

Heartland:

WHERE WATER MATTERS



Accomplishments of the
Heartland Regional Water
Coordination Initiative



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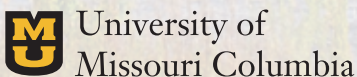
The Heartland Regional Water Coordination Initiative

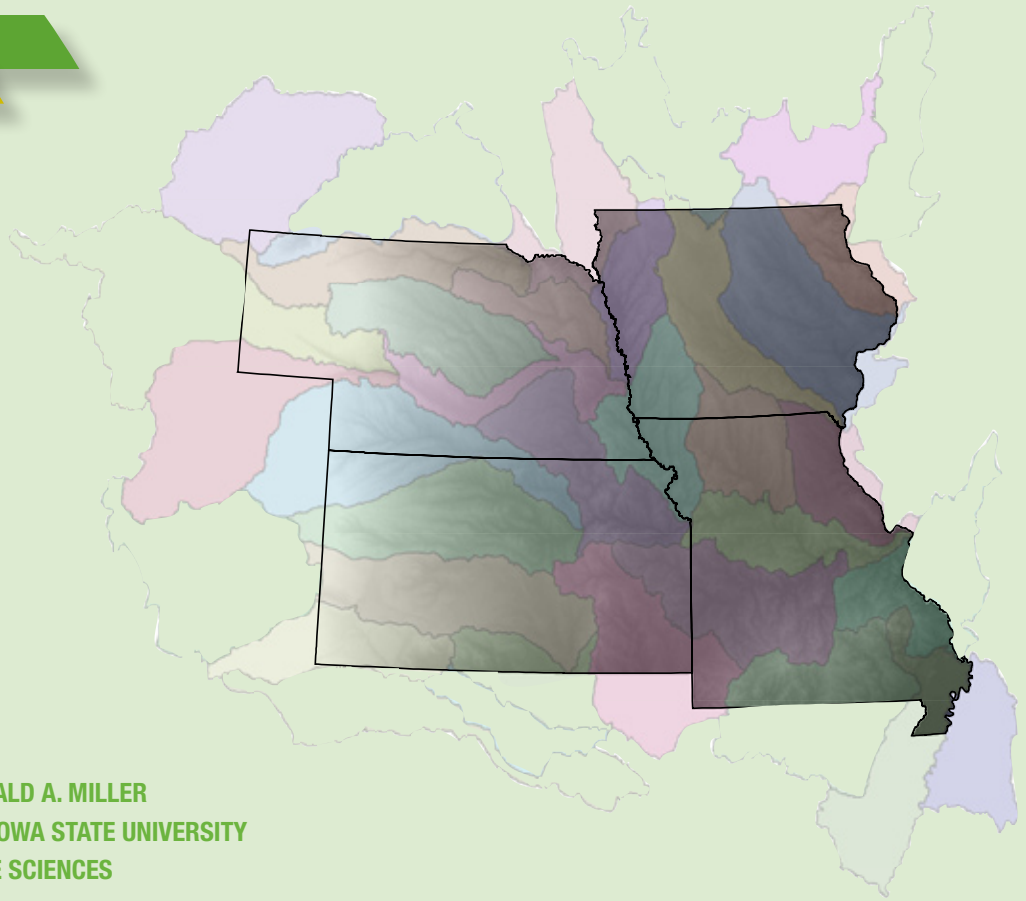
The Heartland VISION

WATER RESOURCES EXTENSION AND RESEARCH ARE REGIONALLY COORDINATED TO ADDRESS PRIORITY WATER ISSUES OF THE HEARTLAND FOUR-STATE AREA.

The Heartland MISSION

THE MISSION OF THE HEARTLAND INITIATIVE IS TO PROMOTE INTEGRATED RESPONSES TO CURRENT AND EMERGING WATER-RELATED ISSUES. WE ACCOMPLISH THIS BY BUILDING ON OUR REGIONAL STRENGTHS OF PRIORITY SETTING, NETWORK BUILDING, CAPACITY DEVELOPMENT AND THE APPLICATION OF SCIENCE-BASED INFORMATION.





WATER MATTERS

BY LOIS WRIGHT MORTON AND GERALD A. MILLER
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Water issues connect people and communities to their landscapes. Water links production and recreation, agriculture and industry. Concerns for the sustainability of water resources, both quality and quantity, force meaningful dialog among urban and rural interests, and among research, education, technical and regulatory entities. Water resource management decisions critically influence USDA NIFA national priorities (e.g. grand challenges) of Global Food Security, Climate Change and Sustainable Bioenergy.

There is a large audience and a great need for water resources research, education and extension in our region. State agencies and EPA have listed some 1,200 - 1,500 streams, rivers and lakes in Heartland states as threatened or impaired by one or more pollutants. Each of these listings impacts hundreds to thousands of people – the many scientists, specialists and planners charged with assessment, remediation and protection planning under the Clean Water Act, and thousands of urban and rural communities and businesses that will be required to implement those plans for their water resources. Increased regulation of agricultural nonpoint sources of water pollutants is also beginning to have a direct impact on the day-to-day management of mid-sized crop and livestock farms, as well as the large operations that have been regulated for some years.

THE HEARTLAND INITIATIVE

The Heartland Regional Water Coordination Initiative is a collaboration among land-grant institutions in Iowa, Kansas, Missouri and Nebraska. It is supported by the NIFA National Water Program. The goal of the Heartland Initiative is to make research-based information, education and other capacity-building resources more available to help citizens, landowners, agencies and community leaders address their water resource concerns. U.S. EPA Region 7 is our principal agency partner.

Heartland Initiative efforts recognize that our citizens share many common problems and needs with respect to water issues - stemming from agriculture as the region's principal land use and economic base. As a result, water quality impacts in the region are also primarily from diffuse, landscape-based agricultural nonpoint sources. There is increasing recognition that nonpoint sources can only be addressed by influencing the motivation and voluntary actions of many individual citizens. The information and education resources of land-grant universities are among society's most important assets capable of exerting such influence.

THE HEARTLAND EFFECT – THE MEANING OF REGIONAL COORDINATION

The Heartland Initiative is organized into multi-disciplinary regional ‘issue teams’, under the leadership of university research and extension faculty. Priority water issues are identified through a broad-based needs assessment with input from university, agency and citizen stakeholders. Heartland priority issue teams, whose accomplishments are presented in this report, address nutrient management, including animal manure management, bioenergy and water resources, human dimensions of water resources, watershed management education, and applied watershed modeling.

When the Initiative was organized in 2002, Heartland leaders conceived a vision for “regional coordination” that went beyond existing programs to focus on *cultivation of regional networks and building institutional partnerships*. Heartland has built bridges across disciplines, among educators, communicators, and researchers, and between land-grant universities in four states and beyond. Further, the Heartland has built and strengthened relationships among land-grant universities, U.S. EPA, USDA, state agencies and other stakeholders.

Networks and partnerships depend on regular communication and development of familiarity and trust relationships among individuals. Heartland has encouraged these linkages through invited participation. Attendees at issue-focused events are identified by the Heartland leaders, issue teams and their institution’s Extension ANR Leaders. Participants are chosen in part for their known interest in water resource issues, and in part for their potential working relationships at the state, county and watershed level. They include representatives of agriculture and natural resource agencies, non-governmental organizations, and local watershed leaders.

These bridges have led to innovation, more productive communications, message consistency, improved relations with agency partners, rapid sharing of regional resources and increased efficiency in creating solutions to common problems. Hundreds of university and agency scientists, field educators and technical specialists have attended Heartland events that provided continuing education and networking opportunities they would not otherwise have had. Enthusiastic praise for the value of frequent, multi-state, issue-based regional communication has been collected in outcomes research and post-event surveys. Heartland and university extension generally are credited as the facilitators.

COMMUNICATION TO COLLABORATION – LOOKING TOWARD THE FUTURE

Over the past 8 years, the Heartland Initiative has facilitated changes in many areas that directly address water resource issues. These include:

- Increased focus on environmental issues in university extension Plans of Work;
- Increased recognition and use of land-grant university resources by agency partners, including regional and national EPA;
- Opportunities for young investigators, graduate students and minority institutions to participate in water resources research, publication and programming;
- New research initiatives in the social sciences;
- Reduced duplication of programs within our region and increased partnerships with land-grant programs outside of our region;
- Increased multi-state dialog on water issues by communities, legislators and the private sector;
- Increased staff support and leveraging of additional grants for water resources research and extension.

The National Network for Collaboration has described a five-stage continuum from communication, the most informal level of commitment to joint effort, through cooperation, coordination, coalition to, finally, collaboration – in which organizations have a sustained commitment to work as a team toward common goals.¹ The Heartland Regional Water Coordination Initiative is actively engaged in moving the land-grant universities of our region and our partner agencies and organizations through that continuum toward joint, long-term support for citizens on priority water issues.

Major changes are occurring in USDA funding programs that will profoundly impact natural resources research and extension. Program priorities increasingly involve large-scale, integrated projects performed by multi-institutional, multi-disciplinary teams, requiring a high degree of coordination and collaboration to be successful. Heartland issue teams have provided a model for development of collaborative, integrated efforts and will continue to do so in the future as we seek to maintain our focus on water quality and quantity issues of importance to producers and communities in the Midwest.

¹ Bergstrom et al, 1995. Collaboration framework: Addressing community capacity. Columbus, Ohio: National Network for Collaboration.

Manure Management Policy and Practice

We realized at the first regional meeting of our stakeholder group that (their network) was the key to successful implementation of the CAFO Rule. Our real success was identified some years later when it became obvious there was now a core multi-state, multi-agency group of experts that communicated regularly, openly talked about creating a *common message* and its importance to farmers' understanding and acceptance of the water quality principles we were all striving to achieve.

The livestock industry in the Heartland region must continue to develop procedures and capacity for implementing water quality protection measures. Heartland states account for approximately 20% of 19,260 operations identified by U.S. EPA as CAFOs (Concentrated Animal Feeding Operations over 1,000 animal units) under current water regulations. Many more, smaller operations will soon be impacted. By the time the next USDA Farm Bill is written and implemented in 2017, it is estimated that *85% of U.S. livestock, dairy, and poultry farms will have participated in a water quality compliance campaign with both the regulatory community and industry.*

Research and educational programs of land-grant universities are central to the development and adoption of manure management practices to reduce nutrient loading. The Heartland Animal Manure Management (AMM) issue team has demonstrated that regional coordination among universities, agencies, and industry stakeholders as facilitated by a targeted extension effort can also influence environmental policy and regulation at the state and federal levels.

OUTCOMES AND IMPACTS

MANURE NUTRIENT MANAGEMENT PLANS – INTEGRATING RESEARCH, REGULATION AND MANAGEMENT

When manure management was identified as a regional priority water issue in 2002, recent changes in federal CAFO regulations had created a need for agencies and universities to integrate their activities for the benefit of regulators, technical assistance providers and livestock operators. The AMM team's primary goal has been to incorporate land-grant university research with extension client-focused priorities into a manure nutrient management plan (NMP) framework that will allow livestock operations to comply with regulatory mandates for environmental manure management while also remaining flexible and profitable.

Improved effectiveness of government and university programs via regional coordination. The Heartland AMM team has made a long-term effort to build trust and respect, establish relationships and utilize regional partnerships. With support of EPA Region 7, Heartland developed a steering committee representing frontline



ANIMAL MANURE
MANAGEMENT

stakeholders –state agencies, NRCS, land-grant research and extension staff in livestock, dairy, and poultry sciences, and industry representatives. Many of these specialists were interacting for the first time. Two regional working groups, on NMPs and regulatory issues, were organized from steering committee members. An annual regional update meeting maintains consistent communication among stakeholders and keeps an environmental focus on the issues.

In 2009, 25 state legislators participated in a Heartland forum to discuss livestock industry environmental issues that require action by state regulatory agencies and state legislatures. Leaders of the AMM team were then invited to brief the Midwest Legislators Conference on the event. Keeping the original core group, the team has also begun engaging livestock and poultry producers and their industry associations, building the skills and resources needed to further assist farm-level management to meet water quality goals.

Greater on-farm functionality of nutrient planning regulation. AMM has engaged the regulatory community in both integration of science and review of implementation policies for the NMP component of the CAFO rule. Joint interagency/university discussions in Nebraska first recognized the practical importance of focusing the CAFO NMP permit more on the producer's decision process in determining application rates than on prescribing specific rates. In 2005 a Heartland working group designed a "narrative" approach placing methodologies and protocols in a strategic and tactical (annual) outline that could serve both regulatory purposes and a farm's operational management.

A Heartland written response to the CAFO proposal during the EPA 2006 comment period influenced incorporation of the narrative approach as an NMP option in the final revised CAFO rule. Heartland working groups have maintained communication among states and EPA concerning the terms and conditions of a NMP that must become part of the NPDES Permit. In 2009, through the Region 7 CAFO specialist, they provided the national CAFO program with a "real" NPDES narrative nutrient plan example. The plan and an accompanying white paper use data from regional case studies to demonstrate a General Permit for a hog farm that includes the terms of an NMP drawn from the Missouri Nutrient Management Technical Standard. The study was drafted with Manure Management Planner software developed by Purdue University. U.S. EPA subsequently used Heartland's narrative cattle feedlot NMP as a training model for the "EPA Permit Writers and Inspectors Training" in September 2010.



Manure testing and spreader calibration help accurately balance application rates with agronomic production goals.

EPA acceptance of the case study essentially documents national approval for this entire planning process, as envisioned and brought forward by Heartland partners.

Promoting the application of alternative technology. A collaborative USDA, NRCS and EPA guidance document "Vegetative Treatment Systems for Open Lot Runoff" was published by NRCS in 2006. Research and demonstration involving the AMM team resulted in EPA Region 7 acceptance in 2008 of states' permitting Vegetative Treatment Systems for the first time in over 30 years of CAFO regulation.

A national team award. In 2010 the Heartland Animal Manure Management Team - including John Lawrence and Joseph Lally, Iowa State University; Richard Koelsch, University of Nebraska; and Joel DeRouchey, Kansas State University – received the first NIFA National Water Program Gerald A. Miller Outreach Team Award for their outstanding water resources extension program.

STAKEHOLDER RESPONSE

Stakeholders highly value the opportunity for regional communication and credit Heartland as the facilitator. In a 2009 study of Heartland nutrient management impacts from 2004-2008, respondents strongly voiced support for continued work on manure management issues and the importance of working on a regional basis coextensive with EPA R7. They cited needs for manure research to inform water quality policy and rule making, and for continued focus on helping producers meet regulatory requirements. State level specialists in particular cited the benefits of regional sharing to help them rapidly adopt or disseminate innovations from other states.

The Workshop Experience as a Stakeholder Magnet

A major objective of the Heartland Animal Manure Management issue team has been to provide research-based information and education for agency and private sector advisors to the livestock industry. They have developed resources, convened roundtables and collaborated with numerous agency and university programs to conduct professional workshops on environmental manure management topics. Surveys and direct feedback indicate that these regional events provide unique professional development and networking opportunities that were not available previously. Individuals frequently ask AMM leadership when the next sessions will be held.

OUTCOMES AND IMPACTS

PRIORITY SETTING

Priority topics are determined through discussions with advisory committees and working groups. It was recognized early on that gaining the trust and holding the interest of a broad range of public and private sector regional stakeholders concerning livestock and water quality would require a continuous communication stream coupled with the latest research-based information and pre-emptive topics with high 'flashpoint.' On post-workshop questionnaires the team often receives detailed narrative responses to questions about issues of greatest interest. These responses also help guide AMM programs, and they have confirmed that topics chosen are meeting their stakeholders' needs.

INFORMATION AND EDUCATION

Since 2003 the team has conducted annual training events, workshops and topical roundtables addressing the two main AMM objectives:

1. Concentrated Animal Feeding Operations (CAFO) rule understanding and implementation, and
2. development and use of NMPs as a way to deliver a common message to the farming community.

Events and partners have included:

- certification and continuing education for Technical Service Providers on writing Comprehensive Nutrient Management Plans, in partnership with a national curriculum project sponsored by USDA NIFA and NRCS

ANIMAL MANURE MANAGEMENT

Livestock producers receive separate and potentially conflicting advice, regulatory, technical and economic guidance from USDA, EPA, state agencies, university extension, technical and business service providers, suppliers and others. While manure management regulation is still a moving target, producers need as much regulatory consistency as possible from their advisors for business decisions and to ensure investments they make in water quality compliance are not wasted. It is extremely important for technical and agency professionals with whom producers interact to deliver an up-to-date and consistent message in order to make on-farm manure nutrient management for water quality protection an achievable goal.

- training for EPA CAFO permit writers and inspectors, in partnership with regional and national EPA
- Conservation Activity Planning, in partnership with a Great Lakes Region program and three states' NRCS
- updates for CAFO feedlot operators, in partnership with Cattlemen's Associations
- roundtables on topics including identifying best environmental performance indicators for NMPs, and feeding distillers grains, in partnership with land-grant university researchers and extension specialists
- an annual regional workshop that brings together all of their stakeholder groups.

Training for Technical Service Providers. A roundtable discussion in 2006 indicated a need for increased involvement with industry professionals as well as agency specialists. In 2008 the first regional "TSP College" for certified technical service providers, crop consultants and other industry specialists provided the latest research-based information on manure and nutrient management, including hands-on training with software tools and an introduction to eXtension resources. In an exit survey, the 42 participants said they would contact over 3,500 clients with the information. They highly agreed they would use the information to make better-informed decisions, to make better recommendations to producers, and to write better manure management plans and permits.

Most recently, in 2009-2010, the team is collaborating with Iowa, Missouri and Nebraska NRCS and the NIFA 'Conservation Planner Training' program in the Great Lakes Region on training technical service providers to develop Conservation Activity Plans (CAPs). The purpose of a CAP is to outline a combination of vegetative, structural, and/or management practices necessary to protect and sustain natural resources on agricultural and forest landscapes, and to serve as a blueprint for future implementation of conservation practices. Financial assistance for private sector advisors to deliver these plans was included in the 2008 Farm Bill.

The 33 participants in the first session came from 8 states and practice in 24 states. All were experienced consultants and together they contact over 3,000 farms per year. NRCS partnered for the first time outside their agency to deliver training in the region, and provided funding to Heartland to host, plan and facilitate the training. In a post-event survey, the great majority of participants indicated they would very likely share new information with colleagues and other, new, contacts, incorporate new or additional resources into their work, and communicate with improved confidence on the topics of the training.

Increased confidence is an important measure of the value of the training as related to the tasks essential to conservation planning – assessing conditions on the land and making practice recommendations. *This is different from a measure of knowledge gained in that it provides a view forward towards the likely implementation of learning.* According to a gradient score applied to the responses, there was a change (increase) in participants' confidence in assessing conditions of 2 points (out of 8) and an increase of 1.6 points for making conservation practice recommendations.

CAPS students also called in to a followup webcast, actively participating in a discussion via texting with each other and with presenters. An evaluation of the training was shared with John Meyers, Iowa NRCS State Resource Conservationist. He wrote, "Interesting remarks, we will use this to improve the training for our (NRCS) new planners and future trainings for TSPs."

REGIONAL RESOURCES

Five AMM regional publications released in 2008 (University of Nebraska-Lincoln Extension Regional Publications nos. RP190- RP194, www.heartlandwq.iastate.edu/ManureManagement/DDGS/) address the expansion of the ethanol industry and nutrient planning impacts for livestock operations feeding distiller grains. These publications and archived webinars provided timely information that was not previously available and *are an important contribution to the issue of alternative biofuels that are relevant right now to many livestock producers in the vicinity of ethanol refineries.*

The AMM team has also produced seven other regional publications since 2005, and over 40 issues of a multi-authored Manure Management newsletter. The newsletter is distributed electronically to over 200 subscribers and made available on the regional website. The website also contains Heartland-developed planning tools and white papers, other NMP reference documents and archived information from workshops, conferences and webinars. On average 350 visitors download materials each month.



Hands-on training demonstrates research-based, practical methods that professionals will deliver with a common voice.

Supporting Watershed Management Education

Effective watershed education is critical to address the entire scope of water issues. Citizens, elected officials, tribal authorities, and technical field specialists must take increased responsibility for managing and reducing nonpoint source pollution in their watersheds. Many have little familiarity with relevant scientific concepts or regulatory mandates.

Extension, agency technical specialists and watershed coordinators find themselves in the role of educator, in non-formal, informal, and formal educational settings, preparing citizens and communities to participate in watershed management. The ability of these educators to work effectively with diverse audiences becomes especially important when helping community-based groups prepare plans to meet EPA expectations. Local citizens depend upon agency and extension professionals to guide them.

OUTCOMES AND IMPACTS

REGIONAL NEEDS

The Heartland leadership team identified three regional needs for capacity building among watershed educators, and successfully included minority land-grant institutions in projects addressing these needs.

Professional development and networking. Many individuals with responsibility for citizen education work in relative isolation. They can serve large regions, have heavy workloads, and water education may only be a part of their responsibilities. Those with strong technical backgrounds often have limited training in effective and credible communication, while educational specialists may not be familiar with current water regulations and pollution issues. Faculty and staff in minority land-grant institutions educate students who may become tribal authorities in charge of watershed management planning and implementation.

Increased clarity and consistency of EPA guidance and expectations. Under Section 303(d) of the Clean Water Act, states, territories, and authorized tribes are required to develop lists of

WATERSHED MANAGEMENT EDUCATION

“Heartland has helped us to come together, identify some of the problems (with 9 Element planning) and start working toward solutions that will satisfy state needs as well as EPA. With your assistance, I look forward to continuing our process and finding viable solutions to the dilemmas of watershed planning.”

*Greg Anderson, Missouri Department
of Natural Resources*

impaired waters which do not meet the water quality standards set by states, and establish priority rankings for waters on the lists. Watershed management plans adhering to EPA's "9 Element" guidance must be developed for these watersheds to access public funding for protection or remediation. Watershed educators need clear and consistent guidance about EPA expectations and how best to help community-based groups develop effective plans.

Tools for communicating with different kinds of audiences.

Watershed educators must effectively work with diverse audiences, ranging from students and their teachers to citizens who must understand management recommendations for their lands and communities.

EFFECTIVE REGIONAL SOLUTIONS

The Heartland Watershed Management Education team has:

- facilitated communication and coordination among state and regional agency staff responsible for consistent guidance to local planners.
- linked educators from minority institutions who typically have the fewest opportunities to network.
- identified technical content that watershed educators need to understand and communicate to diverse audiences.

Education Exchange. In 2009, Heartland sponsored a watershed education exchange for post-secondary and non-formal agency educators at Haskell Indian Nations University in Lawrence, Kansas. Educators from eight of the 1994, 1890, and 1862 land-grant universities in the Heartland region shared where and how water issues are addressed in academic course outlines. Non-formal educators explained how they work with producers and urban watershed audiences with water testing, modeling and demonstrations. They discussed their common challenge to reach audiences unfamiliar with watershed concepts. When educators are effectively networked, innovations spread rapidly.

Consistent guidance for 9-Element Watershed Plans. EPA requests that each state prepare plans for watersheds that have a Total Maximum Daily Load (TMDL) developed. Impaired waters on the 303(d) list are assumed to need a TMDL eventually unless there is a change in environment, policy or regulation. Community-based watershed groups must help prepare the plans addressing their watershed needs and guide funding towards the most effective improvements. The EPA has identified nine planning elements which, when addressed, can help local citizens make needed changes.

The Heartland Community Involvement in Watershed Management team conducted roundtables that brought together the EPA Region 7 nonpoint source program partners with environmental agency personnel from the four states. Marked differences were found among states in how the nine-element guidance was interpreted and implemented. Following the meetings, two EPA state program coordinators produced a checklist based on workshop discussions to facilitate watershed plan evaluation and approval at the state and regional level. EPA produced a draft regional guidance document. Both EPA Region 7 and state managers credited Heartland as facilitator of these developments.

Using Missouri as a pilot area, one-day trainings were held in five locations followed by a larger statewide conference. Evaluations and post-event surveys showed the trainings raised the confidence levels of participants and specifically helped them learn essential skills such as calculating load reductions.

Table Top Model and Watershed Delineation Workshop.

In 2010, the Heartland team addressed a common challenge for watershed educators – helping people connect to their watershed, understand water management and their part in it. Educators learned to delineate a watershed from a topographic map, and constructed a watershed model of the type they could utilize in their own educational situations. They also learned of the variety of supporting resources from the land-grant institutions, and a curriculum for using watershed models.

Tools for watershed education. To reach different audiences, the Watershed Management Education team and their partners have developed the following regional tools for watershed educators.

- Watershed Delineation and Model Building curriculum.
- Nine Element Watershed Management Planning Handbook developed in cooperation with EPA Region 7 staff and 319 state coordinators from Iowa, Kansas, Missouri and Nebraska.
- Watershed Management Plan Workshop and curriculum used for pilot training in Missouri.



Recognizing watershed boundaries is key to watershed management.

"We are just getting started (with environmental programs) at our college and this conference saved me time in research and development hours; helped me to better focus topics and develop connections to agencies where I can ask questions in the future. Thank you!" Colleen Campbell, Little Priest Tribal College, Winnebago, NE

Enhanced Regional Capacity in Nutrient Management

"I have found collaboration between the four states to be the main benefit. It helps me tremendously to **have all of the folks in the same room chew on some of the same issues; multiple heads thinking on the same topics. In the end, I'm confident it helps the producers** to get all of us up to speed with what people are seeing across the river [meaning between the states across the Missouri River]."

*Respondent, Nutrient Management
Evaluation Study, 2009*

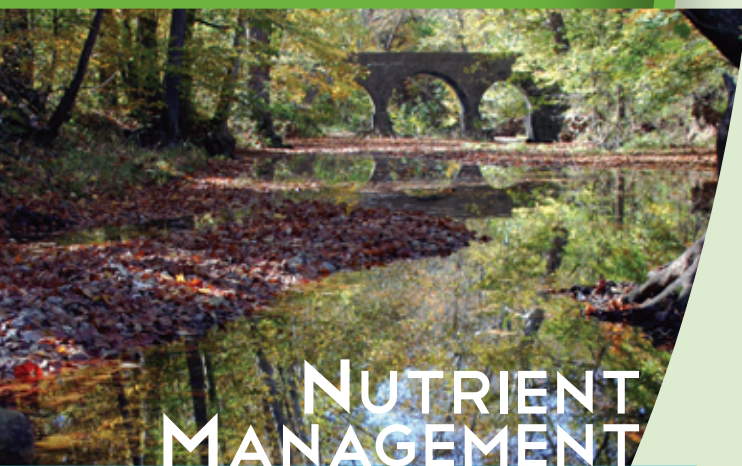
Increasing adoption of nutrient best management practices (BMPs) on agricultural lands is an issue at both the field and landscape levels. Excessive phosphorus application to agricultural fields can overload soils, increasing potential for phosphorus runoff to surface waters. Excess or misapplied nitrogen can lead to nitrogen losses in surface and ground water. In the Heartland, nitrogen and phosphorus are significant components of non-point source pollution with local and regional impacts felt all the way to the Gulf of Mexico.

In 2002 the Heartland leadership team recognized nutrient and pesticide management for crop production as a priority regional issue because of the profound effects on water quality, and established the Nutrient and Pesticide Management issue team. Major issues with nutrients and pesticides include:

- Over 50 percent of streams and 40 percent of lakes and reservoirs in the four-state area have been rated as impaired (2002 *National Water Quality Inventory Report to Congress*).
- Groundwater supplies 39 percent of the public drinking water for cities and towns and 96 percent of the water for domestic self-supplied systems.
- In 2002, herbicides were applied to 16.7 million acres in Iowa, 10.3 million acres in Kansas, 6.4 million acres in Missouri, and 11.3 million acres in Nebraska.
- In the future, it is expected that even more rapid and extensive BMP implementation will be required to reach water quality goals.
- Increasing climate variability will require the agricultural community to adjust their nutrient management practices to accommodate the weather while achieving high productivity.

OUTCOMES AND IMPACTS

The Nutrient Management issue team facilitates coordination and linkage of land-grant university resources of extension and research with the needs of EPA and state agency water quality protection programs. Their multi-state, multi-institutional coordination reduces duplication and enables greater sharing of information and expertise among stakeholders in the region. Their activities have also enhanced collaboration among



university programs. In response to region-wide needs identified by Heartland leadership, the NM team has proceeded to:

- identify the critical and emerging issues;
- strengthen *technical capacity* of individuals and institutions to assist farmers and service providers and educators with improved management guidance and resources;
- improve inter-institutional and interstate relations and collaboration.

The NM team has addressed a priority topic each year since 2004, using a consistent framework of a research roundtable for specialists to share the latest findings, followed by a training workshop for resource management professionals. Roundtable and workshop details are archived on the team's website and form the basis for multi-authored regional extension publications. Recently the team has also conducted webinars that are nationally promoted.

Participants in the roundtables and workshops are specially invited to represent a cross section of land-grant research and extension, agency administrative and field specialists, and industry or private practitioners. This has resulted in new working relationships, rapid sharing and uptake of information on developments and challenges across the region, innovation in sharing of resources and ideas, and increased collaboration.

The topics addressed by the NM team are as follows:

- Phosphorus Management for Water Protection (2004)
- Nitrogen Management for Water Protection (2005)
- Pesticide Management for Water Protection (2006)
- Targeting Critical Source Areas in Watersheds (2007)
- Impact Assessment in Water Quality Protection (2008)
- Improving Cost Effectiveness in Water Protection (2009)
- Nutrient Management for Water Protection in Highly Productive Systems (2010).

SELECTED RESULTS

Successful regional research collaboration. A multi-state pesticide research group formed at the Heartland Pesticide Roundtable in 2006 developed a proposal to the then-CSREES 406 Program for an integrated project. "*Targeting Watershed Vulnerability and Behaviors Leading to Adoption of Conservation Management Practices*" was funded for \$570,000 over three years. Project collaborators represent University of Nebraska-Lincoln (Shea, Milner, Martin, Lynne, and Burbach), Kansas State University (Barnes), USDA ARS, Missouri (Lerch) and the Iowa Geological Survey (Skopec).



Workshop demonstrations and activities share regional resources.

Targeting equipment leveraged. As a result of the presentations of Kiel and Hopkins of Iowa DNR at the 2007 Heartland workshop on targeting critical source areas, EPA Region 7, Kansas Department of Health and Environment, Nebraska Dept. of Environmental Quality, and UN-L Extension purchased hand-held GPS interfaced for stream characterization and tablet computers interfaced for watershed characterization. This equipment enhances the capacity of field staff to apply the latest research-based methods for effective watershed management.

Regional extension publications. Four publications with 30 contributing authors have been produced: *Agricultural Phosphorus Management and Water Quality Protection in the Midwest*, *Agricultural Nitrogen Management and Water Quality Protection in the Midwest*, and *Targeting of Watershed Management Practices for Water Quality Protection* (University of Nebraska Extension RP187, RP189 and RP195) and *Pesticide Management for Water Quality Protection in the Midwest* (Kansas State University Agricultural Experiment Station and Cooperative Extension Service, MF-2822). Also published in the *Journal of Soil and Water Conservation* in October 2005 was the paper, "*Phosphorus indexes in four Midwestern states: an evaluation of the differences and similarities*". Another publication "*Cost-effective Water Quality Protection in the Midwest*" is under review.

Facilitation of joint proposals is an impact of targeted workshops. As an example, a USDA-AFRI integrated proposal involving an inter-disciplinary mix of key personnel from the 4-state Heartland Region was submitted to address nitrogen and water use efficiency with a perspective of climate change mitigation and adaptation. The conceptual basis for the proposal was developed during working group discussions of the Heartland NM-Bioenergy and Water Resources research roundtable of 2010 and many of the key personnel have been Heartland participants.

Regional Capacity Building for Extension Water Programs

In a survey following the 2005 Regional Water Conference, 99% of respondents said the conference gave them a better understanding of water resource concerns in the region, and 88% said the conference would help them in developing future water resource programs.

A major goal of the Heartland Regional Water Coordination Initiative is to build capacity of cooperative extension across the region to address priority water resource issues with their clients in the agriculture industry and rural communities. There is a rapidly growing need to connect land-grant resources to water programs for citizens at all levels.

The Heartland seeks to strengthen extension water programming through a multi-institutional regional effort to:

- Improve access to current scientific and technical findings, environmental regulations, and community development practice related to watershed and water resource protection and management.
- Improve participants' access to up-to-date resources and tools for water quality education and outreach.
- Develop regional support, institutional support and peer networking for increased water resource programming within and among states.

OUTCOMES AND IMPACTS

REGIONAL WATER CONFERENCES

The Heartland Initiative has sponsored two Regional Water Conferences targeting extension educators, in 2005 and 2009. Both conferences consisted of featured presentations on major current and emerging water issues, followed by concurrent sessions organized by each Heartland team to provide more targeted information on regional priorities. The conferences concluded with state-by-state breakout discussions of agency partnerships and needs for future land-grant water programming.

Most extension staff do not have water quality as a formal part of their plan of work. The Heartland conferences sought to re-energize them to identify water quality issues that are important to their clients, find ways to incorporate water quality into their programs, and form more productive partnerships both within and outside the land-grant universities to help them do so.

Invited participants were identified by the Heartland Initiative leadership and their institution's Extension ANR Leaders. Participants were chosen in part for their known interest in water resource issues, and in part for their potential working

REGIONAL CAPACITY BUILDING



relationships at the state, county and watershed level. Attendees also included representatives of agriculture and natural resource agencies, non-governmental organizations, and local watershed leaders.

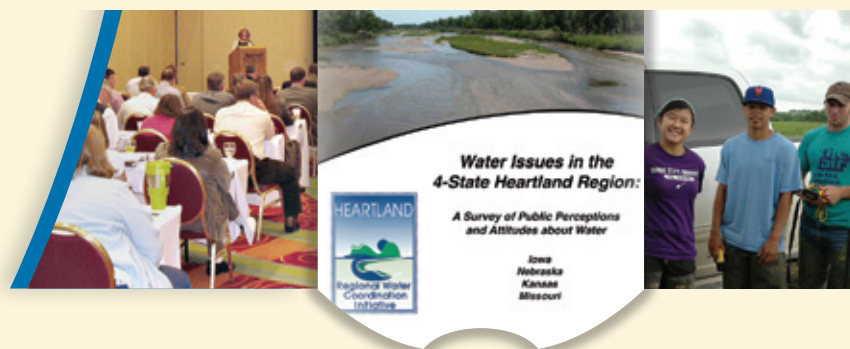
The conferences were held in Kansas City area and were open to EPA staff, many of whom attended. *Their participation in these conferences, along with EPA participation in Heartland issue teams, has had a major impact on Region 7 awareness of land-grant programs and resources.* The EPA Region 7 watershed/communities program specialist noted after the 2005 conference that the event had given her valuable new contacts for information and land-grant resources in her area of responsibility. EPA staff have also helped the Heartland Leadership Team raise visibility of the NIFA Water Quality Program within their agency through briefings presented to regional and national EPA leadership.

In 2005, of the 138 attendees, 80 percent were extension faculty and staff of Iowa State University, Kansas State University, University of Missouri, University of Nebraska, Haskell Indian Nations University and Nebraska Indian Community College. A majority worked at the county or district level. The presentation topics they rated highest were discussions of community development practice concerning watershed protection, and improving their knowledge of resources and tools for water quality education and outreach. Highest recommendations for future topics of interest were related to the “human dimension” and education, planning and evaluating programs, and urban water issues.

Recommendations for state programming which emerged from the Iowa breakout discussions were submitted to Iowa State University Extension Plan of Work committees. *These recommendations and results of the Heartland 2006 Regional Water Survey influenced the Extension program teams in their development of the 2008-2012 Plan of Work.* The new Plan places greater emphasis on natural resources and environmental stewardship education, including water quality, and addresses emerging priority issues and non-traditional audiences. Recommendations from the Nebraska discussions were also shared with their university extension program leaders.

As a result of the 2005 conference, several *Iowa extension field specialists began actively working to organize citizens' watershed groups, and are now part of a NIFA National Water Program- supported Extension Education Project that includes leadership development and an online curriculum.*

There were 117 participants at the 2009 Regional Conference. In a short pre-conference online questionnaire, 59% of respondents said they had attended the previous Heartland Regional Conference. Their answers indicated that, at a regional level



Heartland develops regional support for increased water programming.

they perceive a slight but significant increase over the past 4-5 years in their involvement in water outreach/education for ag and youth, and with colleagues in universities and agencies. About 80% had attended 2 or more water-related professional development programs in that time period. *Seventy-four percent believed their clients had a greater need for water programs and education than 4-5 years ago, but a majority saw less or no change in their clients' requests or interest in these topics.*

In a conference exit survey, the 42 respondents who answered the question indicated they would reach 73,800 people annually with water information. Although they were not asked to specify the nature of the interactions, many qualified their answers and produced a range of types of contacts from face-to-face individual client service to media and multiple audience contacts.

Heartland Regional Survey of Public Perceptions and Attitudes about Water. The Heartland survey was conducted in 2006 in collaboration with a national project managed by Dr. Robert Mahler, University of Idaho. The survey design allowed for statistical evaluation of the data for individual states and for the region. Five technical reports have been published – one summarizing the regional results and one for each state. *Sharing results within the states has increased stakeholder interest in working relationships among land-grant universities, the Heartland teams and state agencies.*

Results of the Regional Water Survey are being used by agencies and universities to create more responsive water programs. Staff of the Iowa Department of Natural Resources used the survey to inform policymakers about the awareness and needs of Iowans for environmental programs. Legislative findings for the Iowa Surface Water Protection Act, passed in April 2008, were derived in part from the Heartland Iowa survey. The Iowa DNR has awarded a grant to study Revolving Loan Fund Programs for Agricultural Best Practices as a direct result of state decision makers' interest in the survey.

B

uilding Regional Capacity for Applied Watershed Modeling

We have found considerable differences in staff orientation and training among our state agencies. We are building a network to share the best available research and resources on a regional basis with a vision to establish, train and support a network of model-users, primarily those working in agency programs.

For the future of American water resources it is crucial that universities focus not only on research to create the best predictive watershed models, but also on training the technical specialists, educators and project managers who must understand and rely on model outputs to develop and implement watershed plans, and to communicate with citizens about needs and results.

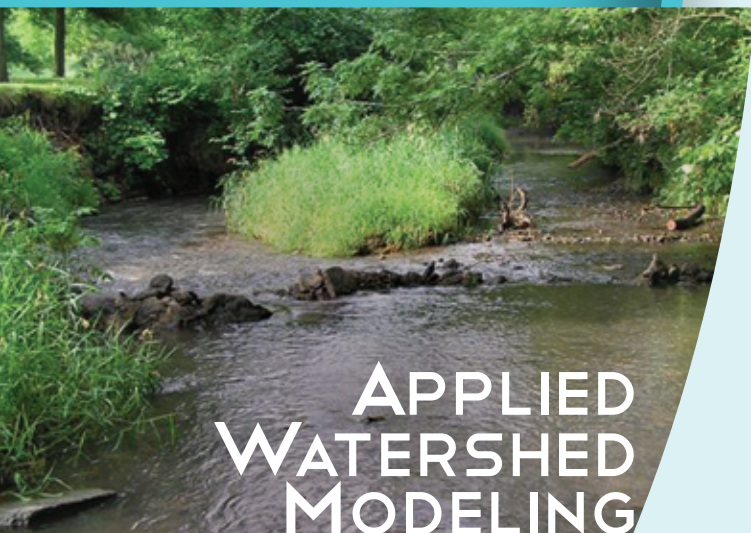
Watershed-scale simulation models developed through collaborative research among land-grant universities and federal agencies play an increasingly important role in our management of water and other environmental resources. Pollution sources, remediation options, and performance tracking at the landscape scale are extremely complex due to the physical and biochemical characteristics of watersheds. Nearly 2,400 priority impaired water bodies in the Heartland and 40,000 nationwide must be evaluated and improved to protect human, livestock and aquatic health, recreation and other uses. For most impaired Heartland waters, decision making can be improved by integrating modeling results with local knowledge.

OUTCOMES AND IMPACTS

NEEDS ASSESSMENT

In 2008 the Heartland leaders established Applied Watershed Modeling as a crosscutting issue that could contribute to the work of all Heartland issue teams. A needs analysis conducted in 2009 identified an opportunity for regional capacity-building in this area that had not been clearly recognized at the individual state level. Approximately two dozen watershed specialists were surveyed by email and telephone concerning their understanding and use of commonly applied models. The survey population comprised a large fraction of those who are administering programs with targeted public funding and need model outputs to complete their responsibilities. They included specialists from state and federal natural resources and environmental agencies.

The regional study found considerable differences in the region among staff orientation, training, and experience and limited communication among those who are currently using



APPLIED
WATERSHED
MODELING

applied watershed models. In addition to the need for sound planning and recommendations, these specialists find that the effectiveness of their programs depends on the trust and credibility they build with their clients. The ability to use and understand models therefore puts these individuals and their institutions on the line every day.

MAKING MODELS WORK

The needs analysis found that state and federal agency water specialists work with more than 7 different models and they described the following challenges:

1. verifying that the right kind of input data was used,
2. understanding model processes,
3. calibration of water quality constituents such as bacteria, nutrients, and sediment,
4. evaluating uncertainty in modeling results, and
5. determining how to model best management practices at meaningful scales.

They said that an overview of the various watershed models, their strengths and weaknesses and applicable scales would be valuable to their work.

CAPACITY BUILDING

The Heartland Initiative is developing a coordinated regional program to support watershed specialists in the use of models. Two webcasts have been conducted:

- “Water Quality Modeling: Choosing Among Watershed-scale Models,” which provided an overview of the HSPF, WARME, AnnAGNPS, SWAT, and APEX watershed-scale models; and
- “Watershed, In-Stream, and Lake/Reservoir Water Quality Models for Planning and Assessment” which provided an overview of the GWLF watershed-scale model, the BATHTUB and CE-QUAL-W2 lake/reservoir models, and the QUAL2E and QUAL2K in-stream water quality models.

These webcasts are archived on the Heartland website. They lay a foundation for modelers in understanding the capabilities of various watershed models, the input data required, the steps for model input, the necessary effort for project construction and model calibration, and the interpretation of simulation results. Approximately 50 people viewed each webcast.

Surveys following the webcasts showed participants found the presentations very valuable to better understand and choose models to best fit their needs. Perhaps most important is finding out how much these specialists need help – more than 80% said assistance using models and regular opportunities to dialog with other model users within the region would be very valuable.

The first online discussion group was conducted in October, 2010 on “Identifying Nonpoint Source Critical Source Areas Using SWAT”. Targeting critical source areas that contribute more pollutants per unit area than others is a primary strategy of today’s publicly-funded water quality and conservation programs.

OUTCOMES

The Heartland Applied Modeling program is developing training modules and educational workshops for applied model users that integrate computer program training with a much broader perspective on the selection and use of decision tools to solve unique local problems at the watershed scale.

The Heartland program addresses a need to make applied modeling more ‘people friendly’ – both for the confidence of the non-specialists who use models, and for educational outreach to citizens on model-based information about the environment. We are increasing the efficiency and effectiveness of existing training by coordinating support for water specialists to share the best available research and resources on a regional basis.



For most impaired Heartland waters, decision making can be improved by integrating modeling results with local knowledge.

The ability to use and understand models puts specialists and their institutions on the line every day.

Connecting Issues in Bioenergy and Water Resources

For U.S. agriculture the potential of bioenergy for addressing part of the nation's demand for energy creates both profitable opportunities and new challenges for using and protecting water resources.

The major economic and environmental impacts in Heartland states are from corn ethanol production. Nationally, bioethanol production for fuel has increased over 10-fold in the past 20 years, and in 2008 and 2009 claimed over 45% of the total corn crop in our region. According to the USDA Biofuels report, there are 79 biorefineries in the region with 40 in Iowa and 22 in Nebraska. The production value of ethanol in the region is over \$11 billion.

Water quality and quantity are both concerns accompanying these developments. Increased production of ethanol feedstocks, including corn, sorghum and cellulosic crops, on irrigated land will seriously increase pressure on water availability. Ethanol refining is also water-intensive. Intensifying crop production even in the most suitable Corn Belt conditions increases nonpoint source pollution risks associated with erodible soils and increased nutrient inputs.

OUTCOMES AND IMPACTS

A NEED FOR EDUCATION

When the Heartland Bioenergy and Water Resources (BWR) issue team was established in 2008 regional interest in economic and technological aspects of bioethanol had proliferated rapidly and engaged both extension and the popular media. However, the impact of biofuel production on water quality and quantity was just emerging as a regional concern and was not widely or well understood. Extension and agency educators and specialists needed a rapid infusion of research-based information to share with the public. Educators also needed exposure to industry, environmental, regulatory and policy perspectives that would help them define the issues more clearly for their clients.

HEARTLAND ACTIVITIES

In the Heartland region, the “water footprint” of biofuels is above all influenced by crop management practices. Four priority topics related to the developing bioenergy industry

BIOENERGY AND WATER RESOURCES

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Heartland provides opportunities for educators to communicate with colleagues across the region.

Heartland provides new knowledge and timely training for educators across the region.

were identified that would most directly reduce negative impacts of expanding biofuel production on Heartland water resources:

- conversion of Conservation Reserve Program (CRP) acres and non-cropped or other marginal lands to production of biofuel crops;
- a need for significant ecological intensification of corn production so that expansion of production on environmentally sensitive acres could be reduced while meeting feedstock demands;
- improved management of irrigation water for biofuel crops; and
- creating the most efficient farm-to-fuel production systems for biofuel crops.

The team is focusing on these issues, one per year, through 2012.

Conversion of CRP acres to crop production was the first issue addressed. Nearly 5 million CRP acres in Heartland states are eligible for retirement between 2009-2012. Much of this land has been in the CRP for 10-20 years. In 2009 the BWR team conducted a research roundtable and workshop bringing together specialists, educators and agency personnel to learn about research and best practices for converting CRP to production of corn, soybean, and wheat. A webinar was conducted on conversion of CRP using no-till practices.

On a post-workshop survey, a majority of respondents with extension/outreach responsibilities said information they learned had a very high potential impact on work output in both areas of extension (68%) and resource management (63%). Respondents most highly agreed with the statement “the audience had the right people with whom to network”. Those with regulatory and extension/outreach responsibilities were more likely than others to feel that they lacked opportunities to communicate with colleagues across the region. These

results suggest that Heartland targeting of educators and agency specialists for their workshops is an appropriate strategy to improve use of research-based knowledge on bioenergy topics.

Ecological intensification, simply defined as increasing crop yield toward its physiological optimum while protecting the environment, is considered a key agronomic strategy to meet the increasing demand for agricultural commodities worldwide while continuing to protect marginal acres. In 2010 a research roundtable and workshop were conducted on this topic. The presentation by leading researcher, Dr. Ken Cassman, University of Nebraska-Lincoln, was recorded and is available on the Heartland website as are other roundtable, workshop and webinar materials.

On a post-workshop survey, respondents especially emphasized their gains in understanding of residue removal impacts on soil and water quality, new technologies to improve nitrogen management, and climate change implications for nutrient management. They were most highly in agreement with the statement “I gained new information that I can use or teach for improving nutrient management.”

CURRICULUM DEVELOPMENT

The Heartland bioenergy and water resources team is a partner in the NIFA National Water Program National Facilitation project, *Energy Independence, Bioenergy Generation and Environmental Sustainability: The Role of the 21st Century Engaged University*. This national project is coordinating regional and national experts and archived resources to create a modular on-line curriculum for Extension educators. The Heartland team is providing leadership for development of a module related to bioenergy and water resources using information and resources from the regional workshops. The module addresses water use in fuel production and impacts to aquifers, biodiesel fuel development and water, and bioenergy policy issues relevant to water.

Connecting Human Action to Improved Water Quality

When the Heartland Initiative made Community Involvement in Watershed Management a regional priority in 2002, few social scientists worked closely with agricultural scientists and engineers on nonpoint source water quality projects. Although extension specialists and some partner agencies, including EPA and NRCS, had begun to recognize the crucial importance of human motivation and peer interactions in water protection, our Heartland land-grant universities had no faculty working on environmental sociology specifically related to water issues. In 2004 Heartland established the Human Dimensions issue team charged with “cross-cutting” responsibility for contributing environmental sociology research and extension elements to all regional priority issues. At about the same time the social sciences were added to the topical areas identified by the NIFA National Water Program.

Since then the Heartland Human Dimensions team has successfully integrated social science into programs of the technical Heartland issues; contributed to state, regional and national survey research; produced three graduate theses, three refereed publications and five extension technical reports; organized a national research network focused on human interactions with water issues; established a multi-state North Central Region research project; and published a multi-authored resource volume that is the first of its kind to address practitioners with both research and implementation review and guidance.

OUTCOMES AND IMPACTS

SURVEY RESEARCH

Since 2004 Heartland has conducted sociological surveys, key informant interviews and focus groups in over 150 watersheds throughout the region. Seven graduate students at three institutions have participated. Funding, implementation and student support has been leveraged from U.S. EPA Region 7, state departments of agriculture and natural resources, the USDA NIFA National Water Program and other university programs.

HUMAN DIMENSIONS

“The term human dimensions refers to how and why humans value natural resources, how humans want resources managed, and how humans affect or are affected by natural resources management decisions. Human dimensions inquiries strive to understand human traits and how to incorporate that understanding into . . . actions. . . including cultural, social, and economic values; individual and social behavior; demographics; legal and institutional frameworks of management; communication and education; and, decision-making processes of management.”

Dobson et al. 2005. Society and Natural Resources, 18:487–491.

Results of a Heartland-conducted **Regional Survey of Public Perceptions and Attitudes about Water** were published in 2006 and widely discussed at conferences and among agency and extension program leaders. Marketing of information from this survey brought Heartland HD resources and the resources of land-grant university sociology extension to the attention of many potential partners and results have influenced program planning within extension and state agencies.

The Heartland regional survey was part of a **national series of state surveys** sponsored by the NIFA National Water Program and managed by Dr. Robert Mahler, University of Idaho. Heartland is responsible for **national meta-analyses** combining their results. One Ph.D. dissertation and a refereed publication have resulted to date. Heartland involvement in the national survey project is ongoing. The template developed for Heartland survey reports has been adopted by the Southern Region and creates the basis for a nationally-consistent presentation of results.

Heartland also conducts studies in targeted watersheds to **identify social connections and patterns of citizen involvement in effective water protection and improvement projects**. Research on local “performance based environmental management” groups in Northeast Iowa explores the “good farmer” identity and the effect of group dynamics on changing agricultural practices that impact water quality. The work has resulted in a Masters thesis and invited presentation to agencies, commodity and professional organizations.

Human Dimensions research has been incorporated in roundtables and technical publications of the Heartland Nutrient Management issue team and a Nebraska “Stakeholder Involvement” workshop for technical professionals and extension educators.

CREATING A NATIONAL RESEARCH NETWORK

Recognizing the lack of connections in the field, Heartland organized a Social Science Roundtable in 2009. Fourteen scientists representing four NIFA Water Program regions outlined social, political and economic research related to citizen participation in water issues. Post-roundtable feedback produced comments such as “an impressive group of like minded researchers” and “the thing that was ‘most useful’ I would say (was) getting connected to other social scientists in a positive community that is seeking to advance knowledge”.

North Central Region project NCDC221 “The Causes and Consequences of Individual and Collective Actions to Protect Water Resources” was developed as the result of the roundtable. This multi-state group of scientists is designing research that will improve our understanding of key sociological and ecological events and conditions that influence changes in conservation behaviors, and management decisions and adaptive strategies that help citizens and leaders respond with sustained action to protect water resources.

RESOURCE PUBLICATION

Pathways for Getting to Better Water Quality, The Citizen Effect This volume, scheduled for publication in November, 2010, includes contributions by researchers and extension specialists from 10 universities within and beyond the Heartland states. The book is primarily aimed at practitioners and offers examples of how citizens in urban and rural communities across the United States have organized and taken action to improve the quality of their local waters.



On-farm field tests allow farmers to evaluate how new farm practices will impact their operations.

One-to-one conversations between farmers facilitate the dispersion of water quality knowledge.

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