SOIL AND WATER CONSERVATION SOCIETY

2014 Abstract Book

July 27-30, 2014 | Lombard, Illinois

69th SWCS International Annual Conference

Making Waves in Conservation

Our Life on Land & its Impact on Water

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Symposia Sessions

Symposia Session Descriptions and Agendas

Adaptive Management for Ecosystem Services
Presenters: *Hannah Birge, University of Nebraska-Lincoln; Craig Allen, University of Nebraska-Lincoln; Kevin Pope, University of Nebraska-Lincoln*

Abstract: Ecosystem services are threatened by global change. Management actions often seek to maintain ecosystem services in the face of changing conditions, including climate change and land use change. However, there is often much uncertainty regarding how ecosystem services might respond to both global change and management activities, and how global change and management interact. Managing the uncertain, dynamic nature of ecosystems and the services they provide requires decision making that is structured and flexible. Adaptive management satisfies this requirement, departing from traditional command-and-control management with a flexible, iterative, and structured approach that emphasizes continuous learning and adjustment. Adaptive management also allows "learning while doing" and informs decision making through monitoring to reduce uncertainty and adjusting management goals as new information is gathered. As a result, adaptive management is a powerful tool for practitioners as we prepare for and respond to the complex and uncertain shifts in ecosystems and their services on which we rely.

This session is composed of speakers from a broad range of disciplines whose research focuses in some way on adaptive management and/or adaptive governance of complex systems where ecosystem services are essential outputs. Speakers will present their work in terms of its impact on the field of adaptive management and ecosystem services. Expected outcomes include a special feature of journal articles presenting the next iteration of adaptive management as a tool for bolstering and conserving ecosystem services essential to human society.

Presentation 1: Investigating the Impacts of Mid-Contract Management on Ecosystem Services from an Adaptive Management Framework - *Hanna Birge, University of Nebraska-Lincoln; Craig Allen, University of Nebraska-Lincoln*

Abstract: Mid-contract management obligations are a recent addition to the Conservation Reserve Program (CRP), and seek to create habitat –an important ecosystem service –by disrupting mature, dense monoculture stands of grasses in the north central Great Plains back to early secondary succession through fire, tillage, interseeding, herbicide application or, in some cases, haying. This disturbance may, however, undermine the Conservation Reserve Program's initial objective of promoting fertile, erosion-resistant soils, which is another key ecosystem service of the Great Plains system. By simultaneously measuring attributes of upland gamebird habitat, plant functional diversity, pollinator dynamics, and soil health, our work seeks to establish the differential impacts of five major mid-contract management activities on critical ecosystem services. Our work will reduce the uncertainties related to the impacts of the aforementioned activities, fitting into an adaptive management framework and helping to establish smart, iterative, long-term monitoring of Great Plains CRP lands for ecosystem services.

Presentation 2: Applying Adaptive Management to Invasive Species: Woody Plant Management in the Niobrara River Valley, Nebraska – *Kent Fricke, University of Nebraska-Lincoln; Craig Allen, University of Nebraska-Lincoln; Joseph Fontaine, University of Nebraska-Lincoln*

Abstract: Biological invasions are capable of significantly altering socio-ecological systems and reducing ecosystem services. Managing invasive species in dynamic landscapes requires the ability to identify novel invasion conditions, embrace new technologies, and adapt to surprises as they arise. Adaptive management is an appropriate approach for managing invasive species to preserve ecosystem services because it allows managers and stakeholders the flexibility to take management actions in a structured manner and learn from the results of those actions. Throughout the Great Plains of the central United States, woody plant encroachment threatens and reduces ecosystem services. Native, invasive eastern redcedar (*Juniperus virginiana*) and non-native, invasive Russian olive

(*Elaegnus angustifolia*) and common buckthorn (*Rhamnus cathartica*) are the predominant species of concern within the Niobrara River Valley of northern Nebraska. Multiple management strategies are currently used to control these species, including prescribed fire, mechanical removal, and herbicide treatments. The effects of these methods on native plant and animal communities and the long-term cost of management are largely unknown. In addition, social perceptions of invasive species and attitudes toward management activities are unclear. The goal of this research is to determine the ecological differences and social acceptance of management techniques and integrate this knowledge into an adaptive plan for woody plant management in the Niobrara River Valley. Methodologies and preliminary results of vegetation sampling, forest restoration techniques, and human dimensions will be presented.

Presentation 3: Adaptive Management of Green Urban Infrastructure for Ecosystem Services – *Ahjond Garmestani, EPA; William Shuster, EPA; Olivia Green, EPA*

Abstract: Consent decree settlements for violations of the Clean Water Act (1972) increasingly include provisions for redress of combined sewer overflow activity through hybrid approaches that incorporate the best of both gray (e.g., storage tunnels) and green infrastructure (e.g., rain gardens). Adaptive management is an environmental management strategy that uses an iterative process of decision-making to improve environmental management via system monitoring. A central tenet of adaptive management is that management involves a learning process that can help regulated communities achieve environmental quality objectives. We are using an adaptive management approach to guide a green infrastructure retrofit of a neighborhood in the Slavic Village Development Corporation area (Cleveland, Ohio). We are in the process of gathering hydrologic and ecosystem services data and will use this data as a basis for collaboration with area citizens on a plan to use green infrastructure to contain stormflows. Monitoring data provides researchers with feedback on the impact of green infrastructure implementation and indicates where improvements can be made.

Presentation 4: Adaptive Management of Agroecosystems for Ecosystem Services – *Craig Allen, University of Nebraska-Lincoln*

Abstract: Agro-ecosystems are under pressure to continue to increase productivity while providing ecological services. Our work examines the potential for adaptive management to reconcile the seemingly opposing goals of increasing food production while maintaining resilience and ecosystem goods and services. The need to simultaneously increase food production while bolstering the system's ability to withstand social and ecological stressors is unlikely to be met with existing management approaches. Due to its structured, integrated and iterative approach, we suggest adaptive management as a tool to better manage agroecosystems under uncertain global futures while meeting both ecological and agricultural goals.

Presentation 5: Adaptive Management's Relationship with Ecosystem Services: From Theory to Application *Kristine Nemec, USDA-ARS*

Presentation 6: Adaptive Management of Fisheries for Ecosystem Services – *Kevin Pope, University of Nebraska-Lincoln*

Abstract: Although more commonly applied to large-scale ecosystems, adaptive management can be used by agricultural producers at the farm-level scale to manage for uncertainty associated with climate change and alterations in nearby land use. Changing climatic and land use conditions may affect the provision of ecosystem services provided by beneficial insects such as pest suppression, pollination, and enhancement of soil quality on a farm, which in turn can affect crop production. Producers can maintain and enhance the provision of ecosystem services by adopting a flexible, adaptive approach to the management of their farms. Trying a range of methods for increasing year-round plant diversity is one approach that can enhance the ecosystem services provided by insects. We discuss the adoption of cover crops as a means for adaptively managing cropland for the ecosystem services produced by beneficial insects.

Subject Area: Adaptive Management of Conservation Efforts

Adventures in Cooperative Conservation: A Review of the First Four Years of the Mississippi River Healthy Watersheds Initiative
Moderator: *David DeGeus, The Nature Conservancy*

Abstract: Watershed projects have been around since the creation of Natural Resources Conservation Service (NRCS) in the 1930s. When Chief White created the Mississippi River Healthy Watersheds Initiative (MRBI) with funding from the 2008 Farm Bill, it built on NRCS's long watershed heritage but included several significant advancements. MRBI was a new breed of watershed program. Computer models were used to target watersheds contributing high nutrient loads. MRBI was unprecedented in its scale—eventually targeting 640 watersheds throughout 12 states of the Mississippi River Basin. MRBI included cost share assistance for a new monitoring practice that allowed producers to install edge of field monitoring. This gave producers real data access to monitor the outcome of their nutrient management practices, thereby enabling true adaptive management to occur. MRBI also used a unique systems approach, funding both in-field and off-field practices such as floodplain restoration. One thing that was not new was the reliance on federal, state, and private sector partners; thousands of them enabled one of the nation's largest ever watershed projects to get off the ground in just four years. Presenters will review successes and failures of MRBI at the local, state, and national scale. They will demonstrate the unique ways MRBI has been used in the basin and make recommendations for improvement and continuation of one of this country's most ambitious watershed initiatives.

Presentation 1: **The Iowa MRBI Experience** –*Marty Adkins, USDA-NRCS*

Abstract: The Mississippi River Healthy Basin Watershed Initiative (MRBI) is providing focused technical and financial resources in 21 HUC-12 watersheds in Iowa. Each of these project areas is located in one of the five priority HUC-8 watersheds in Iowa. The projects were proposed and developed, and are being implemented, by local SWCD and land user leaders with assistance from the NRCS and partner organizations. Project work is underway and is leveraging federal and non-federal dollars to accelerate the rate of conservation work in the target watersheds.

Presentation 2: **Water Quality Landscape Initiatives in Arkansas** – *Nancy L. Young, USDA-NRCS*

Abstract: The success of the Arkansas water quality initiatives such as the Mississippi River Basin Healthy Watershed Initiative, the Illinois River Watershed Initiative, and the National Water Quality Initiative has been very evident by the number of projects accepted into the initiatives, the funding applied to conservation practice planning and implementation, and the sharp rise in conservation awareness and adoption by agricultural producers in the state. Arkansas leads the nation in MRBI projects. The effectiveness of the initiatives is due to the close conservation partnership ties within the state with all partners working toward a common goal. Collaboration and synergism between federal and state agencies as well as non-governmental organizations has led to this success.

Presentation 3: Indian Creek – *Chad Watts, Conservation Technology Information Center (CTIC)*

Abstract: Farmers in Livingston County, Illinois, lead a community effort to drive greater adoption of conservation practices and monitor water quality improvements in the Indian Creek Watershed. The project began in 2010 and aims to implement conservation systems on a minimum of 50 percent of cropland acres in the watershed and engage 50 percent of the watershed's farmers. With financial assistance through the Mississippi River Basin Initiative, farmers are able to adopt conservation practices demonstrated through the Indian Creek Watershed Project. The Indian Creek Steering Committee guides the project's on-farm demonstrations of innovative conservation technologies, agronomic and financial assistance, outreach and social support for watershed farmers. The committee is assisted by the Conservation Technology Information Center, Livingston County Soil and Water Conservation District, USDA's Natural Resources Conservation Service, and Illinois Environmental Protection Agency.

Presentation 4: MRBI: Targeting Factors for Achieving Measurable Improvements in Water Quality – *Michelle Perez, World Resource Institute*

Abstract: The World Resources Institute (WRI) reviewed the Missis-sippi River Basin Healthy Watersheds Initiative (MRBI) to determine how well it was designed to achieve what we determined to be targeting success: landscape-scale water quality improvements. We reviewed literature, interviewed experts and identified six critical factors: (1) stakeholder and producer buy-in; (2) specific, measurable, achievable, results-oriented, time-bound, and quantitative (SMART-Q) goals; (3) geographic targeting; (4) monitoring and evaluation; (5) cost effectiveness; and (6) adaptive management. We assessed MRBI at the programmatic and project level by evaluating 60 percent of the 2010 and 2011 project proposals, interviewing NRCS and project staff, and reviewing MRBI's literature. We rated how well MRBI addressed each factor on a scale from "exemplary" to "very poor."

WRI commends NRCS for focusing conser-vation funds to achieve landscape-scale water quality outcomes through this partnership-based, targeted watershed approach. Overall, MRBI received an average rating of "fair." MRBI excelled at geographically targeting, receiving a "good" rating. It received "fair" ratings for including stakeholders and producers, setting SMART-Q goals, measuring and evaluating progress, and reflecting principles of adaptive manage-ment. It received a "poor" for cost effectiveness.

Based on these findings, we identified 12 specific recommendations for NRCS and its partners to implement to help MRBI achieve measurable reductions in nitrogen, phosphorus, and sediment loads. One of the most urgent actions includes strengthening monitoring efforts. Though NRCS is providing oversight of individual farm-level monitoring efforts, the agency has not yet led or coordinated in-stream and watershed-outlet water quality monitoring efforts, which are key for demonstrating landscape-scale results. With a few adjustments, the MRBI could demonstrate significant water quality improvements over time.

Subject Area: Conservation Models, Tools, and Techniques

Informing Conservation through Social Sciences – Part I
Moderator: *Tommy Bass, Montana State University*

Presentation 1: Farmer Behavior as Related to Conservation Practice Type: Jordan Lake Watershed, NC – *Deanna Osmond, NC State University*

Abstract: A large USDA-NIFA funded project, "Analysis of Conservation Practice Effectiveness and Producer Adoption Behavior in the Lake Jordan Watershed (North Carolina)" had multiple objectives, one of which was to better understand farmer/rancher and hobby farmer decision making relative to nutrient management and conservation practice adoption. A 90-person key-informant survey was conducted with agricultural landowners in the Jordan Lake Watershed, NC to understand famers' adoption and use of conservation practices relative to their beliefs surrounding conservation and land stewardship. The three primary conservation practices used in this watershed are conservation tillage, stream fencing, and nutrient management. Of the farmers who grow row crops, conservation tillage is practiced by 93% of the farmers, some for as long as 40 years and enjoys wide spread support among farmers. Stream fencing was identified as a conservation practice by 62% of participants, with 28% reporting that they presently implement the practice. The data shows significant skepticism regarding the utility, cost and desirability of stream fencing among producers. Finally, nutrient management was not understood as a conservation practice by those interviewed. Partly this is due to considerable pasture acreage, which is under fertilized with nitrogen due to the high cost of fertilizer relative to cattle prices, and partly due to farmer perceptions that they know how to fertilize their crops. By considering the entangled geographic, historical and social experiences of agricultural landowners over time with federal and state conservation programs and non-point source pollution mitigation, the survey data has identified barriers and enhancers to adoption and allows us to address methods for working with and around such barriers and enhancers.

Presentation 2: Women Caring for the Land: Improving Conservation Outreach to Female Non-Operator Farmland Owners – *Leigh Adcock, Women, Food and Agriculture Network*

Abstract: Women, Food and Agriculture Network is a non-profit organization based in Iowa founded in 1997. Since 2009, we have been meeting with female non-operator farmland owners in a "learning circles" format all around the Midwest, to inform and empower them to improve soil and water conservation on their farmland in cooperation with their tenants. Nearly 1,200 women have attended a Women Caring for the Land(SM) meeting since 2009, and more than 50 percent report in surveys that they take at least one conservation action within a year of attending. The meetings include a women-only morning discussion, and an afternoon field tour of area farms to showcase conservation management practices. Most of the women who attend the meetings own conventional commodity-crop farms, and want to learn how to minimize soil and water quality impacts through best management practices. Some are also interested in diversifying crops, implementing cover crops, adding or enhancing wetlands, or exploring low-impact or organic agriculture options. WFAN works closely with the NRCS, FSA, state departments of natural resources and agriculture, soil and water districts and other non-profits to plan and deliver this program. We will also offer train-the-trainer workshops for conservation professionals in 7 upper Midwest states in 2014 to help them improve conservation outreach to this long-underserved but crucial audience of conservation partners. We would like to share the rationale and methodology of Women Caring for the Land with the SWCS audience.

Presentation 3: Investigating Iowa Farmers' Use of Nutrient Management Strategies – *J. Arbuckle, Iowa State University*

Abstract: Nutrient loss from Midwestern agricultural landscapes has long been a cause of water quality degradation and economic impacts for both farmers and the general public. Nutrients from farm fields and animal production facilities in the Mississippi River Basin (MRB) cause local waterway impairments and contribute to the hypoxic zone in the Gulf of Mexico. In 2008, the EPA-led Mississippi River/Gulf of Mexico Watershed Nutrient Task Force recommended that states in the MRB develop strategies to attain major declines in nutrient loading across the

region. In response, Iowa state agencies and Iowa State University developed the Iowa Nutrient Reduction Strategy, which was adopted in May 2013. A key component of the Iowa strategy is a "science assessment" that estimated potential nutrient load reduction associated with us of numerous best management practices. In anticipation of the nutrient reduction strategy, a survey of farmers was conducted in February and March of 2012 to measure Iowa farmers' knowledge and use of nutrient management practices recommended in the strategy. Most farmers reported moderate or heavy use of more common practices such as crop rotations (86%), yield goals (73%), and soil testing (66%). However, reported use of more innovative and effective practices was much lower; smaller percentages reported moderate or heavy use of stalk N tests (10%), nitrification inhibitors (24%), or N rate calculators (10%), and relatively high percentages of farmers reported that they were not familiar with these practices. Socioeconomic factors associated with use of different practices and data on the information sources that farmers use to help them make decisions regarding nutrient management will be reported. Overall, results show that many farmers lack knowledge of innovative nutrient management practices and point to strategies that the agricultural community can employ to more effectively promote the use of both innovative and tried-and-true practices.

Presentation 4: Human Dimensions of Puget Sound Ecosystem Health and Recovery: Social Sciences Scale and Scope – *Mary Rozance, Portland State University*

Abstract: The Puget Sound Basin is surrounded by human settlements that range from resource-dependent communities, to metropolitan areas experiencing rapid population growth. Scientific studies in the biophysical disciplines have documented the Puget Sound's ecological decline, established baseline conditions for recovery, and identified human-based sources of ecosystem impacts. The Puget Sound region is a complex socio-ecological system thus making equal attention to human dimensions an important goal, even a necessity. Social scientists across a variety of disciplines can contribute to large-scale ecosystem health and recovery in two general ways. First, studies can serve to describe and highlight the human systems conditions that generate negative impacts on Puget Sound health. Second, and more importantly perhaps, the social sciences seek to understand how to better address different societal scales in greater awareness, deeper understanding, and committed behavior toward ecosystem recovery. We offer a comprehensive overview of human dimensions topics (generally aligned with various social science disciplines) that can serve to inform policy and action. This extensive literature review seeks to reconcile common perceptions that regard people as the source of ecological problems with knowledge that can support strategies to engage people in solutions. We present a framework of the human dimension of ecosystem recovery, describing how human activity at different scales can affect change in social-ecological systems. Each of the eight topics in our framework is highlighted using a combination of general principles, theory and prior research. Better understanding of this rich potential can contribute to better integration with biophysical knowledge to achieve recovery of large, complex ecological systems. The comprehensive overview of human dimensions topics will foster and support dialog about the scientific basis of a socio-ecological system approach for ecosystem recovery.

Subject Area: Informing Conservation through Social Sciences: Understanding the Human Component of Land Management Stewardship

Informing Conservation through Social Sciences: Understanding the Human Component of Land Management Stewardship – Part II

Beg, Borrow, or Steal to Improve Soil Stewardship: Will Segmenting Midwest Row Crop Actors Improve Management?

Presenter: *Michelle Wander, University of Illinois*

Abstract: Panelists will consider how to use voluntary and regulatory government programs and business-backed efforts to improve stewardship of organic and conventional grain farms, and explore the premise that the efficacy of information or inducements will vary with farmers' market orientation.

This session will evaluate socioeconomic factors determining farmers' willingness or ability to adopt conservation behaviors and consider how to adapt our information and knowledge systems to improve management of different farming segments. A three-year study that compared carbon sequestration and soil quality in organic and conventional grain farms that employ standard or conservation-tillage practices in Illinois will be reviewed. That project applied the theory of planned behavior to explore the attitudes, norms, and behavioral controls determining farmer adoption of conservation behaviors. Measured results, interviews, and surveys suggest business orientation, land access, and social connectedness most influence farmers' practice choice and propensity to participate in voluntary stewardship efforts and can be used to segment producers into groups with distinct information/programmatic needs. Farmer input suggests refining management within segments is unlikely to improve stewardship unless information can somehow be used to reverse the trends of farm-size expansion and increased reliance on crop insurance that promote resource degradation and discourage conservation. Panelists will consider how technical standards and decision tools might be used to alter lease agreements and federal programs to improve stewardship and be tailored for effective use by different farming segments, consumers, and the public.

Subject Area: Informing Conservation through Social Sciences: Understanding the Human Component of Land Management Stewardship

Lessons Learned from Cover Cropping across the Midwest
Presenters: *Scott Wohltman, LaCrosse Seed;*
Anna Boyle, LaCrosse Seed; Farmer Panel

This session will include research conducted from over 500 landowners across the Midwest on the current relevance of cover cropping, a landowner's ease of gaining knowledge on cover cropping and available government programs, the need for making proper equipment available, and the impact local Soil and Water Conservation Districts have on local and/or regional seed suppliers. The results of the findings show that there is tremendous opportunity to teach and educate landowners not only on cover crop practices, but also on less detailed information like seed availability and timing. The information provided will shed light on the needs of the landowner and how the industry ultimately needs to be a better, more consistent supplier of that information.

Subject Area: Cover Crop Practices: Application, Innovation, and Management

Solutions to New Challenges Facing Traditional Conservation Practices
Moderator: *Jorge Delgado, USDA-ARS*

Abstract: The topic of the 15th annual Soil and Water Conservation Society (SWCS)–Soil Science Society of America (SSSA) joint symposium is a topic of great importance and interest to both societies. *There are new challenges facing traditional soil and water conservation practices*. For example, there are the food safety and conservation practice issues. There are also important challenges related to water, from water quality challenges in the Great Lakes to challenges related to water use/conservation in the Great Plains and the Southwest that can potentially be addressed with conservation practices. Maintaining sustainability with the growth of biomass energy agriculture and the conversion of CRP lands to crop production also presents conservation challenges that will need solutions. Additionally, there is the question of how we can increase the effectiveness of conservation practices, and the advancement of new precision conservation techniques may provide an answer. Policies that consider and/or incorporate the use of conservation practices to address these challenges will be important for maintaining sustainable agricultural production and good water and air quality in the United States. 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 challenges in conservation.

Session I

Midwestern Management of Biomass for Energy, Soil and Water Conservation, and Soil Health – *Douglas Karlan, USDA-NRCS*

Abstract: The anticipated 2014 launch of three full-scale corn (*Zea mays* L.) stover bioenergy conversion facilities in the USA is a strong market signal that cellulosic feedstock supplies must increase dramatically to supply 242 million Mg yr^{-1} (266 million tons yr^{-1}) for each facility producing biofuel at 252 L Mg^{-1} (60 gal ton^{-1}). However, the decision to harvest corn stover for bioenergy or bio-product development is not that simple, because stover also supports many ecosystem and soil health services by sustaining profile soil organic carbon (SOC) supplies. Prevention of SOC declines through any soil and crop management decision is crucial because SOC levels influence numerous soil biological, chemical, and physical properties and processes (e.g., fungal:bacterial ratios within soil microbial communities, soil enzyme levels, nutrient cycling, soil aggregation, water entry, retention and release to plants, surface crusting, erosion, etc.). Beginning with the challenge to balance economic drivers and limiting factors associated with sustainable biomass harvest, we will explore the available Natural Resources Conservation Service (NRCS) policies and programs as well as recent multi-location research results that are available to help land owners and managers develop best biomass management practices for their operations. Overall, we conclude that site-specific, sub-field soil and crop management practices are the key, thus confirming the close link between precision agriculture and sustainable development.

Influence of Conservation Reserve Program Age and Conversion to Cropland on Soil Quality, Metabolic Capacity and Microbial Diversity: Implications for Our Decisions about Soil Conservation – *Jennifer Moore-Kucera, Texas Tech University*

Abstract: The conservation reserve program (CRP) has reduced soil erosion and increased aboveground biodiversity and carbon (C) storage. The Texas High Plains (THP) region leads the nation with >890,000 hectares enrolled in CRP. After these contracts expire, some land may be converted back to cropland. In the THP, conversion of grasslands that had year-round cover to cropland that is disturbed by tillage and exposed for part of the year may have a negative impact on many of the ecosystem benefits established during CRP restoration. Assessments of soil microbial community composition and diversity are often coupled to the assessment of soil processes (C storage and nutrient cycling) to better address the ecosystem response to disturbances and recovery. Our first objective was to measure these sensitive soil quality indicators to determine if age of CRP influenced soil quality by comparing soil samples from 7 non-irrigated croplands (0 years restored), 16 CRP lands (range in age from 6-26 years) and 3 native rangelands (NR). Our second objective evaluated the same soil parameters during

the first few years when CRP land is converted to cropland. Objective 1: Preliminary results suggest that the CRP lands have not reached soil C levels of the NR and require decades longer to reach these levels. Additionally, CRP lands had lower ecological stress indicators than cropped fields and stress decreased with increasing CRP age. CRP age also positively influenced enzymatic activities involved in nutrient cycling and key soil organisms such as arbuscular mycorrhizal fungi (AMF) that are important for soil stability and water and nutrient uptake. Objective 2: Indicators of ecological stress were lower in converted fields than CRP. However, CRP had higher AMF biomass during the first year. In the second sampling year, one of the stress ratios was lower in CRP fields. These findings indicate that the initial measures of improved soil quality in the converted fields may be only short lived.

Soil C Dynamics in Grazing Land Ecosystems and the Impacts of Management on Soil C Sequestration and Greenhouse Gas Emissions – *Maria Silveira, University of Florida*

Abstract: Native and improved grazing lands are a significant sink for long-term carbon (C) sequestration as they contain 10 to 30% of the world's soil C reserves (Eswaran et al., 1993; Schimel, 1995). Because grazing lands occupy a vast area throughout the world, small changes in the amounts of C stored in this ecosystem can have significant consequences in the overall C cycle and atmospheric CO_2 levels. Reports have shown that an increase (or loss) of only 1% of the soil C in the top 4 inches of grazing land soils is equivalent to the total C emissions from all U.S. cropland agriculture (Follett et al., 2001). This trend underscores the importance of grazing lands to mitigate at least part of global atmospheric CO_2 emissions. However, soil organic C accumulation in grazing lands is strongly influenced by management. Current management strategies (e.g., fertilization, and grazing management) are generally aimed at increasing forage production to match animal stocking rates or forage demand from hay. However, grazing land management controls organic matter production, distribution and quality and, therefore, has major effects on C sequestration and greenhouse gas emissions. Research has shown that fertilization, grazing management, and changes in vegetation composition can have major impacts on soil C accumulation (Conant et al., 2001; Silveira et al., 2013). Properly-managed grazing lands generally maintain or even increase soil C accumulation compared with native ecosystems. Although opportunities for increasing soil C sequestration in response to management practices vary in intensity and are specific to each ecosystem, adoption of sustainable management practices that favor C inputs and minimize decomposition, is key to increasing C sequestration in grazing land soils. In addition, increasing soil C accumulation can also have significant impacts on the overall soil quality and can potentially contribute to the sustainability of grazing land ecosystems in the U.S.

Managing Weeds in Conservation Systems: Overcoming Herbicide-Resistant Weeds in the Mid-South and Southeastern United States – *Andrew Price, USDA-ARS*

Abstract: Glyphosate-resistant weeds are now present throughout the Southeast. Hundreds of thousands of conservation tillage cotton acres, some currently under USDA Natural Resources Conservation Service (NRCS) conservation program contracts, are at risk of being converted to higher-intensity tillage systems (Price et al., 2011). The shift to higher-intensity tillage facilitates seed burial as well as preplant incorporated and pre-emergence herbicide control of this problematic weed, especially in dry-land cotton production. Conservation tillage has been recognized as a beneficial alternative to conventional tillage practices, but adoption remained sluggish through the '80s and mid '90s due, in large part, to poor weed control and weed control options available for these systems. A turning point was reached when, in 1996, Monsanto introduced Roundup Ready® soybean and subsequent glyphosate-resistant crops offered a successful alternative to conventional weed management that could be incorporated into conservation agriculture systems. Best management practices recommend rotating crops and chemicals to avoid the development of resistance. Unfortunately many producers have had little economic opportunity to grow different crops for a number of reasons. In addition, the system of glyphosate-resistant crops has become so prevalent that rotation of crops does not ensure that chemical weed control choice will change along with a change of crops. It is not surprising that resistance to a single chemical would appear under these conditions. Much research has focused on controlling this problematic weed. An abbreviated list of the solutions offered includes: crop rotation intensification (including pasture-based rotations), improving residual herbicide

performance in dry-land conservation systems, weed management intensification (scouting, timely applications, etc.), and integration of cultural solutions (high residue cover crops, delayed planting, etc.).

Precision Conservation for Riparian Systems to Maintain Balance between Soil, Water, and Wildlife Conservation and Agricultural Production – *Wes Burger, Mississippi State University*

Abstract: Conservation buffers are practical, cost-effective conservation practices which provide multiple environmental benefits. Strategically deployed conservation buffers produce environmental outcomes disproportionate to change in primary land use. Potential placement of buffers within a field, watershed, or landscape is constrained by practice eligibility criteria. However, optimal buffer placement will vary in relation to the specific resource concern. Precision conservation tools including LIDAR derived terrain models, land use/land cover, and nutrient/sediment transport models have been used to identify optimal buffer locations (Dosskey et al. 2011; Galzki et al. 2011; Saleh et al. 2011). Bentrup and Kellerman (2004) illustrated a geospatial approach for identifying optimal buffer placement to enhance biodiversity of riparian wildlife based on species-specific motility and connectivity. These data-informed approaches to practice placement will enhance the efficacy and cost-effectiveness of practices, but leave out the adoption-decision element. Conservation adoption is a multidimensional decision, influenced predominantly by time management, profit, and yields. Producers incur opportunity costs of practice adoption, yet these costs are rarely quantified and programmatic incentives are rarely based on true costs. McConnell and Burger (2011) described a geospatial decision support tool to guide producers and resource planners in making adoption decisions informed by profitability. Recent advances in precision agriculture technologies allow more sophisticated spatially-explicit profit determination to accurately characterize opportunity costs, better informing adoption decisions and structuring of practice incentives. Combining outcomes from nutrient/sediment transport, wildlife habitat value, and profitability in a multiple criteria decision support context would more fully realize the potential of precision conservation.

Session II

Mitigating Agricultural Phosphorus in Western Lake Erie – Opportunities, Uncertainty and Competing Interests – *Peter Kleinman, USDA-ARS*

Abstract: The resurgence of eutrophication concerns in Western Lake Erie is largely associated with an increase in dissolved phosphorus loadings from local tributaries. Extensive blue green algal blooms pose an acute threat to Lake Erie's aquatic ecosystem, and also threaten the drinking water of local communities, including the city of Toledo. Controlling dissolved phosphorus losses in runoff from agriculture is neither simple nor straightforward, particularly in areas such as the Western Lake Erie Basin where sub-surface phosphorus pathways are thought to account for the majority of the non-point source phosphorus load. Indeed, soil conservation priorities that may have been key to historical improvements in water quality may impinge upon innovations intended to curb dissolved phosphorus loss. Trade-offs must be considered with drainage, nutrient and tillage management, a frustrating prospect for those accustomed to emphasizing production or ecological outcomes. Further confounding mitigation programs is ambiguity over specific sources of dissolved phosphorus and the likelihood that legacy phosphorus residing in soils and sediments is contributing to the watershed load. As a result, sound strategies in the areas of nutrient and drainage management, such as the 4R program, Phosphorus Index and controlled drainage management, cannot be viewed, in and of themselves, as complete solutions. Multiple strategies must be fostered, understanding that problems that have taken long periods to manifest and that are incompletely understood will take resources and time to address. Similarly, the murkiness of the problem may awaken other agendas and even attract snake oil, requiring a patient, open-minded perspective that can be immiscible in a politicized environment. We seek to offer internal and external perspectives on the problems in Western Lake Erie, highlighting the complexity of the situation while offering hope for opportunities.

Water Balances in Cover Crops Systems and Positive Impacts in Irrigated Areas of the Southwest – *John Idowu, New Mexico State University*

Abstract: Irrigation water is becoming limited in the arid Southwest, due to drought incidences that this region has faced over the past years. With reduced irrigation water availability, agricultural production has become challenging, affecting the acreage farmed in the region. The Southwest is considered the driest region in the United States, with a population growth rate above the US average, leading to intense competition for water resources. Climate-change projections for the Southwest suggest that the region will experience a rise in temperature between 2.5 – 8°F by the end of the century. The projected increase in warming is expected to lead to more severe droughts which will put further pressure on water availability in the Southwest. While cover crops have been documented to positively impact soil quality, their utility is limited by water availability in the irrigated Southwest. Cover crops can improve the soil organic matter, soil water holding capacity and soil aggregation; protect the soil from erosion; suppress weeds and diseases; and attract beneficial insects to farms. Improving soil quality with cover crops in the southwestern region will make the soil more resilient to drought and other extremes of weather. However, farmers are facing challenges on how to incorporate cover crops into their cropping systems in the irrigated Southwest, especially with limited water. Inappropriate use of cover crops in this region can lead to economic losses on the farm. Successful and economically viable use of cover crops in the irrigated Southwest will depend on choice of cover crop, cost of seeds, appropriate cover crop management, water availability and timing of irrigation. Universally acceptable cover crop recommendations cannot be achieved within this region, but farm-specific recommendations based on the crop rotation, farm equipment available, amount of water available, and the quality of water available can aid sustainable cover cropping in the Southwest.

Conservation Practices and Food Safety in California – *Edward R. Atwill, University of California, Davis*

Abstract: Outbreaks of foodborne illness associated with consumption of leafy green produce have elevated concerns in California about the potential role of wild vertebrates and irrigation water in contaminating produce with microbial pathogens. In particular, concern has focused on wildlife species with direct access to the produce production environment and surface irrigation water supplies that are either exposed to fecal contamination and/or reused as can occur with tail-water recovery systems or sediment basins. In the absence of scientific data the default response by many growers under heavy regulatory and legal pressure has been to minimize all perceived sources of microbial risk. This can result in widespread trapping and removal of wildlife from the production environment, elimination of wildlife and riparian habitat near production fields, biosecurity measures for pre-irrigation reservoirs, and discouragement of reusing irrigation water even during a drought year due to the perceived risk of elevated bacterial concentrations in reused water sources. We will discuss the comparative food safety risks of wildlife intrusion into produce fields and the potential role of pre-irrigation reservoirs, foliar irrigation systems and reuse of irrigation water in microbial contamination of leafy green produce. For example, many wildlife species forage as a group directly in fields of produce leading to in-field defecation, which greatly elevates risk of microbial contamination compared to larger animal species that do not have direct access to produce fields due to fencing. Foliar applied irrigation can create soil and fecal splash from the furrow onto nearby produce, greatly elevating food safety risk. Drip irrigation systems avoid this erosive process and have other water conservation benefits. Ultimately society will need to weigh the potential health risks against the agricultural and environmental benefits of various conservation practices in leafy green production systems.

Policies for Solutions to New Challenges Facing Traditional Conservation Practices – *Andrew Manale, EPA*

Abstract: Protecting soil, water, and wildlife resources on agricultural lands and managing the land to provide ecosystem services that sustain human communities require not just conservation practices but also the incentives and/or reasons for users to adopt the practices that lead to solutions. Policy at various governmental and geographic levels of implementation serves to support the research that produces the practices, the science to identify where and how these practices can best be used, and the measures to induce users to adopt. Policy drives the development and maintenance of the informational infrastructure for sustainable systems and, importantly, the

signaling of what does and does not work. Crafting effective policy in a multidimensional framework of changing market, social, environmental and budgetary conditions is as important as the science itself. This presentation will identify and discuss these new challenges, as well as those that have yet to be addressed, and will propose a framework for identifying and developing new policy given the opportunities presented with a new Farm Bill. In particular, it will explain how institutional barriers can thwart the best intentions regarding how science is used or reflected in policy and suggest alternative paths for avoiding and overcoming these problems. Case examples will be presented and discussed.

Subject Area: Conservation Policy and Program Design

The Next Generation of Conservation: Paying for Performance
Moderator: *Joseph Britt, Sand County Foundation*

Abstract: The magnitude of water quality problems related to production agriculture, combined with increasing pressure on federal and state budgets, necessitates that conservation spending be closely related to specific water quality outcomes. Cost-sharing based on general eligibility criteria is an approach sanctified by tradition, but inadequate to the task of getting the most environmental value from conservation spending. Therefore, new approaches are needed. Pay-for-performance (P4P) conservation motivates producers to supply cost-effective conservation through outcome-based incentives that can improve water quality within constrained budgets.
In P4P conservation, payments are awarded for achieving a specified environmental outcome; they are not attached to any specific practice. This approach gives farmers the flexibility and incentive to reduce nutrient losses in the most cost-effective manner for their specific fields and operations. Quantifying environmental outcomes related to nonpoint source pollution presents a significant challenge for P4P conservation. However, rapidly improving information systems are creating increasingly accurate ways to quantify field- and farm-level performance.
The goal of this symposium is to further develop P4P conservation for use by federal and state programs, as well as downstream regulated point sources of nutrient pollution. Brief presentations will address the pros and cons of various P4P design options and the tools for quantification, as well as the perspectives from the Environmental Protection Agency and USDA on the role of this innovative approach to conservation.

Presentation 1: Pay-for-Performance Conservation and Its Key Program Design Issues – *Jonathan Winsten, Winrock International*
Presentation 2: Understanding the Tools for Quantifying Conservation Performance – *Ryan Anderson, Delta Institute*
Presentation 3: The Challenges of Meeting TMDL Implementation Goals – *Katie Flahive, US EPA*
Presentation 4: Using USDA's Quantification Tools to Tee-Up Pay-for-Performance Conservation – *Shaun McKinney, USDA*

Subject Area: Conservation Policy and Program Design

Water Quality and Quantity in Production Agriculture
Moderator: *Karen Scanlon, Conservation Technology Information Center (CTIC)*

Abstract: This symposium will explore the many challenges that arise when an increasing number of stakeholders are dependent on limited water resources. According to the United Nations, world population has increased by an estimated 78 million each year and is expected to reach 9 billion by 2050. This growth requires global food production to be 70% greater than today's levels in order to feed the world. The increase in food production must be accomplished while addressing sustainability needs, including preserving and protecting our water resources.

Collaborative, science-based efforts are needed to make agriculture more resilient in the face of changing environmental pressures. Conservation practices and solutions must be designed to maintain the productive capacity of working lands; be environmentally effective and economically sustainable; and be voluntary, as these practices are not one-size-fits-all.

Through this panel discussion format, the panelists and audience will be able to discuss key issues related to water quality and quantity in production agriculture. Panelists will draw from a diverse wealth of experiences representing leading academic, environmental, regulatory, and food value chain voices to make this a dynamic conversation. Participants will gain new perspectives and awareness in order to better understand how we can work collaboratively to protect water resources while providing for the world's food needs.

Subject Area: Adaptive Management of Conservation Efforts

69th SWCS International Annual Conference

MAKING WAVES IN CONSERVATION

Our Life on Land & its Impact on Water

LOMBARD, IL • JUL 27–30, 2014

Oral Presentations

A MODEL INTEGRATION FRAMEWORK FOR ASSESING SURFACE AND SUBSURFACE WATER INTERACTION

Author(s): Jorge Guzman*, USDA-ARS GRL; Daniel Moriasi, USDA-ARS GRL; Prasanna Gowda, USDA-ARS CPRL; Jean Steiner, USDA-ARS GRL; Patrick Starks, USDA-ARS GRL; Jeff Arnold, USDA-ARS GSWRL; Raghavan Srinivasan, Texas A&M AgriLife Research

Abstract: To assess anthropogenic impacts on agro-ecosystems a comprehensive modeling capabilities are required accounting complex processes at surface and subsurface domains. To address this need, the SWAT and MODFLOW models were integrated to better represent surface-subsurface water interaction. A modeling framework was developed due to differences in models spatial discretization and representation, and a new application implemented as a project manager, builder, and model performance evaluator. The model was evaluated in the Fort Cobb Reservoir experimental watershed, Oklahoma. Results from streamflow and groundwater levels showed that there was a general agreement with observations trends. However, the model was not able to properly represent low streamflow under dry conditions and aquifer depletions rates due to deficiencies in spatial parameterization and simulated well extractions volumes, which frames our future investigation. This modeling framework is expected to improve simulation at the watershed scale, thus providing a platform for more detailed transport phenomena simulations.

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

**denotes primary author and subject area*

A Decision Support Module for Evaluating the Effects of Alternative Land Management Practices on Florida Surface Water Quality

Author(s): Christy Crandall*, Florida A&M University; Katherine Milla, Florida A&M University; Amita Jain, Florida A&M University; Odemari Mbuya, Florida A&M University; Del Bottcher,

Abstract: Agricultural activities are a major source of nonpoint-source pollutant loadings to surface waters in Florida and adjacent states. This project is a direct response to increased pressure on the state of Florida to reduce nutrient levels in impaired water bodies to meet federally-mandated Total Maximum Daily Loads (TMDLs) of nutrients to streams. Basin Management Action Plans (BMAPs) are developed by the Florida Department of Environmental Protection in impaired watersheds to reduce nutrients loads to streams. Agricultural Best Management Practices (BMPs) are implemented by the Florida Department of Agriculture. It is essential to have land-owner buy-in when encouraging the adoption of BMPs. To address this need we are developing a computer automated decision support module to assist agency personnel in helping landowners develop a specific plan for each farm to reduce nutrient loads to streams. The decision support module uses the Watershed Assessment Model (WAM), a Geographic Information System-based surface-water flow and nutrient transport model that enables users to assess responses to agricultural practices based on physical and hydrologic properties of the watershed and management scenarios. The project provides a means to simulate BMP scenarios and potential loads to streams. Results can then be discussed with the landowner and additional BMP scenarios can be investigated to optimize the suite of management practices. Management can then be tailored for each farm to maximize financial gain and load reduction. For beta-testing the module we have selected a watershed that delivers surface waters into Florida originating in the Attapulgus Creek basin, a forested and agricultural watershed of approximately 238 mi2 that crosses from Georgia into Florida. We have purposely selected an out-of-state basin because it provides the opportunity to demonstrate the usefulness of the module to stakeholders both within and outside of the state of Florida.

Subject Area: Conservation Models, Tools, and Technologies*

**denotes primary author and subject area*

A Novel Test of Artificial Recharge in the Mississippi River Alluvial Aquifer in Arkansas

Author(s): Michele Reba*, USDA-ARS; John Czarnecki, University of Arkansas at Little Rock; J. R. Rigby, USDA-ARS; Lindy Rawlings, USDA-ARS

Abstract: Arkansas irrigates the fourth most number of acres and applies the second most volume of water for irrigation of any state in the US. The primary source for irrigation in the state is the Mississippi River Valley Alluvial Aquifer (MRVAA). Water-level decline in the MRVAA has been documented since the early 1900s. However, substantial water-level declines have been measured since 1980, with an average decline of approximately 1 foot per year in some areas. An extensive cone of depression in the Arkansas portion of the MRVAA is located west of Crowleys Ridge in Poinsett County. Artificial-recharge testing of the MRVAA was done in the early 1960s. Results from those tests indicated that suspended sediment and air entrainment in the recharge waters had the largest impact on recharge rates. Suspended sediment caused well screens to clog during recharge. A novel test of artificially recharging the MRVAA was completed in January of 2014 in Poinsett County. The test was done for several days with a recharge rate of about 500 gallons per minute using well water from a pumped well about ½ mile away. During the test, flow rate, recharge-water turbidity, and water temperature were monitored. Water levels in the injection well and an observation well were continuously monitored prior to, during, and after injection of the recharge water. The adoption of on-farm storage reservoirs to capture surface water in the wet springtime for use during the production season allows for a potential source of recharge water. Results from this completed recharge test, associated water quality sampling of potential recharge sources and future plans for a low-cost filtration system are presented.

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

**denotes primary author and subject area*

A User Assessment of Decision Support Tools for Addressing Nonpoint Source Pollution in the Saginaw Basin Watershed: Environmental Learning Using Computer Interactive Decisions (ELUCID) and the Great Lakes Watershed Management System (GLWMS)

Author(s): Laura Young, Michigan State University; Saichon Seedang*, Michigan State University

Abstract: Addressing nonpoint source (NPS) pollution in nearshore waters is a main focus of the federally funded Great Lakes Restoration Initiative, with phosphorus load and associated harmful algal bloom reductions a key priority for the Saginaw Basin and two other watersheds. The development, integration and assessment of decision support system (DSS) technologies that identify high-risk areas for NPS pollution are critical. Environmental Learning Using Computer Interactive Decisions (ELUCID) and the Great Lakes Watershed Management System (GLWMS) are two decision support technologies designed to identify high-risk land units on which to focus limited resources and provide field-scale assessments of pollutant loadings both before and after best management practice (BMP) implementation. For further improvement of these tools to ensure they help resource managers to deliver more effective and efficient conservation programs to meet water quality improvement goals, there is a need for an end-user evaluation. As part of collaborative efforts and projects, several training sessions and workshops for using these tools will be conducted. A user assessment of these technologies will evaluate their ability to target high-risk sites, integrate into conservation workflows, and engage producers in innovative ways. It is anticipated that these DSS technologies will be found to appropriately flag high-risk sites and significantly enhance planning efforts of technical staff and their initial consultations with producers. The assessment will identify additional features needed to improve DSS technology for future use in addressing NPS pollution and explore barriers in using DSS technology to implement BMPs on high-risk areas.

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

**denotes primary author and subject area*

An Adaptive Teaching, Management, and Outreach Program for Protecting an Urban Forest Watershed

Author(s): Andy SCOTT*, USFS Southern Research Station; Daryl Lawson, Alabama A&M University; Kenneth Ward, Alabama A&M University; Wubishet Tadesse, Alabama A&M University; William Stone, Alabama A&M University

Abstract: The U.S. Forest Service Southern Research Station (SRS), Alabama A&M University (AAMU) and the Birmingham Water Works Board (BWWB) are applying a novel adaptive management, teaching, and outreach program to protect watershed function, integrate forest and watershed education, and engage the community surrounding Lake Purdy, a 400 ha lake located within Birmingham, AL. Lake Purdy supplies drinking water for about 250,000 people and is surrounded by a diverse set of forest communities, including both montane longleaf and cove hardwood communities but dominated by loblolly pine forests. Largely passive management for decades created poor forest health conditions, which culminated in several Southern pine beetle outbreaks. These outbreaks threatened watershed integrity, as the lack of active management and influx of dead wood created heavy fuel conditions which could create extreme fire behaviors and compromise water quality. The BWWB and AAMU are conducting sound research-based forest management across the watershed, and the SRS is collaborating with both to provide an integrated laboratory setting for multiple forestry and watershed management courses, as well as provide work opportunities for students in forest management. We are using this collaboration to increase outreach of sound watershed management to the Young Water Ambassadors, a summer program for Birmingham youth. The program has hosted two integrated field laboratories for over 60 students, employed 20 students in forest management activities, and hosted field days for over 200 youth on sustainable forest watershed management. The students have completed a geo-referenced database of boundary lines, forest stands, soil types, roads, and other information, and have completed multiple timber sales. While management of each stand is occurring, student-led monitoring is used to adapt the next stand prescription for better watershed integrity and to lead toward a variety of research opportunities.

Subject Area: Outreach, Education, and Community Engagement*; Adaptive Management of Conservation Efforts; Conservation in Urban Settings; Water Resource Assessment and Management

**denotes primary author and subject area*

An Outsider's View of Holes to Fill for Transition to Landscape Scales: Diversified Enterprise Budgets, Conversion from Conventional, and Voluntary Organizational Support

Author(s): John Wiener*, U of Colorado

Abstract: Seeking to assist irrigators in transition toward sustainability and reduced financial vulnerability has given this outsider the perception of some important holes to fill. The pursuit of landscape- scale agricultural conservation call for three efforts which may be underappreciated in agricultural outreach. (1) The first is support for and creation of enterprise budgets for polyculture/diversified farming/new rotations of crops both in the traditional one-year form and for multiple years and multiple co-operations. There may be lack of transferable knowledge of transition economics, e.g. duration of lower production from conversion to organics, due to soil depletion, changes in soil microecology, and management changes from conventional high-input agriculture. (2) A second gap may be in transferable knowledge about converting to agroecological rationality, including better management of filter, buffer, shelter belt, and Integrated Pest Management areas to respond to topography and changes in wind exposure from "getting off the grid". That is, landscape management not based on the rectangular land survey but on topography and functional capacity (aiming also for water quality improvements), including drainage flow concentration and support for ecosystem services such as de-nitrification. (3) The third perceived gap is in social promotion for and management of landscape scale farming organization, such as transferable development rights programs, and co-operative ownership of capital equipment without excessive transactions costs, "right-sizing" elements of renewable self-fueling and so forth. Information on many relevant topics may be specialized, and excessively fragmented for practical use by people struggling to keep farms.

Subject Area: Outreach, Education, and Community Engagement*; Agricultural and Conservation Economics; Biodiversity Conservation and Management; Conservation Policy and Program Design

**denotes primary author and subject area*

Arkansas Discovery Farms: Monitoring Edge of Field Runoff from Cotton Farms

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

Abstract: The Arkansas Discovery Farms program is monitoring the quality of runoff water on real, working row crop farms in Arkansas. Both quantity and quality of inflow and outflow are being monitored in order to determine the effect of soil and water conservation practices on water use and nutrient losses. The Arkansas Discovery Farms program is currently working with a cotton farm located in Dumas, Arkansas. The Dumas farm, consisting of about 1,500 acres is located in Desha County, in the Middle Bayou Macon Watershed. The watershed and the monitored farm is a part of the Mississippi River Basin Healthy Watershed Initiative (MRBI). There are three monitored cotton fields located on the farm that consists of management practices ranging from cover crop to no cover crop. Each sampling station is equipped with a trapezoidal flume so water runoff volume can be measured with the use of a pressure transducer. Each station also consists of an ISCO 6712® automated water sampler that is housed in a storage unit and automatically collects water samples at preprogrammed intervals once water flow is detected. The ISCO sampler is programmed to collect one hundred, 100 milliliter (mL) samples integrated across various stages of the flow hydrograph. Once the samples have been taken they are then collected from the sampler to be analyzed following protocol set forth by the USEPA for suspended solids, nitrogen and phosphorus. Runoff volume is calculated from the pressure transducer measurements using the appropriate equations. Flow-weighted concentrations are calculated to determine nutrient and sediment loads (mass) lost in runoff from the fields. Results from 2013 will be presented.

Subject Area: Adaptive Management of Conservation Efforts*

**denotes primary author and subject area*

Arkansas Discovery Farms: Monitoring Edge of Field Runoff from Rice, Soybean, and Corn Farms

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

Abstract: The Arkansas Discovery Farms program is monitoring the quality of runoff water on real, working row crop farms in Arkansas. Both quantity and quality of inflow and outflow are being monitored to determine the effect of soil and water conservation practices on water use and nutrient losses. Currently, the Arkansas Discovery Farms program is working cooperatively with rice, soybean, and corn farmers located in Arkansas (Bayou Meto 8-digit HUC) and Cross (L'Anguille River 8-digit HUC) Counties. The Cross County farm (4300 acres) utilizes both ground and surface water sources for irrigation while the Arkansas County farm (1500 acres) utilizes only surface water. Both of these farms have been selected to participate in NRCS' Mississippi River Basin Healthy Watershed Initiative (MRBI). Sampling stations located at each farm are equipped with flow outlet structures so that runoff volume can be measured by a flow stage pressure transducer or a flow velocity profiler. At each station, an ISCO 6712® automated sampler equipped with a weather station automatically collects water samples at pre-programmed intervals once flow is detected at the outlet so that a composite sample is collected over the course of a runoff event. Each sample is collected and analyzed following protocol set forth by the USEPA for suspended solids, sediment, nitrogen and phosphorus. Runoff volume is calculated from pressure transducer or velocity flow measurements using appropriate equations that describe the flow structure. Flow-weighted concentrations are then calculated to determine nutrient and sediment loads lost in runoff from the fields. Results from rice, soybean, and corn production from these farms will be presented.

Subject Area: Adaptive Management of Conservation Efforts*

**denotes primary author and subject area*

Assessing Critical Source Areas in Landscapes on Downstream Water Quality in North Jersey

Author(s): Zeyuan Qiu*, New Jersey Institute of Techno

Abstract: Hydrological and ecological processes coupled with human interactions through active land use management form various hydro-ecological hotspots or critical source areas (CSAs) in landscapes. CSAs are the agricultural and urban lands within hydro-ecologically sensitive areas (HESAs) in landscape. Our hypothesis is that, relative to the rest of the landscape, CSAs contribute disproportionately to ecosystem degradation such as poor water quality. In this application, spatial data including digital elevation model, land uses and soils for North Jersey were used to derive the HESAs using a topographic index that is in consistence with variable source area hydrology and distribution of CSAs within HESAs. A Bayesian multilevel regional landscape model will be developed to test the hypothesis by directly relating the presence of CSAs in landscapes to downstream water quality indicators including total suspended solids, total phosphorus and total nitrogen and to identify the relative impacts of various land use intensity on downstream water quality in selected watersheds in North Jersey. The results can be used by resource managers to distinguish the landscape for taking spatially-discrete land use management actions to protect water quality and aquatic ecosystem health and therefore enhance ecosystem services in agricultural landscapes.

Subject Area: Water Resource Assessment and Management*; Conservation in Nontraditional Agriculture; Conservation Models, Tools, and Technologies; Conservation Policy and Program Design

**denotes primary author and subject area*

Assessing subsurface hardpan and pond formation using feature extraction technique in a sandy irrigation Scheme, Eastern Saudi Arabia

Author(s): YOUSEF ALRUMIKHANI*, KING ABDULAZIZ CITY FOR SCIENC

Abstract: Irrigated agriculture in the Kingdom of Saudi Arabia faces increasing environmental difficulties, in addition to the limited water resources. This research investigated the formation of ponds due to the presence of an impermeable hard pan layer, underlying the root zone, of a sandy soil profile in a 10 km X 10 km center pivot irrigation scheme in the Eastern region of Saudi Arabia. Using the hyper-spectral feature extracting technique, the 4 bands Geo-Eye-1 satellite images were utilized to locate the aerial distribution of the ponded areas throughout the irrigation scheme. The extent and direction of ponded areas, and growth of a parasitic plant which develops in the ponds, were determined. Further investigations from 32 locations in the irrigation scheme revealed that, the cause of the water ponding is attributed not only to the presence of hard pan, but also to the loamy sand texture and weak average water holding capacity of the soil at 1.6%. All the findings were projected on a shape file map. The water quality was measured in 29 locations to show an average TDS of 23474 ppm, which makes water reuse unprofitable. The onsite high irrigation water requirement to satisfy plants need, has contributed significantly to the formation of ponds.

Subject Area: Water Resource Assessment and Management*; Adaptive Management of Conservation Efforts; Conservation Models, Tools, and Technologies; Conservation Policy and Program Design

**denotes primary author and subject area*

Assessing the Nitrogen Credit of Radish as a Cover Crop

Author(s): Megan Chawner*, UW Madison; Matt Ruark, UW Madison; James Stute, University of Wisconsin-Extension; Michael Ballweg, University of Wisconsin-Extension; Richard Proost, University of Wisconsin-Madison

Abstract: Oilseed radish (Raphanus sativus L) has become a popular cover crop option in the Midwest for the late summer, especially among no-till farmers. However, little, if any information is available on brassica cover crops like radish. The objective of this project was to determine the effects of radish as a cover crop, specifically quantifying the uptake and release of nitrogen, as well as soil compaction and nematode suppression. Radish cover crops were planted in mid-August at two field sites located in Southern and Northeast Wisconsin. Each radish treatment was accompanied by a no cover crop treatment, and all treatments were split into increasing amounts of nitrogen fertilizer. Soil samples (0-1′ and 1-2′) were collected within each plot and analyzed for extractable nitrate using KCl extraction and colorimetric analysis. Radish biomass and volunteer winter wheat was collected from a 4 ft2 area within each whole plot in the fall prior to radish winterkill and analyzed for total dry matter production and total nitrogen uptake. During the growing season, soil samples (0-1′) were collected for each plot and analyzed for root lesion and soybean cyst nematodes. Soil compaction was measured in each plot using a portable constant-rate cone penetrometer. Soil moisture was determined as gravimetric soil moisture with a soil moisture probe. Results from the 2012 growing season indicated that radish increased soil nitrate early in the growing season, but dry growing conditions limited corn yield and response to N. In the 2013 growing season, radish again took up a considerable amount of N, but no N credit was found for either PPNT or PSNT, most likely due to the slow decomposition of radish during the wet and cold spring. Furthermore, the yield data did not confirm the fall N credit from the radish. The data from this project will assist growers in making educated decisions about the suitability of radish as a cover crop for their own individual needs.

Subject Area: Cover Crop Practices: Application, Innovation, and Management

**denotes primary author and subject area*

Best Management Practices Verification: Results from a Huron County, Ontario watershed

Author(s): Mari Veliz*, Ausable Bayfield Conservation; Wanhong Yang, University of Guelph; Ramesh Rudra, University of Guelph; Gabrielle Ferguson, Ontario Ministry of Agriculture and Food

Abstract: Rural non-point sources (NPS) of nutrients (particularly phosphorus), sediment and bacteria can limit both the human uses and the ecological integrity of the near shore area of Lake Huron. To address the concerns, watershed plans that involve community interests and the implementation of Best Management Practices (BMP) have been completed in Huron County, Ontario. The community wondered if the increased uptake of BMPs resulting from the watershed plans improved downstream water quality. Results from within field, edge of field and downstream monitoring, a SWAT model, and literature review of watershed verification projects from across North America showed that watersheds need to be managed for storm events and BMPs need to address these events. For example, a grassed-ditch reduced total phosphorus concentrations by 52 percent. A water and sediment control basin (WASCoB) reduced peak flows and a watershed hydrologic model (SWAT) estimated that the WASCoB resulted in a reduction of phosphorus at the downstream outlet. Precision agricultural practices such as cover crops, nutrient management and reduced tillage were difficult to measure at the within field and edge of field scale. However, the SWAT model estimated total phosphorus reduction at the watershed outlet as a result of implementing these practices. The watershed-based effectiveness study has emphasized the importance of BMPs that improve soil health. Future community-based watershed plans will assist local landowners to improve soil health by addressing potential cost and feasibility concerns.

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

**denotes primary author and subject area*

Beyond the Cover Crops 101 Field Day – Emerging, innovative methods for engaging farmers and landowners in cover crops management

Author(s): Jennifer Filipiak*, American Farmland Trust; Alan Gulso, Illinois Department of Agriculture; Sarah Carlson, Practical Farmers of Iowa; Ryan Stockwell, National Wildlife Federation

Abstract: A tried and true outreach method to educate farmers about cover crops, or any unfamiliar best management practice, is to host local landowners and farmers at a field day. This outreach is absolutely critical to connect farmers to other farmers that have experience with the unfamiliar practice. However with cover crops increasing in popularity, and with more farmers starting to use them, practitioners are asking more complex questions about management and risk, and need forums to discuss these issues. More than simply adding a crop to the rotation, the addition of cover crops to a farming operation necessitates a complete shift in management, and those farmers that become adept at adaptive management reap the rewards of healthier soil and resistance to weather extremes. In this presentation we will discuss and analyze the effectiveness of some of the "cover crops 201" outreach methods being tested in Illinois and regionally. These include blending a women landowner engagement model from Iowa ("Women Caring for the Land") with the typical cover crops field day, the use of audience response technology in an indoor workshop setting, train the trainers workshops, "fishbowl" discussions between experienced cover crop farmers and cover crop researchers, highway billboard networks, and development of regional cover crop "champions" networks.

Subject Area: Cover Crop Practices: Application, Innovation, and Management

**denotes primary author and subject area*

Biggest Bang for the Water Quality Protection Buck. An Environmental Action initiative that helps municipalities meet EPA regulations while developing a Watershed of Caretakers.

Author(s): Gary Swick*, Friends of the Fox River

Abstract: Protecting water quality is everyone's responsibility. The challenge is in finding the most effective ways to empower people. This presentation will offer a replicable model that is practical for any watershed. 20 years of development of this educational initiative has made it an effective educational tool available to formal and informal educators. A local non-profit, the Friends of the Fox River will share their experiences that have in the words of a High School Principal, " Provided the most engaging experience I have every seen for students." The students in turn, become the educators of the parents, peers, and community. The Friends of the Fox River Watershed Monitoring Network program (FRWMN) model introduces students to their relationship to the environment and their impacts upon local water quality. It is a program suitable for elementary through college age students and the general public. The framework of the program involves in-stream collection of physical, biological, and chemical data. The data is available for teachers to utilize at their discretion, and is also shared with decision makers. The educational experience produces an opportunity for cross curricular connections and service learning. The program has been used to GIS map watershed impacts, and has lead to municipal management actions. Students have been involved in shaping their local community's water quality impacts. The FRWMN program was expanded to include the services of an Outreach Educator in 2009. Since then, they have involved over 25,000 students. Due to the increasing demand, this year an additional Outreach Educator was established with plans to soon add a third. This program provides benefits on several levels. It is an educational tool, that leads to water quality protection through awareness, data, and compliance with EPA regulations. Come and see what could be getting real results in your community.

Subject Area: Outreach, Education, and Community Engagement*; Conservation in Urban Settings; Conservation Models, Tools, and Technologies; Water Resource Assessment and Management

**denotes primary author and subject area*

Bloomington's National Monitoring Project Found the Greatest Nitrate Loading Was from Surface Runoff of Agricultural Fields During Major Floods

Author(s): Donald Roseboom*, USGS; Amy Walkenbach, Illinois EPA; tim Straub, USGS

Abstract: The U.S. Environmental Protection Agency National Non-Point Pollution Monitoring Project is located at The Grove housing development near Bloomington, Illinois. The City of Bloomington restored Kickapoo Creek to a more natural state by incorporating green infrastructure—specifically flood-plain reconnection, riparian wetlands, meanders, and rock riffles—at a 90-acre park within The Grove residential development. A team of State and Federal agencies and contractors are collecting data to monitor the effectiveness of this stream restoration in improving water-quality and stream habitat. The Grove watershed lies in the Illinois River Basin which underwent record flooding in the last two weeks of April, 2013. This record flooding is typical of the agricultural floods which creates hypoxia in the Gulf of Mexico near New Orleans. The placement of fixed nitrate probes at three U.S. Geological Survey (USGS) stream gaging stations and a portable nitrate probe allowed the determination of agricultural watershed processes that create the largest nitrate loading during major floods. Surface water runoff from agricultural waterways created the greatest nitrate loading at the peak flood flows on April 18th, 2013. While the tile nitrates concentrations were greater (20mg/l) than the waterway surface runoff nitrate concentrations (11.8 mg/L), the waterway and stream nitrate loadings were greatest at the highest flood flows with heavy sediment transport from the rowcrop fields. Although the peak discharges and sediment of large floods overflow into wetlands during the rising limb, the smaller channel forming flood discharges passes much of the sediment load downstream. The sediment transport capacity is determined by both standard USGS sediment gaging technology with multiple flood samples and by the recently developed technology based on the strength of the sonar return signals during acoustic flow measurements.

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

**denotes primary author and subject area*

Challenges and Opportunities for Farmland Conservation in the Mountains of Nepal

Author(s): Gopal Thapa*, Asian Institute of Technology

Abstract: As agriculture is their economic mainstay, mountain farmers in Nepal have been managing their farmlands carefully. Still farmlands are undergoing degradation due to accelerated soil erosion and nutrients mining. This study analyzed the causes of land degradation based on our several past studies conducted over a period of two decades, and assessed the challenges and opportunities for farmland based on our own past studies as well as other studies. Technically, farmlands on sloping areas are not considered to be suitable for arable agriculture as it accelerates soil erosion. However, due to the scarcity of non-farming employment opportunities and difficult access to market centers, mountain farmers have been carrying out arable agriculture to fulfill their household demand for food. As a result, despite being terraced, farmlands are undergoing unsustainable soil erosion ranging from 6 to 16 tons/ha/year. The land degradation has been aggravated by steady soil nutrients mining. How to control the on-going farmland degradation arising from the arable agriculture and at the same time enable farmers to improve their economic condition stands out as the single most serious challenge. The gradual integration of the mountain economy into the national and global economies, and the on-going large scale out-migration of the mountain youth population offer an opportunity to address the challenge. Appropriate policy instruments and actions conducive to address the challenge by taking advantage of the available opportunities have been suggested. This study contributes to understand the complex causal nexus of farmland degradation, and the challenges and opportunities available to address this problem. The concerned government and non-government agencies of Nepal might consider implementing suggested policy instruments and actions in their pursuit of promoting sustainable mountain farming systems.

Subject Area: Soil Health Resources, Indicators, Assessment, and Management*; Agricultural and Conservation Economics; Conservation Policy and Program Design

**denotes primary author and subject area*

Changes in Public Attitudes about Water Resources in the Pacific Northwest since 2002

Author(s): Robert Mahler*, University of Idaho

Abstract: Large scale surveys have been conducted in Idaho, Washington, Oregon and Alaska since 2002 to measure changes in public attitudes about the conservation, use and protection of water resources. Results from the three surveys (2002, 2007 and 2012) have shown that the public regards the water resource highly. The public also considers that water use by the agricultural sector is very important to the regional economy. A large percentage of the public supports irrigated agriculture and does not consider agriculture disproportionally responsible for many of the current water quality and water quantity issues facing the region. This high level of support for the agricultural sector is unexpected because more that 85% of the region's residents are urban.

Subject Area: Water Resource Assessment and Management*; Conservation Policy and Program Design; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

Classification of Marginal Lands in an Agricultural Watershed for Bioenergy Crop Production and Conservation

Author(s): Herbert Ssegane*, Argonne National Lab; Cristina Negri,

Abstract: This analysis develops a framework to identify sub-productive or vulnerable lands to dedicate to cellulosic bioenergy crop production in a Midwestern agricultural watershed using readily available SSURGO data, hydrologic modeling and remotely sensed data. Marginality is based on pre-defined thresholds of specific environmental and economic sustainability metrics. The environmental susceptibility metrics identify areas which are hydrologically sensitive and critical to the long-term ecological integrity of landscapes, while socioeconomic sustainability metrics allude to incentives for producers or farmers to adopt new crops because profitability is the major motivator for farmer adoption of new crops. The focus of this methodology is to exploit intrafield variability in crop yields and identify areas and fields that are susceptible to environmental pollution so as to carefully place energy crops with phytoremediation attributes while minimizing competition with food crops. This conceptual framework consists of three components. The first component defines marginality using metrics of environmental and socioeconomic sustainability based on SSURGO data. The second component uses a soil and water assessment tool (SWAT) to develop a hydrologic model for the watershed. The hydrologic model provides a modeling platform to estimate biomass productivity if the identified marginal areas are put into bioenergy crop production, environmental effects of such land use change, and the effect on food and feed crop production in the watershed. The environmental effects include significant changes in the water budget, water quality and flow regimes while socioeconomic impacts include impacts on food crop productivity farm income. The third, ongoing component uses high resolution imagery to identify intrafield variability of crop yields by regressing vegetation indices and sample field yield maps within the watershed.

Subject Area: Water Resource Assessment and Management*; Conservation in Nontraditional Agriculture; Conservation Models, Tools, and Technologies

**denotes primary author and subject area*

Clean Water Grows: Using Cover Crops to Improve Water Quality

Author(s): Lara Bryant*, National Wildlife Federation; Trisha White, National Wildlife Federation

Abstract: Across the United States, 41,509 water bodies are considered too polluted to meet water quality standards. When a river, lake or stream cannot be used for drinking, swimming, or fishing, local authorities often face difficult decisions to address these water quality deficiencies. Constructing water quality treatment infrastructure is a costly means of meeting water quality standards. Alternatively, addressing non-point sources of nutrient pollution can improve water quality at a much lower cost. As more states and watersheds adopt nutrient reduction strategies, an increasing numbers of local entities will look for innovative ways to improve water quality through agricultural stewardship. In particular, cover crops are proving to be a valuable agricultural practice that can significantly reduce pollution flowing into water bodies and help meet nutrient reduction goals. Recently, cover crops have become more popular, due in part to local and regional support strategies that have encouraged planting more cover crops. Still, cover crops are not yet standard practice for agricultural producers across the United States, due to a number of barriers, including policy barriers, specific research needs, and the need for local champions. This presentation will highlight six case studies of successful local and regional efforts to improve water quality by increasing cover crop adoption. Each case is unique, but many include common outreach methods, keys for success, and elements of program design. As other watersheds across the country struggle with meeting water quality goals, these case studies offer examples of innovative ways to reduce non-point source pollution.

Subject Area: Outreach, Education, and Community Engagement*; Adaptive Management of Conservation Efforts; Conservation Policy and Program Design; Water Resource Assessment and Management

**denotes primary author and subject area*

Combined experimental and modeling procedure to estimate USLE K factors

Author(s): Dennis Flanagan*, USDA-ARS; Qiuju Wu, Northwest A&F University; Chi-hua Huang, USDA-ARS

Abstract: The Universal Soil Loss Equation (USLE) is used throughout the world to estimate soil erosion by water. While a soil erodibility nomograph exists to estimate the K value, it sometimes performs poorly, particularly for soils high in clay content. This presentation will describe a procedure to estimate USLE K values, through laboratory experiments to measure Water Erosion Prediction Project (WEPP) model erodibility parameters, and then subsequent application of the WEPP model to a unit erosion plot. Estimated long-term soil loss rate from the WEPP model run is divided by the location's USLE rainfall/runoff erosivity factor (R) to produce an equivalent K value. We studied 4 soils: a Miami silt loam from Indiana, an Opal clay from South Dakota, a Vergennes silty clay loam from Vermont, and a Mexico silty clay loam from Missouri. The new approach produced USLE K factors close to those estimated by the nomograph for the Miami and Mexico soils, but larger for the Opal and Vergennes soils. The technique described provides a linkage between the empirical and process-based erosion prediction technologies.

Subject Area: Conservation Models, Tools, and Technologies*

**denotes primary author and subject area*

Comparison of WEPP and APEX runoff and erosion prediction at field scale in Goodwater Creek Experimental Watershed

Author(s): Nayereh Ghazanfarpour*, University of Missouri; Clark Gantzer, University of Missouri; Claire Baffaut,

Abstract: The Water Erosion Prediction Project (WEPP) and the Agricultural Policy/Environmental eXtender (APEX) are process-based models that can predict spatial and temporal distributions of erosion for hillslopes and watersheds. This study applies the WEPP model to predict runoff and erosion for a 35-ha field located in Goodwater Creek Experimental Watershed, in the claypan region of Missouri, using field specific climate, soil and topographic data. We will evaluate WEPP's prediction for the actual crop and management during 1993-2002 by comparing model results with measured runoff and sediment data collected from a discharge flume located at the field outlet. Results will also be compared with the simulated results obtained with APEX for the same location and period and published by Mudgal et al. in 2010. This analysis will highlight capabilities of the WEPP model for predicting runoff and erosion and show the differences between the WEPP and APEX models in simulating runoff and erosion at field scale. Since WEPP simulates soil detachment, transport, and deposition based on rainfall intensity, runoff rate, and soil properties and APEX uses a variant of the Modified Universal Soil Loss Equation, this study examines erosional behavior in these two predictive models. The erosion and runoff results for individual hillslopes and channels within the field have significant implications for improving management and will allow land managers and conservationists to delineate critical areas based on them. Evaluation and comparison of the WEPP and APEX model will help the researchers and action agencies or other users select a model that meets their needs based on modeling objectives, amount of input information available, and the capabilities of the personnel in the organization. Keywords: Erosion, Runoff, WEPP, APEX, Claypan soil, Field scale

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

**denotes primary author and subject area*

Conservation practice impacts on nutrient loads from the Maryland CEAP Choptank River watershed using AnnAGNPS

Author(s): Ronald Bingner*, USDA-ARS; Ali Sadeghi, USDA ARS; Henrique Momm, ; Gregory McCarty, USDA ARS; Dean Hively, USGS; Yongping Yuan, EPA-Office of Research and Dev; Eugenie Kamgue, MTSU

Abstract: The development of watershed conservation management plans involves many decisions that affect various aspects of a watershed system, with consequences that are difficult to measure. In addition, the efficient placement of practices throughout a watershed as part of an integrated management plan can be difficult without the use of watershed modeling technology. The objective of this study is to evaluate water quality effects from cover crops and riparian buffers as part of a comprehensive watershed conservation management plan in the German Branch of the Choptank River Basin in Maryland that is part of the USDA-ARS Benchmark CEAP-Watershed Assessment Study project. The Annualized Agricultural Non-point Source (AnnAGNPS) model will be calibrated and validated for flow and N loading using water quality monitoring data from 1991 to 1995 and 2005-2008. Multiple AnnAGNPS simulations were performed to assess the integrated effects of different conservation practices tailored to sediment erosion and nutrient pollutant control. The results show that significant loads are produced from ephemeral gullies as well as overland flow, but can be significantly reduced using riparian buffers combined with conservation tillage and grassed waterways. The integration of field-scale riparian buffer pollutant loading models with watershed-scale modeling tools can provide a more accurate and applied approach for decision-making on where to apply riparian buffer conservation management practices and their effectiveness in reducing pollutant loads. This study will also describe the research needs for modeling integrated conservation practices and management planning for controlling pollutant loads.

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

**denotes primary author and subject area*

Conservation Strategies for Climate Change Adaptation in Yunnan Province of China

Author(s): Le Zhang*, UMass Amherst; Timothy Randhir, ECO, UMass Amherst

Abstract: Impacts of climate change on developing regions require a multiattribute approach to develop appropriate adaptation strategies. Yunnan province of southwest China is rich in natural resources and biodiversity and is facing the threat of climate change at multiple scales. Impacts include effects on water resources, soil erosion, infrastructure, ecosystems, and rural economies. There is a need for comprehensive policies to balance developmental needs and conservation issues, while planning for climatic adaptation in the region. We use an integrated model to develop multi-sector, adaptation strategies through coordination of efforts in each sector and at multiple scales. The model uses four interacting stages in development of strategic plan: Inventory, Assessment, Analysis, and Design. Spatial and temporal data on economic and ecological parameters is used in GIS and multiattribute methods to identify areas based on vulnerability and adaptation potential. The spatial information is used in quantifying benefits and costs of adaptation strategies for prioritization needs. Conservation practices identified for climate change adaptation include rain gardens, afforestation, buffer strips, spatial refugia, and conservation incentives. This is linked to overall green growth plans for the province. It is expected that comprehensive green growth planning and adaptation policy can achieve economic and ecological needs of growing regions like Yunnan that are facing impacts of climate change.

Subject Area: Increasing Intensity: Rethinking Precipitation Averages and Outliers in Conservation Design and Planning(Symposia Only)

**denotes primary author and subject area*

Coupling Drought Forecasting with the SWAT Hydrology Model to Develop a Decision Making Tool for Water Resource Conservation

Author(s): Rachel McDaniel*, TAMU; Clyde Munster, ; Tom Cothren, ; John Nielsen-Gammon,

Abstract: Drought is a costly natural disaster. The 2011 Texas drought caused an estimated $7.6 billion in damages in the agricultural sector alone. For this reason, water resource managers have spent a lot of time and resources planning and preparing for drought. Therefore, an Early Warning System/ Decision Making (EWS/DM) tool is being created for meteorological, agricultural, and hydrological drought to help producers and water resource managers better plan and prepare for drought. This is accomplished by creating a program package that couples weather forecast information with a hydrologic model to provide forecasted hydrologic conditions, such as streamflow, soil moisture, inflow to reservoirs, evapotranspiration, and crop yields. The Upper Colorado River (UCR) Basin in West Texas is being used as a case study for the development of this tool. The Soil and Water Assessment Tool (SWAT) model has been calibrated and validated for crop yields, streamflows, and soil moisture on a weekly basis. The SWAT model was then run iteratively, with several weather forecast and crop management scenarios. Irrigation management solutions are optimized from these simulations. These solutions are provided to agricultural producers along with other pertinent information, including soil moisture and precipitation forecasts. The EWS/DM tool is designed to help them make better use of their water resources by taking into account current and future hydrologic conditions.

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

**denotes primary author and subject area*

Cover Crop Mixture Diversity, Biomass Production, and Weed Suppression

Author(s): Angela Tran*, University of Nebraska

Abstract: The objective of this study was to evaluate how cover crop mixture species and functional diversity affects cover crop biomass production and weed suppression. Twenty cover crop treatments representing monocultures and mixtures of nine species were used in this study. The species used represented three functional groups of cover crops—cool season grasses, cool season legumes, and brassicas. The grasses used were barley, oats, and spring wheat. The legumes used were Austrian winter pea, mammoth red clover, and yellow blossom sweetclover. The brassicas used were radish, rapeseed, and turnip. This study was conducted on nine fields across eastern Nebraska. The treatments were planted after small grains harvest at three sites, into maturing soybeans at three sites, and into maturing or harvested corn at three sites. Treatments were broadcast at the sites starting in the middle of July and into early September. Species specific biomass was then measured prior to killing frosts. Both increasing the species diversity and increasing the functional diversity of a cover crop mixture tended to increase the average amount of total aboveground biomass produced by the mixture. This pattern was stronger at sites where greater amounts of total biomass were obtained (earlier planted sites), and weaker at sites where lesser amounts of total biomass (later planted sites). Increasing the species and the functional diversity of a mixture also increased weed suppression. This was likely due to there being greater amounts of cover crop biomass with the more diverse mixtures. It is important to note, however, that at the different sites, certain species in monoculture performed just as well as the most diverse of mixtures in terms of biomass production and weed suppression. However, it was not the same species that did so at each site. Thus, the diverse cover crop mixtures were the most consistent performers across all sites.

Subject Area: Cover Crop Practices: Application, Innovation, and Management

**denotes primary author and subject area*

Cover Crops 101 (Current seeding techniques and what criteria goes into making that seeding decision)

Author(s): Scott Wohltman*, LaCrosse Seed

Abstract: This presentation will highlight current practices in seeding cover crops. It will also speak on what the most popular cover crops species do in real seeding environments, seed size, aerial applications, and different type of seeding equipment other than drills. Information given in this presentation will come from results attained from more than 500 growers/landowners across the Midwest. The program will show that current adoption of cover crops is growing, even though the means of getting good stands is widespread and not consistent from region to region.

Subject Area: Cover Crop Practices: Application, Innovation, and Management

**denotes primary author and subject area*

Cover Crops, Native Pollinator Species Field Borders, and Riparian Buffers for Environmental Quality.

Author(s): Clark Gantzer*, University of Missouri; Ranjith Udawatta, University of Missouri; Tim Reinbott, UMC Bradford

Abstract: Fertilizer prices have renewed interest in legume cover crops to provide nitrogen. Cover crops are also important for reducing soil erosion and improving soil quality. Habitat for pollinators is needed because of loss of field borders, and riparian forests, enhancement of floral resources to provide. This presentation presents results of a demonstration field project at the Bradford Center, Columbia, MO on no-till cultivation using cover crops, design and implementation of native species field borders of pollinators, and fast growing woody species riparian buffers. Cover crops were grown into continuous corn or rotations of corn and soybean and a three-year rotation of soybean/wheat/corn. When corn, grain sorghum or wheat is planted, one half of each plot will receive a full rate of nitrogen fertilizer and the other half no N, to demonstrate the nitrogen fertilizer contributed by the legumes to the following crop. Weed control will be based upon post emergent needs to evaluate the weed control benefits of the cover crops. Cover crops included: hairy vetch, crimson clover, Austrian winter pea, tillage radish, cereal rye, and oats, sun hemp, sesbania, and cowpea. Results show fall planted cover crops with cereal rye produced 5-6,000 lbs. of dry matter/acre by mid May. Winter annual legumes including hairy vetch and Austrian winter pea produced 4-5,000 lbs. of dry matter by mid May in 2012, but less than 2,000 lbs. in 2013. Soybean yield in 2013 was 7 bu/acre more following a cereal rye cover crop vs. a control. Corn yield was 24 bu/acre more following a hairy vetch cover crop vs. a control. Pollinator habitat produced with native forbs resulted in consistent flowering from June until frost. Wide ranges of insects were attracted to the boarder. These demonstrations have been used for learning opportunities at field days and specialized workshops. This work demonstrates the advantages of conservation practices of selected vegetative practices.

Subject Area: Cover Crop Practices: Application, Innovation, and Management

**denotes primary author and subject area*

Cover Crops: A California Perspective

Author(s): Kabir Zahangir*, USDA-ARS

Abstract: California is the largest producer of agricultural products in the USA. The state has a Mediterranean climate, receiving most of its precipitation during the winter, with dry and hot summers. Irrigation is used extensively in California to grow high value crops. There are numerous reports that show nitrate leaching from excess irrigation water and winter rainfall with resulting significant impacts on groundwater. The potential for leaching is high in shallow-rooted vegetable crops and in winter-fallowed land. Cover crops grown during the winter are being used in California to scavenge residual chemicals and nutrients thus reduce the nitrate leaching potential. In addition, cover crops can reduce wind and water erosion, increase soil fertility and provide food for soil organisms. However, selection of suitable cover crops is essential to avoid species that may harbor insect pests or serve as hosts for pathogens or parasitic nematodes. The importance of cover crops in California in different cropping systems and their contribution to soil health and crop improvement will be presented.

Subject Area: Cover Crop Practices: Application, Innovation, and Management

**denotes primary author and subject area*

Designing a Program with Moving Environmental Targets and Changing Agricultural Landscape

Author(s): Jacqui Empson Laporte*, OMAF; Christine Schmalz, Ontario Soil and Crop Improvement Association

Abstract: Growing Forward 2 is a federal-provincial initiative that provides funding for Ontario farmers, processors of agricultural commodities, groups and organizations. Funding is available for capacity building and project implementation for both environmental projects, business development, and innovation. The agricultural landscape is constantly changing, and this requires adaptations to the design of programs intended to provide incentives for environmental stewardship. The diversity of environmental issues requires a cumulative effort amongst many landowners to effect change in environmental performance and responsiveness. Researchers at the University of Guelph in the Department of Food, Agricultural & Resource Economics examined the issue of who owns Ontario's farmland. There are impacts on environmental stewardship program design. Jacqui Empson Laporte is an Environmental Specialist with OMAF/MRA, which has funded both research initiatives and stewardship implementation requiring extensive interaction with landowners. She compares two different approaches to agri-environmental communication, outreach and project implementation - one with a non-profit landowner with 850 acres of agricultural land, and another with a significant family operation spanning 25 000 acres. Christine Schmalz is the Senior Environmental Programs Coordinator with the Ontario Soil and Crop Improvement Association. OSCIA has been delivering environmental cost-share programs for farmers across the province for the past twenty years. Efforts in program development have been squarely focused on building initiatives that incorporate a high level of precision and environmental targeting without overburdening the applicant. OSCIA has designed and delivered five unique merit based programs in 2013 that seek to target projects offering the highest societal benefit. Christine will discuss tools and techniques used to build these evaluation mechanisms.

Subject Area: Agricultural and Conservation Economics*; Conservation Models, Tools, and Technologies; Conservation Policy and Program Design; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

Documenting and Monitoring Management Changes in Watersheds

Author(s): Amber Radatz*, University of Wisconsin Discovery Farms; Eric Cooley, UW Discovery Farms; Dennis Frame, UW Discovery Farms

Abstract: The University of Wisconsin Discovery Farms Program has been studying farms and water quality for 13 years, but assessing farms and water quality on a watershed scale was a new and unique challenge. Discovery Watershed projects in Jersey Valley and Dry Run Creek Watersheds in Western Wisconsin started in 2010, and aimed to document, with tangible data, the impact of management practices on water quality. After four years of work, Discovery Farms has documented management and begun implementing farmer led solutions. Through edge of field and stream monitoring of agricultural, non-cultivated woodland, and urban/residential areas, all sources of nutrient and sediment losses are accounted for in the study design of the Jersey Valley Watershed. All farmers have been engaged through either nutrient management planning or whole-farm walkovers. Important lessons learned so far include: there is no low hanging fruit, many solutions can answer the same question, and multiple methods of verification are critical to telling the whole story. We've documented over 25 miles of well-managed waterways in a 7.75 square mile watershed, 100% of farmers are using manure and legume crediting, soil testing, and minimum tillage, and more than 50% of farmers are using cover crops, no-till, and retention dams. A majority of the area has soil test levels less than 50 ppm for phosphorus. Water quality monitoring shows that edge of field losses are lower than averages from past Discovery Farms sites. On average, there is less than 150 pounds per acre of sediment loss, less than 1 pound per acre of phosphorus loss, and only 4.1 pounds per acre of nitrogen loss. After knowing all of this, this project will be able to answer several critical questions including: does this area meet water quality criteria even after a major fish kill event? Does the current suite of practices do an adequate job of protecting water quality and farm sustainability?

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

**denotes primary author and subject area*

Does Precision Agriculture Result in Consistent and Predictable Nutrient Loading Reductions?

Author(s): James Klang*, Kieser & Associates, LLC; Alice Sorensen, American Farmland Trust

Abstract: American Farmland Trust, Kieser & Associates, John Deere, Trimble and several other partners are part of a USDA NRCS Conservation Innovation Grant to develop Water Quality Trading(WQT) credit estimators for Precision Agriculture. To be eligible for WQT, best management practices (BMPs) must provide consistent and predictable reductions in the pollutant loading being traded. Approved BMPs produce "credits" that can be used as offsets to replace wastewater or stormwater pollutant reduction requirements at a permitted site. A credit adjusts the BMP's pollutant reduction to achieve an equivalent or greater reduction than that required by the permittee on-site. Credit adjustments take into account distance from water, stream assimilation rates and the bioavailability of different forms of nitrogen and/or phosphorus. A margin of safety is also added to address introduced uncertainty regarding the credit estimation method and other trading processes. Precision Ag lacks an easy to use and reasonably accurate prediction method that determines the nutrient loading reduction. This project focuses on field scale changes in nutrient loading and uses SWAT model applications calibrated at the field scale to guide the process. One crediting development track focuses on Precision Ag Nutrient Variable Rate Technology (VRT) and the other track focuses on Geographic Positioning Systems (GPS) that reduce overlaps on fertilizer application. First, we had to create a common definition. Precision Ag can encompass many different techniques like on-the-go versus zone mapping, N or P VRT, GPS guidance systems, etc.. In addition, VRT is often based on the agronomist's knowledge and preferences regarding increased yield and/or net profit goals. To provide a WQT credit, a standardized approach and credit equation must exist to provide assurances the reductions will take place. We will introduce how WQT works, describe our methodology and approach and close with current findings.

Subject Area: Conservation Models, Tools, and Technologies*; Agricultural and Conservation Economics; Conservation Policy and Program Design; Water Resource Assessment and Management

**denotes primary author and subject area*

Drainage Water Management Options And Strategies To Improve Water Quality

Author(s): Alex Echols*, Sand County Foundation

Abstract: Widespread adoption of agricultural Drainage Water Management (DWM) offers a key opportunity to improve water quality. DWM is a suite of practices applicable to much of the agricultural landscape to reduce nutrient (N & P) loss to surface waters. DWM benefits are highly quantifiable, replicable, and low in cost. This presentation will review the applicability of DWM, suite of practices available, cost of implementation, net savings in nutrient loss, status of national implementation and opportunity to expand adoption. Flow of water off of agricultural lands is a key factor in contributing to the nutrient loading of our waters. Management of water flowing off of agricultural lands has not received the attention it should as a key strategy to reduce nutrient loading. DWM offers a series of practices (management of tile lines, bio reactors, saturated buffers, nutrient wetlands, sub surface irrigation) applicable to hundreds of millions of acres of agricultural lands. Adoption of these practices as part of a "systems approach" to conservation will vastly enhance the conservation return on investment while protecting the economic value of the farm operation. This suite of practices offer some of the most cost effective management options to reduce nutrient loss to waters. The principle costs are for capital infrastructure investment. Most of these investments are supported by NRCS cost share payments. Once the infrastructure investment has been made the annual operating costs can be zero or very low and easily implemented by farm operators. Most of these practices do not take land out of production and some can enhance production. They have been implemented on less than 1% of applicable lands to date. The conservation effects of these practices are so easily quantified and reliable they offer an important opportunity to advance ecosystem service markets and new and nonconventional conservation funding mechanisms.

Subject Area: Water Resource Assessment and Management*; Adaptive Management of Conservation Efforts; Agricultural and Conservation Economics; Conservation Policy and Program Design

**denotes primary author and subject area*

Ecological Farming System

Author(s): Jeff Rasawehr*, Center Seeds

Abstract: In my presentation, I will discuss how to cover crop effectively, how to select plant options that maximize nutrient utilization and availability, what soil amendments to consider and why, and I will demonstrate and explain how dead dirt creates a discharge "path" for our nutrient particulates into the tile lines. I am very confident that the tile-line discharge of nutrients are worse than we realize in agriculture and that our utilization of our existing and applied nutrients is incredibly inefficient. With my mixes that I use and recommend, I pinpoint what is included for an exudation to enhance the microbe populations ability to improve the usage of various nutrients.

Subject Area: Cover Crop Practices: Application, Innovation, and Management

**denotes primary author and subject area*

Economics of crop and land management practices and water quality impacts for four watersheds located in Manitoba Canada

Author(s): Mohammad Khakbazan*, AAFC; Jason Vanrobaeys, AAFC; Larry Braul, AAFC; John Huang, AAFC; Henry Wilson, AAFC; Jane Elliott, Environment Canada

Abstract: Application of crop and land management practices (CLMPs) on the landscape can have significant cost and benefit effects at both the on- and off-farm level. Crop and land management practices have been assessed at four watersheds in Manitoba to examine the impact on water quality, economic opportunity costs, and producer incomes. The four watersheds studied included the South Tobacco Creek, Boyne, Little Saskatchewan, and La Salle watersheds and CLMPs studied included nutrient management, land conversion into perennial forage, feedlot runoff control retention ponds, small dams to control flooding and wetland restoration. The general economic approaches used included enterprise and capital budgeting techniques, development of cost functions utilizing reported data within each watershed area, development of simulation models that utilize economic costs, benefits and biophysical relationships in combination with local inputs and prices, and then calibrated to available economic and biophysical parameters. Water quality data (exported nitrogen and phosphorus) were related to reported agronomic practices. The results showed that only a few of the CLMPs tested contribute positively to improved farm economics, and for most revenues will not fully offset CLMP costs. Nutrient management planning and small dam/reservoir management were shown to have benefits to producers based on combined experimental and model results. Both of them also positively contributed to reduced sediment and total N export. For phosphorous (P) export, linear relations were found with P application rates, zero tillage and flow. The economic benefits of perennial forage rotation failed to compensate for the opportunity costs from the profit of continuing to plant annual crops. Similarly, the on-farm benefits of retention ponds and wetland restoration were insufficient to justify their capital costs although they provided significant reductions in nutrients, sediment and pathogen exports.

Subject Area: Agricultural and Conservation Economics*; Biodiversity Conservation and Management; Conservation Models, Tools, and Technologies; Water Resource Assessment and Management

**denotes primary author and subject area*

Economics of soil nutrient depletion and its impact on productivity in the Hilly Regions of Nepal

Author(s): Romy Das*, University

Abstract: Soil fertility depletion, a major form of land degradation, has a severe economic impact in developing countries. In Nepal, where more than two thirds of the population is dependent on agriculture, depletion of soil nutrients has directly affected livelihoods and overall economic growth of the country. However, no studies are available on estimates of productivity loss due to depletion of soil nutrients in the Nepalese context. This study assesses the economic impact of soil nutrient depletion on agricultural production in the hilly farming system of Nepal. With primary data collected from randomly selected 280 households, the study estimates balance of nitrogen, phosphorus and potassium in the Kavrepalanchowk district of the mid hill region.Besides soil nutrient data, various socioeconomic variables and information on production practices were also collected to analyze their association with the nutrient deficiency. Further, the study applies a replacement cost approach to value the deficient nutrients. The results showed that average farm households in the study area had an annual surplus of 31 kg ha-1 nitrogen but a deficit of 20 kg ha-1 phosphorus and 45 kg ha-1 potassium. The cultivation of high nutrient exhausting vegetable crops without adequate replenishment can be attributed to low phosphorus and potassium content.The value of replacing depleted phosphorus and potassium using the most available inorganic fertilizers is equivalent to 19 % household income obtained from agricultural production. The marginal value product of phosphorus and potassium was Rs ha-1 17 and Rs ha-1 242 respectively. The study suggests that to reverse the trend of nutrient mining and sustain agricultural production in hilly region, 1) accessibility and affordability to inorganic and organic fertilizers should be improved 2) efforts to promote adoption of locally suitable soil conservation technologies need to be increased.

Subject Area: Agricultural and Conservation Economics*; Conservation Policy and Program Design; Soil Health Resources, Indicators, Assessment, and Management

**denotes primary author and subject area*

Effect of conservation practices on soil carbon and nitrogen accretion and crop yield in a corn production system in the southeastern coastal plain, USA

Author(s): Timothy Strickland*, USDA-ARS; Brian Scully, USDA-ARS; Robert Hubbard, Retired; Dana Sullivan, TurfScout LLC; Reza Savabi, Retired; Dewey Lee, University of Georgia; Dawn Olson, USDA-ARS; Gary Hawkins, University of Georgia

Abstract: We implemented conservation farming practices (winter cover cropping plus strip tillage) for a non-irrigated corn production system in the southern coastal plain of Georgia, USA that had been previously been managed under a plow and harrow tillage regime. Total soil carbon and nitrogen were measured on samples (0-65cm) collected from 57 sites at the beginning of the experiment and after five years under conservation farming practices. Crop yield, winter and summer above ground crop biomass production, and biomass carbon and nitrogen content were also measured annually at each site. Soil carbon increased an average of 20 Mg ha-1 (6-62 Mg C ha-1, depending upon slope position). Although 72-80% of the carbon accretion was in the top 35cm, 3-6 Mg C ha-1 was accreted from 35-65cm. The soil carbon accreted during the study amounted to 36% of the net biomass carbon produced. Corn yield increased 2200 kg ha-1 (1200-2500 kg ha-1, depending upon slope position) during the same time. Step-wise multiple linear regression indicated that soil carbon content from 15-35cm and sand content from 35-45cm were the only significant predictors of corn yield. Growing season rainfall through silking for both corn production years was the lowest in the past 45 years (20-25cm below the net crop demand) suggesting that soil carbon-mediated increase in plant-available soil water was the mechanism improving corn yield. Calculations of increased soil water holding capacity suggest that carbon accretion in the top 35cm of soil potentially increased water storage enough to supply up to four days worth of additional crop water demand. These results indicated that conservation farming practices can increase soil carbon accretion in degraded sandy soils of the humid southeastern US coastal plain, and that increased soil carbon may potentially mitigate the deleterious effects of short term rainfall deficits in non-irrigated production systems.

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

**denotes primary author and subject area*

Engaging Great Lakes Communities in Applying Science to Develop Tipping Point Action Plans

Author(s): Kara Salazar*, Purdue University / IL-IN Sea ; Brian Miller, Univ of IL / IL-IN Sea Grant; Jarrod Doucette, Purdue University / IL-IN Sea Grant; Kristin TePas, ; Jesse Schomberg, ; Martin Jaffe, ; Jinha Jung, ; Dede Frederick, ; Bryan Pijanowski, Purdue

Abstract: Tipping Points and Indicators is a new Great Lakes research and Extension program comprised of a web-based, data driven decision support system (DSS) and facilitated community visioning and action planning process. The program is designed to enable effective protection and management of natural resources throughout Great Lakes states by providing land use planners, natural resources managers, and stakeholder groups with a process to assess community sustainability using Great Lakes tipping points. Research team members identified land use indicator variables that determine the threshold, or tipping points, that when exceeded can impact aquatic ecosystems. Great Lakes Sea Grant Network Extension Specialists developed the associated website and facilitation process that guide community groups through an interactive watershed action planning process. The Tipping Points and Indicators process utilizes the weTable and touch screen monitors as public participation tools to enable community groups to collaborate and explore the website, customized tools, and GIS maps to determine planning priorities linked to community values. The facilitation process results in an action plan that includes an overview of the current community status, whether the community is nearing or exceeding Great Lakes tipping points, and provides customized education strategies, example policies, and sample ordinances to improve current conditions. This presentation will include a program overview and demonstrate the five decision support system modules that result in a community action plan.

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

**denotes primary author and subject area*

Erosion and Runoff Evaluation in Goodwater Creek Experimental Watershed using the SWAT_T Model

Author(s): Sitarrine Thongpussawal*, University of Missouri; Clark Gantzer, University of Missouri; Claire Baffaut, ; Hui Shao, University of Guelph

Abstract: The 72 km2 Goodwater Creek Experimental Watershed (GCEW), in the claypan region, is a Long-Term Agro-ecosystem Research Watershed in Boone and Audrain counties of north-central MO, which has reported problems with degraded water quality from nutrients, sediment, and herbicides. Terraces are effective conservation practices to reduce concentrated flow erosion and intercept runoff. Between 1990 and 2006, 13% of the GCEW area has been treated with terraces and associated grassed waterways or underground outlets. Researchers have simulated terrace effects using the Soil and Water Assessment Tool (SWAT) by adjusting the slope length and the USLE P-factor. A modification of SWAT 2009 (SWAT-T) simulates the effects that temporary storage of water in the terraces has on infiltration, evaporation, flow, sediment, nutrients and herbicides. The objective of this work is to evaluate SWAT-T in simulating the impacts of terraces on erosion and runoff for GCEW. The model will be used to estimate terrace water storage and its effect on sediment and flow. Data collected from 1993 through 2010 will be used to calibrate and validate the model. SWAT-T results will be compared to measured data and to results obtained with SWAT 2009. The SWAT-T modification should improve evaluation of terrace benefits at watershed scale. This work will be useful for conservationists and water resource managers.

Subject Area: Conservation Models, Tools, and Technologies*; Conservation Policy and Program Design; Soil Health Resources, Indicators, Assessment, and Management; Water Resource Assessment and Management

**denotes primary author and subject area*

Estimating the economic impacts of NRCS expenditures on rural America

Author(s): Mark Peters*, USDA, NRCS

Abstract: The federal government currently spends nearly $4 billion for farmers and ranchers to implement conservation on the land. It spends an additional $1.6 billion to provide technical support to farmers and ranchers for the implementation of conservation practices. While the primary purpose of these expenditures is to improve the environment and enhance soil, water and other natural resources there is much interest in the impact of these expenditures on income and employment in rural communities and the nation. While the agricultural economy represents a tiny share of total U.S. economy it represents a significant portion of the economy in rural communities. Some rural counties are heavily farm-dependent, with farm earnings comprising 25 percent or more of total earnings. The purpose of this paper is to provide an assessment of the economic impacts of NRCS payments to producers and technical assistance programs on rural communities and the nation. These impacts will be reported for NRCS as a whole and for major conservation programs. An input-output model (IMPLAN) is used to assess the economic impacts of NRCS expenditures in fiscal year 2012 for the nation, rural America, and USDA StrikeForce counties. Input-output models are commonly used to analyze the impacts of an influx of government or private expenditures into an economy on economic output and jobs. Preliminary results indicate that in NRCS expenditures in 2012 supported an estimated $3.7 billion in economic out (GDP) and 51.3 thousand jobs nationally. They also indicate that NRCS financial assistance provided to producers located in rural counties contributed to about $435 million in economic output and supported 9.5 thousand jobs in those counties. These results broaden our understanding of the importance and contribution of conservation programs to the rural and national economies.

Subject Area: Agricultural and Conservation Economics*

**denotes primary author and subject area*

Evaluating nitrogen export from a tile drained headwater watershed in central Ohio

Author(s): Mark Williams*, USDA-ARS; Kevin King, USDA-ARS; Norm Fausey, USDA-ARS

Abstract: Nitrogen (N) fluxes from tile drained watersheds have been implicated in water quality studies of the Mississippi River basin, yet the role of tile drainage in watershed N export is poorly documented. The objective of this study was to ascertain seasonal and annual contributions of tile drainage to watershed discharge and N loading as well as to determine the relationship between discharge and N concentration. We evaluated discharge, N concentrations, and N loads at the outlet of a central Ohio agricultural headwater watershed (389 ha) and all functioning tile drains within the watershed from 2005 through 2012. Results showed that mean annual tile drain discharge was 283 mm, which was equivalent to 28% of the annual precipitation. Tile drainage accounted for 56% of annual watershed discharge (508 mm) over the 8-year study. Watershed and tile discharge were generally greatest during the winter and spring, coinciding with seasonal trends in precipitation. Nitrate-N (NO3-N) was the predominant form (~90%) of N exported in both watershed and tile discharge and concentrations ranged from 0.1 to > 60 mg L-1. Mean NO3-N concentrations were typically > 10 mg L-1 in field tiles and increased as discharge increased, while mean NO3-N concentrations at the watershed outlet were often < 3 mg L-1. Annual NO3-N loads in tile drainage ranged from 9.6 to 34.9 kg ha-1, with a cumulative NO3-N load of 153.8 kg ha-1. Annual watershed NO3-N loads ranged from 12.4 to 39.6 kg ha-1 and totaled 203.0 kg ha-1 over the study period; thus, tile drainage accounted 78% of watershed NO3-N export. Nitrate-N loads in both watershed and tile discharge were significantly ($p < 0.05$) greater during the summer compared to NO3-N loads in the winter, spring, and fall. Study results will help inform hydrology and water quality models for tile drained watersheds as well as enhance the design and implementation of best management practices that address water quality concerns within tile drained landscapes.

Subject Area: Water Resource Assessment and Management*

**denotes primary author and subject area*

EVALUATING WATERSHED RECHARGE AND IMPLICATIONS FOR SUPPORTING SURFACE WATER USES

Author(s): Greg Wilson*, Barr Engineering Company; Evan Christianson, Barr Engineering Company; Eric Novotny, Barr Engineering Company

Abstract: Managing groundwater resources has become significantly more challenging given the need to balance an increasing trend in appropriations with more frequent drought conditions while properly accounting for groundwater-surface water interactions and the associated effects on water quality, biology and recreational use. Within a watershed, groundwater is recharged primarily by precipitation that infiltrates through the soil and reaches the water table. This recharged groundwater, in turn, supplies an important component to the base flow of streams and groundwater-dependent wetlands. Alterations to topography, land use, and climate will affect groundwater recharge and change the amount of water flowing into streams or available for pumping by wells. New methods have been developed that couple models of surface hydrology with groundwater models, allowing managers to make decisions on how best to protect both surface water and groundwater in a holistic manner. We present an example from the Little Rock Creek watershed (a protected trout stream in Benton County) in Minnesota that applied coupled models to the problem of recharge and changes to surface water runoff resulting from increasing demand for cropland irrigation. This project resulted in Total Maximum Daily Loads (TMDLs) for dissolved oxygen, nitrate and temperature, as well as a Stressor Identification analysis for bedded sediment. The implications of competing groundwater demands will be discussed in the context of developing TMDLs and supporting surface water uses.

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

**denotes primary author and subject area*

Evaluating Wetland Impacts on Nutrient Loads within Watershed Systems Using AnnAGNPS

Author(s): Ronald Bingner*, USDA-ARS; Jill Kostel, The Wetlands Initiative; Jim Monchak, The Wetlands Initiative; Yongping Yuan, EPA-Office of Research and Dev; Henrique Momm,

Abstract: Pollutant loads that leave agricultural fields can be difficult to manage once they enter a stream system. The placement of wetlands within watershed systems can be part of a system-wide plan to reduce pollutant loads moving downstream by trapping and transforming nutrients. Management tools are needed to evaluate the effectiveness of wetlands used in conjunction with a watershed system approach of implementing conservation practices. Without these tools, the placement of wetlands can be subjective without quantitatively assessing their impact on reducing pollutant loads moving further downstream. Watershed management tools that integrate the effect of wetlands and agricultural practices are needed to efficiently develop wetlands into conservation plans. This paper will describe the implementation of wetland components within the USDA Annualized Agricultural Non-Point Source pollution model (AnnAGNPS) to account for the effectiveness of wetlands to trap water, sediment and nutrients transported from agricultural fields into the channel network of a watershed. A description of the approach that adopts conservation mass and current research studies on nitrogen transformation into a daily time step approach to simulating wetland processes within the AnnAGNPS model. The characteristics of each wetland can be used to describe the main parameters used in the model, such as the wetland area, nutrient loss rates, storage, infiltration, and flow characteristics of each wetland. Examples will be discussed on the use of the wetland feature based on a 125,000 ha watershed located in North-Central Illinois. Wetlands in series or individually can be evaluated using the model for their effect on downstream pollutant loadings. This information can then be part of a decision-making approach to conservation management planning.

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

**denotes primary author and subject area*

Evaluation of nutrient reductions for potential wetland locations using the wetland and buffer features of AnnAGNPS

Author(s): Jill Kostel*, The Wetlands Initiative; Jim Monchak, The Wetlands Initiative; Ronald Bingner, USDA-ARS

Abstract: Nutrient runoff from agricultural fields is a major source of pollution in the Mississippi River and a primary cause of the Gulf of Mexico's toxic "dead zone," while many of the Midwest's wetlands, which naturally reduce excess nutrients, have been drained. Wetland-based nutrient credit trading markets have the potential to effectively address both interrelated problems in agricultural watersheds by incentivizing farmers to install small constructed wetlands. Wetlands sited to intercept tile-drainage flow in locations where nutrients originate can significantly reduce delivered loads via transformation, assimilation, and sequestration processes. This study's objectives were to identify potential wetland sites and to estimate the effectiveness of the sites in capturing and treating tile-drainage runoff in a 125,000-ha agricultural watershed in north-central Illinois. A GIS-based approach was developed for identifying potential wetland sites based on the best-available topographic data (10m DEM). A multiple-step process was developed to locate and refine areas of interest (AOIs) and evaluate the suitability of each site based on a specific set of criteria. The USDA AnnAGNPS model was used with wetland and buffer capabilities to evaluate the nutrient reduction capacity of each potential wetland site for a 30-year period of simulated climate. AnnAGNPS results indicated that 80 potential wetland sites, comprising 351 ha, can service a drainage area of 34,900 ha. While the individual wetland complexes have a wide range of effectiveness in reducing nutrient loads, the estimated total effect of the potential sites was a reduction in the annual average nitrogen and phosphorus loads at the watershed outlet by 14% and 11%, respectively. These precision conservation and modeling tools offer a replicable means to inform and accelerate the implementation of an underutilized, but highly effective nutrient reduction practice within the context of a nutrient credit trading program.

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

**denotes primary author and subject area*

Evaluation of Vertical Tillage Tools for Residue Management, Manure Incorporation and Seeding Cover Crops

Author(s): Timothy Harrigan*, Michigan State University; Marilyn Thelen, Michigan State University

Abstract: Advances in equipment and seed genetics have facilitated the transition to no-till and low-disturbance corn and soybean production recent years. The specific demands of no-till cropping have led to a new generation of tillage equipment that use coulters or narrowly spaced, shallowly concave disks rather than conventional tillage shanks. These 'vertical' tillage tools fracture and loosen the top 2-3 inches of soil, level wheel tracks, improve infiltration and can reduce runoff. They do not bury crop residue but they cut and shatter it into smaller pieces for even distribution and better contact with the soil. Growers are concerned about soil quality, minimizing soil compaction and managing their cropping program to protect soil productivity and resiliency. No-till and reduced tillage cropping systems are important in this effort, but additional protection can be gained by adding additional organic matter from cover crops or livestock manure. There is a need to evaluate vertical tillage tools as high capacity tools for seeding cover crops, and as manure incorporation tools for effective and efficient nitrogen retention. A range of vertical tillage implements were evaluated on five farms in varying soils and cropping systems in Michigan. Performance indicators evaluated included corn crop residue reduction, rate of soybean germination and emergence to final stand, corn and soybean crop yield and vertical tillage effects on cover crop establishment and nitrogen volatilization loss following broadcast application of liquid swine manure. Vertical tillage had little impact on yield but did influence the rate of seed germination and emergence. Spring tillage operations generally caused a greater reduction in corn residue than fall tillage. Vertical tillage soon after a broadcast swine slurry application reduced nitrogen losses compared to an untilled manure application.

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

**denotes primary author and subject area*

Evaluation of watershed conservation management practices to reduce pollutant loads in Grand Lake St. Marys using AnnAGNPS

Author(s): Ronald Bingner*, USDA-ARS; Yongping Yuan, EPA-Office of Research and Dev; Henrique Momm, ; Milo Anderson, EPA Region 5; Martin Locke, USDA-ARS

Abstract: Grand Lake St. Marys (GLSM) in northwestern Ohio is experiencing toxic levels of algal blooms resulting from nutrients, especially phosphorus (P) input from agricultural production practices that comprise much of the watershed. The lake was originally constructed as a feeder reservoir for the Miami and Erie Canal, and the algal bloom has made recreation activities, such as swimming, boating, and fishing, unsafe on the 13,000 acre lake. Questions concerning the longer term protection of water quality for GLSM include whether a proposed water quality criteria of 32 ppb for P for large impoundments is sufficient to protect the lake; if conservation practices can be adopted to limit nutrient loadings to the lake; and, if existing drainage entering the lake from the contributing watershed can be controlled or altered to improve the lake's water quality. This study will evaluate these questions using the USDA Annualized Agricultural Non-Point Source pollutant loading model, AnnAGNPS. Conservation practices such as nutrient management, winter cover crop, conservation reserve program (CRP), wetland and riparian buffer construction or restoration, and conservation tillage to reduce soil erosion will be investigated using the model. Strategies to control P releases from feedlots within area farms, and minor permitted discharges that can help to avoid future toxic algae blooms will also be evaluated. Descriptions of techniques used to develop model input parameters will be presented. Simulated loads will be compared to observed loads at a few gaging stations located within the watershed and an estimate of all loads entering the lake and reductions from conservation practices will be developed for use in a comprehensive watershed management plan.

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

**denotes primary author and subject area*

Evolution of the 20+ year old Upper Salt Fork Watershed: from wildlife habitat and flooding to the Mississippi River Basin Initiative and water quality

Author(s): Jennifer Filipiak*, American Farmland Trust; Michael Baise, American Farmland Trust; Jonathon Manuel, Champaign County Soil and Water Conservation District

Abstract: The 381-mi2 Upper Salt Fork (USF) Watershed is located in Champaign (90%) and Vermillion (10%) counties in central Illinois. The landscape is recently glaciated – it is very flat and very fertile. Row crop agriculture with extensive sub-surface drainage dominates the land use. The twin cities of Champaign-Urbana, home to the University of Illinois, make up the largest urban area. The Champaign County Soil and Water Conservation District (SWCD) established a steering committee to draft a watershed plan in 1990 and completed the plan in 2006, following 16 years of debate and meetings. The plan addresses the primary concerns of water quality, flooding, land use management, recreation and wildlife. The steering committee remains active today. Water quality increasingly became a focal point when nitrate measurements began in 2008, and the Vermillion-Ohio (of which USF is part) watershed was designated as a Mississippi River Basin Health Watersheds Initiative in 2010. Extensive behavioral analyses have observed that farmers perceive water quality to be very good, and are generally interested in best management practices for agronomic reasons (81%) vs. conservation reasons (74%). While the USF does have many classic success factors cited in other successful watershed projects – extensive baseline water quality monitoring, an active watershed steering committee, farmer leaders, committed agency and agribusiness partners, and multiple funding sources - adoption of water quality practices has been slow. This talk will address the long history of the USF, challenges, successes, and the future of this watershed.

Subject Area: Water Resource Assessment and Management*; Adaptive Management of Conservation Efforts; Conservation Policy and Program Design; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

Female Non-operating Landowners: Preliminary Results from a National Study

Author(s): Alice Sorensen*, American Farmland Trust; Peggy Petrzelka, Utah State University

Abstract: Non-operating landowners (NOLs) - those who own farmland but do not operate it, control 30% of US agricultural land. Yet, our information on this group of landowners is extremely limited, with the last national study on NOLs conducted in 1999. The data on NOLs which do exist are dated, or are collected by state agencies or researchers working in limited geographical areas and do not contain in-depth information on an important NOL category—female landowners. 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. Given the importance of female landowners, questions regarding obstacles to their role in resource management decision making and implementation on the land arise, particularly given previous research which details gendered power dynamics shape landlord-tenant relations, where female landowners are excluded from conservation decision making on their land. Female landowners also provide challenges to those promoting land conservation goals. There is less interaction by female landowners with local natural resource agency offices, resulting in lower levels of involvement in state and federal government conservation programs. In 2013, American Farmland Trust and Utah State University 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. We present the focus group findings and compare and contrast the regional differences found among female NOLs regarding their conservation attitudes and behavior, obstacles to implementing conservation practices, leasing/tenant arrangements as they relate to conservation and their awareness and use of information resources. We discuss the implications of the focus group findings for conservation outreach, farmland protection and future research.

Subject Area: Outreach, Education, and Community Engagement*; Biodiversity Conservation and Management; Conservation Policy and Program Design; Soil Health Resources, Indicators, Assessment, and Management

**denotes primary author and subject area*

Fractured water quality governance: Mapping public interventions for nutrient reduction in a Midwestern USA watershed

Author(s): Chloe Wardropper*, UW Madison; Chaoyi Chang, UW Madison; Adena Rissman, UW Madison

Abstract: Federal, state, and local governments create and implement water quality policies for nutrient reduction. Spatially targeted interventions are recognized as essential to achieving environmental outcomes, but these efforts can be frustrated by implementation constraints and a lack of goal alignment among policymaking and implementing organizations. We mapped 36 nutrient reduction interventions by federal, state, county, and municipal governments and interviewed 27 policymakers and agency staff in a Midwestern USA watershed to understand how multilevel governance impacts spatial targeting and implementation of water quality policy. The study site is Wisconsin's Yahara Watershed – home to a highly used chain of lakes and a mix of urban and rural landscapes – where the primary water quality problem is phosphorus loading to surface waters. Our Geographic Information System database of interventions showed that county governments implemented the most policies, while the state promulgated the most rules, with spatial variability in the extent of policy interventions. Spatial targeting differed between agricultural and non-agricultural policies and by type of tool (land acquisition, ecosystem stewardship, incentive, and regulation). We found a negative correlation between areas of policy intervention and phosphorus load across government levels, with the strongest negative correlations by implementing agency level ($p < 0.01$). Interviews revealed that for public organizations, spatial targeting is in tension with funding constraints, equity goals and participatory processes. Our findings suggest that in order to target the highest phosphorus yielding subwatersheds, governments will need to alter the spatial location of their efforts.

Subject Area: Conservation Policy and Program Design*; Water Resource Assessment and Management

**denotes primary author and subject area*

Fuzzy Multiple Criteria Evaluation of Conservation Buffer Placement Strategies in Landscapes

Author(s): Zeyuan Qiu*, New Jersey Institute of Techno

Abstract: Conservation buffers are a structural mixture of vegetative strips consisting of selected trees, shrubs, and grasses and are widely used to reduce agricultural nonpoint source pollution. Although well-established conservation buffers in landscape generally have multiple functions and/or benefits in watersheds, the current conservation buffer planning strategies tend to use a single criterion, most frequently a hydrological or soil condition indicator, to guide conservation buffer placement. This study will evaluate planning approaches that prioritize agricultural lands for conservation buffers using multiple criteria. These criteria include soil erodibility, hydrological sensitivity, wildlife habitat, and impervious surface derived from different data sources that capture the conservation buffers' ecosystem services in reducing soil erosion, controlling runoff generation, enhancing wildlife habitat, and mitigating stormwater impacts, respectively. A survey was conducted to conservation professionals including federal employees at NRCS, state and local agencies and nongovernmental environmental organizations to elicit decision makers' preferences over multiple benefits of conservation buffers using fuzzy pairwise comparison methods. The elicited preferences are used to assess and compare various conservation buffer planning strategies that place conservation in landscapes to achieve those benefits. The study area is the Raritan River Basin, New Jersey. Two types of buffer placement strategies are used to prioritize agricultural lands in the watershed for conservation buffer placement. A fuzzy multi-criteria analysis is conducted to calculate and compare the total ecosystem service values of the prioritized agricultural lands under the two planning strategies. The approach should be used to maximize those functions and/or benefits and therefore increase the effectiveness of the program funding for conservation buffer placement and maintenance.

Subject Area: Conservation Models, Tools, and Technologies*; Conservation Policy and Program Design; Outreach, Education, and Community Engagement; Water Resource Assessment and Management

**denotes primary author and subject area*

Garnering Local Buy-In: SWAT Modeling of an Agricultural Watershed

Author(s): Patrick Conrad*, Emmons & Olivier Resources

Abstract: The Whitewater River Watershed is home to one of Minnesota's most scenic and best loved rivers. It may also be one of the most studied watersheds, having a history of conservation efforts dating back to the late 1930s when post-dust bowl era rainfalls washed sediment into the river, essentially choking the life from it. Over the years, the Watershed has slowly recovered from that catastrophic time. Land has been set aside into a large State Park and stream restoration efforts have resulted in one of the region's most popular trout fishing destinations. The restoration is, however, far from complete. In conducting its intensive watershed assessment process the Minnesota Pollution Control Agency has determined that many reaches of the Whitewater River are impaired due to excess turbidity. The impairment is currently being addressed through a Total Maximum Daily Load Study. In support of the TMDL, a SWAT Model was constructed to identify the likely sources of sediment reaching the river and to determine the potential beneficial impact of various conservation practices. The model will serve as a guide for field scale implementation efforts needed to restore the River. At the on-set of the SWAT Modeling exercise it was recognized that willingness to implement conservation practices would depend upon whether or not local producers were on board with the science behind the model. Specifically, the producers needed to be convinced that the model accurately represented the specific characteristics of the watershed. They also needed to have confidence that the model accurately predicted the performance of various conservation practices. Garnering local buy-in for the modeling project was accomplished through actively soliciting input on model input parameter development and by communicating model results in a straight-forward easy to comprehend manner.

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

**denotes primary author and subject area*

Get Dirty! Soil Science Education for Kids and Adults

Author(s): Ross Braun*, SWCS

Abstract: Understanding that soil is a limited resource is essential to appreciating importance and cultivating interest in natural resource protection. The youth of today are the leaders of tomorrow. It is never too soon to introduce children to the importance of soil, the wonders of soil properties, and management issues to protect soil and water resources. Lesson plans designed for classrooms and events at public parks can reach parents and other adults in addition to students. This presentation will describe the soil science demonstrations docents gave at the Smithsonian National Museum of Natural History exhibit - "Dig It! The Secrets of Soil." The same demonstrations are currently given by the presenter at nature reserve field days, teaching other teacher-naturalists and Master Naturalists to give soil science demonstrations, giving demonstrations in schools and to scouts, and serving on the St. Louis Science Center advisory committee for an upcoming exhibit on food and agriculture. Demonstrations are presented using the Socratic method which relies on asking and answering questions and discussing ideas rather than simply dictating facts. In addition to teaching a subject, the Socratic method encourages critical thinking and involves developing theories and determining the best hypothesis. Students work through problems to discover soil properties and management ideas on their own rather than being shown the answer. The goal of this presentation is to encourage soil and water conservation professionals to engage in soil science education and provide them with ideas about where, when, and how to educate students and adults. The number of people impacting soil and water is increasing, over 75 million more people on our planet every year. It is our job to increase the number of people who understand the importance of soil and make informed soil and water management decisions.

Subject Area: Outreach, Education, and Community Engagement*; Conservation in Urban Settings

**denotes primary author and subject area*

Growing Partnerships through the National Water Quality Initiative

Author(s): Erika Larsen, USEPA; Katie Flahive*, US EPA; Meghan Wilson, USDA NRCS

Abstract: In 2012, the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) launched the National Water Quality Initiative (NWQI), in collaboration with the Environmental Protection Agency (EPA) and state water quality agencies, to reduce nonpoint sources of nutrients, sediment, and pathogens related to agriculture in small high-priority watersheds in each state. These priority watersheds have been selected by NRCS State Conservationists in consultation with state water quality agencies and NRCS State Technical Committees. NWQI provides a means to accelerate voluntary, private lands conservation investments to improve water quality with dedicated financial assistance through NRCS's Environmental Quality Incentives Program (EQIP), and to focus water quality monitoring and assessment funds where they are most needed. A key part of the NWQI targeting effort includes the implementation of conservation systems that avoid, trap, and control run-off in these high-priority watersheds. Through EQIP, edge-of-field monitoring projects are also taking place in a few NWQI watersheds in order to assess the impact of conservation practices, calibrate USDA water quality models at the field scale, and inform adaptive management. Meanwhile, state agencies are using Clean Water Act Section 319 or other funds to assess progress through in-stream and watershed-level water quality monitoring in at least one watershed per state. In addition to water quality monitoring, runoff water quality will be qualitatively assessed at the field scale with NRCS's Water Quality Index for Runoff Water from Agricultural Fields (WQIag) tool. These water quality assessments build on partnerships at the local, state, and federal level to address nonpoint sources of pollution in priority watersheds across the United States.

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

**denotes primary author and subject area*

Habitat Restoration and Applied LID Stormwater Practices at an Urban Brownfield Site in the I-95 Corridor

Author(s): Robert Jontos, LandTech Consultants, Inc; Christopher Allan*, landTech Consultants, Inc.

Abstract: A joint effort to remediate a 35.5 ac brownfield site in the urbanized I-95 corridor was undertaken by the CTDOT, Town of Fairfield and a private developer. The respective goals were: the reduction of traffic on I-95 by providing parking for 1500 vehicles, a new rail station, and redevelopment of the parcel for mixed use. Operation of a former foundry on the site resulted in the piping of watercourses, large impervious areas, filling of a tidal creek, and soil and groundwater impacted by VOCs, SVOCs, heavy metals, PCBs and TPH. Site remediation included onsite relocation of 100,000± CY of casting sand under parking areas, building footprints and an engineered cap. Parking and handicapped access to train platforms achieved Town and State goals. Habitat restoration included the daylighting of 725± ft of piped watercourse, creation of a 1.27 ac of inland wetland, 0.22 acres of estuarine wetland, 0.84 ac of tidal wetland basin and tidal fringe along the restored shoreline. Wetland hydrology is driven by the day-lighted stream and discharges from LID measures (biofilters and swales) from 11.8 acres of onsite impervious area and groundwater discharges. Additional mitigation includes: a 9.0± ac. coastal meadow, an elevated pedestrian walkway over the mitigation wetlands and an 11.0± ac conservation easement. The easement provides another link in the town's greenway and pedestrian access from adjacent neighborhoods. The outcome of the project demonstrates that a contaminated urban industrial site can be successfully redeveloped to provide economically viable mixed uses, foster mass transportation, incorporate LID strategies to improve water quality and restore degraded wetland and coastal shoreline habitats.

Subject Area: Conservation in Urban Settings*; Water Resource Assessment and Management

**denotes primary author and subject area*

High nitrate concentrations in Midwestern streams in 2013 following the 2012 drought

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

Abstract: The Midwest Stream Quality Assessment study, a collaboration between the U.S. Geological Survey and the U.S. Environmental Protection Agency, was conducted at 100 stream sites in 11 states in the Midwest between May and August, 2013. Twelve weekly water-quality samples were collected at each of the 100 stream sites for analysis of nutrients and pesticides; additionally, sediment chemistry and toxicity were measured and an ecological survey was done at each site. The Cornbelt region encompassed in this study has some of the highest stream nutrient concentrations and loads in the country, and 2013 saw nitrate concentrations much higher than typical in some streams. Stream nitrate concentrations in the 1,200 samples had a mean of 5.3 mg/L, a 90th percentile of 15.4 mg/L, and a maximum of 41.8 mg/L. The highest concentrations were found in southern Minnesota and Iowa. The sampling period in 2013 was wetter than normal and followed a severe 2012 drought in the region. Antecedent hydrologic condition – a wet year following a dry year – was recently shown to result in anomalously high nitrate concentrations in Mississippi River Basin streams, and is likely the primary cause of Midwest nitrate concentrations observed in 2013.

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

**denotes primary author and subject area*

How understanding field-to-stream sediment and phosphorus fluxes can inform targeted conservation in agricultural areas: Lessons learned from the Pleasant Valley Project

Author(s): Faith Fitzpatrick*, USGS; Laura Good, University of Wisconsin, Soil Science; Jasmeet Lamba, ; Rebecca Carvin,

Abstract: Targeting agricultural best management practices in small watersheds is becoming increasingly popular for decreasing sediment and nutrients in streams. A pilot study in the upper Pecatonica River Basin, Wisconsin Driftless Area, tested the targeting strategy with a paired watershed approach. Baseline assessment and monitoring began in 2006 and included upland inventories of agricultural land management and soil test P, a watershed sediment budget, sediment-source fingerprinting, and stream monitoring for suspended sediment and nutrient loads. From 2010-13, farmers implemented targeted upland erosion and runoff reduction practices and streambank stabilization in the treatment watershed to reduce sediment and phosphorus contributions from high loss areas. Sediment fingerprinting and geomorphic assessment data indicate that suspended sediment and phosphorus in Pleasant Valley is from agricultural areas and eroding stream banks, and that the proportion from each varies within subwatersheds. The proportion of stream sediment having an upland agricultural land source was positively correlated with the percentage of agricultural land in the subwatershed. Eroding streambanks with high P concentrations were common along riparian areas with pasture and woodlands, suggesting a need for a closer look at other causes for bank erosion in addition to watershed land use. Stream monitoring data indicate that sediment and phosphorus loads have not statistically decreased. An on-going agricultural practice inventory in the watershed indicates, however, that the extent of practice implementation to date, while substantial, is not yet sufficient to produce a detectable change, as approximately 10% of the agricultural land that was originally untargeted moved to a higher category following conversion from grasslands to row crops. Storage of sediment and phosphorus in the stream channel may also mask expected decreases in suspended sediment and phosphorus loads.

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

**denotes primary author and subject area*

Identifying Karst and Manure Management Setbacks using LIDaR in New York State

Author(s): Paul Richards*, The College at Brockport; M Walter, Cornell University; Brian Buchanan, Dept. of Biological & Environmental Engineering, Cornell University

Abstract: Manure application in the early spring is a major source of groundwater contamination in New York State. In the past 10 years there have been four well contamination events, the most recent of which occurred last year in Onondaga County. For this reason the New York State Department of Environmental Conservation have implemented a new set of manure management guidelines that must be followed by all Confined Animal Feed Operators (CAFOs). According to these guidelines, manure application is not allowed in the early spring on fields that contain specific soil series (called "targeted soils") that are believed to only occur in thinly-soiled karst areas. These soil series form in carbonate bedrock and are less than 48 inches in thickness. In this presentation, we will discuss how we used LIDaR data to identify sensitive karst areas and to map areas where early spring manure restrictions must be applied. Hill shades of one meter resolution digital elevation models were prepared and overlaid with 2010 aerial photography, targeted soils and available well and borehole data. The topography was classified into glacial features, thinly-soiled karst areas, sinkholes, and glacial facies indicative of thicker (>48 inches) sediment deposits. The analysis identified 55 sinkholes where manure management setbacks may be required. The analysis also suggests that 20% of the targeted soils occur in areas where there is contradicting geological evidence of thick glacial deposits. These results suggest that geological criteria beyond targeted soil series should be used for determining if early spring manure protocols should be applied in a crop field. A complete set of maps detailing manure setbacks and where spring manure protocols should be applied are available for download from our project website: http://www.hydrology.bee.cornell.edu/Karst_Webpage/Webpages/Homepage.htm These maps cover all of the Onondaga Plateau in Genesee County, NY.

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

**denotes primary author and subject area*

Identifying Priority Management Zones for Best Management Practice Implementation in Impaired Watersheds

Author(s): Greg Wilson*, Barr Engineering Company

Abstract: Small portions of the agricultural landscape can have a disproportionately large impact on water quality. Identifying these areas is essential if clean water goals are going to be met. Current research suggests that targeting conservation practices to the most vulnerable areas of the landscape will result in a greater reduction of pollutants than if practices are evenly spread out across the landscape. Critical Source Areas (CSAs) are defined as portions of the landscape that combine high pollutant loading with a high propensity to deliver runoff to surface waters. These areas have a higher likelihood of conveying more pollutants to surface waters than other portions of the landscape. Priority Management Zones (PMZs) are regions of the watershed targeted for conservation practices that address disproportionate or large pollutant loads. PMZs can be characterized by three areas of emphasis: source reduction, interception treatment, and in-channel assimilative capacity. New tools and technology make it possible to target conservation practices to areas of the landscape where they are needed most. With the increasing availability of LiDAR data for Minnesota, there is greater potential for rapid landscape assessments that help identify CSAs and PMZs. The Minnesota Department of Agriculture funded this project to evaluate these new technologies more thoroughly in multiple regions of the state and determine their potential value in targeting specific types of best management practices to areas where they will have the greatest environmental benefit. The project resulted in the development of a compendium of assessment tools and provided decision-support guidance for identifying CSAs and delineating PMZs. Case study examples representing a range of Minnesota's agroecoregions will be presented to illustrate how our project team has integrated various GIS tools, models and indices to further target and prioritize candidate areas for implementation of conservation practices.

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

**denotes primary author and subject area*

IDEP: A real time soil moisture, erosion, and runoff inventory

Author(s): Brian Gelder*, Iowa State University; Richard Cruse,

Abstract: The Iowa Daily Erosion Project (IDEP) 2.0 is an ongoing modeling effort that provides estimates of hillslope runoff, erosion, and soil moisture at the HUC 12 level (~100 km2) on agricultural areas throughout the state of Iowa every morning. It replaces IDEP 1.0, which utilized 15-20 year old USDA Natural Resources Inventory (NRI) crop rotation, management, soil, and topographic survey data and real time weather and remotely sensed rainfall to drive the Water Erosion Prediction Project model. IDEP 2.0 includes high spatial resolution precipitation and climate data, complex hillslopes derived from 3 meter LiDAR elevation models, variable hillslope soil properties from SSURGO, remotely sensed crop rotation and residue management data, and increased spatial resolution of runoff and erosion estimates (using approximately 300,000 hillslopes statewide) while maintaining a near-real-time (ca. 6 hour) operation schedule. We will discuss the methods being used to identify and delineate modeled hillslopes across the state and estimate annual hillslope management practices as well as annual trends in soil erosion over the past decade. We will also discuss plans for expanding the Daily Erosion Project to states surrounding Iowa.

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

**denotes primary author and subject area*

Importance of Nitrogen Stabilization

Author(s): Jason Moulin*, Dow AgroSciences

Abstract: As an agricultural industry, we must work together to ensure that our increasing global food demand is supported with improved technology that conserves our most precious resources. As a leader in bringing innovation and technology to agriculture, Dow AgroSciences understands and works to identify ways to partner with those producers and stakeholders who support and deploy this innovation and work to conserve our resources. Instinct II and N-Serve nitrogen stabilizers reduce nitrogen loss through inhibiting nitrification in the soil. Inhibiting nitrification reduces leaching and denitrification or green house gas emissions. Stabilizing nitrogen provides both agronomic and economic benefits to the US farmer. Dow AgroSciences is a leader in nitrogen stabilization. In this session, learn about the science of nitrogen stabilization, the benefits of stabilizing nitrogen to the farm and the environment and understand future technology that Dow AgroSciences is bringing to market in this area.

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

**denotes primary author and subject area*

Improving Oregon's Agricultural Water Quality through Focused Assistance and Enforcement

Author(s): Michael Powers*, Oregon Department of Agricultu

Abstract: Oregon is working to measure the effectiveness of private and public investments to prevent and control water pollution from agricultural activities under the Agricultural Water Quality Management Program. The Oregon Department of Agriculture has proposed a Strategic Implementation initiative. The initiative engages Oregon's Soil and Water Conservation Districts and other partners in outreach and technical assistance efforts to facilitate voluntary improvements by landowners, and to align agency and partner resources to address water quality concerns. A compliance pre-evaluation identifies potential and significant water quality concerns, based on a field survey and other public information. Voluntary work completed during the outreach phase is captured in a post-evaluation, which measures short-term progress. ODA will follow up with a compliance phase, using enforcement when necessary, to achieve compliance with local agricultural water quality regulations, and will update the post-evaluation. Compliance is achieved through ensuring that: (1) agricultural activities do not place pollutants where they may be carried to surface or ground water, and (2) site-capable streamside vegetation is able to establish and grow in order to provide water quality functions (e.g., shade, filtration, and streambank stability). ODA is initially rolling out the Strategic Implementation initiative in two "test run" areas: Mill Creek in the Lower Deschutes basin (dry climate) and Noyer Creek in the Clackamas basin (wet climate). ODA will use these test run areas to gather feedback from landowners, partners, and stakeholders to adapt the process to better assist agricultural landowners in making measurable progress toward achieving water quality standards, and to attain compliance with local agricultural water quality regulations.

Subject Area: Conservation Policy and Program Design*; Adaptive Management of Conservation Efforts; Water Resource Assessment and Management

**denotes primary author and subject area*

Incorporating conservation practice effectiveness and technological tools to develop watershed conservation plans for improving water quality in tile-drained subwatersheds of the Mackinaw River, Illinois, USA

Author(s): Maria Lemke*, The Nature Conservancy; Krista Kirkham, The Nature Conservancy; William Perry, Illinois State University; Michael Wallace, University of Illinois Urbana-Champaign; David Kovacic, University of Illinois Urbana-Champaign; Kent Bohnhoff, Natura

Abstract: Like much of the Midwestern U.S., land use in the Mackinaw River watershed in central Illinois is primarily row crop agriculture with drainage patterns extensively modified by subsurface tiles. Illinois has more total land area drained by tiles than any state in the Upper Mississippi River Basin and contributes some of the highest nitrogen and phosphorus flux to the Gulf of Mexico. Our research has shown that surface water oriented conservation practices are not enough to improve water quality in these highly tile-drained agricultural watersheds, and has led to subsequent research that tests the efficiencies and effectiveness of constructed wetlands to intercept tile water and reduce nutrient exports. Strategies include: (1) precision outreach and watershed placement of wetlands, (2) quantifying optimum wetland to tile-drained watershed area ratio for nutrient reduction, (3) watershed-scale monitoring of wetland effectiveness, and (4) bundling on-field and off-field practices. We are using a paired watershed design to measure watershed-scale effectiveness of strategically placed wetlands at the 10,000-acre scale. Results from a separate 5-year study show that wetland to watershed ratios of 3% to 9% remove an average of 19% to 47% of nitrate nitrogen and 49% to 58% of orthophosphorus loadings, respectively. In 2010, we began a new watershed project to demonstrate the effectiveness and cost-benefits of using constructed wetlands and nutrient management to reduce nitrate loadings to local drinking water that supplies the City of Bloomington, Illinois. Data from GIS, LiDAR topography, soils maps, and aerial color infrared photography were used to develop a watershed drainage tile map that will help guide our strategic outreach, implementation, and monitoring of conservation practices in the watershed. Collectively, this research will provide a conservation blueprint to the City of Bloomington for conservation planning and implementation in the watershed.

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

**denotes primary author and subject area*

Increasing the Cost-Effectiveness of Conservation Programs: Results of a National Water Quality Targeting Analysis

Author(s): Michelle Perez*, WRI

Abstract: Much of the water quality impairment in the U.S. is associated with excess nutrients – nitrogen and phosphorus – and soil erosion from agricultural activities. One policy challenge facing the federal conservation programs is demonstrating the effective use of limited taxpayer funds to address these concerns. WRI completed a national-level modeling analysis of different conservation funding allocation schemes using modeling results from USDA's NRCS Conservation Effects Assessment Project (CEAP). This analysis estimated the current level of cost effectiveness of the conservation programs on spending related to nutrient and sediment-reducing practices on cropland (referred to as the business-as-usual approach or BAU). Cost effectiveness was defined as dollars spent per environmental benefit (i.e. N, P, and sediment reduction or soil carbon sequestration). We explored how the level of BAU cost effectiveness could be improved through geographic targeting and benefit-cost targeting approaches. We used program payment data from 2006 to 2011 nationwide, the CEAP-NRI farm survey dataset, and results from the APEX model and an economic optimization model. Among the seven major findings, we found that targeting conservation funds both geographically (i.e., to acres where the greatest edge-of-field benefits can be achieved) and according to benefit-cost principles (i.e., to acres and practices that can achieve the greatest benefits per dollar spent) could yield 7 to 12 times more environmental benefits for the same $335 million project budget as the BAU approach. We recognized that many barriers stand in the way of realizing these modeled results and offered four recommendations for USDA and the conservation community to consider as they strive to increase the environmental and cost effectiveness of these public funds.

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

**denotes primary author and subject area*

Integration of Commodity and Bioenergy Crops to Boost Conservation and Environmental Sustainability: A Field Design Approach

Author(s): Cristina Negri*, ; Herbert Ssegane, Argonne National Lab; John Quinn, Argonne National Lab; Meltem Urgun-Demirtas, Argonne National Lab

Abstract: The 2022 and 2030 projected biomass supply for cellulosic biofuels is assumed to be dominated by dedicated crops grown on converted cropland and pasture land. However, in some regions such as the Midwestern U.S., the switch from food crops to dedicated energy crops may be problematic because of current higher profit margins of commodity crops. This field-scale study incorporates concepts of industrial ecology and phytoremediation to explore landscape placement of bioenergy crops to recover nutrients released to watersheds by commodity crops. The placement is based on characterization of the spatial variability of five site variables of 1) soil classification, 2) topography and surface flow path lengths, 3) groundwater elevation, 4) subsurface nitrate concentrations, and 5) corn yields. A contour buffer strip of 0.8 ha (2 acres) on a 6.5 ha (16 acres) field was located to intercept concentrated surface flow, capture and use nitrate leachate, and minimize encroachment on productive field areas. The field monitoring results indicate that the use of a contour buffer would be more effective than an edge-of-the-field buffer, as the latter would not capture substantial nitrate leachate in the upland till plains of the field.

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

**denotes primary author and subject area*

Investigating the Link Between Soil Health, Water Quality and Crop Yield.

Author(s): Ross Wilson*, Ausable Bayfield Conservation ; Mari Veliz, Ausable Bayfield Conservation

Abstract: Healthy soils are important both for sustainable agricultural production as well as minimizing topsoil and nutrient loss from farmland. The Ausable Bayfield Conservation Authority began a research project to identify soil health parameters that best clarify the relationship between soil health, runoff water quality and crop production. The parameters included organic matter, bulk density, porosity, resistance to penetration, wet aggregate stability, water infiltration and crop (corn) yield. The research site consisted of two side-by-side corn fields. One field exhibited visual clues such as deep rills, hard packed soils and a poor corn stand indicative of poor health whereas the other field did not. Both fields featured similar soils, slope, precipitation and other weather variables but different past management. The seven soil health parameters were evaluated at 5 different landscape positions in both fields to clarify the effect of different hydrologic processes at these different positions. Results confirmed the soil health parameters were substantially better for the healthier soils. The healthier soils were less dense and exhibited greater porosity with greater natural internal drainage. Greater infiltration would result in reduced volumes of runoff and therefore less eroded sediment and nutrients. During large rainfall events when runoff is inevitable, the greater wet aggregate stability of the healthier soils would release less sediment and nutrients in the runoff water. Crop yields for the healthier soil averaged 201 bu/ac whereas the unhealthy soil yields averaged 65 bu/ac. An overall analysis suggested that many soil health parameters are necessary to best understand the impact of soil health with no single parameter being complete on its own. This preliminary project strongly suggests that healthy soils contribute less to water quality impairment and support strong crop yields, with further research needed to strengthen these relationships.

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

**denotes primary author and subject area*

Iowa Farmers Use Adaptive Nitrogen Management at Watershed Scales

Author(s): Peter Kyveryga*, Iowa Soybean Association; Heath Ellison, Iowa Soybean Association Environmental Programs and Services; Patrick Reeg, Iowa Soybean Association, On-Farm Network

Abstract: Adaptive management or participatory learning is well suited to improve management of commercial nitrogen (N) fertilizers and animal manure sources within farmers' fields. Previous adaptive management studies showed that farmers can use on-farm replicated trials, corn stalk nitrate test, and aerial imagery of the corn canopy across Iowa to collect feedback information about optimal nitrogen fertilizer rates, forms, method and timing of applications. However, the recent discussions about Iowa nutrient reduction strategies put a larger focus on specific watersheds, which have relatively similar soil and weather conditions but diverse management practices. The objective of this study was to utilize adaptive management to collect feedback information about effect of N rates, sources, placement, and timing of applications on corn N status within corn fields in three HUC 8's watersheds, and in the North Raccoon River, the Boone River, and the Upper Cedar River basins in Iowa. In 2013, late-season corn N status about 400 corn fields was evaluated using aerial imagery of the corn canopy and corn stalk nitrate test. In addition, farmers conducted about 20 on-farm replicated strip trials evaluating different rates, N forms and N stabilizer products within their fields. Historical data of corn N status and farmers' N management were also used to identify effect of different crop rotations, soil properties, and weather conditions within and across multiple years within the studied watersheds. The results of the 2013 adaptive management evaluations at watershed levels, historical data, and farmers experience will be help to develop a manual that will be used by agronomists, farmers, and technical providers to conduct similar adaptive management studies in other watersheds and areas in Iowa.

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

**denotes primary author and subject area*

Iowa Water Quality Initiative-Moving from Strategy to Implementation

Author(s): Matt Lechtenberg*, IDALS-DSC

Abstract: The Iowa Nutrient Reduction Strategy was presented November 2012. The NRS sets forth a science-based approach to addressing the impacts of agricultural production on our land and water resources while strengthening Iowa's leadership in the production of agricultural products. During the 2013 Legislative Session, the Water Quality Initiative (WQI) was established within the Iowa Department of Agriculture and Land Stewardship, to begin implementation of the Nutrient Reduction Strategy (NRS). The WQI seeks to develop a multi-faceted approach to spread awareness of NRS, demonstrate practice implementation, spread adoption and report on progress.

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

**denotes primary author and subject area*

Kicking Dirt for Soil Health

Author(s): Bill Berry*, NACD; Rich Duesterhaus, NACD

Abstract: America's conservation districts have been concerned with soil from their outset. Some of the earliest efforts to prevent erosion helped assure healthy soils. Now that soil health is a national movement, conservation districts and their partners are in the thick of efforts to assist landowners in their efforts. This presentation will trace the history of today's modern soil-health movement and show how producers across the country, with the help of conservation professionals, are leading the way with no-till, precision agriculture, cover-cropping and other systems. In an era when some traditional conservation programs are challenged by high commodity prices, focusing on soil health can yield both financial and conservation benefits for operators. This presentation will focus on these benefits. In many ways, the soil conservation movement is returning to its roots. It's an exciting time for producers and conservation practitioners. We will share techniques for effective communication and education of producers, which often comes on a peer-to-eer basis. Conservation districts are heavily engaged in adult outreach and education, and we will share some of their secrets.

Subject Area: Conservation Models, Tools, and Technologies*; Conservation Policy and Program Design; Soil Health Resources, Indicators, Assessment, and Management

**denotes primary author and subject area*

Land Cover Change Analysis in the Great Lakes, 1985 to 2010: Data and Tools to Improve Conservation and Restoration Efforts

Author(s): Brandon Krumwiede*, NOAA/NOS/CSC; Nathaniel Herold, NOAA/NOS/CSC; Jamie Carter, NOAA/NOS/CSC

Abstract: Land use and land cover play a significant role as drivers of environmental change, and information on what is changing and where greatly improves our understanding of past management practices—and how to respond effectively to these environmental and human-induced changes. Through its Coastal Change Analysis Program (C-CAP), the National Oceanic and Atmospheric Administration's Coastal Service Center produces nationally standardized land cover and change information for the coastal regions of the U.S. These products provide inventories of coastal intertidal areas, wetlands, and adjacent uplands (using documented, repeatable procedures) with the goal of monitoring these habitats every five years. This presentation will summarize some of the major changes and trends observed in the Great Lakes between 1985 and 2010, as well as recent and upcoming improvements to C-CAP data. We will discuss the various ways that users can access existing data, including a demonstration of the Land Cover Atlas (an online viewer that provides user-friendly access to the change information that can be derived from C-CAP data), and ways that the data might be used to help in setting conservation and restoration priorities. In particular, we will highlight a wetland potential data model, discuss impacts to wetland mapping accuracy, and showcase a water quality assessment tool currently in development, and the Nonpoint-Source Pollution and Erosion Comparison Tool (N-SPECT).

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

**denotes primary author and subject area*

Land use Land cover impacts on water quantity and quality in watershed systems

Author(s): Ammara Talib*, SWCS; Timothy Randhir, ECO, UMass Amherst

Abstract: Watershed hydrologic processes are significantly influenced by changes in land use land cover (LULC).Changes in rate of interception, evapotranspiration (ET), infiltration, and runoff have impacts on soil loss and nutrient loads into water bodies. Hence, there is a need to evaluate influences of LULC on watershed system in order to develop effective conservation policies. This study aims to model these effects using LULC change as a driver of watershed processes. This study is conducted in Sudbury, Assabet and Concord (SuAsCo) watershed in Massachusetts that has high runoff , and water quality impacts from sediments and nutrients loading . A calibrated watershed model (HSPF) is used to simulate water flows and water quality changes and validated using field data from MassDEP. Nash-Sutcliffe equation is used to assess the efficiency of the model.Regional built-out scenarios of LULC changes are used to assess watershed wide impacts. Results indicate that changes in LULC significantly affect water flows and water quality. There is a potential for reducing runoff, sediments and nutrients loads by using conservation strategies such as carefully selected best management practices (BMPs), cost sharing and spatially targeted incentives. This study provides valuable information to watershed managers and landowners for protecting those watershed systems that are undergoing LULC changes like rapid urbanization.

Subject Area: Water Resource Assessment and Management*; Adaptive Management of Conservation Efforts; Conservation in Urban Settings; Conservation Models, Tools, and Technologies

**denotes primary author and subject area*

Landscape influence on soil carbon and nutrient levels

Author(s): Sally Logsdon*, USDA-ARS

Abstract: Past runoff, erosion, and management practices influence nutrient levels on the landscape. These starting levels affect future nutrient transport due to runoff, erosion, and leaching events. The purpose of this study was to examine closed-depression landscape effects on surface soil organic matter, extracted ortho phosphate (PO4), and nitrate(NO3), and ammonium (NH4) levels, and on well-water levels of total phosphorus (TP) and NO3. The sites examined include a field in Walnut Creek north watershed and two fields in the South Fork watershed of the Iowa river. For each field thirty sites were sampled from two transects. Three wells were installed in each field. LiDAR 1-m elevation data were cleaned up and used to determine slope, profile and plan curvatures by a Python program, based on neighborhood points at 10 m range. Higher organic carbon was apparent for sites with low slope, low relative elevation, or curvature that was concave, converging, or linear. One field had long-term manure applications, and sites did not show any trend of landscape position with NO3, NH4, or PO4. Instead the loads of nutrients in this field were correlated with each other, and there was a site of high nutrient loads (0-0.15 m depth NO3 130 mg/kg, NH4 124 mg/kg, PO4 91 mg/L). The other two fields showed higher NO3 and PO4 for sites with low slope, low relative elevation, or curvature that was concave, converging, or linear. Results for NH4 were inconsistent. Overall, the manured field had higher levels of PO4 in the 0-0.15 m depth than the other fields, as well as high TP spikes in well water samples. Landscape tools were useful to show areas where surface soil was higher in nutrients. Uneven manure application might result in localized areas of high nutrient load.

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

**denotes primary author and subject area*

Landuse and Agricultural Management Practice web-Service (LAMPS) for agroecosystem modeling and conservation planning

Author(s): Holm Kipka*, Colorado State University; Olaf David, Colorado State University; Timothy Green, USDA, Agricultural Research Service (ARS), Agricultural System Research Unit; Luis Garcia, The University of Vermont; James Ascough II, USDA, Agricultural Resear

Abstract: Agroecosystem models & conservation planning tools require spatially & temporally explicit input data about agricultural management operations. The USDA Natural Resources Conservation Service is developing a Land Management & Operation Database (LMOD) which contains potential model input, however LMOD does not provide high-resolution spatial data. LAMPS complements LMOD data with spatial information by using a 30 meters resolution geo-spatial data source, the CropScape web service from the USDA National Agricultural Statistics Service (NASS). NASS contains a remote sensing based raster Crop Data Layer (CDL) for a specific year & a spatial Area of Interest (AOI). Here, we demonstrate spatial data provisioning to the component-based AgroEcoSystem-Watershed (AgES-W) model implemented under the Object Modeling System. AgES-W simulates hydrological responses, water quality, & agronomic processes across spatially distributed & interconnected hydrological response units (HRUs). Land use inputs are required for each HRU across a watershed. LAMPS handles crop & management data provisioning for AgES-W as follows. LAMPS then queries the annual crop information from CropScape web service for the AOI & for available CDL years. LAMPS selects the dominant crop by calculating a crop confidence index within each HRU using CropScape provided accuracy values. LAMPS also identifies irrigated & non-irrigated crops using geo-spatial irrigation data provided by the USGS. It then detects a sequence of main crops for every HRU & matches the crop sequence to available crop rotation information & all associated management tillage operation information obtained from LMOD. Finally, LAMPS generates required management input files for the AgES-W model over the desired simulation period. Previously LAMPS was evaluated using ground observations of crop type on a farm in Colorado. Here, LAMPS will be demonstrated & evaluated on a watershed in Iowa.

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

**denotes primary author and subject area*

Learning from the Past to Plan for the Future: Historic Nutrient Fluxes in Lake Erie Tributaries Provide a Key

Author(s): Andrew Sharpley, University of Arkansas; Helen Jarvie*, CEH, Wallingford, England; Peter Richards, Heidelberg College, Heidelberg, OH; David Baker, Heidelberg College, Heidelberg, OH; Laura Johnson, National Center for Water Quality Research, Heidelberg U

Abstract: Implementation of conservation measures across the Lake Erie Basin has produced declines in suspended sediment and particulate phosphorus (P) concentrations, but decreases in loads have been smaller or nil because of increasing discharge. Substantial increases in dissolved P translate into increased bioavailable P loading and renewed eutrophication of the lake. This has led many to question the efficacy of these measures and to call for stricter land and nutrient management strategies. In seeking solutions, we must be mindful of the legacies of past management activities, including sinks and stores of nutrients along the land-freshwater continuum which continue to supply nutrients and mask the effects of reductions in edge-of-field losses. Accounting for nutrient legacies along this continuum is important for the correct apportionment of sources and for development of successful watershed remediation strategies. Here, we examine historic water quality data trends in major watersheds draining into Lake Erie and compare the fluxes of conservative and non-conservative elements. In addition, due to the importance of P to Lake Erie algal blooms, we elucidate the drivers of legacy P at the watershed scale, specifically in relation to the physical cascades and biogeochemical spirals of P along the continuum from soils to rivers and lakes, and via surface and subsurface flow pathways. Terrestrial P legacies can include past land management that has increased the potential for P runoff and modified connectivity between terrestrial P sources and fluvial transport. River and lake P legacies encompass a range of processes that control retention and remobilization of P, which are linked to water and sediment residence times.

Subject Area: Lake Erie Case Studies: The Challenge of Maintaining Improvements

**denotes primary author and subject area*

Lessons from the Nation's First Interstate Water Quality Trading Project in the Ohio River Basin

Author(s): Alice Sorensen*, American Farmland Trust; Brian Brandt, American Farmland Trust; Jessica Fox, Electric Power Research Institute

Abstract: Starting in 2009, the Electric Power Research Institute (EPRI), American Farmland Trust (AFT) and other collaborators worked with state agencies in Ohio, Indiana and Kentucky to develop and agree upon a water quality trading (WQT) plan for interstate trading in the Ohio River Basin. Water quality trading is an innovative market-based approach to achieving water quality goals for nutrients such as phosphorus and nitrogen through programs that allow permitted emitters to purchase nutrient reductions from another source. In the ORB WQT project, these nutrient credits come from farmers who implement best management practices that reduce nutrient run-off. The ORB WQT project is innovative and unique in its regional and interstate focus, in the leadership that has been shown by the participating states, in the involvement of major stakeholder groups in the Basin, in its strong emphasis on a scientific framework and defensible trading roles and in its determination to secure ancillary ecosystem service benefits with the water quality trades. At the same time, the project has been careful to build on the efforts that have gone before and this has greatly improved its potential for success. The agencies signed the trading plan in August 2012. During 2013, EPRI and AFT worked with 12 SWCDs in interstate watersheds to complete 16 projects on farms to reduce nutrient runoff with six applications still pending. At the same time, Markit Environmental worked with the collaborators to develop an on-line registry for the ORB market. The project will complete additional pilot trades in 2014 and officially announce the sale of the nation's first interstate water quality stewardship credits in March 2014. Based on the lessons we learned with the initial pilot trades, the Trading Plan was amended by the States in November 2013. We will review the framework we've developed, the barriers we've encountered, the ways we've addressed those barriers and the lessons we have learned.

Subject Area: Conservation Models, Tools, and Technologies*; Agricultural and Conservation Economics; Conservation Policy and Program Design; Water Resource Assessment and Management

**denotes primary author and subject area*

Maintaining Conservation Program Viability In the Face of Changing Ownership

Author(s): Mickey Steward*, Steward Consulting

Abstract: The recent history of a proposed copper mine in BCS Mexico with serious commitments to conservation will be presented to illustrate the challenges of maintaining a viable conservation program in the face of rapid change due to loss of funding, change of ownership, and cost over-runs. The extent and nature of the conservation program will be described, as will the challenges of cross-cultural ownership and employment. The project is currently owned by a Korean company employing primarily Mexican nationals, both local and from other parts of the country. A limited number of other international personnel are temporarily employed under contract. Financing sources are multiple and financing requirements rigid. That notwithstanding, the interests and understandings of the various stakeholders, as well as the limited budget, call for creativity, frugality, and persistence. Perhaps some of the lessons learned here will be applicable to other projects that find themselves under similar circumstances.

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

**denotes primary author and subject area*

Management to achieve greater water use efficiency

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

Abstract: The United States Department of Agriculture (USDA) has identified the US agricultural base as potentially susceptible to changing climate conditions. In Minnesota, annual precipitation is projected to increase under future climate scenarios mostly during the non-growing season while summer precipitation patterns are expected to become less predictable. Too much water early in the growing season can lead to delayed planting, crop loss, and environmental damage while too little water in the summer can lead to reduced yields or total crop loss. The objective of this research was to quantify water budgets and environmental response of diverse, multi-year conventional and organic crop rotations and identify which rotations are most resilient under various climate conditions. This research is a combination of plot-scale and farm field-scale experiments. Farm and plot-scale trials combined meterological data and field measurements to develop comprehensive water budgets for diverse crop rotations. Preliminary data indicate that conventional and organic 4-year crop rotations, on average, had similar changes in soil water storage, -33 mm, which were comparable to reference perennial prairie, -34 mm. In contrast, mean change in soil water storage for a 2-year conventional crop rotation resulted in a change in soil water storage of -25 mm. Crop rotation has an effect on soil water storage and in turn water use efficiency which will become increasingly import under changing climate conditions. Management practice adaptation and mitigation will be required to increase soil water storage to meet food production and environmental goals in the future.

Subject Area: Water Resource Assessment and Management*

**denotes primary author and subject area*

Measuring erosion on irrigation reservoir levees

Author(s): Daniel Wren*, USDA-ARS; Yavuz Ozeren, University of Mississippi, NCCHE; Michele Reba, USDA-ARS

Abstract: Increasing demands on limited groundwater resources have created a growing need for the development of surface water resources for irrigation. On-farm irrigation reservoirs, along with tailwater recovery systems, can provide a means for reducing dependence on groundwater supplies. Levees are typically constructed from local soils that may be low in clay content, and unprotected levees may sustain rapid erosion from both wind-driven waves and surface runoff. There is little published work on erosion rates for unprotected levees. In an ongoing study by the USDA-ARS in an irrigation reservoir in east-central Arkansas, substantial loss of the interior slopes was quantified by comparing Light Detection and Ranging (LiDAR) surveys collected before (June 2012) and after (April 2013) the windy winter season of 2013. The top of the levee retreated by as much as 3 meters and approximately 1400 m3 of soil were lost during the nine month period between the surveys. Wind speed and direction as well as wave properties were collected during the same time period, and estimates of wave characteristics associated with the levee erosion will be included.

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

**denotes primary author and subject area*

Measuring Land and other Capital Inputs

Author(s): Richard Nehring*, ERS; Eldon Ball, ERS; Vince Breneman, ERS; Charlie Hallahan, ERS; Dave marquardt, ers; Sun Wang, 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: Agricultural and Conservation Economics*; Soil Health Resources, Indicators, Assessment, and Management

**denotes primary author and subject area*

Mine Reclamation and Erosion Control Near the Sea of Cortez

Author(s): Mickey Steward*, Steward Consulting

Abstract: Reclamation and erosion control are serious challenges in desert environments and where resources and technology are limited. Reclamation and rehabilitation employees at Minera y Metalurgica del Boleo (MMB) have created leading edge techniques to reduce sediment contribution from mining operations to the phenomenally rich marine environment of the Sea of Cortez. There is considerable hand work, while small equipment is used in reshaping of the topography. Stones and stonework are used extensively for erosion control. Revegetation activities consist of transplantation of native species and application of plant litter, surficial materials, and compost generated from food wastes and woods chips. Because these practices are the first of their kind in this area, reviews are conducted several times per year to adapt practices to observed successes and failures. A handbook of reclamation practices for extreme desert environments has been created. The technology can be exported to assist in reclamation of similar disturbance in areas where resources and technology are limited. The presentation includes survival analysis for re-located protected species, a discussion of regulatory interactions, and photographic analysis of change over time of restored areas.

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

**denotes primary author and subject area*

Modeling Conservation Practices in APEX: From the Field to the Watershed

Author(s): Wendy Francesconi*, National Soil Erosion Research

Abstract: The evaluation of USDA conservation programs is required as part of the Conservation Effects Assessment Project (CEAP). The St. Joseph River Watershed is one of CEAP's benchmark watersheds to conduct research on water quality. The Agricultural Policy/Environmental eXtension (APEX) was used as a modeling approach for quantifying the environmental impacts of conservation practices in this watershed. The simulation of various single and combined (first and second level) conservation practices implemented throughout the St. Joseph River Watershed was conducted. Seven variables (Surface runoff, Sediments, Total Phosphorus (TP), Soluble Phosphorus (SP), Soluble Nitrogen (SN), Tile Flow, and Soluble Nitrogen in Tile (SN-Tile)) were compared. Edge-of-field outputs were extrapolated by the areas encompassed by the different conservation practices at the watershed scale. The results are presented as the percentage reductions in loadings compared to the baseline scenario. When single conservation practices were implemented, the estimated reductions were about 39% for sediment, 7% for TP, and 24% for SN-Tile. In contrast, SP and SN resulted in a -5% and -57% reduction at the watershed. When the conservation practices were combined, the percentage reductions increased for all variables. The total reductions for combined first and second level were 68% and 91% for sediments, 35% and 74% for TP, 1% and 48% for SP, -43% and 28% for SN, and 50% and 85% for SN-Tile. Negative nutrient load reductions is due to the slightly higher SP and SN loads in no-till, mulch-till, and Conservation Crop Rotation practices, and their greater extent of incorporation at the watershed. Overall, the cumulative impact of field conservation practices can help improve the watershed's excessive nutrient and sediment concerns. Yet, the aggregate effect of these conservation practices can amplify such improvements at the watershed, while conserving the soil and water resources at the field.

Subject Area: Lake Erie Case Studies: The Challenge of Maintaining Improvements

**denotes primary author and subject area*

Monitoring and analysis of a novel highway runoff treatment system for application in salt vulnerable areas

Author(s): Bill Trenouth*, University of Guelph; Bahram Gharabaghi, University of Guelph

Abstract: Highway stormwater pollution, if not adequately captured and treated, has been recognized by many agencies as a as a significant potential threat to receiving waters. Stormwater runoff from high-traffic roadways typically comprises a complex chemical cocktail of pollutants including heavy metals, sediments, nutrients, petroleum hydrocarbons and, in seasonal climates, road salts. Many transportation authorities have begun to turn their attention to the control and restricted use of these road salts (chiefly sodium chloride), particularly in vulnerable groundwater recharge areas. Classified as a hazardous material by the Ontario Ministry of the Environment (MOE), road salts dissolve into highly mobile ions capable of contaminating both surface and groundwater. However, their use as a de-icing agent on provincial roads has hampered efforts to reduce application rates. This presentation focuses on controls and alternatives to road salts, with a particular emphasis on research currently taking place at the University of Guelph in conjunction with the Ministry of Transportation (MTO). A novel, newly-designed field facility has been installed along a research section of the 401 – the busiest highway in Canada. Now in its second year of operation, monitoring of the treatment facility seeks to evaluate the performance of different media in terms of their ability to remove highway pollutants – including salts; to explore the attenuation capacity of a linear treatment system designed to infiltrate and temporarily detain stormwater runoff and also to determine the efficacy and field performance of impermeable barriers in terms of their ability to protect sensitive groundwater areas from pollutant contamination. The results from this research suggest that stormwater runoff from highways can be improved (in terms of both quality and quantity) for the benefit of aquatic species and municipal use when using our novel treatment system.

Subject Area: Water Resource Assessment and Management*; Conservation in Urban Settings; Conservation Models, Tools, and Technologies

**denotes primary author and subject area*

Monitoring and Modeling Nitrate Fate in Subbasins within the Choptank River Watershed, Maryland, USA

Author(s): Gregory McCarty*, USDA ARS; Ali Sadeghi, USDA ARS; Sangchul Lee, Universirty of Maryland; In-Young Yeo, University of Maryland; Dean Hively, USGS; Megan Lang, USDA ARS

Abstract: Conservation practices, such as post harvest planting of winter cover crops, are important for water quality improvement in agricultural watersheds. Throughout the Chesapeake Bay watershed (CBW), winter cover crop use has been emphasized and federal and state cost-share programs are available for farmers to compensate for the costs of planting winter cover crops. The objective of this study was to assess the long-term effect of planning winter cover crops at the watershed scale and to identify critical source areas of high nitrate export. A physically-based watershed simulation model, Soil and Water Assessment Tool (SWAT), was calibrated and validated using water quality monitoring data and satellite-based estimates of winter cover crop species performance to simulate hydrological processes and nutrient cycling over the period of 1991-2000. Multiple scenarios were developed to obtain baseline information on nitrate loading without winter cover crops planted and to investigate how nitrate loading could change with different winter cover crop planting scenarios, including different species, planting times, and implementation areas. The results indicate that winter cover crops had a negligible impact on water budget, but significantly reduced nitrate leaching to groundwater and delivery to the waterways. Without winter cover crops, annual nitrate loading was approximately 14 kg/ha, but it decreased to 4.6 = 10.1 kg/ha with cover crops resulting in a reduction rate of 27-67 % at the watershed scale. To further improve model calibration and validation, we have established two in situ nitrate sensors adjacent to stream gauge stations of two rather diverse subbasins, forming paired basins within the Choptank watershed that are now monitored for nitrate flux. Experience with operation of the sensors and some preliminary data will be reported. This study is part of the ARS CEAP Watershed Assessment.

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

**denotes primary author and subject area*

National Survey Results on Farmer Experiences with Cover Crops

Author(s): Robert Myers*, Univ. of MO/USDA-SARE; Karen Scanlon, CTIC; Chad Watts, CTIC; Alan Weber, MARC-IV

Abstract: The North Central Sustainable Agriculture Research and Education program (USDA-NIFA) has provided funding and cooperated with the Conservation Technology Information Center on a national farmer survey on cover crops the last two years. Results from the first round of the survey of 759 farmers in the winter of 2012-13 showed that farmers reported significant yield increases for corn and soybeans following cover crops. They also reported significant growth in acreage, driven by several perceived benefits from cover crops, including reduced soil compaction, reduced erosion, and improved scavenging of nitrogen. Pest management and potential yield benefits were also cited as benefits farmers were hoping for from cover crops. The second round of the survey in the winter of 2013-14 reached a larger number of farmers and will provide an expanded look at farmer experiences with cover crops, including yields. It also includes perceptions about cover crops from farmers who are not yet using cover crops, and farmer opinions about the role of industry with cover crops.

Subject Area: Cover Crop Practices: Application, Innovation, and Management

**denotes primary author and subject area*

Net Returns and Risk for Cover Crop Use as an Integrated Pest Management Practice in Alabama Cotton Production

Author(s): Leah Duzy*, USDA-ARS; Andrew Price, USDA-ARS; Jatinder Aulakh,

Abstract: Cotton producers in Alabama are faced with uncertain yields and prices, as well as increasing weed management challenges such as glyphosate resistant weeds. By utilizing a production system that will reduce risk while maintaining yield, cotton production may be economically sustainable into the future. A conservation tillage production system with cover crops may be an economically viable alternative for cotton producers in Alabama to help control Palmer amaranth (Amaranthus palmeri S. Wats), a highly aggressive, glyphosate resistant weed in the Southeastern United States. The objective of this study is to compare the economics of alternative production systems using different cover crops, such as cereal rye (Secale cereale L.) and crimson clover (Trifolium incarnatum L.), for cotton production relative to a winter fallow system to determine the preferred treatment. Data for this analysis are from a three year field experiment at E.V. Smith Research Center near Shorter, AL. Economic data are analyzed using SAS PROC GLIMMIX. A stochastic simulation model is used to generate net returns for each treatment based on simulated cotton yields for each treatment, as well as cotton price. These net returns are used in the risk analysis. Based on the published yield data (Aulakh et al.; Agronomy 2012, 2, 295-311; doi: 10.3390/agronomy2040295), we hypothesize that the use of a cover crop in cotton production will have higher gross revenues than a winter fallow system. Furthermore, the use of a cover crop and herbicide regime will reduce the risk associated with cotton production. The overall goal of this research is to show that the use of a cover crop in cotton production has the potential to be a profitable, less risky alternative to the use of winter fallow in Alabama.

Subject Area: Cover Crop Practices: Application, Innovation, and Management

**denotes primary author and subject area*

NEW SWAT TILE DRAIN EQUATIONS: MODIFICATIONS, CALIBRATION, VALIDATION, AND APPLICATION

Author(s): Daniel Moriasi*, USDA-ARS GRL; Prasanna Gowda, USDA-ARS CPRL; Jeff Arnold, USDA-ARS GSWRL; David Mulla, University of Minnesota; Srinivasulu Ale, Texas A&M AgriLife Research; Jean Steiner, USDA-ARS GRL; Mark Tomer, USDA-ARS

Abstract: Subsurface tile drainage is a commonly used agricultural practice to enhance crop yield in poorly drained but highly productive soils in many other regions of the world. However, the presence of subsurface tile drainage systems also expedites the transport of nitrate-nitrogen (NO3-N) and other chemicals to surface waters. Hydrologic and water quality models such as the Soil and Water Assessment Tool (SWAT) are widely used to simulate tile drainage systems at various spatial scales. The tile drain algorithms are constantly under modifications as SWAT model gets used and users provide feedback. The most recent (New) tile drain algorithm in SWAT is based on the Hooghoudt and Kirkham equations. Recent modifications to the new tile drain equations will be presented. The modified equations in SWAT are calibrated, validated, and applied in small plots in Waseca located in southern Minnesota to determine the impact of nitrogen (N) fertilizer application and tile drain configuration on nitrate leaching. Detailed results will be presented but overall long-term simulation results indicated that greatest reductions in NO3-N losses can be achieved with reduction in the N application rates. These results showed potential of the new tile drainage equations in SWAT to simulate the effects of tile drain configurations on drainage and associated NO3-N losses.

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

**denotes primary author and subject area*

New Tools for Assessing the Effectiveness of Field-scale Best Management Practices.

Author(s): Ross Wilson*, Ausable Bayfield Conservation ; Mari Veliz, Ausable Bayfield Conservation

Abstract: Agricultural sediment and nutrient loadings from Great Lakes tributaries are significant contributors to the impairment of Great Lakes water quality. The collective effect of many field-scale Best Management Practices (BMPs) represents a partial solution. Assessing the effectiveness of field-scale agricultural BMPs requires monitoring of runoff water quantity and quality at the field scale. While the monitoring at the watershed scale is more highly developed, monitoring at the field scale presents unique challenges. The Ausable Bayfield Conservation Authority was involved in a three year project to assess the effectiveness of four different field-scale BMPs including nutrient reduction, conservation tillage, cover crops and Water And Sediment Control Basins (WASCoBs). WASCoBs are constructed basins located in the runoff flowpaths of agricultural fields and designed to temporarily store water runoff to improve water and sediment management. Typically a single WASCoB treats runoff from 10-20 acres of cropland. Monitoring of the water quality and quantity of inflows and outflows of these WASCoBs is the focus of this presentation. WASCoB effectiveness is determined as the difference between inflow and outflow (water quality parameters) and intensity/duration of runoff with and without the WASCoB (water quantity). Unique methods were borrowed and substantially modified from other waste water sampling methodologies, including GIS, in order to be suitable for this type of application. Results show that these methods have been successful at demonstrating that WASCoBs are highly effective. Runoff concentrations have been reduced by 73% (TSS), 40% (Total P) but only minimally for nitrate (13%). Peak intensity of runoff was reduced from 1000Litres/minute to 150 Litres/min; an 85% reduction. Duration of runoff was extended from 1.5 hours to 9 hours. This project demonstrated that WASCoBs provide substantial benefits at the field-scale level.

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

**denotes primary author and subject area*

NW Indiana Cover Crops: Stories from the pits, rolled cereal rye, a tale of nitrogen kept, and water quality impacts.

Author(s): Daniel Perkins*, Jasper SWCD

Abstract: We are entering our fourth year of discovering the value of cover crops in NW Indiana and we have some great stories from the pits, crimping cereal rye, documenting nitrogen held, and water quality impacts of cover crops. We will share these stories of cover crop challenges and successes via in-depth photos and video discusions from soil pits and cover crop fields, summary observations and trends from the field,and year one results from our replicated strip trial.

Subject Area: Cover Crop Practices: Application, Innovation, and Management

**denotes primary author and subject area*

Optimal Spatial-Dynamic Management of Groundwater Conservation and Surface Water Quality with On-Farm Reservoirs

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

Abstract: An agricultural landscape affects groundwater resources and surface water quality because farms use groundwater to irrigate crops and the runoff from farm tillage and fertilizers can pollute nearby streams. On-farm reservoirs with tail-water recovery recycle water from irrigated fields to alleviate overdraft of aquifers and collect pollutants otherwise entering streams. We examine the joint management of groundwater quantity and surface water quality using on-farm reservoirs with a spatial-dynamic model of farm profit maximization in the Arkansas Delta over a 30-year period. The model evaluates management changes if the planner's objective also includes value for surface water quality or groundwater quantity. Several policies for alleviating groundwater depletion and enhancing water quality are compared to find which strategies are cost-efficient for the conservation goals. With a pure profits objective, the results suggest that the use of reservoirs allows farm profits to rise 13%, final aquifer levels to increase 33%, and pollutant loadings to decrease by 28% for phosphorus and 32% for sediment. The best policy for a severely challenged water quantity and quality area is the cost share on reservoir construction because both conservation goals are achieved cost effectively for a modest redistribution of income.

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

**denotes primary author and subject area*

Overcoming Barriers to Targeting: Viewing the MRBI as a Case Study

Author(s): Michelle Perez*, WRI

Abstract: Despite spending roughly $2.5 billion per year in financial and technical assistance to agricultural producers to implement practices that address resource concerns (e.g., water quality, wildlife habitat) on individual farms, there is limited evidence (mostly in the wildlife arena) that these programs have realized improvements beyond farm boundaries. Better use of conservation funds, for example, to improve water quality measured in streams, involves both geographic and cost-effectiveness targeting. However, according to the literature and interviews with practitioners, many barriers to targeting exist. The World Resources Institute (WRI) identified and categorized the barriers into three major types: scientific and technical, social and political, and institutional and implementation. In addition, WRI reviewed the Mississippi River Basin Healthy Watersheds Initiative (MRBI) to determine how well it was designed to achieve measurable improvements in water quality. WRI reviewed the literature and interviewed experts to produce six factors deemed to be indicators of effective targeting: stakeholder and producer buy-in; presence of specific, measurable, achievable, results-oriented, time-bound, and quantitative (SMART-Q) goals; geographic targeting; monitoring and evaluation; cost effectiveness; and adaptive management. This presentation will combine the results of both of these analysis and share lessons learned and recommendations for overcoming barriers to targeting and improving the MRBI. For example, MRBI received an average rating of "fair" across the six factors we used to rate how likely the program's design is to achieve improved landscape-scale water quality outcomes for nutrient and sediment pollution. By providing greater oversight of the MRBI projects' in-stream water quality monitoring efforts, NRCS will be overcoming both technical barriers as well as institutional barriers.

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

**denotes primary author and subject area*

Planning and Designing High Diversity Cover Crop Mixes

Author(s): Keith Berns*, Green Cover Seed

Abstract: In the world of cover cropping, nothing is as powerful as diversity. The best cover crop mixes are those that borrow nature's template and use as much diversity as possible. Keith Berns, south central Nebraska farmer and owner of Green Cover Seed, has helped design and mix high diversity cover crop mixes for hundreds of thousands of acres over the past 5 years. Using what he has learned and the newly updated SmartMix Calculator, Keith will demonstrate the thought processes followed when designing cover crop mixes - including resource goals, environmental factors, and next crop considerations. Several high diversity mixes will be designed using the SmartMix Calculator version 3.0 which features greatly enhanced user interaction and crop species rankings based on user-selected goals and environmental conditions.

Subject Area: Cover Crop Practices: Application, Innovation, and Management

**denotes primary author and subject area*

Predicting winter rye cover crop biomass and estimating environmental impacts

Author(s): Andrea Basche*, Iowa State University

Abstract: Midwest corn-based cropping systems often result in negative environmental effects such as nitrate pollution leaving agricultural fields. Winter cover crops are proposed as a solution to increase ground cover and subsequently reduce such negative effects. The amount of nitrate reduction or other environmental changes (soil erosion prevented, organic matter accumulation, cash crop yield impacts, for example) is largely contingent upon the accumulation of cover crop biomass. Adequate biomass accumulation can be a challenge for Midwest corn-based cropping systems where there is limited time between the harvest and planting of continuous corn or corn-soybean cash crop rotations. Therefore accurate predictions of cover crop biomass can be beneficial to both growers and policy makers in informing decision-making regarding cover crops. Here we present results of a complex biophysical cropping systems model (APSIM, the Agricultural Production Systems sIMulator) and a less complex statistical model utilized to predict accumulation of a winter rye cover crop, both of which incorporate temperature, rainfall and soil information. The benefits and limitations of both approaches will be discussed as well as how such tools might be utilized to help growers make decisions on planting dates to achieve desired biomass accumulation and subsequent environmental impacts.

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

**denotes primary author and subject area*

Probabilistic Assessment of Agricultural Droughts using Graphical Models

Author(s): Meenu Ramadas*, Purdue University; Indrajeet Chaubey, ; Dev Niyogi, Purdue University; Xiaohui Song, Purdue University; Rao S Govindaraju, Purdue University

Abstract: Since water needs vary with crops, agricultural drought incidences in a region can be assessed better if crop responses to soil water deficits are also accounted for in an agricultural drought index. This study investigates agricultural droughts driven by plant stress due to soil moisture deficits using crop stress functions available in the literature. Crop water stress is assumed to begin at the soil moisture level corresponding to incipient stomatal closure, and reaches its maximum at the crop's wilting point. A new probabilistic agricultural drought index is then developed within a hidden Markov model (HMM) framework that provides model uncertainty in drought classification and accounts for time dependence between drought states. The capabilities of the HMM model for use in crop studies are examined using high resolution soil moisture data at 4 km grid spacing and daily time scale, derived from land surface models and NASA Land Information System (LIS). The proposed index allows probabilistic classification of the drought states and takes due cognizance of the stress experienced by the crop due to soil moisture deficit. Results from the HMM model are compared to those of popular drought indices such as standardized precipitation evapotranspiration index (SPEI) and Palmer drought severity index (PDSI). The HMM model identified critical drought events, and several drought occurrences that were not detected by either SPEI or PDSI, and shows promise as a tool for agricultural drought studies. Model results are found to be site-specific, suggesting the need for advanced regionalization studies for regional agricultural drought outlook. The method developed in this study can thus be used to evaluate droughts and to develop drought mitigation strategies.

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

**denotes primary author and subject area*

Quantification of ephemeral gully erosion with close range digital photogrammetry

Author(s): Karl Gesch*, Iowa State University; Robert Wells, ; Henrique Momm, ; Seth Dabney, Agronomist; Richard Cruse,

Abstract: Soil erosion in agricultural landscapes poses a substantial challenge to conservationists. Soil erosion estimation models are useful tools for conservation planning; however, commonly used models such as the Revised Universal Soil Loss Equation 2 (RUSLE2) or the Water Erosion Prediction Project (WEPP) Hillslope Model cannot predict soil erosion due to topographically concentrated runoff – ephemeral gully (EG) erosion. While the physical processes of concentrated flow erosion that occur in EG channels are similar to those of rill erosion, EG erosion differs because EG channels are larger and locations are non-random. There is a critical need to improve the capability of models by incorporating EG erosion. High-precision data of physical EG development is necessary in order to calibrate new or improved models. This research seeks to augment current scientific knowledge of EG erosion processes through the generation of time-sequenced high-precision digital elevation models (DEMs) of EGs using a novel systematic and practical methodology based on geo-referenced close range digital photogrammetry (CRDP) technology. Photograph pairs collected throughout the year are used to generate detailed sequences of channel DEMs at 5 mm resolution and cross-sections of EGs. DEM post-processing determines volume difference between two time steps and EG cross-section profiles. Measured changes in surface topography will be analyzed with reference to observed rainfall and runoff. Preliminary results indicate that CRDP is an effective method for estimating EG morphology and changes in EG volume over time. Coupling CRDP and DEM analyses with observed rainfall data provides precise three-dimensional data of the time-evolution of EGs. This type of data will be highly beneficial to existing erosion models such as RUSLE2 or WEPP or for the development of new models that explicitly account for EG erosion. Improved data will enhance models and allow for more effective conservation planning.

Subject Area: Conservation Models, Tools, and Technologies*

**denotes primary author and subject area*

Quantifying the effects of tillage practices on annual runoff and phosphorus export through drainage tiles and surface runoff in southern Ontario, Canada

Author(s): Merrin Macrae*, University of Waterloo; Richard Brunke, Ontario Ministry of Food; Michael English, Wilfrid Laurier University; Gabrielle Ferguson, Ontario Ministry of Agriculture and Food; Vito Lam, University of Waterloo; Kevin McKague, Ontario Ministry

Abstract: The objectives of this research are to provide estimates of annual runoff and dissolved and particulate phosphorus (P) export rates in drainage tiles and overland flow from six sites in southern Ontario, Canada, in the Great Lakes Watershed. Sub-objectives of these studies include determining the effects of tillage practices on P export and the relative contributions of surface runoff and tile drainage to field scale biogeochemical losses. Results demonstrate that hydrologic events trigger a rapid increase in P concentrations in drainage tile effluent, although this does not occur for very small events. Annual losses are dominated by winter thaws/spring snowmelt period, although autumn storms are also significant. The effects of tillage practices are small and inconsistent across sites, but our data suggests that P losses from no-till plots are not greater than losses from conventionally tilled plots at our sites. Although we observed P losses in tile drain effluent at our sites, these losses were very small in comparison to P losses in overland flow. These findings are important as they shed light on the overall role of drainage tiles in P losses in a snowmelt-dominated climate, and, how P losses in tile drains may or may not be affected by no-till as a Best Management Practice.

Subject Area: Lake Erie Case Studies: The Challenge of Maintaining Improvements

**denotes primary author and subject area*

Rain, runoff and sediment loss in normal and abnormal weather years in an agricultural landscape in southeastern U.S.: A 10-yr dataset.

Author(s): Dinku Endale*, USDA-ARS; David Bosch, USDA-ARS; Thomas Potter, USDA-ARS; Timothy Strickland, USDA-ARS

Abstract: Erosion and sediment pollution of surface waters are long-term natural resources concerns in the southeastern U.S.A. Climate change is adding to risks in the region related to extreme weather. We evaluated rainfall, runoff and sediment loss from 2000 through 2009 from an agricultural landscape in the Southern Coastal Plain region of Georgia. The site consisted of six 0.2-ha fields with half in conventional tillage and the other half in strip-tillage. The fields were in rotational cotton (Gossypium hirsutum L.)-peanut (Arachis hypogea L.) production with cover crop of rye (Secale cearale). Approximately 69% of the period had no daily rainfall; 4.0% had from 20 to ≤ 50 mm and produced ~38% of the total runoff (mm) and ~40% of the total sediment loss (kg ha-1); and 1.0% had > 50 mm and produced ~41% of the total runoff and ~40% of the total sediment loss. Five hurricane-related tropical storms or depressions and several stalled frontal boundaries contributed to daily rainfall > 50 mm. Approximately 54%, 14% and 32% of months had below normal, normal, and above normal rainfall, respectively. The conventional tillage fields lost an average of 1,823 kg ha-1 yr-1 sediment compared with 237 kg ha-1 yr-1 from the strip tillage fields. Annual average sediment loss exceeded the T value of 2,200 kg ha-1 yr-1 in 3 out 10 yrs and almost matched in one in the conventional tillage fields, but was much less than the T value in strip tillage fields each year. A small number of individual storms of high magnitude contributed disproportionately to greater runoff and sediment loss in both conventional and strip tillage, especially when favored by high antecedent soil water content and low cover conditions. Such long-term research and data help agricultural stakeholders make wise management decisions that can sustain the integrity of natural resources under the expected changes in climate.

Subject Area: Increasing Intensity: Rethinking Precipitation Averages and Outliers in Conservation Design and Planning(Symposia Only)

**denotes primary author and subject area*

Reaching Out to Historically Underserved Customers

Author(s): Bill Berry*, NACD; Rich Duesterhaus, NACD

Abstract: Reaching Out to Historically Underserved Customers America's conservation districts and their partners, including the Natural Resources Conservation Service, are using new tools and techniques to reach out to historically underserved customers. This presentation will focus on examples of conservation partners providing services to customers in a variety of rural and urban settings. In many cases, the effort to serve these customers begins with effective outreach and education. That means understanding how, where and when customers consume information before their needs can be understood and addressed. The results are impressive as these efforts are undertaken. Learn how they helped grow hoop houses for urban agriculture in Cleveland, met the needs of Russian women agricultural producers in North Dakota and led to more conservation practices adopted by Plain Sect members in Pennsylvania.

Subject Area: Outreach, Education, and Community Engagement*; Conservation in Urban Settings; Conservation Policy and Program Design

**denotes primary author and subject area*

Real Impacts of Cover Crop Cocktails - How Seeding Concepts affect the Final Stand

Author(s): Scott Wohltman*, LaCrosse Seed

Abstract: This program will hit on seeding cover crop mixes. The details will hit on how individual species perform in a blend. Also noted will be how the individual specie grow and establish in relation to others, taking into account differences in seeding depth, need for sunlight, ability to compete against other species, and agricultural herbicide affects. The presentation will briefly go into some detail on why different scenarios call for chsnges in mixes, and why matching the goal of the landowner is the real driver in the conversation when putting a cover crop cocktail together. Part of the presentation will include current methods of seeding and blending, as well as highlight current testing being performed at a few universities across the Midwest (U of Wisconsin, Western IL University to name a couple) that show stand establishment issues and differences when putting different cover crop species together.

Subject Area: Cover Crop Practices: Application, Innovation, and Management

**denotes primary author and subject area*

Reducing Climate Change and Water Quality Impacts from Grain Production on Maryland's Eastern Shore

Author(s): Jon Winsten*, Winrock International; Tom Fisher, University of Maryland; Rebecca Fox, University of Maryland; Anne Gustafson, University of Maryland; James Lewis, University of Maryland

Abstract: Climate change and water quality are two of the most important environmental issues of our time. Agriculture plays an important role in both of these issues, which require effective action in an efficient manner so as not to burden economic progress. Nitrous oxide (N2O) is a very powerful greenhouse gas (GHG), having approximately 310 times the radiative forcing of carbon dioxide (CO2). Although N2O is only 7% of total GHG emissions from the U.S., agriculture produces approximately 73% of N2O emissions. Likewise, agriculture remains the leading contributor of nonpoint source (NPS) pollution to ground and surface waters in the U.S. Field research is being conducted on a commercial cash grain farm producing corn, soybeans, and wheat in the Choptank River watershed on Maryland's Eastern Shore. The Choptank is a disproportionately large contributor of nutrients into the Chesapeake Bay. Simultaneous split field treatments have focused on the effectiveness of winter cover crops and nitrogen (N) rate reduction. N2O flux from the soil to the atmosphere has been measured using static chambers and nitrate in ground water has been measured as it exits tile drainage under treatment and control portions of each field. These data are being used to calibrate and validate the DNDC and COMET-Farm models for the area. Either of these models could be used to quantify emission reductions and allow farmers to participate in carbon offset and/or water quality trading markets. This research to date has shown that the use of cover crops reduced N2O fluxes by 36% and nitrate concentrations in near-surface groundwater drained by tile lines by 50%. A 20% reduction in the recommended N application rate resulted in a 50% reduction in both N2O flux and nitrate concentrations. This presentation will discuss the full costs and benefits to the farm of participation in the carbon offset and water quality markets.

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

**denotes primary author and subject area*

Reducing nutrients, fecal coliform, and sediment concentrations in the Lower Mississippi River Sub-Basin

Author(s): Durga Poudel*, Univ. of Louisiana at Laf

Abstract: To reduce nutrients, fecal coliform, and sediment concentrations in waterbodies, the Lower Mississippi River Sub-Basin Committee on Gulf Hypoxia decided to have focused watershed projects in Arkansas, Louisiana, Mississippi, Missouri, and Tennessee in 2003. Accordingly, the Vermilion Soil and Water Conservation District (VSWCD) in southwestern Louisiana led an initiative for building cooperative partnership with landowners, homeowners, and other stakeholders in designing and implementing the Coulee Baton Microwatershed project. A plan for voluntary application of various conservation measures and Best Management Practices (BMPs) by landowners and homeowners was developed. Seven sites were identified for monitoring water quality in the microwatershed. Field installation for monitoring included the installation of 6712 ISCO samplers, 4230 ISCO Bubble Flow Meters, 674 ISCO Rain Gauges with tipping bucket, solar panel, and battery. Water samples were collected for 66 rain events from September 24, 2009 to August 9, 2011. Laboratory determinations of water samples included TSS, BOD5, NO3-N, NO2-N, SRP, TP, TKN, Cl, Fl, SO4, and fecal coliform. Field measurements using YSI Sonde included temperature, DO, turbidity, conductivity, and pH. Dissolved oxygen level ranged between 1.2 mg/L to 14.1 mg/L, BOD5 level ranged between 2 mg/L to 40.1 mg/L, TS concentration ranged between 35 mg/L to 5,719 mg/L , and TDS concentration ranged between 56 mg/L to 4,356 mg/L. Turbidity values for the Coulee Baton microwatershed ranged between 4.23 NTU to 1,864.1 NTU. Fecal coliform count ranged between 400 MPN/100 mL to as high as 17 million MPN/100 mL. However, fecal coliform counts were reduced dramatically following the implementation of septic system installation project by Acadiana RC&D in collaboration with the VSWCD in the microwatershed. Similarly, implementation of BMPs has resulted in the reduction of sediments and nutrient pollution in the microwatershed.

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

**denotes primary author and subject area*

Re-establishing buffer areas around military bases offers opportunity for ecosystem restoration

Author(s): Bernadette Luncsford*, Virginia Tech

Abstract: Reconstructing wildland around a military installation creates an area where the ecosystem can be restored and provides habitat, while offering protection to base operations. Military bases were originally established away from population centers. Residential and urban sprawl from growing cities has now reached many military installations and developed the land surrounding them. This reduces the distance and vegetation that has provided an effective buffer between civilians and military bases. The encroachment up to base property causes several impacts that hinder operations such as reduced training hours, and introduces civilian threats such as residents in crash zones. This paper proposes creating more vegetated buffers around military installations and utilizing that same land for ecosystem restoration. This can be accomplished with incentive programs that enroll land and convert it to compatible uses such as: agricultural, recreational, or protected land. An example is Eglin Air Force Base in Northwest Florida which hosts a thriving Longleaf Savannah restoration. Two populations of threatened and endangered species: the Red-cockaded woodpecker and the Okaloosa darter are increasing population there while installation operations are buffered from encroachment threats. This success is a result of the partnership that was formed between military and civilian stakeholders in the area. This approach has resulted in a massive amount of land being purchased,protected and managed in one of the most ecologically diverse and sensitive areas in the Southeastern United States. This partnership serves as a model for military installations around the world. Their approach has application in military readiness, and in wildland protection, restoration and rehabilitation projects where significant resources are needed to purchase land and many stakeholders are available to engage in organization.

Subject Area: Conservation in Urban Settings*; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

Residue Management Practices and Planter Attachments for Corn Production in Soil Conservation Agricultural Systems

Author(s): Mohammad Raoufat*, Shiraz University; Jalil Nejadi, Shiraz university, Iran

Abstract: Seed placement and failure to establish a uniform plant stand are critical problems associated with production of Maize (Zea mays) following wheat (Triticum aestivum) in soil conservation farming systems. Our objectives were to evaluate the performance of a corn row-crop planter equipped with two planter attachments (smooth and toothed coulters) at six previous wheat residue management schemes (two levels of surface residue and three tillage schemes) at two forward speeds. The study site had loam texture covered with previous wheat residue. The average soil moisture content was 13% (d. b.). A split-split-plot field experiment arranged as a randomized complete block design with three replications was used and amount of residues retained after planting, seeding depth, emergence rate index (ERI) and seed spacing indices were determined. The reduced residue plots tilled by chisel plow followed by disk harrow (BRCD) resulted in minimum residue after planting as compared to other residue treatments. Furthermore, the maximum values of the ERI and uniformity of plant spacing pertained to this treatment. Other results showed that ERI increased up to 18% for the toothed coulter as compared to the smooth coulter. The toothed coulter also established a deeper seed placement as compared to the smooth one. Planting at forward speed of 5 km h-1 resulted in deeper seeding depth as compared to speed of 7 km h-1. However lower values of miss and precision indices were obtained at forward speed of 7 km h-1, indicating a more uniform plant spacing. This study indicated that the conventional planter equipped with toothed coulter and planting in soil prepared under the BRCD residue management system can resulted in a satisfactory soil and energy conservation. Keywords: Soil conservation, Residue management, Conservation farming

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

**denotes primary author and subject area*

Resource Conservation, Land Use Legacies, and Management Perspectives in Great Plains Agroecosystems

Author(s): Benjamin Turner*, South Dakota State University; Roger Gates, South Dakota State University

Abstract: Worldwide crop demand continues to grow and Great Plains agricultural producers face increased pressure to convert conserved (e.g. CRP) or unplowed grasslands to crop production. As more acres are cultivated, risks of soil degradation escalate, particularly on marginal soils (e.g., LCC limitations, highly sloping, rocky, etc.). To ascertain how new acres might be cultivated more sustainably, four working lands managers were interviewed to elicit personal views of farm management, resource conservation, and expanding cultivated acreage. Farm and grassland sites on each operation were identified with varying current land uses and management whose land use histories were reconstructed (one to over 100 years). Ecosystem assessments were then conducted using the interagency method Interpreting Indicators of Rangeland Health, as well as estimates for soil organic matter. Field aggregate stability was greater for grasslands, farmlands more recently converted, and farmlands that were not grazed compared with farmlands that were grazed. Soil water content declined with decreasing duration of current use (grass or farm). Soil organic matter increased with longer duration of use (grass or farm). Departures from ecosystem reference standards were greater for farming sites with grazing, however these were marginally different than those farming sites without grazing (-0.19 rating change). Number of land use changes influenced legacy effect impacts on ecosystem functions differently. Increasing land use changes negatively affected grassland sites (-0.09 change), but positively affected farmland sites (+0.30 change), indicating that long-term legacies continue to exert themselves depending on management histories. Extensions of this exploratory study include using these cases as educational tools for those considering cultivation and new empirical work related to the net ecological economic benefits of grazing cultivated fields.

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

**denotes primary author and subject area*

Roller/crimper designs for cover crops management on different farm scales using conservation practices

Author(s): Ted Kornecki*, USDA-ARS, NSDL

Abstract: In conservation systems, cash crop planting is associated with placing seeds into soil with desiccated cover crop residue on the soil surface. Thus, proper management of cover crops is essential for successful no-till planting of cash crops. In the Southern US, cereal rye (Secale cereale L.) is a widely used cover crop. This tall cover crop can lodge in different directions creating problems with cash crop establishment due to residue interfering with planting units. One method used to manage cover crops is rolling technology. The idea is to flatten plants without cutting stems. Rolling of cover crops in the same direction as cash crop planting, is typically done 3 weeks before planting the cash crop. This period allows for cover crop desiccation and eliminates nutrient and water competition. Rolling technology was introduced to US producers in the past decade, but because of vibration problems at higher speeds, it has not resulted in wide adoption. Research has been conducted with new rollers which are effective in cover crop termination, with less vibration. Several rollers/crimpers have been developed for different farm scales. A spiral roller/crimper and a roller for elevated beds (to terminate cover crops on row-tops and furrows) were among the new roller designs. A smooth roller with crimping bar and a two stage roller were designed to operate with large and smaller tractors. Crimping force can be adjusted by changing spring tension to obtain the best crimping action. On small farms, field operations may be done one bed at a time, and large rollers cannot be used. A new powered roller/crimper was developed for walk-behind tractors to allow small scale farms to effectively manage cover crops. Generally, new roller designs were very effective generating >90% termination at 2 weeks after rolling, and can be successfully used at various farm sizes. The presentation will provide an overview of roller/crimper technology and its application in conservation systems.

Subject Area: Cover Crop Practices: Application, Innovation, and Management

**denotes primary author and subject area*

Runaway Barges Damage Marseilles Lock and Dam System during 2013 Flood on the Illinois River

Author(s): Kenneth Olson*, NRES, ACES, University of Illi; Lois Morton, Department of Sociology, Iowa State University

Abstract: A string of eight locks and dams on the Illinois Waterway runs southwest from Lake Michigan (Chicago, Illinois USA) to Grafton on the Mississippi River connecting Great Lakes barge and boat traffic to the port of New Orleans. Record spring floodwaters in 2013 and three damaged tainter gates at the Marseilles Dam at river mile marker 247 halted navigation on the Waterway. On April 19, 2013 the currents and winds on the Marseilles pool caused seven barges to break free and crash into the Marseilles Dam. Four barges partially sank in front of the dam restricting the capacity of the eight spillway gates to manage water levels in the pool. Water backed-up and flooded portions of the Illinois River floodplain upstream including residential bottomlands in the city of Marseilles. There was an immediate and substantial federal disaster relief response as homes and businesses were flooded with damages in the millions of dollars. The greatest agricultural impact was the suspension of the shipping of fertilizers and grain. In this paper damages to the dam structure caused by the seven run-away barges and repair efforts are discussed as well as flooding impacts in the City of Marseilles and engineering efforts to maintain the 2.7 m (9 ft) navigation channel on the Illinois Waterway.

Subject Area: Lake Erie Case Studies: The Challenge of Maintaining Improvements

**denotes primary author and subject area*

Sediment source tracking in mid-west agricultural basin 30 years after implementation of conservation resource management

Author(s): Tanja Williamson*, USGS; Victoria Christensen, USGS; William Richardson, USGS; Jeffrey Frey, USGS; Allen Gellis, USGS; Kristen Kieta, USGS; Faith Fitzpatrick, USGS

Abstract: Retirement of agricultural land is a supported conservation program because of expected water quality improvements. In practice, land retirement easements are discontinuous along the channel, with varying widths and ages of retirement, complicating quantification of land retirement effects on the sources of sediment and nutrients in the channel. Channel-bed and suspended sediment was sampled at eight locations, ranging in retired-land distributions and ages, to identify and quantify sediment sources for tributaries of West Fork Beaver Creek, MN. Sediment sources – cropland, retired land, streambank, and roads - were identified using a linear discriminant analysis and four-source mixing model. The relative proportion of sediment from the various sources differed significantly between the channel-bed and suspended sediment, indicating that the channel bed integrates sediment over unknown, longer time periods precluding its use as a surrogate for suspended sediment. Retired land contributed to channel-bed sediment but was not discernible as a source of suspended sediment, suggesting that retired land material moved to the channel during relatively dry conditions, including sediment mobilized by freeze-thaw and dry-ravel erosion. At all sites, streambanks were a large contributor to suspended sediment, however, the percentage of streambank sediment in the channel bed was lower in basins with more continuous retired land along the riparian zone. Along agricultural ditches with retired land, there was a lower proportion of suspended sediment from cropland relative to the control site that had almost no riparian land in retirement. Cropland sediments had the highest phosphorous concentrations; channels with the highest proportion of sediment from cropland also had the highest phosphorus sediment concentrations.

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

**denotes primary author and subject area*

Simulated Effects of a Cover Crop on the Yield of a Following Crop using Process-Based Modeling

Author(s): Joel Poore*, USDA-NRCS

Abstract: The addition of cover crops into non-irrigated crop rotations is a potential method to reduce erosion, improve long term soil quality and realize other conservation benefits. The conservation benefits of cover crops in rotations will only be realized and widely adopted when the effect of cover crops and timing of termination on the yield of following crops is understood and predictable. A study was designed using the Wind Erosion Prediction System WEPS to simulate crop growth and yields for a Spring Wheat – Triticale Cover Crop – Field Corn rotation with termination timings of 35, 20 and 5 days prior to planting the following crop corn. The growth and yield for the 3 cover crop management treatments and 1 check management treatment (Spring Wheat – Field Corn) without a cover crop was evaluated for 10 locations, 7 soils and 2 residue/tillage management systems. Crop yields and soil profile hydrology information was gathered from each simulation and the results for the cover crop treatments were evaluated as a fraction of the corresponding results for the check treatments. The relationships between yield of the corn crop following a cover crop and cover crop timing, biomass yield, climate, soils and residue tillage management were studied. The simulated effects of cover crop treatments on soil profile hydrology variables such as runoff, evaporation, drainage and transpiration were evaluated as a fraction of the corresponding check treatment results. A multiple regression equation was developed and used to estimate yield of a following crop based on climate, soil, cover crop biomass and termination timing variables from the simulated yield results of the study.

Subject Area: Cover Crop Practices: Application, Innovation, and Management

**denotes primary author and subject area*

SMALL FARMS COLLABORATIVE CONSERVATION PLANNNING and PRACTICE IMPLEMENTATION INITIATIVE

Author(s): Thomas Esgate*, Kunia Loa Ridge Farmlands

Abstract: Kunia Loa Ridge Farmlands (Coop) is a Hawaii nonprofit corporation. It was established to create a common interest in the 854.23 acre Kunia Loa Ridge agricultural subdivision, made up of over 200 small farm plots ranging from 1 to 35 acres. The Coop members are primarily native Hawaiian and Pacific Islanders who are intent on operating sustainable farms that will produce a variety of agricultural commodities. The farmer/producer members of the Coop are active in a variety of agricultural activities including, multi-cropping of fruit trees and vegetables, aquaculture, and animal husbandry. Implementing conservation practices over a broad and diverse landscape containing 99 individual small farm plots, and over 200 operators, presents unique challenges for conservation planning and practice implementation. Many practices need to be implemented across multiple ownerships in order to be effective. The Coop is addressing these challenges through practices set forth in site specific conservation plans that are tied to an overall landscape scale plan. The project is being funded by a Natural Resources Conservation Service, Conservation Innovative Grant (CIG). A landscape scale conservation plan has been developed to target overall resource protection. Workshops and field trips are conducted for Coop members several times a year to deliver information about practices that conserve and enhance soil and water resources. The Coop Conservation Planner/Project Director meets with individual farmers and small groups to develop site specific plans that identify conservation practices for implementation. The CIG also includes funding to assist with practice implementation. The project demonstrates collaboration and the reduction in planning workload through streamlined individual conservation plans that are tied to the landscape scale plan.

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

**denotes primary author and subject area*

Small-Scale AD Systems for Commercial, Farm Applications

Author(s): Christopher Salam*, RCM Digesters; Mark Moser, RCM Digesters

Abstract: Foodwaste and Farm Anaerobic digestion: 2 case studies: CASE 1: When RCM designed the digester system for Reinford Dairy, the farm had fewer than 500 cows. They had plans for expansion and requested a complete mix system design sized for up to 1000+ herd count, parlor water, sprinkler water and 30% extra volume for food waste. The digester system has been so successful and profitable that the farm never went forward with a herd expansion, using the extra digester capacity to accommodate food wastes. And added benefit, the odorless digester effluent has allowed the farm to implement no-till land practices on their acreages. The farm currently receives an average of 16 tons/day of landfill diverted organics. At times they have received as much as 32/tons per day. Steve Reinford has stated to RCM that he can run his system at maximum capacity; start to finish, including engine operation and maintenance with 1-2 full time employees. CASE 2: The digester System at Brubaker Dairy was designed to accommodate wastes from 1,000 cows and excess capacity for landfill diverted organics. Among other organics, the farm is accepting pulped cafeteria waste from the near-by Elizabethtown College. Both pre-consumer and post-consumer organic food waste from the College dining halls is piped into a pulping system in the building where food waste is broken down and where water is separated from the waste. Up to 1,200 pounds of pulped organic waste and is transported to Brubaker Farms twice a week where it added to a cow manure digester. Since the new pulper system has been installed the school has cut overall water consumption in its dining facilities by 80 percent and cut annual waste hauling charges in half to $15,000. RCM has several small scale farm co-digestion projects. The presentation may include 2-3 case studies including the projects mentioned above or other similar projects.

Subject Area: Conservation in Nontraditional Agriculture*; Agricultural and Conservation Economics

**denotes primary author and subject area*

Soil Thermal Properties under Prairies, Conservation Buffers and Corn/Soybean Management Systems

Author(s): Pradip Adhikari*, University of Missouri; Ranjith Udawatta, University of Missouri; Stephen Anderson, University of Missouri

Abstract: Land management practices with prairies and conservation buffers are becoming popular to improve soil physical properties, erosion control and biodiversity. Very little is known how these practices influence soil thermal properties, which are very important to quantify the coupled flow of vapor and liquid in the vadose zone that has a direct impact on climate change. This study compared and quantified thermal conductivity (λ), thermal diffusivity (D), thermal resistivity (ρ), and volumetric specific heat capacity (C) of Prairies (Tucker Prairie, TP; Prairie Fork, PF), conservation buffers (grass buffers, GB; agroforestry buffers, AG), and corn /soybean (COS) management practices. Core and bulk soil samples were collected from each management practice at 10 cm depth increments in 2013. Soil water characteristic curves and soil thermal properties were determined at 0, -33, -100, and -300 kPa pressures. In addition, soil organic carbon (SOC) and bulk density (BD) were also determined. Analysis of variance (ANOVA), General Linear Model (GLM) and Pearson's correlation were used to compare treatments and correlations analysis. The result showed that SOC was negatively correlated with λ and D and positively with ρ and C. Significantly higher values of SOC and lower BD were observed for AG, TP, GB and PF compared to the COS. Similarly, the λ and D were significantly higher and ρ and C were lower under COS compared to conservation practices. The results suggested that a higher amount of SOC decreases the thermal conductance due to the insulating characteristics of SOC and acts as a barrier to heat transport. Therefore, AGF, TP, GB and PF had lower thermal conductance at deeper soil depths which helps to conserve more moisture as well as assist in increasing the longevity of SOC in the soil matrix. Results imply that buffers and perennial vegetation can help reduce heat flow by increasing the thermal capacity and thereby mitigating climate change.

Subject Area: Biodiversity Conservation and Management*; Adaptive Management of Conservation Efforts; Conservation Models, Tools, and Technologies; Water Resource Assessment and Management

**denotes primary author and subject area*

Strategic watershed-scale outreach and the effectiveness on awareness and implementation of conservation practices by producers in the Mackinaw River watershed, Illinois

Author(s): Krista Kirkham*, The Nature Conservancy; Ashley Maybanks, The Nature Conservancy; Kent Bohnhoff, Natural Resources Conservation Service; Jackie Kraft, McLean County Soil and Water Conservation District; Rick Twait, City of Bloomington; Maria Lemke, The Na

Abstract: In order to achieve long-term conservation goals in agricultural watersheds, it is important to understand producers' perspectives on what practices are effective, practical, and economically attainable. We conducted a series of surveys with farmers in two agricultural subwatersheds of the Mackinaw River in central Illinois to better understand how outreach influenced their views on and adoption of conservation practices. In a separate paired watershed study, we evaluated if focused outreach could increase implementation of conservation practices. Results from both studies showed that directed outreach efforts, such as one-on-one landowner visits, localized workshops, and tours can increase adoption of conservation practices. Results also highlighted the need for outreach that increases awareness and implementation of conservation practices specific to reducing agricultural runoff from tile-drained sources. We have coordinated an integrated outreach team comprised of stakeholders and local conservation agencies to combine targeted and broad-scale outreach to landowners for nutrient management, cover crops, and constructed wetlands. Landowner interest is color-coded to facilitate the development of a "green light map" that will ultimately be used to quantify the number of wetlands that could potentially be constructed in the watershed. Outreach efforts are documented to include the number of producer contacts, time spent conducting outreach, outreach materials and tours, producer responses, and specific concerns and needs of producers. These records will be used to evaluate and further refine methods into an effective outreach program that can be transferable to other agricultural watersheds. Outreach information will be combined with efficiency data from these conservation practices to determine the potential for nutrient reduction and the economic cost-benefit from using a watershed conservation approach to treat nonpoint source runoff.

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

**denotes primary author and subject area*

SWCS and CPESC: An Evolving and Productive Partnership

Author(s): Earl Norton*, Norton & Associates

Abstract: The Certified Professional in Erosion and Sediment Control CPESC) certification began in 1982 under the umbrella of the SWCS. The program was incorporated in 2001 as CPESC, Inc. and is supported by a volunteer Council of regional and area representatives and a paid staff. CPESC is now an international certification recognized by many governments that have passed laws, ordinances and regulations to minimize the misuse of land and water resources. There are over 4,500 CPESCs world-wide with approximately 3,500 CPESCs in the United States. CPESCs work with engineers, architects and other design professions and contractors and compliment the team approach to developing sound resource management plans. Although it is obvious to leaders of both SWCS and the CPESC program that each organization can support the other and gain mutual benefits, only the SWCS international organization and a few SWCS chapters have developed activities to gain the potential benefits. An overview of the CPESC program and its organization will explain how the CPESC program and SWCS Chapters can become partners and examples will be provided of how a SWCS chapter uses the connection for both small and large/major activities. The presentation will describe how SWCS chapters benefit as non-member participants in CPESC activities sponsored by Chapters become familiar with SWCS and consider attending future SWCS events and becoming SWCS members. CPESCs benefit by finding exams and continuing education in more locations. And the environment benefits: more individuals become CPESCS; current CPESCs attain their continuing education; and, ultimately, more CPESCs provide technology in the management of landscapes.

Subject Area: Outreach, Education, and Community Engagement*; Conservation in Urban Settings

**denotes primary author and subject area*

Targeting conservation practices within a watershed - Lessons learned from the Pleasant Valley project

Author(s): Steve Richter*, The Nature Conservancy; Laura Good, University of Wisconsin, Soil Science

Abstract: Pleasant Valley, a 5000 ha watershed in the Driftless Region of Wisconsin, is the site of a project to monitor the effects of targeted conservation efforts on sediment and phosphorus loads in the stream. The Wisconsin Phosphorus Index (WPI) was used as an assessment tool to target efforts to improve water quality. For the baseline period of 2006-2009, we found that changing management on fields and pastures so that they met the state P Index standard would reduce the estimated phosphorus runoff loads from farm land by 24%. Barnyards and stream banks likely to be contributing phosphorus to waterways were also addressed. Practices were implemented from 2010-2013 on targeted farm fields, pastures, barnyards and stream banks. To date, the project has involved 23 farms and 5 miles of stream. The WPI, along with the RUSLE2 soil loss calculator, was used to track expected field level reductions in runoff phosphorus and sediment over the implement period. Averaged over 2010 to 2013, management changes by farmers reduced estimated P delivery by 45% and estimated average erosion by 49% on 1522 acres. These reductions were achieved through reduced tillage, nutrient management, and changes to crop rotations that resulted in more continuous soil cover. During this same 2010-2013 period however, there was conversion from grasslands to row crops resulting in greater erosion. Consequently, estimated watershed-wide reductions averaged just 12% for both RUSLE2 erosion and WPI. To determine if the project has resulted in water quality improvements, Pleasant Valley was paired with a similar agricultural watershed where no specific conservation efforts are underway. The project collected data on stream flow, water quality, stream channel sediment and nutrient delivery and storage to compare differences between the two watersheds. Monitoring results show trends toward reduced event sediment and phosphorus loads, but they are not statistically significant.

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

**denotes primary author and subject area*

Terrace effects on soil erosion processes in a watershed of the Loess Plateau

Author(s): Hui Shao*, University of Guelph; Jianen Gao, ; Claire Baffaut,

Abstract: Terraces in crop fields are one of the most important soil and water conservation measures that affect runoff and erosion processes in a watershed. In this paper, terrace effects on soil erosion and sediment transport in the upstream and middle sections of the Weihe River basin in the Loess Plateau were analyzed using the newly developed terrace algorithm within the SWAT model. Monthly runoff and seasonal sediment yield data between 1960 and 1969 were used to calibrate and validate the model when only a small amount of terraces and reservoirs were installed. The model was then modified to represent terraces based on the survey data. Results indicated that, between 2000 and 2009, terraces in the watershed significantly decreased average annual sediment yields in the upstream and middle sections of the Weihe River by 28 million tons, which is about 10.6% of the sediment transported without terraces. Terraces were also estimated to have decreased sediment transport at the outlet of the watershed by 16.2 million tons per year. The unit area sediment reduction from terrace installation was 3000 t/km2. These effects were important for sediment transport and deposition control, and water quality improvement in the Weihe River basin of the Loess Plateau. Scientists, water resources managers and conservationists will benefit from this algorithm that provides a process-based tool for evaluating and optimizing terrace installation effects at watershed scale.

Subject Area: Adaptive Management of Conservation Efforts*; Conservation Models, Tools, and Technologies; Conservation Policy and Program Design; Water Resource Assessment and Management

**denotes primary author and subject area*

The Conservation Delivery System of the Future

Author(s): Bill Berry*, NACD; Rich Duesterhaus, NACD

Abstract: The Conservation Delivery System of the Future In an era of austerity, conservation practitioners will rely on an array of tools to serve customers. Enhanced user interfaces, desktop information sharing among partners, co-located offices and other tools will be required. Enhanced training for conservation partners will be necessary in order for them to embrace the new delivery system and be positioned to assist customers in the field. Delivery of conservation services will need to be tied more closely to watersheds and landscapes in order to be able to verify that conservation practices and strategies make a difference. This will require the conservation partnership of the future to look beyond jurisdictional boundaries and cooperate across county and state lines. This presentation will review findings of the nationwide 2012 Field Office of the Future exercise conducted by the Natural Resources Conservation Service and National Association of Conservation Districts.

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

**denotes primary author and subject area*

The Conservation Reserve Program Readiness Initiative: Training Impacts and Resources

Author(s): Rebecca Power*, University of WI-Extension; Kevin Erb, University of WI-Extension

Abstract: Since 1985, the Conservation Reserve Program (CRP) has offered landowners an economical and ecologically sound alternative to planting traditional crops in environmentally sensitive areas. In 2012 and 2013, record numbers of contracts and acres were up for re-enrollment, creating a significant potential strain on the conservation workforce. The Natural Resources Conservation Service (NRCS) recognized the need for additional professionals to assist landowners with developing CRP plans and others aspects of the CRP workload. Under guidance from the Conservation Professional Training Program, a national team of Extension staff, NRCS and FSA staff, and representatives from NRCS partner agencies and organizations have collaborated to develop a multi-faceted Conservation Reserve Program Readiness Initiative to help meet CRP needs. This presentation will highlight impacts of the training program and new online trainings available as a result of the project.

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

**denotes primary author and subject area*

The Evaluation of Practice Impacts within the NRCS Ogallala Aquifer Initiative

Author(s): Bernadette Winston*, USDA NRCS; Noel Gollehon, USDA-NRCS

Abstract: The Ogallala Aquifer Initiative (OAI) is a multi-state effort designed to reduce the quantity of water withdrawn from the Ogallala aquifer and to reduce contamination of the water in the aquifer. OAI is an initiative funded through the Environmental Quality Incentives Program administered by NRCS. The OAI objectives are accomplished through implementation of improved cropping systems and conservation practices. These conservation practices are geared towards improved irrigation water management, crop residue and tillage management, nutrient and pesticide management, brush management, proper grazing systems and playa wetland and associated watershed restorations. This presentation will describe the practices implemented through the OAI and compare them to practices implemented through general conservation programs. It will compare the physical effectiveness of OAI and general conservation practices in reducing the quantity of water withdrawn from the aquifer. Information on practice implementation cost, both Federal and estimated total, will be included to determine the cost effectiveness of the practices deployed. The presentation will outline the methods used to determine the reductions in water withdrawn from the Ogallala Aquifer and how effective the improved cropping systems and conservation practices are when meeting the objectives of this initiative. The data collected will be coming from the U.S. Department of Agriculture, Natural Resource Conservation Services ProTracts database which is how the agency tracks and retains data from the field level on conservation programs, initiatives, and practices. ProTracts data will be used to discuss trends in financial assistance/technical assistance to address initiative concerns and the practices implemented. These results will be of interest to anyone who is interested in reducing water withdrawals, especially in Ogallala Aquifer region.

Subject Area: Agricultural and Conservation Economics*

**denotes primary author and subject area*

The Evolution of Agricuture Providing Benifits to Conservation and Agriculture

Author(s): Ray Wright*, UMC Bradford; Tim Reinbott, UMC Bradford; Bob DeWitt, Missouri Department of Conservation

Abstract: The great lesson of the Dust Bowl was that we need to be proactive, rather than reactive. Overuse of tillage, grazing and continuous row cropping has led to degraded soil structure, affecting water infiltration and retention rates. As our climate changes, we need to focus our attention on the health of our soils. Fortunately, agriculture is also changing. No-till and cover crops are being supported through government cost-share programs and incorporated into our agricultural systems. Grazing systems are shifting from cool season to native warm season grasses. These shifts can help provide the basis for soil health that will provide resilience to agriculture production during times of climatic stress. Shifts in agricultural focusing on farming techniques benefiting water, nutrient and soil conservation can provide tremendous opportunities to enhance and increase critical habitats for wildlife ranging from hypoxia reduction to creating pollinator friendly habitats. Polyculture cover cropping provides an herbaceous mixture that adds diversity to the landscape and increases the usable space on working lands for a variety of wildlife species. Conservation agencies are very interested in the effects of cover cropping systems on wildlife habitat. In response we are merging our soil health efforts with those looking at potential wildlife usage of cover cropping systems at selected conservation and agriculture production areas. Information collected will help conservationist make informed decisions on species selection in cover cropping systems. Our information will be used as a tool for making sound conservation management and agricultural cropping decisions. Until recently, land management decisions were generally not mutually beneficial to both entities but with cover crops we will be able to compliment the agricultural communities' goals while enhancing habitat for wildlife, pollinators and promoting soil health and water conservation efforts.

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

**denotes primary author and subject area*

The Illinois Urban Manual: A Technical Reference for Planning and Development

Author(s): Candice Jacobs*, Kane-DuPage SWCD

Abstract: The Illinois Urban Manual is intended for use as a technical reference by developers, planners, engineers, government officials and others involved in land use planning, building site development, and natural resource conservation in rural and urban communities and developing areas. The standards and associated materials describe best management practices (BMPs) for controlling non-point source pollution impacts that affect ecosystems in existing communities and developing areas. The manual includes an array of BMPs in the following broad categories: • soil erosion and sediment control; • stormwater management; and • special area protection. Beyond conventional BMP considerations, the manual addresses fish and wildlife habitat improvement, visual and environmental quality and other relevant ecosystem enhancement applications. Where previous BMP manuals have tended to focus on limited aspects of construction site erosion or stormwater runoff control, this manual is designed for more comprehensive, multi-objective ecosystem protection and enhancement. Initially released in 1995 with significant updates and revisions in 2002, the manual is continuously being revised and updated by a committee made up of federal and state resource agencies, regional planning commissions, local units of government, and the private sector.

Subject Area: Conservation in Urban Settings*; Biodiversity Conservation and Management; Conservation Models, Tools, and Technologies; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

Linking Soil Health to Improved Water Quality Via the Planting of Cover Crops in the Shatto Ditch Watershed, Kosciusko County, IN

Author(s): Sheila Christopher*, University of Notre Dame; Jennifer Tank, University of Notre Dame; Brittany Hanrahan, University of Notre Dame; Ursula Mahl, University of Notre Dame

Abstract: Tile drainage systems are common in the Midwest and facilitate the transfer of excess fertilizer nutrients from agricultural soils to adjacent streams. The planting of winter cover crops offers a potential mechanism to reduce nutrient leaching from fields to tile drains. The objectives of our study were to quantify the effect of cover crops on soil nutrient concentrations and to determine if there are predictable relationships between soil nutrient content and tile drain nutrient leaching. During Summer 2013, we sampled soil and tile drain chemistry from fields in the Shatto Ditch Watershed (SDW). Sampling was partitioned across fields with the following agricultural management: 1) cover crop after corn (CC), 2) no-till corn (NTC), 3) no-till soy (NTS), and 4) tilled corn fields (Till). During Summer, mean tile drain nitrate (NO3-) concentrations were significantly lower from CC fields (15+/-4 mg NO3-N L-1) than from fields without CC (19+/-2 mg NO3-N L-1. Mean soluble reactive phosphorus (SRP) concentrations were also lower from CC fields (44.0+/-17.4 µgP L-1) compared to fields without CC (76.0+/-42.4 µgP L-1). In contrast, soil NO3- was significantly higher in CC fields (29+/-3 mg NO3-N L-1) versus non-CC treatments (9+/-3, 4+/-3, 5+/-3 mg NO3-N L-1), for NTC, NTS, and Till, respectively). Finally, CC fields had significantly higher water extractable P (17.2+/-0.8 µgP L-1) than Till fields (10.3+/-0.8 µg P L-1). We found an inverse relationship between soil and tile drain NO3- ($r^2=0.51$, $p = 0.05$) suggesting that increased soil NO3- retention prevents leaching to tile drains, but there were no significant relationships between soil P and leaching of tile drain P. Given these results, seasonal, year-round study of soil and tile drain chemistry is warranted to determine soil and water quality benefits of cover crops.

Subject Area: Cover Crop Practices: Application, Innovation, and Management

**denotes primary author and subject area*

The role of the P Index in conservation targeting and nutrient management planning: Lessons learned from the Pleasant Valley project

Author(s): Laura Good*, University of Wisconsin, Soil Science; Kim Meyer, NPM Program, Univ of Wi-Extension

Abstract: Pleasant Valley, a 5000 ha watershed in the Driftless Region of Southern Wisconsin, is the site of an on-going project to monitor the effects of targeted conservation efforts on sediment and phosphorus loads in the stream. In order to identify fields with the highest potential to deliver phosphorus to surface water, project partners conducted an inventory of cropland and pasture management within the watershed to get the information needed to run the Wisconsin Phosphorus Index (WPI). The WPI was calculated with SnapPlus nutrient management planning software. The project also used this software to identify appropriate alternative managements that would meet reduction goals and be acceptable to farmers. As a result, no-till and other erosion reduction measures were contracted on most of the farms with targeted fields. Under the project, farmers could contract for nutrient management plans (NMPs). Most of the NMPs were compiled by the farmer's crop consultant, and all of the NMPs were created in the same SnapPlus software as was used for the WPI inventory. Initially, project partners did not make an effort to provide information about the project to the consultants. Consequently, although the NMPs included WPI results, the consultants did not identify potential P runoff problems or reduction strategies for farmers. A subsequent effort to include the consultants in the project had mixed success. After three years of project implementation, the 22 watershed farmers with NMP contracts were surveyed to determine their level of participation and their opinions on nutrient management planning. Most (93%) of the responding participants with a completed NMP said they made some management change on their farm because of the plans, with changes ranging from systemic to minor. The survey showed that the more the farmer understood about NMP concepts in general, and understood why certain changes were proposed on their farm, the more apt they were to make a change.

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

**denotes primary author and subject area*

Thirty Years of Conservation in the Lake Champlain Basin: What Have We Learned

Author(s): Fletcher Potter III*, USDA-NRCS

Abstract: Lake Champlain is a 120 mile long freshwater Lake bordered by Vermont, New York and Quebec. It has been described as the "Jewel of the Northeast" and is vital to the economy and recreation in the region. For 3 decades NRCS and state and federal partners have implemented various conservation management strategies to address the excessive phosphorus loading to the Lake. Improvements in water quality have been limited during this time. A summary of past conservation efforts will be provided including trends in water quality during this time. In recent years a more concerted and targeted approach to conservation has evolved in response to this continuing need. These efforts include monitoring at smaller spatial scales and targeting conservation practices to critical source areas. A new flow weighted water quality data analysis suggests that we are beginning to make progress in improving water quality in some watersheds. Current and proposed conservation management strategies will be discussed as well as counterpoising stress factors such as climate change.

Subject Area: Adaptive Management of Conservation Efforts*; Conservation Policy and Program Design; Water Resource Assessment and Management

**denotes primary author and subject area*

Trading and Offset Programs in the Chesapeake Bay Watershed

Author(s): Olivia Devereux*, Devereux Environmental Consult

Abstract: In 2010, the U.S. Environmental Protection Agency (EPA) established the Chesapeake Bay Total Maximum Daily Load (Bay TMDL) setting the maximum amount of nitrogen, phosphorus and sediment that the Bay can receive while meeting water quality objectives. The Bay TMDL allocates loading caps to sources contributing these pollutants across six states and the District of Columbia. EPA expects that new or increased loadings in the Chesapeake Bay watershed will be offset by load reductions and credits generated by other sources. Beyond permitting and nonpoint source controls, water quality trading is one approach that Bay jurisdictions may use to achieve load reductions. Trading can provide greater efficiency in achieving water quality goals in watersheds by allowing one source to meet its regulatory obligations by using pollutant reductions created by another source with lower pollution control costs. Despite significant activity among policymakers, to date very few water quality trades have occurred or are planned within the Bay watershed. This presentation will address the barriers affecting the incentives for nonpoint sources, such as agriculture, to enter into such trades, explore feasible options for overcoming these barriers, and assess the likelihood that water quality trades can become significant sources for pollution load reductions. The potential impact of trading on conservation practice implementation will be presented along with the programmatic requirements placed on the Bay jurisdictions' new and expanding trading and offset programs. Verification, credit permanence, additionality, local water protection, and other aspects of trading programs will be discussed. Consistency in credit calculation methods is critical for interbasin and interstate trading. A review of the credit calculation methods, including use of NutrientNet and the Nutrient Trading Tool (NTT) will be addressed in this presentation.

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

**denotes primary author and subject area*

Trends in Corn Area versus Riverine Nitrate in Iowa's Raccoon River Watershed

Author(s): Christopher Jones*, Iowa Soybean Association; Peter Kyveryga, Iowa Soybean Association; Anthony Seeman, Iowa Soybean Association; Adam Kiel, Iowa Soybean Association; Keith Schilling, Iowa Department of Natural Resources; Calvin Wolter, Iowa Department of

Abstract: Multiple models have predicted trends in riverine nitrate export in the Mississippi River Basin will increase with the expansion of corn area in the US Corn Belt, this driven by biofuel mandates. Accurately characterizing water quality trends in agricultural watersheds is crucial for downstream users of water resources planning infrastructure needs, informing development of agricultural policy, and quantifying the effectiveness of field and landscape management practices. Our research objectives here were to use tributary and main-stem river nitrate-nitrogen (NO3-N) data to characterize trends in the Raccoon River Watershed and determine if the expansion of corn area that has occurred over the past 15 years has affected water quality. The Raccoon River is an important and bell-weather stream because its water is a source of municipal drinking water supply for over 500,000 Iowans, and nearly 80% of the land within the basin is cultivated in a corn-soybean or continuous corn rotation. We examined NO3-N data from nearly 10,000 grab samples gathered since 1999, and observed fertilizer and crop management data from nearly 500 fields in the Raccoon River Watershed. Our analysis will show that the expansion of corn area did not increase Raccoon River NO3-N levels, and that riverine export of NO3-N tended to decline as corn area has increased over the past 15 years. We conclude that better soybean management in a corn-soybean rotation will reduce NO3-N export from the watershed. Finally, we propose that improving farmers' fertilization practices and, especially, detaining water in this tile-drained system could help achieve water quality objectives.

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

**denotes primary author and subject area*

Trends in Recoverable Manure Nutrients

Author(s): Noel Gollehon*, USDA-NRCS

Abstract: Manure nutrients from confined animal production are a known water quality concern receiving attention from EPA and States. Recoverable nutrients — produced by confined animals — have the potential to be managed in a manner that minimizes their impact on water quality. Non-recoverable manure nutrients — spread by range livestock — have a more limited potential for improved management. This presentation will examine the national trends in manure production from confined animals and changes in the location in confined animals using consistent estimation methods over a 25-year period, from 1982 to 2007. The presentation will outline the methods used to transform farm-level animal numbers to estimates of recoverable manure nutrients and the potential on-farm assimilative capacity to utilize the nutrients produced. Estimates are based on a farm–level analysis of the data collected for the 1982 to 2007 Censuses of Agriculture. Results that will be discussed are the consequences of maintaining about the same number of confined animals while halving of the number of farms with confined animals. The greater concentration of animals is further concentrated spatially, resulting in areas with an imbalance in the quantity of manure nutrients available and the potential demand. This analysis traces this effect over a 25-year period. The estimates will be of interest to anyone working to reduce agricultural nutrient contributions to water pollution, especially water quality modelers.

Subject Area: Water Resource Assessment and Management*; Adaptive Management of Conservation Efforts; Conservation Models, Tools, and Technologies; Conservation Policy and Program Design

**denotes primary author and subject area*

Understanding Nutrient Management Decisions: An Examination of the Agricultural Community in Indiana

Author(s): Linda Prokopy*, Purdue University; Nick Babin, Purdue University; Rebecca Perry-Hill, Purdue University; Aaron Pape, Purdue University

Abstract: Nutrient management across the nation has become an increasingly contentious issue with growing calls for regulation to address issues such as the hypoxic zone in the Gulf of Mexico. A statewide survey of approximately 2500 agricultural landowners and producers in Indiana was conducted in early 2014. This survey collected information about awareness of and use of nutrient management practices among this population, overall water quality attitudes, awareness of different pollutants, trust in different information sources, and basic demographic questions. It also included a number of questions about land tenure and the impact of the landlord-tenant relationship on nutrient management practices. The results of the survey will help illuminate the state of current landlord-tenant relations in Indiana's agricultural sector and reveal how conservation decisions are made on rented land. Survey results will also be used to understand what type of future outreach and education might be successful in increasing the use of nutrient management practices.

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

**denotes primary author and subject area*

Unit Source Area Monitoring with Grade Control Pipe Instrumentation

Author(s): Seth Dabney*, Agronomist; Glenn Wilson, USDA-ARS; J. R. Rigby, USDA-ARS; James Bonta, USDA-ARS

Abstract: The USDA-ARS National Sedimentation Laboratory has monitored rainfall, stream discharge, sediment yield, and water quality in the 21.3 km2 Goodwin Creek Experimental Watershed (GCEW) since 1981. Emphasis has been placed on within stream channel process by employing a network of 26 recording rain gauges, 14 in-channel measurement flumes, channel stabilization structures, suspended walkways across the channel at select sites for additional in-stream measurements, and periodic stream cross section topographic surveys. The watershed is also home to two NRCS Soil Climate Analysis Network (SCAN) stations (pasture, forest), and one NOAA Solar Radiation Budget Network (SRBN) measuring station. The GCEW has been a Conservation Effects Assessment Project (CEAP) ARS benchmark watershed since 2003. In order to examine scale and land use effects on hydrologic and water quality responses, additional monitoring of three small unit source area watersheds was initiated in 2013. Instrument "sleds" were designed and constructed for deployment in culverts or grade-control pipes draining areas of less than 10 ha that had three distinct land uses: cropland, grazed pasture, or plantation pine. Each 3-m instrument sled was equipped with a velocity sensor, a depth sensor, a turbidity sensor, and a pump sampler intake tube. A sluiced baffle plate was mounted downstream of the turbidity sensor to insure sufficient depth for sensor operation and upstream of the low profile depth and velocity sensors. This report will describe the instruments, their calibration, and preliminary results of hydrologic responses of the three source watersheds will be compared with each other and with those of the larger stream system. The influence of subsurface soil pipes on the hydrology of the pasture watershed will be discussed.

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

**denotes primary author and subject area*

Use of Enhanced Ditch Plugs and Riparian Wetlands to Reduce Nitrogen and Phosphorus Export from Small Agricultural Watersheds

Author(s): Neal OReilly*, University of Wis-Milwaukee

Abstract: Stream floodplains and riparian wetlands provide many environmental benefits including flood storage, habitat for fish and wildlife, and water quality treatment. The scientific literature contains many documented reports on the water quality benefits of floodplain buffers and their ability to trap sediment, and nutrients. However, many streams have been channelized to facilitate agriculture or urbanization, reducing the streams connection with it riparian floodplain and wetlands, reducing the abilities to provide the above environmental benefits. To restore the water quality treatment capacity of the floodplain wetlands upstream of Fox Lake in Southern Wisconsin, the Fox Lake Inland Lake Protection and Rehabilitation District and the Wisconsin Department of Natural Resources financed the installation of several specially designed weir structures to improve the natural nutrient trapping capacity of the floodplains of three tributary streams that feed Fox Lake. Monitoring of inflows and outflows illustrated significant reductions in nitrogen and phosphorus loadings. Design criteria, installation methods and results and conclusions regarding nutrient loading reductions will be presented. The project was part of a multi-pronged approach in the use of adaptive management for a small agricultural watershed.

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

**denotes primary author and subject area*

Using agri-environmental indicators to track changes in the risk of nutrient and sediment losses in the Lake Erie basin: I. Grand River Case Study

Author(s): Natalie Feisthauer, Agriculture and Agri-Food Canada; Pamela Joosse*, Agriculture Agri-Food Canada; Keith Reid, Agriculture and Agri-Food Canada

Abstract: Agriculture and Agri-Food Canada has developed several agri-environmental indicator models for national reporting of trends in environmental risk and conditions in agriculture. Components of these national models can be utilized in a modular fashion to inform regional scale issues such as water quality in Lake Erie. The application of the source and transport components from the indicators for phosphorus, nitrogen and soil erosion has been piloted in a study of a Canadian sub-watershed of the Lake Erie basin, the Grand River watershed. By considering the sources and pathways separately for different potential nutrient forms and sediment, appropriate management actions can be inferred. The relative risk of loss of nutrient and soil from agricultural landscapes within the Grand River watershed was estimated for nitrogen, sediment and particulate and soluble phosphorus. The models utilize census information since 1981, allowing a 30-year time series analysis of changes of risk on the landscape. This presentation will present the concepts and results used in the pilot study of the Grand River watershed.

Subject Area: Lake Erie Case Studies: The Challenge of Maintaining Improvements

**denotes primary author and subject area*

Using agri-environmental indicators to track changes in the risk of nutrient and sediment losses in the Lake Erie basin: II. Application from watershed scale to the Lake Erie Basin

Author(s): Pamela Joosse*, Agriculture Agri-Food Canada; Natalie Feisthauer, Agriculture and Agri-Food Canada; Jillian Smith, Agriculture and Agri-Food Canada; Donna Speranzini, Agriculture and Agri-Food Canada

Abstract: Agriculture and Agri-Food Canada has developed several agri-environmental indicator models for national reporting of trends in environmental risk and conditions in agriculture. Components of these national models can be utilized in a modular fashion to inform regional scale issues such as water quality in Lake Erie. The concept of using the source and transport components from the indicators for loss of phosphorus, nitrogen and soil from agricultural landscapes that was piloted in a study of the Grand River watershed (presentation I) is being extended to the Lake Erie basin. The models utilize census information since 1981, allowing a 30 year time series analysis of changes of risk on the landscape and whether or not improvements are being maintained. A farming systems typology has also been developed to better understand the characteristics and distribution of agricultural production systems in the Canadian Lake Erie basin and to facilitate "customization" of recommendations and research by production system. This presentation will present the concepts developed and results for the Lake Erie basin.

Subject Area: Lake Erie Case Studies: The Challenge of Maintaining Improvements

**denotes primary author and subject area*

Using denitrifying bioreactors to treat subsurface drainage discharges

Author(s): Larry Geohring*, Cornell University; William Pluer, Cornell University; M Walter, Cornell University; Tammo Steenhuis, Cornell University

Abstract: Six denitrifying bioreactors have been installed at drain tile outlets on three different farms in New York's High Allegheny Plateau Ecoregion. Two farms are dairy farms and one is a vegetable farm. The bioreactors were installed in pairs at each farm whereby one contains only hardwood woodchips and the other contains a mix of woodchips and BioChar. As part of a CIG grant this presentation will discuss what has been learned to introduce denitrifying bioreactors to farms in this Ecoregion, the headwaters to the Upper Susquehanna River and Chesapeake Bay. Details of the design and construction of the bioreactors will be covered as well as the monitoring and performance results. A unique aspect of this project is that some measurements are also being made of the denitrifying gases to evaluate the completeness of the denitrification reactions within the bioreactors.

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

**denotes primary author and subject area*

Utilization of Biosynthetically Produced Amino Acid Byproducts as Nitrogen for Corn Production

Author(s): Juan Carlos Quezada*, Iowa State University; Andres Lenssen, Iowa State University; Kenneth Moore, Iowa State University

Abstract: Byproducts resulting from the industrial synthesis of amino acids for feed-use might provide a significant and considerable supply of nutrients for crop production specially nitrogen (N). Iowa has a strong amino acid biosynthesis industry, resulting in a continuous supply of biosynthesis byproducts. Byproduct utilization as an N source for crop production may enhance revenues for amino acid producers and Iowa farmers. A field experiment was conducted in 2013 near Ames, IA, to evaluate corn response to tryptophan (TRP) and lysine (LYS) biosynthesis byproducts as N sources. The objectives of this study were to determine corn response to isonitrogenous N fertilization treatments: 1) different levels of dry TRP when replacing NH4-N from ammonium nitrate, 2) combinations of liquid TRP byproduct with different levels of LYS byproduct. Parameters measured included phenological development, chlorophyll readings, leaf area Index (LAI), normalized difference vegetative index (NDVI) which were taken throughout the season on a weekly basis. Grain yield, and yield components were measured at physiological maturity. Grain quality was tested as well. Dry and liquids treatments were applied pre-plant and immediately after planting respectively. Ammonium nitrate and ammonium sulfate were applied with a drop spreader, while both the dry and liquids TRP and LYS byproducts were broadcast spread. All treatments were adjusted to 175 lb. of N ac-1 and arranged in a randomized complete block design with four replicates. First year results of this study indicate that the amino acid and their byproducts can replace ammonium nitrate and ammonium sulfate without compromising growth and development, grain or stover yield of corn. The field experiment is being repeated in 2014 to document efficacy of TRP and LYS biosynthesis byproducts as suitable sources of N for corn production.

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

**denotes primary author and subject area*

Vegetative Barriers: Implications on Soil Properties of a Typic Argiudoll

Author(s): Humberto Blanco*, University of Nebraska; John Gilley, USDA-ARS; Dean Eisenhauer, University of Nebraska

Abstract: Vegetative barriers are narrow (< 5 ft), permanent, and parallel strips of a dense, tall, stiff-stemmed warm-season perennial grass (i.e., switchgrass) established on the contour within croplands to control soil erosion. While the benefits of grass barriers for reducing transport of non-point source pollutants are well recognized, their ancillary benefits on soil processes have received much less attention. Our hypothesis is that switchgrass barriers could improve soil properties within the upper soil profile due to their extensive, deep-root system. We measured soil properties under switchgrass barriers as compared with cropped rows under conventional till and no-till corn-sorghum-soybean-winter wheat rotation on a cropland site after 15 years of management on a Typic Argiudoll (8-12% slope) in eastern Nebraska. Five switchgrass barriers were established at approximately 125 ft intervals within the cropland site parallel to the crop rows. Soil samples were collected from three positions: deposition zone (1.6 ft upslope of the barrier), center of the cropped area (62 ft between two barriers), and near the upper end of the cropped area (4.6 ft below the upslope barrier). Tillage system had no effect, but the presence of a vegetative barrier had significant effects. Compared with the sediment deposition and cropped area, switchgrass barriers increased the proportion of water-stable macroaggregates, soil porosity, and soil organic carbon (SOC) concentration in the 0- to 6-inch depth. Soil aggregation and porosity were positively correlated with changes in SOC concentration, suggesting that switchgrass-induced changes in SOC concentration were partly responsible for the improved soil structural properties. Results suggest that switchgrass barriers can improve soil properties near the surface but not at deeper depths in the soil profile. Data on water infiltration and retention, aggregate associated-SOC, particulate organic matter and pH are also being obtained.

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

**denotes primary author and subject area*

Vegetative Buffer Strips for Reducing Herbicide Transport in Runoff: Effects of Season, Vegetation, and Buffer Width

Author(s): Robert Lerch*, USDA-ARS; Chung-Ho Lin, University of Missouri; Keith Goyne, University of Missouri; Robert Kremer, USDA-ARS; Stephen Anderson, University of Missouri

Abstract: The effectiveness of vegetative buffer strips (VBS) for reducing herbicide transport in runoff may be affected by season, plant species composition, and buffer width. A plot-scale study was conducted from 2007-2012 on an eroded claypan soil with the objectives of: 1) assessing the effects of season (spring, summer, fall), vegetation (fallow control, tall fescue, tall fescue plus switchgrass hedge, and native grasses), and buffer width (-1, 1, 4, and 8 m) on runoff transport of herbicides; 2) developing design criteria for buffer widths; and 3) assessing soil quality in the buffers since their implementation in 2002. Rainfall simulation was used to create uniform antecedent soil moisture content in the plots and to generate runoff. Runoff discharge and composite runoff samples and were collected at each buffer width for determination of atrazine, metolachlor, and glyphosate concentrations. Soil samples were collected in 2011 to assess soil quality changes, including biological and physical soil properties. Preliminary results showed that 8 m of the three VBS treatments reduced the loads of dissolved and sediment-bound atrazine, metolachlor, and glyphosate in runoff by 76 to 85% of the input load. Contaminant mitigation as a function of buffer width followed 1st-order decay models, which can be used to predict expected field-scale results and provide design criteria for buffer widths. The soil quality assessments showed few statistical differences in enzyme activities and saturated hydraulic conductivity. Atrazine degradation was rapid in all treatments, with half-lives ranging from 4.4 to 9.0 d, but the control had a significantly greater atrazine degradation rate than the vegetation treatments. Thus, perennial grass vegetation has had a minimal effect on soil quality nine years after establishment. This study demonstrated that VBS may achieve major reductions in herbicide transport and provided design criteria data for more effective implementation of VBS.

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

**denotes primary author and subject area*

Water quality improvement by converting from surface to sprinkler irrigation.

Author(s): Dave Bjorneberg*, USDA ARS; Jim Ippolito, USDA ARS; Anita Koehn, USDA ARS

Abstract: Surface irrigation uses the soil to convey water through fields. Irrigation water flowing over soil detaches and transports sediment and nutrients. Converting from surface irrigation to sprinkler irrigation greatly reduces the erosion within a field and should reduce the sediment load in irrigation return flow. Water quantity and quality were measured in an irrigation return flow stream upstream and downstream from a 64 ha farm for two years (2012-2013). The farm had sprinkler irrigation on 48 ha the first year and all 64 ha the second year. Average sediment loss from the farm in July and August, when most irrigation occurs, was 13,000 and 7,000 kg/day, respectively, in 2012, compared to 340 and 220 kg/day in 2013. Total sediment loss from the farm from May through September was 7,300 kg/ha in 2012 and 430 kg/ha in 2013. These results indicate how much sediment can be lost from a single field within a farm and how effectively sprinkler irrigation can reduce sediment loss.

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

**denotes primary author and subject area*

Water Quality Protection of the Grand Lake St. Marys in Ohio

Author(s): Yongping Yuan*, EPA-Office of Research and Dev; Milo Anderson, EPA Region 5

Abstract: Grand Lake St. Marys (GLSM) in northwestern Ohio is experiencing toxic levels of algal blooms resulting from nutrients, especially phosphorus (P) input from agricultural runoff. Originally constructed as a feeder reservoir for the Miami and Erie Canal, recreation activities on the 13,000 acre lake included swimming, boating, and fishing. The algae bloom has made the lake unsafe for these recreation activities. For many years, the prevailing philosophy of P management was to apply P as a fertilizer at rates that maintain soil P at or above a critical test level. If P fertilizer applications are routinely made above recommended levels, there may be a buildup of soil P in excess of crop needs. With continuous application of fertilizer P in excess of crop needs, the proportion of labile soil P may increase, resulting in even greater losses of soluble P. In addition, other forms of P (less soluble form of P) bound to soil solids are vulnerable to loss due to association with eroded sediment particles transported in overland flow. The increased off-site loss of P has negative impacts on the freshwater ecosystems and is responsible for algal blooms and associated water quality problems in many lakes and rivers, such as GLSM. Questions concerning the long term protection of water quality for GLSM are whether concentrated animal facility operations in the watershed is sustainable in terms of the amount of animal manure produced and whether the conservation practices can be adopted to limit nutrient loadings to the lake. In this presentation, we provide a comprehensive evaluation of environmental sustainability of Concentrated Animal Facility Operations in the watershed, which is critical in guiding the quantity of manure land application to match the needs of the crop through recycling and using excess animal manure as feed stock.

Subject Area: Lake Erie Case Studies: The Challenge of Maintaining Improvements

**denotes primary author and subject area*

Watershed Soil Loss Assessment following the re-vegetation efforts for reducing the sedimentation at the Talakhaya watershed in the Micronesian island of Rota

Author(s): Mohammad Golabi*, University of Guam; Sydonia Manibusan, University of Guam; Clancy Iyekar, University of Guam

Abstract: Talakhaya watershed in Rota is identified as a Coral Reef Management Priority site for CNMI. The current 'Watershed Soil Loss Assessment' project will assist in evaluating the revegetation objectives of 'Reducing the Soil Loss' as a Conservation Action Plan(CAP). The project will quantify the reduction in sediment by measuring the hydrological parameters. Also water samples as well as the turbidity level of each stream leading to the ocean from the watershed are being monitored for assessing the sedimentation level of each stream under study. The stream monitoring is being compared from badland areas where no mitigation technique is applied with areas where the Vetiver grass is being planted for controlling erosion. The comparison is also being made with areas where tree planting is used as means of reducing sedimentation load into the ocean. The preliminary results of the first year observation has shown that the turbidly level measured from the areas vegetated with vetiver grass were lower than no-vegetated areas. The turbidity level measured from the areas with tree planting was also lower than badland areas. These results have shown that re-vegetation practices with vetiver grass was the most effective mitigating technique for reducing the sediment leading to the ocean. The result also showed relevance to the objectives of the cooperating agencies for implementing the CAP for the restoration of the badland at the Talakhaya watershed in Rota. The data also provides knowledge based management framework to the island's needs for locally adoptable restoration techniques for protecting the coral reef from damages caused by the upland sedimentation. In this presentation the overall monitoring techniques are being reported and the most effective technique is being highlighted as a contributing outcome not only to the local societies but also as a knowledge based findings for scientific communities.

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

**denotes primary author and subject area*

Wind and Wave Measurements in Irrigation Reservoirs

Author(s): Yavuz Ozeren*, University of Mississippi, NCCHE; Daniel Wren, USDA-ARS; Michele Reba, USDA-ARS

Abstract: Irrigation reservoirs are commonly used for irrigation water storage in lower Mississippi river floodplain. The earthen embankments of these reservoirs often experience significant erosion primarily due to wind-generated waves; therefore, require annual repairs if they are not protected. The design of effective embankment protection requires knowledge of the wind-generated wave characteristics and their relationship to embankment erosion. A field measurement station was installed in an irrigation reservoir near Harrisburg, AR, to acquire synchronous measurements of wind and wave properties along with levee erosion data. The 500 m long and 300 m wide rectangular reservoir was located on flat, open agricultural land and had fairly uniform bathymetry with a maximum water depth less than 3 m. The data were used to develop relations between wind speed and direction, reservoir level, and bank erosion. Preliminary results showed that for a given wind speed, fetch length is the key parameter that controls the size of the waves generated in irrigation reservoirs. Therefore, the orientation of the reservoir relative to the predominant wind direction has a strong influence on embankment erosion in irrigation reservoirs, such that, reducing the fetch length in the prevailing wind direction can significantly reduce embankment erosion. Here, a summary of the recorded wind and wave data along with some alternative methods for the optimal design of irrigation reservoirs are presented.

Subject Area: Water Resource Assessment and Management*; Agricultural and Conservation Economics

**denotes primary author and subject area*

69th SWCS International Annual Conference

MAKING WAVES IN CONSERVATION

Our Life on Land & its Impact on Water

LOMBARD, IL • JUL 27–30, 2014

Poster Presentations

1. Arkansas Discovery Farms: Monitoring Edge of Field Runoff from Cotton Farms

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

Abstract: The Arkansas Discovery Farms program is monitoring the quality of runoff water on real, working row crop farms in Arkansas. Both quantity and quality of inflow and outflow are being monitored in order to determine the effect of soil and water conservation practices on water use and nutrient losses. The Arkansas Discovery Farms program is currently working with a cotton farm located in Dumas, Arkansas. The Dumas farm, consisting of about 1,500 acres is located in Desha County, in the Middle Bayou Macon Watershed. The watershed and the monitored farm is a part of the Mississippi River Basin Healthy Watershed Initiative (MRBI). There are three monitored cotton fields located on the farm that consists of management practices ranging from cover crop to no cover crop. Each sampling station is equipped with a trapezoidal flume so water runoff volume can be measured with the use of a pressure transducer. Each station also consists of an ISCO 6712® automated water sampler that is housed in a storage unit and automatically collects water samples at preprogrammed intervals once water flow is detected. The ISCO sampler is programmed to collect one hundred, 100 milliliter (mL) samples integrated across various stages of the flow hydrograph. Once the samples have been taken they are then collected from the sampler to be analyzed following protocol set forth by the USEPA for suspended solids, nitrogen and phosphorus. Runoff volume is calculated from the pressure transducer measurements using the appropriate equations. Flow-weighted concentrations are calculated to determine nutrient and sediment loads (mass) lost in runoff from the fields. Results from 2013 will be presented.

Subject Area: Adaptive Management of Conservation Efforts*

**denotes primary author and subject area*

2. Arkansas Discovery Farms: Monitoring Edge of Field Runoff from Rice, Soybean, and Corn Farms

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

Abstract: The Arkansas Discovery Farms program is monitoring the quality of runoff water on real, working row crop farms in Arkansas. Both quantity and quality of inflow and outflow are being monitored to determine the effect of soil and water conservation practices on water use and nutrient losses. Currently, the Arkansas Discovery Farms program is working cooperatively with rice, soybean, and corn farmers located in Arkansas (Bayou Meto 8-digit HUC) and Cross (L'Anguille River 8-digit HUC) Counties. The Cross County farm (4300 acres) utilizes both ground and surface water sources for irrigation while the Arkansas County farm (1500 acres) utilizes only surface water. Both of these farms have been selected to participate in NRCS' Mississippi River Basin Healthy Watershed Initiative (MRBI). Sampling stations located at each farm are equipped with flow outlet structures so that runoff volume can be measured by a flow stage pressure transducer or a flow velocity profiler. At each station, an ISCO 6712® automated sampler equipped with a weather station automatically collects water samples at pre-programmed intervals once flow is detected at the outlet so that a composite sample is collected over the course of a runoff event. Each sample is collected and analyzed following protocol set forth by the USEPA for suspended solids, sediment, nitrogen and phosphorus. Runoff volume is calculated from pressure transducer or velocity flow measurements using appropriate equations that describe the flow structure. Flow-weighted concentrations are then calculated to determine nutrient and sediment loads lost in runoff from the fields. Results from rice, soybean, and corn production from these farms will be presented.

Subject Area: Adaptive Management of Conservation Efforts*

**denotes primary author and subject area*

3. Potential Use of the New Nitrogen Index to Assess National N2O emissions from Cropping Systems of Mexico

Author(s): Jorge Delgado*, USDA-ARS; Vinisa Saynes, 2Colegio de Postgraduados, Texcoco, Mexico; Caleb Tebbe, USDA-ARS, Soil Plant Nutrient Research Unit, Fort Collins, CO 80526; Jorge Etchevers, Colegio de Postgraduados, Texcoco, Mexico; Daniel Lapidus,, USDA-FAS; Adriana Otero-Arnaiz, USDA-FAS

Abstract: Mexico is ranked as being one of the top 12 largest emitters of greenhouse gases, as well as one of the top 12 largest users of inorganic nitrogen (N) fertilizer, in the world. INECC-SEMARNAT (2013) estimated Mexico's greenhouse gas (GHG) inventory for the agricultural sector and reported that it contributes to about 12% of Mexico's national emissions in CO2 equivalents, with half of that coming from nitrous oxide-N (N2O-N) emissions from agricultural systems that use N fertilizers. The current methodology for calculating Mexico's trace gas inventory for agricultural systems that use N fertilizers simply uses a 1% emissions factor. Mexico's national N2O-N emissions are estimated by multiplying the total N fertilizer used in the country by .01. We tested the Nitrogen Index, a new tool to assess N2O-N emissions, by comparing N2O-N emissions estimated with the tool with reported N2O-N emissions from agricultural systems in Mexico. The N2O-N emissions estimated by the Nitrogen Index were significantly correlated with the N2O-N emissions measured across different cropping systems in Mexico ($P<.01$). We found the current methodology for estimating Mexico's N2O-N emissions for its national GHG inventory underestimated N2O-N emissions from agricultural systems compared to measured values from the field. We suggest that the methodology used to calculate N2O-N emissions for Mexico's trace gas inventory submitted to the United Nations Framework Convention on Climate Change (UNFCCC) significantly underestimates N2O-N emissions. We also suggest that integrating the use of a IPCC Tier 2 tool such as the Nitrogen Index to assess Mexico's N2O-N emissions from agricultural systems, could result in a more accurate assessment of N2O-N emissions that more closely reflects measured N2O-N emissions from field studies. We suggest that with the current methodology for agricultural systems, Mexico's national emissions (from all sources) reported to UNFCCC are being underestimated by 6%.

Subject Area: Adaptive Management of Conservation Efforts*

**denotes primary author and subject area*

4. Role of nutrient stoichiometry on the occurrence of denitrification within agricultural wetlands

Author(s): Brian Grebliunas*, Illinois State University ; William Perry, Illinois State University

Abstract: Wetlands have been successfully installed in agricultural and urban watersheds to reduce excess nutrients. The prolonged residence time in wetlands allows for processing of nitrogen as nitrate (NO3-N) via microbial denitrification. Denitrification is limited by a number of environmental factors, but can be constrained by the stoichiometry of the surrounding environment. A host of common agricultural practices interact to determine the relative concentrations and forms of nutrients that leach from row crop fields. Biologically significant nutrients, namely C:N:P, are critically important in mediating cellular processes and extracellular enzyme production of bacteria responsible for NO3-N reduction. Sediments were randomly cored from wetlands receiving surface runoff or subsurface drain tiles due to the differing stoichiometries each wetland type experience. Sediment slurries were allocated to 150 ml microcosms and amended with differing ratios of C:N:P within a laboratory for 20 days and assayed throughout. Subsets were destructively assayed via the acetylene inhibition technique to measure denitrification, and a modified anoxic microcentrifugation leucine [H3] incorporation method to assess bacterial production. Nutrient amendments in the C:N:P study had a significant effect on denitrification in both types of wetland sediments ($p < 0001$). Only treatments amended with C exhibited a significant increase in denitrification. However, low C:N (1:1) ratios produced a significant increase in bacterial production, but denitrification illicited little to no increase. This suggests preferential allocation of C for cellular growth and processes which limits the availability of C to promote denitrification. The consistent results of our research suggest that constructed wetlands are severely limited by the availability of labile C due to saturating NO3-N concentrations and would likely benefit from an increase in terrestrial derived inputs of labile C.

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

**denotes primary author and subject area*

5. The Power of Peers: The Effectiveness of Farmer Networks

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

Abstract: Streams and rivers throughout the Midwest suffer from the ills of agricultural runoff. Chief among these afflictions is the eutrophication of waterways due to excessive nutrient inputs. Conservation practices exist to combat nutrient runoff, but not enough farmers are implementing these practices to make a significant difference on the landscape. Several formal farmer networks have emerged throughout the Midwest to address this issue. In Indiana the On-Farm Network, Conservation Cropping Systems Initiative, and Adapt Network all foster peer-to-peer learning that allows farmers to teach each other through their own experiences. By learning what works for their neighbors, farmers can adapt their nutrient management practices to maximize yields while minimizing environmental degradation. 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? Semi-structured interviews were conducted with participating farmers from each of the three listed networks to determine how effective the networks were spreading implementation of nutrient management practices. Preliminary results indicate that involvement in a farmer network does indeed result in higher adoption of nutrient management practices, with some diffusion to farmers outside the network. If this network approach to nutrient management practice adoption proves effective, a new tool in increasing conservation practice adoption can be utilized to improve the quality of our nation's land and waterways while ensuring the ability of US agriculture to feed the world.

Subject Area: Adaptive Management of Conservation Efforts*; Conservation Models, Tools, and Technologies; Conservation Policy and Program Design; Outreach, Education, and Community Engagement

**denotes primary author and subject area*

6. Using N and S fertilizer to decompose crop residue: Does it work?

Author(s): DeAnn Presley*, ; Yuxin He, Kansas State University

Abstract: Establishing a uniform crop stand is one of the lasting concerns related to high-residue no-till situations. The application of fertilizer as a mist on the residue to stimulate microbial activity and subsequent decomposition of the residue is often debated for its potential to speed decomposition. We conducted wheat straw decomposition field experiments under different fertilizer rates and combinations at three locations in western Kansas in 2011 and 2012. Urea ammonium nitrate (UAN) was applied at rates of 0, 11.2, 22.4, 33.6, and 67.3 kg N / ha. Ammonium thiosulfate (ATS) was applied at rates of 16.8 and 33.6 kg S / ha, which also contained 7.7 and 15.5 kg / ha N, respectively. There were two application timings, late fall and early spring, for a total of 13 treatments with four replications. Wheat straw was collected in late spring of 2012 and 2013 to determine residue mass and strength. A double shear box apparatus instrumented with a load measured the shear stress required to cut wheat straw. Twenty-five wheat straws from each plot were tested. A photomicrography technique and SigmaScan software were used to measure the cross-sectional area of wheat straw after shearing. Results showed the timing of application did not affect wheat straw strength parameters. The wheat straw from plots sprayed with a mix of UAN and ATS in fall 2011 had significantly lower shear stress at two sites out of three. Also, the UAN with 11.2 kg N / ha rate applied in 2012 spring decreased wheat residue shear stress and specific energy at two sites ($p < 0.05$). Liquid fertilizers decreased straw strength relative to the no-fertilizer control, thus indicating potential benefits of liquid fertilizers to speed decomposition in heavy residue situations.

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

**denotes primary author and subject area*

7. Can Highly Diverse Native Plant Systems Provide Sufficient Biomass for Biofuel Production, Wildlife Habitat and Quality Forage ?

Author(s): Ray Wright*, UMC Bradford; Tim Reinbott, UMC Bradford; Bob Pierce, UMC Extention

Abstract: Mandates require that there will be 36 billion gallons of U.S. biofuels produced by 2022 and that 15 billion gallons will have to come from cellulosic ethanol. Switchgrass and other native warm season grasses (NWSG) are considered excellent species for biofuels production because of their wide adaptation for growth on poor soils with relatively high yield. Marginal soils are targeted for the production of biofuels resulting in the potential of increased soil erosion and nutrient loss. If managed correctly monocultures of NWSG can have many positive soil and water benefits. Monocultures however, have little benefit to wildlife due to the lack of diversity. Another consideration is production cost. To produce large quantities of biomass requires 80 -100 lbs. /acre of nitrogen along maintenance rates of phosphorus and potassium. Other options include Giant Miscanthus which can produce up to 12 tons /acre with little or no fertilizer. A major drawback is that it is an introduced species. Although it is sterile and reproduces only through rhizomes it can spread to waterways and become a noxious weed. Its thick growth does not promote plant diversity and can be a detriment to wildlife. There is also a concern livestock producers will be negatively impacted from the conversion of hay fields and pasture to biofuel production. It is estimated that a 50 million gallon/year cellulosic ethanol plant could require over 120,000 acres of land for production. Taking this amount of ground out of production could hurt livestock production. In 2010, Bradford Research Farms developed a study comparing yields of 18 different native forbs and legumes to monocultures of Switchgrass, Big Bluestem Switchgrass mix, and Miscanthus. Also comparing forage quality of different seasonal harvests to address the potential use for livestock. This study was developed to look at native plantings that could benefit not only the biofuel market, livestock farmers and wildlife.

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

**denotes primary author and subject area*

8. **A Collaborative Evaluation of Woodchip Bioreactors for Improved Water Quality: Multi-Scaled Studies with Stacked Nutrient Reduction Practices**

Author(s): Natasha Hoover, Iowa State University

Abstract: Woodchip bioreactors are gaining popularity with farmers because of their edge-of-field nitrate removal capabilities, which do not require changes in land management practices. However, limited research has been conducted to study the potential of these bioreactors to also reduce downstream transport of contaminants commonly detected in manure amended cropland, including pathogens and phosphorous. The preliminary results of an ongoing controlled laboratory-scale study will be presented, paired with field-scale studies of bioreactor phosphorous and fecal indicator bacterial removal conducted in collaboration with ISA's Environmental Programs and Services. The potential for stacked practices will also be highlighted, with the design of a planned multi pilot-scale bioreactor and watershed complex presented.

Subject Area: Conservation Models, Tools, and Technologies*

**denotes primary author and subject area*

9. A Decision Support Module for Evaluating the Effects of Alternative Land Management Practices on Florida Surface Water Quality

Author(s): Christy Crandall*, Florida A&M University; Katherine Milla, Florida A&M University; Amita Jain, Florida A&M University; Odemari Mbuya, Florida A&M University; Del Bottcher,

Abstract: Agricultural activities are a major source of nonpoint-source pollutant loadings to surface waters in Florida and adjacent states. This project is a direct response to increased pressure on the state of Florida to reduce nutrient levels in impaired water bodies to meet federally-mandated Total Maximum Daily Loads (TMDLs) of nutrients to streams. Basin Management Action Plans (BMAPs) are developed by the Florida Department of Environmental Protection in impaired watersheds to reduce nutrients loads to streams. Agricultural Best Management Practices (BMPs) are implemented by the Florida Department of Agriculture. It is essential to have land-owner buy-in when encouraging the adoption of BMPs. To address this need we are developing a computer automated decision support module to assist agency personnel in helping landowners develop a specific plan for each farm to reduce nutrient loads to streams. The decision support module uses the Watershed Assessment Model (WAM), a Geographic Information System-based surface-water flow and nutrient transport model that enables users to assess responses to agricultural practices based on physical and hydrologic properties of the watershed and management scenarios. The project provides a means to simulate BMP scenarios and potential loads to streams. Results can then be discussed with the landowner and additional BMP scenarios can be investigated to optimize the suite of management practices. Management can then be tailored for each farm to maximize financial gain and load reduction. For beta-testing the module we have selected a watershed that delivers surface waters into Florida originating in the Attapulgus Creek basin, a forested and agricultural watershed of approximately 238 mi2 that crosses from Georgia into Florida. We have purposely selected an out-of-state basin because it provides the opportunity to demonstrate the usefulness of the module to stakeholders both within and outside of the state of Florida.

Subject Area: Conservation Models, Tools, and Technologies*

**denotes primary author and subject area*

10. Assessing the Potential of Crop Water Allocator (CWA) in Making On-Farm Water Conservation Decisions

Author(s): Jonathan Aguilar*, Kansas State University; Isaya Kisekka, Kansas State University; Danny Rogers, Kansas State University

Abstract: There are farmers who are keen at conserving water by splitting their land and then planting different crops on each split without substantially affecting their overall net return. This is particularly important and useful in irrigated areas where the water source is becoming limited, such as some areas underlain with the Ogallala Aquifer. An online tool developed by K-State Research-Extension called Crop Water Allocator (CWA) calculates net economic return for selected combinations of crops in a given crop rotation and water allocated to each crop. The decision support tool examines each possible combination of crops selected for every possible combination of water allocation by 10% increments of the water supply with the intention of helping farmers choose the best combination of crops with the highest net return within the cropping season. The backbone of this tool are the different crop production functions generated on the field for corn, sorghum, winter wheat, alfalfa, soybean, sunflower, and fallow. Individual fields or groups of fields can be divided into the following ways: 100%; 50%-50%; 25%-75%; 33%-33%-33%; 25%-25%-%50; 25%-25%-25%-25%. The study assessed the capability of CWA to determine if this tool can potentially help a farmer in comparing different scenarios of irrigation water allocations in terms of its net returns. Using recent values of crop and fuel prices, and production costs, several irrigation amounts were compared side-by-side with different crop mixes in an iterative process. Statistical analysis was employed once all the scenarios were generated. Given the capability of CWA, we expect that this would be a valuable decision support tool for farmers dealing with limited water availability for irrigation. This tool could potentially help not only the farmers, but also economic analysts, water resource managers, and policy makers in making water conservation decisions.

Subject Area: Conservation Models, Tools, and Technologies*; Agricultural and Conservation Economics; Water Resource Assessment and Management

**denotes primary author and subject area*

11. Developing precision conservation planning tools for HUC12 watersheds transected by large rivers

Author(s): Mark Tomer*, USDA-ARS; Sarah Porter, USDA-ARS; Brian Gelder, Iowa State University; David James, USDA-ARS; Eileen McLellan, Environmental Defense Fund

Abstract: Restoration of rivers can involve a variety of conservation practices installed along channels and in floodplains, with a range of benefits including enhanced water quality and habitat. We are exploring if and how detailed digital elevation models derived from LiDAR (Light Detecting And Ranging) data can be used to propose locations for a variety of conservation practices, including those that contribute towards river restoration goals. Several recent advances in watershed precision conservation use the HUC12 watershed (usually 4,000 – 16,000 ha, or 10,000 to 40,000 acres) as the planning unit. Many HUC12 watersheds occur along major rivers, where broad floodplains occur and river restoration practices may be appropriate. The suite of soil and water conservation practices typically applied in agricultural landscapes can be considered distinct from river restoration practices, suggesting that precision conservation planning technologies for HUC12 watersheds with wide river corridors should address the floodplain as a separate landscape entity. This poster will demonstrate an approach that delineates HUC12 watersheds into floodplains and tributary sub-watersheds. This separates the watershed into two planning domains; one where agricultural conservation practices could be placed within cropped uplands that drain to small tributaries, and a second where practices that re-establish hydrologic connections between the river and its floodplain and/or improve bank stability can be proposed. The approach is designed to address hydrologic routing issues that arise when terrain analyses software is applied to detailed elevation data for watersheds with wide river channels, and is intended for application in any HUC12 watershed transected by a river channel and alluvial floodplain. Results will be demonstrated for a HUC12 watershed in the lower part of the South Fork Iowa River.

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

**denotes primary author and subject area*

12. Development of a Comprehensive System for Monitoring Conservation Tillage Practices using Remote Sensing Technology

Author(s): Mohammad Raoufat*, Shiraz University; Mohammad Rostami, Shiraz University, Iran

Abstract: Present study was devoted to search for accurate methods for monitoring residue management and tillage intensity. With this vision, the potential of WorldView-2 and MODIS sensors local data for delineating crop residue cover and as an estimator of conservation tillage adoption, tillage intensity and residue burning was evaluated using satellite spectral indices and Linear Spectral Unmixing Analysis (LSUA). For this purpose, correlation of residue cover percent, as measured by line-transect and image processing in experimental plots and relevant WorldView-2 data were studied and their correlations were sought. Results indicated that IPVI, RVI1 and GNDVI spectral indices are able to estimate crop residue cover percent regardless of fields size (R2=0.82 - 0.85). The crop residue cover estimated from the LSUA approach was found to be correlated with the ground residue data measured by the line-transect and image processing methods (R2=0.72 and 0.76, respectively). Two criteria named as Infrared Percentage Vegetation Index (IPVI) and Ratio Vegetation Index (RVI1) considered for discriminating tillage intensity. Results indicated that classification accuracy with IPVI and RVI1 indices were within 78-100 percent and agreed closely with ground measurement, observations and field records. Other results indicated that size of burned field can be estimated using WorldView-2 and MODIS images. The two Indices VARI and Index1 were selected as discriminant indices for burned/unburned fields in WorldView-2 and MODIS, respectively.

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

**denotes primary author and subject area*

13. Effectiveness of Conservation Management for Decreasing Soil Loss in Runoff from Cattle Pastures

Author(s): Daniel Pote*, USDA-ARS; Philip Moore, USDA-ARS; David Brauer, USDA-ARS

Abstract: Conservation efforts to decrease soil erosion and nutrient losses in storm runoff from pastures have focused primarily on diminishing soil surface damage caused by intensive livestock hoof action and on finding better methods for applying the nutrients necessary to sustain adequate forage production. Best management practices (BMPs) recommended to help address these problems include rotational grazing systems, exclusion zones, grass buffers, and riparian buffers; but the long-term effectiveness of these techniques has not been adequately assessed. To help fill this knowledge gap at the field scale, a USDA-ARS research team initiated a 15-year study in 2003 using 15 constructed watersheds at the Dale Bumpers Small Farms Research Center in Booneville, AR. Each 0.14-ha (0.35-acre) watershed was isolated by earthen berms topped with barbed wire fencing, and the downslope end was narrowed to direct all runoff through a fiberglass flume equipped with a pressure transducer and automatic water sampler for measuring runoff. All watersheds were hayed the first year while background data were being collected. During years 2-7, broiler litter was applied annually at 5.6 Mg/ha (2.5 t/a), and the following five watershed management strategies (each randomly replicated three times) were evaluated: hayed, continuously grazed, rotationally grazed, rotationally grazed with a nutrient-application buffer, and rotationally grazed with a fenced riparian buffer. Comparing results from grazed watersheds to those managed as hay fields showed that continuous grazing increased watershed soil loss by 200%, while rotational grazing with a fenced riparian buffer increased soil loss by only 40%. Successful completion of the research will provide NRCS field offices with tools they need to accurately identify the most effective and sustainable management practices for decreasing soil, water, and nutrient losses from livestock grazing systems.

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

**denotes primary author and subject area*

14. Forest Harvest Management Effects on Soil Hydraulic Properties

Author(s): Langston Simmons, University of Missouri; Stephen Anderson*, University of Missouri

Abstract: As variable climate becomes a future challenge, the effects of tree harvesting and associated best management practices on water infiltration and runoff are becoming more relevant. According to former studies, many decades are often necessary for forest soils to return to pre-disturbed levels for bulk density and related soil properties following harvest activities. This study was conducted to evaluate the effects of selected harvesting techniques on soil hydraulic properties. Harvested sites for the study occurred on a moderately well-drained Keswick soil (fine, smectitic, mesic Aquertic Chromic Hapludalfs) within the Mark Twain National Forest in Callaway County, Missouri. Treatments evaluated for the study included logging roads and log landing areas, as well as recent and historic logged areas. Hydraulic properties included soil water retention, saturated hydraulic conductivity (Ksat), pore size distributions, and bulk density. Bulk density was significantly higher ($P < 0.01$) and Ksat was significantly lower ($P < 0.01$) for the logging road and log landing areas compared to the logged areas. No statistical differences in property values among treatments occurred at the deepest sampling depth (40 cm). From this study, methods used in logged areas appear to have caused small changes to soil hydraulic properties; however, significant changes occurred with these properties for logging road and log landing areas. Conservation efforts need to focus on management practices to increase hydraulic conductivity for these areas to reduce challenges with water runoff from logged sites especially with future expected increases in storm intensities.

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

**denotes primary author and subject area*

15. Impact of Precipitation Uncertainty on SWAT Model Performance

Author(s): Yongping Yuan*, EPA-Office of Research and Dev; Milo Anderson, EPA Region 5; Ronald Bingner, USDA-ARS

Abstract: The accuracy of a model output is, to a large degree, dependent upon the quality of the input data sets including their spatial and temporal resolution. Among those input data sets, precipitation is one of the most important because of its influence on the hydrological model's performance (defined as agreement between measured and simulated values) and its role in determining surface hydrologic processes. Rainfall data are often obtained from rain gage networks, which sometimes may not cover the study area. Usually, precipitation data from the nearest gage stations are used to represent the study area for model hydrological simulations. However, occasionally unusual meteorological conditions can make it necessary to consider precipitation data from gages as far away from a modeled watershed as the next county. The Chickasaw Creek, one of the major streams draining to the Grand Lake St. Marys, was modeled using SWAT for the purpose of understanding and mitigating a toxic algal bloom that peaked in 2010 in the Grand Lake St. Marys. The Chickasaw Creek watershed, south of the lake, was within 10 miles of two NOAA NCDC precipitation gages on the north side of the lake, but for year 2010 the SWAT simulated flows using either of these gages as precipitation input data lacked any significant correlation to flows observed at a USGS gage on Chickasaw Creek. An assumption was that additional NOAA NCDC gages were needed to capture the majority of observed precipitation events. By considering additional precipitation gages, model performance as measured by R-squared correlation improved by significantly. The nearby precipitation gages essentially showed no correlation (R-squared of 0.03 for year 2010), but using a combination of the additional gages to capture the majority of precipitation events raised this R-squared correlation coefficient to 0.43 for the same year.

Subject Area: Conservation Models, Tools, and Technologies*

**denotes primary author and subject area*

16. Mapping Soil Erosion Risk in a Mountainous Catchment of Iran using a Field Indicator Method

Author(s): Nayereh Ghazanfarpour*, University of Missouri; Clark Gantzer, University of Missouri; Jason Hubbart, University of Missouri

Abstract: Soil erosion is a serious and complex environmental challenge in many regions of Iran. Lack of spatial coverage and time-series data impede conventional approaches to quantify soil erosion. The current study was conducted to quantify the soil loss on hillslopes of Shahrak catchment in Iran using soil erosion indicators. Six soil loss indicators were applied to quantify rill and gully erosion, pedestals, rock exposure, barrier (e.g. shrub, and rock) deposition, and sedimentation in drains. Map units were created by overlaying land use, soil type, slope steepness, and slope aspect information obtained from current literature. Measurement of soil erosion indicators was carried out using transects in represented map units for each indicator. Observed data and total soil loss (t ha-1) were scaled to the catchment level using land use, slope degree and geomorphological attributes from map units. A soil loss risk map with five classes (very low, low, medium, high, and very high) was produced based on the total soil loss associated with soil erosion indicators using ArcGIS v. 10.1. Results indicate that among different land uses agricultural lands and orchards were classified with low soil loss (< 30 t ha-1), while high and very high soil loss class was observed in rangelands (>90 t ha-1). This baseline study demonstrates that soil erosion indicators can provide simple, quick methods with low cost to evaluate, and map soil loss risk in Iran. Results are useful for assessing and predicting soil loss for planning and use of soil water conservation measures in priority areas identified with severe soil loss. Easily quantified soil loss mapping methods based on field indicators will improve information for land users about soil erosion processes in countries like Iran that may have limited access to information to work with process based models.

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

**denotes primary author and subject area*

17. Measured and HYDRUS-simulated water infiltration within areas under conservation buffers and corn/soybean management

Author(s): Janith Chandrasoma, University of Missouri; Ranjith Udawatta*, University of Missouri; Stephen Anderson, University of Missouri; Clark Gantzer, University of Missouri

Abstract: Excessive surface runoff is a principal cause of soil erosion and nonpoint-source pollution (NPSP). Numerical simulations are fast and relatively inexpensive to evaluate effects of management operations and practices on soil erosion and NPSP. Little work has been done to investigate the accuracy of numerical simulations for claypan soils with buffers in a corn/soybean rotation for erosion control and NPSP reduction. This research was conducted on a Putnam silt loam (fine, smectitic, mesic Vertic Albaqualf) in Missouri (Greenley Memorial Research Center, Novelty) on row crop areas and agroforesry buffers (AGF). Reflectometer-measured volumetric soil water content showed increased potential soil water storage with AGF management compared to row crop management. The objective of this study was to compare HYDRUS-1D simulated infiltration with measured experimental data. Model input parameters included the van Genuchten water retention and hydraulic conductivity parameters. Values were based on sand, silt and clay percentages, bulk density (g cm-3) and soil water content at -33 kPa. No evaporation and no root water uptake were assumed during the analyzed 72-hr time period. For both sites, ponded water infiltration and infiltration after the principal recharge event was measured. Preliminary results showed no significant differences between simulated and measured data for ponded infiltration. Simulated results for recharge events showed slightly greater water content compared to measured values. The current analysis did not include root water uptake and evapotranspiration which could have accounted for greater simulated water contents. The analysis showed that HYDRUS-1D can be used as a tool to evaluate soil water infiltration and potential runoff generation to understand effectiveness of conservation buffers. The results can be used to design conservation buffers for row crop management to reduce soil erosion and NPSP when measured soil parameters are available.

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

**denotes primary author and subject area*

18. Socio-ecological impacts of unconventional energy development on western US rangelands: a theoretical evaluation

Author(s): Kristie Maczko*, Sustainable Rangelands Rndtble; Urs Kreuter, Texas A&M University; William Fox, Texas AgriLife Research; John Tanaka, University of Wyoming Dept. of Ecosystem Science & Mgmt; Clifford Duke, Ecological Society of America; Lori Hidinger, Arizona State University Consortium for Science Policy and Outcomes; John Mitchell, USDA Forest Service - Rocky Mountain Research Station; Daniel McCollum, USDA Forest Service Rocky Mountain Research Station

Abstract: The United States requires more diverse energy sources to progress towards energy independence. The USA Task Force on Strategic Unconventional Fuels concluded that achieving this objective requires development of a domestic unconventional fuels industry. Rangelands cover as much as 70 percent of the earth's terrestrial surface and dominate large areas of the western US, representing a major source of alternative energies. The Integrated Social, Economic and Ecological Conceptual (ISEEC) framework was developed by the Sustainable Rangeland Roundtable (SRR) to identify biophysical-socioeconomic links that influence delivery of ecosystem services affected by alternative uses of rangelands. The framework is also useful for selecting suitable indicators to monitor changes associated with energy development. Such an approach may enhance coordination to set policies and regulations for sustainable development of unconventional energy resources on rangelands. This poster summarizes the potential of western rangelands for future production of three energy technologies; natural gas, biofuel and wind energy. These energy sources are vertically distributed - below, at, and above ground level. Their respective development will likely affect rangeland ecosystems in different ways. After establishing key links affecting delivery and use of ecosystem services from rangelands with respect to alternative energy sources, changes in these links must be monitored. The SRR ISEEC framework is used to hypothesize 10 biophysical and socio-economic links. By identifying SRR criteria and indicators to monitor each link, a mechanism is provided for systematically testing the hypothesized effect of each link and tracking changes in links over time. This work can be viewed as a first step toward implementation of energy development approaches that minimize impacts on rangeland ecosystems and introduces responsive management practices to mitigate impacts.

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

**denotes primary author and subject area*

19. Vegetative Buffer Effects on Infiltration and Runoff for Variable Rainfall Processes

Author(s): Syaharudin Zaibon, University of Missouri; Stephen Anderson*, University of Missouri

Abstract: Many scientists anticipate more intense storms in the future due to climate change. This challenge will necessitate inclusion of conservation practices which enhance infiltration and reduce runoff. A study was conducted to measure infiltration as affected by stiff-stemmed vegetative buffers (switchgrass, Panicum virgatum, L.) relative to row crop areas. The experiment was conducted over two years in southwest Iowa on a well-drained Monona silt loam (fine-silty, mixed, superactive, mesic Typic Hapludolls). Treatments included three positions as affected by vegetative buffers: within the grass hedge, within a deposition zone (0.5 m upslope from hedge) and within a row crop zone (7 m upslope from the hedges). The row crop area was in a corn (Zea mays L.)/soybean (Glycine max) rotation. Ponded infiltration was monitored within each treatment area and Green-Ampt and Kostiakov infiltration parameters were fitted to the infiltration curves with coefficients of determination above 0.99. Comparisons among treatments were made using a Type 2 variable rainfall storm with 125 mm rainfall in 24 hours and also with a constant rate storm of 25 mm/hr for 2 hours. Significant differences occurred among the treatments for the infiltration parameters with the grass hedges having saturated hydraulic conductivity 5.3 times higher than the row crop area and 36 times higher than the deposition zone. For a 125 mm storm, no runoff occurred within the grass hedge area while more than thirty percent of the rainfall was lost as runoff for the row crop and deposition areas, respectively. For the constant rate storm, no runoff occurred for either the grass hedge or row crop areas but about 75% of the rain was lost as runoff for the deposition zone. Results show that vegetative buffers may be very useful for increasing infiltration and reducing runoff for agricultural watersheds. This approach may be important for future watershed ecosystem design as rainfall intensities increase.

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

**denotes primary author and subject area*

20. Environmental Education for Rota, CNMI: The Talakhaya Watershed Soil Loss Assessment

Author(s): Sydonia Manibusan*, University of Guam; Mohammad Golabi, University of Guam

Abstract: Accelerated sedimentation from the unprotected watersheds of the Northern Marianas Islands in Micronesia is a growing economic and environmental concern for the region. When soil is disturbed sediment is moved by water and wind into rivers that empty into the ocean. The reefs along the mouths of these rivers are smothered by sediment, killing organisms, and making reefs uninhabitable. Watersheds are dynamic and adaptable to change; however the results are often incompatible with human land use. Human activity such as burning, activities along unprotect upland areas, and clear cutting often has a strong impact on watershed dynamics. The restoration and increase of habitat through the revegetation of watershed systems that have become barren require actions upon the watershed and on minimizing human impacts that will continue to persist without proper community education. The Talakhaya Watershed Soil Loss Assessment is a part of an ongoing larger revegetation effort to improve the watershed and the coral reef system on the island of Rota, CNMI, which is a largely agricultural and fishing community and relies heavily on the island's natural resources. The revegetation project is currently using vetiver grass (Chrysopogon zizanoides) as well as Acacia and Bahia grass. The monitoring being conducted by the assessment includes the collection of data for the watershed including rainfall, stream level and discharge, water quality, and soil properties. Through these monitoring efforts the effect of the revegetation project will be made through a comparison of the various watershed outputs, which are at different stages of the project. It is expected that the completed portions of the watershed will have a lower sediment output than the barren areas. Through this study, concrete evidence of this project can be produced and provide support for the affect that it has on Rota and further the efforts to increase the environmental awareness of the Rota community.

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

**denotes primary author and subject area*

21. Maps of new 2012 Ag. Census farm demographics with USDA Parity Calculations

Author(s): David Buland*, USDA NRCS; Dwain Daniels, USDA NRCS

Abstract: 1) A statement of current relevance or need : The new 2012 Ag. Census, to be released on February 20th will show updated numbers of minority farmers. USDA has commitments to provide service to all minority groups using a parity calculation with the baseline updated every five years from the Ag. Census. This poster and analyses would be the first view to conservationists of FY2013 work related to the new 2012 Ag. Census demographics. 2) General methods and data analysis information : The new Ag. Census farm demographics data will be combined with USDA program demographic data from http://www.regstats.usda.gov/ and mapped on a county basis for major USDA programs. 3) Results or predicted results if the work has not yet been completed : We are not sure, since neither dataset has not been released. The past four Ag. Census have shown a quadrupling of Hispanic farmers through the 40 non-traditional Hispanic farm states with USDA services not reaching these new Hispanic farmers. The 2007 Ag. Census also shown a reversal in the 60-year decline of Black farmers, but in the traditional Black farmer region. The 2007 Ag. Census also show increased in Asian farmers in unexpected pockets. 4) Explanation of how the results or outcomes contribute to science and society : USDA is committed to serving all farmers equally. The previous studies have highlighted shortcomings in USDA services to specific demographic groups, which lead to reappropriation of USDA program and technical resources to meet these shortcomings. The SWCS meeting provides a good forum for analysis and discussion of these results. See the 2007 data in http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_021945.pdf

Subject Area: Outreach, Education, and Community Engagement*; Conservation in Nontraditional Agriculture; Conservation Policy and Program Design

**denotes primary author and subject area*

22. Can a Single Measure of Soil Quality be used to Assess Soil Health in Agricultural Landscapes?

Author(s): Kelsey Smith*, Purdue University; Douglas Smith, USDA-ARS, NSERL; Phillip Owens, Agronomy Department, Purdue University; Brad Joern, Agronomy Department, Purdue University

Abstract: The overall soil quality/health plays a major factor in the production potential for a given field. Having a single measurement that would provide an overall soil quality assessment would save time and money and could even allow farmers the opportunity to make a quick assessment of their own fields. Bulk density is one of the easiest and cheapest properties of soil quality to measure. The objective for this study is to assess the correlation between bulk density and soil quality/health parameters in agricultural soils. Surface (1-6cm) bulk density samples were collected from fifteen sites in four fields (conventional tillage corn, soybean and alfalfa fields and a no-till soybean field) located in the St. Joseph Watershed in northeastern Indiana. Duplicate surface bulk density samples were measured from three landscape positions: summit, backslope, and footslope in each field using a core bulk density probe. In order to test how closely bulk density relates to the overall soil health several soil quality tests for the physical, chemical, and biological properties of soil are being conducted on composite soil samples collected from the same sample locations. If bulk density provides a reasonable assessment of soil quality/health parameters, it will be possible to develop methods for farmers to quickly assess the soil quality/health of their own fields with minimal costs or labor. Questions regarding soil type, sampling conditions and field management details shall be answered in the methods section of the poster.

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

**denotes primary author and subject area*

23. Impact of different organic manures in conjugation with inorganic fertilizers on carbon enrichment in typical inceptisols of jammu (India)

Author(s): Saima Khursheed*, Skuast; Cheryl Simmons, USDA NRCS; sanjay aroora,

Abstract: A pot experiment was conducted during kharif, 2005 to ascertain the response of different organic sources viz., wheat straw, farm yard manure (FYM), vermicompost and poultry manure to rice (Oryza sativa) and also to monitor the effect of manuring on soil carbon pools. Application of poultry manure and vermicompost alongwith NPK fertilization resulted in highest grain yield rice. Soil carbon, labile carbon and water soluble carbon contents also improved with application of organics. Poultry Manure and vermicompost treated soil coupled with NPK resulted in higher MBC as compared to manure treatment. Soil MBP and MBN also increased with the application of wheat Straw, poultry Manure, FYM and vermicompost respectively over control. Similarly the soils showed higher dehydrogenase activity with incorporation of poultry manure, vermicompost, FYM and wheat straw respectively over control.The study thus shows that for better soil management as well as optimizing crop yields and environmental security, organic amendments needs to be added along with use of chemical fertilizers.

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

**denotes primary author and subject area*

24. Utilization of Biosynthetically Produced Amino Acid Byproducts as Nitrogen for Corn Production

Author(s): Juan Carlos Quezada*, Iowa State University; Andres Lenssen, Iowa State University; Kenneth Moore, Iowa State University

Abstract: Byproducts resulting from the industrial synthesis of amino acids for feed-use might provide a significant and considerable supply of nutrients for crop production specially nitrogen (N). Iowa has a strong amino acid biosynthesis industry, resulting in a continuous supply of biosynthesis byproducts. Byproduct utilization as an N source for crop production may enhance revenues for amino acid producers and Iowa farmers. A field experiment was conducted in 2013 near Ames, IA, to evaluate corn response to tryptophan (TRP) and lysine (LYS) biosynthesis byproducts as N sources. The objectives of this study were to determine corn response to isonitrogenous N fertilization treatments: 1) different levels of dry TRP when replacing NH4-N from ammonium nitrate, 2) combinations of liquid TRP byproduct with different levels of LYS byproduct. Parameters measured included phenological development, chlorophyll readings, leaf area Index (LAI), normalized difference vegetative index (NDVI) which were taken throughout the season on a weekly basis. Grain yield, and yield components were measured at physiological maturity. Grain quality was tested as well. Dry and liquids treatments were applied pre-plant and immediately after planting respectively. Ammonium nitrate and ammonium sulfate were applied with a drop spreader, while both the dry and liquids TRP and LYS byproducts were broadcast spread. All treatments were adjusted to 175 lb. of N ac-1 and arranged in a randomized complete block design with four replicates. First year results of this study indicate that the amino acid and their byproducts can replace ammonium nitrate and ammonium sulfate without compromising growth and development, grain or stover yield of corn. The field experiment is being repeated in 2014 to document efficacy of TRP and LYS biosynthesis byproducts as suitable sources of N for corn production.

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

**denotes primary author and subject area*

25. Assessing Groundwater Phosphorus in Forage-based Agroecosystem with Cow-Calf Operation

Author(s): Gilbert Sigua*, USDA-ARS; Chad Chase, Jr., USDA-ARS; Kenneth Stone, USDA-ARS

Abstract: Phosphorus (P) fertilization is vital component of productive farming. Phosphorus is an essential macronutrient that is required to meet global food requirements and make crop and livestock production profitable. While adequate levels of P soils are essential to grow crops, P has the potential to induce eutrophication in our water systems. Recent assessments of water quality status have identified eutrophication as one of the major causes of water quality "impairment". Assessing and controlling P inputs are thus considered the key to reducing eutrophication and managing ecological integrity. In this paper we monitored and evaluated P concentrations of groundwater (GW) compared to the concentration of surface water (SW) P in forage-based landscape with managed cow-calf operations for three years (2007-2009) in central Florida. Groundwater samples were collected from three landscape locations along the slope gradient (GW1: 10-30% slope; GW2: 5-10% slope; and GW3: 0-5% slope). Surface water samples were collected from the seepage area (SW: 0% slope) located at the bottom of the landscape. Of the total P collected (averaged across year) in the landscape, 62.6% was observed from the seepage area or SW compared with 37.4% from GW (GW1 = 8.0%; GW2 = 10.9%; GW3 = 18.4%). Phosphorus in GW ranged from 0.02 to 0.20 mg/L while P concentration in SW ranged from 0.25 to 0.71 mg/L. The three-year average of P in GW of 0.09 mg/L was lower than the recommended goal or the Florida's numeric nutrients standards (NNS) of 0.12 mg P/L. The three-year average of P concentration in SW of 0.45 mg/L was about four-fold higher than the Florida's NNS value. Results suggest that cow-calf operation in pasture-based agroecosystem would contribute more P to SW than in the GW. The risk of GW contamination by P from animal agriculture production system is limited while the solid forms of P subject to loss via soil erosion could be the major water quality risk from P.

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

**denotes primary author and subject area*

26. Evaluation of Effluent Characteristics and Sorption of Nutrients onto Thermally-Treated Biomass in a Woodchip Heavy Use Area for Wintering Dairy Cattle

Author(s): Tom Basden*, West Virginia University; Joshua Faulkner, University of Vermont; David Devallance, West Virginia University

Abstract: Traditional winter feeding areas, or 'sacrifice' areas, for beef cattle can be a significant source of nutrient and sediment pollution. Sustainable and affordable approaches are needed that effectively control manure nutrients during winter feeding, while ensuring a healthy and comfortable animal environment. The use of woodchips as a surface material for areas used to hold cattle during wet periods is practiced on a limited basis in Ireland, Scotland, and New Zealand. The application of this simple technology in the cool humid climates has potential to improve animal comfort and health, protect winter pastures, and reduce the environmental impact of winter feeding and loafing areas. Such a woodchip-surfaced heavy use area has been installed and monitored in northern West Virginia and a second site has been established on the WVU Animal Science Farm. Initial water quality data has indicated that nutrient concentrations in effluent were generally lower than average conventional feedlot (concrete or earthen) runoff concentrations. Total nutrient loads were also generally lower than concrete surfaces, due to the reduced effluent volume. Total nutrient loads were similar to typical earthen surface values, but are associated with much higher stocking densities than are generally employed in earthen lots. Investigation of bench scale columns with various configurations of thermally treated wood chips are underway. Biomass mixes that show the best performance will be added as treatments in the WVU woodchip heavy use area.

Subject Area: Water Resource Assessment and Management*

**denotes primary author and subject area*

27. NUMERICAL MODEL CONSTRUCTION FOR A COMPLEX TROPICAL WETLAND WATERSHED

Author(s): Bahaaeldin Abdelrahim Elwali*, Jazan University; Abu Bakr Serat, ; Ismail Yussoff, University of Malaya; Azmi Jaffri, Drainage and Irrigation Department of Malaysia ; Zainudin Othman, University of Sultan Idris for Education

Abstract: To help quantify existing and future water quantity condition associated with development and other land-use change at Paya Indah Wetlands (PIW), attempt is made by employing the advantages of MIKE SHE integrated modeling system. The integrated surface water (SW) and groundwater (GW) models were constructed using a detailed channel network and a fully-distributed approach to simulate surface water and groundwater flow interactions. Both unsaturated (UZ) and saturated (SZ) models were successfully coupled and calibrated to the extent permitted by the available data. The coupled model was practically used as a management tool to provide a detailed estimation of total water balance for PIW; a first-order catchment where actual evapotranspiration (ET) counts for about 65% and 58% from one hand, and overland flow (OL) to the PIW lakes-system represents 12.38% and 12.3% on the other, of total rainfall during calibration and validation periods respectively. The coupled model demonstrated a satisfactory performance through sustaining a total error of less than 1% of total rainfall.

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

**denotes primary author and subject area*

28. Ranch management strategies for coping with impacts of watershed-scale externalities

Author(s): Benjamin Turner*, South Dakota State University; Roger Gates, South Dakota State University; Galen Hoogestraat, United States Geological Survey; Alexander (Sandy) Smart, South Dakota State University

Abstract: Land use change in the Swan Creek watershed (Walworth, Edmunds, and Potter counties South Dakota) has contributed to increased stream discharge, leading to an excessive flooding problem for Rock Hills Ranch (RHR). Although land conversion has brought positive economic benefits to those directly involved, it has rendered two hundred grassland acres of RHR almost useless. In order to provide guidance to RHR about an appropriate course of action, we modeled stream discharge from similar, single storm events in 2006 and 2012 using the Hydrologic Engineering Center's-Hydrologic Modeling System (HEC-HMS) to quantify the hydrologic effect of the land use conversion. From 2006 to 2012, we estimated an increase in cultivated crop area of over 21,000 acres (or 27%) which contributed to peak discharge increases of over 4.5% (or 110 thousand gallons per second at peak-flow). Then, using a simple strategic management procedure and combined with Net Present Value and Modified Internal Rate of Return (MIRR) estimation, we identified ranch strategies to cope with this change. Each strategy was ranked on how well it mitigated the externality effects, and what financial impacts would be to RHR in order to determine an appropriate response. We suggested an Easement strategy which provided an adequate financial return (MIRR=21%) while creating a vegetative buffer to protect downstream properties in the watershed.

Subject Area: Water Resource Assessment and Management*; Agricultural and Conservation Economics; Conservation Policy and Program Design; Soil Health Resources, Indicators, Assessment, and Management

**denotes primary author and subject area*

29. Real-Time Nitrate Monitoring in Groundwater, Central Illinois

Author(s): Kelly Warner*, USGS; Patrick Mills, USGS; Jacob Wikle, USGS

Abstract: Variability of nutrient concentrations in groundwater in response to seasonal or other temporal variability in nutrient applications and precipitation may play an important role in nutrient loading in streams. Collection of groundwater nitrate data at the frequency and duration necessary to best understand the mechanics and significance of the groundwater contribution to stream loads has been hampered by the approaches of typical data collection. Samples must be collected by a manually or automatically operated pump, often followed by laboratory analysis. Recently, an automated photometric sensor that records near-continuous groundwater nitrate concentrations with real-time broadcast through satellite telemetry has been installed in a well in Illinois. The sensor determines concentrations by measurement of ultraviolet light adsorption by nitrate. The capability of the automated sensor in a groundwater application is under evaluation at a 640 acre, agricultural/residential/prairie-wetland parcel at the lower end of a 9,000 acre, predominantly agricultural watershed near Bloomington, Illinois. The timing and stressors driving periodic fluctuations in groundwater nitrate concentrations are not well understood, nor the relation of these fluctuations to the variability of nitrate loads in the nearby streams. The automated sensor is installed in a shallow well located between a newly established residential neighborhood and the stream. Along with assessment of the performance and maintenance requirements of the sensor, it is anticipated that its use will prove valuable to better understanding of nitrate loading in the watershed.

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

**denotes primary author and subject area*

30. Winter Groundwater Recharge Based on Surface Cover and Different Vegetation

Author(s): Birl Lowery*, University of Wisconsin; Amber Radatz, University of Wisconsin Discovery Farms; William Bland, Uinversity of Wisconsin-Madison; Fred Madison, University of Wisconsin-Madison; David Hart, University of Wisconsin-Madison; Alfred Hartemink, Uinversity of Wisconsin-Madison

Abstract: Over the past 12 years there has been a significant decline in depth to groundwater in the Central Sand Plains of Wisconsin. This has caused concern over the increase in land area under irrigated agricultural crop production. Water dynamics in summer are readily available, but few data exist on the winter dynamics. We investigated the fate of groundwater by collecting continuous water table depth data from monitoring wells with a focus on winter recharge under different vegetation types. Groundwater recharge patterns varied seasonally and are highly influenced by vegetation and cover on the soil surface, especially in winter. During the growing season, interception of precipitation by pine forest yielded little to no groundwater recharge compared to agricultural fields and prairie vegetation. Based on regression equations a precipitation event during the growing season will result in 14 mm greater water table rise under a prairie than an irrigated agricultural field. After snowmelt, the water table under prairie vegetation was higher than of forest and agricultural fields. The lack of plant residue on agricultural fields led to a dense continuous layer of frost in the soil profile that extended to about one meter. Cement frost in the soil profile in agricultural fields inhibited snowmelt water from infiltrating and recharging the groundwater. Soil compaction in agricultural fields likely contributed to dense cement frost development in winter. Increased residue on the surface of agricultural fields may reduce the frost depth and enhance winter recharge to the water table in this region.

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

**denotes primary author and subject area*

31. A preliminary study of nitrogen cycling of Nitro Radish seeded after winter wheat harvest in SW Ontario corn-soybean-winter wheat rotations

Author(s): Xueming Yang*, Agriculture & Agri-Food Canada; Dan Reynolds, Greenhouse and Processing Crops Research Center, Agriculture & Agri-Food Canada; Craig Drury, Greenhouse and Processing Crops Research Center, Agriculture & Agri-Food Canada; jingyi Yang, Greenhouse and Processing Crops Research Center, Agriculture & Agri-Food Canada

Abstract: Radish (oilseed radish and nitro radish) has become a popular cover crop choice in the Midwest in recent years. In this study, the nitrogen cycling of nitro radish (Raphanus sativus L.) seeded in August after winter wheat harvest and the residual effect on succeeding crop (corn) yield have been evaluated on a Brookston clay loam in SW Ontario. We hypothesized that planting nitro radish during the fallow season after winter wheat harvest would benefit the following year corn production. Results showed that nitro radish did scavenge large quantities of N (220 kg N ha-1) in the late fall when the radish biomass was collected at the first killing frost. Nitro radish very quickly decayed in following spring, leaving no radish residues visible from the soil surface in April about a month before seeding corn in the region. Soil mineral nitrogen concentrations showed a pattern of decreasing with increase in distance from the radish roots. Unlike the check plot (no cover crop after previous winter wheat) which nitrate was dominant over the spring, the soil under nitro radish, particularly the soil close to radish roots, was dominated with ammonium in early spring and the ammonium was gradually decreasing and partially being converted into nitrate with time. In general, the check soil (0 - 30 cm) contained about 24 kg N ha-1 and the soil under nitro radish contained 42 kg N ha-1 in spring before seeding corn. There was no difference in corn yields between nitro radish treatment and no cover crop check. Compared with no cover crop check, the nitro radish showed strong ability of scavenging soil residual nitrogen in fall which bears the meaning of reducing nitrogen release to the environment (the water systems). Since this fixed nitrogen did not increase succeeding corn yield, we speculate that the nitrogen being fixed with nitro radish in fall was released from the soil in following spring, and this is worthy of further study.

Subject Area: Cover Crop Practices: Application, Innovation, and Management

**denotes primary author and subject area*

32. Can Cover Crops Increase the Stability of Fall Applied Nitrogen?

Author(s): Shalamar Armstrong*, Illinois State University; Corey Lacey, Illinois State University

Abstract: There is a dearth of knowledge on the ability of cover crops to increase the effectiveness of fall applied N. Thus, the objective of this study was to investigate the efficacy of different cover crop species to stabilize inorganic soil nitrogen following a fall application of N. Fall N was applied at a rate of 200 kg N ha-1 into living stands of cereal rye, tillage radish, and a control (no cover crop) treatments at the Illinois State University Research and Teaching Farm in Lexington, IL. Cover crops were sampled to determine N-uptake and soil samples were collected in the spring at 4 depths to 80 cm to determine the distribution of inorganic N within the soil profile. Tillage radish (179-236 kg ha-1) and cereal rye (189-218 kg ha-1N) absorbed a minimum of 80% of the recommend N rate of the region. Fall applying N without cover crops resulted in a greater percentage of soil NO3-N (40%) in the 50-80 cm depth compared to only 31 and 27% when tillage radish and cereal rye were present at N application. At planting, tillage radish stabilized an average of 91% of fall applied N within the 0-20 cm depth relative to 66 and 57% for the cereal rye and control treatments. This study has demonstrated that fall applying N into a living cover crop stand has the potential to reduce the vulnerability of nitrate and increase the efficiency of fall applied N.

Subject Area: Cover Crop Practices: Application, Innovation, and Management

**denotes primary author and subject area*

33. Cover crops: An alternative practice to improve soil physical properties and soil-water dynamics on Missouri claypan soils

Author(s): Marcelo Goyzueta, University of Missouri; Ranjith Udawatta*, University of Missouri; Clark Gantzer, University of Missouri; Stephen Anderson, University of Missouri

Abstract: Cover crop management practices have emerged in the past decades as an alternative to improve soil physical, biological and chemical properties by acting as a soil surface cover and protecting it from wind and water erosion. This cover crop study had been conducting on eight experimental watersheds at the Chariton County Cover Crop Soil Health (CCSH) farm in north-central Missouri. Watersheds were delineated by topography and soil type; this farm consists of 49% Armstrong loam, 5-9 % slopes; 40% Grundy silt loam, 2-5 % slopes; and 10% Bevier silty clay loam, 2-5 % slopes. Soils series in this area have a claypan layer in the subsoil. Cover crop treatments were established in 2012, six watersheds received different cover crop mixes without tillage and the other two watersheds served as the control with tillage and conventional agricultural practices. Undisturbed soil cores were taken on July 2013 to determine soil water retention, bulk density, and saturated hydraulic conductivity (Ksat). Samples were taken from two pits located in the shoulder slope position on no-trafficked areas of each watershed, two spots were sampled in each of the pits at four depths (0-10, 10-20, 20-30 and 30-40 cm). No significant differences were detected between cover crop watersheds and the control ones. Results from this study show that one growing season is not enough time to evidence significant changes in the soil due incorporation of cover crops in the rotation.

Subject Area: Cover Crop Practices: Application, Innovation, and Management

**denotes primary author and subject area*

34. Cover Crop Management Effects on Soil Physical and Biological Properties

Author(s): Samuel Haruna, University of Missouri; Nsalambi Nkongolo, Lincoln University; Stephen Anderson*, University of Missouri

Abstract: Cover crops have been known, among other benefits, to reduce soil erosion, increase water infiltration, increase organic matter, and also increase soil microbial activity. This study was conducted at Lincoln University's Freeman Farm during 2011 and 2012, on a Waldron silt loam (Fine, smectitic, calcareous, mesic Aeric Fluvaquents) to measure the effects of cover crop management on soil physical and biological properties. The field was 4.05 ha in size and subdivided into 48 plots, each measuring 12.2 m x 21.3 m. The cover crop of choice was cereal rye (Secale cereale). Half of the total plots had cover crop management while the other half had no-cover crop; the main crop for the plots was a corn (Zea mays L.)/soybean (Glycine max) rotation. Soil samples were collected at four depths; 0-10, 10-20, 20-40 and 40-60 cm. For physical property analysis, samples were oven dried for 72hrs. Air dried soils were sent to a commercial laboratory for analysis of soil biological properties. Results show a 3.5% decrease in soil bulk density in cover crop plots compared with no-cover crop plots. The carbon/nitrogen ratio of the organic matter decreased with increasing sample depth for the first three sample depths and increased slightly in the fourth depth. The carbon/nitrogen ratio showed a 5.6% increase in no-cover crop plots compared with cover crop plots. We speculate that cover crops are capable of increasing infiltration and reducing runoff. In general, our results show a significant effect ($p < 0.05$) of cover crop management on the selected soil physical and biological properties measured.

Subject Area: Cover Crop Practices: Application, Innovation, and Management

**denotes primary author and subject area*

35. Evaluating Cover Cropping Systems for Beginning High Tunnel Producers in West Virginia

Author(s): Tom Basden*, West Virginia University; Lewis Jett, West Virginia University; Sigrid Teets, West Virginia University

Abstract: High tunnels are passively-vented, solar-heated structures which protect crops from environmental stress and accelerate growth. Most crops within high tunnels are grown directly within the existing soil under the high tunnel structure. High tunnels permit intensive specialty crop production on a limited area of land. Soil management is one of the most frequent areas of interest and often overlooked by beginning high tunnel producers. The objectives of this USDA Conservation Innovation Grant project are to demonstrate and quantify the effects of cover crop rotations and no-till production on soil physical and biological properties and their relationships with nutrient cycling, soil water availability and plant growth and yield in seasonal high tunnels. Beginning in 2012, baseline soil health data was collected and cover crops were established on approximately ten farms in the Potomac Highlands of West Virginia. Two planting dates and ten cover crop species are being evaluated over a three year period as green manure or no-till residue within a high tunnel. Soil health assessments are evaluated with the Cornell University Soil Health Testing Program. Workshops demonstrating cover crop establishment and management are conducted each year and participants are routinely surveyed. After one year, growers have shown a significant increase in skill and knowledge concerning cover crop establishment and maintenance within high tunnels. Subsurface compaction has been identified as the most significant soil health factor for each high tunnel. Cover crops used for green manure have produced more biomass relative to the no-till cover crops after one season. Soil health data will determine if the cover crops significantly improve soil quality over a three year period.

Subject Area: Cover Crop Practices: Application, Innovation, and Management

**denotes primary author and subject area*

36. Integrating Soil, Crop and Pest Monitoring Using Spatial Technology on Arkansas Cotton Farms to Achieve Nutrient Loss Reduction

Author(s): Tina Teague*, Arkansas State Univ - UAAES; Erin Kelly, Arkansas State Univ - UAAES; Michele Reba, USDA-ARS; Keith Morris, Arkansas State University; Terry Spurlock, University of Arkansas Division of Agriculture - SEREC; Nadine Straitt, Arkansas State University; daniel Fisher, USDA-ARS; Jenifer Bouldin, Arkansas State Univ - UAAES; Leo Espinoza, University of Arkansas Division of Agriculture

Abstract: This poster summarizes results from a two year CIG funded project focused on encouraging expanded adoption of nutrient management practices to increase production efficiency and reduce nutrient yield from cotton farms in the Midsouth. Conservation practices include cereal cover crops and use of spatial technology in an adaptive nutrient management approach that will ultimately employ site specific fertilization based on directed soil sampling and zone management. Wheat cover crops were included and considered a critical management practice in improving water and soil conservation efforts. Also included are crop monitoring with COTMAN for termination decisions on protection from insect pests and irrigation timing. Three cooperating producers selected the paired fields on each farm in 2011. Fields had been precision leveled and had a single outlet structure for automated samplers and sensors for water quality assessments. Field were classed into management zones based on soil EC properties collected from measurements using a dual depth Veris® 3150 Soil Surveyor. Over two seasons, we documented differences in crop and pests among zones. Plants growing in coarse sand and clay textured soil had slower nodal development, fewer nodes and earlier maturity than plants in other management zones. Yields were lower in those zones. Cover crops did not impact yield but did affect insect pests; cover crops reduced risk from early season thrips. Results will include from edge-of-field water quality assessments of nutrient yield from cover crop compared to conventional cropping systems.

Subject Area: Cover Crop Practices: Application, Innovation, and Management

**denotes primary author and subject area*

37. Reclaiming Soil Health and the Natural Productivity of Crop Ground

Author(s): Timothy Harrigan*, Michigan State University; Marilyn Thelen, Michigan State University; Dean Baas, Michigan State University; Paul Gross, Michigan State University; Christina Curell, Michigan State University

Abstract: This in-progress project is funded by a 2012 NRCS Conservation Innovation Grant. We have three cooperators representing three divergent soils and cropping systems: 1) coarse, irrigated soil under seed corn/soybean/wheat-snap bean production, 2) loam soil on a mixed crop (corn/soys/wheat) and livestock (finishing hog and cattle) farm, and 3) a clay-loam, tile-drained soil on a mixed crop (corn/beans/wheat/alfalfa) and livestock (cow-calf) operation near the northern edge of the row crop production area. The results of this work focusing on soil organic carbon accumulation and crop management effects on soil microbial respiration as indicators of directionally correct soil health benefits will be transferrable to nearly all of the cropping regions of Michigan and the tile-drained loam and clay-loam soils of Ohio, Indiana and Wisconsin, and much of New York state. The crosscutting factors are low-disturbance tillage, cover crops and the addition of other organic inputs such as manure. The systems approach has increased farmer awareness and understanding of management factors that impact soil quality and health. It has led to a reduction in seedbed compaction; reduced erosion by increasing surface roughness, improved water infiltration and conserved crop residues, and improved nutrient cycling. Soil quality is enhanced by reducing tillage intensity and adding organic inputs --manure and cover crops-- that stimulate soil building biological processes. The combination of reduced tillage, extended crop and root growth and organic inputs provides for a potential 1% increase in soil organic matter in ten years. This increase in SOM could increase water holding capacity and improve the natural fertility of soils resulting in a 10-20 bu/acre corn yield increase and more resilient and stable yields.

Subject Area: Cover Crop Practices: Application, Innovation, and Management

**denotes primary author and subject area*

38. Short term effect of biomass removal, residue management, tillage, and manure application on soil CO2 efflux in a corn silage crop production system.

Author(s): Andrew Cartmill*, UW-Platteville; Dennis Busch, UW-Platteville

Abstract: This short term observational study was conducted to monitor and characterize the effect of biomass removal (harvest), residue management, tillage, and manure application on soil CO2 efflux in a corn silage crop production system. Soil CO2 efflux was measured bi-weekly along transects through previously established treatment areas at University of Wisconsin-Platteville Pioneer Farm from August 2013 to November 2013. Treatments included: i) Phosphorus Reduction Strategy (no manure application, cover crops grown following corn silage harvest, fertilizer N applied as required); ii) Current Production/Conservation System (narrow based terraces, fall incorporated manure); iii) High Density Manure (fall incorporated manure, cover crops grown following corn silage harvest); and iv) No Till Transition (no till, multi-pass winter daily scrape and haul solid manure application as a cover crop). Findings suggest that soil CO2 efflux in a corn silage crop production system will more likely respond to changes in soil moisture and temperature as a result of management and production practice.

Subject Area: Cover Crop Practices: Application, Innovation, and Management

**denotes primary author and subject area*

39. Modeling and Management Approaches for Soil Erosion and Sediment Control in Lake Erie: A Case Study

Author(s): Gary Overmier*, Great Lakes Commission; Tom Crane, Great Lakes Commission

Abstract: 1. Statement of current relevance The Great Lakes Tributary Modeling (GLTM) Program, facilitated in part by the GLC, promotes partnerships and a coordinated approach to modeling sediment transport and implementing erosion and sediment control practices in priority watersheds. Although these programs are basin-wide in scope, much attention has been focused on tributaries and watersheds within the Lake Erie basin, with numerous sediment modeling and soil erosion control projects in the Western Lake Erie. 2. General methods The GLTM program (authorized through Section 516(e) of the Water Resources Development Act of 1996) addresses sediment production and delivery in critical watersheds around the Great Lakes basin through the development of customized watershed and sediment transport models. The program is a joint initiative between the U.S. Army Corps of Engineers, agency and university partners, and the Great Lakes states. The Corps and its partners develop watershed-specific modeling tools that can be used by state and local agencies and other stakeholders to plan and implement soil conservation and nonpoint source pollution implementation programs. More than 25 models have already been completed for tributaries to the Great Lakes. 3. Results or predicted results There have been five completed models and nine in-progress models developed for the Lake Erie basin. These models provide an insight into the sources and processes that deliver sediment to the harbors, bays and open lake. The models help conservation practice implementers locate and protect priority sediment source delivery areas. 4). Explanation of how the results or outcomes contribute to science and society Modelers can show implementer where the priority areas are to target implementation and implementers can requests modelers to provide them with information on priority areas.

Subject Area: Lake Erie Case Studies: The Challenge of Maintaining Improvements

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40. Reducing P Export From Agricultural Soils in the Maumee River Basin to Lake Erie Using Gypsum Applications

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Abstract: Phosphorus (P) from agricultural and other sources has continued to contribute to water quality problems in Lake Erie. Research has shown that gypsum (calcium sulfate dihydrate or CaSO4.2H2O) is effective in reducing P loss from agricultural soils by forming insoluble calcium phosphate. A demonstration project in the Maumee Basin of western Lake Erie is evaluating field-scale applications of gypsum for reducing P export in surface runoff and tile drainage water. The initial project began with four farms in 2012 and was expanded to 8 farms in 2013. On each farm, separate fields with similar hydrology and management histories, or separate sections within one large field, were either treated or not treated with gypsum at a rate of generally one ton per acre. Soils data showed that available (soluble) P concentrations in the pretreated test fields ranged from 13 to 90.8 mg/kg. Tile drain water samples were collected from areas with or without gypsum and analyzed for P (total and orthophosphate), NO3, and pH. There were 20 total sampling events (collection of samples on one farm on one date) from May 2012 through November 2013. After the initial sampling in May 2012, dry conditions during the remainder of the growing season prevented additional sampling events until December 2012. Average reduction in orthophosphate for gypsum-treated areas was 39%, with median reduction of 48% and range from 0 to 82%. Orthophosphate concentrations (mg/L) in drain water ranged from 0.01 to 0.11 (mean = 0.04) in gypsum-treated areas and from 0.01 to 0.44 (mean = 0.10) in areas without gypsum. Recent results have shown that P reductions in tile drainage water persist at least 20 months after gypsum treatment.

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