ABSTRACT BOOK

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SYMPOSIA PRESENTATIONS

Monday, August 1

Symposia Session Descriptions and Agenda

Conservation Innovation Grants (CIG) Showcase
10:30 AM – 5:00 PM, *Colorado Ballroom F-J on Lower Level 2*
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 innovations in water conservation. The second panel explores building resilient ecosystems. The final panel will address scaling soil health related to cover crops.

This showcase runs from 10:30 AM to 5:00 PM on Monday, August 1. 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.

Conservation Innovation Grants Program Overview and Stakeholder Updates; Innovations in Water Conservation
10:30 AM – 12:00 PM

Introduction: Conservation Innovation Grants Program Overview and Stakeholder Updates - *Caroline Sherony and Havala Schumacher, USDA NRCS*

Presentation 1: Innovative Technologies for Water Conservation in Flood Irrigation Systems - *Saleh Taghvaeian, Oklahoma State University*

Authors: Saleh Taghvaeian, Sumon Datta, Drew Gholson, Matt Yost, Khaled Bali, Daniele Zaccaria, Jason Warren

Flood irrigation systems (a.k.a. surface or gravity) account for 33% of all irrigated lands and 43% of total irrigation water applications in the U.S. However, only 10% of federal financial assistance for irrigation best management practices has been dedicated to flood irrigation. The goal of this CIG project was to evaluate, demonstrate, and transfer innovative technologies that can result in water conservation in flood systems by conducting coordinated extension activities among partners from southern to western U.S. The specific objectives were: i) to evaluate the social dimensions of adopting conservation technologies; and, to evaluate and transfer effective and affordable conservation technologies and management practices related to ii) water delivery (e.g., canal automation); iii) water use (e.g., sensor-based irrigation scheduling) and iv) water removal (e.g., tailwater recovery and reuse) components of flood systems. Sufficiently studied technologies developed in the U.S. and Australia were evaluated and transferred by establishing demonstration sites and disseminating the results using conventional and innovative outreach approaches. The unique characteristics of flood systems in the four collaborating states allowed for identification and evaluation of technologies that can be adopted in other parts of the U.S.

Presentation 2: On-Farm Demonstration and Evaluation of Cloud-Based Soil Moisture Monitoring Technologies for Irrigation Scheduling to Enhance Farm Profitability and Environmental Quality - *Jose Payero, Clemson University*

Authors: José Payero, Udayakumar Sekaran, Dana Turner, Rebecca Hitchcock Davis, Jonathan K Croft, Nathan B. Smith, and Michael W. Marshall

The irrigation team at Clemson University developed an affordable sensor-based irrigation scheduling system using low-cost open-source electronics, cell phone communication, and Internet-Of-Things (IoT) technologies. The system automatically collects data from moisture sensors installed on farmers' fields and transmits the data to the Internet in real-time. The data can be visualized online using a computer or free cell phone app. Farmers can use the site-specific real-time soil moisture information to make more timely and accurate decisions on when and how much irrigation is required. An On-Farm-Trial project funded by the NRCS-CIG program was initiated in 2020. The project's objective was to promote and demonstrate the sensor-based irrigation technology among South Carolina farmers and quantify its potential economic and environmental benefits. We conducted twelve On-Farm-Trials in 2020 and 2021 on local commercial farms. On each farm, two adjacent fields were compared; one was irrigated based on sensors and the other based on the farmer's practice. Suction lysimeters were installed in each field to measure water and nutrient leaching and quantify the environmental benefits of the sensor-based irrigation technology. Agronomic and economic data (i.e., Crop yield, irrigation applied) were collected to quantify its economic benefits. Our results have shown that with few exceptions, the fields irrigated based on the sensor's data had higher net income and lower nutrient leaching than the fields irrigated based on the farmer's practice.

Presentation 3: Accelerating Adoption of Water Conservation Technologies and Management Practices through Innovative Engagement Programming - *Daran Rudnick, University of Nebraska*

Authors: Daran Rudnick, Dr. Matt Stockton, Chuck Burr, Dr. Chittaranjan Ray, Dr. Jason Warren, Dr. Saleh Taghvaeian, Dr. Brian Arnall, Joel Schneekloth, Amy Kremen, Dr. Jonathan Aguilar

The “Accelerating Adoption of Water Conservation Technologies and Management Practices through Innovative Engagement Programming” project fosters peer-to-peer interaction and experiential learning of technology and management techniques through the Testing Ag Performance Solutions (TAPS) farm management competitions centered on efficient and profitable crop production. These competitions are held under variable rate sprinkler and subsurface drip irrigation systems at the University of Nebraska-Lincoln West Central Research, Extension, and Education Center in North Platte, NE, and under a variable rate sprinkler system at the Oklahoma State University McCaull Research and Demonstration Farm near Eva, OK. Competitors make production, management (e.g., irrigation), and marketing decisions for the contest duration that are applied to these plots, competing to be designated the most profitable farm, most efficient user of water and nitrogen fertilizer, and/or the individual/team producing the greatest grain yield. These choices are made under conditions that closely reflect those of a farm business. Contestants are provided access to some of the newest commercially available technology for managing crops. In addition, the project team records and measures data during the growing season, including weather conditions, soil properties, soil water content, canopy reflectance and temperature, crop growth and development, grain yield, nitrogen uptake, as well as the pre-season and post-season management choices. This project connects with many different groups, including producers; natural resource district (NRD) leaders; NRCS technical staff; professional farm advisors; University extension specialists; local, state, and federal agency experts; and ag suppliers. All of these diverse stakeholders provide a rich source of ideas and learning opportunities through social interaction.

Presentation 4: Promoting BMPs of Nursery Production System - *Dharma Pitchay, Tennessee State University*

Authors: Dharma Pitchay and Sunil Gurung

Conservation of water quality is a challenge in container nursery production, compared to field production, due to the leaching of nitrate and phosphate from the soilless media such as pine bark, which has significantly low cation and anion exchange capacity. Currently, measures are taken at non-point source to improve the run-off water quality. However, most effective method of reducing leachate would be at point source by

making certain changes to the current BMPs including routine monitoring and managing container substrate pH, EC, nitrate nitrogen, phosphate etc. Also, placing container grown plants in the nursery according to species' response to nitrate (>70% of total N for species such as roses, apples, pears, etc.) versus ammonium (>70% of total form of nitrogen for species such as azalea, rhododendron, blueberry, blue hydrangea etc.) with associated pH range, nitrogen fixing and mycorrhizae colonizing plant species, which require lower nitrogen and phosphate, respectively, and applying nutrients accordingly will reduce unnecessary application of fertilizers resulting in balanced plant nutrient supply for optimal growth and better economic outcomes for growers, but also protects environment and water quality from unintended pollution. The participating growers could benefit from the Environmental Quality Incentives Program (EQIP).

Building Resilient Ecosystems
1:30 PM – 3:00 PM

Presentation 1: Ecological and Economic Impacts of Resource Conservation on Horse Farms - *Krista Lea, University of Kentucky*

Authors: Krista L. Lea, C. Jill Stowe, Sarah Sebbane, Kathryn Payne and S. Ray Smith

Kentucky is home to thousands of equine operations; survey results from 2012 show that there are 35,000 farms in the state with horses on almost 1 million acres of pastureland. Resource conservation on horse farms has lagged other agricultural enterprises for decades, in part because of a perceived conflict between the needs of the horse owner and the standard practices used in resource conservation. In 2016, the University of KY Forage Extension Program was awarded a NRCS-Regional Conservation Partnership Program (RCPP) grant to implement resource conservation practices on equine operations in the state of Kentucky with the goal of reducing overgrazing and soil degradation. To truly measure the impact of this project, a follow-up NRCS-Conservation Innovation Grant (CIG) was awarded to evaluate the on-farm benefits from these practices. Fourteen of the RCPP farms were monitored for 3-4 years post-practice implementation for soil cover, botanical composition, and nutrient distribution. These farms also provided economic and farm management information to further show the impacts of resource conservation. Fencing, water points, forage and biomass establishment and compost facilities were the most common practices included in grazing plans. The transferability of these technologies was demonstrated by implementing similar conservation practices on horse farms in Virginia. In conclusion, the success of these outreach projects has been shown by the increased interest in resource conservation from many horse farm owners across Kentucky.

Presentation 2: Afognak Island Innovative Silvopastoral and Subsistence Management Project - *Peter Olsen, Koniag, Inc. Regional Native Corporation*

Authors: Peter Olsen, Dr. William A. Wall, Dr. Shannon Finnegan

With 450,000 acres in area, Afognak Island is the second largest Island in the Kodiak Island Archipelago. Extensive timber development has occurred on Native lands over the past 45 years. Important for subsistence use and other forest products, the long-term sustainability of these lands is of vital importance to their owners. A clear understanding of the influence of second timber management on subsistence species such as Sitka blacktail deer is necessary to plan for healthy populations throughout a forest rotation. Koniag's *Afognak Island Innovative Silvopastoral & Subsistence Management Project* does just that. By accurately mapping cutover lands on a landscape scale and modeling second growth forest development, future forest landscape scenarios can be projected for both timber and deer habitat values. As forest canopies close deer will predictably adjust their forage and shelter seeking habits. Innovative techniques for measuring deer population density estimates that utilize a network of trail cameras and infrared drone surveys are being developed that will provide more reliable data on forest use, herd health, and population densities. Better harvest guidelines and forest management practices can be developed with this information. Fertilization of

browse may show increased palatability of secondary browse species such as salmonberry, and thus provide tools and information to better manage browse.

Presentation 3: Increasing Landscape-Scale Adoption of Agroforestry Systems in Central Appalachia through Market-Based Incentives - *Katie Commender, Appalachian Sustainable Development*

Authors: Katie Commender, Gary Bentrup, Christin Small, James Chamberlain, Ryan Huish

Agroforestry is an intensive land management system that combines trees with crops and/or livestock. Despite numerous ecological, economic, and social benefits, adoption rates of agroforestry practices, like alley cropping and forest farming, remain low throughout much of the U.S. To increase the pace and scale of agroforestry adoption in Central Appalachia and beyond, Appalachian Sustainable Development (ASD), in partnership with a network of university, government and non-profit collaborators, were awarded a Natural Resources Conservation Service (NRCS) Conservation Innovation Grant (agreement # NR203A750013G005) in 2020. The purpose of this thirty-six month project was to create a market-based incentives system that merges conservation and commerce goals, and can be used to encourage forest farming and alley cropping adoption as financially viable practices among NRCS Environmental Quality Incentives Program (EQIP) eligible landowners. To accomplish this, project partners conducted 57 forest farming technical assistance site visits and certified 16 forest farmers as Forest Grown Verified. Processing, aggregation, and marketing services were provided to 10 farmers to help sell agroforestry products as financial incentive for practice adoption. Resources were also developed and research conducted to help inform agroforestry adoption, design, and management, including an economic decision support tool called the Forest Farming Calculator, an Alley Cropping Case Study highlighting lessons learned from demonstration sites, and a goldenseal (*Hydrastis canadensis*) sustainable harvest study designed to inform forest farming best management practices. Lastly, partners worked closely with NRCS state forestry staff to identify and address barriers to forest farming (conservation practice 379) and alley cropping (conservation practice 311) adoption by farmers and practice approval by NRCS for EQIP cost-share. This innovative project employed a successful conservation through commerce approach, which can be replicated for increased agroforestry adoption across Appalachia and beyond.

Presentation 4: Piloting the Family Forest Carbon Program in the Central Appalachian Region - *Christine Cadigan and Elizabeth Vranas, American Forest Foundation*

Authors: Elizabeth Vranas, Christine Cadigan, Richard Campbell, Erin Gleeson, Sarah Hall-Bagdonas, Lynn Riley, John Ringer, Nathan Truitt

The Family Forest Carbon Program (FFCP) partners with family forest owners to manage their forests in ways that meaningfully reduce carbon dioxide in the atmosphere. It also partners with businesses in addressing their unavoidable emissions to achieve vital social, economic and environmental outcomes. By combining a market-driven approach with decades of experience with small landowner engagement, the FFCP has been specifically developed and refined to provide landowners with value – through both funding and technical support – and make meaningful environmental impact.

The Family Forest Carbon Program launched its initial pilot in the summer of 2020, just a little over two years ago. It first launched in a 16-county area of Pennsylvania, and has since expanded to all of Pennsylvania and West Virginia, as well as western Maryland. It also recently launched a pilot in the Northeast and will soon be launching an additional pilot in the Upper Midwest.
So far, the FFCP has signed up over 25,000 acres of family-owned forest from 150 landowners who have agreed to complete specific practices that enhance carbon sequestration and storage across the landscape. We expect these acres will directly contribute to the generation of over 650,000 carbon credits over the next two decades. The FFCP has also provided over 600 landowners with forester visits. On the carbon credit sales side, the Family Forest Carbon Program has agreed to sell nearly $50 million worth of credits to companies over the next three decades.

Since the outset of the FFCP, program partners have strived to design a program that could be continually improved for the benefit of forest landowners and the climate. Several lessons have been learned related to technical assistance, landowner motivations, legal aspects of landowner agreements, landowner marketing, carbon impact of forest practices, remote sensing, online software development, and much more. The next phase of the project will build on these lessons to enable a fully-operational scaled forest carbon program for small forest landowners.

Presentation 5: New Opportunities for Establishing NRCS Pollinator Habitat in the Pacific Northwest - *Andony Melathopoulos, Oregon State University*

Authors: Andony Melathopoulos, Serkan Ates, Sandy DeBano, Marcelo Moretti, Ramesh Sagili

On-farm flowering habitat can improve the health and reproductive success of managed bee stocks, as well as native bee populations. Moreover, they serve as a reservoir for natural pest control from a multitude of other beneficial insects including insect parasitoids and predators. For these reasons, a number of federal, state and non-profit initiatives have invested in establishing or enhancing pollinator habitat across the US.
The Natural Resources Conservation Service (NRCS) has been at the forefront of creating pollinator habitat, although the bulk of investments have been made in the Northern Great Plains. Pollinator habitat enhancement in the Pacific Northwestern (PNW) region, in contrast, has lagged behind. We describe a multi-faceted project to reduce the barriers to adopting NRCS practices that help pollinators in the PNW region. Through our work we have identified: (1) how mustard cover crops used in cherry orchard replanting can reduced overall pesticide exposure to bees and boosted beneficial insect populations, (2) determined combinations of preemergent herbicides registered in commercial hazelnut orchards that control weeds but do not impact the growth of important wildflower species and (3) spring sheep grazing practices that increase the nectar and pollen production compared to standard grazing management. We will also talk about field days held with NRCS staff in Oregon and the ways they see our findings being put into practice on the ground.

Presentation 6: Forage Forecasting/Nutritional Analytics: Decision Support for Rangeland/Grazingland Ecosystems - *Bill Fox, Texas A&M University*

Authors: William E. Fox, Jay Angerer, Javier Osorio, Megan Clayton, Jenny Pluhar & Doug Tolleson

Livestock producers face a multitude of challenges in decision making related to both the terrestrial landscape and the markets in which they participate. Most decisions, based upon experience, occur at the operational scale and impacts are seldom recognized until the future. The Forage Forecasting & Nutritional Analytics (FFNA) program was designed and developed to provide land managers a tool to aid in the decision-making process. Through the use of Ecological Site Descriptions, simulation modeling tools, and forecasting techniques, the FFNA provides a tool that allows decision-makers an opportunity to forecast their forage production with a level of assurance 30, 60 and 90 days into the future. Coupled with the forecasted results, the tool allows land managers the ability to assess the forage quality to meet nutritional needs of the livestock classes managed. Using highly vetted process models, Phygrow and NUTBAL, the FFNA dashboard integrates a multitude of variables that are commonly considered by landowners into a user-friendly, web-based tool for ranch scale decision-making. These tools integrate across a wide platform of data (i.e. Web Soil Survey, Ecological Site Descriptions, NOAA Weather Data, etc.) to provide a means of evaluating future potential productivity at fine scales (range sites, pastures, ranch level); all of which are relevant to the land manager in their daily decision-making process. The FFNA system has been applied across a broad area of climatic regions throughout Texas (East Texas, Rolling Plains, South Texas, High Plains) to provide valuable resources for decision-making at both the regional and ranch/operational scales. The prototype developed for the State of Texas is scalable across most all rangeland ecosystems that maintain a minimal level of data resources related to soils, ecological sites, and weather patterns. The program has entered into its last year in Texas and is being rolled out across a wide geographic area within the state for land managers to test. The final integration of land manager inputs will be adapted into the system for a nationwide rollout after the summer 2023.

Scaling Soil Health
3:30 PM – 5:00 PM

Presentation 1: Deploying the Living Mulch Crop Production System to Build Soil Health - *Matt Levi and Chandler Gruener, University of Georgia*

Authors: Chandler E. Gruener, Matthew R. Levi, Nicholas S. Hill, Nicholas T. Basinger, and Nandita Gaur

The most common cover crops used in row crop agriculture are annual species but the use of perennial cover crops (i.e. a 'living mulch') to improve the sustainability of row crop agriculture also has captured the attention of researchers and producers in recent years. Annual cover crops such as crimson clover (*Trifolium incarnatum*) and cereal rye (*Secale cereale*) are planted in the fall and terminated in the spring prior to planting cash crops. Perennial cover crops, specifically the living mulch of white clover (*Trifolium repens* var. 'Durana') can be maintained for multiple years after establishment and positively contribute to soil health and nutrient cycling. This research aimed to quantify the effects of a white clover living mulch on soil health compared to other common cover crops in a cotton production system in the Georgia Piedmont. Our work also evaluated changes in soil health metrics for corn and pecan production systems in Coastal Plain soils of Georgia after 1-3 years of maintaining a living mulch system. A suite of soil properties representing multiple depths in the upper 30 cm were used to quantify changes from the living mulch system including soil strength, bulk density, hydraulic conductivity, water retention, total and mineralizable carbon and nitrogen, Mehlich 1 nutrients, and soil pH. Notable results include significant increases in both saturated hydraulic conductivity and potentially mineralizable nitrogen from the living mulch. Some other important findings include reduced soil compaction and increases in organic matter in the living mulch system compared to other treatments and baseline data. Managing soil moisture is a critical consideration for maintaining the living mulch. The combined soil health benefits of a perennial living mulch make it a viable tool to aid in both agronomic improvements and soil conservation.

Presentation 2: Finding the Commonalities among Successful Soil Health Innovators and Demonstrating Practices for Increased Adoption - *Johs Lofton, Oklahoma State University*

Authors: Josh Lofton, Anna Zander, Chase Harris, Nikki Wyma, Matt Drendel, Brian Arnall, Jason Warren

While soil health practices have garnered a lot of interest in the last several years, adoption rates in the southern Great Plains, especially Oklahoma, have lagged behind much of the United States. This project was a multi-year project to understand, in the simplest terms, why certain soil health practices worked for some growers but did not work for others. The first aspect of the project was to understand how growers felt about soil health practices. Surveys were conducted at conservation and non-conservation focused events, specifically targeting growers, consultants, or landowners. Overall, most answers were fairly divided over the use of certain soil health practices, with cover crops being one of the largest topics. Additionally, it was found that individuals willing to try soil health practices they have never tried before required a fairly short timeframe for seeing the benefit they were interested in and the largest caution was cash crop yield loss following, cost of establishment, and return on investment. Additionally, the project took aspects that adopters said were the most valuable aspect of these soil health systems and demonstrated their use and effectiveness in other production systems around the state. While the project was fairly broad due to wanting to demonstrate several benefits that these soil health practices could achieve, the focus of the project was to find economic value from soil health practices as well as management strategies to ensure that the practices were economically sustainable while still maintaining their environmental sustainability. Several publications and presentations have been made regarding these demonstrations; however, the project has had to be adapted due to COVID regulations limiting the field days or tours originally planned. One major aspect to note was this project allowed for the creation of a cover crop garden on the Oklahoma State University campus. This garden was originally intended as a demonstration of what cover crop mixes look like and to give an experience for students or tours to the university. However, this has been utilized by several classes at the university and spurred several collaborations for future projects. Additionally, work on a training module

highlighting important aspects of cover crops and how they can benefit both production and ecological systems is currently being developed.

Presentation 3: FARMS: Farmers Advancing Regenerative Management Systems - *Joni Mitchek, Colorado Conservation Tillage Association*

Authors: Joni Mitchek, Lauren Hafford, Becky Ravenkamp

FARMS is a three-year USDA-NRCS CIG On-Farm Trials Soil Health Demo project that began in May 2020. The program is a collaboration between Colorado Conservation Tillage Association, Colorado State University, Kansas State University, Health First, and many individuals in the High Plains region. FARMS provides financial assistance to 24 cropland producers in Colorado, Kansas, and Nebraska for implementing a systems approach to soil health management while also providing technical and social support to participants through a mentoring program and soil health education field days and events. Additionally, the project evaluates soil health, nutrient density, economics, and social impacts for participating producers. In two years, FARMS has distributed more than $540,000 to producers for soil health planning, per acre incentive payments, and mentoring activities. Producers have enrolled more than 3,000 acres in the program each year, and FARMS has hosted 23 events to date, including webinars, workshops, field days, hub meetings, and social events. Feedback from participating producers has provided valuable insight not only on incentive program structure, but also successfully facilitating a mentorship network. Producers appreciate program flexibility, being the implementation expert (instead of following a recipe or scheme), and the incentive payments themselves. Although mentors find the relationships that are building during the program beneficial, the administrative burden of mentorship is taxing. Baseline soil health, nutrient density, and social data has been collected, and economic data gathering is ongoing. Data gathering will be completed by summer of 2023, with final analysis to follow.

Presentation 4: Advancing Precision Nutrient and Soil Health Management with Retailer Cooperatives - *Joe Otto, Soil and Water Conservation Society*

Authors: Joe Otto

This presentation will focus on an ongoing NRCS-funded project managed by the Soil & Water Conservation Society and carried out in partnership with Land O' Lakes and select member cooperatives in Nebraska, Kansas and Iowa. The three year project was an inaugural recipient of NRCS's On-Farm Conservation Innovation Trials, a newly established component of the Conservation Innovation Grants program. Through the project, agricultural retailers are working with 65 growers on over 8,000 acres to run cover crop, zone nutrient management, and reduced tillage on-farm trials. The project's objective is to increase producer knowledge of these practices, integrate conservation management programs into retailer services, and broaden and accelerate conservation practice adoption. The underlying theme of this presentation and project is that conservation delivered to growers through their local co-op, and by local co-op personnel, will extend the reach of publicly-funded conservation programming and the private agricultural lands that benefit. This presentation will provide a project overview and progress report on trial activities through the end of the first of three crop years.

Professional and Chapter Development Sessions
10:30 AM – 5:00 PM, *Denver Ballroom 5-6 on Lower Level 2*
The professional and chapter development sessions are for the growth of professionals and chapters. 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.

Effective Networking and Leadership
10:30 AM – 11:15 AM

Moderators: *Alyson Keaton, USDA NRCS; Jeanne Hamilton, USDA NRCS*

Presenters: *Becky Ross, USDA NRCS; Jill Reinhart, USDA NRCS; Angela Biggs, USDA NRCS; Karen Woodrich, USDA NRCS*

Are you looking for ways to effectively broaden your networks to further your career? This panel of women leaders in NRCS may provide some great advice. They will share stories of how they achieved their goals, how networking has helped them reach their milestones, and answer questions from the audience.

Hiring Diversity: Equitable Hiring Practices
11:15 AM – 12:00 PM
Presenter: *Ebony Webber, MANRRS*

Research has shown that organizations with a diverse workforce report greater profits, innovation, and the ability to attract and retain top talent. Join this session led by Minorities in Agriculture, Natural Resources, and Related Sciences (MANRRS), the leading organization for underrepresented minorities in food and agriculture, to learn successful strategies for actually hiring for diversity and diversity recruiting mistakes to avoid.

The Power of Partnerships: Implementing Conservation through Grants and Projects
1:30 PM – 2:15 PM
Presenter: *Joe Otto, Soil and Water Conservation Society*

In this professional development session, SWCS Director of Special Projects and Partnerships Joe Otto will present on the Society's leveraging of grant opportunities to advance the organization's mission and build capacity through forming partnerships around externally funded projects. He will review SWCS's current and recently completed grant projects, the processes of opportunity discernment, proposal preparation, and project management. The session will conclude with Q&A and open discussion about building capacity for organizations to develop grants and special project programming.

Reenergizing Events: Creating Meaningful Community Engagement
2:15 PM – 3:00 PM
Presenters: *Renee Bouldin, Soil and Water Conservation Society; Krista Kirkham, SWCS Illinois Chapter; Arlene Brandt-Jenson, SWCS South Dakota Chapter; Dee C. Pederson, SWCS Georgia Chapter; Cory Hoar, SWCS Virginia Chapter*

After years in a virtual world, it's time to refresh our outlook on what makes for a successful event. In this session, our SWCS chapter leaders will provide rapid overviews of their most unique events from the past year. These events not only promoted soil and water conservation, but did so in a more relaxed and engaging setting. We're excited to find innovative ways to hold meetings and share information, while allowing space for valuable networking and community building.

Crossroads of Indian Country: An Overview of the Native Community in Denver

3:30 PM – 4:15 PM
Presenter: *Rick Waters, Denver Indian Center*

This session provides a conversation on Native history in Colorado and the United States, and how that history impacts relationship building. Further, learn how reservations, treaties, boarding schools, and federal relocation programs impacted and continue to impact the Native American community. Join Rick Waters, the executive director of the Denver Indian Center, as he discusses the organization and how a space was created to support the Native community while preserving and celebrating Native culture. The history of land use is tied to American Indian history. Breaking down the "invisibility" of American Indians will help create a more equitable future.

Stories from the Hill with SWCS CEO

4:15 PM – 5:00 PM
Presenter: *Clare Lindahl, Soil and Water Conservation Society*

SWCS CEO Clare Lindahl worked on location in Washington, DC, for four months this spring. During her visit, she worked closely with the SWCS National Capitol Chapter and met with 69 different organizations and agencies to take the voices of conservation professional members to the desks of leadership and create collaborations to advance issues members care about. Attend this session to learn about her activities during this time and how SWCS priorities and member needs translate into advocacy and policy. Enjoy some fun stories as well!

Improving Water Stewardship and Resilience: California Almonds
10:30 AM – 12:00 PM, *Mattie Silks on Lower Level 1*

Moderator: *Gabriele Ludwig, Almond Board of California*

Presenters: *Tom Devol, Almond Board of California; Michael Roots, Almond Board of California; Ellen Yeatman, American Farmland Trust*

The tremendous diversity of healthy fruits, vegetables, and nuts that California supplies is dependent on the ability to irrigate. Between new regulations and climate change, the quantity of water available for irrigation is changing. This session will showcase how almond growers are taking a multipronged approach to improve irrigation efficiencies and drought resilience. The Almond Board of California (ABC), a federal marketing order, has developed and implemented a unique, comprehensive almond irrigation efficiency program, including research (e.g., irrigation system advancements, soil health impacts, ground water recharge, etc.) and focused outreach centered on the "Irrigation Improvement Continuum," which promotes irrigation efficiency practices for both smaller and larger acreage growers. ABC's California Almond Stewardship Platform tracks conservation practice adoption overtime and estimates additional associated benefits, e.g., appropriate nitrogen applications and irrigation frequency and amounts, using a Nitrogen Calculator and Irrigation Calculator. ABC's irrigation research and outreach program partners with resource conservation districts, Extension, nongovernmental organizations, farm supply companies, etc. to reach growers in different ways, including development of a predictive irrigation efficiency economic assessment tool in partnership with American Farmland Trust (AFT). The ABC-AFT tool uses partial budget analysis to estimate the potential future costs and benefits of implementing practices identified in the Irrigation Improvement Continuum and run "what if" conservation planning scenarios. In this symposium, we will give a sneak-peek of the predictive irrigation efficiency economic assessment tool that is in development.

We (ABC) will share the multipronged approach tried and lessons learned, along with assessments from the California Almond Stewardship Platform on practice changes over time. AFT will present on the economic assessment approach for the irrigation efficiency efforts building on their experience with the SHEC model used for soil health ROI assessments.

Forest Management and Biochar for Continued Ecosystems Services
10:30 AM – 12:00 PM, *Penrose 1 on Lower Level 1*

Moderator: *Carlos Rodriguez Franco, USDA Forest Service*

New approaches to managing the uncertainty associated with climate change implies the use of adaptive management and robust decision-support strategies, with the integration of innovative forest management practices. Advances on forest management alternatives under a changing climate to enhance ecosystem health and sustainability should be designed to ensure the flow of continued ecosystem services, such as water, wildlife, biodiversity, recreation, and forest and grassland products, and help to reverse the decline in ecosystem function from associated ecological disturbances, such as drought, wildfire, insects, and invasive species.

Forest managers, environmental groups, decision makers, technical advisors, and agricultural research and development planning efforts, and the development of resilient agricultural production systems, will help to sustain agricultural production during the 21st century. One of the main elements of sustainable forests and continued ecosystem services is soil productivity. Biochar could help to improve soil productivity, increase soil organic matter content, improve soil characteristics and contribute to water retention, and increase resiliency to the impacts of climate change.

The 90-minute session will frame the current impacts of climate change in forest ecosystems, and it will discuss the technologies available for woody biochar production, how woody biochar could support the redistribution of organic matter in forest ecosystems and also for other uses such as agriculture, and how it contributes to better soil health, closing with examples of biochar applications in different forest conditions.

Presentation 1: Climate Change and Extreme Events Affecting Forest Ecosystems – *Carlos Rodriguez Franco, USDA Forest Service*

Presentation 2: Technologies to Produce Biochar at Different Scales – *Tom Miles, United States Biochar Initiative*

Presentation 3: Management Strategies and Plans in Redistributing Organic Matter in Forest Watersheds – *Jim Archuleta, USDA Forest Service*

Presentation 4: Improving Soil Health with Biochar – *Deborah Dumroese, USDA Forest Service*

Scaling Up Conservation Practices in Dairy: The Nature Conservancy and Partners

1:30 PM – 3:00 PM, *Mattie Silks on Lower Level 1*

Moderator: *Carrie Vollmer-Sanders, The Nature Conservancy*

Presenters: *Michelle Rossman, Dairy Management Inc.; Lara Moody, Institute for Feed Education and Research; Liz Hunt, Syngenta*

An interactive session with the partners of the US Dairy Feed in Focus (FiF) Program. Participants will learn about this new program to pilot and scale the adoption of best management practices in feed/forage production and efficiency, for feed grown on dairy farms. These practices are expected to result in significant benefits for climate change mitigation, improved soil health, and increased water quality on dairy farms of all sizes. The audience will hear from panelists/partners working together in Wisconsin, a leading dairy state. In addition, panelists will discuss a new project emerging to trial dietary interventions to mitigate enteric methane emissions in dairy cattle. The USDA recently announced a $537,440 award for this project through its Conservation Innovation Grants On-Farm Conservation Innovation Trial program. With project partner resource contributions, the project will total more than $800,000. Working with up to 10 dairy farms in Michigan and Wisconsin, this project will combine on-farm trials and demonstrations of emerging technologies with strategic engagement of critical stakeholders including farmers, farm advisors, industry, carbon market players, and regulators for scaling the adoption of feed management strategies. The project will provide direct financial support to participating farmers to cover their costs of participation, in alignment with the Feed Management 592 and Feed Management Plan 108 Practice Standards schedules.

Taking the Watershed Approach: State of Science and Analytical Data Tools at Our Fingertips to Help Us Succeed
3:30 PM – 5:00 PM, *Mattie Silks on Lower Level 1*

Moderator: *Katie Flahive, US Environmental Protection Agency*

Presenters: *Cyd Curtis, US Environmental Protection Agency; Adrienne Donaghue, US Environmental Protection Agency; Ellie Flaherty, US Environmental Protection Agency; Brian Fontenot, US Environmental Protection Agency*

The US Environmental Protection Agency's (EPA) Nonpoint Source Pollution Program (or Section 319 Program) remediates nonpoint sources of pollution using a watershed approach. The practical application of the watershed approach results in watershed-based plans (WBPs) that guide restoration through a series of steps to identify water quality problems and prescribe effective remediation measures by coordinating local, state, and federal stakeholder resources. State Nonpoint Source programs have achieved many successes using WBPs.

To assess how well this approach has worked and what may be done to improve upon it, EPA conducted a literature review of over 100 WBP-focused technical and training articles. This review centered on primary scientific literature as well as local, state, and federal reports that document WBP projects, training, and technical advancements. The results from this work that will be presented provide a "State of the Science" overview of the current technical and training knowledge and answer these questions:

- What are the key technical takeaways?
- What findings will improve current WBP practice in the NPS program?
- Do WBPs continue to be necessary for achieving NPS water quality improvement and restoration?
- How to enhance current training?
- What else should EPA consider?

When developing a WBP, there are two categories of planning to consider: technical elements and community engagement. Panelists will lead participants through exploration of local water quality data using How's My Waterway (HMW), the Water Quality Exchange (WQX), and the Assessment and Total Maximum Daily Load Tracking and Implementation System (ATTAINS). We will demonstrate tools that support the community aspect of watershed planning: environmental justice mapping and screening (EJSCREEN) and Social Indicators Data Management and Analysis (SIDMA). We will highlight outreach tools that can be utilized to increase awareness and engagement during WBP implementation.

Seven Economic Case Studies from California, Oklahoma, Pennsylvania, and New York Featuring "Soil Health Successful" Almond, Row Crop, and Dairy Producers
3:30 PM – 5:00 PM, *Penrose 1 on Lower Level 1*

Moderator: *Ellen Yeatman, American Farmland Trust*

Presenters: *Michelle Perez, American Farmland Trust; Aaron Ristow, American Farmland Trust; Michael Roots, Almond Board of California; Meg Greski, Oklahoma Conservation Commission*

To generate outreach and educational materials that directly answer producer questions about the economic benefits and costs of soil health practices, American Farmland Trust (AFT) in partnership with the Almond Board of California (ABC) and the Oklahoma Conservation Commission (OCC) developed two new California almond case studies and two first-ever Oklahoma corn-soy case studies featuring "soil health successful" producers. All four were developed using materials in the publicly available Retrospective Soil Health Economic Calculator (R-SHEC) Tool Kit. AFT will also present its first-ever Pennsylvania corn-soy case study and New York row-crop dairy farm case study—the latter using the Cornell Dairy Farm Business Summary instead of data collected by the R-SHEC Questionnaire.

Through a 2018 USDA Conservation Innovation Grant, AFT previously published nine economic case studies and the R-SHEC Tool Kit to help our fellow conservationists produce their own case studies. The R-SHEC Tool Kit provides instructions on gathering and analyzing data to produce a partial budget analysis estimating the economic effects of the adoption of soil health practices on a farm. The tool kit also supports use of Nutrient Tracking Tool and COMET-Farm Tool to estimate the effects of the adopted practices on water quality and greenhouse gases.

The AFT, ABC, and OCC authors will present the costs, benefits, and change in net income and the return on investment attributed to soil health practice use by each of their producers. Each author will discuss their experiences recruiting and interviewing soil health successful farmers, analyzing the data, and writing and distributing the case studies. Additionally, we will discuss how each team plans to use the case studies to get soil health curious farmers to say "yes" to soil health practices. This symposium will provide tips on how users may employ the R-SHEC Tool Kit to produce their own locally relevant case studies.

Tuesday, August 2

Symposia Session Descriptions and Agenda

What Do Fish, Butterflies, and Bees Have in Common When It Comes to Conservation Projects?
10:30 AM – 12:00 PM, *Mattie Silks on Lower Level 1*

Moderator: *Caydee Savinelli, Syngenta*

Conservation projects for fish, butterflies, and bees have a number of things in common, including providing needed forage and habitat. These projects also have multifunctional benefits for an array of species as well as protecting water bodies and creating buffers along field margins in farm landscapes. However, when it comes to each conservation project, one size does not fit all, and considerations need to be made relative to the type of habitat restoration and species requirements. This symposium will present examples from nongovernment and crop commodity organizations that are implementing on-the-ground forage and habitat restoration projects for fish, butterflies, and bees. The California Rice Commission is working on a conservation project by using "surrogate wetlands," also known as rice fields, to help Chinook salmon in the Sacramento Valley. The Bee and Butterfly Habitat Fund provides habitat establishment expertise and seed mixtures, for both honey bees and monarch butterflies, for landowners across the Midwest. The Iowa Soybean Association is working with farmers and landowners on oxbow restoration for the Topeka shiner and habitat restoration for the rusty patched bumble bee, which are both listed as endangered via the Endangered Species Act.

Presentation 1: Winter-Flooded Rice Fields as Rearing Habitat for Juvenile Chinook Salmon (*Oncorhynchus tshawytscha*) – *Paul Buttner, California Rice Commission*

Presentation 2: Creating a Big Tent for Conservation Projects Including Butterflies and Bees – *Pete Berthelsen, Bee and Butterfly Habitat Fund*

Presentation 3: What Do Bees and Fish Have to Do with Soybeans? – *Brandon Iddings, Iowa Soybean Association*

Lessons Learned from a Full Year of Measured Soil Health, Economic, and Social Indicators from 13 Conservation Innovation Grant On-Farm Demo Trials in California, Kentucky, New York, Massachusetts, and Connecticut
10:30 AM – 12:00 PM, *Penrose 1 on Lower Level 1*

Moderator: *Michelle Perez, American Farmland Trust*

Presenters: *Ellen Yeatman, American Farmland Trust; Aysha Tapp Ross, American Farmland Trust; June Grabemeyer, American Farmland Trust; Aaron Ristow, American Farmland Trust; Scott Franklin, American Farmland Trust*

American Farmland Trust (AFT) kicked off our five-year On-Farm Soil Health Demonstration Trial (SHDT) Conservation Innovation Grant (CIG) project, "Conquering Cover Crop Challenges from Coast to Coast" in March of 2021. To address the low national cover crop adoption rate (5%), AFT developed a CIG SHDT to identify, evaluate, support, and showcase farmer-driven transitions to improving soil health through adoption of cover crops or modification of cover crop management. Thirteen producers in five states adopted cover crops, either alone or in combination with no-till, nutrient management, compost application, or unique termination strategies, and will be sharing their challenges, progress, and lessons learned with their community.

AFT is collaborating with the following producers:

- 2 California (almond, grape)
- 4 Kentucky (row crops)
- 2 Connecticut (dairy)
- 1 Massachusetts (dairy)
- 4 New York (row crop, dairy)

We will share soil health, economic, and social indicator results thus far for participating farmers based on the following analyses:

- In-Field NRCS Soil Health Assessments that qualitatively evaluate whether 11 indicators meet threshold criteria to assess the soil for four NRCS-defined soil health resource concerns
- Cornell Soil Health Laboratory's Comprehensive Assessment of Soil Health that quantitatively evaluate soil samples for 15 soil health indicators as they relate to other soil samples within soil textural groups
- Partial budget economic analysis using field operations data to compare the costs and benefits observed on the treatment and control plots
- Social indicators reflecting motivations for using soil health practice (e.g., top three soil health outcomes desired, concerns about adopting the new practices, etc.)

Also, we will share lessons learned from the AFT state staff interacting directly with the farmers, and the AFT national initiative staff coordinating the analyses.

Soil Health in the West: Partnerships and Perspectives from a National, Regional, and State Level
1:30 PM – 3:00 PM, *Denver Ballroom 5-6 on Lower Level 2*

Moderator: *Judy L. Bloom, US Environmental Protection Agency*

Soil health management in the West presents many challenges given the arid and sometimes extreme weather occupying the region. However, this also presents additional opportunities for soil conservation and water quality given the unique climactic conditions and agricultural needs. US EPA can support soil health management through its Nonpoint Source/319 program. Many states in EPA Region 8 (covering North Dakota, South Dakota, Montana, Wyoming, Colorado, and Utah) have soil health programs in place to incentivize and accelerate the adoption of soil health practices. These include statewide programs, coalitions, training opportunities, and innovative financing approaches. For example, the Colorado Department of Agriculture (CDA) has implemented a Soil Health Program, which will promote education about soil health, encourage voluntary, widespread adoption of soil health practices, increase producer profitability, and advance the scientific understanding of soil health through grants, a soil health inventory and soil testing system, and other voluntary-based programs. In recent years, the Colorado water quality agency, Colorado Department of Health and the Environment (CDPHE), has prioritized soil health and water quality management in its state nonpoint source program and has documented water quality improvements due to soil health implementation in focused watersheds in the states. Colorado State University has quantified the impacts of soil health management systems on water quality. In this symposium, we will present perspectives from a national, regional, and state level on agricultural conservation opportunities with the 319 program and beyond.

Presentation 1: How the US EPA National 319 Program Supports Soil Health – *Whitney King, US Environmental Protection Agency*

Presentation 2: Western Resilience and Soil Health – *Riley Dayberry, USDA NRCS*

Presentation 3: Colorado's Soil Health Program Launch – *Cindy Lair, Colorado Department of Agriculture*

Presentation 4: Colorado's Agricultural Water Quality Program: Insights on Water Quality and Soil Health – *Erik Wardle, Colorado State University*

Presentation 5: Soil Health Practices in a Semi-Arid Environment....Challenge Accepted – *Derek White Heckman, Local Farmer*

Women in Agriculture: Using Influence for Positive Change
1:30 PM – 3:00 PM, *Mattie Silks on Lower Level 1*

Moderator: *Jackie Byam, National Organization of Professional Women in Natural Resources Conservation Service (WiN)*

Presenters: *Caitlin Joseph, American Farmland Trust; Kriss Marion, Landowner/Producer and Wisconsin Women in Conservation; Tanya Meyer-Dideriksen, USDA NRCS*

The 2017 USDA's Census of Agriculture showed that 36% of US farmers are women and 56% of all farms have at least one female decision maker, compared to 91% with one or more male producers. These female-operated farms accounted for 38% of US agricultural sales and 43% of US farmland.

Many states and organizations are developing education and outreach programs to empower women farmers and landowners to use their voices for positive change in their communities through education, networking, and participation in listening circles and field days.

This panel discussion will explore how federal, state and local governments; nonprofit and faith-based organizations; and agricultural businesses are partnering to provide resources and guidance to female landowners and operators, encouraging them to use their voices and experience to leverage conservation on their lands.

Conservation Practice Adoption: An Evidence-Based Comparison of Adopters and Nonadopters
3:30 PM – 5:00 PM, *Denver Ballroom 5-6 on Lower Level 2*

Moderator/Presenter: *Seth Harden, The Nature Conservancy*

Presenter: *Lourival Carmo Monaco Neto, Purdue University*

Many studies have explored how farmers' demographical and behavioral aspects affect conservation practices adoption (Prokopy et al. 2019). Farm size, livestock number, and other farm characteristics, for instance, have been positively associated with conservation practices adoption (Prokopy 2008).

Our study, using data from the Purdue University Center for Food and Agribusiness Large Commercial Producer Survey conducted in 2021, differentiates itself by analyzing a large number of farmer respondents (1,570 observations), giving it a robust statistical backbone, but also the intention of broadening the body of knowledge on the subject. Primary US farm operations represented were corn/soybean, wheat/barley, cotton, fruits/vegetables, dairy, cattle, and swine. Respondent US farms were also categorized based on their sizes into small, mid-size, and commercial/large groups.

This research has the goal of identifying and understanding the differences in behavioral and demographics variables between farmers who adopt agricultural conservation practices on their farms and those who don't. The analysis will be comprised of farmers' answers to relevant questions asking about conservation practices adoption. Key covariates will be in two groups. The first group consists of demographical characteristics questions such as gender, age, and highest level of education. The second group includes questions related to farmers' experiences and preferences regarding conservation practice adoption, such as decision-making style (intuitive vs. analytical), and attitudes toward dealers/retailers. Through graphics and tables, we will explore these differences and discuss, building upon previous literature to help understand them.

An interactive and conversational environment will be created in which app-based polling systems and questioning will be used with the purpose of engaging the audience, challenging the presenters and peers, and searching for connections in the data and outside of it.

Practical Approaches to Scaling Quality in Transformational Agriculture
3:30 PM – 5:00 PM, *Mattie Silks on Lower Level 1*

Moderator: *Jamie Ridgely, Truterra*

Presenters: *Jason Ackerson, Soil Health Institute; Jack Carlson, Colorado State University*

Growing ESG commitments, coupled with increasing scrutiny over the potential for greenwashing, is creating a market hungry for high-quality, soil-based carbon assets. Yet how does one deliver those quality assets within a fragmented, tradition-bound industry constrained by low margins? For Truterra, the sustainability business of Land O'Lakes, the answer has been a combination of practical, field-based management approaches coupled with a menu of support services and anchored in the trusted farmer-ag retailer relationship. This symposium explores the approach Truterra has taken to drive transformational agriculture by meeting farmers where they are, connecting them to the resources and information required for a successful, sustainable transition, and delivering these critical services through Truterra's network of progressive, sustainability-minded ag retailers. The Truterra support network provides a comprehensive approach to supporting practice change; where most offers are focused on a sole aspect like the financial offer, this network offers a systems approach that includes educational, agronomic, technological, and financial resources. Working in collaboration with the Soil Health Institute and Colorado State University, Truterra is balancing market needs for quality and data integrity (monitoring, reporting, and verification [MRV]) with farmer and retailer needs for simplicity, flexibility, and agronomics.

Social and Behavioral Targeting of Conservation Programs for Increased Effectiveness

3:30 PM – 5:00 PM, *Penrose 1 on Lower Level 1*

Moderator: *Kristina M. Slagle, The Ohio State University*

Privately owned lands are an inescapable conservation challenge in much of the central and eastern United States, where efforts to protect land and water must engage diverse landowners. From wetland mitigation and creation to best management practices in farming to accessible lands for outdoor recreation, private landowners are the gatekeepers to action at large spatial scales, even though most landowners control an individually small footprint. Herein lies the challenge. With limited public lands in much of the United States, the bulk of conservation has traditionally occurred through voluntary, incentive-based programs on private lands. The effectiveness of such programs is limited by the amount of funding available, and by the distribution of funds to those who self-select into participation. Unfortunately, the lands of highest conservation value (whether that be wetlands for migratory birds or locations critical for improving downstream water quality) may not be those owned or managed by the individuals opting into conservation programs. Better targeting of limited funds for conservation to the people and places where they are most needed to support conservation goals may be necessary in these highly privatized landscapes. To this end, this symposium brings together five researchers working in the eastern Corn Belt to discuss social and behavioral targeting of investments. Specifically, panelists will present empirically driven solutions to overcoming behavioral (e.g., basic need satisfaction among landowners) and structural (e.g., parcel size) barriers for individuals managing high value land and identifying groups of landowners with different preferences and payment thresholds who can be differentially engaged through more customized, budget-conscious payment programs. Each panelist will give a five-minute overview of their work, followed by Q&A and a discussion of the feasibility and effectiveness of targeting conservation funds for greater return on investment.

Presentation 1: Crafty Conservation Programs: Don't Hit Me with a Stick and I Don't Like Carrots – *Gabriel R. Karns, The Ohio State University*

Presentation 2: Hunting for Private Lands Access – *Kristina M. Slagle, The Ohio State University*

Presentation 3: Conservation Targeting for Constructed Wetlands – *Robyn S. Wilson, The Ohio State University*

Presentation 4: Teasing Out the Effects of Industrialization on Conservation Practices – *Gillian Chesnut, The Ohio State University*

Presentation 5: Values, Identity, and Basic Needs Satisfaction as Motivators of Farmer Conservation Behavior – *Carrie Dale Shaffer-Morrison, Ohio State University*

Wednesday, August 3

Symposia Session Descriptions and Agenda

The Cutting Edge of Carbon Markets: Opportunities for Profit from Sequestration
8:30 AM – 10:00 AM, *Mattie Silks on Lower Level 1*

Moderators: *Joe Otto, Soil and Water Conservation Society and Adam Chambers, USDA NRCS*

Sponsored by members of SWCS's Science and Policy Committee, "The Cutting Edge of Carbon Markets: Opportunities for Profit from Sequestration" brings together leaders in academia, policy, and the public and private sectors, into a discussion about the state of the science, the positioning of policy, and opportunities for carbon markets to profitably advance conservation practices.

Presentation 1: Potential of Conservation Practices to Sequester Carbon – *Humberto Blanco, University of Nebraska*

Presentation 2: Opportunities and Challenges in the Carbon Markets – *John Shanahan, Agoro Carbon Alliance*

Presentation 3: Providing Farmers and Ranchers with Access to Ecosystem Service Market Opportunities – *Debbie Reed, Ecosystem Services Marketplace*

Presentation 4: Increasing Credibility and Access to Agricultural Climate Markets – *Sarah Alexander, Keystone Policy Center*

Using USDA NRCS Conservation Practice Standards in Innovative Ways

8:30 AM – 10:00 AM, *Penrose 1 on Lower Level 1*

Moderator: *Dana Ashford-Kornburger, USDA NRCS*

The USDA NRCS Conservation Practice Standards (CPS) are science-based and developed to address resource concern needs. They are regularly reviewed and updated to include innovative technologies and methodologies. Practices complement the conservation plan and can be used alone or as a part of a comprehensive system. Join agency technical discipline leads as they provide an overview of some CPS to highlight recent changes and innovative implementation. The symposium will include presentations on conservation planning and practices for feed management, pollinator habitat, rangeland plant communities, and air quality.

Presentation 1: How NRCS Refines and Enhances Conservation Practice Standards to Incorporate Innovations and Meet Conservation Needs – *Dana Ashford-Kornburger, USDA NRCS*

Presentation 2: Review (or Introduction) to Feed Management – *Greg Zwicke, USDA NRCS*

Presentation 3: Practices for Pollinator Habitat – *Ed Henry, USDA NRCS*

Presentation 4: Conservation Practices for Carbon Storage – *Laurie Schoonhoven, USDA NRCS*

Presentation 5: Practices to Improve Air Quality – *Greg Zwicke, USDA NRCS*

Driving Action through a Practice-Based Approach to Sustainability Assessments: The Sustainable Outcomes in Agriculture Standard

10:30 AM – 12:00 PM, *Mattie Silks on Lower Level 1*

Moderator/Presenter: *Steven Wall, Syngenta*

Syngenta Sustainable Solutions has developed the Sustainable Outcomes in Agriculture Standard (SOA) to provide a framework to help agricultural value chain companies and crop producers improve outcomes in regenerative agriculture. The SOA was developed for crop production operations to provide a scalable and easy on-ramp for a wide array of producers and supply chain companies to engage in improving on-farm sustainability. Recognizing that not all producers are at the same level of performance in delivering sustainable outcomes on their farm, Leadership Performance Levels are included in the SOA to differentiate producers and connect each producer to relevant opportunities for continuous improvement. The SOA is a globally applicable standard that measures regenerative and sustainable agriculture practices and decision making. It provides a framework for supply chains to monitor and track progress against sustainable outcomes while identifying improvement opportunities within their sourcing region. Syngenta is implementing the SOA through the Cropwise Sustainability (CWS) platform, providing easy-access to farmers through a mobile-friendly application. The CWS app allows growers to simply answer questions about their farming operation and receive a report of their performance against sustainable outcomes, identify opportunities for improvement, and use those insights for continuous improvement planning for their operation. We will discuss the sustainability outcomes and drivers in the SOA, its implementation via the app, and insights from those who have used the standard in their operations and supply chains.

Soil Health in the United States: Regional Differences and Considerations

10:30 AM – 12:00 PM, *Penrose 1 on Lower Level 1*

Moderator: *Jorge Delgado, USDA ARS*

Soils are a critically important part of the environment. They play a vital role in food production, water purification, carbon and nutrient cycling, and climate modulation, among others. However, soils are at a constant threat of degradation or loss due to management and land development. Given these challenges, there is a great interest in soil health from producers, ranchers, practitioners, and scientists. Soil health can be defined in various ways, but generally it is said to be the capacity of soil to sustain plants and animals over time. Soil functions are at the center of soil health and are divided into chemical, physical, and biological properties. Soil health is an excellent conversation starter and helps us understand the linkage between soil properties. Yet, soil health assessment uncertainties exist between soil types, climate, and cropping systems due to spatial and temporal differences. Further, there are discrepancies between agricultural and environmental soil functions. These agricultural and environmental needs often do not overlap. This symposium will bring together soil health experts from four US regions to discuss regional differences in soil health approaches for agricultural systems. Challenges, opportunities, and vision for future work will be discussed. This is a joint symposium with the Soil and Water Management and Conservation Division of the Soil Science Society of America, and will be also held during their 2022 Annual International Meeting.

Presentation 1: What Does Soil Health Mean in the Southern United States: Challenges and Opportunities – *Deanna Osmond, North Carolina State University; Sindhu Jagadamma, University of Tennessee*

Presentation 2: Soil Health Perspectives in Diverse, Western US Ecosystems – *Jim Ippolito, Colorado State University*

Presentation 3: Soil Health Up North: Assessing the Benefits – *Anna Cates, University of Minnesota*; *Hava Blair, University of Minnesota*

Presentation 4: Crop Residue Management and Nitrogen Fertilization Influences on Soil Health in the Semiarid Pacific Northwest – *Hero T. Gollany, USDA ARS*

ORAL PRESENTATIONS

Monday, August 1

Oral Presentation Descriptions and Agenda

Climate-Smart Practices for Increasing Resilience of Rural and Urban Land Uses at a Watershed Scale

Track: Climate-Smart Agriculture

Location: Penrose 2 on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Emad Mady (University of Massachusetts)*; Timothy O. Randhir (University of Massachusetts)

Climate-smart land use can be accomplished through management practices in rural and urban that enhance sustainability at a watershed scale. Effects of climate change, such as changing precipitation and temperature patterns, as well as increased frequency and severity of storms, have substantial impacts on working landscapes. There is a critical need to develop adaptation strategies at site scales to mitigate these impacts. In this study, a watershed-scale simulation model is developed to study the nature of vulnerability of these sectors to climate change, quantify the influence management practices in mitigating stress, and develop watershed-wide resilience strategies in a mixed land-use watershed. The study area is Mill River- Amherst Watershed that drains into Lake Warner. The watershed has a mix of urban and rural land uses that influence the water quality of the lake and has severe nutrient and sediment contamination issues. The GWLF watershed Model will be used to simulate hydrologic processes in the watershed system using monitored data. Data on climate will be input to simulate processes over a 50 year simulation period. Outputs of the model (runoff, streamflow, including water contamination from nitrogen, phosphorus, and sediment) will be calibrated with monitored information. Climate projections from IPCC AR5 will be used to simulate climate impacts on the watershed. Specific management practices will be implemented in rural and urban uses using parameterization methods to quantify mitigation of impacts and identify resilience mechanisms in the watershed. It is expected that increasing vegetative cover, landscape interventions (buffer), and practices that increase infiltration can be used to develop climate-smart practices in the watershed. The results will identify relative strengths of practices in enhancing climate-smart land use for conservation and is transferable to other watersheds.

**Denotes primary author*

Regenerative Farming and Ranching: A Qualitative Analysis

Track: Climate-Smart Agriculture

Location: Penrose 2 on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Lara Bryant (Natural Resources Defense Council)*

As the impacts of climate change, biodiversity loss, water pollution, and other environmental harms become more dire, regenerative agriculture may offer solutions. Regenerative agriculture emphasizes soil as a critically important resource that has the potential to mitigate global threats to biodiversity, climate, and water.
Any study of regenerative agriculture should be informed by farmer and rancher experiences. We conducted a qualitative analysis of regenerative agriculture in the United States and the associated operational, financial, cultural, and policy challenges and opportunities experienced by farmers and ranchers. We interviewed more than 100 farmers and ranchers from different regions and farm types and sizes. They shared with us their experienced barriers, including the difficulty of farm life, financial barriers to entry, labor, infrastructure, culture, education and research, markets, and policy. Opportunities to support regenerative agriculture include programs and policies that address producers' financial needs, education, and research. We found systemic barriers and interventions needed to build up enabling environments for regenerative agriculture through finance, land access, education, markets, and infrastructure.

**Denotes primary author*

The Confusion, Meaning, and Implications of Good Farming Practices and Crop Insurance Barriers to Conservation in an Era of Climate Disruption

Track: Climate-Smart Agriculture

Location: Penrose 2 on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Jeff Schahczenski (National Center for Appropriate Technology)*

In 2021, farmers and ranchers in the United States suffered insured crop losses of close to $8.4 billion dollars. The public subsidy of the insurance costs that these farmers and ranchers received was over $8.6 billion dollars. While most of the insured causes of loss derived from weather-related sources, the long-term trends of such losses have been increasing and may continue do so because of a changing disruptive climate. Also, it has become clear that this significant incentive may be the source of preventing adoption of climate smart practices and climate resilient systems of production.

Does the current federal crop insurance program create a significant barrier to farmers and ranchers adopting needed changes in conservation practices and modifications of systems of production? Can farmers and ranchers better assess their weather-related and market insurable risks in the face of climate disruption?

In addition, the continued confusion between the USDA Risk Management Agency (RMA) and the National Resource Conservation Services (NRCS) in understanding of how to implement important climate resilient good farming practices such as cover crop practice, inter-seeding, and relay cropping will be explored.

Finally, a demonstration in a case-study format will be presented regarding the underutilized and valuable decision tool called the AgRisk Viewer which can help conservation leaders better understand the historical causes of insurable loss in any county of the United States so as to improve conservation efforts do address those causes.

**Denotes primary author*

Learning from Conservation Practitioners: A Mixed Methods Analysis of Conservation Delivery Systems

Track: 2022 General Conference Theme

Subject: Social Sciences Informing Conservation

Location: Independence on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Chris Morris (Iowa State University)*; J.G. Arbuckle (Iowa State University)

In the spring of 2021, the Soil and Water Conservation Society, in partnership with Iowa State University, conducted the inaugural Conservation Practitioner Poll (CPP), a survey of conservation professionals in six Midwestern states. The goal of the CPP is to provide a voice to conservation practitioners, who serve as the main delivery system for conservation across the United States, to understand their unique perspectives and ideas about what conservation programs and policies are working well and what might be improved. The 2021 CPP was developed using input from a series of focus groups conducted with employees from several conservation organizations and states. The survey was sent to field personnel from the USDA Natural Resources Conservation Service, Soil and Water Conservation Districts, watershed groups, and other conservation agencies from Illinois, Indiana, Iowa, Minnesota, Missouri, and Wisconsin. The survey collected data on conservation practitioners' perspectives on fundamental aspects of their jobs, including the effectiveness of different engagement approaches with farmers and landowners, overall strengths and weaknesses of their respective organizations, suggestions for improving conservation program delivery, employee training needs, and recommendations for increasing conservation adoption. After the initial survey results were collected and reported, a more in-depth and comprehensive mixed methods analysis of the focus group and survey data was conducted in order to identify emergent patterns in the data. This presentation will share findings regarding differences in perspectives between different organizations and states, as well as demographic factors such as gender, length of employment, and personal experience with farming. Results suggest a number of ideas and recommendations for elevating efforts that are working well and for potential improvements in conservation programming.

**Denotes primary author*

Walter Lowdermilk and the SCS in WWII China

Track: 2022 General Conference Theme

Subject: Social Sciences Informing Conservation

Location: Independence on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Shelby Callaway (USDA NRCS)*

During WWII, Walter Lowdermilk, assistant chief of the USDA's Soil Conservation Service, took on a dangerous mission to assist China with wartime efforts to increase food production through conservation. With a team of eight Chinese scientists, he traveled over 7,000 miles in remote, northwestern China conducting land surveys, holding regional demonstrations for local farmers, and planning test plots to measure the effectiveness of various soil conservation measures and soil saving plants. Unlike most American agricultural advisors at the time, Lowdermilk demonstrated a willingness to learn from indigenous conservation practices and appreciated that technical conservation solutions would ran into social, political, and cultural barriers to implementation in China just as they did in the US. Lowdermilk's approach was adaptable to local circumstances, and he was careful to point out at every stop that the Chinese had been practicing most of the measures he recommended in some form for thousands of years. After his return to the US, Lowdermilk worked with the Chinese ambassador to develop a detailed program to carry out his conservation recommendations, but it failed to find political support in the US. Ahead of its time, Lowdermilk's model for developing technical assistance programs in soil conservation abroad that would assist allies in growing more food, preventing natural disasters, increasing the standard of living for rural people, and fighting communism anticipated almost verbatim the goals of USAID when it was founded in 1961.

**Denotes primary author*

Wetlands Protection and Planning: Potentials for Bridging Land and Water Planning through Public Engagement and Ecosystem Services

Track: 2022 General Conference Theme

Subject: Social Sciences Informing Conservation

Location: Independence on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Sarah Church (Montana State University)*; Ashlie Gilbert (Montana State University); William Kleindl (Montana State University)

In the history of the lower 48 United States, over half of our original wetlands have been lost. In 1990, the US instituted a wetland policy for no overall net loss of wetland functions and values. Wetland ecosystem services (ES) has made some advances in defining wetland values. Here, we report a subset of results from a Delphi survey of aquatic systems experts in several western states (Round 1 n=179; Round 2 n=59). The Delphi approach surveys an expert panel several times to generate consensus around an issue. Our results suggest there is a disconnect between aquatic system experts' values surrounding wetlands and the role of the public in wetland protection. In Round 1, respondents reported existing local, state and federal policies are important to wetland protection, but polices should be more stringent. Round 2 confirmed that existing local and state regulations and incentives are not seen as effective. Respondents reported that better coordination between land and water planning is needed and that local land use planners' decisions negatively impact water resources. Respondents also prioritized regulating and provisioning ES over cultural ES. Although in Round 1 we found that respondents did not see importance of public involvement in wetland decision-making in their protection, Round 2 showed mixed results. Most respondents felt the public had an important but limited role, with a few feeling the public was detrimental to wetland protection. We suggest these results may shed light on ways to improve understanding and collaboration between land and water planning: 1) respondents value biophysical components of wetlands that may not be as important to land use planners who plan for and with the public; 2) respondents show inclination toward valuing public ecosystem support and ecological knowledge that may translate to policy support. We suggest that these two overall results could be a starting point for dialogue around wetlands protection and planning.

**Denotes primary author*

What Explains Different Findings about the Determinants of Agricultural Conservation Adoption?: A Meta-Analysis

Track: 2022 General Conference Theme

Subject: Social Sciences Informing Conservation

Location: Independence on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Benjamin Gramig (USDA Economic Research Service)*; Kristin Floress (USDA Forest Service); Pranay Ranjan (Purdue University); Linda Prokopy (Purdue University); J.G. Arbuckle (Iowa State University); Ajay Singh (California State University-Sacramento); Sarah Church (Montana State University); Junyu Lu (Hainan University/ASU Joint International Tourism College)

We construct a database of 35 years (1982-2017) of agricultural conservation practice adoption studies to perform a quantitative meta-analysis of the determinants of adoption findings published in the academic literature. The database contains all reported model statistics and estimated parameters, including dependent and independent variable descriptions, from 171 separate quantitative studies. The results of a statistical meta-analysis of these data are presented, highlighting differences with findings from other study approaches using the same underlying database of studies. We apply conventional statistical methods used in meta-regression analysis to analyze study-level determinants of conservation practice adoption behavior. We compare insights from the meta-regression approach to Sign Test and Vote Count quantitative methods used previously to the same scientific literature.

**Denotes primary author*

Adoption of STAR in Colorado: A Model for Western States

Track: 2022 General Conference Theme

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

Location: Gold Coin on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Ryan M. Taylor (Colorado Department of Agriculture)*; Max Neumeyer (Ground Up Consulting)

The Saving Tomorrow's Agriculture Resources (STAR) Initiative is an important, innovative, and simple framework that allows farmers to evaluate their current production system, identify areas for improved management, document their progress, and share their successes. The evaluation system assigns points for management activities on an annual basis and scores are converted to a 1 to 5 STAR Rating, with 5 STARs indicating commitment to a suite of practices proven to improve soil health and water quality. Originally developed by Champaign County Soil and Water Conservation District focusing on the Illinois Nutrient Loss Reduction Strategy, it is now also administered in several states, including Colorado. In Colorado, STAR evaluates 11 different cropping systems and grazing lands for soil health, creating a complementary tool to the more robust STAR Plus program that includes a soil health test and offers financial incentive to the producer and technical assistance. This presentation will review how STAR was adapted for Colorado, leadership opportunities for conservation districts and partners, and the anticipated tangible ecosystem benefits to be derived from the adoption of soil health principles across Colorado.

**Denotes primary author*

Centering Soil Health: Innovative Drivers to Effective Transition

Track: 2022 General Conference Theme

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

Location: Gold Coin on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: William Schleizer (Delta Institute); William H. Schleizer (Delta Institute)*

For the past several years, Delta Institute created and implemented mechanisms that prioritize improving soil health to drive transition to more climate-smart practices – improving environmental quality and improving a farmer's bottom line. Farmers face steep hurdles to successfully transition to conservation-focused, climate-resilient agriculture. Value propositions, ranging from improved drought/flooding resilience, greenhouse gas instruments, land appraisal and rent value increases, and other benefits from improving soil health through the adoption of conservation practices, are unclear to many farmers. Products and services are needed that integrate these practices seamlessly into a farmer's business and operations decisions. As soil analysis and data collection methods are improving, creating a land valuation process that incorporates soil health is a useful driver for increasing landowner adoption of soil health practices. As the importance of land management in addressing climate change becomes more apparent, the Midwestern agricultural community needs to assess and value soil health for sale valuation, loan and investment underwriting, and—quite notably—carbon sequestration and documented water/soil quality improvements.

This presentation will review current status, lessons learned, and what's next for several mechanisms designed to expand conservation practice adoption while supporting farmer decision making, including soil health testing standardization, role of land valuation and appraisal, accessing carbon markets, and utilizing conservation programs to drive soil health. This includes the creation of a framework for soil health land valuation based on sound science that creates lasting conservation incentives to increase farmers' resilience to climate change, achieve measurable improvements in soil and water health, and provide economic benefits for landowners.

**Denotes primary author*

Effects of Management on Soil Health in Ohio

Track: 2022 General Conference Theme

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

Location: Gold Coin on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: William Osterholz (USDA ARS)*

The size and direction of the effects of cropland management, such as tillage regime, manure and fertilizer application, and cover crops, on soil health remains uncertain. Our research leveraged the existing Ohio edge-of-field water quality research network to measure soil health across ~40 fields. Two analysis approaches were taken: 1.) Quantify changes in soil health over a 3 year period then relate these changes to management practices, and 2.) compare soil health in paired fields with specific differences in management. Indicators of soil health included soil organic carbon, soil respiration, aggregate stability, active C, and soil protein. Results are currently in progress and are expected to reveal the effects of management practices on the soil health indicators. Insights from this work will advance understanding of the range of soil health across a landscape scale, and help inform farmers about which management practices did and did not influence soil health.

**Denotes primary author*

Investing in Success: Implementing the Gulf Hypoxia Action Plan

Track: 2022 General Conference Theme

Subject: Water Resource Assessment and Management

Location: Matchless on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Katie Flahive (Environmental Protection Agency)*

The Infrastructure Investment and Jobs Act/Bipartisan Infrastructure Law of 2021 delivers more than $50 billion to the U.S. Environmental Protection Agency (EPA) between FY22-26 to improve our nation's drinking water, wastewater, and stormwater infrastructure. The BIL provides for the first time an appropriation of $60 million to stand up a new Gulf Hypoxia Program (GHP) to distribute grants that will support actions under the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force's (Hypoxia Task Force or HTF) Gulf Hypoxia Action Plan.

The HTF is comprised of important collective partners that rely on the support of this community to implement Nutrient Reduction Strategies to reach the Action Plan goals, including reducing the 5-year running average areal extent of the hypoxic zone to less than 5,000 sq km by 2035 and an interim target of 20% reduction of nitrogen and phosphorus loading by 2025. A key tenet of the GHP is to support states as they implement and scale their nutrient reduction strategies through planning, tracking progress, research, coordination, direct engagements with farmers, and with innovative conservation practices. As the first year of work gets underway, EPA will ensure that GHP benefits are realized by disadvantaged communities and under this program, advance nutrient reduction, water quality actions that have climate resilience co-benefits.

During this session, EPA staff will provide an overview of the guiding principles and priorities of the GHP and inform participants of the expectations for grantees to describe and communicate nutrient reduction progress towards the HTF goal at the basin scale to the public.

**Denotes primary author*

Selecting the Best Practices for Managing Legacy Phosphorus Fields Identified through a Public Private Partnership

Track: 2022 General Conference Theme

Subject: Water Resource Assessment and Management

Location: Matchless on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Michael Brooker (Ohio State University)*; Jay Martin (Ohio State University); Nathan Stoltzfus (Ohio State University); Sam Francis (The Ohio State University); Rachelle Crow (The Ohio State University); Margaret Kalcic (University of Wisconsin); Ryan Winston (The Ohio State University); Kevin King (USDA ARS); Robyn Wilson (Ohio State); Brian Roe (The Ohio State University); Greg LaBarge (The Ohio State University Extension); Jessica D'Ambrosio (The Nature Conservancy); Chad Penn (USDA ARS)

Legacy nutrients stored in agricultural soils pose a long-term source of nutrient runoff contributing to eutrophication. In the Lake Erie watershed, phosphorus (P) is the primary nutrient of concern that has caused recurrent harmful algal blooms. Regionally, some agricultural fields have accumulated excess P in their soils (elevated-P; defined here as 100 mg/kg) that exceed agronomic needs (2.5×), meaning these sites likely act as disproportionate sources of legacy loads. Targeting of practices to these sites may be efficacious, but this has been prohibited by the inability to locate these fields within the watershed. Through a public private partnership, we were able to identify 12 legacy P fields where water quality monitoring and conservation practices have been established. While some fields discharged P at elevated concentrations, other fields discharged P at concentrations less than expected. Across these sites, the average concentration was 70 ppb P but with a range from <10 – 200 ppb P for individual sites. As a reference, the regional target for P concentrations is 50 ppb. Managing these disparate nutrient loads requires different practices, but also must consider geospatial (e.g., drainage design) and behavioral factors (e.g., receptivity of farmers to practices). These factors guided the decision-making process to select the conservation practices at these fields. The initial results from these management practice have revealed the benefits of targeting practices to legacy P fields and will be used to help further guide the future efforts of watershed management of legacy nutrient loads.

**Denotes primary author*

The Impact of Climate and Geo-Spatial Variability on Nature-Based Solution Co-Benefit Patterns and Evaluation Methods: A Systematic Review

Track: 2022 General Conference Theme

Subject: Water Resource Assessment and Management

Location: Matchless on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Adrienne G Donaghue (ORISE, EPA)*; Cyd Curtis (US EPA); Ellie Flaherty (EPA); Robert Goo (US EPA)

Erosion control, water reuse, and groundwater recharge are examples of environmental co-benefits provided beyond the primary design function of nature-based solutions or green stormwater infrastructure (GSI). Environmental co-benefits are frequently reported. However, the impact of climate change, geo-spatial variability, and site characteristics on the presence and effectiveness of co-benefits remains unclear. Here we use Colandr to conduct a systematic review and screen over 3,000 articles to provide a synthesized summary of co-benefit patterns and evaluation methods. Screening tag categories included co-benefits, land use, location, study type, site features, climate variables, and evaluation frameworks. Visualization tools such as heat maps are used to characterize the frequency of monitored co-benefits as a function of 10 different nature-based solution designs. Additionally, we will explore how the geo-graphic spread of a specific nature-based solution design influences observed co-benefits. For example, design of nature-based solution practices in the southwest will likely target water reuse and groundwater recharge in contrast to east coast practices emphasizing water storage and runoff reduction. Lastly, we will highlight evaluation frameworks reported in literature that qualitatively or quantitatively capture the cumulative value of co-benefits. Evaluation methods can serve as an assessment tool to aid watershed planners, practitioners, and decisions makers in water resource management, planning, and design. Results from this review will be used to update EPA's nonpoint source Grants Reporting and Tracking System (GRTS) to qualitatively track co-benefits and aid grantees in leveraging co-benefits for hazard mitigation grants.

**Denotes primary author*

Quantifying the Environmental Effects of Implementing Managed Agricultural Aquifer Recharge in Agricultural Production Systems

Track: 2022 General Conference Theme

Subject: Water Resource Assessment and Management

Location: Matchless on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Helen Dahlke (University of California, Davis)*; Elad Levintal (University of California, Davis); Cristina Prieto Garcia (University of California, Davis); Wenyi Cui (University of California, Davis); Isaya Kisekka (University of California, Davis); Thomas Harter (University of California Davis)

Agricultural Managed Aquifer Recharge (Ag-MAR) is an emerging managed aquifer recharge technique that uses agricultural fields as percolation basins to recharge the underlying aquifers. Using conventional agricultural production systems for MAR provides several benefits (e.g. large spreading areas connected to surface water conveyance systems, flood mitigation, potential capture of large volumes) but also poses several concerns including crop tolerance to flooding, long-term impact on soil texture, leaching of pesticides and fertilizers to groundwater, and potential greenhouse gas emissions. In this study, we conducted winter flooding experiments to improve understanding of Ag-MAR on nitrate leaching and the growing season root zone nitrogen budget and nitrogen losses to the deep vadose zone. Two Ag-MAR experiments were conducted in two raisin grape vineyards with different soil textures, which were each flooded for 2 weeks and 4 weeks, respectively. A third experiment was conducted on a fallow field, which was flooded for eight days before it was planted with processing tomatoes. Each site's instrumentation included a suite of soil moisture sensors, water level loggers, flow meters, redox probes, oxygen sensors, suction cups for pore water sampling, and static flux chambers for nitrogen (N_2O) and carbon-related (CO_2, CH_4) atmospheric fluxes. Soil samples were taken before and after Ag-MAR events to determine soil N species (TN, DON, TOC, NO_3^-, NH_4^+), pH, EC, and soil texture. Plant and yield were also measured to determine the effect of Ag-MAR on grape and tomato physiology and to close the N-mass balance. Results indicate that: (1) during flooding NO_3^- leaching was the main process with an additional but smaller contribution of denitrification; (2) there were no greenhouse gas emissions observed during the Ag-MAR treatment; (3) soil texture and crop type determined the magnitude of NO_3^- leaching at each site.

**Denotes primary author*

Building Soil Health within the Dairy Supply Chain; How Do We Include Partners to Integrate Change in Soil Health at the Production Level?

Track: At the Intersection of Agriculture and Conservation

Location: Penrose 1 on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Kinzie Reiss (American Farmland Trust)*; Julie Platz (American Farmland Trust)

Consumer interest surrounding the environmental impact on food production has grown in recent years leading to corporations investing in more sustainable sourcing. This project connected farming practices to corporate goals and, in conjunction with additional partners, reported on and implemented soil health best management practices within the supply chain.

American Farmland Trust ("AFT"), worked with partners including Danone North America, Sustainable Environmental Consultants ("SEC"), National Fish and Wildlife Foundation, and Natural Resources Conservation Service to support farmers in meeting their conservation goals in Northwest Ohio and Western Kansas. The technicians provided one on one technical support to those supplying feed resources to area dairies. Utilizing SEC's EcoPractices® platform, AFT conservation technicians provided farmers with a detailed On-Farm Outcomes report, to quantify current conservation and environmental impacts. Sustainable Continuous Improvement Plans also provided long and short-term improvement goals and helped to identify available funding to support implementation.

The conservation technicians reached over 600 farmers, landowners, and resource professionals with outreach and education services through attending and hosting events. Between the two states over 2,000 affiliated acres were enrolled and reported on via an On-Farm Outcomes report and Sustainable Continuous Improvement Plan. Currently, more acres are anticipated to be enrolled before the end of the life of the grant. The technicians empowered farmers to make changes to their farm and encouraged them to tell their regenerative story. This project bridged the gap between working individually with producers, governments, corporations, and nonprofits to affect the dairy supply chain.

**Denotes primary author*

Sanborn Field Long Term Findings: Soil Erosion—Soil Water Availability: Redux

Track: At the Intersection of Agriculture and Conservation

Location: Penrose 1 on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Clark Gantzer (University of Missouri)*; Stephen Anderson (University of Missouri); Tim Rienbott (UMC South Farm Research Center)

Soil water is often the most limiting factor for plant growth and yield, and is an excellent indicator of soil quality. This study reports how soil and crop management influences soil plant available water (PAW) by using results from surface Mexico series (Epiaqualf) samples collected 125 years after treatment establishment. Samples were used to determine the soil water characteristic (SWC), soil organic matter, bulk density (BD), and texture from six long-term historical plots of Sanborn Field consisting of continuous corn, wheat, and timothy, with and without application of farmyard manure and continuously since 1888. Organic matter, BD, and texture data from historical samples from 1915, 1938, 1962, and 1988 are used as input to a pedotransfer function to estimate the SWC for the historical samples. Information will show the influence of soil and crop management on PAW, and will allow estimation of soil physical quality. Data from soil and crop management influences on PAW, National Weather Service data from 28 long-term Missouri locations will be input into a Thornthwaite-Mather climatic water budget model to estimate Shaw's daily moisture stress index from daily evapotranspiration. We will highlight how soil and crop management influences levels of PAW across Missouri claypan soils that impact moisture stress in crops.

**Denotes primary author*

Changes in Accrued and Sequestered Carbon in Agroecosystems Implementing Single Standard Conservation Practices vs. the Integration of Multiple Conservation Practices

Track: At the Intersection of Agriculture and Conservation

Location: Penrose 1 on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Ann Marie Fortuna (USDA ARS)*; Patrick Starks (USDA ARS); Daniel Moriasi (USDA ARS)

Recent additions to the National Conservation Practice Standards codes include best management practices (BMP) that when implemented as a suite of BMPs within an agroecosystem have the potential to improve and or maintain soil health, yield, plant biomass and climatic resilience. Agroecosystems compared are a remnant southern tall grass prairie (STGP) in conservation cover management, code 347, a continuously tilled winter wheat management in conservation nutrient management, code 590 and two conservation tillage managements systems with different previous land management. The long-term minimal disturbance system (code 345) was planted to continuous winter wheat and periodic summer forages until 2018 when the system was converted to fertilized cool and warm season forage cover crops (codes codes 327, 328, 511, 590). The second minimal disturbance system was in STGP for ~40 yr prior to conversion to minimal disturbance fertilized cool and warm season forage cover crops. Highly variable weather and climate require adaptive wheat, livestock management practices to mitigate adverse impacts of climate variation. Incorporation of fertilized, rain-fed, mixed forage cover crops can mitigate this gap while increasing plant cover for improved soil health and nutrient cycling. This research compares shifts in accrued and sequestered C measured via particulate organic matter C (POMC), residual of acid hydrolysis C (ACH) and total soil organic C (TSOC) across the previously described agroecosystems with single or multiple conservation management practices. Both stacked conservation systems in minimal till continuous forage cover crop covers are expected to increase accrued biologically active C fractions (POMC) prior to potential shifts in whole soil C. The minimal till system previously in STGP is expected to contain greater ACH (sequestered C) and POMC (accrued C) relative to the long-term minimal till and tilled systems.

**Denotes primary author*

Assessing Land Health with State and Transition Models

Track: 2022 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

Location: Penrose 2 on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Shane A Green (USDA NRCS)*

Land health assessment tools are commonly used by NRCS during conservation planning. The various assessment tools employed can be lengthy and complex. One alternative for a more efficient process is to formally recognize what obvious resource concerns may exist based on identification of the benchmark state or plant community from state and transition model in the ecological site description.

**Denotes primary author*

Examining the Potential of Conservation Practices to Maximize Subfield Profitability and Environmental Benefits

Track: 2022 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

Location: Penrose 2 on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Haleigh Summers (Iowa State University)*; Meyer P Bohn (Iowa State University); Emily K Zimmerman (Iowa State University); John Tyndall (Iowa State University)

Around 5-15% of an average farm field in Iowa regularly has low yields due to soil properties and landscape position, resulting in lower profitability than the surrounding field and often net financial loss (Muth, 2014). While these unprofitable areas may make economic sense for conversion to conservation practices, it remains unclear if these locations are also the best opportunities to address resource concerns or enhance environmental benefits, such as reduced soil erosion and nutrient loss. I will examine how often the least profitable areas of fields overlap with areas where a conservation practice could be placed to maximize spatially-determined environmental benefits. Preliminary results suggest that subfield areas of low profitability do not often overlap with areas of high runoff or soil loss concern. This research will provide insights into if subfield profitable areas are ideal placement for conservation practices and what possible financial incentives exist.

**Denotes primary author*

Mobile Conservation Applications for Onsite Problem Solving

Track: 2022 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

Location: Penrose 2 on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Donald A Sternitzke (NRCS)*; Chris Stoner (NRCS)

USDA's Natural Resource Conservation Service of Oklahoma has developed several computerized software programs for smartphone and laptop use. These allow the user to instantly solve conservation problems both in the office and onsite. YouTube tutorials explain how to operate most programs and how results are calculated. QR codes give users instant access to the latest downloadable updates and new programs which are constantly being added. From engineering to economics and from irrigation to energy the novel approach is giving users the tools they need to save water, energy, and money.

**Denotes primary author*

Performance-Based Payments for Conservation Adoption

Track: 2022 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

Location: Penrose 2 on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Jeremiah Asher (Institute of Water Research - Michigan State University)*; Glenn O'Neil (Institute of Water Research - Michigan State University); Connor Crank (Institute of Water Research - Michigan State University)

Overview of modeling approach and outcomes of two Great Lakes Restoration Initiative grants aimed at accelerating conservation adoption on farms in the River Raisin and Saginaw Watersheds in Michigan through performance based payments and working with a local farmer-led watershed conservation groups. Both projects establish modeling methods to create a threshold payment rate in dollars per pound of nutrient reduction. These thresholds mark the entry point for participants into the program. The project also equips farmers with tools to help identify environmental risks and conservation solutions. The program helps pay for those conservation solutions identified through the tools. The use of this method to enroll participants in conservation adoption resulted in phosphorus reductions that were seven times more cost effective than a randomized approach.

**Denotes primary author*

Assessing the Impact of an Outreach Training Program on Agricultural Conservation Behavior

Track: 2022 General Conference Theme

Subject: Outreach, Education, and Community Engagement

Location: Independence on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Adam P. Reimer (National Wildlife Federation)*; Jessica Espenshade (National Wildlife Federation); Lekha Knuffman (National Wildlife Federation)

Conservation outreach requires providing technical guidance and support to producers to build the required knowledge and skills to implement practices. Equally important, yet sometimes underappreciated, is the need to building social support among producers who have not yet adopted conservation practices to alleviate social barriers. Leveraging knowledge from the social and behavioral sciences has the potential to improve conservation outreach by better matching messaging to the goals, experiences, and concerns of different segments of the farming population. For conservation professionals and farmers without training in these communication skills, this can be a challenge. The National Wildlife Federation's Grow More program seeks to elevate conservation outreach impacts by building the skills of conservation professionals and farmers to provide targeted messaging to non-conservation adopting farmers, with the ultimate goal of increasing adoption of soil health and other practices. Assessing the impacts of such a train-the-trainer program on both outreach and conservation outreach is crucial. Using a mixed methods approach that includes surveys and interviews, this impact assessment will provide insights about the effectiveness of this program at changing outreach messages and strategies among participants, as well as perceived impacts on conservation adoption among the producers these participants work with.

**Denotes primary author*

Promoting Sustainability through Environmental Stewardship

Track: 2022 General Conference Theme

Subject: Outreach, Education, and Community Engagement

Location: Independence on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Donna S. Gentry (Louisiana States University AgCenter)*

Although Louisiana is known as the "Sportsman's Paradise" for its beautiful waterways and natural resources, agriculture is the dominant industry and considered a potential threat to water quality. Just over twenty years ago, the Louisiana Master Farmer Program was developed for agricultural producers to proactively address environmental and water quality issues, while improving soil health, sustainability, and production. The LSU AgCenter, Louisiana Department of Agriculture and Forestry, Louisiana Cattlemen's Association, USDA/Natural Resource Conservation Service, and Louisiana Farm Bureau Federation collaborate to implement a three-phase certification program that includes education, demonstration, and implementation of Best Management Practices. After a producer completes three phases, they are certified for five years by the Commission of Agriculture and are meeting all state soil and water quality standards and in "Presumed Compliance". To date, more than 3800 producers, landowners, agency personnel and industry leaders are participating in the program with 380 Certified Master Farmers. This elite group of producers represent almost 2M acres of land and include livestock and row-crop operations across the state. This program not only promotes sustainability on the farm level, but is now the "standard" for environmental stewardship programs in the Mid-South.

**Denotes primary author*

The Role of Farmer Networks in Supporting Adaptive Capacity: Opening the Door for Innovation and Transformation

Track: 2022 General Conference Theme

Subject: Outreach, Education, and Community Engagement

Location: Independence on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Alissa C. White (University of Vermont)*

Previous research suggests that farmers' networks are the backbone of practical agricultural knowledge systems in the US, serving as a critical venue where growers exchange and negotiate new ideas. Drawing upon empirical evidence from a regional survey on climate resilience and a series of focus groups conducted in collaboration with nine farmer organizations from Pennsylvania to Eastern Canadian provinces, we examine how the emergence of new ideas and agroecological innovations are influenced by geography, network affiliation, and perceived agency. First, we used regression analysis to identify factors that influence the use of no-till on diversified vegetable and berry farms, which is an emerging innovation in this community. Our analysis shows that geography may not be a significant driver of adoption among the population we sampled, which contrasts with previous research on explanatory factors, yet affiliation with certain farmer networks was significant in predicting the use or intended use of the practice. This quantitative analysis is complemented by qualitative data from a series of focus groups in which farmers identify the characteristics of certain networks which support them in addressing new challenges. Farmers identified that networks support them in learning about new ideas, accessing resources, and engaging in creative problem solving, through facilitation of spaces for exchange with peers and experts and being responsive to their emerging needs.

**Denotes primary author*

An Improved Design Criterion for Optimizing the Performance of Saturated Buffers

Track: 2022 General Conference Theme

Subject: Water Resource Assessment and Management

Location: Gold Coin on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Ehsan Ghane (Michigan State University)*; Yousef Abdalaal (Michigan State University)

Saturated buffers (NRCS standard 604) are designed to reduce nitrate loss from subsurface-drained farms. NRCS engineers use the NRCS Design spreadsheet to design saturated buffers. That design criterion is based on choosing a distribution pipe length that diverts at least 5% of the drainage capacity into the saturated buffer (Design 1). Recently, McEachran et al. (2020) proposed a second design criterion of using a theoretically developed equation for estimating the saturated buffer width (Design 2). However, neither of these design criteria have been tested with field data. The objective of this study is to identify the best design criteria for optimizing the performance of saturated buffers based on field data. To test the NRCS (Design 1) and MacEachran (design 2) criteria, we used daily observed drainage discharge data (2019-2021) from an on-farm research site in Michigan. We designed the width and length of a saturated buffer based on Designs 1 and 2. We proposed a Design 3, where we performed daily simulations for all possible buffer widths from 10 to 60 ft, and we estimated the nitrate load reduction for each buffer width. In Design 3, we picked the buffer width that maximized the nitrate load reduction. To compare the three design criteria, we performed daily simulations of nitrate load reduction for all three designs. The design with the maximum nitrate load reduction was chosen as the best design criterion. We found that Design 3 was the best design criterion because it maximized nitrate load reduction.

**Denotes primary author*

A Decade of Edge-of Field Monitoring: Results from the Arkansas Discovery Farm Program

Track: 2022 General Conference Theme

Subject: Water Resource Assessment and Management

Location: Gold Coin on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Mike Daniels (University of Arkansas System Division of Agriculture Cooperative Extension Service)*; Pearl Webb (University of Arkansas System Division of Agriculture Cooperative Extension Service); Lee Riley (University of Arkansas System Division of Agriculture Cooperative Extension Service); Matt Fryer (University of Arkansas System Division of Agriculture Cooperative Extension Service); Mike Hamilton (University of Arkansas); Bill Robertson (University of Arkansas System Division of Agriculture)

The Arkansas Discovery Farm program began edge-of-field monitoring of runoff on private row crop farms nearly a decade ago for cotton, corn, rice, and soybeans. (1) assess the need for and effectiveness of adopting soil and water conservation practices to reduce nutrient and sediment loss and conserve water for major agricultural systems; (2) provide on-farm verification of nutrient and sediment loss reductions and water conservation; (3) mitigate nutrient and sediment losses that may prevent State waters from attaining designated uses; (4) deliver outreach programs to producers in achieving production and environmental goals; and (5) provide information in support of profitability and sustainability. Monitoring results from various cropping systems and the performance of conservation practices will be presented.

**Denotes primary author*

Quantifying Sulfate Loss in Edge-of-Field Runoff from Selected Arkansas Discovery Farms Research Sites

Track: 2022 General Conference Theme

Subject: Water Resource Assessment and Management

Location: Gold Coin on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: James M. Burke (University of Arkansas)*; Mike Daniels (University of Arkansas System Division of Agriculture Cooperative Extension Service); Matt Fryer (University of Arkansas System Division of Agriculture Cooperative Extension Service)

Research concerning surface runoff of applied and native soil nutrients has primarily been concentrated on nitrogen (N) and phosphorus (P). Nevertheless, other nutrients involved with agricultural production have shown the ability to be lost from fields through surface runoff. The significance of soil and fertilizer-applied sulfate (SO_4^{2-}) during edge-of-field runoff events has not been studied to the extent of N and P. While soil tests predominantly relate to the accessibility of fundamental plant nutrients such as N, P and potassium (K), SO_4^{2-} is still an important constituent of many fertilizer formulations. Therefore, SO_4^{2-} should be a key factor in any agricultural organization's nutrient management plan (NMP). Fertilizers having significant quantities of SO_4^{2-} should observe the four "R's" of fertilizer discipline; right place, right time, right rate, and the right source, that are frequently attributed to traditional fertilizers. By determining the extent of SO_4^{2-} lost in edge-of-field runoff and from the soil environment, a relationship may be observed where the four "R's" can be relevant to SO_4^{2-} comprising fertilizers. The Arkansas Discovery Farms Program (ARDF), along with collaborating regional producers and property-owners, have started research involving SO_4^{2-} edge-of-field runoff from experimental locations throughout Arkansas. These farms embody numerous facets of agricultural research from row crops to forage and livestock production. Thus, the goals of this investigation are: i) to measure the concentrations and totals of SO_4^{2-} in edge-of-field surface runoff from ARDF research sites; ii) to establish if SO_4^{2-} concentrations are displaying any harmful effects on area water quality and if so, recommend means of remediation; iii) to examine soil SO_4^{2-} levels by means of soil sampling and ensuing soil tests; and iv) to determine SO_4^{2-} fertilizer efficiency and the quantity of fertilizer-applied SO_4^{2-} transported by edge-of-field surface runoff.

**Denotes primary author*

Benefits and Consequences of No-Tillage and Cover Crop Use in Semiarid Cotton Production

Track: At the Intersection of Agriculture and Conservation

Location: Penrose 2 on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Joseph Burke (Texas A&M AgriLife Research)*; Katie Lewis (Texas A&M Agrilife); Jamie Foster (Texas A&M AgriLife Research); Paul De Laune (Texas A&M Agrilife); Wayne Keeling (Texas A&M AgriLife Research)

Cotton producers on the Texas High Plains have not readily adopted conservation practices such as no-tillage and cover crops due to concerns regarding water availability and its subsequent impact on the proceeding cotton (*Gossypium hirsutum* L.) crop. A study was initiated near Lamesa, TX to determine the impact of no-tillage and cover crops on water availability and nutrient cycling. Treatments included: 1) conventional tillage, winter fallow; 2) no-tillage, rye (*Secale cereal* L.) cover crop; and 3) no-tillage, mixed species cover crop. Mixed cover crop species included 10% hairy vetch (*Vicia villosa* Roth), 7% radish (*Raphanus sativus* L.), 33% winter pea (*Pisum sativum* L.), and 50% rye, by weight. Soil water was determined using via neutron attenuation. Litterbags were installed at field-scale into the plots following cover crop termination and collected at 4, 8, 16, 32, 64, and 128 days after termination (DAT) during the growing season to determine biomass decomposition. Soil samples were collected to determine carbon and nitrogen cycling. Results indicate that while soil water was significantly reduced prior to cover crop termination, soil water following a cover crop was greater during active cotton growth compared to the conventional system. Approximately 75% and 30% of the terminated cover crop biomass was persistent 128 DAT, in 2020 and 2021 respectively. Soil N followed similar trends indicating that N may not immediately be available to the cotton crop following a cover. Soil protein and inorganic N concentrations peaked 8 and 16 DAT, respectively, before steadily decreasing for the rest of the study period. Results suggest that inorganic N might be limited in semi-arid cotton cropping systems following cover crop termination. These results suggest N immobilization may serve as a viable culprit to the yield reductions observed following cover crops in Texas High Plains cotton production.

**Denotes primary author*

Evidence that Long-Term Cover Cropping-Induced Increases in Soil Organic Matter Enhanced Grain Corn Yield via Nitrogen Availability

Track: At the Intersection of Agriculture and Conservation

Location: Penrose 2 on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Laura L. Van Eerd (University of Guelph)*

Cover crops (CC) are a known best management practice to enhance soil organic matter (OM) and system resiliency. Quantifying these enhancements requires long-term research, but there are few long-term trials that compare various CC approaches. At Ridgetown, Ontario, Canada, a long-term CC experiment with four replicates and two adjacent sites was established in 2007 and 2008 to evaluate the role of CC (oat, winter cereal rye, radish, mix of radish plus rye, and a no CC control (noCC)) in a grain and horticultural crop system. These late summer-planted CC were grown 10 times in 13 years prior to grain corn production in 2020 and 2021. In the spring, the experimental area was sprayed with glyphosate, cultivated, and corn planted with 34 kg N ha^{-1} of fertilizer nitrogen. Consistent with earlier findings, in 2019 OM with long-term CC was 3.7 to 3.9% OM but 3.4% OM without cover crops ($P<0.4$). Optical sensor (SPAD meter) readings confirmed visual observations of nitrogen deficiencies in V8 to V9 corn grown on no-CC plots in both years and with oat in 2020 and rye in 2021 ($P < 0.05$). In both years, grain yield was 2.4 and 3.7 Mg ha^{-1} greater with long-term radish CC than the noCC (avg. 11.5 Mg ha^{-1}), with intermediary responses with the other CC ($P < 0.05$). Moreover, grain yield responded to nitrogen applied to the previous crop and crop residue removal two years prior, but this response varied between years. There was a positive linear relationship of corn grain yield in 2020 to soil OM measured in 2019 (y=4.03OM-0.72; R2=0.54; P=0.0001; n= 16). Overall, results provide evidence that CC-mediated increases in soil OM increased corn yield, likely due to improved nitrogen availability to corn. It is anticipated that the knowledge generated may enhance CC adoption and provide confidence to farmers with long-term CC use to reduce their nitrogen inputs.

**Denotes primary author*

Impact of Crop Rotation, No-Till, and Cover Crops on Soil Physical and Hydraulic Properties in Southeastern South Dakota

Track: At the Intersection of Agriculture and Conservation

Location: Penrose 2 on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Ajoy K. Saha (South Dakota State University)*

Conservation agriculture and different soil health practices can increase plant-available water and enhance the resilience of soil structure against various climate extremes such as drought, excessive rain, and extreme rainfall events by improving the soil's physical, chemical, and biological properties. This study aimed to assess the impact of tillage, crop rotation, and cover crops on field saturated hydraulic conductivity and wet aggregate stability. A tillage-rotation study with conventional till (CT) and no-till (NT), and three crop rotations (2-years: Corn-Soybean, 3-years: Corn-Soybean-Oat and 4-years: Corn Soybean-Oat-Winter wheat) was established at the South Dakota State University Southeast Research Farm (SERF) near Beresford, South Dakota, in 1991. In 2013, cover crop (CC) treatment (with and without CC) was added by dividing each plot. In summer 2021, in-situ infiltration tests were conducted in 36 plots (including three replications) with an automated field dual-head infiltrometer (SATURO, METER Group Inc.) to determine saturated hydraulic conductivity. In Spring 2021, using a truck-mounted Giddings probe soil sampler, undisturbed soil cores were collected within 0-90 cm depth and divided into five different depths (0-10 cm, 10-20 cm, 20-30 cm, 30-60 cm, and 60-90 cm). Each sample was analyzed by wet sieving (Eijkelkamp Wet Sieving Apparatus) to determine the wet aggregate stability. We observed that no-till practice significantly decreases the field saturated hydraulic conductivity, indicating that no-till practice, even long-term (30 years), may have limited or no positive impact on water infiltration. No-till significantly increased the wet aggregate stability for the top 0-10 cm. However, crop rotation and cover crop practices had no significant effect on altering saturated hydraulic conductivity and wet aggregate stability.

**Denotes primary author*

Meeting the Cover Crop Seed Demand

Track: At the Intersection of Agriculture and Conservation

Location: Penrose 2 on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Jennifer Moore (USDA ARS)*; Shannon Cappellazzi (GO Seed); Kristin Trippe (USDA ARS)

Cover crops are promoted as one of the best conservation management practices for improving soil health and combating climate change. A wide variety of crops, mixes, planting windows, and management options provide growers with multiple choices to meet the unique goals for different systems. Although current estimates reveal less than 7% of US cropland has implemented a cover crop, multiple local, state, regional, and national programs are dedicated to accelerating adoption across the country. To meet these imminent goals, practical considerations related to cover crop seed production are needed to best inform and shape these programs. As policies and programs are considered, it is vital that data published on cover crop seed production, seeding rate, and available acreage in appropriate seed production regions represent seed industry practices, capabilities, and potential. Using data from seed industry surveys, regional cover crop seed councils, and recent literature searches, we will report on current land estimates needed to cover 100 million cropland acres. Preliminary estimates suggest nearly 1 million acres of land are needed to meet this demand. However, estimates are based on current yield projections and seeding rate recommendations, which vary depending on region and application goals. We will discuss rates of change projected for cover crops to be implemented from the current estimate of approximately 20 million acres to scale up to 100 million acres, and additional challenges unique to seed production. As farmers look to other functional traits in cover crops, the introduction of legumes, brassicas, forbs, and grasses other than cereal rye are expected to play a more important role in meeting cover cropping needs. Specific production examples will be provided from the Willamette Valley, OR, a region that leads the nation in production of annual and perennial ryegrass, many legumes, turnips, radish and buckwheat.

**Denotes primary author*

Conservation Models as a Service

Track: 2022 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

Location: Independence on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Olaf David (Colorado State University); Jack R. Carlson (Colorado State University)*

The Cloud Services Integration Platform (CSIP) provides a model-as-a-service (MaaS) architecture for calibrating and running high volume agro-environmental model simulations supporting conservation programs and sustainability initiatives. Since it was established in 2011, CSIP model and data services integrate with several public, non-profit, and private sector applications assessing water and wind erosion, sedimentation, nutrient loss, soil health, and other resource concerns. This presentation recaps experience and knowledge gained over the past decade, including on-going enhancements to the platform: expanding web service portfolio, efficient batch processing, container deployments, dynamic scaling, new calibration tools, and surrogate modeling.

**Denotes primary author*

Investigation of Spatial Pollutant Interactions within a Dual-Chamber Woodchip Bioreactor

Track: 2022 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

Location: Independence on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Lindsey Hartfiel (Iowa State University); Michelle Soupir (Iowa State University); Stephen Hall (Iowa State University); Natasha L Hoover (Iowa State University)*

Denitrifying woodchip bioreactors are a proven edge of field technology for reducing nitrate loads from tile drained agriculture. The nitrate removal capacity of bioreactors has been documented in many studies, but the spatial dynamics of nitrate reduction and other pollutants throughout the length and width of the bioreactor is not well documented. The objective of this study was to monitor nitrate removal, other potential pollutants, and various constituents in a parallel dual-chamber bioreactor equipped with nine randomly located sampling wells per bioreactor chamber. Specifically, the bioreactor was monitored for nitrate, total organic carbon, dissolved oxygen, and temperature beginning in 2019. Vented pressure transducers were installed at the outlet of each chamber in 2020 to more accurately record the flow rates throughout the drainage season. The measured flow rates for each chamber (average of 1.00 L/s; median 0.63 L/s) were lower than the bioreactor design flow of 4.8 L/s per chamber. The low flow conditions and resulting high hydraulic retention time in the bioreactor chambers contributed to frequent complete to near complete nitrate removal. Our results indicate that 80% of the NOx-N (nitrate + nitrite) was removed on average in the first 50% and 58% of the two bioreactor chamber lengths. Due to the observed high NOx-N removal rates, monitoring of sulfate and dissolved greenhouse gasses (methane and nitrous oxide) were added in 2021. Our results suggest that maintaining NOx-N concentrations above 3 mg/L reduced potential pollution swapping, limiting sulfate reduction and methane production in the bioreactor system.

**Denotes primary author*

Tracking Conservation Delivery, Implementation, and Watershed Management through Innovative Technological Solutions in Minnesota

Track: 2022 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

Location: Independence on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Matt Drewitz (BWSR)*; Gwen Steel (BWSR)

The Minnesota Board of Water and Soil Resources (BWSR) has utilized the eLINK BWSR Grants Management and Conservation tracking database to collect financial and environmental outcomes data since 2004. The eLINK systems primary role is to capture and manage BWSR grants throughout the entire life cycle (application, award, report and review, close out, and data retention), but has been expanded to include tracking of local government partner contract information, technical training and certification for Soil and Water Conservation District (SWCD) and USDA Natural Resource Conservation Service (USDA) staff in Minnesota, and tracking of comprehensive watershed management plans. The eLINK system is an innovative, custom application that has been updated and revised to meet new and emerging business needs. Currently eLINK is undergoing a major revision to platform, which will be deployed in the fall of 2022. This presentation will provide a general overview of the business case for eLINK, a high-level overview of the functions and user interface of the current and Next Generation system, how data from eLINK is used and visualized, and the highlights of the novel technical training and certification module.

**Denotes primary author*

Agricultural Water Metering and Water Delivery System Efficiency

Track: On the Frontier of Conservation in the West

Location: Gold Coin on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Steven Wallander (USDA Economic Research Service)*

With climate change leading to growing water scarcity in many regions, irrigated agriculture is under pressure to find new methods of water conservation. In recent years, water managers and policy makers are exploring options for improving water delivery efficiency through methods such canal lining, managed acquire recharge, and improved water metering. This study conducts a statistical analysis of data on water metering from USDA's 2019 Survey of Irrigation Organization (SIO). The research examines the links between metering and key drivers of water conservation such as water pricing, water delivery schedules, drought planning, and conveyance losses. The 2019 SIO collected information from organizations that deliver water directly to farms and ranches: irrigation districts, ditch companies, mutuals, and acequias. About one-fourth of organizations rely exclusively on meters, and about one-fifth of organizations rely exclusively on time-of-use estimation techniques. Other organizations use a combination of methods, including metering, time-of-use, and self-reporting by farmers. Organizations that face a greater water scarcity are more likely to adopt metering either alone or in combination with other methods. Organizations that use metering are 20 percentage points more likely to use volumetric pricing. Analysis that is underway examines the link between type of metering and delivery system efficiency. This research provides insight on the potential effectiveness of government incentives designed to accelerate the shift to fully metering irrigation delivery systems.

**Denotes primary author*

Does the El Niño Southern Oscillation Affect Modelled Cotton Yield Response to Irrigation for Thermally Limited Growing Seasons of Western Kansas?

Track: On the Frontier of Conservation in the West

Location: Gold Coin on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: R. Louis Baumhardt (USDA ARS)*; Lucas Haag (Kansas State University); Freddie Lamm (Kansas State University); Prasanna Gowda (USDA ARS); Robert Schwartz (USDA ARS); Gary Marek (USDA ARS)

Annual precipitation in the western Great Plains provides from 40% to 80% of crop evapotranspiration (ETc) and irrigation often provides the rest. Irrigation water in western Kansas is supplied from the Ogallala aquifer, which is practically non-recharging south of Nebraska. Continued pumping of the aquifer has drawn down water tables and reduced water availability, increasing reliance on precipitation, deficit irrigation, or an alternate crop like cotton (*Gossypium hirsutum* L.) with reduced water demand than corn (*Zea mays* L.). Precipitation in parts of the Great Plains varies with the El Niño Southern oscillation (ENSO) climatic phenomenon, which is related to the monitored equatorial sea surface temperatures. Our objective was to compare simulated cotton yield response to irrigation capacity and application period during each of the ENSO phases at three western Kansas locations with different growing season energy. Using actual 1961-2000 location weather records and the crop growth simulation model GOSSYM, we estimated yields of cotton emerging on DOY-145 from soil at 50% plant-available water for all combinations of irrigation period (0, 4, 6, 8, and 10 weeks after first square) and capacity (2.5, 3.75, and 5.0 mm/d). The ENSO phase had no significant effect on growing season energy at any location, but precipitation decreased significantly during La Niña at the southern most location and depressed simulated lint yields. Yield and its ratio to ETc, water productivity, consistently decreased as location elevation or latitude increased due to reduced growing season energy. Depending on location, simulated cotton lint consistently increased ($p = 0.05$) for scenarios with increasing irrigation capacity due to greater early season boll load. Irrigation periods exceeding 4 to 6 weeks did not increase yield because later fruit did not mature. Cotton WUE increased with early high-capacity irrigation that promoted vigorous growth and fruiting for timely maturation.

**Denotes primary author*

Helping Build Drought Resiliency through Federal Investment Coordination

Track: On the Frontier of Conservation in the West

Location: Gold Coin on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Daniel Dostie (USDA NRCS)*; Nickie McCann (US Bureau of Reclamation)

Managing water resources in the American West can be challenging. Drought, aging infrastructure, can strain existing resources. Through WaterSMART, the Bureau of Reclamation (Reclamation) and Natural Resources Conservation Services (NRCS) have coordinated investments for helping farmers, ranchers, water delivery entities, tribes, and others in the same community to build resilience to worsening droughts across the West. Reclamation provides WaterSMART Program investments to states, tribes, and local entities for planning and implementing projects that increase water supply, improve infrastructure, or benefit environmental resources like fish, wildlife, and native plant communities. NRCS uses EQIP WaterSMART Initiative funds to complement specific Reclamation funded projects by helping farmers and ranchers make improvements that align with the paired Reclamation WaterSMART project. By working together, Reclamation and NRCS are making a bigger impact in helping communities manage water resources and be better prepared to respond to and recover from drought.

**Denotes primary author*

Impacts of Long-Term Shrub Willow Production for Bioenergy on Soil Carbon in a Midwest Agricultural Field

Track: 2022 General Conference Theme

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

Location: Matchless on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Colleen Zumpf (Argonne National Laboratory)*; Julian Cacho (Argonne National Laboratory); Yuki Hamada (Argonne National Laboratory); John Quinn (Argonne National Laboratory)

The retention of existing soil carbon and sequestration of atmospheric carbon into agricultural soils has been a large topic of interest in the last several decades from both the perspective of soil health and climate change. Changes in agricultural land management practices (e.g. crop selection, tillage practices, fertilizer application, cover cropping, among others) have been shown to improve carbon retention and sequestration in soils. The changes observed in soil carbon, however, are not always consistent across landscapes, climates, soil types, or production designs. The production of perennial bioenergy crops on marginal agricultural lands has been targeted as one type of production system that has the potential to positively impact soil carbon storage relative to traditional row crops; however, continual long-term evaluation of these perennial bioenergy production systems is needed. This field study evaluates the soil carbon profile (4.4 cm diameter by 120 cm length soil cores) under 8-year-old short-rotation shrub willow bioenergy buffer stands in a central Illinois agricultural field, relative to soils under row crop production. Soil surface reflectance spectrums were measured at a 3-cm spatial resolution using an ASD FieldSpec 4 Spectroradiometer (spectral range 350-2500 nm) along the full profile of the intact soil cores sliced lengthwise. A subset of soil samples was collected from each 3-cm area for analysis of total carbon on a Elementar C:N analyzer. This approach aims to assess the accuracy of quickly scanning soil cores for a higher resolution assessment of the soil carbon profile compared to traditional 10-cm or larger subsampling techniques.

**Denotes primary author*

Still Gaining: Long-Term Benefits of Conservation Bioenergy Practices

Track: 2022 General Conference Theme

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

Location: Matchless on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Catherine Stewart (USDA ARS)*; Grace Miner (USDA ARS); Virginia Jin (USDA ARS); Marty Schmer (USDA ARS); Candiss Williams (USDA NRCS); Rob Mitchell (USDA ARS)

Conservation agricultural management practices and perennial bioenergy crop production can increase soil organic C (SOC) stocks on marginal soils. Co-benefits often associated with increased SOC are positive effects on water and nutrient retention, soil microbial biomass (SMB) and diversity and soil structure, resulting in better soil quality.

However, tracking changes over time is necessary to quantify these benefits, and identify metrics that reflect meaningful long-term soil change. We measured a variety of surface soil (0-30cm) properties and soil quality indicators including SOC, aggregate stability, SMB-C, bulk density (BD), soil volumetric water content (θv) at field capacity (FC) and wilting point (WP), and available water (FC – WP) over 16-year bioenergy study. Switchgrass (*Panicum virgatum* L.), and no-tilled corn (NT-C, *Zea mays* L.) were established under N fertilizer (0, 60, 120, and 180 kg N ha^{-1}) and harvest management treatments on a marginal soil in the western U.S. Corn Belt. Switchgrass, with large, deep root biomass, has the potential for long-term soil C storage and soils continue to linearly accrue SOC. Soil quality indicators SOC, microbial biomass, and aggregation showed greater increases under switchgrass and increased over time. Available water increased with increasing SOC content, but the effect was small and unlikely meaningful for plant growth. Conservation management impacts on water capture and infiltration may be much larger than the water storage. Our results suggest that perennial systems need long-term measurements to accurately quantify bioenergy impacts and evaluate model predictions.

**Denotes primary author*

The Influence of Climate Change on Soil Salinity and Sodicity in a Mediterranean Agro-Ecosystem

Track: 2022 General Conference Theme

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

Location: Matchless on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Michael Z. Litaor (MIGAL & THC)*; Naama Badihi (MIGAL & THC)

Water analysis indicated that the impact of climate change on farming under representative concentrations pathways of 8.5 in 2030 will cause severe water scarcity in the upper catchment of the Jordan River (JR), in northern Israel, a Mediterranean agro-ecosystem. After thorough analysis of the water supply reliability, cost analysis, and evaluation of 3 alternatives the Israel Water Authority decided to construct a pumping water system from Lake Kinneret (LK) to the upper basin of the JR that will cost 200 million dollars. One of the problems with this decision is the poor water quality of LK (300 and 150 mg L^{-1} of Cl- and Na+ respectively) compared with the current irrigation water of the Dan spring (DS) (10 and 7 mg L^{-1} of Cl^- and Na^+ respectively). The possible effects of such a change in irrigation water quality on the soil health were evaluated. The research hypothesis suggests that after several years of intensive irrigation with LK water the sodium adsorption ratio (SAR), exchangeable sodium percentage (ESP) and electrical conductivity (EC) in the soil leachates will reach a hazard state. A multifactor experiment using 25 L pots was conducted using five common soils, three treatments (LK, DS, and mixed (M) water with 150 mg L^{-1} Cl) with six replicates. The results after the first year of intensive drip irrigation at the rate of 12 daily watering periods of 1 L per pot showed a significant increase of mean EC (1960 S/cm) and mean SAR (4.9) in soils irrigated with LK water versus M water (EC = 1050 S/cm and SAR = 2.1) and DS water (EC = 350 S/cm and SAR = 0.3). The ESP varied between 9.5, 5.2 and 1.3 in soils receiving LK, M and DS waters, respectively. These results suggest that irrigation with LK water may cause a significant increase in salinization and sodicity regardless of soil type and most likely will intensify over a much longer period of irrigation. The results strongly suggest that other option such as desalinized water should be considered.

**Denotes primary author*

Tuesday, August 2

Oral Presentation Descriptions and Agenda

#DiverseCornBelt: Imagining a Pathway to a Resilient Future

Track: At the Intersection of Agriculture and Conservation

Location: Penrose 2 on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Linda Prokopy (Purdue University); Emily M. Usher (Purdue University)*; Michael O'Donnell (Purdue University); Aslihan Spaulding (Illinois State University)

There is an elephant in the room every time we talk about soil and water conservation in the Midwestern United States. The corn/soybean monoculture is so firmly entrenched in the Midwestern landscape and our collective imagination that we skirt around discussions of negative externalities and cross our fingers that we can solve all the problems with technological fixes and voluntary adoption of practices such as cover crops and treatment wetlands. The corn/soybean monoculture is reinforced along the food supply chain by federal policies, market infrastructure, consumer demand, agribusiness, agricultural advisors, agricultural lending practices, agricultural educators, grain processors, state agencies, and our own land of imagination. But is it the best agricultural system for a changing world? The environmental, social and economic costs of monocultures are increasingly evident but a pathway to transformative change is not clear This presentation will examine the costs of not shifting the dominant agricultural system, outline barriers to change, and present pathways forward based on the activities of an interdisciplinary, multi-institutional team representing farmers, NGOs, the food industry, government agencies, and academia. The presentation will show a dynamic model of the agricultural value chain in the Midwestern United States and propose levers for change.

**Denotes primary author*

Tools for Communicating Carbon Markets: Sharing a Common Message around Opportunities and Unknowns

Track: At the Intersection of Agriculture and Conservation

Location: Penrose 2 on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Emily Bruner (Soil Health Institute)*; Jean Brokish (American Farmland Trust)

Interest and investments in carbon and ecosystem markets continue to grow with an increasing number of entities offering financial incentives for the generation of agricultural carbon credits. American Farmland Trust partnered with over thirty organizations across the Midwest to help producers, ag professionals, and university and agency staff share knowledge and build confidence in evaluating agricultural carbon programs. Through this engagement, we produced a series of webinars and resources to advance a collective understanding of credit generation and program design across multiple market platforms. This session will provide a brief overview of current carbon programs, highlight key concerns and challenges, and share resources and strategies for how attendees can assist their own farmer networks assess these opportunities.

**Denotes primary author*

Understanding Barriers and Opportunities for Diffusion of a Decision-Support Tool: An Organizational Perspective

Track: At the Intersection of Agriculture and Conservation

Location: Penrose 2 on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Emily M. Usher (Purdue University)*; Pranay Ranjan (Purdue University); Hanna Bates (Iowa Water Center/Iowa State University); Chris Morris (Iowa State University); Emily K Zimmerman (Iowa State University); John Tyndall (Iowa State University); Tom Koontz (University of Washington Tacoma); Linda Prokopy (Purdue University)

Decision-support tools (DSTs) are a means to facilitate science-based decision-making, including nonpoint source pollution management in agricultural watersheds. The Agricultural Conservation Planning Framework (ACPF) is a watershed-scale assessment DST that combines spatial data with soils and land use data to identify field-specific conservation opportunities as well as opportunities for riparian management to reduce nutrient discharge from small watersheds. The ACPF is designed for use at the Hydrologic Unit Code 12 (HUC 12), which is often identified as a 'community-type' sub-watershed scale that can facilitate engagement with farmers. Despite the potential of the ACPF to contribute to water quality management efforts across agricultural watersheds, less is known about agency staffs' perceptions around its use, and more importantly, barriers and opportunities around its dissemination and adoption across the Natural Resources Conservation Service (NRCS). Envisioning NRCS as a multi-level organization that is key to ACPF dissemination and adoption, we conducted semi-structured interviews (n=23) with NRCS staff holding leadership positions. In this presentation, we will draw upon the diffusion of innovations (DOI) theory and literature around the 'use of science' by agency staff to explore how end users (NRCS staff) perceive and use the ACPF, and their perceptions of NRCS' organizational and structural elements that could enable or hinder ACPF dissemination throughout the agency. Results will be discussed broadly in the context of using science to inform decision-making processes, and our contributions to the DOI theory in understanding adoption of complex innovations.

**Denotes primary author*

Utilizing Yield Data to Make Better Management Decisions across the Acre

Track: At the Intersection of Agriculture and Conservation

Location: Penrose 2 on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Brent Nicol (The Nature Conservancy)*

Utilizing yield data to make on-farm management decisions poses a benefit to row crop growers, their agronomic advisors, and to water quality. For agronomic advisors, yield data analysis can be a service offered and can help them retain customers. For growers, it is an easy and often under-utilized tool that could have a significant impact on the farm's productivity and fertility input costs. Yield data is proprietary information. To overcome this barrier, we developed a public-private partnership with agronomic advisors to identify and analyze 20 fields over a 5-year span (2015-2020) that were adjacent to 3 common sensitive area buffer types - woodlots, tree lines, and grasses - where nutrients tend to leave the field and yields can be impacted. We learned that fields next to sensitive area buffers behave inconsistently when considering productivity trends, with the exception of field areas closest to woodlots, which could impact a grower's decision to adopt conservation practices in those areas. When looking at year-over-year yield data, we saw that individual field management could positively influence return on investment and more efficient nutrient utilization. Using findings from the data, we worked with the agronomic advisors to determine effective ways to improve nutrient utilization and offer the customer alternatives for land management to positively impact return on investment on those acres. The main insights to be described include: 1. Forming public-private partnerships to assess yield data is useful in impacting farm management practices and return on investment, 2. Applying a conservation lens to yield data, such as a sensitive area buffer analysis, shows more accurate trends of a field's productivity, and 3. Layering multiple years of yield data builds more robust data sets in trying to predict a field's productivity across the acre, which can benefit growers, agronomic advisors and water quality.

**Denotes primary author*

Can Biochar Conserve Soil and Water?

Track: 2022 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

Location: Independence on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Humberto Blanco (University of Nebraska-Lincoln)*

Biochar is receiving increased attention due to its potential to sequester C and maintain or improve other soil ecosystem services. However, most conclusions on biochar benefits are from laboratory or greenhouse experiments. The question is: What do we really know about biochar potential based on field research data? This presentation will discuss the implications of biochar use for soil and water conservation based on field data. Such discussion of field data can be useful to make recommendations for biochar use at large-scales. It is also relevant under increasing concerns of decreased soil resilience and increased climate variability (i.e., droughts, floods). Identifying and adopting management practices that improve the ability of the soil to adapt to droughts and extreme weather events are a high priority. Thus, this presentation will address the following questions: Can biochar conserve soil and water? Is biochar another tool to improve soil health? What are the factors or mechanisms that may affect biochar impacts and performance? The discussion will emphasize how biochar can affect water conservation, soil erosion, nutrient leaching, soil fertility, crop yields, and other soil ecosystem services. Field research data from different regions (i.e., temperate, tropical) will be presented to better understand biochar impacts on soil ecosystem services under different soil types, biochar management scenarios, and climates. Also, challenges and opportunities of biochar use will be discussed.

**Denotes primary author*

Can Cover Crops Break through Restrictive Layers?

Track: 2022 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

Location: Independence on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Shannon Cappellazzi (GO Seed)*; Jennifer Moore (USDA ARS)

Agricultural practices can create soil conditions that create production challenges. Years of tillage can create highly compacted soil that can be root restrictive. Alternately, years of no-till with synthetic fertilizer application can form zones with low pH. We are conducting an experiment to see if cover crops can break through these root restrictive features. We created three controlled soil settings, each replicate an eight cm diameter tube, one meter deep. The control soil setting is compost mixed with sandy loam soil. The high bulk density soil setting was compacted to a bulk density of 1.6-1.7 g cm^{-3} around 22 cm below the soil surface. The low pH soil was adjusted using elemental sulfur, decreasing pH to 4.2 around 22 cm down. These tubes were placed into PVC lined holes in the ground. In mid-September, five cover crop treatments and a control without plants were implemented in each soil setting. Four replicates of each treatment will be harvested at termination to evaluate above ground biomass, as well as the belowground root distribution, microbial community, and soil conditions. Following termination, the remaining tubes will each have one corn seed planted. Four replicates of each treatment combination will be destructively sampled at V10 to evaluate root biomass and architecture by depth. At harvest, the remaining four replicates of each treatment will be destructively sampled for root biomass, architecture, carbon distribution, microbial community, and soil pH and bulk density. The goal is to determine if any of the cover crops increase the likelihood that the corn roots will make it through the root restrictive features. Initial cover crop biomass, and root architecture and distribution for each soil setting will be presented at this meeting.

**Denotes primary author*

Nitrate Removal in Saturated Riparian Buffers in Iowa

Track: 2022 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

Location: Independence on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Gabriel M. Johnson (Iowa State University)*; Thomas Isenhart (Iowa State University); Dan Jaynes (USDA ARS)

Saturated riparian buffers reroute subsurface tile drainage as shallow groundwater flow along streambanks to remove excess nitrate-nitrogen, primarily via denitrification. This study analyzed the performance of five saturated buffers in Iowa from 2019 to 2021. Water levels were monitored in control structures using pressure transducers and used to calculate flow via calibrated weir equations. Water samples were taken in sampling wells, control structures, and streams approximately bi-weekly or monthly when tile flow occurred. Nitrate load was calculated by multiplying the nitrate concentration by the cumulative flow between sampling dates. Nitrate removal in the buffer was assessed as the difference in concentrations between the control structure and wells closest to the stream. Total removal performance of the buffers was determined by comparing the total nitrate load from the field and the amount removed in the buffer. At the time of abstract submission, removal of nitrate-nitrogen diverted to the buffers ranged from 59 to 99%, while removal of total nitrate-nitrogen load ranged from 11 to 76% across all site-years. Further expected results include analysis of nitrate removal rate normalized for buffer length and drainage area. These results reiterate the findings of prior studies that saturated buffers are highly effective at removing nitrate in diverted water, but their overall effectiveness can be limited by high bypass flow.

**Denotes primary author*

An Evaluation of Soil Properties in Cropland and Natural Habitats in the Mississippi Delta

Track: 2022 General Conference Theme

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

Location: Gold Coin on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Lindsey Witthaus (United States Department of Agriculture - Agricultural Research Service)*; Martin Locke (USDA ARS); Eric Stevens (College of Alameda); Jason Taylor (USDA); Matthew Moore (USDA); Sarah McNamara (Monk & Associates Biological Consultants)

As a historical floodplain of the Mississippi River, Mississippi (MS) Delta soils are anticipated to have high natural nutrient content from deposition of silty and clayey sediment. Years of farming and fertilizer applications have also altered natural nutrient compositions. Currently there are limited publications conveying soil and sediment nutrient levels in this region. This information is critical to improve simulations of nutrient transport in models and to aid watershed management for water quality. This presentation will showcase trends in soil and sediment properties from several studies evaluating natural and agricultural habitats in the Mississippi Delta. In one study soil was sampled from 73 locations comparing agricultural and forested areas within four different soil series common in the MS Delta: Dundee, Forestdale, Alligator, and Sharkey. Results from this study demonstrate that Mehlich-3 phosphorus (P) levels were similar across soils in both areas. Soils in forested areas exhibited higher iron (Fe), carbon (C), and nitrogen (N) concentrations ($p<0.01$) compared to soils in cropped areas. A second study involves soil samples collected from cropland, vegetated buffer, and Conservation Reserve Program (CRP) land use areas within Beasley Lake Watershed, a Conservation Effects Assessment Program (CEAP) watershed. CRP soils had higher P, N, C, and Fe concentrations than cropland soils ($p<0.01$) and also higher C and N compared to buffer soils. Buffer soils were also higher in C, N and Fe compared to cropland soils ($p<0.001$). Finally, data from a study exploring soil and sediment properties in Beasley Lake Watershed ditches, sediment retention pond, wetland, and lake will be presented to provide some context related to Delta sediment nutrient values in agricultural watersheds. This analysis will set the stage for the next phase of a study evaluating legacy phosphorus sources and transport in the MS Delta.

**Denotes primary author*

Efficacy of Traditional Soil Amendments on Reclaiming Salt-Affected Acres in the Northern Great Plains

Track: 2022 General Conference Theme

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

Location: Gold Coin on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Shaina Westhoff (South Dakota State University)*; Cheryl Reese (South Dakota State University); Deepak Joshi (South Dakota State University); Janet Miller (South Dakota State University); Graig Reicks (South Dakota State University); David Clay (South Dakota State University)

Salt-affected soils in the Northern Great Plains are expanding annually. Traditional literature on remediation of these acres recommends application of soil amendments such as gypsum. In the Northern Great Plains, soil amendments have not reliably improved salt-affected soils. The objective of this experiment was to measure the efficacy of gypsum and elemental sulfur on reducing salinity/sodicity and in improving soil health on a loam soil near Clark, South Dakota. At the end of the three-year study, it was shown that amendments did not significantly reduce soil electrical conductivity nor sodium percent.

**Denotes primary author*

Soil Health Assessment under Different Land Management

Track: 2022 General Conference Theme

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

Location: Gold Coin on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Maysoon M. Mikha (USDA ARS)*; Lidong Li (University of Nebraska-Lincoln); Virginia Jin (USDA ARS); Timothy Kettle (USDA ARS); Douglas Karlen (USDA ARS (Retired)); Márcio Nunes (USDA ARS-ORISE Fellow); Michael Lehman (USDA ARS); Jane Johnson (USDA ARS)

Land management decisions are important in sustaining ecosystem functioning, enhancing productivity, and maintaining human livelihoods. Soil health assessment is related to soil functioning and must include soil physical, chemical, and biological properties, all of which can be directly or indirectly influenced by management decisions. A chronosequence of various land management practices was evaluated for soil health using the Soil Management Assessment Framework (SMAF). The study was conducted on 38 fields located on 18 private farms in central Iowa with 0-40 years of management history (Conservation Reserve Program (CRP), pasture, and row crop).. Soil samples were collected from the 0 to 5 cm (~ 0-2 inch) depth at slope positions of 14 to 25% (high) and 2 to 14% (low). The results show that the soils were functioning at 84% and 78% of their theoretical capacity for CRP and row crop, respectively. Both CRP and long-term pasture enhanced soil biological properties which were functioning at ~ 41% of their theoretical capacity, while biological properties in row crop soils were functioning at 25% of their theoretical capacity. Enhancing soil biological, physical, and chemical quality is an ecological benefit of CRP management, especially for highly erosive soils. Overall, this study provided guidance regarding management practices that could improve soil health by sustaining or enhancing ecosystem functioning.

**Denotes primary author*

Watershed Management Authorities: Past, Present, and Future

Track: 2022 General Conference Theme

Subject: Water Resource Assessment and Management

Location: Matchless on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Kyle Ament (Iowa DNR)*

Overview of the creation and evolution of Watershed Management Authorities (WMAs) in Iowa and what the future holds for the 27 WMAs across the state.

In 2010, Iowa lawmakers passed legislation authorizing the creation of Watershed Management Authorities. A Watershed Management Authority (WMA) is a mechanism for cities, counties, Soil and Water Conservation Districts and stakeholders to cooperatively engage in watershed planning and management. The WMA is formed by a Chapter 28E Agreement by two or more eligible political subdivisions within a specific eight-digit hydrologic unit code watershed. A board of directors governs the WMA, which may undertake the following activities:

- Assess and reduce flood risk;
- Assess and improve water quality;
- Monitor federal flood risk planning and activities;
- Educate residents of the watershed regarding flood risks and water quality; and
- Allocate moneys made available to the Authority for purposes of water quality and flood mitigation

Over the past 12 years WMAs have gone from concept to covering 40% of the land area in the state. As of 2022, 22 watershed management plans have been developed with a unmet financial need of 1 Billion Dollars. WMAs have many success to share including the Iowa Watershed Approach Project, Central Iowa water quality blitz, and locally funded watershed coordinator staff. Lastly, discussion about future opportunities for funding in the state of Iowa.

**Denotes primary author*

The Iowa Watershed Approach: A Replicable Framework

Track: 2022 General Conference Theme

Subject: Water Resource Assessment and Management

Location: Matchless on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Kate Giannini (Iowa Flood Center)*

The award-winning Iowa Watershed Approach (IWA) is an adaptive framework that has transformed integrated watershed management in Iowa and beyond. The IWA has brought over $100 million to the state of Iowa from the U.S. Department of Housing and Urban Development to reduce flooding, improve water quality, and develop equitable strategies for increasing community resilience to water resource challenges.

The program brings together local, state, and federal partners and empowers them with science-based information to develop long-term watershed management goals and guide strategic conservation practice implementation efforts. To date, nearly 800 conservation practices have been installed with over $30 million allocated for conservation. Iowa Flood Center (IFC) researchers have developed a new state-of-the-art hydrologic model, GHOST (Generic Hydrologic Overland-Subsurface Toolkit), that estimates watershed responses to rainfall events on the order of decades and includes scenarios based on climate change predictions to assist with long-term watershed planning and management activities.

Additionally, the program has created Flood Resilience Action Plans to improve the use of social resources in watersheds through connecting local partners and stakeholders, enhancing the presence of social resources in watershed planning efforts, and increasing the awareness and communication of established and novel flood resilience initiatives.

One of the goals of the IWA is to develop a program that is scalable and replicable throughout the Midwest and the United States. This session will describe important details critical to the success of the IWA's model framework.

**Denotes primary author*

Every Acre Matters: A Watershed Approach to Municipal Source Water Protection

Track: 2022 General Conference Theme

Subject: Water Resource Assessment and Management

Location: Matchless on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Mary Beth Stevenson (City of Cedar Rapids)*

How does a city that benefits from a strong economic relationship with agriculture respond when nitrate pollution from upstream farm fields threatens its drinking water supply?

The City of Cedar Rapids faces this very situation. Large industries in Cedar Rapids process millions of bushels of corn and soybeans on a daily basis and are a critical part of the local economy. At the same time, periodic spikes in nitrate pollution originating from agricultural fields threaten the City's drinking water supply. If nitrate concentrations reach a point where they exceed levels safe for public health, the City will need to install an expensive nitrate removal system.

Situated at the downstream end of the Cedar River Watershed, which is home to some of the most productive agricultural land in the nation, the health of the Cedar River and the City's drinking water supply is reliant upon upstream farmers implementing conservation measures to reduce nitrate runoff to rivers. For a variety of reasons, farmers are not implementing nearly enough practices to adequately safe guard drinking water supplies for rural residents and Cedar Rapidians alike.

The City is taking a proactive approach to protect drinking water supplies by supporting on-farm nutrient reduction efforts and developing relationships with agricultural stakeholders in the watershed. These investments of financial and human capital have led to meaningful partnerships with key allies around the watershed and the State, and have contributed to more nutrient reduction practices implemented on the ground.

This presentation will highlight new projects and initiatives the City has launched in the past two years to reach beyond its borders and to communicate a critical message to agriculture: when it comes to source water protection, every acre matters.

**Denotes primary author*

Big BMPs on Campus: Monitoring a Systems Approach to Nutrient Loss Reduction on Illinois Central College's Demonstration Farm

Track: 2022 General Conference Theme

Subject: Adaptive Management of Conservation Efforts

Location: Penrose 1 on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Jill Kostel (The Wetlands Initiative)*; Pete Fandel (Illinois Central College); Russell Krueger (Waterborne Environmental)

To meet the goals of the Illinois Nutrient Loss Reduction Strategy, the implementation of best management or conservation practices will need to occur at much higher levels. A whole-farm approach to conservation is key to reducing nutrient loss and improving soil health while sustaining farm profitability. There is an increased demand for technical information relative to nutrient management, reduced tillage, use of cover crops, and edge-of-field practices such as bioreactors and wetlands working in combination to reduce nutrient loss.

To address the growing need to educate students, farmers, and their trusted advisors about a system-based approach that links in-field management with edge-of-field tile-treatment practices, Illinois Central College (ICC) with its partners has developed a multi-year water quality monitoring project on its 70-acre campus farm. Water quality research began in 2016 with a paired field study comparing a continuous no-till and cover crop plot with a conventional management system plot. A bioreactor treating tile flow from 8.5 acres of the paired field study was installed in 2017. A constructed wetland was built in 2019 to capture tile drainage from 50 acres of cropland. Since the plots, bioreactor, and wetland are all on the same tile-drainage system, nutrient levels can be tracked from when the rain falls on the two field plots until it leaves the demonstration farm.

With automated samplers, nitrogen and phosphorous levels in the tile water leaving the individual plots, at the outlet of the bioreactor, and at the inlet and outlet of the wetland are being monitored. We will share preliminary nutrient and flow data comparing the effectiveness of the various individual practices and the whole-farm approach. The goal of the demonstration farm is to obtain and share local research that can be translated to effective and economical on-farm decisions about conservation practices.

**Denotes primary author*

Constructed Wetland Design, Operation, and Maintenance: Lessons Learned to Ensure Wetland Longevity and Nutrient Reduction Efficiencies

Track: 2022 General Conference Theme

Subject: Adaptive Management of Conservation Efforts

Location: Penrose 1 on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Krista G. Kirkham (The Nature Conservancy)*; Jill Kostel (The Wetlands Initiative)

Wetlands provide valuable ecosystem services, including water storage and filtration, and have many economic benefits such as flood control, wastewater treatment, and recreation. Unfortunately, much of the original wetland habitat in the United States has been lost. In Illinois, over 90% of original wetland acreage has been converted for urbanization and agriculture, the latter accounting for 75% of the state's land area. Approximately 39% of Illinois' agricultural acres are tile-drained, emphasizing the importance of edge-of-field practices to help reduce nutrient contributions to the Gulf of Mexico. Research over the past 20 years has shown that constructed wetlands that receive tile drainage water are effective at reducing nitrate-nitrogen and dissolved phosphorus levels, but adoption of wetlands as an agricultural conservation practice has been low.

Over the past 15 years, The Nature Conservancy and The Wetlands Initiative have worked with landowners and partners to install small constructed wetlands for cropland drainage treatment under Farm Bill programs. The wetlands were built on working farms in northern and central Illinois to measure their nutrient reduction potential in tile-drained systems. As a relatively unfamiliar practice in Illinois, we have worked with partners to streamline landowner outreach, site designation, and engineering while gaining on-the-ground knowledge in improving vegetation establishment, damage avoidance, and water quality monitoring. We will share our first-hand experiences on design, implementation, operation, and maintenance of constructed wetlands. Our aim is to support conservation professionals working in tile-drained areas and landowners that install constructed wetlands by offering additional information that can ensure wetland functional resiliency and longevity, thereby increasing landowner acceptance of this cost-effective, multi-beneficial practice.

**Denotes primary author*

Ecosystem Services Technical Enrollment Training

Track: 2022 General Conference Theme

Subject: Adaptive Management of Conservation Efforts

Location: Penrose 1 on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Stacy Cushenbery (Ecosystem Services Market Consortium [ESMC])*

Ecosystem Services Market Consortium (ESMC) is a nonprofit, member-based organization that has launched a national-scale ecosystem services market program for agriculture in 2022. The market program intends to optimize producer's management systems while generating additional environmental benefits through ESMC's market-based program. As part of the program, ESMC is developing materials to help train Technical Enrollment Specialists who will guide, advise, and help enroll prospective farmers and ranchers into the program. This session will work through enrollment materials and provide outcomes from producers and enrollment specialists who participated in pilot projects.

**Denotes primary author*

Nutrient Tracking Tool (NTT): Evaluation of Conservation Practices of Tile Drainage Systems

Track: 2022 General Conference Theme

Subject: Adaptive Management of Conservation Efforts

Location: Penrose 1 on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Ali Saleh (Tarleton State University)*

The Nutrient Tracking Tool (NTT) is a user-friendly web-based computer program providing producers, government officials, and other users a fast and efficient method of estimating the environmental (nutrient, sediment losses, N_2O, soil health index (e.g., C-sequestration), and crop), and economic impacts of different agricultural and silviculture management practices. The information obtained from NTT helps producers to determine the most cost-effective conservation practice(s) to reduce the nutrient and sediment losses while improving soil health and optimizing the crop production. NTT is linked to the Agricultural Policy Environmental eXtender (APEX) and Farm Economic Models and accesses USDA NRCS's Web Soil Survey and PRISM national weather data to obtain field, weather, and soil information. Also, users able to access the local cropping management database in NTT at the state-level. Tile drainage systems are essential for crop production in poorly drained soils. However, excessive nutrient losses (N and P) from tile drains can cause significant water contamination. Therefore, NTT provides three conservation practices, including drainage water management, bioreactors, and saturated buffers, to evaluate the nutrient practices under these practices. The concept and application of these practices will be presented meeting.

**Denotes primary author*

Dubuque County Invests in Watershed Impacts through Innovative Pay-for-Performance Partnership

Track: At the Intersection of Agriculture and Conservation

Location: Penrose 2 on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Eric Schmechel (Dubuque Soil and Water Conservation District)*; Spencer Herbert (Truterra LLC)

The Dubuque County Land Stewardship Initiative is a first-of-its-kind private/public partnership program that was piloted in 2021 to further the efforts of Dubuque County in creating healthy soils and watersheds throughout their jurisdiction. In this pilot program, the County sought to develop a novel pay-for-performance incentive structure, delivered by both private agribusiness cooperatives and public partners, to reward farmers for implementing new sustainable practices like cover crops, reduced tillage, and precision nutrient management.

To effectively develop and deliver the program, Dubuque County partnered with the Dubuque Soil and Water Conservation District, local agricultural retailer Innovative Ag Services, and Truterra LLC, the sustainability business at Land O' Lakes Cooperative. The partnership used the Truterra sustainability tool to develop insights that assist farmers' decision making, determine each farmers' financial incentive potential, and quantify impacts of practices implemented. The partnership successfully engaged farmers to benchmark their historic management practices, identify areas of critical improvement, and determine practice changes that would improve the farmers' sustainability and profitability.

The partnership engaged with 26 farmers, covering nearly 2800 acres, to provide technical and financial support in implementing new practices in 2021. The partnership was able to document important environmental impacts that resulted from practice implementation, including improvements in their sustainability score and soil health, along with reductions in soil erosion, net greenhouse gas emissions, and nutrient loss. The Land Stewardship Initiative successfully demonstrated the ability to use cutting-edge precision conservation technologies, working across private and public sectors, to deliver a targeted and equitable incentive structure to farmers in Dubuque County.

**Denotes primary author*

Remote Sensing of Winter Flooded Agricultural Fields for Migratory Birds in the Mississippi Alluvial Plain

Track: At the Intersection of Agriculture and Conservation

Location: Penrose 2 on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Thomas P. Dill (Arkansas State University)*; Aaron Shew (University of Arkansas); John Nowlin (Arkansas State University); Joseph Massey (USDA ARS Delta Water Management Research Unit); Michele Reba (University of Memphis)

The USDA Natural Resources Conservation Service (NRCS) and private organizations, such as Ducks Unlimited and the U.S. Rice Federation, provide landowners in the Mississippi Alluvial Plain (MAP) millions of dollars to flood agricultural land in the winter for migratory birds. The practice of winter flooding agricultural fields mimics seasonal wetlands that once covered the MAP and provided more than 300 species of migratory birds with food, cover, and resting areas. While conservation funding supports efforts to regenerate migratory bird habitat, detailed information on the spatial extent and timing of winter flooded agricultural land does not exist, and the ability of NRCS and other organizations to obtain this information currently relies on labor and time intensive field visits. To better assess the scale and impact of these conservation efforts in the MAP, new methods are needed to identify winter flooded acres, estimate the time and duration of flooding, and detect patterns in conservation adoption. Therefore, in this study, we use Google Earth Engine (GEE) and archived data from Landsat, Sentinel-1, and Sentinel-2 to calculate spectral reflectance indices, specifically the Normalized Difference Water Index (NDWI) and Normalized Difference Turbidity Index (NDTI), during the winter flooding season of 2021-2022. Field data were collected at specific winter flooded fields on the revisit dates for each satellite platform between November and February. The field data include turbidity, water depth, and edge-of-flood locations. Using the USDA Cropland Data Layer we mask non-agricultural pixels and use supervised classification with the spectral indices to differentiate water from bare or vegetated soil on cropland for each month from November through February and validate the methods against in situ observations. The methods and results of this study provide important insights for conservation planners and newfound abilities to monitor winter flooding remotely.

**Denotes primary author*

Shell Creek Watershed Survey Indicates Water Quality Perceptions and Land Management Practices

Track: At the Intersection of Agriculture and Conservation

Location: Penrose 2 on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Katie Pekarek (University of Nebraska)*; Elbert Traylor (Nebraska Department of Environment and Energy); Matt Bailey (Shell Creek Watershed Improvement Group)

Concerns about flooding, soil erosion and poor water quality in agricultural production led a group of farmers to form a grassroots organization, called the Shell Creek Watershed Improvement Group (SCWIG) to identify and promote essential conservation practices. The objective of this project was to assess producers' perceptions about water quality, gauge the acceptance of practices and identify practices producers are most likely to adopt, after 20 years of conservation work by SCWIG.

A survey was developed for and sent to all producers farming land in the Shell Creek watershed. The survey was sent to 886 addresses. 194 responded (22%).

Overall, 17.7% of survey respondents (n = 194) are very concerned about water quality affecting their farm management. When asked about how concerned they are about specific contaminants affecting water quality, the number of respondents "very concerned" increased to 26% for E. Coli and 26% for Atrazine in Shell Creek, and 30.4% for Nitrate in groundwater.

The conservation practice row crop producers were most likely to try was cover crops, with 21% "Very Likely" to try. Livestock producers were "Very Likely" to try a Manure Management System (16.5%, n=133) and Prescribed Grazing (14.9%, n=134).

While most row crop producers in the Shell Creek watershed already use one or more conservation practice that improves water quality, additional support for implementation of cover crops is the conservation practice that would likely lead to the conservation practice quickest adoption rate.

Producers in this watershed are implementing conservation crops (31%, n=158) and reduced or no-till (79.9%, n=159) at substantially high rates although most respondents do not consider themselves early adopters (12%, n =175). These high rates may be the result of 20 years of grassroots efforts in the watershed.

The survey results will provide guidance for future local conservation education and incentive-based programs.

**Denotes primary author*

Advancing Water Quality and Conservation through Climate-Smart Bridge Payments to Farmers

Track: Climate-Smart Agriculture

Location: Independence on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Jessica S Jurcek (Minnesota Dept. of Ag); Brad Jordahl Redlin (Minnesota Department of Agriculture)*

The developing arena of agriculture and climate mitigation is dynamic, and in many cases unsettled relative to the efficacy of agricultural practices, the performance of private marketplaces, and the federal government's role in new programs. The Minnesota Agricultural Water Quality Certification Program's (MAWQCP) Climate Smart Farms Project responds to this uncertainty with a model of one-to-one personal service and support to producers exploring on-farm climate actions. The new program provides a minimum $1,000 annual bridge payment for up to 5 years to producers who receive an MAWQCP Climate Smart Endorsement. The Climate Smart endorsement functions as a climate audit to identify and educate growers on existing climate-smart practices and management on their farms and identify new practices. The MAWQCP Climate Smart Farms Project then provides a financially supported temporary harbor to maintain pre-existing and develop new climate practices and align and time the new practices to available market structures or public programs. The goal is to support growers to determine their best options for earning climate payments, and to combat the potential unintended consequences of "additionality" (private market protocols making only new practices eligible for credits), which may serve as a negative incentive to:

- Refrain from implementing new practices until a mature market and payment structure is broadly established, or
- suspend or remove existing conservation practices to provide space for later implementation of "new practices."

The successes and lessons learned from the Climate Smart Farms Project will inform future policy around incentivizing agricultural practices that reduce emissions and sequester carbon, creating a more resilient agricultural system. By understanding new opportunities and documenting the benefits of current practices we will ensure no loss of existing climate benefits on the landscape and facilitate the implementation of new ones.

**Denotes primary author*

Rangeland Compost Amendments Improve Productivity and Methane Uptake

Track: Climate-Smart Agriculture

Location: Independence on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Eva Stricker (Quivira Coalition)*; Rae De Van (Los Alamos National Labs); Marie Kroeger (Los Alamos National Labs)

Grasslands store 12% of the world's carbon stock and may be a more reliable source of sequestration than forested lands in the face of increasing fire, drought, and heat with climate change. Land management strategies to sequester soil carbon on working lands may be an important solution to climate change, but more research is needed to understand how the effects of management such as organic amendments differ across diverse landscapes in the dryland southwest. Thus, we added compost to five ranches across New Mexico that range in annual precipitation from 250mm to 425mm. We assessed the effect compost amount (0, ¼, ½, and 1"; two ranches), type (food waste, manure waste, or biosolids; two ranches), and exposure time (6m to 3y; one ranch) on aboveground biomass and gas fluxes in dry rangelands. We measured plant aboveground and belowground productivity and recorded carbon dioxide (CO_2) and methane (CH_4) in the monsoon season of 2021. Overall, we found that compost generally increased aboveground biomass and CO2 emissions but reduced CH_4 emissions or even increased CH_4 uptake compared to controls. We found that aboveground biomass and CO_2 emissions increased with 1" of compost added (~60% for each, $P < 0.05$, $P = 0.11$, respectively) but CH_4 emissions were always at least 2x lower ($P < 0.01$), and even ¼" of compost had beneficial effects. There were not strong differences in biomass or fluxes with different types of compost over short (< 6 month) time scales, and also not strong differences with compost that had been in place up to 3y (though the site was extremely dry when monitored). Our results suggest that compost amendments may be valuable for forage production, stimulation of the decomposition process in the soil, and importantly, uptake of methane, a potent greenhouse gas.

**Denotes primary author*

The Biogas Revolution: Climate-Smart but Conservation-Foolish?

Track: Climate-Smart Agriculture

Location: Independence on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Daniel L. Miller (Duke Environmental Law and Policy Clinic)*; James P. Longest (Duke School of Law)

Most industrial hog farms in the U.S. rely on outdated waste management paradigms, namely the "lagoon and spray field system," that externalize harms onto neighboring communities, pollute water and air, and disrupt ecosystems. Beyond the local impacts, the lagoon and spray field system contributes at least 13% of U.S. agricultural GHG emissions. As concern over climate change grows, corporations and regulators alike are searching for ways to decarbonize agriculture. One popular idea involves capturing "biogas" from existing hog waste lagoons. In this process, a cover placed over the lagoon traps methane and pipes it off-site where it is purified and injected into existing natural gas pipelines.

The presenters' 2020 article on this subject, "Reconciling Environmental Justice with Climate Change Mitigation: A Case Study of NC Swine CAFOs," was selected as one of the top environmental law articles of the year by the Environmental Law and Policy Annual Review. The article analyzed biogas projects in North Carolina and found that while methane capture would likely lower methane emissions, the projects as proposed threaten further harm to environmental justice communities and local conservation interests. Further developments since publication make this topic timelier than ever. For example, it is now clear that the effluent leaving the covered lagoons must still be stored in secondary open-air lagoons and then sprayed onto farmland, releasing more ammonia and increasing groundwater infiltration and runoff of nitrate and nitrite. In another development, EPA recently opened an investigation into whether state air and water permits for these biogas projects violated Title VI of the federal Civil Rights Act.

As agriculture enters the decarbonization limelight, conservationists must understand the tradeoffs posed by animal waste biogas projects. This presentation will provide timely background as such biogas projects proliferate across the country.

**Denotes primary author*

Conservation Agriculture and Supply Chain Development in the "Kentucky Commercial Rye Cover Crop Initiative"

Track: 2022 General Conference Theme

Subject: Conservation Economics and Policy

Location: Gold Coin on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Scott Franklin (American Farmland Trust)*

Commercial-quality rye was once widely cultivated in Kentucky. Over the past several decades, however, production has almost entirely ceased in favor of the production of three primary crops – corn, soybeans, and wheat. To develop a network of farmers and buyers of cereal rye that reimagines cover crops to meet soil health and economic goals, American Farmland Trust partnered in the innovative 'Kentucky Commercial Rye Cover Crop Initiative' with the Kentucky Agricultural Development Fund, DendriFund, the University of Kentucky College of Food, Agriculture, and Environment, and the Kentucky Small Grain Growers Association.

In a 20-minute oral presentation at the SWCS Annual Conference, we will share our second-year results and show how strategic partnerships and innovative market development for rye have increased adoption across Kentucky. Prior to 2020, Kentucky farmers grew limited amounts of cereal rye. Through this Initiative, Kentucky farmers are now growing over 3000-acres of cereal rye in 2022, with a goal of growing 10,000-acres by 2030. The Initiative has secured 3-years of committed funding, scaled enrolled acreage from 75-acres in 2020 to 3200-acres in 2022, leveraged direct grain purchases from distillers and other end-users, and created an innovative fund to continue the work beyond initial funding. This work builds upon a 2021 SWCS oral presentation that focused primarily on rye agronomy trials in Kentucky and how novel breeding efforts can increase revenue over VNS rye and wheat cover crops.

The outcomes of this Initiative are significant since incorporating cereal rye into a cash crop rotation reduces soil loss, improves soil structure, and captures excess nutrients from previous crops. This Initiative also highlights how working collaboratively with farmers, businesses, non-profits, and academic institutions can support the development and growth of a small-grain economy rooted in cover crops that ultimately improves soil health and water quality.

**Denotes primary author*

Field Days Feel Good, but Alternative Funding and Practice Delivery Models Move the Needle for Practice Adoption

Track: 2022 General Conference Theme

Subject: Conservation Economics and Policy

Location: Gold Coin on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Keegan J. Kult (Ag Drainage Management Coalition)*

Traditional conservation practice delivery is not equipped to handle the scaled-up implementation demands needed to meet regional nutrient reduction goals. This is especially true when it comes practices that require technical knowledge like conservation drainage practices as evidenced by historic low EQIP usage rate. From 2009-2020 only 105,288 acres of drainage water management have been enrolled through EQIP despite more than 30 million acres being suitable for the practice. Likewise, a total of only 49 denitrifying bioreactors and saturated buffers have been installed nationwide utilizing EQIP from 2016-2020. USDA has done great work developing and adopting new technical standards for conservation drainage practices, but adjustments to the program delivery framework are needed to address barriers if realizing the needed scale of adoption is going to happen.

Conservation practice delivery program barriers to adoption for conservation drainage include needed technical knowledge, lack of focused outreach, up front capital investment by producers which limits participation from producers with limited resources, responsibility of the producer to manage the contractor, and the timeliness and uncertainty of contract approval which adds complexity to managing the contractor.

Successful pilot projects have considered the practice delivery barriers and have utilized alternative funding arrangements that should be built upon and expanded to accelerate practice adoption. The Minnesota Model cooperative agreement between the Minnesota NRCS and ADMC member Ecosystem Services Exchange as well as the Polk County Saturated Buffer project are two examples of pilots that utilized alternative funding and practice delivery mechanisms to successfully deliver practices on the ground. This presentation will walk through the framework of both pilots and discuss pathways moving forward to result in successful practice deployment across agriculture's drained landscape.

**Denotes primary author*

Increasing Potato Profitability through Rotation Systems and Winter Cover, Efficient Use of Water, Nitrogen Fertilizer, and Conservation Tillage

Track: 2022 General Conference Theme

Subject: Conservation Economics and Policy

Location: Gold Coin on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Mohammad Khakbazan, Agriculture and Agri-Food Canada*

Prince Edward Island (PEI), Canada, produces approximately 24% of Canada's total potato production. The highest average yield in PEI was last seen in 2006 (38.92 tonnes ha-1) and has steadily declined since (Statistics Canada 2021). The average potato yield has decreased by 6.7% in 2019, down from 2006. Agriculture is carried out on shallow soils in rolling landscapes where extreme precipitation events are frequent. The result is a high risk of loss of fertile soil and contamination of receiving waters with nutrients (N and P), pesticides, and sediments. In 2019, Agriculture and Agri-Food Canada lunched an initiative called "Living Laboratories" (LL) to build a nationwide network of sites to promote adoption of BMPs that help the agriculture sector to conserve soil and water, reduce greenhouse gas emissions, adapt to climate change, and increase biodiversity. All provinces in Canada will establish similar projects by the end of 2022. The presentation will highlight results from the Atlantic LL site established in 2019 in PEI. Various potato rotation systems with winter cover, supplemental irrigation, nitrogen fertilizer, and conservation tillage practices were assessed to show how the preceding practices can result in improvements in farm profitability, and therefore increased adoption of the BMPs. The economic model evaluated returns and risk of these practices. The economic model additionally included a simulated crop rotation system that compared longer potato rotation over a typical 3-yr rotation. Use of fall conservation residue tillage produced potato yield and net return similar to the fall conventional moldboard plough. Winter cover crops before and after potatoes provided surface cover reducing erosion and higher farm net returns. The use of fertilization, winter cover, and conservation tillage are recommended to increase profits, and results showed a 3.8% potato yield increase can offset the costs of a 4-year potato rotation over a typical 3-yr rotation.

**Denotes primary author*

Launching a Soil Health Conservation Easement Program

Track: 2022 General Conference Theme

Subject: Conservation Economics and Policy

Location: Gold Coin on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Niki Reynilds (Whiterock Conservancy)*

In 2021 Whiterock Conservancy launched the nation's first-ever soil health conservation easement program. This one-of-a-kind program is focused on preserving an often overlooked natural resource, soil. Soil has been degrading and eroding across the nation at an alarming rate. Soil health conservation easements provide a vehicle for private landowners to take action on climate change while still working the lands they love. Join us to learn more about the creation of the nation's first soil health conservation easement program and how it can be replicated.

Attendees will learn:

- What is a soil health conservation easement?
- Why is soil health critical to the future of our environment and society?
- How to implement a soil health conservation easement program.

**Denotes primary author*

Evaluating Conservation Practices Effect on Nitrogen Leaching and Water Use Efficiency in Processing Tomatoes

Track: 2022 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

Location: Matchless on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Iael Raij Hoffman (University of California Davis)*; Thomas Harter (University of California Davis); William Lennon (University of California Davis); Isaya Kisekka (University of California Davis)

Innovative monitoring techniques are needed to assess the effect of irrigation and nitrogen (N) management practices on agricultural nitrate leaching to groundwater. The objective of this study was to evaluate conservation practices by measuring production and environmental outcomes of a processing tomato cropping system. Monitoring protocols were developed based on deep vadose-zone and groundwater monitoring as well as nitrogen balance assessments at the field scale. A monitoring site was established in Yolo County, CA composed of a 34-ha field cropped in a triticale - processing tomato rotation. Conservation practices included high frequency fertigation, cover crops, soil and water testing informed fertilizer management.

Historic water and nitrogen mass balances were performed using grower information, remote sensing, meteorological data and nitrogen uptake coefficients. From November 2019, water and nitrogen inputs and outputs have been continuously measured. In addition, an intensive network of shallow and deep vadose zone as well as groundwater monitoring instruments were installed, and nitrogen movement monitored from the root zone to the groundwater year-round. During the triticale season, a potential drainage of 189 mm and N loading of 110 kg-N/ha were estimated, yielding a leaching concentration of 59 ppm $N\text{-}NO_3$. During the tomato season, nitrate concentrations at the bottom of the root zone ranged between 50 and 60 ppm N-NO3. At 6.5 m depth, nitrate concentrations were below 10 ppm $N\text{-}NO_3$ at the beginning of the season and showed an increase with time, demonstrating real time in-season N leaching. Winter rainfall showed additional leaching of nitrate to deeper levels of soil in between the seasons. Our results suggest that: 1) including all sources of mineral N will affect the estimated nitrate loading to shallow groundwater and the N use efficiency of the system; 2) monitoring the deep vadose-zone is a very useful tool to observe real-time nitrate leaching.

**Denotes primary author*

Improving Land Management Decisions through Airborne Electromagnetic Mapping of Shallow Depth to Bedrock in Northeast Wisconsin

Track: 2022 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

Location: Matchless on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Matt Komiskey (USGS)*; Burke Minsley (USGS); Matthew A Pronschinske (U.S. Geological Survey); Joseph Baeten (WI DNR); Rachel E Rushmann (Department of Agriculture, Trade and Consumer Protection)

Manure fertilizer applications to cropland are an important part of livestock based agricultural operations. However, protecting groundwater sources, especially in areas of highly transmissive karst geology, requires knowledge of the geologic controls in the system. The State of Wisconsin, USA, has adopted technical standards incorporating the depth to the karstic Silurian bedrock to help protect groundwater. Specifically, manure application is prohibited where depth to bedrock is less than two feet, and restrictions apply where depths are 20 feet or less. This puts the burden on landowners to determine the depth to the Silurian bedrock on their own or research maps to receive permission to apply manure fertilizer. To improve access to this information for landowners, United States Geological Survey in cooperation with Wisconsin Geological and Natural History Survey, Natural Resources Conservation Service and Wisconsin Department of Agriculture, Trade and Consumer Protection conducted an airborne electromagnetic (AEM) survey over an area of about 2,600 square kilometers in northeast Wisconsin. This survey provides a systematic approach for mapping bedrock depth beneath glacial sediments. Electrical resistivity models derived from the AEM data are used to distinguish the top of bedrock.

The use of AEM data provides a consistent approach to bedrock depth mapping over large areas where conventional bedrock mapping can be difficult to access and expensive. Development of the depth to bedrock map relieves the burden on private landowners to verify bedrock depths for nutrient applications on their own as well as provide a consistent approach that avoids erroneous interpretation of bedrock depths. In addition, AEM surveys can be incorporated into water resource studies to better characterize the subsurface geology, and the influence it has on groundwater flow and interaction with surface processes.

**Denotes primary author*

The Great Lakes to Gulf Virtual Observatory: A Decision Support Tool for Effective Planning and Deployment of Conservation Best Management Practices Focused on Nutrient Reduction in the Mississippi River Basin

Track: 2022 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

Location: Matchless on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Ellen Gilinsky (Ellen Gilinsky, LLC)*; Richard Warner (University of Illinois - NGRREC)

To effectively implement and manage conservation practices to achieve positive environmental results, there is a need to fully visualize and understand water quality conditions historically and in real-time, and relate them temporally and spatially to conservation best management practices. The Great Lakes to Gulf Virtual Observatory (GLTG) is an interactive geospatial application focusing on the Mississippi River watershed that integrates water quality data and analytics from multiple sources. It is a user-friendly tool that can be applied by managers and stakeholders to model actions that will improve water quality in the watershed. GLTG, started in 2014, includes historic and current data on water quality, hydrology, land use, and agricultural BMPs, allowing the users to see data source, time-period, geographical location, watershed boundaries, and explore nutrient trends and related metrics. Most recently, project members have been working with the EPA Hypoxia Task Force (HTF) to develop GLTG visualizations of flow-normalized nutrient trends in key state sub-watersheds of the Mississippi River for the period of October 2002 through May 2015. In order to improve the ability to relate these observed trends to agricultural conservation practices, GLTG will incorporate heat maps of agriculture best management practices for each of the 12 HTF states. In addition, new data layers on remote sensing of cover crops and tillage practices related to nitrogen concentrations as well as HydroClim model results for monthly discharge and water temperature data from 1950 to the present, and projected to 2099, will be added. These new data layers and decision support tools will improve the ability of GLTG to relate management actions directly to water quality in the Mississippi River Basin, and provides state and local managers.

**Denotes primary author*

Weather Factors in Smoke Management of Prescribed Burning in the Flint Hills Region

Track: 2022 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

Location: Matchless on Lower Level 1

Time: 1:30 PM - 3:00 PM

Authors: Zifei Liu (Kansas State University)*

Prescribed burning is a long standing practice to maintain the ecosystem in the Flint Hills region. However, the intensive burning in April impacts air quality, and constitutes public health concerns. Smoke from the fires contributes to violation of the ambient ozone (O3) standard. The objective of this study was to identify the weather factors that can be used for better timing in the management of prescribed fires, based on combined analysis of historical data including O3, weather variables, and daily burned area that were obtained from satellite observations.

Our results showed that, the three most important weather variables that affected the daily burned area were solar radiation, cloud cover, and relative humidity (RH). The O3 level was most sensitive to the O3 level on the previous day, followed by the daily burned area, RH, and cloud cover. On average, for every 0.1 million increase of daily burned acres, the maximum O3 level increased around 4 ppb. In order to reduce smoke impact on O3, cloud cover and RH need to be considered when making burning decisions. The optimum conditions for burning is when cloud cover = 30~50%, and under this condition, no O3 exceedance has been observed. Another recommended weather conditions that are suitable for burning are when cloud cover = 10~30%, and RH = 40~80%. When cloud cover = 0~10%, the O3 background is generally higher, and O3 is also most sensitive to fire activities, especially when RH is also low. Under these conditions, burning should be managed not to exceed the maximum daily burned area, which can be determined by the O3 level on the previous day and the RH.

The detailed guidelines generated from this project can assist land managers to better plan their burning activities and enable the continuous practice of burning in a manner that minimize impact on air quality.

**Denotes primary author*

Automated Probabilistic Co-Occurrence Assessments for Pesticides and Federally Listed Species

Track: At the Intersection of Agriculture and Conservation

Location: Penrose 2 on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Jonnie B. Dunne (Stone Environmental)*; Hendrik Rathjens (Stone Environmental); Michael Winchell (Syngenta Crop Protection); Leif Richardson (Stone Environmental); Max Feken (Syngenta Crop Protection); Richard Brain (Syngenta Crop Protection); Iula Ghebremichael (Syngenta Crop Protection); Anthony Burd (Syngenta Crop Protection); Caydee Savinelli (Syngenta Crop Protection)

Section 7 of the Endangered Species Act requires the US Environmental Protection Agency (EPA) to consult with the US Fish and Wildlife Service (FWS) about potential pesticide impacts to federally listed species. Consultation is challenged by the abundance of registered products and listed species, as well as by lack of consensus on best available species distribution data and co-occurrence prediction methods. Our previous work demonstrates that probabilistic estimates of species' ranges and pesticide use patterns improve these estimates. Here we present a freely available software tool and that employs probabilistic methods to efficiently generate batches of maps and statistical summaries of species distributions, pesticide use, and co-occurrence between the two. To generate probabilistic pesticide use footprints the user first specifies crop application rates which multiplied by summaries of USDA Cropland Data Layers to calculate maximum potential usage by year and by county, USDA Crop Reporting District, or state. The user may then provide their own pesticide use data, or use the state level USGS ePest pesticide use estimates provided in the database, to produce Percent Crop Treated (PCT) maps. The PCT maps are then multiplied by probabilistic crop footprint rasters to produce the probabilistic pesticide use footprint rasters. The tool uses Maxent software to generate species distribution models (SDMs) based on occurrence records and gridded models of bioclimatic, geographic, and other predictor variables. SDMs are constructed via an iterative model selection procedure that controls for known sources of error such as spatial autocorrelation and prioritizes model fit. The pesticide use footprint and SDMs are then multiplied to compute probability of co-occurrence, which is summarized within zones of interest to aid in conservation planning. We also present the results of a case study on co-occurrence between a corn herbicide and ten federally listed species.

**Denotes primary author*

Companion Cropping of Spring Canola and Spring Peas in Eastern Oregon

Track: At the Intersection of Agriculture and Conservation

Location: Penrose 2 on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Don J. Wysocki (Oregon State University)*; Alan Wernsing (Oregon State University)

Companion cropping is a strategy of growing various crop species together to take advantage of crop synergies. Companion cropping of spring canola and spring peas can save on nitrogen fertilizer and lowered disease and insect pests. The peas hold on to the canola, improving canola seed shatter tolerance, while keeping peas off the ground, reducing disease risk and making combining easier. Other benefits include better utilization of available inputs and resources, improved fertilizer and water use efficiency, improved soil health and reduced weed pressure. Fifteen combinations of seeding rates of pure canola, pure peas and mixed seed ratios of canola and peas were investigated to determine optimum sowing combinations for companion cropping these species. At prevailing prices, five combinations of canola and peas together had gross returns greater than pure stands of canola or peas.

**Denotes primary author*

Ten Years of Change in Pest Management Practice Adoption: Summary of Conservation Effects Assessment Project Results

Track: At the Intersection of Agriculture and Conservation

Location: Penrose 2 on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Brianna Henry (USDA NRCS)*; Lee Norfleet (USDA NRCS)

The Conservation Effects Assessment Project (CEAP) is a multi-agency initiative led by the USDA Natural Resources Conservation Service to assess the benefits of voluntary conservation on working lands related to edge-of-field sediment, nutrient, and pesticide losses. As part of this effort, detailed farmer surveys including information about pest management practices and pesticide applications were conducted nationally in 2003-2006 (CEAP 1) and 2013-2016 (CEAP 2). For the first time, change in adoption of practices and modeled conservation benefits over time can be assessed by CEAP. This presentation will highlight major trends in pest management practices over time nationally, regionally, and by crop rotation, especially in relation to increases in other agronomic practices such as cover crops and conservation tillage. Initial findings indicate similar levels of overall integrated pest management as determined by the CEAP IPM Indicator Score at both time points, with scouting practices among the highest used in CEAP 2. While there was a 34% relative increase in adoption of conservation tillage between CEAP 1 and CEAP 2 and conservation and conventional tillage present different pest management challenges, there was little difference in IPM scores or scouting prevalence between tillage types in CEAP 1, and no difference in CEAP 2. However, producers applying cover crops had higher average IPM Indicator Scores than those without cover crops, likely driven by the higher presence of scouting deliberately for pests over making general observations while doing other work in the field.

**Denotes primary author*

Improving Sustainable Irrigation Practices in Onion Production in Imperial County, California

Track: On the Frontier of Conservation in the West/Conservation in Organic, Specialty, Small-Scale, or Urban Agriculture

Location: Independence on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Jairo Diaz (University of California)*; Daniel Geisseler (University of California); Roberto Soto (Universidad Autonoma de Baja California)

California has the largest water appropriation of the Colorado River Basin - CRB. Agriculture is the largest offstream use of water in the CRB. Over two decades of persistent drought in the CRB has brought the attention of all water users to adapt to future shortages of water. The Imperial Irrigation District located in Imperial County, California, has delivered water to agricultural and domestic water users for over 100 years. Imperial County has about 500,000 acres in agricultural production with more than 80 commodities. The Imperial County agricultural gross production for 2020 was valued closed to $2B. This region is known as the nation's winter salad bowl, because more than 100,000 acres in vegetables are harvested during the season. In 2018, onion production in Imperial County generated $98.64 million in farm gate value, equivalent to 16% of total gross value in California. The main goal of this project was to evaluate the effects of irrigation management on yield and quality of fresh onion bulb production in Imperial County. Field assessments were performed at the University of California Desert Research and Extension Center (UCDREC) in Holtville, CA during two growing seasons (2019-2020 and 2020-2021). The assessment was carried out with four replicates using sprinkler irrigation for germination and establishment and irrigation treatments with drip irrigation system. Four irrigation levels were established: 40, 70, 100, and 130% of crop evapotranspiration (ETc). Irrigation scheduling was based on weather data from the UCDREC's CIMIS station and stage-specific crop coefficients developed for the region. Jumbo sizes were used for onion quality analysis. Onion yields and bulb size distribution responded to irrigation rates in both years. Onion bulb brix values responded to irrigation rates, but there were no statistical differences in measured firmness in response to irrigation rates.

**Denotes primary author*

Securing the Future of Highly Productive Organic No-Till Vegetable Cropping Systems in California

Track: On the Frontier of Conservation in the West/Conservation in Organic, Specialty, Small-Scale, or Urban Agriculture

Location: Independence on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Jeffrey P. Mitchell (University of California, Davis)*; Anil Shrestha (Department of Viticulture and Enology, CSU Fresno); Tom Willey (T&D Willey Farms)

Since 2018, six experienced California organic vegetable farmers with over 100 private sector, university, and other agency affiliates have been working together to reduce soil disturbance in their production systems in Hollister, Meridian, and Guinda, CA as part of a USDA NRCS Conservation Innovation Grant (NR183A750008G006). The farmers customarily use cover crops and compost as sources of nutrients along with minimum tillage approaches, but during the project attempted strip-tillage, vertical tillage and no-tillage planting systems as well as various cover crop termination techniques for their vegetables. A host challenges including various seedling pests, the inability to terminate and leave winter cover crops on the soil surface as mulches using a roller-crimper or mower, and uncertainties regarding whether nutrient (particularly nitrogen) availability needs are being met within reduced disturbance systems, and other as yet unspecified causes of yield drag were all identified as challenges that have not yet been overcome. The 'hits' that these farmers have had with respect to low yields have been considerable and are not seen as something that can be taken on as replacements of their traditional tillage approaches at this time.

**Denotes primary author*

Using Integrated Modeling to Simulate Environmental Impacts of Increases in Local Table Food Production around Urban Centers in the Midwest

Track: On the Frontier of Conservation in the West/Conservation in Organic, Specialty, Small-Scale, or Urban Agriculture

Location: Independence on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Tássia Brighenti (CARD, Iowa State University); Tiffanie Stone (Natural Resource Ecology and Management, Iowa State University); Philip W Gassman (CARD, Iowa State University)*; Jan Thompson (Iowa State University)

The Iowa Urban FEWS (Food-Energy-Water Systems) project is focused on developing sustainable table food production systems in the six county Des Moines–West Des Moines, IA Metropolitan Statistical Area (DM-MSA). Multiple models are integrated within the project to evaluate the impacts of converting areas of commodity cropland (or other land uses) to vegetable or fruit crops in DM-MSA landscapes. Two key components of the integrated modeling system are: (1) the Soil and Water Assessment Tool (SWAT) model, which is used to evaluate the hydrologic and water quality impacts of land use changes, and (2) the open-source USEEIO life cycle assessment (LCA) model which is used to assess environmental impacts of local table food production scenarios within the DM-MSA.

A multi-phase SWAT testing approach has been initiated to establish accurate hydrologic and pollutant cycling/transport representation of baseline conditions for the Des Moines and Skunk Rivers, which collectively drain most of the DM-MSA area. The baseline SWAT model will support a wide range of DM-MSA landscape change scenarios. Concurrently, an LCA model has been developed to assess systems that would supply 50% of current food consumption (e.g., grains, proteins, and vegetables) in the study area. Model results for baseline and future climate scenarios will incorporate the effects of landscape conversion into table food production. The simulated fruits and vegetables will be determined via initial LCA analyses; the baseline hydrologic, water quality impacts and yields of converting to those crops are subsequently predicted using SWAT. Future food systems outputs of energy and land use, hydrologic and water quality impacts will also be spatially presented which are generated on the basis of the combined SWAT-LCA simulations executed using an ensemble of two GCMs (MPI-ESM-MR and GFDL-ESM2M) and two RCMs (WRF and RegCM4) from the North American (NA)-CORDEX CMIP5 archive.

**Denotes primary author*

Evaluation of Current Rangeland Conditions and Trends on Nonfederal Rangeland Community Types

Track: 2022 General Conference Theme

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

Location: Gold Coin on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Kenneth Spaeth (USDA NRCS); Shane A Green (USDA NRCS); Thomas O Hilken (USDA NRCS)*

In this presentation, a summary analysis of pertinent NRI data relevant to rangeland conditions and trends is presented for several key rangeland types in Omernick ecoregions.

The USDA NRCS in cooperation with Iowa State University's Center for Survey Statistics and Methodology, Ames, Iowa, USA, has conducted large-scale resource inventories for >65 years to assess US natural resources on non-federal lands. On rangeland, the inventory process has evolved from qualitative assessments in the early 1980s to robust quantitative field methods that have been used since 2003 to the present. The NRI rangeland on-site study is scientifically based, using a randomized statistical methodology where each point has a calculated expansion factor which represents the number of hectares for the sample point on the landscape. The full field methodology includes foliar and ground cover estimates by species using line-point intercept; production determination by species; plant height measurements by species; field soil stability test; identification of resource concerns; disturbances, and conservation needs; rangeland health assessment; full plant census; and photographs taken at random points on the landscape. Results indicate that rangeland trends are changing in various rangeland types; however, further investigation and experimentation is needed to determine the cause and effect relationship between trend and disturbances such as climate change, invasive species, and other abiotic (fire) and biotic (livestock) management activities.

**Denotes primary author*

Grazing Management Modifies the Biomass and Activities of Soil Microorganisms in Grasslands

Track: 2022 General Conference Theme

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

Location: Gold Coin on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Michael Lehman (USDA ARS)*; Laura White (USDA ARS)

Variable reports regarding the effects of grazing management on soil properties in grasslands suggest the need for further study. We measured the response of soil microbiological properties to conventional and adaptive multi-paddock (AMP) grazing management practices at five locations arranged in a north-south transect from southern Kentucky to Southern Mississippi. At each location, sampling transects were established at neighboring ranches with contrasting management practices, and 18 independent, composite soil samples were collected and preserved according to analysis. We measured abundance of taxonomic groups by quantitative PCR (qPCR), potential nutrient cycling activities by qPCR of functional genes, and potential mineralization activities including basal respiration and substrate-induced respiration (SIR) with glucose and phenol as substrates. Numbers of fungi ($p=0.060$) and bacteria ($p=0.119$) were higher under AMP management compared to conventional management. The numbers of gene copies encoding for nitrification and denitrification were higher ($p=0.032$ and $p=0.027$, respectively) in AMP ranches compared to the Conventional ranches. Basal soil respiration was elevated ($p=0.125$) in AMP ranches compared to Conventional ranches presumably due to the higher numbers of microbes that were actively transforming plant exudates and residues. In contrast, carbon limitation of respiratory activities was higher ($p= 0.011$) in the Conventional ranches compared to AMP ranches indicating decreased processing of soil C and formation of microbial biomass which are the key processes leading to stable soil carbon. In summary, we found grazing management can influence the numbers and key activities of soil microbes that may increase retention of C and nutrients in these grassland systems.

**Denotes primary author*

The Interactive Effect of Cover Crop Diversity and Tillage Type on Corn Yield

Track: 2022 General Conference Theme

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

Location: Gold Coin on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Victoria N. Snyder (University of Guelph)*; Laura L. Van Eerd (University of Guelph)

Healthy soil is essential to a successful cropping system and best management practices such as cover crops and reduced tillage can be used to replenish and protect soil. Although there is extensive research on the benefits of using cover crops as mono- and bi-cultures, there are limited studies that have evaluated the interactive effect of cover crop polycultures and tillage type on crop attributes. The questions this study poses are i) does cover crop diversity benefit following grain corn yield and i) does it depend on the tillage system used? In a soybean-winter wheat- cover crop- grain corn rotation, the split plot design experiment with four replicates had 13 cover crop treatments (main plot: 1, 2, 4, 8 and 12 species and a no cover control) and two tillage types (subplot: no-till and fall zone-till). Cover crop fall biomass ranged from 1020 to 5030 kg ha-1 in 2017 and 623 to 4190 kg ha-1 in 2020 ($P< 0.001$). Cover crops were chemically terminated in the following spring. All corn grown without fertilizer nitrogen yielded avg. 10827 kg ha^{-1} in 2018 but a late frost and N deficiency lowered yield in 2021 (avg. 7129 kg ha^{-1}; $P<0.001$). There were no main effect interactions with year ($P >0.758$). On this sandy-loam soil with 3.6% organic matter, there was a trend of greater corn grain yield with zone- (9213 kg ha^{-1}) than no-till (8743 kg ha^{-1} (1076 SE); $P = 0.055$) and no tillage by cover crop interaction ($P = 0.938$). Over the two years, cereal rye had the lowest corn yield (6860kg ha^{-1}) which was not different than the no-cover control (8070 kg ha^{-1}). These treatments were less than hairy vetch and hairy vetch+cereal rye treatments, which had the greatest grain yield (10760 kg ha^{-1} 1136 SE kg ha^{-1}; $P<0.001$). However, further increasing cover crop diversity did not impact corn yield. This research is expected to provide recommendations to growers on poly mixtures versus monocultures or bicultures, and coinciding tillage practices.

**Denotes primary author*

Rainfall-Runoff Models Compared for Tile Drained Agricultural Fields in the Western Lake Erie Basin, Ohio

Track: 2022 General Conference Theme

Subject: Water Resource Assessment and Management

Location: Matchless on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Carl Bolster (USDA ARS)*; Barret Wessel (University of Mary Washington); Kevin King (USDA ARS); Vinayak Shedekar (Ohio State University)

Simple models like the curve number method are commonly used to predict runoff volumes from agricultural fields, playing a key role in nutrient transport modeling and watershed management; however, the curve number method has not been evaluated for use in tile-drained fields and it may therefore produce erroneous runoff predictions if applied in these settings. In this study, we evaluate the curve number method at 12 tile-drained research sites in the Western Lake Erie Basin of Ohio. Rainfall and runoff observations at each of these sites were used to calculate curve numbers using six published variations of the curve number method. These were compared to published curve numbers, selected from NRCS tables to correspond to land use in the study sites. In addition to the curve number methods, the complacent-violent method was also used to develop runoff model parameters for the research sites. Methods were compared to one another using Nash-Sutcliffe efficiency, bias, and R-squared. The curve number methods often performed poorly, and sometimes altogether failed to produce a real solution. Of the rainfall-runoff models evaluated, the complacent-violent method produced the most accurate results and should be used in place of the curve number method to make runoff predictions from tile-drained fields.

**Denotes primary author*

Relating Carbon and Nitrogen Transport from Constructed Farm Drainage

Track: 2022 General Conference Theme

Subject: Water Resource Assessment and Management

Location: Matchless on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Anthony Seeman (Iowa Soybean Association)*; Keith Schilling (Iowa Geological Survey); Chris Jones (IIHR Hydroscience & Engineering, University of Iowa)

Fertility and crop production in soils of the recently-glaciated agricultural Midwestern U.S. link to soil inorganic and organic carbon, soil nitrogen and nitrogen inputs. Research relating transport of each to the others through the constructed drainage network to receiving streams is sparse. The main objective of this work was to quantify and characterize concentrations and yields of inorganic and organic carbon (IC and OC) along with nitrate-nitrogen (NO_3-N) using a four-year dataset that included discharge from two managed drainage districts in the Cornbelt state of Iowa. Our analysis shows loss of carbon through these constructed drainage networks averages 124 kg ha^{-1} yr^{-1} with more than 90% of this total in carbonate form and only 7% in organic forms, a small amount relative to soil organic stores. Transport of NO_3-N can total as much as 97 kg ha^{-1} yr^{-1}. Although loads of IC, OC and NO_3-N all vary similarly with discharge, NO_3-N is especially transport-limited. Elevated OC concentrations in March are likely linked to recent manure application to soil surfaces, with concentrations returning to a consistent baseline thereafter. Concentrations of IC are lowest at high flows, indicating dilution by fresh water from recent hydrologic events into the drainage system which disproportionately mobilize NO3-N compared to IC. Although yields of IC and OC to the drainage system indicate tile drainage does not threaten to deplete soil organic matter stores, returning the system to a condition where carbon and nitrogen cycle together could improve stream water quality.

**Denotes primary author*

Reducing Nitrate Loads in Subsurface Tile Runoff through Denitrification in a Woodchip Bioreactor in Northeast Wisconsin

Track: 2022 General Conference Theme

Subject: Water Resource Assessment and Management

Location: Matchless on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Krista A. Hood (USGS)*; Matt Komiskey (USGS)

The Great Lakes Restoration Initiative Priority Watersheds (PW) program is an interagency effort established to accelerate ecosystem restoration in the Great Lakes of North America through the evaluation of targeted conservation practices. The primary goal of the PW program is to characterize water-quality changes from conservation efforts at both the local (edge-of-field) and regional watershed scales. As part of the edge-of-field monitoring efforts to evaluate innovative practices, a bioreactor installed adjacent to an active agricultural farm field in Kewaunee County, Wisconsin was equipped to determine the conservation practice's efficiency treating subsurface drain tile discharge. Bioreactors are widely-used for treatment of nitrate from subsurface drain tile systems by the process of denitrification. Performance of bioreactors is dependent on maintaining ideal conditions for the denitrification process, which includes temperature and discharge rates.

Water-quality and quantity were monitored year-round at the inlet and outlet of the bioreactor structure during two years of alfalfa crop production. Daily nitrate load values were computed using discrete sample concentrations compared to the continuous data from an in-situ nitrate sensor. Influent nitrate concentrations of discrete samples ranged from <0.1 to 85.7 mg/L, while effluent concentrations ranged from <0.1 to 70.8 mg/L. Timing of sample collection has shown variation in nitrate concentration reduction over an event runoff hydrograph. Nitrate output was largest during the spring season (55% of annual total from March to May), followed by winter (18%, December to February), summer (17%, June to August), and fall (10%, September to November). Annual nitrate loads were reduced, on average, by 30% in the first two years of monitoring. Seasonal performance was highly variable, yet a 31% reduction was found during the spring season when nitrate loads were highest.

**Denotes primary author*

The Effects of Channel and Tillage on Runoff and Sediment in Subsequent Runoff Events in Fields under Bare Ground Condition

Track: 2022 General Conference Theme

Subject: Water Resource Assessment and Management

Location: Matchless on Lower Level 1

Time: 3:30 PM - 5:00 PM

Authors: Fangzhou Zheng (Fredericton Research and Development Centre [AAFC])*; Sheng Li (AAFC); David Lobb (University of Manitoba)

Cultivated fields suffer from both water and tillage erosion. Water erosion can create channels and tillage redistributes soil, both will affect runoff generation and water erosion in subsequent runoff events. The objective of this study was to quantify such effects and understand the changes in process induced by existing channel and tillage, separately and combined.

The study was carried out in plots with four treatments: no channel, no tillage (NN, as the control); with channel, no tillage (CN); no channel, with tillage (NT); and with both channel and tillage (CT). A rainfall simulator was used to produce simulated rainfall. Each treatment had four repeats. For each run, the rainfall simulation lasted for one hour after runoff initiation. The effects of treatment on runoff and sediment related measures were analyzed with ANOVA and ANCOVA, respectively.

We found that under bare ground condition, the effects of existing channel and tillage were mostly opposite to each other. Compared to NN, for CN, runoff initiation time was shortened from 22.4 min to 11.5 min. The runoff discharge and sediment export were also greater than those for NN at any given time during the rainfall simulation. For NT, runoff initiation time (24.9 min) was longer than that for NN whereas the runoff discharge and sediment export were lower than those for NN. For CT, the runoff initiation, discharge and sediment were similar to those of NT, indicating the dominant effects of tillage over the existing channel. Applying this knowledge to a real-world example of a potato-cereal crop rotation common in Atlantic Canada, we recommend spring primary tillage after cereal harvesting and late fall primary tillage after potato harvesting to reduce the overall soil erosion.

**Denotes primary author*

Wednesday, August 3

Oral Presentation Descriptions and Agenda

Cover Crop Seeding Rate Effects on Production and Water Quality

Track: 2022 General Conference Theme

Subject: Adaptive Management of Conservation Efforts

Location: Penrose 2 on Lower Level 1

Time: 8:30 AM - 10:00 AM

Authors: Paul De Laune (Texas A&M AgriLife)*; Emi Kimura (Texas A&M AgriLife Extension); Katie Lewis (Texas A&M AgriLife)

Water is often the limiting factor on crop production in water limited environments. Thus, implementation of cover crops as a conservation management practice in such environments raises concerns for interested producers. In addition, recommended cover crop seeding rates often exceed full seeding rates when used as a cash crop (e.g., wheat, rye). Use of higher seeding rates has been justified to provide greater canopy coverage that could potentially further protect against soil and water erosion. The objective of this project was to determine the impact of cover crop seeding rate (0.25x, 0.5x, 1x, and 1.5x) for four cool-season cover crop species (cereal rye, Austrian winter pea, hairy vetch, and winter lentil). Canopy coverage at time of cover crop termination did not differ among seeding rates within species. In addition, herbage mass production did not vary among seeding rates, with 0.5x rates providing optimum production. Cotton lint yields also did not differ among cover crop seeding rates. Initial PLFA data also indicated no differences among seeding rates. Rainfall simulations will be conducted in late spring to evaluate water quality impacts. Overall, cover crop seeding at rates lower than “full” rates can provide optimum herbage mass production without sacrificing soil function benefits.

**Denotes primary author*

Dynamics of Soil Organic Carbon and CO_2 Flux Under Cover Crop and No-Till Management in Soybean Cropping Systems of the Mid-South

Track: 2022 General Conference Theme

Subject: Adaptive Management of Conservation Efforts

Location: Penrose 2 on Lower Level 1

Time: 8:30 AM - 10:00 AM

Authors: Alexandra G. Firth (Mississippi State University)*; Beth H. Baker (Mississippi State University); John Brooks (USDA ARS); Martin Locke (USDA ARS); Dana Morin (Mississippi State University)

The transition of natural landscapes to agricultural uses has resulted in severe loss of soil organic carbon (SOC), significantly contributing to CO_2 emissions and rising global temperatures. However, soil has the largest store of terrestrial carbon (C), a considerable sink and effective strategy for climate change mitigation if managed properly. Cover crops (CC) and no-till (NT) management are two management strategies that are known to increase SOC; however, adoption of these practices has been low in the mid-South due to lack of region-specific research and resistance to unproven practices. Therefore, the purpose of this study was to evaluate the impacts of CC-NT treatments in soybean cropping systems on soil %OC and CO_2 flux following long-term implementation. Results showed significantly greater %OC in NT (1.27% ±0.03) than RT (1.10% ±0.03; $p<0.001$) and greater in both CC (rye: 1.23% ±0.03, rye+clover:1.22% ±0.03) than no cover (1.11% ±0.03; $p<0.001$). Bacteria abundance ($p=0.005$), pH ($p=0.006$), and CEC ($p<0.001$) were significant predictors of %OC. There was no overall significant difference in CO_2 flux between tillage or CC treatments, however, there were significant differences between NT and RT in July of 2020 when %RH increased ($p<0.001$). Microbial abundance negatively impacted CO_2 flux ($p<0.05$), which contradicts most studies. The rate of proportional change and pattern of variability in C pools suggested loss of SOC in RT treatments that were not apparent when considering SOC alone. The results of this study provide valuable insight into C turnover and the effectiveness of CC use in the Mid-South to increase soil C stocks.

**Denotes primary author*

Perception, Value, and Governance of Ecosystem Services in Ecuador

Track: 2022 General Conference Theme

Subject: Adaptive Management of Conservation Efforts

Location: Penrose 2 on Lower Level 1

Time: 8:30 AM - 10:00 AM

Authors: Roberto S. Navarrete Arias (University of Massachusetts at Amherst)*

Land use/land cover (LULC) plays an important role in the provision of ecosystem services. Changing natural vegetation to agricultural or urban uses affect the socio-economic dynamics of the populations surrounding them. Altering land use may also result in impairment of ecosystem services. Rural and urban communities have different realities and perceptions on the importance of ecosystem services, which tend to vary by economic, generational, social and cultural factors. This study assesses the subjective value of people in urban and rural communities on provisioning, regulating, and cultural ecosystem services. A qualitative survey using interviews and spatial analysis with GIS is used to study ecosystem services. The survey evaluates values, perceptions, and benefits of ecosystems in urban and rural regions. Environmental conservation plans that have been implemented on a national level and the traditional ecological activities that local communities play a key role in the governance of ecosystem services. There is a need to understand the effectiveness and awareness on different types of actions resulting from governance regimes to be both applicable and useful in protecting ecosystem services in fragile and diverse ecosystems such as in Ecuador.

**Denotes primary author*

The Effects of Water Eroded Channel on Tillage Translocation

Track: 2022 General Conference Theme

Subject: Adaptive Management of Conservation Efforts

Location: Penrose 2 on Lower Level 1

Time: 8:30 AM - 10:00 AM

Authors: Fangzhou Zheng (Fredericton Research and Development Centre [AAFC]); Sheng Li (AAFC)*; David Lobb (University of Manitoba)

In cultivated fields, water erosion can create channels such as rills and gullies. The creation of these channels changes the local topography and, therefore, impacts soil movement during tillage operations. The objective of this study was to quantify the effect of channels on tillage translocation and to understand the processes leading to such effects.

A plot experiment was conducted and point tracers were used to measure tillage translocation under three tillage treatments: downslope (DT), upslope (UT), and contour tillage (CT) and three channel treatments: no channel (C0), 10 cm by 10 cm channel (C10), and 20 cm by 20 cm channel (C20). Forward and lateral translocation, and their resultant total translocation, were calculated for each individual tracer by comparing the tracer location before and after tillage operation. The average forward, lateral and total translocations for all tracers were used to characterize tillage translocation for the treatments whereas the translocation of each individual tracers were used to infer the soil redistribution processes during tillage translocation.

For DT, the presence of a channel reduced total translocation from 24 cm to 21 cm, whereas for UT, it increased total translocation from 14 cm to 19 cm. This trend was attributed to a decrease in forward translocation under DT and an increase in forward translocation under UT with the presence of a channel, as lateral translocation was not significantly affected by the channel. For CT, the presence of a channel increased both forward and lateral soil translocation, and therefore total translocation (from 8 cm to 16 cm). Individual tracer movement revealed that on one hand, the channel functioned as a trap that restricted further soil movement after it fell into the channel while on the other hand, with the presence of a channel there was less soil being moved thus higher energy intensity for soil movement, leading to greater tillage translocation.

**Denotes primary author*

Leading at the Edge: Partnerships to Identify and Scale Structural Conservation Practices

Track: At the Intersection of Agriculture and Conservation

Location: Independence on Lower Level 1

Time: 8:30 AM - 10:00 AM

Authors: Jessica D'Ambrosio (The Nature Conservancy)*; August Froehlich (The Nature Conservancy

The Nature Conservancy partnered with many entities to create an Edge of Field Roadmap that provides recommendations to implement and scale agricultural edge of field conservation practices to meet water quality and climate goals. In Ohio, we are collaborating with local partners to bring the Agriculture Conservation Planning Framework toolbox to conservation professionals by providing shared datasets and standardized guidance, a shared repository of information, and connection to ACPF outreach materials to help build the economic case, increase the capacity to plan and implement practices and elevate a culture of conservation focused on managing water, nutrients and sequestering carbon at the edge of farm fields. This presentation will discuss the partnerships working together, provide a brief overview of the toolbox, outline how we stay connected to regional and national efforts, and discuss next steps.

**Denotes primary author*

Leveraging Agribusiness Advisers Trusted Relationship with Farmers

Track: At the Intersection of Agriculture and Conservation

Location: Independence on Lower Level 1

Time: 8:30 AM - 10:00 AM

Authors: Carrie L. Vollmer-Sanders (The Nature Conservancy); Valerie Leung (The Nature Conservancy); Leif Fixen (The Nature Conservancy)*

As we look at accelerate conservation practice adoption, it is imperative the conservation community understand how to leverage agribusiness advisers' trusted relationship with their grower customers. The Nature Conservancy has reviewed lessons learned from our agribusiness-related conservation projects, other relevant social science research conducted in the past 3 years, and two related studies from Purdue University's Center for Food and Agriculture Business. We will share the differences in behavioral and demographic variables between farmer adopters and non-adopters of conservation practices. We will review the needs and role for agribusinesses to participate in ecosystem service markets, to educate their grower customers about conservation, and to maintain a profitable business model. We will discuss the research findings and share insights from the Conservancy, Purdue University, and others to better equip listeners about the gaps and opportunities for conservation professionals to leverage the trusted relationship agribusiness advisers have with their grower customers.

**Denotes primary author*

Redefining Stakeholder Analysis: Foundation for Successful Stakeholder Engagement

Track: At the Intersection of Agriculture and Conservation

Location: Independence on Lower Level 1

Time: 8:30 AM - 10:00 AM

Authors: Anil K. Kumar Chaudhary (The Pennsylvania State University)*; Parmveer Singh (The Pennsylvania State University); Sharmistha Basak (The Pennsylvania State University)

The management of natural resources is a complex process considering different uncertainties, diversity of stakeholders, multiple scales, etc. Acknowledging this complexity, over years, natural resource management professionals are leaning towards stakeholder engagement to enhance transparency in decision making and promoting actions by community members. Many stakeholder engagement efforts underscore the importance of stakeholder identification and understanding their roles, interests, power dynamics, influence, and networks. As such, stakeholder analysis is considered a vital step in a stakeholder engagement process since it has the potential to include voiceless stakeholders, avoid biased results and ensure the long-term effectiveness of the process. Stakeholder analysis literature did put enough emphasis on the inclusivity of marginalized stakeholders for the management of natural resources, but a holistic and systematic process that ensures the identification of marginalized stakeholders is still not clearly described. Additionally, the literature is dispersed on practical stakeholder analysis steps including minimal guidance and theoretical rationale for using snowball sampling during the stakeholder identification process. With marginalized stakeholders, the snowball technique may lead to biases if there is a significant difference between well-known groups within established social circles and those who are not.

In this paper, we aim to address these gaps in the existing literature to provide a detailed process for stakeholder analysis through an extensive literature review that practitioners can follow including addressing the challenges with snowball sampling and identification and inclusivity of marginalized stakeholders. We will test and present the results of the revised stakeholder analysis process by conducting a stakeholder analysis for a transdisciplinary project focusing on promoting the sustainability of agriculture in urbanized landscapes.

**Denotes primary author*

Updated Erosivity Values for the Conterminous United States

Track: 2022 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

Location: Gold Coin on Lower Level 1

Time: 8:30 AM - 10:00 AM

Authors: Ryan McGehee (Purdue University)*; Dennis C Flanagan (USDA ARS); Bernard Engel (Purdue University); Chris Coreil (USDA NRCS); Michael J Kucera (USDA NRCS)

Rainfall erosivity is the driving force behind upland soil erosion by water and is utilized in many erosion prediction technologies. Average annual rainfall erosivity, or the R-factor in USLE, can be mapped using spatial interpolation. Unfortunately, current erosivity maps in use in the U.S. are outdated including the RUSLE2 recommended U.S. climate database, which was derived from a mixture of undocumented gauge data spanning the years 1960-1999. This study used more than 3,400 15-minute, fixed-interval precipitation gauges to update the erosivity map for the conterminous U.S. (1970-2013). Erosivity maps were prepared without gap-filling, with metadata-based linear gap-filling, and with a novel gap detection and advanced multiple imputation by chained equations (MICE)-based gap-filling. The RUSLE2 energy equation was used to calculate kinetic energy and erosivity. Maps were prepared with and without small storm omission, and no large events were removed. Several spatial kriging approaches were tested, including ordinary and universal kriging with various spatial models. Erosivity maps with different spatial resolutions (1, 2, 4, 8, 16, and 32 km) were then created for precipitation, erosivity, and erosivity density. Results were compared to existing maps (for precipitation and erosivity), and differences evaluated. In general, the use of the updated precipitation data, advanced gap-filling and kriging techniques, and spatial interpolation to fine resolutions (1-km) resulted in new erosivity maps that indicated substantial changes in most locations. In the eastern U.S., erosivity values were generally greater, and in the western U.S., differences were mixed but represented greater topographic effects in mountainous regions. Finally, mapped erosivity results were compared to benchmarks from two locations in the Eastern U.S. derived from breakpoint and 1-minute precipitation data, and all maps, including this study, were still found to be lower than the benchmarks.

**Denotes primary author*

Effects of Updated US Climate Data and Erosivity Factors on RUSLE2 Soil Erosion Predictions

Track: 2022 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

Location: Gold Coin on Lower Level 1

Time: 8:30 AM - 10:00 AM

Authors: Dennis C. Flanagan (USDA ARS)*; Anurag Srivastava (University of Idaho); Ryan McGehee (Purdue University); Chris Coreil (USDA NRCS); Michael J Kucera (USDA NRCS)

Climate, and specifically precipitation, drives upland hydrologic and soil erosion by water processes. Rainfall erosivity of a storm event is defined in Universal Soil Loss Equation (USLE) technologies as the product of the rainfall energy (E) and the maximum thirty minute rainfall intensity (I30). To calculate average annual erosivity factors (R factor in the USLE), the individual storm erosivity values are summed over the period of record (usually 30+ years), then divided by the number of years. Current R factors used with the Revised Universal Soil Loss Equation version 2 (RUSLE2) were derived from a mixture of undocumented rain gauge data from 1960-1999, which are more than twenty years out-of-date. A new national erosivity study was recently conducted using more than 3400 rain gauges with 15-minute rainfall data from 1970-2013, and updated erosivity maps for the conterminous U.S. were published (McGehee et al., 2022). A companion presentation at this meeting provides the details on that data and the modern processing procedures used to arrive at a comprehensive and superior set of erosivity maps. In this study we utilized the existing RUSLE2 database values and the updated erosivity factors to examine impacts on soil erosion predictions at six locations in Iowa and Illinois, with unit plot conditions, a silt loam soil, and conventional tillage, conservation tillage, and no-tillage corn/soybean cropping systems. Soil erosion predictions with the different climate inputs will be compared and contrasted. Possible implications for other locations across the U.S. will also be discussed.

**Denotes primary author*

Precipitation Influence on the Soil Vulnerability Index Classification

Track: 2022 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

Location: Gold Coin on Lower Level 1

Time: 8:30 AM - 10:00 AM

Authors: Allen Thompson (University of Missouri)*; Claire Baffaut (USDA–ARS); Quang Phung ((formerly) University of Missouri)

The Soil Vulnerability Index (SVI) developed by NRCS uses available inputs from the SSURGO database to classify agricultural land into four levels of vulnerability to sediment and nutrient losses: low, moderate, moderately high, and high. Soil properties considered in the classification include hydrologic soil group, soil erodibility, slope, organic or mineral soil, drainage class, and soil parent material. Improvements in assigning vulnerability classification by including rainfall amount and intensity have been suggested, including the R-factor of the Universal Soil Loss Equation which is used to describe the combined effects of rainfall amount and intensity on sheet and rill erosion. The objective of this research was to evaluate rainfall characteristics on the runoff and sediment yield component of SVI, with the goal to improve SVI vulnerability classification. The study simulated sediment yields using calibrated models developed with the Soil and Water Assessment Tool (SWAT) or the Agricultural Non-Point Source Pollution Model (AnnAGNPS). These models represented four Conservation Effects Assessment Project (CEAP) watersheds having a range of physiographic and hydrologic characteristics. Sediment yields were simulated using precipitation data from 1985 to 2014 from 14 different CEAP watersheds having a range in precipitation characteristics. Classification based on simulated sediment yields were evaluated across a range of landscape slopes. Results indicate that classification can shift to more or less vulnerability due to differing precipitation characteristics of rainfall intensity and R-factor, and this shift is more pronounced for steeper slopes. Possible modifications in the SVI classification rule-set to account for these differences will be discussed.

**Denotes primary author*

Upscaling Small Plot Water Quality Data to Greater Downslope Distances

Track: 2022 General Conference Theme

Subject: Conservation Models, Tools, and Technologies

Location: Gold Coin on Lower Level 1

Time: 8:30 AM - 10:00 AM

Authors: John E. Gilley (USDA - ARS)*

Hydrology deals with the properties and distribution of water on the earth's surface. Runoff is one of the principal variables examined in hydrology and flow rate is used to quantify runoff. The objective of this investigation was to use existing experimental data to identify, quantify, and test nutrient load - runoff rate relationships representative of upland areas. Numerous field studies have been conducted to measure nutrient transport by overland flow on land application areas. Rainfall simulation equipment and experimental protocols established by the U.S. National Phosphorus Research Project (NPRP) were used in many of these investigations. The water quality parameters examined in the present study included dissolved P (DP), total phosphorus, nitrate-N, and total- N. After tests using NPRP procedures were completed, inflow was added to the small test plots in successive increments to simulate runoff from slope lengths as long as 100 m. Two mechanisms were found to govern the transport of nutrients on upland areas: 1. The quantity of overland flow available to transport nutrients that are released and 2. The maximum rate that nutrients can be released to overland flow. Under condition 1 where flow rate is the limiting factor, nutrient transport rate varies in a linear fashion with runoff rate. The slope of the linear equation relating nutrient transport rate to runoff rate correlates well with soil nutrient measurements. Nutrient transport rates are constant once condition 2 is established. Information obtained using P transport rate - flow rate relationships could be employed to better quantify transport factors contained within a phosphorus index. Using the previously identified procedures for upscaling small plot water quality data to greater downslope distances, the extensive NPRP data base could be utilized to better quantify and manage nutrient transport from land application areas.

**Denotes primary author*

Bringing Urban and Rural Communities Together to Improve Water Quality in the Little Arkansas Watershed

Track: 2022 General Conference Theme

Subject: Outreach, Education, and Community Engagement

Location: Matchless on Lower Level 1

Time: 8:30 AM - 10:00 AM

Authors: Ronald Graber (Kansas State University)*

The Little Arkansas River Watershed is located in south central Kansas, where the Little Arkansas River empties into the Arkansas River at Wichita. It covers over 1400 square miles with 478 stream miles and 88 acres of lakes. Cropland is the major land use in the watershed, and production of corn, soybeans, wheat, and grain sorghum contributes to water quality impairments within the watershed. Addressing these impairments can be costly and time consuming. By developing agricultural-municipal partnerships greater economic and environmental efficiencies can be achieved. Kansas State Research and Extension (KSRE) and the City of Wichita have developed innovative programs to address these impairments impacting drinking water and MS4 permit requirements. This presentation will highlight the success and future of these partnerships.

**Denotes primary author*

Engaging Urban Watershed Stewards in Stormwater Management

Track: 2022 General Conference Theme

Subject: Outreach, Education, and Community Engagement

Location: Matchless on Lower Level 1

Time: 8:30 AM - 10:00 AM

Authors: Amanda Gumbert (University of Kentucky)*; Lee Moser (University of Kentucky)

Engaging homeowners and watershed volunteers is necessary to aid in the protection and management of urban streams, stream corridors, and stormwater. A project to evaluate the effectiveness of small-scale residential stormwater practices was conducted in the Wolf Run watershed, Lexington, KY. This project involved identifying, researching, and installing a set of specific practices designed to reduce stormwater volume and treat "first flush" stormwater pollutants on residential properties in flood prone areas. Recent flood mitigation efforts by local government generated interest among homeowners on steps they could take to manage and reduce stormwater runoff from their properties. Two surveys were developed and conducted: a) to determine the capacity and/or willingness of landscape professionals to design/install stormwater practices on residential properties; and b) to determine interest and willingness for homeowners to install stormwater practices. Eight landscape professionals were interviewed; all expressed interest in participating in the installation of practices such as infiltration systems, rainwater harvesting, and permeable pavement. Twelve homeowners were surveyed; five were identified to participate in the project. Seven stormwater practices were installed. Estimated stormwater runoff reductions ranged from 45-98%, and personal testimonials indicated runoff problems had been abated. Water quality Extension Specialists at the University of Kentucky have fostered a partnership with the Friends of Wolf Run for several years to expand engagement of watershed stewards and adoption of residential best management practices to protect and enhance urban water quality. This partnership has resulted in the creation of several components that enhance urban stream stewardship. Extension staff played a key role in engaging homeowners in stormwater practice implementation and facilitating watershed leader interactions in this urban watershed.

**Denotes primary author*

Graham Creek Nature Preserve: Balancing Conservation, Education, and Recreation

Track: 2022 General Conference Theme

Subject: Outreach, Education, and Community Engagement

Location: Matchless on Lower Level 1

Time: 8:30 AM - 10:00 AM

Authors: Leslie Gahagan (City of Foley, Alabama)*

As populations flock to the Gulf Coast, conservation of habitats and headwaters are a primary goal of communities. Coastal Alabama draws drinking water from aquifers and with growing development wellhead protection is critical. Foley, one of the fastest growing cities in state, has developed a 600 acre nature preserve offering passive recreation and educational programs while preserving habitats and protecting groundwater and headwater resources. This presentation will highlight the overall goal of conservation while gathering public support through partnerships, educational opportunities, and recreation. Multiple universities have performed research in the preserve as it is an untouched headwater system that flows to a major coastal bay. The Preserve has been awarded multiple grants and donations to purchase adjacent lands and amenities including a modular large scale hydroponics operation and demonstration longleaf forest; however municipal funds cover all operational costs. Graham Creek Nature Preserve has been in operation for fifteen years demonstrating the collaboration of conservation and passive land use.

**Denotes primary author*

Effects of Land Application of Reclaimed Wastewater on Surface Water Quality

Track: At the Intersection of Agriculture and Conservation

Location: Penrose 2 on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Amita Jain (Florida A&M University)*; Tristum William (Florida A&M University); Ryan Peltonen (Florida A&M University); Katherine Milla (Florida A&M University)

Reclaimed wastewater is used for agriculture and landscape irrigation around the world. A number of studies have been done to determine the effect of irrigation use of reclaimed wastewater on soil and crop quality. However, very little research has been done to determine the environmental impact of the use of reclaimed wastewater for irrigation. The runoff from the reclaimed wastewater irrigated land can transport nutrients into nearby surface waterbodies causing eutrophication and pose environmental risk. The objectives of this study were to assess the nutrient movement from the land-application of the City of Tallahassee's reclaimed wastewater on golf courses and its effect on surface water quality. The study site for this research is located in the Southwood area of Tallahassee, FL. Eight surface water bodies on and in the vicinity of the golf course and one control site were selected for water quality monitoring for a period of one year. Water samples were collected biweekly at each sampling site and field parameters were measured in situ at each sampling event. The water samples were analyzed for nutrients, dissolved organic carbon, and metals in the laboratory. We used SAS ver.9.4 to compute descriptive statistics and a one-way Analysis of variance (ANOVA) to compare treatment means. Mean comparisons were done using Tukey's test at the 0.05 level of significance. The concentrations of nitrate, ammonium, and TKN were not significantly different between the control and the study sites. The water bodies which are located on the golf courses had higher pH, electrical conductivity, and phosphate concentrations compared to the control site. The results of this study will be useful to ensure that long term use of reclaimed wastewater for irrigation is environmentally safe and sustainable.

**Denotes primary author*

How Can Wetland Restoration Efforts be Best Prioritized to Improve Water Quality?

Track: At the Intersection of Agriculture and Conservation

Location: Penrose 2 on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Lily Kirk (EPA)*

Nonpoint agricultural sources are the main drivers of increased nutrients entering freshwaters and degrading downstream aquatic ecosystems across the US. Because wetlands have proven to efficiently remove N and P before they reach surface waters, wetland restoration on agricultural land can be an effective tool to combat nutrient water quality issues and is funded through a variety of government programs. Wetland restoration would be most effective not only where the need is greatest (i.e. watersheds with large amounts of agriculture with potential for high N and/or P loss from the landscape) but also in places with the greatest suitability for wetland restoration (i.e. landscape position with correct hydrology and soil type). We leveraged national nutrient inventory and potentially restorable wetland datasets of the continental US to find this intersection at the HUC8 scale and inform a national strategy to mitigate downstream transport of excess nutrients. As expected, the majority of priority watersheds for wetland restoration on agricultural lands are in the tile-drained Temperate Plains; however, there are also hotspots in most ecoregions nationally. We also evaluated the current extent of federally funded wetland restoration projects on agricultural lands (largest programs are Department of Agriculture's Conservation Reserve Program, CRP, and Agricultural Conservation Easement Program, ACEP) in the context of these identified priority watersheds. Current wetland restoration is better aligned with existing wetland cover than these priority areas where need and suitability intersect, suggesting a need to devise a national wetland restoration strategy.

**Denotes primary author*

Iowa Soybean Association Conservation Agronomist Network

Track: At the Intersection of Agriculture and Conservation

Location: Penrose 2 on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Heath Ellison (Iowa Soybean Association)*

Multiple studies show that Iowa farmers' number one source of information and agronomic advice is their local ag retailer. Ag retail sales agronomists are currently tasked with and trained to provide farmers guidance on soil and plant fertility, weed and pest management, seed selection, fungicide usage, and other agronomic related topics. The ag retail system is competitive and any activity or topic that the sales agronomist is not expertly trained in introduces risk to the farmer client relationship. This is often a non-starter in engaging sales agronomists in conservation delivery.

The Iowa Soybean Association, in partnership with multiple ag retail organizations and funding partners, is building a network of conservation agronomists working in close relationship with ag retail partner sales agronomists. The intent of this effort is to bring conservation expertise in house for the ag retailer to improve access to expertise for the sales agronomists and reduce the perceived risk of promoting conservation practices and programs to farmers and landowners. The first ISA conservation agronomist was hired in 2019 and the network has grown to seven conservation agronomist positions in partnership with seven ag retail partners.

Each conservation agronomist position represents a different model of employment, funding, and engagement with ag retail. This presentation will explore the various models within the Iowa Soybean Association's Conservation Agronomist Network, contrast the successes and challenges of each model, highlight the cumulative impact of this network over the past 2 years, and discuss the growth and adoption potential of these positions across Iowa and the ag retail industry.

**Denotes primary author*

Biomass Productivity and Decreased Nitrogen Input from Planting Green in Western New York

Track: Climate-Smart Agriculture

Location: Independence on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Aaron Ristow (American Farmland Trust)*; David DeGolyer (Western New York Crop Management Association); Stephanie Castle (American Farmland Trust)

American Farmland Trust, in partnership with the Natural Resources Conservation Service, Great Lakes Restoration Initiative and New York Farm Viability Institute is evaluating and demonstrating the performance of planting green in western New York based on measuring nine ecosystem indicators for up to three consecutive years on five farms, using a quantitative approach to assess multifunctionality and service interactions. The five farms are part of a regional Genesee River Demonstration Farm Network, which highlights the impacts of practical and innovative conservation practices on farm viability, water quality, and other natural resources, demonstrated on real working farms. https://farmland.org/project/genesee-river-demonstration-farms-network/.

Planting green can address cover crop management issues and facilitating earlier cash crop planting. It is the practice of planting a cash crop into a living cover crop, wherein the cover crop is terminated with herbicide or roller crimper immediately after cash crop planting. This method allows for drier and more stable soil conditions during planting in a wet spring, an extended growing season for the cover crop to produce more biomass, the potential for increased soil organic matter, additional nitrogen available to the cash crop, and mulch to suppress late season weeds. However, if the cover crop is not terminated in time or is planted too densely, planting green can introduce disservices such as poor crop emergence or poor growth due to competition for light and nutrients, leading to significant cash crop yield losses. Planting green requires knowledge of how many factors interact, including: climate, cover crop and cash crop species, planting rate and timing, and termination timing.

The project leader will present results from the first year of the project which is showing promise for planting green through increased biomass and potential N availability for the cash crop while maintaining cash crop yields.

**Denotes primary author*

Changing Precipitation Patterns Affecting Mediterranean Small Farmers: Adaptation Outreach for Climate Resilience

Track: Climate-Smart Agriculture

Location: Independence on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Zouheir Massri (Michigan State University)*; Eddy De Pauw (Pavocarto.be); Richard J Thomas (Consultant on Natural Resources Management); Boulos Abou Zakhem (AECS)

Mediterranean rainfed farms mainly depend on barley (dominant annual crop) and livestock production with average annual precipitation < 250 mm. Poor soils cultivated with barley are typically open to unrestricted grazing, leaving lands bare for much of the year. With few nutrient amendments, the vegetative cover is decreasing rapidly, leaving soils unprotected. Increasing population pressures result in land being used beyond its carrying capacity, inducing serious land degradation and predicted accelerating climate change impact. Considerable precipitation decline in spring makes adaptation to climate change critically important for poor rural households. This abstract builds on the work of the authors studying precipitation regimes of two meteorological stations in Syria and Cyprus. The Standardized Precipitation Index revealed abnormal exposure to extended droughts during the past three decades.

A novel approach was adopted involving capacity-building in GIS for climate change assessment, which resulted in the development of Climate Change Atlases for several Mediterranean countries. This approach overcomes the shortcomings of assessments generated by complex Global Circulation Models based on scenarios referring to divergent futures, making them difficult to interpret in terms of actual climate change outcomes. Given the threat of altered precipitation patterns to vulnerable countries with limited financial and administrative capabilities, the adoption of robust and promising agricultural practices is urgent. Practices should strengthen resilience and adaptation to declining rainfall regimes, while mitigating rural poverty, and should be prioritized in national development strategies and economic planning. Step one is to raise awareness within poor communities of the implications of climate change. Step two is to co-develop social norms for eco-conservation through supervised scientific management of land and rainwater such as in-situ moisture conservation.

**Denotes primary author*

Effect of Crop Residue Management on Grain Yield and Soil Properties in the Upper Midwest

Track: Climate-Smart Agriculture

Location: Independence on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Jodi DeJong-Hughes (University of Minnesota Extension)*; Rashad Alghamdi (North Dakota State University); Aaron Daigh (NDSU)

Soil erosion from agricultural lands results in an irreversible loss in soil productivity and continues to be a source of sediments to surface waters. However, keeping crop residues on the soil surface effectively reduces the loss of soil to erosion. To maintain an adequate cover of the soil surface with crop residues, producers can minimize the aggressiveness and number of tillage operations. This has the added benefit of emitting fewer greenhouse gasses into the atmosphere.

Minnesota crop producers realize the advantages of reducing tillage on their lands, which include improved water infiltration, building soil structure, capturing carbon, and less soil and nutrients leaving the field. However, producers remain concerned about the potential for lower grain yields due to cooler and wetter soil conditions commonly perceived with reducing tillage. This perception limits many producers from adopting reduced-tillage systems across the upper Midwest.

Tillage implements vary in the amount of crop residue they incorporate or leave on the soil surface and the amount of carbon dioxide that will be emitted. This affects how the soil dries and warms during the cool spring months, soil erosion potential, and ultimately the crop's grain yield. To address the question of which tillage implement works best for different soil conditions in the upper Midwest, the University of Minnesota has conducted tillage research over the past 40 years, along with North Dakota State University in recent years. Ninety percent of the trials were conducted on farmer's fields using full-scale equipment in randomized, replicated trials and the other 10% was conducted at research centers. Tillage treatments were analyzed with analysis of variance. Results show little differences, if any, in grain yields among different tillage systems even though large differences are observed in the amount of crop residue left in the field to protect the soil. This is good news for both farmers and waterways.

**Denotes primary author*

Soil Greenhouse Gas Emissions and Microbial Community Structure of a Central Texas Corn–Corn–Cotton Rotation

Track: Climate-Smart Agriculture

Location: Independence on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Dorothy Menefee (USDA ARS)*; Hal Collins (USDA ARS); Douglas Smith (USDA ARS)

Agricultural soils can be a source of greenhouse gas emissions depending on soil properties and management decisions. Greenhouse gases (CO_2, CH_4, and N_2O) were monitored over the 2020 and 2021 growing seasons for corn and cotton crops using the static chamber method. Microbial analysis via phospholipid and fatty analysis (PLFA) was also performed at multiple dates through the growing seasons. The study took place in a central Texas Vertisol with differing tillage practices (established in 2019).The study is set up with four replicates of each tillage treatment (No-Till, Strip Till, and Conventional Till) in each crop (corn and cotton). Preliminary results for the cotton crop indicate that there were no significant differences in gas emissions with tillage practices. For the corn crop preliminary results suggest increased CO_2 in No-Till and Strip Till and increased N_2O in No-Till. The results of this study can assist in the determination of climate-smart practices that maintain crop yields, maintain soil quality, and minimize greenhouse gas emissions.

**Denotes primary author*

Characterizing Success within Farmer-Led Networks across the United States

Track: 2022 General Conference Theme

Subject: Social Sciences Informing Conservation

Location: Gold Coin on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Pranay Ranjan (Purdue University)*; Ayorinde Ogunyiola (Purdue University); Emily M Usher (Purdue University); Linda Prokopy (Purdue University)

Substantive research on farmers' motivations to adopt conservation practices highlights the importance of their connectedness and interactions with their peers, such as local farmers and farmer leaders. However, a social science evaluation to identify the characteristics of successful farmer-led learning networks and their enabling conditions, is missing from the current scholarship. To address this knowledge gap, we developed sets of criteria to select farmer-led or farmer-to-farmer networks across the US, following which we conducted semi-structured interviews (n=24) with at least one individual holding a leadership position within a given network. We will present insights from the interviews, including the role of farmer networks in the creation and facilitation of platforms for farmers to take on leadership and mentoring positions in their community, and their successes and challenges. Results will be discussed broadly in the context of improving the science behind the creation of farmer networks (such as peer-to-peer or farmer-led), and include our recommendations and best practices for entities interested in establishing farmer-centered conservation networks.

**Denotes primary author*

Factors Influencing Farmers' Willingness to Use Extended Rotations: A Comparative Study in Indiana and Iowa

Track: 2022 General Conference Theme

Subject: Social Sciences Informing Conservation

Location: Gold Coin on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Ayorinde Ogunyiola (Purdue University)*; J.G. Arbuckle (Iowa State University); Linda Prokopy (Purdue University)

The majority of cropland in the Midwestern United States is used for simple crop rotations of corn and soybeans. While this rotation system has several benefits, studies are increasingly showing that corn and soybean rotations can negatively affect the agroecological resource base required for crop production, leading to soil degradation, water quality impairment, and lower agricultural production efficiency. An alternative to the dominant corn and soybean rotation, an extended rotation that includes small grains and forages, has been shown to enhance agroecological resilience by reducing pest and crop diseases, increasing soil health, and at the same time reducing vulnerability to extreme weather events. Despite the potential benefits of extended rotations, few farmers in the Corn Belt use them, and it is unknown what motivates the adoption of extended rotations. We investigate factors that predict interest in using extended rotations among farmers in Indiana and Iowa. We use data from the 2017 Iowa Farm and Rural Life Poll and a survey conducted in Indiana in 2021. This presentation will highlight complementary and conflicting factors associated with interest in extended rotations among farmers.

**Denotes primary author*

Factors Influencing Farmers' Engagement in Watershed Management Activities

Track: 2022 General Conference Theme

Subject: Social Sciences Informing Conservation

Location: Gold Coin on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Suraj Upadhaya (Iowa State University)*; J.G. Arbuckle (Iowa State University)

Studies have pointed to a positive relationship between farmers' active engagement in watershed management (WM) and soil and water conservation practice adoption. If farmers' involvement in WM leads to more conservation, what predicts WM participation? This study seeks to answer that question through binomial logistic regression analysis of data from a survey of 6,006 Iowa farmers conducted to support the implementation of the Iowa Nutrient Reduction Strategy (NRS). Results indicate that public and private sector information sources, awareness of and attitudes regarding nutrient loss reduction strategies, farm contiguity to water bodies, and cost-share and technical assistance were positive predictors of farmers' engagement in WM, while lower agronomic self-efficacy, farm press as an information source, greater age, and higher farm sales were negative. Findings point to several potential actions to improve farmer involvement in WM: (1) more effectively engage with the farm press to disseminate information about the benefits of WM, (2) increase outreach to larger-scale farmers, and (3) focus on nutrient loss management capacity building. Further, a continued emphasis on awareness and attitudes related to the NRS and related actions, such as watershed management, may guide efforts to recruit farmers into watershed groups to help improve soil and water conservation outcomes.

**Denotes primary author*

Predictors of Farmers' Openness to or Adoption of 4R Plus Practices in Iowa

Track: 2022 General Conference Theme

Subject: Social Sciences Informing Conservation

Location: Gold Coin on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Lijing Gao (Iowa State University)*; J.G. Arbuckle (Iowa State University)

Nutrient pollution from intensive agricultural production in the Midwestern United States is degrading to the environment. In recent years, the 4R Plus approach to nutrient management has been promoted as an effective way to reduce nutrient loss. The term "4R" implies the use of the right source, right rate, right time, and right place in nutrient stewardship practices, and "Plus" refers to soil health practices such as cover crops, extended rotations, and other in-field and edge-of-field soil and water conservation practices. While previous research has examined factors associated with adoption of individual practices or several practices, this study provides a holistic examination of how individual, farm, and contextual-level factors are related to use (or non-use) of the full range of 4R Plus practices.

This research used data from the 2017 and 2018 waves of the Iowa Farm and Rural Life Poll, an annual survey of Iowa farmers. Multinomial logistic regression was employed to analyze data from 699 surveys completed in both years. Analysis examined relationships between individual, farm, and contextual-level factors and adoption openness and behavior regarding 4R Plus practices. Findings indicated that farm structural factors, farmers' information sources and identity, and other latent variables influence farmers' adoption openness and behaviors on 4R Plus conservation practices. Predictors of openness to adoption differed from predictors of adoption. For example, farmers' stewardship identity was strongly associated with adoption of Plus practices but not with openness to adoption of most practices; farmers who were further from retirement were more open to adoption of several practices, but retirement horizon was not a significant predictor of adoption behavior. The findings highlight the importance of investigating mediating factors between openness to adoption and adoption behavior.

**Denotes primary author*

Colorado's Agricultural Water Quality Program: Insights on Water Quality and Agricultural Soil Health

Track: 2022 General Conference Theme

Subject: Water Resource Assessment and Management

Location: Matchless on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Erik Wardle (Colorado State University)*; Troy Bauder (Colorado State University); Christina Welch (Colorado State University); Emmanuel Deleon (Colorado State University)

Water and soil are critical resources that sustain life. Colorado is both a headwaters state, supplying water to 17 western states and a diverse agricultural state, growing corn, wheat, alfalfa, potatoes, fruits and high-quality hay. Conventional agricultural practices have the potential to degrade water and soil resources, particularly in intensively managed irrigated systems. Primary impacts to agriculture are nutrient and sediment loss from fields, reducing productivity and long-term sustainability. Many producers recognize that conservation practices, often defined as Best Management Practices (BMPs), can not only reduce environmental impacts but also enhance profitability. Additional research is being done to investigate whether soil health improvements can improve crop productivity and water quality in Colorado. In the intermountain west there is a data gap to increase understanding of how improvements to soil health may have complimentary benefits to water quality.

The Colorado State University (CSU) Agricultural Water Quality Program (AWQP) develops, demonstrates, validates, and promotes agricultural Best Management Practices (BMP's) for Colorado producers. These BMPs target methods to minimize the impact of fertilizer and pesticide applications on Colorado's water resources to the extent technically and economically feasible. The programs work includes research and outreach addressing diverse issues such as; nutrient management, agronomics and economics of conservation tillage, filter strips, Internet of Things (IoT) low-cost technology, private well and septic educational materials and more. To improve the programs impact, work continually focuses on support and guidance from commodity groups, independent crop consultants, individual producers, and state and national regulators. The AWQP continues to adapt as an unbiased science-based program to meet the decision-making needs of producers and policy makers in Colorado.

**Denotes primary author*

Considering Sustainable Water Management in the Eastern Himalayan Mountains of Northeast India

Track: 2022 General Conference Theme

Subject: Water Resource Assessment and Management

Location: Matchless on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Udai Singh (Mississippi Watershed Management Organization)*

Life in the north-eastern states of India, nested in the eastern Himalayan mountains has remained in balance over centuries. However, changes in urban population expansion, via new home sites and road construction have led to the creation of the Centre for Disaster Management at Mizoram University in Aizawl Mizoram. The Mizoram government must weigh infrastructure development options that minimize the risk of soil erosion and landslide collapse to ensure public safety. Mizoram University has collaborated with the Department of Bioproducts and Biosystems Engineering (BBE) in Minnesota USA through a formal Memorandum of Agreement. BBE Has sent several teams over to Mizoram to assess baseline conditions. The most important conclusion was the need to set up a long-term data acquisition network including precipitation, water humidity, wind speed, direction, solar radiation and temperature, Currently, there is no data collected throughout the north-eastern states of India to even track if the climate is changing. The most critical need is to establish one hundred or more rain gauges throughout the region. The central government of India has provided funding through the National Hydrology Project to improve hydro-meteorological data. Outreach has been established to raise awareness and allow government officials to consider options for moving ahead sustainably.

**Denotes primary author*

Evaluating Trends in Stream Water Quality Associated with Agricultural Conservation within the Great Lakes Restoration Initiative Priority Watershed Program

Track: 2022 General Conference Theme

Subject: Water Resource Assessment and Management

Location: Matchless on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Matthew A. Pronschinske (US Geological Survey)*; Matt Komiskey (USGS); Luke Loken (U.S. Geological Survey)

The Great Lakes Restoration Initiative (GLRI) Priority Watersheds program is an interagency effort by the Natural Resources Conservation Service, U.S. Environmental Protection Agency, and U.S. Geological Survey to address nutrient loading to the Lakes through focused conservation implementation and water-quality monitoring to track progress. Six streams in four priority watersheds (Fox River, Wisconsin; Saginaw River, Michigan; Maumee River, Ohio and Indiana; Genesee River, New York) were monitored between 2012 and 2021 as a part of the program. To evaluate the effects associated with conservation efforts across the monitored streams, this study analyzed trends in water-quality parameters (concentrations and loads of phosphorus, nitrogen, suspended sediment, among others) during runoff events using Black Creek in Indiana and East River in Wisconsin as case studies. Because water-quality parameters are influenced by numerous physical, chemical, biological, and hydrological factors, regression models incorporating environmental predictor variables were used to separate water-quality changes associated with conservation implementation and environmental factors (precipitation, event intensity, antecedent discharge, among others). Preliminary results were mixed. Black Creek, within the Maumee River watershed, showed significant reductions in total suspended sediment and total phosphorus event loads and concentrations (averaging approximately -50%). Conversely, East River, within the Fox River watershed, showed significant increases in event loads of total phosphorus and dissolved reactive phosphorus (averaging approximately +60%). This statistical approach can be used to evaluate and quantify the variable trends in stream water quality associated with focused conservation practice implementation throughout priority watersheds of the Great Lakes.

**Denotes primary author*

Effects of Agricultural Conservation Practices on Lake Water Quality and Harmful Algal Blooms

Track: 2022 General Conference Theme

Subject: Water Resource Assessment and Management

Location: Matchless on Lower Level 1

Time: 10:30 AM - 12:00 PM

Authors: Richard E. Lizotte (USDA)*

Water quality issues, including eutrophication and associated cyanobacteria harmful algal blooms, in agricultural watersheds are a continuing challenge. To help address this, the USDA Conservation Effects Assessment Project (CEAP) aims to quantify the effects of agricultural best management practices (BMPs) on environmental quality, including water quality. This study assesses how BMPs influence water quality and associated harmful algal blooms by comparing two Mississippi agricultural watershed lakes with varying BMPs. Beasley Lake, a CEAP watershed, has approximately 17.1% watershed land-use in BMPs, while Roundaway Lake has only 1.4% watershed land-use in BMPs. Both lakes were monitored for nutrients and cyanobacteria (as phycocyanin) from 2017-2019 coinciding with nutrient limitation assessments in 2019. Nutrients and cyanobacteria blooms during the study period were lowest in the lake with highest BMPs. Average yearly total nitrogen (TN) ranged from about 1-1.3 mg/L (Beasley) and 2-2.3 mg/L (Roundaway) while total phosphorus (TP) ranged from about 0.11-0.17 mg/L (Beasley) and 0.23-0.41 mg/L (Roundaway). Lake summer cyanobacteria blooms were frequently below 50 µg phycocyanin/L (31-52 µg phycocyanin/L) in Beasley but frequently above 100 µg phycocyanin/L (152-197 µg phycocyanin/L) in Roundaway. Cyanobacteria nutrient limitation in both lakes ranged from nitrogen-only to nitrogen+phosphorus co-limitation indicating a need for BMPs to aid in controlling both nutrients. Results of this study show that conservation management practices mitigating nutrients can also limit harmful algal blooms to improve lake water quality.

**Denotes primary author*

POSTER PRESENTATIONS

Evaluating the Effectiveness of a "Unique" Agroforestry System for Land Restoration of Degraded Watershed Basin in Southern Guam

Authors: Mohammad H. Golabi (University of Guam)*; Daniel Encio (University of Guam)

Soil erosion and sedimentation, as the result of runoff is the water pollutant that has a long-term negative impact on the environment in southern Guam. These environmental impacts include; the smothering of the local coral populations, and the pollution of freshwater resources following heavy rainstorms in the southern Guam. Sedimentation reduces the water quality down the stream hence affecting the processes that regulate the productivity of coral reefs in southern Guam. This experiment is therefore an examination of the efficiency and effectiveness of a unique agroforestry with different vegetation covers as a means of mitigating erosion in order to protect the aquatic environment from the impacts of sedimentation on such a fragile ecosystem. Multiple plots (flumes) are created and observed with different vegetation types and the runoff is being collected and tested for sedimentation concentrations to evaluate the effectiveness of the different vegetative covers on sedimentation mitigation. The prominent vegetation condition used is the Vetiver Grass System (VGS), which will, potentially, reduce the amount of soil lost over the course of the experiment when compared to other vegetation conditions such as trees and vegetable crops. Sets of suspended runoff/sediment samplers, are constructed in a runoff-collecting tank placed at the lower end of each treatment plot for collecting and measuring sediment discharge as well as for runoff assessment. Samples are used to measure the turbidity and the amount of sediment collected from each treatment plot for erosion assessment and to evaluate the effect of different treatment on sedimentation mitigation. In this presentation, the methodology as well as up-to-date data will be presented to illustrate the effectiveness of this 'unique' Agroforestry system as a 'Management Strategy' for a wider watershed ecosystem.

Track: 2022 General Conference Theme

Subject: Adaptive Management of Conservation Efforts

**Denotes primary author*

Kansas NRCS-USDA Plant Materials Center Cereal Rye (*Secale cereale*) Adaptability Study

Authors: Jason Waite (USDA NRCS)*

Cereal rye has become a popular cool season grass cover crop species. Cereal rye provides soil cover, uptake of excess nutrients and vigorous spring growth that can compete with weed species. Little is known about the adaptability of cereal rye varieties that are not commonly grown in the region for use as a cover crop. To understand difference in named varieties of cereal rye a study was done at the Manhattan, KS NRCS-USDA Plant Materials Center in 2016-2017 and 2017-2018 to evaluate differences in winter hardiness, height at 50% bloom and days to 50% bloom. Cereal rye varieties 'FL 401' and 'Merced' were the only varieties in the study to exhibit poor winter hardiness while all other varieties exhibited good winter hardiness both years of the study. 'Brasetto' was the shortest rye both years of the study at 27 and 33 inches respectively. This study showed characteristics of cereal rye that a producer or conservation planner would evaluate when selecting a variety to address a particular conservation concern.

Track: 2022 General Conference Theme

Subject: Adaptive Management of Conservation Efforts

**Denotes primary author*

Moving the Needle: A Pilot Watershed Approach to Demonstrate Dissolved Phosphorus Reductions

Authors: Laura Johnson (Heidelberg University)*; Jay Martin (Ohio State University)

Over the past two decades, the western basin of Lake Erie has been experiencing re-eutrophication with some of the largest harmful algal blooms (HABs) in the past 11 years. The HABs in Lake Erie are closely associated with bioavailable phosphorus (P) loading, specifically dissolved P, from Maumee River during the period of March through July and the primary source of this loading is agricultural runoff. To reduce the frequency of severe blooms, a target of 40% reduction in total P and dissolved P loads from the Maumee River and other western Lake Erie tributaries was set in 2015. Current modeling approaches indicate that widespread adoption of practices (over 70% of the watershed) focused on reducing dissolved P will be needed to reach that target. To test the model results and demonstrate how to achieve the reduction targets, we are starting a pilot watershed study on a small watershed (<10,000 acres) in the headwaters of the Maumee River. This project builds on an on-going paired watershed project that began in 2018 to establish a baseline comparison between the treatment and control watersheds and we began prioritized EQIP funded implementation of BMPs in 2020. The pilot watershed is bringing together a wide array project partners to achieve our ambitious implementation goal. Practice implementation will start this fall for the 2023 growing season and focus on practices such as subsurface fertilizer placement, variable rate nutrient application, drainage water management, wetland construction, and soil health optimization. We anticipate this project will be an essential part of adaptive management for Lake Erie as management plans associated with the 2012 Great Lakes Water Quality Agreement are continually implemented and updated.

Track: 2022 General Conference Theme

Subject: Adaptive Management of Conservation Efforts

**Denotes primary author*

Native Species Seed Establishment Methods

Authors: Robert J. Glennon (Virginia Tech)*

Establishment of herbaceous native plant communities from seed depends on the ability to sow the seed of native plants precisely.

Major obstacles to the establishment of native grasses and wildflowers in the East are the lack of sophisticated seeding equipment that will deliver low seeding rates of small seeds and the operators' lack of knowledge of how to operate the sophisticated equipment or other equipment that will establish an adequate stand.

Experienced conservationists know that you can establish good stands of native grasses and forbs with many different methods.

Sophisticated seed drills with small and chaffy seed boxes may be able to deliver low seeding rates of small seeds, but broadcasting small and chaffy seeds with an inert carrier can be just as effective.

It is important to calibrate any seeding equipment and take into consideration the conversion of pure live seed per acre to bulk seed per acre and the amount of inert carrier required to carry the seed through a broadcast seeder.

It is also critical to drill seed into or broadcast seed onto a firm seedbed and the compact the seedbed after the seed is sown. There are many ways to create a firm seedbed.

When conservationists, landowners, and seeding contractors are familiar with proper seeding techniques for the seeding of native species, there will be more successful establishment of stands of native plants and more willingness to attempt the seedings.

Track: 2022 General Conference Theme

Subject: Adaptive Management of Conservation Efforts

**Denotes primary author*

Soil Water Depletion and Recharge following Cover Crop Use in Semi-Arid Cotton Production

Authors: Christopher Cobos (Texas A&M AgriLife Research)*; Joseph Burke (Texas A&M AgriLife Research); Katie Lewis (Texas A&M Agrilife); Paul DeLaune (Texas A&M AgriLife); Wayne Keeling (Texas A&M AgriLife Research)

Adoption of cover crops in semi-arid West Texas have been limited due to producer concerns regarding soil water depletion prior to cotton planting. The purpose of this study is to evaluate soil water depletion and recharge with cover crops from 2018-2020 in a West Texas cotton cropping system. Soil water changes were evaluated in long-term (established 1998) continuous cotton cropping systems consisting of (1) conventional tillage, winter fallow; (2) no-tillage, rye cover; and (3) no-tillage, mixed species cover (50% rye, 33% Austrian winter pea, 10% hairy vetch, and 7% radish by weight). Results of the study indicate that soil water is limited in the top 60-cm prior to cover crop termination. However, after termination soil water capture and storage was greatest following cover crops and provided potentially more water to the subsequent cotton crop compared to the conventional cropping system. These results challenge the theory that cover crops cannot be successful in semi-arid cotton production which indicates another variable, like nitrogen immobilization, might be responsible for the yield deficit in these conservation systems.

Track: 2022 General Conference Theme

Subject: Adaptive Management of Conservation Efforts

**Denotes primary author*

Vegetated Buffers and Their Influence on Fish Habitat in Agricultural Streams in Michigan: Implications for Conservation

Authors: Linda I. Ortiz (USDA NRCS)*; Jared Ross (Michigan State University)

Agriculture, which includes cultivation of the soil for growing crops as well as raising livestock, plays a critical role and provides many sources of food for both humans and animals around the globe. However, agriculture is also a stressor that can influence stream habitats and the organisms they support. To reduce negative effects of agriculture on streams, activities known as conservation practices can be implemented to protect water quality, promote soil health, and address other environmental concerns that result from human activities on the landscape. Broadly, the goal of this research is to evaluate the utility of one conservation practice, vegetated stream buffers, in minimizing effects of agriculture on stream fish habitats. On this study, we test for influences of forested buffers on fish habitat variables for 30 small streams draining heavily agricultural land in the Grand and Saginaw River basins in Michigan. Forested buffers have historically been promoted to reduce nutrient and sediment loading to stream channels, but they can also contribute woody debris to streams, moderate stream temperatures, and improve channel stability by preventing bank erosion. Our analyses demonstrated that higher amounts of forested buffers are associated with decreased sedimentation as well as less channel erosion. We also found that wetlands in buffers also represent an important influence on fish habitat based on their association with reduced sediment in stream channels. We extended the results to similar streams in the Grand, Saginaw, Kalamazoo, and St. Joseph River basins to identify where the implementation or preservation of vegetated buffers may promote healthy fish habitat and to identify locations where application of additional conservation practices might minimize agricultural effects. The results will aid stakeholders in Michigan by providing novel information to help guide conservation efforts in heavily agricultural watersheds to improve fish habitat.

Track: 2022 General Conference Theme

Subject: Adaptive Management of Conservation Efforts

**Denotes primary author*

#Diversecornbelt: Enhancing Rural Resilience through Landscape Diversity in the Midwest

Authors: Emily M. Usher (Purdue University)*; Katherine Pivaral (Purdue University); Michael O'Donnell (Purdue University); Sarah Church (Montana State University); Aslihan Spaulding (Illinois State University); Seth Harden (The Nature Conservancy); Linda Prokopy (Purdue University)

Due to the lack of diversity in the U.S. agricultural system, Midwestern agricultural communities continue to face agronomic, environmental, and social challenges. This poster will overview the #DiverseCornBelt (DCB), a USDA-NIFA funded project focused on developing an evidence-based framework and vision of how to enable a more diverse agricultural landscape across the Corn Belt (Illinois, Iowa, and Indiana). This interdisciplinary research will explore and promote diversity at the farm, landscape, and market levels through three broad objectives; research, Extension, and education. With input from stakeholders across the value chain, the research component works to understand the opportunities and barriers of a more diverse agricultural ecosystem by developing model-informed visions of a more diverse agricultural landscape. Extension components include developing policy recommendations and stakeholder engagement to support farm diversification and market development. The education component will develop and disseminate educational materials that prepare secondary and undergraduate students to respond to emerging challenges and support a diversified landscape. Overall, DCB will produce baseline information to inform a coproduced vision for a more economically, environmentally, and socially sustainable agricultural ecosystem across the US Corn Belt.

Track: At the Intersection of Agriculture and Conservation

**Denotes primary author*

Cover Crops and Double Cropping as Sustainable Crop Production Practices for Improving Soil Health and Crop Yields

Authors: Peters E. Egbedi (Louisiana State University)*

There is no doubt that the ever-increasing population worldwide and the quest to meet food demand, shelter and fiber has put immense pressure on soil and water resources. To achieve the global aim of food security without sacrificing the needs of our future generation, soil and water conservation practices are crucial. Thus, this three-year study was carried out at the Northeast Research Station, St Joseph, Louisiana. The objective was to determine how cover crops and no tillage system could improve crop yields and soil health. The no tillage system was compared with conventional tillage in wheat, cotton and soybean cropping systems. Wheat cropping systems were fallow-wheat, summer cover crops-wheat, wheat-cotton and wheat-soybean. The cotton cropping system was winter cover crops-cotton, wheat-cotton and fallow-cotton. Soybean cropping system was winter cover crops-soybean, wheat-soybean and fallow-soybean. Sunn hemp and sorghum sudan grass were the summer cover crops while winter cover crops were winter wheat and winter pea. In 2019, the no-tillage system had a wheat yield advantage of 102 kg ha-1 however, in 2020 wheat yield in conventional tillage was significantly different (p= 0.0277) at 0.1 level. Across the three-year period, cotton double cropped with wheat had a superior yield advantage than the other cropping systems. Our results also reveal buildup of soil organic matter, respiration and infiltration rates in treatments with cover crops compared to the fallow systems. Overall, yields from the no tillage system were relatively same with that of conventional tillage among the treatments. Similarly, treatments with cover crops and double cropping systems had relatively higher or same yield with the fallow-crop systems. Given the buildup of organic matter and increased infiltration rates we had in the cover crop treatments, it is indicative that a long-term practice of some of these conservation practices will sustainably enhance soil health .

Track: At the Intersection of Agriculture and Conservation

**Denotes primary author*

Designing Targeted Conservation Buffers for Water Quality with the Agbufferbuilder Tool

Authors: Patrick T. Oelschlager (Purdue University)*

Targeting conservation practices is crucial to maximize the returns on conservation investments. This project examines potential improvements in sediment runoff capture through targeted buffer placement using AgBufferBuilder, a modelling tool developed by the USFS National Agroforestry Center which designs targeted buffers at field scale using DEM-based flow analysis and soil factors.

Our objective is to model fields across three landscape types to estimate improvement potential when using AgBufferBuilder models compared to existing practices. Three HUC-12 watersheds were selected within Michigan's Shiawassee River basin representing high, medium, and low estimated sediment contributions based on the Great Lakes Watershed Monitoring System (GLWMS). 15 fields were selected from within each watershed and modeled using AgBufferBuilder.

Preliminary results show designed buffers for high, medium, and low sediment-loading HUC-12s represent average increases of 90.7%, 83.1%, and 67.5% in total sediment captured compared to existing practices while using an average 4.3%, 1.8%, and 3.8% of the total AOI, respectively. This compares to an average 7.1%, 11.4%, and 23.7% of AOI currently containing trees and/or other perennial, non-crop vegetation serving as de facto buffer. Most modelled buffers are similar or smaller in area than existing buffers, demonstrating the possibility of spatial rearrangement of non-cropped area to eliminate or reduce additional field area taken out of production.

Ongoing work will add area to tool-designed buffers to accommodate tractor movement. Final designs will show existing, proposed, and overlapping tool-modelled buffer areas, as well as additional buffer area created by modifying model buffers to account for tractor movement. Final analysis will quantify the existing crop production area transitioned to buffer and model crop yields and harvest rates under multiple scenarios to better inform buffer implementation and supporting programs.

Track: At the Intersection of Agriculture and Conservation

**Denotes primary author*

Enhancing Conservation Planning to Meet Desired Environmental Outcomes through the Agricultural Conservation Planning Framework National Hub

Authors: Pam Miksell (The ACPF National Hub/Iowa State University)*; Hanna Bates (Iowa Water Center/Iowa State University); Emily K. Zimmerman (Iowa State University); Robin McNeely (Iowa State University); David James (USDA ARS National Laboratory for Agriculture and the Environment); Richard Cruse (Iowa State University)

Agricultural conservation planners work within a greater mission to establish clean, abundant water; healthy soils; resilient landscapes, and thriving agricultural communities through the voluntary adoption and implementation of conservation practices. Geospatial data and tools play an increasingly important role in guiding efforts so that individual farms can work together to tackle watershed-scale reductions in nutrient loss. In particular, the Agricultural Conservation Planning Framework (ACPF) leverages high-resolution geospatial data to help local farming communities better address their soil and water conservation needs by suggesting suites of best management practice opportunities. Despite the benefits the ACPF offers, the ability to use GIS-based tools in conservation planning may be unavailable at the local level.

The ACPF National Hub is an outcome of a collaborative effort sponsored by the Natural Resources Conservation Service (NRCS) to expand the use of the ACPF in watershed planning on a national scale. The objectives of the ACPF National Hub are to support NRCS and partners in conservation approaches and program delivery by offering data resources, training, and technical support to users of the tool. This poster introduces this new effort, specifically outlining the suite of services and products offered by the ACPF National Hub for GIS technical experts, as well as conservation planners and watershed coordinators. In addition, the poster provides a summary of Hub engagement activities during its first 9 months. After reviewing the material, conference participants will have a better understanding of how the ACPF National Hub will support their efforts to adopt and integrate ACPF into their existing planning processes.

Collaborating institutions for this effort include: the Iowa Water Center, Iowa State University, University of Wisconsin-Madison, The North Central Region Water Network, and University of Minnesota

Track: At the Intersection of Agriculture and Conservation

**Denotes primary author*

Long-Term Effects of Tillage and Crop Rotation on Soil Carbon and Nitrogen Storage in a Temperate Humid Climate

Authors: Inderjot Chahal (University of Guelph)*; Dave Hooker (University of Guelph); Kenneth Janovicek (University of Guelph); Laura L. Van Eerd (University of Guelph)

The effects of conservation tillage and diversification of crop rotations on surface soil organic C (SOC) and total N storage have been previously studied. Yet little is known about the influence of these practices on C and N storage in the deeper soil profile. Therefore, we used a long-term experiment established in 1995 at Ridgetown, Ontario, Canada to evaluate the effect of seven crop rotations and two tillage practices on SOC and total N storage in 0-20 cm, 20-40 cm, 40-60 cm, 60-80 cm, 80-100 cm, and 100-120 cm depth. Crop rotations were continuous corn, corn-soybean, corn-soybean-wheat, corn-soybean-wheat undersown with red clover, continuous soybean, soybean-wheat, and soybean-wheat undersown with red clover. Tillage treatments were conventional moldboard plough and no/zone-tillage. Results suggested that SOC and total N content were different between tillage treatments ($P=0.0014$ for SOC and $P=0.0002$ for total N) and soil depth increments ($P<0.0001$ for SOC and total N), whereas crop rotation differences were not observed in SOC and total N storage. Among the soil depths, SOC (125 Mg ha-1) was surprisingly greatest in the 100-120 cm depth increment whereas total N (10.4 Mg ha^{-1}) was greatest in 0-20 cm depth. Furthermore, a significant three-way interaction between tillage, crop rotation, and soil depth was detected for SOC and total N storage. Within no-tillage system, all tested crop rotations had significantly greater SOC storage in 0-20 cm and 100-120 cm depth than the remaining depths. Within conventional tillage system, all crop rotations had significantly greater SOC content in 100-120 cm depth than the remaining depths. Across all the soil depths and crop rotations, no-tillage had greater SOC (95.5 Mg ha^{-1}) and total N (6.8 Mg ha^{-1}) storage than conventional tillage. The results confirm that long-term adoption of no-tillage production practices might increase the SOC and total N storage in the soil profile.

Track: At the Intersection of Agriculture and Conservation

**Denotes primary author*

Potential to Use Narrow Rows and Plant Populations to Maximize Harvested Grain or Silage Production while Increasing Irrigated Water and Nitrogen Use Efficiencies in Irrigated Systems

Authors: Jorge A. Delgado (USDA)*; Bradley Floyd (USDA); Amber Brandt (USDA); Robert D'Adamo (USDA)

We conducted studies from 2018 to 2021 about the potential to use narrow rows to increase silage or harvested grain yields in a Fort Collins clay loam soil at the Colorado State University-Agricultural Research, Development and Education Center (ARDEC) near Fort Collins, Colorado. We calculated water use efficiencies by dividing silage or harvested grain by the sum of the applied irrigation and precipitation during the growing season. We found increases in silage and/or harvested grain with narrow rows in all our studies. For plots receiving nitrogen fertilizer at a rate of 202 kg N/ha, planting in narrow (15-inch) rows with the same plant population as the 30-inch rows (study 1) increased grain production by 18.9 bushels per acre. When the seed population was doubled (three studies), the N-fertilized narrow row plots increased silage production by an average of 4 tons per acre (dry weight) and 14.5 bushels per acre compared to the N-fertilized plots with 30-inch (conventional) row spacing. When the N-fertilized narrow rows had a 36% higher seed population than the N-fertilized 30-inch rows (two studies), harvested grain increased by 43.4 bushels per acre and silage (dry weight) increased by 3 tons per acre. When the cost of seed is accounted for, narrow rows significantly increased economic returns, and on average increased silage and/or harvested grain produced per unit of water input compared to the 30-inch rows. Planting in narrow rows could potentially reduce erosion and conserve soil and water quality for sprinkler-irrigated systems in the western USA.

Track: At the Intersection of Agriculture and Conservation

**Denotes primary author*

Replacing Fallow Periods: Exploring Species and Varieties to "Green" Annual Crop Rotations

Authors: Katja Koehler-Cole (University of Nebraska-Lincoln)*; Andrea Basche (Department of Agronomy and Horticulture - University of Nebraska-Lincoln); Amanda Easterly (Department of Agronomy and Horticulture - University of Nebraska-Lincoln); Cody Creech (Department of Agronomy and Horticulture - University of Nebraska-Lincoln); Bijesh Maharjan (Department of Agronomy and Horticulture - University of Nebraska-Lincoln)

Soil conservation efforts have long recognized the importance of having living plants in the ground all year, in fact having "continual living plants and/or roots" is one of five soil health principles (USDA NRCS, https://www.nrcs.usda.gov/wps/portal/nrcs/main/nd/soils/health/ accessed Feb. 15, 2022). The rhizosphere of living plants provides food and habitat to soil microbes, increasing functionality of soil microbial communities and in turn improving soil health. Most crop rotations in the midwestern United States consist of summer annual crops (corn, soybean) and are characterized by long fallow periods between harvest and planting of the next crop. Replacing fallow periods with a cover crop is a recommended conservation practice but knowledge on cover crop species and variety selection is limited. The species of cover crop, its biomass production, and biomass quality (C:N ratio) can be predictive of a cover crop's soil health impacts, however, cover crop productivity is constrained in many areas of the Midwest including Nebraska due to harsh climate conditions. In this study, we test cover crop species, varieties, and planting times in terms of biomass production and biomass quality at 6 sites across several cropping systems in Nebraska. Here, we report on the performance of 14 varieties belonging to 7 species, established alone or in mixes during early spring 2022 in 2 sites in western Nebraska (data forthcoming). We expect small grains (oats, triticale, barley) to have the highest biomass and highest C:N ratios, brassicas (collards, rapeseed) to have intermediate, and legumes (spring pea, faba bean) to have the lowest biomass and C:N ratio. We hypothesize that mixes will have intermediate biomass and C:N ratios. The information gained can help growers looking to replace fallow periods and increase plant diversity to select productive species, varieties, and mixes of cover crops.

Track: At the Intersection of Agriculture and Conservation

**Denotes primary author*

The Soil Health Assessment Protocol and Evaluation (SHAPE) Version 2.0

Authors: Kristen S. Veum (USDA ARS)*; Scott Holan (University of Missouri); Paul Parker (University of CA Santa Cruz); Skye Wills (USDA NRCS); Marcio Nunes (USDA ARS); Cathy Seybold (NRCS); Harold van Es (Cornell Unviersity); Joseph P Amsili (Cornell University)

The response of dynamic soil properties to management and land use is dependent on site-specific factors. The Soil Health Assessment Protocol and Evaluation (SHAPE) was developed as a flexible tool that accounts for the interaction of inherent climate and edaphic factors when interpreting changes in dynamic soil health indicators based on a peer group approach. The Bayesian model-based SHAPE tool was initially developed for soil organic carbon and has been expanded to include permanganate oxidizable organic carbon, autoclaved citrate extractable protein, and four-day soil respiration. Data were compiled from the literature, the Cornell Soil Health Laboratory, and the Kellogg Soil Survey Laboratory. Version 2.0 improves upon the original SHAPE curves with spatially-explicit models. These new SHAPE scoring curves demonstrate sensitivity to management practices across multiple soil types and provide a regionally relevant interpretation of these key soil health indicators.

Track: At the Intersection of Agriculture and Conservation

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Using the Agricultural Conservation and Planning Framework (ACPF) in the Southern Piedmont: A Comparison Between ACPF and Local Expert Conservation Practice Selection

Authors: Deanna Osmond (North Carolina State University)*; Zachary Respess (NC State University); Rob Austin (NC State University); Luke Gatiboni (NC State University)

The Agricultural Conservation and Planning Framework (ACPF) is a geospatial decision support tool developed and used throughout the Midwest to prioritize and place conservation practices within agricultural watersheds. We evaluated the utility and extensibility of ACPF in two USGS 12-digit scale hydrologic units (watersheds) in the Southern Piedmont of North Carolina, which consists of primarily pasture systems. Agricultural fields are comparatively smaller, irregularly shaped, and more sparsely distributed in the Piedmont than the Midwest. Local conservation experts in the two watersheds were interviewed about the type and appropriate location of conservation practices in the landscape. Many of the conservation practices identified by the local experts were "soil health" practices, such as cover crops or nutrient management, and are assumed in use before running ACPF. Results revealed that many of the conservation practices output by ACPF were not identified by the local experts in the Southern Piedmont watersheds due to their limited use in pasture conservation, conservation priorities, and landscape characteristics. Contour buffer strips and grassed waterways were the conservation practices most identified by ACPF and were located by ACPF in 75% of cropped fields. Additionally, a far greater number of crop related conservation practices (48 vs 15) were identified by ACPF than by local experts. Overall, 80% of the conservation practices identified by the experts were not identified by ACPF because they were outside the scope of the ACPF toolbox. However, alternative uses and interpretations surrounding ACPF outputs and data layers may provide opportunities for conservation planning outside the scope and intended use of ACPF in the Southern Piedmont.

Track: At the Intersection of Agriculture and Conservation

**Denotes primary author*

Utilizing a New ACPF-Compatible Tool and Exploring the Role of Policy in Conservation Implementation in Iowa

Authors: Emma Bravard (Iowa State University)*; Emily K. Zimmerman (Iowa State University); John Tyndall (Iowa State University); David James (USDA ARS National Laboratory for Agriculture and the Environment)

The Agricultural Conservation Planning Framework (ACPF) is a GIS-based conservation planning tool that uses high-resolution elevation and water flow data to spatially identify critical source areas for nitrogen loss within agricultural watersheds. Incorporating cost and nutrient reduction data into the ACPF was done by developing (1) a multi-state financial data set; and (2) a field-scale nitrogen reduction tool for use when analyzing different conservation scenarios. These two components were added to the ACPF toolbox and are collectively called the ACPF Financial and Nutrient Reduction Tool (ACPF FiNRT; "fine art"). This toolbox allows users to estimate the total costs and outcomes of various conservation scenarios involving HUC12 watersheds in Iowa and Minnesota and to perform field to watershed scale cost effectiveness analyses. The combination of this data, coupled with the ACPF, can provide conservation planners and landowners with increased information about where conservation practices should be placed on the landscape to yield the most effective and lowest cost nitrate-N reduction at a watershed scale, and empower more certain decision making. Current work on this research includes examining the effects of public policy on conservation practice implementation and water quality improvement. Specifically, the aim of this project is to demonstrate the use and utility of the ACPF relative to different policy approaches designed to enhance conservation practice implementation in Iowa to meet Iowa Nutrient Reduction Strategy goals. These financial analyses that can be accomplished by using the ACPF FiNRT and different policy scenarios are illustrated by case study watersheds.

Track: At the Intersection of Agriculture and Conservation

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A Community-Based Approach to Regenerative Agriculture Technology Development and Dissemination

Authors: Brett KenCarin (Nature-Based Climate Initiatives); Marc White (Rid All Foundation); Ellena Ignacio (Rid All Foundation)*

Urban agriculture is increasingly recognized as an important strategy to increase both food security and the quality and nutrient density of foods in underserved urban areas. Similar needs exist in many rural areas, particularly native communities. In order to increase the share of each year in which these foods can be made available, strategies for season extension are necessary. In this initiative, community-based agricultural efforts serving lower income or underserved communities are working together to develop season extending bio energy systems that produce as a coproduct biochar. This biochar material is then being integrated into compost and other soil enhancing strategies to further improve productivity, resource efficiency, and economic viability. This presentation outlines the community-scale technology elements, paired with circular organic materials management as a strategy to improve the long-term viability of these community-based agricultural operations.

Subject: CIG Showcase

**Denotes primary author*

Biocarbon-Driven Dairy Manure Management Demonstration for Enhanced Water Quality

Authors: Eunsung Kan (Texas A&M AgriLife Research Center)*; Jim Muir (Texas A&M University's Agrilife Extension); Jeff Brady (Texas A&M AgriLife Research Center); Paul De Laune (Texas A&M AgriLife Research Center); Kartik Venkataraman (Tarleton State University); Edward Osei (Tarleton State University); Barbara Jones (Tarleton State University); Caitlyn Cooper-Norris (Texas Tech University); Jennifer Spencer (Texas A&M AgriLife Extension Center)

Currently, most dairy concentrated animal feeding operation (CAFO) manure is land applied. While manure can serve as an excellent soil amendment and source of plant nutrients, CAFO manure nutrient field applications often exceed crop requirements. As a result, a manure P and N can contaminate surface and groundwater while stimulating aquatic plant and algal growth leading to eutrophication. Our project is developing a biochar-assisted phytoremediation systems for enhancing water quality following nutrient contamination during dairy manure application. The project integrates, microplot and field-scale experiments/demonstrations, laboratory analyses, and systematic evaluations to improve our knowledge of biochar amendment and biochar-assisted phytoremediation on dairy manure-derived reactive N and P in soil and water. Particularly, our lab-scale studies showed various benefits of metal-functionalized BC such as calcium-functionalized biochar (Ca-BC) for enhancing adsorption of reactive P and N from dairy manure wastewater by microbial and plant uptake of N and P. Various Ca-BC products were prepared under different pyrolysis conditions and analyzed for their physical and chemical properties. The adsorption capacities of various Ca-BC for N and P were evaluated, and the optimal Ca-BC was selected. Field experiments and demonstrations under different biochar types, soils and forage crops were conducted: 1) two BCs (wood-BC, Ca-BC), 2) two soils (sandy, sandy loam soils), and 3) three plants (Bermudagrass, sorghum-Sudan grass, maize). After the soil and plant samples were collected during field experiments, they were analyzed for macro- and micronutrients, and other contaminants. In--depth correlation and statistical analyses for the field experiment results are being conducted to understand the effects of biochar type and properties on soil, subsoil water, surface water runoff, and plant properties, all ultimately affecting water quality.

Subject: CIG Showcase

**Denotes primary author*

Cultivating Conversation: A Pilot Study Using Q Methodology to Understand Information Needs of US Wheat Industry Professionals

Authors: Morgan L. Orem (Texas A&M University)*; Holli Leggette (Texas A&M University); Maureen Victoria (Texas A&M University); Jamie Foster (Texas A&M AgriLife Research); Mark Welch (Texas A&M University); Clark Neely (Department of Crop and Soil Sciences, Washington State University); Haly Neely (Department of Crop and Soil Sciences, Washington State University); Katie Lewis (Texas A&M Agrilife); Josh Lofton (OSU); Md Rasel Parvej (Louisiana State University)

Agricultural producers are a highly diversified and complex population who seek information that is customized for them and their operations, especially as it related to conservation practices. The purpose of our study was to identify wheat industry professionals' communication and education viewpoints and factors contributing to or inhibiting their adoption of soil health management practices (SHMPs) using Q method (Q factor analysis). We developed a 72-statement Q set, a statement set representing all perceptions, opinions, and beliefs about a topic typically identified through qualitative interviews and literature reviews, based on five categories: SHMPs and techniques, current and potential programs for producers, programs that lead to adoption, current and desired information sources, and adoption motivations or barriers. Participants sorted each statement from 'Most Like Me' to 'Least Like Me.' We used PQ Method, an intercorrelation software, to analyze the data in a three-step factor analysis—factor extraction, rotation, and analysis. We extracted five factors that accounted for 10.47% of the study variance. Each factor represents a common viewpoint among wheat industry professionals. Factor 1: Potential for economic impact is important to adoption. Factor 2: Visual evidence specifically related to SHMPs is an effective evidence based for influencing adoption. Factor 3: Information delivered by Cooperative Extension is a driver of adoption. Factor 4: An emotional connection to the land and soil health is impactful when farmers consider adopting SHMPs. Factor 5: Participating in NRCS farming conservation program is important for having access to up-to-date information. Although more data is needed to make specific recommendations on information content, types, and sources that drive adoption, our pilot study results offer five specific ways that research and Extension professionals can use to communicate with U.S. wheat producers about SHMPs.

Subject: CIG Showcase

**Denotes primary author*

Demonstrating Phosphorus Adsorbance in a Slag/Biochar Bioreactor Design for the Treatment of Stormwater Runoff

Authors: Tim Schauwecker (Mississippi State University)*; Todd Mlsna (Mississippi State University); John Ramirez-Avila (Mississippi State University); Casey Johnson (Mississippi State University); Lorena Chavarro-Chaux (Mississippi State University); Chanaka Navarathna (Mississippi State University); Bailey Bullard (University of North Georgia)

Elevated phosphorus (P) in stormwater runoff is a national concern as it contributes to aquatic algal and plant growth. The production of co-products from forestry and steel manufacturing make slag and biochar available for soil conditioning, adsorbent use, and the construction of best management practices (BMP). Slag has been shown to adsorb dissolved phosphorus, while withstanding significant stormwater flow. Engineered biochar has been shown to be effective at adsorbing dissolved P and has a high water-holding capacity. A project demonstrates a bioreactor as a BMP to control gully erosion and reduce stormwater pollution. The bioreactor design consists of an Electric Arc Furnace (EAF) slag check dam backfilled with engineered biochar in gullies feeding an adjacent stream reach. Preliminary physicochemical and biological assessment of the reach has shown poor water quality conditions and low biological diversity. Historically, the adjacent pastures contribute to erosion due to a lack of buffering from grazing, inducing Total P concentrations under baseflow conditions that greatly exceed the state nutrient criteria (annual median from 0.09 to 0.30 mg/l). The project goal is to test a low-cost, filtering BMP with the ability to reduce P concentrations and loads, while addressing severe gully erosion. Six pasture sub-drainages have three randomly-assigned treatments of a slag+biochar bioreactor, a slag-only bioreactor, and a control reach in actively-eroding gullies. Each treatment will be monitored using a pair of box samplers, one upstream and one downstream from each treatment, to compare total P and dissolved P levels before and after the treatments. Lysimeters will be used to estimate the contribution of subsurface flow to the gully reaches. Installation of treatments and monitoring equipment were completed in early 2022. We summarize our successes and failures, and present preliminary results from the first year of research.

Subject: CIG Showcase

**Denotes primary author*

Double-Cropping Wheat System Effects on Soil Extracellular Enzyme Activity Related to Carbon and Nitrogen Cycling across Texas

Authors: Hector L. Valencia (Texas A&M Agrilife Research)*; Katie Lewis (Texas A&M Agrilife); Jamie Foster (Texas A&M AgriLife Research)

Conventional management of agricultural systems can threaten soil health by contributing to soil erosion, soil carbon loss, and inefficient water use in crop production. Cover crops and conservation tillage have been reported to improve soil health, but the additional planting and maintenance comes at an additional cost. Double-cropping systems have the potential to mitigate that cost by providing producers a secondary crop with an additional source of income while providing soil health benefits. One key metric for evaluating the effects of management on soil health is through extracellular enzyme activity which plays a vital role in nutrient cycling of a system. This project evaluated double-cropping wheat systems and tillage practices across 3 study locations in Texas: Texas A&M AgriLife Research in Lubbock, Stiles Farm Foundation in Thrall, and Texas A&M AgriLife Research in Beeville. Tillage treatments included: 1) conventional tillage (disk plow), 2) strip-till, and 3) no-till. Cropping treatments included: 1) wheat-sorghum, 2) wheat-sesame, 3) wheat-cowpea, 4) wheat-cover crop mix, and 5) wheat-summer fallow. Activities of β-glucosidase and β-glucosaminidase, related to carbon and carbon/nitrogen cycling, respectively, will be measured on samples collected from 0-5 and 5-15 cm depths in the summer of 2021. Expectations are to see greater β-glucosidase and β-glucosaminidase activity in study plots that incorporated yearlong cover with a grain crop or a cover crop and no-till compared to a wheat-fallow and conventional tillage system. Results will help to identify conservation management practices, specifically double-cropping, that can help provide additional economic value to producers while providing data on maintaining or improving the health of soil systems.

Subject: CIG Showcase

**Denotes primary author*

Evaluation of Agricultural Nutrient Management Technologies at Vermont Natural Ag Products, Middlebury, Vermont

Authors: Mark Stoermann (Newtrient LLC)*; Finn Bondeson (University of Vermont); Eric Roy (University of Vermont)

This study evaluated nutrient status, financial cost, and energy cost for an existing manure Compost Aeration and Heat Recovery system (CAHR) by Agrilab Technologies, Inc. at the Vermont Natural Ag Products (VNAP) compost facility in Middlebury, Vermont in comparison to conventional windrow manure composting where aeration only occurs via turning. From a time and space management standpoint, compost treated with a forced-aeration system was deemed suitable for market in approximately 75% of the time as a conventionally turned windrow. Analysis of nitrogen species status throughout the study suggests that greater nitrogen losses occurred during conventional treatment than during CAHR treatment. Data also suggest a lower risk for phosphorus loss through leaching from CAHR-treated compost, as WEP concentrations were consistently higher in the conventional treatment. Operational costs for CAHR compost were 2.1 times more expensive financially and 5.5 times more energy-intensive than a conventional compost on a per cubic yard basis. However, the energy and infrastructure cost offsets provided by the CAHR system (as operated at VNAP) could provide a net savings of $4.06/CY finished compost. In this study, it was shown that a CAHR system produced a comparable compost product, with higher operational input, in less time.

Furthermore, the data suggest that land application of either compost treatment evaluated in this study may reduce phosphorus loss due to leaching versus direct manure application. It is probable that either compost treatment, when applied to agricultural land, would release less phosphorus as WEP during rainfall events than direct manure application, providing water quality benefits.

Subject: CIG Showcase

**Denotes primary author*

Farmer-Driven Implementation of Soil Health Management Systems Adapted to Diverse Cropping Systems in Tropical and Subtropical Island Environments

Authors: Jonathan Deenik (University of Hawaii at Manoa); Susan Crow (University of Hawaii, Manoa); Tai M. Maaz (UH Manoa); Sebastian Church (University of Hawai'i at Manoa, Crow Soil Ecology and Biogeochemistry Lab); Kristina Estrada (UH Manoa); Mitchell K. Loo (RCUH); Aleric Krenz (UH Manoa TPSS); Christine Tallamy-Glazer (University of Hawaii, Manoa); Johanie Rivera-Zayas (University of Hawaii Manoa)*

A history of intensive plantation monoculture agriculture degraded the soils of the tropical islands that make up Hawaii and U.S. territories. To support efforts to reverse the trends of declining soil functions and health, our team developed a suite of 11 Hawaii Soil Health indicators appropriate to the assessment of tropical and volcanic soils (in alignment with those proposed by NRCS). Our team is currently cooperating with producers to establish soil health management systems (SHMS) that implement soil health building practices tailored and adapted to our unique agroecological landscapes of Hawaii and U.S. territories. We performed a baseline analysis of soil health status at each SHMS demonstration trial and have begun to assess barriers to adopting soil health practices. The assessment includes a literature review to understand the barriers to adoption SHMS that might be encountered in the Hawaiian Islands and U.S. territories with a particular focus on economic and social-psychological factors. An outreach process will follow to understand the local perspectives on barriers and factors influencing the adoption of SHMS for our cooperating farmers. For the initial phase of our SHMS demonstration trials, we will present Hawaii Soil Health scores for cooperating farms and a framework to guide our ongoing outreach to producers, government agencies, and policymakers.

Subject: CIG Showcase

**Denotes primary author*

Improving Irrigation Water Use Efficiency and Disease Management Using Low-Cost Sensor Technology

Authors: Younsuk Dong (Michigan State University)*; Brenden Kelley (Michigan State University); Martin Chilvers (Michigan State University); Lyndon Kelley (Michigan State University); Steve Miller (Michigan State University)

Efficient irrigation management provides benefits such as saving fresh water and energy, improving disease management, reducing nutrient leaching, increasing crop yield and grain quality, and maximizing return on investments. Improper irrigation schedules or unnecessary irrigation can waste resources and increase the potential risk of plant diseases. Sensor technology has been utilized in many research projects to improve irrigation management. There are many existing suppliers of sensor monitoring technology operating across the United States, but uptake and usage are limited with respect to the number of irrigated acres nationally. Research grade remote monitoring systems are commercially available, but the high cost of the commercial system is a barrier for farmers and crop consultants. Further, the raw data from a data logger is not suitable for farmers to make their farm management decisions without some processing and interpretation. The overall goal of this project is to increase the adoption of irrigation management practice, including sensor technology, to improve irrigation water use efficiency and disease management by demonstrating and evaluating the effectiveness of four irrigation strategies. Four corn and soybean rotation irrigated fields and one tomato field were selected for this demonstration project. The team installed LOCOMOS (Low-cost sensor monitoring systems) stations in demonstration fields to monitor multiple depths of soil moisture levels, leaf wetness duration, temperature, humidity, and precipitation. A 2021 irrigation demonstration study found that the Irrigation Water Use Efficiency (IWUE) can be improved from 2.2 to 5.3 bu/acre/inch in a commercial corn field and from 5.6 to 12.4 bu/acre/inch in a soybean field by applying the irrigation at the right time and correct amount using irrigation scheduling method.

Subject: CIG Showcase

**Denotes primary author*

Making a Breakthrough in Restoring Degraded Rangelands with Novel Seed Coating Technologies

Authors: Matthew D. Madsen (Brigham Young University)*; Christopher Miller (Brigham Young University); Amber Johnson (Brigham Young University); April Hulet (Brigham Young University); Brad Geary (Brigham Young University)

Large expanses of western shrublands are being invaded by exotic-annual weeds that promote wildfires that not only burn within the invaded area but also spread into native shrublands, which allow for the further spread of weeds. The cycle of weed invasion and wildfire can be halted in at-risk areas by successfully seeding desired perennial species after a wildfire. However, our ability to establish a diverse native plant community through seeding is notoriously difficult. Seed enhancement technologies (SETs) have the potential to advance restoration efforts by applying treatments that improve seed delivery and germination, and the tolerance of seedlings to environmental stress. The use of SETs is a standard practice in farming systems where the technology plays a critical role in the production of healthy crops. SETs have had limited use in restoration programs, although an effort is currently underway to develop SETs for rangeland applications. Our presentation will focus on SETs that are being developed for rangeland applications, their potential costs and benefits, and the steps that would need to be taken for their broader adoption.

Subject: CIG Showcase

**Denotes primary author*

On-Farm Demonstration of Cloud-Based Soil Moisture Monitoring Technologies for Irrigation Scheduling in South Carolina

Authors: Jose O. Payero (Clemson University)*; Udayakumar Sekaran (Clemson University)

Competition for limited water resources is one of the most critical issues we face today. The ability to make more water available for domestic, agricultural, industrial, and environmental uses will depend on better management of water resources. At EDISTO research station, we have developed a cost-effective sensor-based irrigation scheduling system for crop production. This system uses low-cost open-source electronics, cell phone communication, and Internet-Of-Things technologies. The system automatically collects data from moisture sensors installed on farmers' fields and transmits the data to the Internet in real-time. The graphical data generated can be accessed remotely by the farmer on a computer screen or a free cell phone app. The farmers can use site-specific real-time soil moisture information to make more timely and accurate decisions on when and how much irrigation is required. This technology will help growers enhance water use efficiency and farm profits by applying water only when needed at the optimum rates. To promote this technology among farmers in the state, an Extension project was initiated in 2020. In 2020 and 2021, we conducted six on-farm demonstration trials in local commercial farms where we installed moisture sensors on six prototype fields along with two adjacent irrigated fields each year. We trained the farmers to irrigate one of the fields based on the soil moisture monitoring system's data and to apply their normal irrigation practice on the adjacent field. Relevant agronomic and economic information was collected to compare the economic impact of the two irrigation management options. Based on the information collected from the farmers, we calculated the net income and found that sensor fields recorded a higher net income and yield compared to companion fields. Crops utilized water effectively when irrigation was applied based on the moisture sensor readings and increased the crop yield compared to the farmer’s practice.

Subject: CIG Showcase

**Denotes primary author*

Organically Sourced Hydroponic Inputs: Knowledge Gaps for Commercial Applications

Authors: Maya Kutz (Brooklyn Grange)*; Ben Flanner (Brooklyn Grange); Liz Dowd (Brooklyn Grange); Gwen Schantz (Brooklyn Grange)

Brooklyn Grange LLC is a rooftop farming company based in New York City with over 3 acres of soil farms and a 2400 sf NFT hydroponic system. The soil areas comprises the bulk of the farming operations, and use organic methods such as organic fertilizers, mechanical and cultural weed management, and an IPM approach to pest management. However, Brooklyn Grange uses synthetic nutrient solutions and media in the hydroponic system, which is the hydroponics industry standard. Hydroponics is a least cost alternative for year round local food production in some urban environments with contaminated or infertile soils, but there are several common challenges in using sustainable inputs. For example, anaerobic activity, poor nutrient availability, clogging, and more make organically-sourced fertilizers and media a difficult proposition on a commercial scale. We suggest that many of these challenges can be overcome using a combination of biofiltration, strainers, and filters such as those found in aquaponics. Brooklyn Grange is installing the appropriate physical and biological filters in part of the existing hydroponic system as the first stage of our CIG grant. By summer, we will be able to share results from the first round of fertilizer trials and their interactions with the filters. The three fertilizers will include one industry standard organic fertilizer, one locally produced alternative, and one custom blend. Our metrics to compare these fertilizers include: ease of use, successful filtration, pH stability, nutrient availability, material origins, financial viability, and crop success. These findings will inform the future stages of the research project: trialing the different organically sourced media, running a second fertilizer trials, and sharing out our findings. Our goal is to demonstrate that organically-sourced inputs are viable on a commercial scale, convert at least part of our own system, and to share the methodology widely with other hydroponic growers.

Subject: CIG Showcase

**Denotes primary author*

Protecting and Restoring Flow in the Pecos River Watershed

Authors: Quinn McColly (Texas Water Trade)*

The Pecos River and tributaries are dependent upon consistent, high-quality freshwater inflow to maintain water quality and ecological stability for dependent organisms particularly in those sections of the watershed which run through the arid Chihuahuan Desert of southeastern New Mexico and West Texas towards the river's confluence with the Rio Grande. Unfortunately, freshwater sources are becoming increasingly scarce and precious in the watershed due to more frequent and severe periods of drought and the introduction of non-native salt cedar in the early 20th century (which has also further depleted freshwater through increased rates of evapotranspiration compared to native vegetation). Red Bluff dam was built on the Pecos River in 1936 at the border of New Mexico and Texas to generate hydroelectricity and provide water for irrigation. The dam significantly altered the downstream hydrograph of the river by storing and subsequently releasing as much as 310,000 acre-feet of water in Red Bluff reservoir for irrigation use downstream as far as Grandfalls by 7 independent water improvement and water control districts; this has further altered the river's flow. Recognizing the importance of continuous flows to maintaining healthy freshwater species, Texas Water Trade (TWT) is working with Audubon Texas to identify landowners within their network who currently utilize water on the Pecos or its tributaries and to design transaction structures that would create operational resilience for those landowners while also restoring freshwater flows to degraded reaches in the Pecos. TWT and Audubon has partnered with a local landowner and, through voluntary contractual agreements to boost instream flows, has made the first steps to improving flow on the Pecos River. As this relationship continues we hope to recruit more irrigators into the program thereby further increasing flows to improve habitat and riparian conditions.

Subject: CIG Showcase

**Denotes primary author*

Subtropical Soil Health Demonstration: On- Farm Trials of Cover Crops in Arid Farms of South Texas—Year 1 Results

Authors: Alex Racelis (University of Texas Rio Grande Valley)*; Daphne Zapsas (University of Texas Rio Grande Valley); Pushpa Soti (University of Texas Rio Grande Valley); Manish Gautam (University of Texas Rio Grande Valley); Odile Umuhoza (University of Texas Rio Grande Valley); Bradley Christoffersen (University of Texas Rio Grande Valley); Adegboyega Fajemisin (University of Texas Rio Grande Valley); Rupesh Kariyat (University of Texas Rio Grande Valley); Daisy Delgado (Texas State University); Xiangping Liu (Texas State University); Mike Morris (National Center for Appropriate Technology); Robert Maggiani (National Center for Appropriate Technology); Cruz Salinas (University of Texas Rio Grande Valley, Center for Sustainable Agriculture and Rural Advancement); Juan Raygoza (University of Texas Rio Grande Valley, Center for Sustainable Agriculture and Rural Advancement)

Launched in 2021, the Subtropical Soil Health Demonstration SSHD focuses on the long-term regional implementation and evaluation of cover crops and improved/reduced tillage practices as the foundation of a soil health management system (SHMS) in degraded subtropical soils in arid, water-limited farms. With a pioneering partnership between Texas producers and researchers and staff at the University of Texas Rio Grande Valley, Texas State University, and the National Center for Appropriate Technology, this project includes a wide scale implementation of cover crops as a cornerstone for soil health management. The principal goal of the SSHD is to identify, document, and evaluate regionally relevant approaches for successful cover cropping in water-limited commodity cropping systems and certified organic systems. The project includes a rigorous, multi-farm evaluation of the potential of cover crops to improve ecosystem services of health subtropical soils. This evaluation includes simple but effective trials that contrast cover cropped areas to side-by-side fields that do not meet SHMS principles (i.e. control plots). Data on soil moisture, pest management, and biodiversity conservation, and subsequent crop yield are collected following a BACI design (Before-After/Control-Impact), where samples from side-by-side cover crop fields (Impact) and adjacent non-cover crop areas (Control) will be collected before and after annual plantings of cover crops. The evaluation team will use this data to explore the link between these indicators and other socio-economic outcomes, collected through interviews, surveys, and close collaboration with the participating famers. This evidence-based assessment will be used to help guide farmers and NRCS staff about the value of cover crops as a conservation innovation across Texas and other water-limited farms.

Subject: CIG Showcase

**Denotes primary author*

The State of the Science for Reducing Ammonia Emissions along Colorado's Front Range: Review of Kinetics and Management Approaches

Authors: Carolina Brandani (Texas A&M AgriLife Research and Extension Center – Amarillo)*; Brent Auvermann (Texas A&M AgriLife Research and Extension Center – Amarillo); Erik Crosman (West Texas A&M University); Myeongseong Lee (Texas A&M University); David Brauer (USDA/ARS Bushland); David Parker (West Texas A&M University); Ken Casey (Texas A&M AgriLife Research and Extension Center – Amarillo); Matthew Beck (USDA/ARS Bushland); Bryan Shaw (Shaw Engineering)

Ammonia (NH_3) transport into Colorado's Front Range is a reasonably predictable, seasonal phenomenon. Specific meteorological conditions (e. g., upslope winds, especially in the spring and summer) and the proximity of emission sources along the adjacent South Platte River basin and surrounding High Plains coincide to move NH_3-laden air masses into Rocky Mountain National Park (RMNP), where wet atmospheric deposition subsequently enriches sensitive alpine ecosystems with reactive nitrogen. To the extent the total NH3 load into RMNP may be attributed to fugitive NH_3 emissions from open-lot cattle-feeding operations along the Front Range, the deposition flux is sensitive to the temperature-, moisture-, chemistry-, and aerodynamics-driven mechanisms that are known to modulate NH_3 emissions from open-lot corral surfaces. Here we present (a) the state of the science with respect to the seasonality and temporality of upslope weather events and (b) how to combine short-term weather forecasts with our understanding of emission dynamics from cattle feedyards to reduce NH_3 deposition in RMNP, thereby contributing to Colorado's "glidepath" target deposition flux of 1.5 kg N ha^{-1} yr^{-1} by 2032. Given the urgency of ensuring that feedyard-management recommendations are both affordable and demonstrably effective, we outline the scientific basis, practicality, effectiveness, and duration of each of the promising mitigation tactics, with marginal costs where those can be rationally estimated.

Subject: CIG Showcase

**Denotes primary author*

Tools to Manage Conflicts and Range Health on Landscapes Shared with Livestock and Predators

Authors: Jared Beaver (Montana State University); Stewart Breck (National Wildlife Research Center, USDA-Wildlife Services); Gary Burnett (Heart of the Rockies Initiative); Alexandra Few (Western Landowners Alliance)*; Emily Harkness (Heart of the Rockies); Matthew Hyde (Colorado State University); Kyran Kunkel (Conservation Science Collaborative); Rae Nickerson (Utah State University); Bre Owens (Western Landowners Alliance); Jay Shepherd (Northeast Washington Wolf-Cattle Collaborative); Julie Young (Utah State University)

The Conflict on Workinglands Conservation Innovation Grant (CoW-CIG) team is working to innovate and evaluate non-lethal tools in the context of comprehensive wildlife conflict reduction. The goal of the project is to reduce the financial and social burden to producers of expanding predator populations on workinglands. The CoW-CIG team is researching costs, efficiency, and effectiveness within varying ecological contexts to determine whether the adoption of three practices - range riding, carcass management, and various fencing scenarios - should and could be incentivized and sustained via Natural Resources Conservation Service Farm Bill programs. These practices offer win-win solutions for predation risk management on shared landscapes to support both livestock production and wildlife, including large predators. Here we share a planning framework and guiding principles that can be used to determine if and where strategic application of these practices within a dynamic working-wild landscape can address localized predation risk in areas that are primarily occupied by humans, wildlife, or both. For example, a permanent multi-strand electric fence is suitable for primarily human-occupied space. Carcass management is suitable for both human and shared spaces, and range riding is suitable for shared space and, at times, predator space, such as near a den location or rendezvous site. This localized approach of spatial and/or temporal separation avoids ecological traps that increase wildlife mortality, leading to more permeable habitats that allow for wildlife movements within and across connected landscapes. Implementation of these practices supports an adaptive management system to maintain or improve a functional landscape by promoting integration of resource concerns including terrestrial wildlife habitat, riparian or rangeland plant structure and composition, streambank erosion, and livestock productivity from a feed and forage imbalance.

Subject: CIG Showcase

**Denotes primary author*

Tree-Age: A Decision Support Tool for Estimating Grassland Bird Response to Brush Management Practices

Authors: Amanda Haverland (American Bird Conservancy); Anne Bartuszevige (Playa Lakes Joint Venture)*; Barry Robinson (Environment and Climate Change Canada)

Grassland bird populations have been declining for decades. Conversion of grassland to cropland is the most common reason articulated for this decline, however, invasion of grasslands by woody plants represent a little recognized and insidious threat to recovering grassland bird populations. Grassland birds are extremely sensitive to increased presence of woody plants on grasslands; some species are found at lower densities on grasslands with as little as 1% woody plant cover compared to grasslands with no woody plant cover. Recent collaborative efforts (e.g., NRCS Great Plains Grassland Initiative, JV8 Central Grasslands Initiative, etc.) are invigorating efforts to restore and conserve grasslands through woody plant (e.g. brush) management. Tree-age (pronounced like triage) is a decision support tool that will estimate the change in grassland bird abundance as a result of a variety of management actions. Estimates can be calculated at both the landscape-scale (aka top down) or from the project-scale (aka bottom up). We will use Boosted Regression Tree analysis to create species distribution and habitat models using available bird monitoring data and geospatial products, like the Rangelands Analysis Platform. Then we will project changes in grassland bird populations using risk models, such as the woody transition risk model available on RAP. We will present model results for a select suite of grassland birds and illustrate how the results will be incorporated into an online decision support tool. We anticipate this decision support tool will be used by conservation planners to estimate wildlife outcomes within the areas of focus. In addition, we anticipate biologists who work with landowners to develop conservation plans for their property could use this tool to illustrate how adoption of conservation actions could benefit wildlife on their property.

Subject: CIG Showcase

**Denotes primary author*

Tribal Lands Carbon and Co-Benefits Tool

Authors: Bryan Van Stippen (National Indian Carbon Coalition)*

The National Indian Carbon Coalition, through the Indian Land Tenure Foundation, and their partners offers a new approach to tribal working lands conservation. The goal of this project is to develop and pilot an operational web-based tool to assess and quantify the co-benefits of enhanced land-based carbon sequestration produced through ecosystem conservation and restoration activities on tribal lands. We will produce open source online-mapping tools for use by partner tribes to assess natural resource assets, including carbon, and will introduce a new framework and metrics for quantification and valuation of the co-benefits of protecting these assets. We will work with partner Native American tribes to develop long-term conservation, sustainability, and climate resilience strategies that meet their unique ecological and cultural values.

The tool will allow for the quantification and valuation of these resources for the co-benefits of sustained air quality, water quality, water supply, wildlife habitat, cultural values, and more. These values can then be more explicitly recognized to increase the monetary value of carbon offsets in the voluntary marketplace derived from greenhouse gas mitigation activities on tribal lands. Current standards in the voluntary carbon offset marketplace recognize the importance of co-benefits but have yet to fully and formally incorporate these values into verified offset projects. Greenhouse gas mitigation through the protection of healthy ecosystems and working lands offers more than the monetization of carbon, and we will be the first to offer co-benefits valuation metrics to the voluntary carbon marketplace.

Subject: CIG Showcase

**Denotes primary author*

Lessons in Developing Community-Driven, State Soil Health Policy and Programs

Authors: Abigail Warner (Yale School of the Environment)*; Darya Watnick (Yale School of the Environment)

Soil health provides a variety of important ecosystem services, including water quality, drought resilience, erosion prevention, crop yields, and carbon sequestration, which in turn contribute to meeting agricultural and conservation goals. However, degradation of working lands has negatively impacted soil health in the United States. As a result, many states are developing soil health policies and programs to support agricultural producers interested in switching their practices and fund soil testing and research.

However, coalitions working to pass soil health legislation do not need to reinvent the wheel. In states who have already had success passing soil health legislation, including California, Colorado, and New Mexico, lessons learned can inform individuals and organizations pushing for soil health elsewhere.

The Soil Health Policy guidebook serves as a practical resource for anyone interested in developing community-driven soil health policies or programs in their state. This project draws from over 30 interviews with producers (farmers and ranchers), academics, scientists, nonprofit organization staff, state legislative or agency staff, and funders. It presents recommendations on how to build an effective and inclusive soil health coalition, logistics to help mobilize a coalition, steps to develop a soil health policy or program, and funding opportunities. The findings could also be applied to building coalitions around other natural resource challenges.

Subject: 2022 General Conference Theme

Track: Conservation Economics and Policy

**Denotes primary author*

Influence of Crop Rotation and Cover Crop Selection on Soil Organic Carbon and Microbial Communities during the First Year of Organic Transition

Authors: Lauren E. Selph (Texas Tech University)*; Katie Lewis (Texas A&M Agrilife); Paul DeLaune (Texas A&M AgriLife)

While there is overlap in potential benefits of organic practices and the needs of producers in the High Plains and Rolling Plains ecoregions of Texas, more study is necessary to establish effective crop rotations. The three-year transition to organic production may be accompanied by an initial decline in yield, but the use of cover crops may improve yields, build soil organic carbon, and stimulate microbial communities. This study sought to examine the impact of cover crop use on microbial populations and soil organic carbon content following cover and cotton crops during the first year of transition to organic production in a West Texas cropping system. Cover crop treatments were rye at 34 kg ha^{-1} and 17 kg ha^{-1}, rye/fenugreek/fennel mix at 17 kg ha^{-1}, and fenugreek/fennel mix at 17 kg ha^{-1} in a randomized complete block design. Soil samples were collected following cover crop termination and preceding cash crop planting in the spring. Soil organic carbon content was tested by Elementar TOC Vario Select analyzer and soil microbial community composition by PLFA testing. Organic carbon content and microbial population composition are predicted to increase during the first year of transition as a result of cover crop use.

Subject: 2022 General Conference Theme

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

**Denotes primary author*

An Overview of the STAR (Saving Tomorrow's Agriculture Resources) Initiative's Web Application: An Innovative Platform to Promote and Track Conservation Improvements at the Field Level

Authors: Emily Bruner (SHI)*; Erin L. Bush (Champaign County Soil & Water Conservation District); Megan Baskerville (The Nature Conservancy)

In 2016, the Champaign County Soil and Water Conservation District (CCSWCD) began to explore ways to support local farmers interested in adopting conservation practices identified in the Illinois Nutrient Loss Reduction Strategy (NLRS) to reduce nonpoint source nutrient pollution. This led to the development of Saving Tomorrow's Agriculture Resources (STAR), an initiative that educates and encourages farmers, ranchers, and landowners to evaluate their current production systems, identify areas for improved management, and document their progress toward improving water quality and soil health.

From its origins in Champaign County, IL STAR has expanded to 68 counties statewide, four counties in Indiana, and is currently being offered in Iowa and Colorado. Additionally, STAR has received promotion via the National Association of Conservation Districts and several other states have indicated interest in bringing STAR to their region, including a signed agreement with Missouri. In early 2020, several key partners of STAR wanted to create a reliable and engaging online platform to encourage enrollment and simplify field form scoring and tracking, resulting in the launch of the STAR Web Application (App) for Crop Year 2021. The new STAR Web App allows users to create customized field improvement plans, connect with local resources and technical assistance, and share their STAR Ratings with their online communities with a few simple clicks.

This poster will introduce the innovative STAR Web App, detailing functionality for front-end (farmers and landowners) and back-end users (STAR Licensees and Soil and Water Conservation District Staff), including integration of financial and technical assistance resources as well as streamlined practice tracking, verification, and outcome quantification.

Subject: 2022 General Conference Theme

Track: Conservation Models, Tools, and Technologies

**Denotes primary author*

Calculation Requirements May Contribute to Low Controlled Traffic Farming Adoption

Authors: Marcia L. Deneke (USDA NRCS)*; Eric Barsness (USDA NRCS); Charles Vandever (ACES Program Technician); Jessica Michalski (USDA NRCS)

Controlled Traffic Farming (CTF) is confining all high load wheel traffic from farm equipment to specific lanes or tramlines (traffic pattern) in crop fields year after year to address soil compaction and plant productivity. Published results from CTF studies indicate an economic yield benefit in the range of 4-5%. South Dakota (SD) raises corn and soybeans on approximately 9,500,000 acres annually. If revenue increased by $25 per acre, the economic impact to SD producers would be $237,500,000. Yet the adoption of the CTF conservation practice in SD and nationwide is minimal.

The inability to accurately quantify trafficked area of the field, may be contributing to the lack of adoption. To remedy the manual computation requirements, an excel based spreadsheet was developed to analyze the relationship between the primary piece of equipment's working width or pass width and all other equipment that works in the field. The user enters equipment specifications along with information about the field, commodity, and travel patterns occurring as equipment moves across the field. Users have the option of lining up equipment on the centerline or offsetting implements from the edge of the field. Additionally, imprints from equipment working at an angle to the field orientation and adjustments to the trafficked area when grain carts leave the tramline for loading can be included in the trafficked percentage.

Each piece of equipment moving across the field impacts the soil and plant's ability to reach its full potential. The ability to accurately assess the CTF footprint traveled in relation to the field surface has the potential for increased profitability with less environmental impact.

Subject: 2022 General Conference Theme

Track: Conservation Models, Tools, and Technologies

**Denotes primary author*

Consideration of Restored Floodplain Easements in the Agricultural Conservation Planning Framework (ACPF)

Authors: Kelsey D. Karnish (Iowa State University)*; Emily K. Zimmerman (Iowa State University)

Non-point source nitrogen and phosphorus pollution from agricultural landscapes has negatively impacted water quality across the United States. Conservation planning using geospatial data and tools has become an increasingly used technique to efficiently place best management practices (BMPs) to reduce non-point source nutrient loss. The Agricultural Conservation Planning Framework (ACPF) was developed to identify areas of potential soil and water resource concern and provide suites of options of appropriate BMPs to mitigate non-point source sediment and nutrient pollution of surface and ground waters. This research created the methodology to consider an additional BMP, restored floodplain easements, in the suite of ACPF BMP tools to assist natural resource practitioners in locating and prioritizing potential floodplain easements for restoration to enhance water quality and applied the methodology in a case study watershed. Key data layers and criteria used include adjacency to perennial streams, suitable land use (corn, soybeans, timber), height-above-stream channel, proportion of field within the 2-, 5-, and 10- year floodplain, and connectivity to existing floodplain easements. This research provides natural resource practitioners with a tool to identify and prioritize suitable land for floodplain easements and assists with informing where key opportunities may exist to restore floodplains. Future research includes estimating potential nutrient reduction and other environmental benefits associated with restored floodplain easements and costs associated with restoring and maintaining the easements.

Subject: 2022 General Conference Theme

Track: Conservation Models, Tools, and Technologies

**Denotes primary author*

How Much Grass Will Grow on Your Rangelands This Year? Grass-Cast Sheds Light on the Question!

Authors: Julie Elliott (NRCS/Northern Plains Climate Hub)*

A challenge for ranchers and grazing managers is knowing how much grass to expect in the upcoming growing season. If they could know sooner how much grass will grow, then they could make stocking decisions earlier in the season. This could reduce their financial risk and ecological risks to the land. But grass growth is a complex process - one cannot simply know how much grass production there will be. Therefore, Grass-Cast (the Grassland Productivity Forecast) fills an important knowledge gap by forecasting expected total grass production for western rangelands.

Grass-Cast uses information about soils, plant community, and historical weather to arrive at a soil moisture profile. By adding in future possible temperature and precipitation information, Grass-Cast 'forecasts' total expected production. However, we don't know for sure how much precipitation might fall in the upcoming growing season. Therefore, three maps are created to represent below, near, and above normal precipitation scenarios.

Smart et al reported in the Rangeland Ecology & Management (Smart et al 2019, https://doi.org/10.1016/j.rama.2019.09.005) that studies on the Central and Northern Great Plains reported shows that spring to early summer moisture is a strong indicator of total forage production on rangelands. This includes sites in CO, KS, MT, NE, ND, SD and WY. This is reflected in the Grass-Cast maps, which achieve 70% accuracy on average by mid-June. This suggests that grazers could consider adjusting their stocking levels earlier in the growing season by looking at Grass-Cast and other tools to inform their decisions.

The Grass-Cast model is currently available in the Great Plains and the Southwestern states of Arizona and New Mexico. Forecasts are generalized on the large scale but customized on 6-mile by 6-mile grid-cells. Thus, Grass-Cast may be a useful addition to a rancher's planning toolbox to see potential drought impacts both regionally and locally.

Subject: 2022 General Conference Theme

Track: Conservation Models, Tools, and Technologies

**Denotes primary author*

Quantifying the Conservation Effects of CREP Practices Using STEPL In Illinois Watersheds

Authors: Elias Getahun (Prairie Research Institute, University of Illinois Urbana-Champaign)*; Laura Keefer (Illinois State Water Survey, Prairie Research Institute, University of Illinois Urbana-Champaign)

Tracking the progress of conservation effects is critical in identifying best management practices (BMPs) that help reduce non-point source (NPS) pollutant loads from watersheds. Various models have been used to assess impacts of conservation measures and EPA's STEPL model is one such model that has been used to estimate not only average annual NPS pollutant loads but also impacts of BMP implementations. In this study, STEPL models were developed for two subwatersheds of Spoon River in Illinois, namely Court and Haw Creeks to estimate average annual sediment and nutrients loads, and their annual reduction as a result of CREP implementations in the two watersheds through the years. The ISWS has been conducting hydrologic and water quality monitoring of the two watersheds since 1999 for more than two decades. To develop the models, local watershed data were used when available (e.g., land use, annual precipitation, etc.) although STEPL has nation-wide input data organized by HUC-12 watersheds. Watershed areas under CREP implementation for each year were derived from CREP enrollment spatial data that includes the type and implementation durations of the conservation practices. To facilitate multi-year simulations and integration of annual inputs for the watershed models where possible, Python codes of the STEPL worksheets were developed. CREP areas in the study watersheds were modeled as land retirement BMPs. Preliminary results for Court Creek watershed indicate that average annual load reductions for 2000 – 2016 period range from 0.9% – 2.9% for sediment, 1.1% – 2.7% total N, and 1.0% – 2.4% for total N. The STEPL models will be updated every year and thus can be used to track CREP progress towards reducing annual NPS loads in Illinois watersheds.

Subject: 2022 General Conference Theme

Track: Conservation Models, Tools, and Technologies

**Denotes primary author*

Utilizing Overland Flow Elements from the Daily Erosion Project (DEP) to Calculate Sediment Delivery in the Context of the Agricultural Conservation Planning Framework (ACPF)

Authors: Chelsea L. Ferrie (Iowa State University)*; Emily K. Zimmerman (Iowa State University); Brian Gelder (Iowa State University); Daryl Herzmann (Iowa State University); David James (USDA ARS National Laboratory for Agriculture and the Environment); Thomas Isenhart (Iowa State University); Richard Cruse (Iowa State University)

Over the past ten years, increasing availability of high-resolution geospatial data has facilitated the application of tools, such as the Daily Erosion Project (DEP) and Agricultural Conservation Planning Framework (ACPF), to assist stakeholders in identifying areas of soil and water resource concern and opportunities for best management practices (BMPs) in agricultural landscapes. The objective of this research was to aggregate 10 years of output data from DEP to estimate annual sheet and rill erosion at the field and watershed scale for use in agricultural conservation planning. By leveraging information from hillslope overland flow elements (OFEs) from DEP, which estimate sheet and rill erosion associated with unique combinations of soil, slope, and land use, we identified OFE combinations for each raster cell in a watershed and assigned erosion rates from the aggregated DEP data for each unique OFE. The developed methodology was applied to Walnut Creek watershed in central Iowa as a case study. This process and data could be used to inform sampling structures in DEP and in conservation planning tools (e.g., ACPF) to estimate potential sediment and phosphorus reduction resulting from BMPs in agricultural landscapes.

Subject: 2022 General Conference Theme

Track: Conservation Models, Tools, and Technologies

**Denotes primary author*

Farmers' Motivation for Participating in Pennsylvania's Environmental Quality Incentives Program (EQIP)

Authors: Elsie Assan (Pennsylvania State University)*; Anil K. Kumar Chaudhary (The Pennsylvania State University)

Farmers' participation in farm bill conservation programs such as Environmental Quality Incentives Program (EQIP) can help Pennsylvania to meet the Total Maximum Daily Load reduction goal set by EPA by 2025 for the watershed through adoption of conservation practices. There is a plethora of research assessing farmers' motivation to adopt best management practices, but few studies have investigated the motivators of farmers' (non-) participation decisions in EQIP, in the context of Pennsylvania. To account for farmers' perspectives on addressing environmental challenges through voluntary participation in conservation programs, we conducted in-depth interviews with farmers, comprising 11 EQIP participants and 6 non-participants, in the Bedford, Center, and Lebanon counties of Pennsylvania. We found that EQIP participants were motivated by program characteristics such as cost-share, fit of program goals with farm management practices, and ability to meet different regulatory requirements and personal reasons such as farm sustainability goals and social recognition for efforts towards addressing environmental programs. These participants viewed technical and financial assistance received from the program as very helpful in identifying and addressing farm resources needs. The non-participants cited distrust for the government, inadequate information on EQIP goals and benefits, limited resources, and perceived mismatch between program and farm business goals as factors contributing to their disinterest in the program. We also observed that understanding the differences between the two groups of farmers can help conservation professionals in accounting for diverse voices in efforts to address water quality issues. In this presentation, we will discuss how understanding the differences between the two groups of farmers can help conservation professionals in accounting for diverse voices in efforts to address water quality issues in the Chesapeake Bay watershed.

Subject: 2022 General Conference Theme

Track: Social Sciences Informing Conservation

**Denotes primary author*

Comparative Effects of Cover Crops with Tillage on Soil Hydro-Physical Properties

Authors: Melis Çerçioğlu (Izmir Katip Celebi University)*

Using cover crops in agriculture can provide a multitude of agronomic and environmental benefits. Impacts of soil tillage and cover crops on soil water retention, pore-size distributions, saturated hydraulic conductivity (Ksat), and bulk density were investigated on a silt loam soil in Chariton County, Missouri, USA. 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.). Undisturbed soil cores were collected using a grid sample design from six replicate locations before and after tillage in response to cover crop (CC) and no-cover crop (NCC) management. Results showed a significant effect of cover crop on total pores and macropores both sampling period. Especially total pores and macropores of second soil samples (after tillage and cover crop termination) were found approximately 19% and 113% higher compared to first soil samples (before tillage and cover crop termination) by cover crop, respectively. Cover crop management significantly affected water content in first soil samples for some pressures (0.0, -2.5 and -1500 kPa) and in second soil samples for all pressures. Generally greater water content values of second samples were determined from 30–40 cm depth for all pressures as compared with other depths due to claypan horizon. Additionally, no significant effect was observed on soil bulk density and Ksat by cover crop. Future, long-term cover crop studies are needed to compare on soil hydro-physical properties by specific effects of cover crop and tillage.

Subject: 2022 General Conference Theme

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

**Denotes primary author*

Customizing Cover Crop Species Mixes for Acid Soil Conditions

Authors: Larry J. Cihacek (North Dakota State University)*

Cover crop mixes provide valuable benefits for soil health and provide opportunities for diversifying cropland use (e.g. high-quality forage for haying or grazing). Over the past several decades, soil acidity has been increasing in the northern Great Plains due to changes in crop mix, soil management and increased fertilizer use. Different crop species can have differing tolerances to soil acidity that may affect their establishment and subsequent growth. Since seed costs for some species is high, avoiding using acidity-intolerant species in mixes can keep seed costs down while establishing an effective cover crop. We evaluated sixteen (16) cover crop species by germinating them in soils of pH 4.4, 5.6, and 7,4, respectively. The soils were used at their natural pH or amended with the equivalent of 4 T/A of beet lime. Seed germination ranged from 27 to 98 % for the pH 4.4 soil, 8 to 96% for the pH 5.6 soil and 57 to 98 % for the pH 7.4 soil, respectively when unamended. The lime amended soils showed marked germination improvement in some but not all species for the two acid soils but relatively little change for the pH 7.4 soil, as expected. Implications for developing customized cover crop mixes for acid soils will be discussed.

Subject: 2022 General Conference Theme

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

**Denotes primary author*

Does Soil Organic Matter Accrual Increase Nitrogen Use Efficiency? A Field Study of Long-Term versus First-Time versus No Cover Cropping

Authors: Yajun Peng (University of Guelph)*; Laura L. Van Eerd (University of Guelph)

Soil organic matter accrual is usually detected with long-term cover cropping rather than in the short-term, which limits research on how soil organic matter level affects nitrogen use efficiency. We hypothesized that the nitrogen use efficiency would be higher with long-term cover cropping than first-time or without cover crops grown, because of the higher carbon and nitrogen storage in the particulate organic matter fraction. To test this, 15N micro plots were established on two long-term cover cropping field sites (University of Guelph, Ridgetown Campus) where cover crops were annually used 11 times within 14 years in a horticulture-grain system. We applied 99% enriched 15N ammonium sulfate (12 kg N/ha) to cover crops and followed into grain corn. Cover crop treatments were no cover crop control, oat (*Avena sativa* L.), winter cereal rye (rye; *Secale cereale* L.), oilseed radish (OSR; *Raphanus sativus* L. var. oleoferus Metzg. Stokes), and a mixture of OSR and rye, with four replications. Moreover, the profile distribution of carbon and nitrogen within soil organic matter fractions (particulate and mineral-associated organic matter) were analyzed to elucidate the effect of soil organic matter on nitrogen use efficiency. Understanding the importance of cover cropping in enhancing carbon storage and nitrogen use efficiency might drive its widespread adoption in croplands and help reduce nitrogen fertilizer applications.

Subject: 2022 General Conference Theme

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

**Denotes primary author*

Dynamic Soil Properties: Snapshot in Time for Deuel County, South Dakota

Authors: Carrie Werkmeister (USDA NRCS)*; Lance Howe (USDA NRCS); Steve Winter (USDA NRCS); Nathan Jones (USDA NRCS); Kent Vlieger (USDA NRCS); Tanse Herrmann (USDA NRCS)

The purpose of the South Dakota (SD) Dynamic Soil Properties (DSP) study is to show how different management systems, such as conventional till, native range, and conservation reserve program (CRP), impact soil properties, such as organic matter (OM) content and microbial activity in a side-by-side evaluation. The DSP design gathers information on how soils are altered through anthropogenic management and how this impacts soil functions (e.g., infiltration, aggregate stability, soil color) within the management system. Understanding these changes is a crucial part in practicing regenerative range and program practice systems across the state. The DSP project provides valuable information to producers allowing them to make better informed decisions regarding long-term management practices. This site is in Deuel County SD, located on the eastern side of the state with Barnes soils located on till plains. Three sites were evaluated: 1) conventional till with manure; 2) conventional till; 3) new CRP; and 4) native range. Overall, there were subtle differences between the DSP locations when comparing the sites as well as varying infiltration rates. Re-evaluations of these sites after 10 years would further provide better understanding of the influence that different management systems can have on DSP.

Subject: 2022 General Conference Theme

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

**Denotes primary author*

Economic Evaluation of Conservation Practices and Management for Rangeland Soil Health: Economic Modeling

Authors: Jessica Windh (Sustainable Rangelands Roundtable); Savannah Warwick (University of Wyoming); Kristie Maczko (Sustainable Rangelands Roundtable - University of Wyoming)*; John Tanaka (University of Wyoming Agricultural Experiment Station)

Management of rangelands is exceedingly important to ensure that these ecosystems, and the communities built around them, may prosper. In California, rangelands cover approximately 38 million consist of private and public rangelands that are owned or managed by ranchers. Soil health is crucial to healthy and productive rangeland systems, and the economic viability of ranching operations that steward these rangelands. California's agriculture is valued at almost $50 billion total, with $3.19 billion valued in beef cattle ranching operations. Soil health and forage production are tightly linked. In this study, three regions of California are modeled to reflect how increasing forage production can influence financial outcomes on private cattle ranches. The three regions represented include the Coast, the San Joaquin Valley, and the Sacramento Valley. Each region consists of a designated group of counties. To be able to represent a private ranch in the three regions, information was gathered that includes financial information for assessing probable livestock production and costs, land resources and forage supply, and ranch characteristics which include herd type, size, and forage requirements. A representative ranch for each region was developed based on the average ranch characteristics of each region including herd size, calving rate, replacement rate, percentage of heifers kept, cow to bull ratio, and fixed expenses. We used a 35-year ranch economic model to track changes and outcomes as the representative ranches move through the simulated scenarios. Without having the direct relationships of management, soil characteristics, and forage production, this project identifies trends over the 35-year model. Across 3 regions, improvements in forage spanned a range of $695 to $988 in increased economic viability. However, due to data limitations, it was not possible to quantify a statistically significant relationship between soil carbon and forage production.

Subject: 2022 General Conference Theme

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

**Denotes primary author*

Evaluating Differences in Soil Properties and Management on a Long-Term Watershed Study in Kansas

Authors: Kendra Stahl (Kansas State University); DeAnn Presley (Kansas State University)*; Gerard Kluitenberg (Kansas State University); Kraig Roozeboom (Kansas State University); Peter Tomlinson (Kansas State University); Ganga Hetiarachchi (Kansas State University); Nathan Nelson (Kansas State University)

Cover crops and no-till have been demonstrated to improve soil physical properties, such as water stable soil aggregation, however, there has been less research on the effects of P fertilizer timing and placement. The Kansas Agricultural Watershed (KAW) field laboratory near Manhattan, Kansas was established in 2014. The soil at the site is mapped as a Smolan silty clay loam with 6-8% slope. The experiment was a 2 × 3 factorial design with two cover crop treatments (with and without) and three phosphorus fertilizer treatments (none, spring injected P, and fall broadcast P). The field lab contains 18 watersheds that are about 1.2 acres each, and each watershed contains 3 subplots that were sampled. Due to the slope gradient and visible surface erosion present at this site prior to the establishment of the study, it was hypothesized that there might be differences in soil organic C and soil texture with respect to landscape position. Thus, there might be some simultaneous effects of landscape position and study treatments on the texture, soil organic C, and aggregate stability. Samples from the 0-5 cm depth were collected in 2017 and used for particle size analysis to determine the percent sand, silt, and clay, as well as soil organic C. Water stable aggregate samples were collected for the 0-5 and 5-10 cm depths in 2017, 2018, and 2019. At the backslope the particle size was generally in the silty clay loam texture class, but at the bottom of the slope, in this case the terrace channel, the texture was most often a silt loam. The results of the texture, soil organic C, and the cover crop and P treatments will be evaluated together to determine the combined effects of soil properties and soil management on soil aggregation.

Subject: 2022 General Conference Theme

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

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Land Management for Improved Yields, Environmental Resilience, and Sustainability

Authors: Natasha L. Hoover (Iowa State University)*; Michelle Soupir (Iowa State University); Daniel Andersen (Iowa State University); Rameshwar Kanwar (Iowa State University)

Soil health and agricultural water quality are closely linked. This study layers multiple management practices to potentially improve yields, environmental resilience, and sustainability. Twenty-seven ¼-acre individually tile drained plots were established in 2021 to study the impact of combining cover crops, reduced tillage, and poultry manure management on soil health and water quality under a corn-soybean rotation. The manure management treatments include either early winter or spring applied poultry manure, balance early winter manure with chemical fertilizer (UAN), or UAN treated plots as a control. Each treatment is paired with winter cereal rye or no cover crop. Extreme deep core samples were collected to a depth of 8-9′ for analysis of various soil characteristics, which will provide a detailed soil profile for the field. Initial analysis at the site evaluates the existing weed seed bank, starting P levels, and soil health parameters including aggregate size distribution and POM to provide a baseline to compare to future results to identify early indicators of changes in soil health.

Subject: 2022 General Conference Theme

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

**Denotes primary author*

Effects of Cover Crops on Soil Moisture Retention and Yield in Four On-Farm Sites in Kansas

Authors: Alexis Correira (Kansas State University); DeAnn Presley (Kansas State University)*; Peter Tomlinson (Kansas State University)

Cover crops are being studied nationwide for their potential role in improving the sustainability of cropping systems and benefiting the soil. It is important for researchers, extensionists, and farmers to understand how cover crops impact physical and chemical soil properties and cash crop yield. For this ongoing project, we are cooperating with four farmers in eastern and central Kansas. Cover crops were established with the farmer's choice of seeding method and cover crop species. Soil moisture probes were installed at three of the four sites measuring moisture at the soil surface, 15 cm, 40 cm, and 80 cm depths. Biomass samples of the cover crop were collected right before termination and placed into plastic mesh litterbags. They were placed in the field and periodically collected over the course of the growing season (planting to harvest), dried and ground for carbon and nitrogen analysis. Harvest and yield data were collected using weigh wagons and plot area. Preliminary results from the first full year of this study indicate a positive relationship between soil moisture and the presence of cover crops. Additionally, crop yields were lower in cover crop plots in three of the four sites. This experiment is part of ongoing research, and more years of data collection will be necessary to fully understand the impact of cover crops in these operations.

Subject: 2022 General Conference Theme

Track: Water Resource Assessment and Management

**Denotes primary author*

Historic Precipitation Values Contrasted to Potential Soil Infiltration in Northeast Colorado

Authors: Mark M. Hartelt (USDA NRCS)*

The climate of northeast Colorado is semi-arid punctuated by infrequent intense precipitation events. An evaluation was made of monthly precipitation and average annual precipitation for a 100 plus year period and the interval of 2000 to 2021 (22 years), at the following eight weather reporting sites in Colorado: Akron, Brighton, Burlington, Fort Morgan, Greeley UNC, Julesburg, Leroy, and Wray. Averaged precipitation amounts reported at the eight sites show a similar pattern of monthly precipitation between long term reporting and the past 22 years, with 15 years of data for Fort Morgan. At the sites listed, 83 to 89 percent average annual precipitation recorded for the 22-year interval occurred during the monthly interval of April through November. The accumulated precipitation amounts, and frequency were evaluated within and across months using the ranges: > 0 to ≤ 2.54, > 2.54 to ≤ 6.35, > 6.35 to ≤ 12.7, > 12.7 to ≤ 25.4, > 25.4 to ≤ 38.1, and > 38.1 mm. The accumulated precipitation at all sites shows a low frequency of days of recorded precipitation in the ranges greater than 25.4 mm, between 28 and 71 days of the 8036 days included in the 22-year interval: This same range contributed 23 to 32 percent of all precipitation recorded between April to November. The low frequency yet high contribution to potential soil water accumulation, when considered across years, suggest the need for conservation practices to retain this moisture in soils when it arrives. Soil water infiltration directly affects the ability to efficiently retain precipitation arriving in the upper ranges evaluated. An ongoing informal survey of crop and rangeland in northeast Colorado is underway to characterize the infiltration ability of area soils, using Cornell Sprinkle Infiltrometers. Preliminary data, based on a low sample number, suggest cover crop use in both no-till and minimum till cropping systems could increase water infiltration into soils.

Subject: 2022 General Conference Theme

Track: Water Resource Assessment and Management

**Denotes primary author*

Mapping of Center Pivot Irrigation Systems in South Carolina Using Quantum Geographic Information System

Authors: Udayakumar Sekaran (Clemson University)*; Jose O. Payero (Clemson University)

The adoption of overhead irrigation systems, especially center pivots, to irrigate row crops have been steadily increasing in South Carolina in recent decades. This increase has been due to a combination of economic factors, and to the need to adapt to drought periods under the predominance of soils with low water holding capacities. As the trend of using overhead irrigation systems in the state increases it is important to understand their number, location, and characteristics for better managing available water resources. This research's primary objective was to map and characterize each center pivot and lateral move system in South Carolina. The Quantum Geographic Information System (QGIS) was used to manually map and measure each overhead irrigation systems in the state using a 2022 Google satellite image. In addition to the location of each irrigation system, measurements included the length, number of spans, wet radius (with end gun, if applicable), and degrees rotation. We found that most of the overhead irrigation systems in the state were located in the mid-state region. County extension agents and other stakeholders in South Carolina could use this information to study and identify farms with center pivot and lateral move irrigation systems, and to determine information such as the acres irrigated and the number of systems per county.

Subject: 2022 General Conference Theme

Track: Water Resource Assessment and Management

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The Use of Biochar to Reduce Excess Nutrients in Water Bodies Used for Livestock Production

Authors: Nakana'ela R. Morton (USDA NRCS)*

Livestock (lvst) ponds with excess nutrients can cause a sudden increase in algae growth, causing hypoxia and leading to eutrophication (EU, excessive algae growth). EU often leads to Harmful Algal Blooms (HAB). As the bloom dies, certain cyanobacteria release toxins fatal to lvst when they drink the water. Thus, a method of removing nutrients from water is needed to prevent HAB growth. This project will examine biochar used as a filter in water bodies to absorb excess nutrients and prevent EU. Biochar is charcoal made from plant material and is capable of sequestering nutrients from water and soil. Biochar water treatment has values beyond existing practices like sand filters, lagoons, or treatment wetlands. Biochar is a low-cost and renewable adsorbent created using available biomaterials. Biochar enriched with nutrients may be used as a soil amendment to improve soil texture and provide a slow release of N and PO_4^{3-}. This project will use large biochar pellets encased in mesh placed along a flow path from lvst to ponds. If lvst have access to the pond, the filter can be placed in the pond itself to remove nutrients. The filter can be replaced as nutrient absorption maxes out. The design can be as simple as a large "teabag" of biochar placed near the lvst watering site for smaller water sources or moving waters like drainage ditches. Based on previous tests, we expect the size of the filter and receiving waters to be a significant design issue. Nutrient absorption efficiency is expected to decrease in larger or fast-moving streams where water can by-pass physical contact with the filters. A company located in AR has already begun the production of biochar, converting it into Powders for AG and lvst use that provide solutions for lvst waste mgmt. Applying biochar technology to remove nutrients from livestock wastewaters will benefit water quality in agricultural ponds. It will improve lvst health by avoiding issues associated with nutrient or algal toxin ingestion.

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