70TH ANNUAL

SOIL AND WATER CONSERVATION SOCIETY CONFERENCE

COMING HOME TO CONSERVATION

PUTTING SCIENCE INTO PRACTICE

Abstract Book

PRESENTED BY THE

SOIL AND WATER CONSERVATION SOCIETY

JULY 28, 2015
SHERATON GREENSBORO AT FOUR SEASONS
GREENSBORO, NC

70TH ANNUAL
SOIL AND WATER CONSERVATION SOCIETY
CONFERENCE
COMING HOME TO CONSERVATION
PUTTING SCIENCE INTO PRACTICE

Symposia Abstracts

SOIL AND WATER CONSERVATION SOCIETY

Communicating the Hope in Healthy Soil: A behind the scenes look at an international award-winning campaign

Author(s): Ron Nichols*, USDA-NRCS; J. Arbuckle, Iowa State University

Overall Abstract: Background: How do you take a subject like soil health, make it accessible and create a campaign that your target audience can really "dig?" The answer: "The old fashioned way – with solid research, focused planning, creative execution and frequent evaluation – all created with in-house talent. Though the subject matter may seem dry to some audiences, improving the health of our soil may be the single most important environmental endeavor of our time. The campaign: A fully integrated marketing communications campaign titled "Unlock the Secrets in the Soil," leveraged by a wide range of communications tactics, was developed for the campaign. To reduce cost, most of the marketing and educational materials are made available via the campaign's web site as print-on-demand or electronic products. Using NRCS' network of stakeholder groups, conservation districts and its 3,000 offices nationwide and focusing on influential agricultural media outlets, and stakeholder groups, the campaign provided easy-to-read materials on the basics and benefits of soil health and farmer testimonials for the agriculture producer and landowner audience. Evaluation: Within just the first two years of the campaign, earned media placement and stakeholder ad buys promoting the campaign are estimated to be valued at more than $6 million. An estimated three-fold increase in soil health system adoption (to 10 million acres) has occurred since the campaign's inception. Thanks to the campaign's success (and the work of farmers who have implemented soil health management systems on these 10 million acres of cropland) the U.S. is annually saving, more than 9 million tons of top soil; sequestering 1 million pounds of carbon and reducing nitrogen loss to rivers and lakes by 150 million pounds.

Subject Area: Outreach, Education, and Community Engagement*; Social Sciences Informing Conservation ; Soil Health Resources, Indicators, Assessments, and Management

**denotes primary author and subject area*

Demonstrating and Disseminating the Best Practices and Technologies for Watershed Rehabilitation to Help Rural Farmers: A Case Study in Pakistan

Author(s): Matt Stellbauer, Foreign Agricultural Service ; Otto Gonzalez , Foreign Agricultural Service; Cheryl Simmons*, Natural Resources Conservation Service; jon fripp, Natural Resources Conservation Service

Overall Abstract: Agriculture is a key element in the socioeconomic development of most developing countries. Sustainable agricultural production can make significant contributions to stabilizing rural areas in counties struggling to feed their people and manage domestic conflict. Viable rural economies not only improve food security, they can enhance income levels and social well-being. Sustainable agriculture production relies on the adequate use, management, and conservation of soil and water. Improvements in soil and water management technologies have significant potential for improving production, the prosperity of farmers, and the quality of life in rural areas. This paper presents and discusses a four year project that is nearing completion. The overall goal of the project was to promote sustainable agricultural production, higher incomes and improved livelihoods of rural communities in irrigated and rain fed areas through better management of land and water resources. The focus is on low tech soil and water conservation practices and techniques that are applicable to the small farms and communities in rural Pakistan. The goal of this project is to demonstrate and disseminate practices and technologies that can help farmers in Pakistan to more efficiently capture, store, and use water for irrigation, and reduce loss of water and soil. This paper will illustrate how innovative approaches as well as multi-disciplinary cooperation and collaboration have been able to achieve improvements in the use of water and soil conservation technologies. Lessons learned as well as accomplishments will be discussed and presented. This paper will be of interest to professionals working the developing world.

Presentation 1: An Approach for Providing USDA Technical Expertise to Support US Foreign Policy Objectives – Otto Gonzalez, USDA-FAS

Abstract: The U.S. Government has stated its commitment to strengthen the United States' relationship with Pakistan and to advance their shared interest in a stable, secure, and prosperous Pakistan and region. A priority focal area for U.S. civilian assistance to Pakistan is economic growth, including agriculture. The United States Department of Agriculture (USDA), at the request of and with the support of the U.S. Department of State and the U.S. Agency for International Development is providing technical expertise in a 4-year project (2011 – 2015) to strengthen the capacity of Pakistani agricultural institutions to demonstrate and disseminate technologies and practices to rural farmers to improve watershed rehabilitation and irrigation efficiency. Coordinated by the USDA Foreign Agricultural Service (FAS), with technical expertise primarily from the USDA Natural Resources Conservation Service (NRCS), USDA has collaborated with an international partner, the International Center for Agricultural Research in the Dry Areas (ICARDA), and 10 Pakistani agricultural institutions to establish 46 demonstration sites, develop extension materials, and provide training or awareness to thousands of farmers and other agricultural professionals. The collaboration of USDA FAS and USDA NRCS in the design of the project, and subsequent collaboration with the international partner ICARDA in the implementation and guidance of on-the-ground activities, has enabled technical expertise from USDA to have a positive impact on the capacities of agricultural institutions in Pakistan and the rural farmers they serve.

Presentation 2: Demonstrating and Disseminating Agriculture Practices in Pakistan – Matt Stellbauer, USDA-FAS

Abstract: A good extension system can facilitate both the initial adoption and the spread of innovations if properly focused, providing for a continuous flow of information from existing sources both from research and from other actors in the system. In Pakistan institutional linkages are key in the facilitation of knowledge and innovation, though in many cases these linkages are weak or non-existent. In an effort

to strengthen these linkages The United States Department of Agriculture (USDA), at the request of and with the support of the U.S. Department of State and the U.S. Agency for International Development is providing technical expertise in a 4-year project (2011 – 2015) to strengthen the capacity of Pakistani agricultural institutions to demonstrate and disseminate technologies and practices to rural farmers to improve watershed rehabilitation and irrigation efficiency. By using technical expertise primarily from the USDA Natural Resources Conservation Service (NRCS), USDA has collaborated with an international partner, the International Center for Agricultural Research in the Dry Areas (ICARDA), and 10 Pakistani agricultural institutions to establish 46 demonstration sites, develop extension materials, and provide training on service provision as well the use of digital technology to deliver extension messaging to thousands of farmers. By helping to strengthen these institutional linkages, this project has shown how farmers are no longer passive receivers of information but active participants in the process.

Presentation 3: Collaborating with International and Local Organizations to Improve Soil Health and Soil Fertility – Thomas Reinsch, USDA-NRCS

Abstract: The United States Department of Agriculture (USDA), International Center for Agricultural Research in the Dry Areas (INCARDA), and Food and Agriculture Organization of the United Nations (FAO) are collaborating to improving soil health and fertility in Pakistan through demonstration and dissemination of best management practices for farmers The objectives are to identify and visually display current practices, demonstrate improved soil fertility and health methods to local farmers, develop and disseminate extension method, and facilitate public and private sector communicate a coordinated soil fertility and health message. The message uses the 4R's campaign of right rate, time, product, and place joined with best management practices to improve soil health. The desired outcome is that more producers learn and adopt new soil fertility and health technologies on more land.

Presentation 4: Consider Gender in Sustainable Agriculture Outreach – Cheryl Simmons, USDA-NRCS

Abstract: In many cultures, just telling people to include women doesn't work. Looking at the gender aspect in demonstrating and disseminating sustainable agricultural practices opens the door to implementing newer technologies and supports practitioners from all cultures to value work regardless gender. Working with Gender experts and led by the International Center for Agricultural Research in the Dry Areas (ICARDA), the USA component co-led a group working on better and more effective incorporation of women into activities that promote soil fertility and soil health. Topics include Sex and Gender; Equity and Equality, the 24 Hour Day, Gender Roles and Valuation of Labor and Gender Mainstreaming in research and applied sciences. The presentation will highlight the work in Pakistan and touch briefly on some current projects in the U.S.

Subject Area: Conservation in Nontraditional Agriculture*; Adaptive Management of Conservation Efforts; Conservation Models, Tools, and Technologies; Outreach, Education, and Community Engagement; Social Sciences Informing Conservation

**denotes primary author and subject are*

Detection, Monitoring, Prediction and Prevention of Harmful Algal Blooms (HABs)

Author(s): Tamara Newcomer Johnson*, Sea Grant; Sarah Bowman, NOAA

Overall Abstract: NOAA's National Sea Grant College Program (Sea Grant) is a federal-state partnership of 33 university-based programs in every coastal and Great Lakes state and US territory. Sea Grant programs support efforts to detect, understand, and reduce the occurrence of harmful algal blooms (HABs). HABs can cause taste and odor problems in drinking waters, pollute beaches with scums, reduce oxygen levels for fish and other animals, and cause processing problems for public water supplies. For example, during August 2014 over 400,000 residents in Toledo, Ohio were banned from using their water because a massive bloom in Lake Erie washed into their drinking water intake. HABs have been known to produce a wide array of neurotoxins, liver toxins, cell toxins and skin irritants. Though HABs are natural, their occurrence has increased since the mid-1990s. Malfunctioning septic systems, products with phosphates like dishwasher detergent, and runoff from urban and agricultural lands are thought to contribute to more frequent HABs. Sea Grant-funded research helps to forecast how factors like river runoff, nutrient loads, and molecular indicators influence HABs and toxin production. Sea Grant's education and extension efforts empower elected officials, beach managers, pet owners, the media, and the public to make informed, data-driven decision regarding managing HABs and protecting the health of coastal inhabitants. Additionally, several Sea Grant programs work with citizen scientists to monitor local waters for the presence of HABs. Continued efforts to improve detection, monitoring, prediction, and prevention of HABs is vital to coastal economies and communities.

Subject Area: Water Science in the Public Interest

**denotes primary author and subject area*

Documenting the Economic Benefits of Soil Health Management for Farmers

Author(s): Sarah Mine*, Datu Research

Overall Abstract: Soil health management provides wide-reaching economic and environmental benefits, but for adoption of practices like no-till, cover cropping, and crop rotations to increase, a fair share of these benefits must accrue to farmers. Currently, there is a lack of data on the economic returns of soil health management practices for producers. A number of collaborative efforts to fill this data gap—via demonstration farms, case study research, and data integration and analysis—are currently underway. This symposium session will bring together major players to assess the current state of prominent, nationwide efforts. The National Corn Growers' Soil Health Partnership is identifying, testing, and measuring management practices that improve soil health and benefit farmers' bottom lines over a five-year time series. The Soil Renaissance, an initiative of the Farm Foundation, NFP and the Samuel Roberts Noble Foundation, is evaluating measurement tools and working to quantify the effects of soil health on economic risks and returns. The National Association of Conservation Districts and global consulting firm Datu Research are exploring which soil health management practices work under various conditions, and what impact they have on producers' net revenues. To make efficient use of existing data, food and agricultural policy group AGree is engaging with the U.S. Department of Agriculture (USDA) in an effort to integrate and analyze existing data within USDA on conservation practices, yield, yield variability, soil health, and other key indicators. Leaders of these efforts will share preliminary findings and identify emerging gaps. What do early findings tell us about the economic benefits for farmers? What questions do we expect to have answered by the time these efforts are completed, and where will more work be needed? How can we best "divide and conquer" the remaining work to get high-quality information in farmers' hands as soon as possible?

Presentation 1: Nicholas Goeser, Soil Health Partnership

Abstract: Farmers across the United States have expressed an increasing interest in continued adoption of practices to implement as part of conservation cropping systems. However, questions remain regarding the links between soil health, productivity, environmental responses, and farm-level economic functioning.

The Soil Health Partnership, which is administered by the National Corn Growers Association (NCGA), with support from the Walton Family Foundation (WFF), Monsanto, and a USDA-NRCS Conservation Innovation Grant and technical advice from The Nature Conservancy (TNC), has set out to help catalyze enhanced agricultural sustainability and productivity by demonstrating and communicating the economic and environmental benefits of improved soil health. Initial demonstration and outreach farms throughout Iowa, Illinois, Indiana, Minnesota, Nebraska, Ohio, and Wisconsin have been established to initiate a network of proactive crop producers for the collection of economic data. Economic data on inputs for each demonstration field include chemicals, nutrients, seed, labor, equipment, and other input costs. The data collected in this project will be utilized in conjunction with collaborating projects to demonstrate the financial impacts of such integrated system approaches (motivated by a focus on soil health) on net revenue, net cost, yield variability, and other measures of economic risk. The impacts will be quantified through the development of enterprise budgets based on the results generated across the entire network.

Presentation 2: Sarah Mine, Datu Research

Abstract: Soil health management practices in agriculture show great potential for limiting soil loss, reducing run-off, enhancing biodiversity, and providing economic benefits to farmers and landowners through short-term reductions of costly inputs and long-term sustainability of the land. A body of research shows the benefits of practices such as strip/no-till, cover cropping, and crop rotation—to name a few examples—yet some of these practices can be successful under certain soil and climate conditions but not in others. More information is needed on what works, under what conditions.

Working under a FY2014 USDA-NRCS Conservation Innovation Grant, with support from the Walton Family Foundation, the National Association of Conservation Districts (NACD) and partner Datu Research, LLC (Datu) have made significant progress in implementing a project to raise awareness of best-management practices for soil health and increase their adoption by farmers and landowners. First-year achievements include collecting in-depth economic data from four case study farmers in Upper Mississippi River Basin states and coordinating nominations for a Soil Health Champions network to circulate information on the economic benefits of soil health practices that perform well under local conditions.

With input from NRCS economists, Datu and NACD have developed a strong case study methodology for demonstrating the economic impacts of soil health management practices. Academic experts and producers have been actively engaged in developing and refining Datu's approach, which pairs partial budget analysis with a strong narrative component.

Presentation 3: Neil Conklin, Soil Renaissance

Abstract: Surveys of farmers have repeatedly found that a major barrier to the adoption of conservation practices is the lack of credible, site-specific information about the economics of conservation practices. The Soil Renaissance is working to close this gap through efforts to improve the collection of data to support economic analysis and the development of economic decision tools for farmers and their advisors.

The lack of consistent farm- and field-level data linking farming practices and measures of soil health to costs and returns over multiple years is a significant barrier to economic research. The Soil Renaissance is working with other groups working on soil health to develop standard protocols for collecting these data. In addition to efforts at improving data, Soil Renaissance is inventorying and reviewing existing decision tools for producers, identifying areas for improvement and encouraging the development of new tools.

Presentation 4: Deborah Atwood, AGree

Abstract: AGree, a multi-year collaborative initiative launched in 2011, has convened hundreds of experts and senior leaders across the U.S. food system, supply chain, NGOs, and academia, to identify food system challenges and reach consensus on transformative private-sector and government policy change. As part of AGree's efforts to implement its Working Landscapes Initiative, a group of leading experts, economists, researchers, NGOs, former USDA leadership, and others, known as AGree's Conservation and Crop Insurance Task Force, has been exploring a range of strategies for driving broader adoption of conservation practices through the nexus of conservation and crop insurance. The Task Force is currently supporting the integration and analysis of existing federal datasets to improve the understanding of the impacts of conservation practices on soil health, yield, yield variability, and crop resilience during extreme weather events. AGree will use this analysis to ensure the risk reduction benefits of conservation practices are accurately reflected in the crop insurance program and advocate for

specific changes to the federal crop insurance program that support innovation and prevent it from impeding producers' ability or willingness to adopt conservation and soil enhancing practices. Findings from these data analysis efforts could also benefit private sector supply chain sustainability initiatives and markets for ecosystem services, as well as producers' on-farm decisions.

Subject Area: Conservation Economics and Policy *; Outreach, Education, and Community Engagement; Social Sciences Informing Conservation ; Soil Health Resources, Indicators, Assessments, and Management

**denotes primary author and subject area*

Economics of Soil Health Practices

Author(s): Lynn Knight*, USDA NRCS; Lauren Cartwright, NRCS; Bryon Kirwan, NRCS; Leah Duzy, ARS; Tara Wade, ERS

Overall Abstract: As conservation tillage, cover crops and other soil health related practices gain attention and focus, questions are moving from the agronomic to the economic. Understanding how producers are making decisions to adopt these practices can help target assistance that promotes future implementation. We propose to discuss three topic areas: Analysis of historic use of conservation tillage using ARMS data; Costs and Benefits of Adopting Viable Soil Health Conservation Systems in the Southeastern US; and a Cover Crop Economic Decision Support Tool. The ARMS conservation tillage study is the first to use data on tillage history as well as current tillage practices to distinguish farms that use no-till continuously from those that alternate no-till with other tillage practices. Revealed preference data is used in an ordered logit regression analysis to determine the effect of land characteristics, climate, farm characteristics, and producer demographics on producer choice among tillage regimes. Our primary objective is to develop a richer understanding of producer no-till adoption decisions. In the Southeast, conservation systems are a viable production option for producers to positively impact soil health. Current ARS research explores the costs and benefits of adopting a conservation system by producers in the Southeast. The Cover Crop Economic Decision Support Tool helps address some of the economic and financial questions that arise. It is an Excel based, partial budgeting tool that has been developed to assist landowners, producers, and planners make informed decisions regarding those questions. The tool highlights a producer's changes in operating costs and benefits over both the short term and long term; assessing both profitability and affordability.

Presentation 1: Modeling No-Tillage Adoption by Corn and Soybean Producers: Insights into Sustained Adoption: Tara Wade, Research, Postdoctoral Researcher, Department of Economics, North Carolina A&T State University; Roger Claassen (presenter), Agricultural Economist, Economic Research Service, USDA

Abstract: No-till acreage has increased in recent years but many farmers continue to alternate no-till with other tillage practices, effectively limiting both public and private benefits from sustained no-till adoption. Revealed preference data is used in an ordered logit regression analysis to determine the effect of soil characteristics, climate, farm characteristics, and producer demographics on producers' choices to use continuous tillage, alternating no-till systems with tillage systems, or continuously use no-till. The model provides insight into the characteristics and conditions that are conducive to each tillage regime. Attributes found to significantly affect continuous no-till adoption are erodibility, soil drainage, farm size, and climate.

Presentation 2: Economics of Conservation Systems Research in Southeastern United States: Leah M. Duzy, USDA-ARS (presenter); Kipling S. Balkcom, USDA-ARS; Ted S. Kornecki, USDA-ARS; Andrew J. Price, USDA-ARS

Abstract: The use of conservation systems in crop production is not a new concept in the southeastern United States. In 1978, researchers from across the Southeast met in Griffin, Georgia for the first annual Southern Conservation Agricultural Systems Conference. Four of the ten presentations specifically mentioned the use of winter annual crops as a mulch as part of a "no-till plus" system. Today this system is more commonly called a conservation system. At the 1988 conference, one of the invited presentations was on the economics of conservation tillage research in Texas. This presentation places emphasis on the importance of economics in evaluating conservation practices, particularly related to tillage. While

technology related to conservation systems has changed since the 1980's, the need for evaluating economics in conservation systems research has not changed. Current conservation systems research strives to investigate agronomic and economic benefits of conservation systems given current technology and environmental conditions. The objectives are to discuss the importance of economics in evaluating conservation systems, identify economic benefits and costs of conservation systems, and summarize current economics of conservation systems research from the Southeast.

Presentation 3: Cover Crop Economic Decision Support Tool: Lauren Cartwright (presenter), USDA-NRCS, Missouri; and Bryon Kirwan, USDA-NRCS, Illinois

Abstract: The Cover Crop Economic Decision Support Tool helps address some of the economic and financial questions that arise. It is an Excel based, partial budgeting tool that has been developed to assist landowners, producers, and planners make informed decisions regarding those questions. The tool highlights a producer's changes in operating costs and benefits over both the short term and long term; assessing both profitability and affordability.

The analysis is highly customizable to specific locales and utilizes user supplied values. The tool focuses on costs and benefits that accrue to the landowner/producer. It highlights the changes in operating costs and benefits over both the short term and long term; assessing both profitability and affordability. The tool comes with preloaded defaults to begin an analysis. These can be overwritten to meet the needs of the individual user. The tool is capable of storing up to 5 scenarios to look at 'what if' scenarios. In addition, analysis results are displayed both numerically and graphically; and hard copies can be printed out.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*; Conservation Economics and Policy ; Social Sciences Informing Conservation

**denotes primary author and subject area*

Engaging Farmers in Watershed Planning through Precision Conservation: Midwestern Case Studies Utilizing the Agricultural Conservation Planning Framework

Author(s): Mark Tomer*, USDA/ARS; Linda Prokopy, Purdue University

Overall Abstract: Watersheds have become a focus of our efforts to improve the environmental performance of agriculture, particularly at the smaller (HUC12) scale. A set of precision conservation planning tools has been developed to facilitate watershed planning at this scale through a participatory process involving landowners. The approach emphasizes the need to improve soil health across a watershed, and provides multiple options to place a variety of structural and vegetative practices to control, trap and treat water flows within and below fields in locations suited to each type of practice. The Agricultural Conservation Planning Framework (ACPF) comprises a set of ArcTools that can identify multiple options for site-specific placement of conservation practices throughout a watershed based on landscape (hydrologic) and soil criteria, which allows local farm producers the discretion to select preferred practices and locations. The ACPF tools have been applied in HUC12 watersheds in four states. This session will highlight case studies and report on the responses of farm producers to watershed-specific information and the flexible planning options that can be provided at the watershed scale using these precision conservation GIS tools. Representatives from six watershed and four states (Indiana, Minnesota, Iowa, and Illinois) will be included in the panel. The 90-minute session will be formatted to include an 8-10 minute presentation for each watershed followed by a facilitated 30-minute panel discussion.

Presentation 1: Watershed planning approach in two northern Indiana Watersheds - Jill Reinhart*, USDA/NRCS; Susi Stephan, Wabash County SWCD

Abstract: Indiana has piloted the Watershed Approach in two small watersheds in northeast Indiana: Matson Ditch, located in the St. Joseph watershed which drains to Lake Erie, and Beargrass Creek in the Middle Eel watershed, part of the Mississippi River Basin. Both pilot projects underwent an evaluation of land use, flow paths and best locations for conservation practices, a social indicators study, and extensive stakeholder meetings with farmers and conservation professionals. While funding shifted away from the Matson Ditch project before full implementation could take place, many lessons were learned from the planning process. In the Beargrass watershed, targeted funding through the Mississippi River Basin Initiative and the National Water Quality Initiative are allowing practice implementation based on the Watershed Approach. In addition, existing and ongoing water quality monitoring is in place in the Beargrass watershed to monitor change over time.

Presentation 2: Application of the ACPF to the Upper Silver Creek Watershed - John Sloan*, Great Rivers Research and Education Center; Janet Buchanan, Heartland Conservancy; Wayne Kinney, Midwest Streams

Abstract: Silver Creek watershed, in southwestern Illinois, drains into the lower Kaskaskia watershed, a tributary to the Mississippi River. Our project area, the Upper Silver Creek watershed, drains 120,000 acres through a 480-mile network of streams. Most of the project area lies in Madison County, with smaller portions in Macoupin and Montgomery counties. The Silver Creek watershed has been on the Illinois EPA's 303d list of impaired waters since 2004 due primarily to excessive sediments, total phosphorus, manganese, and low dissolved oxygen. The National Land Cover database indicated that 58% of the Upper Silver Creek watershed is covered by harvested row crops, consisting almost entirely of corn, soybeans and wheat. The 2013 Illinois Soil Conservation Transect Survey conducted by the Illinois Department of Agriculture reported that Madison County ranked in the lower quartile of counties using

conservation tillage practices and 10th out of 98 counties in the amount of ephemeral erosion. Work began in 2014 to develop a watershed management plan for the Upper Silver Creek Watershed. Heartland Conservancy is leading the process with additional support from Madison County Planning & Development Board and the National Great Rivers Research & Education Center. The Spreadsheet to Estimate Pollutant Loads (STEPL) predicted that increasing the use of conservation tillage practices could have a significant impact on reducing pollutant loads. The Agricultural Conservation Planning Framework (ACPF) is being used to develop a list of potential conservation practices. Future plans are to present potential conservation practices to landowners through a series of interactive stakeholder meetings.

Presentation 3: Watershed planning approach in Beaver Creek, Iowa - Adam Kiel, Iowa Soybean Association

Abstract: Stakeholders in the 11,000 acre Beaver Creek watershed requested support from the Iowa Soybean Association and Environmental Defense Fund to develop a watershed plan to reach the goals of the Iowa Nutrient Reduction Strategy and other water quality and quantity objectives. The resulting plan utilized the "Watershed Approach" in conjunction with assessment and planning tools employed by the Iowa Soybean Association. The Beaver Creek watershed plan lays out a 10-year timeline for reaching the NRS targets of reducing nitrogen and phosphorus losses by 45%. Recent work by watershed partners has implemented numerous practices, including two nitrate removal wetlands, cover crops, no-till and more. Implementation in 2015 will result in the construction of 6 additional wetland structures. Watershed modeling by the Iowa Soybean Association helped estimate the benefit of recently installed practices and estimate future reductions resulting from implementation of the watershed plan.

Presentation 4: Watershed planning approach in Dobbins Creek, MN - Joe Magner, University of Minnesota

Abstract: The Minnesota Board of Water and Soil Resources announced in 2014 that $5.7 million in Clean Water Fund grants would be available to help improve Minnesota's waters through its "Targeted Watershed Demonstration Program", a new funding approach for addressing water pollution. The program focuses on watersheds where the amount of change necessary to improve water quality is known, the actions needed to achieve results are identified, and those actions would be implemented within a four-year time period. The Cedar River Watershed District was awarded $1.5 million to implement the "Watershed Approach"; a methodology being encouraged by the Environmental Defense Fund in a small minor watershed. Dobbins Creek was the only stream project selected in Minnesota to receive targeted funding to address excessive nutrients, bacteria and sediment. A University of Minnesota team lead by Dr. Joe Magner will assist CRWD in the implementation of the Watershed Approach to select sites using ACPF, design BMPs, help oversee BMP implementation and conduct effectiveness monitoring to evaluate BMP performance and overall water quality response.

Presentation 5: Use of the ACPR in Subwatersheds of the Le Seuer River, MN – Jessica Nelson*, Minnesota State University; Rick Moore, Minnesota State University

Abstract: Historically, best management practices (BMPs) have been implemented opportunistically and voluntarily in agricultural watersheds of Minnesota. Research elucidates that traditional natural resource management is not reducing pollutant loading within these watersheds. The Le Sueur River watershed, an agricultural watershed of the Minnesota River Basin, has numerous impaired waters on the 303(d) list and is one of the largest contributors of sediment to the Upper Mississippi River Basin. In order to address these water quality concerns, the Agricultural Conservation Planning Framework is being applied to subwatersheds of the Le Sueur River, as prioritized by local and state agency priorities and under advisement from the citizen-led watershed group, Le Sueur River Watershed Network. The Network was

first introduced to the ACPF's significance using outputs for Bull Creek watershed, and were particularly interested with calculated locations for water and sediment control basins (WASCOBs) and grassed waterways. A tour of the subwatershed was coordinated with producers and natural resource managers to verify ACPF's BMP placement and inform landowners about targeting efforts. ACPF's process for conservation planning provides an opportunity to engage many landowners in a discussion at a watershed-scale, instead of traditional one-on-one field surveying and opportunistic program enrollment. By targeting conservation efforts in these subsheds, a balance of practices can be implemented that keeps soil in place, temporarily stores the water and addresses near channel sources, in order to achieve pollutant/stressor reduction goals identified in the Le Sueur River Watershed Restoration and Protection Strategy.

Presentation 6: From Field to Stream: Advancing Conservation Planning and Delivery in Minnesota's Root River - Kevin Kuehner, Minnesota Dept. of Agriculture

Abstract: The Root River watershed covers six counties in southeast Minnesota, and is dominated by row crop and livestock production. The region has numerous springs and some of the best trout streams in the Midwest. The watershed has a complex geology, with artificially drained glacial plains to the west, karst geology with shallow topsoil in the central portion, and bluffs near the Root River's confluence with the Mississippi River in the east. Given these complexities and >50 water quality stream impairments, we are collecting baseline land management and water quality data for sub-watershed scale conservation planning. The Root River Field to Stream Partnership (RRFSP) is supporting intensive water quality monitoring, long-term research and a cooperative approach to engage farmers and residents in the Root River watershed. The RRFSP consists of farmers, agricultural groups, conservation organizations and state agencies. In sub-watersheds representing the three unique geologic settings within the basin, sediment, nutrient and hydrologic data have been collected from each outlet and from edge-of-field runoff flumes since 2010. Monitoring results, coupled with LiDAR based terrain analysis planning tools and field walkover assessments are being used to inform the placement of new conservation practices. Walkovers by a planning technician have been completed on >70% of the study area acres. The most common conservation needs being found are for grassed waterways (both new and reconstruction), and fine-tuning nitrogen rates. Through outreach activities and one-on-one meetings the results are discussed with farmers and other stakeholders to promote advanced conservation planning and delivery.

Subject Area: Precision Conservation

**denotes primary author and subject area*

Engaging Non-operator Women Farmland Owners in Agricultural Conservation

Author(s): Jennifer Filipiak*, American Farmland Trust; Peggy Petrzelka, Utah State University; Jim Baird, American Farmland Trust; Jill Reinhart, NRCS-Indiana; Bridget Holcomb, Women Food and Agriculture Network; Ann Sorensen, American Farmland Trust; Brianne Lowe, NRCS-Indiana; Jean Eells, E Resources Group

Overall Abstract: Non-operating landowners (NOLs) control 30% of US agricultural land. Yet, information about NOLS is sparse, with the last national study on NOLs conducted in 1999 and more recent data collected by state agencies or researchers working in limited geographical areas. Less information exists about women NOLS, yet projections state up to 70% of U.S. farmland will change hands in the next 20 years, with women owning up to 75% of this transferred land. Surveys indicate that women tend to place a high priority on conservation and soil health because they view their land as a family and community asset that should be protected. However, they are underrepresented in conservation programs. USDA views women as an important, but underserved, target audience. In 2013, AFT and USU began a two-phase effort to survey women NOLs nationwide. In the first step of the research, we developed and tested a survey instrument in focus groups with female landowners in the 10 USDA production regions. In 2009, Women Food and Agriculture Network (WFAN) developed and tested a model to specifically engage women NOLS in conservation discussions throughout Iowa. The Women Caring for the LandSM conservation learning circle is based on an informal, peer-to-peer learning model shown to be effective through research in adult education. In 2012, WFAN began work with partners in 7 Midwestern states to expand the reach of the model and test its effectiveness in other geographies. In Maryland and Virginia, AFT is partnering with conservation districts, Departments of Agriculture, NRCS, Extension, Forestry, land trusts and watershed organizations to test a progressive version of the model. In this symposium we will explore the social science tenets that make this a successful model, discuss what we've learned about regional differences among women landowners, and dive deeper into the lessons learned by adapting the model for different topics, settings and regions.

Subject Area: Social Sciences Informing Conservation *; Outreach, Education, and Community Engagement; Soil Health Resources, Indicators, Assessments, and Management; Water Resources Assessment and Management

**denotes primary author and subject area*

Haiti Soil Survey and Natural Resources Conservation Initiative

Author(s): Thomas Reinsch, USDA-NRCS; Charles Kome, USDA-NRCS; Zamir Libohova*, USDA-NRCS-NSSC; Tony Rolfes, USDA-NRCS; Nathan Jones, USDA-NRCS; Manuel Matos, USDA-NRCS; Steve Monteith, USDA-NRCS; Pierre karly Jean Jeune, Haiti Ministry of Agriculture; Jean Pierre-Louis Oge, Haiti Ministry of Agriculture; Donald Joseph, Haiti Minstry of Agriculture

Overall Abstract: Following the 2010 earth quake in Haiti, President Obama directed US government agencies to contribute toward the recovery effort and a sustainable future for Haiti. Funded by the USAID, under the flagship Feed the Future initiative, the USDA-NRCS World Soil Resources in collaboration with the Haiti Ministry of Agriculture (MARNDR) the Haiti School of Agriculture and the NGO, WINNER completed a detailed soil survey (1:24000) for a 3000 ha pilot area in the Cul de Sac plain. The main goal of the symposium is to highlight some of the major achievements and challenges faced during the project. The impacts of the project on (i) capacity building for Haiti to expand the soil survey beyond the pilot area; and (ii) soil resources assessment at government and local levels will be discussed. The current status of soil resources from the soil survey perspective and possible future conservation practices to restore and sustain soil health and productivity will also be discussed including perspectives from Haitian specialists collaborating in the project.

Presentation 1: Impacts and Perspectives of Pilot Soil Survey of Cul de Sac on Haiti's efforts to restore soil health and productivity

Abstract: The Haiti Ministry of Agriculture (MARNDR), the Haiti School of Agriculture and the NGO, WINNER funded by the USAID and the USDA-NRCS World Soil Resources completed a detailed soil survey (1:24,000) for a 3000 ha pilot area in the Cul de Sac Valley. The pilot project presented an opportunity for the Haiti scientists and specialists at government, academic and farm levels to bring into focus the soil status of Haiti. The only Haiti soil inventory is a general soil map published at a scale of 1:250,000 which is not suitable for management planning at the farm level. Other sources for soil data such as fertility surveys are conducted mostly for fertility practices to support seasonal recommendations for the application of fertilizers. The detailed soil survey conducted for portions of Cul de Sac Valley revealed the presence of many different soils and in particular their status. The benefit of such survey is the ability to provide not only a detailed map of soil distribution but an assessment of the soil limitations and capabilities in the context of historical land uses. These are clear advantages never realized before by other surveys that were broad in scale like the general soil map or focused mostly on surface and short term assessment such as fertility surveys. Haitian scientists learned to describe soils, collect soil samples, conduct field and laboratory analyses, and use the data to prepare interpretative tables and maps for guiding farmers, policy makers and other land users. Soil resources are a vital part of Haiti's future and a national detailed soil survey is key in providing the much needed information for long term and sustainable management of natural resources.

Presentation 2: Opportunities and Challenges Promoting Soil Survey Technology Transfer in Haiti

Abstract: Following the 2010 earth quake in Haiti, President Obama directed US government agencies to contribute toward the recovery effort and a sustainable future for Haiti. Funded by the USAID, under the flagship Feed the Future initiative, the USDA-NRCS World Soil Resources in collaboration with the Haiti Ministry of Agriculture (MARNDR) the Haiti School of Agriculture and the NGO, WINNER completed a detailed soil survey (1:24000) for a 3000 ha pilot area in the Cul de Sac plain. The goal was to build capacity for Haiti to conduct soil survey and demonstrate practical applications of soil survey information

to guide agricultural production, conservation planning for sustainable use of natural resources for current and future generations. Approximately 20 Ministry Leaders were trained to support soil survey activities, 36 scientists had hands-on training in collecting field data, describing soils, and other related activities. In addition, 9 soil laboratory technicians as well as 10 database and GIS managers received training on conducting and supporting digital soil survey activities, developing and utilizing soil interpretations and disseminating soil information to farmers and policy makers. During the end of project conference held in Port-au-Prince from September 10-11, 2014, Haitians scientists demonstrated their newly acquired skills by presenting the project deliverables: a soil survey manuscript, interpretative maps, the SoilWeb, WebSoil Survey and RUSLE2 digital tools to USAID, NRCS and Haiti national Leaders. The Haitian government has announced plans to expand the project to an additional 17,000 hectares. The project which was completed on schedule and within budget serves as a proof of concept for a national soil survey program. An investment in soil survey has the potential to assist in protecting Haiti's most valuable resources: its soils, waters, biodiversity and people. Challenges and opportunities encountered during this project will be presented.

Presentation 3: Soil Erosion and Soil Quality Modeling for Sustainable Agricultural Systems in Haiti

Abstract: Soil erosion is a major problem in Haiti. Given the high cost of field measurements, models used to predict erosion are validated using limited field data. The 3000 ha USAID-funded pilot soil survey within the Cul-de-Sac valley provided NRCS and Haiti scientists the opportunity to use Haiti-specific soils, climate and crop management data to run the RUSLE2 model under various crop management scenarios. NRCS and Haitian specialists interviewed farmers and conducted field observations to collect needed RUSLE2 input data and information. Climate data from two weather stations, soil properties from the pilot soil survey area, crop management calendars, as well as available records and expert opinion were used to develop RUSLE2 attributes. Sheet and rill erosion and soil quality trends based on the Soil Conditioning Index (SCI) for the pilot area were then estimated. Multiple runs were conducted to train Haitian scientists and by comparing the effectiveness of alternative conservation practices on soil erosion and soil quality for the different soil types. Soil loss estimates ranged from less than 11 t ha^{-1} on the alluvial plains to over 300 t ha^{-1} with mostly negative SCI scores for cultivated fields on very steep slopes. Ministry Leaders discussed recommendations for integrated sustainable systems that address soil, water, air, plant, animal, human, and energy resource concerns for further evaluation in subsequent projects. Haitian scientists who had used spreadsheets or hand calculated soil loss using the USLE were impressed with the robust RUSLE2 tool and requested in-depth training to improve skills not only for water erosion prediction but for conservation planning. Skills learned during training and project activities contributed toward capacity building to meet Haiti's agenda for sustainable land use, soil and water conservation and agricultural productivity.

Presentation 4: Soils Geomorphology of Cul de Sac Valley, Haiti

Abstract: Soil is an important natural resource for many countries. In Haiti the only soil inventory is a general soils map published at a scale of 1:250,000. This is not suitable for management planning at the farm level. A soil survey for a 3000 ha segment of the Cul-de-Sac Valley in Haiti was conducted at a scale of 1:24,000 using traditional and digital soil mapping approaches. Terrain analysis derived from Light Detection And Ranging (LiDAR) high resolution elevation data was combined with condition Latin

Hypercube (cLHC) sampling scheme to determine site locations for establishing soil-landscape models, describing soils and collecting soil samples for chemical and physical characterization. Eleven soil types and map units were identified in the study area. Approximately 60% of the area is dominated by flood plains, while foothills, hills and dissected alluvial fans make up the remaining 40%. Dominant parent materials of marine sediments and limestone bedrock combined with the varied spatial-temporal precipitation patterns resulted in soil profiles dominated by CaCO3 and sodium accumulations. The soils and associated soil map units were aggregated to a general soil geomorphology map based on terrain and soil characteristics. The new soil geomorphology map derived from the detailed soil map was similar to the existing general soil map and geomorphology map. However, the new soil geomorphology map was spatially more accurate and provided a better understanding of soil development through the addition of two geomorphic units (Foothills and Lower Flat Plains). The Cul de Sac Valley resulted from a combination of uplifting due to tectonic movements and erosion/deposition processes. The study area covered only a small portion of the Cul de Sac Valley and further studies are needed for a complete and comprehensive understanding of the soil geomorphology process of this complex system.

Presentation 5: Water Management in sub-tropical climate in Haiti Cu De Sac from the soil perspective

Abstract: Soil is an important natural resource for many countries including Haiti. The only soil inventory is a general soil map at 1:250,000, which is not suitable for water management planning. A soil survey for a 3000 ha area of the Cul-de-Sac Valley in Haiti was conducted at 1:24,000. Approximately 70 % of the area is flat and dominated by moderate- to high-density agriculture. The remaining 30 % is composed of a mixture of limestone sedimentary rocks overlain by dissected calcareous alluvial deposits. The area is confined by the Grey River to the west and White River to the east, and brackish Lake Azuei and Lake Calman to the north. The mean annual temperature in the area is 26.2°C and the mean annual precipitation is 740 mm that falls in two rainy seasons April–June and October–November. The relatively dry climate conditions of the area lead to concentration of salts and accumulations of carbonates over time. The soil survey revealed salt-affected soils in the lower landscape positions that were affected by marine influenced groundwater, whereas carbonates were present in all landscapes and are inherited from the calcareous marine-origin parent material and secondary pedogenic carbonates. Many soils have carbonate contents in some horizons of 50 % of more. In many locations, carbonates are concentrated into indurated petrocalcic horizons due to wetting and drying cycles. The petrocalcic horizons adversely affect productivity and must be managed for. Carbonates are not as highly soluble as salts, and cannot be easily altered. Management requires using adapted crops and practices to improve physical characteristics and prudent water management including drip irrigation. As salt is more soluble than carbonate, management of saline soils through irrigation management might be more feasible, but saline locations in the area may be difficult to manage due to the presence of salty marine-influenced groundwater and upward capillary movement of salts due to evapotranspiration.

Presentation 6: Soil Health in Cul-de-Sac Valley, Haiti from Soil Survey Perspective

Abstract: In 2014 the USDA-NRCS completed a 3000 ha soil survey pilot project in Haiti's Cul-de-Sac Valley. It provided a glimpse of the natural resource and soil health concerns. Soil health degradation in Haiti has been ongoing for over 500 years due to colonial exploitation of natural resources and more recently accentuated with over ten million people in a small country leading to land exhaustion. Haitian farmers when asked about the major agricultural problems they faced described it as "Te a Faitige" "The

earth is tired". NRCS specialists had their boots on the ground and worked with the Haitian Ministry of Agriculture and USAID WINNER agronomists to see firsthand some of the soil health issues, challenges and opportunities. The team observed large agricultural fields that were conventionally tilled with little or no residue. Livestock browsed on the sparse remaining vegetation leaving bare ground. The soil surfaces were silt loam or silty clay loam with less than 3 percent organic carbon and high calcium carbonate contents. With no plant or residue cover soils are susceptible to moisture depletion and wind erosion during the drought periods and water erosion during the two distinct rainy seasons. Implementing simple practices such as plant residue and manure could mitigate some of these soil health problems. Land tenure consists chiefly of renting and sharecropping with short term agreements on agricultural plots 1 ha or less, which is not conducive to implementing long term soil health practices. Coupled with small scale family subsistence farming in a country where basic needs for food and water must be met, soil health is not a high priority. U.S. government agencies and NGO's are looking for ways to help the people of Haiti with food productivity and food security. On farm soil health demonstrations with a few innovative farmers in the Cul-de-Sac area could potentially have a great impact on shifting Haitian farmer's ideas on sustainable soil resources.

Presentation 7: Impacts and Perspectives of Pilot Soil Survey of Cul de Sac on Haiti's efforts to restore soil health and productivity

Abstract: The Haiti Ministry of Agriculture (MARNDR), the Haiti School of Agriculture and the NGO, WINNER funded by the USAID and the USDA-NRCS World Soil Resources completed a detailed soil survey (1:24,000) for a 3000 ha pilot area in the Cul de Sac Valley. The pilot project presented an opportunity for the Haiti scientists and specialists at government, academic and farm levels to bring into focus the soil status of Haiti. The only Haiti soil inventory is a general soil map published at a scale of 1:250,000 which is not suitable for management planning at the farm level. Other sources for soil data such as fertility surveys are conducted mostly for fertility practices to support seasonal recommendations for the application of fertilizers. The detailed soil survey conducted for portions of Cul de Sac Valley revealed the presence of many different soils and in particular their status. The benefit of such survey is the ability to provide not only a detailed map of soil distribution but an assessment of the soil limitations and capabilities in the context of historical land uses. These are clear advantages never realized before by other surveys that were broad in scale like the general soil map or focused mostly on surface and short term assessment such as fertility surveys. Haitian scientists learned to describe soils, collect soil samples, conduct field and laboratory analyses, and use the data to prepare interpretative tables and maps for guiding farmers, policy makers and other land users. Soil resources are a vital part of Haiti's future and a national detailed soil survey is key in providing the much needed information for long term and sustainable management of natural resources.

Subject Area: Conservation Models, Tools, and Technologies*; Soil Health Resources, Indicators, Assessments, and Management

**denotes primary author and subject area*

Hydrogel and Compost on the PhotoSynthetic Activity and Production of Maize (Zea mays L.) Grown for Forage

Author(s): Aurelio Pedroza-Sandoval*, Universidad Autónoma Chapingo

Overall Abstract: The increase in the incidence and intensity of drought caused by climate change is a critical factor in agricultural production in some regions of the world. Dry lands are often more severely affected by water shortages caused by low rainfall. This study evaluated the effect of compost and hydrogel used to retain soil moisture on photosynthetic activity and forage corn production. The experiment was designed as a randomized block with a split plot design; the main plots were the hydrogel application rates (0, 12.5 and 25 kg ha-1), and the subplots were the compost application rates (0 and 20 tons ha-1). Photosynthetic activity increased by 20.2-28.0% when the hydrogel was applied at rates of 12.5 and 25 kg ha-1, respectively, compared with the control. As a result, the production of fresh forage increased from 19.5 tons ha-1 in the control to 77.6 and 81.6 tons ha-1 when the hydrogel was applied at rates of 12.5 and 25 tons ha-1, respectively. A similar effect was observed for dry matter production. The compost had a weakly effect on photosynthetic activity. Keywords: Physiology, productivity, aridity, soil.

Subject Area: Ag Irrigation and Precision Technologies to Reduce Water Use

**denotes primary author and subject area*

International Year of Soils

Author(s): Lillian Woods*, USDA-NRCS

Overall Abstract: This symposium will celebrate the 2015 International Year of Soils through presentations highlighting the importance of soils and how soils impacts our everyday lives internationally. Examples of impacts will be featured through presentations on current international collaborative projects and activities.

Presentation 1: Overview of International Year of Soils – David Smith, USDA-NRCS

Abstract: This symposium will celebrate the 2015 International Year of Soils through presentations highlighting the importance of soils and how soils impact our everyday lives internationally.

Presentation 2: Global Soils Partnership – Jon Hempel, USDA-NRCS

Abstract: The Global Soil Partnership was developed in response to the renewed recognition of the central role of soil resources as a basis for food security, climate change adaptation and mitigation, sustaining biodiversity, and bioenergy production, along with provisioning of other key ecosystem services.

Presentation 3: Improving Soil Fertility and Soil Health in Pakistan through Demonstration and Dissemination of Best Management Practices for Farmers – Otto Gonzalez, Foreign Agricultural Service

Abstract: Examples of impacts will be featured through presentations on current international collaborative projects and activities. Participants will also learn about demonstrations and tests on research and extension plots in Pakistan of best management practices of maintaining or building soil organic matter and improving soil health to result in improved soil moisture conservation, soil fertility, and reduced dependence on chemical fertilizer.

Presentation 4: Latin America Soil Science Collaboration – Thomas Reinsch, USDA-NRCS

Abstract: USDA-NRCS has collaborated with the Latin America Soil Science Society through participation in workshops, conferences, and publications. Collaboration has resulted in sharing new technologies, data, information, and strengthened capacity. This collaboration has favorably impacted shared resource concerns along the common boundary of Mexico and the United States.

Presentation 5: International Soils Judging Contest: Changes to Soils Curriculum – Maxine Levin, USDA-NRCS

Abstract: A new generation of students are experiencing the International Soils Judging Contest activities. Opportunities of changes to the soils curriculum will be considered.

Subject Area: Outreach, Education, and Community Engagement*; Adaptive Management of Conservation Efforts; Conservation in Nontraditional Agriculture; Soil Health Resources, Indicators, Assessments, and Management

**denotes primary author and subject area*

Long-Term Agricultural Research: A means to Achieve Resilient Agricultural Production for the 21st Century and Beyond

Author(s): Jeffrey Strock*, University of Minnesota

Overall Abstract: This proposal is for the development of the 16th Annual SWCS-SSSA Joint Symposium which would be held at the 2015 SWCS and SSSA annual meetings. Resilient long-term agricultural production is a topic of great importance and interest to both societies. In 1989, a symposium on long-term field research was organized at the ASA-CSSA-SSSA meeting. It seems appropriate that a quarter century later another symposium be organized to look back at what has been done, what is being done and a look forward to new opportunities for long-term experiments. Contemporary scientific and societal concerns of climate change, extreme weather variability, environmental quality (air and water), biodiversity, ecosystem services and profitable, sustainable and resilient food feed, fiber and energy production systems make such a symposium timely. This symposium will explore how new technologies and innovative means of improving crop production systems are being used or should be used in long-term agricultural research to meet future food, feed, fiber and energy needs. This symposium will explore how systems science can provide sound solutions and multiple options for decision making by producers and those involved in agri-business and conservation professions. Invited presentations will include an overview of contemporary long-term agricultural research and visions of future long-term agricultural research. A series of presentations will synthesize long-term agricultural research on discipline specific topics including: soil fertility, soil water, tillage, cropping systems, weeds, diseases and insects. 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: The Oldest, Continuous Cotton Experiments in the World

Presenters: Charles Mitchell, Department of Crop, Soil and Environmental Sciences, Auburn University, Auburn, AL. Dennis P. Delaney, and Kipling S. Balkcom

Abstract: In the late 1800s, the Southern U.S. was producing most of the world's cotton on highly erodible soils with little or no lime or fertilizer inputs. Continuous cotton with no cover crops was taking a toll from the land and its farmers. Land Grant Universities and Experiment Stations were just getting started when Professor J.F. Duggar at Alabama Agricultural and Mechanical College (now Auburn University) established an experiment to test his theories that agriculture could thrive if only farmers would ". . . keep their fields green in winter." Thus began Alabama's "Old Rotation" experiment (circa 1896) followed by the nearby "Cullars Rotation" experiment (circa 1911) two of the oldest, continuous experiments in the world involving cotton. They were established because of a local need for information and maintained because of new and relevant data gleaned from the treatments. Administrative support has been critical. Getting them listed on the National Register of Historical Places and gleaning support from several agencies including USDA-ARS and state commodity groups have been paramount to their continuation. Keeping the experiments relevant by initiating conservation tillage, irrigation, and IPM and using data to support relevant topics such as "sustainable agriculture", "soil health", and "nutrient use efficiency" have been important in maintaining these historical projects.

Presentation 2: Long term Research on Nutrient Management of California Irrigated Cropping Systems : Russell Ranch Sustainable Agricultural Facility

Presenters: Kate Scow and Emma Torbert, Department of Land, Air, Water Resources, University of California, Davis.

Abstract: The Russell Ranch Sustainable Agriculture Facility (RR), a long-term experiment at UC Davis, was established in 1993 to measure the sustainability of different cropping systems, including properties such as crop yields and quality, carbon sequestration, and resource use efficiency,. The tomato-corn cropping systems at RR include irrigated conventional, organic (cover crop and compost) and a mixed (conventional with cover crop) tomato-corn rotations and, more recently, a 6 year alfalfa-corn-tomato rotation. The conventional corn-tomato system had significantly higher corn yields, but not significantly different tomato yields, as compared to the organic corn-tomato system. The mixed system tomatoes, however, have out-yielded the other systems in for the past 5 years. By ten years, the organic corn-tomato systems had increased soil carbon sequestration and soil microbial biomass as compared to the conventional and cover-cropped conventional systems, as well as potassium and phosphorus. Soil physical properties differ dramatically across the systems with substantially higher infiltration rates in both the organic and mixed than conventional systems. From 1994 to 2004, the concentration of flavonoids, plant secondary metabolites and anti-oxidant compounds potentially related to reduction of cardiovascular diseases and obesity, were significantly higher in organic as compared to the conventional tomatoes.

Presentation 3: Weed Management and Climate Change: Monitor, Measure, Manage

Presenter: Lewis H. Ziska, USDA-ARS, Crop Systems and Global Change, Beltsville, MD

Abstract: Rising concentrations of atmospheric carbon dioxide, C_a and subsequent changes in climate, including temperature and precipitation extremes, are very likely to alter weed pressures in both managed and unmanaged plant communities. Such changes in weed pressures can be positive (migration from a region), or negative (new introductions), but are likely to be accompanied by significant economic and environmental consequences. Recent studies indicate the range of invasive weeds like kudzu have already expanded to more northern regions as temperatures have risen. To reduce these consequences, a better understanding of the link between C_a /climate and pest biology is needed in the context of existing and new strategies for pest management. Here we provide an overview of the probable biological impacts, the vulnerabilities of existing weed management, (esp. chemical control) and provide a preliminary synthesis of research needs that could potentially improve our ability to monitor, mitigate and manage weed impacts.

Presentation 4: Nearly 20 years of Bt hybrids: what have we learned and where do we go from here?

Presenter: Michael E. Gray, Department of Crop Sciences, University of Illinois, Urbana, IL

Abstract: In 1996, a seismic event took place in the evolution of agriculture – transgenic corn hybrids were commercialized in the United States. These so-called "Bt" hybrids expressed a high dose of a crystalline (Cry1Ab) protein derived from a ubiquitous soilborne bacterium *Bacillus thuringiensis (Bt).*

The primary target for this new generation of hybrids was the European corn borer, O*strinia nubilalis* (Hübner). To prolong the usefulness of the technology, producers were required to implement a 20% structured refuge that was planted to a non-Bt hybrid. This high dose/refuge strategy has proven very effective – to date, the evolution of field resistance by European corn borers has not occurred. In 2003, Bt hybrids entered the marketplace that offered root protection against the western corn rootworm, *Diabrotica virgifera virgifera* LeConte. Unlike Bt hybrids used to control the European corn borer, these transgenic hybrids expressed the Cry3Bb1 protein at lower doses. Regardless of the differences in Cry protein expression levels (low dose vs. high dose), insect biology, mating behavior, and dispersal characteristics, the same structured refuge (20%) requirement was established for Bt hybrids aimed at both of these major insect pests of corn. Perhaps not surprisingly, 6 years following commercialization, western corn rootworm resistance to the Cry3Bb1 protein was confirmed (Gassmann et al. 2011 *PLoS ONE*) by conducting plant-based bioassays on the offspring of adults collected from severely damaged Bt cornfields (2009 and 2010) in northeastern Iowa. Looking ahead – transgenic hybrids will remain the foundation for insect management in the Corn Belt; however, the use of planting-time soil insecticides has escalated due to mounting concerns regarding corn rootworm resistance to Bt hybrids. Additionally, the widespread use of neonicotinoid insecticidal seed treatments (corn and soybeans) is receiving increased scrutiny due to environmental concerns. By the current decade's end, the use of transgenic hybrids that pyramid various Cry proteins with the RNAi technology will likely become more common place to achieve insect control. Even this approach will need to become part of an integrated pest management (IPM) program to endure.

Presentation 5: Long-Term Agricultural Research- Plant Diseases

Presenters: Timothy Paulitz, USDA-ARS; William Schillinger, Washington State University; David Huggins, USDA-ARS; Chuntao Yin, Washington State University; Dipak Sharma Poudyal, Oregon Department of Agriculture; Kurt Schroeder, University of Idaho; Scot Hulbert, Washington State University

Abstract: Plant disease epidemiology involves the study of pathogen movement over time and space. Foliar airborne pathogens such as rusts can spread in a large region over a short period of time within a season. These pathogens have short generation times and can be spread long distances by wind and rain. But soilborne pathogens that infect plant roots spread more slowly in the soil. Most are non-motile, and can only be spread by movement of soil or water. These may take many years to move within a field or between fields and long term studies are need to model or describe their spread. Spatial analysis studies were conducted at the Cook Agronomy Farm in Pullman WA to determine the distribution of soilborne pathogens and identify those factors that impact these organisms. This no-till farm of over 90 acres was initiated in 1998, and contains a wealth of georeferenced information on soil edaphic factors, N, C, environmental factors, pathogens, and weeds. Another area where long-term agriculture research has been indispensable is the study of suppressive soils. These are soils where the pathogen is present, the host is susceptible, but the disease is held in check by a microbial community that has developed to suppress the disease. Typically, the disease develops the first few years after a susceptible host is planted, then declines as the soil becomes suppressive. Suppression of take-all of wheat is the most well-studied example. The first example of suppression to Rhizoctonia bare patch of wheat in North America was discovered and described in a long-term cropping systems experiment near Ritzville, WA. With the advent of next-generation sequencing methods, it is now possible to describe in fine detail the microbial communities in the soil. Long-term sites with cropping practices such as no-till or long-term herbicide application of glyphosate, can be used to study the effects on bacterial and fungal communities in wheat soils. Shifts in these microbial communities may play a role in the dynamics of soilborne pathogens such as *Rhizoctonia*.

Presentation 6: Agronomic, Economic, and Environmental Performance Characteristics of Conventional and More Diverse Cropping Systems in the U.S. Corn Belt

Presenter: Matt Liebman, Department of Agronomy, Iowa State University, Ames, IA

Abstract: Conventional corn and soybean production in the U.S. Corn Belt typically occurs in short rotations or monocultures and relies heavily on the use of mineral fertilizers, herbicides, and fossil energy. To test the hypothesis that cropping system diversification allows large reductions in chemical inputs while maintaining or improving yields, profits, and environmental performance indicators, a 9-ha field experiment was conducted in Boone Co., IA, over a 12-year period by a multi-disciplinary team of investigators. Systems compared within the experiment included a conventional 2-yr corn (*Zea mays* L.)/soybean (*Glycine max* (L.) Merr.) rotation and two more diverse systems: a 3-yr corn/soybean/small grain + red clover (*Trifolium pratense* L.) rotation, and a 4-yr corn/soybean/small grain + alfalfa (*Medicago sativa* L.)/alfalfa rotation, both of which received cattle manure periodically. Mineral N fertilizer use was 81% and 87% lower in the 3-yr and 4-yr systems, respectively, than in the 2-yr system; similarly, herbicide use was reduced 88% and 91% in the 3-yr and 4-yr systems. Mean corn yield was 4% greater ($p<0.01$) and mean soybean yield was 11% greater ($p<0.0001$) in the more diverse systems compared with the conventional system. Weed biomass in corn and soybean crops was low ($\leq$20 kg ha^{-1}) in all systems. Incidence and severity of sudden death syndrome, a key disease affecting soybean in the Corn Belt, were both markedly lower ($p<0.0001$) in the longer rotations compared with the 2-yr rotation. Estimated soil erosion was 28% lower, fossil energy consumption was 59% lower, and freshwater toxicity associated with herbicide use was two orders of magnitude lower in the more diverse systems than in the conventional system. Net return to land and management did not differ among systems ($p=0.68$, mean=\$812 ha^{-1} yr^{-1}), though it tended to rise as rotation length increased. Results of this study indicate that diversification of conventional corn-soybean systems can lead to decreased dependence on chemical inputs and to less environmental damage, while maintaining profitability and improving productivity.

Presentation 7: Long Term Research- Soil Water Availability

Presenters: C. Gantzer, B. Svoma, S. Anderson, R. Udawatta, and R. Miles.Gantzer, Department of Soil, Environmental and Atmospheric Sciences, University of Missouri, Columbia, MO

Abstract: Soil water is often the most limiting factor for plant growth and yield, and is an excellent indicator of soil quality. This study reports how soil and crop management influences soil plant available water (PAW) by using results from surface Mexico series (Epiaqualf) samples collected in 2014, 125 years after treatment establishment. Samples were used to determine the soil water characteristic (SWC), soil organic matter, bulk density (BD), and texture from six long-term historical plots of Sanborn Field consisting of continuous corn, wheat, and timothy, with and without application of farmyard manure and continuously since 1888. Organic matter, BD, and texture data from historical samples from 1915, 1938, 1962, and 1988 will be used as input to a pedotransfer function to estimate the SWC for the historical samples. This information will show the influence of soil and crop management on PAW, and will allow estimation of soil physical quality using Dexter's S-Index. Data from soil and crop management influences on PAW, National Weather Service data from 28 long-term Missouri locations will be input into a Thornthwaite-Mather climatic water budget model to estimate Shaw's daily moisture stress index from daily evapotranspiration annually. These data will highlight how soil and crop management influences levels of PAW across Missouri that can impact moisture stress in corn.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*

**denotes primary author and subject area*

Long Term Water Conservation Technology that Doubles Production and Preserves Ground Water

Author(s): Alvin Smucker*, Michigan State University; Andrey Guber, Michigan State University; Zouheir Massri, Michigan State University; Kurt Thelen, Michigan State University

Overall Abstract: Agricultural irrigation water sources face declines and greater demands by competing municipal, industrial and commercial interests. Droughts, limited water supplies, soil erosion, shortages of agricultural lands for sustainable production of food and cellulosic biomass require the commercialization of a new long term soil technology that provides essential water and nutrient conservation within marginal soils. Recent developments in the new soil water retention technology (SWRT) incorporate multiple environmental safeguards designed to double plant available water contents in soil root zone with less irrigation. Greater quantities of uniformly distributed plant-available water and nutrients promote aboveground plant growth by reducing photoassimilate losses to dying plant roots subjected to spatial and temporal droughts. Strategically installed soil water retention membranes combined with prescription applications of supplemental irrigation enhanced grain and biomass production by removing plant drought. Three-year corn grain production on irrigated SWRT membrane-improved sand soils increased 3.39-fold (239%) over non-irrigated controls without membranes. Combining prescriptive irrigation and fertigation coupled with higher plant populations, yielded 325 bu/a in 2014. SWRT membranes substantially increased corn biomass and vegetable production. Soil-plant contributions to productions included doubling shoot to root ratios, retaining 3-fold more nutrients and improved plant water use efficiency. Total life cycle analyses of 27 production components associated with SWRT membrane installations and maize production demonstrate that returns on investment costs for membrane installation can be fully recovered in 2 to 4 years. The USDA estimates 162 million hectares of highly permeable USA soils can be converted into sustainable agricultural production landscapes.

Subject Area: Ag Irrigation and Precision Technologies to Reduce Water Use

**denotes primary author and subject area*

NOAA's National Sea Grant College Program - Engaging Diverse Audiences for Building Resilient Communities

Author(s): Tamara Newcomer Johnson*, Sea Grant; Sarah Bowman, NOAA

Overall Abstract: NOAA's National Sea Grant College Program (Sea Grant) is a federal-state partnership of 33 university-based programs in every coastal and Great Lakes state and US territory. Sea Grant programs support community adaptation research and outreach projects intended to help build resilience to natural hazards, including severe weather, increased shoreline erosion, sea level rise and Great Lakes water level changes and other impacts of a changing climate. Many coastal areas are in need of plans to mitigate these coastal hazards, which provides Sea Grant programs the opportunity to build relationships between key decision-makers, citizens, practitioners, and experts in the field. The incorporation of diverse audiences within a community strengthens the initial stages of a collective planning process and guides subsequent local and state response to our changing coasts. The speakers will share useful tactics for effectively engaging a diverse audience of community leaders, stakeholders, and citizens and highlight common pitfalls to avoid. This will be followed by a facilitated discussion which engaged the audience to explore additional best practices, challenges and perhaps solutions for effective community engagement on resilience and climate adaptation processes. Join Sea Grant specialists to examine ways to overcome obstacles encountered along the way to preparing communities for a changing future.

Presentation 1: Planning for Sea Level Rise in Georgia - Mark Risse and Jill Gambill, University of Georgia; Jason Evans, Stetson University

Abstract: Facing threats from rising seas, increased flooding and intensified storm surges, coastal governments throughout the United States are launching efforts to plan for the future. Georgia Sea Grant will share lessons learned working hand-in-hand with coastal communities, combining local knowledge with interdisciplinary research to identify vulnerabilities, weigh potential actions and facilitate decision-making.

Drawing from our award-winning project on Tybee Island, Georgia, a case study in the U.S. Climate Resiliency Toolkit, we will explore public engagement and climate communications strategies, as well as mechanisms, such as benefit-cost modeling and FEMA's Community Rating System, that can enable local action. Learn about how the successful pilot project on Tybee Island has sparked similar planning efforts in St. Marys, GA; Hyde County, NC; Monroe County, FL and the City of Islamorada, FL. We also will discuss future opportunities to expand public participation to better account for the social, cultural, economic and physical vulnerabilities of a changing climate.

Boundary organizations, such as Sea Grant, hold enormous potential in building bridges between academia, practitioners, coastal stakeholders and decision-makers. With expertise in extension, natural and social science research, education, communications, law and policy, Sea Grant specialists are "boots on the ground," tackling some of the first conversations in the country with local governments about sea level rise. Join us in exploring how planning can translate into real results to make communities safer and more resilient to coastal hazards.

Presentation 2: Implementing Comprehensive Community Flood Resilience Planning in Hyde County, NC - Jessica C. Whitehead, North Carolina Sea Grant; Jason Evans, Stetson University

Abstract: Given the seriousness of climate risks for the Southeast, demonstration and implementation of benefits from resilience planning for local communities is a priority for sustainable management of regional coastal resources. Facilitating and planning strategies focusing on identifying critical infrastructure vulnerabilities, flood risk prevention and mitigation, and future resilience of valued natural systems can productively overcome outward political divides about hazard vulnerability. In response, a project team is implementing innovative local resilience adaption planning processes to support Hyde County, NC. This team integrates local knowledge in Hyde County with North Carolina Sea Grant's (NCSG) expertise in the participatory Vulnerability Consequences Adaptation Planning Scenarios (VCAPS) process, as well as the expertise of Georgia Sea Grant (GaSG), Stetson University, and the University of Georgia's Carl Vinson Institute of Government (CVIOG) in developing GIS-based benefit/cost evaluations of resilience and climate adaptation planning. Specific policy adaptation options for local government consideration for flood resiliency will be developed in coordination with recommendations from the 2013 Community Rating Systems (CRS) guidebook. Initial VCAPS meetings were held in Hyde County, and follow-up iterative meetings for residents to review and revise the cost-benefit scenarios began in February 2015 with a participatory mapping exercise for Hyde County farmers. The team is analyzing the options identified by decision-makers in each community resilience using cost-benefit analysis to help quantify which options best reduce future flood vulnerabilities. Additionally, the linkage of local adaptation actions to the CRS credit system can translate into potential reductions in National Flood Insurance Program (NFIP) premiums for community residents, providing a tangible near-term economic benefit that will increase likelihood of project recommendations being adopted by the partner governments.

Presentation 3: Building Adaptive Capacity and Resilience through Local Conservation Collaboration -

Clara Rubin, University of Rhode Island; Pam Rubinoff, University of Rhode Island; Don Robadue, University of Rhode Island; Joanne Riccitelli, South Kingstown Land Trust; Clark Collins, South Kingstown Land Trust; Kevin Ruddock, The Nature Conservancy; Caitlin Chaffee, Rhode Island Coastal Resources Management Council; Pete August, University of Rhode Island; Christopher Damon, University of Rhode Island

Abstract: As the impacts of climate change increasingly affect coastal regions, measures must be taken to support adaptation and resilience to natural hazards that pose a threat to natural habitats and ecosystems as well as built infrastructure and human communities. Collaborative planning is a key component of developing adaptive capacity and is strengthened by the inclusion of a variety of participants. The South Kingstown Land Trust Pilot Project brought leaders of a local Land Trust together with technical experts, coastal managers, outreach professionals, and scientists. This diverse group created a new tool for conservation organizations to use in planning for habitat preservation incorporating climate change conditions. Land Trusts are uniquely placed within conservation networks and have the experience, capacity, and infrastructure necessary to implement climate change adaptation strategies on a local, regional, and national scale. The collaboration of this group of experts from several fields demonstrates the successful engagement of a variety of stakeholders in a project focused on improving natural habitat resilience and climate change adaptation. The combined experience, strengths, and specialized skills of the project's participants produced a valuable set of conservation tools and strategies that capitalized on the diversity of the team. Through the involvement of a diverse group of stakeholders and experts, the South Kingstown Land Trust Pilot Project serves as a successful collaborative model for conservation organizations and communities working to improve adaptive capacity and resiliency.

Subject Area: Water Science in the Public Interest

**denotes primary author and subject area*

Precision Irrigation Management Based on Crop Canopy Temperature

Author(s): Saleh Taghvaeian*, Oklahoma State University; Jason Warren, Oklahoma State University; Randy Taylor, Oklahoma State University

Overall Abstract: At a time when irrigation water resources are becoming increasingly scarce, the need for developing and implementing efficient irrigation technologies to reduce water use is greater than ever. The real water conservation will not be achieved if farmers are not provided with cost-effective and practical methods to optimize irrigation scheduling under field conditions. Most of advanced irrigation scheduling technologies are based on monitoring/modeling of either soil moisture or crop water use to determine the root zone soil moisture depletion. Another approach, however, takes advantage of the crop canopy temperature to quantify the water stress level and consequently the need to irrigation. This approach is based on the fact that crop transpiration is one of the major factors influencing the canopy temperature. However, since other factors such as atmospheric variable (mainly solar radiation, air temperature, and relative humidity) also affect the energy balance at the canopy, measured temperatures must be converted into stress indicators before they can be used for precision irrigation management. This presentation reviews the evolution of the temperature-based water stress indicators and provides more details on some of the most-widely used indicators. It then presents the results of two studies conducted in Oklahoma. Different stress indicator with the greatest potential to be implemented by farmers were used to monitor the water stress level in variably-irrigated corn and sorghum. The results suggest that stress indicators can be used effectively in precision irrigation management. In addition, the correlation between stress indicators and soil water content in the root zone was statistically significant. Temperature-based indicators have the potential to be adopted by farmers, especially if indicator thresholds are developed for different agro-climatological regions as a function of anticipated yield reduction.

Subject Area: Ag Irrigation and Precision Technologies to Reduce Water Use

**denotes primary author and subject area*

Sod-based Rotation-A Best Management Practice for Soil and Water Sustainability

Author(s): Sheeja George*, University of Florida; David Wright, University of Florida; James Marois, University of Florida

Overall Abstract: Sod-based rotation (SBR) is an economically and environmentally sustainable agricultural practice that has been demonstrated at experimental and commercial farms in the southeastern United States, consistently displaying increased crop yields with reduced irrigation demand, fertilizer and pesticide use, increased soil health, and reduced energy consumption. It is a practice incorporating at least 2 years of perennial grass followed by cash crops. Benefits of this system have been documented widely in a bahiagrass-bahiagrass-peanut-cotton rotation, with promising research on bahiagrass-bahiagrass-soybean-corn rotations and vegetable production following bahiagrass, indicating the potential range of its applicability. The theory behind SBR is that high biomass inputs of the perennial grass combined with minimal tillage and cover cropping increase organic matter in the soil, which has important consequences to soil and water management. Integrating cattle into SBR has demonstrated a model for improved economic returns and efficient use of nutrient and water resources. Our modeling studies indicate that a non-irrigated SBR system has significant advantage over irrigated conventional rotation systems by reducing irrigation costs while maintaining comparable or better yields. Economic models developed from research efforts to date have combined savings due to reduced water demand in addition to other production management savings. These models indicate that a 200-acre farm can increase its net profit from less than $50,000 per year under traditional row crop rotations to over $90,000 per year under SBR. This effort, now in its 15th year continues to be an outstanding example of increasing productivity using minimal resources, water savings being central to the system. The talks in this symposium will provide an in-depth overview of SBR, past and current research, and future direction focusing on strategies integrating Science and Policy for increased adoption.

Presentation 1: Effects of water savings due to implementation of a sod-based crop rotation system on reservoir elevations and river flows

Author: Steve Leitman-University of Florida

Abstract: The Apalachicola/Chattahoochee/Flint (ACF) river basin is a large watershed in the southeastern United States which drains into the Gulf of Mexico. Management of the basin has been the source of conflict and competition over use of the basin's water resources between the States of Alabama, Florida, and Georgia, and the federal government of the United States for several decades. This presentation examines the hypothesis that a reduction in consumptive losses to stream flow in the Flint basin through a large scale implementation of sod-based rotation can have a positive effect on Apalachicola River flows. An integrated reservoir/reach model of the ACF basin was used to examine the effects of several scenarios which have differing effects on stream flow in the lower Flint basin from various levels of sod-based rotation: 1) current irrigation withdrawals, 2) a 25% increase, 3) a 25% decrease, 4) a 50% decrease and 5) rain-fed farming (100% decrease in irrigation). The modeled effects of these changes in irrigation water usage were examined relative to 1) outflow from the reservoir just above the Florida border (Jim Woodruff Dam), 2) elevations at the three principal storage reservoirs in the watershed and 3) on several environmental performance metrics. It was found that the effects of implementing sod-based rotation on a large scale results in greater reduction in the drawdown of storage reservoirs and increased flow in the Apalachicola River. The distribution of what proportion of improvement is at the reservoirs and what proportion is in flows, however, is variable and related to the climatic conditions for a given year. In periods of extreme drought, most of the benefits from reduced

irrigation manifest at the storage reservoirs, and in periods of normal rainfall, most of the benefits manifest in increased streamflow.

Presentation 2: Soil health in a sod-based crop rotation system

Author: Sheeja George-University of Florida

Abstract: Knowledge of physical, chemical, biochemical, and microbiological status of the soil is key to understanding short and long-term effects of farming systems on soil-plant interactions. We compared soil microbiological and biochemical properties in a four year sod-based rotation (Bahiagrass-Bahiagrass-Peanut-Cotton) with a conventionally practiced 3 year rotation (Peanut-Cotton-Cotton). We also studied a system that integrated cattle into the four year rotation to understand the effects of grazing on soil properties that could be a driving factor for increased crop yields especially under water-limiting conditions. Microbial biomass carbon, total organic C and enzymes involved in C, P, N, and S cycling were compared in these systems. Microbial communities play a central role in all of these processes and are greatly influenced by both rotation and livestock. We used the automated ribosomal intergenic spacer analysis (ARISA) and Fatty Acid Methyl Ester (FAME) analysis to study bacterial and fungal community shifts as affected by the type of management practice. Soil microbial biomass and enzyme activities were more favorable in the sod-based crop rotations and these could be contributing toward the beneficial effects of this cropping system. Grazed sod-based systems also had greater activity of nutrient cycling enzymes and soil microbial biomass C as compared to non-grazed systems. Two consecutive years of Bahiagrass, and grazing, seemed to promote greater fungal populations as compared to systems without Bahiagrass or grazing. Overall, sod-based rotations promoted soil health through enhanced microbial activity and higher organic matter. Integrating cattle into sod-based rotations provided efficient nutrient cycling further making this system resource efficient and sustainable.

Subject Area: Conservation Models, Tools, and Technologies*; Outreach, Education, and Community Engagement; Soil Health Resources, Indicators, Assessments, and Management; Water Resources Assessment and Management

**denotes primary author and subject area*

Soil Health Demonstrations in Cropland and Pasture Land Use

Author(s): Kevin Ogles*, NRCS; Steve Woodruff, NRCS

Overall Abstract: What is Soil Health? Soil Health can be defined as the capacity of the soil to function. The soil is a vital living ecosystem that sustains plants, animals, and humans. Why the Concern about Soil Health ? Soil is the factory of our food. It is critical that we focus on ensuring the health and productivity of our soil. But still today soil erosion, water pollution in rural watersheds and nutrient depleted soils occur on millions of acres in the U.S. Focusing on improving soil health could lead to systemic, continental-scale improvements in water, air, wildlife – all while enhancing long-term agricultural productivity and would provide the best solution for our nation. In an effort to increase the production of our nation's pasturelands, the livestock industry has focused their efforts on the physical and chemical properties of soil through increased inorganic and mechanical inputs rather than the biological activity of soil. The biological activity of the soil is an indicator of the overall health of a soil and is a response to proper management rather than external inputs. Four Core Soil Health Principles There are core principles of soil health that apply not only to cropland but definitely to humid region pastures of the U.S. as well. These principles can also be used to restore health to cropland and degraded pasture soils with time. • Minimize Soil Disturbance • Keep the Soil Covered • Maximize Living Roots and Root Cycling • Increase Diversity What You Will See The effects of using these soil health principles, or the lack thereof, can be demonstrated by a rainfall simulation and the results of runoff and infiltration. The same soil types with different management systems and practices will be demonstrated so the audience can clearly see the results on both cropland and pasture land use. NOTE: This demonstration needs to be done outdoors. This can be done at the conference location.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*; Water Resources Assessment and Management

**denotes primary author and subject area*

Soil Health on the Ground: Opportunities and Challenges in Fostering Practice Adoption

Author(s): Rebecca Power*, Univ. of Wisconsin-Extension; Kevin Erb, University of Wisconsin-Extension; Nancy DeLong, DuPont Pioneer

Overall Abstract: The concept of soil health has become a popular way to frame agronomic and conservation practices that affect the soil's ability to provide for plants, animals, and people sustainably over time. The term soil health, because it does the ability of the soil to produce crops, manager on-farm risks due to extreme weather events, keep soil and nutrients in place, and therefore protect downstream resources, can help farmers, their advisors, and conservationists establish common goals. However, communicating about soil health and the practices necessary to promote it, is in a transformative phase, with new science and practices emerging daily. This symposium will feature four panelists experienced in soil health management and communication/education. An NRCS resource conservationist will describe NRCS's approach to soil health awareness; a university soil scientist will discuss the strengths and potential pitfalls of communicating about soil health and practices that promote soil health; Nancy DeLong, DuPont Pioneer, will talk about the value of soil health training as way for Pioneer to improve productivity and add value for their customers. DeLong and Kevin Erb, University of Wisconsin-Extension, will present the results of a blended (on-line and in-field) soil health pilot training program and lessons for training farm advisors.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

Syngenta Crop Protection's Watershed Monitoring and Stewardship Program

Author(s): Lula Ghebremichael, Syngenta; Clint Truman*, Syngenta

Overall Abstract: The Atrazine Ecological Monitoring Program (AEMP) focuses on soil and water resource assessment, atrazine fate and transport, nitrate-nitrogen and sediment transport, and stewardship within vulnerable watersheds in major corn and sorghum producing States. A goal of the AEMP is to protect invertebrates, fish and amphibians, and their habitat and food sources from the direct effects of sediment and runoff transported agrichemicals. Hydrology (rainfall, stream flow), land use (farming practices, agrichemical use), and selected water quality parameters associated with AEMP watersheds have been monitored for multiple years to assess if, and if so, then the magnitude and duration in which streams exceed interim water quality triggers. Field and watershed monitoring data also help guide stewardship programs through best management practice (BMP, cultural and structural practices) implementation. This symposium will have sections on 1) AEMP overview (2004-Present), which will briefly describe the history of the monitoring program, site selection process, study design, and highlight monitoring results from the last five years; 2) stewardship and education outreach and agricultural community engagement activities, which will include utilizing remotely sensed, fly-over data coupled with grower survey data to quantify structural and cultural BMP adoption; 3) modeling tools to accurately represent existing long-term watershed monitoring data; and 4) model output evaluation to address watershed-wide BMP implementation (adoption and effectiveness).

Presentation 1: Atrazine Ecological Monitoring Program (AEMP) - Sunmao Chen and Clint Truman, Syngenta

Abstract: This presentation will provide a brief overview of the Atrazine Ecological Monitoring Program (AEMP) including the site selection process, study design, sampling methods and highlights of monitoring results.

Presentation 2: Atrazine Ecological Monitoring Program (AEMP): Hydrology & Water Quality Data - Clint Truman and Sunmao Chen, Syngenta

Abstract: This presentation will provide a detailed description of the hydrology and water quality data associated with the Atrazine Ecological Monitoring Program (AEMP) including planting and application windows, rainfall, chemographs, stream flow, and selected ecological indicators.

Presentation 3: Atrazine Ecological Monitoring Program (AEMP): Stewardship Program - Mark White, Todd Barlow, Clint Truman, Sunmao Chen, Dan Campbell, Jerry Wells, Syngenta

Abstract: This presentation will provide a detailed description of the Stewardship program associated with the Atrazine Ecological Monitoring Program (AEMP) including identifying and implementing adoptable and effective best management practices to reduce atrazine residues exiting watershed outlets via surface water.

Presentation 4: Evaluating PRZM-Hybrid to Predict Hydrology, Atrazine Concentrations, & BMP effectiveness in AEMP Watersheds - Lula Ghebremichael, Clint Truman, Sunmao Chen, Jorge Guzman, Mark Cheplick, Rohith Gali, Mark White, Syngenta

Abstract: This presentation will provide a detailed description of the hydrology and water quality data associated with the Atrazine Ecological Monitoring Program (AEMP) including exploring model

prediction performances of best management practices (BMPs), and ranks BMPs, or combination of BMPs, based on their quantitative effectiveness specific to each selected watershed.

Subject Area: Water Science in the Public Interest

**denotes primary author and subject area*

University of Georgia Smart Sensor Array (UGA SSA) for Scheduling Irrigation

Author(s): George Vellidis*, University of Georgia; Mike Tucker, University of Georgia; Vasilis Liakos, University of Georgia; Camden Lowrance, University of Georgia; Xi Liang, University of Idaho

Overall Abstract: The University of Georgia Smart Sensor Array (UGA SSA) is a wireless soil moisture sensing system which allows for a high density of sensor nodes – a feature needed to account for soil variability and enable precision irrigation. The UGA SSA was designed specifically to integrate with variable rate irrigation capable center pivots. It was developed by the UGA Precision Ag Team under the leadership of Dr. George Vellidis and licensed to FirstWater Ag during 2014. It became commercially available on a limited scale during 2015. This presentation will describe the UGA SSA which includes a dedicated user interface from which users can view their data in multiple formats from any internet-capable device, an integrated irrigation scheduling decision support system, and the ability to wirelessly download daily prescription maps to VRI-enabled center pivot irrigation systems. This paper will also present data on soil moisture variability in Georgia fields as measured by the UGA SSA during the 2014 growing season.

Subject Area: Ag Irrigation and Precision Technologies to Reduce Water Use

**denotes primary author and subject area*

70TH ANNUAL
SOIL AND WATER CONSERVATION SOCIETY
CONFERENCE
COMING HOME TO CONSERVATION
PUTTING SCIENCE INTO PRACTICE

Oral Presentation Abstracts

SOIL AND WATER CONSERVATION SOCIETY

Implementation of a Progressive Manure Application Risk Management (ARM) System to Reduce Agricultural Runoff and Leaching Events

Author(s): Nichole Embertson*, Whatcom Conservation Distirict; Chris Clark, Whatcom Conservation District; Steve Cox, US Geological Survey

Abstract: Impacted and poorly managed agriculture has been advanced as a leading contributor to surface and ground water pollution. Improvements in manure application methods and tools are necessary to further protect resources. This study developed an innovative Application Risk Management (ARM) System targeting the transport of manure pathogens and nutrients (N, P) via runoff and leaching by using validated real-time assessment tools. The study was conducted on dairy forage fields from 2010-15 in Whatcom County, WA. A vigorous sampling campaign was conducted on 6 plots comparing conventional manure application strategies to strategic application using a real-time ARM system developed by this project. Soil water was sampled at storm events using 6 gravitational lysimeters placed at 12, 24 and 36 in below the soil surface at random locations within each plot. Co-located groundwater monitoring wells were sampled monthly at water table and background. Soil samples were taken 1-2 times monthly at same depths and locations. In addition, surface water was sampled in-stream at storm events; manure was sampled at each application; forage was sampled at each cutting; and meteorological and management parameters were collected daily. Data was used to create and proof a web-based, easy to use worksheet that farmers use to evaluate manure application runoff risk on a specific field and day using real-time forecast, soil and field parameters. A Manure Spreading Advisory (MSA) was developed to provide a three day risk rating map for runoff based on precipitation forecast. Support tools included a website, dynamic manure application setback distances, and field level risk mapping. Results indicated that strategic manure application using ARM can reduce nitrate leaching by 30% in fall and 15% annually; pathogen runoff by 58%; and increase forage yield by 44%. The ARM system provided flexibility and accountability to farmers for maximizing crop production and protecting water quality.

Subject Area: Adaptive Management of Conservation Efforts*; Conservation Models, Tools, and Technologies

**denotes primary author and subject area*

Western Arkansas Woodland Restoration Project (WAWRP)

Author(s): John Kluthe*, USDA-NRCS

Abstract: During the 2014 SWCS conference a common call from the participants was that conservation dollars be tied more closely to specific outcomes rather than a shotgun smattering of dollars spent for generally "good" conservation practices. The Western Arkansas Woodland Restoration Program (WAWRP) targets conservation dollars to specific resource concerns in a specific area. The purpose of WAWRP is to promote the voluntary installation of forestland conservation practices to help restore, maintain, and enhance more open woodland structure to improve wildlife habitat and forest health. This presentation will cover the resource concerns treated by the program, the dollars spent, and the conservation practices that have been awarded in the FY2014 funding allocation. Results of acres treated will be compared to the dollars spent. These outcomes will show specifically how the conservation dollar is being used to improve specific resource concerns. This presentation will begin to answer the call of SWCS members that conservation dollars be spent for specific results.

Subject Area: Conservation Economics and Policy *; Adaptive Management of Conservation Efforts

**denotes primary author and subject area*

Strategic and Prioritized Implementation of Conservation and Compliance For Improved Water Quality and Aquatic Life Habitat

Author(s): Kevin Fenn*, Oregon Department of Agricultu

Abstract: Oregon's Agricultural Water Quality Management Program (Program) was established in 1993. This Program is a unique partnership between the Department of Agriculture (Department), Soil and Water Conservation Districts (SWCDs), and agricultural producers. The first regulations were established in 1997. Compliance activities have primarily been initiated in response to public complaint or notification from partner agencies. In 2009, Department staff began initiating investigations based on observation. To proactively address water quality issues and ensure compliance, the Department initiated a Strategic Implementation Initiative in 2013. Initially, this involves working in two small watersheds (12 digit hydrologic unit code (HUC)) to complete: 1) pre-evaluation to identify water quality concerns using publicly available remote information and field survey; 2) outreach to all landowners with an opportunity for voluntary improvements to address water quality concerns; 3) compliance site visits with landowners that have not addressed concerns. If violations are documented, landowners are required to take corrective action; and 4) post-evaluation of compliance with regulations. Compliance is achieved through ensuring that agricultural activities do not place pollutants where they may be carried to surface or ground water, and site-capable streamside vegetation is able to establish and grow in order to provide water quality functions (e.g., shade, filtration, and streambank stability). There are 3,116 12 digit HUCs in the state of Oregon and approximately 2,300 with agricultural use. To continue the Strategic Implementation Initiative, the Department has developed a tool to score and prioritize all 12 digit HUCs (statewide) for water quality and aquatic habitat for future implementation. The presentation will give an overview of the Program, the Strategic Implementation Initiative, and 12 digit HUC prioritization process.

Subject Area: Water Resources Assessment and Management*; Conservation Models, Tools, and Technologies; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

Treating Subsurface Drainage Discharges with Denitrifying Bioreactors

Author(s): Larry Geohring*, Cornell University; Will Pluer, Cornell University; Bahareh Hasanpoor, Cornell University; Michael Walter, Cornell University; Tammo Steenhuis, Cornell University

Abstract: Subsurface drainage discharges from three farms in upstate New York are being diverted and treated with denitrifying bioreactors. Two farms are dairy farms in the High Allegheny Plateau Ecoregion, the headwaters region to the Upper Susquehanna River and Chesapeake Bay; and the third farm is a vegetable farm in the Finger Lakes area within the Great Lakes Ecoregion and watershed. As part of a NRCS-CIG grant to determine if both nitrate-nitrogen and phosphorus could be reduced, six bioreactors were installed in pairs at each farm whereby one contains only hardwood woodchips and the other contains a mix of woodchips and BioChar. This presentation will discuss the design and construction details of these bioreactors as well as what has been learned from the monitoring and performance results to date. Incoming nitrate concentrations are being reduced by 45 to 60 percent, which translates to 50 pounds less nitrogen discharged to the stream for one of the sites between July and November, 2014. An additional aspect of this project is evaluating the completeness of the denitrification reactions and the gases produced by the bioreactors. The project findings are being used to develop a Conservation Practice Standard for Bioreactors in New York.

Subject Area: Water Resources Assessment and Management*

**denotes primary author and subject area*

Water management in Saudi Arabia using deficit irrigation Strategy

Author(s): Abdulrasoul Alomran*, King saud university

Abstract: Saudi Arabia is impoverished by water resources and irrigation water management is considered as the most important point to investigate. There is an urgent need for methods and practices that reduce the excessive amount of water applied in irrigation without decline in productivity. The main aim of this study is to investigate the impact of deficit irrigation (DI)on cucumber crop yield (Cucumbis sativus L.) planted on open field. The irrigation treatments were four level of ETc (40, 60, 80, and 100%), and the treatments were replicated three times. The data showed that the cucumber could tolerate shortage of water during the middle season growth stage. The crop response factor (Ky) values of the cucumber ranged between 0.96 and 1.02. This means that cucumber grown in open field under Saudi Arabia arid conditions, cannot be tolerate severe water stress. However, the crop water productivity (CWP) values increased when water amount decreased. Finally, the results confirmed that the highest values of CWP were found in most stressed treatment,40% ETc; however, the overall productivity decreased.

Subject Area: Adaptive Management of Conservation Efforts*; Conservation in Nontraditional Agriculture

**denotes primary author and subject area*

1890s Land Grant Universities Water Center: Its Activities Past and Present

Author(s): Asmare Atalay*, Virginia State University

Abstract: The 1890s Land Grant Universities Water Center was established in 2010 through a grant funded by the USDA/NIFA under its Capacity Building Grant (CBG) Program. The Center is housed at Virginia State University and administered by a Center Director. The Center supports water-related proposals from any 1890 university. The Director evaluates all proposals and funds those that meet the primary objectives and goals of the Center. A sub-contract is drawn between VSU and each applying University for transfer of funds. Since inception, nine universities have been awarded mini-grants totaling $400,000. Through the Center a variety of research, teaching and extension proposals have been funded that trains students, assist rural communities, and produce both refereed and non-refereed publications.

Subject Area: Water Resources Assessment and Management*; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

The Role of Unmanned Aircraft Systems In Natural Resource Management

Author(s): Michael Hutt*, Cherokee Nation Technologies; Owen Unangst, Cherokee Nation Technologies

Abstract: Unmanned Aircraft Systems (UAS) are emerging as a cost effective, efficient capability to monitor environmental conditions, analyze the impacts of climate change, respond to natural hazards, understand landscape change rates and consequences, conduct wildlife inventories and support related land management missions. Precision agriculture is also an emerging potential for UAS. The pace of UAS development is progressing at an exponential rate as scientists and resource managers turn to UAS to perform their old jobs more cheaply and do new jobs that hadn't been previously conceived of. This is partially attributed to the acceptance of the "digital native" generation of scientists and resource managers of information technology. Tully (2013) has called it the rise of "personal remote sensing" where more and more people will have access to the technology, while others have heralded its ability to let the science questions drive the remote sensing data acquisitions as opposed to the data driving the science. UASs come in an array of shapes, sizes, and configurations and support a variety of sensor packages. UAS provide scientists an ability to look longer, closer and more frequently at areas that were too dangerous or expensive to monitor in the past. UAS can provide data in real-time and permit timely, cost effective data acquisition, which results in better science, safer acquisition of data and at a savings over conventional remote sensing techniques. UAS technology enhances our ability to provide unbiased scientific information to help stakeholders make in¬formed decisions. They provide us with a record that can be archived and used when monitoring events or conditions. Similar to the use of the Internet, Geographic Information Systems and Global Positioning Systems, UAS are enabling us to be better stewards of the land. The tangible benefits of UAS operations can be summed up in three words: Science, Safety, and Savings.

Subject Area: Conservation Models, Tools, and Technologies*; Conservation Economics and Policy ; Conservation in Nontraditional Agriculture; Soil Health Resources, Indicators, Assessments, and Management; Water Resources Assessment and Management

**denotes primary author and subject area*

Conservation Practices used in the Tropical Climates of the Pacific Basin

Author(s): Bernadette Luncsford*, NRCS

Abstract: Tropical landowners deal with large rainfall amounts, steep slopes, intensively farmed soils, and a fair amount of animal waste. These factors combined have the potential to devastate water quality, and in many areas it has. Water quality is a global resource concern, but the Pacific islands each have a limited supply of freshwater for use. Additionally they have the responsibility of the direct effects their water quality has on Coral Reefs. Specialized conservation practices have been developed to address the unique challenges faced by those working the land on tropical islands. Conservation practices used in the tropics may become valuable to conservationists in temperate areas as the climate changes. This presentation will share suites of practices used to mitigate water quality impacts from various land uses in the Pacific Islands Area.

Subject Area: Conservation in Nontraditional Agriculture*

**denotes primary author and subject area*

Using the Vetiver Grass Technology (VGT) to protect shorelines from siltation and other potential pollutants

Author(s): Mohammad GOLABI*, University of Guam

Abstract: The paradise island of Guam relies heavily upon its beautiful beaches and clean waters as well as its colorful corals to draw tourists to its shores. However, the well being of Guam's shorelines specially the corals are being threatened by upland sedimentation caused by unprotected construction sites near the shorelines. The need to find low-cost and innovative methods for protecting Guam's beaches and the shorelines specially the coral from upland sedimentation is an important economic as well as environmental undertaking for the island's well being and its sustainability as a tourist destination. In this regard, protecting the beaches and controlling sedimentation and reducing pollution from upland storm water run-off are a priority consideration for environmental as well as economical sustainability for Guam and the other neighboring islands of Micronesia. Vetiver Grass Technology (VGT) is proven to be an effective measure for controlling erosion and holding back the sediments in storm water run-off, thus improving water quality of the rivers and the ocean hence protecting the beautiful coral from rapid degradation due to siltation. In this demonstrated case study Vetiver grass was tested for its effectiveness as a mitigation technique for sedimentation while being able to stand shoreline salinity as well as other harsh environmental factors including constant punishment from the wave actions of the nearby ocean. The results from this demonstrated research clearly showed that, natural and low-cost VGT was able to effectively protect the shoreline from siltation by trapping sediment before entering the ocean at Pago Bay construction site in southern Guam. In this paper all the measured parameters including the methodology for mass producing and planting of Vetiver grass in the aforementioned environment will be presented and discussed. Key words: Guam, Shorelines siltation, Coral Reef, Vetiver grass, Island sustainability.

Subject Area: Water Resources Assessment and Management*; Adaptive Management of Conservation Efforts

**denotes primary author and subject area*

Cultural Capital and Nutrient Reduction

Author(s): Cornelia Flora*, Kansas State University; Adam Wilke, Iowa State University

Abstract: Cultural capital determines how we see the world, how the seen is related to the unseen, what we value, and what we think possible to change. Culture capital is a community level variable as well as an individual one. The dominant cultural capital in the Mississippi-Atchafalaya River Basin defines private property as one of the two important rights (carrying fire arms being the other) and that nutrient run off is unfortunate, but an inevitable part of the modern agriculture that feeds the world. While this cultural capital is contested, it is deeply ingrained and cultivated by a variety of institutions that have the power to reinforce individual cultural capital and impact public policy. The continuing and emergent symbols that reinforce that cultural capital and the institutions that present an alternative cultural capital are analyzed as to their response to and impact on nutrient management strategies.

Subject Area: Social Sciences Informing Conservation *

**denotes primary author and subject area*

National 303(d) Vision – A State Perspective

Author(s): Jeff Berckes*, Iowa DNR

Abstract: In August, 2011, the Environmental Protection Agency (EPA) and State program managers began the process of developing a new long-term vision for the Clean Water Act Section 303(d) Program, which includes the Total Maximum Daily Load (TMDL) Program. During the first decade of the TMDL Program, most TMDL documents across the country were developed as a response to some kind of Consent Decree – a legal requirement to complete TMDLs for most or all waters listed on the Impaired Waters List. When a state's Consent Decree is officially closed out, the State has the ability to shift to a new priority for developing TMDL documents. Thus, an opportunity was born for Clean Water Administrators and the EPA to refocus the program. The next iteration of the Section 303(d) programs look to combine successful elements learned throughout the past 15 years throughout the country while responding to new pressures. The Long-Term Vision does not stand as a static document as priorities, funding, personnel, etc. all play a role in how the programs most efficiently and effectively deliver a product that is both defensible and useful to help aid in improving water quality. The Long-Term Vision identifies six pillars. Four of these pillars are "load bearing" in that they will play a lead role in all TMDL programs throughout the country: Prioritization, Assessment, Engagement, and Integration. The other two pillars, Protection and Alternatives, allow for creative approaches when a standard TMDL may not be the optimal choice. The ability to develop state specific priorities, engaging appropriate local stakeholders, integrating our work with other program priorities, and employing our creativity in addressing issues better and smarter as they present themselves truly gives rise to a tailored approach. This presentation will focus on how the new 303(d) Vision could benefit nonpoint pollution and nutrient management issues from the State of Iowa TMDL program manager.

Subject Area: Water Resources Assessment and Management*; Conservation Economics and Policy

**denotes primary author and subject area*

An assessment of the regional effects of agricultural conservation practices on nutrient transport in the Upper Mississippi River Basin

Author(s): Ana Maria Garcia*, USGS

Abstract: The Conservation Effects Assessment Program (CEAP), initiated by the USDA Natural Resources Conservation Service (NRCS), has the goal of quantifying the environmental benefits of agricultural conservation practices. USGS and USDA scientists have conducted a semi-empirical assessment of a suite of practices using the SPAtially Referenced Regression On Watershed attributes (SPARROW) modeling framework and NRCS-CEAP conservation effects data. A measure of conservation adoption intensity was developed to function as an explanatory variable in a SPARROW model of the Upper Midwest. The results showed that the suite of mostly structural (soil management) conservation practices, catalogued by CEAP surveys and model interpretations, are statistically associated with reduced levels of total nitrogen delivery to streams in the basin. Reduced total phosphorus delivery was also associated with conservation, with very low statistical significance. Estimates of the magnitude of the statistical relations indicated that for major river basins in the Upper Mississippi conservation adoption were associated with stream nitrogen reductions between 7 and 37 percent and phosphorus load reductions from 2 and 11 percent. Physical processes such as denitrification and increased dissolved phosphorus mobility are proposed as possible explanations. The results provide some empirical evidence at the regional scale that conservation practices may have contributed to statistically detectable reductions in nutrient loadings in streams and rivers of the Upper Mississippi Basin and that the effectiveness of structural conservation practices in reducing nutrient delivery to streams is primarily controlled by soil and subsurface hydrological and biogeochemical conditions that may vary geographically across different environmental settings

Subject Area: Conservation Models, Tools, and Technologies*; Water Resources Assessment and Management

**denotes primary author and subject area*

A Study of Ecosystem Services Provided by a Stormwater Retrofit System on a Public School Campus in Orange County, North Carolina

Author(s): Eric McDuffie*, Orange County Schools; Dusty Pate, Duke University; Becky Smith, Duke University; Nate Mallari, Duke University; Liseth Zeder, Duke University

Abstract: According to the EPA, stormwater runoff is the number one source of pollution entering waterways (2012). Impervious surfaces that generate runoff are common features of our built environment, loading waterways and wetlands with nutrients such as Nitrogen and Phosphorous which impair both fresh water and marine environments. This environmental damage represents a negative externality of common development practices. The following case study examines a stormwater retrofit completed at an Orange County, North Carolina school campus to estimate its value to society. The services provided by the project examined in the study include avoided irrigation costs, value of nitrogen and phosphorus mitigation, and its educational value. We quantify and monetize each of these services, and compare them to the cost of the project in order to calculate the net value of the project to society. Our analysis indicates that total social value of the services generated by the project should exceed costs in the first year. The project is an example of public investment that can rapidly produce significant social benefits. Typical school campuses are an attractive target for future investments of this type because of their facilities, operations, and the educational value demonstrated by the project in Orange County. The model is potentially applicable to other schools.

Subject Area: Water Resources Assessment and Management*; Adaptive Management of Conservation Efforts; Conservation Economics and Policy ; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

Improving Watershed Planning Using Bacterial Source Tracking

Author(s): Kevin Wagner*, Texas Water Resources Institut; George DiGiovanni, UT-Houston School of Public Health, El Paso Regional Campus; Elizabeth Casarez, UT-Houston School of Public Health, El Paso Regional Campus; Joy Truesdale, UT-Houston School of Public Healt

Abstract: Bacteria are the primary cause of water quality impairments in Texas. According to the 2012 Texas Integrated Report for Clean Water Act Sections 305(b) and 303(d), 272 waterbody segments are impaired due to excessive levels of E. coli, enterococci, and fecal coliforms. Proper bacterial source evaluation is needed to target management practices and develop bacterial total maximum daily loads or watershed protection plans to address these impairments. Bacterial source tracking (BST) is a valuable tool for identifying sources of fecal pollution. In 2003, Texas initiated a BST program to improve bacterial source assessments using enterobacterial repetitive intergenic consensus sequence-polymerase chain reaction (ERIC-PCR) and RiboPrinting® (RP) DNA fingerprinting methods. These methods require development of a known-source BST Library (The Texas E. coli BST Library) that currently contains 1,669 E. coli isolates obtained from 1,455 domestic sewage, wildlife, livestock and pet fecal samples collected from twelve watersheds. Comprehensive BST, to identify the source of bacterial impairments, is complete or underway in 16 Texas watersheds using this library. The Texas E. coli BST Library performs particularly well when identifying broad source categories, such as the relative contributions of human, domestic animals, and wildlife. For most studies, the majority of tested isolates (~88%) were source-delineated with only a small proportion of isolates (~12%) unidentifiable. A major finding of the BST program is that wildlife are often the greatest contributors (~23-65%) of E. coli to Texas waters. BST provides watershed planners bacteria source data not previously available. Prior data deficiencies caused wildlife contributions to be underrepresented and other non-point sources (i.e. livestock) to be over-allocated in watershed planning efforts. This presentation summarizes these and other findings from completed work and discusses future directions of BST in Texas.

Subject Area: Water Resources Assessment and Management*; Conservation Models, Tools, and Technologies

**denotes primary author and subject area*

Experimental validation and regulatory application of USLE/RUSLE in Uruguay

Author(s): Mario Perez-Bidegain*, Fac de Agronomia; Carlos Clerici, RENARE/MGAP; Mariana Hill, RENARE/MGAP; Jorge Sawchik, INIA; Jose Terra, INIA; Fernando Garcia-Préchac, Facultad de Agronomía-UdelaR

Abstract: Soil erosion is the main environmental problem that concurrently reduces soil productivity in Uruguay. From 1980 -2001, three erosion sites (soils) with "Wischmeier" runoff plots were monitored in Uruguay, generating a data base of 376 erosive storms and 144 runoff plots-years, during 16 effective years of data generation. With 17 combinations of sites-soil use and management systems, the linear regression between annual average measured soil erosion (EroExp) and USLE/RUSLE estimates was: EroEst = 1.485 + 0.96 EroExp, r^2= 0.96. Also, in one site a regression line was obtained between experimental Soil Loss Ratios (SLR) and SLR estimated with the RUSLE algorithm: SLRRusle= 0.015+ 0.016 SLRExp, r^2= 0.83, during twelve 15 days periods from May-Dec. 1997, in 6 different soil use and management systems. Once the model was validated, a software (EROSION 6.0) was developed for users (http://www.fagro.edu.uy/~manejo/). In 2008 soil management and conservation legislation updates began and were fully applied in 2013, after a period of training for farmers and agronomists. Cropland farmers must have a soil use and management plan (SUMP) developed by a certified agronomist that covers the expected rotation period. The SUMP has to demonstrate that the estimated annual erosion rate is below the T value established for the soil used. Each piece of land has an official approximate soil map at 1:20x103 scale, from which the Agronomist can get the soil information for each plan. The SUMP is presented on-line and it constitutes an implementation protocol that can be analyzed and monitored by the official authority (Ministry of Agriculture). Those in violation can be fined according to the regulation. At the end of the 2013-14 agricultural year, over 95% (1.438.168 hás) of the Uruguayan cropland implemented the SUMPs, which is considered a success relative to mitigating soil erosion and collateral environmental impacts of runoff.

Subject Area: Conservation Economics and Policy *; Adaptive Management of Conservation Efforts; Conservation Models, Tools, and Technologies

**denotes primary author and subject area*

Building Capacity to Educate Private Water Supply Users: Virginia Master Well Owner Network and Virginia Household Water Quality Program

Author(s): Erin Ling*, Virginia Tech; Brian Benham, Virginia Tech

Abstract: More than 1.7 million Virginians (22% of the population) rely private water supplies such as wells, springs and cisterns. Many of these private water supply users lack access to objective information about protecting and maintaining their systems and often wait to take action until a problem arises. This presentation will provide an overview of two linked Virginia Cooperative Extension programs: the Virginia Household Water Quality Program (VAHWQP) and Virginia Master Well Owner Network (VAMWON). Through VAMWON, Virginia Cooperative Extension (VCE) extension educators/agents and screened volunteers are trained in topics including wellhead protection, system maintenance, and water testing, treatment, and conservation. VAMWON members then reach out to other Virginians through drinking water clinics conducted through local extension offices and other informal outreach mechanisms. Since 2008, 75 extension agents and 95 volunteers have completed VAMWON training workshops. From 2008-14, VAHWQP well water testing clinics were held in nearly every county across Virginia, resulting in analysis of 5,200 samples serving a total of 11,929 people. This presentation will summarize impacts, key partnerships, discuss lessons learned and resources developed, and provide an overview of water quality sample analysis results. We will also discuss future directions for these successful programs, including efforts to strengthen research initiatives connecting human health and private water supplies, targeted outreach to underserved populations, and our new WellCheck initiative: a partnership with the Virginia Water Well Association to develop and market affordable, standardized well inspections for homeowners across Virginia.

Subject Area: Outreach, Education, and Community Engagement*; Water Resources Assessment and Management

**denotes primary author and subject area*

Shooting a Moving Target: A Dissolved Phosphorus Problem Paradigm

Author(s): REM CONFESOR*, HEIDELBERG UNIVERSITY; Laura Johnson, Heidelberg University; David Baker, Heidelberg Univeristy; Kenneth Krieger, Heidelberg University

Abstract: There is a consensus among scientists, government agencies, and stakeholders that the recurrence of severe harmful algal blooms (HABs) in Lake Erie's western basin is mainly attributed to increasing dissolved reactive phosphorus (DRP) export. Limited funding inhibits watershed-wide implementation of best management practices (BMPs) to reduce DRP runoff from agricultural lands. Thus, the approach of most implementation programs is to target agricultural areas that are most vulnerable to nutrient and sediment loss. These critical source areas (CSAs) are usually characterized by soil type, land use and cover, and terrain. This information also comprises the critical input data for the Soil and Water Assessment Tool (SWAT). A highly detailed SWAT setup that incorporated 4-year crop rotations and corresponding agricultural management practices for each crop was used to identify CSAs in the Sandusky watershed in northwest Ohio. Results showed that the CSAs of DRP are not static but change both temporally and spatially. The CSAs were highly dependent on weather conditions (i.e., rainfall amount) as well as the crop planted and its associated management practices (e.g., tillage and fertilizer application methods) in a given year. When implementing BMPs in the top 33% of the areas contributing the most DRP, the annual watershed-wide DRP was not substantially reduced and nowhere near the target reductions, i.e., the low DRP export rates recorded in the early-1990s. The results imply that limited targeting to specific areas may not be effective in significantly reducing DRP. A watershed-wide approach that focuses on cultural and management practices (e.g., 4R principle, subsurface fertilizer application) is necessary to reduce DRP loads and, ultimately, the severity of HABs. This approach however, especially subsurface fertilizer application, will require subsidy to farmers.

Subject Area: Conservation Models, Tools, and Technologies*; Adaptive Management of Conservation Efforts; Social Sciences Informing Conservation ; Soil Health Resources, Indicators, Assessments, and Management; Water Resources Assessment and Management

**denotes primary author and subject area*

Vegetated Treatment Area Effectiveness at Reducing Nutrient RUnoff from Small Swine Facilities in Central Texas

Author(s): Kori Higgs*, USDA-ARS; Daren Harmel, USDA-ARS; Kevin Wagner, Texas Water Resources Institut; Patricia Smith, TAMU

Abstract: There have been numerous studies, both modeling and field, related to the design and evaluation of vegetative treatment systems used to treat animal feeding operation runoff; however, none of these have studies evaluated the effectiveness of vegetative treatment areas (VTAs) receiving direct runoff from small swine operations (< 100 animals) during natural rainfall events. Is it possible that a sufficiently sized VTA alone, with no solids pretreatment, can effectively treat direct runoff from small swine operations? This research aims to answer that question and evaluate the effectiveness of VTAs as a practical and cost-effective alternative wastewater management option to protect surface water quality on small swine facilities. Three locations in central Texas were established in 2012, and sampling sites were installed to monitor runoff water quantity and quality at the inlet and outlet of the VTA and a nearby control area not receiving swine effluent. Data show that the VTAs provided substantial treatment of the swine facility runoff in terms of reduced NO3-N, NH4-N, PO4-P, TN, and TP concentrations (29%-93%) and loads (50%-99%), but VTA runoff was still higher in nutrients than the control site. Further research of design elements and site management impacts on VTA performance is needed to develop guidelines for VTAs as a waste management option at small swine facilities.

Subject Area: Conservation Models, Tools, and Technologies*; Adaptive Management of Conservation Efforts; Conservation in Nontraditional Agriculture

**denotes primary author and subject area*

Conservation Modeling and Verification in Agriculture Operations

Author(s): Bethany Reinholtz*, GDS Associates, Inc

Abstract: Agriculture energy audits are becoming commonplace as federal, state, and utility programs encourage producers to have them performed to find ways to decrease energy use and out of pocket expenses. As a result, there have been many energy modeling tools created to use for modeling of these facilities by independent consultants, universities, and equipment dealers. In the end, these calculations are typically based either on the equipment recommended by the producer's equipment dealer or based on best management practices. Recommendations can be driven by what the utility feels is important, what the equipment dealer feels is most important, or based on best management practices for that producer for his location and operational needs. Unfortunately, this means that there is often a disconnect between what is being recommended, what is being installed, and what are the best opportunities for the operation. Calculations done based on best management practices will generally benefit the agriculture operation the most, however, if the specifics of the recommendations are not passed onto equipment dealers, the energy savings will not be realized. It is vital for the equipment dealer to have these details so that the correct equipment gets installed as improper sizing of equipment is often found to be a main cause for minimized energy savings from recommended equipment installations and can lead to additional un-needed equipment being installed, which can increase energy use and costs. It may be worthwhile for an agriculture operator to have a third party verify that the equipment is operating as promised energy savings will be realized. Examples of estimated energy savings from the same technologies will be compared across different locations to show the importance of modeling that takes into account environmental considerations, producer location, and operational differences.

Subject Area: Conservation Models, Tools, and Technologies*; Adaptive Management of Conservation Efforts; Conservation Economics and Policy ; Social Sciences Informing Conservation

**denotes primary author and subject area*

Responses and Attitudes Toward Soil and Water Conservation Needs and Potential Climate Change Scenarios by Farmers in Dry Land Areas of the Inland Pacific Northwest

Author(s): Robert Mahler*, University of Idaho; J.D. Wolfhorst, University of Idaho; Sanford Eigenbrode, University of Idaho

Abstract: In the last 10 years a total of seven grower-based surveys supported by USDA (National Water Resources Program, Pacific Northwest Regional Water Resources Program, Conservation Effectiveness Assessment Program (CEAP) and CEAP and Regional Approaches to Climate Change (REACCH) have evaluated grower attitudes and responses toward urgent soil and water conservation issues and the potential impact of climate change on agriculture in eastern Washington, northeastern Oregon and northern Idaho. This paper summarizes the relevant soil and water conservation findings contained in these seven surveys. Statistically designed surveys were administered to growers within the region. We relied on mail-based survey instruments using the Dillman methodology. Over 5,000 growers have been surveyed since 2002. Based on the survey results growers are aware of the conservation practices that are needed to insure the sustainability of dry land agriculture in the region. Tillage practices have changed to reduce soil erosion and to conserve water. Although growers generally do not see a large impact from climate change on agriculture in the region they have made many adjustments in agronomic practices in the last 10 years which can be attributed to climate change (planting dates, pest control, fertilizer application timing, etc.). This paper is important because it documents the changes that growers have made in the last 13 years. These changes will allow scientists and politicians to understand the effectiveness of research and Extension programs and well as many of the locally implemented USDA farm programs.

Subject Area: Adaptive Management of Conservation Efforts*; Outreach, Education, and Community Engagement; Soil Health Resources, Indicators, Assessments, and Management

**denotes primary author and subject area*

U.S.Agricultural Water Conservation, Emerging Demands, and the Challenge for a Sustainable Future

Author(s): Glenn Schaible*, USDA-ERS

Abstract: Emerging water demands from non-agricultural sectors and expected water demand/supply impacts from climate change have heightened awareness of the importance of water conservation and the sustainability of the irrigated agriculture sector. This presentation examines the challenge for agricultural water conservation in the face of increasing water scarcity, using data from USDA's Censuses of Agriculture, Farm and Ranch Irrigation Surveys, and USGS's Water Use Estimate reports to characterize the current status in the demand for water resources, how important irrigation is to U.S. agriculture, how efficient irrigated agriculture is, and the case for improving real agricultural water conservation, i.e., integrating: 1) onfarm water-management practices with improved irrigation application efficiency; and 2) public water conservation programs with institutional/watershed (landscape-scale) water-management programs. Study results demonstrate that while substantial improvements in irrigation water-use efficiency have already occurred, there still exists significant room for improvement. At least 50 percent of irrigated cropland acreage across the U.S. is still irrigated with less efficient irrigation application systems, and most irrigators do not make use of the more conserving onfarm water-management practices. Given the probability of climate change, its prognosis for reduced water supplies, a sustainable future for irrigated agriculture requires a broader water-conservation policy focus than the traditional emphasis on physical irrigation application-system improvements. Greater emphasis on producer adoption of conserving “irrigation production systems”, and the integration of onfarm water conservation with institutional water-management initiatives could enhance the potential for real agricultural water conservation, and help ensure a more sustainable future for the irrigated agriculture sector.

Subject Area: Conservation Economics and Policy *; Water Resources Assessment and Management

**denotes primary author and subject area*

Restoring Hydrological Function on Landscapes Through the Removal of Western Juniper

Author(s): Thomas Esgate*, Pit Resource Conservation Dist; Eileen Carey,

Abstract: Western juniper (Juniperus occidentalis) invasion of western U.S. rangelands has not only replaced native plant communities but has also degraded the hydrologic cycle in invaded rangelands. Juniper canopies intercept and transpire greater quantities of precipitation than native grass and shrub communities. The combination of less water entering the soil and strong ability of western juniper to extract and transpire water means that little water has a chance to percolate beneath the root zone. Therefore, invasion of western juniper on large areas that were once primarily grassland has strong implications for recharge of aquifers. In this pilot study, passive capillary lysimeters were installed to obtain measurements of deep soil water drainage in a control watershed and a treatment watershed where juniper was removed. Data were collected during the winter and spring following juniper removal. Drainage in the treatment area increased 3-7 days after the first precipitation event of the year and subsequent precipitation events. In the control area, precipitation reached the deeper soil layers approximately two months after winter precipitation began. The difference in deep drainage collected in the treatment lysimeter as compared to the control was 1.8” which is equal to 9% of the total precipitation during the monitoring period. The data illustrate the difference in the amount of rain and snow intercepted and evaporated by the juniper canopy in the control as compared to the treatment watershed, and water taken up and transpired by juniper in the control watershed during the mild winter and spring when native grasslands were dormant. This study demonstrates how removing western juniper from invaded landscapes has the potential to restore hydrologic function thereby making more water available for native plant communities in support of wildlife and agriculture and contributing to the maintenance of a sustainable water supply.

Subject Area: Water Resources Assessment and Management*; Soil Health Resources, Indicators, Assessments, and Management

**denotes primary author and subject area*

Economic and Spatial Assessment of Crop Irrigation in the Arkansas Delta

Author(s): Kuatbay Bektemirov*, University of Arkansas; Eric Wailes, ; Grant West,

Abstract: Adoption of appropriate crop irrigation practices can provide significant irrigation efficiency improvement, save water resources and reduce production and environmental costs. An accurate assessment of the potential conservation savings and the costs to achieve them in the Arkansas Delta is important. The proposed project will assess the costs and benefits of adopting improved irrigation practices. We will develop a comprehensive spatial data set of irrigation practices in the Arkansas Delta using remote sensing and the collection of secondary data from the National Agricultural Statistics Service (NASS) and the Natural Resources Conservation Service (NRCS). Data from these agencies will be evaluated and used to develop an inventory which will allow the creation of a map of irrigation technology adoption and an associated GIS data layer. The information collected will be used to depict the status of on farm water use in the Delta, and to assess technology costs and benefits. It will identify where adoption and potential adoption of improved irrigation practices exist. This information will assist policy decision makers to address concerns related to the functioning of the state water policy plan. The results of this project will also benefit specialists in the management of water conservation programs as well as policymakers in future analyses of water resource policies and agricultural practices.

Subject Area: Conservation Economics and Policy *; Adaptive Management of Conservation Efforts; Outreach, Education, and Community Engagement; Social Sciences Informing Conservation ; Water Resources Assessment and Management

**denotes primary author and subject area*

Creating a Clean Water Future

Author(s): Leslie Gahagan*, City of Foley, Alabama; Ashley Campbell, City of Daphne

Abstract: On the Gulf Coast, water quality equates to quality of life. The Mobile Bay National Estuary Program along with numerous partners developed the Create a Clean Water Future campaign. The campaign is a public education and outreach program to bring awareness to stormwater pollution. The partners in development as well as implementation includes federal and state agencies, county and municipal governments, environmental groups and non profits, and the business community. Step up for what you can do to address stormwater issues. Speak up so your voice can be heard on the issues. Follow up by contacting regulatory officials and spreading the word. The campaign includes a website with numerous resources and logo to be used freely by all partners. Commercials educating on stormwater pollution introduced the campaign to the Gulf Coast. Ideas to spread the word has also led to the success of the campaign. Create a Clean Water Future is a simple outreach program that has been embraced by the community to address the serious impacts from stormwater.

Subject Area: Outreach, Education, and Community Engagement*

**denotes primary author and subject area*

Evaluation of GIS-based erosion-deposition modeling for land management at military installations

Author(s): Helena Mitasova*, North Carolina State Universit; Steven Warren, U.S. Forest Service, Rocky Mountain Research Station, Provo, UT; Thomas Ruzycki, Center for Environmental Management of Military Lands, Colorado State University; Matthew Hohmann, US Army ER

Abstract: In order to meet mandates requiring the prevention of excessive soil erosion and sediment production from military lands, Department of Defense installations need an easy to use method to map critical sources and sinks of sediments. Although several agricultural erosion models have been adapted to military installations, the Universal Soil Loss Equation (USLE) remains the predominant tool used for erosion assessment. To provide a simple approach more suitable for complex military lands we present an evaluation of a GIS-based model for mapping erosion/deposition (ED) and focused on identifying erosion hot spots and prioritizing remediation and conservation measures. The model estimates ED as a change in sediment transport capacity using standard GIS tools. To support simple implementation, sediment transport is estimated using a combination of USLE parameters and GIS-based flow routing. Remote sensing and ground transects are used to map the ground cover (C) factor. The model is evaluated by comparing the computed ED classes with visual field estimates at random locations within each of six ED classes. An evaluation has been performed at 5 high priority training facilities that represent the breadth of climate and topography in the military land inventory: Yakima Training Center, WA; Fort Hood, TX; Schofield Barracks, HI; Fort Campbell, KY; Eglin Air Force Base, FL. We discuss combining this simple model with advanced approaches that can be used at areas targeted for conservation using high resolution 3D data such as lidar. To support the model adaptation we present innovative visualization and geodesign techniques based on 3D landscape models. The project will help prioritize the use of the limited erosion and sediment control resources available to the military land managers and support precision conservation at military installations, leading to improved water quality and sustainability of training areas.

Subject Area: Conservation Models, Tools, and Technologies*; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

Influence of Biochar and Diversified Cropping Systems on Soil Physical and Chemical Properties

Author(s): Deborah Aller*, Iowa State University; David Laird, Iowa State University; Ross Mazur, ; Kenneth Moore, ; Roger Hintz,

Abstract: Corn residue removed from Midwestern farms is the largest potential source of biomass for cellulosic bioenergy production in the U.S. Long-term harvesting of biomass, however, may lead to the degradation of soil and water quality unless new management practices are used to increase carbon inputs to soils. Alternative cropping systems that include small grains, perennial grasses and biochar amendments may help reduce negative effects of biomass harvesting on soil and water quality. A long-term crop-rotation and biomass harvesting experiment was established in 2006 to evaluate multiple bioenergy crops (corn stover, triticale and switchgrass) in diversified cropping systems. This experiment also provides the opportunity to investigate the impact of non-traditional rotations with and without biochar on soil quality. Here we report the effect of biochar, biochar age and cropping systems on soil physical and chemical properties. Intact soil cores were collected and analyzed for: solute transport, saturated hydraulic conductivity, bulk density, porosity, pH, EC, total C, total N, C/N ratio, cation exchange capacity, and anion exchange capacity. Chemical breakthrough curves, quantified by changing the leaching solution concentration from 0.001 to 0.005 M CaCl2, and measuring EC of the effluent, indicates that biochar amendments and non-conventional crop rotations retard ion transport relative to controls. Crop rotations that include small grains or switchgrass impact both solute dispersivity and retardation relative to continuous corn and corn soybean rotations. Across all crop rotations there was an increase in total soil C, soil C/N ratio and gravity drained water content, and a decrease in bulk density for soils treated with biochar relative to no-biochar controls. The results suggest that soil biochar amendments and crop rotations that include switchgrass may help mitigate some of the adverse effects of biomass harvesting on soil and water quality.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*; Conservation in Nontraditional Agriculture

**denotes primary author and subject area*

A framework for setting realistic expectations for water quality improvements based on changes in agricultural activities

Author(s): Paul Capel*, US Gelogical Survey; David Wolock, US Geological Survey

Abstract: Agricultural activities can impact water quality and the health of aquatic ecosystems. Many water-quality impacts originate with the movement of water, agricultural chemicals, and eroded soil from agricultural areas to streams and groundwater. Most agricultural activities are designed to sustain or increase production; some are designed to protect soil and water resources. Many of these soil- and water-protection practices are designed to reduce the volume and velocity of runoff and increase infiltration. This work presents a conceptual framework that combines the movement of water, the environmental behavior of chemicals and eroded soil, and the designed functions of various agricultural activities to help set realistic expectations for the protection and improvement of water quality that could result from a change in an agricultural activity. The conceptual framework is built on a generalization of catchment hydrology—water moves by a combination of expected flowpaths based on soils and topography. This water can move via slow flowpaths (recharge to groundwater to stream discharge), fast flowpaths (surface and shallow subsurface flows), and sub-surface drain flowpaths. The degree to which specific chemicals and eroded soil are transported can be generalized and are predictable based on their degrees of association with sediment. Finally, the effects of various agricultural activities on the movement of water, chemicals, and eroded soil are largely known. The fundamental concepts of this framework will be described and examples provided for the movement of non-reactive, water-associated and particle-associated chemicals in a range of hydrologic settings. Understanding the connections between agricultural activities, water flowpaths, and movement of specific chemicals and eroded soil within this simple framework can help guide policy and management decisions to reduce current and prevent new water-quality impacts.

Subject Area: Water Resources Assessment and Management*; Adaptive Management of Conservation Efforts; Conservation Economics and Policy ; Conservation Models, Tools, and Technologies; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

Using Soil Respiration Tests to Measure Plant Available Nitrogen in Cover Cropped Soils: Demonstrations, Research, and Outreach in South Carolina

Author(s): Chanda Cooper*, Richland SWCD; Robin "Buz" Kloot, University of South Carolina

Abstract: The combination of cover cropping and reduced tillage can create significant pools of organic, plant-available nitrogen in agricultural fields which are not accounted for in traditional soil tests and fertility recommendations. Because these nitrogen pools are not considered, farmers often apply too much nitrogen, resulting in higher input costs, water pollution, and even reduced crop yields. In South Carolina, biological soil respiration tests are being piloted and promoted as a means to address this problem through a partnership with the University of South Carolina and the Dillon, Marlboro, and Richland Soil and Water Conservation Districts. This effort involves twice-yearly soil testing using the Haney Soil Health Test, cover crop biomass sampling, and crop yield monitoring in five demonstration fields. First-year results indicate that nitrogen applications can be reduced in cover-cropped fields in accordance with the Haney Test recommendations without negative effects on crop yields or profitability, but questions remain about how much less nitrogen is advisable in southeastern soils. Field trials are currently under way to answer these questions and finesse nitrogen fertility recommendations. Results and recommendations generated from these field trials and demonstrations are being disseminated through a coordinated outreach campaign which includes soil health meetings, workshops, and field days; print, video, and social media; and an online forum, the Carolina Cover Crop Connection, which provides farmers the opportunity to share information, questions, and experiences. This work is funded, in part, by a Conservation Innovation Grant from the SC-USDA-NRCS.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*; Conservation Models, Tools, and Technologies; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

Mitigation of eutrophication in river basins, lakes, and coastal waters requires and integrated and adaptive approach; experiences from The Netherlands.

Author(s): Joachim Rozemeijer*, Deltares; Stefan Jansen, Deltares; Leonard Oste, Deltares; Jos Van Gils, Deltares; Roelof Stuurman, Deltares; Nicky Villars, Deltares; Miguel Dionisio Pires, Deltares; Hilde Passier, Deltares

Abstract: We propose a guideline for mitigation of eutrophication in river basins, lakes, and coastal waters. The proposed strategy is based on our experiences with implementation of manure legislation and the Water Framework Directive (WFD) in Europe. These regulations led to reduced nutrient losses from highly productive agricultural areas. For example in The Netherlands, the worldwide second largest exporter of agricultural products, nutrient concentrations in agricultural headwaters reduced since the early 1990's. Our guideline builds on three basic principles: (1) a conceptual framework integrating water quality, water quantity, soil, groundwater, and surface water, (2) the 'from catchment to coast' approach for up-scaling field-scale pilot results to downstream ecological effects, and (3) a mitigation order of preference from (a) optimizing nutrient uptake efficiency to (b) enhancing nutrient retention and recirculation to (c) nutrient discharge and applying effect oriented measures. The tools needed to mitigate eutrophication are system understanding, smart monitoring, smart modelling, smart measures, and smart governance. Following these principles and using these tools enables an integrated, adaptive approach for selecting, implementing, and evaluating the most cost-effective and sustainable set of mitigation actions.

Subject Area: Conservation Economics and Policy *; Adaptive Management of Conservation Efforts; Conservation Models, Tools, and Technologies; Water Resources Assessment and Management

**denotes primary author and subject area*

Soil Organic Carbon Simulation by Using the APEX model for Organic and Chemical Management under Conservation and Conventional Tillage Systems

Author(s): Kieu Le*, North Carolina A&T State Unive; Manuel Reyes, North Carolina A&T State University; Deanna Osmond, North Carolina State University; Erika Larsen, North Carolina State University

Abstract: Conservation tillage (CT) sequesters significant amount of carbon into the soil whereas organic farming can produce chemical-free foods. Despite the large literature on CT and organic farming system, the long-term effects of combining conservation and organic farming are largely unknown. In this study, we predicted the amount of soil organic carbon (SOC) in the soil under chemical and organic management with conservation and conventional tillage systems by using the Agricultural Policy Environmental Extender (APEX) model. The experimented site is located at the Horticulture Crop Research and Extension Center, Mills River, NC, with four replications of five treatments (plowed organic, plowed chemical, strip/no-till organic, strip/no-till chemical and plowed control – no cover crop, no fertilizer applied). Each treatment plot was split: continuous vegetables (12 years of tomato and 8 years of sweet corn) and rotated vegetables (i.e. sweet corn, cabbage, cucumber, tomato, pepper, squash, and broccoli). We hypothesized that the organic strip-till/ no-till with rotated vegetable would have the most carbon sequestration because it has the most residue left on the field and no or minimum soil disturbance. To test the hypothesis, 20-year and 100-year scenario have been run to estimate the amount of SOC in the five treatments at two subplots – continuous and rotated vegetables. The APEX model simulated the entire period from 1994 to 2014 for both crop yields and SOC. Crop yields are used for model calibration and validation; while, the SOC data in 2009, 2010 and 2011 is used for validation. Our preliminary results of 100-year scenario shows that there is a trend in which final total organic C sequestered is highest in the strip/no-till organic treatment, followed by strip/no-till chemical, plowed organic, plowed chemical and plowed control. Current work focuses on calibration and validation of the model to improve the accuracy of the prediction.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*; Adaptive Management of Conservation Efforts; Conservation Models, Tools, and Technologies; Water Resources Assessment and Management

**denotes primary author and subject area*

Impact of Cropping Practice on Soil Potassium Supply

Author(s): Eric Bremer, Western Ag Innovations; Marko Davinic*, Western Ag Innovations

Abstract: Soil conservation practices potentially have a large impact on the capacity of soils to supply K because they modify the fate of plant materials, which are an important source of K in many cropping systems. We conducted a meta-analysis of studies where Plant Root Simulator (PRSTM) probes (ion-exchange membranes in plastic supports) were used to monitor impacts of cropping practice on soil K supply. Soil K supply was generally reduced by crop growth and increased by addition of crop residues, but relative impacts varied widely among soils and crops. Conservation practices have significant impacts on soil supply of K and other nutrients.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*; Conservation Models, Tools, and Technologies

**denotes primary author and subject area*

On-Farm Soil Quality Testing in Organic and Conventional Peach Orchard Systems

Author(s): Esther Thomsen*, Utah State University; Mae Culumber, Utah State University; Jennifer Reeve, Utah State University

Abstract: Farmers would benefit from knowing whether their management practices are aggrading or degrading their soils. Soil quality problems such as erosion, depleted soil organic matter, nutrient reserves and reduced water holding capacities are of increasing concern to farmers in the Intermountain West. Marginal soils require more amendments and fertilizers to meet crop needs. As input costs rise and water resources are increasingly limited, effective methods of evaluating soil quality and fertility is of growing importance. Comprehensive soil quality tests are not routine, hence are often cost prohibitive or unavailable. Soil quality results obtained can also be time consuming and confusing to interpret. Standard commercial tests typically quantify soil nitrogen, phosphorus, potassium, pH and salinity. These factors alone are not able to predict the long-term suitability of management practices. This study will determine the accuracy, efficiency and the ease of using simple chemical, biological, and physical soil quality indicator tests that can be completed on-site. The indicative on-site soil tests include modified slaking tests, litter bag tests, berlese funnel tests and LaMotte and Rapid soil test kits and have been selected to measure aggregate stability, decomposition rates, macroflora, macronutrients, and pH respectively. These tests will be compared to comparable lab analyses. The trend in enhancement or degradation of soil quality by current management practices will be estimated. Soil samples will be collected from two experimental peach orchards located on the Utah State University Research farm in Kaysville, Utah. The orchards consist of 12 replicated orchard floor treatments with documented differences in soil quality. The goal of this study is to increase the participatory role of farmers in the maintenance and health of their soils, which could potentially reduce nutrient overload, soil erosion and degradation of ecosystem services on and off-site.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

Engaging Missed Demographics in Conservation Changes: Women Farmland Owners and Wetlands in IA

Author(s): Angie Carter*, Iowa State University

Abstract: Women own approximately half of the farmland in Iowa and this is a national trend, yet women continue to experience cultural barriers to implementing conservation on their land. Even though previous research has stressed the importance of social relationships and social structure upon conservation decision-making, the predominance of research studying conservation decision-making continues to focus on men who are farmer-operators, thus missing an important demographic who have authority to make decisions about their land's management. How do women farmland owners work with their tenants and co-owners to make long-term conservation changes on the agricultural landscape given the increased social pressure to increase production? How might creating social networks for women interested in water quality improvements assist in increasing conservation adoption? Given that women rent out farmland at a higher rate than their counterparts, and often cede decision-making to co-owners or tenants, we need an improved understanding of how women farmland owners work with their tenants and co-owners in conservation decision-making. I present findings from qualitative and quantitative data collected from a 3.5 year research project developed in collaboration with the Women, Food and Agriculture Network, a non-profit group whose program, Women Caring for the LandSM, provides conservation outreach through participatory learning. This presentation will identify how women farmland owners navigate social relationships with their farm tenants and co-owners to make decisions related to water quality improvements, specifically wetlands, on their farms. These findings inform the creation of a curriculum for conservation professionals working with women farmland owners. Findings will be of interest to conservation professionals, Extension staff, and others providing conservation outreach and education to farmland owners.

Subject Area: Social Sciences Informing Conservation *; Outreach, Education, and Community Engagement; Water Resources Assessment and Management

**denotes primary author and subject area*

Balancing Food Safety and Sustainability: Co-management for Conservation and Production Goals in Fresh Produce Systems

Author(s): Mary Bianchi*, UC Cooperative Extension; Karen Lowell, USDA NRCS

Abstract: Balancing food safety and ecosystem services in fresh produce production presents an emerging example of adaptive management of conservation and agricultural practices. Food Safety Modernization Act Rules call for producers and food safety and conservation professionals to understand how food safety practices may impact conservation goals and vice-versa. Agricultural producers are active stewards of the land, protecting soil and water quality and supporting wildlife populations by preserving habitat. At the same time, producers must ensure that their crops are free from contamination that can cause foodborne illnesses. While key research questions remain, many have been defined during the critical conversations surrounding on-farm decisions regarding co-management. Responsibility lies with the research community for creating an open and integrated approach to interpretation and implementation of research results surrounding contamination, transport and survival of pathogens in the production environment. Agricultural, food safety and conservation scientists must keep pace with co-management questions supporting food safety and the environment. A multidisciplinary, multi-agency team has developed outreach and extension materials that demonstrate robust and informed conversations among all stakeholders, increase knowledge of conservation practices within and adjacent to fresh produce production and the implications of those practices for food safety. Online learning is paired with a co-management practices tool to explore the nature of co-management decisions in the field and the benefits and hazards of conservation practices in addressing conservation and food safety goals. Strategies are presented for co-management in the production environment. These materials are available online through the UC Food Safety Website.

Subject Area: Adaptive Management of Conservation Efforts*; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

Measuring Land and other Capital Inputs

Author(s): Richard Nehring*, USDA-NRCS; Vernon Ball, ERS; Dave marquardt, ERS; Vince Breneman, ERS

Abstract: This project provides a farm sector comparison of levels of capital input for eighteen OECD countries and Argentina, Australia, Brazil, China, and India for the period 1973-2008. Spatial differences in land characteristics prevent the direct comparison of observed prices of land across countries. To account for these differences, indexes of relative prices of land are constructed using hedonic methods (land price on the LHS and common characteristics on the RHS using a semilog specification) where a commodity like land is viewed as a bundle of characteristics. Two data sources are used: Soil stress data and the fertility capability soil classification (FCC). The World Soil Resources Office of the U.S. Department of Agriculture's Natural resource Conservation Service has compiled data on characteristics that capture differences in land quality. These characteristics include soil acidity and moisture stress—12 characteristics in all. The most recent version of FCC was developed over by Sanchez et al. 1982 (Geoderma, 2003) to interpret soil taxonomy and additional soil attributes in a way that is relevant to plant growth. Smith (1989 PhD dissertation NC State) developed a rationale for each FCC class. The characteristics include soil moisture stress and clayey topsoil—23 characteristics in all. The "level" of each characteristic is measured as the percentage of the land area in a given region that is subject to each characteristic. We harmonize the World Resources and FCC data sets with a soil taxonomy developed by the OECD. In areas with moisture stress, agriculture is not possible without irrigation. Hence irrigation is included. In addition to environmental attributes, we also include a "population accessibility" score for each region in each country. The computed quality adjusted land prices allow us to compute the purchasing power parity for land as the ratio of the quality-adjusted land price in each country relative to the United States.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*

**denotes primary author and subject area*

Managing Denitrification Woodchip Bioreactors for Maximum Nitrate Removal and Minimum Carbon Expended

Author(s): Keegan Kult*, Iowa Soybean Association; Christopher Jones, Iowa Soybean Association

Abstract: Best management practices must not only be placed using precision conservation, but must be optimized for cost effectiveness due to limited funding. For denitrifying bioreactors, this means targeting tile lines that minimize the length of time which the system is nitrate limited while maximizing nitrate removed:carbon expended. The cost effectiveness is determined by the amount of carbon expended during denitrification as well as during other redox processes. Alternative flow regimes were studied to determine nitrate removal efficiency. The first regime increased flow volume. Maximum flow volume reduces retention time, decreasing potential nitrate reduction and other redox processes. The second regime increased the retention time to achieve high concentration reductions while reducing potential flow volume. The alternative flow designs help answer the questions about carbon usage and whether high flow volumes or high retention times increase load reductions. The Iowa Nutrient Research Center funded weekly monitoring of six bioreactors in 2014. Three had high flow volumes and three had high retention times. Data collected from these bioreactors complimented data collected from an additional six bioreactors through funding from an USDA-CIG and landowner contracts. Nitrate levels were analyzed using EPA method 300.0. Carbon depletion was quantified by analyzing alkalinity and total organic carbon. Flows were calculated by using modified weir equations to convert pressure transducer recorded depths. This study aims to optimize bioreactors through flow management. We believe that managing bioreactors for higher flow rates, to the detriment of retention time, will increase the nitrate load removed from the system. The cost effectiveness of the practice may also improve since more carbon is consumed during denitrification rather than ancillary redox processes.

Subject Area: Conservation Models, Tools, and Technologies*; Adaptive Management of Conservation Efforts

**denotes primary author and subject area*

Discharge and suspended sediment patterns in a small mountainous watershed with widely distributed stony soils

Author(s): Zhihua Shi*, Institute of Soil and Water Co; Nufang Fang, Institute of Soil and Water Conservation, Chinese Academy of Sciences

Abstract: Understanding and quantifying sediment loads is important in watersheds with highly erodible materials, which will eventually cause environmental and ecological problems. Within this context, suspended sediment transport and its temporal dynamics were studied in a small mountainous watershed with sloping lands that contain stony soils in a subtropical area of China. The average runoff coefficient of this watershed was 0.65 over a 7-year period. The suspended sediment was strongly transported during the summer months, when frequent, intense flood events occurred. Overall, 30 flood events were monitored over 5 hydrological years and accounted for 27.3% of the precipitation, 17.1% of the runoff, and 95.5% of the suspended sediment load during the time period. In total, 12 related variables were separated using the classical hydrograph separation method. A partial least-squares regression was used to determine the control variables of the discharge. The results indicated that runoff could be explained using partial least-squares regression. The rainfall related variables, maximum flood suspended sediment concentration, flood peak discharge, base flow, and runoff duration have important effects on the discharge, while antecedent precipitations had little effect on discharge. The relationship between discharge and suspended sediment concentrations exhibits a high degree of high scatter. During 24 of the flood events, three types of hysteresis loops were observed: clockwise (17 events), figure-eight (3 events), and complex (4 events). During the hydrological years, an extreme event occurred on 14/8/1990, and caused a soil loss of 20499 t (4.6 times the average yearly soil loss). These results confirm the important role of the extreme event, which determined the magnitude of soil loss over several years.

Subject Area: Water Resources Assessment and Management*

**denotes primary author and subject area*

Evaluation effects of magnetized saline water on seed germination and seedling growth of bean (Phaseolus vulgaris)

Author(s): Fateme Aghamir*, Tarbiat Modares University; Hosseinali Bahrami, Tarbiat Modares University; Mohammad Jafar Malakouti, Tarbiat Modares University; Saied Eshghi, Shiraz University

Abstract: Magnetized water (MW) is water that has been passed through a magnetic field. The MW treatment techniques have shown promising potentials in different areas specially agriculture. Increment quality of crop yield, induce seed germination, improvements of irrigation water quality, soil improvement and water saving are some of the reported benefits of MW in agriculture. In addition, magnetic treatment of saline irrigation water can be used as an effective method for soil desalinization. The aim of this study was to evaluate the effects of magnetized water treatments on bean (Phaseolus vulgaris) germination under saline conditions (0, 25, 50, 75, 100 and 120 mM NaCl). An electromagnetic field generator (Water Clear Environment Technologies Company-SB 150) produced the MW (0.05-0.5mT). The experiment was carried out in a cultivated media box filled with peatmoss and perlite (1:1), and was performed as factorial in a complete randomized design with three replications. The boxes were placed in green house at 25°C. After 2 weeks, plants harvested and then the growth paramerets, including the roots and shoots length, fresh and dry weight of shoots and roots and roots to shoots ratio were measured with scale 0.001 g. The results revealed that the roots and shoots length, fresh and dry weight of shoots and roots and roots to shoots ratio, chlorophyll content index, water uptake, tissue water content were significantly affected by magnetized water. Irrigation with magnetized water significantly increased the physiologic factors such as germination percentage and index, vigor index and salt tolerance index, compared to untreated control seeds. The results also demonstrated that magnetized water was conducive to promote the growth of bean seedlings under saline conditions. It is believed that magnetized water used for irrigation can improve water productivity, thus conserving water supplies for the expected future global water scarcity.

Subject Area: Water Resources Assessment and Management*; Conservation in Nontraditional Agriculture; Soil Health Resources, Indicators, Assessments, and Management

**denotes primary author and subject area*

Quantifying the Greenhouse Gas Benefits of Agricultural Conservation and Management

Author(s): Marlen Eve*, U.S. Dept of Agriculture

Abstract: The U.S. Department of Agriculture (USDA) has many programs and initiatives that help to enhance management with conservation goals. Many of these efforts also reduce greenhouse gas (GHG) emissions or enhance carbon sequestration. When considering implementation of a conservation practice, land managers require scale-appropriate tools that will enable them to quickly and easily assess environmental benefits and environmental market opportunities. USDA enlisted the help of nearly 100 scientists to develop a technical report that provides guidance on best methods for estimating GHG fluxes at the local farm, ranch or forest scale. Four rounds of review by federal and academic experts were conducted to ensure validity and transparency of the contents. The report provides detailed quantification methods for a wide range of management practices across the cropland, grazing land, livestock and forest management. The methods are being used in development of user friendly tools that provide land managers with standardized and vetted GHG assessments. The tools, such as COMET-Farm, help land managers to assess various management options and opportunities to enter into voluntary markets for environmental benefits, potentially enhancing the amount of conservation management implementation. Additionally, this effort will aid USDA in assessing the GHG performance of current and future conservation programs and practices. The report authors noted many significant areas where additional research and data will further improve the accuracy and reliability of the methods. This presentation highlights the methods, provides a status on progress implementing the methods in user-friendly management tools, and outlines strategic areas for future research.

Subject Area: Conservation Models, Tools, and Technologies*; Adaptive Management of Conservation Efforts; Conservation Economics and Policy ; Soil Health Resources, Indicators, Assessments, and Management

**denotes primary author and subject area*

Households' adoption of drought tolerant plants: An adaptation to climate change?

Author(s): Yubing Fan, Univ. of Missouri; Laura McCann *, Univ. of Missouri

Abstract: The U.S. Midwest is experiencing climate change. The severe drought of 2012 may be an example. While farmers were most severely affected, adaptation at the household level is also important. A survey of 2000 residents near Columbia, Missouri was conducted in the spring of 2014, resulting in a 44 percent response rate and 625 usable responses. The objectives were to study the factors affecting adoption of drought tolerant plants (DTPs) and, more generally, to characterize residents' yard and stormwater management practices in one of the Midwest's rapidly urbanizing watersheds. The dependent variable is binary, whether drought tolerant plants were adopted or not. Thirty-two percent of the respondents had adopted DTPs, more than other water management practices. Probit regression results show that residents who were concerned about longer drought periods were significantly more likely to adopt DTPs, while those concerned with more frequent intense rains were less likely to adopt. These results may indicate that expected future watering costs affect adoption. Other significant results were that adoption of mowing lawns high, which promotes root development, was positively correlated with adoption of DTPs. Residents who spent more time maintaining their yards were more likely to adopt. Trust in information from local watershed groups increased adoption. Those earning less than $25,000 were more likely to adopt DTPs than those earning $25,000 to $49,999. Watering costs may be more of an issue for this group. Those living either in city or suburban areas were less likely to adopt than those in rural areas, who would need to water larger areas. Owning versus renting their homes had a positive effect on adoption. Extension efforts that highlight the long-term benefits of DTPs, such as lower watering and maintenance costs, may increase adoption of this practice in newly drought-prone areas.

Subject Area: Conservation Economics and Policy *; Outreach, Education, and Community Engagement; Social Sciences Informing Conservation ; Water Resources Assessment and Management

**denotes primary author and subject area*

Factors Affecting Adoption of Stormwater Management Practices by Homeowners : Rain Gardens and Rain Barrels

Author(s): Dong Won Shin*, Univ. of Missouri; Laura McCann , Univ. of Missouri

Abstract: Urban stormwater runoff contributes to environmental problems like surface water pollution, flooding, and deterioration of aquatic habitats, so managing stormwater runoff is important. This study explores the factors affecting adoption of two stormwater management practices, rain barrels and rain gardens, in an urbanizing watershed in Missouri. A mail survey was conducted in Columbia, Missouri in spring of 2014. There were 783 respondents from a random sample of 2000 residents for an effective response rate of 44% after deleting people who had moved or were deceased. The adoption of rain gardens and rain barrels are binary dependent variables, whether each practice was adopted or not. Only 3.12 percent and 7.47 percent of respondents are currently using rain gardens and rain barrels, respectively. Regression results show that respondents who spend more time on yardwork are significantly more likely to adopt rain gardens and rain barrels. Also, those who have a pro-environmental attitude, concern about water problems in their basement, and water their yard frequently, are more likely to adopt rain gardens. On the other hand, those who are concerned about drought are more likely to adopt rain barrels. Questions were asked about specific potential barriers to adoption. Knowledge about how to install the practices and compatibility with the features of their property are significant limitations to adoption of both practices. For rain gardens, respondents are less likely to adopt if they are not able to see a demonstration of the practice beforehand. For rain barrels, those who agreed that a lack of equipment, the time requirement, and concerns about appearance were barriers, were less likely to adopt. Surprisingly, if they indicated that their own physical limitations were a barrier, they were more likely to adopt.

Subject Area: Conservation Economics and Policy *; Adaptive Management of Conservation Efforts; Outreach, Education, and Community Engagement; Social Sciences Informing Conservation

**denotes primary author and subject area*

Soil Health, Resilience and Climate Change

Author(s): Bill Berry*, NACD

Abstract: As the soil health movement grows across the country, landowners and conservation professionals are identifying and quantifying the benefits of restorative soil health practices and their ability to serve as adaptation strategies to mitigate the impacts of climate change in addition to the benefits for the protection and enhancement of soil productivity. The National Association of Conservation Districts has engaged in efforts to enhance awareness of the potential of soil health practices to mitigate the impacts of climate change. Information will be shared about NACD's findings, including input and insights from producers and conservation professionals on how soil health practices help to mitigate climate-change impacts in a variety of landscapes. Examples to be shared will include producer testimonies on drought and flood resilience and water quality enhancement in several regions, including the Northern Plains and Midwest. Information will also be shared about conservation district engagement in the Model Forest Policy Program’s Climate Solutions University (CSU). The Western Shasta Resource Conservation District in California assembled and led a team of local stakeholders to assess forest and water resources in the county, and develop a plan for adaptation in relation to climate change.

Subject Area: Adaptive Management of Conservation Efforts*

**denotes primary author and subject area*

NACD Soil Health Team and National Outreach

Author(s): Bill Berry*, NACD

Abstract: The soil health movement in America is being propelled by outreach, education and community engagement. The National Association of Conservation Districts (NACD) and conservation partners are heavily involved in these efforts. Highlights of NACD's efforts include building a team of Soil Health Ambassadors comprised of conservation district leaders/producers from across the country. NACD has also collected or created and made available an array of materials to increase understanding of the potential of soil health measures in a variety of landscapes. NACD has conducted focus groups, webinars, workshops and forums to seek producer and partner input on soil health strategies. The association has also developed training templates and certification protocols to build technical expertise, engaged advisory bodies, and taken other steps to incorporate soil health into the ongoing delivery of conservation across the country and territories.

Subject Area: Outreach, Education, and Community Engagement*

**denotes primary author and subject area*

Diffuse Water Pollution from Agriculture and Mitigation Measures: A case study in Lincolnshire, UK

Author(s): Gueorgui Anguelov*, University of Lincoln; Isobel Wright, ; David Stainton, ; Sarah Swift, Environment Agency, Lincoln; David Hutchinson, Environment Agency, Lincoln

Abstract: Diffuse water pollution from agriculture (DWPA) has received growing attention since the 1980s, when in many countries including the UK, water quality deteriorated as a result of increasing anthropogenic impact, such as urbanization, industrialization and agricultural intensification. Amongst the most prone to pollution are limestone aquifers such as the farmland in the area of the University of Lincoln. Locally, the River Witham and its tributaries are in moderate or poor ecological condition and require water quality improvement. The important limestone and chalk aquifers throughout the Lincolnshire are at risk from nitrates and pesticides from diffuse agricultural sources. This is a particular issue for drinking water supply. This study aims to determine whether N fluxes and phosphorus (P) instabilities within farms fields of a catchment, and eventually towards the water bodies, can change with management practices under the new 2015 Common Agricultural Policy (CAP) scheme. The crop diversification (3 crop) rule, cover or companion cropping and nitrification inhibitors are some of the mitigation options that can assist farmers in implementing soil and water conservation/protection measures. Some of these practices have been put in place on the University farmland for 2014-2015. Their effectiveness in decreasing N and non-N nutrients leaching is being observed by ceramic/suction-cup samplers and water resources monitoring. The results from the initial three sampling events under four cover crops revealed that NO3-N in the soil solution is between 1 and 4 mg/l and is decreasing with time. There are differences in potential leaching between N and non-N nutrients depending on the cover crop grown. A further analysis of nutrients concentrations in soil, water and crop plants will be conducted to evaluate overall impact of mitigation measures on water quality protection.

Subject Area: Adaptive Management of Conservation Efforts*; Conservation Models, Tools, and Technologies

**denotes primary author and subject area*

Soil quality and profitability effects of conventional and conservation irrigated potato rotation systems in western Canada

Author(s): Mohammad Khakbazan*, Agriculture and Agri-Food Cana; John Huang, Agriculture and Agri-Food Canada; Frank Larney, Agriculture and Agri-Food Canada; Ramona Mohr, Agriculture and Agri-Food Canada; Nathan Berry, Agriculture and Agri-Food Canada; Drusilla Pear

Abstract: Conventional irrigated cropping systems where high value crops such as potatoes, sugar beets, and beans are produced contribute little crop residue to the soil which may have negative long-term effects such as reduced soil quality and increased erosion risk. Careful selection of crops and rotations as well as use of best management practices can have significant effects on improving soil quality, crop yields, and profitability. A 12-yr (2000-2011) study was initiated in Vauxhall, Alberta to examine the impact of crop sequences and conventional (CONV) and conservation (CONS) management practices using potatoes, sugar beets, beans, soft wheat, oats, and timothy hay on soil quality, crop yield and farm profitability. A total of 7 rotations utilizing different combinations of crops, rotations lengths (3-6 yr), and management as well as a 1-yr CONV continuous wheat rotation (used as a baseline) were included in this study. The CONS rotations used 4 specific practices not used on the CONV rotations: direct seeding/reduced tillage, fall-seeded cover crops, feedlot manure compost application, and straight cutting of solid-seeded narrow-row beans vs. conventional wide-row beans (bean rotations only). Although soil quality attributes showed the largest increases under CONS management practices, economic results indicated no significant difference among rotations except for the 1-yr continuous rotation. The 5-yr CONS rotation ranked highest for soil quality (100%) with CONV rotations substantially lower (33-37%), but the 4-yr CONV produced similar net revenue compared to 3-yr, 4-yr, and 5-yr CONS rotations. Organic C via compost addition had significant effects on soil quality attributes and was likely the main factor in improving soil quality compared to the other 3 CONS practices. Despite significant soil quality improvement under CONS practices, results showed that increased crop yields from improved soil quality was insufficient to cover increased costs.

Subject Area: Conservation Economics and Policy *; Adaptive Management of Conservation Efforts; Conservation Models, Tools, and Technologies; Soil Health Resources, Indicators, Assessments, and Management; Water Resources Assessment and Management

**denotes primary author and subject area*

A Landscape-Level Analysis to Identify Drainage Water Management Opportunities

Author(s): Jennifer Olson*, Tetra Tech; Peter Cada, Tetra Tech

Abstract: Major changes in the corn belt since the 1940s, including a shift away from small grains and forage crops to corn and soybeans and use of larger machinery, have enhanced the need for tile drainage. While artificial drainage has greatly increased crop yields while helping to reduce surface erosion, drainage may result in significant potential water quality issues including increased transport of dissolved nitrogen and phosphorus to surface waters and other hydrologic and water quality challenges. The purpose of this project was to provide relevant information on drainage water management (DWM) to inform local planning decisions and funding priorities. This US EPA Region 5 project was completed in 2014 and provided an important opportunity to develop and implement a GIS-based approach to approximate tile drained agricultural land in major watersheds (HUC-8 scale), as well as an analysis to recommend specific DWM practices including controlled drainage, constructed wetlands, bioreactors, and saturated buffers at smaller scales. DWM practice selection criteria were developed to identify the most applicable DWM practices using available spatial datasets including slope of fields, where tile drain outlets were expected, riparian vegetation, and soils. The approach was piloted in two Ohio watersheds tributary to Lake Erie and two Michigan watersheds in the Saginaw Bay watershed. The methodology and results were reviewed with local NRCS and state agency staff and limited field verification was conducted. This presentation will focus on the technical aspects of the project and resulting outcomes which included spatial representation of priority implementation areas and a DWM practice selection matrix. Key challenges and lessons learned will be discussed including recommendations for future similar studies.

Subject Area: Conservation Models, Tools, and Technologies*; Soil Health Resources, Indicators, Assessments, and Management; Water Resources Assessment and Management

**denotes primary author and subject area*

Implementing watershed conservation goals in an agricultural landscape through innovative partnerships, education, and community engagement in the Mackinaw River watershed, Illinois.

Author(s): Krista Kirkham*, The Nature Conservancy; Kent Bohnhoff, McLean County Natural Resources Conservation Service; Jackie Kraft, McLean County Soil and Water Conservation District; Rick Twait, City of Bloomington, Illinois; David Kovacic, University of Illinoi

Abstract: In many Midwestern watersheds, water quality and native habitat is often compromised from agricultural and urban impacts. Lake Bloomington and Evergreen Lake are two drinking water sources for ~80,000 people in McLean County, IL, within the Mackinaw River watershed. Although the watersheds for these reservoirs are ~90% agricultural, most of the water users are located in the cities of Bloomington and Normal. In addition, the wastewater from this urban area flows to a different watershed south of the cities. These intricacies concerning water use and discharge allow for unique partnerships to form within the county to improve water quality and reduce urban and agricultural waste in adjacent waterways. Several non-profit and governmental partners in McLean County have worked together over the years to develop plans and programs to reduce and mitigate urban and agricultural impacts while maintaining profits for farmers and water security for municipalities. Since these watersheds are largely agricultural, agencies such as the NRCS, SWCD, and The Nature Conservancy have partnered to implement agricultural conservation practices that address soil erosion and nutrient runoff from tile-drained sources using intensive outreach and financial incentives through Farm Bill programs. Local non-profit groups such as ParkLands Foundation and the Friends of EverBloom work to improve habitat around and within the lakes by purchasing and ecologically restoring high quality habitat and implementing projects that enhance the structural and biological function within the lakes. The Ecology Action Center focuses on residential awareness of urban impacts from storm water and other household water conservation programs. All of these organizations emphasize outreach, education, and community involvement in McLean County to raise awareness of local water issues to achieve the overall objective of improving water quality in the Mackinaw River watershed.

Subject Area: Outreach, Education, and Community Engagement*; Adaptive Management of Conservation Efforts; Conservation Models, Tools, and Technologies; Water Resources Assessment and Management

**denotes primary author and subject area*

Water Quality Monitoring in the Jersey Valley Watershed

Author(s): Callie Herron*, UW-Discovery Farms

Abstract: In 2010 the Jersey Valley Watershed project in southwest Wisconsin began documenting the impact of agricultural management practices on water quality. This project has created a robust dataset to help understand the relationship between edge-of-field, stream, and lake water quality. Land use is primarily agricultural, with the majority of cropland in corn and forages for dairy cattle. Average sediment loss from edge-of-field sites was 52, 85, and 247 lbs per acre for the first three years (2011-13) studied. This is less than the average of 670 lbs/acre from past Discovery Farms' sites. The average phosphorus loss from edge-of-field sites was 0.5, 0.4, and 1.1 lbs per acre from 2011-13, which is less than the Discovery Farms' site average of 2.0 lbs per acre. P losses at most sites were in the dissolved form because soil conservation practices have kept sediment losses, and thus particulate phosphorus losses, relatively low. Edge-of-field results show that nutrient management and conservation practices have resulted in both low sediment and phosphorus loss from fields. The 5,000 acre watershed empties into a 52 acre impoundment lake. Data indicates that the stream above the lake is of excellent water quality. In-stream site phosphorus data was compared with criteria set by the WI Department of Natural Resources (DNR). For 2011-2013 the stream is below the criteria (75ug /l) set by the DNR. Lake water quality monitoring began in 2012. The average summer phosphorus levels at the lake's surface exceeded the recreational use threshold set by the WI DNR (40ug/l). However, they fell below the fish and aquatic threshold (100ug/l), ranging from 52ug/L in 2012 to 63ug/L in 2013. After knowing this, several questions arise: What additional steps can be taken to improve the lake's water quality? Can impoundment lakes in the Southwest georegion of Wisconsin meet recreational use water quality standards even if all controllable factors, such as runoff and erosion, are reduced?

Subject Area: Water Resources Assessment and Management*; Adaptive Management of Conservation Efforts; Conservation Models, Tools, and Technologies; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

Assessing and building local watershed steward capacity via the NC Watershed Stewardship Network

Author(s): Christy Perrin*, Water Resources Research Insti; Michele Drostin, UNC-IE

Abstract: The North Carolina Watershed Stewardship Network (NCWSN) is a new and growing community of watershed stakeholders across North Carolina connected by our shared work to increase communication, involvement, and collaboration for healthy water bodies and clean water. The need for the network was identified in a three-pronged needs assessment of watershed professionals and volunteers across NC. The needs assessment consisted of an online, statewide survey of paid watershed professionals (n=161), seven regional focus groups with watershed volunteers (n=50), and an online statewide survey of watershed volunteers (n= 93). This needs assessment sought to 1) identify existing watershed programs and resources (i.e., staff, volunteers, funding and skills), 2) assess and document any gaps in resources and geographical coverage, and 3) better understand programmatic needs and networking opportunities. Major findings include the identification and location of relevant skill sets across NC, opportunities to partner and share skills, volunteers' motivations for getting involved, training and assistance needs, and preferences for learning new information and networking. The NCWSN was established in October 2013 by representatives of state and local governments, academic institutions, and non-profit organizations who heard the needs assessment findings and decided to take action. They determined the mission of the NCWSN is to empower more effective watershed stewardship because water is critical to economic, environmental, and community health. Efforts are guided by a steering committee, which developed a strategic plan and is developing communication, training, and networking tools for the NCWSN. This presentation will provide an overview of the needs assessment findings, and NCWSN's approach to addressing these needs in North Carolina. More information about the NCWSN is available at http://ncwatershednetwork.org/

Subject Area: Outreach, Education, and Community Engagement*; Social Sciences Informing Conservation

**denotes primary author and subject area*

Assessing the Greenhouse Gas Balance of Farming and Ranching Practices with COMET-Farm

Author(s): Mark Easter*, Colorado State University; Keith Paustian, Colorado State University; Kevin Browne, Colorado State University; Crystal Toureene, Colora; Ernie Marx, Colorado State University; Amy Swan, Colorado State University; Stephen Williams, Colorado S

Abstract: COMET-Farm is an integrated web-based decision support tool developed to aid farmers, agricultural producers, natural resource professionals, land managers and conservationists in making on-farm decisions regarding greenhouse gas emissions and carbon sequestration. COMET-Farm provides total farm/ranch greenhouse gas accounting, including cropland, pasture, range, agroforestry, livestock and on-farm/ranch energy use modules. This presentation will describe applications for using COMET-Farm in assessing the greenhouse gas benefits of conservation scenarios in livestock, cropland, and agroforestry, and will highlight recent changes in the COMET-Farm tool, including full integration with the USDA document Quantifying Greenhouse Gas Fluxes in Agriculture and Forestry: Methods for Entity-Scale Inventory.

Subject Area: Conservation Models, Tools, and Technologies*; Adaptive Management of Conservation Efforts; Conservation Economics and Policy ; Conservation in Nontraditional Agriculture; Soil Health Resources, Indicators, Assessments, and Management

**denotes primary author and subject area*

Improving Construction Site Stormwater Quality

Author(s): Richard McLaughlin*, North Carolina State Universit

Abstract: Sediment is one of the most pervasive and destructive water pollutants around the world. Preventing soil erosion has been a focus of most efforts in agricultural settings for the last century. While many of the same principles can be applied to construction sites, a fundamental difference is that these areas usually involve large-scale grading that removes topsoil and leaves disturbed subsoils exposed for long periods of time. Managing these sites to prevent sediment movement from them was federally mandated in 1972, but there is a considerable range in how states regulate them. In general, there is less emphasis on erosion prevention than sediment capture relative to agriculture. This presentation will cover research we have conducted on erosion control, sediment capture, and turbidity reduction in simulated or actual construction site conditions. Erosion control products have been evaluated for both erosion prevention and vegetation establishment on steep slopes throughout the state. There have been no clear advantages of any type of product for erosion control among straw, erosion control blankets (ECBs), and hydromulches (HMs), but grass growth was often better with a straw cover. Adding polyacrylamide (PAM) at 22-33 kg ha-1 to straw often improved erosion control. Sediment control through the use of sediment basins can be greatly enhanced with the addition of porous baffles and surface outlets, with more than 99% sediment capture being observed on one site. Recent studies have shown that changing the typical basin orientation from 2:1 length:width to 1:2 may improve sediment capture when porous baffles and surface outlets are use. Turbidity, which is often still quite high in spite of the sediment capture rate, has been reduced by >80% by passively dosing the runoff with polyacrylamide. At relatively low cost, we have demonstrated that sediment discharged in construction site runoff can be greatly reduced.

Subject Area: Conservation Models, Tools, and Technologies*; Water Resources Assessment and Management

**denotes primary author and subject area*

“I just call it practical economics – survival economics”: Understanding Nutrient Management for Improved Conservation

Author(s): J. Arbuckle, Iowa State University; Hanna Rosman*, Iowa State University

Abstract: There has been increasing focus on the environmental costs of crop production in the US Corn Belt. Commodity crop production often creates nutrient loss and soil erosion that leads to impaired local waterways and a hypoxic zone in the Gulf of Mexico. As a response, in 2012, the State of Iowa developed the Nutrient Reduction Strategy that outlines goals to reduce losses of nitrogen and phosphorus into waterways. Coinciding with this strategy, the state started the Iowa Farm Environmental Leadership Award program to recognize and publicize those who take extraordinary efforts to implement conservation practices on their farms. A major goal of the Nutrient Reduction Strategy is to help farmers to improve their nutrient management strategies. This research seeks to inform that goal by examining the question, “What are farmers’ motivations and rationale for the nutrient management strategies they implement on their farms?” In-depth interviews with a sample of Environmental Leadership Award winners were conducted over the summer and fall of 2014. The theoretical framework that guides this study is an amalgamation of innovations theory and complex adaptive systems theory to understand contextual factors that shape land stewardship. Results suggest that farmers consider nutrient management practices primarily in terms of their economic value rather than their value as conservation practices. Detailed interview data and recommendations for improved communication with farmers about nutrient management to spur enhanced soil and water conservation among Corn Belt farmers will be presented.

Subject Area: Social Sciences Informing Conservation *

**denotes primary author and subject area*

Using Tillage to Improve Post-Construction Soil Infiltration

Author(s): Richard McLaughlin*, North Carolina State Universit; Joshua Heitman, North Carolina State University; Fatemeh Mohammadshirazi, North Carolina State University

Abstract: During the process of constructing buildings and roads, the topsoil is usually removed and the subsoil graded and compacted. This results in conditions that are poor for establishing vegetation and which will generate excessive runoff similar to impervious areas. We have been studying various methods to improve soil conditions in compacted subsoils as a way to reduce runoff volumes in urban settings, with the potential to create areas which could infiltrate runoff from adjacent areas as well. An initial investigation into conventional rotary tillage and grass establishment provided a strong indication that a well-developed root system can help maintain the high infiltration rates found immediately after tillage. A 3-year study at three sites around North Carolina ensued to investigate tillage depth and amendment effects on grass establishment and infiltration rates over time. Root development and infiltration capacity was directly related to the depth of tillage, and the addition of compost or water-absorbing gel did not generally affect infiltration. However, there was some evidence that the compost provided some protection against compaction from mowers over time. Infiltration rates of 10-20 cm h-1 and higher were maintained over the 2-3 year monitoring period in the tilled subsoils. The current study underway is similar except the soil was brought in as fill and compacted, instead of topsoil removal and subsoil compaction (cut soils) used in the earlier studies. Compaction did not reduce infiltration with the fill soil compared to the cut soils, and tillage did not have as much effect. However, this may be related to soil differences or other factors. Overall, a vigorous grass cover on tilled subsoils can result in relatively high infiltration rates which can reduce the runoff volume from developed areas.

Subject Area: Conservation Models, Tools, and Technologies*; Water Resources Assessment and Management

**denotes primary author and subject area*

The Central Mississippi River Basin LTAR site infrastructure

Author(s): Edward Sadler*, USDA-ARS; Kenneth Sudduth, USDA-ARS; Robert Lerch, USDA-ARS; Claire Baffaut, USDA-ARS; Newell Kitchen, USDA-ARS; Scott Drummond, USDA-ARS

Abstract: The Central Mississippi River Basin member of the Long-Term Agro-ecosystem Research (LTAR) network is centered on the Goodwater Creek Experimental Watershed (GCEW), in place since ~1970. Since formal membership in the LTAR was confirmed, several infrastructure improvements have been made to the GCEW. The purpose of this presentation is to bring these changes to the attention of the broader scientific audience. Some improvements are simply additions to the CMRB that provide relevance to other networks, including broad-scale weather and flux networks. Some are equipment that may have utility at other research sites, including edge-of-plot flow measurement and sampling, for which this presentation will include descriptions of the methods. Changes in the collaborative network will be presented to inform others of linkages that now exist and may open opportunities at other sites. A final goal is to alert scientists to the extensive literature documentation of the web-based STEWARDS data repository of GCEW/CMRB data published in 2015.

Subject Area: Water Resources Assessment and Management*

**denotes primary author and subject area*

Power of Peers: The Effectiveness of Farmer Networks

Author(s): Aaron Pape*, Purdue University; Linda Prokopy, Purdue University

Abstract: Several formal farmer networks have emerged throughout the Midwest to address the issue of nitrogen runoff and eutrophication. In Indiana, the On-Farm Network and Adapt Network attempt to foster peer-to-peer learning that allows farmers to teach each other through their own experiences. The goal of this study is to determine the effectiveness of these formal farmer networks. The research was guided by two main questions; (1) Are farmers who participate in the networks actually implementing nutrient management practices? (2) Are participating farmers spreading their knowledge of nutrient management practices to other farmers outside the formal networks? Interviews with select network members were conducted in early 2014 and a mail survey of the 230 network members was conducted in the summer of 2014. Survey results were compared to the results of a statewide Indiana Nutrient Management Survey conducted during the winter of 2014. The results show that of four specific nutrient management practices (soil testing, variable rate application, split application, and nutrient management plans), network farmers were conducting soil tests more than other farmers, but were not more likely to be using the other practices. Nearly 75% of respondents said they talk with farmers outside the networks about nitrogen management, but only 10% see their conversations resulting in management changes. This talk will discuss ways that these networks are functioning as expected and ways that they could be improved.

Subject Area: Social Sciences Informing Conservation *; Adaptive Management of Conservation Efforts; Water Resources Assessment and Management

**denotes primary author and subject area*

Assessing the groundwater resources and estimating future demand for irrigation in three districts of Nepal

Author(s): Romulus Okwany*, Interl. Water Management Inst.; Ram Bastakoti, Int. Water Management Inst.; Sanmugam Prathapar, NSW Office of Water

Abstract: This study presents the results of an assessment of the status of groundwater resources in three districts of Nepal's Terai. We examined both potential groundwater availability and demand as a physical component of rural agricultural development. We examined historical groundwater status and modelled the likely future water use influenced by climate change and changes in cropping patterns as a result of growing agrarian economy. Climate change has been projected to lead to increased incidences of extreme rainfall events without no significant changes in precipitation received. This will result in increased flooding and droughts by causing higher incidences of flash flooding and reduced recharge to groundwater aquifers. The impact to groundwater availability is thus very complex and poorly understood as the large flows and floods may enhance recharge in some areas whereas the short duration of the floods may limit recharge in some areas. Further, the projected increase in irrigated agriculture to support the agrarian based economy of Nepal will put more demands on groundwater use and irrigation withdrawals further complicating the groundwater status. This study will thus describes the findings of case studies in three districts by evaluating the historical trends in groundwater status and modeling future pressures against an increased irrigation intensity visions of the national government policy.

Subject Area: Water Resources Assessment and Management*; Adaptive Management of Conservation Efforts; Conservation in Nontraditional Agriculture; Conservation Models, Tools, and Technologies; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

Repeated Survey of Public Attitudes Following an Extended Period of Exceptional Drought in Texas

Author(s): Diane Boellstorff*, Texas A&M University System; Drew Gholson, Texas A&M AgriLife Extension S; Scott Cummings, Texas A&M University System; Mark McFarland, Texas A&M AgriLife Extension Service

Abstract: Texas A&M AgriLife Extension Service in conjunction with a national needs assessment project initiated through the Pacific Northwest Regional Water Program has facilitated two random sample surveys of Texans to evaluate citizen awareness, attitudes and willingness to act on water issues. The first survey was conducted in 2008 at the beginning of a relatively mild drought. The drought intensified through 2009-2012 when much of the state was categorized as enduring exceptional drought. The drought has since eased, although about half of the state remains in moderate or more severe drought. The original survey was re-issued to another random sample of Texans in 2014 and represents an opportunity to investigate changes in public attitudes following extended exposure to municipal drought contingency plans and restrictions, water conservation educational programs and genuine concern, in some cases, that some communities would lose access to their water supply. From 2008 to 2014, the percentage of Texans replying that water quantity was an issue in their area increased from 47% to 61% ($p < 0.0001$). Similarly, the percentage of Texans believing that that their area would suffer from prolonged drought increased from about 52% in 2008 to 69% in 2014 ($p < 0.0001$). Although 20% of Texans in 2008 believed there was a high chance that there would be an adequate water supply to meet demands in 10 years, only 7% of Texans responded in the same way in 2014 ($p < 0.0001$). Additionally, the percentage of Texans replying that global warming would result in changing precipitation levels increased from 44% to 48%, while those replying that they did not know if global warming–related rainfall change would occur also increased from 30% to 34%. These changes in response percentages appear to have come from the response category that no global warming-related precipitation change will occur, which decreased from 26% in 2008 to 18% in 2014 ($p < 0.0001$).

Subject Area: Outreach, Education, and Community Engagement*; Water Resources Assessment and Management

**denotes primary author and subject area*

From Field to Stream: Measuring Sediment and Nutrient Losses to Demonstrate the need for Sub-Watershed Scale Conservation Planning

Author(s): Kevin Kuehner, Minnesota Dept. of Agriculture; Margaret Wagner, Minnesota Dept. of Agriculture; Heidi Peterson, Minnesota Dept. of Agriculture; Jeppe Kjaersgaard*, Minnesota Dept. of Agriculture

Abstract: The Root River watershed covers over 400,000 hectares across six counties in southeast Minnesota, and is dominated by agricultural row crop production and high livestock density. The watershed has a complex geology varying from fairly flat, deep till in the west, karst geology with shallow topsoil in the central portion to blufflands near the Root River's confluence with the Mississippi River in the east. Because of these complexities and to effectively address the more than 50 water quality impairment, there is a need to characterize the water quality and hydrology in the watershed. One objective of this study is to collect baseline land management and water quality data for sub-watershed scale conservation planning. The Root River Field to Stream Partnership (RRFSP) is supporting intensive water quality monitoring, innovative research and a cooperative approach to engage farmers and residents in the Root River watershed. Formed in 2009, the RRFSP consists of farmers, agricultural groups, conservation organizations and state agencies. The approach taken by the Partnership has been to select three sub-watersheds to represent the three geologic regions of the watershed. Since 2010, sediment, nutrient and hydrologic data have been collected in-stream at each sub-watershed outlet and at edge-of-field runoff flumes. The edge of field sites averaged 17 surface runoff events per year, of which 44% of the runoff volume occurred during frozen soil conditions. Runoff amounts were highly variable by site year. For instance in 2013, 15-25% of the annual precipitation resulted in runoff while in 2012 the amount was less than 2%. The results from the monitoring, along with LiDAR based analysis tools will be used to inform the placement of conservation practices. Through outreach activities and one-on-one meetings the results are discussed with farmers, landowners, fertilizer dealers and water managers to promote an advanced level of conservation planning and delivery.

Subject Area: Adaptive Management of Conservation Efforts*; Conservation Models, Tools, and Technologies; Outreach, Education, and Community Engagement; Water Resources Assessment and Management

**denotes primary author and subject area*

Evolution of Soil Surveys: From County Datasets to a Regional Approach

Author(s): Debbie Anderson*, USDA-NRCS; Greg Taylor, USDA-NRCS; Charles Ferguson, USDA-NRCS; Dan Wing, USDA-NRCS

Abstract: Soil surveys have been ongoing for over 100 years in the United States. Much of the initial mapping has been completed on a county by county approach. Soil science is a dynamic field and our knowledge and expertise is constantly evolving. Soil surveys did not end with the field mapping. Currently, we are evaluating and documenting what was learned in the initial phase on a subset basis to re-correlate soils to a modern concept and dissolve political boundaries. Soils do not change at a county or state boundary, but flow across Major Land Resource Areas (MLRA). The soil survey database is being updated and the interpretations improved to provide more consistent reports for users of soil survey information. Soil survey activities are still critical in our land use decisions and management.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*; Conservation Models, Tools, and Technologies; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

Conservation Agriculture with High Tunnels

Author(s): Don Immanuel Edralin*, NCATSU; Manuel Reyes, North Carolina A&T State University; Godfrey Gayle, North Carolina A&T SU; Kieu Le, North Carolina A&T State Unive; Dat Tran, NCA&T; Alexander Joyce, NCATSU

Abstract: Unheated High tunnel structures have the potential to regulate cold during winter and spring seasons and thus can serve as a good environment for growing vegetables off-seasonally. The practice of Conservation Agriculture (CA), which is a combination of minimum soil disturbance, continuous mulch and diverse species rotation, could also improve the soils ability to retain moisture and nutrients and prevent the soil from being scorched from intense heat. The performance of vegetables under unheated high tunnels and CA was tested under sandy soil condition in North Carolina. This presentation shows that summer squash and tomatoes can be grown earlier inside tunnels compared to outside and also collard greens and mustard greens can be grown late fall and during winter season due to high tunnels.

Subject Area: Adaptive Management of Conservation Efforts*; Soil Health Resources, Indicators, Assessments, and Management

**denotes primary author and subject area*

Estimation of the crop-tillage choices with aggregate data: an application to modeling conservation tillage frequency

Author(s): Lyubov Kurkalova*, North Carolina A&T State Univ; Dat Quoc Tran, North Carolina A&T State University

Abstract: Conservation tillage (CT) is a method of soil cultivation that leaves at least 30% of the soil surface covered by the previous year crop residue. Continuous conservation tillage, i.e., a farming system in which CT is practiced for several years in a row, is known to contribute to soil organic matter and nutrient availability, water retention, macro-invertebrate activity and soil carbon sequestration. However, even a single year of conventional tillage in between the years of CT releases most of the accumulated carbon back to atmosphere. Despite a large literature studying CT, little is known about the time patterns of farmers' tillage choices. To address this gap, we propose a first order Markov process model in which farmers' yearly crop-tillage choices are classified into 4 alternative states based on the cropping pattern in the state of Iowa: CT tillage corn, conventional tillage corn, CT soybeans, and conventional tillage soybeans. The major goal of the study is to estimate the 4 by 4 matrices of transition probabilities, i.e., the probabilities of transition from one crop-tillage category to another crop-tillage category, for each county. We assume that transition matrix remained unchanged for the years 2002-2004 and use the cross-entropy approach to estimate the matrices by using a combination of state-total data on crop and CT areas available from the U.S. Department of Agriculture, and the 2002 and 2004 county-level data from Conservation Technology Information Center. Consistent with anecdotal evidence, we find that tillage and crop choice dynamics are closely linked: conservation tillage corn has only a 5.9% chance of remaining in the same state next year, but a 77.7% chance of becoming conservation tillage soybean next year. Our findings underscore the importance of crop rotation considerations if a conservation policy goal is to promote a continuous rather than intermittent use of conservation tillage.

Subject Area: Social Sciences Informing Conservation *; Conservation Economics and Policy

**denotes primary author and subject area*

Texas Well Owner Network: Protecting Groundwater Resources and Human Health

Author(s): Drew Gholson*, Texas A&M AgriLife Extension S; Diane Boellstorff, Texas A&M University System; Ryan Gerlich, Texas A&M AgriLife Extension Service; John Smith , Texas A&M AgriLife Extension Service; Mark McFarland, Texas A&M AgriLife Extension Service

Abstract: Over 1 million private water wells in Texas provide water to citizens in rural areas and increasingly to those living in small acreages at the growing rural-urban interface. Private well owners are independently responsible for all aspects of their water well system including monitoring the water quality, maintenance, and responding to water quality or water quantity problems. To support this need to educate private well owners, the Texas Well Owner Network (TWON) was initiated as a partnership between Texas A&M AgriLife Extension Service and the Texas State Soil and Water Conservation Board. 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 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. 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 fecal coliform bacteria. 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.

Subject Area: Outreach, Education, and Community Engagement*; Water Resources Assessment and Management

**denotes primary author and subject area*

Options to Address Nutrient Pollution from Agricultural Drainage

Author(s): Jan Goldman Carter*, National Wildlife Federation; Lara Bryant, National Wildlife Federation

Abstract: Artificial drainage, commonly referred to as tile or surface drainage, has intensified in the Midwest in the latter half of the 20th century. Drainage allows for higher yield and productivity on wet soils, serving as an incentive to convert land and wetlands that were considered marginal into cropland. While drainage has been a profitable practice for farmers, studies show that it can be a major factor allowing increased levels of nutrient pollution to waterways. Its contribution to freshwater and saltwater eutrophication and hypoxia is especially problematic in the highly-agricultural Mississippi River Basin (MRB). Current policy approaches that rely entirely on voluntary conservation are not going far enough to increase adoption of best management practices (BMPs), but there are numerous political, cultural, and economic barriers to achieving the necessary level of conservation. We will examine this problem from different angles and recommend some high-level pathways to counter the negative effects of artificial drainage. First, we will examine a number of BMPs recognized as being effective at nutrient pollution in a tile-drained system, and discuss each in terms of their adoption status, cost, water quality impact, advantages, and disadvantages. We will also compare several policies aimed at reducing nutrient pollution for their advantages and disadvantages, and possible applicability to tile-drained systems. We will present several promising ideas that are worthy of further development.

Subject Area: Conservation Economics and Policy *; Water Resources Assessment and Management

**denotes primary author and subject area*

A Synthesis of the NIFA Water Portfolio: Early Lessons and Future Directions

Author(s): Linda Prokopy*, Purdue University; Mike O'Neill, University of Connecticut; Sarah Church, Purdue University; Laura Esman, 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. This talk will present preliminary results of a survey distributed to Principal Investigators of funded projects. We report on 1) how Principal Investigators characterize success of each project, 2) how knowledge generated from projects is translated to end-users, 3) the extent to which funded projects achieved NIFA and USDA goals and priorities, and 4) whether and how synergies were built between and among projects in the NIFA portfolio. We will also discuss future directions for this synthesis project. This study contributes to the understanding of the impacts of the NIFA Water Portfolio, including how knowledge is translated to end-users, identification of measurements of success, and whether multiple NIFA funding streams have been used in a coordinated fashion to achieve NIFA and USDA goals.

Subject Area: Social Sciences Informing Conservation *; Adaptive Management of Conservation Efforts; Outreach, Education, and Community Engagement; Water Resources Assessment and Management

**denotes primary author and subject area*

Mycorrhizal Fungi in Soil Health Paradigm

Author(s): Zahangir Kabir*, USDA-NRCS; Dennis Chessman, USDA-NRCS; Kay Joy Barge, 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 it 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 will be discussed.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*; Adaptive Management of Conservation Efforts; Water Resources Assessment and Management

**denotes primary author and subject area*

Image processing and GIS techniques for assessing agroforestry practices

Author(s): Dacia Meneguzzo*, U.S. Forest Service; Greg Liknes, U.S. Forest Service

Abstract: Windbreaks were planted across the central United States in the 1930s under the auspices of the Prairie States Forestry Program as a strategy for controlling wind-driven erosion during the Dust Bowl era. These windbreaks and other agroforestry practices (e.g., alley cropping, silvopasture) serve a variety of ecological functions on the landscape. Yet there is no coordinated, long-term interstate program to monitor the location and status of these resources. In response to the U.S. Department of Agriculture (USDA) Strategic Framework for Agroforestry, the Forest Inventory and Analysis program of the USDA Forest Service is developing methods for monitoring trees in agroforestry practices and trees found in narrow riparian corridors. We discuss techniques for mapping tree cover in agricultural landscapes from high resolution aerial and satellite imagery using study areas in the central Great Plains. Specifically, we cover approaches for classifying land cover on images acquired during different times of the growing season. In addition, we discuss GIS-based methods for distinguishing “working trees”, such as riparian tree cover and agroforestry practices, from larger contiguous blocks of forest as well as techniques for categorizing their ecosystem functions. We believe these developments will serve as valuable tools for the inventory and monitoring of agroforestry resources.

Subject Area: Conservation Models, Tools, and Technologies*; Conservation in Nontraditional Agriculture; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

Iowa farmers' willingness to take action in support of nutrient reduction strategy goals

Author(s): 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. Because agriculture is the primary source of nutrient-related water quality impairment in Iowa, a critical first step in the implementation process was to ascertain farmers' perspectives on the strategy. In spring 2014, 1,128 Iowa farmers were surveyed to measure their knowledge of the strategy, their attitudes and concerns toward it and its goals, and, importantly, their willingness to take action to help meet those goals. A regression analysis was conducted to evaluate factors that influence farmers' willingness to take steps to support the strategy. Results showed that the most important positive predictors of willingness to take action were awareness of and concern about water quality issues. Greater knowledge about the strategy was also a positive predictor. Levels of concern about potential economic costs of action were negatively associated with stated willingness to act. Farm size, crop diversity, percent of land rented, and farmer age were not significant predictors of willingness to act in support of the strategy. Results suggest that outreach should focus on raising awareness of agriculture's impacts on water quality while addressing farmer concerns about the costs of nutrient reduction practices.

Subject Area: Social Sciences Informing Conservation *

**denotes primary author and subject area*

Soil and Crop Management influences on Soil Physical Quality of Sanborn Field

Author(s): Evren Cetin, Univ of Missouri; Clark Gantzer*, University of Missouri; Stephen Anderson, University of Missouri; Allen Thompson, University of Missouri; Randall Miles, University of Missouri

Abstract: Soil water is often the most limited factor for plant growth and yield, causing plant available water to be the best indicator of soil quality. This study explores how soil and crop management influences soil physical quality, by using soil samples from ten long-term historical plots of Sanborn Field, and determining Dexter's S-Index of soil physical quality. The soil water characteristic curve, soil organic matter, bulk density, soil strength, aggregation, and texture from plots of continuous corn, wheat, timothy, and a rotation of corn, wheat, and red clover both with and without application of farmyard manure cultivated for 126 years will be presented. We hypothesize that the soil from the continuous timothy plots will have the highest soil physical quality as indicated by the S-Index, followed by the corn-wheat-red clover rotation, wheat, and corn. We also hypothesize that application of farmyard manure will significantly improve soil physical quality more than full fertility without manure.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*; Conservation Models, Tools, and Technologies; Water Resources Assessment and Management

**denotes primary author and subject area*

Nuts & Bolts of Crop Rotation Planning: Finding the Data Necessary to Make Informed Decisions

Author(s): Jeremy Bunch*, Shepherd's Grain

Abstract: One key element of conservation agriculture is proper crop rotation planning. This planning relies on numerous sources of data and information that is available in different forms. Gathering all of the necessary information to make informed crop rotation management decisions is an in-depth exercise, and knowing where to start is half the battle. This talk will focus on presenting tools that will assist in making crop rotation decisions, including discovering farm soil types, soil water holding capacity, annual rainfall, growing degree days, first and last frosts, and other basic climate factors. From there knowledge of specific crops should be explored, and this presentation will look at how to analyze what crops are regionally appropriate for a specific locale. This will include looking at what crops will grow and mature in the particular climates, how the native vegetation of those climates presents a template for rotational planning, and how water use efficiency is maximized in crop rotations. This presentation has two goals: 1. To lay out key elements of sustainable crop rotational planning, and 2. To present tools that will assist that planning process.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*; Conservation Models, Tools, and Technologies; Water Resources Assessment and Management

**denotes primary author and subject area*

Incorporating bioenergy in sustainable landscape designs: a discussion of bioenergy's potential role in conservation from two DOE workshops.

Author(s): Maria Negri*, Argonne National Laboratory; Virginia Dale, Oak Ridge National Laboratory

Abstract: To fulfill the Energy Independence and Security Act of 2007, the deployment of cost-competitive, environmentally sound, and socially acceptable bioenergy sources is required. Sustainable bioenergy is that which effectively addresses impacts to water quality and quantity, soil quality, land use change, greenhouse gas emissions, provides for economic livelihood and is socially acceptable and equitable. If properly deployed, lignocellulosic bioenergy crops, and particularly perennial crops, may provide important ecosystems services on the landscape. The use of landscape design principles has been proposed to integrate bioenergy into existing agricultural and forestry systems to enhance conservation, social wellbeing and economic productivity in the face of limited land and water resources. The Department of Energy's Bioenergy Technologies Office convened two workshops in 2014 to explore the current state of the science, priority research needs, and methods for the implementation, demonstration, and monitoring of landscape designs for bioenergy across the supply chain and across sustainability metrics. Workshop discussions concluded that involvement of all stakeholders is critical, a higher systems view is necessary when considering landscape options, and attention must be paid to what is doable. They pointed also at the need to address current risks and problems inherent to growing bioenergy crops and adopting landscape designs, at the importance of developing markets and supply chains, at the need for policy to support the production of bioenergy and ecosystems services, and at the need to build on existing knowledge to develop advanced tools to design and monitor at scale. Proposed activities include the development of case studies and the promotion of partnerships between the research community, farmers, markets, and those who value conservation. An inclusive process of communication will ultimately deliver solutions that are both achievable and acceptable.

Subject Area: Conservation in Nontraditional Agriculture*; Conservation Economics and Policy ; Conservation Models, Tools, and Technologies; Soil Health Resources, Indicators, Assessments, and Management; Water Resources Assessment and Management

**denotes primary author and subject area*

Improved Bioreactor Management through Monitoring of Potential Contaminants

Author(s): Keegan Kult*, Iowa Soybean Association; Robert Hudson, University of Illinois at Urbana-Champaign; Mark Dittrich, Minnesota Department of Agriculture

Abstract: Denitrifying bioreactors have been identified as an effective tool for reducing the load of nitrate-N delivered to streams from subsurface agricultural drainage systems in the Upper Midwest. Bioreactors are belowground cavities filled with wood chips through which subsurface drainage water is routed. The water-saturated, carbon-rich environment makes them optimal for supporting denitrifying bacteria, spurring rapid denitrification. Bioreactors have a low cost per pound of nitrogen removed compared to other practices. Advantages of bioreactors include that a minimum amount of land is taken out of production and they can be retrofitted to existing drainage systems. A disadvantage to bioreactors is that there is a finite amount of carbon and if not managed properly, bioreactors can produce undesirable environmental byproducts due to ancillary redox processes. It is important that managers be aware of conditions that minimize the production of contaminants, so a decrease in the load of nitrate-N reaching surface waters does not come at the expense of other water and air quality concerns. The purpose of this project was to monitor the potential byproducts and document conditions which generate the highest production. Byproducts monitored were methylmercury (a neurotoxin that bioaccumulates in fish), dissolved organic carbon (a cause of oxygen depletion in streams), and nitrous oxide (a greenhouse gas). Collaborators monitored denitrification as well as production of contaminants to guide the adaptive management of residence time within the bioreactor, as well as bioreactor design. Residence time can be manipulated by the stop logs within the control structures. Initial results indicate that the potential for production of methylmerury, DOC, and nitrous oxide exists, but can be effectively minimized to acceptable amounts through proper bioreactor design and effective management. The project was funded through an USDA-NRCS Conservation Innovation Grant.

Subject Area: Adaptive Management of Conservation Efforts*; Water Resources Assessment and Management

**denotes primary author and subject area*

Scientific Basis for Soil Health

Author(s): Charles Honeycutt*, USDA-NRCS; Bianca Moebius-Clune, NRCS; David Lamm, USDA-NRCS

Abstract: Improving soil health allows us to simultaneously improve water quality, increase soil water availability, enhance resilience to extreme weather, enhance nutrient cycling, increase carbon sequestration, provide wildlife habitat (including pollinators), enhance rural economic opportunity, and meet the food production needs of a rapidly growing population on a shrinking available land base. Consequently, USDA's Natural Resources Conservation Service has developed and launched an integrated campaign to increase the adoption of Soil Health Management Systems (SHMS) among America's farmers and ranchers. A fundamental focus is ensuring the scientific basis for the conservation practices and recommendations to enhance soil health that are pertinent to a range of cropping systems, climates, landowner objectives, and others. Research results will be presented that provide that basis.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*; Adaptive Management of Conservation Efforts; Conservation Economics and Policy ; Conservation Models, Tools, and Technologies; Water Resources Assessment and Management

**denotes primary author and subject area*

Agricultural Water as a Potential Source of Bacterial Contamination to Fresh Produce: A Rainfall Simulation Study

Author(s): Fawzy Hashem*, University of Maryland Eastren Shore

Abstract: Pathogenic bacteria in water used for irrigation or in runoff are potential sources of contamination contributing to foodborne illnesses from consumption of raw produce. This study was conducted to compare the impact of different manure types on the bacterial quality of runoff water over a 1-month period. Simulated rainfall events were conducted at weekly intervals in runoff boxes packed with Othello soil and amended separately with various manure types with five replicated (n=5) treatments: surface applied=1) dairy manure slurry, 2) poultry litter (feces+sawdust), 3) poultry manure (feces only), 4) fertilizer (control), and incorporated=5) poultry litter. Simulated rainfall using non-chlorinated well water delivered approximately 7 cm h^{-1} to boxes at a 3% slope and lasted for 40 min with a coefficient of uniformity >0.83 within a 2x2 m area directly below the nozzle. Runoff was collected via a gutter positioned at the lowest edge of each runoff box. Sub-aliquots of runoff samples (150mL) were analyzed for total coliforms and E. coli by standard IDEXX Quanti-tray2000. No E. coli O157:H7 or Salmonella were recovered from any treatments in this study using selective/differential agar plating and BAX-PCR. Results showed that concentrations of E. coli in runoff of all manured soils were significantly greater than those from fertilizer-amended control soil. Concentrations of total coliforms and generic E. coli in runoff varied by treatment and by week with decreasing concentrations by week 4 for all treatments except dairy slurry and poultry manure. Concentrations of generic E. coli in broadcast poultry litter and dairy manure were significantly greater in week#2 runoff than in other weeks. Incorporation of poultry litter consistently and significantly reduced E. coli concentrations in runoff after week#2. These results indicate the benefits of incorporation of poultry litter in reducing E. coli from manured sandy loam Othello soil runoff over a few weeks.

Subject Area: Water Resources Assessment and Management*; Soil Health Resources, Indicators, Assessments, and Management

**denotes primary author and subject area*

Introducing the new NRCS Soil Health Division

Author(s): Bianca Moebius-Clune*, NRCS; Charles Honeycutt, USDA-NRCS; Diane Stott, USDA/NRCS; David Lamm, USDA-NRCS

Abstract: Widespread adoption of soil health management systems has the potential to result in continental-scale, systemic improvements in environmental factors, farm resilience and productivity, as well as profitability. Concentrated efforts to improve soil health will thus provide significant return on the nation's conservation investment. The new NRCS Soil Health Division was initiated to leverage resources, skills, technology, and partnerships nationally to facilitate increased implementation of science-based, effective, broad-acreage soil health management systems on the nation's diverse agricultural lands. NRCS educational, technical, and financial assistance programs will be expanded and adjusted to implement key functions of the new Soil Health Division. These functions will include efforts to provide advanced soil health technical training and education to stakeholders, to standardize and increase the use of publicly available soil health testing that leads to result-informed soil health management recommendations, to guide soil health management planning and implementation, and to monitor and adapt services for sustained, long-term adoption. Planned Soil Health Division activities and potential opportunities for collaboration will be discussed.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*; Adaptive Management of Conservation Efforts; Conservation Economics and Policy ; Conservation Models, Tools, and Technologies; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

The Evolution of a Local Soil and Water Conservation District - From Traditional Technical Assistance and Program Funding to Environmental Regulatory Enforcement

Author(s): Danon Lawson*, Gaston Natural Resources Dept.

Abstract: One of the greatest threats to soil stability in many areas throughout the country is its loss through accelerated water erosion. Rapid development and an ever changing terra have created a formula for increased soil loss on delicate highly erosive landscapes through stormwater transport. Through overseeing the installation and management of BMPs and SCMs, regulatory agencies can effectively reduce the pollution of offsite sedimentation. In addition, agricultural incentives for installing land stabilizing practices are equally effective in the rural community. With a shift in dynamic, a largely rural county in southern North Carolina illustrates the challenges of population explosions in the rural Southeast. Gaston County, lying just to the west of the city of Charlotte, has experienced exponential population and development growth within the last several decades. With a transition from rural agricultural land to a more developed county, the role of the local Soil and Water Conservation District has become a pivotal one, gradually evolving into an agency challenged by balancing both traditional assistance and a new role in the field of soil and water regulation. Under the authority of the State of North Carolina, The Gaston Soil and Water Conservation District currently operates a local erosion control program, and regulates post construction stormwater for most of the county. At the same time, the Gaston SWCD continues to maintain the traditional role of technical and financial assistance to rural and urban landowners that has long been the foundation of Conservation Districts. In this presentation, Gaston SWCD staff would like to illustrate not only the fundamental adaptation this particular district has undergone, but how local districts in general can effectively engage with citizens and provide necessary resources to greatly improve water quality and reduce soil loss in their communities.

Subject Area: Outreach, Education, and Community Engagement*; Water Resources Assessment and Management

**denotes primary author and subject area*

A Protocol for Continuous Improvement Plans to Enhance Water Quality Protection

Author(s): Tom Simpson*, Simpson; Ron Korcak, Korcak

Abstract: Farmers are being asked to reduce nutrient losses but may not know needed reductions or how to best achieve them on their farm. To address this, we developed protocols for an assessment, verification and Continuous Improvement Program (CIP) while at Water Stewardship, Inc. (WSI). A farmer confidentiality agreement is signed to protect farm specific information. Information is reviewed and a farm walkover conducted to verify existing practice implementation and identify issues and opportunities for improvement. WSI's Nutrient Load Estimator software is used to estimate reductions for both existing and recommended BMPs. A CIP is drafted and discussed with the farmer. After agreeing on practices to implement over a 3-year CIP cycle, the farmer and WSI sign the CIP as a symbolic commitment to action. CIPs have been developed on over 200 farms, primarily in the Virginia Shenandoah Valley using grant funds. Farmers supported the CIP process as it offered private water quality assessments with future recommendations. The semi-quantitative reduction estimates for practice implementation were better received and used than expected. Farmers often shared CIPs with SWCDs to request assistance. A CIP reassessment was conducted for an early farmer group in the program. We found many farmers had implemented CIP recommended practices. Implementation number and intensity varied with cost and extent of changes but farmer commitment to the process was better than anticipated. The work also created a confidential database to better understand the current farm situation, what farmers will consider, needed incentives and practices unlikely to be adopted voluntarily. Funding remains an issue as CIPs cost $10-20/A to develop and updates cost about $500 per farm. Experiences and lessons learned from this program offer a farmer accepted protocol for verified continuous improvement that could increase accountability and better engage the private sector in achieving water quality goals.

Subject Area: Conservation Models, Tools, and Technologies*; Adaptive Management of Conservation Efforts

**denotes primary author and subject area*

The Perfect Storm: Nitrate concentrations in the Midwest in a wet year following the drought of 2012

Author(s): Jeffrey Frey*, USGS; Peter Van Metre, USGS; Wesley Stone, USGS

Abstract: In 2013, the U.S. Geological Survey (USGS) and the U.S. Environmental Protection Agency (USEPA) collaborated to assess stream quality across the Midwestern U.S. The goal of this effort, the Midwest Stream Quality Assessment (MSQA), was to characterize water-quality stressors—contaminants, nutrients, sediment, and habitat—and ecological conditions in streams throughout the Midwestern U.S. From early May through early August 2013, 100 stream sites were sampled every 7-10 days (12 samples total per site) to characterize water quality. Sites were selected to maximize an agricultural intensity gradient. At the end of this collection period, ecological surveys were conducted at all sites and sediment chemistry and toxicity were tested. The occurrence and distribution of nitrate concentrations were evaluated as well as the environmental factors affecting nitrate occurrence. Coincidently, wet conditions in the spring of 2013 followed a drought in 2012 in much of the Midwestern U.S. "Cornbelt" producing prime conditions for nutrient transport. The highest nitrate concentrations were found in surface-water samples from Iowa, southern Minnesota, and western Illinois. The highest nitrate concentration detected was 41.8 mg/L as nitrogen (N) in an Iowa stream and 21 streams averaged more than 10 mg /L as N for the 12 samples. Nitrate concentrations were higher in the western part of the study area compared to the eastern area. A comparison of historical data found that nitrate concentrations were higher in 2013 in the western states in the sampled region. However, nitrate concentrations in Iowa and southern Minnesota were 3-5 mg/L as N greater than other Cornbelt states in 2013 and historically, suggesting that differences in wet and dry years was not the only factor. A multiple regression analysis identified that the amount of corn grown in the watershed accounted for 64 percent of the variability for the study sites.

Subject Area: Water Resources Assessment and Management*; Soil Health Resources, Indicators, Assessments, and Management

**denotes primary author and subject area*

Support people, the planet and increase profit through using organic soil conservation practices

Author(s): Ib Hagsten*, IOIA

Abstract: When producers manage their land organically, per NOP standards, their soil conservation practices support people, the planet, and profit in the fast-growing, well-regulated niche of nonconventional agriculture. When managed organically, soil supports the health of the people thru absence of commercial fertilizers, herbicides, pesticides, GMO's. Increased presence of vitamins, minerals, nutrients, antioxidants, come from the soil by a healthy microcosm and reduced contamination of mycotoxins (up to 300%). Soil organically managed improves the planet through land stewardship where organic soils excel in carbon sequestration, nitrogen fixing, microbial biomass, active enzymatics, and micronutrient assimilation that optimizes soil health, nutrient retention, improve bio-availability for plant synthesis, enhanced water-holding capacity (up to 25%), and root colonization by mycorrhizal fungi. Added soil health-improving feature of organic management is heightened biodiversity that provides habitat, and food sources for essential, life-enhancing pollinators. When managing the soil organically, there is significant profit potential (avg. 30%) for farmers who cultivate the land to promote a diversity of soil microorganisms, while using cover crops to reduce erosion, improve subsequent crop yield by avg. 12%, to grow foods appreciated by their farmers market customers, up-scale restaurant buyers, and wholesale purchasers, who appreciate the extended shelf-life provided by the use of these attentive growing methods. Organic production is a fast-growing segment of U.S. agriculture (~20% increase) where customers show that they understand organically-grown produce, the independent verification of operations, improved nutritional value (3-10 fold greater), and replenishment of the underlying biosphere, which means the farmer-steward providing the labor/inputs justifiably derives a profit for the effort.

Subject Area: Conservation in Nontraditional Agriculture*

**denotes primary author and subject area*

Systematic Analyses of Erosion, Wtaer Quality and Air Quality by12 KM Grid for the U.S.

Author(s): Verel Benson*, Benson Consulting

Abstract: In this study, we estimate the NH3 emission from the agricultural fertilizer application in the U.S. using an agricultural fertilizer modeling system coupling a regional air quality model (the Community Multi-Scale Air Quality model, CMAQ)and an agro-ecosystem model (the Environmental Policy IntegratedClimatemodel, EPIC), which improves the spatial and temporal resolution of NH3 emission from this sector. EPIC also estimates Wind and Water erosion and water quality impacts of alternative management systems. Soils data, NRI crop/soil linkage, national fertilizer sales data, Agricultural Census data, crop characteristics, and GIS land use data are combined by a series of programs that use weather data and process modeling to create a system of 247,000 EPIC simulations. Results are summarized in GIS maps. The system is available on a University of North Carolina website for public use.

Subject Area: Conservation Economics and Policy *; Soil Health Resources, Indicators, Assessments, and Management

**denotes primary author and subject area*

Soil Quality Assessment in urban gardening: Trace Metals and Phosphorus

Author(s): Tolessa Deksissa*, UDC; Yacov Assa, UDC; Sebhat Tefera , UDC

Abstract: As the availability of vacant lots and abandoned properties is one of the driving forces for the expansion of urban gardening, potential contamination with trace metals and excess nutrient inputs is presenting a unique challenge. The objective of this study is to assess the soil quality of home and community gardens in the District of Columbia and explore the potential impacts of this practice on the health of the gardeners and the environment. Last summer, we collected soil samples from home and community gardens analyzed for extractable macro and micro nutrients and trace metals using Inductive Couple Plasma Mass Spectrophotometer. Based on the selected soil quality parameters such as phosphate, arsenic and lead, we assessed the potential impact of urban gardening. Based on soil quality data of 142 samples from community gardens and 257 samples from home gardens, 87% of the samples have medium to excessive phosphate level. Thirty percent of the community gardens and 52% of home gardens have a pH level less than 7, which is acidic. Furthermore, 34% of samples from the community garden and 26% of the samples from home gardens exceeded the EPA soil screening level 0.4 mg/kg in arsenic. Low soil pH level with excess phosphorus can result in nutrient leach off and ultimately contaminate water bodies. Acidic soil with high level of lead and Arsenic may cause contamination of fresh produce as well as waterways. For other trace metals, the overall quality of urban gardens shows that most samples are below the EPA soil screening level. Using ArcGIS 10.3, spatial analysis and geo-referenced results will be presented. For sustainable urban gardening, the urban gardening practice requires frequent monitoring and guidelines to overcome its unique challenges.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*; Conservation in Nontraditional Agriculture

**denotes primary author and subject area*

Particulate Phosphorus Removal in Piedmont Stormwater - a Mechanistic Model based on Continuous Particle Size Distribution, Implications for BMP's

Author(s): Mark River*, Duke University; Curtis Richardson, Duke

Abstract: Particulate phosphorus (PP) is often the largest component of the total phosphorus load in stormwater. In highly-weathered landscapes such as the Piedmont, much of this PP is sorbed to iron oxide coatings on clay particles. Fine-resolution measurement of particle sizes allows us to investigate the mechanisms behind the removal of this PP in stormwater BMP's, since the diameter of these particles determines both their settling velocity and the amount of phosphorus sorbed to them. In this paper, we utilize laboratory settling experiments along with flow imaging particle analysis technology to investigate particle settling mechanisms and the relationship between PP and the individual particles in North Carolina Piedmont stormwater. Our model simulations and lab experiments show that the rate constant (k) for PP removal progressively decreases over time and that the rate of decrease is determined by the particle size distribution; this is in contrast to commonly used first-order decay models of phosphorus removal which assume a constant k value.

Subject Area: Conservation Models, Tools, and Technologies*; Water Resources Assessment and Management

**denotes primary author and subject area*

Payments for Hydrologic Environmental Services and Environmental Perceptions of Forest ladnowners of the Iztaccihuatl – Popocatepetl Region in the State of Puebla, Mexico

Author(s): Angel Bustamante Gonzalez*, Colegio de Postgraduados; Diego Martinez Cruz, Consultores en Ingeniería Ambiental; Samuel Vargas Lopez, Colegio de Postgraduados

Abstract: In the Iztaccihuatl –Popocatepetl region, in the State of Puebla, Mexico, the National Forestry Commission has paid since 2003 to the voluntary forest landowners for maintaining the Hydrological Environmental Services (HES) by maintaining the forest intact and by promoting soil conservation and restoration practices. Forest cover changes are assessed using satellite images and visual field assessment, but little attention has been paid to the economic and social impacts of the program. This study aims to assess perception of the PHES impacts on the participant and non-participant forest landowners. A questionnaire with 22 items measuring landowner perception on awareness of the importance of forest conservation, environmental forest problems, PHES perceived benefits and intend of participation in conservation programs, and willingness to offer hydrological environmental services to downstream communities was administrated to landowner participants and non-participants in the PHES. A Mann Whitney U test was used to compare the responses of both landowners groups. Participant landowners tend to emphasize economic forest value over forest conservation, they intend to participate in conservation programs only if they obtain an economic benefit, and are aware that they are in position to provide hydrological environmental services to downstream communities. Non-participants landowners tend to emphasize non-use value over use value, they are aware of forest perturbation, and they are willingness to participate in conservation programs even if they were not paid to do so. Both groups believe that the forest resource is inexhaustible. The study provides evidence indicating that the PHES has influenced the landowner perception on the value of forest resources and hydrological environmental services, promoting the perception that both have an economic value and can be traded.

Subject Area: Conservation Economics and Policy *; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

Early Season Rainfall for Quantifying Agronomic Risk in Nitrogen Management

Author(s): Peter Kyevryga*, Iowa Soybean Association; Patrick Reeg, Iowa Soybean Association; Tristan Mueller, Iowa Soybean Association; Chris Anderson, Iowa State University

Abstract: Large unpredictability related to corn nitrogen (N) management across the Midwest can be attributed to early season rainfall and N losses. The challenge is to quantify the rainfall impact on the risk of over or under fertilizer applications during and by the end of the growing season. Farmers participating in local groups in Iowa collect feedback information from their fields needed to quantify these risks. We will demonstrate a tool developed based on the data of the end of season corn N status from 3500 famers' corn fields across Iowa evaluated using late-season aerial imagery and corn stalk nitrate test between 2006 through 2014. The tool uses site-specific June or April through June monthly rainfall observations to predict the risk of deficient or excessive corn N status. The input information required is timing and form of N, total N rates applied and previous crop. The estimated risk values of deficient or excessive corn N status can be used to play various before in-season "if what scenarios analysis" for different amount of observed or historical rainfall for a given area. The process of collecting feedback information or so-called "annual N Check-up", engages growers and agronomists in dynamic, participatory learning about complex effects of management practices and rainfall variability on the risk in N management. The risk tool can be used in nutrient, manure, 4R management planning or calibrating crop and soil models.

Subject Area: Conservation Models, Tools, and Technologies*; Adaptive Management of Conservation Efforts

**denotes primary author and subject area*

Sensitivity and stability of Iowa Daily Erosion Project 2 to variable landscape and rainfall intensity

Author(s): Victoria Scott, Iowa State University; Brian Gelder, Iowa State University; Daryl Herzmann, Iowa State University; David James, ARS-USDA; Richard Cruse*, Iowa State University; John Laflen, Iowa State University; Dennis Flanagan, USDA-ARS; Jim Frankenberg

Abstract: With the release of the Iowa Daily Erosion Project (IDEP) 2.0 model, more comprehensive and dynamic estimates of sediment delivery, soil erosion, and hill slope runoff are available for agricultural land areas across Iowa. The integration of highly spatial and temporally resolute precipitation and climate data, spatially variable soil properties from current SSURGO information, remotely sensed crop rotation and residue management data, and increased spatial resolution of runoff and erosion estimates (elucidated from approximately 300,000 complex, 3-meter LiDAR elevation modeled hillslopes statewide) affords the opportunity to test components within the model that influence output stability of field-scale erosion event estimates. Discussion of the methods used to test the proper number of flowpath estimates within a watershed to obtain output stability of this WEPP-based model--as well as the appropriate effective length of those flowpaths randomly selected from the flow network generated per HUC 12 will be key points of the presentation. Impacts of these variables on model robustness will be discussed, with respect to outputs across plausible landscape and climatic ranges. Understanding these areas of sensitivity is paramount as work begins to expand the use of the existing technology into surrounding Midwestern states.

Subject Area: Conservation Models, Tools, and Technologies*; Adaptive Management of Conservation Efforts

**denotes primary author and subject area*

Water quality performance of wetlands receiving nonpoint source nitrogen loads and potential of targeted wetland restoration to reduce nitrogen loads in Iowa.

Author(s): 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.

Subject Area: Water Resources Assessment and Management*

**denotes primary author and subject area*

Soil conservation and greenhouse gas emissions: The role of reduced tillage and organic agriculture in soil nitrous oxide production

Author(s): Sean Bloszies*, North Carolina State Universit; Peyton Ginakes, University of Minnesota; Shuijin Hu, North Carolina State University

Abstract: A majority of the world's anthropogenic nitrous oxide (N2O) emissions come from agricultural soils. Because emissions levels depend on a combination of factors, including soil organic matter (SOM) levels and mineral N availability, it is not clear how farm management strategies may affect net production of this potent greenhouse gas. Furthermore, it is important to understand which of several diverse SOM pools is driving N2O emissions. This research examines both organic and conventional farming methods as well as different rotations within each for their impact on soil N2O emissions. Both organic and conventional annual cropping systems have been managed since 1999 in the Coastal Plain of North Carolina using reduced-till, clean till, or a 3 year rotation with pasture. Data to be collected from field soil include microbial biomass carbon and nitrogen (MBC/MBN), soil heterotrophic respiration, particulate organic matter (POM), permanganate oxidizable C (POX-C). In 2014, fields were planted with soybean and soil samples were taken before cover crop termination, after termination, after soybean planting, and at harvest. Laboratory incubations were also conducted to quantify N2O emissions from 0-15cm depth samples of field soil. Preliminary results from these experiments indicate that the farming systems differ in the size of the initial flush of N2O that occurs following a simulated rain event in soils collected after soybean planting and harvest ($P < 0.0001$), but not earlier in the season. Work is ongoing to further explain these results using the SOM pools.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*; Conservation in Nontraditional Agriculture

**denotes primary author and subject area*

Cover Crop Decision Making - New Tools and Technology for 2015 & Beyond

Author(s): Scott Wohltman*, La Crosse Seed

Abstract: Cover crops continue to be an ever-changing dynamic. With numerous variables at play every season, the establishment and ultimate success of cover cropping differs greatly year to year and from one region to another. The idea of standardizing the practice of cover cropping makes sense, both from the standpoint of getting more producers to try them without the thought of risk, and from an economic perspective. As the cover crop seed industry evolves, so to do the tools available for producers and the agribusiness community advising farmers in the field. The decision making process will never be fully standardized, but it can be made easier and with a lesser amount of risk.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*; Adaptive Management of Conservation Efforts; Conservation Models, Tools, and Technologies

**denotes primary author and subject area*

I Heart Soil: Dr. Dirt and the International Year of Soil

Author(s): Clay Robinson*, ACSESS; David Lindbo, North Carolina State University; Susan Chapman, ACSESS; Wale Adewunmi,

Abstract: 2015 is the International Year of Soil. The Soil Science Society of America is using its "I Heart Soil" campaign to raise awareness of the importance of soil to all of life. As Dr. Dirt says, "Without soil, we would all be hungry, naked, homeless, and breathless." The SSSA K-12 Committee has developed and reviewed many resources for K-12 teachers, available at soils4teachers.org. The committee is compiling 4- to 8-page booklets for each state soil. These resources and activities may be used by soil and natural resources practitioners to educate K-12 and adult learners about the importance of soil. In order to engender confidence in outreach, Dr. Dirt will demonstrate some brief kinesthetic activities that may be used with many audiences.

Subject Area: Outreach, Education, and Community Engagement*

**denotes primary author and subject area*

Continuing Education for Certified Professionals

Author(s): Clay Robinson*, ACSESS; Luther Smith, ACSESS; Dawn Gibas, ACSESS

Abstract: The Soil Science Society of America and American Society of Agronomy encourage professional standards and conduct through their certification programs: Certified Professional Soil Scientist, Certified Crop Adviser, and Certified Professional Agronomist. Continuing education is required to remain certified. The Education Manager will provide an overview of the existing materials, and give an update on efforts to collaborate with other societies and organizations to increase the scope and content of the educational materials, as well as to expand the scope of influence of soil, natural resource and agronomic professionals by reaching out to nontraditional audiences.

Subject Area: Outreach, Education, and Community Engagement*

**denotes primary author and subject area*

Ag/climate decision support tools for farmers and ag advisors: The products, outreach and evaluation

Author(s): Jenna Klink*, University of Wisconsin; Dennis Todey, South Dakota State University; Vikram Koundinya, University of Wisconsin Environmental Resources Center; Chad Hart, Iowa State University Extension; Linda Prokopy, Purdue University

Abstract: Useful to Usable (U2U) is a USDA-funded research and Extension project focused on improving the uptake of climate information by Midwestern U.S. cereal crop farmers and agricultural advisors. Long-term outcomes are for farmers to make more informed decisions that help them, society, and the environment. This presentation will give an overview of the project's products (decision support tools or DSTs), outreach, and evaluation findings. Products: AgClimate View DST showcases customized historical climate and corn/soybean yield data for the U.S. Corn Belt. Growing Degree Day DST allows users to track real-time and historical GDD accumulations, assess spring and fall frost risk, and guide decisions related to planting, harvest, and seed selection. Climate Patterns Viewer DST shows how global climate patterns like the El Niño Southern Oscillation and Arctic Oscillation have historically affected local climate conditions and crop yields across the U.S. Corn Belt. Corn Split Nitrogen DST helps determine the feasibility and profitability of using post-planting nitrogen application for corn production, combining historical data on crop growth and fieldwork conditions with economic considerations. Outreach: Extension educators and marketing specialists are working together to present the products at producer and advisor meetings, partner with a media company to achieve a broader reach, and distribute a "sales kit" of DST educational materials to ~100 educators/advisors that expressed interest in helping to spread the message. Evaluation: Between 60-73% of respondents to event surveys report being at least "somewhat likely" to use the DST(s) in their work in the next year. Through 1/7/15, there have been close to 10,000 U2U website users in the 12-state North Central region. Google Analytics data on the website also indicates nearly half of all 23,000 web sessions are from returning visitors, indicating that users have more than fleeting interest.

Subject Area: Outreach, Education, and Community Engagement*; Conservation Economics and Policy ; Conservation in Nontraditional Agriculture; Conservation Models, Tools, and Technologies; Social Sciences Informing Conservation

**denotes primary author and subject area*

Water Use and Economic Impacts of Furrow Irrigation Initiation Delays in Mid-South Soybean Production Systems

Author(s): C. Robert Stark*, U. of AR at Monticello/UASEREC; Paul Francis, UA-Monticello/UASEREC

Abstract: Mid-South soybean production relies heavily on irrigation to obtain maximum yields. 2013 and 2014 crop years have seen new statewide yield records certified for producers in Southeast Arkansas, exceeding 100 bushel per acre. The predominant Delta region production system is furrow irrigation using water from wells tapping underground aquifers or from streams/surface storage facilities. Delaying initiation of treatments has potential for economic savings to producers and reduction of water use from the environment. Research into optimal timing of furrow irrigation initiation has been conducted since 2007 at the Rohwer Research Station of UA Southeast Research & Extension Center in Monticello. To this point, agronomic research has shown yield impacts of initiation delays to be variable dependent on variety maturity group. This study expands those results by quantifying potential water quantity savings and estimating economic impacts of delaying irrigation initiation. Southeast Arkansas is currently experiencing deficit water usage in selected locations. Projects for alternative water sources have been initiated. Timely management of irrigation practices can complement these efforts. Agronomic data in the study covers 2008-2010. Current Arkansas soybean cash market and production input prices are added within a partial budgeting framework to conduct the economic analysis. The major economic objective is to identify maturity group soybean varieties that can profitably tolerate delayed irrigation initiation. Producers already are moving toward earlier maturing varieties. Profitability associated with delayed irrigation initiation will be a major determining factor toward success or failure of soybean production systems and their capacity to better conserve the water resources available.

Subject Area: Water Resources Assessment and Management*; Conservation Economics and Policy ; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

Water Quality Success Stories Due to Conservation Targeting

Author(s): Michelle Perez*, World Resources Institute

Abstract: WRI will share results of our 2015 “targeting success stories” report. The objective of this research is to showcase watershed-scale projects that are already achieving environmental outcomes due, in part, to their use of a conservation targeting approach. Lessons learned are tailored for federal and state leaders of water quality projects in the Mississippi River Basin but readers in other parts of the country and in other countries will benefit as well. Additional recommendations are provided for improving the farm bill conservation programs and initiatives to better prioritize conservation activities and areas to cost-effectively maximize environmental benefits. The compendium of case studies reviews successful targeted efforts that achieved or are achieving landscape-scale environmental outcomes or are at least achieving measurable reductions in on-farm losses (e.g., nutrient, sediment, pathogen, and pesticides) that are linked to degraded water quality. We present selected examples of targeted watershed projects conducted under programs such as the Mississippi River Basin Healthy Watersheds Initiative (MRBI), the Environmental Protection Agency (EPA) Section 319 Nonpoint Source Pollution Control Program, as well as state-level initiatives such as Iowa’s Cooperative Extension Service-led Watershed Projects and other successful projects led by nongovernment organizations. Our research methods include literature reviews and interviews with key targeting, water quality, and farm conservation experts to first identify the successful projects and then investigate the factors leading to success. Preliminary findings suggest that farmer-led projects are particularly important for galvanizing significant behavior change from multiple farmers. In addition, projects that involve farmers establishing outcome-based goals (e.g., "We want to remove our stream from the Dirty Waters List.") help to motivate participation in the targeted watershed project.

Subject Area: Adaptive Management of Conservation Efforts*; Conservation Economics and Policy ; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

Rangeland Soil Health

Author(s): Diane Stott*, USDA/NRCS; Bianca Moebius-Clune, NRCS

Abstract: Assessing what is known about the soil health of the western U.S. rangelands is important as we move forward in developing management systems designed to improve soil health while maintaining economic viability. This paper will review what we know and what our knowledge gaps are with regard to grazing and rangeland management practice impacts on soil health (or soil quality) related properties as well as productivity and resilience of these systems. Information will be drawn from published scientific literature and long-term experiments currently in progress. This will be placed within the context of the mission of the new USDA/NRCS Soil Health Division.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*; Adaptive Management of Conservation Efforts

**denotes primary author and subject area*

Impact of Levee Breaches, Flooding and Land Scouring on Soil Productivity

Author(s): Kenneth Olson*, U. of Illinosi; Lois Morton, Iowa Sate University

Abstract: Flooding of agricultural lands after a natural or human-induced levee breach can have large and persistent effects on soils, crop productivity and water quality, with negative economic, social, and ecological consequences. A federal damage assessment of the effects of levee breaches and flooding on public and agricultural lands is needed each time a levee fails. Most federal damage assessments only include a land scouring and deposition survey, a survey of the levee itself and the adjacent crater lakes, gullies and sand deltaic deposits but not the remaining flooded areas. The 2011 human-induced Bird's Point Levee breach resulted in the creation of three gully fields on O'Bryan Ridge, Missouri. The largest gully field with 78 ha (195 ac) was selected to determine the impact on land use and soil productivity. The flooding changed the land use from agricultural land to ponds and wetlands for the 20 ha (51 ac) of gullies and resulted in no soybean production for that area; and much of the remaining 58 ha (144 ac) had lower soil productivity as a result of topsoil loss. Some of the land use was returned to agriculture by draining the ponds and covering the newly formed wetlands by pushing the ridge topsoil and subsoil into the gullies, re-grading the field. The productive capacity of the O'Bryan Ridge gully field was restored to 70% which has resulted in a 30% permanent soil productivity loss.

Subject Area: Water Science in the Public Interest

**denotes primary author and subject area*

Water Quality Monitoring in Bayou Chene and Lacassine Bayou in Louisiana

Author(s): Durga Poudel*, University of Louisiana at Laf; Paul Klerks, University of Louisiana at Laf

Abstract: Weekly monitoring of surface water quality was conducted at nine locations on Bayou Chene and Lacassine Bayou in Louisiana, from June 2012 to May 2014. Biological sampling was conducted for benthic organisms and for fish, at the same sites, during summer and fall of 2012 and 2013. Water quality parameter values showed wide ranges, being 0.32 - 13.94 mg L-1 (DO), 3.2 - 1,650 NTU (turbidity), 3.4 - 2,997 mg L-1 (TSS), 29 - 5,125 mg L-1 (TDS), 63 - 6,374 mg L-1 (TS), 0.07 - 2.3 mg L-1 (NO3-N), 0.08 - 15.04 mg L-1 (TKN), 0.03 - 1.06 mg L-1 (SRP), and 0.01 - 3.59 mg L-1(TP). Analyses of monthly median values showed peak values for turbidity (611.1 NTU) and TSS (151 mg L-1) in March and peak values for TDS (612 mg L-1), TS (773 mg L-1), TP (0.63 mg L-1), TKN (2.94 mg L-1), and BOD5 (5.79 mg L-1) in April. These results indicate that the impairment of surface water quality in these watersheds is largely tied to agricultural activities that begin in March. There were no clear temporal trends in the fish community. However, there were differences among sites and among bayous, with generally fewer fish in Bayou Chene than in Lacassine Bayou. The density of benthic organisms was clearly higher in Lacassine Bayou than in Bayou Chene. A general increase in macrobenthos abundance over the study period provides some indication of an improving water quality in these watersheds.

Subject Area: Water Science in the Public Interest

**denotes primary author and subject area*

Weak links in communication contribute to harmful algal blooms in Lake Erie

Author(s): Laura Johnson*, Heidelberg University; REM CONFESOR, HEIDELBERG UNIVERSITY; David Baker, Heidelberg Univeristy; Kenneth Krieger, Heidelberg University

Abstract: Harmful algal blooms (HABs) in the western Lake Erie basin (WLEB) garnered national attention in August 2014 when microcystin toxins exceeded World Health Organization limits in Toledo's drinking water resulting in a 3-day ban on drinking tap water. Yet the recurrence of HABs in the WLEB have been an on-going problem for many years– the first Ohio Lake Erie Phosphorus Task Force was formed in 2007. Increases in HAB intensity and extent over the past decade correspond closely to increasing dissolved phosphorus (DP) loads to Lake Erie from the agricultural Maumee River. The uptick in DP exports followed a period of intense land management change in the 1980s aimed at reducing soil erosion through conservation tillage and reserves. While this program succeeded in decreasing both suspended sediment and particulate P concentrations in the Maumee River, it encouraged use of broadcast P fertilizer and enhanced soil P stratification. Thus, increased DP runoff is the product of these unintended consequences in combination with intensified subsurface drainage installation, increased soil compaction, and increasing extreme spring weather events. Although other sources (wastewater inputs, residential fertilizer use, failing septic tanks) are acknowledged as minor contributors of P, producers are largely blamed for the events in Toledo. Based on the media coverage following Toledo's drinking water incident, there appears to be a knowledge gap among producers regarding how and what form of P is entering Lake Erie, which influences how producers reduce P loss. Thus the current state of the lake is partly due to weak or slow communication among researchers/educators and the agricultural community. Our biggest challenge is to better disseminate accurate information to the agricultural community that results in implementation of practices focused on DP runoff and to foster flexibility in adopting new practices as our understanding improves or the pollutant of concern evolves.

Subject Area: Water Science in the Public Interest

**denotes primary author and subject area*

Assessing the Impact of Farm Management on Water Quality: Can Science Really Change Public Perceptions

Author(s): Andrew Sharpley*, University of Arkansas; Mike Daniels, University of Arkansas; Kristofor Brye, University of Arkansas; Karl VanDevender, University of Arkansas; Timothy Kresse, University of Arkansas

Abstract: Nutrient enrichment remains a major impairment to the designated uses of fresh and coastal waters of the U.S. While there are many sources of nutrients, the contribution of agriculture, in particular intensive crop and livestock production, has received increased attention to reduce nutrient losses. This attention has been fueled by recent large-scale modeling efforts and surveys that have suggested that agriculture remains a major contributor of nutrients to surface waters and thereby to their impairment. However, there have been few farm-scale studies of nutrient loss from farms in the largely agricultural state of Arkansas in the Lower Basin. Concurrent with this environmental pressure for farmers to practice environmental stewardship, is the need to intensify production, in efforts to feed an ever-increasing population. This has led to expansion of livestock operations in particular. One such farm, a swine-breeding Concentrated Animal Feeding Operation (CAFO), was recently permitted to operate in the Buffalo River Watershed; the first National Scenic River designated. The farm is located in the karst terrain of the Ozark Plateau of mid-continental U.S. and has drawn attention from pro-farming and pro-environmental groups and led to close scrutiny of monitoring the farm's impact on water quality in hydrologically complex systems, and ultimately on the Buffalo River's recreation value. This presentation will describe the water quality and farm sustainability assessment project funded by the Governor of Arkansas in 2013. The unique monitoring issues arising from voluntary on-farm monitoring will be compared with those associated with highly contentious and closely scrutinized farm operations. We also discuss the pros and cons of having all data collected immediately available to the public via open access requirements and show how this can benefit and hinder the process of ensuring sound science is used to formulate future water and land use regulations.

Subject Area: Water Science in the Public Interest

**denotes primary author and subject area*

Putting Technology to Work Leading to Real-Life Solutions - Aquahacking

Author(s): Jacqui Empson Laporte*, OMAFRA; Nicholas Betts, OMAFRA

Abstract: Aquahacking is a stimulating get-together in which technology will be put to work for water and lead promptly to real-life solutions that enhance collaboration and knowledge exchange. AQUAHACKING 2015 - Ottawa River Summit, will round up more than 200 young computer enthusiasts – developers, programmers, computer experts, web and mobile application designers, environmental technologists and other specialists. For 48 hours straight, they will focus their attention on a series of issues defined by the Ottawa River community and the team of hackers. Their challenge will be to develop technology-based solutions to solve water-related issues. Mentors who are experts in the field, including biologists, ecologists, environmentalists, planners, engineers, mayors and others, will help our hacking teams by pulling together their combined talents to develop working prototypes and solve previously identified problems. Each team will submit its project to a jury who will then award a prize to the winners. OMAFRA will be participating in Aquahack Ottawa River Summit 2015 as event organizers, Influencers and Field Experts. It is our opportunity to bridge a divide between urban and rural, joined by a common interest in improving water quality. We will be leveraging our investment in research for a much broader audience. http://aquahacking.com/en/

Subject Area: Water Science in the Public Interest

**denotes primary author and subject area*

Defining and analyzing agricultural production systems to determine the capacity to make soil and nutrient management improvements in the Canadian Lake Erie basin

Author(s): Pamela Joosse*, Agriculture & AgriFood Canada; Donna Speranzini, AAFC; Natalie Feisthauer, AAFC; Keith Reid, AAFC; Ted Huffman, AAFC

Abstract: Domestic action plans to reduce excess phosphorus entering Lake Erie are to be developed in the US and Canada by 2018 under the Great Lakes Water Quality Agreement. While it is recognized that not all landscapes are equal contributors of phosphorus, it is also true that not all agricultural production systems in the basin are equal in their contribution or capacity to reduce phosphorus. A farming systems typology was developed by Agriculture and Agri-Food Canada scientists and used to classify individual farms from the Census of Agriculture into particular production systems. Nutrient and soil management metrics are calculated from census data and models to compare within and across systems. Geospatial links will be made between production systems and the landscapes they are situated on as part of the assessment of the relative importance of management among systems. Results of the project test our assumptions and provide an objective assessment of: 1) the extent of crop rotation and tillage practices that influence soil cover and erosion; and, 2) the nutrient assimilative capacity of the land base associated with manure. This information provides scale and perspective to the relative opportunities different production systems have to make environmental improvements, and to the messages used in knowledge and technology transfer to different production system audiences.

Subject Area: Water Science in the Public Interest

**denotes primary author and subject area*

A Collaborative Modeling Approach to Assess Resiliency of Snow-fed Arid Land River Systems: Results from an Organizational Survey of Water Managers

Author(s): Kelley Sterle, University of Nevada, Reno; Karen Simpson, University of Nevada, Reno ; Maureen McCarthy, University of Nevada Reno Academy for the Environment; Loretta Singletary*, University of Nevada, Reno; Derek Kauneckis, University of Nevada, Reno; G

Abstract: Management of snow-fed, arid river systems in the western U.S. has taken on critical importance in response to the impact of variable climate conditions on water supply. By conducting an in-depth study of the Truckee-Carson River System (TCRS), in northern Nevada, the NSF-WSC and USDA funded Water for the Seasons project aims to build a research model for examining climate resilience in snow-fed arid basins in the U.S. and abroad. Over the next four years, a highly interdisciplinary team will work collaboratively with local stakeholders to assess the impact of different climate scenarios on the river system, and explore the potential for adaptation in terms of water management. This project will fill gaps in existing research by: integrating groundwater, surface flow and climatic models to create water supply scenarios, examining the preferences and decision-making processes of local water users and managers to create policy scenarios, and integrating both policy and hydro-climatic models via collaborative modeling. This presentation will introduce the Water for the Seasons project objectives, describe the structure and components of the hydrologic and policy models, explain the role of stakeholders in the collaborative modeling process, and discuss preliminary results of an organization survey administered to water managers on the river system.

Subject Area: Water Science in the Public Interest

**denotes primary author and subject area*

Using novel geospatial tools and approaches for identifying critical nutrient source areas for implementing best management practices in the Grand River Watershed, Ontario, Canada.

Author(s): Sandra Cooke, Grand River Conservation ; Zoe Green, Grand River Conservation Authority; Jill Marshall, Grand River Conservation Authority; Anne Loeffler, Grand River Conservation Authority; Jeff Pitcher, Grand River Conservation Authority; Bryan McIntosh

Abstract: Non-point sources of nutrients remain the most challenging to manage or control for watershed water quality improvement. However, most of the nutrients in a watershed are generated from only a few areas on the landscape that are hydrologically connected to streams. Identifying these critical areas will prove effective in managing nonpoint sources of pollution. A multi-agency partnership to update the Water Management Plan for the Grand River Watershed, Ontario, Canada, provided an opportunity to explore and apply novel geospatial tools/approaches for identifying hydrologically connected landscapes that could be nutrient source areas. The creation of a large-scale, three dimensional vector hydrology layer provided the foundation for creating a high resolution Digital Elevation Model. Two geospatial analytical approaches were used to identify critical source areas: (1) slope and flow accumulation, termed 'stream power index' identified rill/gully erosion quite successfully through field inspections; and (2) the revised universal soil loss equation for application in Canada identified areas with high sheet erosion potential. These approaches were combined to identify the spatial extent of hydrologically connected nutrient sources areas within a small pilot watershed. The farm-scale maps that showed the location of these source areas were used by Conservation Specialists to start a discussion with local farmers about nutrient loss and solicit feedback on the application of such novel approaches. The maps were well received and yielded interest in implementing on-farm soil erosion projects. Since funding for the implementation of agricultural best management practices is limited, these novel tools/ approaches will assist Conservation Specialists with identifying critical areas for implementing conservation practices in the Grand River watershed, a high priority watershed that drains to the eastern basin of Lake Erie.

Subject Area: Precision Conservation

**denotes primary author and subject area*

Livestock Trail Erosion: Some Treatment Options

Author(s): Dennis Schrodt*, USDA/NRCS

Abstract: Paths created by pastured livestock traveling to watering systems, feeders and loafing areas can result in severe erosion problems. This presentation will summarize project results of some cost effective treatments and alternative approaches that have been implemented on Iowa farms. Planning considerations that include watering system locations, drainage management, animal behavior and walkway maintenance will be shared. The pros and cons of these treatments along with products that can be utilized in high traffic areas will be discussed to help others choose options and avoid the impact that trails can have on their soil and water resources.

Subject Area: Precision Conservation

**denotes primary author and subject area*

Irrigating Sweet Corn with Drip Irrigation to Conserve Water Resources

Author(s): Gary Hawkins*, Univ of Georgia; Calvin Perry, Univ of Georgia

Abstract: Water resources in Southwest Georgia are at the forefront of discussions between states, between farmers and environmental groups and many others. That same SW portion of Georgia is where most of the sweet corn is grown in the state. So, various ways to conserve a valuable resource is needed for all concerned. Therefore, a research project was designed to investigate the use of plasticulture practices for growing sweet corn as a means to conserve the water resources. The replicated experiment was designed to test the standard overhead irrigation verses three drip irrigation methods. The three methods were plastic beds with drip, beds without plastic but drip, and standard row spacing with drip. The sweet corn was grown according to standard practices associated with the method of water delivery. The corn was irrigated based on the sweet corn water use curve. At the beginning of the experiment, the soil profile was full and there were timely rains to keep the soil moisture above 20%. With a wet soil profile, it is hard to differentiate the water that resulted from irrigation or natural rainfall. Sweet corn grown with typical overhead irrigation had a longer ear than the other treatments, but the girth was not different between the overhead and the plastic with drip. Sweetness was higher in the treatment that was significantly lower in both length and girth of the other treatments. This presentation will present the results from the study and draw some conclusions on the potential of using different practices to conserve water in a region of Georgia where water is a major issue.

Subject Area: Precision Conservation

**denotes primary author and subject area*

EphGEE: Ephemeral Gully Erosion Estimator

Author(s): Seth Dabney*, USDA-ARS; Dalmo Vieira, USDA-ARS

Abstract: Ephemeral gully erosion seriously degrades agricultural soils and disproportionately contributes to the transport of sediment and associated contaminants from agricultural fields. Nevertheless, few conservation planning tools adequately account for this form of erosion. To address this deficiency, a new Ephemeral Gully Erosion Estimator (EphGEE) has been developed and linked to the widely used RUSLE2 model. Geographic information system tools deduce surface drainage from topography, determine the locations of areas of flow concentration that end sheet and rill erosion hillslopes and are potential ephemeral gullies, and subdivide the study area into sub-catchments. Hillslope runoff and sediment loads estimated by RUSLE2 for each sub-catchment are passed to EphGEE and ephemeral gully erosion or deposition is calculated for the channel network. To illustrate EphGEE, modeled average annual runoff and sediment yield were compared to values measured from 1975 to 1991 on a 6.3 ha instrumented watershed near Treynor, Iowa, that was managed with conventional tillage corn and contained a grassed waterway. Using a 3 m rectangular grid, concentrated flow channels delineated where contributing areas exceeded 600 m2 resulted in an ephemeral gully network that was similar to that seen in aerial photographs taken during the period of record. Computed gully evolution based on soil properties, runoff, and sediment transport contributed about one-fourth of the total erosion with the rest contributed by sheet and rill erosion. More than half of eroded sediment deposited within the grassed waterway. Without local calibration, simulated sediment yield of 17.5 Mg ha-1 yr-1 was 20 % larger than the measured 14.6 Mg ha-1 yr-1. The grassed waterway in the last 200 m of the main channel thalweg reduced sediment delivery from the field by about 50%. The new EphGEE model can be used to estimate the soil conservation benefits of critical area erosion control.

Subject Area: Precision Conservation

**denotes primary author and subject area*

Pinpointing the Most Erosive Areas Within A Field: Precision Conservation Intersects With Precision Agriculture

Author(s): Tom Buman*, Agren; Jamie Ridgely, Agren

Abstract: For precision conservation to be practical and effective, farmers and agronomist must have tools that can pinpoint conservation needs. SoilCalculator is a substantial scientific improvement over the current RUSLE2 interface. Conservation practitioners can quickly and easily target appropriate management practices to areas that contribute the most sediment loads and evaluate which practice alternatives provide the most environmental benefit. SoilCalculator calculates soil erosion on 9×9 meter grids. It utilizes the computational engine of the RUSLE2 erosion model and combines it with scientific methodology, co-developed with USDA's ARS, to define slope length and steepness. Using LiDAR to measure the slope length and steepness, SoilCalculator calculates soil erosion about 8,000 times in a 160 acre field and generates an image that depicts the distribution of sheet and rill erosion across a field. Now farmers and resource professionals are able to view the outputs of RUSLE2 in a visual representation. Similar to a yield map, this report shows a geographic distribution of high and low areas of soil erosion of the current system and up to two alternatives. With a SoilCalculator report, landowners can: • Visualize erosion amounts across the field • Target practices on high soil erosion areas • Use actual slope steepness values in conservation planning • Calculate average soil erosion and the total annual soil erosion • Easily compare up to 3 management systems to determine the system that maximizes soil savings • Add this data layer to other Precision Agriculture layers to determine the effects on yield and nutrient loss No GIS experience is required. The tool operates in a web-based environment. There is no software or updates for the user to install. There are no databases to download or update. Everything is contained within the online program. This technology is a necessity for application of precision conservation.

Subject Area: Precision Conservation

**denotes primary author and subject area*

Targeting Critical Ephemeral Gully Erosion Sites in a Watershed

Author(s): Tom Buman*, Agren; Robert Buman, Agren

Abstract: Throughout Iowa's South Fork Watershed, and similar to many watersheds in the Corn Belt, entire farms and fields are managed uniformly to simplify farming operations. However, land conditions such as soil type and topography vary substantially at smaller scales. This in-field variability impacts the need for and effectiveness of conservation best management practices for erosion control resulting in reduction of sediment delivery to receiving water bodies. Therefore, in order to reduce soil loss and improve water quality, it is imperative that conservation practices be applied to these critical areas on the landscape. Defining critical areas at the field-scale, where conservation decisions are made, can be a challenge. However, new technologies such as high-resolution elevation data derived from LiDAR (Light Detection and Ranging) and advanced geographic information systems can provide resource management professionals with effective decision tools. Today, targeting critical resource areas is possible not only at a watershed scale, but also at a farm and field scale. In this project Agren's three key objectives were: 1) Utilize Ephemeral Gully Erosion Estimator (developed by USDA's Agricultural Research Service) to target the most critical sites in the watershed; 2) utilize precision conservation planning technologies to fully-plan BMPs for ephemeral gully, and 3) Direct market practice plan (Grassed Waterways and Water & Sediment Control Basins) for ephemeral gully control to landowners of high-priority sites. Once the practices were sited, sized, and priced and soil loss savings had been calculated, specifications on each structure were entered into a spreadsheet. A spreadsheet model was developed to score and rank practice sites based on tons sediment saved per dollar of estimated project cost (cost/benefit ratio). This ranking was then used to determine priority sites for landowner outreach efforts.

Subject Area: Precision Conservation

**denotes primary author and subject area*

Irrigation Scheduling and Outreach to Protect Groundwater Quality in Central Minnesota

Author(s): Luke Stuewe*, MN Department of Agriculture

Abstract: Since 2006, the East Otter Tail County Soil and Water Conservation District (EOT) has offered irrigation scheduling assistance to producers. Often irrigation water scheduling is associated first with conserving water quantity and this is certainly an important benefit of the practice, however equally important goal of this program is to minimize the amount of nitrogen lost below the crop root zone to shallow groundwater (< 30 feet). The predominant geologic formation here is a deep outwash sand plain providing a large reservoir for groundwater. The accessible groundwater supply and predominantly well-drained soils have supported the development of highly productive irrigated land. Potatoes, corn, dry beans, soybeans, and wheat are the major crops grown under irrigation and the use of nitrogen fertilizer is critical in these rotations. Groundwater is also the predominant source of drinking water for the cities and rural homeowners that live in this region and monitoring has confirmed that nitrogen levels above the safe drinking water standard of 10 mg/L exist throughout the region. To support the conservative use of groundwater and limit the loss of nitrogen below irrigated fields, the EOT irrigation scheduling program provides a weekly visit to enrolled fields to verify field moisture conditions and provide a printed update. Irrigation technicians utilize a local network of weather stations dedicated to providing agricultural weather data and a checkbook method is employed to keep record of field moisture conditions. Over 100 fields currently participate and the program success has led to the start of similar programs across MN. This widespread and sustained enrollment appears to be having a positive impact with some local groundwater sampling data indicating nitrogen levels are not trending upward. Groundwater quality protection is critically important to the citizens of MN and this program is a great example of local problem solving to accomplish that goal.

Subject Area: Precision Conservation

**denotes primary author and subject area*

70TH ANNUAL
SOIL AND WATER CONSERVATION SOCIETY CONFERENCE
COMING HOME TO CONSERVATION
PUTTING SCIENCE INTO PRACTICE

Poster Presentation Abstracts

SOIL AND WATER CONSERVATION SOCIETY

Adaptive Management of Young Longleaf Pine Stands in Southeastern Virginia

Author(s): Robert Glennon*, Virginia Tech

Abstract: The motivation for longleaf pine restoration is the restoration of the ecosystem, which includes a herbaceous understory maintained by prescribed fire and a suite of wildlife species dependent on that herbaceous understory. The prescriptions for burning do not always exist at the time of planting or during the grass stage when the trees are tolerant of fire. To maintain optimal habitat conditions and control broadleaf woody plants, burning must often be attempted during the bottlebrush stage when the trees are highly susceptible to damage by fire. A prescribed burn on a stand in southeastern Virginia achieved the desired results with out damaging the longleaf pine stand. The variety of grasses, forbs, vines, and shrubs that comprise the habitat that is associated with longleaf pine responded well to the treatment. The grasses include velvet panicgrass (Dichanthelium scoparium), variable panicgrass (Dichanthelium commutatum), needleleaf rosettegrass (Dichanthelium aciculare), purpletop (Tridens flavus), broomsedge (Andropogon virginicus) and purple lovegrass (Eragrostic spectabilis), and hairawn muhly (Muhlenbergia capillaris). The forbs include lespedeza (Lespedeza spp.) and beggarweed species (Desmodium spp.). Vines include muscadine grape (Vitis rotundifolia), roundleaf greenbrier (Smilax rotundifolia), and poison ivy (Toxicodendron radicans). Shrubs include winged sumac (Rhus copallina) and scrub oak (Quercus ilicifolia). The poster will summarize the results of transects on a forest converted from loblolly pine to longleaf pine with well-drained Uchee loamy sand in Sussex County, Virginia.

Subject Area: Adaptive Management of Conservation Efforts*; Conservation Economics and Policy ; Outreach, Education, and Community Engagement; Soil Health Resources, Indicators, Assessments, and Management; Water Resources Assessment and Management

**denotes primary author and subject area*

Adaptive Nitrogen Management for Corn, Sorghum, and Wheat in the Coastal Plain of North Carolina

Author(s): Daniel Hedgecock*, NC State Unviersity; Deanna Osmond, NC State University; Rob Austin,

Abstract: Determining nitrogen (N) rates is difficult because the economic optimum nitrogen rate (EONR) varies by crop, yield, soil, climate, and farmer practices. Additionally, there is no soil test for N in North Carolina that has been shown efficacy. Recommended N rates have been established for each soil and crop combination based on the realistic yield expectation (RYE). However, often these rates are disregarded in actual nutrient application. Through previous research, we know that farmers learn best through self-experimentation or farmer-to-farmer programs. To address this, our current adaptive N management project works directly with farmers on N application to corn, sorghum, and wheat. The objective of this research is to help farmers optimize commercial N inputs through multiple rate strip trials. Twenty producers in the Coastal Plain of North Carolina participated in the project and 54 trials (over 100 acres spanning 5 counties) were conducted through 2014. The rates of N tested were i. the grower's typical N rate, ii. 25% greater than the grower's N rate, and iii. 25% less than the grower's N rate. N rates were randomized and replicated 4 times within spatially contingent blocks. N was applied at V6 for corn, GSII for sorghum, and GS30 for wheat. Grower N rates ranged from 111 to 211 kg ha-1 for corn, 85 to 148 kg ha-1 for sorghum, and 74 to 162 kg ha-1 for wheat. Yield data was collected using calibrated yield mapping equipment. Results from 2013 indicate significant spatial yield variability within both trials and individual treatments. In 80% of the trials, the recommended N rate (based on RYE) was either optimum or slightly greater than that required to observe a significant increase in yield. The yield response to the 3 varied N rates will be assessed to help determine an EONR for each participating producer.

Subject Area: Adaptive Management of Conservation Efforts*; Water Resources Assessment and Management

**denotes primary author and subject area*

Arkansas Discovery Farms: Increasing Water Sustainability with Irrigation

Author(s): Mike Daniels*, University of Arkansas

Abstract: Proper irrigation scheduling can increase irrigation efficiency by reducing excessive irrigation events. For years, the computerized irrigation scheduler has been considered the standard for scheduling, however the atmometer is much easier and less cumbersome and time consuming to use. However, it needed to be tested for climatic conditions in Eastern Arkansas. To do so, a 103- acre soybean field was split in half and the computerized irrigation scheduler was compared to the atmometer side by side. Both methods called for the same number of irrigations, 6, and within a day or two apart for each method. Total irrigation water applied was 15.77 inches. Yield for both sides of the field was 67 bu/A. This trial indicates that the atmometer produces the same irrigation scheduling as the more cumbersome computerized irrigation scheduler. Soil moisture sensors indicated that the irrigations were effective in replenishing soil water down to 12 inches. Solube Nitrate-N and ortho-P were 0.4 and 0.1 lbs/A, respectively. This indicates low losses.

Subject Area: Adaptive Management of Conservation Efforts*

**denotes primary author and subject area*

Arkansas Discovery Farms: Monitoring Nutrient Loss in Runoff From Soybean Fields

Author(s): Mike Daniels*, University of Arkansas

Abstract: The Arkansas Discovery Farm program works with agricultural producers to monitor impacts of farming practices on natural resources and the environment. Nutrients losses in runoff from real, soybean production fields are monitored using state-of-the-art, automated samplers. Four fields in rice-soybean rotations were monitored for nitrogen and phosphorus loss in runoff. Nitrate-N ranged from 0.048 to 0.975 mg/l (milligrams/liter), which is well below the national drinking water standard of 10 mg/l. Total nitrogen ranged from 0.86 to 1.938 mg/l while soluble P ranged from 0.012 to 0.183 mg/l. Total P ranged from 0.126 to 0.554 mg/l. In all cases, mean concentrations of Nitrate-N, Total N, soluble P and Total P were relatively small compared to national averages in from streams in agricultural watersheds from across the United States.

Subject Area: Water Resources Assessment and Management*

**denotes primary author and subject area*

Assessing Agroforestry Greenhouse Gas Emissions and Sequestration with COMET-Farm

Author(s): Mark Easter*, Colorado State University; Justin Ziegler, Colorado State University; Keith Paustian, Colorado State University; Kevin Browne, Colorado State University; Adam Chambers, Natural Resource Conservation Service; Marlen Eve, U.S. Dept of Agriculture

Abstract: COMET-Farm is an integrated web-based decision support tool developed to aid farmers, agricultural producers, natural resource professionals, land managers and conservationists in making on-farm decisions regarding greenhouse gas emissions and carbon sequestration. COMET-Farm provides total farm and ranch greenhouse gas accounting, including cropland, pasture, range, agroforestry, livestock and on-farm/ranch energy use modules. Agroforestry is practiced widely in the U.S., and the potential carbon sequestration co-benefits of agroforestry practices are beginning to be recognized. With the use of COMET-Farm, users can input current and future agroforestry practices along with alternative management scenarios to accurately estimate the relative greenhouse gas balance of different agroforestry practices, as well as integrating agroforestry with cropland and livestock production. The tool estimates the balance of biomass carbon, soil carbon, soil nitrous oxide, and trace gases from biomass burning associated with agroforestry practices, using the methods in the USDA document, Quantifying Greenhouse Gas Fluxes in Agriculture and Forestry: Methods for Entity-Scale Inventory. To showcase the tools capabilities, real-world agroforestry systems are assessed showing how on-farm/ranch practices influence the greenhouse gas flux from agroforestry systems. The results from various agroforestry systems throughout the US will be presented.

Subject Area: Conservation Models, Tools, and Technologies*; Adaptive Management of Conservation Efforts; Conservation Economics and Policy ; Conservation in Nontraditional Agriculture; Soil Health Resources, Indicators, Assessments, and Management

**denotes primary author and subject area*

Assessing and Demonstrating Soil Restoration Practices on Disturbed Land in New Jersey's Coastal Plain

Author(s): Chas Schmid, Rutgers University; James Murphy, Rutgers University; Stephanie Murphy*, Rutgers University

Abstract: Land development - including but not limited to building activities - often has detrimental effects on soil quality, specifically with regards to topsoil depth, organic matter content, and bulk density. While the basic knowledge of soil properties and management can guide plans for remediating damaged soils, the practices used to attempt restoration of soil function should be assessed on ranges of soil types to determine the most effective and economical measures to reach the goal. Recognizing that the consequences of damaged soil may include reduced infiltration, greater erosion and nutrient runoff, and water pollution, a project was initiated within Jakes Branch Park in Ocean County, New Jersey to investigate the short- and long-term effectiveness of soil restoration efforts. Therefore, plots were established on a deeply compacted sandy Coastal Plain soil which had been used as a staging area for construction. The variables imposed included compost amendment (to enhance soil organic matter and support biological activity) at three rates and tillage (control vs. deep ripping and rototilling) in a randomized complete block plot design with four replications. Tillage and amending with leaf compost had a limited or negative effect during the early stages of turf establishment due, in part, to the high C:N ratio of the leaf compost causing symptoms of N deficiency in the turf. Improved turf cover with tillage and amending were apparent by May 2013. Tillage and amending soil with leaf compost reduced the bulk density of the sandy loam and increase soil organic matter (SOM). The greatest reduction in soil bulk density and increase in SOM was observed in plots that were tilled and amended with the greater amount of leaf compost.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*; Water Resources Assessment and Management

**denotes primary author and subject area*

Assessing Cropland Greenhouse Gas Emissions using COMET-Farm

Author(s): Mark Easter*, Colorado State University; Crystal Toureene, Colora; Keith Paustian, Colorado State University; Kevin Browne, Colorado State University; Adam Chambers, Natural Resource Conservation Service; Marlen Eve, U.S. Dept of Agriculture

Abstract: COMET-Farm is an integrated whole-farm/ranch, web-based, decision support tool developed to aid farmers, ranchers, agricultural producers, natural resource professionals, land managers, and conservationists in making on-farm decisions regarding greenhouse gas emissions and carbon sequestration. COMET-Farm is a powerful greenhouse gas accounting tool allowing users to assess the greenhouse gas emissions from their current management practices as well as future management scenarios. 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. The DayCent simulation model in conjunction with the methods described in the USDA document, Quantifying Greenhouse Gas Fluxes in Agriculture and Forestry: Methods for Entity-Scale Inventory are used to estimate past, present and future emissions. 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-Farm allows rapid assessment of conservation scenarios to aid in conservation planning. To showcase the tools capabilities, real-world production systems are assessed showing how on-farm conservation practices influence the greenhouse gas flux in agricultural cropland systems. The results from various farming practices across the US will be presented.

Subject Area: Conservation Models, Tools, and Technologies*; Adaptive Management of Conservation Efforts; Conservation Economics and Policy ; Conservation in Nontraditional Agriculture; Soil Health Resources, Indicators, Assessments, and Management

**denotes primary author and subject area*

Assessing Livestock Greenhouse Gas Emissions with COMET-Farm

Author(s): Mark Easter, Colorado State University; Crystal Toureene*, Colora; Keith Paustian, Colorado State University; Kevin Browne, Colorado State University; Adam Chambers, Natural Resource Conservation Service; Marlen Eve, U.S. Dept of Agriculture; Shawn Archibeque, Colorado State University

Abstract: COMET-Farm is a whole-farm/ranch, integrated, web-based decision support tool developed to aid farmers, ranchers, agricultural producers, natural resource professionals, land managers and conservationists in making on-farm decisions regarding greenhouse gas emissions and carbon sequestration related to agricultural practices. COMET-Farm provides total farm greenhouse gas accounting including cropland, pasture, range, agroforestry, livestock and on-farm energy use modules. It is well known that agricultural practices involving livestock management contribute a significant amount of greenhouse gas emissions in the agricultural sector. With the use of COMET-Farm, livestock producers can input their current management practices as well as future potential management scenarios to accurately estimate their current emissions and how applying more efficient conservation practices can reduce the emissions associated with their current practices. Users may also assess various conservation scenarios to determine the relative greenhouse gas balances of each. Methane from enteric fermentation and 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, real-world livestock production systems are assessed showing how on-farm practices influence the greenhouse gas flux from livestock production systems. The results from various livestock production systems throughout the US will be presented.

Subject Area: Conservation Models, Tools, and Technologies*; Adaptive Management of Conservation Efforts; Conservation Economics and Policy ; Conservation in Nontraditional Agriculture; Soil Health Resources, Indicators, Assessments, and Management

**denotes primary author and subject area*

Balancing river flow and associated ecological and cultural needs at the Chattahoochee River National Recreation Area

Author(s): Christopher Anderson*, Auburn University; Hanna Schurman, Auburn University

Abstract: The Chattahoochee River National Recreation Area (CRNRA) consists of 48 miles of river and 16 land based park units adjacent to the Chattahoochee River north of Atlanta. It is an important ecological and cultural resource and provides 70% of metropolitan Atlanta's green space. Situated downriver from Lake Lanier, CRNRA is directly affected by dam release and resulting flow from Buford Dam. Severe flow alterations related to short-term and high-velocity dam releases can reduce ecological and cultural resources provided by rivers and adjacent lands. There are current and future concerns about flow regimes prescribed for the Chattahoochee River and how it would influence water quality, recreational opportunities, shorelines, and fish populations (including native shoal bass and recreationally important trout species). To inform current and future decisions regarding flow, we evaluated literature regarding its influence on the ecological and cultural resources at CRNRA while ensuring ample flows to maintain lake and river management requirements. At the completion of our review, we 1) synthesized all available studies examining flow and its potential effects on CRNRA, 2) identified gaps in the knowledge base, and 3) developed a comprehensive conceptual model to assess how flow affects the various ecological and cultural resources of the river. Workshops involving academics, natural resource managers, government personnel, and other relevant scientists will be used to help fill in information gaps and develop consensus on critical elements of the river flow regime. Data from the literature and experts will be synthesized into a conceptual model to determine optimum flow regimes for CRNRA while accommodating downstream flows and other stakeholder needs.

Subject Area: Water Science in the Public Interest

**denotes primary author and subject area*

Bridging the Gap between University Science and Local Policy to Achieve Nutrient Loss Reduction: The Role University Centers Can Play

Author(s): Brian Miller *, Illinois Water Resources Cente

Abstract: Dr. Brian K. Miller, Director Illinois Water Resources Center and Illinois-Indiana Sea Grant College Program – University of Illinois University based centers operate in the important space between university research, developing tomorrows professionals, stakeholder engagement, and facilitating policy discussions and informed decision-making. A case study and 3 products necessary for facilitated nutrient policy discussions and decision-making will be presented: 1) Illinois Nutrient Loss Reduction Strategy 2) Tippingpointplanner.org 3) Greatlakesmonitoring.org 4) Gltg.ncsa.illinois.edu University based centers supported by long term partnerships with federal agencies such a NOAA and USGS can also support important functions necessary to move from policy creation to policy implementation and adaptive management. Three ongoing strategies (a. integrated science assessments; b. facilitation of statewide workgroups; and c. adaptive management features integrated into decision support tools) that are being implemented to bridge this gap will be presented.

Subject Area: Adaptive Management of Conservation Efforts*; Conservation Economics and Policy ; Conservation Models, Tools, and Technologies; Outreach, Education, and Community Engagement; Social Sciences Informing Conservation

**denotes primary author and subject area*

Climate Variability and Change with Elevation in Kenya, East Africa

Author(s): Brandy Garrett Kluthe*, University of Arkansas

Abstract: Climate change is widely researched. One aspect of this research is exploring the increase in the global mean temperature. This increase is documented as being more dramatic at higher latitudes. The purpose of this study is to examine if there is also an change in temperature and rain levels at higher altitudes. The research area covers a densely populated area in Kenya with an elevation range from sea level to over 3000 ft. Detailed temperature and rainfall records were examined using the KNMI climate explorer tool for the past 40 years. The results show an increase in temperature and decline in precipitation. This changing weather pattern can have a significant impact on the agrarian societies living in the region and may indicate a serious water resource concern in the future requiring oversight and best practice policies to be implemented in the region.

Subject Area: Water Science in the Public Interest

**denotes primary author and subject area*

Collaborative Opportunities for Watershed Protection and Flood Prevention through USDA's Regional Conservation Partnership Program

Author(s): Jan Surface*, USDA NRCS

Abstract: The Regional Conservation Partnership Program (RCPP) is a new, comprehensive and flexible program that mobilizes partnerships to multiply conservation investments and reach common conservation goals on a regional or watershed scale. For designated Critical Conservation Areas (CCAs), USDA's Natural Resources Conservation Service (NRCS) implements RCPP through several conservation authorities, including Public Law 83-566— Watershed Protection and Flood Prevention Act. RCPP projects in CCAs may use all PL 83-566 authorized purposes except watershed rehabilitation. RCPP applicants requesting use of PL 83-566 authority must follow all statutory and programmatic rules of PL 83-566. Through RCPP, NRCS will promote leveraging of other Federal and non-Federal resources. The agency goal is to at least double the total investment in conservation, including cash and in-kind contributions. NRCS will measure the success of the new program through the four criteria; solution, innovation, contribution, and partnership. The use of PL 83-566 authority for RCPP projects provides communities an opportunity to address larger issues that cannot be resolved through land treatment practices alone. PL 83-566 requires the development of physically, environmentally, socially, and economically sound watershed project plans with actions scheduled for implementation over a specified period of years within a specified geographic area for the benefit of the general public. The plan must include required National Environmental Policy Act and economic documentation. PL 83-566 watershed projects require one or more sponsoring local organizations (SLO). The requirements for SLO can be found in NRCS's National Watershed Program Manual. To be eligible for program funding under the PL 83-566 authority, the RCPP applicant or their project partners must meet the requirements of a sponsoring local organization.

Subject Area: Water Resources Assessment and Management*; Conservation Economics and Policy

**denotes primary author and subject area*

COMET – Farm, a Modeling and Measuring tool for Greenhouse gases (GHG) that can target Soil Health

Author(s): Mike Collins*, Nrcs

Abstract: Soil ecosystems seem complicated and misunderstood at times. How can we increase our overall understanding by defining what carbon does in our soil and how it affects our greenhouse gases? Soil Health has been defined as the soils capacity to function at a high level as a vital living ecosystem and to store carbon. Are you wondering on how to build carbon or to store more in the soil? It's not just a medium to hold the plants up. Do you wonder how fertilizers and animal impact the greenhouse gases? Do you use nutrients on your farm and wonder on how that impacts greenhouse gases? Should we be growing our own nitrogen and import other nutrients back to your agricultural enterprise. Do you look under your cover to see the land and its storage of carbon and its value? COMET-FARM estimates the 'carbon footprint' for all or part of your farm/ranch operation and allows you to evaluate different options. The Field Module asks you for your crop or pasture management practices starting at least 2000, including cropping sequence and approximate planting and harvest date; type of grazing system (for pasture or range areas), type of tillage system; rate, timing, type and many other attributes. For the Livestock Module you need information on your herd size and composition (i.e., species, sex and age ratios) and type of manure management system. More advanced methods to estimate livestock-related emissions are available if you have information on feed characteristics and feed supplements. The final step is converting what CO2 you have saved in tonnes/year and equating it to how many cars have you taken off the highway in a years time. This poster will illustrate soil health/soil carbon, fertilizer usage and animal impacts to greenhouse gases. Poster will illustrate the users and how any can input their data and get their own results, it is open to the public.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*; Adaptive Management of Conservation Efforts; Conservation Models, Tools, and Technologies; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

Considerations and Resources on Feed and Animal Management to Reduce Greenhouse Gas Emissions and Improve Business Value for Dairy Farms in the U.S.

Author(s): Juan Tricarico*, DMI

Abstract: Enteric methane produced by dairy cows during the process of feed digestion is the single largest source of greenhouse gas emissions in the U.S. dairy supply chain. Also, consumers increasingly demand dairy products that minimize environmental impact. The challenge for the industry is to reduce enteric methane emissions while simultaneously meeting the growing global market demand for milk and dairy foods. Reducing enteric methane emissions intensity (i.e. methane per unit of milk output) and improving individual farm business value can often be achieved concurrently by means of selecting suitable feed and animal management practices at each individual farm. Cow of the Future® developed a report to help dairy farmers and dairy professionals who influence on-farm decisions find and select feed and animal management practices to mitigate enteric methane and improve profitability that are best suited for each individual operation. Because every dairy farm is different, the report provides guidance (considerations) and hyperlinks (resources) to relevant and in-depth information on 34 dairy feed and animal management topics. The topics include ration formulation and feeding, forage and concentrate management, and calf, heifer, and cow management. The report also provides value to other dairy industry stakeholders, such as veterinarians, nutritionists, farm advisors, and dairy science educators as basic educational and training program material. The Cow of the Future® project focuses on consumer-acceptable technologies that reduce enteric emissions while increasing dairy farm profitability with the long-term goal to grow dairy sales and enhance consumer trust. Adoption of management practices included in the Considerations and Resources report will help the dairy industry continue to make progress towards its voluntary goal to reduce emissions by 25% by 2020.

Subject Area: Conservation Models, Tools, and Technologies*; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

Dryland Cropping Systems for the Central High Plains of North America

Author(s): Alan Schlegel*, Kansas State University; Dan O'Brien, Kansas State University; Lucas Haag, Kansas State University

Abstract: The change from conventional tillage to no-till cropping systems has allowed for greater intensification of cropping in semi-arid regions. In the central High Plains of North America, wheat-fallow (1 crop in 2 years) has been a popular cropping system for many decades. This system is being replaced by more intensive wheat-summer crop-fallow rotations (2 crops in 3 years). There has also been increased interest in further intensifying the cropping systems by growing 3 crops in 4 years or continuous cropping. The objective of the study was to identify whether more intensive cropping systems can enhance and stabilize production in rainfed cropping systems to optimize economic crop production, more efficiently capture and utilize scarce precipitation, and maintain or enhance soil resources and environmental quality. The study was conducted from 2008 to 2014 at the Kansas State University, Southwest Research-Extension Center near Tribune in west-central Kansas. The soil was mapped as a Richfield silt loam, less than 1% slope, moderate permeability, high available water holding capacity, and no root-restrictions. The crop rotations evaluated were continuous grain sorghum, wheat-fallow, wheat-corn-fallow, wheat-sorghum-fallow, wheat-corn-sorghum-fallow, and wheat-sorghum-corn-fallow. All rotations were grown using no-till practices except for WF, which was grown using reduced-tillage. Grain yields were determined by machine harvest. Soil water was determined near planting and after harvest to a depth of 2.4 m. An economic analysis compared the relative costs and returns for each system. Precipitation capture was greater with more intensive rotations. Wheat yields were not affected by length of rotation. Corn and grain sorghum yields were about twice as great when following wheat than when following corn or grain sorghum. Grain sorghum yields were almost twice as great as corn in similar rotations. The most profitable cropping system was wheat-sorghum-fallow.

Subject Area: Conservation Models, Tools, and Technologies*; Adaptive Management of Conservation Efforts

**denotes primary author and subject area*

Efforts to Improve Soil Restoration Requirements on Disturbed Land in New Jersey

Author(s): Stephanie Murphy*, Rutgers University

Abstract: • Abstract: Since 1975, Soil Erosion and Sediment Control Standards have provided the rules for managing construction sites and other non-agricultural land disturbances (development) in New Jersey. In 2010, State legislation was developed which was intended to ensure that the land regulated by New Jersey's SESC Standards be restored to a well-functioning soil system after disturbance. A strong factor in creating and approving (January 2011) this "Soil Restoration" legislation was the potential reduction in water pollution, as the public and legislators were made aware of soil compaction's relation to vegetative establishment, infiltration/runoff, erosion, and sediment and nutrient pollution of water. In fact, the Soil Restoration legislation was touted as one goal of a 10-point plan to restore water quality of Barnegat Bay, which lies between NJ's coast and its barrier peninsula. The steps to define the Soil Restoration Standard and the obstacles and revisions necessary will be described. Obstacles might be classified by source: regulators, regulated, and administrative. An administrative obstacle to implementing the proposed revisions was the requirement for a cost/benefit analysis, which initiated an exercise in valuation of ecosystem services within suburban/developed landscapes to balance against the cost of site remediation. A summary of the cost/benefit effort (to date) will be provided. Progress with this effort will determine whether the Soil Restoration Law can be implemented in 2015.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*; Water Resources Assessment and Management

**denotes primary author and subject area*

Facilitating community-based conservation initiatives in Chesapeake Bay, Morgantown, and Berks County, Pennsylvania.

Author(s): Dan Dostie*, USDA NRCS ; Kefeni kejela, USDA NRCS ; Jeff Overstreet, Berks County Conservation District

Abstract: This poster presents the results of a community based conservation project in the Berks County, Pennsylvania drainage area to the Chesapeake Bay. Methods utilized model programs that fostered cooperative stakeholder-based decision-making, incorporated unique cultural considerations, integrated voluntary and regulatory conservation efforts that engaged schools, townships and local farmers, used new technologies adopted through research, and included technical assistance to landowners and communities. Over a four year period, partners facilitated meetings with farmers and officials from Caernarvon Township to promote installation of agricultural best management practices. A cover crop demonstration site was established to show the benefits of diverse cover crops mixes such as increased soil function and economic value. Students further learned through classroom lectures and laboratory exercises how the soil and plants work together to change properties and functions. But most importantly, students and farmers directly participated in field installation of conservation practices. Outreach, education, and engagement help integrate qualitative knowledge and social concerns, thereby making the decision-making process more effective and acceptable. As a result of this experience, the students, farmers, and other stakeholders now have a better understanding of the importance of soil and water conservation to the economic and ecological health of their community. We conclude that direct participation in program planning and installation of practices encourages community members to work together to achieve set goals, and provides all stakeholders with sufficient education and support to determine for themselves the most appropriate solutions to resource concerns. This demonstrates the wisdom inherent in land care for the local farmers' motto of: "Tell me and I'll forget, Show me and I may remember; involve me and I'll understand".

Subject Area: Outreach, Education, and Community Engagement*; Soil Health Resources, Indicators, Assessments, and Management

**denotes primary author and subject area*

Future Directions of Usable Science for Rangeland Sustainability

Author(s): Kristie Maczko*, Sustainable Rangelands Rndtble; Lori Hidinger, Arizona State University Consortium for Science, Policy, and Outcomes; Chad Ellis, The Samuel Roberts Noble Foundation; John Tanaka, University of Wyoming Dept. of Ecosystem Science and Mgmt

Abstract: As funding for rangeland research becomes more competitive, researchers must ensure that needs of public and private land managers are met. Coupled with rangeland research funding constraints are ever-expanding environmental, financial, and societal pressures. The Sustainable Rangelands Roundtable partnered with the Samuel Roberts Noble Foundation and the Consortium for Science Policy and Outcomes to convene a workshop of researchers, public and private land managers and producers, and representatives of funding organizations to develop a research agenda focused on Future Directions for Usable Science for Rangeland Sustainability. Rangelands provide ecosystem services including domestic livestock forage, open space, clean air and water, carbon sequestration, recreation opportunities, wildlife forage and habitat, food security, and scenic landscapes. Areas of emphasis for this workshop included soils, water, plants, animals, and socio-economic aspects of rangeland sustainability. Workshop results and conclusions reflect 20 hours of dialogue among over 30 contributors from varied backgrounds and rangeland professions. Usable science considers the needs of its users throughout the scientific enterprise, in this case to ensure that rangelands continue to provide a desired mix of economic, ecological, and social benefits to current and future generations. Ecological drivers identified as influencing socio-economic aspects included climate change, drought, flooding, fire and invasives. Research questions developed address: restoration of abandoned cropland; assessing resilience of rangeland systems to extreme events; integration of agricultural production and wildlife habitat conservation; effects of spatial pattern of plant communities and soils on livestock production, wildlife habitat, and water quality; developing methods to rehabilitate degraded soils, recover from wind erosion, and deal with soil stabilization; and cost benefit analysis of restoring forage crops.

Subject Area: Adaptive Management of Conservation Efforts*; Outreach, Education, and Community Engagement; Social Sciences Informing Conservation ; Soil Health Resources, Indicators, Assessments, and Management

**denotes primary author and subject area*

Geospatial products for conservation and monitoring of tree resources in agroecosystems

Author(s): Dacia Meneguzzo*, U.S. Forest Service; Brian Walters, U.S. Forest Service; Greg Liknes, U.S. Forest Service

Abstract: Trees in agricultural landscapes serve important ecological functions whether they occur naturally, such as along rivers, or are strategically planted for conservation practices, such as windbreaks that help reduce soil erosion. Despite their importance, little information is available about their location, extent, or the ecosystem services they provide. We have developed methods that identify and map tree cover from very high resolution digital aerial imagery provided by the National Agriculture Imagery Program (NAIP). The resultant tree-cover maps are available at a resolution of 1-meter and provide detailed information about the location and amount of tree cover. In addition, they can also provide guidance for proactive implementation of tree-planting programs for conservation purposes. For example, they can be combined with other geospatial datasets, such as highly erodible soils and waterbody data, to identify potential target areas that would benefit from planting a windbreak or riparian buffer. This poster illustrates how we utilized a high-resolution tree cover map for Antelope County, Nebraska, USA, combined with ancillary spatial data to create a variety of geospatial products that can be used for the inventory and monitoring of tree cover as well as in the development of practical, on-the-ground, tree-based conservation applications.

Subject Area: Conservation Models, Tools, and Technologies*; Adaptive Management of Conservation Efforts; Social Sciences Informing Conservation

**denotes primary author and subject area*

Grass and Agroforestry Buffer Influence on Spatial Differences of Selected Soil Quality Parameters

Author(s): Janith Chandrasoma*, University of Missouri; Ranjith Udawatta, University of Missouri; Shibu Jose, University of Missouri; Marcelo Altamirano , University of Missouri

Abstract: ABSTRACT Better understanding of soil quality parameters under conservation management practices such as Agroforestry (AGF) and Contour grass (CGS) buffers can help explain how buffers reduce nonpoint-source pollution (NPSP) (or improve environmental quality). The objective of this research was to evaluate the spatial variability of soil bulk density, carbon (C), nitrogen (N) and enzyme activity (Glucosidase and Glucosiminidase) as influenced by AGF and CGS 15 years after the establishment. The research was conducted at Greenley Memorial Research Center, Novelty, MO on Putnam silt loam, Kilwinning silt loam, and Armstrong loam. Grid soil samples were collected by 10-cm increments for 0-30 cm depth. Arc GIS 10.2 was used to generate interactive maps with inverse distance weighting (IDW) technique to quantify spatial variations of parameters. Results showed lower bulk density throughout the watershed in the first layer while deeper layers showed higher values. Bulk density of grass water way near AGF buffer showed higher values compared to other locations tested. N, C and enzyme data showed significant accumulation near grass water way compared to AGF. N accumulation followed the land slope and high concentrations were observed near grass water way of CGS buffer. Results showed a pattern which suggests significant retention from AGF buffers compared to GB. The results can be used as a template to illustrate the effect of conservation buffers on NPSP. Based on the results it can be concluded that spatial variation can be monitored on conservation buffers over a period of time, and the output information can be used to evaluate the performance and efficiency of conservation buffers. Keywords: Agroforestry buffers, Grass buffers, GIS, Watershed

Subject Area: Adaptive Management of Conservation Efforts*; Conservation Models, Tools, and Technologies; Soil Health Resources, Indicators, Assessments, and Management

**denotes primary author and subject area*

Improving food security through soil conservation for smallholder farmers in rural El Salvador

Author(s): Angel Cruz*, North Carolina State Universit; Michelle Schroeder-Moreno, North Carolina State University; Dean Hesterberg, North Carolina State University; Jay Jayaratne, North Carolina State University

Abstract: Despite a half century of agriculture intensification that has doubled global food production, hunger and malnutrition are still prevalent in developing countries. El Salvador has a considerable food-security challenge, in particular due to high population density and lack of arable land. The proportion of food insecure has consistently increased for the last decade and is higher in rural farming areas. Therefore, the most efficient and sustainable use of land for agricultural production is essential for El Salvador to address food security. While synthetic fertilizers, pesticides, and herbicides have been efficient at improving yields, access to such products is limited and costs are prohibitive. There is great potential to improve corn and bean yields and household food security through soil conservation and agroecological production practices in El Salvador. However, there is a lack of research documenting how soil conservation can improve food security for smallholder farmers. The goal of this study was to determine the main challenges to improving household food security and for increasing household food production; in addition to, gaining an in depth understanding of current soil conservation and crop production practices. Results of semi-structured interviews conducted with 43 households from farm cooperatives were analyzed to evaluate the strongest drivers of corn and bean yields and household food security. Overall, 98% of households were food insecure, with 31% experiencing severe food insecurity. Corn and bean yields were not correlated with N or P fertilizer inputs. The majority of families indicated that harvests were increasingly worsening, and an unpredictable weather was one of the main challenges to feeding their families and to improving agriculture production. Results of this research indicate that farmers are interested in improving soil conservation and food security may be improved for smallholder farmers through soil conservation.

Subject Area: Social Sciences Informing Conservation *; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

Improving Irrigation Efficiency in Soybeans with Pipe Planner Design and a Surge Valve

Author(s): Mike Daniels*, University of Arkansas

Abstract: The State of Arkansas has declared parts of 13 counties in Eastern Arkansas "Critical Ground Water Decline Areas" due to large cones of depression in the underlying Mississippi alluvial aquifer. Furrow irrigation of soybeans with poly tubing as a delivery header is practiced on thousands of acres in Arkansas. Pipe Planner and PHAUCET are computer-assisted hole sizing programs that can improve furrow irrigation efficiency on average by 25%. It is thought that by integrating a surge valve into the design that irrigation efficiency can be further increased. A field trial was conducted by dividing a 100-acres soybean field in half to compare the use of a surge valve against a control. Tail water losses totaled 3.94 inches and 7.45 inches for the treatment (Surge Valve) and control, respectively. Irrigation efficiency was calculated for each irrigation event as tail water loss / irrigation amount. The mean efficiency was 0.22 and 0.43 for surge valve treatment and control, respectively. This indicates that the surge valve was 20% more efficient in reducing tail water losses. Nitrate-N losses were 0.25 and 0.46 lbs./Acre from the treatment and the control respectively while soluble P losses were 0.028 and 0.078 lbs./Acre, respectively. Results from this field trial indicated that the surge valve can increase irrigation efficiency (tail water loss / irrigation applied) by 20% while minimizing soluble nutrient losses in runoff.

Subject Area: Adaptive Management of Conservation Efforts*

**denotes primary author and subject area*

Incorporating Multiple Ecosystem Services into the Design of Low Impact Development Strategies

Author(s): John Lewis*, NC State University; Jennifer O'Brien, NC State University; Danesha Seth Carley, NC State University; Richard McLaughlin, North Carolina State Universit; David Tarpy, NC State University; Joshua Heitman, North Carolina State University

Abstract: The Southeastern United States has had the greatest proportion of population increase over the past 60 years compared to other regions of the country and is projected to continue growing at a rapid rate. Habitats are being converted to roads, industrial centers, and neighborhoods, negatively affecting the ecosystem services they provide as well as altering existing soil conditions. Compacted soils lead to an increase in surface runoff resulting in accelerated erosion rates and diminished surface water quality. Improving stormwater infiltration into soils that are disturbed from construction activities is a Low Impact Development Strategy (LIDS) that developers may implement. Another issue associated with urban development is the loss of important ecosystem services. The decline of insect pollinators can be attributed to habitat loss and increased habitat fragmentation. The objective of this study was to investigate soil tillage and amendments in compacted soils with pollinator-friendly plants to determine the potential of implementation for stormwater treatment and reduction while improving pollinator habitat. Four treatments (tilled, no till with unincorporated compost, tilled with incorporated compost, and a control treatment where no amendment strategy was applied) were replicated four times on 1.8 meter by 3.0 meter plots. Seeds were evenly broadcast over the plots. After establishment, infiltration rates were measured using two different methods. Insect pollinators were collected using colored pan traps bimonthly and were identified by species. Further research should focus on the type of soil amendment strategy that is most beneficial for improving soil structure, the type of amendments that are cost-effective, and the species of plants that provide sufficient habitat while maintaining high infiltration rates. Combining multiple ecosystem services into the design of LIDS could offset the effects of development and help restore ecosystem service functions.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*; Adaptive Management of Conservation Efforts; Water Resources Assessment and Management

**denotes primary author and subject area*

Influence of Agroforestry Buffers and Row Crop Management on Soil Hydraulic Properties

Author(s): Eda Akdemir*, University of Missouri; Stephen Anderson, University of Missouri; Ranjith Udawatta, University of Missouri

Abstract: Agroforestry (AgB) and grass (GB) buffers have been developed as a part of the management system for row crop areas in temperate regions to improve soil and water quality and diversify farm income. The objectives of this experimental study were to evaluate the effects of agroforestry and grass buffers relative to row crop management on soil hydraulic properties for a claypan soil. The soils in the study area were mapped as Putnam silt loam (fine, smectitic, mesic Vertic Albaqualf). The watershed was under no-till management with a corn (Zea mays L.)-soybean (Glycine max L.) rotation since 1991. The agroforestry buffer watershed and grass buffer watershed had vegetative buffer strips planted which were 4.5m wide and 36.5 apart (lower slope positions are 22.8 m) with vegetation composed of grasses, legumes, and trees. Throughout the grass buffer and agroforestry buffer strips, redtop (Agrostis gigantea Roth), brome grass (Bromus spp.), and birdsfoot trefoil (Lotus corniculatus L.) were planted in 1997. For the agroforestry buffers, pin oak (Quercus palustris Muenchh), swamp white oak (Quercus bicolar Willd.) and bur oak (Quercus macrocarpa Michx.) trees were planted at 9 m intervals for species in the center of the grass buffer strips at 3 m intervals between trees. Hydraulic properties (saturated hydraulic conductivity, soil water retention, pore-size distributions, and bulk density) were measured using soil core samples (76 mm diam. by 76 mm long) from four 10 cm depth increments with six replicates. Significant differences were found among the treatments for saturated hydraulic conductivity. Although the claypan horizon will dominate the surface hydrology, buffers may provide some benefits by reducing runoff, soil loss and nutrient loss from row crop management.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*

**denotes primary author and subject area*

Long-term soil and crop management effects on soil physical properties related to soil erodibility

Author(s): Sebahattin Acikgoz*, University of Missouri; Stephen Anderson, University of Missouri; Clark Gantzer, University of Missouri; Allen Thompson, University of Missouri; Randall Miles, University of Missouri

Abstract: Understanding the long-term effects of crop rotations with annual manure applications is critical for assessing the production potential of land. A study was conducted to evaluate the effects of 125 years of continuous crop management on selected soil physical properties for Sanborn Field, Columbia, Missouri. Intact soil cores (76 mm diam. by 76 mm long) were collected from continuous corn (Zea mays L.), continuous wheat (Triticum aestivum L.), continuous timothy (Phleum pratense L.), and a rotation of corn–wheat–red clover (Trifolium pratense L.). These plots have been in continuous cultivation for 125 years. Some plots received no fertilization and others 13.5 Mg/ha manure each year. The soil was Mexico silt loam (fine, smectitic, mesic, Aeric Vertic Epiaqualfs). Soil samples were removed from the surface horizon throughout one year 125 years after initiation of the plots (April, July, and November sampling dates). Aggregate stability, soil splash detachment, bulk density and soil strength were monitored. Significant differences in aggregate stability were found among the treatments with the Timothy plots having the highest values. Other properties supported these results. Learning the effects of long-term soil management on soil quality and erodibility is critical for society to assess the level of soil erosion with soil management and develop appropriate conservation practices to minimize this challenge. It is also important to know which land management methods maintain soil quality and long-term sustainability.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*

**denotes primary author and subject area*

Market-Based Solutions in Conservation

Author(s): Jessica Pope*, North Carolina State Univ.; Fred Cubbage, NCSU; Nils Peterson, NCSU; Michelle Lovejoy, The NC Foundation for Soil and Water Conservation

Abstract: Market based solutions for maintaining and restoring ecosystem services are becoming more popular as means to encourage conservation through the interaction of government incentives and market efficiency to get the most returns for limited funds. The federal "Farm Bill" programs have established cost share and annual payment mechanisms to encourage conservation, and these have now been implemented with new innovations in reverse auctions, where program participants help establish market prices for the conservation that they will provide. However, there are relatively few evaluations of these reverse auction approaches for designing programs and recruiting participants. In this study we evaluated the Market Based Conservation Initiative (MBCI), a pilot program that used a reverse auction system in eastern North Carolina. In this initiative landowners with property under a 2-mile wide military training flight path bid for conservation contracts to keep lands in productive farm or forest use, but undeveloped, under the flight path. Landowner applications include proposed annual payments, contract length, and numerous characteristics about the landowners. The initial payments and contract lengths requested in the first round varied from 10 to 30 years and annual payments required of $20 to more than $1000 per year. The military generally accepted only the lowest bids, which forced subsequent bid rounds to quickly approach a more limited range of $20 to $80 per acre, and favored shorter commitments of 10 to 20 years. We will examine the data with general linear models to predict bid amounts and bid lengths based on geographic and demographic attributes of landowners. We will also examine which landowners should be targeted for market-based solutions. The continued expansion of these models in North Carolina could help create a more efficient process for planning and managing conservation programs and thus improve the level and quality of conservation in North Carolina.

Subject Area: Conservation Economics and Policy *; Conservation Models, Tools, and Technologies

**denotes primary author and subject area*

Monitoring Nutrient Runoff from Cotton on the Arkansas Cotton Discovery Farm

Author(s): Mike Daniels*, University of Arkansas

Abstract: Arkansas cotton farmers are under increasing pressure to operate with environmental sustainability. To help agricultural producers take ownership of documenting environmental impact and water-related sustainability, the University of Arkansas' Division of Agriculture in conjunction with many stakeholder groups launched the Arkansas Discovery Farm (ADF) program in 2011 and established a Cotton Discovery Farm in 2013 on the C.B. Stevens farm in Desha County. This program utilizes a unique approach based on agriculture producers, scientists and natural resource managers working jointly to collect economic and environmental data from real, working farms to better define sustainability issues and find solutions that promote agricultural profitability and natural resource protection. Edge of field monitoring of runoff results will be shared.

Subject Area: Water Resources Assessment and Management*

**denotes primary author and subject area*

Nitrogen Rate and N Loss-Prevention Additive Effects on Corn and Wheat Yields in North Carolina

Author(s): Shelby Rajkovich*, North Carolina State Universit; Deanna Osmond, NC State University; Randy Weisz, North Carolina State University; Carl Crozier, North Carolina State University

Abstract: Determining optimum nitrogen (N) fertilization rates is critical to preventing over-application and environmental losses of N to soil and water. These trials were designed to: 1) determine optimum N rates for corn and wheat in three different regions of North Carolina, the Coastal Plain, Piedmont, and Mountains; and 2) determine the value of alternative fertilizer additives in reducing N losses. The standard fertilizer treatment of urea ammonium nitrate (UAN) was compared with UAN with AgrotainPlus®, UAN with Instinct®, and UAN with NZone® at six different nitrogen rates in corn and five different nitrogen rates in wheat. Data on optimum N fertilizer rates, determined using a linear-plateau statistical model, will be presented. The fertilizer additives did not appear to lend an advantage to yield in either crop, nor were there any differences in nitrogen use efficiency (NUE) based on fertilizer additive. These products may not significantly prevent N loss compared to UAN alone, indicating that proper N application rates may be more effective in protecting the surrounding environment and water quality.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*; Water Resources Assessment and Management

**denotes primary author and subject area*

Nutrient dynamics in root zone of soil water retention technology

Author(s): Alvin Smucker*, Michigan State University; Zouheir Massri, Michigan State University; Xilan Yang, Michigan State University; Samrawi Berhanu, Michigan State University

Abstract: Low retention of water and nutrients in the root zones of highly permeable sandy soils are primary contributors to their low production capacities of corn in Michigan. Excessive irrigation combined with excessive drainage cause excessive leaching of nitrates and potassium leading to high nitrate concentrations of in groundwater. Low water contents in the root zones of sandy soils result in little plant available water. Although recent developments in drip irrigation/fertilization scheduling have increased corn yields, groundwater concentrations of nitrates continue to increase. The MSU soil water retention technology (SWRT) coupled with prescription irrigation and fertigation has produced record yields of 325 bu/a of corn, yet little is known of the soil nutrient retention, ion distribution and crop uptake efficiency. This study was initiated in newly applied subsurface water retention technology (SWRT) to retain essential soil solutions in the root zone of crop plants. Measurements of chemically extracted nitrate and potassium from soil were compared with solution concentrations directly extracted from soil solutions by the RHIZON micro-lysimeter soil solution samplers placed near soil water, temperature and salinity probes. These measurements were used to compare nutrient retention and flux rates in the root zone above SWRT water impermeable membranes. Field samples were taken at multiple depths during various plant growth stages and compared with side dressing, fertigation and rainfall events. Greater quantities of nitrates leached than potassium. The wetting–drying (W–D) cycles of the soil greatly affected the concentration of nitrate and potassium in the soil solution.

Subject Area: Precision Conservation

**denotes primary author and subject area*

Optimal Allocation of Agricultural Water Use in the Humid Southeastern U.S Using Hydro-Economic Modeling

Author(s): Christopher Clark, University of Tennessee; Lixia He, University of Tennessee; Burton English*, University of Tennessee; Dayton Lambert, University of Tennessee; Thanos Papanicolaou, University of Tennessee; Christopher Boyer, University of Tennessee; Jamey Menard, University of Tennessee

Abstract: The stress on Southeastern water resources is increasing due to expansions in irrigated acres, urbanization, population growth and economic development, coupled with a relatively limited storage capacity, an aging urban infrastructure, and reliance of large inland population centers on relatively small watersheds with limited water supplies. Climate change threatens to exacerbate this stress, with uncertain rainfall patterns and the amplified risk of extreme weather events, including both droughts and high rainfall events. These changes also imperil the resiliency of agricultural and forestry economies and the jobs and businesses that depend on these sectors since they are the major consumptive water users. Cost-effective adaptation to these changes and mitigation of their adverse impacts requires a deeper understanding by researchers, policymakers, educators and agricultural producers of the complexity characterizing the dynamics of land use and water availability for agriculture and competing uses under changing climatic conditions. A partial equilibrium (PE) model is developed to estimate the economic value of water in the poultry, row crop, beef cattle, goat, and dairy sectors operating in different geographic locations and to analyze different water management strategies that may mitigate the stress of water shortages on the economic performance of these enterprises. The hydrological model Variable Infiltration Capacity (VIC) will be used to simulate water scarcity scenarios. The output of VIC will be used as water resource constraints of each agricultural sector to determine changes in gross sector income, changes in input use, crop mix, and livestock production, and changes in the economic value of water attributable to these shocks. The model output directly relevant to producers is examples of proactive, cost-effective measurements that can be implemented on their operations to moderate the impact of prolonged water scarcity or acute inundations.

Subject Area: Water Resources Assessment and Management*; Conservation Economics and Policy

**denotes primary author and subject area*

Phosphorus Recoery Prior to Land Application of Biosolids Using the "Quick Wash" Process Developed by USDA

Author(s): Ariel Szogi*, USDA-ARS-CPSWPRC; Matias Vanotti, USDA-ARS-CPSWPRC

Abstract: Excess soil phosphorus (P) beyond the assimilative capacity of soils is a major factor to discontinue application of biosolids to land nearby municipal wastewater treatment plants. For this reason, municipalities incur in hefty fees for transportation and landfilling biosolids that otherwise could be used as soil amendment. A new treatment process, called "quick wash" was developed and patented by the USDA-ARS for recovery of P from manure solids. Additional research showed the approach is very effective to recover P from municipal biosolids prior to land application. This process was developed for rapid wet extraction of P from raw waste and recovery of P in solid concentrated form, improving the nitrogen (N) and P balance in the waste. This process consists of selectively extracting P from organic wastes using mineral or organic acids, and recovery of P from the extract by adding lime and an organic polymer forming a calcium-containing P precipitate. The quick wash process can recover more than 80 % of the P from the waste stream, while leaving most of the N in the washed solid residue. Consequently, the washed solid residue has a more balanced N:P ratio for crop production and is safe for land application. Because the quick wash process is conducted at ambient temperature, it avoids loss of oxidizable organic carbon (C) and N from washed residues. Thus, the land application of washed solid residues contribute with C and N to maintaining soil health while reducing the environmental risks of excess soil P. The concentrated P materials contain more than 90% of its P in plant available form that provides a recycled P source for use as crop fertilizer. The inclusion of this treatment process in municipal wastewater treatment systems offers both rural and urban communities an opportunity to minimize P losses into the environment and sustain soil health while recovering and recycling P as a valuable product.

Subject Area: Adaptive Management of Conservation Efforts*; Conservation in Nontraditional Agriculture; Water Resources Assessment and Management

**denotes primary author and subject area*

Prediction of Drawdown Around a Radical Collector Well

Author(s): Bahaaeldin Elwali*, Jazan University; Ismail Yussoff, University of Malaya; Wan Zamri Wan Ismail, Kelantan Water Co Ltd., Malaysia; Abu Baker Serat, University of Tripoli

Abstract: Using Well and Drainage packages of visual MODFLOW the performance and dynamic of the pumping rate of proposed horizontal wells in Pintu Geng area in Kelantan State in North Malaysia Peninsular were simulated. The model was used to determine an optimum pumping rate that would safely maintain an ideal drawdown of < 2m within an area of 300m surrounding the Pintu Geng horizontal collector well (PGHCW). Furthermore, the model can be used as a reference for the design of the horizontal well components. Results reveal that under natural flow conditions (3m bgs), the model demonstrates satisfactorily when the six collectors (drains) tap a volume of 19,200 – 43,700 m3/day with a minor impact of drawdown (0.5m) within the immediate area surrounding PGHCW. This fluctuation was attributed to the variation of the estimated recharge which in turn suggests increasing the pumping rate during the dry season to sustain to desired yield of 33 m3/day.

Subject Area: Water Resources Assessment and Management*; Conservation Models, Tools, and Technologies

**denotes primary author and subject area*

Private and Public Sector Conservation Collaboration Engages Plain Sect Farmers to Improve Soil and Stream Health in the Lancaster County, Pennsylvania Drainage Area to the Chesapeake Bay

Author(s): Dan Dostie*, USDA NRCS ; Lamonte Garber, Stroud Water Research Center; Wendy Coons, NRCS

Abstract: This poster presents the results of a collaborative effort to assist Plain Sect Farmers improve comprehensive nutrient cycling across the farm, in on-farm soils and in downstream water bodies. The Chesapeake Bay Region faces a "wicked" nutrient problem requiring enhanced efforts to solving it. A CEAP progress report in November 2013 finds opportunities still exist to increase conservation on cropped acres. To get more conservation on the ground and in the water, professionals in Lancaster County, Pennsylvania must overcome the inherent apprehension by Plain Sect farmers of government assistance. In this project traditional outreach methods were enhanced with collaboration from both non-profit and for profit businesses. Private funding of boat tours of the Bay, crop consultant meetings and field days, forest buffer vouchers, and multiple major workshops helped farmers better understand costs and benefits and overcome fear of new state regulations. Behavior change is currently being measured by monitoring participation in public and private sector programs while outcomes are being measured by changes in nutrient flows on the farm and macro-invertebrates in the stream. Over a 5 year outreach campaign by the collaborating partners, awareness was raised among at least 1000 Plain Sect farmers across Lancaster County about the costs of desired societal outcomes and availability of both private and public sector financial assistance. The campaign has resulted in 136 new program contracts with Plain Sect participants implementing over 1100 new conservation practices including 40 riparian forest buffers. Results demonstrate that enhancing traditional approaches with involvement from private foundations and for profit business interests accelerate adoption of comprehensive conservation. Facilitating social connections between diverse community members and raising awareness about private funding sources increases adoption among Plain Sect farmers.

Subject Area: Outreach, Education, and Community Engagement*; Conservation in Nontraditional Agriculture; Soil Health Resources, Indicators, Assessments, and Management; Water Resources Assessment and Management

**denotes primary author and subject area*

Several Years Application of Some Amendments on Soil Physical Properties of a Light-Textured Soil

Author(s): Melis Cercioglu*, Dumlupinar University

Abstract: The objective of this study was to investigate the influences of application of some amendments as composted tobacco waste (CTW), chicken manure (CM), bio-humus (BH), zeolite (Z) and lime (L) on soil physical properties. This research was performed in the experimental fields of the Agriculture Faculty's research farm at Ege University in Menemen, Izmir, Turkey in 2009, 2010, 2011. The experiment was arranged in a randomized block design with four replicates. Treatments were as follows: (1) 1 t ha-1 Z+NPK, (2) 4 t ha-1 CM+NPK, (3) 1 t ha-1 L+NPK, (4) 300 kg ha-1 NPK, (5) 50 t ha-1 CTW, (6) 10 t ha-1 BH+NPK and (7) control. During the research, soil samples were taken six times in three years.(I, 3 June 2009; II, 23 October 2009; III, 1 June 2010; IV, 5 November 2010; V, 13 July 2011; VI, 21 October 2011). In this study, tobacco wastes gathered from the cigarette industry were composted and bio-humus (composted plant residuals), chicken manure were obtained from organic manure industry for this study. It has been analyzed that application of organic amendments (CTW, BH, CM) increased porosity, field capacity, available water content, wilting point, sturucture stability index between the rates of 14% and 26.4%; decreased bulk density, particle density of soil samples between 3.4% and 15.8% rates when compared with the variation of the control. The results show that these organic wastes were determined as the most effective amendments on soil physical properties.

Subject Area: Adaptive Management of Conservation Efforts*; Conservation in Nontraditional Agriculture; Conservation Models, Tools, and Technologies

**denotes primary author and subject area*

Small Scale Agriculture – FAS and NRCS International Program

Author(s): Cheryl Simmons*, Natural Resources Conservation Service; Otto Gonzalez , Foreign Agricultural Service ; Matt Stellbauer, FAS

Abstract: With Foreign Agriculture Service, the Natural Resources Conservation Service (NRCS) International Program Division is working with local Institutes, nongovernmental organizations, and local government representatives from all provinces in Pakistan. Projects include Watershed and Irrigation Demonstration and Dissemination Projects and the Soil Fertility and Soil Health Project. Small scale agriculture is one focus of the projects. • Watershed and Irrigation Demonstration and Dissemination Project – Projects include solar powered irrigation systems, simplified water bucket irrigation for crops and gardens, and drip irrigation options. • Soil Fertility and Soil Health Project – Part of the project includes composting process, structures, and use. It also includes using compost as fertilizer for seasonal high tunnels, roof runoff water management and basic soils information /education. This poster will present lessons learned and future directions identified by the project outcomes and on-going interaction with Pakistan participants.

Subject Area: Outreach, Education, and Community Engagement*; Social Sciences Informing Conservation ; Soil Health Resources, Indicators, Assessments, and Management; Water Resources Assessment and Management

**denotes primary author and subject area*

Soil & Water Science Curriculum for Informal Youth Education

Author(s): Natalie Carroll*, Purdue University

Abstract: A new 4-H Soil and Water Science curriculum for youth in grades 3 through 12 through a partnership between Purdue University, the Tippecanoe County Partnership for Water Quality, Christopher B. Burke Engineering Limited, and the Wabash River Enhancement Corporation. The new curriculum includes 3 youth manuals, each with a facilitator's guide. Level 1 introduces basic terms and concepts. Activities focus on understanding important soil and water processes. Level 2 activities help youth put the basic concepts into action to understand more advanced soil and water concepts and interactions with the environment. Level 3 delves more deeply into soil and water science concepts, and prepares youth to be well informed and for advanced studies at college or university. Activities are divided into chapters based on how youth might use the information they have learned — as a homeowner, as a resident of a watershed, as a food and fiber producer, as a mayor, as a teacher, and as a legislator. The manuals are available online from Purdue University's The Education Store (www.edustore.purdue.edu). Level 1 is also available in print.

Subject Area: Outreach, Education, and Community Engagement*; Soil Health Resources, Indicators, Assessments, and Management; Water Resources Assessment and Management

**denotes primary author and subject area*

Subsurface Application of poultry litter to Improve Air and Water Quality

Author(s): ARTHUR ALLEN*, UMES; NANCY CHEPKETER, UMES; PETER KLEINMAN, ARS-USDA; LOU SAPORITO, USDA-ARS; RAY BRYANT, USDA-ARS; FAWZY HASHEM, UMES; ERIC MAY, UMES; ROBIN BRANDT, PSU; MIKE HILE, PSU

Abstract: Surface broadcasting of poultry litter leaves nitrogen (N) and phosphorous (P) vulnerable to being lost in runoff and leachate and, provide an escape route for N to be lost to the atmosphere through ammonia volatilization. This practice has played some role in the pollution of the Chesapeake Bay, surrounding Coastal Bays, and Chesapeake Bay Watersheds. Subsurface application of poultry litter incorporates and places N and P below the soil surface, where they are less susceptible to runoff, and volatilization loss. The development of a novel technology that places these nutrients beneath the soil surface has been shown in some studies to minimize the loss of N and P to significant water bodies, and reduce odor emission to the atmosphere. Since 2007, researchers at the University of Maryland Eastern Shore, Penn State University, University of Maryland, and USDA-Agricultural Research Service units at Auburn University, University Arkansas at Booneville, and others tested a novel technology, the Subsurfer. We evaluated N and P runoff and leachate amounts, and odor emission levels using conventional methods (control, disking, broadcasting,) with subsurface application of poultry litter using the Subsurfer. During the study period, losses of P and N in surface runoff and leachate did not differ significantly in all years, and sporadic difference reductions in leachate and runoff were observed between the subsurface application and conventional litter application treatments in some years. The Subsurface treatment reduced odor emissions by as much as 92% compared to broadcasting.

Subject Area: Precision Conservation

**denotes primary author and subject area*

Texas Watershed Steward Program

Author(s): Michael Kuitu*, Texas A&M AgriLife Extension S; Mark McFarland, Texas A&M AgriLife Extension Service; Galen Roberts, Texas A&M AgriLife Extension Service; Ward Ling, Texas A&M AgriLife Extension Service

Abstract: Stakeholder participation is paramount 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 drive local actions to improve and protect their water resources. However, many stakeholders are not well informed about local water resource issues, watershed processes, or potential management strategies. In fact, most individuals are unaware of whether water quality issues even exist in their area and, more importantly, how they as individuals can make a difference. The Texas Watershed Steward (TWS) program was developed to address this need by providing training on the fundamentals of watersheds and watershed management. TWS is designed to educate stakeholders about their watershed, potential impairments, and steps that can be taken to protect and improve water quality. The curriculum provides a comprehensive summary of water quality management in Texas and is delivered using a team approach through a blend of PowerPoint modules, interactive stations, and hands on demonstrations. Since the first workshop was held in December 2007, 64 TWS educational events have been delivered in watersheds throughout Texas, reaching a total of 2,928 people as of December 2014. Pre/Post-program test data not only show a 62% increase in participants' knowledge concerning water quality and watershed management, but also indicate a large percentage of attendees intend to adopt behaviors to protect or improve water quality. Survey data collected from participants six months after attending a workshop indicate 75% of respondents have adopted one or more best management practices. Implementation of the TWS program has facilitated initiation of new water quality improvement projects, increased stakeholder involvement in existing watershed protection efforts, and has motivated individual citizens to take greater personal responsibility for protection of their water resources.

Subject Area: Outreach, Education, and Community Engagement*; Adaptive Management of Conservation Efforts; Conservation Models, Tools, and Technologies; Soil Health Resources, Indicators, Assessments, and Management; Water Resources Assessment and Management

**denotes primary author and subject area*

The Application and Use of Unmanned Aerial Systems in Precision Agriculture

Author(s): Joseph Taylor*, NSCU Soil Science Department; Deanna Osmond, North Carolina State University; Joshua Heitman, North Carolina State University; Rob Austin, ; Carl Crozier, NCSU Soil Science Department; Alan Meijer, NCSU Soil Science Department

Abstract: Unmanned Aerial Systems (UAS) are a new and promising tool for use in precision agriculture and farm management. When equipped with small digital sensors (e.g., multi-spectral cameras), UAS are able to acquire remotely sensed information at temporal and spatial scales previously unthinkable. UAS are targeted for use in water and irrigation management, pest and disease identification, precision application of fertilizer and chemicals, and nutrient management. As a benefit for water conservation in irrigation management, UAS are marked for use in identifying water stressed vegetation as well as pinpointing mechanical problems within irrigation equipment (e.g., clogged nozzles, poor spray patterns, etc.). In nutrient management, UAS provide an opportunity for growers to identify and manage the within-field spatial variation of plant nutrients. Because of UAS's ability to acquire images on short notice, growers may be able to identify nutrient problem before yield-limiting deficiencies take place. Using this information, growers will be able to target nutrient (and chemical) applications, maximizing their efficiency while minimizing harmful environmental impacts. Our research investigates the use of UAS in precision agriculture and nutrient management by testing, analyzing, and validating multispectral imagery captured using both ground-based, and UAS-based, platforms against in-situ field measurements of plant nitrogen and spectral response.

Subject Area: Conservation Models, Tools, and Technologies*; Water Resources Assessment and Management

**denotes primary author and subject area*

The Effects of Land Use Changes and Climate Variability on Reservoir Sedimentation for the Little Washita River Experimentation Watershed

Author(s): Hollie Skibstead*, USDA ARS; Daniel Moriasi, USDA ARS; Jean Steiner, USDA ARS; Patrick Starks, USDA ARS; Jorge Guzman, Waterborne Environmental Inc. ; J Verser, USDA ARS

Abstract: In the 1930's, the United States experienced a period of severe dust storms known as the Dust Bowl, caused by severe drought and lack of proper farming methods. Lack of vegetation combined with isolated periods of intense rainfall caused increased erosion and flooding. As a result of the Flood Control Act of 1936, the Washita River Basin (WRB) was one of eleven pilot watershed projects chosen to construct flood control reservoirs. These reservoirs were implemented to prevent and manage soil erosion and flooding. A total of 45 reservoirs were installed between 1969 and 1982 in the Little Washita River Experimental Watershed (LWREW) within the WRB. Over time, these reservoirs lose water holding capacity due to sedimentation whose rates are dependent on land use changes and climate variability. This study sought to determine the impact of land use changes and climate variability on reservoir sedimentation. The main focus was determining the soil physical properties such as bulk density and soil texture. Sediment cores were collected from ten reservoirs using state-of-the-art coring system. The cores were cut, weighed, and dried to determine the bulk density of each sample. After determining the bulk density, samples were tested in the lab using the hydrometer method to determine the soil texture. Results indicated that variability of bulk density and soil texture were significantly impacted by land use changes and climate variability for the areas contributing to the respective reservoirs within the LWREW. Therefore, it is important to utilize proper farming methods to minimize the negative impacts of soil erosion.

Subject Area: Water Resources Assessment and Management*; Adaptive Management of Conservation Efforts

**denotes primary author and subject area*

Treatment of BPA Contaminated Stormwater with Manganese Oxide-Coated Sand

Author(s): Julianne Rolf*, UC Riverside; Joe Charbonnet, UC Berkeley; David Sedlak, UC Berkeley, ReNUWIt

Abstract: As municipalities consider stormwater as a potential source for clean water, stormwater contamination by organic compounds is a concern. Such organic compounds pose threats to human and ecosystem health, but many of these compounds could be removed by infiltration through reactive geomedia. In these experiments, sand was coated with manganese oxide to remove organic contaminants from stormwater. Water with 1µM bisphenol A (BPA) was passed through upflow columns packed with Mn-oxide-coated sand in simulated stormwater matrices. Effluent concentrations of BPA from the column were measured using liquid chromatography/mass spectrometry. Mn (II) washout from the column was measured using UV-Visible Spectrophotometry to quantify reactivity and Mn(II) sorption by the geomedia. Both commercially available media and media synthesized in the lab demonstrated good removal of BPA over a long period of time. These results suggest such technologies could be employed in municipal infiltration systems for treatment of organic stormwater contaminants.

Subject Area: Water Resources Assessment and Management*; Adaptive Management of Conservation Efforts; Soil Health Resources, Indicators, Assessments, and Management

**denotes primary author and subject area*

Useful to Usable (U2U): Transforming climate information into usable tools to support Midwestern agricultural production

Author(s): Linda Prokopy*, Purdue University; Melissa Widhalm, Purdue University

Abstract: There is a close connection between weather and climate patterns and successful agricultural production. Therefore, incorporating climate information into farm management is likely to reduce the risk of economic losses and increase profitability. While weather and climate information is becoming ever more abundant and accessible, the use of such information in the agricultural community remains limited. Useful to Usable (U2U): Transforming Climate Variability and Change Information for Cereal Crop Producers is a USDA-NIFA funded research and extension project focused on improving the use of climate information for agricultural production in the Midwestern United States by developing user-driven decision tools and training resources. The U2U team is a diverse and uniquely qualified group of climatologists, crop modelers, agronomists, and social scientists from 9 Midwestern universities and two NOAA Regional Climate Centers. Together, we strive to help producers make better long-term plans on what, when and where to plant and also how to manage crops for maximum yields and minimum environmental damage. To ensure relevance and usability of U2U products, our social science team is using a number of techniques including surveys and focus groups to integrate stakeholder interests, needs, and concerns into all aspects of U2U research. It is through this coupling of physical and social science disciplines that we strive to transform existing climate information into actionable knowledge.

Subject Area: Social Sciences Informing Conservation *; Conservation Models, Tools, and Technologies

**denotes primary author and subject area*

Water for the Seasons: Evaluating the Feasibility of Domestic and International Implementation

Author(s): Karen Simpson*, University of Nevada, Reno ; Kelley Sterle, University of Nevada, Reno; Maureen McCarthy, University of Nevada Reno Academy for the Environment; Loretta Singletary, University of Nevada, Reno; Derek Kauneckis, University of Nevada, Reno; Greg Pohll, Desert Research Institute; Michael Dettinger, U.S.G.S. Scripps Institute; Rich Niswonger, U.S.G.S.; Shehadri Rajagopal, Desert Research Institute; Justin Huntington, Desert Research Institute; Staci Emm, University of Nevada, Reno

Abstract: The NSF-WSC and USDA funded Water for the Seasons project is designed to create a collaborative research model for assessing climate resilience in snow-fed arid basins. Although the initial research will focus on the Truckee-Carson River System (TCRS) in northern Nevada, the project team intends to create a package of models and methods that will be applicable to water management elsewhere in the U.S., as well as abroad. The TCRS was selected for in-depth study because the diversity of local water-use and the complexity of water-use arrangements makes it possible to explore the impact of a variety of factors on resilience and enhances the generalizability of the results. Transferring this research to other basins, however, requires careful consideration of local conditions and resources. This poster is intended to describe an initial evaluation of the areas where this research might be utilized, the potential barriers created by differing economic and regulatory environments, and some potential solutions to these issues.

Subject Area: Water Science in the Public Interest

**denotes primary author and subject area*

Water Infiltration in Claypan Soils Influenced by Agroforestry and Grass Buffers for Row Crop Management Systems

Author(s): Handan Sahin*, University of Missouri; Stephen Anderson, University of Missouri; Ranjith Udawatta, University of Missouri

Abstract: Agroforestry buffers have been recently introduced in temperate regions to enhance conservation of soil and water resources in row crop management. The effects of agroforestry and grass-legume buffers on in situ water infiltration relative to row crop management were assessed for a claypan soil in northeastern Missouri, USA. Infiltration rates were observed in June for watersheds under corn (Zea mays L.)-soybean (Glycine max (L.) Merr.] management; these watersheds had agroforestry buffers or grass buffers. The dominant soil for the watersheds was Putnam silt loam (fine, smectitic, mesic Vertic Albaqualf). The watersheds were in no-till management and established in 1991 with agroforestry and grass buffers implemented in 1997. Agroforestry buffers, 4.5 m wide and 36.5 m apart, consisted of redtop (Agrostis gigantea Roth), brome (Bromus spp.), and birdsfoot trefoil (Lotus corniculatus L.) with pin oak (Quercus palustris Menchh.), swamp white oak (Q. bicolor Willd.), and bur oak (Q. macrocarpa Michx.) trees; trees were spaced 3 m apart. Grass buffers, 4.5 m wide and 36.5 m apart, consisted of redtop, brome, and birdsfoot trefoil. Infiltration rings (25 cm diam.) were installed into the claypan soil horizon for measuring water transport. Significant differences were found among the treatments for steady infiltration rates. For this soil, the surface hydrology will be significantly affected by the claypan horizon; however, buffers will provide benefits of reducing sediment loss and nutrient runoff from row crop management.

Subject Area: Soil Health Resources, Indicators, Assessments, and Management*; Water Resources Assessment and Management

**denotes primary author and subject area*

Water Vulnerability to Diffuse Pollution from Agriculture: A case study in Lincolnshire County, UK

Author(s): David Hutchinson, Environment Agency, Lincoln; Sarah Swift, Environment Agency, Lincoln; Gueorgui Anguelov*, University of Lincoln; Isobel Wright,

Abstract: Diffuse water pollution from agriculture has received growing attention since the 1980s when in many countries including the UK. Amongst the most prone to pollution are chalky soils over limestone such as the farmland around University of Lincoln. Nitrogen concentrations, sediments and phosphorus instabilities require improvement in water quality. Locally, the River Witham and its tributaries are in moderate or poor ecological condition in part due to diffuse agricultural inputs of sediment and phosphate. The important limestone and chalk aquifers throughout the Lincolnshire are also at risk from nitrates and pesticides from diffuse agricultural sources. This is a particular issue for drinking water supply. To achieve good or potentially good status in both our surface and ground waters a range of measures will be required across catchments including those that mitigate the impact of agricultural activity. This study aims to identify farm fields most vulnerable to pollution and offer mitigation options with management practices under the new Common Agricultural Policy. The crop diversification (3-crop) rule, cover or companion cropping and buffer strips along waterways are some of the mitigation options that can assist farmers in implementing soil and water conservation measures. Some of these practices have been put in place by the management of the university farmland. Their effectiveness in water quality improvement and potential pollution decreasing are observed by automated samplers. The preliminary data reveal that NO3-N concentrations are between 4-5 mg/l and 5-6 mg/l upstream and downstream respectively, while the P is between 0.02 and 0.09 mg/l. A further analysis of water quality parameters including temperature, pH, conductivity, turbidity in addition to nitrogen and phosphorus will be evaluated and presented.

Subject Area: Water Resources Assessment and Management*; Adaptive Management of Conservation Efforts

**denotes primary author and subject area*

Watershed Planning in Texas

Author(s): Galen Roberts*, Texas A&M AgriLife Extension Service; Ward Ling, Texas A&M AgriLife Extension Service

Abstract: The United States Environmental Protection Agency (EPA) has embraced the watershed approach for addressing water issues, including the development of watershed plans as a means to achieve water quality standards and protect water resources. In Texas, Watershed Protection Plans (WPPs) are a key part of the state's water quality management strategy and the Texas A&M AgriLife Extension Service (Extension) has demonstrated an effective model for WPP development. The development model relies on an accelerated stakeholder engagement strategy and uses a unique set of analytical methods. Stakeholder involvement is a key component; however, rapid plan development is essential to maintain momentum throughout the process and into the implementation phase. Watershed characterization analyses include standard components such as land use classification and load duration curve (LDC) development, but also employs Texas A&M's Spatially Explicit Load Enrichment Calculation Tool (SELECT). The SELECT analysis is utilized to produce subwatershed scale maps that clearly present the likely distribution of potential pollutant sources across the watershed and their relative degree of contribution. These visualization tools enable stakeholders to assess, prioritize, and target best management practices more confidently and effectively. They also present a clear strategy to regulatory managers. Accordingly, this approach produced Texas' first EPA accepted watershed plan, the Plum Creek WPP (2009), and more recently, the Geronimo and Alligator Creeks WPP (2012) received approval in just two weeks. Based on this success, the approach is used statewide as the model for WPP development in Texas.

Subject Area: Water Resources Assessment and Management*; Adaptive Management of Conservation Efforts; Conservation Models, Tools, and Technologies; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

Yields of No-till Irrigated Continuous Corn Can Be Increased with Controlled-Release Fertilizer

Author(s): Jorge Delgado*, USDA; Ardell Halvorson, USDA; teve DelGrosso, USDA; Daniel Manter, USDA; Catherine Stewart, USDA

Abstract: Corn responds to nitrogen (N) fertilizer applications and there is potential to sync the availability of N from fertilizer with corn N demands to increase N use efficiency and yields. To test the effects of urea versus controlled-release, polymer-coated urea (ESN) on yields, we established six N treatments from 0 to 224 kg N ha-1 in a Fort Collins clay loam soil at the CSU ARDEC near Fort Collins, CO. We included 34 kg urea-N ha-1 as a starter in the ESN treatments. Both treatments were applied to irrigated corn grown in corn-dry bean (CB) (Phaseolus vulgaris L.) and continuous corn (CC) (Zea mays L.) rotations. Nitrogen fertilizer increased yields of corn (P 0.0001). The ESN average yields of 9.4 Mg dry grain ha-1 were higher than the 8.8 Mg dry grain ha-1 with urea (P 0.08). The corn yields of the CB were the same for the ESN and urea treatments. The CB average yields of 10.5 Mg dry grain ha-1 were higher than the 9.1 Mg dry grain ha-1 with the CC (P 0.001). These preliminary results suggest that at current corn prices the ESN could potentially be a viable, economical source of N for CC. These responses suggest that the slow N release from the ESN contributed to higher CC yields, and that N release from leguminous residue (LR) contributed to higher CB corn yields. Both ESN and LR contributed to increased yield and helped sync available N with crop N uptake at the 134 kg N ha-1. Synchronizing N fertilizer applications with plant demand using controlled-release fertilizer or leguminous residue (LR) can increase crop nitrogen use efficiency and yields.

Subject Area: Adaptive Management of Conservation Efforts*; Conservation Models, Tools, and Technologies

**denotes primary author and subject area*