SOIL AND WATER CONSERVATION SOCIETY

BRIDGING the DIVIDE:

Uniting Rural and Urban Landscapes for Conservation

74th SWCS International Annual Conference
July 28-31, 2019 • Pittsburgh, Pennsylvania

ABSTRACT BOOK

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74th SWCS International Annual Conference

BRIDGING the DIVIDE:

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SYMPOSIA PRESENTATIONS

Monday, July 29

Symposia Session Descriptions and Agenda

Conservation Innovation Grants (CIG) Showcase
10:30 AM – 5:00 PM, *Rivers on the Ballroom Level*

The USDA Natural Resources Conservation Service (NRCS), in conjunction with SWCS, will host the CIG Showcase at the SWCS Annual Conference. Since 2004, CIG has supported the development of innovative natural resource conservation approaches and technologies on working lands.

This year's showcase includes an overview of the CIG program and three themed panels. The first panel highlights innovative ways to incentivize conservation. The second panel explores CIG projects that address water quality and quantity issues. The final panel includes presentations from CIG grantees demonstrating innovative technologies related to cover crops.

This showcase runs from 10:30 AM to 5:00 PM on Monday, July 29. Following the showcase, CIG project posters will be included in the poster presentation session held in the poster display area of the exhibit hall from 5:00 PM to 7:00 PM.

Introduction: Conservation Innovation Grants Program Overview and Stakeholder Updates (10:30 AM)
Presenter: *Caroline Sherony, USDA NRCS*

Presentation 1: Innovative Ways to Incentivize Conservation (11:00 AM)
Moderator: *Leah Hermens, USDA NRCS*

Presentation 2: Addressing Water Quality and Water Quantity Issues (1:30 PM)
Moderator: *Jan Surface, USDA NRCS*

Presentation 3: Innovation in Cover Crops (3:30 PM)
Moderator: *Steve Woodruff, USDA NRCS*

Professional and Chapter Development Session

10:30 AM – 5:00 PM, *Benedum on the Lobby Level*

The Professional and Chapter Development Committee has developed sessions for the growth of professionals and chapter leaders. These sessions will help professionals become more effective across the diverse set of fields that serve conservation. You will learn from the experiences, challenges, and successes of other conservation professionals. Sessions on chapter development are relevant not only to SWCS chapters but also to any small organization seeking to have a big impact with minimal staff and budget.

Presentation 1: Reimagining Your Chapter or Small Organization (10:30 AM – 11:15AM)
Speaker and Moderator: *Clare Lindahl, Soil and Water Conservation Society CEO*

Presentation 2: Putting Your Best Foot Forward: Business Etiquette in Today's Work World (11:15 AM – 12:00 PM)
Speaker and Moderator: *Rex Martin, Soil and Water Conservation Society Chair*

Presentation 3: Holding Successful Meetings and Professional Development (1:30 PM – 2:15 PM)
Speaker and Moderator: Heidi Ackerman and Hanna Bates, *Soil and Water Conservation Society Iowa Chapter*

Presentation 4: Bridging the Gap between Employees and Employers (2:15 PM – 3:00 PM)
Speaker and Moderator: *Autumn Mohler, Soil and Water Conservation Society Intern*

Presentation 5: Let's Party Like It's 1946: SWCS Celebrates 75 Years of The Conservation Professional (3:30 PM – 4:15 PM)
Speaker and Moderator: *Catherine DeLong, Soil and Water Conservation Society*

Presentation 6: Women in Conservation Leadership Panel (4:15 PM – 5:00 PM)
Speakers: *Denise Coleman, USDA NRCS; Shefali Mehta, Soil Health Partnership; Dale Threatt-Taylor, Wake County Soil and Water Conservation Department and Soil and Water Conservation Society Board Member*
Moderator: Wendi Goldsmith*, Soil and Water Conservation Society Board Member*

Impacts of the New Farm Bill on Soil and Water Conservation

10:30 AM – 12:00 PM, *Birmingham on the Lobby Level*

Moderator: *Bruce Knight, Strategic Conservation Solutions*

Presenters: *Jonathan Burgess, Allegheny County Conservation District; Jean Steiner, Retired USDA ARS; John Peterson, KEMPS Consultants; Andy Manale, Retired US Environmental Protection Agency; Raqueeb Bey, Executive Director, Black Urban Gardeners and Farmers of Pittsburgh Co-op*

The Soil and Water Conservation Society's Science and Policy Committee invites you to attend a dynamic discussion on the 2018 Farm Bill impacts to soil and water conservation. The symposium will include flash presentations from five speakers whose expertise range from federal policy to on-the-ground management, and from rural field crop production to urban agriculture. Speaker presentations will be followed by a facilitated session where there will be ample time for questions and further discussion. Presentation topics will include Farm Bill funding for research, outreach, and conservation programs; new opportunities; and the impact of Farm Bill policies at the local level.

Advancing Soil Health for Productive Agriculture and Clean Water

10:30 AM – 12:00 PM, *Smithfield on the Lobby Level*

Moderator: *Lisa Blazure, Clinton County Conservation District*

A fundamental shift is occurring in agriculture—in Pennsylvania and nationally—as producers adopt management practices to improve soil health. Farmers implement these practices for on-farm benefits, but an expected effect is improved water quality in local streams and rivers. Pennsylvania producers exceed national adoption rates for no-till and cover crops. A large portion of Pennsylvania is within the Chesapeake Bay Watershed, an impaired estuary with challenging pollution reduction goals. Improving soil health on agricultural lands is viewed as a low cost, long-term opportunity for meeting bay water quality goals. The farmer-based Pennsylvania No-Till Alliance has been at the forefront of soil health research and adoption of management practices. Members have participated with multiple university research projects and have conducted their own on-farm research trials. Some of these data have shown that soil health scores on regenerative, conventional farms are comparable to the soil health on organic farms. Members have also shown the ability to maintain corn yields using only 30% of the recommended nitrogen fertilizer rates. This symposium will share farmer-led research results and highlight the unique partnerships the No-Till Alliance has formed with nonprofit organizations, such as the Stroud Water Research Center, to educate farmers about the benefits of improved soil health and forested riparian buffers.

Presentation 1: Rising to the Challenge of a Cleaner Chesapeake Bay: How Improving Soil Health Is a Win-Win for Farmers and the Environment – *Lisa Blazure, Clinton County Conservation District*

Presentation 2: Beyond BMPs and Buffers: Are Healthy Soils the "Silent Giant" for Clean Water? – *Lamonte Garber, Stroud Water Research Center*

Presentation 3: Sustainable Row Crop Production Using No-Till and Cover Crops – *Jim Hershey, Hershey Farms, LLC, and Pennsylvania No-Till Alliance*

Advancing Water Quality through Market-Based Solutions, Research, Collaborative Engagement, and Financial Leadership Practices

10:30 AM – 12:00 PM, *Ft. Pitt on the Lobby Level*

Moderator: *Jennie Pugliese, US Environmental Protection Agency*

The US Environmental Protection Agency (EPA) supports states, tribes, and stakeholders as they work to make progress improving water quality and reducing excess nutrients in watersheds across the country while improving the efficiency of land use practices and optimizing treatment technologies. Nationally available water quality data indicate that nutrient pollution continues to be widespread, particularly in the Mississippi River Basin, and that phosphorus levels in some surface waters have risen over time. EPA is working with USDA and other partners to ensure that all tools available to address excess nutrients in watersheds are accessible, including nonregulatory and market-based programs. This symposium will comprise four presentations (15-20 minutes) with facilitated discussion.

Each of these presentations will provide:

- Program or policy overview
- Current opportunities for engagement
- Expectations for results

Presentation 1: Water Quality Trading and Market-Based Approaches – *Tom Wall*, *US Environmental Protection Agency*

Presentation 2: Goals and Initial Outcomes of EPA and USDA Collaborative Stakeholder Engagement – *Katie Flahive, US Environmental Protection Agency*

Presentation 3: EPA Office of Research and Development Five-Year Strategic Plan for Nutrients – *Scot Hagerthey, US Environmental Protection Agency*

Presentation 4: Community Financial Leadership Practices in Funding and Financing Water Infrastructure Projects – *Ellen Tarquinio, US Environmental Protection Agency*

State and Transition Models to Support Conservation Decision-Making

1:30 PM – 3:00 PM, *Birmingham on the Lobby Level*

Moderator: *Joel Brown, USDA NRCS*

Landscape models used as the basis for assessing climate change impacts and developing adaptation plans are collections of community-scale dynamics. These dynamics frequently lack transparency in terms of spatial and temporal scale, and, thus, are difficult to translate into management actions. Ecological Sites (ES), based on soil map units, are the finest spatial scale landscape divisions available. Each ES has unique State and Transition Models (STMs) to describe the temporal dynamics of the site. Together ESs and STMs have the potential to improve the efficiency, transparency, and repeatability of conservation planning decisions across land uses and management goals in response to changes in climate and land use patterns. ES/STMs have been applied to conservation problems in rangelands (grasslands, shrublands, deserts, savannas) around the world and have been proven to improve both the decision-making process and communications among researchers, advisors, land managers, and public interests. STMs are especially useful when applied to ecological outcomes resulting from complex interactions between management actions (conservation practices) and climate variability. Two decades of application in rangelands have identified key elements in developing, testing, applying, and refining STMs for conservation planning. First, ESs should be developed within a nested spatial hierarchy so that key relationships can be scaled to larger spatial units. Second, STM development should be considered iterative as key climatic and disturbance drivers are likely to change. Finally, all land uses should be included to support complex landscapes and changing land uses in models. In this symposium, we will review existing efforts on range, forest, and pasture lands; survey emerging work on riparian, urban, subaqueous, and cropland applications; and propose new principles that can transcend land use.

Presentation 1: Symposium Introduction: Overview, Challenges, Objectives – *Joel Brown, USDA NRCS*

Presentation 2: State and Transition Models to Support Conservation Decision-Making: Including a Climate Change Context –*Joel Brown, USDA NRCS*

Presentation 3: Accounting for Climate Variability in State and Transition Models on Rangelands: History, Status, Lessons Learned – *Curtis Talbot, USDA NRCS*

Presentation 4: State and Transition Models on Croplands: Examples, Challenges, Emerging Principles – *Mike Kucera, USDA NRCS*

(Continued) 3:30 PM – 5:00 PM, *Birmingham on the Lobby Level*

Presentation 5: Accounting for Climate in the Application of State and Transition Models on Landscapes with Mixed Land Use – *Greg Schmidt, USDA NRCS*

Presentation 6: Integrating Changing Land Use into a State and Transition Model Framework: Urban and Subaqueous Sites – *Michael Margo, USDA NRCS*

Presentation 7: A Knowledge Base for State and Transition Models – *Brandon Bestelmeyer, USDA ARS*

Presentation 8: Translating Site Level State and Transition Model to Landscape Levels – *Joel Brown, USDA NRCS*

Implementing Nutrient Management Combined with Conservation Planning: The Rest of the Story

1:30 PM – 3:00 PM, *Smithfield on the Lobby Level*

Moderator: *Jeffrey Strock, University of Minnesota*

The 20th Annual Joint SWCS–SSSA Symposium will be held at the 2019 SWCS annual meeting in Pittsburgh, Pennsylvania, and at the 2019 SSSA annual meeting in Phoenix, Arizona. Previous joint symposia have been very successful and contributed to the development of special issues, research editorials, features, books, and/or other significant technology transfer efforts. The title of the 20th Joint SWCS-SSSA Symposium is "Implementing Nutrient Management Combined with Conservation Planning: The Rest of the Story." This is a continuation of the very successful 19th Annual Joint Symposium on nutrient management for crop production to meet environmental goals. Nutrient management and conservation planning are of very high interest to members of the SWCS and SSSA. The goals of nutrient management and conservation planning are not mutually exclusive, and both require consideration of plant nutrient supply needs; minimization of nutrient losses to address water quality concerns; and maintenance or improvement in soil physical, chemical, and biological conditions. Social considerations also play an important role. This joint symposium aims at bringing together farmers, scientists, conservation practitioners and agricultural industry representatives to examine nutrient management and conservation planning, plan implementation, and evaluation for achieving food and environmental security. This joint symposium will continue the tradition of cooperation between these professional societies and help bring together scientists, conservation practitioners, and other national and international cooperators.

Presentation 1: Connecting Environmental Aspects of Nutrient Management and Conservation Planning

Presentation 2: How to Connect Site Risk Assessment with Nutrient Management Planning and Conservation Planning

Presentation 3: Where and Why the 4R+ Concept Is Getting Traction

Presentation 4: Where the Rubber Hits the Road: A Farmer's Perspective

Building Agricultural Landscapes into State Climate Plans

1:30 PM – 3:00 PM, *Ft. Pitt on the Lobby Level*

Moderator: *James Daukas, American Farmland Trust*

Presenters: *Jennifer Moore-Kucera, American Farmland Trust; Thayer Tomlinson, Coalition on Agricultural Greenhouse Gases*

One of the greatest near-term opportunities for progress on adapting agricultural landscapes to climate change—reducing greenhouse gases, sequestering carbon, and increasing resilience—involves supporting the 22 US Climate Alliance (USCA) states, who have committed to achieving the goals of the Paris climate agreement, in the design and implementation of plans to achieve their 2050 climate goals. USCA invited a group of nonprofit organizations to be Impact Partners, providing technical assistance to states to develop their Natural and Working Lands (NWL) climate policies and programs. As part of that effort, American Farmland Trust and Coalition on Agricultural Greenhouse Gases are undertaking research and policy analysis to identify priority potential agriculture practices that reduce GHG and sequester carbon in their states and recommendations on effective policies and programs to accelerate adoption of those practices. Speakers will present overview of USCA and NWL initiative, the collective work of the NWL Impact Partners, and interim results of their research as well as engage attendees in an interactive process identifying additional promising areas of inquiry. This work will result in an agriculture practice and policy online resource available to all and will be shared via webinars, convenings, and conferences. This should help influence and enhance state carbon smart farming policies and programs, which will ensure agriculture realizes its potential as an essential and significant element of state plans to combat and adapt to climate change.

Water Erosion Prediction Project Technology for Use by NRCS and Conservation Partners

3:30 PM – 5:00 PM, *Smithfield on the Lobby Level*

Moderator: *Michael Kucera, USDA NRCS*

The USDA Agricultural Research Service (ARS) and cooperators (Natural Resources Conservation Service [NRCS], Forest Service, Bureau of Land Management) initiated the Water Erosion Prediction Project (WEPP) in 1985. The goal was to produce new-generation, process-based water erosion prediction technology for federal agencies to use for soil and water conservation planning and assessment. WEPP technology provides daily simulation results and is a runoff event–driven model. Inputs include rainfall amount and intensity; soil texture; plant growth; residue decomposition; tillage operations; ground cover; slope shape, steepness, and orientation; and soil erodibility. WEPP simulates daily rainfall events over 100 or more years. If runoff is predicted to occur, WEPP calculates soil detachment, sediment transport, sediment deposition, and sediment delivery of the event. At the end of the simulation period, values for detachment and deposition are reported for points down a hillslope, and for each detachment or deposition region.

In conjunction with WEPP, NRCS has led the development of the Conservation Resources-Land Management Operations Database (CR-LMOD) that is used by WEPP, the Wind Erosion Prediction System (WEPS), and the Integrated Erosion Tool, version 2 (IET2). CR-LMOD is also utilized for other applications, including the Resource Stewardship Evaluation Tool (RSET), the Field-to-Market Fieldprint Platform, the Soil and Water Assessment Tool (SWAT), and the Carbon and Greenhouse Gas Accounting (COMET) suite of tools. One of the primary reasons to apply the WEPP model is to evaluate the risk of planned cropping systems on sheet and rill erosion, ephemeral erosion, water quantity, water quality, soil water usage/efficiency, energy use, and soil health. With daily WEPP model outputs, statistical summaries can be produced for runoff, water use and erosion using a 100-year simulation period. NRCS and ARS are committed to continued refinement/improvement of WEPP databases and science.

Presentation 1: WEPP Technology Implementation by NRCS – *Michael Kucera, USDA NRCS*

Presentation 2: The USDA Water Erosion Prediction Project (WEPP) Model Science – *Dennis C. Flanagan, USDA ARS*

Presentation 3: WEPP Software Architecture in the NRCS Cloud Computing Environment – *James R. Frankenberger, USDA ARS*

Presentation 4: WEPP Model Validation, Testing, and Comparisons with RUSLE2 – *Anurag Srivastava, Purdue University*

Thinking BioRegional: Steps toward Implementing Agroforestry at the Watershed Level

3:30 PM – 5:00 PM, *Ft. Pitt on the Lobby Level*

Moderator: *Andrew S. Kilduff, TK.designlab*

Presenters: *Tim Tensen, TK.designlab; Russell Wallack, Terra Genesis International; Luke Smith, Terra Genesis International*

Geographic Information Systems (GIS) help to assess, inventory, and map the appropriate implementation of agroforestry systems and perennial staple crops at a watershed level. This process considers the geology, hydrology, vegetation, and land use history of a place, in order to design productive agroforestry systems. These systems can serve as green infrastructure to increase drought and flood resilience, decrease erosion and riparian sedimentation, and enhance carbon sequestration. We know these systems are commercially viable, yet they remain vastly underimplemented in the United States.

The BRASA process is built on two distinct GIS analyses: elimination and classification. Elimination seeks to assess land use data to exclude uses unsuitable for agroforestry production—like forests, impermeable surfaces, and water bodies—after which only agriculturally productive land remains. Classification explores independent class schemes for systems and crops based on stakeholders' goals. In this case study, the crop is hybrid chestnuts.

In any given watershed, the BRASA tool can geolocate and quantify the prioritized crops and agroforestry systems based on the stakeholders' needs. For example, in the Connecticut River watershed in Massachusetts, our team identified and located 104,000 acres out of 1.7 million suitable for hybrid chestnut production.

A bioregionally informed agroforestry strategy provides a foundation for economic and ecological resilience. The benefits of this approach include sustained annual staple crop production and expanded opportunities for rural economic development. Moreover, the impact of agroforestry on the environment has significant implications for climate resiliency. Established agroforestry systems produce ecological benefits such as aquifer recharge, flood management, and water purification. In particular, soil regeneration—a key to regulating earth's atmosphere and increasing nutrient and minerals availability—is a critical benefit of agroforestry.

Tuesday, July 30

Symposia Session Descriptions and Agenda

Conservation Practice Standards and Tools Showcase
10:30 AM – 3:00 PM, *Rivers on the Ballroom Level*

The USDA Natural Resources Conservation Service (NRCS), in conjunction with SWCS, will host the Conservation Practice Standards and Tools Showcase at the SWCS Annual Conference. To enhance the customer experience in receiving conservation assistance, NRCS is undertaking efforts to modernize and streamline the conservation delivery process. This showcase includes a review of conservation practice standards, state-created innovations, and an update on the development of the Conservation Assessment Ranking Tool (CART). Presentations in this track will highlight progress to automate processes, reduce time between requests for assistance and on-the-ground conservation actions, and implement changes authorized by the 2018 Farm Bill. Come learn about innovations and strategies that help minimize complexity and eliminate redundancy to accelerate the delivery of comprehensive conservation planning, ecological science-based systems, engineering practices, and highly erodible land and wetland conservation compliance assistance.

Innovative NRCS Technology Demonstrations (Walk-Thru Exhibits) (10:30 AM – 12:00 PM)

Innovation Showcase Table One – Michael Kucera, USDA NRCS, WEPP and WEPS WebStart Process Based Erosion Tools

Innovation Showcase Table Two – Emily Helms, USDA NRCS, North Dakota SD Drought Tool

Innovation Showcase Table Three – Jarred Kneisel, USDA NRCS, Stream Visualization Assessment Protocol 2 (SVAP2) Application

Innovation Showcase Table Four – Shaun P. McKinney, USDA NRCS, Water Quality Index for Agricultural Runoff: An Integrated Tool to Assess Water Quality

Innovation Showcase Table Five – SSRA Technology Demonstration

Conservation Assessment Ranking Tool (CART) Overview (1:30 PM – 3:00 PM)
Moderator: *Jimmy Bramblett, USDA NRCS*

Presentation 1: Introduction to CART for Streamlining of the Conservation Planning Process – *Aaron Lauster, USDA NRCS*

Presentation 2: Resource Assessment for Soil and Water Conservation and Other Resource Concerns – *Chris Gross, USDA NRCS*

Presentation 3: Transition between Program Neutral Conservation Planning and Application Ranking for Programs – *Aaron Lauster, USDA NRCS*

Design and Planning for Climate Smart Communities

10:30 AM – 12:00 PM, *Birmingham on the Lobby Level*

Moderator: *Nancy Somerville, American Society of Landscape Architects*

Presenters: *Shawn T. Kelly, University of Wisconsin—Madison and Kelly Design Group, LLC; Neil Weinstein, Low Impact Development Center, Inc.*

Climate change is a threat to people and the ecosystem services on which we depend. Even without climate change, standard development practices are putting people and communities at risk. Smart Policies for a Changing Climate, the report of ASLA's interdisciplinary Blue Ribbon Panel on Climate Change and Resilience, is a call to action and an invitation to collaboration. Smart Policies identifies the most critical planning- and design-based approaches for creating healthy, climate-smart, and resilient communities, along with specific public policy recommendations to support those approaches. Recommendations cover natural systems, community development, vulnerable communities, transportation, and agriculture, and are applicable to communities of all sizes and in all regions. Speakers will provide an overview of the recommendations in the Smart Policies report and show how these strategies are already being used successfully in communities across the country.

Solar Sites, Pollinators, and Performance Vegetation

10:30 AM – 12:00 PM, *Smithfield on the Lobby Level*

Moderator: *Rob Davis, Fresh Energy*

Presenters: *Jordan Macknick, US Department of Energy; Gavin Meinschein, Engie North America; Robin Ernst, Ernst Pollinator Services*

In the last nine years, the price of new solar development has fallen by more than 85%. The National Renewable Energy Laboratory (NREL) forecasts that between now and 2050, farmers and other landowners will choose to use more than six million acres for ground-mounted photovoltaic solar systems. Despite the fact that we already have more than 40 million acres of turfgrass lawns in the United States, a significant percentage of these six million acres of solar farms will be developed on arable land and seeded with turfgrass. Solar farms seeded and managed to establish perennial flowering and pollinator-friendly meadows are a once-in-a-generation opportunity to direct private sector investment to meaningfully help pollinators and improve soil health, at scale. Though the managed landscape inside the fence of a solar site will be less than a full ecological restoration, a significant percentage of solar farm working lands will support a diverse mix of native vegetation to provide urgently needed ecosystem benefits. The speakers are nationally recognized experts on the topic.

A Soil Health CIG Project: Quantifying Outcomes with NTT, COMET, and Partial Budget Analysis

10:30 AM – 12:00 PM, *Ft. Pitt on the Lobby Level*

Moderator: *Michelle Perez, American Farmland Trust*

During this 90-minute symposium, American Farmland Trust (AFT) will disseminate 4 two-page case studies featuring quantification of the economic, soil health, water quality, and climate outcomes achieved by 4 farmers who have been using soil health management system (SHMS) practices in California, Illinois, Ohio, and New York. This 2018 USDA Conservation Innovation Grant (CIG) project addresses the current dearth of quantitative evidence that soil health practices do provide the touted benefits, especially return on investment.

AFT and our partners developed an economics questionnaire and Excel-based calculator to conduct a partial budget analysis that calculates the economic costs and benefits associated with the SHMS adopted by each farmer. In addition, we developed an Excel-based questionnaire to obtain information needed by USDA's Nutrient Tracking Tool (NTT) and COMET-Farm Tool to estimate the SHMS' water quality and greenhouse gas benefits.

We believe these case studies will be useful to conservation partners (e.g., USDA Natural Resources Conservation Service [NRCS], conservation districts, ag retailers, extension, supply chain, NGOs, etc.) in these five states and nationwide as persuasive outreach and education materials. We are also training interested conservation partners to use these questionnaires and tools so they can produce their own case studies too.

Presentation 1: Project Overview, Key Findings, and Walk Through of the Questionnaires Developed for the NTT and COMET Tools – *Michelle Perez, American Farmland Trust*

Presentation 2: Walk Through of the Economics Questionnaire and Calculator Used to Conduct the Partial Budget Analysis – *Florence Swartz, Consultant*

Presentation 3: Experience Finding Four Already "Soil Health Successful" Farmers in Illinois and Completing the 19 Steps to Achieve Publication of Their Case Studies –*Emily Bruner and Kris Reynolds, American Farmland Trust*

Up a Creek with Many Paddles: Collaborative Watershed Science and Restoration in Mixed Ag and Urban Landscapes

10:30 AM – 12:00 PM, *Benedum on the Lobby Level*

Moderators: *Jennifer Fetter, Penn State Extension; Kristen Kyler, Penn State Agriculture and Environment Center*

Presenters: *Jamie Shallenberger, Susquehanna River Basin Commission; Kelly Gutshall, LandStudies, Inc.; Justin Evans, Mount Joy Township; Matt Royer, Penn State Agriculture and Environment Center*

In Pennsylvania, as in many regions across the country, waterways are being impaired by a combination of stormwater coming from both agricultural and urban landscapes. Working with these two major sectors as separate entities can create significant barriers to success, while also preventing the use of a holistic approach to restoration. By bringing local champions from government agency, academic, municipal, agricultural, and private sectors to one table, adaptive management plans may be created to address the diverse concerns of mixed urban/rural community members. This symposium will present cross-sector strategies used to benefit water quality in an ag/urban mixed watershed in Pennsylvania through a pilot alternative approach to traditional total maximum daily loads (TMDLs). Due to past and ongoing impacts contributing to the health of the Chesapeake Bay, the Chiques Creek Watershed, among others in Lancaster County, Pennsylvania, are now in the spotlight for nutrient and sediment reduction. A tremendous amount of resources, collaboration across sectors, and experience from decades of local conservation efforts are being leveraged to make the awesome lift needed to reach local water quality goals. Facilitating diverse stakeholder collaboration has helped prioritize restoration projects at a regional scale, while addressing their unique needs (i.e., load reductions, costs, and maintenance concerns) and has provided a platform from which conservation professionals can engage local communities and landowners. Resources used in this process have included watershed assessment via GIS and field surveys, water quality modeling, community engagement by sector partners, management planning and plan development by all sector leaders, and innovative leveraging of multiple funding sources for implementation. Replicating this process in similar watersheds could result in regional resources being used more efficiently to achieve large-scale pollutant load reductions as well as to improve quality of life.

Building a Conservation Connection: Linking Women Nonoperating Landowners to Their Tenant Farmers

1:30 PM – 3:00 PM, *Smithfield on the Lobby Level*

Moderator: *Brianne Lowe, USDA NRCS*

Presenters: *Jean Eells, E Resources Group; Jennifer Filipiak, American Farmland Trust; Jill Reinhart, USDA NRCS*

In the United States, about 39% of farmland is leased, with as much as 80% of that land being owned by nonoperating (nonfarming) landowners. Almost half of the nonoperating landowners are women, and according to several researchers, female ownership will only increase over the next 20 years as nearly 70% of the nation's private land will change hands. These landownership changes will have a profound impact on farm viability and land stewardship. Many of these nonoperating landowners live in urban and metropolitan areas and have had limited exposure to land management practices. Many have limited knowledge of, or access to, information about the importance of soil health. As a conservation partnership, we have prioritized the need to identify and reach out to this demographic, as their decisions will be important to determining the future of America's farmland. In 2017, Women Food and Agriculture Network, Women4theLand, American Farmland Trust, Natural Resources Conservation Service (NRCS), and other partners worked together to build upon existing outreach to women landowners with a specific focus on those landowners living away from their property, typically in urban or suburban areas. The project aims to develop and test outreach efforts to successfully identify, contact, interact, and engage urban nonoperating landowners connecting them to their most important asset—their land and their soil. By empowering women landowners with this information, they can have substantive discussions with the tenants operating on their land, leading to conservation solutions. Join this interactive discussion about the Conservation Learning Circle methodology, how it was modified and adapted for this unique audience, lessons learned, and next steps.

Understanding Conservation Practice Adoption: New Results from the Midwest

1:30 PM – 3:00 PM, *Ft. Pitt on the Lobby Level*

Moderator: *Linda Prokopy, Purdue University*

This symposium loosely builds upon the symposium "Understanding Conservation Practice Adoption: Review of 35 Years of Literature and Next Steps for Research," but participants will benefit from this symposium even if they do not attend the previous one.

1. Uncertainty and Complexity in Farmer Nitrogen Decisions: This presentation uses data from surveys and interviews with corn growers from the upper Midwest region to understand factors that influence nitrogen management decisions.
2. Understanding Midwest Corn Farmers' Perceptions of Crop Insurance and Its Impact on Conservation Adoption: We conducted semistructured interviews and a multistate survey with farmers in Indiana, Iowa, and Illinois to understand the relationship between crop insurance and conservation practice adoption.
3. Do Conservation Plans Make a Difference in Practice Adoption?: Evidence from Iowa Farmers: This study analyzed data from the 2015 and 2016 Iowa Farm and Rural Life Poll to examine the relationship between having an NRCS conservation plan and farmers' implementation of selected soil and water conservation practices.
4. The Role of Systems Thinking in Early Adopter Conservation Behaviors: Implications for Middle Adopters: We report data from producer surveys administered in three Indiana watersheds, and producer and conservation staff interviews in two watersheds to understand the relationship between systems thinking and conservation practice adoption.
5. Testing the Efficacy of a Field Experiment in Promoting Conservation Behavior on Rented Farmland: A Mixed Methods Perspective. This presentation will report results from a survey and semistructured interviews of the NOLs enrolled in an experiment conducted by The Nature Conservancy, Purdue University, and Johns Hopkins.

Presentation 1: Uncertainty and Complexity in Farmer Nitrogen Decisions – *Adam Reimer, Michigan State University*

Presentation 2: Understanding Midwest Corn Farmers' Perceptions of Crop Insurance and Its Impact on Conservation Adoption – *Michelle Hemler, Purdue University*

Presentation 3: Do Conservation Plans Make a Difference in Practice Adoption?: Evidence from Iowa Farmers – *Chris Morris, Iowa State University*

Presentation 4: The Role of Systems Thinking in Early Adopter Conservation Behaviors: Implications for Middle Adopters – *Sarah Church, Purdue University*

Presentation 5: What Helps or Hinders Nonoperating Landowners from Taking Steps toward Conservation: Mixed Methods Results from Implementing a Trial Conservation Program – *Pranay Ranjan, Purdue University*

A Comparison of Watershed Surface Runoff Coefficients to Present a Unified Time of Concentration that Defines Drainage Basin Extents for Green Infrastructure

1:30 PM – 3:00 PM, *Benedum on the Lobby Level*

Moderator/Presenter: *Ken Kagy, City of Milton*

This two part symposium explores fundamental techniques used in all hydrology evaluations. The presentation assesses standard methods used to estimate the time it takes rainfall runoff to travel amidst specific watershed characteristics. The research compiles four years of calculated data. The study compares Manning's sheet flow coefficients with watershed percentage impervious surface, rational method coefficients, and USDA Natural Resources Conservation Service's (NRCS) soil curve numbers. Time of concentration graphs are created to demonstrate how watershed characteristics affect the rainfall runoff timing. The discussion attempts to standardize watershed runoff coefficients. This standardization is applied among three different time of concentration equations. These graphs are compared to demonstrate an underlying premise observed from storm runoff in small watersheds. Equations are created from these principles to assist in the prediction of estimating a drainage basin's time of concentration. These time equations are compared to traditional stormwater runoff equations. The extent of small drainage basin parameters are ascertained via graphs by means of the basin's time of concentration and the basin's runoff parameters. The graphical conclusions are demonstrated for various green infrastructure design requirements. These same results can apply to other stormwater conveyance infrastructure for capacity and flow designs. The established equations can be used to abridge hydrology calculations in urban and rural environments. The presentation offers discussion on several aspects of hydrology runoff basics.

4R Nutrient Stewardship in the Chesapeake: Agribusiness Partnerships to Meet Clean Water Goals

3:30 PM – 5:00 PM, *Smithfield on the Lobby Level*

Moderator: *Katie Turner, The Nature Conservancy*

The Chesapeake Bay watershed faces big challenges in meeting total maximum daily load goals by 2025: nitrogen must be reduced by over 48 million pounds and phosphorus by 671,000 pounds. Almost half of the total nutrients contributed to the bay comes from Pennsylvania, making it a focal area in targeting conservation measures. With current emphasis on nitrogen and phosphorus pollution reduction goals in the Chesapeake, 4R practices serve to address the component of nutrient pollution attributed to farms. The 4R Nutrient Stewardship framework, an agribusiness-led initiative, promotes applying nutrients in a way that supports the economic, social, and environmental sustainability of farms: the right nutrient source applied at the right rate, at the right time, and in the right place to maximize nutrient use efficiency and crop yields.

Partnering with agribusiness, Natural Resources Conservation Service (NRCS), and The Nature Conservancy, the MidAtlantic 4R Nutrient Stewardship Association was founded as a nonprofit organization in 2017 to provide oversight and connection between the PA4R Alliance (established in 2012 with NRCS support) and the Delaware/Maryland 4R Alliance (established in 2015). The alliances are led by partners representing agribusinesses, researchers, government agencies, and conservation groups committed to advancing 4R Nutrient Stewardship practices that will reduce nutrient loss to waterways while balancing farm economic productivity with environmental stewardship.

Speakers in this session will convey how collaborations through the 4R alliances are advancing implementation of 4R nutrient stewardship practices to meet clean water goals in the Chesapeake Bay.

Presentation 1: The Role of Agribusiness to Engage Farmers for 4R Nutrient Stewardship – *Dean Collamer, Growmark FS*

Presentation 2: Linking 4Rs to Pennsylvania NRCS Conservation Programs – *Dan Dostie, USDA NRCS*

Presentation 3: 4Rs for Clean Water: Nutrient Management and Pennsylvania Regulatory Compliance – *Frank Schneider, Pennsylvania State Conservation Commission*

Presentation 4: 4R Partnerships to Advance Clean Water Goals: The Nonprofit Perspective – *Katie Turner, The Nature Conservancy*

Presentation 5: 4R Practices for the Conservation Practitioner's Playbook – *Eric Rosenbaum, Rosetree Consulting*

Presentation 6: Baseline Survey of 4R Practices in Targeted Pennsylvania Watersheds: Tracking and Opportunities – *Matt Royer, Penn State Agriculture and Environment Center*

Land Stewardship as a Basis for an Agricultural Producer-Focused Ecosystem Services Market

3:30 PM – 5:00 PM, *Ft. Pitt on the Lobby Level*

Moderator: *Bruce Knight, Strategic Conservation Solutions*

Presenters: *Chad Ellis, Noble Research Institute; Debbie Reed, Coalition for Agricultural Greenhouse Gasses*

Healthy soils are paramount to ensuring the future of the agriculture industry, maintaining ecosystem function, and sustaining plant communities. Consequently, the mismanagement of the soil resource has led to physical soil loss via erosion and a large decline in soil organic matter. It has been estimated that nearly 40% of the earth's arable lands have been degraded at some level by anthropogenic activities due to soil erosion, extensive soil cultivation, over grazing, etc. Current ecosystem service markets that include soil carbon are laden with barriers that preclude working agricultural producers from participating. Today, agricultural producers are compensated for producing two ecosystem services—food and fiber—but they produce many more services that benefit our growing population. It's time to change this standard and tell the rest of the story. To address these challenges, The Noble Research Institute convened a diverse, multisectoral group of experts over the course of 2017 to 2018 to explore and assess the potential to successfully scale a program to generate and sell carbon and ecosystem service credits from working agricultural lands. Foundational to this effort is the establishment of an ecosystem market for both carbon and water quality attributes based upon advances in soil health. The ecosystem market is designed to quantify the ecologic and economic benefits of managing land with soil health as a focus. This collaboration has successively outlined the process for ecosystem service metrics to be quantified and subsequently valued and marketed for agricultural producers. In this session, we will hear from several agriculture, policy, and financial sector experts that will explain why and how this agriculture working lands–focused ecosystem service model is designed and will function. The presentations will highlight the development of the market from quantification to funding opportunities.

What is Successful Watershed Management?: An In-Depth Evaluation of the National Water Quality Initiative (NWQI)

3:30 PM – 5:00 PM, *Benedum on the Lobby Level*

Moderator: *Linda Prokopy, Purdue University*

Presenters: *Dee Carlson, USDA NRCS; Sarah Church, Purdue University; Emily Usher, Purdue University*

The USDA Natural Resource Conservation Service's (NRCS) National Water Quality Initiative (NWQI) is a watershed improvement program that provides technical and financial assistance to accelerate on-farm voluntary adoption of conservation practices in targeted watersheds across the United States. In this symposium, we will provide an overview of NWQI and share results of participatory forums conducted in five NWQI watersheds across the country (North Carolina, Washington, Illinois, Vermont, and Oklahoma), partnering agency interviews, and surveys of NWQI watershed managers. Using participatory data collection methods, researchers identified predominant stakeholder priorities, resource needs, and education and outreach strategies important for successful watershed management. Interviews with the US Environmental Protection Agency (EPA) and state water quality agencies provided an interagency perspective of NWQI's strengths and weaknesses, and surveys offered insights in to the needs of local resource managers. In this symposium, we will discuss elements of successful watershed management, suggestions for effective outreach, and recommendations to increase interagency collaboration. We will also provide the first view of a practitioner's guide to successful watershed management that evolved from this work.

Applying Conservation across a Diverse Texas Landscape

3:30 PM – 5:00 PM, *Sterlings 1 on the Lobby Level*

Moderator: *Mike Oliver, USDA NRCS*

Presenters: *Russell Castro, USDA NRCS; Tyler Maxwell, USDA NRCS*

From the arid lands of the Trans-Pecos to the Piney Woods in the east, the Texas landscape is a diverse mix of ecosystems. The continued transformation of landscapes from rural to metropolitan land uses presents numerous challenges for conservation professionals. USDA Natural Resources Conservation Service (NRCS) in Texas meets those challenges through innovative conservation practices and unique partnership opportunities.

In Texas, 95% of the lands are privately held. A core mission of NRCS is working with land owners and operators to implement voluntary conservation systems on these private lands. NRCS offers innovative approaches to conservation assistance through farm bill programs. Increasingly, NRCS is asked to expand its roles in conserving natural resources across the state, including urban and suburban areas.

In this session, Texas NRCS conservation leaders will share ongoing work being conducted in partnership with landowners on the state's vast private lands. Presentations will discuss the technical work being done across the various landscapes from forests to wetlands to arid ecosystems. The challenging facets of applying conservation across diverse landscapes containing urban, suburban, and rural land uses will be discussed, as well as methods used by the NRCS to accomplish these tasks. NRCS Farm Bill programs such as easement programs will be highlighted, along with conservation planning. Specialized tools developed for use in Texas will be covered. Current partnership efforts along with innovative new opportunities for other agencies, businesses, and organizations to partner with NRCS will be presented and discussed.

Don't miss this opportunity to learn about USDA NRCS conservation efforts in Texas as well as opportunities to partner with the agency in working with landowners and managers on conservation projects across the landscapes of Texas.

Wednesday, July 31

Symposia Session Descriptions and Agenda

Update on the Agricultural Conservation Planning Framework (ACPF)

8:30 AM – 10:00 AM, *Benedum on the Lobby Level*

Moderators: *Mark Tomer, USDA ARS; Rebecca Power, University of Madison-Wisconsin Extension*

The Agricultural Conservation Planning Framework consists of (1) a holistic planning concept for management of agricultural watersheds; (2) geospatial databases to inform watershed planning with high-resolution data on soils, land use history, and terrain; and (3) a set of ArcGIS-based tools to identify edge-of-field conservation practice placement options that can be considered at field and watershed scales. ACPF results can be used to develop and evaluate planning scenarios through consultative planning processes involving local landowners. The ACPF is being used for watershed planning in many areas of the Midwest, involving state agencies, soil and water conservation districts, private consulting firms, and other nongovernmental organizations that work in agricultural and environmental arenas. Version 3 of the ACPF was released in fall 2018. This symposium will summarize recent developments and expansion of the ACPF. The first two presentations will present highlights from an upcoming special section of the *Journal of Soil and Water Conservation* that will focus on the ACPF. These will be followed by presentations on new ACPF training resources, farmer engagement, and an economic optimization tool that is under development. The session will conclude with an overview of ongoing and future expansion of the ACPF from USDA Natural Resources Conservation Service (NRCS) and Extension perspectives.

Presentation 1: Watershed Applications of the ACPF for Stakeholder Engagement, Research, and Modeling – *Ann Lewandowski, University of Minnesota Water Resources Center*

Presentation 2: ACPF Version 3: Riparian Watersheds with Applications for Landscape Analyses – *Mark Tomer, USDA ARS*

Presentation 3: Expanding Access: ACPF Website and Training Resources – *Anne Nardi, University of Madison-Wisconsin Extension*

Presentation 4: Farmer Engagement Using Precision Approach to Conservation Planning: What Do We Know? – *Pranay Ranjan, Purdue University*

Presentation 5: A Tool to Evaluate Economic Opportunities and Tradeoffs Using the ACPF – *Emily Zimmerman and John Tyndall, Iowa State University*

Presentation 6: Use and Support of ACPF within USDA NRCS – *Lisa Duriancik, USDA NRCS*

Presentation 7: Planning Toward Future Expansion of the ACPF – *Rebecca Power, University of Wisconsin-Madison Extension*

Lessons in Integration of Conservation from the Agriculture Supply Chain

8:30 AM – 10:00 AM, *Sterlings 1 on the Lobby Level*
(Continued) 10:30 AM – 12:00 PM, *Sterlings 1 on the Lobby Level*

Moderator: Seth Harden, The Nature Conservancy

Presenters: Betsy Bower, Ceres Solutions LLP; Lexi Clark, Field to Market; Leslie Fisher, Benton County SWCD; Jason Weller, Land O Lakes SUSTAIN; Jill Reinhart, USDA NRCS; Jon Radtke, The Coca-Cola Company

The symposium will bring together conservation and private sector partners to present and discuss identified barriers and opportunities to integration of conservation methods across the agriculture supply chain. The focus will be on qualitative and quantitative outcomes of ongoing collaboration in the Big Pine Creek watershed (BPC) in Indiana. A series of nine interlinked public-private initiatives in the BPC are feeding a growing dataset and analysis that will inform scaling of watershed and market-based conservation solutions in numerous similar watersheds across the Corn Belt. Innovative research, strategy, and implementation will drive discussion between presenters and symposium participants. It will outline emerging frameworks and technology being developed and tested in the BPC, which will enable both conservation professionals and farmers to benefit society, through environmental, agronomic, economic, and social science. After a concise overview of the initiatives, the symposium will engage attendees in focus groups that will explore past experiences, emerging work, and research gaps for integrating conservation in the agriculture supply chain. The opportunities identified will become the subject matter for concluding discussion between the attendees and the expert panelists. A three-hour format will allow for comprehensive discussion of the subject matter. Recognizing the demands and interests of conference attendees, it is developed to be valuable to those attending at least half of the symposium. The first 90 minutes will focus on partnerships with ag retail and government programs. The second 90 minutes will move up the agriculture supply chain to processors and consumer-facing agribusiness. Full symposium attendees will walk away with immediately applicable action steps and talking points for engaging the agriculture supply chain in their geography. This symposium will include components that align with multiple conference track and general topics.

Understanding Conservation Practice Adoption: Review of 35 Years of Literature and Next Steps for Research

10:30 AM – 12:00 PM, *Benedum on the Lobby Level*

Moderator: *Linda Prokopy, Purdue University*

Presenters: *J. Arbuckle, Iowa State University; Sarah Church, Purdue University; Ben Gramig, University of Illinois-Urbana Champaign; Pranay Ranjan, Purdue University*

Last year at SWCS, we presented summary results from a completed review of 35 years (1982 to 2017) of quantitative and qualitative social science research papers that have examined motivations of and barriers to adoption of conservation practices in US agriculture. In this symposium, we will present more detailed and in-depth results. Results will be presented from a statistical meta-analysis using reported model statistics and estimated parameters as explained by the characteristics of the research studies themselves instead of the farmers. The meta-analysis will explore whether there are attributes of the studies themselves—sample size, study location, type of conservation practice studied, etc.—that can explain differences in the statistical significance as well as the magnitude of the effect on adoption. This has implications for interpretation of past research, but also for the design and conduct of future research on adoption of agricultural conservation practices. Studies included in this comprehensive review examined adoption of a wide diversity of conservation practices. We categorized these practices into several broad categories, including edge-of-field, soil management, nutrient management, water management, and pest management. We hypothesize that the determinants of adoption are different for different conservation practices. We will summarize the different determinants of adoption across conservation practice type. Finally, results from the quantitative and qualitative review will be compared, and gaps in the literature will be identified. Numerous research questions that the soil and water community needs to prioritize in future work will be highlighted, and time will be allocated for a full discussion around these questions.

ORAL PRESENTATIONS

25 Years of Kentucky Soil Test Phosphorus: Lawn and Gardening Our Way to Hell in a Vegetable Basket

Authors: Brad Lee, University of Kentucky*

An excess of phosphorus (P) in the environment can lead to eutrophication and degradation of surface waters. Research at the University of Kentucky has demonstrated that at soil test P levels greater than 60 mg kg^{-1} P becomes water soluble and has a greater potential to reach surface water than at concentrations below 60 mg kg^{-1}. Often urban residents blame water quality impairments on agricultural (ag) practices that lead to nutrient runoff without reflection on their own nutrient management practices at home. To address this concern, a temporal and spatial analysis of all soil P tests collected 1990 – 2014 from ag fields including row crops and pastures (ag: 810,978 tests) was compared to residential lawns and gardens (urban: 179,184 tests). Results indicate that in 119 out of 120 counties the average soil test is 93 mg kg^{-1} higher in urban soils relative to ag soils. Amongst physiographic regions, the Bluegrass, which has the highest population, has significantly higher average soil test P levels (ag: 156 mg kg^{-1}, urban 261 mg kg^{-1}) than any other region. The lowest average soil test P levels were found in the western Coalfield (ag: 76 mg kg^{-1}, urban 137 mg kg^{-1}) and western Pennyrile (ag: 68 mg kg^{-1}, urban 142 mg kg^{-1}). Amongst all of the soil tests collected, 79% of all urban soil tests were greater than 60 mg kg^{-1} while only 34% of all ag soil tests where greater than 60 mg kg^{-1}. Temporally, the state average amongst all county ag soils was 62 mg kg^{-1} in 1990 and has decreased steadily to 51 mg kg^{-1} in 2014, demonstrating that the ag community has been effective at reducing P levels in their row-crop fields and pastures. Alternatively, the state average soil test P amongst all urban soils was 94 mg kg^{-1} in 1990 and has increased steadily to 113 mg kg^{-1} in 2014. These results suggest that an educational campaign resulting in the reduction of P application to urban soils is needed to avert excess P being released into the environment.

Track: Watershed Conservation to Unify Urban and Rural Communities

**Denotes primary author*

A Comparative Analysis of Agricultural Conservation Cost Share Approaches: Pay for Practice versus Pay for Performance

Authors: Benjamin Wickerham, The Nature Conservancy*

Low participation in publicly-funded agricultural conservation cost share programs (i.e. Farm Bill), has opened an opportunity and need for adaptive and user-friendly approaches to incentivizing adoption of new soil conservation practices. In response, The Nature Conservancy (TNC) launched a sediment reduction "Pay for Performance" (PfP) style of cost share program in Michigan's Saginaw Bay Watershed in 2015. This program aimed to develop and refine a PfP program that based financial transactions on actual sediment runoff reductions achieved, rather than gross acreage of practices implemented (as is used as a transactional metric in traditional USDA cost share programs). This innovative Saginaw Bay PfP program also sought to remove some identified barriers to enrollment (research based) to thus accelerate the adoption of soil health practices in Michigan's Saginaw Bay Watershed. Since its launch in 2015, TNC has tracked and analyzed the efficacy of this Sediment Reduction PfP program in comparison to traditional cost share models. TNC was afforded this unique opportunity of comparative analysis because it has co-led an NRCS Regional Conservation Partnership Program (RCPP) program—which uses traditional cost share methods— over the same time period. In both programs, TNC used consistent watershed models (GLWMS) to track results and assess environmental outcomes; thereby determining the implied soil-saving return on investment (ROI) for both programs. These two methods of conservation cost share, ran simultaneously within the same geography for the same time span and for the same soil health practices, has yielded informative results. Based on three years of data, results indicate that, if afforded additional cost share funding, conservation organizations could achieve greater environmental ROI by utilizing a PfP framework as compared to traditional conservation cost share methods. This session will provide evidence and comparative results accrued 2015-2018.

Track: Engaging the Private Sector in Conservation

**Denotes primary author*

A Coupled Agronomic – Economic Web Application: Can Irrigation Management of High Cash Crops be Environmentally-Friendly?

Authors: Effi Tripler, The Hebrew University of Jerusalem*

The combination of increased food production with increasing water scarcity has led in arid and semi-arid regions to utilization of water with high concentrations of salts for crop irrigation. The Arava Valley, shared by Israel and Jordan, is characterized by extreme aridity and deep aquifers containing brackish (2-7 dS/m) water. An integrated capital water framework plan for the Arava valley, recently adopted by the Israeli water authority, suggests providing desalinated water, originated from local brackish well and from sea water, to the region.

Recently, the ANSWER (ANalytical Salt WatER) web application was introduced. The application provides an integrated solution of plant response to irrigation water salinity and application rate that includes feedback from soil, crop and climate. We coupled ANSWER with a MATLAB optimization procedure to maximize farm net returns from agricultural production subject to land water constraints. A case of a single farm unit in the Arava comprised of two crops (date palm and bell pepper), under variable irrigation water EC (0.4-4 dS/m) was studied. We assumed that the farmer can mix desalinated water with local brackish water in order to reach any desirable irrigation water salinity.

Results indicate that the volumetric water pricing policy and salinity have a significant effect on land and water allocation, for both investigated crops. Crop net-profit response to salinity, under elevated irrigation levels, showed that the maximum profit for date palm is reached when irrigating with water of 2 dSm^{-1} while peppers profit most when irrigated with water of 0.4 dS/m (e.g. fresh or desalinated water). Similarly, annual salt load was found to be minimized when irrigation with fresh water qualities was applied for both crops. Thus, high profits obtained under irrigation with desalinated water or when local brackish water were diluted with desalinated water, minimized salinity buildup in irrigated soils.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Models, Tools, and Technologies

Denotes primary author

A Plot Study of the Impact of the Water-Induced Channel on Tillage Translocation

Authors: Fangzhou Zheng, Agriculture and Agri-Food Canada *; Sheng Li, Agriculture and Agri-Food Canada; David Lobb, University of Manitoba

Water-induced channel is one of the primary forms of water erosion in cultivated fields. Other than water erosion, cultivated fields are also subject to tillage erosion. As a result, interaction effects may exist between these two erosive processes. For instance, a water erosion induced channel, such as a rill or an ephemeral gully, will change the soil surface geometry substantially, and thereby change the landscape erodibility for the following tillage erosion event. Therefore, the existence of a channel may significantly affect the soil translocation by tillage. However, no field study has been carried out to characterize such interaction effects. In this study, the effect of water-induced channels on tillage translocation was examined using the point tracer method under three types of tillage conditions: upslope, downslope and contour tillage and three surface condition: flat soil surface, 10 cm by 10 cm channel and 20 cm by 20 cm channel. For each plot, the soil movement was indicated by coloured concrete tracers incorporated into the soil. Both forward and lateral tillage translocations were calculated by the locations of each tracer before and after the tillage operation. The results show that, with a water-induced channel, tillage translocation was greater in the lateral direction, whereas the forward tillage translocation was less. Also, the effect of channel size appeared with downslope tillage. The forward tillage translocation decreased with an increasing channel size, whereas the lateral tillage translocation increased with a larger channel. Overall, the study suggests that the existence of the water-induced channel can affect tillage translocation.

Track: 2019 General Conference Theme Submissions

Subject: Water Resource Assessment and Management

Denotes primary author

A Spatial Optimization Approach for Evaluating Alternative Agricultural Management Practices

Authors: Lucia R. Levers, University of Minnesota*

The Mississippi River Basin is dominated by corn and soybeans. Harvested in the fall and left barren through the winter, these fields can deliver excess nitrogen fertilizer to both groundwater and surface water. This impacts local and regional water quality, including rural drinking wells, downstream urban environments, and the Gulf of Mexico hypoxic zone. Potential remedies include introduction of winter cover crops, or establishing perennial cover. To evaluate these alternatives, we combined a biophysical watershed model (SWAT) with an agro-economic optimization approach; our framework simulates policy driven land use and environmental effluent shifts. While it is common to evaluate farm practices at a fine resolution, many management decisions are made at the scale of the farm field—suggesting there exists a spatial disconnect between managing for optimum outcomes vs. in a practicable manner. Thus, we employ a novel and more realistic management unit approach, in addition to HRU (hydrologic response unit) level shifts. We applied our framework to Beaver Creek watershed, a Minnesota River tributary, and simulated land management changes required to achieve nitrogen reduction benchmarks. We found while perennial crops are more environmentally beneficial, strategically located cover crops can achieve significant benchmarks. As the management unit increases in size, the loss of potential profit to the farmer increases. Additionally, high levels of precipitation greatly influence the environmental damages as well as the relative amount of alternative practices needed to reach nutrient reduction goals. Spatially determining effective locations for alternative practices has implications for program design and incentive levels. With climate change projected to increase rainfall in our study region (i.e. nutrient reduction becoming ever more difficult to achieve), holistic approaches would necessitate greater social engagement across both rural and urban communities.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Models, Tools, and Technologies

Denotes primary author

Advancing Green Infrastructure Practice through Life Cycle Cost and Co-Benefits Analysis

Authors: Jennifer Egan, University of Maryland*

More communities are implementing or considering the use of both green and gray infrastructures to reduce the overall costs of meeting stormwater management requirements, while offering additional co-benefits. GI can be a cost-effective approach to improve water quality and help communities maximize the value of their infrastructure investments by providing other environmental, economic, and community benefits. This presentation will discuss the framework and decision support tool for conducting life cycle cost analysis for stormwater infrastructure (including both green and gray infrastructure). In addition, the presentation will cover the framework and a supporting tool for quantifying the co-benefits of implementing green infrastructure and evaluating its economic, environmental and social values. Participants will learn from an EPA-funded project entitled "Community-enabled Lifecycle Analysis of Stormwater Infrastructure Costs (CLASIC)" along with a related project on "Framework and Tools for Quantifying Green Infrastructure Co-Benefits".

Track: 2019 General Conference Theme Submissions

Subject: Water Resource Assessment and Management

Denotes primary author

Advancing Groundwater Implementation through Watershed Planning

Authors: Carrie J Raber, Minnesota Department of Health*

In Minnesota, as elsewhere, water resource issues are on the rise; however the majority of water resource planning efforts are focused on surface water quality. An interagency effort, led by the Minnesota Department of Health, is seeking to change this by developing a process that integrates groundwater concerns into comprehensive watershed planning. Groundwater Restoration and Protection Strategies (GRAPS) are being develop utilizing existing state information to identify management strategies that can be focused on the most critical groundwater resource needs within a watershed. The hope is that this new innovative process will force a paradigm shift in how water is managed, drawing greater recognition and resources to groundwater and drinking water concerns across the state.

Track: Watershed Conservation to Unify Urban and Rural Communities

**Denotes primary author*

Algal Blooms, Agricultural Water Management, and Climate Change in Western Lake Erie

Authors: Glenn O'Neil, Institute of Water Research - Michigan State University*; Rebecca Muenich, Arizona State University; Margaret M Kalcic, Ohio State University

Lake Erie has long suffered from harmful seasonal algal blooms primarily attributed to nutrient runoff from agricultural lands in its western basin. Though there are multiple projects addressing nutrient loading rates in western Lake Erie, few are exploring how those rates might change in the future. The authors are using the Soil and Water Assessment Tool (SWAT) to forecast phosphorus, nitrogen, and sediment loading from the River Raisin watershed, a tributary of western Lake Erie. Future climate inputs for the model come from an ensemble dataset of regional climate models under multiple emission scenarios for the 2041-2060 time period. In addition to simulating the impacts of climate change on loadings, the authors are exploring how water management practices may affect discharges into western Lake Erie. Specifically, the authors are simulating broader adoptions of controlled drainage, an expansion of tile drainage, and increased irrigation. The future climate models used in this study forecast an overall 10%-20% increase in precipitation from current levels, with seasonal fluctuations. The authors anticipate that the larger volume of water moving through the landscape will increase loadings to western Lake Erie, that the adoption of controlled drainage will mitigate that outcome, but that the expansion of tile drains and an increased need for summer irrigation will exacerbate it. The results from this research will inform efforts to balance the need for maintaining agricultural productivity and the preservation of water quality and aquatic habitat in the face of climate change. At the policy level the forecasts of nutrient loading to Lake Erie will help set reduction targets to minimize the occurrence of harmful algal blooms. For producers in the region the evaluation of the impacts of water management practices will help them plan for the increasing amount of water and changing timings of precipitation that they will likely face in the future.

Track: Adapting Landscapes to Climate Change

**Denotes primary author*

Abandoned Mine Drainage (AMD) Treatment for Water Quality Improvement, Nutrient Management, and Soil Remediation

Authors: Naomi Anderson, Hedin Environmental

Across Appalachia, a persistent legacy effect of coal mining is abandoned mine drainage (AMD). AMD forms when water flows through abandoned mines and reacts with pyrite and other minerals to form metal-laden, sometimes acidic discharges. In Pennsylvania alone, around 2,500 miles of streams are polluted by AMD, rendering their biota impaired, or in many cases, nonexistent. The goals of AMD treatment are to remove metals and, when necessary, increase the water's pH and alkalinity. This is accomplished by a variety of methods, which can be divided into two categories: active and passive treatment. Active treatment involves mechanical aeration, pumping, and the addition of chemicals, while passive treatment relies on natural and biological processes as well as gravity. Active and passive treatment are appropriate in different scenarios—for large AMD discharges where land area is limited, an active chemical system is preferred; in rural areas or in cases where ongoing funding is limited, passive treatment is more fitting. The first part of this oral presentation will focus on passive treatment of AMD. The presenter will highlight the different methods of passive treatment, their applications, and their outcomes. Regardless of the category, a byproduct of all AMD treatment is a solid waste containing the metals once present in the water, and any unreacted chemical materials added during treatment. These solids, referred to as mine drainage residuals (MDR), have chemical characteristics that make them particularly reactive with oxyanions such as phosphate, and with toxic heavy metals such as lead, selenium, and arsenic. The second part of the presentation will explore the feasibility of using MDR to lessen the environmental mobility of phosphorus in land-applied manure, and to remediate lead-containing soils. The speaker will share and discuss the results of comprehensive studies on both of these topics; mine drainage residuals will be presented as an innovative BMP.

Track: 2019 General Conference Theme Submissions

Subject: Water Resource Assessment and Management

**Denotes primary author*

An Ecohydrological Assessment of Potential Impacts of Climate Change on Herpetofauna in the Connecticut River Watershed

Authors: Cayla Paulding, University of Massachusetts Amherst; Timothy O. Randhir, University of Massachusetts*

Climate change is bringing challenges to wildlife worldwide. Effects of climate change such as changing precipitation and temperature patterns, as well as increased frequency and severity of storms are already being seen and are forecasted to magnify. This change in hydrology is altering earth's ecosystems. The resident biota must either adapt to these changes, shift ranges, or face extinction. Herpetofauna are particularly vulnerable to these changes based on their physiology and natural history. Since reptiles and amphibians are vital components of ecosystems at large, it is necessary to determine if and how they may be affected. This study examines the Connecticut River watershed at a hydrologic unit code (HUC) 10 watershed-scale. The Hydrologic and Water Quality System (HAWQS) model produced three scenarios for the watershed: baseline or default, climate change relating to a representative concentration pathway (RCP) 4.5, and climate change RCP 8.5. These scenarios shed light on the watershed's current hydrologic regime and how it may change with climate change based on medium (RCP 4.5) or severe (RCP 8.5) levels of greenhouse gases being emitted. This assessment is useful in determining measures need to be taken in order to protect herpetofauna of the Connecticut River Watershed. Adaptation measures include identifying and protecting active river areas, the creation of spatial refugia, and enhancing continuity of habitat over landscape scales.

Track: Adapting Landscapes to Climate Change

**Denotes primary author*

An Integrated Environmental Farm Management Decision-Making Tool: Nutrient Tracking Tool (NTT)

Authors: Ali Saleh, Tarleton State University; Mindy Selman, USDA OCE*

The Nutrient Tracking Tool (NTT) is a user-friendly web-based computer program and is linked to the Agricultural Policy Environmental eXtender (APEX) model. It also accesses USDA NRCS's Web Soil Survey and PRISM to obtain field, weather, and soil information. NTT provides producers, government officials, and other users with a fast and efficient method of estimating the nutrient, sediment losses, and atmospheric gases (N_2O, CO_2) emission, and crop production under different conservation practices regimes at the farm-level. The information obtained from NTT can help producers to determine the most cost-effective conservation practice(s) to reduce the nutrient and sediment losses while optimizing the crop production. Also, the recent version of NTT (NTT-RE) has been developed for those countries without access to national databases, such as soils and weather. The NTT-RE also has been designed as an easy to use APEX interface. In addition to providing real-world information on the impact of conservation practices on production and sustainability of agricultural operations, the NTT aids in developing markets where farmers get paid for the water quality benefits they provide. Known as water-quality credit trading, these programs help reduce water pollutants, especially nitrogen and phosphorus, by letting pollution sources in a watershed trade among themselves to find the most cost-efficient way of reducing the nutrients. NTT has been released for public use by USDA office (www.ntt.tarleton.edu). A version of NTT (CBNTT) is also currently being used for trading and other water quality programs in Chesapeake Bay regions. During this presentation the new capabilities of NTT-RE will be described and demonstrated.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Models, Tools, and Technologies

**Denotes primary author*

Analysis of Aerial Seeding of Cover Crops in Southwest Kansas

Authors: Thomas W Roth, USDA NRCS*

In Kansas, more acres are being planted into cover crops to improve soil health and increase biological activity. Most research has been confined to the Kansas State University experiment stations. A constraint is the timing of seeding the cover crops after fall harvest. In 2017, variances were granted for aerial seeding in Edwards, Pratt, Seward, and Stevens counties. Sixteen center pivots were selected. Fifteen points were identified in each center pivot. A range square was used to count the number of plants and the species composition was determined. Plant growth was estimated every two weeks using Canopeo, until cold temperatures terminated the brassicas.

Track: 2019 General Conference Theme Submissions

Subject: Soil Health Resources, Indicators, Assessment, and Management

**Denotes primary author*

Are Nonconfinement Roofed Winter Feeding Barns on Small Cow/Calf Operations a Sustainable Conservation Practice or Not?

Authors: Tom Basden, West Virginia University*; Justin Brackenrich, Penn State Extension Service; David Shipman, USDA NRCS

USDA NRCS has successfully used EQIP to add Roofed Winter Feeding Barns to many Cow/calf operations in WV. These Barns do have a manure storage component, but the livestock herds are not confined so only a portion of the manure is captured. The remainder is deposited in an adjacent loafing area or sacrifice winter pasture field. These cow herds in this type of partial confinement system are fed stored hay, protein and energy supplement feeds for a period of 150 days, between November 15th to April 15th. Manure phosphorus (P) additions on the adjacent pasture area to the feeding barns is a concern and conservationists are now questioning if a permanent nonconfinement winter feeing area has potential to cause environmental losses due to excessive P loading to soils. To determine the degree of nutrient accumulation around roofed winter feeding barns a case study farm was selected. The farm had a 50 cow herd with a roofed winter feeding barn with a manure storage area. During the winter feeding period the cow herd had access to an 8 acre pasture area that provided loafing areas, watering facilities and mineral feeders. Cows spent most of their time in this pasture after feeding in the barn. Phosphorus nutrient flows onto the farm, soil P within the farm and P nutrients moved off the farm were determined. Phosphorus content was determined from forage analysis of on farm harvested hay, sampling and analysis of stored manure, forage analysis of purchased concentrate feed and minerals, bales of on farm harvested hay sold off the farm and soil test P levels determined during comprehensive nutrient management plan. Within the 8 acre pasture where cows were wintered grid soil samples were collected to determine the level of Soil Test P enrichment. Preliminary conclusions from grid soil sampling show a moderate P saturation level. Annual imports of purchased P in fertilizer, mineral and feed supplements will continue to flow onto the winter pasture.

Track: 2019 General Conference Theme Submissions

Subject: Conservation in Organic, Specialty, Small-Scale, or Urban Agriculture

Denotes primary author

Assessing Soil Health Metrics in the Piedmont of North Carolina

Authors: Caitlin L. Caudle, North Carolina State University*; Deanna Osmond, North Carolina State University; Matthew Ricker, North Carolina State University; Joshua Heitman, North Carolina State University; Skye Wills, USDA NRCS

There is growing interest in assessing soil health in a range of settings. Several soil health tests are available, but there remains no standardized set of metrics or sampling protocol for soil health evaluations. The USDA Natural Resources Conservation Service is leading an assessment of soil health metrics across multiple agroecological regions in order to determine their usefulness in assessing soil health. One agroecological region of interest is the piedmont of North Carolina, with specific focus on the Cecil soil series (fine, kaolinitic, thermic Typic Kanhapludults). Two common land management systems, row crop and hay land, were chosen to evaluate the variability of the selected soil metrics across different agricultural land uses. Three fields under each land management system, each mapped as Cecil were selected. Within each field, three sampling locations were identified along a slope transect. At each sample location, soil cores were collected to a depth of 100 cm and divided into five depths (0-5 cm, 5-10 cm, 10 cm to the bottom of the A horizon, and two B horizons). Each land management system had a total of nine sample locations and 45 unique samples based on depth. Soil metrics analyzed include surface infiltration rate, soil organic carbon content, aggregate stability, aggregate size distribution, soil respiration, enzyme activity, active carbon content, protein content, and bacterial community composition. Differences in soil health metrics were observed between the two land management systems, between the individual fields in a given management type, and within a given field. On-going analyses will evaluate the significance of differences observed in soil health metrics between and within the land management systems.

Track: 2019 General Conference Theme Submissions

Subject: Soil Health Resources, Indicators, Assessment, and Management

Denotes primary author

Assessing Variability of *E. Coli* in Streambed Sediment and its Attachment Rate to Sediment Particles and Monitoring the Effect of Seasonal Riparian Area Management (SRAM)

Authors: Sadia Salam, South Dakota State University*

According to US EPA, fecal indicator bacteria (FIB) considered as the prime responsible for water quality impairment. Literatures reported sediment as a reservoir for bacteria, including pathogenic organisms, from fecal material. Because sediment gives more favorable condition to grow bacteria. But problem gets more complicated when the sediment bed gets disturbed, because of the bed disturbance the bacteria attached to sediment particles can resuspend to the water column and cause water quality impairment. There are two types of bacterial attachment to particles: attached and unattached. The unattached bacteria create more problem than attached one as they can act as free floats and travels further. Conventionally, FIB like *E. coli* has been used for identifying fecal contamination. The goal of this study is to determine *E. coli* variability in streambed sediment throughout the recreational season and its attachment rate to sediment particles. The study sites located in Skunk Creek, a tributary of the Big Sioux River. There are four monitoring sites abbreviated as Sk1, Sk2, Sk3 and Sk4. Except Sk1, all site is under SRAM BMP's. Three to five Samples from each site were collected from May to October from 2017 to 2018. 2017 data showed SRAM has a positive impact in decreasing *E. coli* levels in the streambed sediment. The *E. coli* concentration range from 2017 and 2018 is 20 ~ $1.6X10^3$ $CFUg^{-1}$ and 20 ~ $1.4X10^4$ $CFUg^{-1}$, respectively. For attachment rate, a sedimentation procedure was followed. The results showed 30% to 95% of *E. coli* attached to sediment particles.

Track: 2019 General Conference Theme Submissions

Subject: Water Resource Assessment and Management

**Denotes primary author*

Assessment of Long-Term Effects of Different Nitrogen and Tillage Management Practices on Irrigated Corn Yields and Nitrogen Uptake

Authors: Jorge A. Delgado, USDA ARS*; Ardell Halvorson, USDA; Alexis Villacis-Aveiga, Virginia Tech; Steve DelGrosso, USDA; Catherine Stewart, USDA; Daniel Manter, USDA; Jeffrey Alwang, Virginia Tech); Bradley Floyd, USDA; Robert D'Adamo, USDA; Grace Miner, Colorado State University/USDA ARS

Corn is the most nitrogen-fertilized crop in the USA, and management practices such as nitrogen fertilizer rates and tillage intensity affect grain yields and nitrogen uptake. Since 2001 we have been studying the long-term effects of nitrogen fertilizer and tillage management practices on irrigated corn yields and nitrogen uptake in a Fort Collins clay loam soil at the Colorado State University Agricultural Research, Development and Education Center (ARDEC) near Fort Collins, Colorado. Several nitrogen rates were used for irrigated no-till (NT), conventional tillage (CT) and strip-till (ST) corn. Biomass production was monitored by collecting samples at about 146 days after planting (DAP) to determine corn grain, cob, stalk and total aboveground biomass. Corn harvest grain yields were determined by harvesting 15 m of row at about 173 DAP. Nitrogen analyses were conducted for all plant compartments. We used a linear-plus-plateau model, defined by a classic switching regression type of function, to assess the effects of nitrogen rates on NT, ST and CT systems. For this study, the R-NLS function was used to solve this nonlinear fixed-effects regression model. Results were also checked with the MATLAB ® FITNLM function for robustness. Results presented will include fitting the linear-plus-plateau model to determine the minimum nitrogen level to reach the plateau yield of grain and/or other biomass compartments as well as nitrogen uptake and nitrogen use efficiencies.

Track: Adapting Landscapes to Climate Change

**Denotes primary author*

Assessment of Soil Phosphorus Content from Three Fields in the Buffalo National River Watershed

Authors: James M. Burke, University of Arkansas*; Andrew Sharpley, University of Arkansas

Increased amounts of soil phosphorous (P) from the long-term application of manure can have potentially detrimental consequences on the quality of receiving waters. Excess nutrient transport into streams through runoff and leaching have been shown to limit aquatic species diversity and impair water use. In the Buffalo National River Watershed near Mount Judea, Arkansas, swine manure in the form of liquid slurry is applied to agricultural fields adjacent to Big Creek, which is a tributary of the Buffalo River. This manure is used as an inexpensive source of nutrients for optimal forage production and replaces the need for commercial fertilizer on these fields. Soil test P data was collected from three fields in the Big Creek Watershed in 2014, 2016, and 2018, two of which received swine slurry annually, with the third field commercial fertilizer only. Statistical analysis using a paired t-test at $p = 0.05$ showed that all of the fields sampled showed a significant increase in surface soil test P (0 – 15 cm depth) from 2016 to 2018. The causes of these soil test P increases were attributed to cattle congregation patterns, as well as periodic slurry applications in two of the three sampled fields. The increase in soil test P in the third field, was believed to be the result of the accumulation of legacy soil P over time, with mineral fertilizer and occasional poultry litter applications. The major beneficial outcome of this research has been to inform farmers, who have agreed to closely manage cattle grazing patterns, as well as reduce the number of slurry applications. Rigorous P monitoring and adoption of these conservation measures needs to continue to confirm that the water quality of Big Creek and the Buffalo National River is not impaired.

Track: 2019 General Conference Theme Submissions

Subject: Water Resource Assessment and Management

Denotes primary author

Balancing of Soil Nutrients to Aid Soil Fertility Programs and Improve Soil Resilience to Extreme Weather Conditions

Authors: Zouheir Massri, AgroLiquid*

Climate variability is one of the most important factors affecting soil nutrients availability. Assuring balanced nutrients inputs to soils aids soil fertility programs increases the soil cations exchange capacity (CEC) dynamic entity, and improves soil resilience to extreme weather conditions. Soils show considerable variability in fields. Soil texture, soil organic matter, and soil pH, as well as nutrient levels, can vary widely as you move across a field and impact soil CEC. This is common knowledge that has led to Variable Rate Technology (VRT). VRT practice was thought to enable a reduction in the overall nutrient application which likely will help growers to adjust inputs based upon the soil properties, increase their yield, and to benefit the environment. Therefore, the main focus is to evaluate the long-term spatial and temporal nutrients variability associated with fertilization programs, equalize soil nutrient dynamics using soil test information conducted to determine affordable fertilizer application rates, improve crops economic revenue, and improves soil conditions resilience. An experiment was begun at the NCRS with the objective of adjusting the soil test of potassium (K) levels based on soil CEC and K% base saturation of soil testing to make them equal or at least very close. There was a significant yield response to the application of the K dry fertilizer. The fertilized plots showed a significant positive correlation with the recommended application and soil CEC. Fertilizer applications over time will give guidance to 1) the ability to equalize soils enabling better research in experiments, and 2) the ability for growers to more accurately make VRT applications based on research. Effective nutrient management is especially important in the urban-rural interface where water quality is scrutinized by stakeholders and regulators alike. Equipping producers with suitable techniques for fertilization is drawing wider attention.

Track: Adapting Landscapes to Climate Change

**Denotes primary author*

BEG Group LLC's Habitat Pollinator Initiative

Authors: Joe Greco, BEG Group LLC*

The purpose of this project is to plant slopes with as little harmful effect on the environment as possible along highways. Phalanx Bio Switch™ (PBS) manufactured by BEG Group is a nationally certified USDA biobased/biopreferred product engineered for controlling erosion & containing/retaining sediment in disturbed areas. It is a 100% biodegradable sock filled with switchgrass that is placed perpendicular to sheet-flow runoff. PBS filters are applicable to construction sites or other disturbed areas where stormwater runoff occurs as sheet flow. The filter is supercharged with milkweed to help the growth of this wildflower & benefit pollinators such as the Monarch butterfly. The filters can be secured on hillsides with wooden stakes, minimizing erosion until it biodegrades & filler decomposes. First a preliminary vegetation/pollinator survey is conducted. PBS supercharged with common milkweed seed are to be placed along contours of roadsides to reduce erosion & promote growth. About 6-8 months in, the top layer of the PBS can be removed & milkweed will most likely be noted. The filters do well with erosion control, filtering & germination. A follow up survey conducted about 10-12 months in should find a number of milkweed growing from within & below the PBS. Such projects are frequently a success in terms of their ability to promote milkweed growth. Milkweed supercharged PBS is an effective method of introducing milkweed onto projects increasing habitat for Monarch butterflies as well as adding native plants. Given the proven benefit of milkweed, the only host plants acceptable for monarch caterpillars, this is a great way to improve roadside habitat for Monarch, a species which has been experiencing declines. BEG Group has proposed a very broad definition of private sector engagement as an activity that aims to engage the private sector for development results & participation. The public sector, especially State DOT workers, are prime candidates as installers.

Track: Engaging the Private Sector in Conservation

**Denotes primary author*

Bringing Diverse Perspectives Together to Support Watershed Management in Iowa

Authors: Hanna Bates, Iowa Water Center/Iowa State University*

In 2010, Iowa Code established the Watershed Planning Advisory Council (WPAC) to bring together a diverse group of stakeholders to review research and make policy recommendations for water management. These members included the leadership from major farm commodity organizations and water associations. By 2016, little progress had been made in the yearly meetings due to diverse political platforms of the council members. Discussions would end in a deadlock without meeting the goal of fulfilling their intended purpose. WPAC considered seeking to amend the legislation to disband the group. In the fall of 2016, the Iowa Water Center (IWC) was invited in to facilitate WPAC meetings as a last attempt to help guide conversations to achieve their purpose of providing recommendations for water resource management to the Iowa legislature. After three years of IWC facilitation, WPAC meetings are civil and productive, and WPAC has made many strides in creating tangible and specific recommendations to the Iowa legislature. The evolution of WPAC serves as a model organization in respect to how unlikely individuals with little visible enthusiasm for collaboration can work together. This presentation will outline the process for how to address roadblocks in committee work, how to engage sometimes reluctant participants, and how to bring people of diverse political platforms together on science-based recommendations for water resource policy.

Track: 2019 General Conference Theme Submissions

Subject: Outreach, Education, and Community Engagement

**Denotes primary author*

Building Capacity for Watershed Leadership in the Mississippi River Basin

Authors: Rebecca Power, University of Wisconsin*; Amanda Gumbert, University of Kentucky; Jamie Benning, Iowa State University; Mike Daniels, University of Arkansas; Margaret M. Kalcic, Ohio State University; Amulya Rao Ponna Vishweshwer, University of Wisconsin-Extension; Anne Nardi, University of Wisconsin; Elizabeth Schwab, The Ohio State University; Lee Riley, University of Arkansas

Efficient use of agricultural lands and nutrients is critical for 1) the production of sufficient food, fiber and fuel to supply a growing human population and 2) providing for the designated uses of rivers, lakes, streams, and wetlands in the Mississippi and Atchafalaya River Basins and the Gulf of Mexico (MARB). If land and water resources are to maintain their resilience, rich local knowledge and the best available science and decision-support resources need to be applied. To accomplish these goals, leaders engaged in watershed projects as well as leaders from the agricultural sector looking to increase nutrient use efficiency and minimize environmental damage need to combine forces. They need support in learning from one another and applying that learning locally, in their states, and across the MARB. To address this need a team of extension professionals and partners has completed a needs assessment that 1) characterizes distinctive features of farmer leadership in watershed management and 2) identified training needs to support and grow farmer leadership in watershed management. The project is also using basin-wide summits as forums for learning among farmers, farm advisors, and watershed practitioners in public and private sectors. Finally, the project is working with two local watersheds to examine how basin-wide learning forums and local training impacts local watershed management. This presentation will present results from each facet of this project and describe new work that will expand farmer and farm advisor leadership in watershed management. Needs assessment results found that farmer leadership off the farm typically falls into three categories: peer-to-peer, consultation, and watershed level decision-making. Support for farmer leaders can be organized into the following categories: initiating; facilitating; material support; technical support; educational support; and motivational support.

Track: Watershed Conservation to Unify Urban and Rural Communities

**Denotes primary author*

Changing the Watershed Relationship: Collaboration of Community Groups and Local Government for Mutual Benefits

Authors: Amy Miller, Allegheny County Conservation District*; Rebecca Zeyzus, Allegheny Watershed Alliance

Stormwater (SW) regulations associated with the Federal Clean Water Act place economic burdens on Municipalities and Authorities, which are ultimately passed on to a tax- or ratepayer. Many requirements of Pennsylvania's Municipal Separate Storm Sewer System (MS4) program can be addressed through unique partnerships between new and existing watershed groups and municipalities. MS4s are conveyances designed or used for collecting or carrying SW. The Pennsylvania Department of Environmental Protection manages the MS4 program in PA. Every MS4 requires a SW management plan, which includes elements of education and outreach to residents and development of a 5-year Pollution Reduction Plan. Creating and strengthening partnerships between watershed groups and municipalities can assist in meeting certain permit requirements, lessening economic impacts, increasing environmental benefits, and providing a mechanism for community engagement in SW management. The Allegheny Watershed Alliance (AWA) is a place-based, non-profit organization founded and sponsored by the Allegheny County Conservation District (ACCD). AWA is devoted to strengthening watershed groups and fostering collaboration among municipalities and partners. Uniquely positioned alongside ACCD, AWA serves as a community partner with specialized expertise and relationships in the technical and regulatory fields of SW and watershed management. With an arm in each world, AWA is able to leverage and build relationships to bring restoration projects and public engagement initiatives to fruition. A focused mission of promoting and supporting collaboration on a watershed basis has the potential to usher our region into modern water resource and SW management practices, and elevate environmental literacy among the public. Empowering partners on a watershed basis via network building allows us to teach, rather than catch, a fish on behalf our partners. This model can be replicated anywhere with the proper support.

Track: 2019 General Conference Theme Submissions

Subject: Outreach, Education, and Community Engagement

**Denotes primary author*

Comparison of Soil Health Measurements and Soil Conservation Practices

Authors: Alan Sundermeier, Ohio State University Extension*; Vinayak Shedekar, Ohio State University

There is a need to understand the correlation between soil health measurements and their accuracy to determine effects of soil conservation practices. Research conducted in Ohio compared the following soil practices: 1. No-till grass sod (*Festuca* spp), 2. Tillage with less than 30% crop residue on corn/soybean crop production, 3. No-till corn/soybean crop production with multi-species cover crop. Soil samples were analyzed for the following soil health measurements: Phospholipid Fatty Acid (PLFA), soil respiration, active carbon, and nitrate nitrogen. Results for no-till sod were; 4710 ng/g PLFA, 42.9 ppm C respiration, 1112 lb/acre active carbon, 7.0 ppm nitrate. Results for no-till crop production with cover crops were; 5237 ng/g PLFA, 41.6 ppm C respiration, 1181 lb/acre active carbon, 9.7 ppm nitrate. Results for tillage crop production were; 1490 ng/g PLFA, 19.8 C respiration, 304 lb/acre active carbon, 5.7 ppm nitrate. Measurements correlated well between the various testing methods. The no-till sod and the no-till crop production with cover crops had similar soil health measurements, which were significantly higher compared to tillage crop production.

Track: 2019 General Conference Theme Submissions

Subject: Soil Health Resources, Indicators, Assessment, and Management

**Denotes primary author*

Comparisons of Twenty-Five Years of Surface Runoff Quantity and Quality from Native Prairie and Cropped Livestock Grazing Systems in Central Oklahoma

Authors: Amanda Nelson, USDA ARS*; Ann Marie Fortuna, USDA ARS; Daniel Moriasi, USDA ARS; Jurgen Garbrecht, USDA ARS; Patrick Starks, USDA ARS; Jean Steiner, USDA ARS)

In 1976, eight 1.6 ha watersheds were established and instrumented at the USDA ARS Grazinglands Research Laboratory. The lab is located approximately 30 miles west of Oklahoma City near El Reno, Oklahoma. Each of the eight watersheds is 80 m wide and 200 m long with drainage areas of 1.6 ha sloping 3%-4%. The watersheds were constructed and instrumented to measure precipitation and surface runoff quantity and quality. The cropped watersheds are surrounded by manmade berms and the grassed watersheds by ridges and natural boundaries. Land use of the watersheds has remained constant since 1976. Variations in land management have been dictated by research objectives. Decisions regarding land management have been largely representative of native grass and wheat management in the Reddish Prairies of the Southern Great Plains. The dominant soil is Bethany and Kirkland silt loam. Smaller areas are occupied by Milan loam, Aydelotte silt loam, and Renfrow silt loam. Prior to construction, all watersheds were in native grass. After construction, four of the eight watersheds were cropped into winter wheat (two conventionally tilled and two into no-till), while the other four watersheds remained in native grass. The watersheds have been used to address a number of research objectives in the areas of surface runoff and erosion, water quality, spatial variability of soil properties, soil moisture distribution, groundwater levels, impact of land management alternatives, effects of land use and so forth. An overview of forty years of investigations addressing the impact of livestock grazing on runoff and erosion and the impact of climate variations on the dynamics of soil moisture availability will be presented. This study is part of the Conservation Effects Assessment Project (CEAP) and the Long-Term Agroecosystem Research (LTAR) Network, whose goal is to quantify the effects of land management on soil and water resources under variable climate.

Track: Adapting Landscapes to Climate Change

**Denotes primary author*

Cost Effective Water Treatment: Sustainable Agriculture Solutions

Authors: Elizabeth Lillard, National Wildlife Federation*

Water contamination from nitrates is often linked to the over application of fertilizers and animal manures on private lands, and mitigation can be prohibitively expensive for water utilities. Working with local farmers to implement conservation practices in the surrounds watershed is an affordable alternative, but communities often lack the knowledge, capacity, and partnerships to be successful. To address this challenge, National Wildlife Federation (NWF), has been working with water utilities to bridge the gap between communities and farmers. NWF will hold a mini-training on how to build relationships between urban and rural interests and focus communications on farmer value systems. It will go over the 7 steps of successfully reaching people more hesitant to changing their behavior. These strategies have been tested and applied in real world farmer outreach efforts. This training has two goals: 1) increase understanding of farming values and motivation based messaging; 2) increase effectiveness of outreach messengers to reach farmers regarding adoption of practices that improve water quality. Once achieved, both objectives will increase the ability of outreach staff to communicate with farmers and ranchers. To achieve these goals, NWF will present a PowerPoint which will last approximately 15 minutes, with 5 minutes for questions at the end.

Track: 2019 General Conference Theme Submissions

Subject: Outreach, Education, and Community Engagement

**Denotes primary author*

Cover Crop Effects on Corn Plant Sap Flow Rates and Soil Water Dynamics

Authors: Clark Gantzer, University of Missouri*; Lalith M. Rankoth, University of Missouri; Ranjith Udawatta, University of Missouri; Shibu Jose, University of Missouri; Kelly Nelson, University of Missouri

Cover crops (CC) are used for soil quality improvement. However, information on soil water competition from CC on cash crop is mixed. To add knowledge on this topic, plant sap flow measurement techniques are among the most useful methods to detect water stress and to evaluate plant water consumption by measuring the whole plant transpiration. The objective of the study was to quantify plant sap flow dynamics in corn (*Zea mays* L.) and soil water dynamics in response to growth with CC and with no cover crop (NCC) management. The study was conducted in Bradford Research Center, University of Missouri, Columbia, in 2017 and 2018 during the growing season. Dynamax Flow32-1K sap flow measurement system and CR1000 data logger with dynagage sensors was used to measure hourly and daily sap flow rates in corn plants. Water uptake in plants under NCC treatment showed higher levels than that of CC treatment for tasseling to grain filling period in 2017. After maturity, corn plants in CC treatment used more water compared to NCC, indicating a greater soil water holding capacity in CC soil. Three replicate soil moisture sensors were installed in 2018 in CC and NCC treatments at 10, 20, and 30 cm depths to record volumetric soil water content (VWC) at 15-minute intervals. Results showed significantly greater VWC in the CC treatment compared to NCC at 10, 20 and 30 cm soil depths. Overall results of the study indicate that CC use can increase soil water storage and allow cash crops to use water for a longer period.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Models, Tools, and Technologies

**Denotes primary author*

Demonstrating Methods for No-Till Organic Gardening Using Cover Crops

Authors: Duane Friend, University of Illinois Extension*

Previous research has shown the potential for gardening using no till and including the use of cover crops. This presentation looks at how well this works using methods that most gardeners could employ without having to spend a lot of money on special equipment. A demonstration garden in West Central Illinois has examined the use of tillage radish and rye cover crops in a no till garden setting for two years. Using hand seeding of the cover crop, a human powered crimper, and strategic use of plastic weed barrier, organic weed control was shown to be feasible for gardeners to employ for less than $100, with minimal disturbance of soil.

Track: 2019 General Conference Theme Submissions

Subject: Conservation in Organic, Specialty, Small-Scale, or Urban Agriculture

Denotes primary author

Development of Management Zones for Cropping Systems in the Lake Winnipeg Basin to Improve N and P Application and Crop Productivity, and to Reduce Environmental Impacts

Authors: Mohammad Khakbazan, Agriculture and Agri-Food Canada*; John Huang, Agriculture and Agri-Food Canada; Patsy Michiels, Agriculture and Agri-Food Canada

Declining water quality and eutrophication of Lake Winnipeg is a major concern. The majority of land in the Lake Winnipeg basin is used for agriculture. Delineating agricultural land into management zones and managing each according to its needs and specifications has considerable potential to increase crop yield and N and P use efficiency, thereby reducing environmental impacts. Climate and soil properties within a given management zone may affect crop response to N and P application and should be considered when selecting nutrient management practices. The aims of this study are to: evaluate management zones based on climate and soil variability for wheat, canola, and soybean; identify yield efficiency gaps among zones; identify BMPs that optimize N and P applications and environmental benefits. Data and land management information from studies in the Lake Winnipeg basin together with historical yield and fertilizer data will be used to delineate management zones. Productivity zones will be defined at a detailed scale within the 16 crop production risk areas in the basin. This productivity index will be used to identify narrowly-defined management zones for wheat, canola, and soybean. Optimal N and P fertilizer for each zone will be determined by statistical analysis, actual N and P application and crop yield will be compared to optimal scenarios, and BMPs that reduce the gaps between actual and optimal scenarios will be discussed. Preliminary results have shown that narrowly-defined management zones that take spatial variability into account provide the potential to identify yield gaps, increase crop yield and farm profitability, and reduce GHG emissions. Results for the watershed scale study indicate that spatial and especially temporal variability in soil and crop factors both had effects on crop productivity. The development of zone-specific agricultural practices that optimize N and P application will play an important role in reducing environmental impacts.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Economics and Policy

**Denotes primary author*

Development of the Agricultural Economic Performance Engine: Targeting Marginal Land at the Sub-Field Scale for Economic and Environmental Benefit

Authors: Matthew Nowatzke, Iowa State University*

Agricultural soil and nutrient loss contribute to water pollution in the corn belt and hypoxia in the Gulf of Mexico, impacting human health, increasing water treatment costs, and degrading wildlife habitat. To help address the problem, we developed the Agricultural Economic Performance Engine (AEPE), a framework to identify marginal and underperforming areas of land. AEPE employs the concept of disproportionate benefits, wherein small but strategic landscape changes can have large, positive impacts on human and environmental health. We use simulations of crop yield, nitrate leaching, nitrous oxide emissions, and changes in soil organic carbon at a subfield level using the APSIM crop model and public soils, weather, and spatial data. Output from APSIM is then fed into a statistical emulator to model beyond the field scale. Profitability is calculated using historic commodity prices and crop production budgets. Other frameworks have identified upwards of 27% of land in Iowa as being unprofitable and 49% as having unstable or consistently low yields. We hope to be able to not only identify economically unprofitable areas for targeted change but simulate what that land-use change and its effect on the greater environment and farm economy might look like, including future additions like perennial biomass crops. Working within open-source principles, it is our hope that by equipping researchers, stakeholders, and landowners with the AEPE framework we can mitigate economic loss for Midwest farmers, increase landscape diversity for wildlife habitat, and help prevent the degradation of soils and water.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Models, Tools, and Technologies

**Denotes primary author*

Dynamic Soil Properties for Soil Health Assessment: Coordinating a National Project

Authors: Skye Wills, USDA NRCS*; Michael Robotham, USDA NRCS; Jason Nemecek, USDA NRCS; Carmen Ugarte, University of Illinois; David Myrold, Oregon State University; DeAnn Presley, Kansas State University; Deanna Osmond, North Carolina State University; Francisco Arriaga, University of Wisconsin-Madison; Garrett Lilies, Chico State Univeristy; Julie Gross, University of Minnesota; Joshua Heitman, North Carolina State University; Katherine Naasko, Washington State University; Katie Lewis, Texas A&M Agrilife; Laura Adams, University of Wisconsin-Madison; Isaac Madsen, Washington State University; Paul De Laune, Texas A&M Agrilife; Peter Tomlinson, Kansas State University; Savanna Crossman, Kansas State University; Laura Starr, Kansas State University; Sharon Perrone, University of Minnesota; Haiying Tao, Washington State University; Bill Pan, Washington State University

Interest in soil health indicators as a tool for land management continues to expand within government agencies, the larger scientific community and with the public. Producers and managers look to compare practices and track changes over time by with both quantitative and qualitative field and laboratory metrics. However, guidelines and publicly accessible tools are not widely available for soil health assessment. The NRCS soil survey provides limited interpretations of soil properties as they relate to soil health related properties but doesn't provide reference or benchmarks for most soil health metrics. The soil management assessment framework (SMAF) uses inherent soil properties to standardize some laboratory soil health indicators based on inherent soil properties. The Complete Assessment of Soil Health has simplified the SMAF scoring curves to communicate laboratory results to producers and managers. Concurrent efforts recommend sets of laboratory methods to standardize procedures across the United States. To bridge soil health assessment and soil survey products, the Soil and Plant Science Division of NRCS is coordinating a project called Dynamic Soil Properties for Soil Health Assessment as part of a broader Science of Soil Health Initiative. The project consists of nine individual cooperative agreements with common protocols and procedures in order to assess the accuracy, repeatability and usefulness of a standard set proposed soil health metrics across a range of regions for locally important soils and land management systems. A secondary goal is to link benchmark and reference soil health indicator values to soils and soil survey. Results to date, including difficulties in replicating study design, standardizing laboratory protocols, and database development will be discussed. The data will be incorporated into soil survey products and the information will enhance soil health management recommendations.

Track: Watershed Conservation to Unify Urban and Rural Communities

**Denotes primary author*

Ecosystem Services and Environmental Justice in an Urban Environment

Authors: Joseph Pellegrino, City of Springfield, Massachusetts; Timothy O. Randhir, University of Massachusetts*; David Bloniarz, US Forest Service and University of Massachusetts

Urban environments often display spatial variability in ecosystem services with a wide disparity between high-income and low-income neighborhoods. Sustaining the health of urban watersheds is often a challenge due to rapidly changing land uses. Neighborhoods with high poverty and unemployment, persistent language barriers, and under-represented minorities, considered as Environmental Justice communities, often face poor ecosystem services from low investments in urban ecosystem restoration. High rates of asthma, flooding, poor water supplies, and lack of green infrastructure in these neighborhoods can be attributed to a disruption in ecosystem services of watershed systems. The goal of this study will be assessing the state of environmental justice communities in Springfield, Massachusetts using GIS spatial analysis, ITree-Canopy software, and qualitative interviews. It is observed that Environmental Justice communities had a high impervious cover, low amounts of the tree canopy, and face an undue burden of low ecosystem services. There is a need for efforts to involve multiple stakeholders including residents, government agencies, educators, and non-profits to develop policies to improve the ecosystem services and ecological health in environmental justice communities of Springfield.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Models, Tools, and Technologies

Denotes primary author

Effects of a Precision Agriculture System on Soil and Water Quality in the Central Mississippi River Basin

Authors: Claire Baffaut, USDA ARS*; Fessehaie Ghidey, USDA ARS; Bob Lerch, USDA ARS; Kristen Veum, USDA ARS; John Sadler, USDA ARS; Ken Sudduth, USDA ARS; Newell Kitchen, USDA ARS

Conventional cultivation of claypan soils leads to soil and water quality degradation and plot studies have highlighted trade-offs between erosion control and herbicide or nutrient runoff. There is a need for long-term field scale evaluation of practices that reduce sediment, nutrient, and herbicide losses by runoff. A 36-ha field located in Missouri was under a conventional corn-soybean system from 1993 to 2003 with fertilizer application and tillage prior to planting in the spring. A two management zones precision agriculture system was implemented from 2004 to 2014: wheat and soybean in 60% of the field, and corn and soybean in the remaining 40%. The system included no-till, cover crops, atrazine split-applications, and variable rates of nitrogen and fall-applied phosphorus. The objective of this study was to compare runoff water quality from the two management systems, based on flow and load duration curves, cumulative distribution functions, and conclusions from replicated plot studies. The precision agriculture system did not affect annual runoff but increased the duration of low flows. Sediment losses were reduced by 87%. Atrazine and phosphorus losses were lower than expected, despite the lack of incorporation into the soil. Nitrate-nitrogen losses decreased and resulted in an overall decrease of nitrogen losses despite a slight increase of ammonium-nitrogen losses. No-till, the presence of cover crops, the wheat filtering capacity, and different nutrient and herbicide application timing likely contributed to these findings. An aspirational management system is proposed to further improve on the performance and practicality of the precision agriculture system.

Track: 2019 General Conference Theme Submissions

Subject: Adaptive Management of Conservation Efforts

**Denotes primary author*

Evaluating Consistency of Conservation Practice Adoption among Farmers in the Western Lake Erie Basin

Authors: Maggie Beetstra, Ohio State University*; Robyn Wilson, Ohio State University

The largely agricultural Maumee River watershed encompasses much of northwest Ohio and parts of Indiana and Michigan. Since the 1960s and 70s, harmful algal blooms (HABs) have periodically appeared in the warmer and shallower western basin of Lake Erie near the Maumee River's entry point. In recent years, the HABs have increased in scale dramatically, resulting in large-scale dead zones in the Lake. A major cause of the HABs is non-point source nutrient runoff from agricultural fields. The 4Rs of Nutrient Stewardship were developed as a campaign and certification program to encourage and teach farmers to apply fertilizer at the right time, place, rate, and from an appropriate source to minimize nutrient runoff into waterways. We conducted a panel study of farmers in the Western Lake Erie Basin (WLEB) to understand their level of familiarity with the 4Rs, their perceptions of the effectiveness of these practices, and the extent to which they have adopted the practices in recent years. We collected data at two points, early 2016 and 2018, to determine the behavioral impact of 4R educational efforts on the knowledge, beliefs, and management practices of crop growers in the WLEB. Initial results revealed that there was no net increase in adoption over time, but that while new individuals were adding particular practices over time, an equivalent number of individuals were dropping those same practices. To compare those individuals who were consistent in their adoption of conservation practices to those who were inconsistent, we conducted panel regression analysis to understand what might explain longer-term or more sustainable adoption behavior. We also used latent class analysis to capture the underlying characteristics of farmers from each adoption category. The results explain why some individuals are more consistent in their behavior than others, and what farm and farmer characteristics are the most likely to be associated with consistent or inconsistent adoption.

Track: 2019 General Conference Theme Submissions

Subject: Social Sciences Informing Conservation

**Denotes primary author*

Factors Influencing Use of Online Decision Support Tools for Farmers and Advisors in the Midwestern United States

Authors: Junyu Lu, Purdue University*; Ajay Singh, California State University-Sacramento; Jackie Getson, Purdue University; Tonya Haigh, University of Nebraska; Jenna Klink, University of Wisconsin; Vikram Koundinya, University of California; Pranay Ranjan, Purdue University; Linda Prokopy, Purdue University

Agricultural decision support tools (DSTs) with weather and climate information can provide useful information to help farmers and agricultural advisors make decisions about operational farming tasks and adapt to increasingly variable local weather and climate in the context of climate change. However, many of these DSTs are still not fully utilized by stakeholders. Understanding what factors influence the use of DSTs can help to find solutions to increase the adoption rate and promote the use of DSTs to more end users. Farmers and advisors are the two most important groups of end-users for agricultural DSTs and surveys were conducted for farmers (n = 2,633) and advisors (n = 2,719) respectively across 12 states in the Midwest in 2017. This paper reviews similarities and dissimilarities between farmers and advisors. Advisors were more likely to take advantage of free and publicly available sources than farmers, especially services provided by a university or government agency including extension. Advisors were also more likely to agree on the usefulness of DSTs, feel social pressure to meet expectations in using DSTs, perceive risks and threats from variable/unusual weather and climate change, and show positive attitudes toward adaptation to climate change than farmers. A logistic regression model suggested that concerns about weather or climate affecting farm management, descriptive social norms, size of farmers'/clients' farm, and general propensity to adopt a new technology had significantly positive effects on the probability of adopting DSTs for both farmers and advisors, while perceived behavioral control to deal with weather-related risks, injunctive social norms, and gender only had significant effects for crop advisors, and adaptation attitude towards climate change and education level only had significant positive effects for farmers. Implications of these results for future development of DSTs will be discussed.

Track: 2019 General Conference Theme Submissions

Subject: Social Sciences Informing Conservation

**Denotes primary author*

Farm Bill Implementation and Stream Restoration Practices

Authors: William B. Southerland (USDA NRCS)*

Stream Corridors represent between 1% and 2% of landscapes we work with; however, that small but most vital resource is home to the greatest biological diversity and restoration potential for many American Farmers/Ranchers and the USDA NRCS. Although the roots and origins of the formation of the NRCS and SCDs date back to dust bowl era where uplands, and principally croplands, where undergoing one of the greatest ecological transformation, streams and river systems were heavily impacted too and subject to intense alterations. For the most part stream and river corridors were treated as low priority compared to highly erodible cropland. It was understood, early on, that the planning and design complexity to work with rivers was considerably more time consuming and yet so much use from both anthropocentric and wildlife was essential to prosperity and survival, in many socio-economic settings. Partnerships and shareholder interests are considerably more complex in the riverine restoration environment, but the awards are considerably greater per unit area of landscape. This paper addresses the reality of ecological planning needed for natural channel restoration through on-going farm bill practices. Conservation Practice Standards such as streambank stabilization, channel bed stabilization open channel flow, riparian forest buffer, fish habitat improvement and management, and wetland restoration are practice standards necessary to implement Farm Bill programs in stream corridors. This paper addresses and introduces the science and technology of applied fluvial geomorphology, which is the physical science of natural channels and floodplains. When practices are applied using known design principles in fluvial geomorphology, natural channels are self-sustain and at lowest O&M. It is in the order, "physics proceeds biology," and the natural stream dynamics that is needed in-order-to successfully apply stream corridor restoration practices.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Models, Tools, and Technologies

**Denotes primary author*

Farm Management Impacts to Tile Drainage Water Quality

Authors: Kevan Klingberg, UW Discovery Farms

UW Discovery Farms has conducted tile drainage research in eastern Wisconsin for the past 15 years. That historical data led to more questions about regional tile flow patterns, nutrient concentrations in tile water, and farm management impacts on tile water quality. To address these questions, UW Discovery Farms partnered with Minnesota Discovery Farms to undertake a large tile drainage research project through an NRCS CIG grant, monitoring 24 sites in each state. This project utilizes a unique three tier monitoring method to balance high quality data collection with spreading cost-effective monitoring to more locations. We will share how tile flow patterns vary regionally, how soil health metrics relate to tile water quality, and how to benchmark tile nutrient concentrations to farm management types.

Track: 2019 General Conference Theme Submissions

Subject: Water Resource Assessment and Management

**Denotes primary author*

Farm to Lake: How Conservation Practices Affect Eutrophication

Authors: Richard Lizotte, USDA ARS*; Lindsey Yasarer, USDA ARS; Martin Locke, USDA ARS; Ron Bingner, USDA ARS

Modern farming is crucial to meet the needs of a growing population but such intensive agriculture can impact downstream water bodies. Implementation of well-managed conservation practices can reduce nutrient loads in runoff and, in concept, reduce algal biomass (and harmful algal blooms) and dissolved oxygen stress (reduced eutrophication). Beasley Lake, a CEAP watershed in Mississippi, was assessed as a good example of a system to demonstrate this concept. Approximately 17% of the watershed contains various conservation practices, and has available long-term runoff (10 years) and lake water quality (>20 years) data, as well as more recent information on harmful algal blooms and dissolved oxygen stress. Trends in runoff water quality demonstrate clear reductions in nutrient loads with conservation practices concomitant with reductions in lake nutrient concentrations and increases in water clarity. Recent measures of harmful algal blooms indicate low levels of cyanobacteria and infrequent oxygen stress (<4 mg/L). Nutrient limitation studies suggest lake nutrient levels would need to be further decreased to continue reducing lake eutrophication. Research is ongoing to attempt to ascertain whether: a) current conservation practices are sufficient to further reduce eutrophication; b) within-lake nutrient loads and biogeochemistry will limit further reduction in eutrophication; or c) additional conservation practices would continue to reduce eutrophication.

Track: 2019 General Conference Theme Submissions

Subject: Water Resource Assessment and Management

Denotes primary author

First Findings from Two Maryland Healthy Soil Initiatives

Authors: Alisha Mulkey, Maryland Department of Agriculture*

The Maryland Department of Agriculture (MDA) has a long history of providing technical and financial resources to address soil conservation and water quality. Many of the state's existing programs were initiated to address water quality concerns in the Chesapeake Bay; however, the state also recognizes important co-benefits exist between conservation practices that achieve improved soil health and water quality. As such, the Maryland legislature passed a bill in 2017 authorizing the MDA to adapt existing programs and initiate the promotion of soil health programs and practices. In support of the legislation, MDA is undertaking new initiatives that promote soil health including 1) a federal RCPP grant award entitled "Taking Soil Health in Maryland to the Next Level," and 2) a healthy soil biomass pilot program. The first initiative is a 5-year, $1 million grant to promote conservation practices that enhance soil health in four target counties on the Eastern Shore. The University of Maryland is a grant partner pursuing the development of an affordable tool so farmers can measure soil carbon levels. The second initiative was launched in fall 2018 as a "pay for performance" pilot study to plant qualifying small grains in fields unable to plant traditional cover crops. Killdown is prohibited before May 1 as research shows that delaying killdown of a cover crop contributes substantial amounts of carbon and root matter to the soil while providing a protective mulch that guards against erosion. Results of both initiatives are forthcoming, but MDA plans to identify early practice adopters to assist in the outreach and promotion of these measures to the broader ag community, and to improve program delivery for greater participation.

Track: 2019 General Conference Theme Submissions

Subject: Soil Health Resources, Indicators, Assessment, and Management

**Denotes primary author*

Five Years of Feedback: Farmer-Driven, Partner-Supported Soil Health Education

Authors: Jennifer Nelson, Delaware Soil Health Partnership*

The Delaware Conservation Partnership has held more than 20 soil health workshops and field days since 2014. Our goal throughout this initiative has been to facilitate a community conversation about soil health, and to support our farmers in the adoption of new management practices. Since the beginning, through participant surveys and farmer advisory groups, we've collected feedback along the way that continually informs our programming. Farmer feedback has helped us gauge the needs of our target audience, determine the influence of our speakers and different outreach methods, and quantify the impact of our programs on the adoption of management practices. As our fellow SWCS colleagues work to develop programs that support farmers in adopting practices that improve soil health, this session will help to advance those efforts by sharing the methods that we use to gather input from our target audience and summarizing the insights that we've acquired over the last five years.

Track: 2019 General Conference Theme Submissions

Subject: Social Sciences Informing Conservation

Denotes primary author

Forest Cover and Water Quality in Tropical Agricultural Watersheds

Authors: Kaline Mello, University of São Paulo; Roberta Valente, Federal University of São Carlos; Carlos Vettorazzi, University of São Paulo; Timothy O. Randhir, University of Massachusetts*

Tropical forests are under continual threat due to deforestation and forest fragmentation processes. Replacing forest with other land uses can generate severe impacts on river water quality, altering its physical, chemical and biological characteristics. This study evaluates the relationship between forest cover and water quality of tropical agricultural watersheds. For that, six experimental watersheds with different percentage of forest cover were selected in the Sarapuí River watershed, Brazil. Water samples were collected during a year. Multivariate statistical models were applied to identify differences in impacts. The relation of land use/land cover within the watershed and within its respective riparian zone with water quality was compared through mixed models and redundancy analysis to identify the main factors that influenced water quality variability. Watershed modeling was applied to simulate the impact of riparian forest restoration on water quality of the Sarapuí River watershed. The results show that the degraded watersheds presented higher levels of solids, turbidity, nutrients, and coliforms, besides presenting greater temporal data variability compared to forested watersheds. This variation is associated with the stream flow changes during the year. In general, forest cover was related to good water quality, while agriculture and urban areas were responsible for water quality degradation. The water quality parameters responded differently to the influence of land-use/land-cover patterns in the watershed and riparian zone, but the overall water quality is better explained by the landscape composition of the watershed. The riparian zone restoration reduced the sediment and nutrients loading into the river. We find that tropical forest plays a fundamental role in water resources conservation, and restoration strategies for the entire watershed are critical for the maintenance of water quality to the water supplies.

Track: 2019 General Conference Theme Submissions

Subject: Water Resource Assessment and Management

Denotes primary author

From Sewer Creek to Cardinal Creek: How Students in a Struggling Iowa Town Renamed a Forgotten Creek and Transformed It into a Source of Community Pride

Authors: Stephen K Hopkins, Iowa Department of Natural Resources*; Courtney Wolken, Newton (Iowa) High School

Newton, Iowa, a community of 15,000 people, has struggled economically since the loss in 2007 of its largest employer, the Maytag Corporation, which at its peak employed 4,300 employees. Since then, Newton has developed various positive community initiatives to turn the town around. When students in Courtney Wolken's biology class at Newton High School became aware that the forgotten, eroded creek that starts next to the high school and flows next to a popular trail was officially named Sewer Creek, they wanted to do something positive, build awareness of the creek, and begin to restore it. They took on as a class project an initiative to apply to the US Geological Survey to change the official name of the creek to a more positive name: Cardinal Creek. Since the high school mascot is the Cardinal, renaming the creek to match the name of the high school teams has enormous community support. After soliciting letters of support from the Newton School District, Newton City Council, and several other community organizations, the class submitted an application for the name change, which was officially accepted in July of 2017. Shortly after the official name change, the Iowa Dept of Natural Resources (DNR) worked with the Iowa Dept of Transportation to install new signs labeling Cardinal Creek at the busy Interstate 80 bridge that crosses the creek just a mile south of the high school as part of DNR's efforts to raise awareness of Iowa's creeks and streams. The City of Newton then installed a sign labeling Cardinal Creek at its source, along a busy street and sidewalk just one block from the high school. And, the local Newton newspaper published several articles highlighting the creek's name change and the installation of new "Cardinal Creek" signs. Since then, the class has begun testing water quality in the creek, completed a streambank assessment, and plans to develop a stream restoration plan as part of its coursework.

Track: 2019 General Conference Theme Submissions

Subject: Outreach, Education, and Community Engagement

**Denotes primary author*

Heterogeneous Impacts of Deglobalization on Regional Land Use Decisions and Water Quality

Authors: Mary Doidge, Ohio State University*; Robyn Wilson, Ohio State University

After many years of globalization, recent political trends reveal a growing potential for deglobalization. This shift will alter global resource flows and ultimately regional food, water, and energy system dynamics. One likely driver of these dynamics is changing land use patterns as farmers shift land in and out of commodity production, conservation and alternative energy development in response to changing agricultural prices. This is likely to lead to significant but uncertain effects on regional water demand and environmental quality. Ultimately, the implications of deglobalization for these regional systems will depend on the heterogeneous behavior of producers and landowners in response to these shifts. The goal of this research is to determine the sources of spatial and behavioral heterogeneity that are most critical in explaining farmer land use decisions in response to trade and environmental policy changes, and to explore the economic and environmental implications of heterogeneous land use decisions. We will present the results of a choice experiment of landowners in the Great Lakes region, estimating the impact of potential shifts in commodity revenue, conservation payments, and alternative energy income on land use decisions. We will also estimate latent class models to examine how behavioral and physical heterogeneity determine different landowner classes and how land use decisions vary across these types. Our results will allow us to identify the relative importance of different income sources in land use decisions. Past work has improved the representation of heterogeneity in decision making to explain adoption of conservation practices and changes in water quality. We build on past work by incorporating landowners' motivations, cropping choices, field characteristics, and management practices in determining heterogeneous responses to changes in policy-driven economic incentives, and the implications of land use decisions on regional water quality.

Track: 2019 General Conference Theme Submissions

Subject: Social Sciences Informing Conservation

Denotes primary author

Innovative Agriculture: Meeting the Needs of a Growing Population and Adapting to Climate Change Using Recycled Drainage Water for Irrigation to Increase Crop Yields while Reducing Nutrient Pollution

Authors: Stephanie M. Singer, The Nature Conservancy*

Agriculture in the Western Lake Erie Basin is under pressure to reduce nutrients, specifically dissolved phosphorus, from leaving fields and fueling harmful algal blooms. Weather extremes, such as intense rain storms, lead to large pulses of nutrient rich run-off to fill waterways. In addition, there are longer periods of drought throughout the growing season impacting crop yields. Drainage water recycling projects take nutrient rich water from drain tile or nearby water sources during periods of intense flow to a constructed pond. The landowner will then use this water during dry periods to irrigate crops and significantly increase yield. Demonstration projects will allow this practice to be evaluated for more widespread adoption as a dual win for benefits to agriculture and water quality.

Track: Adapting Landscapes to Climate Change

**Denotes primary author*

It Takes a Village: A Case Study on Collaboration and Implementation to Reduce Sediment and Phosphorus from Agricultural Landscapes in the Maumee River Basin, Ohio

Authors: Stephanie M. Singer, The Nature Conservancy; Jessica D'Ambrosio, The Nature Conservancy*

A unique collaboration was developed between researchers, a local conservation district, and an environmental organization when all three were awarded separate Great Lakes Restoration Initiative projects under the same state-sponsored award. Putnam Soil and Water Conservation District is working directly with landowners to get a suite of practices installed, The Ohio State University and USDA-Agriculture Research Service are monitoring and studying the practices for sediment and phosphorus reduction potential, and The Nature Conservancy is conducting outreach and education events to build overall awareness and encourage practice adoption. Together, they are creating a Best Management Practices Handbook that would act as both a scientific resource for tile-drained agricultural landscapes in the Midwest as well as a practical decision support tool for technicians and producers. The team presents its findings so far on the efficacy of those practices, the willingness of landowners to adopt them, and lessons learned on collaborating and communicating across multiple public awards.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Models, Tools, and Technologies

**Denotes primary author*

Legume Cover Crops Boost Nitrogen to Corn During a Three Year Transition to Organic Cropping

Authors: Xueming Yang, Agriculture and Agri-Food Canada*; Craig Drury, Agriculture and Agri-Food Canada; Dan Reynolds, Agriculture and Agri-Food Canada; Jingyi Yang, Agriculture and Agri-Food Canada; Mary-Anne Reeb, Agriculture and Agri-Food Canada

Crop yields are often lower in organic management than in conventional systems during the ''3-year transition'' period. This paper presents the results from an organic cropping trial which used summer-seeded legume cover crops as the primary nitrogen (N) source for the corn in soybean-winter wheat-corn rotation. The cover crops seeded after winter wheat harvest included crimson clover (CC, *Trifolium incarnatum* L.), hairy vetch (HV, *Vicia villosa* L. Roth) and red clover (RC, *Trifolium pratense* L.), and a conventional control (CKC, with synthetic fertilizers) and an organic control (CKO, no synthetic fertilizer) with no cover crops. The accumulation of carbon (C) and N in cover crops aboveground biomass, the impacts of cover crop on residual soil mineral N (RSN) before over-winter leaching and on corn grain yields in the 3-year transition period from conventional to organic farming were evaluated. The overall reduction of RSN before dominant over-winter winter leaching was 51 kg N /ha in cover crop treatments compared to the CKC treatment. In early May before terminating (plow-down) cover crop for planting corn, significantly more aboveground biomass and N were found in HV (3,313 kg C /ha, 240 kg N /ha) and RC (2,766 kg C /ha, 199 kg N /ha) treatments than in the CC (1,787 kg C /ha, 119 kg N /ha) treatment. In the 3-year transition period, the average corn yields were 13.3 Mg ha^{-1} for the HV treatment and 13.2 Mg ha^{-1} for the RC treatment which were statistically similar to the CKC corn yield (14.0 Mg /ha). This study highlights the effectiveness of using HV or RC as a primary N source for organic corn production in S. Ontario.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Models, Tools, and Technologies

**Denotes primary author*

Linking Geospatial Information and Effects of Land Managements to Water and Soil Quality Parameters

Authors: Ann Marie Fortuna, USDA ARS*; Jean Steiner, USDA ARS; Amanda Nelson, USDA ARS; Daniel Moriasi, USDA ARS; Patrick Starks, USDA ARS; Brian Northup, USDA ARS; Prasanna Gowda, USDA ARS; Jurgen Garbrecht, USDA ARS; Ken Turner, USDA ARS; John Zhang, USDA ARS

Assessment of indicators of water (H_2O) quality and soil parameters can require separate research plots due to the differences in scales needed to evaluate water vs soil quality or health. This study combines geospatial data and a landform element classification scheme to derive landform complexes to codify the collection of soil and water data at variable scale within a single field experiment, the water resources and erosion watersheds experiment (WRE) located at the USDA ARS Grazinglands Research Laboratory El Reno, OK. The experiment contains eight 1.6 ha watershed treatments established in 1978 to monitor water quality that include runoff amount, suspended sediment, nitrogen and phosphorus. Current treatments include native warm season grasslands or winter wheat (*Triticum aestivum*) managed by either conventional or no-till systems. We have also established new water quality and soil health baselines that will integrate a diversified adaptive crop livestock system. The landform complexes serve as replicates within and among the eight 1.6 ha sized watershed treatments that serve as paddocks (3%-4% slope, westerly exposure) allowing us to monitor soil health at field (m^2) and watershed scales (ha). We conducted a Class I soil survey in conjunction with measurements collected by electromagnetic induction sensing to define the landform complexes needed to create uniform zones of management that represent the variable characteristics affecting production within the larger watersheds. Soil quality measurements provide information with respect to properties that affect H_2O movement, soil fertility and plant nutrient efficiency, which can directly impact water quality. Soil quality parameters related to agronomic management collected from smaller meter sized spatial zones will be used to monitor as well as parameterize and validate the Agricultural Policy/Environmental eXtender Model (APEX) to predict the effects of alternative land management on water quality.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Models, Tools, and Technologies

**Denotes primary author*

Livestock Production, Water Scarcity, and Potential for Collaborative Water Governance in Northwest Iowa

Authors: Maggie Norton, Iowa State University*; J. G. Arbuckle, Iowa State University

The northwestern corner of Iowa has the highest concentration of animal feeding operations (AFO) in the state and the water demand from AFO's in several rural water systems far exceeds the demand from human populations. A drought in 2012 limited alluvial groundwater supplies and rural water systems struggled to meet their customers' water needs. Timely rains averted a crisis, but since that incident, livestock numbers have continued to grow. In anticipation of the next drought, the Iowa Department of Natural Resources (IDNR) has attempted to coordinate stakeholders to address the issue and future plans. This presentation provides an outline of the circumstances of the 2012 drought, changes in the livestock industry, and outlook for future plans. Preparation efforts for the next drought are viewed through the lens of collaborative governance. The project has employed in-depth interviews with stakeholders including rural water system managers, livestock groups, government agency staff, and livestock producers to explore and document the range of stakeholder interests, perspectives, and the needs and barriers that are impacting efforts to implement collaborative governance processes and potential outcomes. Emergent themes regarding barriers include a lack of communication between stakeholder groups, infrastructure limitations, and uncertainty about changing water demands. Themes indicating support for collaborative efforts include a pre-existing awareness of the importance of water conservation, a lingering concern about future water availability since the 2012 drought, and an eagerness for information and planning options. The synthesis of stakeholder perspectives will assist collaborative governance efforts by providing a baseline for expectations and challenges.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Models, Tools, and Technologies

Denotes primary author

Manure versus Inorganic N Fertilization: An Assessment of Amendment Impacts on Soil Health and Crop Quality

Authors: Grace Miner, Colorado State University/USDA ARS*; Jorge A Delgado, USDA ARS; James Ippolito, Colorado State University; Catherine Stewart, USDA; Daniel Manter, USDA; Steve DelGrosso, USDA; Bradley Floyd, USDA; Robert D'Adamo, USDA

Extensive research has focused on developing chemical, physical, and biological soil indicators to evaluate management impacts on soil health. While improvements in soil health can promote crop yield (i.e., via increased nutrient cycling, water capture and storage), published literature statements suggest that soil health also influences crop quality (i.e., protein and mineral concentrations), and there is a potential confounding of the terms 'yield' and 'quality'. However, studies explicitly examining the connections between changes in soil health and crop quality are scarce, and potential associations require additional study and clarification. We evaluated these linkages in a continuous corn experiment containing a zero nitrogen (N) treatment, an inorganic N treatment (179 kg N ha^{-1}), and a N-based manure treatment. These three treatments vary in input amount and type, potentially affecting soil health indicators, yields, and crop quality in differing ways. Manure is an important source of N, carbon, and other nutrients, which can positively influence soil chemical, biological, and physical properties. However, manure poses environmental and management challenges, and it is important to understand the benefits and trade-offs of manure versus inorganic N fertilization on soil health and crop quality. We assessed select chemical, physical, and biological soil health indicators after 6 cropping years (0-15 cm depth), and also utilized the Soil Management Assessment Framework indexing tool to quantitatively assess changes in soil health. Additionally, we measured plant protein, macronutrient, and micronutrient concentrations in each plant fraction at harvest. Changes in soil health, yields, and crop quality under the different management practices will be discussed, as well as the connections and interactions between soil health and crop quality.

Track: 2019 General Conference Theme Submissions

Subject: Soil Health Resources, Indicators, Assessment, and Management

Denotes primary author

Marketing Soil Health as a Component of Grass-Fed Local Products

Authors: Sjoerd W. Duiker, Penn State*

The importance of healthy soil is widely recognized by agricultural professionals but most consumers are ignorant of the concept. If soil health would be linked to a better price for their products, farmers would be highly motivated to use soil health improving practices. We set out to assist farmers who use Management Intensive Grazing methods that improve soil health to obtain a price premium that would reward them for their management. Based on consumer studies and market research we formulated a production protocol for farmers in northwestern Pennsylvania that includes more than only soil health, to accommodate consumer preferences. Therefore, our production protocol is based on the concepts of sustainability (healthy soil, clean water water), local production, animal welfare (Certified Animal Welfare, maximize pasture access), purity of final product (non-GMO, no antibiotics, no hormones), taste (Beef Quality Assurance Certified), and nutritional value (raised on forages only, no grain). Practices that promote soil health within this initiative are: no-tillage, cover crops during fallow periods, diversity in crop rotations, diversity in crop and forage mixtures, management intensive grazing, avoidance of soil compaction, and a conservation and manure management plan. In January 2019 the protocol had been finalized and is being tested with potential buyers, processors, and sellers. Feedback from actors and progress on implementation of this initiative will be shared during the conference. If successful, the initiative helps bridge the rural-urban divide and will assist farmers to get an economic edge from soil health improvement.

Track: Watershed Conservation to Unify Urban and Rural Communities

**Denotes primary author*

Modeling Stream Runoff from Three Watersheds with Different Forest Stands in Korea Using the WEPP Model

Authors: Hakjun Rhee, Chungnam National University*; Hung Tae Choi, National Institute of Forest Science; Anurag Srivastava, Purdue University

Forest watershed can be managed for water resources, and watershed modeling is needed to access the effects of forest management on water resources. To apply a watershed model, we need to evaluate it with monitoring data. This study applied GeoWEPP, the GIS version of the Water Erosion Prediction Project (WEPP) model, to three watersheds with different forest stands (coniferous, deciduous, and mixed) in Gwangneung and Yangju, Korea, and compared the modeling results with 15 years of stream runoff monitoring data from 2003 to 2017. The comparisons of daily results showed the Nash-Sutcliffe efficiency (NSE) of 0.723, 0.668, and 0.570, indicating reasonable predictions of the stream runoff from the three watersheds. However, the GeoWEPP predicted the average runoff of 555, 566, and 496 mm/m^2/year, compared to the monitoring average runoff of 797, 1011, and 724 mm/m^2/year for coniferous and deciduous watersheds in Gwangneung and mixed-forest watershed in Yangju, which indicates that the WEPP underestimated the runoff, especially in winter and spring. The inputs for the WEPP were developed based on conifer forests in the western United States and were used for this study. Therefore, the WEPP likely overestimated the evapotranspiration from the three forest watersheds. The study finds that WEPP can be used to model forest watersheds in Korea. However, the improvements should be made on the WEPP soil and management inputs to simulate different forest stand types and conditions in Korea.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Models, Tools, and Technologies

**Denotes primary author*

Modified Silage Corn Production System for Improving System Sustainability and Soil and Water Conservation

Authors: Sultan Begna, New Mexico State University*

Dairy industry's contribution to New Mexico's agricultural revenue (40%) is vital for rural economies. Silage corn is the main feed for dairy. However, silage corn production system with 30" row spacing, low cutting height with no residue and long-fallow makes soil and water resources susceptible to wind and water erosion and unsustainable system. Decreased row spacing and increased silage cutting height has potential to improve and conserve soil and water resources, increase forage quality with minimal reduction in yield. A two-year farm scale study was conducted in producer's field in Clovis, NM in 2017 and 2018 under center pivot irrigation. The objectives were to evaluate the effect of row spacing (15 vs. 30"; main factor) and silage cutting height (6 vs. 21", sub-factor) arranged in a split-plot design on 1: forage and milk production, 2: selected soil health indicators, and 2: wind dynamics. Dry forage yield was greater (22%) with 15" than 30" spacing reflected in milk production as well. Forage yield and milk production was lower (15%) with 21" compared to 6" cutting. Forage quality was improved with 21" compared to 6" cutting. Soil health indicators involving potentially mineralizable carbon and nitrogen: PMC and PMN, inorganic nitrogen (N), total C and N were assessed before corn planting and after harvesting. An increase in mean PMC (29%), a decrease in inorganic N (61%) and PMN (18%) was measured before planting in 2018 than in 2019 indicating short-term microbial activity. Wind speed was reduced with narrower row spacing and increased cutting heights. In the long run, the modified silage production system is expected to leave more plant residue resulting in better soil coverage, improvement in soil health, conservation and moisture retention, soil carbon sequestration and silage corn production and dairy farming sustainability in New Mexico and the region.

Track: 2019 General Conference Theme Submissions

Subject: Adaptive Management of Conservation Efforts

**Denotes primary author*

Monitoring Irrigation Ditch Sediment and Agricultural Crops to Characterize the Nature and Extent of Impact from the August 2015 Gold King Mine

Authors: Gaurav Jha, New Mexico State University*; April Ulery, New Mexico State University; Kevin A. Lombard, New Mexico State University

On August 5, 2015, three-million gallons of acid rock drainage was accidentally released into the Animas Watershed from the Gold King Mine (GKM) in Silverton, Colorado (USA). The spill impacted the cultivation of crops all across the watershed when irrigation ditches were closed for several weeks while the contamination moved downstream. The total concentrations of nine elements including arsenic, lead, manganese, iron, copper, calcium, zinc, aluminum, and chromium have been measured in these irrigation ditches, fields, plant tissues and produce for two growing seasons. Eight of the nine metals measured in the irrigation ditch sediments were below the EPA Residential Soil Screening Levels (SSL) in the 15 sites evaluated. Only As exceeded the EPA and NMED SSL. The data collected from agricultural fields indicates that with the exception of As, all of the elements evaluated in this study were below the EPA or NMED soil screening limits for residential soils. Almost all of the fields in the study area scanned using PXRF had at least one point (hotspot) where the As concentration exceeded the NMED soil screening limit of 7.07 ppm. This study collected and analyzed plant samples from eight agricultural fields. Metal concentrations in alfalfa and pasture grass rinsates were very low and in several cases below the detection limits of the instruments. In vegetable fields, the rinsate collected from corn leaves were the lowest and that from chile leaves were highest, probably because the corn leaves were well above ground level having sampled a fully developed leaf. On analyzing the metal concentrations in leaf tissues collected from alfalfa, pasture and vegetable fields the higher concentrations of As in the hotspots of fields did not correlate with higher concentrations in leaf tissues. This research is trying to answer the questions about the safety of the soils, sediments and produce.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Models, Tools, and Technologies

Denotes primary author

Monitoring to Evaluate the Water Quality Impact of Stacking Agricultural Conservation Practices

Authors: Elizabeth Callow, The Ohio State University*

Non-point source pollution commonly drives water quality degradation, such as harmful algal blooms and hypoxia, in waterbodies across the United States. In agricultural settings, these water quality issues have required thoughtful innovation to retain nutrients on the field for use by crops, at the edge-of-field, or in the agricultural ditch. Stacking of conservation practices is being investigated to evaluate the efficacy of the individual practice, as well as the benefit of placing practices in series. Such stacking of practices is already a reality in the western Lake Erie watersheds, where an average of 2.4 best management practices are applied per cultivated acre. Research is needed to evaluate the effectiveness of stacked practices and whether some practices, in stacked systems, result in diminishing returns. The practices investigated in this study include a perennial crop (alfalfa), a restored agricultural drainage ditch in a two-stage design, and grassed surface drainage furrow ditches. Base and event flow water samples were collected continuously during times of flow at each discharge point to the ditch, including before and after the two-stage design, each subsurface tile drain, and at the outlet of the surface drainage furrow ditches. Samples were analyzed for nutrient and sediment concentrations and were correlated to the continuously collected discharge measurements which are used to calculate loadings. Preliminary analysis of nutrient concentrations indicated a more nuanced analysis of nutrient loadings from each practice over storm and base flow will be critical in determining the efficacy of stacking these practices.

Track: 2019 General Conference Theme Submissions

Subject: Adaptive Management of Conservation Efforts

**Denotes primary author*

Motivating Farmers to Move the Needle on Nutrient Loss Reduction in Old Woman Creek through Pay-For-Performance Conservation

Authors: Jon Winsten, Winrock*; Breann Hohman, Erie County SWCD; Eric Dodrill, Erie County SWCD; Rem Confessor, Heidleburg University

To move the needle on water quality, we need: 1) more farmers and acres participating in conservation and 2) farmers implementing the most cost-effective actions for their specific fields. This project has been using performance-based incentives for phosphorus (P) and nitrogen (N) loss reductions at the farm-level to motivate farmers to use their knowledge and skills to reduce nutrient loads into Lake Erie. Any given BMP will have widely varying effectiveness on different farms and fields. This project incentivizes farmers to implement the most cost-effective actions for their specific fields with a focus on reducing P and N loss by offering $35/lb of P and $5/lb of N reduced. Nutrient loss reduction from each practice are estimated using the Nutrient Tracking Tool (NTT) before the farmer decides what actions to take and which fields. We have examined 97 different conservation scenarios on 68 different fields across 5 farms. Each farmer is given information on the nutrient reduction, payment, cost, and profit of each scenario to use to make informed conservation decisions. Farmers are motivated by the performance-based payments to seek out the most cost-effective actions for their specific fields.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Models, Tools, and Technologies

**Denotes primary author*

Northeast Wisconsin Demonstration Farms Network: Collaborative Approach to Improving Soil Health and Water Quality

Authors: Barry A. Bubolz, USDA NRCS*; Tyrone Larson, USDA NRCS

The Northeast Wisconsin Demonstration Farms Network is a Great Lakes Restoration Initiative (GLRI) funded project, designed to showcase and demonstrate leading edge conservation practices that improve Great Lakes water quality by reducing phosphorus and sediment runoff. It is a unique partnership that brings producers, local, state, and federal agencies together to help reach the Total Maximum Daily Loading (TMDL) targets. With soil health at the forefront of our message, the Demo Farms project has been working towards solutions that benefit both the environment and a producer's bottom-line. The producers have been eager to try new practices, such as "planting green," grazing cover crops, and using new equipment to apply manure. Additionally, the Demo Farms project has partnered with the U.S. Geological Survey and WI Discovery Farms to measure the sediment and nutrient loss in surface and subsurface runoff at edge-of-field sites. Preliminary data suggest that switching to no-till planting practices and cover crops could reduce sediment and nutrient losses. In the last two years, we have established four new Demonstration Farms in the Door-Kewaunee Watershed and are looking forward to expanding Demonstration Farms into the Wolf River Basin, we are excited to apply similar conservation principles to these new projects.

Track: 2019 General Conference Theme Submissions

Subject: Outreach, Education, and Community Engagement

Denotes primary author

NRCS Soil Databases: Information for Conservation Questions

Authors: Stephen M. Roecker, USDA NRCS*; Kyle Stephens, USDA NRCS; Jennifer Wood, USDA NRCS; Chris Morse, USDA NRCS; Jason Nemecek, USDA NRCS; John Hammerly, USDA NRCS; Kevin Norwood, USDA NRCS

The NRCS Soil and Plant Sciences Division manages several of the United States most detailed soil databases. These databases have accumulated over a century. They encompass everything from field and laboratory data, to soil series and components, maps at several scales, and hundreds of soil interpretations. The purpose of all this information is to answer conservation questions such as the extent of highly erodible land, the location of wetland soils, and the relative productivity of soils. An analysis of web usage metrics shows there is a large demand for this information. This presentation reviews the existing NRCS Soil Databases, their various interfaces, and several applications.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Models, Tools, and Technologies

Denotes primary author

NRCS Water Erosion Prediction Project (WEPP) Software Demonstration

Authors: Michael J. Kucera, USDA NRCS*

During this presentation, a live demonstration will be provided on the Water Erosion Project Technology (WEPP) model. USDA NRCS plans to implement the WEPP model to replace the RUSLE2 technology. It provides daily simulation and is runoff event driven. The model is web-based and utilizes Chrome, Firefox, Edge, or Safari browser options. A detailed Users Guide has been developed, which walks users through the six different screens of the WEPP Model Interface. The screens include Projects, Results Analysis, History, Maps, Management, and Help. Users input client, location, field, soil, slope profiles, and detailed management information (tillage, crops, planting/harvest dates, and yields). Climate, soils, land management and other data are cloud-based and specific to a user defined management unit. The WEPP model calculates sheet and rill erosion rates, as well as amount of sediment deposition and delivery. The model also provides spatial information regarding soil/sediment flux, deposition, and loss from specific regions of a field over time. The model is intended for use during conservation planning and for the assessment of water erosion and other related natural resource concerns. For each erosion simulation, a report titled “Profile Erosion Calculation Record” is created which contains information on management operations, vegetation type, and surface residue cover estimates after each operation. This report can be used to develop conservation plans with the client, as the report includes crop rotations, cover crops, residue management, operations (i.e. tillage, harvest, planting, termination) and other details. In addition, a 100-year statistical report provides output on evaporation, soil water drainage, crop transpiration, runoff, irrigation water use, and erosion rates. The results analysis screen provides detailed graphs such as residue cover, crop biomass, root mass, precipitation, erosion rates, slope profile, canopy cover and other key parameters.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Models, Tools, and Technologies

Denotes primary author

Passive Managed Aquifer Recharge in the Mississippi River Valley Alluvial Aquifer of Northeast Arkansas

Authors: Ian Godwin, Arkansas State University; Michele Reba, USDA ARS*; Deborah Leslie, Arkansas Tech University

The development of irrigated agriculture in Arkansas since the early 20th century has been largely dependent on the shallow Mississippi River Valley Alluvial Aquifer (MRVAA). Overdraft of this groundwater resource for irrigation has led to the development of two major cones of depression; the Grand Prairie and Cache River Critical Groundwater Areas (CGA). In parts of these areas, as little as 5% of the original saturated thickness of the aquifer remains, and this continues to shrink. In both areas, recharge from the surface is limited by low-permeability surficial clay. Although current conservation efforts are focused on conversion of groundwater to surface water through the construction of on-farm storage reservoirs, underground storage of excess winter surface water has yet to be applied. Storage of excess water underground through Managed Aquifer Recharge (MAR) is common in many areas with groundwater shortages, but the hydrogeologic conditions in eastern Arkansas pose challenges to most MAR methods. This study seeks to determine the feasibility of farm-scale passive MAR systems for local recharge of the MRVAA, using infiltration galleries. Focusing on the Cache CGA, spatial distribution of on-farm reservoirs, surficial geology, aquifer hydraulic properties, recharge water quality, and pollutant removal capacity were considered. A significant area of the study region, including 33 existing reservoirs, was found to have appropriate surface geology for use of infiltration galleries. Based on aquifer conditions measured at a few select sites, it is possible that wide adoption of even small gallery systems could contribute to groundwater conservation in the region.

Track: 2019 General Conference Theme Submissions

Subject: Water Resource Assessment and Management

Denotes primary author

Potato Yield and Farm Revenue as Functions of Crop Rotation and Tillage Practice in New Brunswick, Canada

Authors: Eric Liu, ELG; Sheng Li, Agriculture and Agri-Food Canada*; Van Lantz, UNB; Edward Olale, GNB

In the province of New Brunswick (NB) in Canada, agriculture is dominated by potato production systems. Potato cropping requires high inputs and intensive field management, which poses various threats to the environment. To reduce the negative impacts of intensive potato production systems, crop rotation and conservation tillage have been promoted as Beneficial Management Practices (BMPs) in NB. However, there is a lack of quantitative information on their economic impacts. In this study, a rare dataset with crop rotation, farm inputs, and soil and climate data have been collected from operating farms in a small watershed in NB. A two-step regression analysis with a stochastic production function method was used to assess the impacts of crop rotation and tillage practice on potato yield. The established two-step yield model was run under different crop rotation scenarios to estimate the effect of crop rotation on farm revenue. The results showed that potato yield increased when the frequency of potato increased in the rotation, which was largely due to increased fertilizer and other inputs associated with rotations of higher frequency of potato. Compared to the traditional fall moldboard plough, spring moldboard plough had negative effects on yield. The revenue analysis suggested that rotations with lower potato frequency had higher net revenue for the potato year, largely due to reduced input costs. However, rotations with higher potato frequency had higher overall (multi-year) net revenues, largely due to the more valuable potato years in the rotation. It was concluded that the overall financial impacts of lower potato frequency rotations were negative. These findings suggest that in order to promote the adoption of such BMPs for public good, other incentives need to be provided to farmers.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Economics and Policy

Denotes primary author

Precision Conservation Management: Targeting Soil Health for Agronomic Profitability

Authors: Gretchen Sassenrath, Kansas State University*

Targeting yield gains has been the common approach of farmers and agriculturalists to enhance profitability of the farming system. However, reducing inputs to unproductive areas may be a more realistic approach to improve return on investment. This research examined site-specific yields from production fields and determined profitability for corn/wheat/soybean rotation systems in southeast Kansas. Using profitability as the driving force, site-specific management practices were developed that improved overall system profitability and enhanced soil health and conservation. The results demonstrate that managing crop production based on potential return on investment rather than yield gives an opportunity to implement methods to improve soil health for greater system functionality over the long term. These results will assist farmers in implementing long-term sustainable solutions for crop production and agroecosystem health.

Track: 2019 General Conference Theme Submissions

Subject: Soil Health Resources, Indicators, Assessment, and Management

Denotes primary author

Private Sector Engagement in Iowa Watersheds

Authors: Roger R. Wolf, Iowa Soybean Association*; Heath Ellison, Iowa Soybean Association; Jason Gomes, North Iowa Agronomy Partners

Surveys indicate agriculture retailers and crop advisers are trusted and dominant resource where farmers get information. Ag retailer and independent agronomists in Iowa are engaging watershed coordinators and farmers in dedicated projects. These efforts may be a key strategy to scale-up adoption of soil and water conservation practices. Groups like the Agriculture's Clean Water Alliance, Iowa Soybean Association, and North Iowa Agronomy Partners support projects and programming in the Raccoon, Des Moines, Boone, and Cedar River watersheds and interface directly with the urban downstream cities of Des Moines and Cedar Rapids. Program tactics include watershed planning, water monitoring, conservation assessments and planning, on-farm research, communication and outreach, partnerships, and dedicated technical and financial assistance. Presenters will share their techniques to engage farmers using data and information and other innovative tactics to support adoption of performing conservation and environment management practices and solutions.

Track: Engaging the Private Sector in Conservation

**Denotes primary author*

Remote Sensing of Crop Residue Conditions for the Daily Erosion Project

Authors: Brian Gelder, Iowa State University*

Remotely sensing crop residue information is useful for numerous purposes including monitoring tillage adoption rates, estimating conservation compliance, and estimating soil erosion and runoff as done by the Daily Erosion Project. Numerous attempts to remotely sensing crop residue have been attempted previously with accurate estimates typically requiring hyperspectral imagery that are not regularly available. Calibrated indices used with moderate resolution systems that have shortwave infrared capabilities, such as Landsat and Sentinel 2, can provide useful, although not as accurate, indications of residue cover. These estimates are often confounded by changes in soil moisture and color. Other drawbacks of these methods is that they require continuous collecting of ground truth data and there is little knowledge of the extent of the inference space. To attempt to improve residue cover surveys and quantify this uncertainty, residue cover information was gathered from disparate survey methods including windshield survey, photographic survey, and line-transect, across a large geographic range (the western Corn Belt). This data was analyzed using multiple strategies to attempt to account for underlying soil texture, moisture, and organic matter content differences. Tillage indices that account for these factors can provide improved estimates of residue cover across some but not all areas, with correlation coefficients of roughly sixty percent and few large errors in classification. Generally, areas with lower slopes, and lower erosion potential, have lower levels of residue cover, indicating higher tillage intensity. This work also highlights difficulties in obtaining comparable residue cover data from numerous agencies with differing objectives for residue cover collection.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Models, Tools, and Technologies

**Denotes primary author*

Research Partnerships for Soil Health: Experiences from Cover Crop Trials on Corn and Soybean Fields in the United States

Authors: Shefali Mehta, Soil Health Partnership*

Soil health practices, such as reducing tillage or growing a cover crop, can make farmers more economically and environmentally sustainable by making them more resilient to extreme weather events or reducing the need for costly inputs. Soil health practices can also benefit society by improving water quality and providing other ecosystem services. Cover crops are typically grown during the winter, and are usually left in place as residue or incorporated into the soil prior to planting the next cash crop. Cover crops have many potential benefits, but also require labor, seed, and other inputs. Their impact on cash crop yield also varies with location, soil characteristics, and management practices. In order to investigate the impact of cover crops on corn and soybean yields on working farms, we use a novel panel dataset collected by the Soil Health Partnership (SHP). Between 2014 and 2018, SHP partnered with approximately 140 farms in 14 US states to engage in on-farm research trials. Of these farms, roughly 80% implemented a strip trial to look at the impact of cover crops on yield, soil health outcomes, and other variables. Using an unbalanced panel dataset of these research plots, we directly estimate via panel regression the impact of the cover crop treatment on corn and soybean yield, while controlling for other variables known to affect yields, such as temperature and rainfall, soil properties, and farm management practices. We also include year- and farm-level fixed effects in some specifications to control for variables affecting management decisions that vary over time (such as policies and prices), and variables specific to a farm, such as level of experience with cover crops, and other farmer characteristics. Understanding the impact of cover crops on yield is critical to understanding their impact on a farmer's bottom line, and our results will inform the challenges to and potential for widespread adoption of cover crops in the United States.

Track: 2019 General Conference Theme Submissions

Subject: Soil Health Resources, Indicators, Assessment, and Management

Denotes primary author

Researching the Effectiveness of Agricultural Incentive Programs

Authors: Callia A. Tellez, The Ohio State University*; Robyn Wilson, The Ohio State University

In recent years, much attention has been given to reducing phosphorus loading from agriculture to address eutrophication of the Great Lakes. The Great Lakes Restoration Initiative (GLRI) has invested $100 million in farmer incentive programs aimed at increasing conservation practices that benefit water quality. These investments work to offset short-term costs associated with conservation practices and gaps in understanding that may serve as a barrier. To evaluate the effectiveness of targeted investments, we examine the relevant socio-psychological factors that influence farmer decisions about conservation adoption, and ultimately influence the effectiveness of GLRI programs. We conducted a mixed mode survey of 3500 farmers in four EPA priority watersheds in winter 2019: the Genesee (NY), Saginaw Bay (MI), the Lower Fox (WI), and Maumee (western Lake Erie). We gathered data on the attitudes and beliefs of this population toward two common GLRI funded practices, cover crops and filter strips. We also explored farmer beliefs about incentive program structure and participation. We analyze adoption of practices and program participation across the four priority watersheds to identify how future GLRI investments could be targeted to local and place-based motivations and constraints. We hypothesize that individual level differences in attitudes and beliefs will explain variation in the impact of GLRI investments across the priority areas. These results will help us understand how effective GLRI has been at reaching the unique needs of farmers in conservation attempts and how to better engage farmers through improved program structure. We expect that these results will point toward ways to leverage this opportunity in GLRI and in the broader investments in Great Lakes water quality programs. Involving farm-level analysis to inform GLRI investments presents an opportunity to involve local actors in transboundary decision making and management of Great Lakes water quality.

Track: Watershed Conservation to Unify Urban and Rural Communities

**Denotes primary author*

Results of the USDA-NIFA Climate and Water Portfolio Synthesis

Authors: Linda Prokopy, Purdue University*; Jackie Getson, Purdue University; Sarah Church, Purdue University; Laura Esman, Purdue University; Mike O'Neill, University of Connecticut; Jerry Hatfield, USDA ARS

Over the past decade, federal agencies have been pushed to demonstrate greater accountability for programmatic funds. The increased focus on accountability has prompted renewed attention to defining and describing the impacts of federally funded programs. The United States Department of Agriculture National Institute of Food and Agriculture (NIFA) Water Portfolio (2001-2013) and the NIFA Climate Portfolio (2010-2015) consisted of multiple funding sources that supported research, education, and extension programs, and promoted solutions to climate and water issues. Our team analyzed the impacts and effectiveness of projects within these portfolios. We collected the following data types: project director surveys and focus groups, surveys with federal agency staff, interviews with national project leaders, and case studies. These data were synthesized to evaluate successes, lessons learned, spatial relationships, and impacts, which we present here. Results of this analysis will inform future project development, management, requests for proposals, and funding priorities.

Track: 2019 General Conference Theme Submissions

Subject: Social Sciences Informing Conservation

**Denotes primary author*

Right Practice, Right Place: Increasing the Nutrient Reduction Potential of Conservation Activities in the Upper Macoupin Creek Watershed in Illinois

Authors: Kris Reynolds, American Farmland Trust*; Emily Bruner, American Farmland Trust; Jeff Boeckler, Northwater Consulting

The Macoupin River basin is one of the highest nonpoint source phosphorus loading watersheds in Illinois. The Upper Macoupin Creek (UMC) Watershed Partnership was formed in 2015 with the goal of increasing the adoption of agricultural best management practices (BMPs) capable of reducing phosphorus and sediment losses in the UMC project area. Our ongoing efforts have identified a lack of adequate technical and financial assistance as significant barriers to successful practice adoption, and demand for cost share funding has consistently exceeded available funds. In fact, federally funded conservation programs will only be able to meet an estimated 11% of the P reduction needed to meet project targets. In order to achieve our project goals, conservation staff working in the UMC need to use available funds in a manner consistent with the greatest potential to reduce nutrient runoff. The project team has utilized the Spatial Watershed Assessment and Management Model (SWAMM) to target conservation practices that demonstrate the greatest capacity for improvements in water quality across the landscape. SWAMM allows for the identification of spatially-explicit nutrient and sediment "hotspots" and enables users to quantify current conditions as well as estimate sediment and nutrient load reductions from proposed BMPs. Model outputs are then used to provide landowners with maps highlighting the right combination of in-field and edge-of-field nutrient reduction strategies on a field by field basis.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Models, Tools, and Technologies

**Denotes primary author*

Risk-Return Framework in Conservation Evaluation: An Application to Cover Crop Use in Different Soil Types

Authors: Naveen Adusumilli, Louisiana State University AgCenter *; Hua Wang, Louisiana State University AgCenter; Donna Morgan, Louisiana State University AgCenter; Michael Deliberto, Louisiana State University AgCenter

Stochastic efficiency with respect to a function (SERF) is used to rank conservation practices and place an upper and lower bound on their value. Production data and yield of soybeans over three years are collected from demonstration plots. The data are used to build cumulative distribution functions of returns for cover crop practices with different seeding rates in two different soil types. The methodology examines the most-risk efficient suite of practices in terms of maximizing economic profitability across a range of risk-aversion preferences. Analysis of Louisiana data indicated that for the continuous non-irrigated soybean cropping system in silt loam soils, cereal rye and radish with medium and low seeding rate, respectively, are equally preferred compared to a fallow system among risk-neutral and risk-averse decision makers. Similarly, in clay soil, crimson clover with a low seeding rate is the preferred alternative to fallow among risk-neutral and risk-averse decision makers. However, in clay soils, cereal rye with a low seeding rate is the least preferred across all individuals. The analysis provides a methodology to compare multiple conservation practices simultaneously with consideration to risk, providing an assessment of the value of conservation in their production region.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Economics and Policy

Denotes primary author

Scalability and Impact of Implementing Saturated Buffers throughout the Midwest

Authors: Keegan J. Kult, Ag Drainage Management Coalition*

The Farm Services Agency (FSA) has made significant investments through the Conservation Reserve Program (CRP) at addressing nutrients, specifically nitrogen, reaching America's surface waters through the riparian buffer programs CP 21 and CP 22. Riparian buffers have been shown to be effective at removing nitrogen from surface flows as well as shallow subsurface ground water, but in the tile-drained landscape of the Midwest, a significant portion of the nitrogen lost from agricultural fields does not have the opportunity to interact with the carbon rich buffers. Saturated buffers and denitrifying bioreactors have been studied and shown to be effective at treating tile fed flows within the riparian buffers. With adequate data, FSA began allowing the incorporation of saturated buffers, as well as denitrifying bioreactors, into CP 21 and CP 22 enrolled acres in 2016 through the Clean Lakes, Estuaries and Rivers (CLEAR) program. Saturated buffers have been shown to be an effective tool if properly sited, but it was not known how big of an impact they could have at a regional scale. With FSA funding, ADMC contracted with the Department of Crop Sciences from the University of Illinois, Urbana-Champaign to develop a decision support tool to identify sites that will likely provide cost-effect locations for saturated buffer installations in the Midwest. Results of the model revealed that 9.5 million tile drained acres in the Midwest have the potential to be treated with a saturated buffer. This represents 22% of the tile drained acres. With previously published data showing that saturated buffers effectively remove 22%-44% of the nitrate-N load, we estimate that 5%-10% of the tile-drained nitrate-N load can be removed with saturated buffers or 2%-5% of the overall load reaching the Gulf of Mexico.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Models, Tools, and Technologies

Denotes primary author

Short-Term Effects of Water Treatment Sludge on a Sandy Soil Properties and Performance of Fodder Sorghum (*Sorghum Bicolor* L.)

Authors: Mubarak A. Abdalla, Tottori Universit *; Yamanaka Norikazu, Tottori University; Tsuneyoshi Endo, Tottori University; Karen L. Johnson, Durham University; Yaser Hassan, University of Khartoumj

Turning sandy soils productive needs building resilience through application of soil improvement technologies. In a glasshouse experiment, we investigated the effects of application of water treatment (WTR) sludge with a clay texture at rates of 0, 10, 15, 20 and 25% (wt/wt) on properties of a sandy soil and performance of fodder sorghum (*Sorghum bicolor* L.). The pH, OC, CEC, clay and water holding capacity of the WTR sludge were 7.1, 2.8%, 42.1 cmolc kg^{-1}, 68.5% and 66.5%, respectively. Adding WTR sludge significantly increased soil TN, OC, cation exchange capacity and water holding capacity over the control by 22-26, 21-181, 71-135 and 21-45%, respectively. The dry matter of sorghum and K content in sludge treatments were significantly higher than without sludge by 27-40 and 39-53%, respectively. However, increase application of WTR sludge has consistently decreased content of dry matter P from the control treatment by 19-64%. It could be concluded that mixing coarse textured soils with WTR sludge at a rate of 20% (wt/wt) increased dry matter yield of fodder sorghum through improvement of soil quality parameters including water retention capacity, OM, TN and CEC. Keywords: Sandy soil, quality, resilience, amelioration, degradation, WTR.

Track: 2019 General Conference Theme Submissions

Subject: Adaptive Management of Conservation Efforts

Denotes primary author

Simulating Nitrate Leaching and the Annual Reactive N Budget for Canadian Agricultural Land

Authors: Jingyi Yang, Agriculture and Agri-Food Canada*; Craig Drury, Agriculture and Agri-Food Canada; Xueming Yang, Agriculture and Agri-Food Canada

Increased nitrogen (N) additions to agriculture soil as a result of the increasing global demand for food, fiber and renewable energy has resulted in excessive levels of reactive N (Nr) in our environment. A reactive N model was developed to account for all N inputs into and N outputs from Canadian farmland at an annual step, to deliver estimates of all reactive N components. Nitrogen inputs includes fertilizer N addition, biological N fixation and atmosphere N deposition, as well as N mineralization from manure and leguminous crop residues. Nitrogen outputs from agriculture include N uptake by food crops used for human consumption, livestock feed crops, and N losses via gasses emissions (N_2O, NH_3) and NO_3 loss through leaching and runoff. In this reactive N balance, total manure N is considered as an internal component of the N cycle, equal to the total feed crop N produced minor animal meat and carcass outputs. The reactive N model (CANBNr) is based on the land use and soil databases from our Canadian Agricultural Nitrogen Budget (CANB) model and it includes ~3500 Soil Landscapes of Canada (SLC) polygons for the period from 1981 to 2016. The nitrate leaching module was recently updated based on the seasonal drainage estimates from the DNDC model using daily weather datasets. Nitrogen addition to Canadian farmland from fertilizer and biological fixation increased by 2.73 and 1.64 times, respectively over the 35 year period, while food and feed crop N removal only increased by 2.18 and 1.15 times This resulted in a 2.2 fold increase in the annual residual soil nitrogen (RSN) remaining in soil after crop harvest.. At a national scale, up to 16-50% of the RSN was lost by nitrate leaching losses annually depending on weather conditions. At a provincial scale, over 50-80% of the RSN was lost by nitrate leaching in Central and Eastern Canadian provinces. The trends and maps of reactive N at temporal and special scales will be presented and discussed.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Models, Tools, and Technologies

**Denotes primary author*

Soil Health and the City

Authors: Holly Rippon-Butler, National Young Farmers Coalition*; Nick Lubecki, Pennsylvania Farmer

Farmers have been producing food in cities for generations. In recent years, however, urban farming has received renewed attention for its social and economic benefits. Farming on a small, community scale in urban areas not only helps farmers access robust markets, it has the potential to help combat food apartheid by providing year-round access to fresh food and promoting healthy lifestyles in urban settings. In addition, urban farming provides increasing opportunities for a new sector of young, beginning, and socially disadvantaged producers to access land in close proximity to a large customer base. Despite these opportunities, urban farmers can be held back by a lack of support from state and federal programs. Many of these producers encounter difficulties working with USDA conservation programs due to regulatory barriers. However, urban farms have many of the same natural resource concerns of other farms—such as erosion and poor soil health. Contamination and degradation from industry, construction, traffic, and buildings, along with additional challenges navigating the legal context of land access in cities, make urban agricultural conservation unique. In this presentation, the National Young Farmers Coalition will share results from our work with young urban producers—outlining federal, state, and local policy challenges and solutions that can be implemented for these growers. We will discuss changes in the recently passed 2018 farm bill, including a number of provisions that will streamline federal programs for urban farms working with the NRCS and other agencies. We will feature findings from a Young Farmers report on young farmers in Pennsylvania, highlighting challenges for urban farmers in the state. Throughout the workshop we will share stories of young, urban farmers building soil organic matter, saving drought-tolerant seed, integrating new technology, and working in partnership in their communities to build resilience, health, and abundance.

Track: 2019 General Conference Theme Submissions

Subject: Conservation in Organic, Specialty, Small-Scale, or Urban Agriculture

**Denotes primary author*

Soil Health Indicators in Semi-Arid Regions of Texas

Authors: Paul De Laune, Texas A&M Agrilife*; Katie Lewis, Texas A&M Agrilife; Joseph Burke, Texas A&M AgriLife; Partson Mubvumba, Texas A&M AgriLife

Soil health has become an increasingly important area of emphasis in land management, particularly agricultural land management, within NRCS, in the larger scientific community and with the general public. As interest in soil health management continues to increase, so does the need for consistent, replicable, scientifically sound indicators and associated data that will allow for the assessment of how agricultural management practices are affecting soil health over time. In semi-arid regions of Texas, research has shown that soil organic C, a standard soil health indicator, has shown little or no change over the long-term while other soil properties have been greatly impacted in the short-term. As part of the NRCS coordinated project Dynamic Soil Properties for Soil Health Assessment, we evaluated the effects of various long-term management practices on soil properties and subsequent correlation with soil health and crop yields. Two benchmark soils, Amarillo and Pullman, were selected for evaluation. For each soil, three management practices were quantified: 1) native grassland; 2) no-till row cropping; and 3) conventional tillage row cropping. Soil physical, chemical, and biological properties were quantified for each scenario. While analysis has yet to be fully completed (January 2019), initial results have shown mixed results among various measured properties. Initially, measured soil health indicators have not been well correlated to crop yields. We will provide complete details during our presentation.

Track: 2019 General Conference Theme Submissions

Subject: Soil Health Resources, Indicators, Assessment, and Management

Denotes primary author

Soil Hydraulic Properties Affected by Cover Crop Management Practices

Authors: Melis Cercioglu, Kutahya Dumlupinar University*; Stephen H. Anderson, University of Missouri; Ranjith Udawatta, University of Missouri; Salah M. Alagele, University of Missouri

Cover crops have potential to improve soil quality parameters for determining soil productivity. The aim of the study was to compare differences in saturated hydraulic conductivity, soil water retention, bulk density, and pore-size distributions of soil affected by cover crop management practices over time. This study was conducted in the Chariton Country Soil Health Farm, Missouri, USA. The main grain crops were a corn (*Zea mays* L.) / soybean (*Glycine max* L.) rotation. Cover crops were (*Raphanus sativus* L. var. longipinnatus), cereal rye (*Secale cereals* L.), cowpeas (*Vigna unguiculata*), buckwheat (*Fagopyrum esculentum*), barley (*Hordeum vulgare* L.), red clover (*Trifolium pretense*), turnips (*Brassica rapa* L.), hairy vetch (*Vicia villosa* Roth.), triticale (*Triticale hexaploide* Lart.), and winter peas (*Lathryrus hirsutus* L.). Six replicates each of undisturbed soil cores were collected 1, 2 and 5 years after cover crops were established from four soil depths (0-10, 10-20, 20-30, and 30-40 cm). Results showed that saturated hydraulic conductivity (Ksat) values were found significantly higher 5 years after cover crop establishment compared with the first and second year soil samples. Soil bulk density values were significantly lower at the first soil depth. Macropores, coarse and fine mesopores, and Ksat values were significantly higher at the first and second soil depths compared to deeper soil depths. Soil water content was greater at the fourth soil depth for all water pressures because of higher clay content. Significantly greater water retention values were observed 5 years after cover crop establishment for the -2.5 kPa soil water pressure. The study illustrates that cover crops slightly improve some hydraulic properties in claypan soils, though the changes may take several years.

Track: 2019 General Conference Theme Submissions

Subject: Soil Health Resources, Indicators, Assessment, and Management

**Denotes primary author*

Source Water Collaborative: Protecting Drinking Water Sources for Generations to Come

Authors: Joe Lee, Source Water Collaborative and Ground Water Protection Council

Twenty-nine (with the addition of SWCS) national organizations are now united to protect America's drinking water at the source—in the lakes, rivers, streams, and aquifers we tap for drinking purposes. The Source Water Collaborative (SWC) was originally formed in 2006 with the goal to combine the strengths and tools of a diverse set of member organizations to act now, and protect drinking water sources for generations to come.

Comprised of federal, state, and local partners, the SWC has come together to further the goals of protecting sources of drinking water—recognizing that resources are extremely limited, authorities are split, and the actors who can actually protect source waters are diffuse. Each national organization in the Collaborative understands and appreciates the importance of source water protection. Individually, each promotes implementation of source water protection in their overall mission. Each organization recognizes the synergy of coordinated actions and the need for leveraging each other's resources in order to increase the chances for success over each entity going it alone.

During this session, member Joe Lee will show how the collaborative is joining forces to support local source water protection efforts in urban and rural areas.

Track: Watershed Conservation to Unify Urban and Rural Communities

**Denotes primary author*

Strategies to Minimize the Impacts of Coastal Flooding and Salt Water Inundation on Cropland

Authors: Christopher F. Miller, USDA NRCS*

The USDA NRCS Climate Change Vulnerability Assessment Adaptation Plan (2014) lists salinization of near coastal waters due to sea level rise and greater storm activity as a significant future impact to agriculture. In the five years since this report was written, the issue of saltwater inundation due to storm surge from more frequent and intense storm events has become increasingly problematic for agricultural producers as predicted. The Mid-Atlantic States have been identified as especially vulnerable to coastal flooding because of both sea level rise and land subsidence occurring simultaneously. Also related to saltwater inundation are potential water quality issues, as this process can mobilize legacy phosphorus and nitrogen from the soil that enter adjacent water bodies. To compound the problem, increased temperature effects will result in changes in plant adaptability in specific geographic locations and local environments due to shifts in Plant Hardiness Zones. As time goes on, a new suite of plant species may be recommended for a given geographic area. Unfortunately, the technical information available to address these concerns is somewhat limited and scattered. This presentation will expose participants to possible short-term mitigation techniques and viable long-term adaptation strategies and methods to deal with this problem. Managing the impact of saltwater inundation will require producers to use more adaptive agricultural practices. With better site assessment tools and implementation of appropriate conservation practices with updated planting recommendations, producers in these impacted areas may not need to completely abandon their affected fields. In addition, potential income opportunities may be possible by growing value-added, alternative niche conservation plants that also provide valuable ecosystem services.

Track: Adapting Landscapes to Climate Change

**Denotes primary author*

Successful Watershed Management in the Midwest: Getting to Scale

Authors: Rebecca Power, University of Wisconsin*; Amulya Rao Ponna Vishweshwer, University of Wisconsin-Extension

After decades of experience and research in watershed management, much has been learned about developing and implementing successful watershed initiatives that improve environmental and social outcomes. However, currently available water quality data from United States Environmental Protection Agency shows that 51% of assessed rivers and streams; 70% of assessed lakes, reservoirs, and ponds; 79% of assessed bays and estuaries; 73% of assessed coastal shoreline; 92% of assessed ocean and near coastal waters; 48% of assessed wetlands; 98% of assessed Great Lakes shoreline; and 100% of assessed Great Lakes open waters are impaired. Nitrogen, phosphorus, mercury, and polychlorinated biphenyls are among the most common causes of impairment. Given the current condition of Midwest water resources and the complexity of actions needed to achieve lasting success, deliberate efforts need to be made to implement watershed management across larger geographies in a robust way. This presentation summarizes a new white paper that offers a vision and theory of change for how successful watershed management systems can be scaled up across the Midwest. It (a) proposes a primary unit of watershed management that can be scaled up and sustained over time, b) articulates the necessary elements to foster and support the scale-up efforts, and (c) proposes actionable strategies for operationalizing the scale-up effort. This white paper is informed by two sources of data: (a) Peer and nonpeer reviewed literature and (b) watershed experts who attended a summit in November 2017 and (c) follow-up conversations with these and other experts in conservation and water resource management. While the white paper focuses the cases and recommendations of this paper in the Midwestern U.S., we hope that some of the recommendations will have applicability in other regions of the U.S. and to the field of watershed management as a whole.

Track: 2019 General Conference Theme Submissions

Subject: Water Resource Assessment and Management

**Denotes primary author*

Supplementing Field Monitoring with Remote Sensing and Machine Learning on Public Rangelands

Authors: Philip Heilman, USDA ARS*

Public land management agencies follow the National Environmental Policy Act (NEPA), with 10-year reviews of grazing allotments. Budget constraints limit both the amount of monitoring data collected and the time available to perform reviews. As a result, public land management agencies have difficulty documenting both a fair assessment of grazing management and their own stewardship. We propose a technological solution, using the 30+ year record of Landsat imagery. Unfortunately, there is no way to directly interpret Landsat data to address NEPA. We propose comparing remotely sensed vegetation production and cover against the production and cover observed on areas with similar productive capacity, with the interpretation that more of either implies better management. We examined Major Land Resource Area 41 in southeastern Arizona, a 40,158 km^2 transition area between the Sonoran and Chihuahuan deserts, using two estimates of production, the maximum annual NDVI value and the Annual Net Primary Production (ANPP), as well as an estimate of canopy cover as a proxy for protection from soil erosion. Machine learning algorithms (Generalized Linear Modeling, Random Forest, Gradient Boosting Machines, and Deep Learning) were used individually, as part of model ensembles, and as part of a fully-automated tool to estimate the expected production and cover for each pixel. Combinations of landscape position, precipitation, temperature, slope, aspect, and fire history were used as predictors across the grazing allotments of MLRA 41. The two best algorithms were Random Forest and Gradient Boosting Machines with coefficients of determination of 0.8 and 0.7 respectively for Net Primary Production. The difference between actual and expected annual production and cover were assessed using expert opinion of Bureau of Land Management range conservationists for individual allotments and on intensively monitored research areas.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Models, Tools, and Technologies

**Denotes primary author*

The Case for Formal Apprenticeship as a Pathway to Careers in Farming

Authors: Franklin Egan, Pennsylvania Association for Sustainable Agriculture; Dan Dalton, Pennsylvania Association for Sustainable Agriculture; Aaron de Long, Pennsylvania Association for Sustainable Agriculture

Informal farm apprenticeships have served as an important pathway for beginning farmers to gain hands-on experience, but there is little data available concerning their structure and effectiveness. In 2015, we conducted a mixed-method study of the experiences and concerns of farmers hosting informal apprenticeship programs in Pennsylvania. We found that 62% of farmers reported being generally satisfied with their apprenticeship programs, but they also described needing help recruiting qualified applicants and developing more structured educational programs. Formal apprenticeships that combine paid on-the-job training with technical coursework and peer networking could help farmers with labor challenges while also effectively training a new generation of farmers. Drawing on data and lessons from this study, PASA (Pennsylvania Association for Sustainable Agriculture) has helped to develop formal, registered apprenticeships for both vegetable and dairy farm managers. In this presentation, we'll report on our early-stage successes and challenges training new farmers through formal apprenticeship.

Track: 2019 General Conference Theme Submissions

Subject: Social Sciences Informing Conservation

**Denotes primary author*

Tracking US Agricultural Conservation Adoption: Trends from 2004 to Present

Authors: Kathryn Zook, USDA*

The U.S. Department of Agriculture (USDA) supports the use of conservation practices and technologies on working lands as a strategy to improve environmental outcomes. In order to improve the effectiveness of USDA and other organizations supporting agricultural conservation, it is important to understand recent trends in adoption of conservation practices. However, until recently, USDA did not have a comprehensive, uniform way to track recent adoption of agricultural conservation. In 2016, USDA and ICF sought to improve the understanding of agricultural conservation practice adoption by tracking trends in adoption of a variety of conservation practices that reduce GHG emissions and provide additional environmental benefits. Survey data were collected from the years 2004 to 2016, in order to observe trends in adoption over the past decade. Data were split by type of crop (corn, soy and wheat), USDA region, and farm size. The resulting USDA report, "Agricultural Conservation on Working Lands: Trends from 2004 to Present," was released in November 2018. As an example, Corn Belt findings include:

- Variable Rate Technology (VRT) has spiked in adoption. For corn, between 2005 and 2016, adoption increased from about 5% to almost 40%.
- Adoption of no-till on corn acres has been somewhat stagnant, with rates of adoption remaining around 30% in corn between the years 2005 and 2016.
- For cover crops, adoption has increased from approximately 518,000 acres in 2010 to 3.8 million acres in 2015.

This is a dramatic increase, however, rates of adoption remain around 5%. For USDA, these data will inform setting priorities and managing natural resources. Companies within the food and agricultural sectors with GHG reduction targets can use this information to track progress towards GHG goals. This presentation will provide an overview of the report's findings, and promote discussion of ways to continue to encourage adoption of conservation on farms across the United States.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Economics and Policy

**Denotes primary author*

Understanding the Effects of Place, Perception, and Age on Nutrient Management Decision-Making among US Farmers

Authors: Caela O'Connell, University of Tennessee*; Deanna Osmond, North Carolina State University

Understanding farmer nutrient management decision making is critical to minimizing nutrient loss to water resources. This research examines farmer nutrient decision making among interviewed 105 farmers in Missouri, North Carolina, and Ohio. Data were collected between 2015-2016 using a mixed-methods approach of in-person farmer interviews and accompanying quantitative surveys with demographic and Likert ranking questions. This talk will address findings regarding 1) how farmers made decisions, 2) who they consult with, and 3) how their views on water quality and pollution impact their choices. Farmers report multiple resources for nutrient management decision making including yield data, market prices of fertilizers, weather, availability of products, past experience, risk avoidance, university research reports, tissue sampling, and social networks. Place also shaped how farmers made nutrient management decisions both because of differences in the structure and types of professional and informal support available to farmers and how individuals perceived the severity of local water problems. Younger saw more room for improvement in their nutrient management practices while farmers older farmers were more likely to be satisfied with current practices and decisions. Ultimately, we suggest that developing diverse strategies for supporting nutrient management choices given the variety of support and constraints that farmers in different places are working, improving inter-generational trust, and increasing visibility and access to reliable information on local water quality are all critical steps to improving water quality outcomes.

Track: 2019 General Conference Theme Submissions

Subject: Soil Health Resources, Indicators, Assessment, and Management

**Denotes primary author*

Understanding the Impacts of the Fox Demo Farms Project

Authors: Whitney C.P. Prestby, University of Wisconsin Extension*

Our evaluation project is designed to understand the social impact that the Lower Fox Demonstration Farms Network (Fox Demo Farms) has had on the Lower Fox River Watershed. The Fox Demo Farms is a Great Lakes Restoration Initiative (GLRI) funded project, built to identify and implement conservation practices that reduce phosphorus and sediment loading into the Fox River and bay of Green Bay. It is a unique partnership that brings farmers, local, state, and federal agencies together to help reach the Total Maximum Daily Loading (TMDL) targets. With soil health at the forefront of our message, the Fox Demo Farms project has been working towards solutions that benefit local waterways, as well as the farmer's bottom-line. We have designed and implemented a comprehensive outreach plan to communicate the positive changes happening throughout the watershed. This multi-pronged approach utilizes a wide range of social science strategies to engage with farmers, both middle and late adopters, non-operating landowners, as well as the non-agricultural community. Through this work, we are striving to create opportunities for people to learn from each other, so that we can develop lasting solutions that benefit our shared water resources. With a combination of group and individual interviews, we plan to use ripple effect mapping to better understand the social impacts that this GLRI funded project has had on the region. As the Demonstration Farms Network expands throughout Wisconsin, understanding its strengths, as well its shortcomings, will be of great importance.

Track: 2019 General Conference Theme Submissions

Subject: Outreach, Education, and Community Engagement

Denotes primary author

Urban Soil: Assessing Legacy Impacts and Cost Effective Remediation Strategies

Authors: Jonathan K Burgess, Allegheny County Conservation District*

In the 21st century, post-industrial cities like Pittsburgh are reinventing themselves into progressive centers of growth with a focus on sustainability, emerging technologies, green infrastructure and smart development. However, they must contend with the legacy impacts of heavy industry, extraction, and the systemic blight that followed the downturn of those industries. Distinct among these are the impacts decades of activity have left on urban soil health, particularly contamination, compaction, low-organic matter and other features that directly correlate to the success of land reuse projects. The Allegheny County Conservation District (ACCD) has been at the forefront of researching urban soil trends across blighted communities, with a focus on mapping heavy metal contamination, soil health assessments, technical assistance for municipalities and non-profits, and developing best practices for cost-effective remediation. This talk will briefly outline the programs themselves, discuss the results of that research, and give an overview of ACCD's phytoremediation research pilot.

Track: 2019 General Conference Theme Submissions

Subject: Soil Health Resources, Indicators, Assessment, and Management

**Denotes primary author*

Using a Land Use Change Analysis to Inform Wetland Protections in New Jersey

Authors: Trish Long, USDA NRCS*

In this presentation, I will describe an analysis recently completed by New Jersey NRCS, which is intended to improve wetlands protection by spatially identifying areas of potential wetland conversion. I will present the results of the analysis, which involved geospatial data manipulation and creation of a new GIS data layer for the state. This layer was developed from publicly available Land Use/Land Cover datasets produced by the NJDEP. Because the analysis was completed for the entire state, this data layer will help determine the statewide extent of potential areas of concern. The ultimate goal of the analysis and new data layer is to help NRCS work better with farmers and customers in NJ. As a result of the analysis, we are now able to identify 1) where additional outreach to the farm community regarding wetlands protection is needed, and 2) where additional training and support to our local NRCS field offices might be needed.

Track: 2019 General Conference Theme Submissions

Subject: Conservation Models, Tools, and Technologies

**Denotes primary author*

Using Creek Signs to Build Awareness of Creeks, Lake Tributaries, and Watersheds in Iowa

Authors: Stephen K. Hopkins, Iowa Department of Natural Resources

Iowa's Nonpoint Source Management plan calls for developing and implementing a statewide campaign to inform people about water quality issues. However, survey data show that many Iowans are unaware of even the name of their local creek, much less understand water quality issues of their creeks, streams, and lakes. Until citizens become aware of and take ownership of their local waters, little progress is made to improve them. To build awareness of creeks and watersheds in Iowa, the state Dept of Natural Resources (DNR) worked with the Dept of Transportation (DOT) to install new creek signs at highway bridges within watershed improvement projects areas. (DOT normally installs river signs, but not creek signs, as part of its signage of waterbodies). DNR also encouraged watershed projects to work with counties and cities to install creek signs at bridges on local roads within their watershed. Informal feedback to the projects about the signs has been very positive. DNR has also begun to work with local road authorities to install separate signs labeling creek tributaries as the source of a downstream lake when the lake has a different name than the creek tributary. The first sign combination (creek sign and lake tributary sign) of this type was installed in late 2018 through the Lake Geode Watershed Project in southeast Iowa. In this case, a creek sign was installed labeling "Cedar Creek", and below it a separate sign was installed saying "Source of Lake Geode." The project has already received comments from local residents that they were not aware that Cedar Creek was the source of the lake. Since Iowa spends tens of millions of dollars annually to restore impaired streams, rivers, and lakes, the ultimate intent of new creek signs is not only to build awareness but to motivate citizens to adopt water quality actions on their own. DNR will conduct surveys to test whether new creek signs have enhanced awareness and resulted in water quality actions.

Track: 2019 General Conference Theme Submissions

Subject: Outreach, Education, and Community Engagement

**Denotes primary author*

Using Goats to Graze Weeds in Urban Public Spaces

Authors: Jennifer Cook, Colorado State University Extension*

With the rise in weed control costs and health concerns of pesticide use, many urban municipalities are looking for alternative weed control methods in parks and open spaces. Using goats for weed control is a viable option, but many variables and implications should be considered before, during, and after the use of goats for weed control. This presentation will describe the economic, social, and environmental considerations of using goats as an alternative weed control method in urban public spaces. Material presented is based on a public/private partnership project using goats to graze weeds in multiple urban parks in Colorado. Qualitative and quantitative data will be summarized, highlighting lessons learned. A Guide for Using Goats to Manage Weeds in Urban Public Space was developed as a result of this project. The guide is a useful tool for city planners, open space managers, Extension and federal land management personnel, and goat contractors to navigate the considerations, potential impacts, and easy monitoring methods when using goats for weed control in urban parks and open spaces. The safety of the public and the livestock are essential in urban public grazing. Signage and other forms of communication will help maintain safety around the grazing animals. Both the community history and the residents' perceptions of landscapes and livestock may affect the acceptance of such projects. Good working relationships and communication among key players in this project were found to be very valuable. The economic costs of urban grazing projects will be different in each situation, and depend on material and labor costs, but environmental ethics and quality of life should also be considered in cost benefits. Site considerations and ongoing vegetation monitoring should include evaluation of environmental impacts, plant species available for grazing, site location limitations, potential impacts to threatened and endangered species, and safety.

Track: Engaging the Private Sector in Conservation

**Denotes primary author*

Water for Irrigation and Energy Production: Tradeoffs and Cooperation under Drought Conditions

Authors: Noel R. Gollehon, Water Policy Economics*; Lessly Goudarzi, OnLocation, LLC; Charles Zelek, Department of Energy

The two sectors with the largest water withdrawal footprint are thermoelectric energy production and irrigation. These two sectors can, and often do, clash when water supplies are short due to drought. In this work the existing stock of thermoelectric plants drives a seasonal planning model to identify and inform the potential tradeoffs associated with a constrained water supply. The National Energy Technology Laboratory (NETL) has combined a national water model based on availability and withdrawals with the National Energy Modeling System (NEMS) containing thermoelectric energy production and cooling options across a range of climatic conditions. The combined model operates over a 30-year simulation at a HUC-8 level to addresses the power sectors need for cooling allowing tradeoffs among alternative water sources (surface, ground, waste-water, brackish water and other local sources) and alternative cooling technologies. The model explicitly includes irrigation water demands thus allowing the tradeoff set to include reductions in irrigation water withdrawals, whether by conservation efforts or decreases in irrigated area. The model is being used to identify areas where agriculture water conservation might limit reductions in energy production when water supplies are short. In areas with amenable water transfer conditions, potential collaboration between the National Resource Conservation Service (NRCS) and the Fossil Energy Office of the Department of Energy could foster NRCS sponsored water conservation that minimizes generating plant curtailments and insolates consumers (including irrigators) from higher power costs thus improving regional economic resiliency, and enhancing power grid reliability.

Track: 2019 General Conference Theme Submissions

Subject: Water Resource Assessment and Management

Denotes primary author

Western Lake Erie Basin Farmers' Perceptions of Nutrient Management Adequacy

Authors: Elizabeth R. Schwab, The Ohio State University*

Agricultural nutrient loss has the potential to result in a number of environmental consequences globally, including eutrophication of lakes and coastal hypoxia. Use of agricultural best management practices is encouraged to minimize nutrient loss, but these practices are not universally adopted. While previous studies have examined factors contributing to farmers' adoption of agricultural best management practices, less is known about farmer perceptions of the impact of their farm's agricultural nutrient loss on water quality. This project seeks to a) understand farmers' perceived sufficiency of their nutrient management practices in minimizing nutrient loss, and b) understand which factors explain accuracy versus inaccuracy of these perceptions. The study uses survey data collected in the Maumee Watershed; this watershed is a major contributor to the formation of harmful algal blooms in western Lake Erie and spans parts of Ohio, Indiana, and Michigan. The survey provides information including water quality perceptions and beliefs; perceived control over factors influencing water quality; concern about, perceived seriousness of, and likelihood of nutrient loss-related water quality impacts; farmer identity; and specific field management information. These and other supporting details are used in determining factors explaining perceived sufficiency of nutrient management practices. To assess accuracy of perceptions, simulated field-scale nutrient outputs from a watershed model are used to compare farmer perceived versus "actual" nutrient loss risk at the local and farm scale. With a better understanding of farmers' beliefs about the adequacy of their nutrient management practices, as well as the accuracy of these beliefs, we can be more prepared to appropriately target funds for conservation practices and encourage adoption among groups that need the most support.

Track: 2019 General Conference Theme Submissions

Subject: Social Sciences Informing Conservation

**Denotes primary author*

White Clover as a Living Mulch in Georgia: Transferring a Crop Production System to Improve Soil Health

Authors: Nicholas S. Hill, University of Georgia*; Matt Levi, University of Georgia; Nicholas Basinger, University of Georgia; Jill Mullican, University of Georgia; Renata Nave-Oakes, University of Tennessee; Agustin Rius, University of Tennessee; Sindhu Jagadamma, University of Tennessee; Chris Agee, The Pennington Seed Company

Modern agriculture resulted in major land use changes during conversion of grass and forested systems to arable lands at a cost of water quality, nutrient leaching, and soil erosion. Arguably, the long-term sustainability of farming is dependent upon developing production systems that are both profitable and beneficial for the environment. One potentially profitable system capitalizes on the principles of building soil health through perennial living mulch (LM) cover crops. We compared a white clover (*Trifolium repens* L.) LM with crimson clover (*Trifolium incarnatum* L.) and cereal rye (*Secale cereal* L.) annual cover crops for various soil quality parameters in a corn production system. The LM system increases soil organic carbon, pH CEC, nutrient status, labile C, water infiltration, and porosity; and increases water quality by reducing water runoff and sediment. We are deploying the LM system to Georgia producers and testing the LM system in a corn-silage production system. The system is adaptable to cotton production for crop rotation. Field-specific growing conditions can hamper technology transfer and being nimble to solve these problems requires immediate experimentation to solve unexpected site-specific production issues.

Track: 2019 General Conference Theme Submissions

Subject: Soil Health Resources, Indicators, Assessment, and Management

Denotes primary author

Years to Come: A Case Study on a Collaboration and Implementation to Reduce Sediment Runoff and Expand Conservation Education in the Western Lake Erie Basin

Authors: Rebecca J. Wicker, The Nature Conservancy*

Sauder Village has been a historical resource for the community for forty-two years and is looking to become a regional education and demonstration site for how to do both productive agriculture and water quality conservation. After collaborating with ODNR division of wildlife, Fulton County Soil and Water Conservation District, and The Nature Conservancy, they decided to do the wetland after learning about the harmful algal blooms in western Lake Erie and needed a way to protect their historical assets from flooding. Once they realized there could be an educational aspect to the project, they were all in. Wetlands can be part of profitable and productive farming in the Midwest, and this case study can serve as a model for similar places facing nutrient water quality problems. Demonstration and education sites that are publicly accessible are valuable to partners trying to build education and awareness on water quality impacts of farming practices and possible solutions that farmers can implement. Together these organizations will work to provide an educational conservation land piece that will serve many more generations to come. The team presents how this collaboration was started, what efforts are being made as we near the finish, and the hopes this restoration project has for the future.

Track: 2019 General Conference Theme Submissions

Subject: Outreach, Education, and Community Engagement

Denotes primary author

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POSTER PRESENTATIONS

Poster Number 1

Importance of the Hydrologic Model in Simulating Future Water Quality under a Changing Climate

Authors: Haley A Kujawa, The Ohio State University*; Margaret M. Kalcic, Ohio State University; Rebecca Muenich, Arizona State University; Noel Aloysius, University of Missouri; Todd Redder, LimnoTech; Chelsie Boles, LimnoTech; Grey Evenson, The Ohio State University; Asmita Murumkar, The Ohio State University; Anna Apostel, The Ohio State University; Yu-Chen Wang, University of Michigan; Awoke Teshager, University of Michigan; Richard Becker, University of Toledo

Over the past few decades, extensive research has been conducted on how future predictions of hydrology (e.g. average discharge, 7-day low flows, flooding etc.) are affected by the choice of watershed model. However, there is currently no research highlighting how the choice of watershed model affects predictions of water quality. It is reasonable to expect predictions of future water quality would be more difficult to simulate than hydrology as it is also more difficult to simulate under current conditions. This research is necessary as many climate change studies on water quality are still being conducted with use of a single watershed model. This study uses a watershed model ensemble and climate model ensemble to quantify uncertainty from each in climate change analysis. Five models for the Maumee River Watershed, located mainly in northwest Ohio and partially in Indiana and Michigan, were created by independent research groups using the Soil and Water Assessment Tool (SWAT). Each group was allowed freedom to retain differences in model structure, management, and parameterizations, and was calibrated to a gauge near the outlet. We drove the SWAT ensemble with daily temperature and precipitation predictions from an ensemble of six general circulation models (GCMs). An ANOVA approach was used to partition the uncertainty between GCMs and SWAT. The results show the GCM is the main source of uncertainty in discharge (96%) and nitrogen (63%), but the choice of SWAT model drives more uncertainty in phosphorus loads (57%-72%). This study demonstrates the importance of prediction uncertainty derived from the watershed model in climate change analysis and highlights the need for improvement of climate and watershed models to reduce uncertainty in water quality predictions.

Track: Adapting Landscapes to Climate Change

**Denotes primary author*

Nutrient Tracking Tool Application of Land Use Alternatives for a Grazing Ranch in North East Texas

Authors: Ali Saleh, Tarleton State University*; Lisa E Akinyemi, Tarleton State University; Narayahan Kannan, TIAER, Tarleton State University

The Nutrient Tracking Tool (NTT) is a user-friendly web-based computer program and is linked to the Agricultural Policy Environmental eXtender (APEX) model. It also accesses United States Department of Agriculture Natural Resources Conservation Service's Web Soil Survey and Parameter-elevation Regressions on Independent Slopes Model (PRISM) to obtain field, weather, and soil information. NTT provides producers, government officials, and other users with a fast and efficient method of estimating the nutrient, sediment losses, and atmospheric gases (N_2O, CO_2, and NH_4) emission, and crop production. Also, the recent version of NTT (NTT-RE) has been developed for those countries without access to national databases, such as soils and weather. The NTT-RE also has been designed as an easy to use APEX interface. In addition to providing real-world information on the impact of conservation practices on production and sustainability of agricultural operations, the NTT aids in developing markets where farmers get paid for the water quality benefits they provide. Water quality trading markets may provide a single marketplace for total maximum daily limit (TMDL) overages to be remedied or they may use advertising and partnerships to obtain monetary benefits for agriculture producer's conservation practices among other uses. NTT has been released for public use by the USDA office. A version of NTT (CBNTT) is also currently being used for trading and other water quality programs in Chesapeake Bay regions. Here, we describe evaluated land use changes on a NE Texas cow-calf ranching operation. The total area is 297 ac of which about 77 acres is native and 220 acres Bermuda grass. Factors tracked through various scenarios include N, P, and sediment losses, crop yields, and water and temperature stress. With simulated information, the ranch managers will have ecological values to consider as well as economic values when deciding among available conservation practices to implement.

Track: Adapting Landscapes to Climate Change

**Denotes primary author*

Poster Number 3

The USDA Nebraska Climate Hub: A Regional Source for Adaption Information

Authors: Curtis Dell, USDA ARS

Changing rainfall and temperature patterns and the probability of a greater frequency of extreme weather events with a changing climate presents increasingly greater challenges for farmers, foresters, and other land managers. While a wide range of currently available information sources, technologies, and conservation practices are available to help producers adapt to our changing climate, finding the right approach to address commodity-specific local issues can be difficult. The USDA Northeast Climate Hub works across USDA agencies and with partner universities to help provide land managers with the information they need to address those challenges in the Northeastern US. The poster highlights the climate adaption information products available through the Northeast Hub including: vulnerability assessments, adaptation workbooks for crop production and forestry, factsheets summarizing research findings, and the "As If You Were There" video series on adaption approaches for a range of commodities and locations.

Track: Adapting Landscapes to Climate Change

**Denotes primary author*

Poster Number 4

Tribal Soil Climate Analysis Network Outreach and Support for Agriculture and Forestry

Authors: Christopher F. Miller, USDA NRCS*; Suzanne Baker, USDA NRCS; Michael A. Wilson, USDA NRCS; Deb Harms, USDA NRCS; Barry Hamilton, USDA NRCS; Arthur DeGaetano, Cornell University

The Tribal Soil Climate Analysis Network (TSCAN) is a cooperative federal and university effort to coordinate placement of climate stations on tribal lands. The project is led by the USDA Natural Resources Conservation Service (NRCS), and Bureau of Indian Affairs, NOAA Northeast Regional Climate Center at Cornell University, and USDA Climate Hubs are supporting partners. Goals are to (1) provide localized climate data from TSCAN units to selected tribes around the U.S. for agricultural and forestry management decisions, (2) strengthen tribal outreach to support production management as well as STEM education, and (3) connect tribes with local entities to strengthen partnerships and alliances. TSCAN units monitors soil temperature and moisture at three depths, as well as multiple atmospheric parameters. Data is made available through the NRCS SCAN website. This project is also developing a web-based platform to improve data utility from the entire SCAN and TSCAN network by linking data to tools useful for agricultural production. Tools such as growing degree days, livestock heat index, and water deficit will provide producers with improved decision-support information. These data will also be a spring-board to engaging tribal students for increasing their scientific understanding of climate, land use and associated technology.

Track: Adapting Landscapes to Climate Change

**Denotes primary author*

Integrated Systems' Synergy and Regenerative Agriculture in the Semi-Arid Region of Western North Dakota

Authors: Douglas Landblom, North Dakota State University*

Initiated in 2011, a long-term, 10-year, integrated crop and livestock research project is comparing spring wheat grown continuously in the semi-arid region of western North Dakota to a five-crop rotation that includes spring wheat. The systems comparison deviates from traditional crop harvest and utilization by grazing some of the crops instead of mechanical harvesting, thereby delaying feedlot entry for yearling steers and reducing feedlot days on feed by 61%. Crops grown in the no-till five-crop rotation and compared to continuously grown spring wheat (C – *Triticum aesitivium* L.) are spring wheat (R), winter triticale-hairy vetch (*Triticale hexaploid* Lart. - *Vica villosa* Roth), field pea-barley intercrop (*Pisum sativum* L. – *Hordeum vulgare* L.), mixed specie cover crop, corn (*Zea mays* L.), and sunflower (*Helianthus annus* L.). Rotation spring wheat during the first five-year period was characterized by reduced N fertilizer input, increased wheat production, and net return of $15 more/acre. Paralleling the observed crop response, no-till farming conserves soil moisture and regression analysis contrasting soil organic matter (SOM) and potential mineralized nitrogen (PMN) indicates that soil microbial activity has the potential to mineralize 8.4 mg N per each 1% increase in SOM/kg. Perennial native range (7.16 Ac/steer) and annual forage (1.08 Ac/steer) grazing delayed feedlot entry 211 days during which time yearling steers gained 224.5 kg (1.06 kg/day) and a grazing net return of $426/steer ($51.70/Ac). Extending the grazing period increased feedlot efficiency. Grazing steers subsequently finished in the feedlot were ready for slaughter after an average 82 days on feed gained 0.57 kg faster and consumed 0.64 kg less feed/unit of gain than non-grazing control steers with no difference in meat quality. Understanding soil health principles and identifying soil health indicators is the focus of an annual soil health workshop (Ave:150 attendees) for university students, producers, agency, and community stakeholders. In conclusion, systems' integration reduces inputs, soil fertility and crop yields are improved, delayed yearling steer feedlot entry reduces days on feed and increases profitability, increases wildlife habitat, and improves quality of life.

Track: 2019 General Conference Theme

Subject: Adaptive Management of Conservation Effort

**Denotes primary author*

Wetlands at Work: Nitrogen Reduction and Phosphorus Sequestration of Constructed Wetlands Receiving Tile-Drained Waters from Agricultural Systems in the Midwestern United States

Authors: Krista G. Kirkham, The Nature Conservancy*; Maria Lemke, The Nature Conservancy; Michael Wallace, University of Illinois Urbana-Champaign; David Kovacic, University of Illinois Urbana-Champaign; Jacob Berkowitz, US Army Corps of Engineers; Christine VanZomeren, US Army Corps of Engineers

The Nature Conservancy, University of Illinois, and the Franklin Family of Lexington, IL have a 15-year partnership on the 250-acre Franklin Research and Demonstration Farm (FRDF). The farm showcases various in-field and edge-of-field agricultural conservation practices, including sequential constructed wetlands that represent 3%, 6%, and 9% of farm drainage areas. Two major goals of the FRDF are to determine: 1) the effectiveness of constructed wetlands in reducing nutrient concentrations in tile runoff, and 2) what wetland/watershed ratio is needed for significant nutrient reduction. Ten years of water quality analysis demonstrate that the wetlands removed an average of 13%-41% of nitrate- nitrogen and 45%-94% of orthophosphorus loadings from tile drainage waters. Denitrification is the primary removal process for nitrogen in wetlands, however the phosphorus (P) cycle lacks an equivalent atmospheric removal pathway. As a result, the capacity of wetlands to sequester P often decreases over time as the availability of soil sorption sites declines. In response, we evaluated the P sorption capacity of the treatment wetlands. Results indicate that the wetlands sequestered P, with water soluble P displaying significant decreases in sequential treatment cells (range 61.0 – 81.7% reduction). However, the magnitude of P retention varied significantly across wetlands, underscoring the influence of soil properties on P sequestration dynamics. Soil P sorption capacity increased in the direction of treatment water flow as anticipated but varied significantly between treatment wetlands with soils ranging from P sinks to potential P sources. Future management actions may be required to enhance P retention in constructed wetland systems. Study results highlight that soil type, land use history, and nutrient inputs are important considerations for proper placement and operation of wetlands in the landscape to optimize long-term reduction of nutrients in tile-drained systems.

Track: 2019 General Conference Theme

Subject: Adaptive Management of Conservation Effort

**Denotes primary author*

Measuring Soil Health Benefits on Private Rangelands through Wyoming Ranchers' Profitability from Improved Forage Production

Authors: Kristie Maczko, University of Wyoming*; Holly Dyer, University of Wyoming; John Ritten, University of Wyoming; John Tanaka, University of Wyoming; Jennifer Moore-Kucera, American Farmland Trust

Livestock operations in rangeland systems are largely excluded from most US research evaluating environmental and economic benefits from improved soil health focuses. To address this knowledge gap in Wyoming, this study provides a framework to evaluate benefits from improving rangeland soil health. Using a multi-period linear programming approach, the model quantifies rancher benefits for forage production responses from various hypothetical practices implemented to improve soil health. Rancher benefits were quantified as the difference in maximum net present value of profits for various forage responses over time given typical resource limitations and cost/return parameters representative of Fremont County. Outcomes of conservation practices implemented by Wyoming private producers influences their operation's profitability over time, as well as soil health and the provision of public ecosystem goods. Results show forage response timing and initial conditions drive private benefits from practices aimed at increasing soil health. The benefits were compared to the costs of implementing a rotational grazing plan, as a potential practice aimed at improving soil health on private rangeland. As expected, results show forage response timing and initial conditions drive private benefits from practices aimed at increasing soil health. This would imply that targeting ranches that still have functioning soils may provide a better investment opportunity to restore soil health and ultimately forage production. Scenarios experiencing greater implementation costs than projected benefits suggest additional incentives may be necessary to promote use of certain management practices on private rangeland. Depending on how the public sector values rangeland ecosystem services including air and water quality, wildlife habitat, and carbon sequestration, investors can decide to allocate funding to landowners requiring additional incentives to implement a practice.

Track: 2019 General Conference Theme

Subject: Conservation Economics and Policy

**Denotes primary author*

Profit-Maximizing Nitrogen Rates for Corn Production and Tillage Systems Using Non-Linear Mixed Effects Production Functions

Authors: Alexis Villacis-Aveiga, Virginia Tech*; Jorge A. Delgado, USDA ARS; Jeffrey Alwang, Virginia Tech

Research has shown stochastic yield response functions fit crop production data better than deterministic yield response functions. Nonetheless, little research exists for profit-maximizing fertilizer rates for corn under different tillage systems using non-linear mixed effects production functions. The objective of this research is to determine profit-maximizing nitrogen rates for corn under no-tillage (NT), conventional-tillage (CT), and strip-tillage (ST) using linear response plateau production functions with random parameters. Data come from a unique long-term study conducted in a Fort Collins clay loam soil at the Colorado State University Agricultural Research, Development and Education Center (ARDEC) near Fort Collins, Colorado. The study was initiated in 2001 and includes 16 years of crop production data. Plots were irrigated and several nitrogen rates were used for NT, CT, and ST corn. Different prices of Corn and N reflecting Colorado prices in 2017 are combined with partial budgets and profit-maximizing nitrogen rates for the net returns analysis. Results show that CT and ST net returns are larger than NT. In both cases, the advantage emerges because CT and ST produce larger yields and require less nitrogen. Even when taking into account the additional costs incurred by CT or ST, both still outperform NT profits, and moreover, the economic advantage of CT and ST over NT is virtually the same. These results might have environmental implications that could favor the use of ST over CT, as strip tillage provide more conservation and efficiency benefits than CT. If one assigns market values to these benefits, ST would be clearly preferred to CT. This information can help improve extension recommendations for nitrogen fertilization of corn in Colorado and the Great Plains. Additional research is needed focusing on price uncertainty and producer's risk preferences in determining optimal nitrogen fertilizer rates under different tillage systems.

Track: 2019 General Conference Theme

Subject: Conservation Economics and Policy

**Denotes primary author*

Demonstration Plots of Alternative Pollinator Habitat Seed Mixtures

Authors: Robert J. Glennon, Virginia Tech*

The USDA, Natural Resources Conservation Service, Eastern Shore Soil and Water Conservation District, and Virginia Tech established demonstration plots of different pollinator habitat seed mixtures to show the public how the different seed mixtures performed. There are many different goals in establishing pollinator habitat and designing seed mixtures. Some landowners want seed mixtures that contain some annual plants that will bloom the first year. Others want a seed mixture on which they can use labelled herbicides. Still others want a seed mixture that can be managed through the first year with mowing and without herbicides. Many want a seed mixture that they can buy already mixed from a reputable seed grower. The demonstration seed mixtures included a typical mixture of annual and perennial species, a mixture of species tolerant of the herbicide imazapic, a mixture of all perennial species, and two seed mixtures from eastern seed growers. The seed mixtures were established with and without perennial native grasses. The stands established from seed mixtures without native grasses can be treated with a grass specific herbicide to control non-native grasses. Each seed mixture was established at seeding rates that delivered 45 seeds per square foot. They were established by broadcasting the seed mixed with pelletized lime onto a firm seedbed and the seedbed was packed after the seed was sowed. Each seed mixture performed well and demonstrated that there are many different routes to establishing good pollinator habitat. The demonstration plots have been used for workshops each year at different times of the year to illustrate different species in bloom and different pollinating insects using the plots. Photographs have been taken monthly and posted to the Virginia Bobwhite Bulletin Facebook page. Scientists from Virginia Tech have been sampling insect populations in each plot.

Track: 2019 General Conference Theme

Subject: Conservation in Organic, Specialty, Small-Scale, or Urban Agriculture

**Denotes primary author*

Poster Number 10

Investigating Urban Agriculture Practices in Mwanza, Tanzania

Authors: Shefaza Esmail, University of Waterloo*

The research focuses on the diversion of organic (food) waste in rapidly urbanizing developing cities and the use of compost on small scale urban agriculture, with a focus on Mwanza in Tanzania. Urban agriculture is a prominent activity and feeds much of the urban population. However, the continuously cultivated soils are vulnerable to nutrient and soil organic carbon (SOC) depletion. This study investigated cultivation practices and the use of soil amendments in urban agriculture through in-depth interviews with urban farmers. The effects of four soil amendments on soil health and plant growth were also investigated through a field experiment conducted in the dry and rainy season. The soil amendments include poultry manure, store-bought fertilizer, and two types of compost. The soil parameters such as soil organic carbon, total nitrogen, total available phosphorus, and soil microbial biomass were analyzed and compared among the amendment-use plots and against the control plots. The interviews were transcribed and coded to identify major themes emerging in maize crop disease, decline of soil health, and reliance on unpredictable rains for rain-fed agriculture. Trends show that compost is a comparable soil conditioner to poultry manure and that urban farmers would be open to the idea of using compost created from organic food waste collecting from within the city. Ultimately, the research provides insight into how urbanization will impact future food production but also how urban agriculture and compost generated from urban organic food waste can become part of the solution.

Track: 2019 General Conference Theme

Subject: Conservation in Organic, Specialty, Small-Scale, or Urban Agriculture

**Denotes primary author*

Phosphorus Balances in Conventional and Organic Grain Cropping Systems from the Initial Nineteen Years of the USDA-ARS Farming Systems Project

Authors: Kathryn White, USDA ARS*; Michel A. Cavigell, USDA ARS

Phosphorus balances in conventional and organic grain cropping systems from the initial nineteen years of the USDA-ARS Farming Systems Project Reliance on heterogenous nutrient sources such as manure makes balancing nutrient inputs with crop requirements a challenge to sustainable nutrient management in organic agriculture. At the long-term USDA-ARS Farming Systems Project in Beltsville, Maryland poultry litter (PL) is applied to supply nutrients in three organic cropping systems while two conventional systems receive only synthetic fertilizers. Fertility in all systems is managed following Maryland nutrient management recommendations. Beginning in 2002, crop rotations were corn-soybean-wheat/soybean (C-SB-W/SB) in conventional systems and C-SB in Org2, C-SB-W in Org3 and C-SB-W-alfalfa in Org6. Poultry litter was applied to corn, supplementing nitrogen inputs from legume cover crops, and to wheat. Cover crop establishment was critical to reduce PL applications and the risk of excessive soil phosphorus (P). From 2002 to 2014 mean P application to Org2 corn was 53% and 63% greater than for Org3 and Org6, respectively, due to poorer legume cover crop yields compared to Org3 and three years of alfalfa in Org6. Corn harvest removed 25% of P applied to Org2 versus 43% for Org3 and Org6, while Org3 and Org6 wheat removed an average of 27% of applied P. Alfalfa harvest in Org6 removed 61% of all applied P. In contrast, Org2 and Org3 soybeans only removed 17% of excess P applied to the other rotation phases. Conventional system farm-gate P balances averaged -11.6 kg/ha/y. Phosphorus exports in alfalfa forage removed the excess P from PL applications to corn and wheat in Org6 resulting in a balance of 0.2 kg/ha/y, thus maintaining soil test P at optimum levels, while Org2 and Org3 P balances were 18.5 and 12.5 kg/ha/y, respectively, elevating soil P. Results demonstrate that extended rotations that include perennial forage are effective in balancing P inputs while successful legume cover crop establishment also allows for conservative PL applications improving P balances in shorter organic rotations.

Track: 2019 General Conference Theme

Subject: Conservation in Organic, Specialty, Small-Scale, or Urban Agriculture

**Denotes primary author*

Exploring the Extent of Artificial Agricultural Drainage Using GIS Tools

Authors: Jay Christensen, US Environmental Protection Agency*

Artificial agricultural drainage (i.e. surface ditches or subsurface tile) is an important agricultural management tool that allows for timely fieldwork and adequate root aeration allowing for higher crop yields. This practice is widespread throughout many regions of the United States, especially in flat, poorly-drained yet fertile regions like the glaciated Midwest. While beneficial for crop yields, agricultural drains can also alter watershed storage and hydrology and increase conveyance of nutrients into natural water bodies. Despite the importance of drainage to agricultural production and water quality, the spatial extent of artificial agricultural drainage is poorly known. Data from the agricultural census, soil surveys, crop productivity indices and crop-specific land cover were used to create estimates of potential agricultural drainage across the United States, with a focus on the eastern two-thirds of the contiguous US. Estimated agricultural drainage extent is likely across over 27 million hectares of agricultural land, covering greater than 80% of available land for 164 12-digit HUCs. Agricultural drainage is widespread in the upper Midwest Corn Belt as well as in other concentrated areas in the Mississippi Alluvial Valley and the Carolina Coastal Plain. When summarized at the county scale, GIS estimates align well with county census data. Estimated drainage values for numerous counties indicate that even moderately well drained soils are subject to artificial drainage. Overestimations of GIS drainage estimates were present in areas that are dominated by crops other than corn/soybean or have specific geological features that discourage widespread adoption of drainage practices. The use of GIS tools to provide spatial estimates of artificial drainage is promising and can be used to support agricultural, hydrological and nutrient modeling within agricultural watersheds.

Track: 2019 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

**Denotes primary author*

Glyphosate-Resistant Palmer Amaranth Management in Cotton Using Winter Cover Crop

Authors: Michael W. Marshall, Clemson University*

A glyphosate-based weed management strategy in cotton in the southern U.S. has resulted in the selection and rapid increase of glyphosate-resistant Palmer amaranth. Cultural programs are urgently needed to manage these weeds that are effective, low-cost, and sustainable. Plant surface residue from cover crops significantly reduces the germination of small seeded weeds, such as Palmer amaranth. Therefore, the objectives of this experiment were to determine efficacy of fall planted cover crops on glyphosate-resistant Palmer amaranth populations in cotton and determine impact of selected herbicide programs in conjunction with fall cover crops on cotton growth and yield. A rye cover crop was seeded at 40 lb/A between October and December 2015, 2016, and 2017. In addition, a non-rye cover area was left fallow during the winter of each year. Rye/weedy fallow were terminated using glyphosate, 2,4-D ester and Valor approximately 21 days before planting Cotton was planted in mid-May of each year. Reflex at 1.0 pt/A plus diuron at 1.0 pt/A plus paraquat at 3 pt/A was applied shortly after planting followed by POST1 (APT1) [treatments were glyphosate at 32 oz/A plus Warrant at 3 pt/A or Liberty at 29 oz/A plus Dual Magnum at 1.0 pt/A or Liberty at 29 oz/A plus Staple at 1.6 oz/A] at 2-3 lf cotton, POST2 (APT2) [treatments were glyphosate at 32 oz/A + Warrant at 3 pt/A, Liberty at 29 oz/A, or Liberty at 29 oz/A plus Dual Magnum at 1.0 pt/A] at 6-8 lf cotton, and LAYBY [MSMA at 2.67 pt/A plus diuron at 1.0 pt/A] at 18-20 inch cotton. Cover crops significantly reduced early season Palmer amaranth populations compared to no cover crop when combined across treatments. Liberty plus Staple and Dual Magnum significantly reduced Palmer amaranth populations in the no cover regime compared to the glyphosate-based programs. In conclusion, fall seeded cover crops appeared to significantly reduce early season emergence of Palmer amaranth from the soil seed bank.

Track: 2019 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

**Denotes primary author*

How Does Long-Term Crop Management Affect Soil Organic Matter in the Texas High Plains?

Authors: Heidi M. Waldrip, USDA ARS*; Robert C. Schwartz, USDA ARS; Zhongqi He, USDA ARS; Richard W. Todd, USDA ARS; R. Louis Baumhardt, USDA ARS; David B. Parker, USDA ARS; Mingchu Zhang, University of Alaska

Soil organic carbon (SOC) is an essential component of soil fertility due to its well-known effects on water retention, microbial growth/metabolism, and nutrient mineralization. Water-extractable organic matter (WEOM), aka labile soil C, can serve as an indicator of SOC stocks and overall soil fertility. In the semi-arid southern High Plains, dryland cropping systems to produce food and forage are essential agricultural due to the declining saturated thickness of Ogallala Aquifer for irrigation and limited precipitation. This study examined the long-term effects of different dryland winter wheat (Triticum aestivum) cropping systems [i.e., continuous wheat (CW) and wheat-fallow rotations (WF)], tillage methods (i.e., disk plow (DP), stubble-mulch tillage (ST), and delayed stubble-mulch tillage (DST)] on the quantity and quality of the WEOM. Ultraviolet-visible spectroscopy (UV-vis) and other analyses characterized WEOM from soils under long-term wheat systems, as compared to native rangeland. Soils were collected (0-300 mm depth) and evaluated to determine the potential sustainability of common dryland cropping systems in this semi-arid region. Results indicated that WEOM concentrations, particularly in surface soils, were rapidly depleted regardless of cropping system, compared to native rangeland, with reductions of up to 13% in 1977 and 60% in 2013. In addition, the forms of WEOM differed over time, where cropped soils from 2013 had higher concentrations of aromatic and phenolic compounds, and more lignin-like organic matter, likely due to input of wheat residue over time. In contrast, soils from 1977 and native rangeland (2013) showed increased levels of functional groups and humic character than cropped soils collected in 2013. This work suggested that typical conservation cropping systems may be insufficient to maintain or replenish soil WEOM after rangeland conversion to dryland cropping. However, the relatively low WEOM contents of native rangeland, along with adequate crop yields in the wheat systems over the years, brings into question the importance of this fraction of soil C to soil fertility in semi-arid regions. Ideally, conservation systems will improve WEOM/SOC stocks towards long-term sustainability, but this goal may be difficult to achieve in regions where high temperatures and limited rainfall/irrigation water tend to promote C mineralization and loss as carbon dioxide (CO2).

Track: 2019 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

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Hydrologic Restoration in the Lower Apalachicola River and Bay Contributing Area

Authors: Christy A. Crandall, Florida A&M University*; Victor Ibeanusi, Florida A&M University; Charles Jagoe, Florida A&M University

The Apalachicola National Forest (ANF), one of the largest National Forests in the Eastern United States, contributes the majority of freshwater discharge to the Apalachicola River, Estuary, and Bay (ARBE) in northwest Florida. The forest contains critical habitat for several federally listed Threatened and Endangered species, including pine forests, wet savannahs, tupelo swamps, and blackwater and alluvial rivers. A century of management practices that have included road construction and grading, bridge, ditch, and culvert installation, stream channelization, pine plantation and clear-cut forestry management, and the dredging, draining, and filling in of many swamps and wetlands, have decreased the area and function of many critical habitats and negatively altered the quality and quantity of freshwater discharge to the ARBE. This study proposes to develop a decision support tool to identify and prioritize areas within the ANF for hydrologic restoration. The tool will be used to prepare a Landscape Assessment plan with recommendations of structures to be altered or removed, i.e., culverts, ditches, roads, etc. and areas of native vegetation restoration to improve hydrologic and ecosystem function, sustainability, and services. The tool and lessons learn from the Landscape Assessment will be used to produce a Comprehensive Hydrologic Assessment and Restoration (CHAR) plan for forested areas throughout the ARBE contributing area. Existing geospatial data including: USDA Forest road, culvert, LiDAR elevation data, forest and ecologic zone maps, the National Hydrography Dataset, soil maps, and others will be used to develop the tool and plans. The tool will be improved as new technology and higher resolution data become available. The methodology will be scalable and allow scarce resources to be focused on providing the maximum hydrologic and ecosystem benefits for improving resilience, sustainability, and function in the ARBE contributing Area.

Track: 2019 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

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Multistate Financial Data for Use with the USDA Agricultural Conservation Planning Framework

Authors: Emma Bravard, Iowa State University*; John Tyndall, Iowa State University; Emily K. Zimmerman, Iowa State University

The overarching goal of this research is to develop and provide multi-state financial data regarding water quality best management practices (BMPs) for use with the USDA Agricultural Conservation Planning Framework (ACPF). The ACPF uses high-resolution elevation data and an ArcGIS toolbox to spatially identify areas within agricultural watersheds for implementing conservation practices. Incorporating financial data into this process will support watershed management by assessing the economic cost factors associated with conservation planning. This involves calculating direct long-term annualized costs for BMP installation and management in multiple Midwest states. Financial assessments are being done using discounted cash flow techniques. Practices to be accounted for are drainage management, grassed waterways, contour buffer strips/ prairie strips, water and sediment control basins, bioreactors, saturated buffers, nutrient removal wetlands, and multi-species and grassed riparian buffers. Land use opportunity costs of BMPs that require removing cropped/pastured land from production will be spatially determined according to state-relevant weighted-average crop productivity indices and land rent relationships. Financial data will be integrated into a land-use scenario evaluation process to assess the cost effectiveness of Nitrate-N reduction. The combination of this data will assist water quality stakeholders and technical service providers determine where conservation practices should be placed on the landscape to yield the most effective and lowest cost Nitrate-N reduction at a watershed scale. To illustrate how these financial analyses can be accomplished using the ACPF, a case study watershed in Indiana was selected for assessment. The Kirkpatrick Ditch watershed is a row crop dominated watershed located in northwestern Indiana, with a rich conservation history that has been actively studied as part of the Indiana Watershed Initiative since 2015.

Track: 2019 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

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Remote Sensing of Crop Residue Using the SWIR Bands of the Worldview-3 Satellite Platform

Authors: Dean Hively, US Geological Survey*

Agricultural crop residues preserve soil moisture, build soil organic carbon, and prevent erosion. Percent crop residue cover (%CRC) on a field surface reflects the outcome of tillage intensity and crop management practices. The 2014 launch of the WorldView-3 (WV3) satellite provided a space-borne platform for the collection of narrow band shortwave infrared (SWIR) reflectance imagery capable of measuring cellulose and lignin absorption features found between 2100 nm and 2300 nm, enabling robust measurement of %CRC. This poster reports the results of three manuscripts that used WV3 imagery to map %CRC. Satellite imagery was acquired over farmland on the Eastern Shore of Chesapeake Bay (Maryland, USA) on 14 May 2015, and eight different SWIR surface reflectance indices were applied to the calculation of residue cover. Calibration was provided by on-farm photographic sampling of %CRC at 174 locations within 10 agricultural fields, ranging from plow-till to continuous no-till management. Results demonstrated that spectrally narrow residue indices including the Shortwave Infrared Normalized Difference Residue Index (SINDRI) and the Lignin Cellulose Absorption Index (LCA) outperformed spectrally broad Landsat-compatible indices such as the Normalized Difference Tillage Index (NDTI). The model with the highest correlation (SINDRI, R2 = 0.94) was used to convert the SWIR imagery into a map of %CRC for non-vegetated agricultural fields throughout the imagery extent, describing the distribution of tillage intensity within the farm landscape. In the second manuscript, this SINDRI-derived map was used to calibrate used to calibrate analysis of Landsat imagery at a larger spatial resolution and extent. Overall accuracy for maps derived from Landsat 7 (ETM+) and Landsat 8 (OLI) were comparable at roughly 92% (+/- 10%). The approach, which employed boosted regression trees applied to a 12-band image stack of six tillage spectral indices and six individual Landsat bands, was shown to be adaptable to variable soil moisture conditions: under dry conditions (Landsat 7; May 14, 2015) %CRC was accurately predicted by SWIR indices while under wet conditions (Landsat 8; May 22, 2015) single band reflectance was more effective in describing variability in %CRC. In the third manuscript, eight center pivot irrigation fields were identified to be in mid-irrigation at time of WorldView-3 satellite imagery acquisition, allowing comparison of %CRC measurements under dry and wet conditions. These fields were subdivided into wedges within the dry and wet portions of each field, and the SWIR bands were extracted for each wedge. When reflectance in each band was moisture-adjusted based on wetness index difference between wet and dry wedges, the moisture corrections reduced the root mean square error of NDTI %CRC estimates from 22.7% to 4.7%, and SINDRI %CRC estimates from 6.0% to 2.2%. Overall, WorldView-3 satellite imagery provides spectrally narrow SWIR reflectance measurements that support robust mapping of %CRC, and the hybrid method combining WV3 and Landsat imagery sources shows promise for monitoring progress in the adoption of conservation tillage practices. Accuracy is improved if compensation can be made for soil moisture conditions.

Track: 2019 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

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Sediment Yield from Small Rangeland Plots under Rainfall and Run-On Conditions

Authors: Viktor Polyakov, USDA ARS*; Mark Nearing, USDA ARS; Jaffry Stone, USDA ARS

In order to predict and mitigate soil erosion it is necessary to understand the mechanism of detachment by raindrops and by shallow flow. The relative contribution of these drivers to the overall erosion process is not well understood and field experimental data is limited. The experiment was conducted using simulated rainfall on 56 small natural plots located on 7 arid sites in Arizona, USA. The goals of the study were (i) to compare raindrop driven and shallow flow driven erosion rates on arid range land, and (ii) assess the role of flow hydraulics, vegetation, and cover on attenuation of erosive impact of raindrops. A total of 520 measurements of steady state flow under two treatments (rainfall and run-on) were obtained. Flow discharge on the plots varied between 3 and 355 mm h^{-1} and unit sediment yield varied between 0.02 and 30 g m^{-2} min^{-1}. Sediment yield was best predicted by flow discharge for both rainfall and run-on treatments on all sites explaining 18% to 75% of its variability. There was statistically significant difference between two treatments. Rainfall regime generated 2 to 44 times more sediment than run-on at the same discharge rate. We found no strong evidence of raindrop impact affecting overland flow velocity. Among 19 variables related to surface conditions a weak correlation was found between sediment yield and canopy cover, structure, and surface litter. However, there was no single best cover predictor common for all ecological sites tested.

Track: 2019 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

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Sensitivity Analysis of Residual Soil Nitrogen at Regional Scale in China's Croplands from 1984 to 2014

Authors: Rong Jiang, Agriculture and Agri-Food Canada; Jingyi Yang Agriculture and Agri-Food Canada*; Craig Drury Agriculture and Agri-Food Canada; Wentian He Agriculture and Agri-Food Canada; Ping He, Chinese Academy of Agricultural Sciences; Wei Zhou, Chinese Academy of Agricultural Sciences

Estimating regional soil nitrogen (N) balance in croplands is critical to improve management practices, reduce environmental risks and develop sustainable agriculture. In this study, spatial and temporal variations of residual soil N were evaluated from 1984 to 2014 in China's croplands. Results indicated that the total residual soil N was in surplus and increased by 7.3 Tg N (130.4%) between 1984 and 2014, which was attributed to the increased N input of 29.3 Tg N, compared with the increased N output of 22.1 Tg N. Residual soil N continually increased from the 1980s (1984–1989) to the 2000s (2000–2009), and then decreased in the 2010s (2010–2014). Meanwhile, N use efficiency decreased gradually from the 1980s to the 2000s, but it increased in the 2010s. The N loss (N_2, N_2O, NO, NH_3, NO_3^- leaching and runoff) increased significantly from the 1980s to the 1990s, while the increasing trend gradually reduced from the 1990s to the 2010s. The spatial-temporal distribution of the residual soil N balance at the regional scale showed that the total highest and lowest soil N balance was in the middle and lower reaches of Yangtze River (2.1–3.7 Tg N) and northeast of China (0.3–1.0 Tg N), but the highest and lowest N balance per cropping area was in the southeast (93.4–129.7 kg N ha^{-1}) and northeast (19.6–43.9 kg N ha^{-1}) regions respectively from the 1980s to the 2010s. The residual soil N decreased for all regions from the 2000s to the 2010s, excluding the southeast and southwest of China due to higher increased rate of N input than the lower increased rate of N output. Recently, a user friendly residual soil N balance model was developed using Intel Fortran so that the scenario and sensitivity analysis tasks could be made to assess the impacts of the residual soil N by varying input parameters and the results will be presented and illustrated.

Track: 2019 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

**Denotes primary author*

Soils2026 and Digital Soil Mapping: Foundation for the Future of Soils Information and Conservation Activities

Authors: Jim Thompson, West Virginia University*; Suzann Kienast-Brown, USDA NRCS; Tom D'Avello, USDA NRCS

Soils are our most critical natural resource. However, urgent natural resource issues are forcing us to seek answers to questions using incomplete and/or inappropriate information. The USDA-NRCS, Soil and Plant Science Division has launched Soils2026, an ambitious initiative to provide an inventory of soils and provisional ecological sites for all areas of the United States by 2026. Soils2026 aims to provide basic soil and ecological site information useful to natural resource professionals. This effort will employ digital soil mapping to produce the next generation of soil information products in a flexible raster-based format for rapid interpretation of soil properties and precision conservation planning across the United States. The Digital Soil Mapping Focus Team, comprised of collaborating members from the National Cooperative Soil Survey, was formed to support Soils2026. The team will be applying the latest digital soil mapping methods to produce nationwide, 30-m resolution, continuous soil property predictions for 12 key soil properties at six depths and estimates of uncertainty. The option to expand properties or add class predictions to support precision conservation or other user needs exists. High-resolution, flexible, raster-based soils information will allow for rapid assessment and decision making for conservation and land management needs at local and national scales. Fundamental pedology and communication of soil knowledge will be the primary focus of this effort, yielding a framework for delivery of nationwide seamless raster-based soils data annually. This framework will foster an environment of continuous improvement and support a complete, consistent, correct, comprehensive, and current soils inventory of the United States.

Track: 2019 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

**Denotes primary author*

Using Portable X-Ray Fluorescence (PXRF) for Rapid Trace Metal Analysis

Authors: Richard Shaw, USDA NRCS; Edwin Muniz, USDA NRCS; Olga Vargas, USDA NRCS; Amy Norton Langner, USDA NRCS*

Urban agriculture is increasing, and soils affected by urban and industrial processes are more likely to be contaminated with trace metals. Trace metals can have adverse effects on humans, so screening, outreach, and education are needed for those farming in soils where trace metal contamination is more probable. Portable X-Ray Fluorescence (pXRF) allows for in situ analysis of 26 elements for soil samples, including lead, arsenic, and cadmium. Instead of spending money and time in a lab with acid digestions, soil can be analyzed in a couple of minutes with little to no preparation. The United States Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS) in New York and New Jersey has collaborated with the Agency for Toxic Substances and Disease Registry (ATSDR), New York State Department of Health, US EPA, Brooklyn College, State University of New York (SUNY) College of Environmental Science and Forestry, Rutgers University, College of Staten Island, and Cornell University to screen soils for trace metals using the pXRF. USDA-NRCS has screened soils associated with college and university research projects, over 150 community gardens, outreach for under-served communities and non-traditional agriculture, technical soil services for USDA-NRCS, soil health testing in agricultural fields, and soil survey work. Work in New Jersey led to Urban Technical Note No. 4 which provides best management practices for farming in soils contaminated with trace metals. Collaboration with the College of Staten Island resulted in three master's projects related to atmospheric deposition rates of trace metals in woodlands and mapping of serpentinitic soils. Use of the pXRF at ATSDR soilSHOPs increased community member awareness of soil trace metal content where they live and grow food. Overall, use of the pXRF allowed NRCS to rapidly assess trace metal content resulting in educating various stakeholders about trace metals in soil.

Track: 2019 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

**Denotes primary author*

Erosion and Sediment Control Planning Approach in Pennsylvania

Authors: Frank X. Schneider, State Conservation Commission*

Pennsylvania has a large and diverse agricultural sector with more than an estimated 7,704,444 acres in agricultural production. In PA, Conservation Planning (CP) under USDA NRCS has lead the way in developing and implementing an erosion and sediment control (E&S) planning standard for agriculture. The simplest conservation plan in Pennsylvania is the record of decisions, made by the planner and operator, to control sedimentation and accelerated erosion from cropland. PA enacted the Pennsylvania Clean Streams Law (CSL). The E&S requirements are covered under the Pennsylvania Department of Environmental Protections (DEP) Chapter 102 regulations. The purpose of the regulations requires persons proposing or conducting earth disturbance activities to develop, implement and maintain BMPs to minimize the potential for accelerated erosion and sedimentation and to manage post construction stormwater. In 2010, DEP revised the regulations to provide more clarity on the requirements for agriculture. The current regulations require an Agricultural E&S Plan or an NRCS Conservation Plan, meeting at a minimum the provisions of the state regulations, for any agricultural operation that plows or tills (including no-till) or has an earthen animal heavy use area (AHUA)equal to or greater than 5,000 square feet. The basic planning elements of an E&S Plan required under the DEP regulations include: plowed or tilled lands which must be managed to hold soil erosion to a nationally defined tolerable (T) level, concentrated flow erosion must be addressed, AHUA which must be managed to minimize accelerated erosion and sedimentation from these areas, and near stream areas where additional protections to minimize accelerated erosion from these areas are required. Seeing the need for increased planning, Pa enlists the assistance of certified persons and TSPs to write E&s and conservation plans that are to be implemented and kept on the farm for review and approval, if needed.

Subject: Engaging the Private Sector in Conservation

**Denotes primary author*

Impact of Ecosystem Services Management Incentives on Farmer Adoption of Conservation Practices

Authors: Lisa E Akinyemi, Tarleton State University*; Barbara Bellows, Texas Institutes for Applied Environmental Research; Jim Muir, Texas A&M University's Agrilife Extension; Edward Osei, Tarleton State University; Benjamin Turner, Texas A&M University-Kingsville

Conservation agriculture systems (CAS) have the potential to provide ecosystem services that mitigate critical environmental concerns of global climate change, eutrophication, and aquifer depletion. Effective CAS enhance ecosystem services by strategically combining multiple best management practices. While the Natural Resources Conservation Service provides land-owners with cost-share assistance, supportive government funding is limited. Alternative CAS funding solutions are being implemented and developed. Water quality trading programs typically provide a single marketplace for total maximum daily load (TMDL) overages to be remedied in three ways: credit purchases from TMDL conservers, improvements to the overage location, or combinations. CAS promoting carbon markets include state-regulated cap-and-trades and voluntary offsets. An innovative public-sector based program is piloted by the Nobel Foundation with agriculture producers in mind. Current barriers to ecosystem service markets (ESM), such as verification method expenses and the low value of ESM credits, need to be addressed to allow ESM to serve as an effective CAS adoption incentive. Increased credit supply from CAS implementers would simultaneously increase the demand for payments, which has potential to increase the value of ESM credits. A survey was conducted with current Texas CAS producers to understand factors affecting their initial and continued CAS implementation and the potential impact of ESM to further CAS adoption. An economic analysis was developed using Farm Economic Model. Spearman Rho correlations were analyzed in R Studio to find causal relationships from dependent and independent variables. Additional research will use the survey data to inductively develop a system dynamic analysis using Vensim Pro software. This research will help agricultural producers and their support personnel more effectively implement ESM programs to enhance CAS adoption and ecosystem services.

Subject: Engaging the Private Sector in Conservation

**Denotes primary author*

Nutrient (Manure) Management Planning Approach in Pennsylvania

Authors: Frank X. Schneider, State Conservation Commission*

Pennsylvania has a large and diverse animal sector with an estimated 59,000 farms with 40,000 of those farms containing livestock. Manure and nutrients are regulated under two different but similar programs in the Pennsylvania. The State Conservation Commission (SCC), Department of Environmental Protection (DEP), and the Natural Resources Conservation Service (NRCS) all have separate oversight responsibilities for ensuring proper nutrient (manure) management. It has been key to the successful implementation of these related programs that the three agencies have worked together to develop a unified approach to manure/nutrient planning. Pennsylvania enacted the Clean Streams Law (CSL). Under the CSL, the Manure Management Manual, outlines the planning and implementation criteria for a farm specific Manure Management Plan (MMP), which is to be followed on every farming operation that generates or utilizes manure unless a more detailed form of planning in utilized. Pennsylvania also enacted the Nutrient Management Act (NMA). The NMA required more detailed Nutrient Management Plans (NMPs) for high density animal operations (Concentrated Animal Operations (CAOs)). Concentrated Animal Feeding Operations (CAFOs), as defined under DEP regulations, are required to meet the permitting obligations outlined under the Federal NPDES program, The DEP has enacted the NMP template to meet the NPDES nutrient management planning requirement. NRCS has specific required criteria for NMP under Conservation Practice Standard 590 and Comprehensive Nutrient Management Plans (CNMP). Pennsylvania NRCS has adopted the NMP format with minor additions, to meeting the standards. All state and federal agencies that have a vested interest in nutrient (manure) management have worked together to provide a uniform template for Nutrient Management Plans for COAs, CAFOs, and NRCS participants. Only MMPs are developed in a different format. Pa enlists the assistance of certified public persons to write and review plans.

Subject: Engaging the Private Sector in Conservation

**Denotes primary author*

Engaging Youth in Manure Management Education and Compliance

Authors: Jennifer Fetter, Penn State Extension*

A 2016 survey of youth raising animals in Pennsylvania's 4-H and FFA programs revealed a lack of proper manure management plans in place. In particular, animals being raised on smaller, hobby, and equine farms (and not as part of larger operations) were more likely to have no plans or have plans that were uncertain to meet state requirements. As a result, Penn State Extension developed a youth-oriented curriculum full of hands-on activities that make manure management fun and easier to understand. The ultimate goal of the curriculum is to lead youth in these programs to work with their families and get their plans written. This ongoing project has already trained over 136 educators across the state. Since just the beginning of 2019, over 200 youth have already been reached using the curriculum. Immediate impacts have been recorded demonstrating increased knowledge and intent to implement lessons learned, as well as working new manure management plans where applicable. Complete data should be available at the time of presentation. As Pennsylvania continues to grapple with meeting TMDL goals for the Chesapeake Bay, they have directly identified that all farms with animals must be in compliance with manure management plan regulations (PA Phase III WIP - Draft.) This curriculum tool and approach has the potential to be a great opportunity for reaching less traditional audiences and could increase the rate of bringing all farms into compliance.

Subject: 2019 General Conference Theme

Track: Outreach, Education, and Community Engagement

**Denotes primary author*

Fill the Pantry with Iowa SWCS

Authors: Heidi M Ackerman, Iowa Chapter SWCS*; Hanna Bates, Iowa Water Center/Iowa State University

In the spring of 2019, the Iowa Chapter of the Soil and Water Conservation Society (SWCS) hosted a food drive campaign that produced a series of five events across the State of Iowa. Inspired by the effects of recent economic turmoil and a frigid winter, chapter leaders partnered with several organizations to address local hunger. Efforts behind this project were focused on expanding the perspective of Iowa SWCS members to see the full scale of food and environmental systems, as well as to address unmet needs in local communities. Success was measured by donation item counts, new SWCS members enrolled, and self-reported positive experiences by attendees in a follow-up survey. Ultimately, this poster examines the value that conservation-oriented clubs give to its members and to the public through civic engagement in modern society.

Subject: 2019 General Conference Theme

Track: Outreach, Education, and Community Engagement

**Denotes primary author*

Pollinator Habitat Establishment Methods

Authors: Robert J Glennon, Virginia Tech*

A critical conservation need in the eastern United States is the knowledge of how to establish pollinator habitat with native harasses and wildflowers. Very few landowners establish native grasses and wildflowers for any reason and few conservation professionals or vegetation contractors have experience establishing native grasses and wildflowers. Specialized drills designed to sow native grass seed are scarce. The author is a retired Plant Materials Center Manager and Specialist with the USDA, Natural Resources Conservation Service who is working as a contract biologist in southeastern Virginia and assists landowners to establish habitat with native plants. The poster presents a variety of establishment methods from drills with special boxes for small seeds and chaffy seeds to large drop seeders to small drop seeders to hand planting containerized plants. It also features the details of calibration and mixing seed with pelletized lime to make a homogenous seed mixture that will flow through a seeder. The poster contains different kinds of seedbed packing implements from cultipackers to large rollers to hand-pulled rollers. Good stands of pollinator habitat have been established with all of the equipment and strategies featured.

Subject: 2019 General Conference Theme

Track: Outreach, Education, and Community Engagement

**Denotes primary author*

The Black Urban Gardeners and Farmers of Pittsburgh Co-Op (BUGFPC): Challenges and Progresses

Authors: Kefeni Kejela, USDA NRCS*; Raqueeb Bay, BUGFPC; Dan Dostie, USDA NRCS

The Black Urban Gardeners and Farmers of Pittsburgh Co-op (BUGFPC) was created out of the need to unite black urban agriculturalist in the Pittsburgh area for support and to dismantle the systemic racism that infiltrates black communities. As a grassroots organization it brings together a collective group of black gardeners and farmers to solve challenges the face as urban growers in seeking sustainability and food sovereignty. Over 20 members work as a collective cooperative with over 50 years of experience in farming and gardening as well as in social activism, community engagement, land conservation and acquisition and entrepreneurship. The farm addresses the dire food desert problem in many majority-black communities by making fresh food available to people who have limited transportation options. Greens, peppers, tomatoes, okra and fruits are their main products. With help from the local USDA/NRCS office they installed a high tunnel. The BUGFPC has the support of the residents of Monticello Street, where the farm, as well as many of the Homewood community residents share their gifts and talents for the advancement of community. BUGFPC has partnered with the Phipps Conservatory, Grow Pittsburgh, PaWgn, the Penn State Cooperative Extension's Pittsburgh Food Policy Council, Landslide Community Farm, the Homewood YMCA, and many other groups in several majority-black neighborhoods. Together they bring fresh food, fresh knowledge, and fresh leadership around food and spread it around the neighborhoods to promote economic equality, and urban sustainability.

Subject: 2019 General Conference Theme

Track: Outreach, Education, and Community Engagement

**Denotes primary author*

A Comparison between Fatty Acid Methyl Ester Profiling Methods (PLFA and EL-FAME) as Soil Health Indicators for Microbial Community Composition

Authors: Chenhui Li, University of Missouri*; Amanda Cano, USDA ARS; Veronica Acosta-Martinez, USDA ARS; Kristen Veum, USDA ARS; Jennifer Moore-Kucera, American Farmland Trust; Meagan Schipanski, Colorado State University

Fatty acid methyl ester (FAME) profiling for characterizing microbial community composition (MCC) typically is conducted via phospholipid fatty acid (PLFA) or ester-linked fatty acid methyl ester (EL-FAME) methods. This research's aim was not to identify one prevailing method, but to quantify the similarities and advantages of each method to allow for informed method selection. Specifically, this study compared PLFA and EL-FAME methods for detecting and interpreting profiles of MCC using 185 soil samples from 15 states representing a wide range of soil properties, geographical regions, and management practices. Descriptive and multivariate analyses were used to investigate: 1) differences in biomarker absolute and relative abundances between two methods; and 2) the agreement on discriminating soil samples based on FAME profiles. The Spearman correlation and Mantel tests showed the absolute abundance of microbial groups (e.g., AMF, GM+, GM-, and Actinobacteria) and overall FAME profile positively correlated between methods. Principal coordinate analysis showed a common set of fatty acids were highly influential in the MCC and the two methods were comparable to discriminate samples along ordination 1. Also, measured soil properties (SOM, active C, pH, and clay%) had a strong relationship across microbial groups in both methods. However, distance-based redundancy analysis (db-RDA) showed PLFA was more responsive to changes in soil properties, especially pH and SOM, than EL-FAME. Additionally, comparisons were made for required time and supplies cost. The time and consumable cost of PLFA (2.5d/96 samples and $5.02/sample) could be 2-fold of EL-FAME (1d/96 samples and $2.48/sample) without considering potential reusable supplies. Overall, although being less complex and cost-effective, EL-FAME may produce consistent results compared with PLFA, but PLFA has the potential to discriminate soil samples better than EL-FAME due to its sensitivity to changes in soil properties.

Subject: 2019 General Conference Theme

Track: Soil Health Resources, Indicators, Assessment, and Management

**Denotes primary author*

An Accuracy Assessment of Total Station Scanning and Close-Range Photogrammetry Methods on Measuring Water-Induced Channels

Authors: Fangzhou Zheng, Agriculture and Agri-Food Canada*; Sheng Li, Agriculture and Agri-Food Canada; Rene Wackrow, Loughborough University; Fanrui Meng, University of New Brunswick; David Lobb, University of Manitoba

Water-induced channel is a major form of water erosion in cultivated fields, causing soil loss and crop yield reduction. Traditionally, rulers or measuring tapes were used to measure geometry and volume of water-induced channels, estimating erosion rate. However, these methods are time and labour consuming, and can cause soil surface disturbance. To overcome these limitations, remote sensing technologies, such as Total Station Scanning (TSS) and Close-Range Photogrammetry (CRP), have been introduced. However, there is a lack of information on how the channel factors will affect the accuracy and how practical are both methods in cultivated fields. In this study, an artificial surface approximately 2.4 m x 2.4 m in size with eight different artificial channels was built for mimicking the channel types observed in the field, such as V-shape channels and U-shape channels of different sizes and orientations. Three parameters: the maximum channel width, maximum channel depth, and cross-sectional area were used to characterize the geometry of these channels at 10 different locations. These parameters were first measured manually and then were obtained using the TSS with different station heights and the CRP methods with different shooting angles and image overlap rates. Besides, the applicability of both methods was tested by comparing equipment, time consumptions and detection area. The results suggested that TSS method and CRP method with high shooting angle and overlap rate were able to provide the estimations at cm or cm2 accuracy level. Both of them were accurate enough to estimate the volume of a water-induced channel in fields. However, it was not accurate enough to estimate the sheet erosion. For the applicability aspect, although the TSS method collected the data much slower than the CRP method, it could detect a much larger area than the CRP.

Subject: 2019 General Conference Theme

Track: Soil Health Resources, Indicators, Assessment, and Management

**Denotes primary author*

How Do Crop Rotation and Poultry Litter Inputs Impact Soil Biogeochemistry and Biology?

Authors: Michel A Cavigelli, USDA ARS*

The Beltsville Farming Systems Project, a long-term cropping systems experiment, was established in Maryland in 1996 to evaluate the sustainability of five cropping systems, including three organic systems that differ in crop rotation complexity. A two-year vetch/corn-rye/soybean rotation consists of summer annual cash crops and winter annual cover crops. A three-year vetch/corn-rye/soybean-wheat rotation adds a winter annual cash crop and a six-year corn-rye/soybean-wheat-alfalfa-alfalfa-alfalfa rotation adds a perennial forage crop. Mean poultry litter (PL) inputs, which were applied during the corn and wheat phases of the rotations, varied by system in the order: Org3>Org2>Org6. While total soil carbon and nitrogen did not differ among treatments at various soil depths, various soil carbon and nitrogen pools varied, reflecting both differences in crop rotational diversity and PL input variability. Further impacts of these cropping systems on soil biogeochemistry and biology will be discussed.

Subject: 2019 General Conference Theme

Track: Soil Health Resources, Indicators, Assessment, and Management

**Denotes primary author*

Inherent Soil Property Characterization for Defining Dynamic Soil Property Potential Ranges

Authors: Daniel F. Wallace, USDA NRCS*; John Paul Schmidt, University of Georgia

Soil health assessment is an urgent topic necessary to characterize soil change processes at management relevant time scales. One daunting hurdle in such assessment is synthesizing the results by inherent soil type. Multiplying the 20,000 or so soil series used in mapping the United States by the myriad of vegetative communities, crops, cultivation types, and management philosophies present on those soils shows the immense scope involved. This project attempts to characterize the ranges of inherent and dynamic soil properties (DSPs) in an example landscape of sufficient size and diversity to model the problem. The product of the analysis is groupings of soil map unit components where property differences between groups would significantly affect productivity and composition of natural and managed vegetative communities. These groupings are then used to assess the completeness of land use by inherent soil type DSP research and inventory within the area to visualize the potential ranges of DSPs in each land use by inherent soil type category. Such analysis of properties, as opposed to interpretations, yields a mechanistic understanding important to improving recommendations for management and conservation. The example landscape is a subset of longleaf pine (*Pinus palustris*) supporting areas of the southeast where a DSP inventory project using the Soil Change Guide procedures was accomplished. The synthesis is done in R for transparency and repeatability. Additionally, public portals of the National Cooperative Soil Survey are used to increase the availability of the results beyond the National Soil Information System (NASIS) using community. Achieving reliable inventory of DSP ranges in land use by soil type categories could augment soil health conservation planning, conservation practice effects assessment, soil ecosystem service research, cooperative soil survey and, ultimately, land management.

Subject: 2019 General Conference Theme

Track: Soil Health Resources, Indicators, Assessment, and Management

**Denotes primary author*

P-Nitrophenol Phosphate Enzyme Activity across Varying Management in Palouse Soils

Authors: Katherine Naasko, Washington State University*; Haiying Tao, Washington State University; Bill Pan, Washington State University; Isaac Madsen, Washington State University; David Huggins, Washington State University/USDA ARS

The Palouse is recognized for its vast skies and rolling hills of wheat, with grassland patches, but what really drives its' unique beauty and productivity is the soils underneath. This agriculturally-driven eco-region is spread across eastern Washington, northwestern Idaho and northeastern Oregon. This study is a part of a NRCS-funded project evaluating effects of agricultural management on soil health, with a defined set of in-field and laboratory methodologies. Fall soil sampling was across a defined precipitation gradient and included a grassland site for native reference and recently harvested wheat fields, practicing either conventional tillage or no-till management methods. This experiment focused on soil enzymes, a biological indicator of soil health. Enzymes are essential to the phosphorus, carbon, nitrogen and sulfur cycles, which control availability of macronutrients for uptake by plant roots and sustenance for other living soil organisms. Enzymes in the soil are responsible for the rate at which decomposition occurs and also stimulate microbial activity. Also included are some standard analyses that show the biogeochemical productivity and health of these Palouse soils, such as organic matter, soil pH, moisture content, and relative carbon and nitrogen present across varying management.

Subject: 2019 General Conference Theme

Track: Soil Health Resources, Indicators, Assessment, and Management

**Denotes primary author*

Spherical Magnetic Micro Particles as Indicators of Soil Erosion and Health

Authors: Alexander N. Gennadiyev, Moscow State University Faculty of Geography*; Andrey Zhidkin, Moscow State University Faculty of Geography; Roman Kovach, Moscow State University Faculty of Geography

The method of spherical magnetic micro particles (SMMP) was applied by the authors for a quantitative assessment of soil erosion and ecological status of soils in the United States (Olson et. al. 2002; Gennadiyev et. al. 2004) and Russia (Gennadiyev et. al., 2006; Zhidkin et.al., 2010). SMMPs are products of pyrolytic processes related to coal combustion. Active deposition of technogenic SMMPs onto the soil surface began with the appearance of steam engines about 150 years ago. Magnetic micro spherules are relatively stable and inert in the soil mass. Their sizes range from several fractions of a micrometer to hundreds of micrometers. The deposition of SMMPs onto the soil surface from the atmosphere within a given area has a relatively even character. Therefore, changes in concentrations of SMMPs in the soil cover result from the erosion of the soil material. It is supposed that the mass of SMMPs redistributed under the impact of erosion is proportional to the mass of redistributed soil material. The equation is used to calculate the intensity of soil erosion (or deposition). With the help of the SMMP method quantitative parameters of soil loss and soil health degradation for the slopes of different shapes and aspects were found. The interzonal trend of the change of slope exposure effect on soil erosion was quantitatively characterized. The segments of slopes distinguished by acceleration or deceleration of soil erosion and profile transformation were described. The relationships between the intensity of erosion and ecological state of the soils were characterized, and the effect of erosion control measures (rows of trees planted along contour lines, and special water catching ditches dug within these shelterbelts) on the rates of soil erosion and degradation was estimated. In order to assess the connections between redistribution of toxic technogenic pollutants (polycyclic aromatic hydrocarbons) in soils cover and soil erosion the SMMP method was used.

Subject: 2019 General Conference Theme

Track: Soil Health Resources, Indicators, Assessment, and Management

**Denotes primary author*

Poster Number 35

Correlating Water Quality Data to Assess Risk to Human Health

Authors: Justine M. Chester, Arkansas State University*

Pollution of streams and rivers in the United States is damaging the environment and risking the health of humans in recreational areas. Fecal coliform bacteria are an indicator bacteria for dangerous diseases such as *Escherichia coli*, hepatitis, and salmonella. The most common way to contract these diseases via polluted water is by oral ingestion or through breaks in the skin. Assessing and correlating water quality for fecal coliform bacteria can pinpoint locations where humans are at risk for contracting harmful diseases. Northern Arkansas is a major hotspot for recreational fishing, which can be a risk to health if fishing in polluted waters. Fifteen tributary sites of the White River in Arkansas were tested twice a month to assess water quality parameters such as temperature, pH, dissolved oxygen, conductivity, turbidity, total suspended solids, total nitrogen, total phosphorus, and fecal coliform bacteria. Three sites where fishing is common were also chosen for a study to swab fish for fecal coliform bacteria on the skin of the fish. Statistical analyses were performed to determine the correlation between water quality parameters and fecal coliform bacteria. Geographic analyses were also performed to determine if land use was correlated to the aqueous fecal coliform counts in the stream.

Subject: 2019 General Conference Theme

Track: Water Resource Assessment and Management

**Denotes primary author*

Modeling the Responses of Agricultural Productivity to Water Availability in Haitian Watershed and Irrigation Systems

Authors: Redjino Mompremier, University of Florida*; Young Gu Her, University of Florida; Gerrit Hoogenboom, University of Florida; Rafael Munoz-Carpena, University of Florida; Kati Migliaccio, University of Florida; Zachary Brym, University of Florida; Raphael W. Colbert, Escuela Agrícola Panamericana-Zamorano; Wesly Jeune, University of Florida

Agricultural system productivity is dependent on natural resources available as well as the efficiency of management practices applied. Thus, agricultural productivity improvement requires an integrated understanding of how a cropping system is controlled by associated natural systems. This study investigated the responses of dry bean yields to water availability in Haitian watershed and irrigation systems to provide information necessary for agricultural management planning. The watershed system, the source of water for downstream fields, has been monitored to understand the irrigation water availability and its temporal variations. The dry bean production systems were mathematically represented using a crop growth simulation model, Decision Support System for Agrotechnology Transfer (DSSAT). The model parameters were calibrated to dry bean yield observations, and the calibrated model was used to investigate the dry bean yield responses to different water availability scenarios represented by moving crop growing seasons. Fifteen irrigation scenarios were developed based on management practices implemented at the fields and then fed to the calibrated DSSAT model to see the yield responses to the scenarios over 35 years (1983 to 2018). The modeling experiment results showed that optimal planting and water application timing could increase dry bean yield substantially (1,353 kg ha^{-1}) in the study areas, compared to that achieved using the current practice (923 kg ha^{-1}). The dry bean yields estimated from the scenarios were significantly different from that of the control at a significance level of 0.05, and the yield increased when the dry bean was planted earlier (October to February), indicating the current cropping system is limited by water availability rather than the air temperature and solar radiation. The results demonstrated how an integrated understanding of upstream watershed and downstream agricultural systems can help improve agricultural productivity.

Subject: 2019 General Conference Theme

Track: Water Resource Assessment and Management

**Denotes primary author*

P3-Building for Resiliency, Not Recovery

Authors: Pamela P. Billingsley, USDA NRCS*

Once threatened, the deep, confined Sparta aquifer's groundwater levels in Union County, Arkansas have risen dramatically since 1997. One well's water level has risen 99.8' since 2004 when the Union County Water Conservation Board--created June 1999 to conserve and protect the Sparta, then the county's only source of drinking and industrial water--began delivering an alternative surface source from the Ouachita River to three major industries that had relied solely on the aquifer: an oil refinery, a brominated products manufacturer, and a fertilizer manufacturer. In 1997, South Arkansas groundwater levels were declining rapidly—as much as 7' per year in Union County. In response Union County formed an expansive P3 coalition that began addressing the declining aquifer as its economic development priority. This led to $65 million of new infrastructure to provide lightly treated river water to the three industries--the county's largest groundwater users. The Natural Resources Conservation Service joined the coalition by providing the Conservation District a truck to regularly measure groundwater levels in 130+ Sparta wells within a 60-mile radius of the deepest cone of depression. At the time, Union County had little sound science on groundwater levels. Providing "wheels on the ground" to monitor and record in five contiguous South Arkansas counties the Sparta's response to Union County's conservation efforts is in keeping with the NRCS practice of helping producers by improving water health and ensuring long-term sustainability. For example, a 2018 NRCS project helped two farmers drill Sparta wells—one each in Union and Ouachita Counties. Without Union County's conservation efforts, the farmers would have drilled deeper to reach water, which may have been salty. Union County's Sparta recovery initiative exemplifies "Working together to foster the science and art of natural resource conservation" by protecting the aquifer, a sustainable source of fresh water.

Subject: 2019 General Conference Theme

Track: Water Resource Assessment and Management

**Denotes primary author*

Return of the Tide: Herring River Restoration Project (Wellfleet and Truro, Massachusetts)

Authors: Christine A. Odiaga, Friends of Herring River*

In its historic natural state, the Herring River (along with its floodplain, tributary streams and associated estuarine habitats) supported a vibrant ecosystem and the largest diadromous fish run on outer Cape Cod. Construction of a dike at the mouth of the river in 1909 and subsequent stream channelization and ditching for mosquito control eliminated tidal flow to the salt marsh and drained the wetlands. Prolonged tidal restriction has resulted in nearly complete loss of native tidal wetland habitat, degraded water quality, impediments to fish passage, loss of harvestable shellfish habitat, reduced coastal resiliency, increased non-native & invasive species, methane emissions and loss of carbon storage. Today, Herring River is one of the largest tidally-restricted estuaries in northeastern US. Fortunately, the damaging effects of disconnecting the river from the marine environment can be reversed over time. Following several decades of hydrologic and ecological research, an incremental restoration of tidal exchange is proposed for the Herring River estuary to remediate degraded conditions and restore native self-sustaining coastal habitats and estuarine ecosystems on a large portion of the former 1,100-acre estuary. The Herring River Restoration Project will be adaptively managed through regular monitoring and assessment of system response to stepwise increases in tidal flow through the redesigned dike and the modification or removal of other man-made restrictions. Key components include mitigation of inundation impacts, vegetation and marsh management, and carefully-calibrated incremental restoration of tidal flow that will use a structured decision-making computer tool developed for the Project to factor in dozens of ecological and social considerations. The Project represents an unmatched opportunity to restore the environment of Cape Cod and revive the ecological and economic benefits provided by a healthy natural coastal river and tidal wetland system.

Subject: 2019 General Conference Theme

Track: Water Resource Assessment and Management

**Denotes primary author*

Modern Ag: Local Impact Project

Authors: Sean Arians, Bayer Crop Science*

Mitigating agriculture's impact on greenhouse gas emissions and water quality is a significant undertaking that no one organization can do alone. Given agriculture contributes 24% of the greenhouse gas emissions, it is important for the industry to take the lead in reducing its contribution. As part of an integrated system, soil health and nutrient management play key roles in reducing the agriculture footprint. That's why Bayer Crop Science, farmers, and industry leaders have partnered to work towards a solution to address this issue. It is our goal the collaboration will drive the adoption of innovative, carbon smart agriculture practices to reduce the carbon footprint while improving soil health and water quality. The partnerships represented as part of the Modern Ag Experience farm are Bill and Tim Couser of Couser Cattle Company and Greenfield Farms respectively. The Story County (Iowa) Soil and Water Conservation District, Environmental Defense Fund, Pheasants Forever, Iowa Soybean Association and Bayer Crop Science. All partners share the vision that on-farm demonstrations will provide an opportunity to educate and promote modern agriculture and sustainable agriculture practices. The focus will be on an integrated systems approach to improved soil health through reduced tillage, cover crops, and crop rotation. Continued focus on nutrient management practices as part of the Nutrient Loss Reduction Strategy, to improve water quality, conservation, and efficiency on the farm. This location is particularly important because it is in a key watershed that supplies Des Moines Iowa with drinking water. The site will continue to host society and industry leaders and groups in 2019 as the implementation of new projects and practices expand. Evaluating and measuring change will drive our project forward to share the learnings with visitors at the Modern Ag Experience Farm.

Subject: 2019 General Conference Theme

Track: Water Resource Assessment and Management

**Denotes primary author*

The Effect of Edge-of-Field Management Practices on Transporting E. Coli in Subsurface Drainage Systems

Authors: Sara Mardaninejadjouneghani, South Dakota State University*; Rachel McDaniel, South Dakota State University; Bruce Bleakley, South Dakota State University

Denitrifying bioreactors and phosphorous adsorption beds are among edge-of-field management practices filled with carbon source media (usually woodchips) and phosphorous adsorption media (such as steel shaving and biochar), respectively to reduce the amount of nitrate and phosphorous transport in subsurface drainage systems (SDSs). Although these systems have been found to be effective at removing nutrients from tile drainage water, not much is known regarding the fate of microbes by these systems. Therefore, the main objective of this study was to quantify the potential effects of these management practices on transporting microbes into the environment by assessing changes in the concentrations of fecal indicator bacteria (e.g., *E. coli*). To reach this objective, a laboratory study was conducted by using four laboratory scale bioreactors. The reactors were labeled with 1, 2, 3, & 4 and filled with woodchips; half woodchips, half steel shavings; steel shavings; and a mixture of woodchips (75%) and biochar (25%), respectively receiving the same synthetic water by four separate peristaltic pumps in a constant rate (down-flow), allowing a hydraulic retention time equal to 6 hours. The synthetic water was continuously passed through the reactors for 60 days and water samples were taken 10 times over this course of experiment. All water samples were collected from both the inlets and outlets on the sampling days and processed for *E. coli* concentrations. The results indicated a reduction of *E. coli* in all reactors under different media. *E. coli* removal were 73%, 72%, 63%, and 44% for reactors 4, 2, 1, and 3, respectively, providing some evidence for the broader capability of different media (woodchips, steel shaving, & biochar) to improve water quality from SDSs.

Subject: 2019 General Conference Theme

Track: Water Resource Assessment and Management

**Denotes primary author*

Poster Number 41

Common Ground Common Water: Film as a Tool for Shared Understanding of Water Resource Protection

Authors: Sarah Church, Purdue University*

Urban residents are generally aware of the impact of stormwater runoff on water quality. Farmers understand that agricultural practices impact water quality. However, research suggests that each group tends to place some amount of blame for water degradation on other users and sectors. There is an apparent disconnect between efforts of cities and efforts of the agricultural community that may contribute to a lack of understanding of each sector's influence on water quality and watershed health. This disconnect may also contribute to a lack of motivation for individual action toward water quality improvement. Such a "blame game" is counter to sustainable food production, and watershed health and restoration efforts. This poster describes the development and implementation of a short film that highlights urban and agricultural best management practices in Northwest Indiana. Survey evaluation data are presented that indicate the film is an effective learning tool, showing statistically significant increases in participants' understanding of stakeholder groups' efforts to protect water quality (farmers, municipalities, homeowners, your own). In addition, elements of the film that may contribute to learning are described (e.g., diversity of voices, local examples, testimonials, proactive voice). Finally, the film is discussed as a means to begin a conversation around watershed health and watershed planning through an example in the Kankakee River Basin in Indiana. This project will be of interest to water and conservation planners as they contemplate developing watershed planning processes and methods of building community around watershed health.

Subject: Watershed Conservation to Unify Urban and Rural Communities

**Denotes primary author*

Poster Number 42

Patterns in Nutrient Transport and Load from Agricultural and Urban Sources: Implications for Load Reduction Goals and Point to Nonpoint Source Nutrient Trading

Authors: William G. Crumpton, Iowa State University*; Greg Stenback, Iowa State University

The Iowa Nutrient Reduction Strategy calls for a 45% reduction in annual nitrogen and phosphorous exports to downstream waters based on a combination of point source and non-point source reductions. We present here an analysis of the temporal and spatial patterns of nutrient loads in representative Iowa watersheds and the degree to which local weather and flow conditions influence these patterns. Differences in seasonal and finer scale loading patterns from point sources and non-point sources suggest the need to adjust load reduction goals and also reveal limits to the potential for point source to non-point source trading. Iowa's 45% annual load reduction targets are based primarily on reducing hypoxia in the Gulf of Mexico. Although agriculture contributes over 90% of the annual nitrogen and phosphorous loads in the study basins, point sources can contribute over 90% of these loads during critical low flow periods extending for several months each year. Load reduction goals should consider both annual and seasonal patterns to protect local as well as downstream waters. To the extent that point sources are required to meet daily or seasonal load limits, the potential for point to non-point source trading could be significantly reduced

Subject: Watershed Conservation to Unify Urban and Rural Communities

**Denotes primary author*

Presentation of Topographical Features in Southern and Northern Guam via a Small Scale Model as a Tool for Community Education toward Watershed Conservation Efforts

Authors: Mohammad H. Golabi, University of Guam*

Accelerated sedimentation from the unprotected watershed of southern Guam and the other islands in Micronesia is a growing economic and environmental concern for these islands. When soil is disturbed sediments are moved by water and wind into rivers that empty into the ocean. The reefs located near the mouths of these rivers are smothered by the settling sediments, killing microbial organisms, and making the reefs uninhabitable. Human activity such as the use of off road vehicles, frequent hiking from unprotect upland areas, clear cutting, etc., often has a strong impact on watershed dynamics in one form or another. Soil and environmental scientists are challenged to develop conservation and restoration strategies that address watershed management within a framework of increasing environmental and financial constraints. One factor that can aid in the preservation and increase of habitats through the re-vegetation or reforestation of watershed systems that have become barren are not only actions upon the watershed itself, but on the human impact on such systems. Such changes to human activity may include education of the public on the natural resources such as watershed. These objectives are achieved by showcasing the sedimentation load into the ocean via a topographical model of the island of Guam in which watershed features as well as limestone landscape of southern and northern Guam are presented in a small scale model at the UOG campus. In addition to model presentation, we also illustrate the presence of badlands and their impact on coral reefs both in Guam and the other neighboring islands, The impact of sedimentation from these badlands on the water quality of nearby streams and rivers as well as the shorelines of Guam and other islands are presented in this poster presentation. Protective measures as well as watershed management strategies are illustrated and highlighted in this presentation for educational purposes.

Subject: Watershed Conservation to Unify Urban and Rural Communities

**Denotes primary author*

Suitability of Phosphorus Adsorption Materials for Agricultural Nutrient Management Practices

Authors: Austin D. Bartos, University of Toledo; Tvisha Martin, The University of Toledo*; Daryl Dwyer, University of Toledo; Ryan Jackwood, University of Toledo

Phosphorus (P) loads to Lake Erie in recent years have increased the occurrence and severity of harmful algal blooms (HABs), which impacts water quality, recreation, human health, and tourism. To reduce the occurrence and severity of HABs, the International Joint Commission recommends a 40% reduction in phosphorus loading from the Maumee River watershed. We created a phosphorus interceptor by initially comparing ten different, calcium- and aluminum-based materials including industrial byproducts and natural materials. Adsorption rates of each material were measured by shaking the materials within phosphorus concentrations relevant to agricultural runoff (0.5, 1.0, 5.0 and 10.0 mg/L) over a 24 hr period (samples collected at 1 min, 10 min, 30 min, 1 hr, 5 hr, and 24 hr). In general, adsorption of phosphorus (mg of P adsorbed/g of material) for each material increased with phosphorus concentration and retention time. Water treatment residuals, a municipal byproduct from a local water treatment plant, demonstrated the highest sorption maximum for phosphorus (0.437 mg/g) after only 1 min of retention time; traits that are beneficial for use in a phosphorus interceptor. The phosphorus interceptor is designed to allow continuous flow of agricultural runoff through water treatment residuals, which are characterized as a powder with limited pore space. Therefore, water treatment residuals were pelletized using paraffin wax (PW) to prevent pore clogging, mass loss, and decreased phosphorus retention over time in the phosphorus interceptor and then reevaluated for phosphorus adsorption maxima. The new maximum adsorption of phosphorus was 6.87 mg P/kg pellet. Working with farmers and land owners to install the PW pellet nutrient interceptor in drainage ditches and other waterways can help meet phosphorus load reduction targets for the Maumee River watershed.

Subject: Watershed Conservation to Unify Urban and Rural Communities

**Denotes primary author*

Poster Number 45

Teamwork in the Honey Hollow Watershed, a National Historic Landmark

Authors: Dan Dostie, USDA NRCS*

This poster presents the results of the cooperative conservation project in the Honey Hollow Watershed, a National Historic Landmark located in Bucks County, Pennsylvania. The Bucks County Audubon Society is the steward of this landmark, the first ever-in-the-nation small upland watershed in agricultural use and private ownership to demonstrate that the locally led cooperative approach supported by Federal assistance is a successful method of achieving national goals to improve water quality, soil conservation, wildlife conservation and flood prevention. Over the eighty years since the 650-acre watershed conservation area was created new challenges and opportunities have occurred yet the spirit of teamwork inspired by the original six farmers continues today. An indoor exhibit about the project history, outdoor exhibits on a self-guided field tour, and educational events highlight the many conservation practices still in action preserving farmland and protecting the stream as well as new enhancements to manage soil health and grow healthy delicious organic food specifically for donation to populations who lack access to a balanced diet. To continue conserving the soil, water, and wildlife resources of this watershed for future generations while contributing to overcoming food insecurity and other societal challenges partnerships need to continuously evolve and address changes in the landscape, local community, and external forces.

Subject: Watershed Conservation to Unify Urban and Rural Communities

**Denotes primary author*

A Forest Bank: Funding Mechanisms for Landscape-Level Restoration for the Swinomish Indian Tribal Community

Authors: Lizzie Marsters, Ecotrust*

The Swinomish Indian Tribal Community, like many other Tribes, are encumbered with a legacy of federal land allotment policies that fragmented Reservation lands into a checkerboard of many Indian and non-Indian owners. More than 45% of the 4,650 acres of forestland on the Reservation are currently held in individual Indian allotments (trust), most often with fractionated ownership among numerous Tribal members. Another 30% of Reservation forestlands—nearly 1,400 acres—are held in fee by non-Indian private owners. This mixture of ownership complicates any landscape approach to forest ecosystem management and has challenged the Tribe's efforts to coordinate the locations, scope, and timing of forest management actions. The Swinomish Tribe and Ecotrust have been examining innovative methods for coordinating ecological forest management across a matrix of mixed ownerships, and to finance landscape-level management and restoration of forests in ways that build ecological and community resilience to climate change. Ecotrust will present findings regarding building a funding mechanism, a "Forest Bank," that can leverage and coordinate limited public and Tribal resources with private funding to sequester carbon, protect and restore salmon and other native species habitat, and conserve valuable forest and cultural resources. These business models have unique potential to support other Tribes to overcome the legacy of fragmented land ownership on Indian Reservations and subsequent barriers to ecological forest management.

Subject: CIG Showcase Poster

**Denotes primary author*

An Assessment of Three Sustainability Tools as Impact Verification in Small Grains Supply Chain Programs

Authors: Alisha Bower, Practical Farmers of Iowa*

Since 2017 Practical Farmers of Iowa and Sustainable Food Labs have worked on connecting Corn Belt farmers' desire to diversify their crop rotations with companies' sustainability goals in their supply chains to create more markets for small grains. A key aspect of this project evaluated solutions to quantifying and verifying impact of extended crop rotations. Farmer production data was collected in small grains production years as well as subsequent years of the rotation (hay, corn or soybeans) in 2017 and 2018 and this data was entered into three sustainability tools: Cool Farm Tool, Fieldprint Calculator and Resource Stewardship Evaluation Tool. The outputs were then analyzed to assess which models produced soil health, water quality, biodiversity, greenhouse gas and energy use scores most accurate to what we would expect from published literature. We also evaluated the tools based upon value to the farmer, ease of use, utility for company claims and relevance of outputs to understanding resource concerns. This work is funded by a Conservation Innovation Grant from the Natural Resource Conservation Service.

Subject: CIG Showcase Poster

**Denotes primary author*

Conserving Water Resources in the US Pacific Islands Region by Optimal Irrigation of Farmlands

Authors: Sayed Bateni, University of Hawaii at Manoa*; Jonathan Deenik, University of Hawaii at Manoa; Mohammad H. Golabi, University of Guam; Ian Gurr, American Samoa Community College; Michael Cahn, University of California Cooperative Extension; Christopher Neale, University of Nebraska-Lincoln

Water is by far the major constraint to crop production in most regions of Hawaii, Guam, and some parts of American Samoa. Even areas with abundant rainfall experience a high seasonal variability that does not maintain adequate water for vegetable crops throughout the year. Additionally, the limited supply of water in the Pacific Islands is subject to ever-increasing demands. Growing demands on the allocation of limited fresh water resources and potential decreases in precipitation at the local scale make it imperative that farmers acquire the ability to match irrigation application with crop water needs (i.e., optimal irrigation scheduling) to increase water use efficiency and improve water conservation In this project, an existing online smart irrigation scheduling software (CropManage) was adapted for optimal irrigation scheduling of farmlands in Hawaii, Guam, and American Samoa. This tool uses the reference evapotranspiration (ETo), soil type, crop coefficient, and root depth as inputs, and generates recommendations for irrigation water with the application volumes appropriate to the developmental stages of different crops. Soil type, canopy development, and root depth were measured in vegetable fields of collaborating farmers. Micrometeorological data recorded with weather stations at the field sites are used in the Penman-Monteith equation to estimate ETo. As ETo is the main input of the online smart irrigation tool, Multi Adaptive Regression Splines (MARS) and Genetic Expression Programming (GEP) approaches were used to develop robust equations for the estimation of ETo from limited climatic data (for cases in which one or more sensors on the weather stations fail). Flowmeters will be installed at the field sites to measure the irrigated water used by growers. This allows us to conduct field trials to validate the online tool in improving water use efficiency at the farm level.

Subject: CIG Showcase Poster

**Denotes primary author*

Evaluating Mobile Drip Irrigation in Water Technology Farms

Authors: Jonathan Aguilar, Kansas State University*; Danny Rogers, Kansas State University; Bill Golden, Kansas State University; Daniel Devlin, Kansas State University

The Ogallala Aquifer of western Kansas is in decline. The importance of using more efficient irrigation systems are exemplified when well capacities are also diminishing. Producers are looking for new methodologies and technologies to extend the useable aquifer life and limit the economic impact. The mobile drip irrigation (MDI) system is one of those technologies that producers are testing at some of the network of water technology farms. MDI refers to the concept of applying irrigation water through surface drip hoses that are dragged by center pivot or linear move systems across the field. MDI has the potential to greatly reduce water losses due to wind drift, soil water evaporation, and canopy evaporation. The poster will focus on the preliminary results and lessons learned and the challenges identified on these technologies from the three years of implementation.

Subject: CIG Showcase Poster

**Denotes primary author*

Improve Outreach to Improve Soils: Combining Data, Economics, and Communication to Improve Soil Health across the South Central United States

Authors: Ayush Gyawali, Texas A&M University*; Clark Neely, Texas A&M AgriLife Extension; Katie Lewis, Texas A&M Agrilife; Jamie Foster, Texas A&M AgriLife Research; Josh Lofton, The Ohio State University; Josh Copes, LSU AgCenter; Mark Welch, Texas A&M AgriLife Extension; Holli Leggettee, Texas A&M University

Management practices, such as leaving the soil fallow and conventional tillage, threaten soil health and agriculture's long-term sustainability. Cover crops and conservation tillage contribute to soil health but producers face obstacles to implementation including: concerns over water availability and nutrient cycling, lack of identified suitable crops or cropping systems, uncertainties about grain yield and biomass production, questions about on-farm economics and long-term economic risk, and/or a lack of knowledge on implementing a new management strategy. The objectives of this study are: 1) use research trials and on-farm demonstrations of double-cropping systems under multiple tillage methods to collect quantitative data on the impact of soil health management practices on soil properties and cropping system productivity; 2) use the data from research and on-farm trials, perform economic analyses on the effect of increasing diversity and reducing tillage on on-farm profitability and the potential for reducing long-term economic risk; and 3) develop communication messages based on producers' preferences that are most effective in increasing implementation rates of soil health management practices, and evaluate their impact through producer feedback. This whole-picture approach addresses the majority of the identified obstacles producers face when implementing soil health management practices. We are also using an innovative double-cropping system for both research trials and on-farm demonstrations. This project will serve as a model for other regions to fine-tune their outreach efforts to encourage soil health management practices. Deliverables include soil property and crop production data, detailed economic analyses, and communication messages and modules. We expect this project will increase implementation of soil health management practices and therefore improve soil health across the region.

Subject: CIG Showcase Poster

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Installation and Operation of Prototype Edge-of-Field Runoff Monitoring Systems to Support NRCS Conservation Investments and On-Farm Decision Making: Lessons Learned

Authors: Dennis Busch, Water Resources Monitoring Group LLC*; Jim Anderson, WRMG, LLC; Mike Daniels, University of Arkansas; Jeremiah Asher, MSU; Alaina Nunn, WRMG, LLC

The United States Department of Agriculture's Natural Resource Conservation Service has supported development of low-cost approaches to edge-of-field runoff monitoring to increase adoption of this practice and promote standardization of monitoring activities. Water Resources Monitoring Group, LLC is currently conducting field test of monitoring hardware which is designed to address challenges identified in prior testing, enhance the capability of the hardware, and evaluate the new prototype hardware under varying field conditions. Our intent is not only to reduce the cost of hardware associated with edge-of-field monitoring; but also move toward offering a fully integrated intensive monitoring program. An integrated monitoring program will include: turn-key hardware and software solutions that are easy to install and operate, provide standard protocols for installation, operation, and maintenance of equipment; and provide training and education on monitoring methods and procedures to ensure transparent and consistent results across monitoring projects. Our poster presentation will include lessons learned during the first two years of the monitoring project, preliminary monitoring results, preliminary evaluation of system performance, and a discussion of future work being pursued within the Conservation Innovation Grant project.

Subject: CIG Showcase Poster

**Denotes primary author*

Linking Chicago's Urban Agricultural District: Continued Conversion of the Englewood Rail Line into a Nature Trail

Authors: Micheál Newman-Brooks, City of Chicago Department of Planning and Development*

The 59th Street Line is a former 1.7 mile elevated rail line that will be converted into a multi-use trail to provide open spaces for recreation, transportation and a source of jobs to the residents of Englewood and surrounding communities. It will link several vital projects in Chicago's Urban Agricultural District and fulfill the community's aspirations for a safe, inviting, and peaceful space for all to enjoy. The 59th Street Line is the first phase of a larger loop that will connect to the 49th Street Line in the Back of the Yards neighborhood to the north. The trail has been recommended in a number of City plans and community-driven planning processes, including the New Era Trail completed in 2009, A Recipe for Healthy Places in 2013 and the Green Healthy Neighborhoods Plan in 2014. The trail located at the center of Chicago's Urban Agricultural Districts recently expanding farming operations include Growing Home adjacent to the trail, Eat to Live farms, and Goodness Greeness, a certified organic produce distributor. In addition, several community partners including Urban Pathways, convened by NeighborSpace and Grow Greater Englewood, has implemented a plan for urban farmers from around the city to own and farm land in the district and work together through common infrastructure, storage facilities, processing and distribution. With a total of 54 acres of vacant land along the line and a total of 20 acres of land comprising the former rail line, the trail will provide an immediate return to productive use of land as a spur for community investment. As originally envisioned in the Neighborhood Plan, the trail will expand the vision of this urban agriculture district to revitalize the community, provide jobs and recreational opportunities. Our presentation will highlight the sites and design, partners, continued progress of the project, policy and governmental changes to aide implementation. We will also share the scope of work for Phase II implementation.

Subject: CIG Showcase Poster

**Denotes primary author*

Poster Number 53

National Indian Carbon Coalition Carbon Sequestration Projects on Tribal Land

Authors: Bryan Van Stippen, National Indian Carbon Coalition*

The National Indian Carbon Coalition is an Indian-led non-profit program that helps tribal nations and individual Indian landowners take advantage of carbon credit and enter environmental commodities markets through the development of carbon sequestration or offset projects. NICC views these projects as economic development opportunities that preserve tribal nation and tribal member land ownership while returning profits to reservations economies and communities. NICC's mission is to preserve tribal land ownership and reduce the effects of climate change by conserving the natural resources of tribal lands in order to minimize human-caused greenhouse gas emissions.

Subject: CIG Showcase Poster

**Denotes primary author*

On-Farm Research Demonstrates Diverse Pathways to Soil Health

Authors: Franklin Egan, PASA*; Sarah Bay Nawa, PASA

Soil health is the foundation of sustainability on any farm, and farmers need a clear understanding of the status of their soil resources to manage for the future. Since 2016, PASA has been working through our Soil Health Benchmark Study to document and improve soil health outcomes through farmer-generated data. In 2018, we worked with 34 diversified vegetable farmers, 15 row crop farms, and 8 grazing dairies to quantify soil health using field samples and farm records for practices including cover cropping, soil disturbance, and soil amendments. Based on the Cornell Comprehensive Assessment of Soil Health, we found that despite a range of cropping systems, farm scales, and management techniques, most of our farms showed excellent to optimal organic matter ratings (medians of 95, 96, and 100 on Cornell's 100-point scale for vegetable, row crop, and grazing farms, respectively). Vegetable and row crop farms tended to have low soil protein (medians of 52 and 49, respectively) and microbial respiration (median of 45 and 59, respectively) ratings and poor aggregate stability ratings (median of 27 and 36, respectively). Grazing farms tended to have opting ratings (scores of 80 and higher) for all of the 12 soil health indicators in Cornell's "standard package," demonstrating the power of perennial systems. Surprisingly, we found that on vegetable and row crop farms, intensive tillage was often compatible with high organic matter ratings (sometimes even without inputs of compost, manure or other off-farm organic matter sources), although aggregate stability ratings were typically lower on farms with intensive tillage. These data suggest that different farming systems can successful apply different techniques and strategies to grow soil health. We also bring our farmer collaborators together for field days and workshops that use these data to guide discussions and collaboratively generate new ideas for improving soil health.

Subject: CIG Showcase Poster

**Denotes primary author*

Paddocktrac© Web-Based Mobile App to Measure, Monitor, and Manage Grazing Systems

Authors: Stacey Hamilton, University of Missouri; Ryan Lock, University of Missouri*; Robert Kallenbach, University of Missouri; John Lory, University of Missouri

The University of Missouri offers the online "Grazing Wedge" to help producers make grazing and harvesting decisions in forage/livestock systems (http://grazingwedge.missouri.edu/). The tool helps producers optimize forage mass and nutritive value and assists with fertilization decisions in grazing systems. Using the tool to guide management decisions increases forage yield and utilization. Thus producers enhance beef or milk production per unit land area. Producers like the benefits of the Grazing Wedge, but time constraints of collecting the information on a weekly basis limit its frequency of use. The time needed to measure, record, and manually enter forage availability data into a website detracts from other labor and management on farms. The University of Missouri developed an automated system to measure pasture height with an atv-mounted ultrasonic sensor calibrated to dry mass availability in pastures. PaddockTrac (©2018) integrates Bluetooth communication between the ultrasonic sensor and a smartphone. The app extracts the GPS location of the phone as producers drive the atv through the grazing system to collect data. PaddockTrac stores 1-second-interval location and pasture height data to a csv file on the phone, then uploads the data to a GIS-based website when the measurement session is complete. The website parses data to the user's mapped farm and presents average forage availability in paddocks. It simplifies weekly data collection, entry, and processing. The Grazing Wedge outputs are immediately available for decision-making after PaddockTrac uploads the data. Producers need affordable, time-saving tools to optimize forage allocation and utilization in grazing systems. We present an option to integrate adaptive management strategies in forage systems that mitigate overgrazing, degraded plant vigor and soil loss, while enhancing forage yield, utilization, sustainability and profitability.

Subject: CIG Showcase Poster

**Denotes primary author*

Practicing 4Rs (Right: Source, Rate, Time and Place) Nutrient Stewardship Management and Conservation for Container Grown Blueberry

Authors: Dharma S Pitchay, Tennessee State University*; Steven Kennedy, Tennessee State University; Rob Mikkelsen, International Plant Nutrition Institute

Some species are more sensitive to sub/supra optimal nutrient supply than others. This is significant in species of Ericaceae family that prefer ammonical form nitrogen rather than nitrate form for healthy growth and development. It can be a challenge to produce container grown blueberry plants in nurseries just by providing all the 14 essential nutrients, without any concern for the right source and rate of nitrogen fertilizer. Failure to deliver appropriate nitrogen source may result in imbalance in nutrient availability for uptake. This could result in poor growth and nutrient deficiency, which express the visual symptoms on shoots specific to that particular nutrient. Referring to the documented visual deficiency symptoms with description guidelines, nursery growers could develop a precise corrective measure that leads to conservation of resources. Once a nutrient deficiency has been confirmed, a consideration of the 4R's should be made before applying a corrective fertilizer treatment. The 4R concept of Nutrient Stewardship consists of determining the "Right" way to meet the needs of blueberry plants considering: The Right Source of nutrient applied at the Right Rate, the Right Time, and the Right Place. This process allows blueberry growers to consider the economic, environmental, and social impacts before applying any nutrient. The BMPs of 4R nutrient stewardship and the visual nutrient deficiency symptoms of macro and micronutrient for blueberry will be presented.

Subject: CIG Showcase Poster

**Denotes primary author*

Retrofitting the Rural Roadside Ditch Network to Treat Nitrogen from Agricultural Runoff Using Woodchip Bioreactors

Authors: Eric Chase, Penn State University*; Rebecca Schneider, Cornell University

Rural roadside ditches play a very significant role in nitrogen movement across the landscape because they efficiently transport agricultural runoff to streams and rivers. In situations where there is a single point of agricultural runoff, such as a tile drain, woodchip bioreactor basins have been used to reduce nitrogen entering the environment. However, in many agricultural settings, the topography and farm sizes do not lend themselves to treatment of agricultural runoff as a point source. To address this issue, this study evaluated the potential of installing scaled-down woodchip bioreactors into roadside ditches to treat dissolved nitrogen from agricultural activities. Two scaled-down bioreactor "socks" were installed in a ditch that drained approximately 40 acres of cropland. Sampling during 2018 consisted of collecting grab samples on 11 different dates and an automated sampler captured 7 complete or partial storm events. Over the entire monitoring season, removal efficiencies varied from 0% to 100% and were highly dependent on ditch flow. The bioreactors reactors performed well in the spring and early summer when ditch flows were not overtopping the bioreactors; however, in the later summer and fall high flows due to record breaking rainfall severely impacted removal efficiencies. Additional data will be collected in 2019 to further quantify the efficiency of nitrogen removal and temporal changes in effectiveness of nitrogen removal and the environmental conditions influencing those changes. Specifically, the influence of temperature on nitrogen removal efficiency will be a focus during the early and late growing season in 2019. The data collected to date demonstrate that the existing road ditch infrastructure has potential to be more widely utilized as a watershed-wide nutrient removal system.

Subject: CIG Showcase Poster

**Denotes primary author*

The Benefits of Cover Crops on Soil Moisture Retention in Coastal Plain Soils

Authors: Michael W. Marshall, Clemson University*; Jose O. Payero, Clemson University

Coastal plain soil profile typically consists of a high percentage of sand with very little organic matter content (usually less than 1.0%). The storage of water in these soil types is limiting due to the large particles sizes that lack effective surfaces areas for adsorption during times of drought compared to silty or clayey based soils. In addition, temperatures in the coastal plain region are frequently high during the production season, which significantly increases evapotranspiration from the crop and can result in drought stress even after adequate rainfall during the growing season. Cover crops have been shown to aid in soil moisture retention in sandy soils. The added biomass from the cover crop increases organic matter which helps capture and retain moisture from rain events. In this project, we established cover crop demonstration sites in the fall 2017 across several grower sites across South Carolina. A cereal rye cover crop was planted at 40 to 60 lbs per acre depending on the cooperator. In addition, an area of the farmer's fields was left fallow for comparison (no rye cover crop planted). In the spring of 2018, herbicides were used to terminate the cover crop after sufficient biomass was achieved, approximately 2 to 3 weeks before planting of cotton or soybean. After the crop was planted, watermark soil moisture sensors were installed at 6, 12, 18, and 24 inches deep in the soil profile in both the cover crop and non-cover crop (fallow) areas of the grower's fields. The soil moisture sensors were connected to a data logger, which transmitted the data through a cellular modem to a website for display and storage. This poster will show the effects of cover crop residue on soil moisture retention and storage in coastal plain soils.

Subject: CIG Showcase Poster

**Denotes primary author*

Poster Number 59

SWCS Professional and Chapter Development Committee: Working for You

Authors: Erika Crady, SWCS Staff Liaison; Becky Fletcher, Indiana (Chair); Sharon Hartzold, Illinois; Josh Ketch, Oklahoma; Rob Lawson, Illinois; Shelly Lassiter, Washington; Hida Manns, Ontario; Cathy McGuire, Arizona; Susan Meadows, Indiana; Dale Threatt-Taylor, North Carolina

The Professional and Chapter Development Committee works with SWCS Board Regional Directors to develop the leadership skills of Chapter officers and provide support to local Chapters. Committee members serve as a member of the regional team, working with their respective regional director to ensure better communications between the Society and Chapter leaders. We assist in providing regional training opportunities and we provide resources and tools that help build the capacity of local Chapters.

Subject: Professional and Chapter Development

**Denotes primary author*

Poster Number 60

SWCS Chapter Achievers

Authors: 2019 Chapter Achievement Recipients

The Chapter Achievement Award is intended for a singular stand out chapter activity. The 2019 Chapter Achievement Recipients share a unique activity accomplished in the last year in their state.

Subject: Professional and Chapter Development

**Denotes primary author*