

Confluence

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Introduction

Scaling Up the Power of the Land Grant Mission

The land-grant universities have a three-part mission - undergraduate and graduate education, research and extension outreach. They have traditionally provided services predominantly at a local (county) and state scale, as well as contributed to regional, national and global problem-solving. The nature of water resource management often dictates working at multiple geographical scales as issues are often identified geographically in large regional basins such as the Mississippi River basin which include nested watersheds of varying sizes. Yet solutions involving land uses such as agriculture are often applied at a much smaller scale such as a field or farm. As such, it makes sense for land grant universities to work collectively at the regional scale to identify issues and solutions, yet use their local and State Extension systems to implement solutions on a smaller scale. As human land and water management activities become more intensive and pervasive, cross-scale impacts emerge. Research and extension engagement and technology transfer activities that intentionally consider scale are necessary to promote positive impacts and mitigate negative ones.



One multi-scale effort, the Mississippi River Gulf of Mexico Watershed Nutrient Task Force (Hypoxia Task Force), a coalition of five federal agencies and 12 state agencies, has been working together since 1997 to address both state nutrient management and the interstate challenge of reducing the hypoxic zone in the Gulf of Mexico. While land-grant universities have been informing nutrient management decisions for decades and have been instrumental in the development of several state nutrient strategies, we recently formed a new team of researchers and extension educators from the 12 states along the Mississippi and Ohio Rivers to work in partnership with the Hypoxia Task Force and its members. The goal of the team (named SERA-46) is to "promote effective implementation of science-

based approaches to nutrient management/ soil and water conservation that reduce nutrient losses to the environment." SERA-46 effectively "scales up" land-grant efforts to match the scale of a complex natural resource management issues.

The team met for the second time on May 18-19 to finalize a list of shared land-grant and Hypoxia Task Force priorities. Priorities cover research and outreach needs that take into account environmental, social, and economic factors that contribute to nutrient loss from agricultural lands, state-level nutrient impairments, and hypoxia in the Gulf of Mexico. Example priorities include sharing the latest research on nutrient management and adoption of best practices; identifying common attributes and gaps across state nutrient strategies, highlighting opportunities for cross state information sharing and learning; developing social measures of impact for use in priority watersheds; and strengthening a network of watershed leaders (including those that are farmers) to increase the effectiveness of strategies for reducing nutrient losses from agricultural lands. For updates you can visit the [SERA-46 web page](#) or contact [Jason Hubbard](#) or [Rebecca Power](#).

If you think this information would be useful to other professionals you work with, please forward it on. Your colleagues can sign-up using our [newsletter subscription form](#).

Please consider submitting articles as a way of sharing success stories, outreach programs, or research findings that will move conservation forward in the Mississippi and Ohio River corridors. We also invite you to submit questions, comments and any announcements of conservation-related events. Submissions can be made to either [Mike Daniels](#) or [Rebecca Power](#). Through our confluence, we can make a difference in our efforts to feed the world while ensuring plentiful natural resources for future generations

Sincerely, your Co-Editors

Mike Daniels, Ph.D.
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University of Arkansas
Division of Agriculture

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Desha County Conservation District

(Editor's note: Conservation districts are political subdivisions found in each State that help local residents conserve and protect local land, water, forest and wildlife resources. For more information on Districts please visit <http://www.nacdnet.org/about/districts>. We intend to include articles in Confluence so that local conservation district can share their stories and accomplishments. If your local conservation district would like to submit an article, please have a representative of the district contact Rebecca Power or Mike Daniels.)

Desha County is located in Southeastern Arkansas. The Desha County Conservation District (DCCD) is governed by a five member board; three of whom are elected by land owners in the district for three year terms, and two of whom are appointed by the State. The district employs an office manager, and a technician, both of whom work in close concert with the Natural Resources Conservation Service District Conservationist to assist land owners and operators in addressing the resource concerns within the district. These include water quality, water quantity, soil erosion, nutrient management, herbicide resistant weeds, wild life and recreational needs, and addressing resource concerns of local officials.



Communication and outreach efforts include regular attendance at Quorum Court meetings, making local presentations at the request of partners such as Farm Service Agency information events, Arkansas Game and Fish Commission, NRCS Private Lands biologists, U.S. Fish and Wildlife agents and the University of Arkansas Division of Agriculture's Cooperative Extension Service. The DCCD has had cooperative agreements totaling over \$1.6 million with the Arkansas Natural Resources Commission, who administer's EPA 319 funding issues relating to water quality and soil erosion. These funds were made available to land owners and operators, on a 50/50 match basis, to address the stated concerns resulting in over 60 of open surface water conveyance being converted to enclosed underground delivery to provide cleaner, more efficient and reduce the movement of resistant weed seed and diseases via water. Additionally, several hundred grade control structures (drop pipes) were installed to help prevent erosion.

The DCCD has also been a participant in the Mississippi Healthy River Basin Initiative (MRBI), a landscape initiative that provides funding through the Cooperative Conservation Partnership Initiative (CCPI) for financial assistance to reduce nutrient and sediment losses as a means to reduce the hypoxia zone in the Gulf of Mexico, as the DCCD developed a CCPI proposal that resulted in funding for the MRBI project "Middle Bayou Macon" (2011-2014). This resulted in \$5,558,666.00 being brought into the watershed project area to address the stated issues, and impacting 19,682 acres. These efforts are in addition to \$688,670.00 EQIP funds, affecting 3,951 acres.

DCCD assisted NRCS personnel in the implementation of the Conservation Stewardship Program (CSP), beginning in 2014. A total of 155 contracts were executed, affecting 167,256 acres, and obligating \$21,870,848.00. CSP addresses a multitude of resource concerns, and allows operators to choose the approach to be used. DCCD, in recent years, has sampled the discharge water, for salinity and alkalinity, from 2000 of the 2300 irrigation wells within the district. The results have been cited state-wide and region -wide.

The DCCD, as well as the Arkansas Association of Conservation Districts, was a major player in the efforts to address and bring under control the wholesale spread of herbicide resistant weeds. The

district and AACD sponsored numerous educational forums and meetings, which involved partners such as chemical dealers and equipment vendors, University of Arkansas' Division of Agriculture's Cooperative Extension Service's Weeds Specialists as well as NRCS personnel including their National Agronomist. THE AACD was instrumental in developing a training program that certified 87 crop consultants as qualified to write management plans to address this problem. Prior to this effort, only 3 such certifications existed nation-wide, excluding NRCS personnel.

The DCCD is a partner in the Arkansas Discovery Farm program, with the "cotton" Discovery Farm site located within the Middle Bayou Macon MRBI boundaries. This program endeavors to integrate all best management practices in a "whole farm" scenario, and measures edge-of-field losses of nutrients and sediment in runoff. Cotton Incorporated is a financial partner.

Other miscellaneous activities of the DCCD includes conducting a pecan and "sweets" sale prior to the Christmas holiday season, which provided funding to publish two Plat Books, delineating land ownership over the last 10 years. The district supports local churches with appropriate literature in observance of "Earth Week" each year. Speakers are provided, to local schools and organizations, to further conservation outreach, as may be requested. The district, each year, solicits applications from local high school students for essays written to compete for scholarships at institutions of higher learning. We have had two applicants in recent years that won the state competition.

--- Andrew Wargo, Chairman of the Desha County Conservation District

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Healthy Soils for Healthy Waters

In 2013, Greenleaf Advisors joined with The Ohio State University to bring together leaders in research, agribusiness, farming, conservation and government, through an initiative Dr. Andrew Ward and I called Healthy Soils for Healthy Waters. [Greenleaf Advisors](#), a sustainability services firm, brings together people working in the natural environment with those working in the built environment. Today, Greenleaf Advisors is known for Bridging Enterprises for a Healthy and Sustainable World. We build bridges across the sectors of science, business, policy and capital to protect the long-term sustainability of those resources (land, water, material, and energy).

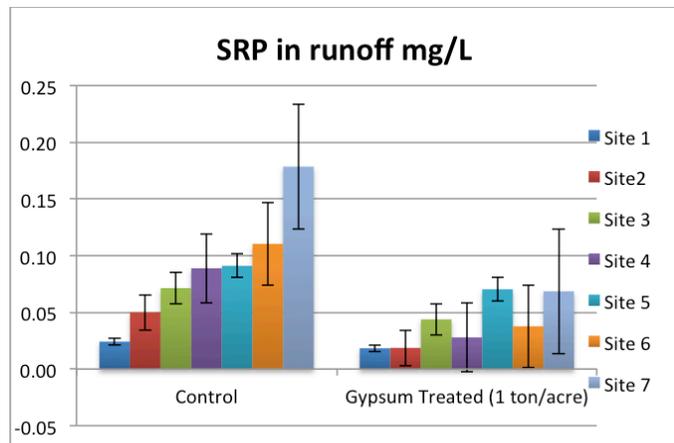
When I met with Dr. Ward of The Ohio State University at the Soil and Water Conservation Society meeting in 2013, we discussed the need for an integrated whole systems approach to agricultural land management. This started us down a path to the [Healthy Soils for Healthy Waters](#) initiative that brings together a community of interested parties to do just that.

This initiative works to protect and restore the healthy functioning of productive agricultural lands while preventing the loss of valuable topsoil and nutrients into waterways. Excess nutrients cause eutrophication and hypoxic or dead zones, where dissolved oxygen concentrations are depleted to levels that cannot sustain aquatic life in nearby as well as distant waterways. They are a primary cause of the Hypoxic Zone in the Gulf of Mexico. They also cause harmful algal blooms such as the blue-green

algae that, in 2014, caused the city of Toledo, OH to issue a public drinking water ban. All states have inland lakes that are impacted by eutrophication and harmful algal bloom. The World Resource Institute [maps](#) 762 coastal areas around the world with these problems. Promising solutions are being discovered, and in some cases re-discovered. Through the Healthy Soils for Healthy Waters initiative, they are being shared between parties across the Great Lakes and Mississippi Watersheds.

Last fall, progressive farmers and crop consultants joined a group of 100 expert researchers, watershed managers and conservationists at the Healthy Soils for Healthy Waters Workshop held in Columbus alongside Ohio's Annual [Farm Science Review](#). Participants shared more than a dozen case studies in best agricultural land management, targeting reduction of nutrient loadings to waterways. I've witnessed these best practices on visits into the fields, where expert crop consultants like Nester Ag manage nutrients in part by taking an array of soil samples, then testing for chemical and physical properties that will define management zones for differential practices. These zones form oblique shapes that look on a map like those amoeba we studied in school. Their boundaries inform satellite (GPS) - directed equipment for precision planting and nutrient application. Million dollar machine systems move across landscapes guided by intelligence that helps keep the soil and nutrients (the farmer's primary capital) on the land and out of the waterways.

One of the best practices shared at this gathering was the rediscovery of an old methodology used by farmers for more than a millennium - the application of gypsum (calcium sulfate) as a soil amendment to improve soil physical structure and chemical properties. At The Ohio State University, [Dr. Warren Dick](#) is researching the use of gypsum for its beneficial contributions to crop productivity as well as soil and water health. His most recent study on more than a dozen fields in northwest Ohio is demonstrating that gypsum applications can reduce (soluble) phosphorus in tile flow concentrations by 35-62%. Greenleaf's board member and past head of the USDA National Soil Erosion Laboratory at Purdue, [Dr. Darrell Norton](#), tells us that the use of gypsum as a soil amendment is not a new practice, but rather an ancient one. Benjamin Franklin is attributed with bringing knowledge of the practice to America from Europe. New and old insights, informed by disciplined research, are enabling the farm community to feed a growing populace in a way that keeps soil and nutrients on the land and out of the waterways. At the Midwest Soil Improvement Symposium in 2013, Dr. David Montgomery (author of "DIRT - the



Erosion of Civilizations") chronicled the decline of societies due to the loss of productive soils from poor land management. It is imperative that we address similar threats today.

The Healthy Soils for Healthy Waters initiative is cosponsoring two meetings this year (May and December). The May meeting is associated with the multi-agency Hypoxia Task Force (HTF) and SERA-46. In 1997, the HTF was established to understand the causes and effects of eutrophication in the Gulf of Mexico. Membership includes 5 federal agencies and 12 states. Earlier this year, Land Grant Universities in the 12 states represented on the HTF established the Southern Extension and Research Activity (SERA) 46 project. SERA-46 is working in partnership with the HTF to promote effective implementation of science-based approaches to nutrient management/conservation.

This coming December, presentations and updated case studies will be made by leading experts as part of a conference that is being organized by Dr. Michael Daniels at the University of Arkansas, Rebecca Power at the University of Wisconsin, and the Soil and Water Conservation Society. Knowledge will be shared on projects being studied within numerous watersheds that feed into the Great Lakes and Mississippi River systems. These gatherings are intended to continue alongside the Hypoxia Task Force meetings over the next three years as the region deliberates on making investments into best practices, then measuring and monitoring water quality outcomes at various scales. Support from the industry supply chain, as well as government policies, are needed to advance the full scale development and integration of improved practices within the agricultural community, as informed by sound research.

We at Greenleaf Advisors feel privileged to collaborate with so many leaders who are working together to address one of the most pressing issues of our time - Healthy Soils for Healthy Waters.

Greenleaf Advisors, LLC - Bridging Enterprises for a Healthy and Sustainable World.

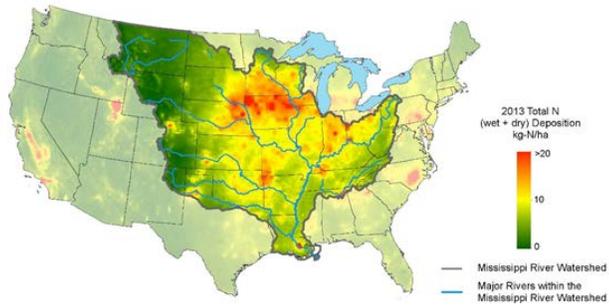
--- John A. Anderson Jr.

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Nitrogen Deposition in the Mississippi River Basin

The National Atmospheric Deposition Program (NADP) now provides maps of total nitrogen deposition for the U.S. (<http://nadp.isws.illinois.edu/tdepmaps>). The State Agricultural Experiment Stations organized what is now NADP in 1977 as a research committee to measure atmospheric deposition in rainfall and study its effects on the environment. In 2010, the Ammonia Monitoring Network (AMoN) was created through NADP to provide a consistent, long-term record of ammonia gas concentrations across the United States. Ammonia monitoring was a key ingredient to be able to estimate dry nitrogen deposition. Dry nitrogen deposition is estimated using sophisticated atmospheric chemistry models and the air concentration data. Estimates of total nitrogen deposition are obtained by combining the wet deposition values with the dry deposition values. In the figure below, values of total nitrogen deposition have been estimated for the U.S. with special emphasis placed on the Mississippi River Basin.

The loading of nutrients like nitrogen to the Gulf of Mexico via the Mississippi River has created conditions for algae to thrive. These microscopic waterborne plants cloud water and block sunlight, which can interfere with aquatic plant and animal productivity. Decomposition of algae and other dead matter removes oxygen from bottom waters and can lead to hypoxia, a low-oxygen condition. A large hypoxic zone in the Gulf of Mexico has averaged about 5,300 square miles for the past 30 years. Fish, shrimp, and crabs evacuate the hypoxic area leading to loss of a very important commercial fishery. Understanding the contributions of various sources of nutrients to the Mississippi, such as atmospheric nitrogen deposition, will allow scientists and policy makers to develop solutions to reduce the size of the hypoxic zone. The Hypoxia Task Force met in Columbus, Ohio on May 20, 2015 where they continued a dialogue between States in the Mississippi River Basin and the federal government on strategies to reduce the loading of nitrogen to the basin. The new multi-state land grant university science committee (SERA-46) met with the Hypoxia Task Force for the first time at their May meeting. SERA-46 will coordinate and facilitate research and extension needs across 12 states to reduce nutrient loading from agricultural sources to the Mississippi River Basin.



--- Ray Knighton, Air Quality National Program Leader, National Institute for Food and Agriculture-USDA

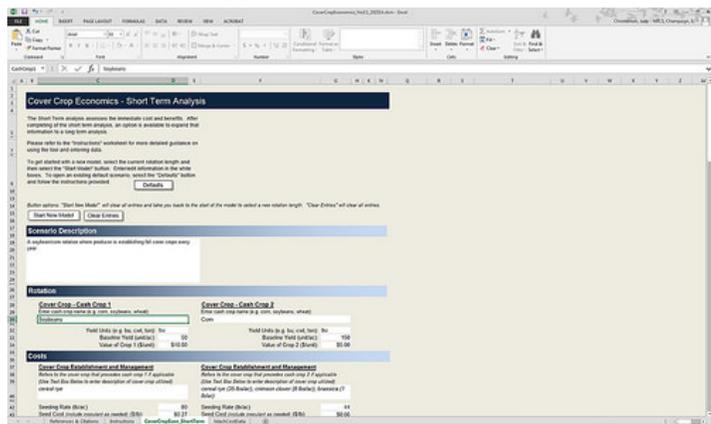
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A Tool Helps Farmers, Conservationists Measure Cover Crop Economics

What happens when you get two energized agriculture economists together? Possibly one of the best economic tools out there for farmers using or considering cover crops. The [Cover Crop Economics Decision Support Tool](#), an Excel spreadsheet, was created by two economists with USDA’s [Natural Resources Conservation Service](#) – Bryon Kirwan in Illinois and Lauren Cartwright in Missouri. The tool has taken off with great success, and the [second version](#) was released last fall.

“Where this tool has landed is not what we initially envisioned,” said Kirwan. “We wanted to build a tool valuable for producers and planners locally, and we have received many positive comments. Then it took off.”

It took almost 16 months before the first



version was released. Kirwan and Cartwright worked as a team while still performing their other duties. “The idea came from an outgrowth of conversations and shared interest,” said Kirwan. “Our backgrounds complemented each other’s strength and weakness. We wanted this to be a science-based tool and focused on making it logical and easy to use.”

Kirwan came with a strong economic and agronomic background working for NRCS and Illinois Extension Service for many years as well with practical experience owning a farm. Cartwright has degrees in environmental science and economics and is strong in programming. She has created seven other economics tools. Between the two they became, and remain an effective team.

The tool uses a few preset values, mostly to get the user started. Those values can all be changed. Once data is entered, the cost factor and benefits will be calculated for both long-term and short-term. The software can save up to five scenarios, but there’s always the option to print copies if more are needed. There is a text box to type specifics that meet the location needs and specification such as climate, region and soil types.

Cartwright said she saw the need for the Cover Crop Economics Decision Support Tool while attending soil health demonstrations. They often featured nationally known farmers who talked about the benefits of incorporating cover crops into their farming operations.

“I would be at these workshops, and I would hear these guys say back-of-envelope things like ‘I produce corn for less than \$2 a bushel.’ And I found myself thinking ‘That’s good. But how did you get to that point, and how much did it cost to get there,’” she said.

The tool is designed to assess individual situations. But there are a few basics that become evident in general. For example, the tool indicates that a long-term commitment to making cover crops work is the key to maximizing their benefits, and incorporating grazing improves the short-term economics.

Cover crops and improved soil health provides lots of benefits, such as improved water quality and wildlife habitat, but Kirwan and Cartwright designed this tool to take into account only their on-farm economic benefits.

Kirwan and Cartwright have gone on the road showcasing the tool on webinars and personal appearances at Purdue University, University of Missouri and Arkansas State University. “The tool went through a peer-review that included agency employees, university staff and private companies,” Kirwan said.

They wanted to make sure the tool was rigorous and unbiased. Future versions may address new technologies and risk factors. Kirwan said, “The tool is intended to be dynamic so the work is never done.”

Download the [cover crop tool](#). To get started with NRCS, visit your local [USDA Service Center](#) or www.nrcs.usda.gov/GetStarted.

- See more at: <http://blogs.usda.gov/2015/04/09/a-tool-helps-farmers-conservationists-measure-cover-crop-economics/#sthash.B9TpM30Q.dpuf>

--- Jody Christiansen and Charlie Rahm, Natural Resources Conservation Service

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Arkansas Conservation Partners Have a Big Impact in the St. Francis River Watershed



Fred Stuckey, of Stuckey Farms Partnership, reviews his conservation plan with Chris Culver, the local NRCS district conservationist in Poinsett County. NRCS photo.

The St. Francis River in Missouri and Arkansas has suffered for years from turbidity, or cloudy water caused by runoff of sediment, but thanks to the dedication of government and non-government groups as well as farmers, the river's water quality is improving.

Two segments in Arkansas were listed in 2006 as an impaired waterway under the [Clean Water Act](#) because of poor water quality. But in 2014, following years of focused conservation work, the two segments were removed from the impaired waterway list because water quality had greatly improved.

The St. Francis River begins in southeastern Missouri, flows across Arkansas, and empties into the Mississippi River near Helena, Arkansas. Soils eroding from farm fields have washed into waterways that flow to the river, contributing to water quality problems downstream.

Beginning in 2010, USDA's [Natural Resources Conservation Service](#) (NRCS) accelerated efforts with farmers and ranchers, as well as conservation partners in the watershed, to implement conservation systems on 479 farms and ranches in order to curb soil erosion, improve the quality of water coming off of fields, and enhance irrigation efficiency.

This conservation work was through NRCS' [Mississippi River Basin Healthy Watersheds Initiative](#), which funded five projects in the St. Francis River watershed. These projects enabled farmers to implement NRCS conservation systems that avoid, control, and trap nutrients and sediment leaving their fields. NRCS invested more than \$14 million through five projects in the watershed, putting conservation systems on more than 81,227 acres.



Water is pumped onto a rice field through an irrigation pipeline, a component of an irrigation water management system that helps improve water quality and quantity. NRCS

Through a targeted approach to implementing voluntary conservation systems, the partners identified areas of high conservation need and tailored practices, such as nutrient management, residue and tillage management, water control structures, and irrigation pipelines, to the uniqueness of small watersheds near the St. Francis River and specific environmental concerns, including the turbidity issue, and excess nutrients.

MRBI provided Fred Stuckey, of Stuckey Farms Partnership, the financial assistance to help establish a detailed nutrient management plan throughout his 8,000 acre operation. The financial incentives supported development of detailed soil maps, and combined with yield maps, provide even more data to better make nutrient management decisions.

“As a result, we have seen our overall input costs decrease,” Stuckey said. “We are also confident that increased management has led to improved water quality benefits not only on the farm but also throughout the watershed.”

This work builds on the work of conservation districts in the area, including the Cross County Conservation District and Poinsett County Conservation District. The districts have helped farmers install water control structures that trap sediment and have been leaders in promoting the use of no-till.

“By bringing all of the partners to the table to address the water quality concerns in the St. Francis, we were able to get results,” said Mike Sullivan, NRCS State Conservationist in Arkansas. “These MRBI projects have shown that targeted approaches in small watersheds can be very effective to improve water quality and maintain viable agricultural operations.”

MRBI is one of many landscape-level efforts to address water quality; similar efforts are ongoing in the [Great Lakes region](#), [Gulf of Mexico region](#), [Chesapeake Bay watershed](#) and [California Bay Delta region](#).

- See more at: <http://blogs.usda.gov/2015/04/01/arkansas-conservation-partners-have-a-big-impact-in-the-st-francis-river-watershed/#more-57492>

--- Diane Schlenker, *Natural Resources Conservation Service, Arkansas*

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