NUTRIENT MANAGEMENT AND EDGE OF FIELD MONITORING CONFERENCE

From the Great Lakes to the Gulf

Memphis, Tennessee | December 1 - 3, 2015
Sheraton Memphis Downtown Hotel

FINAL PROGRAM

SOIL AND WATER CONSERVATION SOCIETY

GLA GREENLEAF ADVISORS, LLC

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Conference Agenda

Time	Tuesday, December 1, 2015	Location
9:00 a.m. - 6:00 p.m.	Registration Desk Open	**Heritage Foyer**
Healthy Soils for Healthy Waters Opening Symposium		
10:00 a.m. - 10:10 a.m.	**Symposium Welcome** – Randall Reeder, The Ohio State University	**Heritage Ballroom**
10:10 a.m. - 11:40 a.m.	**Measuring and Monitoring Systems: An Introduction to Nutrient Assessment Systems at Edge of Field** – Andy Ward, The Ohio State University, Kevin King, USDA-ARS; Brittany Hanrahan, University of Notre Dame; Shelia Christopher; Laura Christianson; University of Illinois; Jessica D'Ambrosio, Antioch College	**Heritage Ballroom**
12:00 p.m. - 1:00 p.m.	**Luncheon with Speaker:** Kristin Weeks Duncanson, Duncanson Growers, and Jim Moseley, AGree	**Heritage Ballroom**
1:15 p.m. - 5:15 p.m.	**Plenary Presentations including Panels: Nutrient Management, No-Till, Cover Crops, and Water Management**	
1:15 p.m. - 2:15 p.m.	**Nutrient Management and Soil Amendments** – Nick Goeser, National Corn Growers Association and Soil Health Partnership, and Joe Nester, Nester Ag With support from Warren Dick, The Ohio State University, and Leo Espinoza, University of Arkansas Moderator: Shannon Zezula, Indiana NRCS	**Heritage Ballroom**
2:15 p.m. - 3:15 p.m.	**Quality No-Till** – Forbes Walker, University of Tennessee; Dan DeSutter, Indiana Producer; Anne Paulson, John Deere Moderator: Karen Scanlon, CTIC	**Heritage Ballroom**
3:15 p.m. - 3:30 p.m.	**Refreshment Break**	**Heritage Foyer**
3:30 p.m. - 4:30 p.m.	**Cover Crops** – David Brandt, Ohio Producer, and Mike Taylor, Arkansas Producer With support from: Dennis Chessman, USDA-NRCS, and Trent Roberts, University of Arkansas Moderator: Betsy Bower, Ceres Solutions	**Heritage Ballroom**
4:30 p.m. - 5:15 p.m.	**Water Management: Drainage and Irrigation –** Kevin King, USDA-ARS; Steve Stevens, Arkansas Discovery Farms; Matt Helmers, Iowa State University Moderator: Jessica D'Ambrosio, Antioch College	**Heritage Ballroom**
5:15 p.m. - 5:45 p.m.	**Summary Thoughts and Views on Advancing Integrated Solutions to Healthy Soils for Healthy Waters** – Andrew Sharpley, University of Arkansas, and Jim Moseley, AGree	**Heritage Ballroom**
5:45 p.m. - 6:00 p.m.	**Bridging Forward Nutrient Management from the Gulf to the Great Lakes** – Mike Daniels, University of Arkansas and Rebecca Power, University of Wisconsin Extension	**Heritage Ballroom**
6:00 p.m. - 8:00 p.m.	**Exhibitor and Poster Welcome Reception**	**Heritage Foyer**

<table>
<tr><th>Time</th><th colspan="3">Wednesday, December 2, 2015</th><th>Location</th></tr>
<tr><td>7:15 a.m. - 6:30 p.m.</td><td colspan="3">Registration Desk Open</td><td>Heritage Foyer</td></tr>
<tr><td>8:00 a.m. - 8:15 a.m.</td><td colspan="3">Conference Welcome – Mike Daniels, University of Arkansas</td><td>Heritage Ballroom</td></tr>
<tr><td>8:15 a.m. - 9:30 a.m.</td><td colspan="3">Panel Presentation:
Importance of Edge of Field Monitoring – Ann Bartuska, USDA
Advancing towards Improved Water Quality in the Great Lakes and the Gulf – Ellen Gilinsky, USEPA
Farmer Implementation as a Part of State Water Quality and Nutrient Reduction Strategies – Matt Lechtenberg, Iowa Department of Agriculture and Land Stewardship
Moderator: Jim Gulliford, Soil and Water Conservation Society (SWCS)</td><td>Heritage Ballroom</td></tr>
<tr><td>9:30 a.m. - 10:00 a.m.</td><td colspan="3">Break in Exhibit Hall</td><td>Heritage Foyer</td></tr>
<tr><td>10:00 a.m. - 11:30 a.m.</td><td colspan="3">Plenary Session: Edge of Field Monitoring – What We Monitor for and What We Learn at Different Monitoring Scales – Mark Tomer, USDA-ARS; Andrew Sharpley, University of Arkansas; Kevin King, USDA-ARS
Moderator: Lara Moody, The Fertilizer Institute</td><td>Heritage Ballroom</td></tr>
<tr><td>11:30 a.m. - 12:00 p.m.</td><td colspan="3">Break with Exhibitors</td><td>Heritage Foyer</td></tr>
<tr><td>12:00 p.m. - 1:15 p.m.</td><td colspan="3">Lunch with Speakers: Healthy Soils for Healthy Waters – Jim Moseley, AGree; Dennis Dimick, National Geographic Magazine
Moderator: Andy Ward, The Ohio State University</td><td>Heritage Ballroom</td></tr>
<tr><td colspan="5">Breakout Session 1</td></tr>
<tr><td></td><td>Research and Monitoring Track
Magnolia I</td><td>Application Track
Magnolia II</td><td colspan="2">Implementation Track
Nashville</td></tr>
<tr><td>1:30 p.m. - 3:15 p.m.</td><td>Breakout 1A – Plot Scale Monitoring of the Effectiveness of Individual Water Quality Protection Practices
Matt Helmers, Iowa State University; Nathan Nelson, Kansas State University; Beth Baker, Mississippi State University

Moderator: Jim Gulliford, Soil and Water Conservation Society</td><td>Breakout 1B – Applying Edge of Field Monitoring Projects, Practice Effectiveness, and Results to Meet Water Quality Protection Policy and Goals
Lisa Duriancik, USDA-NRCS; Mark Tomer, USDA-ARS; Ali Saleh, Tarleton State University

Moderator: Scott Manley, Ducks Unlimited</td><td colspan="2">Breakout 1C – Importance of Edge of Field Monitoring to Effective Practice System and Project Implementation: Case Studies
Steve Stevens, Arkansas Discovery Farm Program; Andrew Sharpley, University of Arkansas; Warren Dick, The Ohio State University; Lori Krider, University of Minnesota

Moderator: Mike Daniels, University of Arkansas</td></tr>
<tr><td>3:15 p.m. - 3:45 p.m.</td><td colspan="3">Break in Exhibit Hall</td><td>Heritage Foyer</td></tr>
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Breakout Session 2			
	Research and Monitoring Track **Magnolia I**	**Application Track** **Magnolia II**	**Implementation Track** **Nashville**
3:45 p.m. - 5:30 p.m.	**Breakout 2A – Field Scale, Edge of Field Monitoring of Surface and Sub-surface Water Quality** Dennis Busch and Randy Mentz, University of Wisconsin-Platteville; Bill Crumpton, Iowa State University; Michele Reba, USDA-ARS Moderator: Dennis Busch, University of Wisconsin-Platteville	**Breakout 2B – Do Edge of Field Monitoring Results Inform, Support, and Improve the Predictive Models for Water Quality Protection?** Jane Frankenberger, Purdue University; Daren Harmel, USDA-ARS; Scott Manley, Ducks Unlimited Moderator: Karma Anderson, USDA-NRCS	**Breakout 2C – Farmer Motivation and Decision Making to Implement Water Quality Protection Practices** Amber Radatz, Wisconsin Discovery Farm Program; Linda Prokopy, Purdue University Moderator: Linda Prokopy, Purdue University
5:30 p.m.	Night on Your Own		

Time	Thursday, December 3, 2015	Location
7:30 a.m. - 12:30 p.m.	Registration Desk Open	**Heritage Foyer**
8:00 a.m. - 9:00 a.m.	**Plenary Session – Application of Monitoring to Inform Policy and Achieve Water Quality Objectives –** Katie Flahive, USEPA; Deanna Osmond, North Carolina State University; Lisa Duriancik, USDA-NRCS **Moderator:** Linda Prokopy, Purdue University	**Heritage Ballroom**

Breakout Session 3			
	Research and Monitoring Track **Magnolia I**	**Application Track** **Magnolia II**	**Implementation Track** **Nashville**
9:15 a.m. - 10:45 a.m.	**Breakout 3A – Scale Matters: Assessing the Benefits of Agriculture Practices from the Field to the Watershed** Claire Baffaut, USDA-ARS, Missouri; Shannon Zezula, USDA-NRCS; Kevin King, USDA-ARS Moderator: Mike Woodside, US Geological Survey	**Breakout 3B – Can Water Quality Practices and State Nutrient Reduction Strategies Meet Nutrient Reduction Goals for Protection, TMDL, Great Lakes, and Gulf of Mexico Water Quality Goals?** Douglas R. Smith, USDA-ARS; Matt Lechtenberg, Iowa Department of Agriculture and Land Stewardship; Kevin Fermanich, University of Wisconsin-Green Bay Moderator: Katie Flahive, USEPA	**Breakout 3C – Training Natural Resource Professionals to Organize Watershed Projects and Engage Farmers** Jamie Benning, Iowa State University; Ann Lewandowski, University of Minnesota; Jennifer Filipiak, American Farmland Trust Moderator: Rebecca Power, University of Wisconsin

10:45 a.m. - 11:15 a.m.	Refreshment Break	**Heritage Foyer**
11:15 a.m. - 11:50 a.m.	**Session Reports – 5 minute report and 5-10 minutes of discussion on each track by an assigned individual** Moderator: Scott Manley, Ducks Unlimited Breakout Sessions A, Science: Jessica D'Ambrosio, Antioch College Breakout Sessions B, Application: Karma Anderson, NRCS Breakout Sessions C, Implementation: Rebecca Power, University of Wisconsin	**Heritage Ballroom**
11:50 a.m. - 12:00 p.m.	**Closing Remarks:** Mike Daniels	**Heritage Ballroom**

Conference Registration and Facility Information

REGISTRATION HOURS

Tuesday, 9:00 a.m. – 6:00 p.m.
Wednesday, 7:15 a.m. – 6:30 p.m.
Thursday, 7:30 a.m. – 12:00 p.m.

NAME BADGES AND TICKETS

The conference registration fee covers one participant. All registered attendees will receive a name badge, conference program, and other promotional items.

Your name badge acts as your admission ticket to educational sessions, exhibits, meals, breaks, and the Welcome Reception. Please be sure your name badge is worn at all times in the conference area. For your safety, it is recommended that you do not wear your name badge outside the conference area.

Formal name badges are not provided for guests. Additional tickets for guests to attend the Welcome Reception and Wednesday luncheon may be purchased at the conference registration desk and are subject to availability. Guest tickets will be collected at the door for these events.

Please Note: No refunds will be given for conference registrations or special events onsite. If you are no longer able to attend the conference or attend ticketed events, please visit with one of the SWCS staff at the registration desk. It may be possible to gift your registration to a friend or colleague.

LOST AND FOUND

Check with the hotel registration desk or at the SWCS registration desk for lost items.

PARKING

Garage parking at the hotel is $22 per day with in and out privileges.

INTERNET

If you are staying at the hotel, we have arranged for you to have complimentary Internet service in your sleeping room. Internet service is not available in the meeting space. However, the Sheraton offers complimentary high-speed access, PC stations, and printing in the lobby.

CEUs

SWCS has worked to secure continuing education credits (CEUs) from various certifying organizations. Agronomists (CPAg), soil scientists and classifiers (CPSS and CPSC), crop advisors (CCA), crop consultants (CPCC), and other professional conservationists may be able to obtain CEUs.

Sign-in sheets for Certified Crop Advisor CEUs will be provided for each session. Please be sure to sign in and out of each session you attend. Room moderators will return sign-in sheets to the registration desk, and SWCS will submit on your behalf. You may also scan the barcode at the bottom of each sign-in sheet to receive real-time credit for CEUs.

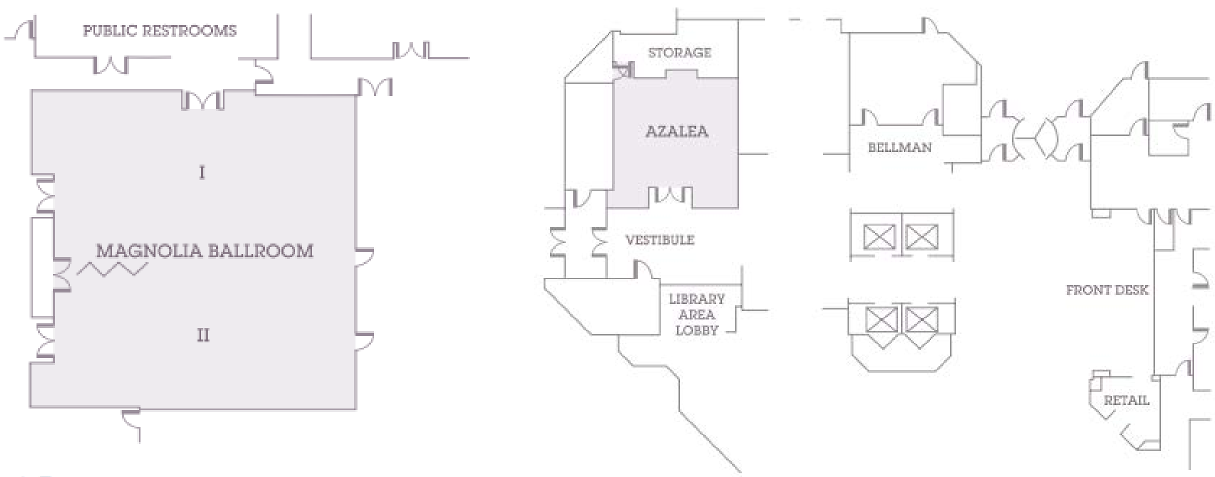
NUTRIENT MANAGEMENT & EDGE OF FIELD MONITORING CONFERENCE

Sheraton Meeting Space Map

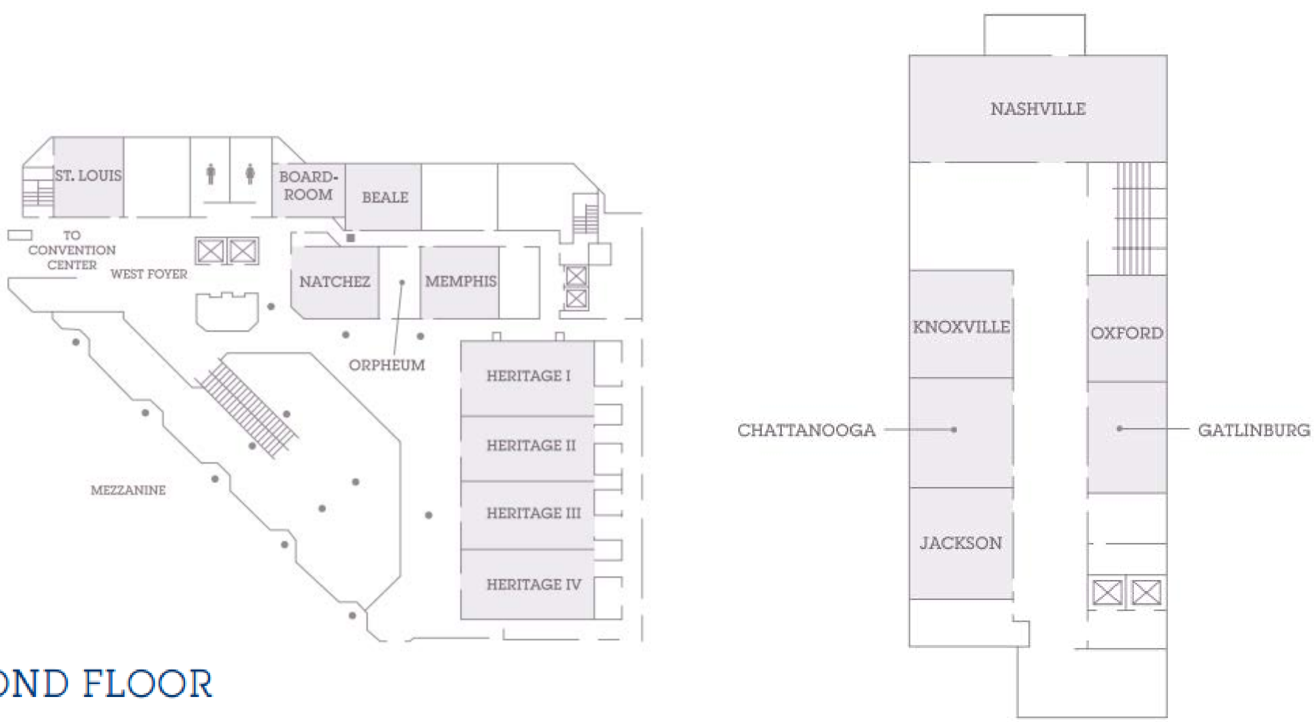
PLENARY SESSIONS AND LUNCH – Heritage Ballroom

EXHIBIT HALL AND RECEPTION – Heritage Foyer

BREAKOUT ROOMS – Magnolia I, Magnolia II, and Nashville



FIRST FLOOR



SECOND FLOOR

Conference Planning Committee

Thank you to all who assisted in planning the
Nutrient Management and Edge of Field Monitoring Conference!

John Anderson, Greenleaf Advisors
Karma Anderson, USDA-NRCS
Larry Antosch, The Ohio Farm Bureau Federation
Dennis Busch, University of Wisconsin-Platteville
Larry Clemens, The Nature Conservancy
Mike Daniels, University of Arkansas
Katie DeMuro, Greenleaf Advisors
Nick Goeser, NCGA - Soil Health Partnership
Katie Flahive, USEPA
Craig Goodwin, USDA-NRCS
Jim Gulliford, Soil and Water Conservation Society
Amanda Gumbert, University of Kentucky
Matt Helmers, Iowa State University
Kim Johnson-Smith, Soil and Water Conservation Society
Scott Manley, Ducks Unlimited
Eileen McLellan, Environmental Defense Fund
Lara Moody, The Fertilizer Institute
Debbie Moorland, University of Arkansas
Jim Moseley, Agree
Joe Nester, Nester Ag
Rebecca Power, University of Wisconsin-Madison
Michele Reba, USDA-ARS
Randall Reeder, The Ohio State University
Andrew Sharpley, University of Arkansas
Mark Smith, USDA-NRCS
Jeffrey Strock, University of Minnesota
Jennifer Tank, University of Notre Dame
Mark Tomer, USDA-ARS
Carrie Vollmer-Sanders, The Nature Conservancy
Forbes Walker, University of Tennessee
Andy Ward, The Ohio State University
Mike Woodside, USGS
Shannon Zeaula, USDA-NRCS

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Exhibitors

AGRI DRAIN CORPORATION
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www.agridrain.com
Booth #1

THE SOIL HEALTH PARTNERSHIP
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www.soilhealthpartnership.org
Booth #2

GYPSOIL
Karen Bernick
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www.gypsoil.com
Booth #3

THE FERTILIZER INSTITUTE
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Booth #4

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Booth #5

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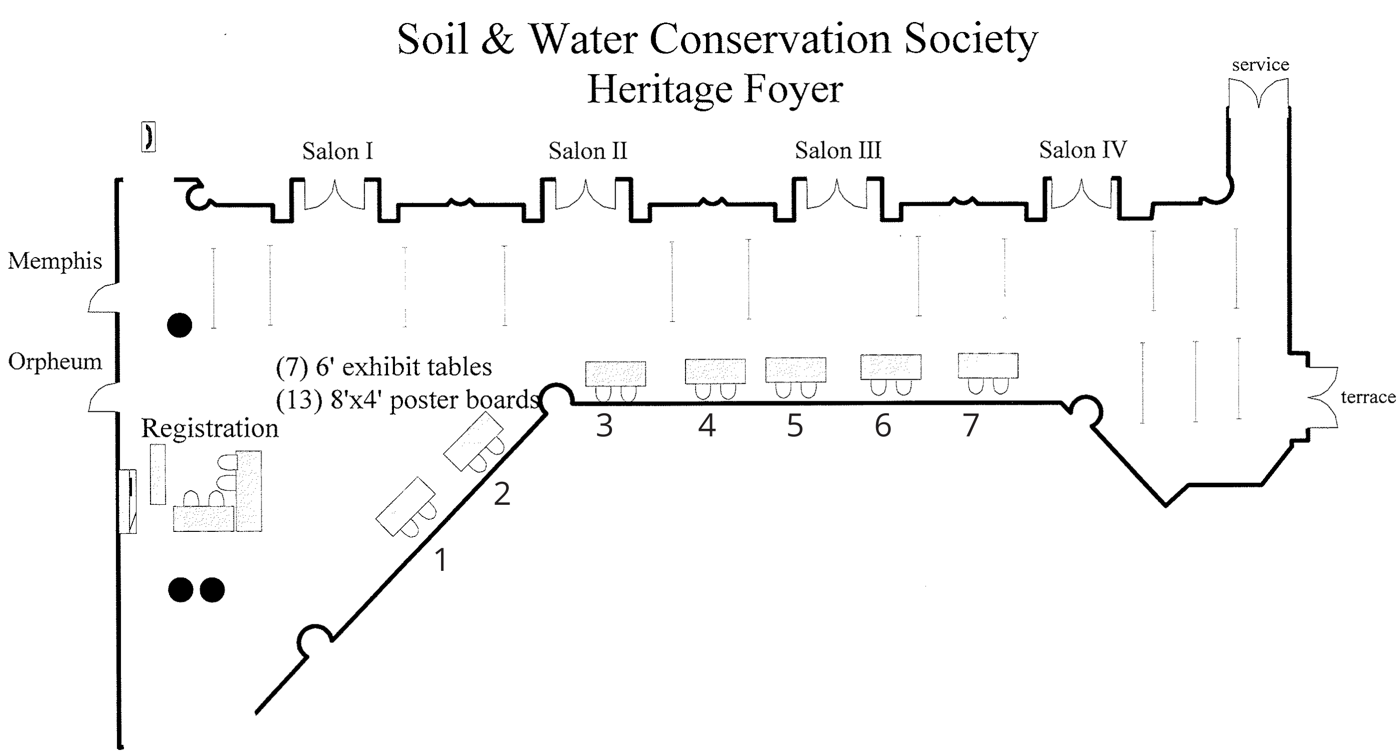
www.ads-pipe.com
Booth #6

KB SEED SOLUTIONS
Jay Brandt
jay.brandt@walnutcreedseeds.com
www.kbseed.com
Booth #7



Healthy Soils for Healthy Waters Symposium
Tuesday, December 1, 2015

WELCOME – **Randal Reeder**, The Ohio State University

Randall Reeder was an Extension agricultural engineer at The Ohio State University, retiring in 2011. He continues as president of the annual Conservation Tillage Conference, organizes conferences and field days for the Ohio No-Till Council, and writes a monthly news page for *Ohio's Country Journal*. His research and Extension programs focused mainly on conservation tillage systems and soil compaction, including crop rotation, cover crops, and drainage. He headed the group that wrote *Conservation Tillage Systems and Management* in 1992 and an expanded second edition in 2000. He coauthored a chapter on soil management for the 2007 book, *Environmental Effects of Conservation on Cropland*, published by USDA.

MEASURING AND MONITORING SYSTEMS: AN INTRODUCTION TO NUTRIENT ASSESSMENT SYSTEMS AT EDGE OF FIELD – **Andy Ward**, The Ohio State University; **Kevin King**, USDA-ARS

Andy Ward is a professor in the Department of Food, Agricultural, and Biological Engineering at The Ohio State University. He has 35 years of international experience in the areas of watershed hydrology, stream geomorphology, reservoir sedimentation, modeling hydrologic systems, drainage, soil erosion, water quality, and the development and implementation of techniques to prevent or control human impacts on water resources, streams, and drainage networks. He is a co-author of the textbook *Environmental Hydrology*. He provided leadership to the development of the two-stage ditch concept, and recent work has focused on agricultural best management practices to reduce agricultural nutrient exports to water resources.

Kevin King is a research agricultural engineer with the USDA-ARS specializing in edge-of-field research to assess the impacts of prevailing and conservation management practices on water quality. His research is at the center of efforts to understand and address phosphorus-related water quality issues in Lake Erie.

LUNCHEON WITH SPEAKER – **Kristin Weeks Duncanson**, Duncanson Growers; **Jim Moseley**, AGree

Kristin Weeks Duncanson is a partner/owner at Duncanson Growers in Mapleton, Minnesota. Duncanson Growers is a diversified family farms that subscribes to a triple bottom line approach to growing corn, soybeans, hogs, and children. She is the former chair of the Minnesota Agri-Growth, Council, former president of Minnesota Soybeans, and director at ASA. She is a consultant to K·Coe ISOM and a member of the AGree Advisory Task Force.

Jim Moseley has played a key role in developing public policy regarding agriculture, the environment, and natural resources conservation at the state and national levels. He served as deputy secretary of the USDA from 2001 to 2005, a Senate-confirmed position. In this capacity, Moseley oversaw the day-to-day activities of the USDA and served as the primary lead on the post 9/11 security needs of the food and agricultural system in the United States. While at the USDA, he also worked on international development issues, with a focus on agriculture in Afghanistan, Iraq, Africa, and Asia. His most recent activities include chairman of the Farm, Ranch and Rural Advisory committee for USEPA, steering committee member of 25 x '25, board member of Farm Safety 4 Kids, and member of the board of the Lafayette Community Foundation.

NUTRIENT MANAGEMENT AND SOIL AMENDMENTS – **Nick Goeser**, National Corn Growers Association and Soil Health Partnership; **Joe Nester**, Nester Ag

Nick Goeser is director of the Soil Health Partnership and director of Soil Health and Sustainability for the National Corn Growers Association. He is building a demonstration farm network to connect soil health with on-farm management, crop productivity, profitability, and environmental responses. Goeser has over a decade of research in the areas of crop production, nutrient cycling and management, and environmental quality. He completed a MS in agronomy and PhD in horticulture from the University of Wisconsin-Madison.

Joe Nester owns Nester Ag, LLC, an independent crop consulting company in northwestern Ohio. Nester Ag provides nutrient management plans for farmers in Ohio, Indiana, and Michigan, and primarily in the Western Lake Erie Basin. Nester also manages the Maumee Adapt Network of on-farm research and is a research partner with Ohio State on several projects. He is past board chair of the Ohio Certified Crop Advisers and is current chairman of the 4R Nutrient Stewardship Certification Program Advisory Board in Ohio.

QUALITY NO-TILL – **Forbes Walker**, University of Tennessee; **Dan DeSutter**, Indiana Producer; **Anne Paulson**, John Deere

Forbes Walker received a PhD in soil science from North Carolina State University in 1998 and since then has worked as the environmental soils specialist for the University of Tennessee Extension. He is responsible for coordinating educational and research programs in Tennessee in the areas of the areas of nutrient and manure management, the appropriate use of alternative fertilizer materials, waste utilization, nutrient cycling, and water quality. Much of his work is related to the impact of agriculture on the environment and assessing practices that will improve agricultural productivity without negatively impacting the environment, specifically water and air quality. He has received a number of grants from agencies such at the USEPA, the Tennessee Valley Authority, and the Tennessee Department of Agriculture. He currently manages several research and Extension projects looking at the impact of agriculture from the plot to field to watershed scale.

Dan DeSutter farms 4,900 acres of corn, soybeans, wheat, pasture, and cover crops in west-central Indiana. He is also a partner in Hoosier Grassfed Beef. As a 2015 Eisenhower Fellow, Dan spent two months down under studying the adoption of good soil health practices in New Zealand and Australia. In 2012, he was chosen as National No-Till Innovator of the Year. He has served his local community as past president of both the local school board and community foundation. He and his wife Barbie have two sons in college and one in high school. He is an avid pilot, snorkeler, and skier.

Anne Paulson is a solutions specialist with John Deere and is based in the Delta. Her role focuses on integrating John Deere's Precision Agriculture strategy with the dealer channel. She serves as a point person between John Deere and the dealer channel to facilitate adoption of new technologies, product, and service offerings. She has a BS in Agriculture from South Dakota State University and is in the process of getting her MS in Ag Economics from Purdue and an MBA from Indiana University. Paulson grew up on a farm in Minnesota and has been with John Deere four years.

COVER CROPS – **David Brandt**, Ohio Producer; **Mike Taylor**, Arkansas Producer

David Brandt is president of the Ohio No-Till Council. He farms 1,150 acres in Ohio's Fairfield County. He began no-till farming in 1971 and has been using cover crops since 1978. Brandt has participated in yield plots for corn, soybeans, and wheat into various covers. This information has been used to encourage other farmers to adopt no-till practices in their farming operations. He is working with The Ohio State University's Randall Reeder and Rafiq Islam on reducing input costs of fertilizers and herbicides using various cover crops. Additional research is being conducted to determine grain nutrient value of no-till with cover crops grains. He is also working with the regional NRCS soils lab in Greensboro, North Carolina, on the benefits of cover crops to improve soil health.

WATER MANAGEMENT: DRAINAGE AND IRRIGATION – **Kevin King**, USDA-ARS; **Steve Stevens**, Arkansas Discovery Farms; **Matt Helmers**, Iowa State University

Matt Helmers is the Dean's Professor in the College of Agriculture and Life Sciences and professor in the Department of Agricultural and Biosystems Engineering at Iowa State University, where he has been on the faculty since 2003. Helmers received his PhD from the University of Nebraska-Lincoln in 2003, a MS from Virginia Tech in 1997, and BS from Iowa State in 2005. His research areas include studies on the impact of nutrient management, cropping practices, drainage design and management, and strategic placement of buffer systems on nutrient export from agricultural landscapes.

Steve Stevens grew up on a row crop farm, learning from his dad at an early age to protect the land. After attending University of Arkansas, Stevens returned to the farm, growing from 1,400 to 4,800 acres. They adopted reduced tillage in the early 1980s; stale seed bed in early 1990s; and Phaucet poly pipe hole selection in 2008, saving 40% in irrigation costs. More recently, he has practiced delayed fertilizer application until crop emergence to reduce runoff.

SUMMARY THOUGHTS AND VIEWS ON ADVANCING INTEGRATED SOLUTIONS TO HEALTHY SOILS FOR HEALTHY WATERS – **Andrew Sharpley**, University of Arkansas; **Jim Moseley**, AGree

Andrew Sharpley is Distinguished Professor in the Department of Crop, Soil and Environmental Sciences, University of Arkansas, Fayetteville. His research investigates the fate and transport of nutrients in soil and water systems. He also evaluates the role of stream and river sediments in modifying phosphorus transport and response of receiving lakes and reservoirs. He works closely with farmers and action agencies, stressing the dissemination and application of his research findings and is leading an on-farm demonstration, verification, and research program to show the benefits of conservation practices that protect water quality and promote sustainability of farming systems.

BRIDGING FORWARD NUTRIENT MANAGEMENT FROM THE GULF TO THE GREAT LAKES – **Mike Daniels**, University of Arkansas; **Rebecca Power**, University of Wisconsin Extension

Mike Daniels has served Arkansas for the past 19 years as an environmental management specialist for the University of Arkansas Division of Agriculture Cooperative Extension Service. He has focused on addressing water-related issues facing Arkansas Agriculture by developing educational and training programs for agricultural professionals with emphasis on soil and water conservation, water quality, and nutrient management. He has conducted cutting-edge applied research in characterizing, quantifying, and reducing agriculture's footprint on water resources. He currently serves as co-director of the Arkansas Discovery Farm Program and co-chair of the Division of Agriculture's Environmental Task Force. He has authored over 100 educational publications, has made over 400 presentations to Extension audience, and has received more than four million dollars in grant funding to conduct applied research and develop Extension programs.

Rebecca Power is a water resource program manager at the University of Wisconsin Extension and director of the North Central Region Water Network. During her 15 years with Extension, she has developed and supported successful multistate, multidisciplinary teams to address water resource issues in the Upper Midwest and created stronger linkages between the environmental and social sciences in water resource management. She began her career with a private consulting firm restoring savannas, prairies, wetlands in the Upper Midwest, and spent eight years with the US Fish and Wildlife Service using adaptive management strategies in the conservation and restoration of savanna ecosystems.

Breakout Session Descriptions

BREAKOUT 1A – PLOT-SCALE MONITORING OF THE EFFECTIVENESS OF INDIVIDUAL WATER QUALITY PROTECTION PRACTICES

Beth Baker, Mississippi State University; **Matt Helmers**, Iowa State University; **Nathan Nelson**, Kansas State University

Beth Baker, Mississippi State University – Widespread concern for nutrient enrichment of freshwater and marine environments led to the formation of the Mississippi River/Gulf of Mexico Hypoxia Task Force, which aims to reduce riverine loads of total phosphorus (P) from the Mississippi and Atchafalaya River Basins by 45% by 2015. Efforts to identify best management practices (BMPs) to reduce nutrient loads led to funding support from the Mississippi Department of Environmental Quality (MDEQ) and US Environmental Protection Agency (USEPA) to assess BMPs on the ground in Harris and Porters Bayou, residing within the Sunflower River Watershed, which is part of the larger Yazoo River Basin. Together with partners from Mississippi State University, Delta Farmers Advocating Resource Management (FARM), the US Geological Survey (USGS), MDEQ, and USEPA, tiered monitoring of BMP efficacy for nutrient reductions was implemented in the Sunflower River Basin. Data collection and evaluation efforts focused on evaluating three types of BMP structures within the Harris and Porters Bayou watersheds that have the ability to reduce nutrient concentrations. These structures include slotted pipes, low grade weirs, and tailwater recovery system with on-farm storage reservoir. Assessment of sediment deposition and accumulation behind slotted pipes provided evidence toward the accumulation of sediment behind slotted pipes showing a clear stabilization of accumulation rate over time with an average time to reach maximum P accumulation at 396 days post-installation. These results suggest that maintenance around day 396 post-installation may improve functionality of slotted inlet pipes. Assessment of sediment deposition and accumulation behind low-grade weirs concluded that average sediment and water depth was greater upstream of weirs than at reference sites. These results suggest that weirs increase the hydrological capacity of drainage ditches and significantly retain more sediment and P in ditches with weirs within one year of construction. However, no significant differences in total P concentrations of sediments or between any P fractions were found between one-year old weirs when compared with in-ditch reference sites. Bioavailability ratios of P were also found to be similar between weir and reference sites. In general, nutrient and sediment variability was observed between sites for all water quality parameters for both routine and storm event sampling. Independent channel characteristics of each site, drainage area, and crop management regime are likely factors affecting observed variability. Routine concentrations were found to be lower than storm concentrations for all parameters, indicating that the majority of nutrient and sediment loss occurs during storm events. Assessments of nutrient and sediment reductions utilizing tailwater recovery are still ongoing.

Matt Helmers, Iowa State University – Monitoring of water quality performance of agricultural management practices at the plot scale is critical to determining which practices hold greatest potential for providing water quality improvement. For certain practices, monitoring surface runoff is critical, and for others, monitoring leaching is critical. This will presentation will discuss some of the challenges and opportunities of water quality monitoring at the plot scale. Discussion of surface and subsurface flow monitoring will be included.

Nathan Nelson, Kansas State University – There are economic and management benefits to fall, surface fertilizer applications. However, surface-applied phosphorus (P) fertilizers can increase the risk of P loss to surface waters, which contributes to eutrophication and water quality degradation. The objective of this study is to determine the effects of cover crop and fertilizer management on P loss in surface runoff. A 2 x 3 factorial experiment with three replications was established with two levels of cover crop (with and without) and three levels of P fertilizer management (no P, fall surface broadcast P, and spring injected P). Treatments were applied to 18 watersheds (~0.5 ha each) in a corn–soybean rotation equipped with 0.46 m H-flumes and automated water samplers. A cover crop was planted in November of 2014 and terminated at corn planting in April of 2015. Management prior to cover crop planting was conventional tillage. Results are from the first year of a five-year study. The October of 2014 to October of 2015 water year had a dry winter followed by a very wet spring and summer with 12 runoff events. Although cover crop growth was below average, the cover crop reduced runoff by 17%, total sediment loss by 58%, and total P loss by 40%. Fertilizer management did not affect runoff, sediment, or total P loss. However, there was a significant fertilizer by cover crop interaction that influenced dissolved P (DP) concentration and loss. On plots without a cover crop, DP concentration was 10 times greater from surface-applied P fertilizer. The cover crop reduced DP concentration by 40% and DP load by 45% in the surface-broadcast treatment, but did not affect DP concentration or load in other fertilizer treatments. These results show that cover crops may be an effective method of reducing DP losses from surface-applied fertilizers in conventional tillage corn systems. Additional data are needed to confirm treatment effects during all phases of the cropping system and with different precipitation patterns.

BREAKOUT 1B – APPLYING EDGE OF FIELD MONITORING PROJECTS, PRACTICE EFFECTIVENESS, AND RESULTS TO MEET WATER QUALITY PROTECTION POLICY AND GOALS

Lisa Duriancik, USDA-NRCS; **Ali Saleh**, Tarleton State University; **Mark Tomer**, USDA-ARS

Lisa Duriancik, USDA-NRCS – USDA Natural Resource Conservation Service (NRCS), in partnership with the USDA Agricultural Research Service (ARS), National Institute of Food and Agriculture (NIFA), Farm Service Agency, and National Oceanic and Atmospheric Administration (NOAA) as well as other collaborators, established a national network of smaller scale watershed assessment studies in 2004 to assess the effects of conservation. The Conservation Effects Assessment Project (CEAP) Watershed Assessment Studies have focused on documenting the measureable effects of conservation on water and soil resources and on building the science base for more effective conservation. In 2008, CEAP Watersheds added a goal of developing and applying knowledge to support better management of agricultural watersheds, described as "translating science into practice." Now, new scientific and technical findings based on these assessments have yielded numerous insights into conservation practices and effects, watershed planning, program design and assessing outcomes to address policy goals. Significant efforts have been made to synthesize key lessons learned among CEAP Watersheds and summarize and extend those insights to practitioners and decision makers. There has been effort across NRCS to share these key findings with staff and partners and begin to apply them. Collaboration with the NRCS staff on water quality-focused initiatives, programs, and practices have focused on several areas of support to translate CEAP science into practice:

1. Assessing outcomes of conservation efforts and investments in small watersheds
2. Documenting success to enhance understanding and communication of conservation benefits
3. Targeting for effective watershed water quality conservation
4. Identifying challenges to more effective conservation and informing new strategies
5. Improving conservation practices or application to address gaps
6. Developing and evaluating approaches to support targeted watershed conservation planning

These topics will be discussed, and examples will be provided of how CEAP Watersheds' monitoring and assessment insights have been and are being used to address conservation needs, program design and delivery, and policy goals.

Ali Saleh, Tarleton State University – The Nutrient Tracking Tool (NTT) is an enhanced version of the Nitrogen Trading Tool, an earlier model that was developed by the USDA. NTT provides farmers, government officials, researchers, and others an efficient, web-based, and user-friendly method of evaluating the impacts of proposed and existing conservation practices (CPs) on water quality and quantity. In addition to cultural or nonstructural practices (e.g., nutrient management), commonly used structural CPs, such as filter strips, grassed waterways, cattle exclusion, terraces, and wetlands, can be evaluated in NTT with a few key strokes after selecting the user's field of interest. NTT estimates the impacts of each practice, or combination of practices, on sediment losses, nutrient losses, and runoff, as well as farm production indicators such as crop yield. Through its interface with the Agricultural Policy Environmental eXtender (APEX) model, NTT simulates all CPs using rigorous algorithms while providing the user with a simple interface to access the results. The latest version of NTT (www.nn.tarleton.edu/nttg2) will be demonstrated during this meeting.

Mark Tomer, USDA-ARS – Monitoring at the edge of farm fields can too easily provide data of limited utility, due to inherent constraints associated with site-specificity of observations and their variability, as well as conservation practice selection. Also, the need to pair observations to compare runoff volumes and pollutant losses between treated and non-treated agricultural land with statistical validity makes monitoring expensive in terms of financial cost and time. Beyond the topic of edge of field monitoring, we have also recognized that no single practice will enable us to meet our water quality goals in watersheds and that we will need to identify strategies to use conservation practices in combination to be successful. Knowing all this, can we afford to monitor conservation effectiveness by a "one practice in one place at one time" approach? For several important reasons, the answer appears to be "no." This presentation will present an experimental design to evaluate the effectiveness of paired practices, and the interaction of their effectiveness, that can be applied at field and small watershed scales. With careful evaluation of conservation opportunities at regional (major land resource area [MLRA]) scales, practices appropriate for pairing in distinct landform regions could be selected for targeted evaluation, in replicated fashion. This presentation will describe this experimental approach and suggest use of the Agricultural Conservation Planning Framework to implement it. While the likelihood of success of this approach to inform regional planning and policy is not guaranteed, its utility can be tested statistically.

BREAKOUT 1C – IMPORTANCE OF EDGE OF FIELD MONITORING TO EFFECTIVE PRACTICE SYSTEM AND PROJECT IMPLEMENTATION: CASE STUDIES

Warren Dick, The Ohio State University; **Lori Krider**, University of Minnesota; **Steve Stevens**, Arkansas Discovery Farm Program; **Andrew Sharpley**, University of Arkansas

Warren Dick, The Ohio State University – Reductions in soluble phosphorus (P) concentrations have been found to be associated with the addition of calcium (Ca), as gypsum, to the soil. Soluble P concentrations were measured in surface and tile flow water from paired fields treated with or without gypsum. Eight paired sites were included in our study. Measurement of soluble P concentrations from fields with/without gypsum began in May of 2012. There was a clear trend for reduced P concentrations from fields treated with gypsum. The initial results showed reductions that ranged from about 18% to 79%. After three years, the average reduction in soluble P concentrations across all paired sites was 31%. The effect of gypsum on soluble P concentrations declined with time. Plotting soluble P concentrations (y-axis) versus days since gypsum was applied to a field (x-axis) yielded a regression coefficient of 0.02063 (significant at the $p < 0.04$ level). The best-fit equation of a line to the data was $y = 43.85 - 0.02063x$, where y is the percentage reduction in soluble P concentration and x is the number of days since gypsum application. This implies that for each day post-gypsum application, soluble P concentrations affected by gypsum application were reduced by 0.021%. After 100 days, the gypsum effect on soluble P concentrations in tile drainage water is reduced by 2.1%, and after 1,000 days, the gypsum effect is reduced by 21%. Thus, although the gypsum effect wanes with time, it is still evident even three years after application.

Lori Krider, University of Minnesota – Water quality across the state is under increased threat as land use and hydrologic pathways are altered to accommodate a growing population. Many watersheds are highly impacted by human influences, particularly by agriculture in the south and west as well as the urban/suburban areas throughout the state. Problems such as erosion and nutrient pollution in southern Minnesota negatively affect human and natural systems. Restoration and protection are the driving forces behind improving water quality. Strategic placement of in-field best management practices (BMPs) to mitigate water quality impacts is of utmost importance. The Board of Water and Soil Resources is developing a plan to prioritize watersheds for selection of focused efforts with the assistance of GIS-generated data. A combination of in-field BMPs as part of a treatment train approach will be most effective at improving water quality. In southern Minnesota, examples from the Cedar River Watershed in Mower County include the Mullenbach Two-Stage Ditch and Dobbins Creek. Methods and results of some of these studies give insight into the feasibility and effectiveness of this approach.

Steve Stevens, Arkansas Discovery Farm Program – Cotton farmers are under increasing pressure to operate with environmental sustainability from environmental groups and retailers alike. To help agricultural producers address natural resource concerns, the University of Arkansas Division of Agriculture in conjunction with many stakeholder groups established a Cotton Discovery Farm in 2013 on the CB Stevens farm in Desha County. This program utilizes a unique approach based on economic and environmental data from real, working farms to better define sustainability issues and find solutions that promote agricultural profitability and natural resource protection. Four fields in cotton and corn rotations were selected for monitoring the quantity and quality of both inflow (precipitation and irrigation) and outflow (runoff). At the lower end of each field, automated runoff water quality monitoring stations were established to (1) measure runoff flow volume, (2) to collect water quality samples of runoff for water quality analysis, and (3) measure precipitation. In addition, tools, such as the Field to Market Alliance for Sustainable Agriculture FieldPrint Calculator, were utilized to better understand on-farm sustainability. Total nitrogen (N) loss during the growing season ranged from 1% to 6% of total N applied as fertilizer in runoff, while phosphorus (P) losses were similar across fields at 2% of total P applied as fertilizer. Nutrient loss data and results from the FieldPrint calculator from all three years will be presented. The producer will provide perspective on the usefulness of this data in making management decisions.

Andrew Sharpley, University of Arkansas – Programs that have monitored nutrient runoff following implementation of conservation practices over the last decade have yielded valuable information on the effectiveness of these practices to reduce nutrient runoff (nitrogen [N] and phosphorus [P]), primarily at an edge of field scale. Further, studies have shown that while some practices can reduce the potential for P loss, some can increase that risk. For instance, measures that promote soil organic matter increase via no-tillage can stratify P at the soil surface unless nutrient application methods are adapted, which can in turn increase P runoff risk. Similarly, land drainage to increase or expand grain production can create new source areas directly linked to a water course. Plus, there is the continued concern that P management must be considered in conjunction with N and that watershed strategies should be directed at both and not one or the other. Even though we can show overall reduction in edge-of-field loss of P following targeted implementation of conservation practices, these losses are not always translated to a decrease in watershed-scale export of P. More information is now becoming available that demonstrates how the legacy effect of past management and P stored in soil and fluvial systems can become a long-term source of P. The transition from P sink to P source can, in some cases, mask conservation effects at a watershed scale. From what we have learned, a balanced P input-output production system is ideal and should be a long-term goal of agricultural production strategies. In reality, this may not be achieved for socioeconomic, political, and food demand reasons. Thus, an emphasis should be placed on ensuring natural sinks for P (e.g., buffers, wetlands, and deep soils) are managed in a way that either extends their functionality of factors in conservation to mitigate them becoming future sinks or hot spots of P loss.

BREAKOUT 2A – FIELD-SCALE EDGE OF FIELD MONITORING OF SURFACE AND SUBSURFACE WATER QUALITY

Dennis Busch and **Randy Mentz**, University of Wisconsin-Platteville; **Bill Crumpton**, Iowa State University; **Michele Reba**, USDA-ARS

Dennis Busch and Randy Mentz, University of Wisconsin-Platteville – Conservation practices are implemented within agricultural fields, and knowledge of conservation impacts on water quality are incomplete without monitoring at the individual field scale. To determine the export of sediment and/or nutrients at the field scale, accurate measurements of both discharge and concentration must be obtained at the edge of the field. A widely used conventional method of monitoring edge of field runoff involves the use of a pre-fabricated fiberglass h-flume, datalogger, refrigerated sampler, stage sensor, and enclosure. This system provides a high degree of flexibility and very good accuracy; however, it also requires experienced, technically skilled staff to operate. The high capital and labor costs prevent conventional systems from being widely deployed. Recently, with support from the USDA-NRCS Conservation Innovation Grant (CIG) program and Wisconsin Department of Natural Resources, low-cost prototype edge of field runoff monitoring equipment has been developed, installed, and evaluated under field conditions in multiple areas of the Mississippi River Basin. Key components of the prototype systems include a low-cost microcontroller/logger, submerged flow detection, redundant data and power systems, a passive sampler, an integrated flume heater (expedite station preparations for snowmelt monitoring), and a larger enclosure for ease of access and use. The goals of field-testing activities include the following:

1. Installation, maintenance, and operation of prototype gauging stations at multiple locations within the Mississippi River Basin
2. Evaluation of individual gauge components (e.g., logger, sensor, and sampler)
3. Comparison of discharge and load estimates of the prototype gauge to that of a conventional gauging station
4. Qualitative evaluation the functionality of the gauge in differing landscapes across the region
5. Suggestions for improvements to the prototype gauge based on the results of the quantitative and qualitative evaluations

The presentation will discuss preliminary results regarding functionality of prototype hardware under varying field conditions.

Bill Crumpton, Iowa State University – Wetland restoration is a promising strategy for reducing surface water contamination in agricultural watersheds and in particular for reducing agricultural nitrate loads to the Mississippi River and its tributaries. Over the past 10 years, more than 70 wetlands have been restored through the Iowa Conservation Reserve Enhancement Program (CREP) with the explicit goal of intercepting and reducing nonpoint source nitrate loads, and we have measured the nitrogen (N) mass balances of a selected subset of these wetlands. Our goals were to evaluate the effectiveness of wetlands at reducing agricultural, nonpoint source N loads and to develop models for predicting wetland performance at scale and in combination with other practices. The monitored wetlands were selected to ensure a broad spectrum of major external forcing functions affecting wetland performance including hydraulic loading rate, residence time, nitrate concentration, and nitrate loading rate. Nitrogen loads to the wetlands were primarily in the form of nitrate, and all of the wetlands were effective in reducing both nitrate and total N loads. Nitrate removal efficiency (expressed as annual percentage mass removal) ranged from 8% to 91% and was primarily a function of hydraulic loading rate and temperature. Mass nitrate removal ranged from 120 to 2,800 kg N ha y^{-1} and was primarily a function of hydraulic loading rate, temperature, and nitrate concentration. Our results demonstrate that wetlands can be effective sinks for nonpoint source nitrate loads across a wide range of conditions and that performance can be reasonably predicted based on hydraulic loading rate, temperature, and nitrate concentration. We extended these results to project statewide nitrate load reductions for Iowa using a combination of nutrient management and targeted wetland restorations. Our analyses suggest that targeted wetland restorations will be critical to achieving a 45% reduction in annual nitrate load for Iowa.

Michelle Reba, USDA-ARS – Modeling of the Lower Mississippi River Basin indicated that yields of suspended sediment, total phosphorus (P), and total nitrogen (N) were higher than in other river basins in the United States. The objective of this study was to improve our understanding of water quality runoff from production-sized fields of soybean, rice, and cotton under typical production practices in the Midsouth. Six fields (16 to 30 ha) were instrumented to measure discharge and collect water samples during both precipitation and irrigation events. Dissolved PO_4, NO_3, and NO_2 and suspended sediment concentration were analyzed. Findings were linked to production management and event timing. Dissolved PO_4 values were greater in cotton and coincided with greater application rates of this fertilizer. Dissolved NO_3 values were greater in rice and dominated by large individual events linked to management and precipitation events. Findings are confined to the sites measured but provide site-specific support to incorporate improved water management and the use of cover crops. Uncertainty is inherent in field measurements of this type and was estimated between 11.6% and 18.2%.

BREAKOUT 2B – DO EDGE OF FIELD MONITORING RESULTS INFORM, SUPPORT, AND IMPROVE THE PREDICTIVE MODELS FOR WATER QUALITY PROTECTION?

Jane Frankenberger, Purdue University; **Daren Harmel**, USDA-ARS; **Scott Manley**, Ducks Unlimited

Jane Frankenberger, Purdue University – Watershed-scale models like the Soil and Water Assessment Tool (SWAT) simulate hydrologic and nutrient processes in field-scale hydrologic response units and aggregate the outputs in subbasins and watersheds. Although some individual process algorithms and parameters have been thoroughly evaluated, others have been programmed into the model based on theory with little field testing. Edge of field measurements are critical for testing and improving these process simulations so that good predictions at the watershed scale are not based on simulations that poorly represent the actual processes at the field scale. This presentation will discuss the need for testing with edge of field data, show how to use such data in SWAT, and provide an example for subsurface tile drainage.

Daren Harmel, USDA-ARS – Models are increasingly used to make on-farm management decisions and support national agricultural policy formulation, as well as predict the resulting impacts. This presentation will discuss several related topics focusing on how monitoring can and should be used to support and improve hydrologic and water quality (H/WQ) modeling. First, practical guidance on small watershed monitoring to achieve sampling goals and produce high quality data within financial, personnel, time, and watershed constraints will be discussed. The uncertainty in measured H/WQ data will also be presented along with its impact on model evaluation, research (data reporting), policy, and regulation. Then, the "Measured Annual Nutrient loads from Agricultural Environments" (MANAGE) database will be described. MANAGE is the only known near-comprehensive compilation of measured load and concentration data from agricultural and forest lands, and it continues to be used in modeling projects and meta-analyses. Finally, the relationships between and deficiencies of measured data and model predictions will be discussed and recommendations will be made on how to use both to support decision making.

Scott Manley, Ducks Unlimited – The ability of water resources to support aquatic life and human needs depends, in part, on reducing nonpoint source (NPS) pollution amid contemporary agricultural practices. Winter retention of shallow water on rice and other agricultural fields is an accepted management practice for wildlife conservation, and now soil and water conservation benefits are well documented. In the late 1990s we evaluated the ability of four post-harvest rice field treatment combinations (stubble-flooded, stubble-open, disked-flooded, and disked-open) to abate NPS exports into watersheds of the Mississippi Alluvial Valley (MAV). Total suspended solid (TSS) exports were 1,121 kg ha^{-1} from disked-open fields where rice stubble was disked after harvest and fields allowed to drain, compared with 35 kg ha^{-1} from stubble-flooded fields where stubble was left standing after harvest and fields captured rainfall from November 1 to March 1. Using GIS/remote sensing techniques, we extrapolated these field results to estimate landscape effects. Estimates of TSS exports from rice fields based on Landsat imagery and USDA crop data are 0.43 and 0.40 Mg km^{-2} d^{-1} in the Big Sunflower and L'Anguille watersheds, respectively. Estimated reductions in TSS exports from rice fields into the Big Sunflower and L'Anguille watersheds range from 26% to 64% under hypothetical scenarios in which 65% to 100% of the rice production area is managed to capture winter rainfall. Since the time of our research, numerous USDA conservation programs have adopted practices to hold winter runoff on agricultural fields for multiple benefits: wildlife, water quality, and flood abatement. We speculate on future progress where landscape water management can address additional resource concerns such as conserving water quantity and reducing greenhouse gas emissions.

BREAKOUT 2C – FARMER MOTIVATION AND DECISION MAKING TO IMPLEMENT WATER QUALITY PROTECTION PRACTICES

Linda Prokopy, Purdue University; **Amber Radatz**, Wisconsin Discovery Farms Program

Linda Prokopy, Purdue University – Participants will hear results from Prokopy's research group about what motivates farmers to adopt conservation behaviors. She will discuss the types of watersheds where programs are likely to succeed and how to get individual farmers to adopt practices once a watershed is selected. Specifically, she will discuss the importance of environmental attitudes, networks, and including the retail sector as trusted partners. She will include some preliminary results from a recent survey on the effectiveness of demonstration projects in the agricultural sector.

Amber Radatz, Wisconsin Discovery Farms Program – The University of Wisconsin Discovery Farms Program enlists Wisconsin farmers as research partners to understand and address agriculture's impact on water quality. Discovery Farms conducts field-scale water quality research on privately owned Wisconsin farms to identify management practices that mitigate water quality impacts. The program has partnered with dozens of farmers for over a decade, working with them to enhance farm profitability and environmental sustainability. Currently, the Discovery Farms Program is working with 60 farmers in two watersheds and 20 additional farmers in two more areas as part of a nitrogen use efficiency project. Both projects are specifically geared toward implementing conservation and nutrient stewardship practices. Farmers in the watershed projects have implemented over 40 suggested changes over the past two years that have affected nearly 4,000 acres. The program is also conducting surveys and focus groups to further measure impact. Discovery Farms is farmer-driven and nationally renowned for its ability to get farmer buy-in by having a strong understanding of agricultural communities and respect for professional agriculturists. Statewide, the program has prompted changes in practices such as manure management, cover crop use, conservation practices and tillage systems, and nutrient management. On-farm monitoring data, along with an explanation of what it means; a description of possible tweaks; and committing to partnering on the evaluation of changes motivates farmer partners to try new things. However, not every farm can have a monitoring site. For those without a monitoring site, farmer-to-farmer interaction, one-on-one engagement, and content crafted specifically for them is crucial. Educational materials are developed specifically with farmers in mind and undergo a farmer peer-review process prior to release to make sure messaging is effective and the tone and diction are appropriate. The program priorities are to build relationships on respect, clear and consistent communication, and trust first, and conduct research second.

BREAKOUT 3A – SCALE MATTERS: ASSESSING THE BENEFITS OF AGRICULTURE PRACTICES FROM THE FIELD TO THE WATERSHED

Claire Baffaut, USDA-ARS, Missouri; **Kevin King**, USDA-ARS; **Shannon Zezula**, USDA-NRCS

Claire Baffaut, USDA-ARS – In many watersheds, monitoring at the outlet of small watersheds has not been able to demonstrate that conservation efforts have had any impact on stream water quality. Reasons are multiple, including legacy issues, time for the conservation practices to have any benefit, temporal variability of weather, and lack of replicates. Multiscale monitoring may be one strategy to help identify the benefits. The objective of this presentation is to present monitoring efforts at the plot (0.34 ha), field (~35 ha), and small watershed scale (7,200 ha) and show how they, along with some modeling, can help demonstrate impacts of management practices on sediment and nutrient transport. Weather, management, and soil properties were very well known at the plot scale and replicates allowed statistical analysis. At the field scale, weather, management, and soil properties were well known, but no replicate was available. Interpretation of monitoring data at the watershed scale was affected by the lack of information and control on land use and land management in the watershed. However, simultaneous consideration of monitoring data at multiple scales helped demonstrate the effect of cover crops and no-till on flow, sediment, and dissolved nutrient transport. Similarly, we will show how simultaneous consideration of monitoring data on chemical transport helps scale conclusions obtained at the plot scale to larger drainage areas. The presentation will also touch on the challenges of year-round monitoring and data management.

Kevin King, USDA-ARS – Excess nutrients continue to affect and plague many water bodies across the globe, leading to hypoxic zones and harmful and nuisance algal blooms (HNABs). Much emphasis and focus has been on the role agriculture plays in contributing to this eutrophication. The first step in understanding the role of agriculture in the transport of nutrients is to quantify the edge of field (EOF) impacts of agricultural practices. A network of edge of field research stations was established in Ohio to quantify the impacts of different agricultural management practices and assess the benefits of best management practices. Twenty paired surface and subsurface (tile) locations were instrumented with control volumes and automated samplers. The sites are representative of production agriculture in the Eastern Corn Belt. The paired approach permits the assessment of single or stacked practices using a before-after, control-impact (BACI) design. Discharge and water quality samples are collected year round. In this tile-drained landscape, a larger proportion of water and nutrients are transported through the tile than the surface. To date, the EOF data suggests that the following strategies offer the greatest potential for reducing eutrophication: (1) soil testing and fertilizer application recommendations adhering to soil tests, (2) disconnection of hydrologic pathways, (3) subsurface placement of nutrients, and (4) timing of the nutrient applications when large rainfall events are minimal.

Shannon Zezula, USDA-NRCS – Previous attempts to document water quality improvements from agricultural conservation practices at the watershed scale have proven difficult due to insufficient baseline data; incomplete separation of agricultural influences from non-agricultural sources; inadequate sampling duration and intensity to account for "lag time;" seasonal influences and storm events; annual and permanent changes to land use management; and insufficient adoption of complete conservation systems within watersheds. A collaboration of federal, state, local, and academic entities, along with dedicated conservation-minded farmers, offers a unique monitoring opportunity to assess the chemical, physical, and biological impacts of conservation practices at the watershed, subwatershed, and edge of field scales in the School Branch watershed (Hendricks County, Indiana). The project will measure water quality associated with conservation cropping systems that improve soil health in predominantly corn and soybean row crop agriculture. The data collected in this watershed will allow evaluation of how production agriculture can complement sustainable water resources. Streamflow and groundwater levels are being measured; stream water and edge of field surface runoff and subsurface flows are monitored for nitrogen (N), phosphorus (P), and suspended sediment; and groundwater is monitored for N and P. Supplementary biological indicators are used to evaluate factors affecting water quality. Nutrient source tracking from field, in-stream bed and bank, and residential sources, and sediment characteristic analyses are conducted. Soil moisture, water-holding capacity, and nutrient content parameters are measured. From this level of intense data collection, partners will evaluate the water quality associated with complete conservation cropping systems from other agricultural and nonagricultural sources of sediment and nutrients.

BREAKOUT 3B – CAN WATER QUALITY PRACTICES AND STATE NUTRIENT REDUCTION STRATEGIES MEET NUTRIENT REDUCTION GOALS FOR PROTECTION, TMDL, GREAT LAKES, AND GULF OF MEXICO WATER QUALITY GOALS?

Kevin Fermanich, University of Wisconsin-Green Bay; **Matt Lechtenberg**, Iowa Department of Agriculture and Land Stewardship; **Douglas R. Smith**, USDA-ARS

Kevin Fermanich, University of Wisconsin-Green Bay – The Lower Fox River (LFR) Basin and Lower Green Bay total maximum daily load (TMDL) focuses on waters impaired by excessive sediment and phosphorus (P) that originate from both point and nonpoint sources. Point sources of P currently represent <20% of the total load at the Fox River outlet. Dairy agriculture in the LFR Basin is a primary source of P entering the river and bay. To meet restoration goals, a target P load reduction of ~43% was identified. Multiscale monitoring shows that the Wisconsin P-Index-based nutrient management strategy alone will not meet nutrient reduction goals. However, watershed modeling of reducing and stabilizing soil P levels to agronomic needs shows that total P export from the Fox River could be reduced by 9% to 35%. Combining reduced soil P with conservation tillage and cover crops on all agricultural land in the basin has the potential to reduce P by 44%. Targeting a suite of practices to high P-yielding watersheds within the basin will result in only about a 23% reduction in P. Confounding the potential success of nutrient reduction strategies is the reality that, on average, more than 65% of the annual P load occurs during less than 14 days a year. In addition, the LFR basin is vulnerable to high P export when weather conditions are suboptimum (risky) during annual manure land application time. If we are to progress toward meeting restoration goals, it is critical that watershed managers and stakeholders continue to devise comprehensive programs and implementation strategies that reduce vulnerabilities and minimize risks, not only during high runoff times of the year, but also during years with significant weather constraints for dairy agriculture operations. Several current initiatives within the LFR Basin are moving us in the right direction. These include usage of annual cover crops, adoption of reduced tillage, intensive soil testing and nutrient management, conversion of row crops/confined cattle to managed grazing, and more perennial vegetation. The extent of implementation will be key to reaching restoration goals.

Matt Lechtenberg, Iowa Department of Agriculture and Land Stewardship – Since release of the Iowa Nutrient Reduction Strategy (NRS) in May of 2013, the Iowa Department of Agriculture and Land Stewardship (IDALS) and stakeholders have continued to advance implementation efforts to addressing the goal of the Hypoxia Task Force (HTF). Lechtenberg will describe the process and illustrate the “Logic Model” approach Iowa is taking in order to document and show progress of the collective effort of both point and nonpoint sources in meeting the HTF goal.

Douglas R. Smith, USDA-ARS – Many conservation organizations have attempted to find the “silver bullet” that will solve the nonpoint source water quality problems watersheds. No estimates of conservation adoption have shown that a single practice, or even a single set of practices, within agricultural fields will solve the nutrient/sediment loading problems in disturbed watersheds.

BREAKOUT 3C – TRAINING NATURAL RESOURCE PROFESSIONALS TO ORGANIZE WATERSHED PROJECTS AND ENGAGE FARMERS

Ann Lewandowski, University of Minnesota; **Jamie Benning**, Iowa State University; **Jennifer Filipiak**, American Farmland Trust

Management of water resources at a watershed scale relies on the effectiveness of local staff and leaders. Individuals taking on these roles must not only have expertise in the natural sciences, but must have skills in policy, leadership, administration, communication, and collaboration. They must be able to integrate these skills to solve problems and have access to peers who are also learning and adapting to changing management conditions. Finally, in agricultural watersheds, their communication and collaboration skills must be tailored to engage farmers as leaders or co-leaders of watershed projects. Natural resource professionals have access to a broad range of training and professional development opportunities, but few are tailored to meet their unique needs. Land grant universities and nongovernmental organizations (NGOs) are delivering watershed education and leadership training aimed at building core skills for professionals leading and facilitating watershed projects. This panel will share insights from several existing training programs in the Midwest, discuss methods for linking professional development and policy implementation, and share best practices for engaging farmer leaders developed through a peer-to-peer “community of practice”—Leadership for Midwestern Watersheds.

Ann Lewandowski, University of Minnesota – Online delivery has been an important training mode to meet the needs of working professionals dispersed across a state, but it has required trainers to examine how to best use online tools in conjunction with more traditional training modes. Lewandowski’s presentation will discuss core skills and competencies that are essential in becoming a successful watershed leader; how four universities have approached this training; and how to effectively use various training methodologies, especially distance learning approaches.

Jamie Benning, Iowa State University – The Iowa Watershed Academy is in the early phases of development and seeks to increase the effectiveness and success of watershed projects in Iowa. As watershed-based projects increase in Iowa to implement the Iowa Nutrient Reduction Strategy and address local water quality improvement, the need for training opportunities for watershed coordinators and other technical specialists has also increased. Benning will describe how, through facilitated discussions among water quality and conservation professionals and discussions and surveys of current watershed project coordinators, priority topics for the Iowa Watershed Academy were identified. Topics include project management, project effectiveness measurement tools, agronomics, outreach and education planning, and development of evaluation plans. Full program development will build on identified needs and ongoing assessments with project coordinators, water quality and conservation leaders, and partner organizations in Iowa.

Jennifer Filipiak, American Farmland Trust – Training and learning never really stops. Filipiak will discuss methods for ongoing peer-to-peer learning and provide a case study on the Leadership for Midwestern Watersheds (LMW) community of practice. The LMW group has met annually since 2010 to discuss and summarize current best practices regarding some of the more vexing topics of watershed management, such as measuring effectiveness, leading diverse partnerships, and engaging farmer leaders. Filipiak will specifically discuss common best practices of engaging farmers in agricultural watershed projects.

Plenary Session Speakers

Ann Bartuska is the deputy undersecretary for USDA's Research, Education, and Economics (REE) mission area. She comes to REE from the USDA Forest Service, where she was deputy chief for Research and Development, a position she has held since January of 2004. She served as acting USDA deputy undersecretary for Natural Resources and Environment from January to October of 2009, and was the executive director of the Invasive Species Initiative in the Nature Conservancy. Prior to this, she was the director of the Forest and Rangelands staff in the Forest Service in Washington, DC. She is an ecosystem ecologist with degrees from Wilkes College (BS), Ohio University (MS), and West Virginia University (PhD).

Dennis Dimick serves as executive environment editor at *National Geographic* magazine. He has guided creation of several major projects including an April of 2010 issue on global freshwater, a 2011 series called "7 Billion" on global population, and the 2014 Future of Food series on global food security. In September of 2004 he originated and orchestrated creation of a 74-page, three-story project on climate change called "Global Warning: Bulletins from a Warmer World." Dimick co-organized the Aspen Environment Forum from 2008 to 2012 and regularly presents lectures on global environmental issues. He holds degrees in agriculture and agricultural journalism from Oregon State University and the University of Wisconsin-Madison. For 17 years he has been a faculty member of the Missouri Photo Workshop, and in 2013 he received the Sprague Memorial Award from the National Press Photographers Association for outstanding service to photojournalism.

Lisa Duriancik is the leader for the Watershed Assessment Studies Component of the Conservation Effects Assessment Project (CEAP) in USDA-NRCS. She provides national leadership for a network of watershed-scale projects in CEAP to assess the effects of conservation on water and soil resources at the watershed scale and works closely with research partners and agencies. Duriancik has coordinated activities in CEAP for the last eight years and has over 20 years of experience conducting research or leading national programs for water quality, availability, and soils.

Katie Flahive is an agricultural engineer with the Nonpoint Source Control Program at USEPA headquarters. She works with federal, state, nonprofit, and industry partners that research, develop, implement, track, and measure the results of voluntary and/or incentive based controls to improve water quality in agricultural and rural areas.

Ellen Gilinsky has served since 2011 as the senior policy advisor for the Office of Water at the USEPA. In this position, Gilinsky addresses policy and technical issues related to all EPA water programs, with an emphasis on science, water quality, and state programs. Prior to this appointment she spent seven years as the director of the Water Division at the Virginia Department of Environmental Quality (DEQ), where she supervised a diverse array of water quality and quantity programs. She also served for five years at DEQ as manager of the Office of Wetlands and Water Protection, helping to craft Virginia's nontidal wetlands regulations and permitting program. In addition, Gilinsky has 12 years of experience as an environmental consultant at several regional and national environmental engineering firms, focusing on water issues. She received her BA in biology from the University of Pennsylvania and her PhD in zoology, with a concentration in aquatic ecology, from the University of North Carolina at Chapel Hill.

Kevin King is a research agricultural engineer with the USDA-ARS specializing in edge of field research to assess the impacts of prevailing and conservation management practices on water quality. His research is at the center of efforts to understand and address phosphorus-related water quality issues in Lake Erie.

Matthew Lechtenberg works as the Water Quality Initiative (WQI) coordinator for the Iowa Department of Agriculture and Land Stewardship (IDALS). Lechtenberg manages implementation activities of the Iowa Nutrient Reduction Strategy (NRS). He has been with IDALS since 2006, working on various watershed projects and managing the Iowa Conservation Reserve Enhancement Program (CREP) and Integrated Farm and Livestock Management (IFLM) fund. Prior to working for IDALS, he earned his degree from Iowa State University in agricultural systems technology with an environmental emphasis.

Jim Moseley has played a key role in developing public policy regarding agriculture, the environment, and natural resources conservation at the state and national levels. He served as deputy secretary of the USDA from 2001 to 2005, a Senate-confirmed position. In this capacity, Moseley oversaw the day-to-day activities of the USDA and served as the primary lead on the post 9/11 security needs of the food and agricultural system in the United States. While at the USDA he also worked on international development issues, with a focus on agriculture in Afghanistan, Iraq, Africa, and Asia. His most recent activities include chairman of the Farm, Ranch and Rural Advisory committee for USEPA, steering committee member of 25 x '25, board member of Farm Safety 4 Kids, and member of the board of the Lafayette Community Foundation.

Deanna Osmond was trained as an anthropologist, agronomist, and soil scientist at Kansas State, North Carolina State, and Cornell universities. For over 20 years she has worked at the interface of nutrient management, conservation practices, and water quality. Her research and extension programs span scales—field to watershed—and topics—riparian buffer effectiveness to farmer decision making.

Andrew Sharpley is Distinguished Professor in the Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville. His research investigates the fate and transport of nutrients in soil and water systems. He also evaluates the role of stream and river sediments in modifying phosphorus (P) transport and response of receiving lakes and reservoirs. He works closely with farmers and action agencies, stressing the dissemination and application of his research findings and is leading an on-farm demonstration, verification, and research program to show the benefits of conservation practices that protect water quality and promote sustainability of farming systems.

Mark Tomer is a research soil scientist with the National Laboratory for Agriculture and the Environment (NLAE) of the USDA-ARS in Ames, Iowa. Tomer is lead scientist for watershed research at NLAE; he has served on ARS's Leadership Team for the Croplands Conservation Effects Assessment Project (CEAP), and led the development of the Agricultural Conservation Planning Framework, a GIS-based approach for precision conservation planning in watersheds.

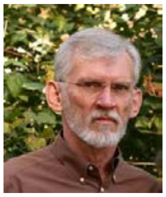
Breakout Session Speakers

Beth Baker is a research scientist with Mississippi State University, working with both the Water Quality Laboratory and the REACH extension program. She received her BS in biomedical science and MS in cell and molecular biology from St. Cloud State University in St. Cloud, Minnesota. She received her PhD in forest resources from Mississippi State University working under Robert Kröger and Eric Dibble in the Wildlife, Fisheries, and Aquaculture Department.

Claire Baffaut holds an engineering degree from the School of Hydraulic Engineering in Grenoble, France, and a PhD from Purdue University. She is currently a research hydrologist with the USDA-ARS in the Cropping Systems and Water Quality Research Unit in Columbia, Missouri. Her research interests include monitoring and modeling watershed and landscape processes, developing practical tools to identify areas that need particular attention, and developing alternative agricultural practices for improved watershed management under changing land use, climate, and economic constraints.

Jamie Benning is the water quality program manager with Iowa State University Extension and Outreach. She coordinates existing extension program activities related to water quality, connects with water researchers, and develops new programs to meet stakeholder needs. Benning connects with external partners and stakeholders to support water quality improvement efforts throughout the state. She obtained a BS in agronomy and MS in soil science, both from Iowa State University. She has experience in multidisciplinary research and extension projects focusing on water quality, watershed management, farmer leadership, soil quality, and nutrient management.

Dennis Busch is the research leader at the University of Wisconsin-Platteville Pioneer Farm, an applied agricultural research facility located in the driftless area of southwest Wisconsin. Busch is responsible for directing research activities at UW-Platteville Pioneer Farm related to the Wisconsin Agricultural Stewardship Initiative, the USDA's Long-Term Agroecosystem Research Project, and the Global Farm Platform. His research is focused on monitoring surface-water runoff from agricultural landscapes to determine the impact of farming practices on the environment. In addition, Busch is developing and testing alternative, low-cost methods for monitoring edge of field surface-water runoff.



Bill Crumpton is a professor in the Department of Ecology, Evolution and Organismal Biology and Chair of the Undergraduate Environmental Science program at Iowa State University where he teaches courses on environmental systems and conducts research on the hydrologic and water quality functions of wetlands. Crumpton is an authority on the functions of wetlands in agricultural landscapes, and his research provided the scientific and technical foundation for development and implementation of the Iowa Conservation Reserve Enhancement Program, a $100 million program that uses targeted wetland restorations to reduce nitrate loads from agricultural watersheds.

Warren Dick grew up on a farm in North Dakota. He was a chemistry major at Wheaton College, Illinois, and then attended Iowa State University. Since 1980 he has worked at The Ohio State University (OSU) in Wooster. For more than 25 years, Dick has studied the use of gypsum for remediation of degraded minelands and as an agricultural soil amendment. He headed a national network of 12 sites in seven states that conducted research on agricultural uses of gypsum. Dick coauthored the widely distributed OSU Extension Bulletin 945 titled "Gypsum as an Agricultural Amendment: General Use Guidelines," published in 2011.

Kevin Fermanich is a professor of Environmental Science and Geoscience at the University of Wisconsin (UW)-Green Bay, where he holds the Hauxhurst-Cofrin Professorship of Natural Sciences. Since 2003, Fermanich has been the director of a program involving local, state, federal, and university scientists and managers to assess impairments, sources, and management of runoff pollution. He served on the Lower Fox River TMDL technical advisory committee and currently is co-PI on several modeling studies of watershed nutrient reduction scenarios in the Green Bay basin. Fermanich earned his BS in soil science from UW-Stevens Point and MS and PhD in soil science from UW-Madison.

Jennifer Filipiak, associate midwest director for the American Farmland Trust, works collaboratively with farmers, farmer organizations, and government agencies to overcome barriers to conservation practice adoption and advance common ground solutions for agriculture and the environment. Filipiak brings more than 15 years of project management experience in conservation and sustainable agriculture, having previously worked with organizations such as the Illinois Stewardship Alliance, The Nature Conservancy of Iowa, and the Lake County (Illinois) Forest Preserve District. Filipiak holds a BS in ecology from Northern Michigan University and an MS in wildlife ecology from Southern Illinois University at Carbondale.

Jane Frankenberger is a professor of agricultural and biological engineering at Purdue University. Her research and extension program focuses on water quality in drained agricultural watersheds, specifically quantifying nutrient impacts from subsurface drainage and the potential of various conservation practices to reduce nutrient loads.

Daren Harmel received a PhD in biosystems and agricultural engineering from Oklahoma State University in 1997. Since 1999, Harmel has conducted applied hydrology and water quality research at the USDA-ARS Grassland, Soil and Water Research Laboratory in Temple, Texas, and was promoted to director in 2011. His research interests include data collection methodology, measurement uncertainty, and land-use impacts on water quality and hydrology. He has represented USDA-ARS on the National Water Monitoring Council's Methods and Data Comparability Board since 2006. Harmel currently serves on the American Society of Agricultural and Biological Engineers Board of Trustees.

Matt Helmers is the Dean's Professor in the College of Agriculture and Life Sciences and professor in the Department of Agricultural and Biosystems Engineering at Iowa State University, where he has been on the faculty since 2003. Helmers received his PhD from the University of Nebraska-Lincoln in 2003, a MS from Virginia Tech in 1997, and BS from Iowa State University in 2005. His research areas include studies on the impact of nutrient management, cropping practices, drainage design and management, and strategic placement of buffer systems on nutrient export from agricultural landscapes.

Lori Krider is a second year PhD candidate in the Department of Bioproducts and Biosystems Engineering at the University of Minnesota. She has an interdisciplinary background in natural systems, including biology, ecology, and hydrology. The focus of her work is on nutrient management in agricultural settings for improving water quality. For her PhD research she will be conducting a large-scale laboratory experiment testing the effectiveness of a novel bioreactor design that takes a systems approach to nitrate removal.

Ann Lewandowski is a research associate for the University of Minnesota Water Resources Center where she coordinates research, training, and outreach projects related to agriculture and water quality. Lewandowski leads the Watershed Specialist Training program, and is coordinating the development of a rural stream handbook. Previous projects related to agricultural drainage, applications of LiDAR data, phosphorus and nitrate management, and more. Before working for the University, she was a member of the Soil Quality Institute of the USDA-NRCS. She has a MS in geography from the University of Minnesota.

Scott Manley is actively engaged with private industry, agricultural producers, and public resource managers to find solutions that have both positive bottom line impacts and quantifiable ecological benefits across the southern United States agricultural landscapes. Manley has built and delivered partnerships with private industry; federal, state, and local agencies; nonprofits; and private landowners that have made positive impacts on our nation's water quality and natural habitats. Manley has a BS in wildlife management from Texas State University-San Marcos, and MS and PhD in wildlife ecology from Mississippi State University.

Randy Mentz, a graduate of the University of Wisconsin-Stevens Point with a BS in water resources, is the research program manager at Pioneer Farm. He coordinates research activities, supervises and trains technicians, configures equipment, analyzes and summarizes data, publishes and presents research findings, participates in grant writing, develops maps, and assists with fieldwork. He coordinated the CIG project, "Monitoring edge-of-field surface water runoff: A three-state pilot project to promote and evaluate a simple, inexpensive, and reliable gauge" by establishing contracts, managing the budget, purchasing and distributing equipment, operating runoff stations, conducting training workshops, analyzing data, and writing reports.

Nathan Nelson is an associate professor in the Kansas State University Department of Agronomy. He teaches graduate and undergraduate courses in soil fertility and nutrient management. His research program uses a combination of field studies and processes-based modeling to develop best management practices that minimize nutrient loss and maximize nutrient use efficiency. He received his BS from Kansas State University and MS and PhD from North Carolina State University.

Linda Prokopy is an interdisciplinary social scientist who is recognized nationally and internationally for her work incorporating social science into the fields of agricultural conservation, agricultural adaptation to climate change, and watershed management. She has developed a highly successful integrated program focused on the role of human decision making in natural resource management. Prokopy's research directly informs her engagement and education activities. Prokopy has published over 70 peer-reviewed articles in consistently high-tier journals, she has generated over $11 million in competitive research funds, and she has graduated and mentored numerous graduate students and postdocs.

Breakout Speakers

Amber Radatz is co-director of the University of Wisconsin Discovery Farms Program. Her work focuses on assisting farmers with issues related to manure management, water quality, and nitrogen (N) use efficiency in Wisconsin. She also has a major role in program development, grant writing, and communications. Radatz received her BS and MS in soil science from the University of Wisconsin-Madison. Having grown up in Wisconsin on her family's dairy farm she is personally connected to and passionate about helping farmers understand water quality and make positive changes. Radatz and her husband are enjoying raising their two young sons in western Wisconsin.

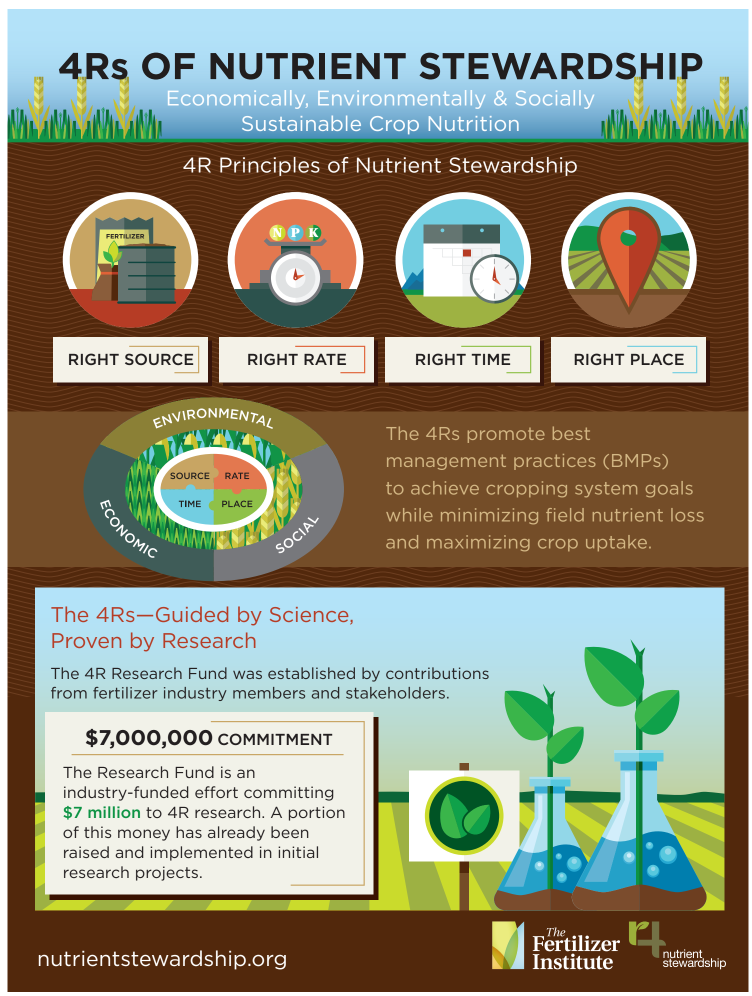
Michelle Reba is the lead scientist and a research hydrologist at the USDA-ARS-Delta Water Management Research Unit in Jonesboro, Arkansas. Reba's current research focus is preserving water availability and water quality for agriculture in the Lower Mississippi River Basin. Reba works closely with researchers and producers to answer research questions associated water management, water quality, and impacts of conservation practices. She received her BS in civil and environmental engineering from the University of Michigan, MS in forest hydrology and civil engineering from Oregon State University, and PhD in civil engineering from the University of Idaho. Reba has studied water resources issues in the Lower Mississippi River Basin, the western United States, China, the Dominican Republic, Haiti, and Antarctica.

Ali Saleh received his BS in judicial law from Tehran University, MS in agricultural science from California State University, and PhD in soil physics/agricultural engineering from Utah State University. Saleh is currently the associate director and research coordinator of a multidisciplinary team of scientists, economists, and engineers at Texas Institute for Applied Environment Research (TIAER). His main focus during the past 18 years has been to enhance, develop, and evaluate environmental and economic models such Comprehensive Environmental and Economic Optimization Tool (CEEOT), Nutrient Tracking (NTT), and NutrientNet (NN) programs.

Douglas R. Smith worked for 12 years at the USDA-ARS National Soil Erosion Research Laboratory, in West Lafayette, Indiana. In 2014, Smith moved to the USDA-ARS Grassland, Soil and Water Research Laboratory in Temple, Texas. He studies the effects of agriculture and conservation on nutrient fate and transport. His work includes laboratory, plot, field, and watershed scale research.

Steve Stevens grew up on a row crop farm, learning from his dad at an early age to protect the land. After attending University of Arkansas, Stevens returned to the farm growing from 1,400 to 4,800 acres. They adopted reduced tillage in the early 1980s; stale seed bed in early 1990s; and Phaucet poly pipe hole selection in 2008, saving 40% in irrigation costs. More recently he has practiced delayed fertilizer application until crop emergence to reduce runoff.

Shannon Zezula, state resource conservationist in Indiana for USDA-NRCS, oversees the conservation planning and technical advice that NRCS employees provide to Indiana's private landowners to address their resource concerns related to soil health, erosion control, water quality, wildlife habitat, and forest management. He is a graduate of Purdue University and The Ohio State University, and enjoys hunting, trapping, fishing, and other activities with his wife and two kids.



Poster Presentations

1. Agricultural Nonpoint Source Pollution and Edge of Field Monitoring of Water Quality in the Mississippi River Basin
Authors: Yujie Huang and E.R. Buckner, University of Arkansas at Pine Bluff

Abstract: The Mississippi River Basin Healthy Watershed Initiative (MRBI) is a project led by the USDA Natural Resources Conservation Service (NRCS). This project focuses on implementing conservation practices to improve water quality, water quantity, and wildlife habitats in the Mississippi River Basin. Elevated nutrients, pesticides, and chemicals in surface water runoff are becoming one of the biggest water quality concerns. The degradation of surface water quality poses potential harms to human health and agricultural productivity. Intensified agricultural land uses in forms of crops and livestock with chemical uses (fertilizer, pesticides, etc.) speed up the soil losses, which in turn result in nutrient and chemical loss during runoff, contaminating the water. Thus, in order to analyze the nutrient loading generated from agricultural runoff on water quality, we have installed automatic samplers at farm sites. We are analyzing water quality from runoff from agricultural fields whenever rain and irrigation events occur. The 13 states participating in this project are Arkansas, Kentucky, Illinois, Indiana, Iowa, Louisiana, Minnesota, Mississippi, Missouri, Ohio, South Dakota, Tennessee, and Wisconsin. The monitoring process will take place on a farm located in Lonoke County, Arkansas. Within the front two years of project, we will monitor baseline measurements without any conservation application. The remaining three years of the project will be used to compare a cover crop application to a control field without a cover crop.

2. Assessing the Effectiveness of Agricultural Best Management Practices through Edge of Field Monitoring within the Great Lakes
Author: C.M. Rachol, US Geological Survey

Abstract: The Great Lakes face many threats to water quality, habitat, ecology, and coastal health. Many of these threats are attributed to the delivery of excess nutrients into the Great Lakes from agricultural nonpoint sources, resulting in the formation of harmful algal blooms (HABs) that adversely affect fish and humans. The Great Lakes Restoration Initiative (GLRI) was launched in 2010 to address these threats and provide a framework to restore and protect the Great Lakes. As part of GLRI, the US Environmental Protection Agency (USEPA) and the USDA Natural Resources Conservation Service (NRCS) identified priority watersheds to focus efforts for reducing nutrient inputs by targeting important sources of transport into the Great Lakes. By supplying financial and technical assistance to producers, the USDA-NRCS is saturating small-scale subbasins within the Fox River (Wisconsin), Saginaw River (Michigan), Maumee River (Indiana and Ohio), and Genesee River (New York) with best management practices (BMPs) to target nutrient reduction efforts. To determine the impact of BMPs in the Great Lakes Basin, the US Geological Survey (USGS) is conducting pre- and post-BMP implementation monitoring and modeling small-scale subbasins and multiple edge of field (EOF) and tile drainage sites. The USGS is using enhanced techniques that enable real-time, two-way communications with the monitoring sites, which enable the use of adaptable equipment configurations to suit the diverse settings being studied. The modeling component will assess the impact of GLRI-funded and implemented BMPs to nutrient transport with the Soil and Water Assessment Tool.

3. Development of Wetland Components within the AnnAGNPS Watershed Model for Nutrient Management
Author: Ronald L. Bingner, USDA-ARS National Sedimentation Laboratory

Abstract: Pollutant loads leaving 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. Enhanced wetland features have been developed within the USDA Annualized Agricultural Nonpoint Source pollution model (AnnAGNPS) to account for the effectiveness of wetlands to trap water, sediment, and nutrients transported from agricultural fields into watershed stream systems. These features includes a GIS-based wetland tool to identify and characterize individual constructed or natural wetlands at a watershed scale for application using AnnAGNPS. The wetland tool provides a simplified, semi-automated, and spatially distributed approach to quantitatively evaluating conservation management alternatives based on constructed wetlands. These enhancements adopt conservation mass and current research studies on nitrogen (N) transformation to simulating wetland processes within the AnnAGNPS model. 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 using wetlands in conservation management planning.

4. Edge of Field Monitoring on a Field with Controlled Tile Drainage in Southwestern Ontario
Author: Sonja Fransen, Agriculture and Agri-Food Canada

Abstract: Subsurface tile drainage continues to be viewed as a contributing source of nutrient loading to surface water in the Great Lakes-St. Lawrence River Basin. Agriculture and Agri-Food Canada (AAFC) researchers have found that the adoption of controlled tile drainage (CD) as a best management practice (BMP) has the potential to reduce nitrogen (N) and phosphorus (P) loading from tile drains and increase producer profit margins through increased yields. However, the ability for CD to reduce N and P loading under different climate and soil conditions has not been thoroughly investigated. Year-round monitoring has also been a challenge, especially when trying to capture the significant contribution of the spring thaw event. As part of an AAFC project to address the barriers to CD adoption by the agriculture sector (mitigating nutrient losses through tile drainage by developing and transferring AAFC's research in CD/SI), a team of AAFC Water Management Engineers have equipped a field near Stratford, Ontario, that has controlled tile drainage with edge of field monitoring equipment to provide year-round measurements of N and P concentrations.

5. Edge of Field Water Quality Monitoring for On-farm Water Storage Systems Assessment in Mississippi

Authors: Juan D. Pérez-Gutiérrez, Joel O. Paz, and Mary Love Tagert; Mississippi State University

Abstract: Agricultural practices adversely alter the nutrient natural cycle by overusing fertilizers in supporting a highly demanding food and fiber production, which in turn is a consequence of a growing global population that needs to be fed. Induced by watershed-scale processes, large amounts of these nutrient inputs migrate from agricultural fields to streams and rivers and eventually reach coastal areas. Nutrients become a major contributing factor of eutrophication causing harmful effects, such as the dead zone in the Gulf of Mexico. To remedy this environmental impact, best management practices (BMPs) have been implemented in the Mississippi River Alluvial Valley region; however, their effectiveness and benefits on ecosystems are not well understood. Therefore, better understanding and documentation of how these BMPs impact the environment is required. On-farm water storage (OFWS) systems are gaining popularity because of their potential benefits of reducing nutrients reaching receiving waterbodies and storage water for irrigation purposes. An OFWS is a structural BMP that allows the collection and storage of surface runoff and irrigation tailwater by combining ditches and on-farm reservoirs. In this study, we used edge of field water quality monitoring data and statistical analyses to evaluate the effectiveness of OFWS in decreasing nutrient loading downstream in Porter Bayou watershed, Mississippi. We employed the non-parametric Wilcoxon and Kruskall-Wallis rank-sum tests to determine whether differences in water quality occur between and among sampling stations by season. Preliminary results reveal statistically significant differences in nutrients' concentrations at the study sites, spatially and temporally. These initial results provide evidence that nitrogen (N) and phosphorus (P) species are captured in the OFWS systems. The results of this study will help improve the understanding of OFWS systems for water quality pollution control and water conservation.

6. Estimating Loads at Agricultural Drainage Ditches and Edge of Field in Mississippi and Wisconsin: Promises and Challenges

Authors: Jenny Murphy and Matt Hicks, US Geological Survey Lower Mississippi-Gulf Water Science Center

Abstract: Determining nutrient and sediment delivery from agricultural fields to streams typically requires monitoring drainage ditches and edge of field (EOF) sites. Ideally, such monitoring would be accomplished by high-frequency sampling of all runoff events. However, the ephemeral nature of overland runoff at these locations combined with equipment malfunctions and limited financial or personnel resources can result in less frequent sampling. For example, in a study of agricultural runoff in the Mississippi River Alluvial Plain in northwestern Mississippi, the US Geological Survey (USGS) Lower Mississippi-Gulf Water Science Center (WSC) sampled one to thirteen runoff events per year (6% to 78% of runoff events annually) from 2008 to 2015 at several sites. To estimate nutrient and sediment loads at these sites, regression models were developed that relate hydrologic characteristics of each runoff event, plus seasonal and temporal variables to corresponding loads calculated from measured concentrations and discharges. To test this regression-based approach, a more robust water-quality dataset from three EOF sites collected by the USGS Wisconsin WSC and the University of Wisconsin Discovery Farms Program was used. At these sites, composite storm samples were available for almost all runoff events from 2004 to 2010. Additionally, the Wisconsin data were subsampled to simulate less frequent sampling to identify the optimal number or percentage of sampled runoff events per year needed for reasonable estimates of annual and seasonal load. Results of the subsampling and an analysis of error and uncertainty will be discussed, along with the application of this regression-based approach to the Mississippi agricultural drainage ditch data.

7. Evaluating Producer Efficiencies Across Seven Metrics Used to Measure Sustainability

Author: Amanda Free, University of Arkansas

Abstract: Utilization of the Fieldprint Calculator assists producers in determining how their current method of production affects sustainability. The Fieldprint Calculator makes calculations over seven metrics to evaluate sustainability: land use, soil conservation, soil carbon (C), irrigation water use, water quality, energy use, and greenhouse gas emissions. The objective was to determine if the most efficient producers in terms of cost per unit of production would rank higher than others in several of the metrics measured by the calculator. Research was conducted in eight counties over a span of four years. The fields selected for observation varied from potentially high yielding fields to low yielding fields. During the study all of the producers' inputs were recorded providing the information needed to calculate fixed and variable costs. Field information was entered into the Fieldprint Calculator and summaries for each field were evaluated. Comparisons were made among the different fields to rank the producers efficiency with regards to output from the calculator. Our results showed a wide range of variability in efficiency of production based on calculator metrics when comparing different locations. Yield provided the best relationship to per unit cost of production. Further work is needed to establish links in sustainability metrics and profitability.

8. Gypsum and Nitrogen Treatments and Their Effect on Soil Properties and Corn Yield

Author: Warren A. Dick, The Ohio State University

Abstract: Farmers are increasingly applying gypsum to their fields to improve soil quality and crop yields. Questions remain as to the best strategy that should be followed regarding this application. Field plot trials were conducted at two sites in Ohio to test the interaction of nitrogen (N) rates (four levels) and six gypsum treatments. The gypsum treatments were designed to test whether gypsum treatments applied at lower rates every year result in differences compared to higher rates applied less often (i.e., every other year or every fourth year). Preliminary results obtained revealed few significant effects of N and gypsum treatments on soil fertility properties. There were some decreases in base saturation of magnesium (Mg) or potassium (K). At Hoytville, enzyme activity of beta-glucosidase decreased with increasing N rate. First-year corn yields were increased by N rate (as to be expected), but not by gypsum. Corn ear leaf samples from the first-year showed a number of significant N rate and gypsum effects. At both sites, N increased ear leaf concentrations of copper (Cu) and manganese (Mn), but decreased Mg. Gypsum increased leaf concentrations of sulfur (S) and decreased molybdenum (Mo). It is concluded that, with the exception of S, fertility adjustments generally do not rapidly occur when gypsum is applied as a soil amendment.

9. Gypsum as a Soil Amendment in the Walnut Creek Watershed in Indiana

Author: Pierre-Andre Jacinthe, Indiana University-Purdue University Indianapolis

Abstract: The impact of gypsum as a soil amendment on soluble reactive phosphorus (SRP) export from agricultural fields, and soil chemical

properties was investigated at two adjacent fields in the Walnut Creek watershed (Indiana). The fields supported a corn crop during the monitoring period and were similarly managed, with one field treated with gypsum (1 tn ac^{-1}) and the other acting as a control. Results showed significantly lower SRP concentration (41% lower) during the growing season in tile waters from the FGD-treated field compared to the untreated field. The concentration of water-extractable P (an index of P export) was 1.5 times higher in soils from the untreated compared to the FGD-treated field. In the latter field, plant available P (Olsen test) was highest in the 20 to 30 cm soil depth range, whereas in the untreated field available P was highest in the surface layer (0 to 5 cm) where it is most susceptible to loss in runoff. Results also showed a trend toward higher levels (although not significant) of labile organic carbon (C; microbial biomass, soil respiration) and cation exchange capacity (CEC) in the FGD-treated field compared to the control. These results indicate that even a one-time application of FGD can have measurable effects during the first year post application on soil properties linked to nutrient cycling, soil fertility, and soil health. The principal investigator on this project was Pierre-Andre Jacinthe and was sponsored by Indianapolis Power & Light, GYPSOIL, and Greenleaf Communities, NFP.

10. How Paired is Paired? Comparing Nitrate Concentrations in Three Iowa Drainage Districts
Author: Anthony Seeman, Iowa Soybean Association

Abstract: Quantifying the effectiveness of perceived best management practices (BMPs) at the field and landscape scale is difficult, so paired watershed studies are used to detect water quality improvements. We evaluated concentrations of nitrate-nitrogen (NO_3-N) discharged from three tiled Iowa watersheds during a five-year period to assess their suitability for a paired watershed approach. Our objectives were to evaluate similarities in physical characteristics, concentration patterns, and correlation among the three paired sites and perform a minimum detectable change (MDC) analysis on paired site configurations. We also explore the effect of extreme hydrologic events (flood and drought) on concentration variability and its relevance to the paired watershed and MDC approach. The study results demonstrate that concentration variability within and between sample sites affected correlation among the paired basins, even though the physical characteristics of the basins are quite similar. High correlation between sites during normal and wet periods at the beginning of the calibration period was reduced with the onset of drought conditions. The lack of a suitable correlation may impair the ability to detect changes expected to result from BMP implementation. The MDC for NO_3-N concentration change detection varied from 6.9% to 12.9% and averaged 8% for the best control-treatment pair. To ensure that conservation resources are being used effectively, implemented BMPs should focus on practices capable of achieving at least this magnitude of change.

11. Implementation and Monitoring Edge of Field and In-Ditch Approaches to Reduce Nutrient Losses on the Delmarva Peninsula
Author: Arthur Allen, University of Maryland Eastern Shore

Abstract: Developing technologies and strategies for controlling nutrient loss from artificially drained agricultural lands requires a comprehensive approach that includes field and drainage management practices to address production and water quality concerns while maintaining agricultural sustainability for producers. Our objectives were to implement and demonstrate the effectiveness of integrated drainage and ditch management systems on farms; provide comprehensive drainage and ditch management education for producers, drainage associations, and conservation personnel; evaluate the cost-effectiveness of these approaches; and develop strategies for targeting their placement. Recent work on the Atlantic Coastal Plain of Delaware, Maryland, and Virginia has demonstrated significant edge of field reductions in nitrogen (N) and phosphorus (P) export using conventional and novel management practices (e.g., drainage control structures, permeable reactive barriers, and biofilter reactors). Two tile drainage biofilter reactors resulted in N reductions of 15% to 90% dependent on inflow concentration and water temperatures, with higher concentrations (8 to 20 mg L^{-1}) and temperatures (>12°C) resulting in greater removal. Calculated N removal rates ranged from 11 to 29 kg N ha^{-1} y^{-1}. Phosphorus removal by biofilter reactors was variable, sometimes removing P, and sometimes releasing P. However, P removal was the dominant process during the growing season, which corresponded with periods of low flow when water bodies were most vulnerable to eutrophication. When used in combination with edge of field sawdust wall reactors, gypsum curtains removed 90% of dissolved P from shallow groundwater. This presentation highlights some successes and provide suggestions for the design, development, testing, and demonstration of these systems so that they can be readily adopted by producers.

12. Integrated Field (RUSLE2) and Watershed (AnnAGNPS) Conservation Practice Management Planning Technology
Author: Henrique Momm, Middle Tennessee State University

Abstract: Effective evaluation of conservation practices implemented to reduce sediment loads as part of a watershed management plan requires consideration of their impact on loads at various scales. Sediment loads originate at field scales and are transported through concentrated flows where sediment may be deposited or added to downstream by streams to produce integrated watershed scale impacts. This study developed technology to integrate two important USDA modeling technologies working at different scales: the Revised Universal Soil Loss Equation, Version 2 (RUSLE2) at the field scale and the Annualized Agricultural Nonpoint Source watershed pollutant load model (AnnAGNPS) at the watershed scale. RUSLE2 provides a detailed assessment of conservation practice impacts from field-scale sediment loads by characterizing an individual field using a complex multisegment profile, where each segment can be characterized by a complex representation of different landscape features. AnnAGNPS subdivides the watershed into many field-scale components flowing into streams to represent sheet and rill erosion sources as a less-complex, one-segment profile. Technology was developed to link the enhanced capabilities of RUSLE2 at the field-scale with the watershed assessment capabilities of AnnAGNPS. Utilizing RUSLE2 for sheet and rill erosion to then route these sediment loads downstream by AnnAGNPS produces an integrated watershed sediment load from all field-scale sources. This technology integrates a state-of-the-art field-scale sheet and rill erosion model and a watershed model to evaluate multiple nonpoint source pollution sources and mixed type conservation practices at a watershed scale to provide detailed conservation practice impacts on watershed sediment loads.

13. Is it Working? A Look at the Changing Nutrient Practices in the Southern Willamette Valley's Groundwater Management Area
Author: Susanna L. Pearlstein, Oak Ridge Institute for Science and Education Fellow based at USEPA

Abstract: Groundwater nitrate contamination affects thousands of households in the southern Willamette Valley. The southern Willa-

mette Valley Groundwater Management Area (SWV GWMA) was established in 2004 due to groundwater nitrate levels exceeding the human health standard of 10 mg nitrate-nitrogen (N) L^{-1}. Much of the GWMA N inputs comes from agricultural N use, thus efforts to reduce N groundwater inputs are focused upon improving N management. Work in the 1990s in the Willamette Valley by researchers at Oregon State University determined the importance of cover crops and irrigation practices and made recommendations to the local farm community for reducing N leaching. We are re-sampling many of the same 1990s fields to examine the influence of current crops and nutrient management practices on nitrate leaching below the rooting zone. This study represents important crops grown in the GWMA, including four grass seed, three vegetable row-crop, two peppermint and wheat fields, and one hazelnut and one blueberry. New nutrient management practices include slow release fertilizers and precision agriculture. Results from the first year of sampling in 2014 show nitrate leaching is lower in crops like row crops grown for seed and higher in others like perennial ryegrass seed when compared to the 1990s data. We will use field-level N input-output balances to determine the N use efficiency and compare this across crops and over time. This projects goal is to provide information and tools to help farmers, managers, and conservation groups quantify the water quality benefits of management practices they are conducting.

14. Monitoring to Guide Bioreactor Management

Author: Keegan Kult, Iowa Soybean Association

Abstract: Many states within the Mississippi River Basin have identified bioreactors as a critical conservation practice for reducing the amount of nitrate reaching surface waters from artificial subsurface drainage. Bioreactors have the capability of removing significant amounts of nitrogen in a cost effective manner, but differ from traditional conservation practices in that they need to be managed to perform optimally. Management can increase the amount of nitrogen removed while reducing the potential for production of contaminants such as methylmercury and nitrous oxide. In order to optimize bioreactor management, monitoring is needed to provide crucial feedback in order to ensure the bioreactor performs as designed while minimizing contaminant generation. With funding from an USDA-NRCS conservation innovation grant along with the Iowa Nutrient Reduction Center, five bioreactors were monitored for nitrate, sulfate, alkalinity, and flow. Monitoring for methylmercury and nitrous oxide is difficult and expensive, so sulfate reduction and alkalinity generated were used as indicators for methylmercury and nitrous oxide production respectively. Monitoring data will be used to alter the management of the bioreactors. The five bioreactors were shown to reduce the nitrate load that flowed through the bioreactor between 50% and 80%; however, alkalinity data implies that nitrous oxide formation may have occurred in three of the five bioreactors. Nitrous oxide formation indicates incomplete denitrification has taken place and that flow within the bioreactor should be reduced or, alternatively, that the bioreactor may need to be recharged with a fresh carbon source.

15. Nitrogen Concentration in Rice Floodwater Following Fertilization Application

Author: Grant Beckwith, University of Arkansas Division of Agriculture

Abstract: Agriculture is considered to be a leading source of nutrients delivered to the Gulf of Mexico and thus contributing to the hypoxia issue. Arkansas is the leading rice-producing state in the nation. Besides the environmental concerns, rice farmers are looking for ways to be more efficient in nutrient applications due to high fertilizer prices. In Arkansas, nitrogen (N) is typically applied in split applications with the first application before first flood and a second mid-season application where the N is directly applied to flooded fields using aerial application. Previous plot-scale studies have shown that N concentrations in flooded rice fields can dissipate in a matter of days. The purpose of this study was to determine changes in N concentration in rice floodwater following fertilizer applications on a commercial rice field. To determine how the concentration of N in rice floodwater changes and how long it takes it to move into the soil, water samples were collected using Sigma 900 automated water samplers located in three different rice bays within a private, commercial rice field. Samples were collected initially at one hour intervals and decreased to once a day from day five to fourteen. Samples were processed in the field and shipped to the Arkansas Water Resources Center lab for analysis. The results indicate that rice fields act as a wetland and N concentration in the floodwater decreases rapidly after a few days and the concentration is less than two thirds of most streams in agricultural watersheds in the United States.

16. Seasonal Variations in Nitrate Sources and Distributions in the Upper Illinois River Basin: An integrated Study of Geochemical Measurement of Stream Nitrate and Hydrologic Modeling (SWAT)

Author: Jiajia Lin, USEPA , University of Illinois at Chicago

Abstract: Isotopic/chemical measurements and hydrologic modeling were integrated to study nitrogen (N) behavior in the Upper Illinois River Basin (UIRB). Over 400 water samples were collected on the Upper Illinois River, major tributaries, and wastewater treatment plants (WTP). The isotopic compositions of nitrate demonstrated the large pulse of stream nitrate during the annual spring-flush was mostly derived from agricultural input, whereas there was a less variable year-round input from WTP effluent sources. Isotopic data indicated that tile drainage was a primary nitrate source to some major tributaries, and nitrification of reduced fertilizer and mineralization of soil organic N were the dominant sources for spring agricultural nitrate. Our measurements defined an apparent denitrification trend in tributaries with agricultural and mixed land use. The fall nitrate yields were less than 10% of the spring yields in some subbasins. A 10-year average showed that over 70% of nitrate export occurred during the January-June period. The Soil and Water Assessment Tool (SWAT) was applied to simulate the impact of fertilizer application on crop and nitrate yield in the UIRB. For example, increasing fertilization by 25% caused less than 15% increase in corn yield in 30% of the 132 subbasins; however, it could lead to large enhancement in N yield. Our implementation of denitrification to SWAT also assisted us to understand in-stream nitrate removal process and control of hydrological conditions on N transport. The model outputs were consistent with the geochemical study result that there was an enhanced trend of denitrification effect downstream.

17. Soil Conservation and Long-Term Improvement in Surface Water Quality in a Drinking Water Reservoir Catchment

Author: Miroslav Dumbrovsky, Brno University of Technology, Institute of Landscape Water Management

Abstract: The aim was to explore how soil and water conservation measures, applied in the process of land consolidation, affected

nutrient concentrations in surface waters of the drinking water reservoirs in the Czech Republic. Land degradation and water quality, especially in small rural catchments, are influenced by the way in which agricultural and forested areas are managed. High losses of nutrients from mineral and organic fertilizers, mostly from arable land, negatively affect the quality of many surface waters. The source areas of intensive diffuse pollution must therefore be identified and made less harmful, especially in the catchments that supply water to drinking water reservoirs. The conservation measures, based on the Good Agricultural and Environmental Conditions, were applied. The protection measures, such as restrictions on the maximum amount of manure and nitrogen (N) and phosphorus (P) fertilizers, were applied in the case study area according to recommendations of a soil conservation project. The reservoirs water resources were monitored for 25 years (1990 to 2015) in order to collect water quality data on nitrate-N (NO_3-N), total phosphorus (Ptot), and total suspended solids. The results of monitoring indicate a linear trend of decrease in NO_3-N and Ptot concentrations following the soil and water conservation measures applied.

18. Subsurface Drainage Water Quality Monitoring Options for Edge of Field and Replicated Plot-Scale Research Sites
Author: Laura E. Christianson, University of Illinois

Abstract: The tile drainage pipes on the more than 30 million drained acres in the United States could easily reach to the moon and back if laid end-to-end. While these drainage networks provide important crop production benefits, water quality concerns associated with artificial drainage have recently come to a head due to development of state nutrient loss reduction strategies in the upper Mississippi River Basin, as well as major events like the 2014 toxic algal bloom in Lake Erie. Increasing interest by academia, government agencies, and agricultural and environmental organizations and nonprofits has generated momentum to better quantify and understand subsurface drainage nutrient losses via edge of field monitoring. There is also growing curiosity about the use of replicated plot-scale drainage research to improve statistical power in comparison of specific treatments such as 4R practices, cover crops, and drainage design. There are a variety of options to instrument drainage research sites, both for replicated plots and edge of field monitoring. Selection of a monitoring system depends upon a balance of factors including cost, labor, scientific robustness, site details, and the research question. This poster describes and compares several potential instrumentation arrangements to assess both subsurface drainage flow and nutrient concentrations, which allows calculation of drainage nutrient loadings.

19. The Effect of Winter Forage Planting Methods on Water Quality in a Beef Cattle Grazing System
Author: Donna Morgan, Louisiana State University AgCenter

Abstract: Evaluating Best Management Practices (BMPs) is critical in determining environmental impacts from agricultural fields, regardless of cropping system. Research has shown that the utilization of BMPs can reduce the amount of nutrients leaving the field, especially in beef cattle production systems. A multi-year study (2013 to 2015) was conducted at the Louisiana State University (LSU) AgCenter Dean Lee Research Station in Alexandria, Louisiana, to evaluate the effect of winter forage planting methods on sediment and nutrient runoff. Our hypothesis was that forage planting methods can affect nutrient and sediment runoff. Conventional tillage, conservation tillage, and untreated control methods for establishment of winter annual ryegrass were compared, and soil preparation treatments included: (1) prepared seedbed, (2) over-seeding, (3) no-till drill, and (4) untreated control. Plots received phosphorus (P) and potassium (K) according to soil test recommendations at the beginning of the study and received additional urea applications post-grazing (grazed once forage height = 21 cm). Runoff samples were analyzed for total solids, total P, phosphates, K, and nitrates. There were no differences among treatments for the average amount of total P, phosphates, K, or sediment, but nitrates were higher ($p = 0.003$) from the prepared seedbed (6.2 + 0.67 ppm) compared with the untreated plots (3.02 + 0.62 ppm) across the two grazing seasons. The prepared plot was grazed a total of five times compared with four and a half times for no-till drill and four times for sod-seeded plots. These results illustrate that winter forage planting methods can affect nutrient runoff from Louisiana pastures under various rainfall and environmental conditions.

20. Using Gypsum to Reduce Phosphorus Exports from Agricultural Soils in the Maumee River Basin to Lake Erie
Author: Warren Dick, The Ohio State University

Abstract: Phosphorus (P) from agriculture contributes to water quality problems in Lake Erie. Gypsum (calcium sulfate dihydrate [$CaSO_4.2H_2O$]) is effective in reducing P loss from agricultural soils by forming insoluble calcium phosphate. A demonstration project in the Maumee River Basin that contributes flow to western Lake Erie is evaluating field-scale applications of gypsum for reducing P export in surface runoff and tile drainage water. Separate sections within eight large fields were either treated or not treated with gypsum at a rate of generally 1 tn ac^{-1}. Tile drain water samples were collected and analyzed for soluble P, nitrates, and pH. Average reduction in P concentrations for gypsum-treated areas was 54% and ranged from 0% to 93%. The P reductions in tile drainage water persist at least 20 months after gypsum treatment, and then new applications of gypsum are generally needed. Warren Dick of The Ohio State University was principal investigator on this project. Project participants included NesterAg, GYPSOIL, and Greenleaf Advisors.

21. Water Quality Benefits of Conservation Practices on Edge of Field Monitoring
Authors: Ranjith P. Udawatta and Shibu Jose, University of Missouri

Abstract: Four decades after the implementation of the Clean Water Act in the 1970s, nonpoint source pollution (NPSP) remains a major challenge in protecting and restoring water quality. Agricultural practices of grazing and row cropping are often blamed for adverse effects on the quality of surface and ground waters. This study evalauted effects of grass waterways, crop rotation, cover crops, and tile drain on water quality from corn–soybean rotational watersheds in Missouri. Watersheds were instrumented with H-flumes, water samplers, and bubbler flow meters. Water samples were collected after each rain event and analyzed for sediment, total nitrogen (N), and total phosphorus (P) losses. Significant losses in sediment and nutrinets were reduced by grass waterways. Watersheds without grass waterways had larger sediment losses and undercutting. Tile drain resulted in higher nitrate concentration in water. Cover crops reduced runoff, sediment, and nutrient losses. Results of the study show that adoption of conservation practices helps reduce sediment and nutrinet losses from row crop agricultural watersheds.

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