access to in-depth survey and interview data conducted with farmers in the Midwest and Inland Pacific Northwest on a suite of behavioral and attitudinal questions. Collaborator Dr. Arbuckle has also indicated that additional meta-analyses could be available for this effort based on this original survey and interview data (following Prokopy et al.'s 2008 meta-analysis approach). Much of this survey work is focused on producers in the U.S. Corn Belt, however additional data is also available based on other regional farmer surveys (e.g., wheat producers in Idaho, Oregon and Washington via www.reacchpna.org).
- Biophysical data will include information on where certain conservation practices are occurring as well as data on erosion, soils, and climatic factors such as temperature and precipitation.

The limitation with some of the data available for this synthesis effort is that they are collected at incompatible scales. For example, much social science data is captured at a micro-scale (e.g., individual farmers) as compared to biophysical data measured at the field or landscape-scale. Therefore this analysis will require transformation to enable comparison on equivalent scales, which will allow for assessment of patterns and relationships that could lead to further analysis. The analytical components (programming code) which will be used to construct these transformations will also be reproducible and modular.

The major foci of this project will be on major commodity crop production in the U.S.; however, the conceptual framework and existing literature sources spans geography and cropping systems so will have applicability across, and potentially beyond, the U.S. There is a great deal of research on corn, soybeans and wheat production which will likely form the primary set of cropping systems that the team evaluates; however, it may be that other systems are integrated into the analysis depending on the availability of data on practices and how they mitigate soil degradation processes for that particular cropping system.

Table 1. Datasets proposed to be used for synthesis products with information about source, scale and access information.

	Data/Indicator	Source	Scale	Access
Biophysical, Climate and Conservation Practice Data	Regional climate data (precipitation and temperature)	-NOAA -MACA Datasets, University of Idaho	State and county-level	Publicly available
	Soils data (e.g. highly erodible land regions, available water holding capacity)	SSURGO	Spatial dataset available across the United States	Publicly available
	Conservation practices and their known links to soil health indicators	Peer-reviewed literature search	Global: Extract quantitative main findings from meta-analyses to strengthen scientific links between practices and their ability to confer climate resilience	Available through institutional access to scientific literature
	No-Till & Cover Crops	2012 Agricultural Census	State level (can be converted into percent of cropped acres)	Publicly available
	Perennial crops	USDA-NASS	Such as hay or alfalfa, available at state level	Publicly available
	Erosion	2012 NRI database	State level (erosion rate)	Publicly available
Policy and Economic Data	Conservation funding (e.g., Conservation Reserve Program)	2012 NRI database	State level, total acres	Publicly available
	Crop insurance	USDA-RMA	County level, sorted by crop, insurance payout, and source of payout (i.e. flood or drought)	Publicly available
Sociological Data	-Farmer attitudes/beliefs: -Identity/soil health ethic, -Attitudes towards conservation and climate adaptation -Risk perception and experiences with extreme weather	Farmer interview and survey data from REACCH, and Sustainable Corn/U2U projects and subject area meta-analyses (see Prokopy et al 2008	U.S. Corn Belt and Inland Pacific Northwest	Publicly available (partial)- PI/collaborators have access to survey information

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- Williams et al. 2016. "Soil Water Holding Capacity Mitigates Downside Risk and Volatility in US Rainfed Maize: Time to Invest in Soil Organic Matter?" *PloS ONE.* 11(8): e0160974. doi:10.1371/journal.pone.0160974

Diversity statement

In an effort to pull together this Pursuit proposal, a diversity of interdisciplinary backgrounds with many collaborators who have expertise in social-ecological research were recruited to be a part of this proposal. We have put together a proposal with a diverse group of interdisciplinary scientists with expertise in agronomy/crop science, agroecology and soil science (9 participants), sociology and political science (4 participants) and two participants with geospatial expertise and data mining. A number of the participants have extensive experience doing on-farm research with farmers, including six participants whose current work entails doing on-farm research with farmers in diverse field-level settings. Over half (9 in total) of the participants are women and the majority are in early career stages (7 participants) while the rest of the participants are mid and late career thus providing a diversity of perspectives and approaches based on career stage. Both PI's are early career scholars and were intentional about bringing together more early career scholars who are interested in developing a collaborative research agenda that might guide our nascent research efforts into the future while also engaging with more senior scientists who have extensive experience and can provide a historical perspective on the proposed work. We also have a diversity of institutions represented with five collaborators working in academia/university extension, two working with non-profit organizations, seven working in both local, regional and federal government roles and one private consultant. Given the emphasis of the project on U.S. agriculture, all participants currently work in the U.S. and Puerto Rico. The PI's did not ask explicitly about disability or sexual orientation, therefore we cannot speak to whether any of our collaborators identify with having a disability and while Co-PI Roesch-McNally identifies as queer, other participants sexual orientation is unknown.

The main thrust of this proposal was primarily to bring together U.S. researchers who are experts and at the cutting edge of soil health research from multiple disciplines with an emphasis on social-ecological systems. We also prioritized including participants who work with farmers and conservation/agriculture agencies whose interest is on actionable and applied science with relevant policy and education relevance. However, we made a strong effort to recruit women scientists who continue to be underrepresented in STEM fields. Additionally, Stephen Machado, who is originally from Zimbabwe, has agreed to participate as he is a leader in research and extension on resilient agroecosystems in the Pacific Northwest. Additionally, Nora Alverez-Berrios from Puerto Rico has indicated interest in participating given here expertise in climate change and agriculture and geospatial analysis. However, given the devastating impacts of Hurricane Maria, Dr. Alverez-Berrios is unable to make a firm commitment at this time.

Other Information

Data and Cyberinfrastructure needs:

The computational requirements for this proposal are not comprehensive but will rely on ArcGIS and the Story Map architecture for developing final outputs. Other analytical software, such as R, will be used to assist in exposing outputs in an open-source manner. For example, a developed soil heath Story Map may contain datasets that were previously transformed to facilitate regional or temporally-specific analysis. In this instance, the analytics which transformed the included datasets could be exposed as R functions, and included in an R package. With regards to computational storage and network access, we would like to utilize computing and storage support from SESYNC for ease of communicating and sharing resources with the team of collaborators. The outputs we produce would be available to collaborators and others in the SESYNC network and ultimately the broader public at some point after the completion of the pursuit. We have explored the potential to host the Story Maps on the SESYNC website with Dr. Kristal Jones, Assistant Research Scientist with SESYNC. At of the timing of this submission, this is a tentative option. Another option would be to host the database and accompanying Story Maps with collaborators via our existing networks. Two potential options would be to post via NRCS Soil Health website (https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) in partnership with collaborator Dr. Jen Moore-Kucera or via the Soil Health Institute with partnerships cultivated by collaborator Dr. Laura Lengnick. We anticipate further refining our web approach and broad outreach and engagement plan of action with the SESYNC communications specialist Emily Cassidy.

Work Plan:

We currently have 11 confirmed collaborators with the rest of participants tentatively interested. We anticipate 2.5 days of workshop activities with travel on either side of that for a total of three meetings over the course of two years. At the moment, all confirmed participants are residents of U.S. or Puerto Rico and thus anticipate that all participant travel will be domestic.

We propose tentative meeting times with one meeting occurring during the summer of 2018 with the other two meetings occurring in 2019 during winter and fall. Given the need to coordinate 15 busy collaborators, this timeline is tentative although general enough to allow the team flexibility in setting up exact meeting times.

The PI's will be leading the effort to coordinate sharing of literature, data sets, and will be facilitating the workshops yet other collaborators will also be enrolled to help facilitate certain components of workshop(s), with input from SESYNC given the unique areas of expertise. We propose breaking our team of collaborators out at each meeting based on specific areas of expertise with time set aside for small group and large group discussion, analysis and synthesis activities.

CV for Principle Investigators

GABRIELLE E. ROESCH-MCNALLY
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ResearchGate Profile

PROFESSIONAL SUMMARY

Interdisciplinary social scientist with expertise in farmer decision making, climate change adaptation and resilience, stakeholder engagement, coproduction and sustainable agriculture. Professional training includes extension and outreach, grant writing, science communication, and undoing racism and diversity training.

SKILLS

Computer: Microsoft Office Suite, SAS, NVivo, ArcGIS
Research: mixed methods research design and analysis, qualitative data analysis, multi-level modeling, structural equation modeling, and other regression techniques
Professional: project management, social media engagement and science communication

EDUCATION

Ph.D.	Sociology and Sustainable Agriculture**,** Iowa State University, 2016
M.S.	Forestry, University of Washington, 2011
B.A.	Social Justice through Environmental Advocacy, Fairhaven College, Western Washington University, 2005

PROFESSIONAL EXPERIENCE

2017-Cur.	Author for Pacific Northwest chapter of the Fourth National Climate Assessment.
2016- Cur.	USDA Northwest Climate Hub Postdoctoral Fellow, Corvallis, OR.
2016-Cur.	Guest Editor (Co-editors Rebecca Schewe (Syracuse University); Andrea Basche (Union of Concerned Scientists) for Special Issue on Climate, Agriculture and Food Systems, for the journal *Renewable Agriculture and Food Systems*.
2012-2016	Research Assistant, USDA National Institutes of Food and Agriculture grant project, Iowa State University, Ames.
2014-15	Graduate Student Leadership Team Representative, Cropping Systems Coordinated Agricultural Project, USDA-NIFA "Corn CAP" (www.sustainablecorn.org).
2013-15	Editor and Managing Editor for *Journal of Critical Thought and Praxis*, Iowa State University

SELECT HONORS AND AWARDS

2017	Certificate of Merit award for "outstanding performance in strengthening partnerships, publishing findings, communicating with stakeholders and contributing significantly to product and outcomes for the USDA Northwest Climate Hub", U.S. Department of Agriculture.
2016	Research Excellence Award for distinction in research ($500 competitive award), Iowa State University
2015/2014	Marvin B. Lind Scholarship in Rural Sociology ($1,500/$3,000 competitive award), Iowa State University

2015 Print and Grace Powers Hudson Scholarship in Agriculture ($1,000 competitive award), Iowa State University

SELECT PUBLICATIONS

Extension and Outreach Publications:

Roesch-McNally, Gabrielle E., Jamie Benning, Adam Wilke, J. Arbuckle and Lois Wright Morton. University extension learning, communicating, and engaging on climate change adaptation and mitigation: Lessons from the U.S. Corn Belt. Forthcoming 2018. Eds. Paul R. Lachapelle and Don E. Albrecht in *Approaches to Address Climate Change at the Community Level*.

Yorgey, G., C. Kruger, B. Saari, S.A. Hall, E. Whitefield, N. Embertson, V.P. Jones, K. Rajapogalan, E. Allen, **G.E. Roesch-McNally**, B. Van Horne, J. Abatzoglou, H. Collins, L. Houston, C. Seavert, and T. Ewing. 2017. Agriculture in a Changing Climate: Research and Extension Priorities in the Northwest. *Frontiers in Ecology and Evolution: Agroecology and Land Use Systems*, https://doi.org/10.3389/fenvs.2017.00052.

Basche, A. and **G.E. Roesch-McNally**. 2017. Research topics to scale up cover crop use: Reflections form innovative Iowa farmers. *Journal of Soil and Water Conservation*, 72(3):59A-63A, https://doi.org/10.2489/jswc.72.3.59A.

Basche, Andrea D., **Gabrielle E. Roesch-McNally**, Lindsay A. Pease, Christopher D. Eidson, Guy Bou Lahdou, Mike W. Dunbar, Trevor J. Frank, Laura Frescoln, Lei Gu, Ryan Nagelkirk, Jose Pantoja, and Adam Wilke. 2014. Challenges and opportunities in transdisciplinary science: The experience of next generation scientists in an agriculture and climate research collaboration. *Journal of Soil and Water Conservation* 69*(*6*)*:176A-179A, https://doi.org/10.2489/jswc.69.6.176A.

Other Research Publications:

Roesch-McNally, Gabrielle E., J. Gordon Arbuckle and John C. Tyndall. Soil as social-ecological feedback: Examining the "ethic" of soil stewardship among Corn Belt farmers. *Rural Sociology*, doi.10.1111/ruso.12167, Online first: http://onlinelibrary.wiley.com/doi/10.1111/ruso.12167/abstract

Roesch-McNally, Gabrielle E., Andrea Basche, J. Gordon Arbuckle, John C. Tyndall, Fernando Miguez, Troy Bowman and Rebecca Clay. 2017. The trouble with cover crops: Farmers' experiences with overcoming barriers to adoption. *Renewable Agriculture and Food Systems*, https://doi.org/10.1017/S1742170517000096.

Morton, L.W., **Gabrielle E. Roesch-McNally** and Adam Wilke. 2017. Upper Midwest Farmer Perceptions: Too Much Uncertainty about Impacts of Climate Change to Justify Changing Current Agricultural Practices. *Journal of Soil and Water Conservation*, 72(3):215-225, https://doi.org/10.2489/jswc.72.3.215.

Roesch-McNally, Gabrielle E., J. Gordon Arbuckle and John C. Tyndall. 2017. What Would Farmers Do? Adaptation intentions under a Corn Belt climate change scenario. *Agriculture and Human Values* 34(2):333-346, https://doi.org/10.1007/s10460-016-9719-y.

Arbuckle, J. Gordon and **Gabrielle E. Roesch-McNally**. 2015. Cover Crop Adoption in Iowa: The role of perceived practice characteristics. *Journal of Soil and Water Conservation* 70(6):418-429, https://doi.org/10.2489/jswc.70.6.418.

Extension and Outreach Technical Writing

Seamon, E., **G. Roesch-McNally**, L. McNamee, I. Roth, J.D. Wulfhorst, S. D. Eigenbrode and D. Daley Laursen. 2017. Producer perceptions on climate change and agriculture: A statistical atlas. University of Idaho Agricultural Economic Extension Series 17-01. Available here: https://www.reacchpna.org/sites/default/files/REACCHStatAtlasWEB.pdf

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PROFESSIONAL SUMMARY

Interdisciplinary agricultural scientist with expertise in soil and water resources seeking to advance research on cropping systems sustainability. Broadly trained with additional professional experiences including grant writing, science communication, public outreach and project management.

SKILLS

Computer: Microsoft Office Suite, R, Matlab, ArcGIS, SAS, NVivo
Research: meta-analysis, literature review, crop modeling, hydrology modeling, data mining, qualitative data analysis
Professional: project management, blogging, advocacy, media

EDUCATION

Iowa State University, Ames, IA 2011-2015
Doctorate of Philosophy, Crop Production and Physiology & Sustainable Agriculture
Columbia University, New York, NY 2009-2010
Master of Arts, Applied Climate Science
Fordham University, Bronx, NY 2002-2006
Bachelor of Science, Biological Sciences & Philosophy

PROFESSIONAL EXPERIENCE

U.S. Department of Agriculture, National Institute of Food and Agriculture, Washington, DC 2017-2018
American Association for the Advancement of Science, Science and Technology Policy Fellow
Union of Concerned Scientists Food and Environment Program, Washington, DC 2015-2017
Kendall Science Fellow
NSF-Symbi GK-12 Program at Iowa State University, Ames & Des Moines, IA 2014-2015
Teaching Fellow and Resident Scientist
Iowa State University Department of Agronomy, Ames, IA 2011-2015
Graduate Research Assistant
Earth Institute at Columbia University, New York, NY 2010-2011
Teaching Assistant & Guest Lecturer
Smithsonian Business Enterprises, New York, NY 2008-2009
Interactive Account Manager
CBS Interactive, New York, NY 2006-2008
Sales Planner, Account Manager

SELECT PUBLICATIONS

Peer reviewed publications

Basche, A.D., DeLonge, M. The impact of continuous living cover on soil hydrologic properties: a meta-analysis. 2017. *Soil Science Society of America Journal*. doi: 10.2316/sssaj2017.03.077
Basche, A.D., and Edelson, O. Improving water resilience with more perennially-based agriculture. *Agroecology and Sustainable Food Systems*. 41(7): 799-824. http://dx.doi.org/10.1080/21683565.2017.1330795

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Extension publications, outreach and perspective pieces

Basche, A., Roesch-McNally, G.E., Clay, R.M. and Miguez, F.E. 2016. Answering Common Producer Questions on Cover Crop Use in Iowa. Iowa State University Extension. https://store.extension.iastate.edu/Product/Iowa-Cover-Crop-Resource-Guide
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Basche, A. Engaging Middle School Students in Environmental Science through an Iowa Lens. Getting into Soil & Water 2016. Publisher: Iowa Water Iowa Water Center and Iowa State University's Soil and Water Conservation Club. http://www.water.iastate.edu/content/getting-soil-water
Andrea Basche author archive, Union of Concerned Scientists blog: http://blog.ucsusa.org/author/andrea-basche

AWARDS

- Best Research Paper for Impact and Quality, *Journal of Soil and Water Conservation*^ 2017
- Iowa State Graduate Symposium 1st Place 3-Minute Thesis Contest ($300 award) 2015
- Iowa State Agronomy Dept. Outstanding Graduate Student ($500 award) 2014
- Agronomy-Soil Science-Crop Science Societies Elevator Speech Contest 2nd Place ($75 award) 2014
- Iowa State University Live Green Award for Excellence in Sustainability* 2014
- Iowa State University Commitment to Service Award* 2014
- Climate Change Mitigation and Adaptation in Corn-Cropping Systems, USDA-NIFA Project Annual Conference 1st Place Graduate Student Poster 2013
- USDA Agricultural Outlook Forum Graduate Student Participant, Student Diversity Forum 2013
- Gamma Sigma Delta National Agriculture Honor Society 2013-2014
- Iowa State University Agronomy Department Research Training Fellowship (approx. $100,000 in tuition and stipend support) 2011-2013
- Psi Sigma Tau National Philosophy Honor Society 2006
- Fordham University Dean's List 2002-2003

*Sustainable Agriculture Student Association, Food at First service efforts

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PI Gabrielle Roesch-McNally is currently funded as a Fellow with the USDA Northwest Climate Hub as an employee of the U.S. Forest Service. Other current and pending support includes:

- Tullos, Desiree, John P. Bolte, Thomas G. Dietterich, Lisa J. Gaines, Ganti S. Murthy, Dwaine E. Plaza and **Gabrielle E. Roesch-McNally**. 2017. Risk-Sensitive Optimization of Floodplain Agroecosystem Management for Resilience to Climate Induced Disturbance. USDA National Institute of Food and Agriculture (FY2017). $1,070,783. (Under Review)

- **Roesch-McNally, G.E.** 2017. Building Soil Health from the Ground-up: Social-ecological connections between farmers and their soil resources in the Northwest, U.S. USDA NIFA Postdoctoral funding under RFA: Food, Agriculture, Natural Resources and Human Sciences Education and Literacy Initiative (FY2017). $164,947.90. (Under Review).

Co-PI Andrea Basche is currently funded as a AAAS Fellow with USDA's National Institute of Food and Agriculture. While serving in this role (through August 2018) she is ineligible for Federal Grants but can participate in the Pursuit if awarded because only travel costs are covered by the SESYNC funding. Co-PI Basche has no current or pending support to report.

Addendum- Resubmission

New submission under Environmental Dynamics and Food Systems Theme Pursuit:
Soil as a social ecological feedback: Mapping the social and ecological processes for agroecosystem resilience in the era of climate change

Previous Submission: May 2017
Workshop Proposal*: Soil as social ecological feedback: evidence from the field; a synthesis for setting a new research agenda to build resilient soils in production agriculture*

We greatly appreciate the opportunity to resubmit our proposal with SESYNC. We followed the advice outlined in our decision letter, which suggested that we revise our submission to fit the requirements for a SESYNC Pursuit. Due to limitations with space, we have consolidated some of the language from the reviewers to maximize space for a complete response. Comments made by reviewers are in red with our responses below.

Overall reviewer comments on original proposal:

• Further description of the proposed S-E synthesis activities is needed beyond the development of a conceptual framework. Narrow the focus of the research questions to direct the synthesis effort.
• Clarify what will actually happen during the meeting(s); what is the process that will lead to fruitful outcomes? A more detailed and focused research plan that produces fundamental science is needed.
• Propose outputs beyond the development of a framework and a paper, and consider how the outputs would be useful to end-users (and who those people might be). Relatedly, include additional stakeholders as participants (e.g., farmer alliances in the Midwest) to assist in co-developing research questions.

We agreed with the reviewer feedback that a Pursuit project allowed for more space and time to devote to a synthesis effort. In this proposal, we worked to revise, focus and simplify our research questions. From the text of the proposal we describe these as "First, given the preliminary research evidence that soil health can act as a social-ecological feedback loop, what additional social, economic, biophysical/climatic and policy-level drivers (e.g., changes to crop insurance or conservation reserve program payments) foster the adoption of farm management practices that achieve the goal of resilient soils? Further, how can this soil adaptation feedback loop be leveraged to encourage greater stewardship amongst U.S. farmers, to preserve and enhance soil resources for climate resilience?"

Further, we clarified our conceptual framework which has been modified significantly from the original Workshop proposal. We identify the available datasets, their conceptual linkages and proposed methodologies to conduct a robust spatial analysis. We believe that this approach will improve our understanding of the use and adoption of soil health practices, as well as their subsequent impacts on climate resilience. We also describe what we would do before and during meetings to accomplish the outputs that we identify in the proposal. We begin outlining how we intend to build educational materials that would potentially lead to more actionable science and possible policy change, through collaboration with our team of applied scientists, farmer outreach professionals and those with expertise in policy. We specifically propose engaging our network of policy organizations, such as National Sustainable Agriculture Coalition, National Farmers Union and Union of Concerned Scientists, to inform the development of, as well as to share and distribute these materials.

Reviewer 1:
It would be useful to see some details on the 'process' behind the workshop itself – i.e. the questions are clearly laid out, but what does "conduct a more qualitative analysis" mean? How will it lead to the questions being answered?; Though the goal of the Workshop has a US focus (production agriculture in the US), it would be useful to at least

begin building towards a more international network (given the global, and particularly developing world, challenges around soil health and erosion).

In the proposed activities, as well as in the data and data analysis sections, we detailed the process behind the development of our products and the subsequent analyses that we hope to conduct. While we appreciate the interest of the reviewer to integrate an international perspective, we determined that we needed to focus our efforts on U.S. agriculture. However, we note in the proposal that the conceptual framework and our methods has applicability beyond the U.S. and an explicit output of the Pursuit is to share our methodology so others can use it in an open source manner.

Reviewer 2:

The main weakness I see is that I am not fully convinced that this specific proposal will result in actionable science, but they do have a clear plan to develop further research grants based on the workshop products (a paper, a list of important research questions and key gaps that need to be addressed, a database of literature). Other than a paper and a list of further research questions, there are not a lot of products from this workshop. And I am not sure a peer-reviewed paper is going to do a lot to help move forward the connection between observing change in the soil to soil conservation and stewardship. So, I would have liked to see a stronger tie to how this workshop might inform outreach to farmers/communities, or something that felt like a more direct relationship back to the farmers.

We appreciate the focus on actionable science by reviewer 2 and sought to improve our proposal so that a synthesis on the topic of soil as a social-ecological feedback might actually lead to improvements in conservation practice adoption and soil stewardship. Specifically, we note multiple products that are public facing that move beyond the traditional peer review literature. We have several collaborators with direct contact with farmers, as well as agency personnel and an extended network that includes policy experts. Our intent is to utilize these networks to review our products, including the Story Map and educational briefs, such that the network can provide insight on how our synthesis results might influence policy incentives designed to improve soil health stewardship. This may lead to additional policy engagement, outside the formal scope of this proposal, with policy-oriented organizations (e.g., National Farmers Union, National Sustainable Agriculture Coalition, and others).

Reviewer 3:

Some key aspects of the proposal are under-developed. The questions and ideas to be addressed by participants are extremely broad - so broad that they seem to undermine the proposed workshop. More importantly, the proposal fails to make a strong case for the value of the workshop outputs. Developing a conceptual framework to be the basis for future research questions could add little value. Combined with the typos, these omissions contributed to a sense that this was a rushed effort - a few iterations away from a strong proposal. The workshop theme is relevant to ongoing policy and management discussions. Selecting a particular theme or region or type of farming or set of case studies in advance could help the group better defend the composition of the team and increase the feasibility of achieving the stated outcomes. Strengthen the diversity statement as well.

We appreciate the concerns about a rushed approach to our first proposal, and we have sought to remedy these through engaging multiple collaborators and SESYNC staff, Dr. Kristal Jones, to provide comments on preliminary drafts of our revised proposal. We believe that this proposal more comprehensively outlines Pursuit products that have the potential to create more actionable science. We have focused our efforts primarily on large-scale agricultural systems in the U.S., primarily focusing on corn, soybeans and wheat due to the data available. We also intend to include case studies in our Story Map efforts and will be engaging a network of stakeholders to provide feedback on preliminary products. Additionally, the Diversity Statement has been revised and strengthened by including greater gender, disciplinary, institutional and career stage diversity.