

Abstract Book

PRESENTED BY THE



JULY 24 – 27, 2016 GALT HOUSE HOTEL LOUISVILLE, KY

Table of Contents

- 3 Symposia Presentations (Monday, July 25)
- 9 Symposia Presentations (Tuesday, July 26)
- 15 Symposia Presentations (Wednesday, July 27)
- 19 Oral Presentations
- 115 Poster Presentations
- 154 Conservation Innovation Grants Showcase Oral Presentations
- 157 Conservation Innovation Grants Showcase Poster Presentations



JULY 24-27, 2016 • LOUISVILLE, KENTUCKY



SYMPOSIA PRESENTATIONS



Monday, July 25 Symposia Session Descriptions and Agendas

Precision Conservation: Landscape Design for Wildlife, Water Quality and Agricultural Productivity 10:30 a.m. – 12:00 p.m., Stanley

Presenters: Michael Schwartz, The Conservation Fund; Gwen White, Tallgrass Prairie, LCC; Jorgen Rose, Indiana

University

According to water quality assessments, Midwest states within the Mississippi River Basin (MRB) contribute the greatest nutrient load to the Gulf of Mexico. The Gulf Hypoxia Initiative, spearheaded by seven Landscape Conservation Cooperatives (LCCs), is an objective-driven process to target delivery of wildlife conservation practices across the MRB. Work teams of researchers and managers drafted design and policy considerations for 13 high-impact conservation practices that benefit wildlife, water quality, and agricultural productivity ("what to do"). The Conservation Fund has developed data sets and spatial decision support tools to be utilized as part of the Precision Conservation Blueprint v1.0 to map, evaluate, and select the most strategic places to implement these actions ("where to do it"). State, federal, tribal, and NGO partners in the LCCs have developed this framework to avoid duplication of effort and align their conservation work across multiple scales. This process is intended to be complementary to related efforts—such as the Hypoxia Task Force, Mississippi River Basin Initiative, and state nutrient reduction strategies—but with an emphasis on the ecological, economic, and social values of wildlife habitat. Participants in this working session will examine the set of high-impact conservation practices, web-based spatial analysis tools, and research products to (1) identify immediate opportunities to target investments in conservation delivery across the MRB, and (2) recommend next steps for research and model integration. Outcomes will be a well-defined set of actions including overcoming program/policy barriers, guiding user-designed tool interfaces, proposing demonstration sites for emerging practices, and developing basin-level, cross-sector monitoring strategies. View the spatial analysis and download data layers on Data Basin at http://databasin.org/groups/d52de40d017e4ce98c3914dba1bc4ee7.

Track: 2016 General Conference Theme Submissions - Great River Landscape

Subject Area: Adaptive Management of Conservation Efforts

Mississippi River Basin Partnerships: Working Towards Common Goals 10:30 a.m. – 12:00 p.m., French

Presenters: Katie Flahive, Environmental Protection Agency; Gwen White, USFWS; Paulette Akers, Kentucky Department for Environmental Protection; Rebecca Power, University of Wisconsin; David DeGeus, The Nature Conservancy

The Mississippi River Basin drains 41% of the contiguous United States, encompassing a variety of land uses. Managing this great river watershed to meet societal needs while protecting the water resource is a challenge requiring science-based policies, tools, cooperative stakeholder engagement, and robust plans and goals. The Hypoxia Task Force (HTF) was established in 1997 to understand the causes and effects of eutrophication in the Gulf of Mexico; coordinate activities to reduce the size, severity, and duration; and ameliorate the effects of hypoxia. The HTF supports implementation of state nutrient reduction strategies and management activities from all sources in the Mississippi River/Gulf of Mexico watershed. Although the HTF is a partnership of federal, state, and tribal agencies, managing nutrients across the basin to reduce Gulf impacts requires collaborative engagement across stakeholders. This symposium will showcase the partnerships and the diverse scope of work that is undertaken. Following an overview of the HTF history and goals by the co-chair, representatives from the state and federal members will share perspectives on managing this landscape. The SERA-46 multistate committee of researchers and extension specialists will describe HTF collaborations. Nongovernment organizations, industry, and foundations will describe work that the HTF leverages. The audience will be able to interact with and gain an understanding from these panelists of the goals in the Mississippi River Basin, the various players at work, and the ways extensive participation and communication are instrumental to reducing the size of the hypoxic zone in the northern Gulf of Mexico.

Track: 2016 General Conference Theme Submissions - Great River Landscape

Subject Area: Water Resources Assessment and Management

17th Annual SWCS-SSSA Joint Symposium: The Grand Challenge – Water: Food, Energy and Environmental Security

1:30 p.m. – 5:00 p.m., Stanley

Moderator: Jeffrey Strock, University of Minnesota

Food, energy, and environment are inextricably linked by water, and actions in one area more often than not have impacts in one or both of the others. Improved food, energy, and environmental security can be achieved through approaches that integrate management and policy sectors and scales. This symposium will explore how challenges and opportunities related to water supply and water quality intersect with meeting future food, energy, and environment goals. This symposium will explore how systems science can provide sound solutions and multiple options for decision-making by producers, manufacturers, consumers, and those involved in conservation professions. Invited presentations will include contemporary and visionary addresses on the connectivity between water and future food, energy, and environmental security. A series of six, 30-minute presentations will include various perspectives on water for food, energy, and environmental security. This joint symposium will continue the tradition of cooperation between the two societies and will help create opportunities to disseminate information regarding solutions to new opportunities in soil and water management and conservation.

Presentation 1: Water Availability and Management for Food Security – Jerry Hatfield, UDSA-ARS

Food security is directly linked to water security for food production. Water availability for crop production will be dependent upon precipitation or irrigation, soil water holding capacity, and crop water demand. The linkages among these components in rainfed agricultural systems shows the impact of a variable precipitation regime among years, the increasing crop water use rates due to climate change, and variable soil water holding capacity within a field. In rainfed environments water management strategies focused on increasing water storage in the soil profile and reducing soil water evaporation rates provide for increased crop productivity and reduced variation in production among years. In temperate regions, the shift in seasonality of precipitation to a reduced and more variable summer rainfall pattern increases the positive impact of water management on food security. Irrigated environments are often considered as being more resilient to variations in environmental conditions because of the ability to supply water to meet atmospheric demand; however, there are two aspects which need greater attention. First is management practices that improve irrigation efficiency to enhance food production per unit of water applied. Second is the improved understanding of how climate and soil interact to determine the need for irrigation and how supplemental irrigation could offset the impacts of short-term water stress at critical growth stages. If we assume that food production is a direct function of water availability then food security will also depend upon water availability. Management of agricultural systems to provide food security will require increased attention to the soil resource in both irrigated and rainfed environments because both result in increased quantity and quality of food production to ensure food security. Management of our agricultural systems for food security will place a greater emphasis on the management of our soil and water resources.

Presentation 2: Water and Energy Security: Can We Satisfy the Need for Both? – Alan Hoffman, USDA-NRCS

Water and energy are as basic as it gets. Access to both is critical to food production, economic activity, public health, poverty reduction, and national security. It is also true that policy goals associated with providing adequate supplies of clean water and adequate supplies of energy are often in conflict. This creates a conundrum: can we satisfy increasing demands for both as populations increase and expectations and demands increase in both developed and developing parts of the world? What is today's water-energy situation and what are those demands? What are the necessary trade offs? The conflict arises from the fact that water and energy issues are inextricably linked, and this linkage is referred to routinely today as the water-energy nexus. Water is needed to produce fuels and energy and energy is needed to ensure water availability and delivery of water services. As demand for one increases so does the demand for the other. This was not a problem in 1900 when the world's population was 1.8 billion, but with today's population of 7 billion, estimated to reach as high as 10 billion in 2050, a serious and potentially overwhelming problem exists. What can we do

to meet these global needs in a sustainable fashion? How do we ensure water and energy security? This presentation will provide a context for examining these questions and some thoughts on possible answers.

Presentation 3: Multisector Landscape Planning Can Meet Large-Scale Conservation Challenges Supporting Water Quality, Agricultural Productivity, and Wildlife Habitat from Midwest Grassland Birds to Gulf Coast Shrimp – Gwen White, US Fish and Wildlife Service

According to water quality models and related assessments, Midwestern states and the Mississippi Alluvial Valley within the upper Mississippi River watershed currently contribute the greatest nutrient load to the Gulf of Mexico hypoxic zone. The community could use optimization tools that prioritize the design and configuration of conservation actions that would appeal to upstream agricultural communities under a range of climate extremes. The Mississippi River Basin/Gulf Hypoxia Initiative, spearheaded by seven Landscape Conservation Cooperatives, is undertaking a strategic and transparent process to create an integrated framework that supports planning, design, configuration and delivery of water quality enhancement and wildlife conservation practices within targeted locations across the watershed. Work Teams of researchers and managers across the LCCs have identified and described the design/policy considerations for 14 highly effective conservation practices that protect and enhance wildlife habitat while complementing ongoing efforts that reduce nutrient loads to the Gulf of Mexico hypoxic zone and benefit agricultural production through ecosystem services. The Conservation Fund is working with the LCCs to develop datasets and decision support tools formulated as a Precision Conservation Blueprint 1.0 to map, evaluate, and select the most strategic and cost effective places to invest conservation dollars. Scenario planning could explore land use shifts, climate forecasts and consequences for adaptation strategies in response to ecological or economic drivers over a range of time scales. The Initiative plans to use this framework to enhance organizational capacity, avoid duplication of effort, streamline prioritization and evaluation of conservation actions, and align the work of agencies and organizations across multiple scales. This effort is complementary to related on-going efforts, like the Gulf of Mexico Hypoxia Task Force, Mississippi River Basin Initiative, and state nutrient reduction initiatives, but with an added emphasis on the ecological and social values of wildlife habitat.

Track: 2016 General Conference Theme Submissions - Great River Landscape

Subject Area: Water Resources Assessment and Management

Farmer Leadership for Improved Water Quality 1:30 p.m. – 3:00 p.m., French

Moderator: Julia Olmstead, University of

Wisconsin Extension

Nutrients and associated contaminants running off of agricultural lands degrade and threaten water quality and aquatic ecosystems across much of the United States as well as internationally. Yet policies and plans supporting conservation practices to reduce agricultural runoff rely primarily on incentivized voluntary actions by farmers. While the importance of engaging farmers to accomplish water quality goals is widely recognized, implementing plans on working landscapes remains very challenging. Some watersheds in the Midwest are gaining experience with a collaborative watershed council model that relies on farmer leadership in identifying and addressing these water quality issues. This farmer-led model is also driven by farmer-selected or defined performance measures and low-cost, locally determined incentives. This symposium will explore the challenges, limitations, and opportunities of a collaborative approach to natural resources management that relies on planners and agencies to initiate a process and then step back to allow farmers (with local and applied knowledge) to define the problem on their terms and outline performance measures and incentives for addressing the problem. Analysis of this approach is based on data from farmer-led watershed council projects in Iowa and Wisconsin, Chad Ingels, from Iowa State University Extension, will present on northeast Iowa watersheds that have substantially reduced nutrient and sediment loading to surface waters using an adaptive, performance-based incentives approach. Julia Olmstead and Ken Genskow, from University of Wisconsin Extension, will present on four farmer-led watershed councils established in that state in 2013, based on the Iowa model. Analysis of these councils is based on biological data, participation rates, conservation practice adoption, and interviews with key participants and with conservation and agency stakeholders observing from a distance with varying degrees of skeptical optimism.

Track: 2016 General Conference Theme Submissions - Great River Landscape

Subject Area: Outreach, Education, and Community Engagement

From Farm to Table: A Continuum of Agricultural Evolution and Community Supported Agriculture 3:30 p.m. – 5:00 p.m., French

Presenters: Dana York, Green Earth Connection; Bob Ensor, Howard Soil Conservation District, Maryland

This symposium will track methodologies and successes in engaging communities in agricultural activities starting with increasing on-farm awareness through training of new nontraditional and beginning farmers, to marketing efforts that have proven successful. This presentation will start with an effort to increase community awareness (Farm Academy, Maryland); travel through training of budding agricultural entrepreneurs (East Tennessee Beginning Farmer Field School, Tennessee); include marketing through community farmers' markets and a nonprofit farm store (Boone Street Market, Tennessee); and end with a program of novel product packaging and delivery to disadvantaged neighborhoods (Roving Radish, Maryland). In this presentation, you will find out how concerned citizens and the local food movement in vastly different areas of the United States gave birth to these efforts and how they are now supporting a new generation of nontraditional farmers who want not only to protect and enhance our agricultural resources, but also provide healthy, locally produced vegetables and meats for themselves and profit. It will discuss the shift from a Saturday farmers' market to a six-day-a-week, year-round farm store as well as to delivery of farm products to neighborhoods, including disadvantaged areas. With the increased interest for locally produced food, the continued loss of more traditional farms, and more individuals wanting to "start" a small-scale farm enterprise, these efforts can be duplicated in virtually every area of the United States if properly initiated and implemented with community support. The positive outcomes from these efforts are increased agricultural literacy among the general public; beginning farmers who are well versed in agricultural production and conservation; creation of markets for locally grown foods, and improved access in disadvantaged communities to fresh farm products.

Track: 2016 General Conference Theme Submissions - Great River Landscape

Subject Area: Conservation and Nontraditional Agriculture

Tuesday, July 26 Symposia Session Descriptions and Agendas

10:30 a.m. - 12:00 p.m., Stanley

Water Quality Targeting Success Stories: Achieving Cleaner Water through Farm Conservation Watershed Projects

Presenters: Michelle Perez, American Farmland Trust; Chad Ingels, Formerly Iowa State Extension; Shanon Phillips, Oklahoma Conservation Commission; Kandi Manhart, Glenn County Resource Conservation District; Lester Messina, Colusa Glenn Subwatershed Program

How do you clean up agriculturally impaired waterbodies with farm conservation practices? One targeted watershed project at a time. This symposium will share lessons learned from six "Water Quality Targeting Success Stories" featured in an upcoming report by World Resources Institute and the American Farmland Trust. The projects used instream monitoring to detect water quality improvements attributable to farm conservation practices adopted in the watershed. Successful projects were found in California, Oklahoma, Iowa, Wisconsin, and Indiana. Leaders of three projects will participate in the symposium.

Given that hundreds of similar projects exist under several USDA programmatic frameworks (e.g., Landscape Conservation Initiatives or LCIs) and hundreds more are getting started (Regional Conservation Partnerships Program), the report highlights best practices to increase the likelihood of similar levels of success.

Methods included literature reviews and interviews with USDA staff, farm conservation and water quality experts, and leaders of the six projects. Project leaders attribute their success to 16 key factors. Comparing the case studies resulted in 11 lessons about designing, implementing, and evaluating successful targeted watershed projects. Recommendations are provided for USDA, EPA, and others to help other projects achieve and measure landscape-scale environmental outcomes.

Findings include the following: three projects (California, Oklahoma, and Iowa) relied on farmer leadership to design their projects and encourage farmer participation; three projects (Oklahoma, Iowa, and Wisconsin) used their state Phosphorus Indices (PI) to geographically target project resources to fields with the highest phosphorus losses; two projects (Iowa and Wisconsin) used the PI to also estimate field-scale and project-level outcomes; one project (Indiana) detected a third less in-stream nitrate and phosphorus just nine months after practice implementation; and two projects proposed their streams be delisted for *E. coli* (Oklahoma) and sediment (Wisconsin).

Track: 2016 General Conference Theme Submissions - Great River Landscape

Subject Area: Water Resources Assessment and Management

1:30 p.m. - 5:00 p.m., Stanley

Effectively Engaging Private Water Well Owners in Best Practices for Protecting Groundwater and Human Health

Presenters: Diane E. Boellstorff, Texas A&M AgriLife Extension Service; Jason Barrett, Mississippi State University; Drew M. Gholson, Texas A&M AgriLife Extension Service; Erin Ling, Virginia Tech; Steve Wilson, Illinois State Water Survey

More than 13 million households nationwide depend on private water wells for their water supply. Public drinking water supplies are generally of good quality and are monitored through requirements of the federal Safe Drinking Water Act; however, private well owners are independently responsible for monitoring the quality of their wells and frequently at greater risk for compromised water quality. Well owners also may be simultaneously introducing contaminants to groundwater resources stored in aquifers. Management and protection of private water wells are under the landowner's control, and therefore, depend primarily on education rather than regulation. The primary goals of the symposium are to share recent approaches for and challenges to effectively delivering educational information to private well owners, and to discuss further regional or national collaboration or planning. Additional topics such as using microbial tracking techniques to identify *E. coli* sources; environmental justice issues including strategies for assisting low and fixed income well owners; and best practices for communicating how to test for and treat emerging contaminants in well water may be included. Representatives from eight states (Illinois, Virginia, Kentucky, Georgia, Mississippi, Rhode Island, North Carolina, and Texas), EPA, and the National Ground Water Association are included on the panel and will participate in the discussion.

Presentation 1: Addressing Clientele Needs: Recent Increased Installation of Irrigation Wells in Western Kentucky – Brad Lee, University of Kentucky; E. Glynn Beck, University of Kentucky

Kentucky precipitation was uncharacteristically low in 2010 and 2012. This environmental condition coupled with the high corn prices in 2011 - 2013 (average annual price > \$6.00 bu⁻¹) led to the increased installation of pivot-irrigation systems in western Kentucky. From 2010 to 2015 over 100 high-yield (300 to 1200 gal/min) irrigation wells were installed. Irrigation is relatively new to Kentucky corn producers and there are numerous questions from clientele groups ranging from seeding rates and nutrient requirements to water quantity and quality. To address these educational needs the Kentucky Geological Survey (KGS), Kentucky Division of Water and the University of Kentucky College of Agriculture, Food and Environment are partnering in several endeavors. The western Kentucky UK Research and Education Center is expanding to include the Grain Crops Center of Excellence, which will include a scaled irrigated corn and soybean production system as well as edge-of-field water quality monitoring demonstration sites. The KGS has installed a groundwater monitoring network across the state to monitor baseline levels in the major aquifers and key springs in row crop agricultural regions of the state. Collaborative educational programs are being developed to educate the western Kentucky County Cooperative Extension Service (CES) agents in a train-the-trainer format to prepare the 34 western Kentucky CES offices (50% have Agriculture and Natural Resource Agents with less than 4 years experience) to address well and irrigated agricultural system questions. These programs include extension district and statewide workshops, monthly webinars and new agent training sessions. Resources developed for the agents to deliver to their clientele include Kentucky CES bulletins, videos and newsletter articles.

Presentation 2: Texas Well Owner Network: Protecting Groundwater Resources and Human Health – *Drew M. Gholson; Diane E. Boellstorff, Texas A&M AgriLife Extension Service*

The Texas Well Owner Network (TWON) is offered state-wide for Texas residents to become familiar with groundwater resources, septic system maintenance, well maintenance, water conservation, water quality and water treatment. Primary goals of the program are changes in knowledge, awareness, attitudes and actions of private water well managers and improvement of private well management to safeguard homeowner health and protect aquifer integrity. The program also offers the opportunity for participants to bring water samples from their own water well to be screened for nitrate-nitrogen, total dissolved solids, and *E. coli*. Participants with water samples exceeding the maximum containment levels are provided recommendations to improve water quality. Training is delivered through educational presentations and easy-to-understand publications. Post-training evaluation data not only indicate a large percentage of attendees intend to adopt behaviors to protect or improve water quality, but also 6 month follow-up surveys confirm that a high number of

participants have adopted best management practices protecting or remediating their well water. The TWON program aims to help private well owners understand their role in protecting their water supply and groundwater resources.

Presentation 3: Bacterial Source Tracking: Potential Application to Drinking Water Wells – Terry Gentry, Texas A&M University; Diane Boellstorff, Texas A&M AgriLife Extension

Bacterial Source Tracking (BST) has been used for over ten years in Texas to determine sources of water impairments. Various BST approaches have been integrated into numerous watershed protection plans and total maximum daily load projects across the state. Considerable effort has been made toward developing a statewide Texas *E. coli* BST library from potential sources of fecal contamination including humans, livestock, and wildlife. Additionally, library-independent methods targeting source-specific *Bacteroidales* markers including humans, ruminants, feral hogs, and horses, have been used to complement the library-dependent work. These, and other, BST methods will be discussed along with their potential use for characterizing fecal bacterial impairments in drinking water wells.

Presentation 4: Lead in Well Water: Concentrations, Remediation, and Regulations – *Kelsey Pieper, University of North Carolina*

To prevent waterborne exposure, the USEPA regulates and monitors lead in water and plumbing components per the Safe Drinking Water Act. However, approximately 47 million U.S. residents (15% of population) are reliant on private water systems, which are not regulated by the EPA and not subject to the standards outlined in the Lead and Copper Rule. With system maintenance and water quality monitoring solely the responsibility of the homeowner, state surveys report that 12-19% of private systems exceed the lead action level of 15 μ g/L, with concentrations as high as 24,740 μ g/L. This presentation provides an overview of recent research conducted at Virginia Tech. Between 2012 and 2014, 2144 private drinking water samples were analyzed to identify factors that increased the likelihood of lead release and evaluate lead remediation strategies. A follow-up study was conducted to assess lead leaching throughout the entire plumbing system, and revealed three patterns of waterborne lead exposure in Virginia: (1) no elevated lead or lead elevated in the first draw of water only; (2) spikes of particulate lead mobilized from plumbing during periods of water use; (3) and sustained detectable lead concentrations (\geq 1 μ g/L) even with extensive flushing. Lastly, lead leaching potential from brass and galvanized steel meeting the lead-free requirements was examined to determine risks related to waterborne lead in private systems and provide insights into the protection offered to private system homeowners.

Presentation 5: Rhode Island Private Well Owners Take Action to Protect Their Drinking Water – Alyson McCann, University of Rhode Island Cooperative Extension

Approximately 10 - 15% of Rhode Islanders (100,000 - 150,000) depend on private wells for their drinking water supply. Areas in Rhode Island (RI) that rely on private wells are a mix of suburban and rural land uses that can contribute contaminants to the groundwater. The RI Department of Health requires well water testing at property sale or when a new well is installed. However, routine testing is not regulated and is the voluntary responsibility of the private well owner. These well owners need to know what to test for, where to have the testing done, how to interpret the test results, and if any follow-up steps are needed. Most importantly, they need to know where they can go for trusted, expert information.

Promotion of private well protection has long been the focus of educational programming by the University of RI Cooperative Extension's Water Quality Program and the RI Department of Health. We partner with community agencies and organizations to educate and motivate private well owners to test and take action to protect their drinking water. We use a modified Home*A*Syst—based approach as an active-learning process that seeks to engage participants in site-specific activities at their home to test and protect their well water; an approach that has been successful in empowering well owners to take action.

Our program methods include single-session workshops; a community-intercept campaign; techniques to promote well water testing; audience-tested written materials; and a web presence. We use Geographic Information Systems (GIS) to identify: 1) areas that require targeted outreach based on specific land use criteria and well water testing results; and, 2) locations for community events that are convenient for our audience. Program impact assessments indicate that participants take action to protect their drinking water, including: testing drinking water wells; contacting resource experts for more information and assistance; sharing information with family and friends; and, adopting best management practices to protect well water.

Presentation 6: A Study of Private Well Owner Outreach Programs: Discovering Factors Critical to Effectively Motivating Well Owners to Act to Protect Drinking Water Quality – Cliff Treyens, National Ground Water Association

Background: Approximately 38 million people (about 13 percent of U.S. households) rely on domestic wells as their source of drinking water. Unlike community water systems, which are regulated by the Safe Drinking Water Act, there is no comprehensive national program to ensure that the water is tested and safe to drink. In 2014, the Centers for Disease Control and Prevention collaborated with the National Ground Water Association (NGWA) to collect data from private well educational outreach program managers to gain a better understanding of existing programs and their gaps and barriers.

Methods: Using a structured data collection instrument, NGWA interviewed, by phone and in-person, 30 state and local well owner outreach program managers, eight private-sector home water treatment providers, and four regulators. Information collected from the instrument included program descriptions, program assessments, and program manager expert opinions. Programs were selected based on factors including (a) size [i.e., statewide to local]; (b) approaches [i.e., traditional and novel]; (c) experience; (d) testing focus [single contaminant versus multiple contaminants]; and (e) existing well owner awareness [i.e. programs driven, in part, by public awareness of a groundwater-based health threat.] A literature search and analysis developed a framework that delineated key components of an effective private well owner outreach program, and the interview information was compared to that framework.

Results: Most program managers believed they were only reaching a small percentage of the total private well owners in their target areas. Program managers described inconvenience, cost, and lack of knowledge and motivation as common barriers preventing well owners from testing and treating their well water. Few programs measured the proportion of well owner population reached or whether those reached acted to mitigate water-related health risks. Program managers offered innovative approaches to overcoming the barriers of insufficient funding, personnel, and/or expertise to reach and effect behavior changes among well owner populations in their target areas.

Conclusions: These findings can be used by CDC and state/local environmental health staff to develop practical guidance and tools for current and future well owner outreach programs to improve effectiveness in motivating well owners to protect their water.

Track: 2016 General Conference Theme Submissions - Great River Landscape

Subject Area: Outreach, Education, and Community Engagement

1:30 p.m. – 3:00 p.m., French

Water Quality Trading: Lessons from the Field Presenters: Bill Berry and Beth Mason, National Association of Conservation Districts; Brian Brandt, American Farmland Trust; James Klang, Kieser and Associates, LLC; Ann Sorensen, American Farmland Trust

Water Quality Trading continues to emerge as one strategy to achieve water quality goals in certain settings. The National Association of Conservation Districts (NACD) and American Farmland Trust (AFT) are cooperating in a Conservation Innovation Grant designed to accelerate and expand participation of farmers and private land managers in environmental markets by fully engaging Soil and Water Conservation Districts (SWCDs) across the nation as key market intermediaries. To engage and empower SWCDs, NACD and AFT have undertaken an effort to analyze and summarize the experiences of 10 SWCDs involved in three different environmental markets and prepare a business case for SWCD involvement in environmental markets. The business case will include development of model criteria, funding needs, and recommendations for districts interested in engaging in ecosystem markets. The project includes developing and distributing a handbook that outlines an educational/engagement approach and includes materials (PowerPoint presentations, fact sheets, and supporting materials) for use by SWCDs, their state associations, NACD, and partners. Participants will learn about key findings from case studies. Their input will be sought on lessons learned from their own experiences, appropriate messaging, and other needs to encourage development of secure and robust trading programs.

Track: Water Quality Trading

Subject Area: N/A

3:30 p.m. - 5:00 p.m., French

Build It and Will They Come? Engaging Farmers in Water Quality Trading

Presenters: Kari Cohen, USDA-NRCS; Jessica Fox, Electric Power Research Institute; Peter Hughes, Red Barn

Consulting; Brian Brandt, American Farmland Trust

Water quality trading markets depend on both a demand for and a sufficient supply of water quality credits. While it appears that a lack of demand is currently afflicting a number of water quality trading programs, it is often assumed that farmers are willing and able to generate sufficient supplies of credits through implementation of conservation practices on their operations.

This symposium will explore the validity of this assumption and address a number of questions--What factors are critical to gaining participation by farmers in trading programs? To a farmer, is participating in a trading program different from participating in federal, state or local conservation programs? How concerned are farmers about transparency requirements that are often included in trading programs? What are the ramifications for farmers of having their nutrient reductions quantified and shared?

This symposium will feature three speakers/panelists who will address these critical questions and more. They will dig into details about how to successfully engage farmers in water quality trading programs, share experiences (both good and bad), and make recommendations for other water quality trading practitioners.

Track: 2016 General Conference Theme Submissions - Great River Landscape

Subject Area: Water Resources Assessment and Management

Wednesday, July 27 Symposia Session Descriptions and Agendas

8:30 a.m. - 10:00 a.m., Stanley

NRCS Resource Stewardship Evaluation: A New Framework for Achieving Conservation Stewardship Goals,

Landscape Resiliency, and Sustainability Moderator: *Aaron Lauster, USDA-NRCS*

The USDA Natural Resources Conservation Service (NRCS) is piloting the new Resource Stewardship Evaluation (RSE) tool and service, which provides farmers and ranchers with a roadmap to achieve their natural resources stewardship goals, landscape resiliency, and sustainability. The RSE tool is designed to improve planning efficiency and measure environmental benefits. It is being developed with the expectation of receiving additional incentives for achieving a stewardship threshold. This symposium will feature a discussion of the tool and pilots and results achieved during the past two years. Speakers include RSE developers, pilot partner organizations, and client farmers.

Track: 2016 General Conference Theme Submissions - Great River Landscape

Subject Area: Conservation Models, Tools, and Technologies

8:30 a.m. – 12:00 p.m., French

The Watershed Approach: Finding a Way to Achieve a 45% Nitrogen Reduction

Moderator: Joe Magner, University of Minnesota

Reduced nutrient export from watersheds in the upper Midwest to the Gulf of Mexico is moving forward through the development of state nutrient management strategies and field-based research. This symposium will focus on the lessons learned from a minor (12-hydrologic unit code) watershed in north-central Indiana. In 2011, the Environmental Defense Fund pulled together a team of conservation experts in Washington, DC, to brainstorm how focused research efforts could be integrated into an overall approach to reduce nitrogen export from the upper Midwest to the Gulf of Mexico. Concepts were presented to NRCS management to suggest an alternative approach to getting best management practices (BMPs) on the landscape in a more comprehensive and dynamic way. The team, led by Eileen McLellan, explored how technical tools (e.g., GIS/LiDAR) could be coupled with social savvy to augment landowner adoption. A "Watershed Approach" protocol has been unfolding over the last 4 years, initially with small watershed projects in Iowa, Minnesota, and Indiana, followed by a three-year Conservation Innovation Grant (CIG) in the Beargrass Watershed near Manchester, Indiana. We are in the final year of the Beargrass CIG and desire to share lessons learned and obtain feedback from symposium participants.

Presentation 1: Introduction to the Watershed Approach – *Eileen McLellan, Environmental Defense Fund*

A "Watershed Approach" protocol has been unfolding over the last four years; initially with small watershed projects in Iowa, Minnesota and Indiana, followed by a three-year conservation innovation grant (CIG) in the Beargrass Creek Watershed north central Indiana, North Manchester IN. This presentation will describe the components of the watershed approach to a 45% nitrogen reduction.

Presentation 2: Physical, Chemical, and Biological Monitoring of Beargrass Creek – *Jerry Sweeten, Manchester University*

We have conducted geomorphic surveys of the stream channel, developed two gage stations (at the mouth and mid-shed) to define flow and concentration of nutrients. We have also conducted fish and macroinvertebrate surveys to assess the aquatic health; multi-years of data will be presented to define the project starting point.

Presentation 3: Building a Comprehensive Nutrient Budget – Herb Manifold, University of Minnesota

A comprehensive nutrient budget is need to better understand the extent of the nutrient sources within a watershed. A strategic plan was developed and implemented to track nutrients from application, as manure or commercial fertilizer, to the exit point of the watershed. This data provides two benefits. First, it provides a baseline nutrient budget for the watershed to compare future work. Secondly, data can be used to determine where there are "leaky" elements of the watershed to more precisely implement BMP's.

Presentation 4: Building a Comprehensive Menu of BMPs Using the Agricultural Conservation Precision Framework (ACPF) – Mark Tomer, USDA-ARS

ACPF provides a framework for discussing conservation options. In the Beargrass Creek watershed we specifically looked at best management practices focused on how to reduce nitrogen loss to the flowing creek water. Maps are presented to illustrate the type and location of practice.

Presentation 5: Engaging Beargrass Creek Landowners Using ACPF Maps – Susi Stephan, Wabash County Soil and Water Conservation District

We held two meetings where landowners were invited to learn about the project and ask questions about options. We approached each landowner to learn more about their operation and to meet one-on-one using the ACPF map menu to both educate and spark interest in trying something new.

Presentation 6: Field Validation of ACPF Options and Landscape Tailoring of BMP Design – *Joe Magner, University of Minnesota*

ACPF map results were very consistent with on-the-ground observations. The tool can only estimate the depth of the water table, so validation of field tile locations and relative elevation proved helpful in estimating hydrologic pathways and processes. Further recon of oxbow re-connection to the main channel was necessary to evaluate economic feasibility.

Presentation 7: Assessing Landowner Interest and Responsiveness – Linda Prokopy, Purdue University

Presented results will illustrate how social science data is a key component of the watershed approach that helps identify watersheds with sufficient capacity to create positive change, provides information to help design stakeholder meetings, and generates insights into local awareness, attitudes and concerns about conservation practices.

Presentation 8: SWAT Modeling of Nutrient Response to BMPs in the Beargrass Creek Watershed – *Kartin Bieger, Texas A&M AgriLife Blackland Research Center*

A SWAT model was constructed for the Beargrass watershed to provide long-term evaluation of the implemented BMPs. Both EQIP and Section 319 funds have been set aside for the Beargrass Creek watershed.

Presentation 9: Resources to Implement the Plan – *Jill Reinhart, USDA-NRCS*

NRCS has worked with project partners to continue to make targeted Farm Bill funding available in the Beargrass watershed to support the partnership efforts. The project originally had Mississippi River Basin Initiative targeted funding (2010-2016), and now has also been named a National Water Quality Initiative watershed. These funds are available to help farmers implement best management practices to help protect water quality in conjunction with productive farming.

Track: 2016 General Conference Theme Submissions - Great River Landscape

Subject Area: Water Resources Assessment and Mangement

10:30 a.m. – 12:00 p.m., Stanley

Innovation in Conservation Policy: Updates on the Conservation Stewardship Program and Reports from the Field

Presenters: Alyssa Charney, National Sustainable Agriculture Coalition; Rex Dufour, National Center for Appropriate Technology; George Reistad, Michael Fields Agricultural Institute

The Conservation Stewardship Program (CSP) is a comprehensive working lands program that provides technical and financial assistance to farmers and ranchers to protect critical natural resources, including major river landscapes. CSP enhancements allow producers to address water quality through activities related to nutrient and pest management. grazing, tillage, crop rotation, and cover cropping. This symposium will examine the significant changes planned for CSP in 2017, as well as the National Sustainable Agriculture Coalition's (NSAC) analysis of more than 70 million acres enrolled in CSP since 2009. CSP contract holders selected over 75,000 water related enhancements, representing more than 30 percent of all enhancements chosen between 2009 and 2015. This analysis also sheds light on a disconnect between the most frequently selected and highest ranked conservation enhancements. This disconnect presents a clear need for 2017 updates to ensure that CSP participants are appropriately rewarded for their conservation benefits. In addition to an analysis of program results and the upcoming major changes, the symposium will bring forward farmer perspectives through organizations that have worked closely with CSP participants over the past 10 years. Combined analyses have identified significant barriers to accessing the program for small acreage, specialty crop, and organic producers. The NSAC will provide a detailed analysis of what the upcoming changes mean for conservation outcomes, activities available to participants, and how the new system will reward environmental benefits. NSAC's analysis will include the upcoming rollout of the revised program and also consider future options for additional changes via another round of administrative changes and the next farm bill. Organizations from Wisconsin and California will present findings from their CSP surveys, speaking to how the upcoming changes will address barriers that participants have encountered in the past.

Track: 2016 General Conference Theme Submissions - Great River Landscape

Subject Area: Conservation Economics and Policy



ORAL PRESENTATIONS



Adaptive Management Methods to Protect the California Sacramento-San Joaquin Delta Water Resource

Authors: David Bubenheim*, NASA Ames Research Center

Abstract: The California Sacramento-San Joaquin River Delta is the hub for California's water supply, conveying water from Northern to Southern California agriculture and communities while supporting important ecosystem services, agriculture, and communities in the Delta. Changes in climate, long-term drought, water quality changes, and expansion of invasive aquatic plants threatens ecosystems, impedes ecosystem restoration, and is economically, environmentally, and sociologically detrimental to the San Francisco Bay/California Delta complex. NASA Ames Research Center and the USDA-ARS partnered with the State of California to develop science-based, adaptive-management strategies for the Sacramento-San Joaquin Delta. We will present specific remote sensing and modeling methods developed to provide unique mapping and assessment capability at a landscape scale. On the ground/water validation and operational utilization of these products by management agencies to improve decision making, management effectiveness and efficiency will be discussed. Results of modeling for the San Joaquin and Sacramento River watersheds and input to the California Delta using the Soil-Water Assessment Tool (SWAT) as well as modifications to SWAT to account for unique landscape and management of agricultural water supply and drainage within the Delta will be presented. Modifications include addition of aquatic plant models responsive to altered environments. These tools are combined to identify and quantify the presence and distribution of floating and submerged invasive aquatic plants, understand the forces driving recent population expansion, and aide in directing and assessing management practices. The project combines science, operations, and economics related to integrated management scenarios for aquatic weeds to help land and waterway managers make science-informed decisions regarding management and outcomes.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Adaptive Management of Conservation Efforts

Adapt-N: A Cloud-Based Computational Tool for Crop Nitrogen Management that Improves Production and Environmental Outcomes

Authors: Aaron Ristow*, Cornell University; Harold van Es, Cornell Unviersity

Abstract: Maize production accounts for the largest share of crop land area in the US and is the largest consumer of nitrogen (N) fertilizers, while also having low N use efficiency. Routine application of N fertilizer has led to documented environmental problems and social costs. Adapt-N is a computational tool that combines soil, crop and management information with near-real-time weather data to estimate optimum N application rates for maize. Its cloud-based implementation allows for tracking and timely management of the dynamic gains and losses of N in cropping systems. This presentation will provide an overview of the tool and its implementation. We also evaluated Adapt-N tool during five growing seasons using both side-by-side (SBS) strip trials and multi-N rate experiments. The SBS trials consisted of 115 on-farm strip trials in Iowa and New York, each including yield results from replicated field-scale plots involving two sidedress N rate treatments: Adapt-N-estimated and Grower-selected (conventional). The Adapt-N rates were on average 53 and 30 kg ha-1 lower than Grower rates for NY and IA, respectively (-34% overall), with no statistically significant difference in yields. On average, Adapt-N rates increased grower profits by \$63.9 ha-1 and resulted in an Adapt-N estimated decrease of 28 kg ha-1 (38%) in environmental N losses. A second set of strip trials involved multiple N-rate experiments which allowed for the comparison of Adapt-N and conventional static recommendations to an Economic Optimum N Rate (determined through response model fitting). These trials demonstrated that Adapt-N can achieve the same profitability with greatly reduced average N inputs of 20 lbs N/ac for the Midwest and 65 lbs N/ac for the Northeast, resulting in significantly lower environmental losses. In conclusion, Adapt-N recommendations resulted in both increased growers profits and decreased environmental N losses by accounting for variable site and weather conditions.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Adaptive Management of Conservation Efforts

Analyzing Future Threats to Farm and Ranchland at the National Level

Authors: Alice Sorensen*, American Farmland Trust; John Larson, American Farmland Trust; David Theobald, Conservation Science Partners

Abstract: American Farmland Trust and Conservation Science Partners are using remotely-sensed and mapped datasets, advanced techniques in data analysis and predictive models to better understand current and future threats to America's most valuable farmlands. In this presentation, we will showcase our methodological development. We will discuss our completed base map of current agricultural lands in the U.S. This unique map harmonizes key land cover and use data from the National Resources Inventory, National Land Cover Data and the NASS Cropland Data Layer at a 2-5 acre resolution to show the extent of agricultural production in a spatially explicit way. We will then combine land cover data with data about farmland quality from SSURGO (e.g. prime, state important, soil productivity, unique) and other attributes of agricultural land that make it important to the public (local foods, wildlife habitat, watershed functions, scenery/open space, recreation) to identify the nation's most valuable farmland. We will then describe our plans to conduct a retrospective analysis of farmland lost to development over the past three decades, and the development of future predictive maps to incorporate likely scenarios of housing density changes along with likely impacts of climate change to 2040. Concurrent with the development of maps, AFT is developing a policy scorecard to set a baseline and measure the progress of individual States towards protecting and conserving farmland resources for future generations and provide citizens with the technical assistance they will need to take action on the ground. The ultimate goal of AFT's efforts is to ensure that the U.S. protects and conserves enough land to produce an adequate supply of food and fiber to feed an expanding population.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Adaptive Management of Conservation Efforts

Effects of Cover Crops, Residue Removal and Tillage on Soil Organic Carbon

Authors: Jennifer Turner*, USDA/NRCS; Kenneth Olson, University of Illinois

Abstract: Retaining soil organic carbon (SOC) is important to soil health and sustainable agriculture. This study examines the effects of cover crops, residue removal, and tillage on soil organic carbon (SOC) stock using pretreatment method to determine storage, retention and loss of SOC in the Grantsburg soil. The Grantsburg soils were on a sloping (6%) upland interfluve near Dixon Springs, Illinois. Grantsburg soils are well drained with a crop rotation was corn and soybeans grown in alternate years. The tillage treatments were no-till, chisel plow and moldboard plow. The cover crop treatments were cereal rye after corn and hairy vetch after soybeans. Approximately 90% of the corn residue was removed with no removal of the soybean residue from 3 replications. The impact of the various tillage methods, cover crops, and row crop residue removal on SOC stock was determined. The SOC stock was measured to a 75 cm depth (root zone). A pretreatment SOC stock (baseline) was compared with the end of the study SOC stock with or without cover crops, with or without residue removal, and for 3 tillage method treatments. The soil loss on the MP and CP treatments were higher than tolerable (T) limit for the Grantsburg soil and NT treatment was within T. The study found that SOC stocks increased after four years for all three tillage treatments. Under the application of cover crops the SOC stocks were higher than without cover crops. Residue removal treatments lowered the SOC stocks when compared to plots with residue retained. For most treatments, the corn and soybean yields were not statistically different. Cover crops appear to be a way to mitigate the SOC losses result of corn residue removal and to restore and maintain SOC stocks.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Adaptive Management of Conservation Efforts

Nitrogen Fertilizer and Rotation Effects of Sorghum-Sudangrass on No-Till and Strip-Till Corn Yields and Physiological Responses

Authors: Jorge Delgado*, USDA; Ardell Halvorson, USDA; Steve DelGrosso, USDA; Daniel Manter, USDA; Catherine Stewart, USDA; Robert D'Adamo, USDA; Bradley Floyd, USDA

Abstract: Rotation effects of irrigated no-till (NT) and strip-till (ST) sorghum-sudangrass (Sorghum bicolor x S. sudanense) (Ssg) and nitrogen (N) fertilizer on corn (Zea Mays L) yields were studied during the 2014-2015 growing seasons in a Fort Collins clay loam soil at the CSU ARDEC near Fort Collins, CO. We compared continuous corn NT (CC-NT) and ST (CC-ST) with C-Ssg-NT and C-Ssg-ST. The NT N fertilizer rates were 0, 34, 67, 134, 202 and 246 kg N ha-1. The ST N fertilizer rates were 0, 67, 134 and 202 kg N ha-1. Fifteen corn plants were collected at 146 days after planting (DAP) to determine corn grain, cob, stalk and total aboveground biomass. Harvest grain yields were determined by harvesting 15 m of row at 173 DAP. Nitrogen fertilizer inputs increased NT and ST corn yields (P < 0.0001). Incorporating Ssg in the crop rotation increased corn yields in ST (P < 0.13). For the NT plots, harvested grain yields were increased by the lower N-fertilizer rates ranging from 0-120 kg N ha-1 (P<0.11). A similar trend of higher biomass production at 146 DAP was observed for the C-Ssg-ST with higher grain (P<0.13), cob (P<0.16), and total biomass (P<0.24) than the CC-ST plots. Similarly, the NT plots receiving lower N fertilizer rates (0 – 120 kg N ha-1) had higher grain (P<0.08), cob (P<0.14), and total biomass (P<0.19) than the CC-NT plots. Additional research is needed to determine why these higher harvested yields at 173 DAP were observed, and why the biomass grain, cob and total biomass tended to be higher at 146 DAP following Ssg. These data suggest that rotations with Ssg may be a method to increase corn yields and aboveground total biomass.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Conservation and Nontraditional Agriculture

^{*}denotes primary author and subject area

Nutrient Tracking Tool: A User-Friendly Tool for Evaluation of Water Quality and Quality as Affected by Various Agricultural Management Practices

Authors: Ali Saleh*, Tarleton State University

Abstract: The Nutrient Tracking Tool (NTT) is a user-friendly web-based computer program that estimate nutrient (nitrogen and phosphorus) and sediment losses from fields managed under a variety of cropping patterns and management practices. The NTT includes a user-friendly web-based interface and is linked to the Agricultural Policy Environmental eXtender (APEX) model. It also accesses USDA-NRCS's Web Soil Survey to obtain field, weather, and soil information. NTT provides producers, government officials, and other users with a fast and efficient method of estimating the nutrient, sediment losses, and crop production under different conservation practices regims at the farm-level. The information obtained from NTT can help producers to determine the most cost-effective conservation practice(s) to reduce the nutrient and sediment losses while optimizing the crop production. Also, the recent version of NTT (NTTg2) has been developed for those coutries without access to national databasis, such as soils and wether. The NTTg2 also has been designed as easy to use APEX interface. During this presentation the new capabilities of NTTg2 will be described and demonstrated.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Adaptive Management of Conservation Efforts

^{*}denotes primary author and subject area

Overview of 15 Years of Best Management Practice Research in the Mackinaw River Watershed, Illinois

Authors: Krista Kirkham*, The Nature Conservancy; Maria Lemke, The Nature Conservancy; Ashley Maybanks, The Nature Conservancy; Jackie Kraft, McLean County Soil and Water District, Illinois; Kent Bohnhoff, Natural Resources Conservation Service; Williaim Perry, Illinois State University; David Kovacic, University of Illinois Urbana-Champaign; Michael Wallace, University of Illinois Urbana-Champaign; Terry Noto, Conservation Strategies Consulting, LLC; Rick Twait, City of Bloomington, Illinois

Abstract: The Nature Conservancy and partners have been working in the Mackinaw River watershed in central Illinois for over 15 years to determine how well best management practices perform to improve water quality in a row crop dominated landscape. Results from a 7-year paired watershed study (10,000acre scale) demonstrated that traditional conservation practices are not enough to improve water quality in these highly tile-drained agricultural watersheds, and has led to subsequent research testing efficiencies and effectiveness of constructed wetlands to intercept tile water and reduce nutrient exports. Eight years of wetland research at a farm scale (~250 acres) has demonstrated wetland to watershed ratios of 3% to 9% can remove an average of 18% to 44% of nitrate nitrogen and 62% to 73% of orthophosphorus loadings, respectively. Knowledge gained from these previous research projects was incorporated into a new watershed project in 2010 to demonstrate the effectiveness and cost-benefits of using constructed wetlands (specifically CRP CP-39 Farmable Wetlands Program) and nitrogen management to reduce nitrate loadings in a local watershed that supplies drinking water to the City of Bloomington, Illinois. Research strategies include: (1) precision outreach and placement of wetlands using innovative watershed mapping, (2) site-specific and watershed-scale monitoring of wetland effectiveness, (3) bundling in-field nitrogen management with edge-of-field constructed wetlands, and (4) streamlining implementation of CP-39 wetlands in McLean County, Illinois. Our goal is to create a successful blueprint for watershed conservation that can be expanded to other tile-drained watersheds throughout the Midwest.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Adaptive Management of Conservation Efforts

Effect of Skip-Row Planting on Cotton Yield, Biomass, and Soil Moisture in South Carolina

Authors: Jose Payero*, Clemson University; Ahmad Khalilian, Clemson University; Rebecca Davis, Clemson University; Michael Marshall, Clemson University; Ali Mirzakhani Nafchi, Clemson University

Abstract: Drought is one of the climate extremes that most affects agricultural producers. Farmers can use a variety of technologies to conserve water and enhance resilience to drought. One of these technologies is skip-row planting, which has proven to be effective in many areas. However, it is not a practice commonly used by farmers in South Carolina. During 2013 to 2015, studies were conducted in Barnwell County, SC, to evaluate and demonstrate the benefits of skip-row planting as a drought adaptation strategy in cotton production in South Carolina. In 2013, replicated experiments were conducted under dryland conditions in two cotton fields. In one field, "Solid" and "Single Skip" planting configurations were evaluated. In the other field, four planting configurations, including "Solid", "Single Skip", "Double Skip", and "Alternate Skip" were compared. In 2014 and 2014, the four planting configurations were compared under three water regimes, under a center pivot. The water regimes included: (1) dryland, (2) deficit irrigation and (3) full irrigation. The deficit irrigated portion of the field received irrigation to replace 50% of calculated crop evapotranspiration (ET) while the full irrigated portion replaced 100% ET. Biomass and yield were collected at the end of the growing season, and either soil moisture or soil water tension was measured at three depths (8", 16" and 24") during the growing season. In this poster, data on the effect of planting configuration on cotton yield, crop biomass, soil water dynamics and economics will be presented.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation and Nontraditional Agriculture

Sensor-Based Nitrogen Management for Cotton in Coastal Plain Soils

Authors: Ahmad Khalilian*, Clemson University; Michael Marshall, Clemson University; Joe Maja, Clemson University; Ali Mirzakhani Nafchi, Clemson University; Jose Payero, Clemson University; Phillip Williams, Clemson University

Abstract: Crops in the southeastern Coastal Plain region are generally produced in fields known to have a high degree of variability in soil texture which has a major influence on fertilizer management strategies. In this region, a high correlation exist between soil texture and crop yield. In addition, the yield response to nitrogen fertilization is also affected by soil texture. Therefore, uniform application of nitrogen over the entire field can be both costly and environmentally unsound. This poster presents the results sensor-based nitrogen management in cotton production on five commercial farms, utilizing an algorithm developed at Clemson University. The Clemson system utilizes optical sensors combined with calibration equations (algorithms) and soil electrical conductivity data (zone management) to calculate side-dress N requirements. In a test field with different soil types, the Clemson algorithm recommended 54, 47, and 31 lbs. of N per acre in low, medium and high EC (electrical conductivity) zones, respectively, compared to grower's conventional uniform rate N application method (90 lbs./acre). On average, the Clemson algorithm applied 47% less nitrogen without affecting cotton yields in this field. Similar results were obtained with other field trials in South Carolina, reducing N usage by 15 to 100 lbs./acre in cotton, compared to growers' application rates (\$9 to \$60 savings/acre) with no effects on cotton yields.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation and Nontraditional Agriculture

Utilizing Cover Crops for Management of Glyphosate-Resistant Palmer Amaranth in Cotton

Authors: Michael Marshall*, Clemson University; Colton Sanders, Clemson University; Jacob Hair, Clemson University

Abstract: A glyphosate based weed management strategy in cotton in the southern U.S. has resulted in the selection and rapid increase of glyphosate-resistant Palmer amaranth. Cultural programs are urgently needed to manage these weeds that are effective, economic, and sustainable. Heavy plant surface residue significantly reduces the germination of small seeded weeds, such as Palmer amaranth. Therefore, the objectives of this poster were to determine efficacy of fall planted cover crops on glyphosate-resistant Palmer amaranth populations in cotton and determine impact of selected herbicide programs in conjunction with fall cover crops on cotton growth and yield. Cover crop mixture (rye, oats, turnip, vetch, radish, and clover) was seeded at 70 lb/A between October and December 2012, 2013, and 2014 in half of the field. Cover crops/weedy cover sections were terminated using glyphosate, 2,4-D ester and Valor approximately 20 days before planting. Cotton was planted in mid-May of each year. Reflex at 1.0 pt/A plus diuron at 1.0 pt/A plus paraquat at 3 pt/A was applied shortly after planting followed by POST1 (APT1) [treatments were glyphosate at 32 oz/A plus Warrant at 3 pt/A or Liberty at 29 oz/A plus Dual Magnum at 1.0 pt/A or Liberty at 29 oz/A plus Staple at 2.5 oz/A] at 2-3 lf cotton, POST2 (APT2) [treatments were glyphosate at 32 oz/A + Warrant at 3 pt/A, Liberty at 29 oz/A, or Liberty at 29 oz/A plus Dual Magnum at 1.0 pt/A] at 6-8 lf cotton, and LAYBY [MSMA at 2.67 pt/A plus diuron at 1.0 pt/A] at 18-20 inch cotton. Cover crops significantly reduced early season Palmer amaranth populations compared to no cover crop when combined across treatments. Liberty plus Staple and Dual Magnum significantly reduced Palmer amaranth populations in the no cover regime compared to the glyphosate based programs. In conclusion, fall seeded cover crops appeared to significantly reduce early season emergence of Palmer amaranth from the soil seed bank.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation and Nontraditional Agriculture

Aligning Economic Returns and Ecosystem Services for a Spatially Delineated Farm Landscape Reliant on Groundwater for Irrigation

Authors: Kuatbay Bektemirov*, University of Arkansas; Kent Kovacs, University of Arkansas

Abstract: Groundwater overdraft is a problem in farming regions throughout the world. This has consequences in the long run for the crops grown, the economic viability of the agricultural community, and the provision of ecosystem services from the landscape. We investigate the trade-off of economic returns and ecosystem services in the Mississippi Delta farm production region of Arkansas, USA. The current rate of pumping of the alluvial aquifer is not sustainable unless pumping is reduced or a recharge mechanism is created. The groundwater scarcity influences the landscape over a thirty year period, and we track economic returns, groundwater supply, surface water quality, and greenhouse gas (GHG) reductions. Farmers are turning to conjunctive water management with on-farm reservoirs and tail water recovery when groundwater is depleted. Economic return or ecosystem service value objectives determine whether on-farm reservoirs are built amidst the backdrop of crop mix change. We find reservoirs enable farmers to choose a landscape that sustains higher levels of economic returns and ecosystem services. Reservoirs strengthen a synergy between economic returns, groundwater conservation, and GHG reductions by lowering irrigation costs and reducing the fuel combustion and associated GHGs from groundwater pumping. Keywords: Ecosystem services, Economic returns, Conservation policies, Conjunctive water management, Spatial-dynamic optimization

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Conservation Economics and Policy

^{*}denotes primary author and subject area

Assessing the Economic and Environmental Benefits and Costs of Cover Crops in Cotton Production System in Red River Basin, Northwest Louisiana

Authors: Naveen Adusumilli*, LSU; Dan Fromme, LSU

Abstract: Cover crop adoption by producers as part of a production cycle depends on their objectives regrading time management, cost vs benefits, and environmental obligations. A myriad of studies that examined the economics of cover crops found them to be often idiosyncratic, i.e., results depend on the region, weather patterns, soil type, and management practices. The studies determined that lack of long-term economic outlook for the incorporation of cover crops as one of the factors for their minimal adoption in many parts of the country. Thus, we aim to assess the economic impact of long-term adoption of cover crops as part of a production cycle. Partial budgeting tool, CoverCropEconomics, is used to generate the overall costs and benefits. The data on agronomic variables, i.e., yield, organic matter, applied nitrogen, soil microbial counts, and among others are obtained from cover crop research conducted in Northwest Louisiana. The results indicate a statistically significant increase in yield for crops planted following cover crops. Additionally, research shows improvements in soil nitrogen and soil organic matter suggesting added profits to the farmer. Other economic variables like crop prices, fertilizer prices, fuel price, and other input prices are accounted for estimating long-term economic net returns of cover crops.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Conservation Economics and Policy

Barriers and Opportunities to Diversified Agriculture in the Mississippi River Basin

Authors: Lara Bryant*, Natural Resources Defense Council

Abstract: In recent years, many thought leaders have emphasized the need to transition away from intensive monoculture cropping, as the key to addressing the water quality problems facing the Mississippi River Basin (MRB). Midwestern agriculture is built on a system that inherently drives monoculture cropping, and it may take a sea change in policy to reverse this trend. Any change must first start with a vision of the alternative: environmentally, socially, and economically thriving agriculture built on diversified farming systems. Examples of diversified farming may be farms with three or more crops in rotation, three to six year rotations, portions of farm acreage planted to non-commodity or nichemarket crops, and/or integration of livestock in the cropping system. Ecosystems with greater diversity have greater soil health, lower erosion rates, and less need for chemical inputs; a 2012 study by Davis et al. showed that freshwater toxicity in more diverse cropping systems was two orders of magnitude lower than conventional systems. Diverse systems are more resilient to the impacts of climate change and have a lower greenhouse gas footprint. Food consumers and rural economies benefit from diversified agriculture. A larger supply of diverse crops, including different types of grains, legumes, fruits and vegetables, would contribute to a more affordable and nutritious food supply. Smaller, more diversified farms provide more jobs and spread economic benefits among a wider range of small businesses. Finally, taxpayers will benefit from diversification. The cost of the federal crop insurance program will continue to rise, due to extreme weather impacts brought on by climate change. Diversified agriculture is a natural risk management strategy that can lower the societal cost of monoculture cropping. NRDC will present our findings on the economic and policy barriers to diversified agriculture, as well as opportunities to overcome these challenges.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Economics and Policy

Costs of Reducing Nitrogen Loadings through Wetland Restoration

Authors: LeRoy Hansen*, USDA/ERS

Abstract: The objective of this research was to estimate the total quantity of nitrogen (N) that can be removed by restoring wetlands as a function of N-removal cost. We used WRP contracts and other data to estimate a wetland cost function (with an adjusted R-square of 0.78). The function generates county-level estimates of the expected costs of restoring and preserving wetlands. We used a GIS model and appropriate data to generated estimates of N removal by restored wetlands across the 100,671 grid points of our 183 million-acre study area. Overlaying the costs and N-removal estimate, we found that Nremoval costs ranged from \$0.03 to \$6.71 per pound. The cost and total quantity of N removed depend on the number and cost-effectiveness of restored wetlands. Wetlands cannot be restored at all 100,671 points. Historically, wetlands are usually restored on hydric soils. GIS soils data (SSURGO) identify hydric soils. Assuming wetlands might only be restored on hydric soils, we select grid points that lie on hydric soils. Next, we assumed that the probability that a wetland once existed at a given point, Prob(exist), equals the ratio of the converted wetland acreage relative to the acres of hydric soils. Assuming participation rates of 50 percent, the probability that a wetland might be restored at a specific grid point is 0.5*Prob(exist). Combining the locational and cost-effectiveness estimates, we estimate the quantity of N removed as a function of N 'price' (removal cost). For example, a program that restores wetlands with N prices less than \$0.50/lb is likely to restore 4 million wetland acres and reduce annual N losses to surface waters by 3.5 million tons. As N prices rise, more wetlands are restored and N loadings are reduced. Previous analyses of on-field N conservation practices found N removal costs of more than \$0.70/lb, but those estimates are dependent on the total reduction in nitrogen losses.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Conservation Economics and Policy

Economic Differences in Soybean Production Systems of Budget Estimated Irrigation Water Use Versus Actual Use

Authors: C. Robert Stark*, University of Arkansas at Monticello; Paul Francis, University of Arkansas at Monticello; Leo Espinoza, University of Arkansas Division of Agriculture; Chris Henry, University of Arkansas Division of Agriculture; Mukhammadzakhra Ismanov, University of Arkansas Division of Agriculture; Larry Earnest, University of Arkansas Division of Agriculture; Scott Hayes, University of Arkansas Division of Agriculture

Abstract: Mid-South U.S. soybean production relies heavily on irrigation to obtain maximum yields. Producers use cost-of-production budgets to choose production systems, calculate operating loan requirements, project input requirements, and determine profitability. Accurate budgets require proper input use estimates. Mid-South water use is a growing issue with deficit areas identified and policy alternatives discussed. Mississippi initiated a voluntary metering program that now includes almost 10% of irrigation wells in 19 Delta/part-Delta counties. Participation was encouraged by possible mandatory water reporting policies. Researchers estimate that furrow irrigation events apply 2.0-2.5 acre-inches of water when developing budgets. But field procedures often use visual guides with irrigation applied until it travels a full row length. This study expands research by comparing standard budget water volumes per event to actual quantities applied in a recently initiated irrigated agronomic project. Primary study goal was evaluation of yield benefits from gypsum and in-row deep ripping. Irrigation choices were dryland control and furrow events at 2, 3, and 4 inch soil water deficits indicated by monitoring equipment. Total water utilized was recorded from flow meters. Differences between a standard 2 inch event value and actual usage were compiled. Aggregating water usage provides an economic error estimate between standard and actual irrigation practices. Differences also indicate water management volume errors in budgets. Knowledge of errors should improve economic/resource use estimates for soybean under furrow irrigation, the predominant Mid-South irrigation system. Recognizing errors can be a major step toward better voluntary water management policies reduce probabilities of policies imposing mandatory water use regulations. These initial findings will be compared with future irrigated projects as flow meters have been acquired for standard procedure use.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Conservation Economics and Policy

Evaluation of Economic Barriers to Incentivizing Ecosystem Services in Minnesota

Authors: Jessica Nelson*, Water Resources Center, Minnesota State University, Mankato; Jim Klang, Kieser & Associates, LLC

Abstract: Conservation Marketplace Midwest (CMM) a nonprofit whose concept was founded in a Conservation Innovation Grant (CIG) award in 2008. This presentation is a discussion of how the environmental market support initiative has changed in response to dramatic and a wide variety of shifting market forces. Decisions made to manage soil and water resources in agricultural watersheds occurs at an individual field scale and based on economic incentives commonly undervaluing ecosystem and social uplift. CMM was established as an alternative market-based approach to support environmental markets by cost-effectively connecting buyers and generators of ecosystem services to help meet air and water quality goals. Founded based on an expectation of viable CCX and water quality trading markets in Minnesota, CMM faced challenges surviving when these markets did not materialize. To overcome this barrier CMM expanded initiatives to consider other possible markets. The framework CMM employs first identifies market-based conservation opportunities with corporations, government, nonprofits and landowners, where a Certified Field Representative then recruits and enrolls land managers to generate credit/certification projects. Standards for the project are tailored by CMM to meet the buyer's expectations. Generators are paid according to each unique ecosystem market rate. CMM's efforts have been applied establishing pollinator habitat, source water protection, supply chain sustainability (Field Stewards), and quantification and valuation of water storage markets. In 2016, an estimated 5,500 acres will be enrolled in Field Stewards with support of CIG, allowing certified farmers to sell certificates to food companies, such as GNP Company, as a way to offset the potential of water quality impacts from corn and soybean commodities in their supply chain. CMM continues to evolve and adapt to new markets to overcome challenges associated with new and developing environmental markets.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Economics and Policy

New Life for Conservation Planning

Authors: Bill Berry*, NACD; Rich Duesterhaus, NACD

Abstract: Conservation professionals and producers are often challenged for time and resources in their efforts to accomplish effective conservation planning while managing and implementing conservation programs. Recognizing the need to strengthen conservation planning in this environment, a robust partnership engaging conservation professionals from across the nation has undertaken a strategic effort to reinvigorate the conservation planning process, which serves as the underpinning of conservation efforts on private lands. Five action teams are charged with developing recommendations that will lead to a multi-year plan to incorporate the many aspects of conservation delivery into a conservation planning strategy. This session will review the findings and recommendations of the respective teams in the following areas: Communications and Messaging; Performance, Outcomes and Accountability; Partnership and Leveraging Capacity, Organization and Planning; Technical Processes, Tools and Integration; and Training. Partners in the national conservation planning partnership include the Natural Resources Conservation Service, the National Association of Conservation Districts, the National Association of State Conservation Agencies, the National Association of Resource Conservation and Development Councils and the National Conservation District Employees Association.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Conservation Economics and Policy

Quantifying the Benefits of the USDA Climate Change Mitigation Building Blocks: Conservation Legacy Effects, Conservation Ripple Effects, and the Atmospheric Benefits of Working Lands Conservation

Authors: Adam Chambers*, USDA-NRCS

Abstract: On April 23, 2015 the U.S. Secretary of Agriculture announced a set of ten major climate change mitigation Building Blocks. The Building Blocks set ambitious yet attainable greenhouse gas (GHG) emission reduction and carbon sequestration targets for the U.S. agricultural and forestry sector by 2025. The Climate Change Mitigation Building Blocks introduced the agriculture and forestry sectors as part of the climate change solution. The Secretary established an attainable goal of reducing 120 million metric tonnes of carbon dioxide equivalent (MMTCO2e) per year by 2025. In order to accomplish this goal, USDA and the agricultural and forestry sectors will need focus on quantifying the benefits of atmospheric-beneficial conservation practices, ensuring that the economy values the carbon benefits that producers generate, and begin to think strategically about how to build partnerships that will achieve the Building Block mitigation targets. This oral presentation will provide an overview of the methods used to establish a baseline of conservation practice benefits. Many conservation practices persist for years or decades, the persistence of USDA-supported conservation practices after their contract period has expired has been defined as the "conservation legacy effect". NRCS has conducted extensive research on the conservation legacy effect and quantified the benefits of historic practices. These quantification methods as well as NRCS support of atmospheric-beneficial conservation practices will be discussed during this session. In parallel to highlighting the GHG reduction and/or carbon sequestration benefit of conservation practices, NRCS has developed quantification methods and tools that can help farmers, ranchers, and policy makers quantify the atmospheric benefits of targeted NRCS conservation practices. New opportunities for NRCS financial programs to contribute to exceeding the Secretary's ambitious mitigation goal will provided as a conclusion.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Conservation Economics and Policy

Unifying Watershed Management through an Off-Site BMP Implementation Program in the Little Arkansas River Watershed

Authors: Trisha Moore*, Kansas State University

Abstract: We will present a framework for an offsite BMP program developed in partnership with the City of Wichita and the Little Arkansas Watershed Restoration and Protection Strategy (WRAPS) to maximize the environmental and economic effectiveness with which the city meets stormwater permitting requirements. The program aims to integrate watershed stakeholders across sociopolitical bounds and provide a sustainable funding mechanism to implement and maintain water quality practices in the rural landscape, a critical need as watershed managers struggle to meet water quality targets (e.g., TMDLs). Based on dialogue between watershed stakeholders and the Kansas Department of Health and Environment, which administers TMDLs and water quality permits, the program works to optimize the placement of BMPs within the watershed for maximum water quality benefit of the integrated system. A program framework in which urban developments participating in the program pay a "sediment credit" fee, which is then used to finance implementation and maintenance of offsite BMPs as facilitated through the Little Arkansas WRAPS program. Adoption of this offsite program is anticipated to lead to greater reductions in sediment (and other pollutant) loads leaving the watershed than could be achieved through conventional implementation of BMPs within urban bounds to meet MS4 permit requirements. Although this program has not been officially rolled-out, we will present the essential elements and steps needed for this program to successfully meet its water quality objectives when implemented.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Economics and Policy

Watershed Scale Precision Farming and Soil Conservation to Enhance Nutrient Use Efficiency and Profitability

Authors: Mohammad Khakbazan, Agriculture and Agri-Food Canada; John Huang, Agriculture and Agri-Food Canada; Alan Moulin, Agriculture and Agri-Food Canada; Henry Wilson, Agriculture and Agri-Food Canada; Jason Vanrobaeys, Agriculture and Agri-Food Canada; Ramona Mohr, Agriculture and Agri-Food Canada; Mohammad Khakbazan*, Agriculture and Agri-Food Canada

Abstract: Precision agriculture, together with soil conservation, has considerable potential to better match crop inputs with crop requirements, as they vary over space and time. Both landform and spatial variability of soil properties may affect crop nitrogen (N) response; therefore, implementation of precision farming and soil conservation may enhance crop productivity and nutrient use efficiency (NUE). The objective of this study is to assess the potential for watershed scale precision agriculture and soil conservation to increase NUE and production profitability, and to reduce nutrient losses to the environment. The South Tobacco Creek (STC) watershed in Manitoba, Canada, with more than 25 years of land management data will be used to test the hypotheses that crop NUE and profitability will be improved, and N and phosphorus (P) losses will be reduced, under precision farming and soil conservation systems, as compared with conventional N and P application. The STC watershed fields will be delineated into zones based on historical crop yields, N and P fertilizer inputs, soil and hydrological properties, and land management data. STC dataset will be used to develop NUE, crop yield and cost relationships using multivariate regression estimations, to optimize N and P use for different crops within each zone in the watershed. The relationships developed, and the input-output data collected from both research sites and literature, will be incorporated into an economic simulation model, in order to identify benefits of N and P reduction from precision farming and soil conservation. Preliminary results have shown that fertilizer N accounts for more than 60% of the energy input used in the watershed. Also, a significant amount of applied N and P fertilizer leaves the STC watershed under conventional N and P application, going unrecovered in crops and soil. This suggests that precision farming and conservation management could effectively reduce nutrient losses to the environment.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Economics and Policy

A Verification Protocol for Resource Stewardship

Authors: Bill Berry*, NACD

Abstract: NRCS has developed a voluntary Resource Stewardship tool that uses an evaluation and conservation plan to help producers communicate the stewardship benefits of their conservation efforts. In connection with the national Resource Stewardship Initiative pilot, which employs this tool in watersheds across the country, the National Association of Conservation Districts has constructed a draft verification protocol for use by producers and conservation professionals. The protocol addresses key Resource Stewardship indicators in the areas of soil and resource health, water quality, water quantity, air quality and habitat health. While the RS tool and protocol initially address row-crop practices, key components will be applicable in other working landscapes including grasslands, farmsteads, and woodlands. The draft protocol is being tested in several pilot watersheds. Participants in this session will review the draft protocol, learn about findings from testing activities and provide input on the tool's efficacy.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

Assessing the Greenhouse Gas Balance of California Specialty Crops with COMET-Farm

Authors: Matthew Stermer*, Natural Resource Ecology Laboratory-Colorado State University; Adam Chambers, USDA- Natural Resources Conservation Service; Mark Easter, Natural Resource Ecology Laboratory-Colorado State University; Amy Swan, Natural Resource Ecology Laboratory-Colorado State University; Stephen Williams, Natural Resource Ecology Laboratory-Colorado State University; Will Horwath, UC Davis; Mary Carlson, Natural Resource Ecology Laboratory-Colorado State University; Lucas Thompson, Natural Resource Ecology Laboratory-Colorado State University; Kevin Brown, Natural Resource Ecology Laboratory-Colorado State University; Amrith Gunesekara, California Department of Food and Agriculture; Keith Paustian, Natural Resource Ecology Laboratory-Colorado State University

Abstract: Specialty crops make up a significant portion of California's irrigated cropland, however no tools have existed until now for evaluating the whole system greenhouse gas emissions on nut crops, grapes, strawberries, lettuce and cole crops. Through a unique collaboration between Colorado State Univ., the California Department of Food and Agriculture, the Univ. of California – Davis, USDA's Agricultural Research Service and Natural Resource Conservation Service, we are working to fill these gaps and make comprehensive analysis of the greenhouse gas balance of specialty crop systems available in the COMET-FarmTM system. In this presentation we will contrast the whole-system greenhouse gas balance of several specialty crop systems and describe opportunities for conservation practices to reduce overall greenhouse gas emissions. COMET-FarmTM is an integrated web-based decision support tool developed in collaboration with and support from the NRCS and USDA to aid farmers, agricultural producers, natural resource professionals, land managers and conservationists in making land and livestock management decisions regarding greenhouse gas emissions and carbon sequestration. COMET-FarmTM provides total farm, ranch and woodlot greenhouse gas accounting, including cropland, pasture, range, agroforestry, forestry, livestock and on-farm/ranch energy use modules.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Conservation Models, Tools, and Technologies

Calculating the Economic Value to Producers of Improved Sustainability Performance in Crop Production

Authors: Josiah McClellan*, United Soybean Board

Abstract: A critical aim of conservation initiatives is to increase the environmental sustainability of crop production while minimally affecting yield and profit. To explore the complex interplay between yield, profitably and sustainability, this research assessed all single season NRCS soybean management templates in two Crop Management Zones (CMZs 4 and 16) within the United States. Selected parameters from the management operations in each template, representative soil properties, and historical weather data were input into a deterministic soybean yield model to account for differences in production at locations within the CMZs. The modeled yield was incorporated into the template operations to define "scenarios" for the Field to Market (FtM) Fieldprint Calculator (FPC) sustainability calculations. The same scenarios were input into an economic budget to determine their profitability. The model, calculator, and budget results were then sorted and optimized to identify which soybean single season management templates provided the best balance of yield, sustainability, and profitability. To illustrate that the analysis approach could be used on other crops, the single season assessments of sustainability were carried out for a few corn and winter wheat management templates in the same CMZs. In addition to the single season crop sustainability assessments, the effects of a soybean crop in rotation with corn on sustainability, and profitability were also assessed. A review of the assessment and study results point to higher yields increasing productivity but also having a positive impact on sustainability through increasing biomass to reduce erosion and increasing resource and input use efficiency. The analysis demonstrated that a yield model, sustainability calculator, and an economic budget can be employed together to identify those management operations that have high yields, high sustainability, or high profitability, or a balance of all three.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

Delivering Conservation in Great River Landscape: The USDA-Natural Resources Conservation Service Mississippi River Basin Healthy Watersheds Initiative (MRBI).

Authors: Martin Lowenfish*, USDA/NRCS; Dee Carlson, USDA/NRCS

Abstract: USDA-NRCS has made a \$30 million dollar per year commitment under the current Farm Bill to improve water quality in the Mississippi River Basin by continuing the Mississippi River Basin Healthy Watersheds Initiative (MRBI). Launched in 2010, this 13 state initiative builds on the cooperative work of NRCS and its conservation partners in the basin and offers agricultural producers in priority watersheds the opportunity for voluntary technical and financial assistance. This presentation will focus on the tools and methods NRCS and partners use to target watersheds and measure success. Within watersheds, we will discuss when and how critical acres are identified to achieve water quality goals for the project. The multi-state scale of water quality issues in the Mississippi Basin provides a challenge to delivering a coherent effort. NRCS addresses that challenge by working with the conservation partnership in each state to select targeted watersheds that align with the State Nutrient Reduction Strategies and focus on reducing nutrient and sediment loss from working agricultural lands. Each watershed project has identified critical acres needing treatment and a suite of conservation practices that address the concept for Avoiding, Controlling or Trapping pollutants. Within each watershed there are set of defined goals and metrics established that further help focus each project. Assessment of goals include geospatial analysis, amount and extent of conservation practices applied, modeling, and edge of field and watershed scale monitoring.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

Determining Sources of Suspended Sediment in an Agricultural Watershed in Atlantic Canada

Authors: Monica Boudreault*, Agriculture and Agri-Food Canada

Abstract: In Atlantic Canada, many cultivated fields are prone to serious water erosion due to the intensive management associated with the potato cropping systems. As a result, elevated levels of suspended sediments are observed in the surface water. In order to better control the adverse effects of suspended sediment, it is necessary to quantify the contribution from each source. The objectives of the study are: (I) to determine the main sources of sediments and the contributions from each source at the watershed scale. (II) To examine the spatial variation and explore more effective approaches for sediment fingerprinting studies in a dynamic system. The study was carried out in Black Brook Watershed (BBW), a small watershed in the potato belt of the province of New Brunswick in Atlantic Canada. Soil samples were taken from different sediment sources, including cultivated fields, forested areas, and stream banks. Suspended sediment was collected seasonally at five locations in the watershed for six years. All samples were measured for a set of chemical and biophysical properties, such as Cs-137 radioactivity, trace elements and spectral reflectance which were used as fingerprints to distinguish the different sources. Our results showed that cultivated topsoil accounted for the highest sediment source contribution with an average of approximately 46.6% followed by cultivated streambanks, upstream, forest streambanks and forest topsoil which accounted for approximately 30.3%, 15.8%, 6.2% and 1.3% of sediments respectively at the watershed outlet. However, there appear to be a substantial variation in sediment source contributions across the watershed with trends suggesting strong influence from scale and land use. Therefore, sampling solely a watershed's main outlet was not adequate in capturing the change. Advances to sediment fingerprinting, especially with regards to the sampling approach, is necessary for the proper identification of sediment sources

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

Estimating the Magnitude of Prediction Uncertainties for Field-Scale P Loss Models

Authors: Carl Bolster*, USDA-ARS

Abstract: Models are often used to predict phosphorus (P) loss from agricultural fields. While it is commonly recognized that model predictions are inherently uncertain, few studies have addressed prediction uncertainties using P loss models. In this study, an uncertainty analysis for the Annual P Loss Estimator (APLE) model was performed by estimating the uncertainty associated with model input variables and model parameters. Specifically, a method is presented for estimating model parameter uncertainties associated with the regression equations used to estimate total soil P from measurements of soil clay content, organic matter, and labile P; the P enrichment ratio from erosion rates; concentration of P in runoff due to labile soil P; and partitioning of P between runoff and infiltration from applied manures and fertilizers. Uncertainty associated with model input variables was based on error estimates published in the literature. This analysis included calculating both confidence and prediction intervals. The relative magnitudes of the two sources of uncertainty to the overall uncertainty associated with APLE predictions of P loss are compared. How estimation of model parameter uncertainty can identify model limitations is also discussed.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Conservation Models, Tools, and Technologies

Evaluation of Conservation Practice Impacts on the USDA-ARS CEAP Beasley Lake Watershed, Mississippi Using AnnAGNPS

Authors: Lindsey Yasarer*, United States Department of Agriculture - Agricultural Research Service; Ron Bingner, United States Department of Agriculture - Agricultural Research Service; Martin Locke, United States Department of Agriculture - Agricultural Research Service; Richard Lizotte, United States Department of Agriculture - Agricultural Research Service; Henrique Momm, Middle Tennessee State University

Abstract: Beasley Lake watershed is located in an agriculturally intensive area of the Lower Mississippi River Alluvial Plain (i.e. the Delta). As a part of the Conservation Effects Assessment Project (CEAP) and the Mississippi Delta Management Systems Evaluation Area (MD-MSEA) project (1996 -2003), there are over 20 years of monitoring data and assessment of management practices available in this watershed. This study uses the USDA Annualized Agricultural Non-Point Source pollution model (AnnAGNPS) to provide an integrated assessment of the effects of conservation practices on water quality in the Beasley Lake Watershed using an enhanced AnnAGNPS simulation of riparian buffer and wetland components. Detailed data sources are used, such as LiDAR for cell boundary and flow path identification, and long-term records of land-use, crop rotations, and management practices. Conservation practices assessed include vegetative buffers, conversion of 87 ha of cropland to the Conservation Reserve Program (CRP), conservation tillage, and implementation of constructed wetlands. Water quality components such as water, sediment, nitrogen, and phosphorus are examined for impacts by conservation practices. Water quality monitoring studies in this watershed suggest that practices such as reduced tillage on soybean cropland and conversion of key erodible cropland to CRP have led to significant reductions in sediment and nutrient concentrations in Beasley Lake. Simulations with AnnAGNPS will provide a more comprehensive evaluation of these practices and also evaluate the capability to simulate vegetative buffers in agricultural watersheds. Understanding the impact these management practices have on water quality in Beasley Lake watershed would help in the development of conservation management plans in other watersheds in the Delta with similar flat topography, land-use, and water-use practices.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

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Evaluation of Improved Poultry Litter Storage Sites in Kansas as a BMP to Protect Water Quality

Authors: Barrett Smith, Kansas State University; Peter Tomlinson*, Kansas State University; Herschel George, Kansas State University

Abstract: Poultry litter continues to be readily available in southeast Kansas, primarily driven by environmental regulations on the land application of poultry litter in Missouri, Arkansas and Oklahoma. In response to concerns about the impact on water quality from poultry litter stored infield, improved poultry litter storage site demonstration projects where established in 2013 and 2014 as a possible best management practice (BMP). The storage sites were designed to include buffer areas (grass or cropland) to minimize the transport of nutrients to water bodies. Cost share was provided through two local Watershed Restoration and Protection Strategies (WRAPS) groups for the development of six demonstration sites. The objective of the study was to evaluate edge of storage area and of buffer nutrient losses from an improved poultry litter storage site. One demonstration project site was instrumented in the fall of 2014 with automated water sampling equipment. Water samples were analyzed for total N and P, nitrate, ammonia, total dissolved solids, and total suspended solids. During the April to June 2015 sampling period the buffer reduced total-nitrogen by 97%, total phosphorus by 93%, ammonium-nitrogen by 97%, nitrate-nitrogen by 99%, and ortho-phosphorus by 94% compared to the runoff leaving the storage area. During the July to September 2015 sampling period the buffer reduced total-nitrogen by 89%, total phosphorus by 85%, ammonium-nitrogen by 96%, nitrate-nitrogen by 96%, and orthophosphorus by 88% compared to the runoff leaving the storage area. The initial findings suggest that the design of the storage site and utilization of cropland as a buffer is an effective means of protecting water quality. Additional site years are needed to understand how long-term use of the site will impact buffer performance and the effectiveness of these improved storage sites as a BMP.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

Evaluation of the TBET Model for Improving P-Indices in Southern states

Authors: David Radcliffe*, University of Georgia; Adam Forsberg, University of Georgia; Carl Bolster, USDA-ARS; Aaron Mittelstet, Oklahoma State University; Dan Storm, Oklahoma State University; John Ramirez Avila, Mississippi State University; Deanna Osmond, North Carolina State University

Abstract: Management of agricultural nonpoint source phosphorus (P) requires identification of fields susceptible to P loss. P-Indices are the most common tools used to identify critical source areas of P loss. However, the success of the P-index approach is impeded by insufficient measured P loss data. Simulated data from a quantitative P transport model may be used to modify a P-index for scenarios where P loss data is not available. The objective of this study was to compare predictions from the Texas Best Management Evaluation Tool (TBET) against measured P loss data to determine whether the model can be used to improve P-Indices in the South. Field-scale measured P loss data from study sites in AR, GA, and NC were used to assess the accuracy of TBET for predicting field-scale loss of P. Goodness of fit was measured using the Nash-Sutcliffe Efficiency (NSE) and Mean Absolute Error (MAE) statistics. We found that TBET can generate satisfactory event-based predictions (NSE \geq 0.3) of runoff, sediment and P loss with site-specific calibration. We also compared TBET predictions of average annual P loss against the three state P-indices for the sites in this study. Goodness-of-fit between measured average annual total P loss and the calibrated TBET model (MAE = 4.4 kg/ha/yr) was similar to the P-Indices (MAE = 6.9 kg/ha/yr). We conclude that a well-calibrated TBET model can be used to improve P-Indices for certain management scenarios. However, developing a version of TBET that can simulate all of the management, soil, and weather combinations that are likely to be encountered in a state will require extensive work.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

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Improving the Spatial Representation of Hydrological Soil Properties using Topography in Waterhshed Models

Authors: Daniel Fuka*, Virginia Tech; Amy Collick, USDA ARS; Dan Auerbach, EPA; Peter Kleinman, USDA-ARS; Andrew Sommerlot, Virginia Tech; Moges Wagena, Virginia Tech; Zach Easton, Virginia Tech University

Abstract: Topography exerts critical controls on many hydrologic, geomorphologic, and environmental biophysical processes. Unfortunately many watershed modeling systems use topography only to define basin boundaries and stream channels and do not explicitly account for the topographic controls on processes such as soil genesis, soil moisture distributions and hydrological response. We develop and demonstrate a method that uses topography to spatially adjust soil morphological and soil hydrological attributes [soil texture, depth to the C-horizon, saturated conductivity, bulk density, porosity, and the field capacities at 33kpa (~ field capacity) and 1500kpa (~ wilting point) tensions]. In order to test the performance of the method the topographical adjusted soils and standard SSURGO soil (available at 1:20,000 scale) were overlaid on soil pedon pit data in USDA experimental watersheds. The topographically adjusted soils exhibited significant correlations with measurements from the soil pits, while the SSURGO soil data showed almost no correlation to measured data. We also applied the method to the watersheds using the Soil and Water Assessment Tool (SWAT) model to fields as a proxy to propagate changes in soil properties into field scale hydrological responses. Results of this test showed that the topographically adjusted soils gave similar predictions of field runoff with the SSURGO soils. However, the topographically adjusted soils generally predicted baseflow response more accurately, reflecting the influence of these soil properties on non-storm responses. These results indicate that adjusting soil properties based on topography can result in more accurate soil characterization and, in some cases improve model performance.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

Lessons Learned from Applying APEX to Field-Sized Agricultural Watersheds Underlain by a Restrictive Layer

Authors: Claire Baffaut*, USDA-ARS; Nathan Nelson, Kansas State University; John Lory, University of Missouri; Anomaa Senaviratne, University of Missorui; Ammar Bhandari, Kansas State University; Antonio Mallarino, Iowa State University; Matthew Helmers, Iowa State University; Ranjith Udawatta, University of Missouri; Dan Sweeney, Kansas State University; Mike van Liew, University of Nebraska

Abstract: Phosphorus indices are water quality risk assessment tools of phosphorus (P) loss but there are insufficient water quality data to fully test them. Process based models like the Agricultural Policy/Environmental Extender (APEX) model have potential to generate estimates of P loss over a large range of hydrologic conditions and management systems. APEX is designed to simulate edge-of-field water, sediment, and nutrient losses. The objectives of this study were to determine the accuracy of APEX estimated runoff, sediment and P loss, and the consistency of BMP efficacy at reducing P loss after three calibration strategies: watershed-specific parameterizations based on full calibration/validation at each site, a minimal parameterization based on best professional judgment (BPJ), and a regional parameterization derived from the fully calibrated parameter sets. The analysis was conducted at four sites representing soils with a restrictive layer in Missouri and Kansas. Five and nine data sets were used for model calibration and validation, respectively. Full calibration provided excellent fit for runoff and P loss and marginal fit for sediment. In contrast, the BPJ resulted in unacceptable estimates of sediment and P loss, and marginal fit for runoff. The regional parameter set resulted in excellent estimates of runoff and marginal estimates of sediment and P loads at each site but excellent fit over the whole region. In addition, the fully calibrated and the regional parameter sets produced consistent estimates of BMP efficacy, but not the BPJ approach. These results emphasize that failure to calibrate APEX with runoff and water quality data (the BPJ approach) will result in poor estimates of annual sediment and P loads, and BMP efficacy. Success with regional calibration suggests an opportunity to use APEX to generate data for situations beyond the calibrated watersheds, within limits that remain to be defined.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

Long-Term Effect of Grain Cropping Systems on Crop Yield, Runoff, and Water Quality on Claypan Soil

Authors: Fessehaie Ghidey*, USDA-Agricultural Research Services; Claire Baffaut, USDA-Agricultural Research Services; Newell Kitchen, USDA-ARS; Ken Sudduth, USDA-ARS; Matt Yost, USDA-ARS; Bob Lerch, USDA-ARS; John Sadler, USDA-ARS

Abstract: Herbicide and nutrient contamination from surface runoff remains a problem for cropland underlain by claypan soils. The objectives of this study were to evaluate the effect of three cropping systems on crop yield, runoff, atrazine, NO3-N, and dissolved phosphorus (P) losses in Northeast Missouri. Cropping System (CS) 1 was a mulch tillage corn-soybean rotation with all inputs incorporated. CS 2 was a no-till corn-soybean rotation system with herbicide and P surface-applied and not incorporated. CS 5 was a no-till corn-soybean-wheat system with split herbicide application and cover crops. N was injected for the no-till systems. For each phase of each system, yield was measured from 1991 to 2010 on three 0.37-ha replicates, of which two were monitored for runoff and water quality during the 1997-2002 growing seasons. Measured data were used to calibrate the Agricultural Policy/ Environmental eXtender (APEX) model. Grain yields were well simulated except for dry years. The model performed well in estimating runoff, atrazine, NO3-N, and dissolved P losses during 1997 to 2002. Long-term (1991-2009) simulation showed that annual atrazine losses to surface runoff were similar to seasonal losses and twice as much for no-till systems than for CS1. Annual NO3-N losses were 10 to 20% and annual dissolved P losses were 50% higher than seasonal losses; however, the trends between the Cropping systems were not clear. These results expand the usefulness and relevance of short-term water quality data sets to longer periods with a wider range of climatic conditions.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Conservation Models, Tools, and Technologies

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Modeling the Dynamics of Conservation Tillage Adoption: Effects of Crop Rotation and Erodibility of the Soil on Continuous Conservation Tillage Adoption in Iowa

Authors: Dat Tran*, North Carolina A&T State University; Lyubov Kurkalova, North Carolina A&T State University

Abstract: Carbon gain with conservation tillage adoption is only realized when conservation tillage is adopted continuously. However, most empirical econometric studies of tillage choices did not take into account the dynamics of conservation tillage. Thus, there is a need for understanding the farmer's tillage choice over time and the factors driving the choices to produce efficient and practical policy promoting conservation tillage. Targeting policies to cropland that contributes the most to an environmental problem necessitates to understand the effects of erodibility of the soil on the dynamics of famers' tillage choice. In addition, little is known about effects of crop rotation on continuous conservation tillage (CCT) adoption. The study presents an application of Markov chain to model the dynamics of conservation tillage adoption, and to investigate the effects of erodibility of the soil and crop rotation on the farmers' tillage choice over time in Iowa. Quadratic Programming was used to estimate the probabilities of transition from one tillage-crop combination to another tillage-crop combination for all Iowa counties using countyaverage, year-and crop-specific tillage data from Conservation Tillage Information Center. The estimated transition probabilities and the ensuing probabilities of CCT were then analyzed in relation to crop rotations and environmental vulnerability as measured by the Highly Erodible Land (HEL) code from the Iowa Soil Properties and Interpretations Database GIS soil data layer. The results showed that CCT and alternating conservation tillage(ACT) occurs more often on HEL when compared to other cropland. In addition, we identified a significant effect of crop rotations on CCT and ACT adoption. The results of the study indicate that both natural conditions (soil erodibility) and other economic choices (crop rotations) affect farmers' choices of CCT and ACT in Iowa.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

Multispectral Imagery and LiDAR Services from the KYAPED: Surveying Erosion Patterns to Help Save Soil and Dollars

Authors: Demetrio Zourarakis*, Kentucky Division of Geographic Information

Abstract: The Kentucky-acquired high resolution, leaf-off, multispectral aerial imagery and LiDAR elevation data are the result of the Kentucky Aerial Photography and Elevation Data Program (KYAPED), and provide an opportunity to survey and photointerpret erosion patterns at the field level. In addition to the National Agricultural Imagery Program (NAIP), high resolution and high accuracy leaf-off imagery, and in conjunction with bare earth digital elevation models (DEM) are valuable data for monitoring and assessing erosion control needs. This paper shows how REST services can be used in a GIS environment to exploit imagery and terrain datasets.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

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New Tools for Assessing the Effectiveness of Agricultural Water and Sediment Control Basins

Authors: Ross Wilson*, Ausable Bayfield Conservation Authority; Mari Veliz, Ausable Bayfield Conservation Authority

Abstract: The challenge of improving water quality at a large river scale is daunting and nearly impossible. Only by implementing Best Management Practices (BMPs) at a manageable scale (field to sub-watershed) on thousands of the small contributing watersheds, can the cumulative improvements be observed at the large river scale. Agricultural Water and Sediment Control Basins (WASCoBs) are promoted as a BMP to reduce erosion and improve water quality at the field scale. The temporary ponding of surface runoff in these basins allows some sediment and some nutrients to be deposited in the basin, with cleaner runoff entering the drainage tile network. However, the hydrology of WASCoBs is not well understood. In particular, the effectiveness at reducing the sediment and loading to the drainage tile is not well documented. The Ausable Bayfield Conservation Authority was involved in a multi-year study to assess the effectiveness of WASCoBs in a highly erodible area on the shores of Lake Huron, which supported an intensive cash crop and livestock industry. Annual precipitation approaches 1000mm per year. A combination of low infiltration clay-loam soils and rolling topography (4-10% slopes), and a short travel time to Lake Huron, create the need for effective erosion and sediment control. The hydrology of five different WASCoBs have been observed and quantified from multiple runoff events between 2012 and 2015. Results from the monitoring of these WASCoBs show that this BMP can be very effective. Peak flow reductions in the range of 90% have been observed. The removal of surface runoff from the surface eliminates downstream erosion. Reductions in sediment and nutrient loading to the tile was strongly affected by ponding time. The longer ponding times yield much smaller loads exiting the basin. Soluble nitrate loadings were not affected by this BMP.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

Nitrogen and Phosphorus Consumption and Balance in the Mississippi River Basin: 1987 to 2012

Authors: Clifford Snyder*, International Plant Nutrition Institute; Paul Fixen, International Plant Nutrition Institute; Scott Murrell, International Plant Nutrition Institute; Quentin Rund, PAQ Interactive; Ryan Williams, PAQ Interactive

Abstract: Efficient and effective use of commercial fertilizer and animal manure nutrient resources helps to provide an abundant and high quality food supply, and improves and sustains soil fertility. The U.S. Mississippi-Atchafalaya River Basin (MARB) has been the focus of improved cropping system conservation and nutrient management improvements for several decades; especially since the mid-1990s when hypoxia in the Gulf of Mexico (GOM) and nutrient losses within the MARB landscape began to be better recognized. The impacts of nutrient losses from farm fields to streams and rivers that empty to major rivers that drain to the Mississippi River and the GOM are receiving greater attention and many states in the MARB have completed nutrient loss reduction strategies in response to actions called for by the federal and state agency Hypoxia Task Force; in 2008 and in 2013. Some state water quality agencies and the USGS have monitored stream flows and nutrient loads for multiple years, there have been few reports of state- or major river basin-level nutrient (fertilizer and recoverable manure) consumption and balances. We have assembled data from the USDA (NASS, ERS, NRCS) and from reports by the Association of American Plant Food Control Officials (AAPFCO), and developed a Nutrient Use Geographic Information System (NuGIS) tool that can be used by the public to evaluate nutrient consumption, balances, removal to use ratios and related indices that reflect information about nutrient performance at different temporal and spatial scales. Trends in several nitrogen (N) and phosphorus (P) indices were evaluated using data from 1987 to 2012 for the entire MARB, and its six major sub-basins. These trends will be reported and discussed in association with trends in N and P loads from the major rivers draining to the Mississippi River and delivery to the GOM, and implications for water quality and soil health.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Conservation Models, Tools, and Technologies

^{*}denotes primary author and subject area

Phosphorus Index and TopoSWAT Comparisons for Pennsylvania Watersheds

Authors: Jennifer Weld*, Penn State University; Douglas Beegle, Penn State University; Tamie Veith, USDA-ARS PSWMRU; Amy Collick, USDA ARS; M.G. Mostofa Amin, Penn State University; Jian Liu, Penn State University; Peter Kleinman, USDA-ARS

Abstract: The Chesapeake Bay Conservation Innovation Grant (CIG) regional P Index project was established to address increased focus on phosphorus index (P Index) efficacy in identifying fields vulnerable to phosphorus (P) loss. Comparing P Index risk assessments with quantitative P losses simulated using water quality models such as the Soil and Water Assessment Tool (SWAT), is a targeted project outcome that provides direction for potential P Index revisions. In this study, Pennsylvania P Index assessments will be compared to dissolved P, sediment P, and total P losses simulated using the TopoSWAT (a modified version of SWAT which incorporates variable source area hydrology). Phosphorus Index assessments will be determined for fields selected within three Pennsylvania agricultural watersheds for which TopoSWAT results are available. Fields will represent a range of agricultural management practices, tillage practices, and soil properties, including runoff potential. Linear regression and as appropriate, outlier analysis, will be used to evaluate the comparisons between P Index assessments and TopoSWAT P losses. These comparisons will assist in identifying soil properties, landscape properties, and agricultural management practices, for which improved representation by the Pennsylvania P Index may be needed to better identify critical source areas vulnerable to P loss. Additionally, field and management data will be used to evaluate future Pennsylvania P Index revisions by comparing revised assessments with current assessments used in this study.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

Stream Flow Monitoring for Watershed Studies Following "Re-vegetation" Efforts for Reducing the Sediment Loading on the Shorelines of Micronesian Island of Rota, CNMI

Authors: Mohammad Golabi*, University of Guam

Abstract: The Talakhaya watershed in Rota is identified as a Coral Reef Management Priority site for CNMI (Commonwealth of Northern Mariana Islands). In 2010 federal and jurisdictional partners came together to develop a Conservation Action Plan (CAP) for the Talakhaya watershed. The CAP highlights the need for continued re-vegetation of eroding areas, as well as monitoring and assessing the rate of soil loss in the watershed. The re-vegetation efforts in the watershed however, did not have monitoring system in place to quantify the effects that they were having in terms of reduced sedimentation. This 'Talakhaya Watershed Soil Loss Assessment Project' assisted in evaluating the re-vegetation objectives of 'Reducing the Soil Loss' of the Talakhaya CAP. The project objective was to quantify the reduction in sediment by determining the hydrology and by measuring the hydrological parameters following the installation of equipments such as water meters, barometric level loggers, turbidity meters and rain gauges. The water flow as well as the turbidity level of each stream leading to the ocean from the Talakhaya watershed was therefore measured and sedimentation level was assessed accordingly. The stream monitoring was compared in areas where no mitigation techniques were applied with areas where the Vetiver grass as well as other vegetation were planted as means of controlling erosion. The comparison was also made with other areas where tree plantation was being practiced as a mean of reducing sedimentation load into the ocean shorelines. In this presentation, the preliminary results of first years' of monitoring are being reported here for evaluating the effectiveness of the aforementioned mitigation techniques thus far. Keywords: Watershed Management, Vetiver grass system, Coral, Badlands, Micronesia, Rota

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Conservation Models, Tools, and Technologies

Targeting for Diverse Ecosystem Service Outcomes in an Agricultural Matrix

Authors: Emily Zimmerman*, Iowa State University; Lisa Schulte Moore, Iowa State University; John Tyndall, Iowa State University

Abstract: Row-crop agricultural landscapes are highly productive with respect to the production of provisioning ecosystem services (ES), but neglect to deliver other progressively more demanded supporting, regulating, and cultural ES. This research investigates opportunities to help state and federal agencies explore options to enhance and diversify ES outcomes obtained from agricultural landscapes. Presently, conservation programs are voluntary, and as a result conservation programs have not been targeted to those fields that contribute disproportionately to enhancing regulating and cultural ES such as water quality. We hypothesize that by spatially identifying parcels that contribute disproportionately to water quality concerns in the watershed and strategically implementing best management practices (BMPs) on those parcels, water quality can be improved while minimizing land-use tradeoffs and increasing ES delivery. We use a two-stage modeling approach in a Central Iowa watershed to examine the concept. Using a new, innovative GIS-based targeted conservation protocol developed by USDA-ARS (the Agricultural Conservation Planning Framework) coupled with the Agricultural Policy/Environmental eXtender (APEX), we assess the effect on water quality from nutrient and sediment losses under current and alternative land management scenarios. Alternative land management scenarios were designed to assess land-use tradeoffs associated with efficient and cost effective ES production at varying levels of strategic adoption of BMPs (i.e., random placement or coordinated placement of BMPs based on fields with highest vulnerability). We predict that relatively large reductions in nutrient and sediment loss at the watershed level will be achieved by coordinated placement of conservation practices and management techniques on relatively few, high-contributing parcels (>10% area).

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

The Chippewa 10% Project: Ecosystem Services Resulting from Continuous Living Cover in an Agricultural Watershed

Authors: George Boody*, Land Stewardship Project; Steve Ewest, Land Stewardship Project; John Westra, Louisiana State University Agricultural Center; Rebecca Wassernan-Olin, Land Stewardship Project; Paul Wymar, Minnesota Pollution Control Agency; Bradley Heins, West Central Research and Outreach Center – University of Minnesota; Jim Paulson, University of Minnesota Extension Service; Terry VanDerPol, Land Stewardship Project; Kylene Olson, Chippewa River Watershed Project; Sharon Weyers, North Central Soil Conservation Research Lab, Agricultural Research Service; Robin Moore, Land Stewardship Project

Abstract: The Chippewa River Watershed (CRW) drains 5387 km2 of natural and managed landscapes in West Central Minnesota, where annual crops predominate. High-value ecosystem services are affected by flow of water from farm fields, nitrate-nitrogen, total suspended solids and other land degradation stressors. A decade of in-stream monitoring correlated to land-use in each major sub-basin indicated that an additional 9% of row-crop fields needed to be converted to perennials to achieve water quality goals. This study sought to answer the question: Could shifting to 10% continuous living cover achieve habitat and water quality goals, while being profitable for farmers? GIS mapping identified 46,137 ha of ecologically sensitive and marginal fields in the CRW and three 10-digit sub-basin focal areas were chosen. Ecosystem services resulting from more continuous living cover on the identified areas were estimated through Agricultural Production Systems Simulator, Hydrologic Simulation Program FORTRAN and integrated economic modeling. A scenario based on shifting 3.7% of corn/soybean fields in focal areas to continuous living cover as buffers, management intensive rotational grazing, prairie strips or longer crop rotations was the most effective at reducing runoff. The predicted in-stream load reductions and changes toward goals for load reductions, respectively, from this scenario were: phosphorous (-17%/ 100%), nitrogen (-18%/41%) and total suspended solids (-16%/31%). By targeting marginal fields we estimated \$2.1 million greater profits annually from adopting continuous living cover systems (using 10yr average prices). This scenario has broad applicability as a way to include continuous living cover in models used at watershed scale. This study is part of a comprehensive project, which also includes development of decision tools for farmers and watershed planners, monitoring, and farmer and community engagement. Tools are transferable.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

The Conservation Effects Assessment Project – Cropland: Analyses of Conservation Practices in the Western Lake Erie Basin in 2003-06 and 2012

Authors: Mari-Vaughn V Johnson*, USDA NRCS; Jay Atwood, USDA NRCS; Kathrine Behrman, Univ. of Texas, Dept. of Integrative Biology; M. Lee Norfleet, USDA NRCS

Abstract: The Conservation Effects Assessment Project – Cropland (CEAP) quantifies conservation practice adoption and determines its impacts on conservation concerns at the regional scale. The Western Lake Erie Basin (WLEB) was surveyed in 2003-06 and again in 2012. Notably, adoption of structural water erosion practices increased; acres managed with at least one class of structural practice controls (overland flow, concentrated flow, or an edge-of-field practice) increased from 25 percent of acres in 2003-06 to 40 percent of acres in 2012. Acres managed with more than one class of structural practice control increased, from 9 to 15 percent of acres in 2003-06 and 2012, respectively. Another major improvement in conservation management during the time between the two surveys was expansion of acres treated with drainage water management, which increased from less than 1 percent in 2003-06 to 9 percent in 2012. Tillage practices and the majority of nutrient management practices did not change between the two surveys. However, nutrient application management improved for both nitrogen and phosphorus. Acres on which all nitrogen applications were incorporated increased from 29 to 43 percent of cropland acres, while acres on which all phosphorus applications were incorporated increased from 45 to 60 percent of cropland acres between 2003-06 and 2012. The 2012 CEAP survey does not capture all of the conservation practice adoption in WLEB today. Complementary data shows that numerous practices were adopted in the years following the 2011 algal bloom, years not captured by the 2012 survey. CEAP-Cropland findings will be used to determine outstanding achievements and remaining needs in the region so that conservation efforts can be more efficient and effective at developing systems that meet farmer yield goals in ecologically sound and sustainable ways.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

^{*}denotes primary author and subject area

The Daily Erosion Project

Authors: Timothy Sklenar*, Iowa State University; Richard Cruse, Iowa State University; Brian Gelder, Iowa State University; Daryl Herzmann, Iowa State University; David James, USDA-ARS

Abstract: The Daily Erosion Project (DEP) is an ongoing modelling effort which has evolved from the Iowa Daily Erosion Project. DEP provides comprehensive and dynamic estimates of sediment delivery, soil erosion, and hill slope runoff for agricultural land areas across the Midwestern United States every day for Hydrologic Unit Code 12 (HUC 12) size watersheds. Results are posted every morning at dailyerosion.org. Currently DEP covers all of Iowa and portions of Kansas and Minnesota, but expansion of coverage is ongoing. The integration of highly resolute spatial and temporal climate data, soil properties, crop rotation and residue management data affords the opportunity to test components within the model that influence output stability of field-scale erosion event estimates. Understanding these areas of sensitivity is paramount as expansion continues into surrounding Midwestern states. The presentation will provide an overview of the DEP technology, including how input data are derived and used to make daily erosion estimates on over 200,000 flowpaths in the modelling area, as well as a discussion of the impact of modelling different flowpath densities on output data and plans for future expansion (both land area and model functionality).

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

Vegetated Treatment Area Effectiveness For Treating Runoff From Small Swine Operations

Authors: Kori Higgs, North Carolina A&T University; Daren Harmel, USDA-ARS; Kevin Wagner*, Texas Water Resources Institute; Patricia Smith, Texas A&M University

Abstract: More than 70% of swine operations nationwide are considered 'small' with less than 100 head. These producers need practical, low-cost waste management options to protect water quality and avoid potential regulation. Vegetated Treatment Areas (or VTAs) are an inexpensive alternative to standard waste management systems (i.e. lagoon systems) to help reduce soil, nutrient, and bacteria runoff from small operations. VTAs are composed of perennial grasses used to improve runoff water quality associated with livestock, poultry, and other agricultural operations. VTAs are typically part of a vegetative treatment system (VTS) that includes additional components to remove solids, such as a settling or vegetative infiltration basin. There have been numerous studies, both modeling and field, related to the design and evaluation of VTSs used to treat animal feeding operation (AFO) runoff; however, none of these have studies evaluated the effectiveness of VTAs receiving direct runoff from small swine operations during natural rainfall events. This study determined whether a sufficiently sized VTA alone could effectively remediate direct runoff from small swine operations (<100 animals). Three study locations were established in 2012, and sampling sites were installed to measure runoff water quantity and quality at the VTA inlet, VTA outlet, and a nearby control. Results showed that VTAs reduced runoff volumes by more than 17%, nutrient concentrations by more than 23%, and nutrient loads by more than 50%. Based on these results, VTAs appear to be a practical, environmentally-friendly waste management alternative for small swine operations if they are properly designed and managed (e.g., solids management, perennial grass cover and subsequent haying and removal, and nutrient loads/VTA area).

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

Woodchip Bioreactors: Multi-Contaminant Removal from Agricultural Drainage

Authors: Natasha Hoover*, Iowa State University; Michelle Soupir, Iowa State University; Thomas Moorman, USDA-ARS

Abstract: Multiple studies have confirmed the ability of woodchip bioreactors to remove nitrate from agricultural tile drainage, but the effect of these reactors on other contaminants is not well understood. A pair of lab-scale bioreactor column studies, one at room temperature (~22°C), and one at a controlled 10°C, were conducted to investigate the potential of woodchip bioreactors to treat multiple contaminants, and quantify the impact of hydraulic residence time and limestone amendment on the removal of nitrate, phosphorous, and fecal indicator bacteria by woodchip bioreactors. Synthetic tile drainage, periodically augmented with E. coli and Salmonella enterica, was pumped through two sets of three bioreactor columns, one set at room temperature, and the other at a controlled 10°C. Hydraulic retention time (HRT) and temperature were systematically altered between a 12-hour and 24-hour HRTs. Fecal indicator bacterial removal was measured in both sets of experiments, with reductions surpassing 90% at room temperature. Bacteria removal was more variable at 10°C. Analysis confirms expected nitrate removal in both sets of columns at each HRT. Minimal phosphorus removal was also observed, however, the mechanism for removal has not been determined.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

Assessing Water Quality and Engaging Public through Illinois RiverWatch Citizen Science Program

Authors: Allison Rhanor*, The National Great Rivers Research and Education Center

Abstract: Water quality is an important issue for resource managers in Illinois given the state's extensive agricultural landscape and location along the Mississippi and Ohio Rivers. However, it is easy for stream quality figures to go unnoticed outside the scientific community. According to the 2014 Integrated Water Quality Report put out by the Illinois EPA, 39% of assessed stream miles in Illinois are "impaired," meaning one or more designated uses outlined in the Clean Water Act are not satisfied. As most of these water quality issues are caused by non-point source pollution, it is more important than ever to involve citizens in protecting and restoring our local waters. Illinois RiverWatch (RW) is the statewide volunteer stream monitoring program that seeks to document long-term trends in stream health as reflected by monitoring of macroinvertebrates and habitat condition. In 2015, RW volunteers monitored 91 stream sites on 73 different waterbodies. Total stream quality was determined using taxa richness, EPT taxa richness, and MBI metrics for the site. Overall, the Kankakee River watershed exhibited the best water quality with 66% of sites monitored achieving "Good" or "Excellent" scores. The Kaskaskia River watershed exhibited the worst scores, with 54% of sites being rated as "Poor" or "Very Poor". Water quality trends were analyzed for all RW sites monitored in 2015 using Pearson's Correlation for all three metrics, A Sangamon River tributary in Champaign County, Hells Branch in Jo Daviess County, and Waubansee Creek in Lake County showed the strongest improvement, while the Sangamon River in Champaign County and Hickory Creek in Will County showed the strongest decline in water quality. Illinois streams are monitored by the IEPA on a 5 year rotation, and RW results can raise potential red flags of poor water quality in the interim. Additionally, discrepancies between the IEPA and RW water quality scores are used to assign priority for future RW monitoring efforts.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Outreach, Education, and Community Engagement

Carp Wall: Enforcing the Continental Divide

Authors: Gerald Roach*, Natural Resources Conservation Service; Duane Riethman, Natural Resources Conservation Service

Abstract: The Eagle Marsh project is a 752 acre restored natural area, located in Allen County, south of Fort Wayne, the second largest city in Indiana. In 2005, this land was placed under permanent easement within the Wetlands Reserve Program-a Farm Bill program which restores, enhances and protects wetland habitat. At the time of enrollment the majority of the land was cropland planted to corn and soybeans. Wetland restoration activities were planned and completed by the Natural Resources Conservation Service. The project area lies at the hydrological dividing point (Continental Divide) of waters going to the Atlantic Ocean (through Lake Erie) and waters going to the Gulf of Mexico (via the Mississippi River). This unique landscape position allows for waters from these two watersheds to intermingle during high flood events, allowing for the passage of organisms, including invasive species, into either watershed. Most concerning are the invasive Asian Carp, which have been expanding their range up the Mississippi River watershed, but as of yet have not been detected within the Great Lakes. Asian Carp, have been identified as far north as Huntington County, not far from Eagle Marsh. In 2011, several state and federal agencies met to develop a plan to try and stop the movement of Asian Carp into the Great Lakes. Eagle Marsh's position on the Continental Divide was identified as high priority to stop such movement. A multi-partner (federal, state, and local) plan was implemented to design and install 9000 lineal feet of levee to separate the two watersheds. This levee will prevent waters from the Mississippi and Lake Erie watersheds to cross hydrologic boundaries during flood events. This closes one of the key potential crossover points for the Asian Carp. The structural portion of this project was installed in the summer and fall of 2015, with final vegetative restoration to be completed in spring and summer of 2016.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Outreach, Education, and Community Engagement

Construction Stormwater Activities by a State Chapter: Benefits and Lessons Learned

Authors: Earl Norton*, Alabama Soil and Water Conservation Committee

Abstract: The Alabama Chapter of SWCS prepared a vision plan in 2000 that provided the basin for a state-wide erosion and sediment control program that has continued since the plan was implemented in 2001. Over the years, the program has prepared and maintained the technical handbook for erosion and sediment control that is recognized in the non-point source construction stormwater program managed by the state environmental agency. Related educational activities have evolved and include field days and seminars. Additional technical materials produced include a pocket field guide containing handbook details and a brochure explaining the importance of protecting the aquatic environment from sediment and turbidity. The program has developed and succeeded because of strong leadership provided by the Alabama SWCS Chapter and the support of partners that have a vested interest in stormwater management. An overview of the activities will explain how the program was initiated and how it evolved. The presentation will describe how the Alabama SWCS chapter has benefitted as non-members participate in various educational activities sponsored and co-sponsored by the Chapter and consider attending future SWCS events and becoming SWCS members. Ultimately, the technology that the Chapter helps provide is applied to the landscapes of Alabama and both the citizens and environment gain the benefits. The information about the various activities has many positive implications for other SWCS chapters.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Outreach, Education, and Community Engagement

From Boot Camp to Jamboree: Successful Partnerships in Kentucky

Authors: Paulette Akers*, Ky Division of Compliance Assistance; Amanda Gumbert, University of Kentucky

Abstract: Kentucky's agricultural landscape is diverse, both in terms of animal and plant production systems. These systems are supported with research-based information from land-grant universities, federal technical agencies, and regulated through state agencies. To ensure accurate and up-to-date information is available for agricultural producers, the KY Division of Compliance Assistance partnered with the University of Kentucky, Kentucky Natural Resources Conservation Service, and the Kentucky Divisions of Conservation and Water to host multiple workshops for each entity's personnel. Ag Boot Camp served as a primer for basic agricultural information related to environmental compliance, and was targeted to agency personnel with limited ag backgrounds. Agricultural Professionals Workshops (Jamborees) were targeted to project partners' regional offices to connect personnel to agency counterparts and clear up confusion regarding who is responsible for which pieces of the agricultural and regulatory information for farmers. More than 200 people attended the workshops that were held across the state. As a result of these workshops, 96% of attendees agreed that they would be able to apply the information that they gained in their jobs. Additionally, more than 50% expressed a desire for additional training on environmental regulations, nutrient management or partner agency interactions. Three of the agencies report increased communications as a result of the workshops. We plan to grow the program in the future by adding other agencies and specific hands-on training as requested by participants.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Outreach, Education, and Community Engagement

Saving Lake Mauvaise Terre: Farmers, Golfers, and Mayors

Authors: Michael Baise*, American Farmland Trust

Abstract: Lake Mauvaise Terre is the reserve water supply for the City of Jacksonville in West-Central Illinois. Mauvaise Terre Creek flows to the Illinois River and then to the Mississippi. The Lake also borders the municipal golf course "The Links" and the local country club golf course. The lake was slowly dying from decades of sedimentation and conservation inaction. After a significant rainfall event in June 2011 knocked out the municipal water treatment plant, American Farmland Trust and the Illinois Environmental Protection Agency partnered with the City to promote outreach and conservation education to the farmers, landowners, and golfers in the watershed. Today the Lake has been dredged and farmers are installing soil saving structures and practices.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Outreach, Education, and Community Engagement

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Strategies in Program Outreach, Advertisement, and Community Engagement: Lessons Learned by the Texas Watershed Steward Program

Authors: Michael Kuitu*, Texas A&M AgriLife Extension Service; Jake Mowrer, Texas A&M AgriLife Extension Service; Galen Roberts, Texas A&M AgriLife Extension Service; Ward Ling, Texas A&M AgriLife Extension Service; Drew Gholson, Texas A&M AgriLife Extension Service

Abstract: Stakeholder participation is the key to success in planning and implementing effective water quality and watershed management efforts. Individuals who live, work, and recreate in a watershed know it best and can most effectively drive local actions to improve and protect their water resources. Therefore, inclusion of the public in environmental management and conservation of natural resources is crucial. To address this need, the Texas Watershed Steward (TWS) program was developed to educate stakeholders about their watershed and its potential impairments. These stakeholders are then better prepared to take the necessary actions to protect and improve water quality throughout rural, urban, and agroecosystem environments as a whole. More than three thousand persons have attended one of the 75 completed TWS workshops to date. However, advertising and promoting these workshops in a way that motivates the public while accurately conveying the need for their involvement has proven challenging. This presentation will detail the valuable lessons learned towards the art and science of event promotion and public motivation since the TWS program inception in 2007. Pre/post program tests and six month post program voluntary evaluations indicate a 34% average attendee knowledge gain and 84% best management practice adoption rate. Therefore, we believe these strategies are effective in realizing the goals of this outreach, education, and community engagement program. Major TWS program benchmarks include new water quality improvement projects, increased stakeholder involvement in existing watershed protection efforts, and motivation of individual citizens to take greater personal responsibility for protection of their water resources and the necessary ecosystem services watersheds provide. These kinds of educational and participatory achievements are made possible only through successful outreach and community engagement strategies, developed and refined through experience.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Outreach, Education, and Community Engagement

The Chippewa 10% Project: Ramping Up Farmer and Community Engagement in Watersheds on Ecologically Sensitive and Economically Marginal Areas

Authors: Terry VanDerPol*, Land Stewardship Project; Robin Moore, Land Stewardship Project; Andy Marcum, Land Stewardship Project; Jennifer Hoffman, Chippewa River Watershed Partnership

Abstract: The Chippewa River Watershed is 5387 km2 of farm and recreational land in Western Minnesota. Row crops dominate in the south. In northern section, some grazing livestock and crop diversity remain although row crops are encroaching. The Chippewa 10% Project uses a systematic strategy to engage farmers or landowners who have ecologically sensitive and economically marginal land in row crops or poorly managed grasslands to explore changes to their management practices to reach water quality and habitat goals. 12,600 acres have been brought under improved conservation, over 10% of our ten-year goal. Our farmer/landowner engagement strategy is to build relationships, develop community and nurture conservation leaders. Profit is important in any farm enterprise decision but stewardship values, culture and community also impact decisions. Stewardship values one-one conversations have been held by staff with 300+ farmers and landowners to elicit often long unspoken values for land, water and community, obstacles to change and referrals to conservation resources. Conservation and profit are linked with an Economic Decision Making Tool to evaluate costs and returns from shifting monocultures to longer rotations, cover crops, buffers, or managed grazing. Discovery, innovation and leadership are supported through networks on rotational grazing, soil health and cover crops, and conservation leasing by women non-operating landowners. Project activities build community between farmers, hunters, and clean water advocates. The Simon Lake grazing network joins 29 recreational grassland owners and farmers to improve grasslands with conservation grazing of combined cattle herds. The Bio-Blitz brings together farmers, environmentalists and experts to record observed species on grazed grasslands. Changing land management decisions is difficult and risky. It is important to go beyond outreach to engagement and community building. Our strategies form a robust, transferable model.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Outreach, Education, and Community Engagement

Watershed Planning in Texas: Lessons Learned

Authors: Ward Ling*, Texas A&M AgriLife Extension Service; Jake Mowrer, Texas A&M AgriLife Extension

Abstract: Stakeholder participation is critical to successful watershed planning and implementation. In some cases, simple steps could be taken to help promote participation of stakeholders and demonstrate federal and state government recognition of their unpaid contributions of time and effort in the planning process. When plan development is protracted, stakeholder 'fatigue' and normal turnover of local officials and personnel can further slow the process and seriously impact the potential for success. In addition, synchronization of transitional funding from plan development to implementation is critical. Significant lag time during this period can substantially reduce vital momentum which is essential to sustain stakeholder engagement. To improve the success of watershed planning and increase the potential for planning and implementation success, water resource management agencies should: design and promote expedited planning, review, and approval processes; Allow appropriate preemptive work in advance of stakeholder engagement; Be engaged (including EPA) during planning so approval is rapid and assured; Synchronize planning and implementation funding to enable seamless transition; Clearly value the investment of local stakeholders by: Allow and document stakeholder time as a matching contribution in planning and implementation budgets; and allow use of federal funds for meals and refreshments at planning meetings to lessen the burden on stakeholders who are donating significant personal and/or professional time to support a government process.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Outreach, Education, and Community Engagement

Examining Factors that Facilitate or Serve as Barriers to use of Diverse Nutrient Loss Reducing Conservation Practices: Evidence from Iowa

Authors: J. Arbuckle*, Iowa State University

Abstract: In 2008, the USEPA-led Gulf Hypoxia Task Force released an Action Plan that called for Mississippi River Basin states to develop strategies to attain major reductions in the amount of nitrogen and phosphorus that flows from agricultural production systems into waterways. In May 2013, the state of Iowa instituted its Nutrient Reduction Strategy to help guide efforts to reduce nutrient loadings in surface water by 45%. It is increasingly recognized that to reach those reduction goals, nearly all Iowa farmers will need to establish and maintain a diverse array of conservation practices. In spring 2015, 1,746 Iowa farmers were surveyed to measure their knowledge of and attitudes toward the strategy, awareness and concerns about agriculture's impact on water quality, perspectives regarding facilitators of and barriers to conservation practice adoption, and current use of selected conservation practices. This paper will present results of analyses examining the factors that predict diversity in conservation practice use and provide insight into both facilitators of and barriers to farmer use of diverse suites of practices that can reduce nutrient loss into waterways.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Social Sciences Informing Conservation

Oil Seeds to Jet Fuels: Networks and Hydrology

Authors: Cornelia Flora*, Kansas State University; Joseph Jakubek, Kansas State University

Abstract: The Office of Naval Research and USDA invested in an ambitious research project to provide drop-in jet fuels for jet planes. This effort required innovations from germ plasm to the refinery. The focus on oil seeds, particularly Brassica (in this case, canola and camelina, as an alternative to wheat, has important implications for soil and water quality. Focus groups with farmers innovating or considering innovating with these crops revealed that concerns for profit were matched by concerns for the environment and a feeling of strong personal agency. However, the unwillingness to lock into a single use for the oil (and the need for a market for the by-product of the oil extraction process) meant that complicated social and economic networks were necessary to make the alternative a viable one. Our focus groups were conducted in 2013-2014 in the Dakotas, Pacific Northwest, and Oklahoma-Kansas. We found distinct regional differences, but in all regions concern for soil quality was a major motivator for continuing to experiment with canola production. The Pacific Northwest focus groups participants showed the greatest concern for soil quality. In all five focus groups, the producers sought multiple markets for both the oil and the press residue.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Social Sciences Informing Conservation

^{*}denotes primary author and subject area

Pathways for Effective Information Transfer between Nutrient Management Professionals

Authors: Nichole Embertson*, Whatcom Conservation District; Erin Cortus, South Dakota State University

Abstract: Water quality education, and in particular, manure nutrient management education, takes a concerted team approach by Extension, government and industry to transform research findings to implemented practices. This concerted effort is faced with many challenges, including organizational differences in language and communication methods at our disposal, and the sometimes controversial nature of the topic. The goal of this Pathways Project was to establish documented and effective pathways for information dissemination and use among manure nutrient management professionals that facilitate successful integrated (research/outreach/education) projects and programs. Specifically, the short-term outcomes were to develop an understanding of the needs of various ag professional organizations and individuals, the barriers for successful information transfer, and the terminology used by the different audiences. A national team of professionals from the university, government and private sectors created and disseminated a national survey over two years (2013-2015) to collect information use and dissemination information, along with demographic and organizational connections. What came from this data is an enlightening and useful approach to understanding who uses what type of information, how one can strengthen their impact to certain groups, and how to best target an outreach effort. Additionally, a "mind map" style decision tool was created to walk an information producer or user through the format, audience, and language they should use to get to their end user or product. This presentation will present the descriptive results of data gathered through this national survey, demonstrate the mind map, and serve as a platform for identifying strong pathways for use in conservation program information dissemination in the field of manure nutrient management.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Social Sciences Informing Conservation

Perception of Ecological Services of Riparian Agroforestry Systems by Farmers of the Tlapaneco River in the State of Guerrero, Mexico

Authors: Angel Bustamante-Gonzalez*, Colegio de Postgraduados; Samuel Vargas-Lopez, Colegio de Postgraduados; Taurino Hernandez-Moreno, Comisión Nacional de Áreas Naturales Protegidas; Julio Cesar Flores-Cesareo, Benemérita Universidad Autónoma de Puebla; Karina Velazquez-Muñoz, Secretaría de Medio Ambiente y Recursos Naturales

Abstract: The riparian agroforestry systems of the Tlapaneco River, in the state of Guerrero, Mexico, have partially replaced the ecological functions of the original riparian vegetation in the functions of biodiversity, landscape, flood protection and climate regulation. The continuity of these systems is related to the ecological, economic and social values that farmers give them and the decision of these to continue keeping these diverse systems combining annual crops and trees. Using aerial photographs and field trips the presence of four farming systems were identified: annual monocultures, agroforestry alley cropping system (moderate agrobiodiversity), orchards of a single species (low agrobiodiversity) and orchards with various species (high agrobiodiversity). Subsequently, a representative picture of each type of system was selected and was shown to 42 farmers to know what type of system the farmer prefer. For each photograph, respondents valued aspects of landscape, recreation, biodiversity and agricultural productivity. 59.5% of respondents preferred the system of orchard of a single species, while annual monoculture system and agroforestry alley cropping system had the same preference (16.7%), and 7.1% preferred orchards with various species. The preference of orchard of a single species was associated with a perception of greater beauty, productivity, profitability, biodiversity, workability, environmentally friendly, and likeable, although considered to be the system that uses more water. Although respondents value the environmental services of agroforestry systems and orchards, the determining factor in his preference is the economic value of the production system. They consider that the growth of trees on their land have effects such as shading and competition for nutrients, reducing production and economic returns.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Social Sciences Informing Conservation

The Influence of University Extension Field Days and Demonstration Events on Farmer's Adoption of Conservation Practices

Authors: Linda Prokopy*, Purdue University; Ajay Singh, Purdue University; Brian MacGowan, Purdue University; Bryan Overstreet, Purdue University; Michael O'Donnell, Purdue University; Heidi Klotz, Purdue University; Jessica Ulrich-Schad, South Dakota State University; Mike Dunn, Forestry Research, Edinburgh

Abstract: One of the core objectives of university extension is to transfer knowledge and understanding about new research to farmers and other natural resource managers so that new practices and technologies can be adopted more efficiently and effectively. Diffusion of Innovation theory is a commonly used theoretical framework for explaining the process by which a new idea, practice or technology is communicated through members of a social network over time. Since the mid-20th century it has been widely believed that if farmers could see a practice or technology demonstrated that they would be more likely to adopt those practices and technologies. Demonstration projects are a common method in which the Cooperative Extension Service has used to communicate new practices and technologies. To our knowledge, there is no research to date which shows the level of influence of extension demonstration projects on levels of adoption of conservation practices. We present research from interviews and surveys of farmers in three counties that examine if extension field days and demonstration events focused on cover crops influenced adoption by farmers. Our research will provide insight into how university extension activities could be more effective and the factors which lead to successful, continued adoption.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Social Sciences Informing Conservation

Using Face-to-Face Interviews to Design Outreach and Communication in Two New Mississippi River Basin Initiative (MRBI) Watersheds in Illinois

Authors: Jennifer Filipiak*, American Farmland Trust

Abstract: A commonly cited "success factor" in agricultural watershed projects is the active engagement of farmer leaders in the watershed – essentially identifying the "innovators" and "early adopters", supporting their leadership to bring along the "early and late majority". This application of E.M. Rogers 1962 "Diffusion of Innovation" theory relies upon knowledge of the population you are working with, and that information often comes anecdotally from local community members or more formally from survey instruments. American Farmland Trust is leading watershed partnerships in two new MRBI watersheds in Illinois – the Vermilion Headwaters in Livingston and Ford Counties (focused on reduction of nitrate loss) and the Upper Macoupin Watershed in Macoupin County (focused on reduction of phosphorous loss). Project teams in both watersheds are anxious to invest in more face-to-face time with producers at the start of the project and have set goals to personally interview 75% of producers in each watershed from January – March 2015. Through these interviews, we hope to gain information on the types of practices producers are currently using, evaluate their willingness to implement new practices, detect unknown barriers to adoption, identify technical assistance needs (to inform subsequent outreach) and inform producers of program funding. Initial findings from the interview project will be presented in the context of the Diffusion of Innovation theory.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Social Sciences Informing Conservation

^{*}denotes primary author and subject area

U.S. Corn Belt Advisors' Perspectives on Their Role in Farmer Adoption of Conservation Practices

Authors: Linda Prokopy*, Purdue University; Amber Mase, University of Wisconsin-Madison; Michael Dunn, UK Forestry Commission; Tonya Haigh, University of Nebraska; Sarah Church, Purdue University; Nick Babin, Taylor University

Abstract: Midwestern row-crop agriculture has negative impacts on water quality in the region. Corn farmers' voluntary adoption of conservation practices has been the primary mechanism for reducing non-point-source pollution in the U.S. This paper considers professional agricultural advisors' recommendations of conservation practices to reduce water quality impacts, but also to increase resilience and ameliorate threats to farm viability. Conservation practices are designed to protect or improve soil health and water quality, but interviews with advisors in Indiana and Nebraska suggest that conservation practice adoption is also a means of avoiding further regulation, mitigating biological risks, and enduring erratic extremes of weather, which are expected to increase with climate change. Perceived barriers to adoption from the advisors' point of view will also be discussed. The findings demonstrate that even those producers least inclined to foster environmental benefits should consider adopting conservation practices to improve the long-term resilience of their operations.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Social Sciences Informing Conservation

An Overview of Brazilian Experience on Measuring Runoff and Soil Loss Rates

Authors: Jamil Alexandre Ayach Anache*, Purdue University; Paulo Tarso Sanches de Oliveira, University of São Paulo; Edson Wendland, University of São Paulo; Dennis Flanagan, Purdue University

Abstract: Efforts have been made to determine soil erosion rates using runoff plots, mainly in the last century. In Brazil, the first experimental studies in plot-scale monitoring sites started in the 1940s. Thus, we aim to show an overview of plot-scale studies under natural rainfall over the country. We reviewed the ISI Web of Science, Scopus, SciELO, and Google Scholar databases to compile rainfall and soil loss under natural rainfall studies from scientific journal articles, conference papers, books, MSc thesis and PhD dissertations (grey science). The plot data studies have to meet the following requirements to be considered in the database: experimental plot data under natural rainfall; continuous monitoring data; and clear information about the experimental site: coordinates, plot description, land cover, and monitoring period. Our findings tell that the south and southeast regions of Brazil have the greatest number of runoff and soil loss monitoring sites under natural rainfall. In addition, the amount of plot-year is decreasing in the last 15 years. However, the number of published documents containing runoff and soil erosion experimental data is increasing. Lastly, more than 50% of the experimental studies have up to 2 years of monitored data.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Soil Health Resources, Indicators, Assessment, and Management

Arbuscular Mycorrhizal Fungi in Soil Health Paradigm

Authors: Zahangir Kabir*, USDA-NRCS

Abstract: The rate of mycorrhizal fungi is reduced both through soil disturbance and leaving the land fallow. Mycorrhizal fungi are found in virtually all soils, where they are able to colonize the roots of more than 85% of all plant species including most agricultural crops. These fungi are obligate symbiont, which means they can live only in or on plant roots and are an essential part of soil health. The roots provide them with carbohydrates, and the fungi benefit the host plant by enabling plants to more efficiently take up P and other nutrients of low mobility. Soil disturbance through tillage reduces the effect of mycorrhizae on plant growth and nutrient uptake by disrupting the hyphal network. Land fallowing also substantially reduces mycorrhizal propagules. Viability of mycorrhizal propagules and nutrient concentrations of plant are inversely related to the duration of the fallow. The influence of tillage and land fallowing on mycorrhizal fungi and soil health assessment and management will be discussed. Key words: Soil Health Assessment, Conventional Tillage, Conservation tillage, Land Fallow, Mycorrhizal fungi

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Soil Health Resources, Indicators, Assessment, and Management

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Consistency and Replicability of Active Carbon Measurements: A Preliminary Analysis

Authors: Michael Robotham*, USDA-NRCS; Candiss Williams, USDA-NRCS; Skye Wills, USDA-NRCS; Rich Ferguson, USDA-NRCS; Steve Monteith, USDA-NRCS

Abstract: Soil organic matter (SOM) is a widely acknowledged indicator of soil health. Soil organic carbon (SOC), the dominant component of SOM, is commonly measured and reported in literature. While there is widespread agreement on the importance of SOC, changes in SOC with changes in land management practices and over time have proven to be very difficult to detect due to spatial variability and method imprecision. Permanganate oxidizable carbon, often called "active carbon", is thought to represent the labile fraction of total SOC that is believed to be related to soil biological processes. As a consequence, active carbon has been proposed as an early (1-3 year) indicator of soil health status after land management changes. While there is general agreement on the laboratory methodology used to measure active carbon, no studies have evaluated the method using the diversity of samples that are available to be analyzed at the Kellogg Soil Survey Laboratory (KSSL). This presentation will discuss the standard active carbon measurement method used by the KSSL and other laboratories. The outcomes of this investigation, including the consistency, replicability, and sensitivity of this method with respect to small changes in sample mass and sample preparation will be discussed for a range of soil types from a range of geographic locations.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Soil Health Resources, Indicators, Assessment, and Management

Effects of Conservation Tillage on Soil Strength in Arkansas Cotton Production Systems

Authors: Daniel Pote*, USDA-ARS; Randy Raper, Oklahoma State University; John Snider, University of Georgia; Michele Reba, USDA-ARS; Tina Teague, Arkansas State University

Abstract: In recent years, many Arkansas cotton producers are adopting conservation tillage, often including winter cover crops, to help improve the soil and prevent erosion. However, no-till and reduced tillage systems do not allow the frequent tillage that has historically been used to help alleviate soil compaction problems in this region. To help address these concerns, a three-year experiment was conducted in eastern Arkansas to compare effects of the following three tillage systems on soil compaction: conventional tillage, no-till, and reduced tillage with a cover crop. A soil probe was used annually after cotton harvest to obtain a full set of cone index (CI) data at five locations across the row, with six replications of each plot x row position combination. Soil moisture for each treatment was determined from soil cores collected at two depths. First-year CI values indicated possible root-limiting conditions below the 30-cm depth in all treatments, but were greater in no-till and cover crop treatments than in conventional-tillage plots. However, tillage treatment showed very little effect on CI in the second year, and no-till treatments had the lowest overall CI values in the third year, regardless of row position, indicating the no-till system gradually decreased compaction in the soil profile at 20-cm depths and below. Relatively high CI values still existed near the surface in all treatments; but these were not necessarily root limiting, and were shallow enough in the no-till system that in-row subsoiling should be a viable option to eliminate any possible compaction effects on the crop.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Soil Health Resources, Indicators, Assessment, and Management

Effects of Flue Gas Desulfurization Gypsum on Crop Yields and Soil Health in Kansas

Authors: DeAnn Presley*, Kansas State University

Abstract: Flue gas desulfurization (FGD) gypsum was applied at multiple rates in a two site, three year study in Kansas to examine potential effects on crop yield and soil properties. Rates ranged from 0.5 to 2.25 Mg per ha of FGD-Gypsum. One site had silt loam soil texture at the surface, and the other site had sandy loam surface texture. Crop yield and grain feed values were measured each year, and soil properties including numerous chemical, physical, and biological parameters were measured in years 1 and 3. There were no yield differences for any site years. Sulfur content of the grain increased with increasing FGD application rates. There were no treatment differences for any physical or biological properties. Some soil chemical properties, including sulfur, pH, and electrical conductivity had treatment differences for some site years.

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Evaluating Ephemeral Gully Erosion and Conservation Practices on Cultivated Fields: A Paired Watershed Study in Central Kansas

Authors: Aleksey Sheshukov*, Kansas State University; Ronald Graber, Kansas State University; Tim Keane, Kansas State University; Daniel Devlin, Kansas State University

Abstract: Ephemeral gullies are incised channels on cultivated croplands resulting from concentrated overland flows during intensive rainfall events, which can be removed or "fixed" by tillage. Ephemeral gully erosion carries out the essential part of topsoil, affecting soil health, crop productivity, and impacting management operations on the field. Locating gullies, predicting their trajectory, geometrical features, and dynamic behavior are crucial for estimating sediment load and planning conservation strategies. In Little Ark watershed in central Kansas, almost 25% of all cropland fields were found to contain ephemeral gullies with their length exceeding 0.5 linear yard for one acre of land. A paired watershed study, conducted in Little Ark watershed to evaluate significance of ephemeral gully contribution to soil erosion rates, found terraces and grassed waterways significantly reducing ephemeral gully occurrence and associated soil erosion. The study employed gully surveying, field monitoring, and GIS and physically-based modeling. A GIS framework was developed to estimate locations of gully sensitive fields and length of ephemeral channels. Ephemeral gully risk maps were prepared for several watersheds in central Kansas that can be used for planning of conservation practices. Applicability of several BMPs specifically targeted to minimize sediment loads transported through ephemeral channels is being discussed.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Soil Health Resources, Indicators, Assessment, and Management

Improving Soil Health with Cover Crops and Cropping Diversity

Authors: Alan Sundermeier*, Ohio State University Extension; Rafiq Islam, Ohio State University; James Hoorman, Ohio State University Extension

Abstract: Crop productivity and soil health can be improved by increasing cropping diversity and adding cover crops which act as a biological primer. The long-term effects (1995 to 2014) of increasing no-till cropping diversity (continuous corn, corn-soybean and corn-soybean-wheat rotation) with and/or without cover crop) on soil health and crop productivity as compared to chisel-plowed continuous corn were evaluated. Soil samples collected at 0 to 30 cm depth at 15 cm interval were analyzed for selected soil biological, chemical, and physical health indicators, respectively. Temporal corn, soybean and wheat yield data were collected and normalized as relative crop yields. The soil and crop data were normalized to calculate a soil health scale based on inductive and deductive additive approaches. Results showed that increasing cropping diversity under continuous no-till had significantly higher values of soil health indicators and overall soil health than that of no-till or chisel-plowed mono-cropping system. Cropping diversity impact on soil health was more pronounced with cover crops due to diverse quantity and quality of residues. Continuous no-till impact on soil health improved over time due to surface placement of residues and biological efficiency as compared with chisel-plowing. Soil biological health indicators have shown more sensitive and consistent changes than that of the soil chemical and physical health indicators. It was to observe that improvements in crop yields lagged behind improvements in soil health. Based on our results, we concluded that when switching to no-till, it is very important to use cover crops from the very beginning of the crop rotation to improve soil health.

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Incorporation of a New A Horizon 'Soil Fingerprinting' Framework into Soil Health Assessments

Authors: Natalie Feisthauer*, Agriculture and Agri-Food Canada, Guelph, Ontario, Canada; Catherine Fox, Agriculture and Agri-Food Canada, Harrow, Ontario, Canada (retired); Gabriele Broll, University of Osnabrück, Osnabrück, Germany; David Kroetsch, Agriculture and Agri-Food Canada, Ottawa, Ontario, Canada; Charles Tarnocai, Agriculture and Agri-Food Canada, Ottawa, Ontario, Canada (retired); Elizabeth Kenney, Agriculture and Agri-Food Canada, Agassiz, Ontario, Canada (retired); Monika Joschko, Leibniz Centre for Agricultural Landscape Research, Müncheberg, Germany; Natalie Feisthauer@agr.gc.ca, Agriculture and Agri-Food Canada, Guelph, Ontario, Canada

Abstract: Soil health is fundamental to soil biodiversity, function, resilience to climate stress and provision of services like crop production. Soil health is derived from characteristics of soil biological, chemical and physical components and each should be considered in soil health assessments. However it is difficult to describe the constituents of soil physical, chemical and biological components in a manner that is succinct, repeatable and has the potential to be quantified. A unique "soil fingerprinting" framework has been developed to record and monitor the impacts on soil health from environmental stressors and land use management. The framework provides an enhanced soil A horizon descriptor methodology to systematically track and record change in soil chemical, physical and biological characteristics. The enhanced horizon designation generated is analogous to a genetic code or "soil fingerprint" for an individual soil sample at the time it was collected. The framework monitors A horizon characteristics that not only represent dynamic soil properties (e.g., soil structure, organic carbon, etc.) but also soil and land information (e.g., soil texture, land use) providing data to allow comparative interpretations of soil health changes and identify trends due to human activities (e.g., soil management practices) among different soils, or the same soils under different conditions or times. The design of the framework is modular, meaning any level of information can be removed and new levels can be added. For example, levels for soil microbial respiration, root biomass, earthworm population etc. can be added. The framework generates fingerprints that are unique identifiers of the nature and context of the key dynamic soil properties related to soil health as one integrated descriptive label. A database of fingerprints, generated either over time or among sites, provides enhanced opportunities to quantitatively assess soil health at field to landscape scales.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Soil Health Resources, Indicators, Assessment, and Management

In-Field Variability of Terrain and Soils in Southeast Kansas: Challenges for Effective Conservation

Authors: Gretchen Sassenrath*, Kansas State University; Tom Mueller, John Deere, Inc; Vladimir Alarcon, Universidad Diego Portales; Stacey Kulesza, Kansas State University

Abstract: A particular challenge for crop production in southeast Kansas is the shallow topsoil, underlain with a dense, unproductive clay layer. Concerns for topsoil loss have shifted production systems to reduced tillage or conservation management practices. However, nutrient and sediment loss is still a problem in the high-rainfall area. To improve crop production and encourage adoption of conservation practices, identification of vulnerable areas of fields is needed. This research explores within-field variability of farm production fields and uses online databases to collect information on vegetation and topography, and develop protocols for alternative management to protect vulnerable areas and reduce topsoil loss. Yield and plant growth information were collected from production fields at harvest in collaboration with producers. Soil electrical conductivity measurements further delineated in-field variabilities. Plant canopy coverage was analyzed using high resolution imagery. Although fields commonly have only a moderate slope, calculation of surface curvature indicates areas of fields at higher elevations; these often coincide with areas of thin vegetation, indicating high erosion losses. Analysis of digital elevation maps revealed areas within fields that held water and areas of high potential runoff where soil loss was likely. These areas could benefit by altered management practices to slow water runoff from the field and keep topsoil and nutrients on the field. Transitioning to conservation management practices such as reduced tillage and use of cover crops has been shown to improve the soil microenvironment and enhance the long-term sustainability of the agronomic production system. These conservation practices are being implemented in research and production fields.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Soil Health Resources, Indicators, Assessment, and Management

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Introducing the Soil Health Institute

Authors: C. Wayne Honeycutt*, Soil Health Institute; William Buckner, Samuel Roberts Noble Foundation; Steve Shafer, Chief Scientific Officer, Soil Health Institute

Abstract: Over 70% of our nation's rivers and streams are in only fair to poor biological condition, owing to high levels of N, P, sediment and other constituents. While approximately 1% of land is generally impacted by drought, this is predicted to increase to 30% by the year 2100. Given the high level of interest in "soil health", a significant opportunity currently exists for capitalizing on the productivity gains that soil health management systems provide to farmers and ranchers to achieve the water quality and climate change adaptation/mitigation benefits afforded by these same management systems. Research has shown that soil health-promoting practices such as no-till and cover crops significantly reduce soil, nitrate, and phosphorus loss. For example, converting a conventional till cotton system to no-till reduced soil and nitrate loss by over 50%. Adding a cover crop to that system reduced loss of soil by 88%, nitrate by 84%, and total phosphorus by 68%. Research has also shown that increasing a soil's organic C (SOC) content increases its available water holding capacity (AWHC) and therefore drought resilience. In general, a 1% increase in SOC results in a 1-5% increase in AWHC. Not only does research show that soil health-promoting practices increase SOC, but doing so also increases a soil's infiltration rate, thereby providing both environmental and resilience benefits. Additional research is needed to expand and capitalize on these SOC vs. AWHC relationships, assess the economics of these systems to increase their adoption, and assess the current state of soil health practice adoption to establish a baseline for measuring future progress. Given such challenges, opportunities, and needs, the Soil Health Institute was initiated to safeguard and enhance the vitality and productivity of soil through science based research and advancement. We at the Institute are committed to seeking and providing the additional resources needed to achieve these goals.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Soil Health Resources, Indicators, Assessment, and Management

Measuring the Effect That Soil Conservation Treatments Have on Soil Health Indicators

Authors: Alan Sundermeier*, Ohio State University Extension; James Hoorman, Ohio State University Extension; Curtis Young, Ohio State University Extension

Abstract: As producers and soil scientists become more familiar with soil health testing, there is a need to understand the correlation between different soil tests and their accuracy to determine effects of soil management systems. Research conducted in Northwest Ohio compared soil conservation treatments: 1. No-till permanent grass sod (Festuca spp), 2. Tillage with 30% crop residue (disc chisel), 3. No-till red clover (Trifolium pretense) cover crop, 4. No-till winter pea (Pisum sativium) cover crop, 5. No-till multispecies mix of cover crops, 6. No cover crop. These randomized and replicated soil treatments were performed on wheat stubble going to corn the following year. Soil samples were analyzed for soil nitrate, ammonium, Solvita soil test, and Haney Soil Health test (Ward lab). The soil nitrate (\$11), ammonia test (\$12.75), and Solvita (\$10) were less expensive per sample than the Haney test (\$50), but the Haney test evaluates several additional soil health parameters. Soil test levels correlated well between the various testing methods. Red clover soil nitrate was 18 ppm, ammonium was 5.7 ppm, Solvita CO2-C was 148, and Haney test soil quality was 13.3. This compared to no cover at soil nitrate at 5 ppm, ammonium was 4.3, Solvita CO2-C was 28.9, and Haney soil quality was 9.7. Therefore, soil scientists may have confidence that these tests accurately reflect the impact of conservation treatments on soil health.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Soil Health Resources, Indicators, Assessment, and Management

National Commodity Crop Productivity Index (NCCPI): A Tool for Land Use

Authors: Robert Dobos*, USDA-NRCS; Maxine Levin, USDA-NRCS; Cathy Seybold, USDA-NRCS

Abstract: The National Commodity Crop Productivity Index (NCCPI) is a tool developed at the National Soil Survey Center in Lincoln, Nebraska that uses the soil survey database to array the soils of the United States on the basis of their inherent ability to foster crop growth. It uses the soil chemical and physical properties, along with landscape and climatic data to derive the index. This index has proven useful for informing soil rental rate determination and for risk assessment for crop insurance. Seed companies, farm equipment manufacturers, and farm planners have also found the index useful. Derivatives of the NCCPI have also proven to be interesting in projecting possible geographic trends in crop productivity with climate change.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Soil Health Resources, Indicators, Assessment, and Management

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No-Till Pumpkin Production using Cover Crops in the Great Plains: Soil Health and Fruit Yield

Authors: DeAnn Presley*, Kansas State University; Peter Tomlinson, Kansas State University; Cary Rivard, Kansas State University; Kimberly Oxley, Kansas State University; Jason Griffin, Kansas State University

Abstract: Horticultural crop production can be highly disruptive to soil health, particularly when significant cultivation is used and can lead to soil erosion and compaction. Pumpkin production, in particular, can lead to severe erosion as little residue is left to provide cover during winter months. No-till production methods have been widely adopted by agronomic (field corn, soybean, wheat, etc.) growers in the Great Plains and throughout the US. However, no-till practices in fruit and vegetable production in Kansas is relatively rare. Furthermore, research is needed to assess the impact of cover crop species for potential effects on pumpkin production such as fruit quantity and quality, as well as upon soil health. Replicated, large-scale trials were conducted for three growing seasons and at two experiment stations in Kansas. Dynamic soil properties were measured three weeks after planting and following harvest each site year for infiltration, microbial biomass, inorganic N, wet aggregate stability, and bulk density. Few significant treatment differences existed for soil properties measured in this experiment, however, soil density was greatest for the conventional tillage control treatment. Microbial biomass C was numerically greater for the cover cropped treatments as compared to the conventional tillage control, though not statistically significant.

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A Brief History of Water Quality Trading (from a CIG Perspective)

Authors: Kari Cohen*, USDA NRCS

Abstract: USDA's Natural Resources Conservation Service has administered the Conservation Innovation Grants (CIG) program since 2004. From its inception, CIG has been the premier Federal funding support vehicle for water quality trading programs in the United States. From the Chesapeake Bay to the Pacific Northwest and points in between, nearly every water quality trading program of note has received some measure of funding support from CIG. While over the past 11 years, the science and policy of water quality trading has developed and matured, the question remains--what have we learned, and will the promise of water quality trading ever be fulfilled? Viewing water quality trading through the lens of 11 years of CIG projects--digging into the results of past CIG projects and even a peek into applications that weren't funded--yields some answers.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Water Resources Assessment and Mangement

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A Midwest Regional Network for Continuous Nutrient Monitoring

Authors: Kelly Warner*, U.S. Geological Survey; Stephen Kalkhoff, U.S. Geological Survey; Jeffrey Frey, U.S. Geological Survey; Peter Cinotto, U.S. Geological Survey

Abstract: Monitoring is critical to understanding the effectiveness of nutrient reduction strategies on the transport of nitrate and phosphorus to the Mississippi River. Historically, water-quality data are determined from discrete samples collected periodically and various models are used to estimate concentrations between sample events. New technology and procedures to continuously measure nitrate, orthophosphate, and turbidity concentrations in near real-time will provide additional knowledge about the variability in concentrations of nutrients between discrete measurements. The network of U.S. Geological Survey (USGS) gaging stations is ideal for a regional framework for continuous nutrient monitoring where comparable and consistent methods are used for data collection. Over 70 sites in the Missouri, Upper Mississippi, and Ohio River basins have been identified as potential locations for continuously monitoring nutrients. Continuous water-quality data are currently being collected at a small number of the potential sites on the Mississippi River and major tributaries. Eight of the 70 network sites are already operated by the USGS in cooperation with the Illinois Environmental Protection Agency to continuously monitor the nitrate, orthophosphate, and sediment loads leaving the State. Additionally, the measured loads can improve models of nutrient loads. Recent research by the USGS on the Illinois River showed that models underpredicted the nitrate load by 8 percent. Long-term data collection will be necessary to determine impacts from climatic variation, effects from nutrient reduction strategy implementation due to travel times in groundwater, and other factors on the water-quality of rivers in the Midwest.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Water Resources Assessment and Mangement

Adding Water Supply to NRCS Watershed Rehabilitation Projects to Boost Resiliency to Climate Change

Authors: Jan Marie Surface*, USDA NRCS

Abstract: The USDA Natural Resources Conservation Service's (NRCS) Watershed Rehabilitation Program helps project sponsors rehabilitate aging dams that are reaching the end of their 50-year design lives. This rehabilitation addresses critical public health and safety concerns. Since 1948, NRCS has assisted local sponsors construct more than 11,800 dams. During the past 20 years, more than 4,300 inventory dams reached or exceeded their 50-year design life. Over the next 10 years, another 3,500 dams will have met or exceeded their design life. To protect public health and safety, as well as evaluate the potential for expansion of water supply in drought areas, USDA invested \$73 million in fiscal year 2015 through NRCS' Watershed Rehabilitation Program to rehabilitate and assess 150 dams in 23 states. Beginning in fiscal year 2014, the Watershed Rehabilitation Program allows sponsors to create new, or add to, existing water supplies. More than 80 rehabilitation projects now being planned may include increases in water storage capacity. Once built, these projects would protect the lives and property of more than 119,000 people and boost resilience to climate change. Purposes for adding new or expanding current water supply may include: Agricultural water management including irrigation water supply, agricultural use, or rural community use; watershed protection including ecosystem restoration-type activities such as low-flow augmentation for downstream fisheries and fish and wildlife habitats; municipal and industrial water supply including hydropower; public fish and wildlife (areas developed to improve the habitat for fish and wildlife); water quality management (augmentation of stream flow from waste treatment areas); and public recreation. Project sponsors will be asked to provide proof that there is enough future demand and demonstrate that there is a compelling need (including environmental justice concerns).

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Water Resources Assessment and Mangement

An Approach to Optimize Water Quality Monitoring within Indiana and on a Regional Level

Authors: Jeffrey Frey*, U.S. Geological Survey; Jeremy Webber, Indiana University - Purdue University at Indianapolis

Abstract: It is known that federal, state, local agencies, and other watershed groups monitor water quality within their respective state. Each group has its own mandate and reason for monitoring including status assessment, trends, enforcement, or general research. Typically this work is done within the confines of each agency or group and provides invaluable information but the lack of coordination can lead to duplication of efforts. Even within the Indiana water monitoring community there is not a good understanding of existing active monitoring networks. The Indiana Water Monitoring Council (InWMC) was formed to "Maximize resources through improved communication, coordination, data sharing, and collaboration." The InWMC completed a study to (1) highlight the existing ongoing river and stream water quality networks that provide the data that could be used in Indiana and (2) identify potential sites to augment the existing networks or find sites that could be reduced to save monitoring funds. More specifically, this paper assesses whether Indiana: (1) has a good spatial coverage of water quality networks; (2) can determine the loads of important contaminants entering and leaving the State; (3) has the necessary types of sampling sites, such as reference sites, or sites to assess Best Management Practices (BMPs); (4) has sampling sites sampled by multiple agencies that could be eliminated by one of the agencies to save costs, move funds to other pressing needs, or allow the agencies to work together to increase the coverage and quality of the data; (5) identify sites where continuous nutrient and other parameter monitoring could be helpful within Indiana, across state borders, and regionally; and (6) determine trends at all important sampling locations for the greater Indiana and Regional network. This coordination and collaboration within and across states will help to ensure that sufficient monitoring is done to cost-effectively meet the needs of environmental managers.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Water Resources Assessment and Mangement

Hydrological Assessments of Tidal Creeks to Inform Presumptive Total Maximum Daily Load (TMDL) Recommendations

Authors: Kathryn Ellis*, College of Charleston

Abstract: The purpose of this study is to provide regulatory agencies with specific information about the hydrology of tidal creeks by developing mathematical relationships between time, stage, and discharge. This information will be generated in part for a larger project to describe how physical and biological responses affect nitrogen and phosphorus levels in coastal wetlands in South Carolina. This thesis will focus on four research sites located in coastal South Carolina: two in the Ashepoo-Combahee-Edisto (ACE) Basin and two in the Charleston Harbor system. Opportunistic sampling, with the goal to encompass as large a range of discharge measurements as possible, will occur over a two year period to measure discharge in each creek with an acoustic Doppler current profiler (ADCP) unit. Currently, there are no stage-discharge or time-discharge relationships for these creeks, or many other similar creeks, in the South Carolina Coastal Plain, so the results of this research will fill an existing information gap. The discharge data, combined with information from a related effort to collect nutrient and phytoplankton data will be used to calculate presumptive Total Maximum Daily Load (TMDL) estimates for these sites. A runoff model will be used to estimate the potential water entering the creeks from the land surface; this quantity will be compared to the total volume of water that enters or exits the creeks (the tidal prism) to better understand how runoff may affect the nutrient loading in these creeks. The TMDL calculations will support the evaluation of biological health of coastal wetlands by estimating nitrogen inputs to the tidal creeks of interest. The TMDL approach is useful for coastal resources and wetlands management because it allows managers, engineers, and regulators to understand how land use affects water quality and it is a widely-accepted regulatory approach to reduce pollutant runoff to receiving water bodies.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Water Resources Assessment and Mangement

Implementing the PR&G at USDA

Authors: Noel Gollehon*, USDA-NRCS; George Townsley, USDA-NRCS; Rich Iovanna, USDA-FSA

Abstract: The Federal process for evaluating water projects has recently changed and this presentation will cover these changes and their implementation at USDA. The retired Principles and Guidelines were used by NRCS, Bureau of Reclamation, Tennessee Valley Authority and the U.S. Army Corps of Engineers for over 30 years to evaluate water project investments. The Principles, Requirements, and Guidelines (PR&G) replace this familiar, historic process and make two significant changes in doing so. First, an ecosystem service framework is now used to comprehensively account for impacts, both good and bad, of an investment alternative under consideration. Second, a greater diversity of projects and programs, which may be administered by agencies other than the original four, are subject to evaluation, with some watershed activities of the Forest Service and some water supply activities of Rural Development now included in the increased scope. The watershed activities of NRCS, primarily flood control projects and their rehabilitation, will continue to utilize the Federal water investment evaluation process. The process will not apply to Farm-Bill Conservation programs of the Farm Service Agency or NRCS.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Water Resources Assessment and Mangement

^{*}denotes primary author and subject area

Investigation of Fecal Contamination in the Little River Basin, Kentucky, Using Microbial Source Tracking and Fecal Indicator Bacteria, 2013 -2014

Authors: Mac Cherry*, U.S. Geological Survey

Abstract: This study evaluated general, human, ruminate (cattle, sheep, deer), canine, and waterfowl genetic markers and found the primary source of fecal contamination in the North Fork Little River (NFLR) was human waste and the main source in the South Fork Little River (SFLR), particularly the headwaters, was ruminate-animal waste. In 2009, the Kentucky Energy and Environment Cabinet— Division of Water developed a pathogen Total Maximum Daily Load for the Little River Basin including the NFLR and the SFLR. From 2013 to 2014, the U.S. Geological Survey (USGS), in cooperation with the Little River Consortium, used E. coli concentrations to assess fecal contamination and microbial source tracking to isolate sources of fecal contamination in the Little River basin near Hopkinsville, Kentucky. Water and fluvial sediment samples were collected at 19 sites and MST samples were collected at 10 of these sites. Thiry-four percent of water samples were above the U.S. Environmental Protection Agency statistical threshold value of 410 col/100 mL for E. coli. Lower densities of E. coli in fluvial sediments were found more in the headwaters than downstream. The human-associated marker (qHF183) was found above the detection limit in 100 percent of samples from the NFLR basin compared to 15 percent in the SFLR basin. The median ruminant-associated marker (BoBac) was up to three-fold greater in the SFLR headwaters compared to the NFLR. The results of this study will help resource managers prioritize areas where waste management and remediation is the most necessary due to high levels of fecal contamination.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Water Resources Assessment and Mangement

Is it Working? A Look at the Changing Nutrient Practices in the Southern Willamette Valley's Groundwater Management Area

Authors: Susanna Pearlstein*, ORISE Post-Doc at EPA; Jana Compton, U.S. EPA; Audrey Eldridge, Oregon Department of Environmental Quality; Alan Henning, U.S. EPA; John Selker, Oregon State University; J. Renee Brooks, U.S. EPA; Donna Schmitz, Benton Soil & Water Conservation District

Abstract: Groundwater nitrate contamination affects thousands of households in the southern Willamette Valley and many more across the Pacific Northwest. The southern Willamette Valley Groundwater Management Area (SWV GWMA) was established in 2004 due to nitrate levels in the groundwater exceeding the human health standard of 10 mg nitrate-N L-1. Much of the nitrogen inputs to the GWMA comes from agricultural nitrogen use, and thus efforts to reduce N inputs to groundwater are focused upon improving N management. Previous work in the 1990s in the Willamette Valley by researchers at Oregon State University determined the importance of cover crops and irrigation practices and made recommendations to the local farm community for reducing nitrogen (N) leaching. We are currently resampling many of the same fields studied by OSU to examine the influence of current crops and nutrient management practices on nitrate leaching below the rooting zone. This study represents important crops currently grown in the GWMA and includes four grass fields, three vegetable row-crop fields, two peppermint and wheat fields, and one each of hazelnuts and blueberries. New nutrient management practices include slow release fertilizers and precision agriculture approaches in some of the fields. Results from the first year of sampling in 2014 show nitrate leaching is lower in some crops like row crops grown for seed and higher in others like perennial rye grass seed when compared to the 1990s data. We will use field-level N input-output balances in order to determine the N use efficiency and compare this across crops and over time. The goal of this project is to provide information and tools that will help farmers, managers and conservation groups quantify the water quality benefits of management practices they are conducting or funding.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Water Resources Assessment and Mangement

Landscape Effects on the Physical Features of a Watershed

Authors: Jamil Alexandre Ayach Anache*, Purdue University; Isabel Almeida, UFMS; Cláudia Bacchi, UFMS; Teodorico Alves Sobrinho, UFMS

Abstract: Watersheds must be delineated and discretized to allow interpretation of the topographical features identified. In addition, geology, geomorphology and pedology are important landscape aspects that can be associated to morphometric characteristics of a territorial unit. In this respect, the present study evaluated the correlation between physical features and geological, geomorphological and pedological aspects in the Guariroba stream subwatershed, a 5th order watershed located in an Environmental Protection Area. The Geographic Information System (GIS) was used in data survey and integration, and the associations evaluated by Pearson's Correlation Coefficient. To that end, we determined the basic and derivate physical factors of the watershed and obtained spatial data for geology, geomorphology and pedology. The spatial discretization identified 7 hydrologic response units of at least the 3rd order in the Guariroba stream subwatershed, with predominance of 1st and 2nd order watercourses and dendritic, poorly developed drainage system. Physical features of the watershed and landscape (geology and geomorphology) did not exhibit linear dependence. However, a strong linear correlation was found between watershed pedology and a number of physical features (area, perimeter, elevation, drainage density and length of overland flow).

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Water Resources Assessment and Mangement

Little River Drainage District - Conversion of the Big Swamp to Fertile Agricultural Land

Authors: David Speidel*, SWCS Member Missouri; Kenneth Olson, University of Illinois; Lois Wright Morton, Iowa State University

Abstract: Understanding the factors supporting land use conversion of the Mississippi hardwood bottomlands to the productive working cropland is important to guiding wise future land use decisions. The organization of the early drainage projects was enabled by visionary legislation and improvements in engineering technology. Early entrepreneurs' collective efforts to organize the Little Rivers Drainage District resulted in one of the largest successful programs of its kind. The management of bottomlands which have a predisposition to flood is not unique just to this region, but impact many important food producing regions around the world. Today the conversion of wetlands would be controversial; but food production is necessary. To better adapt these competing, but important land uses of cropland and wetlands understanding this drainage district's formation and operation process will assist land use decisions by policy makers and operators to better utilize these important resources.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Water Resources Assessment and Mangement

Long Term Variations of Land Management Practices and Their Impacts on Runoff and Water Quality in a Small Agricultural Watershed in Atlantic Canada

Authors: sheng li*, aafc

Abstract: Management practices in agricultural lands are always changing due to technical improvements, economical pressure or other reasons. These changes may affect runoff generation in the field and sediment and nutrient losses to the receiving water systems. The impacts of land management practices are normally assessed at the field scale. However, due to the scale effect, data obtained at the field scale are often not directly transferable to what observed in the stream. In addition, some land management practices were applied at a larger scale so that their impact cannot be assessed at the field scale. Under these circumstances, it is necessary to examine long term data at the watershed scale. In this study, a small watershed located in the potato belt of the province of New Brunswick in Atlantic Canada was examined. The watershed is well-instrumented for climate, runoff and water quality data monitoring. Land use survey was carried out every year to record land management practices for each field in the watershed. Data collected from 1992 to 2011showed that there was a slight decrease in forested areas and a slight increase in cultivated areas. Within agricultural land uses, there was a decrease in potato but an increase in grains, probably because longer rotations have been used more recently. Soil conservation structures (SCS, such as diversion terraces and grassed waterway system) have been adopted quickly in the mid-1990s and by 2012, about 67% of cultivated land were protected by these structures. Runoff discharge, sediment and nutrient yields at the watershed outlet were all highly variable. The variations, more or less, followed the pattern of precipitation, indicating the dominant effect of climate on the hydrological system. Annual total precipitation did not show a significant trend with time, neither did the runoff discharge. However, there was a significant decrease in sediment load with time, which was attributed mainly to the construction of SCS.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Water Resources Assessment and Mangement

Managing Tennessee and Cumberland River Landscapes

Authors: Kenneth Olson*, University of Illinois; Lois Morton, Iowa State University

Abstract: Controlling Tennessee and Cumberland River flooding and tributary back flow were not the only problems facing Kentucky in the 1930s. Many rural areas lacked rural electricity, year around passable roads, and other public infrastructure. Joblessness and rural poverty were exacerbated by the Great Depression. Eroded hillsides from years of poor farming practices and depressed agricultural markets made it difficult for rural families to produce and sell enough to meet basic food and housing needs. However, by 1937 much of the land had been farmed too intensively without good conservation practices resulting in depleted and eroded soil unable to produce the agricultural yields of the past. As crop yields decreased so did farm incomes. President Franklin Roosevelt proposed a number of innovative solutions to lift the nation out of the depths of the Great Depression. One of his most successful New Deal ideas was the creation of the Tennessee Valley Authority (TVA), a corporation with the power of government but possessed with the flexibility and initiative of a private enterprise. The TVA Act was passed by Congress in 1933 to address a wide range of economic, environmental, and technological issues, including the delivery of low-cost electricity and the management of natural resources. Since the construction of the Kentucky Dam on the Tennessee River in the 1940s and the Barkley Dam in 1960s the USACE has had the ability to store water during floods and release water during droughts to maintain shipping canals. This strategy worked until the record flood of 2011 and drought of 2012. With the Kentucky and Barkley reservoirs at full capacity, USACE were forced to release excess water and contributed to the 2011 record crest at the confluence of the Ohio and Mississippi rivers. The drought of 2012 made it difficult to maintain Great River shipping channels without dredging.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Water Resources Assessment and Mangement

Maryland's Nutrient Trading Infrastructure

Authors: Jason Keppler*, Maryland Department of Agriculture

Abstract: The Maryland Departments of Agriculture and Environment are developing a cross-sector water quality-based trading program to accelerate the Chesapeake Bay restoration efforts in response to the Total Maximum Daily Load (TMDL) established by US Environmental Protection Agency. This market-based strategy offers a cost-effective alternative in financing cleanup efforts while creating opportunities for farmers to receive income for implementing and maintaining the practices that will generate tradable nutrient credits. The proposed presentation will introduce Maryland's Nutrient Trading Program. While an overview of the nutrient trading structure will be discussed, emphasis will be placed on the highly sophisticated platform that will ultimately manage trading in Maryland. This consists of a suite of tools for use by those interested in producing and selling nonpoint agricultural credits: a farmscale assessment tool to determine baseline compliance, estimate nutrient loads and reductions, and calculate credits generated by agricultural BMPs; a registry to catalogue certified credits and completed trades; a marketplace to enable participants to post and track credits and manage individual accounts; an administrative module to assist in the supervision of the overall program and the generation of relevant data and reports, and an interactive mapping feature to delineate field boundaries and retrieve and forward allied information. A complementary site-specific assessment tool also incorporates a variety of land uses and different baseline requirements (TMDL or other) and will be calibrated for urban stormwater BMPs and their approved load reduction efficiencies. The new tool will provide a "one-stop shop" for trading between non-point sources in the state of Maryland and could serve as a prototype for other programs with similar needs.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Water Quality Trading

Missouri Ozark Plateau Headwaters Diversion and the Draining of the Big Swamp

Authors: David Speidel*, SWCS Member Missouri; Kenneth Olson, University of Illinois; Lois Wright Morton, Iowa State University

Abstract: Understanding the water resource management of the Headwaters Diversion in Southeast Missouri is important to making wise land use decisions involving large drainage systems. The Headwaters Diversion cuts off the annual runoff from several tributaries draining the Ozark Highlands. This project at the turn of the last century enabled the development of the "Big Swamp" in the Missouri Bootheel. Prior to the innovative engineering, creative legislation, and risk taking of entrepreneurs for this project only 15 percent of the region's Mississippi bottomland was under cultivation. The consequences to flood plain management in the lower Mississippi River caused changes in the levee system management. The lessons learn by this study was the timing of infrastructure improvements with supporting legislation before collaboration by the entrepreneurs enabled the project's success. Application of the lessons will help policy makers and engineers bring creative solutions to future complex water resource challenges.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Water Resources Assessment and Mangement

Phosphorus Loss Estimation and P-Index Evaluation with the APEX Model

Authors: Nathan Nelson*, Kansas State University; John Lory, University of Missouri; Claire Baffaut, USDA-ARS; Anomaa Senaviratne, University of Missorui; Ammar Bhandari, Kansas State University; Antonio Mallarino, Iowa State University; Matthew Helmers, Iowa State University; Ranjith Udawatta, University of Missouri; Dan Sweeney, Kansas State University; Charles Wortmann, University of Nebraska

Abstract: Confidence in results of P-indices requires documenting the accuracy of P-index risk assessments. Evaluation can also assist with P index revision and harmonization of P-index interpretation across state boarders. Measured P-loss data suitable for P-index evaluation is scarce. It has been proposed that P-indices could be evaluated by comparing the index results to P loss estimates from process-based computer models, such as the Agricultural Policy/Environmental eXtender (APEX) model. This presentation describes the methods by which P-indices within the Heartland Region (IA, KS, MO, and NE) will be evaluated using the APEX model. P loss estimates from APEX are highly influenced by the model parameterization. Effects of the model parameterization on P loss estimates from contrasting management practices and P-index evaluation will be discussed. Examples will illustrate the advantages and limitations of using models to estimate effects of agricultural management on P loss and how the limitations may influence model use for P-index evaluation.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Water Resources Assessment and Mangement

Southern P Indices, Water Quality Data, and Modeling Results: A Comparison

Authors: Deanna Osmond*, North Carolina State University; Carl Bolster, USDA-ARS; Miguel Cabrera, University of Georgia; Sam Feagley, Texas A&M University; Adam Forsberg, University of Georgia; Charles Mitchell, Auburn University; Aaron Mittelstet, Oklahoma State University; Rao Mylavarapu, University of Florida; Larry Oldham, Missississippi State University; David Radcliffe, University of Georgia; John Ramirez-Avila, Mississippi State University; Andrew Sharpley, University of Arkansas; Dan Storm, Oklahoma State University; Forbes Walker, University of Tennessee; Hailin Zhang, Oklahoma State University

Abstract: Phosphorus (P) indices in the south frequently produce different results for similar conditions. After collecting data from benchmark sites throughout the south (6 Arkansas, 1 Georgia, 2 Mississippi, 4 North Carolina, 4 Oklahoma, and 4 Texas site/treatment water quality and land treatment data sets), we compared predictions of each state P-Index assessment tool to water quality data derived from the benchmark sites using RUSLE 2 erosion data as well as actual sediment losses. We also compared predictions of southern (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, and Texas) P-Index assessment tools against calibrated fate and transport water quality models (APEX, TBET, and APLE). We then compared P Indices to each other for each data set. Comparisons of the different information sources show dissimilarities between P Indices but also water quality data and modeling results. Finally, it is unclear how to assign losses and potential risk since water resources have different sensitivities to phosphorus and typically this is not standardized in P-index loss ratings, including the national nutrient management standard (590 USDA-Natural Resource Conservation Service).

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Water Resources Assessment and Mangement

^{*}denotes primary author and subject area

Surface Ditch Vegetation in the Paulding Plains of the Lake Erie Watershed

Authors: Kayla Miller*, Ohio State University; Kevin King, USDA ARS; Andy Ward, Ohio State University; Albert Maag, Putnam County Soil and Water Conservation District

Abstract: Lake Erie, among other inland waters, faces persistent threats from harmful algal blooms and hypoxia. The Western Lake Erie Basin algal bloom has especially been impacted by agricultural practices within its watershed; including the increased amount of surface field drainage in the heavy clays of the Paulding Plains. These surface ditches, 6 m wide, 0.5 m deep, and at least 100 m long, are too small to qualify under NRCS grassed waterway standards. They are traditionally left unvegetated throughout the year, though sometimes grain crops are planted through them during growing season. The presentation will describe a three paired site study in the region where each have an instrumented unvegetated surface ditch and a ditch vegetated with Kentucky bluegrass, 31 fescue, and perennial ryegrass. Edge of field monitoring at the outlet of each surface ditch, is being conducted with a cut throat flume and ISCO sampler programmed to sample storm discharges. Samples are being analyzed for nitrates, phosphates, suspended solids and total dissolved sediment. It is predicted the vegetation will reduce the nutrient and sediment runoff. If the hypothesis is supported, Ohio NRCS could add vegetation of these surface ditches to its list of government supplemented conservation practices. Adoption of this new practice, together with other practices being studied in the region, will help develop watershed strategies to reduce the adverse environmental impacts of excess sediment and nutrient discharges from agricultural systems.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Water Resources Assessment and Mangement

The Great Lakes to Gulf Observatory: An Interactive Geospatial Application Focused on Nutrients in the Mississippi River and its Tributaries

Authors: Edward Kratschmer*, Lewis and Clark Community College; Brock Angelo, NCSA - University of Illinois; Marcus Slavenas, NCSA - University of Illinois; Jason Votata, NCSA - University of Illinois; John Sloan, National Great Rivers R&E Center; Isaac Chapman, The Horinko Group; Jong Lee, NCSA - University of Illinois; William Kruidenier, University of Illinois - NGRREC; Richard Warner, University of Illinois - NGRREC

Abstract: The Great Lakes to Gulf Observatory (GLTG), www.greatlakestogulf.org, is an interactive geospatial application that integrates water quality data from multiple sources to better facilitate analysis and ultimately, knowledge of nutrient pollution, large river ecology and water quality conditions in the Mississippi River watershed. The GLTG's web-based application allows users to dynamically browse, search for and visualize water quality information on the Mississippi River and its tributaries. The application uses a combination of different respected data sources including long-term historical datasets and continuous real time sensors, providing the users with a better picture of water quality in the watershed. Meant to add value to users of existing datasets and projects, the application's features, visualizations and design allow researchers, communities, and decision makers to better understand nutrient inputs and loads, expedite data-to-knowledge-to policy connections, enhance risk management decisions, empower emergency response and inform long-term strategic planning. With the first phase of the project focused on nutrient pollution, the application and its infrastructure is relevant to state nutrient reduction strategies, watershed planning efforts and focused watershed initiatives. Led by the National Great Rivers Research and Education Center, data integration and visualization occurs within a cyberinfrastructure framework constructed in collaboration with the National Center for Supercomputing Applications (NCSA) and the Illinois-Indiana Sea Grant Program (IISG) at the University of Illinois.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Water Resources Assessment and Mangement

The Great Rivers Ecological Observatory Network (GREON) for Monitoring Water Quality in the Upper Mississippi River Basin

Authors: John Sloan*, National Great Rivers R&E Center; Miles Corcoran, National Great Rivers R&E Center; Edward Kratschmer, Lewis and Clark Community College; John Chick, Illinois Natural History Survey

Abstract: The ability to continuously monitor water quality throughout the Mississippi River Basin is important for assessing nutrient and sediment transport and the ecological health of the river system. The National Great Rivers Research & Education Center has established a network of water quality monitoring buoys at strategic locations on the Mississippi River and its tributaries. The network has grown from a single buoy deployed in 2013 on the main stem of the Mississippi River near Saint Louis, Missouri during a historic flood event, to the 2015 deployment of five buoys on the Mississippi River from Lacrosse, Wisconsin to Cape Girardeau, Missouri, as well as two buoys in reservoirs on the Sangamon River and Kaskaskia Rivers in Illinois. The GREON buoys are based on the YSI, Inc. Pontoon Platform for In-Situ Characterization of Environmental Systems (PISCES). The buoys include calibrated sensors that monitor a suite of water quality parameters including temperature, dissolved oxygen, specific conductance, turbidity, chlorophyll, blue-green algae, fluorescing dissolved organic matter, and nitrate. Additionally, one of the GREON buoys was fitted with a micro-fluidic phosphate analyzer capable of measuring orthophosphate in situ on a filtered (<10µm) sample. For quality assurance purposes, data from the GREON units is compared to grab samples collected adjacent to each unit and analyzed in the laboratory using standard methods. Data from the GREON units is available through the Great Lakes to Gulf (GLTG) virtually observatory.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Water Resources Assessment and Mangement

The Pulse and Presses of the Ohio River

Authors: Lois Wright Morton*, Iowa State University; Kenneth Olson, University of Illinois

Abstract: Rivers are linked human-natural systems whose functioning are affected by press and pulse processes. Press processes alter the structure of the river in small increments; pulse processes transform the social and ecosystem functions suddenly. Soil erosion into streams are press processes that continually move sand, gravel, and loamy soils into mainstem rivers. Sedimentation affects water quality and changes the river depth and flow patterns. Floods are pulse processes that can destroy river settlements, overflow agricultural lands and change the course of a river in hours and days. Historical presses and pulses of the Ohio River with its seasonal drought and flood cycles have been altered through the construction of floodwalls, levees, locks & dams, reservoirs, and dredging to achieve human economic and social goals. In this paper we examine the press and pulse processes of the Ohio River to understand how these processes affect flooding, navigation and the river ecosystem. Flooding of lands along the river have been amplified by human factors and 37-71% increase in very heavy precipitation over the Ohio River valley. Early snowmelt and prolonged precipitation in 1937 and 2011 led to record flood crests with runoff exceeding the capacity of many levees, upland reservoirs and floodplains to control the river. Analyses of climate, upland and floodplain vegetation, and human activities reveal impacts management has had on navigation, flood control, water quality, and river ecosystem functioning. Efforts to integrate flood management, river navigation, and river ecosystem protection is a challenge because of competing human values. Investments in strengthening public and private partnerships are needed to address risks from future climate uncertainty and the diversity of human preferences for using the river.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Water Resources Assessment and Mangement

Water Quality Performance of Wetlands Receiving Nonpoint Source Nitrogen Loads and Potential of Targeted Wetland Restoration to Reduce Nitrogen Loads in Iowa

Authors: William Crumpton*, Iowa State University; Matthew Helmers, Iowa State University

Abstract: Wetland restoration is a promising strategy for reducing surface water contamination in agricultural watersheds and in particular for reducing agricultural nitrate loads to the Mississippi River and its tributaries. Over the past 10 years, more than 70 wetlands have been restored through the Iowa Conservation Reserve Enhancement Program (CREP) with the explicit goal of intercepting and reducing nonpoint source nitrate loads and we have measured the nitrogen mass balances of a selected subset of these wetlands. Our goals were to evaluate the effectiveness of wetlands at reducing agricultural, nonpoint source nitrogen loads and to develop models for predicting wetland performance at scale and in combination with other practices. The monitored wetlands were selected to ensure a broad spectrum of major external forcing functions affecting wetland performance including hydraulic loading rate, residence time, nitrate concentration, and nitrate loading rate. Nitrogen loads to the wetlands were primarily in the form of nitrate and all of the wetlands were effective in reducing both nitrate and total N loads. Nitrate removal efficiency (expressed as annual percent mass removal) ranged from 8-91% and was primarily a function of hydraulic loading rate and temperature. Mass nitrate removal ranged from 120-2800 Kg N ha/year and was primarily a function of hydraulic loading rate, temperature, and nitrate concentration. Our results demonstrate that wetlands can be effective sinks for nonpoint source nitrate loads across a wide range of conditions and that performance can be reasonably predicted based on hydraulic loading rate, temperature, and nitrate concentration. We extended these results to project statewide nitrate load reductions for Iowa using a combination of nutrient management and targeted wetland restorations. Our analyses suggest that targeted wetland restorations will be critical to achieving a 45% reduction in annual nitrate load for Iowa.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Water Resources Assessment and Mangement

What Was Learnt from the Multi-Regional Phosphorus Index Assessment

Authors: Andrew Sharpley*, University of Arkansas; Peter Kleinman, USDA-ARS; John Lory, University of Missouri; Deanna Osmond, North Carolina State University; Zach Easton, Virginia Tech University; Nathan Nelson, Kansas State University; David Radcliffe, University of Georgia

Abstract: Charged with a need to review and revise current Phosphorus (P) Indices that have become an integral part of the NRCS 590 Nutrient Management Planning process, three regional CIG projects completed a four-year study in Sept., 2016. The three regions were the Chesapeake Bay (DE, MD, NY, PA, VA, WVA), Heartland (KS, IA, MO, NE), and Southern States (AR, AL, FL, GA, KY, LA, MS, NC, SC, TX). These studies were needed because; (1) water quality improvements are not being seen following adoption of Indices, (2) there is a wide range in Index outcomes among States with similar topography and climate, and (3) with P becoming an endangered element, there are calls for its more sustainable use, especially when soil test P was above crop optimum levels. Each group had individual project goals, with overarching commonalities, such as compiling available edge-of-field runoff P information to form a data base that could be compared with State P Index rankings. While there has been much research documenting P runoff under a range of land use and management, it became apparent that there was limited data that could be used to directly test P Indices in most states. Available models were used as a data-providing platform to establish the accuracy of P Indices to estimate the risk of P loss form a wide range of management scenarios. Using models such as SWAT, APEX, and APLE, it was clear that careful parameterization and calibration must precede data generation for scenario testing, and highlighted a need for detailed land use and management inputs, along with an "experienced modeler." Without this, model errors and uncertainty can increase to unacceptable levels. This presentation explores these findings and summarizes overarching conclusions and recommendations that while regionalization of Indices may be possible, a user-friendly national P Index that reliably accounts for subtle changes in land use and management, water body vulnerability, and state policies, is not yet feasible.

 $\textbf{Track:}\ 2016\ General\ Conference\ Theme\ Submissions\ -\ Great\ River\ Landscapes$

Subject Area: Water Resources Assessment and Mangement

Phosphorus Index Project Overview: Refining and Harmonizing Phosphorus Indices in the Chesapeake Bay Region to Improve Critical Source Area Identification and to Address Nutrient Management Priorities

Authors: Peter Kleinman*, USDA-ARS; Tom Basden, West Virginia University; Douglas Beegle, Penn State University; Zach Easton, Virginia Tech University; Quirine Ketterings, Cornell University; Amy Shober, University of Delaware

Abstract: Efforts of the regional Conservation Innovation Grant (CIG) project have progressed the evaluation phosphorus indices (P Indices) in the Chesapeake Bay region. Stakeholder panels for each of the region's physiographic regions have been established. These panels have met to provide perspectives on representative agricultural management practices to be assessed during the evaluation process and on strengths and weaknesses of current P Indices. Information from panel members was further supported with survey feedback from nutrient management planners in three of the cooperating project states, Delaware, New York, and Pennsylvania, regarding possible P Index revisions as well as P Index implementation. Approaches for most appropriately representing study watershed hydrology and phosphorus loss using water quality models has been identified. Agricultural and nutrient management practices have been characterized for several of the identified study watersheds. Dissolved, sediment, and total phosphorus (P) losses have been simulated for these watersheds using the water quality model, TopoSWAT. These simulated P loss results have facilitated the development and evaluation of preliminary comparisons between P Index assessments and simulated P losses.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Water Resources Assessment and Mangement



POSTER PRESENTATIONS



Best Management Practices and Soil Water Quality: Adams County, Indiana

Authors: Heath Hurst*, IPFW; Solomon Isiorho, IPFW

Abstract: Best Management Practices is a term that describes measures taken to decrease contaminants in a watershed when used in the context of soil and water conservation. Best Management Practices have come under fire by some, and yet are prized by others. This report investigates the effectiveness of four different Best Management Practices: no till farming, cover crop usage, controlled drainage systems, and the two-stage ditch. A small Adams County farm that utilizes these methods was chosen as the study site. Water and soil samples were collected from the farm, nearby neighbors that use conventional farming methods, and streams that run alongside both properties during the fall season. Comparisons of water quality parameters and soil hydraulic conductivity were made. Soil tests indicated that samples from sites using Best Management Practices could have greater hydraulic conductivity (K-value), with a K-value of 4.704 x 10-4 cm/sec compared to 1.734 x 10-4 cm/sec from the field using conventional farming practices. There appears to be no trend or correlation between the locations when the water chemistry (nitrates, nitrites and phosphates) data was examined. As part of an ongoing project we are monitoring the variability of the water chemistry throughout the planting and growing seasons.

Track: Protecting Water Quality at a Multi-State Scale **Subject Area:**

Macroinvertebrates as Bio-indicators of Pollution in Rivers

Authors: christine odinga*, Moi University; Phillip Raburu, University of Eldoret; Joash Okeyo-Owuor, Rongo University

Abstract: River Sosiani, a tributary of Kipkarren River, passes through Eldoret town. The use of macroinvertebrates as bioindicators, provides great opportunity for monitoring water quality. This study was conducted to determine the distribution and abundance of macroinvertebrates and their interrelationship with the water quality of River Sosiani. Macroinvertebrates were sampled using standardized kick sampling and identified to genera level. Water samples was also taken and analysed for Physico-chemical parameters using standard procedures. Total Phosphates and Nitrates were analysed using electrometric and Ascorbic acid methods. A macroinvertebrate-based index of biotic integrity (M-IBI) was developed for bioassessment of the River. Analysis was in Minitab for Windows (Version 13) and Statistical analysis was performed using Microsoft Excel, Graphpad 5 and SPSS computer packages. The total number of benthic macroinvertebrate taxa and their overall density were significantly higher in the upstream stations. Using physico-chemical and nutrients data, individual metrics, final M-IBI and human activity, a notable response was the association of poor water quality and dominance of tolerant and filterer individuals. Chironomids and oligochaetes gained prominence downstream corresponding with organic pollutants dumped into the river, especially at stations 4 and 5, which were classified under "poor" sites. This study provides baseline information for further studies on the potential tolerance, adaptations and survival of the macoinvertebrates in polluted water resources. Key words: Macroinvertebrates, rivers, bio-indicators, pollution

Track: Water Quality Trading Subject Area:

Nitrogen Recommendations in North Carolina: Evaluation of Adapt-N

Authors: Deanna Osmond*, North Carolina State University; Shelby Rajkovich, NC State University; Rob Austin, NC State University

Abstract: As awareness of the environmental and economic cost of excess nitrogen (N) applications in agriculture increases, the need for producers to be able to confidently make precise N management decisions is critical. Adapt-N, a nitrogen recommendation tool, is designed to recommend N application rates in corn at or after V-6 and quantify the environmental fate of N. Soil and climate data from North Carolina have recently been incorporated into Adapt-N, but the tool has not been validated against field conditions (e.g. soil, management, crop, yield goals, and weather parameters) in the Southeast. Data from two different trials will be presented. First, yield data from two years of N rate trials in three locations across the state (coastal plain, piedmont and mountains) was evaluated with linear-plateau, quadratic, and quadratic plateau models to determine agronomic optimum N rates (AONR) and economic optimum N rates (EONR) for a total of 18 simulations. These rates were then compared to N rate recommendations based on Adapt-N and the North Carolina Realistic Yield Expectation (RYE) database recommendations. RYE and Adapt-N rates were with within 10 lb N ac-1 of each other for all but one site year with an average difference of 0.2 lb N ac-1. The exception was on floodplain soils at the mountain location, where Adapt-N exceeded AONR rates by more than 200 lb N ac-1. In a separate trial, the Adapt-N rate was compared to the grower N rate and +/- 25% of that rate in strip trials in the lower coastal plain for a total of 18 site years. Treatment significantly affected yield in only 7 site years. Yield was significantly greater when N was applied at the grower N rate compared to the Adapt-N rate in 4 of the 7 site years, and there was no significant difference in yield between the two treatments in the remaining 3 site years. By using the lowest N rates for optimum yield, farmers can minimize their environmental footprint.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Adaptive Management of Conservation Efforts

Winter-Hardy Legume Cover Crops Contribute a Significant Amount of Nitrogen to an Organic Managed Corn in Southern Ontario, Canada

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

Abstract: The fallow period after winter wheat harvest in the humid temperate southern Ontario, Canada, bears a high risk for N leaching out of the crop root zone into the water systems, eventually into the Great Lakes in the region. Cover crops have the potential to scavenge N losses and increase cropping system resiliency by providing nutrients to crops and adding organic residues to the soils. This poster reports a 3yr cover crop study including Crimson clover (CC), hairy vetch (HV), red clover (RC), a non cover crop conventionally managed control (CK) and a non cover crop organic control (CKO) after winter wheat harvest. The objectives are to reports: (1) how much N can be scavenged; (2) what is the reduction of residual mineral N in soil profile in cover crop fields; (3) what is the contribution of cover crops to the consequent corn yields. Before freeze-up, the amounts of total N in above ground biomass were 175, 146, and 107 kg ha-1, respectively, in CC, HV and RC treatments and 9.1, 16.9, and 24.8 kg ha-1 in roots for corresponding treatments. The N contents in plant above ground biomass changed to 87, 241 and 207 kg ha-1 in CC, HV, and RC plots before corn planting. It indicates that the HV and RC gained more N but CC lost N over winter. The contents of soil mineral N was around 75-80 kg N ha-1 in 0-90 cm after winter wheat harvest for all treatments (including CK). After about 3 month cover crop growth, the contents of residual soil mineral N diverged, with about a 10 kg N ha-1 decrease in the cover crop treatments versus a significant increase (65 kg N ha-1) in the non cover crop control treatment. The corn grain yields were 14363 kg ha-1 for the fertilized conventional control (CK) and only 6566 kg ha-1 for the organic control (CKO). In comparison, the corn grain yields were 10233 kg ha-1 for the CC, 12234 kg ha-1 for the HV and 12315 kg ha-1 for the RC treatments, respectively.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Adaptive Management of Conservation Efforts

An Interseeding System for Soybean to Reduce Pest Occurrence and Energy Consumption

Authors: Ahmad Khalilian*, Clemson University; Michael Marshall, Clemson University; Jose Payero, Clemson University; Ali Mirzakhani Nafchi, Clemson University; Phillip Williams, Clemson University

Abstract: One major advantage the southern U.S. has over other crop production areas is a long growing season, making it possible to double-crop winter and summer crops. The most popular double-cropping system is winter wheat followed by soybean. A double-cropping system developed at Clemson University, allows planting (interseeding) of soybean into standing wheat, about 2-3 weeks before wheat harvest. This poster presents the results of three-year field study to determine the effects of interseeding system on pest management; soil properties; fuel consumption; and crop responses in soybean production. The results showed wheat yields were not affected by row spacing or interseeding; Interseeded soybean yielded significantly more than soybean planted after wheat harvest (conventional double-cropped). There were no yield differences between full season and interseeded soybean. However, revenues from the interseeded soybean were higher due to harvest of the wheat crop (60 Bu/acre). Therefore, interseeding allows growers to capitalize on the economic advantages of two crops per year on the same land. Crop residue associated with the interseeding production system also reduced weed populations and required fewer herbicide applications compared with the conventional system. Columbia lance nematode populations were reduced in the interseeding system by 80% without a nematicide application. In addition, Interseeded system required 56% less fuel than conventional production method and positively impacted soil properties by increasing organic matter content and available K by 56% and 33%, respectively.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation and Nontraditional Agriculture

Effect of Three Cover Crop Treatments on Biomass Production and Soil Water Conservation

Authors: Jose Payero*, Clemson University; Michael Marshall, Clemson University; Rebecca Davis, Clemson University; Ahmad Khalilian, Clemson University; Ali Mirzakhani Nafchi, Clemson University

Abstract: In recent years, the use cover crop is becoming a popular technology among growers, which is expected to deliver a variety of benefits such as improving soil health, increasing soil organic matter, controlling weeds, and helping conserve soil water and nutrients. Although expecting these benefits seems reasonable, in general terms, knowing how much of these benefits to expect is less certain. In order to quantify the benefits of cover crops, in terms of biomass production and water conservation, an experiment was established in South Carolina in 2015 comparing three cover crop treatments using four replications. The treatments included: (1) Rye planted alone; (2) a mix of six cover crop species [including rye (56.7%), oats (14.1%), turnip (3.45%), vetch (7%), radish (3.45%), and crimson clover (14.1%)]; and (3) a control treatment with no-cover. EC-5 capacitance moisture sensors (Decagon Devices, Inc.) were installed at four depths (6", 12", 18" and 24") in each plot and Em50R data loggers were used to automatically read the sensors and store data every hour. An automatic and a manual rain gauge were also installed in this field to quantify daily rainfall. In spring of 2015, biomass samples were taken from each plot and the cover crop was terminated (sprayed with herbicide and rolled with a tractor). The field was then planted to cotton and soil moisture monitoring was continued during the cotton growing season. We found no significant difference in biomass production between the Mix and Rye cover crop treatments, which produced around 500 lb/acre of biomass. The control treatment (without cover crop) produced a considerable amount of biomass from weeds (around 200 lb/acre). Water infiltration was significantly improved by the cover crops, with cumulative seasonal infiltration of 5.9, 7.3, and 9.1" for the control, Mix and Rye cover crop treatments, respectively.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation and Nontraditional Agriculture

^{*}denotes primary author and subject area

Effects of Deep-Rooted Cover Crop on Soil Compaction and Crop Productivity

Authors: Ahmad Khalilian*, Clemson University; Michael Marshall, Clemson University; Jose Payero, Clemson University; Ali Mirzakhani Nafchi, Clemson University; Phillip Williams, Clemson University

Abstract: Soil compaction is a significant problem in the Southeastern USA. This compacted zone or hardpan limits root penetration below the compacted layer and reduces yield, limits productivity, and makes crops more susceptible to drought stress. Deep rooted cover crops can penetrate the compacted soil zone and create channels which cash crop roots, such as cotton, could follow to capture critical moisture and nutrients from the subsoil. This reduces and/or eliminates the need for annual deep tillage. This poster presents the results of field studies, conducted on three different soil types to determine the effects of cover crops on soil properties, crop productivity, and pest pressure. Results showed the soil texture had a significant effect on the amount of cover crop biomass. In no-till plots, cover-crop significantly reduced soil compaction in the E-horizon (hardpan). Reductions in soil compaction due to cover crop, significantly increased cotton lint yield in the no-till plots. Averaged over three soil types, the yield was increased by 38%. In addition, since cover crop eliminated the hardpan layer for the cotton crop, growers would save additional money for not performing deep tillage operations. There was a strong linear correlation between cover crop biomass and cotton lint yield increase. Also, cover crop increased soil moisture content by about 10 percentage points. The cover crop also significantly reduced population densities of root knot nematode. It also positively impacted soil properties by significantly increasing available P, K, Mn, and organic matter content.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation and Nontraditional Agriculture

APEX Model Application for Southern P Index Evaluation

Authors: John Ramirez-Avila*, Mississippi State University; David Radcliffe, University of Georgia; Carl Bolster, USDA-ARS; Dan Storm, Oklahoma State University; Deanna Osmond, North Carolina State University; Adam Forsberg, University of Georgia; Aaron Mittelstet

Abstract: The feasibility of using different models to determine potential phosphorus loss from agricultural fields in lieu of phosphorus indices in the southern region was evaluated. Project results include the comparison of the Agricultural Policy/Environmental eXtender (APEX) model predictions with edge of the field experimental data from crops and pasture fields in AR, NC, GA and MS. Assessments of model adjustment at site specific and regional level were performed. Model accuracy was assessed to determine APEX applicability to improve Southern P-Indices. Site specific calibration of the model evidenced APEX could be satisfactorily considered as an appropriate tool to develop action plans to enhance the nutrient reduction strategy at field scale. However, results were not satisfactory at regional level.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Conservation Models, Tools, and Technologies

Assessing Forestry Greenhouse Gas Emissions and Sequestration with COMET-Farm

Authors: Matthew Stermer*, Natural Resource Ecology Laboratory-Colorado State University; Justin Ziegler, Natural Resource Ecology Laboratory-Colorado State University; Mark Easter, Natural Resource Ecology Laboratory-Colorado State University; Amy Swan, Natural

Abstract: COMET-FarmTM is an integrated web-based decision support tool developed in collaboration with and support from the NRCS and USDA to aid farmers, agricultural producers, natural resource professionals, land managers and conservationists in making land and livestock management decisions regarding greenhouse gas emissions and carbon sequestration. COMET-FarmTM provides total farm, ranch and woodlot greenhouse gas accounting, including cropland, pasture, range, agroforestry, forestry, livestock and on-farm/ranch energy use modules. Forestry is practiced widely in the U.S., and the potential carbon sequestration co-benefits of specialized forestry practices are recognized nationally. COMET-FarmTM users define forest stand management such as stand boundaries, using a geospatial interface, stand composition, structure, and silvicultural practices. COMET-FarmTM predicts the impact of each forest stand's current and future greenhouse gas balances. Users can view greenhouse gas balances broadly, such as comparing totals across stands and silvicultural options, and narrowly, such as comparing different carbon stocks within stands. Using a comprehensive approach, users with mixed agricultural and forest lands can integrate forest practices with other land uses to ascertain the relative impact of their forest management practices. The tool accounts for forest growth and biomass dynamics, harvesting, and the fate of forest products. The tool is firmly grounded scientifically, using GHG inventory methods provided in, Quantifying Greenhouse Gas Fluxes in Agriculture and Forestry: Methods for Entity-Scale Inventory and methods demonstrated in the USDA Forest Service report, Methods for calculating forest ecosystem and harvested carbon with standard estimates for forest types of the United States. To demonstrate the power of this tool, we showcase the tool's capabilities to estimate greenhouse gas fluxes on forestland using real-world examples of forestry practices

 $\textbf{Track:}\ 2016\ General\ Conference\ Theme\ Submissions\ -\ Great\ River\ Landscapes$

Subject Area: Conservation Models, Tools, and Technologies

CNMP Development in West Virginia Using University Interns

Authors: Tom Basden*, West Virginia University

Abstract: Statement of Need: To promote conservation education to undergraduate students and provide them with an environment where they can learn the conservation planning process while assisting USDA staff with nutrient management plan generation. Students are provided training that included the conservation planning process, field sampling, and software derived plan development. Five students were placed across the State during 2015 and assisted USDA conservationists with a targeted program of CNMP development using new software. The Interns were introduced to conservation planning during the summer intern period with site visit and interaction with local farming landowners. During the summer of 2016 interns will be placed again in local USDA offices and continue the nutrient management planning and their conservation planning training. This conservation education program agriculture students at West Virginia University is unique because of its targeted focus on nutrient management skill development. Students learn how to use multiple pieces of software, they are also trained to collect accurate soil samples, cropping data, manure storage and handling information. This internship program has tangible outcomes, completed USDA CNMPs. The field staff provide over site and guidance for the students ensuring a quality planning process occurs. Results: In 2015 five interns, assisted >35 different landowners, collecting data on more than 20 beef, dairy and poultry farms. They completed preplan data entry for >4000 acres, Gained valuable software experience and learned to communicate with farmers. Conclusions/Significance of these Efforts: Preparing university students to move from classroom to conservation careers is best done with hands on internships that provide both a strong learning environment and tangible results that USDA can use to improve their conservation planning. First year results show that this may be a successful way to grow the conservation community.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

Environmental-Friendly Methodology for The Detection of Subsurface Pollution

Authors: Bahaaeldin ELWALI*, Jazan University; Aboubaker Farag Srat, University of Tripoli; Abdul Rahim S, National University of Malaysia (UKM); Wan Zuhairi WY, National University of Malaysia (UKM); Abdul Ghani MR, researchaffiars.mrc@gmail.com; Ismail Yusoff,

Abstract: Two-dimensional direct current resistivity imaging (2D DC) is now becoming widely used in environmental applications where increased knowledge about the near-surface pollution is required. In this concern and in the vicinity of an unlined open dumpsite in west Malaysia, a total of seven lines of 2D DC resistivity imaging were established around seven boreholes which were installed particularly to trace and map the level of leachate dispersivity from the source point into the surrounding. Results reveal that the resistivity value of the decomposed waste material is relatively low (< 2.46 □m) compared to those of the uncontaminated soil outside the disposal site. The electrically conductive anomaly on the dumping site was related to leachate plumes which appear to have seeped at depth as far as 20 m below surface and migrated away downslope the dumpsite. Furthermore, it seems that the groundwater upslope of the site has deteriorated as a result of some stagnant leachate portion that drained from the site by double mixing with rainwater and groundwater respectively when the water table rises above ground surface during flash floods in the wet season. This result highlights the usability of 2D DC method as an noninvasive and cost-effective technique to delineate the extension of contamination plumes at pollution source points.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Conservation Models, Tools, and Technologies

Evaluating Greenhouse Gas Emissions and Carbon Sequestration from Rice Production in Eastern Arkansas Using COMET-Farm

Authors: Matthew Stermer*, Natural Resource Ecology Laboratory-Colorado State University; Mark Easter, Natural Resource Ecology Laboratory-Colorado State University; Amy Swan, Natural Resource Ecology Laboratory-Colorado State University; Keith Paustian, Natural

Abstract: COMET-FarmTM is an integrated web-based decision support tool developed in collaboration with and support from the NRCS and USDA to aid farmers, agricultural producers, natural resource professionals, land managers and conservationists in making land and livestock management decisions regarding greenhouse gas emissions and carbon sequestration. COMET-FarmTM provides total farm, ranch and woodlot greenhouse gas accounting, including cropland, pasture, range, agroforestry, forestry, livestock and on-farm/ranch energy use modules. Biomass and soil carbon; CO2 emissions from liming, urea fertilization and drained organic soils; CO from biomass burning; N2O from soil, wetland rice cultivation, biomass burning and drained organic soils; and CH4 from soil, wetland rice cultivation and biomass burning are accounted for in the tool using the methods described in the USDA document, Quantifying Greenhouse Gas Fluxes in Agriculture and Forestry: Methods for Entity-Scale Inventory. Calculations are done to estimate past, present and future emissions for user designed and selected management scenarios. Agricultural soil management is the leading source of greenhouse gas emissions in the agricultural sector. Applying conservation practices can greatly reduce the amount of greenhouse gas released into the environment and aid in building and storing soil carbon. COMET-FarmTM allows rapid assessment of conservation scenarios to aid in conservation planning. To showcase the tools capabilities, conservation scenarios are contrasted in real-world rice production systems in eastern Arkansas, demonstrating how on-farm practices influence the greenhouse gas flux from rice production systems.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

^{*}denotes primary author and subject area

Evaluating Greenhouse Gas Emissions from Swine Production in Central Iowa Using COMET- Farm

Authors: Matthew Stermer*, Natural Resource Ecology Laboratory-Colorado State University; Crystal Toureene, Natural Resource Ecology Laboratory-Colorado State University; Mark Easter, Natural Resource Ecology Laboratory-Colorado State University; Keith Paustian

Abstract: COMET-FarmTM is an integrated web-based decision support tool developed in collaboration with and support from the NRCS and USDA to aid farmers, agricultural producers, natural resource professionals, land managers and conservationists in making land and livestock management decisions regarding greenhouse gas emissions and carbon sequestration. COMET-FarmTM provides total farm, ranch and woodlot greenhouse gas accounting, including cropland, pasture, range, agroforestry, forestry, livestock and on-farm/ranch energy use modules. The impact of greenhouse gas emissions from livestock management are well understood in the agricultural sector. Using COMET-FarmTM, livestock producers can accurately assess current greenhouse gas emissions against emissions under various conservation scenarios to determine the relative greenhouse gas balances of each. Methane from enteric fermentation as well as methane and nitrous oxide emissions from housing and manure management are estimated using the methods set forth in the USDA document, Quantifying Greenhouse Gas Fluxes in Agriculture and Forestry: Methods for Entity-Scale Inventory using detailed animal and feed characteristics. To showcase the tools capabilities, conservation scenarios are contrasted in real-world swine production systems in central Iowa, demonstrating how on-farm practices influence the greenhouse gas flux from livestock production systems.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

^{*}denotes primary author and subject area

Phosphorus Reclamation from Aqueous Solution Using Modified Waste Eggshell: Equilibrium, Kinetics, and Sorption Mechanism

Authors: Mohammad Alwabel*, king saud university; Munir Ahmed, King Saud University; Mahtab Ahmed, king saud university; Adel Usman, king saud university

Abstract: Increasing global demand of phosphorus (P) is leading towards rapid depletion of P resources. Reclamation of P from waste supplies may partially compensate for the future P stock. In this study, waste eggshell powder and its modified derivatives via thermal and magnesio-thermal treatments were used as low-cost green sorbents for the removal of P from aqueous solutions. Results indicated changes in structural and chemical properties of the derived materials as compared to the parent material. Consequently, the P sorption efficiency was influenced by these changes. Magnesio-thermally modified eggshell presented the highest P sorption capacity of 43.33 mg g-1 (Langmuir predicted), and a high sorption rate of 4.32 mg g-1 min-1 (Psudo-second order predicted). Freundlich and Langmuir models well described the P sorption onto magnesio-thermally and thermally treated eggshells, respectively. Dynamics of P sorption was explained properly by the Psudo-second order rate equation, suggesting chemisorption as the operating sorption mechanism at low initial P concentration (200 mg L-1). Hydroxylapatite [Ca10(PO4)6(OH)2] and brushite [CaH(PO4).2H2O] were observed as a result of precipitation at high P concentration (>200 mg L-1). Afterwards, the P-loaded sorbents may be used as a source of P and other essential elements (Ca and Mg) in the nutrients deficient acidic soil.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Conservation Models, Tools, and Technologies

^{*}denotes primary author and subject area

Quantifying the Benefits and Risks of Winter Bale Grazing to Develop an Improved BMP

Authors: Sharon Reedyk*, Agriculture and Agri-Food Canada

Abstract: Winter bale grazing is an economic system for winter feeding of cattle that is increasingly being used on the Canadian prairies. The nutrient amounts imported in the feed are estimated to be in the 50-70 lbs/acre P and 580-820 lbs/acre N. Most imported nutrients remain in the feeding area with only an estimated 1% removed from the site as animal weight gain. Current recommendations suggest that to avoid high soil nutrient loading, this practice should be restricted to once every five years. On one hand, the practice is viewed as a best management practice for improving soil and forage quality through the addition of organic matter and nutrients, but alternatively, the nutrient amounts that remain on-site can be moved off-site or redistributed by runoff or through infiltration to shallow groundwater, creating significant environmental risk. This project is documenting the impact of bale grazing on soil, forage and water quality resources at sites with different soil and climate regimes to improve our knowledge on the spatial variability of nutrient loading from bale grazing. Our results indicate that (1) significant nutrient loss/redistribution occurs and that soil nutrient loadings are over-estimated by our current tools, (2) uneven nutrient distribution has resulted in a patchwork pattern of high production and low production spots where forage production levels can be 30 to 80 percent lower in-between bale locations, suggesting that the sites could benefit by a greater return frequency and (3) concentrations of N and P in surface water runoff and shallow groundwater in areas under bale grazing can be an order of magnitude higher than those outside bale grazing, but that the risk for nutrient export from the site is highly dependent on site characteristics. These results will be used to develop best practice guidelines for winter bale grazing, including estimates of return frequency and indicators for assessing environmental risk.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Conservation Models, Tools, and Technologies

The Multi-Year Crop Water Allocator

Authors: Jonathan Aguilar*, Kansas State University; Dan O'Brien, Kansas State University; Danny Rogers, Kansas State University; Steven Briggeman, Sprout Software LLC; Bill Golden, Kansas State University

Abstract: Many aquifer systems, especially the southern parts of the Ogallala Aquifer, have declining irrigation well pumping capacities and irrigators, resource managers and the state agencies are looking for ways to either conserve water or optimize water productivity of irrigated agriculture. Producers that are currently physically constrained by low well capacity or are enrolled or considering enrollment into a conservation/institutional program that offer conservation incentives and flexibilities, such as Local Enhanced Management Areas (LEMA), 5-Year Flexible Account (MYFA), and Water Conservation Areas (WCA), want to make good cropping decisions and be innovative in their cropping system management. Some irrigators want and need a plan that would provide a crop sequence for the next 5 to 6 years given their water allocation for that same period. It is important for irrigators be able to make these long-term decisions based on the best available information. But to evaluate the many possible outcomes of a long term crop rotation, a decision support program that evaluates various crop sequences and water application for a multi-year period is needed. In this poster, we introduce the K-State's Multi-Year Crop Water Allocator (MY-CWA) leveraging on the annual CWA version. The program is primarily designed to help in managing limited irrigation practices using crop production functions as its backbone. The MY-CWA can be freely accessed at www.bae.ksu.edu/mobileirrigationlab.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

Update on the Agricultural Conservation Planning Framework, Database, and Toolbox

Authors: Mark Tomer*, USDA-ARS; Sarah Porter, USDA-ARS; David James, USDA-ARS

Abstract: The Agricultural Conservation Planning Framework (ACPF) is an approach to conservation planning in agricultural watersheds that is based on the use of consistent-quality, high-resolution geospatial data, and on a flexible suite of precision GIS analyses to identify options for implementation of multiple conservation practices. The ACPF comprises a conceptual framework, supported by a spatial database and ArcGIS® toolbox that were released for public use in October 2015. This poster will provide an update on the ACPF by describing expansion of the database to enable application across a broader area, development of new tools, and training activities. The database, which began with coverage of HUC-12 watersheds in Iowa, Illinois, and southern Minnesota, is being expanded to provide ACPF input data from eastern Kansas to northern Minnesota and the western Lake Erie basin. The ACPF database structure is shared with the Daily Erosion Project (http://dailyerosion.org/), providing linkage between modeling activities that can estimate ongoing soil erosion and improve data resources for watershed planning. New tools being written for inclusion in the ACPF toolbox will help identify locations suitable for practices such as saturated buffers, bioreactors, and two stage ditches, provide improved riparian analyses, and assess the extent of soils prone to inundation, drought and/or erosion in a watershed. The North Central Region Water Network, a regional network aimed at water quality extension activities, is providing website hosting for the ACPF (http://northcentralwater.org/acpf/).

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

Using Soils Data and Information in Soil and Water Conservation: What Information is Right for You?

Authors: Michael Robotham*, USDA-NRCS

Abstract: The USDA-NRCS provides multiple types and scales of data on the location, extent and properties of the soils of the United States as well as a wide range of interpretive information. As of 2016, certified soils data (SSURGO) is available for over 90% of the continental US with the missing 10% concentrated on federal properties west of the Rocky Mountains. The SSURGO database contains estimates of a wide range of soil physical and chemical properties for soil polygons (components and mapunits), typically at a 1:24000 scale. In addition, the database contains interpretive values used to inform modeling and decision making in a variety of fields including American Association of State Highway and Transportation Officials (AASHTO) soil groups, saturated hydraulic conductivity (Ksat), soil erodibility (k) and hydrologic soil group (HSG). As a consequence, SSURGO data and information that has been incorporated into a wide variety of successfully applied soil and water conservation assessment tools and models that have been developed by the government, universities and the private sector. However, SSURGO data is not the only source of official soils data and information available. In addition to the gridded SSURGO (gSSURGO), a raster-based version of the SSURGO information, the USDA-NRCS provides broader scale STATSGO2 information as well detailed laboratory analysis of soil properties from over 60,000 point locations worldwide. This poster will summarize the strengths and weaknesses of the various types of soils data and information and will provide examples of how they can be used appropriately to inform soil and water conservation models, decision support tools and land management activities.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Conservation Models, Tools, and Technologies

Wetland Restoration and Protection in Western Kentucky

Authors: Shelly Morris*, The Nature Conservancy

Abstract: The Nature Conservancy (TNC) has identified the Mississippi River watershed as a high conservation priority. The main objective in the watershed is the reduction of sediment and nutrient inputs contributing to the dead zone in the Gulf of Mexico. One key strategy to reduce sediment and nutrient inputs to our waterways is to restore and protect wetlands, which provide natural water filtration for agricultural runoff. Although wetlands make up only about 3.5% of the U.S. land area, more than onethird of threatened and endangered species live only in wetlands. They also play an important role in the storage of floodwaters, which reduces flooding risks to our communities. In 2011, the Kentucky Chapter of TNC, in partnership with USDA Natural Resources Conservation Service (NRCS), was awarded funding through the USDA Wetland Reserve Enhancement Program (WREP). This program provides restoration and permanent protection on enrolled acres. Between 2011and 2014 over 4200 acres were enrolled into the program within the project focus area. During 2015, an additional 670 acres were enrolled into the USDA Agricultural Conservation Easement Program - Wetland Reserve Easement (ACEP-WRE). In October 2015, TNC was awarded a second WREP project for the same project area. This continuation of funding will allow for enrollment of another 2500 acres over the next three years. The primary goal under the new WREP is to build on previous success by expanding and reconnecting existing blocks of protected land through focused WREP enrollment and additional easement and land acquisition. Prioritized acquisitions will lead to the development of a system of high quality habitat at a scale that is meaningful to both water quality and wildlife. In addition to program success, this project has led to increased partnerships, staff capacity, private funding, and increased planning and collaboration on wetland conservation in western Kentucky.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Conservation Models, Tools, and Technologies

Common Ground: Connecting Absentee Landowners to Soil, Water Quality Issues

Authors: Megan Baskerville*, Macon County Soil and Water Conservation District; Carol Hays, Prairie Rivers Network

Abstract: Central Illinois is home to arguably the most productive soils in the world. Given their high value, much of the land is owned by trusts, far away investment groups, and people who do not operate the ground. Prairie Rivers Network, in partnership with over 10 SWCDs in east central Illinois, is creating an educational newsletter specifically for this type of landowner. Their needs are much different than the traditional farm operator, and a more directed outreach effort will have better results in engaging this group. The newsletter looks to empower these landowners, inform them of the larger environmental issues going on in farms' watersheds, and notify them of new practices that can be implemented to keep their soils healthy, increase water quality, and be a good (absentee) neighbor. By the time of the SWCS conference, the inaugural newsletter will have gone out, and surveys will have been collected. In the survey, we hope to gage their demographics, their current involvement in management decisions, interests in conservation, and what they'd like to see in future issues of this newsletter.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Outreach, Education, and Community Engagement

^{*}denotes primary author and subject area

Implementing Novel Irrigation Solutions for Limited Resource Farms in the Alabama Black Belt

Authors: Raymon Shange*, Tuskegee University; Richard Martin, Tuskegee University; Walter Hill, Tuskegee University

Abstract: Leading issues in rural Alabama, as in many other rural areas, exist at the Food, Energy, Water nexus. In the case addressed in this project, Limited Resource farmers in the Alabama Black Belt were in need of equipment, supplies, and education regarding irrigation for consistent crop production. The project led to the implementation/demonstration over 30 sustainable irrigation systems suing various sources of water and energy, for varying crop varieties. Participating farmers were able to learn various methods of water resource use and management, and change their practices in order to conserve water, energy and money. As a result, Tuskegee University was able to establish a Water Resource Management and Education program that has helped greater than 12 farmers produce fruit and vegetables consistently enough to market to commercial grocery stores, schools, and restaurants; this is in addition to large amounts of other small, new and beginning, and hobby farmers.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Outreach, Education, and Community Engagement

A Synthesis of the NIFA Water Portfolio: Explaining Project Success

Authors: Linda Prokopy*, Purdue University; Mike O'Neill, University of Connecticut; Sarah Church, Purdue University; Laura Esman, Purdue University; Ajay Singh, Purdue University

Abstract: Over the past decade, federal agencies have been pushed to demonstrate greater accountability for programmatic funds. The increased focus on accountability has prompted renewed attention to defining and describing the impacts of federally funded programs. The National Institute of Food and Agriculture (NIFA) Water Portfolio consists of multiple funding sources that support research, education, and extension programs, promoting solutions to water problems in agricultural, rural, and urbanizing watersheds. Our team is analyzing the impacts and effectiveness of NIFA Water Portfolio projects between the years 2001 and 2013. In this presentation, we provide results from 389 project surveys (56.7% response rate) of Project Directors collected between April-June 2015. We focus on our synthesis of respondents' perceptions of project success and opinions on how their project could have been more successful. We present what emerged as the key elements of successful grant projects, and follow with recommendations to NIFA for changes to the granting processes and requirements. Our results will be of interest to granting agencies and will aid others in successful project development and implementation.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Social Sciences Informing Conservation

Farmer Response to Introduced Eucalyptus in Kenya: Responding to the Environmental Concern and Economic Importance to the Small Plot Farmer

Authors: Brandy Garrett Kluthe*, University of Arkansas, Mourad Ben Hassine Ben Ali, University of Arkansas; Diana Chen, University of Arkansas

Abstract: The promotion of Eucalyptus as a fast growing wood source increased in prominence in agricultural settings in Kenya and many parts of the world beginning in the late 1800's (Doughty 1996). This rise in cultivation also came with concerns from farmers who noticed that water sources were becoming compromised and crops growing near Eucalyptus exhibited poor growth (Bennett 2010). The objective of this study was to assess the small plot farmer's view of the Eucalyptus as it pertains to its effect on the environment and their farm in particular. In order to assess the farmer's impressions of the Eucalyptus trees in their woodlots and elsewhere, a survey was carried out. This survey included questions about the trees they plant, the uses of the trees, other things they find in the woodlot and their general impression of how the Eucalyptus affects with the surrounding environment. Surveys were carried out in the Eastern, Central, Rift Valley and Western Regions of Kenya. The results of the survey indicate that the farmers did experience negative environmental effects from their Eucalyptus woodlots but the economic benefits were a greater benefit. Farmers employed techniques to mitigate the negative influences of the trees such as where they planted them and the use of trenching. Responses indicated that further research and education could both improve ecological influence and economic outcomes to small plot farmers in Kenya.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Social Sciences Informing Conservation

Human Perceptions and Optical Water Quality in Rivers

Authors: Amie West*, University of Arkansas; Justin Nolan, University of Arkansas; Thad Scott, University of Arkansas

Abstract: Rivers are revered worldwide for their ecologic, scenic, and recreational value. Effective communication among groups with vested interest in water resources can best be achieved with an interdisciplinary perspective. This study was aimed at the intersection between optical water quality and human perceptions of water quality. With 26 underwater photographs and corresponding optical water quality measures, we conducted a pile-sort activity and interviews with 151 water resource experts and non-experts. Our results suggest human perceptions of water quality may not be dependent upon respondent expertise, experience, or demographics, but may be guided by culturally-constructed criteria. However, text analysis of responses revealed notable differences in the frequency patterns of descriptive words among groups of study participants. Additionally, measured optical water quality parameters were strongly related to perceived differences among the underwater images. We suggest water quality variables directly linked to observable characteristics, and the most common words describing them, may be the foundation for a common understanding of water quality in rivers that can enhance communication among stakeholders.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Social Sciences Informing Conservation

Rangeland Ecosystem Services Provided by Western Ranchers

Authors: Kristie Maczko*, Sustainable Rangelands Roundtable - University of Wyoming; John Tanaka, University of Wyoming Agricultural Experiment Station

Abstract: Rangeland ecosystem goods and services include extractable goods, tangible and intangible services, and core ecosystem processes that underlie them. While rangeland amenity values matter to some, profit potential may motivate others to engage in conservation and provision of goods and services. As competing land uses vie for finite resources, identifying rangeland goods and services, along with conservation practices contributing to their viability, becomes more important. Ranchers manage rangeland systems for their livelihood, also providing wildlife habitat, clean water, carbon sequestration, open space, hunting, fishing, and recreation opportunities. The Sustainable Rangelands Roundtable (SRR) recognized that querying ranchers about goods and services their operations provide would produce useful information. SRR distributed the survey in the Great Basin, Colorado Plateau, Southwest, and Central Rockies, during Spring and Summer of 2015. Preliminary results reflect the value and importance of activities and resource uses to ranching operations; management practices used to improve conditions, and motivations for doing so; species for which habitat is provided; how much is charged for recreation activities; and days of recreation provided. Responses show that ranchers steward a variety of ecosystem services on their public and private rangelands. Ranchers also make management decisions to enhance these goods and services, and they don't always charge a fee to those who enjoy the benefits. As society becomes more urbanized, it is important to publicize varied benefits emanating from rural communities while ranchers pursue their core business of providing protein to a growing population. Additionally, as the economics of ranching become more complex, sharing strategies for enterprise diversification and alternative income streams associated with ecosystem goods and services may also help ranchers improve their operations' long term sustainability and resilience.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Social Sciences Informing Conservation

Effect of Tillage, Cover Crop, and Corn-Soybean Rotation on Earthworms Biodiversity in Central Missouri

Authors: afolasade balogun*, Lincoln University; Nsalambi Nkongolo, Lincoln University of Missouri

Abstract: Knowledge of the dynamics of earthworms in a soil under the influence of different agricultural treatments is very important for soil fertility conservation. Amongst the organisms living in soil, earthworms have been globally recognized for their importance in the improvement of the biological, chemical and physical properties of soil. The objective of this study was to investigate how earthworm biodiversity was affected by tillage (TL), cover crop (CC) and crop rotation (CR) treatments in a corn and soybean field. The study was conducted on a silt-loam soil at Freeman farm of Lincoln University of Missouri. A three factor factorial design in a randomized block was used. Tillage had two levels (notillage vs conventional tillage), cover crop had also two levels (rye vs no rye) and crop rotation had four levels (continuous corn, continuous soybean, corn/soybean and soybean/corn rotations) for a total of 48 plots. Earthworms were extracted from the plots using the formaldehyde extraction method. Results showed a significant interaction (p=0.0464) between cover crop and crop rotation for adult earthworms. In addition, crop rotation was significant (p=0.0317) for juvenile earthworms. Tillage had a significant effect (p=0.0005) on the biomass of the earthworms. Among earthworm species, Pheretima spp was significantly affected by the tillage (p=0.0201). All plots with soybean had more juvenile earthworms. Overall, conventional tillage decreased the biomass of the earthworms while earthworm abundance was the same for all the treatments.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Soil Health Resources, Indicators, Assessment, and Management

Effect of Topsoil Thickness on Soil Water Infiltration in Corn-Soybean Rotation and Switchgrass Production Systems

Authors: SYAHARUDIN ZAIBON*, UNIVERSITY OF MISSOURI; Stephen Anderson, University of Missouri; Newell Kitchen, USDA-ARS; Allen Thompson, University of Missouri; Clark Gantzer, University of Missouri; Ranjith Udawatta, University of Missouri

Abstract: Switchgrass and corn are sometimes used as a resource for biofuel production. The effect of production management systems on water infiltration is very critical in claypan landscape to increase production as well as minimize economic and environmental risks. The objective of this study was to evaluate the influence of topsoil thickness on water infiltration in claypan soils for grain and perennial grass production systems. The experiment was performed at the Soil Productivity Assessment for Renewable Energy and Conservation (SPARC) plots at the University of Missouri. Plots were planted with either switchgrass (Panicum virgatum L.) or a corn (Zea mays L.)-soybean (Glycine max (L.) Merr.) rotation. Plots were initially established in 1982 with varying levels of topsoil thickness (0, 12.5, 25, and 37.5 cm) on a Mexico silt loam (Vertic Epiaqualfs). Infiltration rates were measured using ponded infiltrometer units during two years (2014 and 2015) for the two levels of 0 cm and 37.5 cm topsoil thickness with four replicates for each treatment. Physically-based Parlange and Green and Ampt infiltration models were used to estimate saturated hydraulic conductivity (Ksat) and sorptivity (S) parameters. Infiltration depths (I) for both years, 2014 and 2015, were significantly higher (about 80%, P < 0.01) for the switchgrass treatment compared to the row crop treatment. Results show that the I parameter was 73% higher (2014) and 72% higher (2015) for the deep topsoil thickness compared to the zero topsoil thickness (P = 0.01). Results showed that perennial grass (switchgrass) production systems enhanced water infiltration compared with row crop management for claypan soils

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Soil Health Resources, Indicators, Assessment, and Management

^{*}denotes primary author and subject area

Comparison of Infiltration Capacity as Measured by the Cornell Sprinkle Infiltrometer and a Double-Ring Infiltrometer

Authors: Kirk Barrett*, Manhattan College; Danielle Rodgers, Montclair State University

Abstract: The Cornell Sprinkle Infiltrometer (CSI) and a double-ring infiltrometer (DRI) were used multiple times to measure infiltration capacity of three different, homogenized sands in a laboratory. Agreement between measurements by the different instruments was good for one sand (4% difference in the means) but larger for the other two sands (32% and 48% difference in means), with the CSI giving the larger value in both of these cases. That the measurements differed significantly for two of three sands, even for these simplified soils under laboratory conditions, indicates that the choice of instrument can significantly affect measurement of infiltration capacity. The reproducibility of each instrument was also assessed. The reproducibility of the CSI was much better than that of the DRI for one sand (relative standard deviations of 7% vs 26% respectively), but slightly worse for the other two sands (relative standard deviations of 23% vs. 18% and 22% vs 19%, respectively). With relative standard deviations of ~20% in 5 out of 6 idealized cases indicates that field measurements of infiltration capacity by infiltrometers will likely vary significantly, above and beyond variability attributable to temporal and spatial variability in soil properties.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Water Resources Assessment and Mangement

Differences in Nitrogen and Phosphorus in Groundwater between Claypan and Loess Watersheds in Missouri

Authors: Niranga Wickramarathne*, University of Missouri

Abstract: Groundwater provides more than 33% of the public drinking water supplies in the United States. Nitrogen (N) and phosphorus (P) pollution of water resources has been a major problem for years, causing contaminated water supplies, harmful effects on aquatic and human health and formation of hypoxic zones. The main objective of the study was to understand N and P transport to groundwater between two hydrologic regimes with strongly contrasting soils and land use in Missouri. Claypan (Goodwater Creek Experimental Watershed, GCEW) and deep loess soil (Horticulture and Agroforestry Research Center, HARC) experimental sites were equipped with 3- to 15-m deep wells. At HARC, two transects of five wells were installed across a catena sequence from the summit to foot slope and land use was grazed pasture. At GCEW, three monitoring wells were installed in strategic locations around a resurgent flow area adjacent to a row crop field. Groundwater samples were collected weekly from wells at both study sites and analyzed for nitrate (NO3-N), total N (TN), orthophosphate (PO4-P), and total P (TP). The time series data of different analytic concentrations for 45 sampling events showed a considerable amount of N and P contamination in all wells. At HARC, higher concentration of NO3-N and TN was found in the wells at summit compared to wells located at the foot slope where denitrification was likely removing the NO3-N. The PO4- P and TP concentrations in the HARC wells showed the opposite result compared to NO3-N and TN. In GCEW, concentrations of NO3-N and TN were comparatively higher than those found at HARC while concentrations of PO4- P and TP were lower. Results showed that row crop production at the claypan site has had a major impact on groundwater N concentrations while cattle grazing at the HARC site has significantly impacted groundwater P concentrations.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Water Resources Assessment and Mangement

Empirical Examination of the Relationship between Volumetric Runoff Coefficient and Imperviousness in New Jersey

Authors: Kirk Barrett*, Manhattan College; Derek Caponigro, Manhattan College

Abstract: The goal of this project was to empirically determine the relationship between volumetric runoff coefficient (Rv) and imperviousness in New Jersey and to compare the relationship with a previously determined relationship based on the entire nation that is widely used (Schueler, 1987). We determined Rv for multiple rainstorms in spring and summer 2014 for 11 drainage areas in New Jersey for which both streamflow and precipitation were measured at the same location by the U.S. Geological Service. We determined the percent of each drainage area that was covered by impervious surfaces by analyzing a 2007 land-use/land-cover dataset for New Jersey in ArcGIS. Imperviousness ranged from 0.6% to 29.4%. We performed two linear regressions between percent impervious and Rv for all drainage areas: one using the median Rv for each area and one using the Rv determined by regression between stormflow depth and rainfall depth for each storm. We found unexpectedly poor correlations between Rv and imperviousness. Our regression equations between Rv and imperviousness were much different than that reported by Schueler (1987): our equations' slopes were <1/3 of Schueler's slope. Possible explanations for these results include that the Schueler's analysis included many highly impervious watersheds, while the maximum percent imperviousness in this study was only ~30% and that all of the watersheds in Schueler's analysis were smaller than those in this study.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

^{*}denotes primary author and subject area

Evidence of Urea Release from Intermittently Flooded Agricultural Sediments and Assessment of Microbial Activity

Authors: Mason King*, University of Maryland Eastern Shore; Sabrina Klick, University of Maryland Eastern Shore; Louis Saporito, USDA Agricultural Research Service; Fawzy Hashem, University of Maryland Eastern Shore; Arthur Allen, University of Maryland Easter

Abstract: Urea is an organic N molecule implicated in the development of harmful algae blooms and also widely used as fertilizer. Elevated urea-N concentrations have been documented in agricultural watersheds, with notably high concentrations found in the lentic drainage ditches and wetland streams that characterize coastal plain headwaters under base flow conditions. However, previous research shows that the export of urea-N from farm fields is unlikely and indicates that urea-N in ditches and wetlands is of autochthonous origin. Our research assesses the potential for urea-N accumulation in surface water due to release from microbial metabolism in sediments from an agricultural landscape. Experiments on mesocosms containing flooded sediments examined N dynamics in the sediment-surface water system and were supported by field sampling. Additional field sampling and another set of mesocosm experiments will characterize the resident microbial community with 16S rRNA and metabolic functional genes using high-throughput sequencing. Results show that flooded drainage ditch sediments and 27°C temperatures produce significantly greater urea-N concentrations in surface water than nonagricultural sediments and cooler temperatures, respectively. We expect microbial community and metabolic activity results to indicate specific biologically mediated N cycling regimes associated with greater urea accumulation in drainage ditches. These results and ongoing work suggests that urea-N production in the sediment and efflux to surface water may explain concentrated urea-N in agricultural headwaters better than the physical transport of untransformed urea—N from crop fields. This phenomenon may be widespread in ditches and similar environments, and the export of accumulated urea-N by high flow conditions could elevate the risk of harmful algae blooms in receiving waters.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

^{*}denotes primary author and subject area

Historical, Empirical Analysis of the Relationship between of Urbanization and Baseflow in Connecticut, USA

Authors: Kirk Barrett*, Manhattan College; Samantha Corrado, Manhattan College

Abstract: In theory, increased impervious cover caused by urbanization will cause decreased infiltration and, consequently, decreased baseflow in streams. However, in practice, other processes associated with urbanization could confound this relationship. This study examined this relationship using historical streamflow data and estimates of concurrent imperviousness for watersheds in Connecticut, USA. Seventeen USGS streamflow gauges were selected with drainage areas <400 square miles and lengths of record >25 years. Population in each drainage area was estimated annually. Imperviousness was estimated by regression with population density. Only 6 of the 17 watersheds experienced increases in percent imperviousness of greater than 5 percentage points, with the largest being 7 percentage points. Annual (water year) baseflow was computed using an Eckhart digital filtering method. Annual baseflow index (BFI=baseflow volume / total flow volume) was computed to discount variations in annual precipitation. Concurrent BFI and estimated imperviousness were regressed linearly for each watershed to determine if there was a statistically significant relationship. No watersheds showed the theoretically expected, inverse relationship at statistically significant levels, with the lowest p-value of 0.17. Conversely, 4 of the 17 watersheds showed a significantly significant (alpha = .05) positive relationship between baseflow and imperviousness. The gauges showing positive correlation included 3 of the 6 watersheds with ranges in percent imperviousness greater than 5 percentage points. Interpretation of results are confounded because the small change in imperviousness may not be enough to produce a predictably detectable change in baseflow. However, the results indicate that the theoretical relationship between increasing urbanization and decreasing baseflow is not always readily observable. In fact, sometimes the opposite relationship can be observed.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Water Resources Assessment and Mangement

^{*}denotes primary author and subject area

Modeling and Assessing Nitrogen Delivery in the Calapooia River Watershed, and the Impact of Small Streams Delivery on Downstream Watershed

Authors: Jiajia Lin*, EPA; Jana Compton, U.S. EPA; Scott Leibowitz, U.S.EPA

Abstract: The Calapooia River is a major tributary to the Willamette River in western Oregon, which is characterized by a mountainous forested upland and a flat agricultural lowland. Here we report on a modeling study of watershed's N budget, and quantify the influence of different streams on the delivery of water and N to downstream waters. Surface water was sampled between 2003 and 2011 at 73 sites on the Calapooia River and its tributaries. Daily discharge simulations from a hydrologic model are integrated with concentration measurements to calculate TN loads using LOADEST (Load Estimator). ArcGIS data of landscape N inputs were used to calculate contributions of various N sources. Nearly 40% of the total area has a net TN input of 100-200 kg/ha/yr, dominated by agricultural land, and 48% has an input of <100 kg/ha/yr. About 2.4% of the area has a TN input of >200 kg/ha/yr, where animal feeding operation and farmland are the dominant land use. Mountainous area has a TN input of <30 kg/ha. Based on 2008 data, dry summer yield is as low as <1 kg/ha, while nearly 50% of the annual yield occurs during the wet winter, and reaches 50 kg/ha over the season. The fraction exported ranges from 2 to >60% at the subbasin level with the highest values found at the mountainous areas. Annual TN export is 25% of the inputs for the Calapooia watershed and is relatively high for western watersheds. Subbasins with the greatest TN input do not correspond with areas with the highest yield. Differences in crops, riparian buffers or soil could explain the discrepancies. Future modeling work with SWAT (Soil and Water Assessment Tool) will be used to understand stream N delivery under various land use, soil, and management scenarios, and to calculate the seasonal contribution of N from different stream types (e.g., intermittent vs. perennial). The results of this study should provide insights into establishing more effective nutrient management and reduction plans for the Calapooia watershed.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Water Resources Assessment and Mangement

^{*}denotes primary author and subject area

National Wetland Condition Assessment 2011: Exploring Relationships between Soil Properties and Ecological Condition of Wetlands

Authors: Ann Rossi*, ORISE-EPA; Gregg Serenbetz, US-EPA

Abstract: To assess the ecological condition of wetland resources across the conterminous United States, the US Environmental Protection Agency and its federal, state, and tribal partners conducted the first National Wetland Condition Assessment (NWCA) in 2011. NWCA is part of the National Aquatic Resources Surveys completed by EPA to improve understanding of the quality of the nation's waters. A goal of NWCA was to identify and develop indicators of ecological condition, which were evaluated in relation to measures of stress, disturbance, and reference condition. NWCA sites were selected using a probability based design, such that the sites selected and results reflect the full range of wetlands in the target population. Field crews sampled 1,138 wetland sites across the US, collecting data on vegetation, soils, water chemistry, algae, hydrology, and the wetland buffer. Vegetation data collected at each site was used to develop a national Vegetation Multi-Metric Index (VMMI), which indicates "good", "fair", or "poor" condition based on properties of vegetation that vary in relation to human-mediated disturbance. NWCA 2011 found that nationally, 48% of wetland area is in good condition, 20% is in fair condition, and 32% is in poor condition. NWCA 2011 also identified a number of physical, chemical, and biological indicators of stress that reflect potential negative impacts to condition. This study builds upon the work of NWCA 2011, examining relationships between ecological condition and soil parameters measured at each site. The objective is to identify properties associated with soil health that could be used as indicators of condition or stress in wetlands. Wetland soil quality indicators may be a useful assessment tool in future iterations of NWCA, as well as in state and regional wetland monitoring and assessment efforts. NWCA 2011 also provides a baseline description of soil properties in wetlands nationally, allowing for change and trend analyses in subsequent surveys.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Water Resources Assessment and Mangement

Processes Affecting the Transport of Nitrogen in Groundwater and Factors Related to Slope Position

Authors: Niranga Wickramarathne*, University of Missouri

Abstract: Groundwater provides more than 33% of the public drinking water supplies in the United States. Nitrate (NO3-) pollution of water resources has been a major problem for years, causing contaminated water supplies, harmful effects on human health, and widespread eutrophication of fresh water resources. This problem is associated with the application of nitrogen fertilizers, manures, and livestock grazing management. The main objective of this study was to understand the processes affecting NO3- transport to groundwater beneath a grazed tall fescue (Festuca arundinacea) pasture under livestock management and to assess the fate of NO3- as influenced by landscape position. The experimental site was established on two grazed plots (give approximate dimensions) in which cattle (give stocking rates) were rotationally grazed; one plot was grass only and the other had a row of mature poplar trees at the foot slope. Two transects of three wells were installed across a catena sequence from summit to foot slope. Soil core samples collected during installation of each well were analyzed for total and soluble organic C, and total and inorganic N and P forms. Groundwater samples were collected weekly from piezometers at and analyzed for NO3- concentration. Results showed decreasing NO3- concentrations with decreasing depth to the water table. Average NO3- concentrations were 4.53 ppm in summit wells and only 0.01 ppm in footslope wells. Anoxic conditions in the footslope wells apparently resulted in denitrification of NO3-. The results of this experiment showed that the depositional environment and shallow water table at the footslope position creates a setting with high potential for denitrification. Given the significant NO3- contamination at depths in excess of 10 m at the summit, these results demonstrated the ability of riparian areas to significantly reduce NO3- contamination along the groundwater flow path from summit to footslope.

Track: 2016 General Conference Theme Submissions - Great River Landscapes **Subject Area:** Water Resources Assessment and Mangement

Using Science to Inform Conservation Strategies in the Great Lakes

Authors: Lisa Duriancik*, USDA NRCS

Abstract: The need to address water quality concerns and contribute to nutrient reduction goals are ever pressing in the Great Lakes Basin and watersheds. Science and assessment to support conservation have made significant advances in recent years, with efforts like the Conservation Effects Assessment Project (CEAP) at others. In the past few years alone, major advances in knowledge in the Great Lakes region have been made. Our understanding of processes and practices has grown, through field and watershed assessment to regional analyses and science syntheses. Now, the opportunity is here to apply this new insight and information to develop science-based conservation strategies and watershed approaches. Recent science is explored and applied to conservation approaches that can support greater water quality outcomes.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

^{*}denotes primary author and subject area

Water Quality Sampling and Assessment for Bayou Chene in Louisiana, USA

Authors: Durga Poudel*, University of Louisiana at Lafayette

Abstract: To assess the surface water quality of Bayou Chene, which is one of the 303(d) listed water bodies in Louisiana, USA, we monitored surface water quality of the bayou from June, 2012 to June, 2015. Water quality sampling involved the weekly collection of surface water samples from each location (initially at four locations and later at 10 locations) by grab using a Van Dorn sampler. Laboratory determination of these samples included TSS, TDS, TS, BOD5, NO3/NO2-N, TKN, SRP, TP, Cl, Fl, and SO4. Surface water temperature, DO, turbidity, conductivity and pH were determined in the field using YSI Sonde. While average annual TSS, TDS, TS, nutrients and turbidity values declined remarkably in the the third year as compared to the first year of the study, the DO and BOD5 values showed further impairment of the water body. Both the average concentrations and loads for sediments and nutrients were found to be higher for the upstream sites than the downstream sites suggesting that the hotspot sites for sediments and nutrients in the watershed were located upstream. Based on these findings, we suggest that the BMPs should be implemented focusing on the hotspots emphasizing agricultural activities that occur specially during the months of March-September for nonpoint source pollution control in the watershed. In addition, a vigorous outreach and community awareness program in relation to nonpoint source pollution control in the watershed is suggested.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

Subject Area: Water Resources Assessment and Mangement

Water Quality Variability from Production Sized Cotton Fields in the Mid-South

Authors: Michele Reba*, USDA-ARS; Nadine Straitt, Arkansas State University; Tina Teague, Arkansas State University; Mike Daniels, University of Arkansas; Amanda Mann, University of Arkansas; Richard M. Smith, Arkansas State University

Abstract: Excess nutrients from agricultural fields influence local and regional water quality. In the Lower Mississippi River Basin of the United States the regional concern is most noted in the hypoxic zone in the northern Gulf of Mexico. In order to determine the local losses of excess nutrients from agriculture in the region a state-wide network of agricultural edge-of-field monitoring sites was established in 2010 in Arkansas. The network is made up of approximately 30 monitoring sites, on 12 separate farms where rice, soybean, cotton, corn, poultry and beef are produced. The objective of the network was to collect scientifically sound data at field scales under typical and innovative management for the region. This study consists of sites in central and northeastern Arkansas each with two fields (control and treatment field). Water quality estimates of sediment, nitrogen (nitrate, nitrite, and total) and phosphorus (soluble and total) were measured at each site. Each monitoring station was equipped with a flow outlet structure such as a flume, weir or open-channel pipe. The outlet structure was outfitted with flow sensors, data loggers and communication devices. This study presents data from the four cotton sites within the network between 2011 and 2015. Early data was collected on the impact of winter cover crops, while data collected from 2014 and 2015 provided baseline information.

Track: 2016 General Conference Theme Submissions - Great River Landscapes

^{*}denotes primary author and subject area



CONSERVATION INNOVATION GRANTS SHOWCASE



The Central Valley Habitat Exchange: A Market Based Approach to Integrating Agriculture and Habitat

USDA-NRCS Conservation Innovation Grant: #69-3A75-13-237

Authors: Katie Riley (kriley@enviroincentives.com) and John Cain (jcain@americanrivers.org)

Abstract: Floods events across the nation over the last decade and new research in the Central Valley have revealed that floodplain restoration is one of the most effective measures for both reducing flood risk to human communities and restoring critical fish and wildlife habitat (Sommer et al. 2001; Golet et al. 2008; Seavy et al. 2009). Proposals to increase the area of floodplains and the frequency with which they are inundated are important elements of multiple state and federal plans to restore endangered species and reduce flood risk in the Central Valley. But too often, the restoration of inundated floodplain habitat is perceived as harmful to agriculture and an imposition on private landowners. The Central Valley Habitat Exchange (Exchange) is designed to reverse that perception by providing landowners with an opportunity to generate new revenue sources from floodplain restoration while continuing agricultural production. The goal of the Exchange is to enable farmers and ranchers to profit from floodplain restoration while continuing agricultural production. The Exchange will provide a mechanism to compensate growers and ranchers for land stewardship activities that result in quantifiable floodplain habitat benefits in the context of a working landscape. A successfully functioning Exchange will expedite recovery of threatened and endangered fish, reduce the associated regulatory burdens on water users and flood managers, and reduce conflicts between farmers, environmentalists, and regulatory agencies. The Exchange will create a model that is broadly applicable to floodplains and agricultural lands across the Central Valley, California, and the Nation.

The Exchange has developed tools to quantify the suitability of floodplain lands for agriculture and as habitat for various floodplain dependent species including Chinook salmon, Swainson's hawk, riparian song birds, and giant garter snake. These tools can help landowners design and implement management practices that restore habitat on working lands. The Exchange has developed administrative infrastructure to expedite transactions between buyers and seller to enable agricultural producers to profit from habitat restoration. The Exchange is now working with equip eligible producers, flood, and water management agencies, and regulatory agencies to enable landowners to obtain and sell credits for the habitat they create.

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Mobilizing Access to Low-Cost Irrigation Scheduling Technology and Tools

USDA-NRCS Conservation Innovation Grant: #69-3A75-13-193

Authors: Casey Cox, Flint River Partnership

Abstract: The Flint River Basin in Georgia is one of the most ecologically rich river systems in the United States and the epicenter of Georgia's agricultural economy. The annual farm gate value for the Lower Flint River Basin alone is over \$2 billion. Many farmers depend on the natural resources of the region for production, especially water for irrigation. Water management and irrigation efficiency have tremendously improved over the last several years, but new technologies present the opportunity to further enhance wise use of the region's water resources. The Flint River Soil and Water Conservation District's (SWCD) USDA-NRCS Conservation Innovation Grant entitled "Mobilizing Access to Low-Cost Irrigation Scheduling Technology and Tools" is employing one of the most innovative methods of irrigation scheduling – soil moisture sensors – in concert with a specialized crop model to help farmers make more informed irrigation decisions at a lower cost. The purpose of the grant is to integrate real-time data from low-cost soil moisture sensors with automated irrigation recommendations derived from Irrigator Pro, a crop model developed by the USDA-ARS National Peanut Research Lab (NPRL). This integration will be achieved through the development of a smartphone application for both Android and iOS devices. The Flint River SWCD is working with the University of Georgia to develop and deploy the sensors in up to 50 fields throughout the Lower Flint River Basin. USDA-ARS NPRL manages Irrigator Pro, which has been converted from desktop software to a cloud-based platform. The next step, currently in progress, is the development of a smartphone application to read the sensors in the field, transmit the soil moisture data to the cloud, and populate the Irrigator Pro server, prompting an irrigation recommendation within a few minutes of data transmission. Achieving this connectivity will enhance both advanced irrigation scheduling and continued innovation through data management. Reducing the costs of sensors for irrigation will make the technology more widely adaptable and affordable for a broad spectrum of producers.

Poster Display

Water and Nutrient Conservation Technology for Best Management of Great River Buffer Zones in Arid and Humid Climates

USDA-NRCS Conservation Innovation Grant: #69-3A75-13-093

Authors: Alvin Smucker¹, Kurt Thelen¹, Charles Sanchez² and Brian Levene¹

¹Department of Plant, Soil and Microbial Sciences Michigan State University

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Abstract: The expanding competition for irrigation water demands more judicial use of agricultural water by current food and cellulosic biomass producers without contaminating freshwater resources. Also the need to bring more marginal soils into sustainable agricultural production encouraged us to design a new soil water retention technology (SWRT) that doubles the retention of soil water and nutrients in plant root zones. This new water, nutrient and energy conservation technology has been developed to protect groundwater and other fresh water sources from contamination by nearby production of food and cellulosic biomass cropping systems. Collaborative soil physics and engineering research at Michigan State and Arizona Universities, has modeled, developed and field tested the importance of strategically installing U-shaped polymer trough membranes to maximize the capture and retention of plant available water and nutrients. Rainfall and supplemental irrigation of sand soils equipped with subsurface water retention technology (SWRT) membranes maintain optimal volumetric soil water contents between 17.5% and 19.5% at 15 and 30 cm soil depths within the root zone. This new technology has a four-year average of 229% greater grain production than non-irrigated controls and 97% more maize biomass than irrigated controls. Strategically installed SWRT membranes combined with prescription irrigation/fertigation scheduling during 2014 and 2015, produced 20.4 and 20.5 Mt/ha (325 and 327 bu/a) of maize grain and 14.7 MT/ha stover on sand soil. Four years of incorporating these high maize stover biomass production rates added approximately 10 tons of C sequestered per acre for these sand soils. Therefore we believe sands located along shores of all rivers need to be equipped with SWRT water retainers, designed to double soil water and nutrient contents in plant root zones and rapidly drain following high river flow, can be used to stabilize sand buffer strips along rivers, preserving the quality groundwater and surface river water. Prolonged quantities of optimal soil moisture enhances cellulosic biomass production year around, reducing surface runoff into nearby fresh water resources.

Species Dynamics and Forage Productivity of Multi-Species Cool-season Annual Forage Crops Overseeded on Warm-Season Grass Pastures

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Abstract: Pasture ecosystems based on overseeding with a multi-species forage mixture was evaluated for its potential contribution to the conservation and sustainability of forage-based livestock production in the southeastern USA. The study was conducted on a commercial cattle ranch in Woodville, Mississippi. Predominant soils at the study site are Memphis silt loam with 5-8% slope (fine-silty, mixed, active, thermic Typic Hapludalfs) and Loring silt loam with 2 - 8% slope (fine-silty, mixed, active, thermic Oxyaquatic Fraguidalfs). Specific objectives were to assess sward dynamics of highly diverse cool-season mixtures of annual grasses, legumes, and crucifer species overseeded on warm-season perennial grass pastures in the south-central region. A secondary objective was to demonstrate the multiple-species overseeded pasture through presentation of results to local producers and those providing producer information. In October each year, diverse mixtures of annual grasses, clovers, and crucifer species were overseeded on warm-season grass pastures without inorganic fertilizer inputs. Through the 2014-2015 and 2015 -2016 winter-spring growing seasons, data were collected to determine plant population dynamics, forage mass, and nutritive value in herbage from the overseeded pasture. Even though patterns of dominance by different species were distinct across the landscape, these patterns were not consistent between years. Overseeded pastures had a season-average herbage mass of approximately 1500 lb/acre during late winter to spring. Herbage crude protein content ranged from 12.5 to 16.8%. The average phosphorus content was 0.24%, which indicates the P recovered through plant uptake was 3.5 lb/acre. Diverse multiple-species cool season annual crop overseeding has potential to enhance forage productivity and forage quality of less intensively managed warm-season grass-based southern pastures.

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Water Quality Benefits of Cover Crops on Corn/Soybean Watersheds in the Claypan Soils

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Abstract: Excessive surface runoff is a principal cause of soil erosion and nonpoint-source pollution (NPSP). Adoption of conservation practices are being promoted to improve soil and water quality on corn-soybean watersheds. The objective of the study was to quantify water quality benefits of cover crops on corn-soybean watersheds as compared to the control. Soils of the Chariton County Cover Crop Soil Health (CCSH) farm in Missouri were Armstrong loam (fine, smectitic, mesic Aquertic Hapludalfs, 5-9% slopes eroded), Grundy silt loam (fine, smectitic, mesic Aquertic Argiudolls, 2-5% slopes) and Bevier silty clay loam (fine, smectitic, mesic Aeric Vertic Epiaqualf, 2-5% slopes, eroded). Eight small watersheds were instrumented with water samplers flow meters, approach sections and flumes. Six treatment watersheds were managed with cover crops and no-till applications, with cover crop planting beginning in the fall of 2012. Two control watersheds received no cover crops with no-till management practices. Water samples were collected after each runoff event and analyzed for sediment, total nitrogen (TN) and total phosphorus (TP) concentrations. Cover crop establishment was poor due to drought conditions in 2012 and 2013. Watersheds generated runoff on subsequent years. The two control watersheds recorded four times greater sediment loads as compared to the cover crop watersheds. Most rain events caused sediment deposition on the flume beds of both watersheds. Nutrient losses were significantly greater on the two watersheds without cover crops. Results of the study indicated that cover crops significantly reduce the sediment and nutrient losses from corn-soybean watersheds during runoff events. Adoption of cover crops and successful establishment could help improve water quality and farm economics.

Soil Quality and Cover Crops on Corn-soybean Watersheds during Drought Years

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Abstract: Improved soil productivity will be vital to meet expected food and fiber demands of the growing population. The concept of soil health assessment focuses on specific soil properties and determining ability of soil to maintain a range of ecological functions in a defined ecosystem, supporting long term sustainability. The objective of the investigation was to determine the influence of cover crop, no-till, and rotational crop practices on soil health parameters, specifically biological indicators. Four watersheds within the Chariton County Cover Crop Soil Health (CCSH) farm on Armstrong loam (fine, smectitic, mesic Aquertic Hapludalfs, 5-9% slopes eroded) were used for the study. Two of the watersheds were managed with cover crop, rotational planting and no-till applications. Initial cover crop planting occurred during fall 2012. Two watersheds were designated as controls and received no cover crop management. It is important to note drought conditions persisted over the 2012 and 2013 growing seasons, with below normal rainfall. Variations between sampling events using selected soil health indicators helped evaluate changes in soil ecosystems over time and treatments. Analyses performed included soil enzymatic activity, soil microbial diversity, soil nutrient and physical properties. Select parameters displayed significance (p<0.10, 0.05, 0.01) among the factors of watershed, depth, landscape and year. Generally, the relationship between the collected parameters and soil profile depth displayed an expected correlation of decreased activity and nutrient levels with increasing depth. Landscape position showed mixed variation regarding the measured parameters, with shoulder, back and foot/toe slope positions displaying maximum values, which varied across the sampled watershed plots. Significant differences were observed across depth, landscape and watershed factors. Determining cover crop effects between watersheds proved challenging due to poor stand establishment and the short duration of the monitoring period. Findings from the investigation will help further development of soil health assessment practices and their associated biological, chemical and physical analyses.

Estimating the Costs and Returns for Cover Crops on a Missouri Corn and Soybean Rotation

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Abstract: Cover crops are being promoted as a method of improving soil conservation while at the same time, improving organic matter, soil moisture, and fertility. However, there are very few studies that show the economic costs and returns to planting cover crops over a period of time. Short run economic analysis focuses on just the additional costs of planting cover crops. Long run economic analysis not only considers the economic costs of planting cover crops, but also the impact those cover crops have on yields and soil characteristics. This study was conducted in Chariton County, Missouri at the Chariton County Soil Health Research and Demonstration Farm. Originally established in 2013, five mixes of cover crops were incorporated into a corn and soybean rotation and a corn, soybean, and wheat rotation. Planting costs, including the cost of equipment, fuel, chemicals, and labor, were collected over three establishment periods. Additionally, yields of the major commodity crops were recorded for each field and GIS data across the fields were used to identify variances in yields. A cost/benefit analysis comparing the costs of establishing the cover crops and the benefits of reduced fertilizer and higher yields was conducted. Costs of establishing the cover crops averaged about \$71.87 per acre in the first year. Substantial yield increases were recorded in 2014 for both soybeans and corn. Net economic returns attributed to cover crops in the first year ranged from \$15 per acre for soybeans to \$25 per acre for corn. Second year data indicated that this trend may be sustainable over a crop rotation. Results of the study indicate that adoption of cover crops will help improve yield potential of corn-soybean watersheds while providing other ecosystem services.

Utilizing Outreach and Grazing to Improve Conservation and Soil Health

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Abstract: The National Grazing Lands Coalition (NatGLC) was awarded a Conservation Innovation Grant with the USDA NRCS in 2014 to conduct outreach/education/demonstration opportunities on how prescribed grazing impacts pasture and range productivity, conservation and soil health. The cornerstone of this project is the use and on-farm demonstration of rainfall simulators to facilitate technology transfer to producer lead community based organizations of underserved, limited resource and socially disadvantaged groups on a nationwide scope. Hands-on workshops held by our project partners in Texas, Louisiana, South Dakota, South Carolina and New York accompany these demonstrations to enhance assimilation and adoption of grazing land management practices.

Our poster at the Soil and Water Conservation Society, presented by Chad Ellis, Chair of the NatGLC Steering Committee, will showcase these demonstrations with pictures and technical information for conference attendees. Dates and locations of future demonstrations will be listed.