Mississippi River
Gulf of Mexico
Watershed Nutrient
Task Force

Moving Forward on Gulf Hypoxia

Annual Report

2010

Hypoxia Task Force

Comments from the Task Force

This is the second release of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force's (Hypoxia Task Force) Annual Report. The report tracks interim progress on the actions accomplished in Fiscal Year 2010 by Task Force member states and federal agencies and their partners to reduce nitrogen and phosphorus loading in the Mississippi/Atchafalaya River Basin (MARB) and, ultimately, to reduce the size and severity of the Gulf of Mexico hypoxic zone.

The report is composed of two parts: (1) quantitative indicators (based on currently available data) of programmatic outputs and environmental outcomes of Task Force member organizations' activities and (2) a series of success stories that highlight some of the projects and programs undertaken by Task Force members and their partners.

The Task Force, after a visit to a nitrate removal wetland site that is part of the Iowa Conservation Reserve Enhancement Program (CREP). Efforts like this wetland are helping the Task Force move forward on hypoxia in the Gulf of Mexico.

Members of the Task Force

State Agencies

Arkansas Natural Resources Commission
Illinois Department of Agriculture
Indiana State Department of Agriculture
Iowa Department of Agriculture and Land Stewardship
Kentucky Department for Environmental Protection
Louisiana Governor's Office of Coastal Activities
Minnesota Pollution Control Agency
Mississippi Department of Environmental Quality
Missouri Department of Natural Resources
Ohio Department of Natural Resources
Tennessee Department of Agriculture
Wisconsin Department of Natural Resources

Federal Agencies

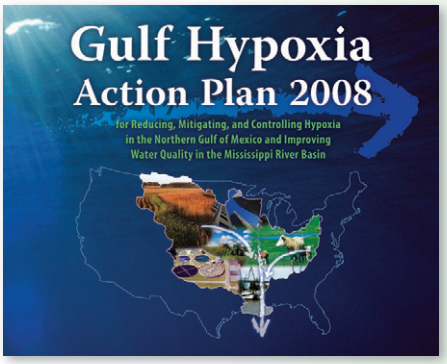
U.S. Army Corps of Engineers
U.S. Department of Agriculture
U.S. Department of Commerce (National Oceanic and Atmospheric Administration)
U.S. Department of the Interior (U.S. Geological Survey)
U.S. Environmental Protection Agency

Federally Recognized Tribes

Cover Photo: The Mississippi River Delta is of significant ecological, economic, and cultural value, and is pictured on the cover to highlight (with enhanced coloration) the extent of its wetlands and channelization. (Source: NASA)

Task Force Actions

1. Complete and implement comprehensive nitrogen and phosphorus reduction strategies for states within the MARB encompassing watersheds with significant contributions of nitrogen and phosphorus to the surface waters of the MARB, and ultimately to the Gulf of Mexico.
2. Complete and implement comprehensive nitrogen and phosphorus reduction strategies for appropriate basin-wide programs and projects. Target first those programs and projects with significant federal lead or co-implementation responsibilities.
3. While developing comprehensive state and federal nitrogen and phosphorus reduction strategies and continuing current reduction efforts, examine and, where possible, implement opportunities to enhance protection of the gulf and local water quality through existing federal and state water quality, water management, and conservation programs.
4. Develop and promote more efficient and cost-effective conservation practices and management practices for conserving nutrients within the MARB watershed and evaluate their effectiveness at all scales beginning with local watersheds and aggregating them up to the scale of the MARB.
5. Identify, and, where possible, quantify, the effects of the hypoxic zone on the economic, human and natural resources in the MARB and Northern Gulf of Mexico (NGOM), including the benefits of actions to reduce nitrogen and phosphorus and the costs of alternative management strategies.
6. Coordinate, consolidate, and improve access to data collected by state and federal agencies on Gulf Hypoxia and MARB program activities and results.
7. Track interim progress on the actions to reduce nitrogen and phosphorus by producing an annual report on federal and state program nutrient reduction activities and results.
8. Continue to reduce existing scientific uncertainties identified in the Science Advisory Board and Monitoring, Modeling, and Research (MMR) workgroup reports regarding source, fate, and transport of nitrogen and phosphorus in the surface waters of the MARB to continually improve the accuracy of management tools and efficacy of management strategies for nutrient reduction.
9. Continue to reduce uncertainty about the relationship between nitrogen and phosphorus loads and the formation, extent, duration, and severity of the hypoxic zone, to best monitor progress toward, and inform adaptive management of the Coastal Goal.
10. Promote effective communications to increase awareness of hypoxia and support the activities of the Task Force.
11. In five years (2013) reassess nitrogen and phosphorus load reductions, the response of the hypoxic zone, changes in water quality throughout the MARB, and the economic and social effects, including changes in land use and management, of the reductions in terms of the goals of this Action Plan. Evaluate how current policies and programs affect the management decisions made by industrial and agricultural producers, evaluate lessons learned, and determine appropriate actions to continue to implement or, if necessary, revise this strategy.



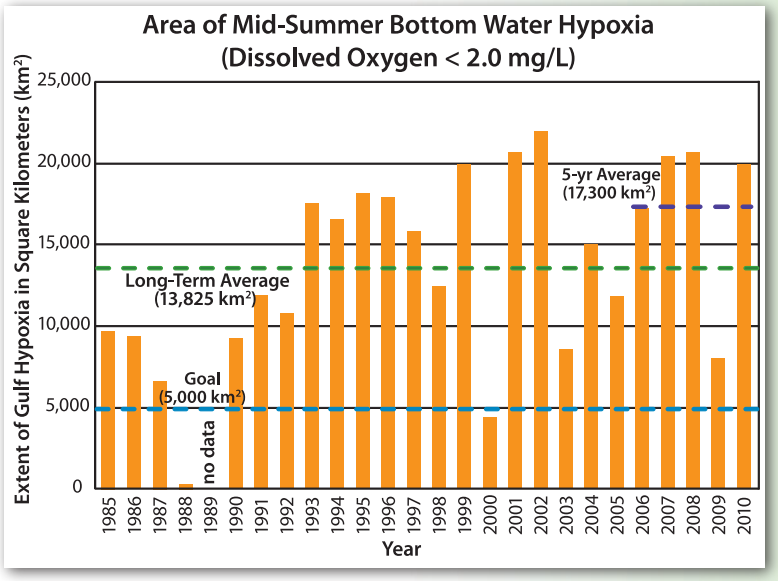
"We are moving forward on Gulf hypoxia."

Indicators

Science helps to inform policy, so the work of these scientists, measuring dissolved oxygen in this small order stream, is a critical step towards identifying and reducing nutrient loading.

Extent and Severity of the 2010 Gulf of Mexico Hypoxic Zone

The NGOM hypoxic zone, also known as the *dead zone*, is fueled by nutrient loadings—primarily in various forms of nitrogen and phosphorus—from agricultural and other human activities in the MARB that stimulate an overgrowth of algae, which, in time, die, sink to the sea floor, and are then decomposed by bacteria. It is that decomposition process that ultimately consumes the life-giving oxygen supply in bottom waters. The NGOM dead zone is of particular concern because it threatens valuable commercial and recreational gulf fisheries that generate about $2.8 billion annually.

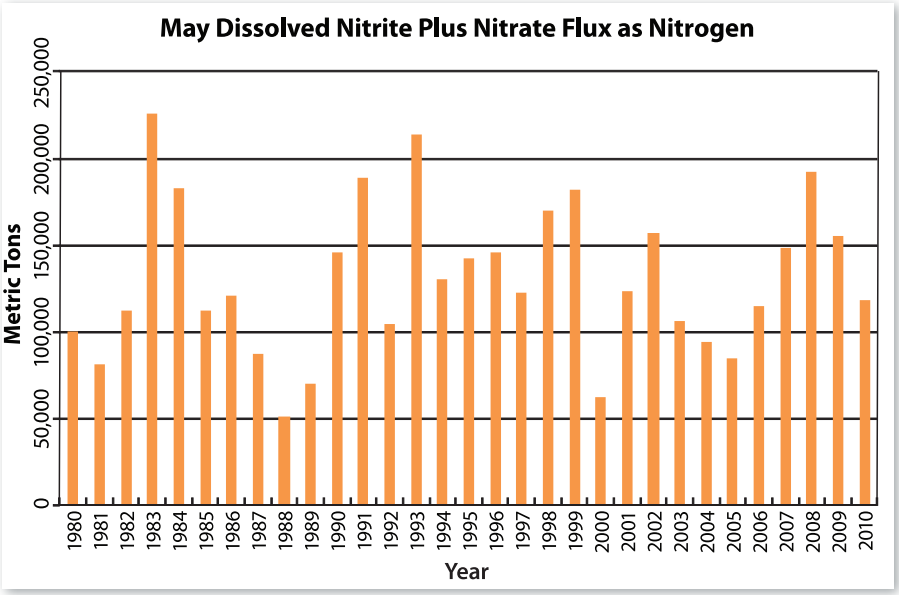


Source: Nancy N. Rabalais, Louisiana Universities Marine Consortium, and R. Eugene Turner, Louisiana State University; Funding: NOAA, Center for Sponsored Coastal Ocean Research

To successfully address hypoxia requires an understanding of the complex interactions among nitrogen and phosphorus, climate, weather, basin morphology, circulation patterns, water retention times, freshwater inflows, stratification, and mixing. Nitrogen and phosphorus loadings from the MARB, coupled with temperature- and density-induced stratification, are the primary causes of hypoxia in the NGOM. Variation in year-to-year inputs of both freshwater, nitrogen, and phosphorus from the MARB make it difficult to identify the relative importance of increased algal growth, known as eutrophication, versus increased stratification in any given year over the recent past.

National Oceanic and Atmospheric Administration (NOAA)-supported scientists determined that this year's Gulf of Mexico dead zone is the fifth largest on record at 20,000 square kilometers (7,722 square miles)—an area the size of New Jersey and near the upper limit of their projections. However, tropical storm activity in the Gulf of Mexico caused the zone to be a patchwork rather than a continuous band.

The summer 2010 dead zone is nearly double the size of the 2009 dead zone, which was smaller than average. The area of low oxygen off the upper Texas coast in the western portion of the dead zone is the largest it has ever been since surveys began in 1985. Even though the eastern portion of the dead zone overlaps with the region significantly affected by the Deepwater Horizon/BP oil spill, scientists conducting the cruise think it is unlikely that the oil spill had a significant impact on the size of the zone. "Large algal blooms seen in surface waters to the west of the river were not unusual considering the prediction of size for 2010 and the continued input of fresh water and nutrients from the river," said Nancy Rabalais, Ph.D., director of the Louisiana Universities Marine Consortium and principal of the research cruise. "It may be difficult to link conditions seen this summer with oil from the BP spill."



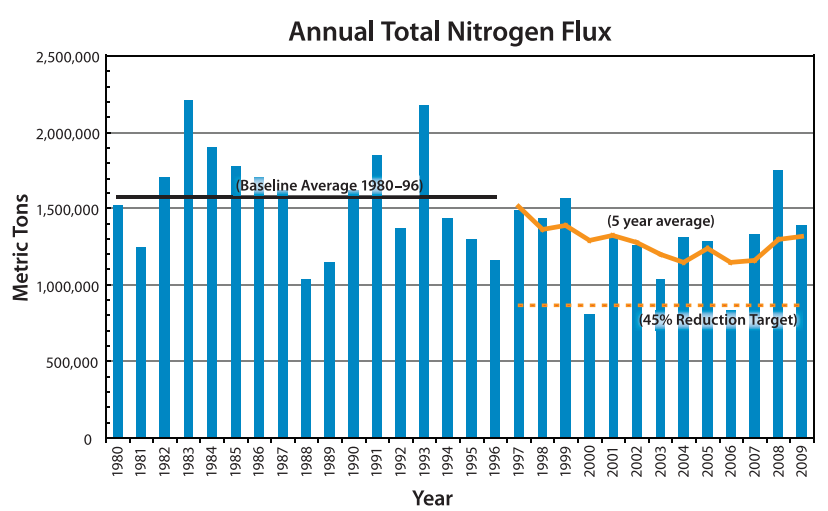
Source: Aulenbach and others, 2010

2010 Spring Nutrient Load

The amount of nutrients transported from the MARB to the gulf during the spring is a major factor influencing the size of the hypoxic zone. Sources of the nutrients include fertilizers applied to agricultural fields, golf courses, and suburban lawns; atmospheric deposition; animal manure; erosion of soils containing nutrients; and industrial and sewage treatment plant discharges. The amount of nutrients delivered to the gulf each spring depends, in large part, on precipitation and the resulting amounts of nutrient runoff and streamflow in the MARB. Streamflows in May 2010 were about 2 percent above the average May streamflow over the past 30 years. The U.S. Geological Survey (USGS) estimates that 118,000 metric tons (in the form of nitrate) were delivered to the NGOM in May 2010, which was about 11 percent below the average delivered from 1979 to 2009.

Annual Total Nitrogen Flux

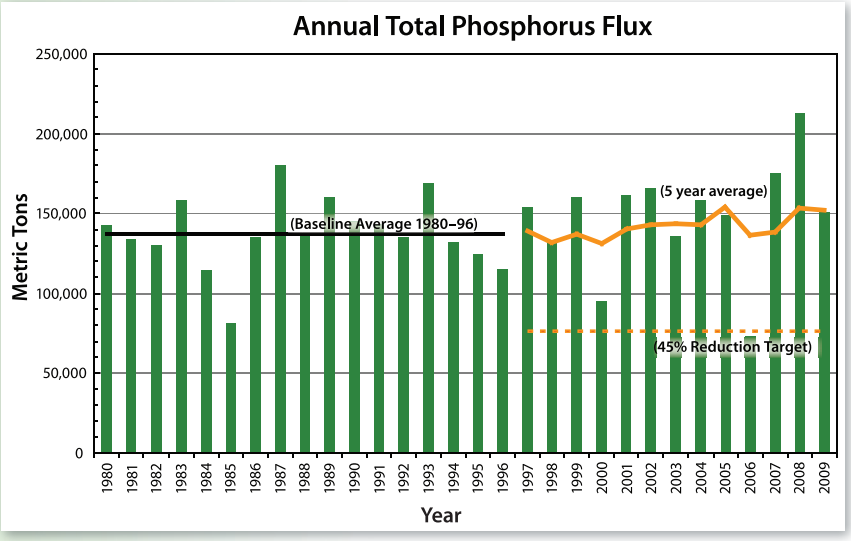
The *Gulf Hypoxia Action Plan 2008* calls for a 45 percent reduction by 2015 in the total nitrogen (TN) load delivered annually to the NGOM. The average load of nitrogen delivered to the NGOM from 1980 to 1996 was established as the baseline condition. There has been a general decline in the 5-year average of TN since 1996. Even though the 2005–2009 average is 16 percent less than the baseline, meeting the 45 percent reduction target will require targeted nitrogen reduction actions.



Source: Aulenbach and others, 2010

Annual Total Phosphorus Flux

Since 1996, there has been a general increase in the 5-year average of total phosphorus (TP) load delivered to the NGOM. The 2005–2009 average is 11 percent greater than the baseline. Of note, in the Ohio River and Missouri River sub-basins, average TP for 2005–2009 exceeded the 1980-1996 baseline average by 30 percent or more. Note that those findings are inconsistent with the decreases noted in TN.



Source: Aulenbach and others, 2010

Explanation of Flux versus Yield

- The flux (sometimes referred to as the load) of a river-borne constituent such as nitrate is the amount (or mass) that passes a given point on the river over a given period.
- The yield of a river-borne constituent is the flux per unit drainage area. Nutrient flux and yield are calculated as follows:

  Nutrient flux = streamflow (discharge) x nutrient concentration in streamwater

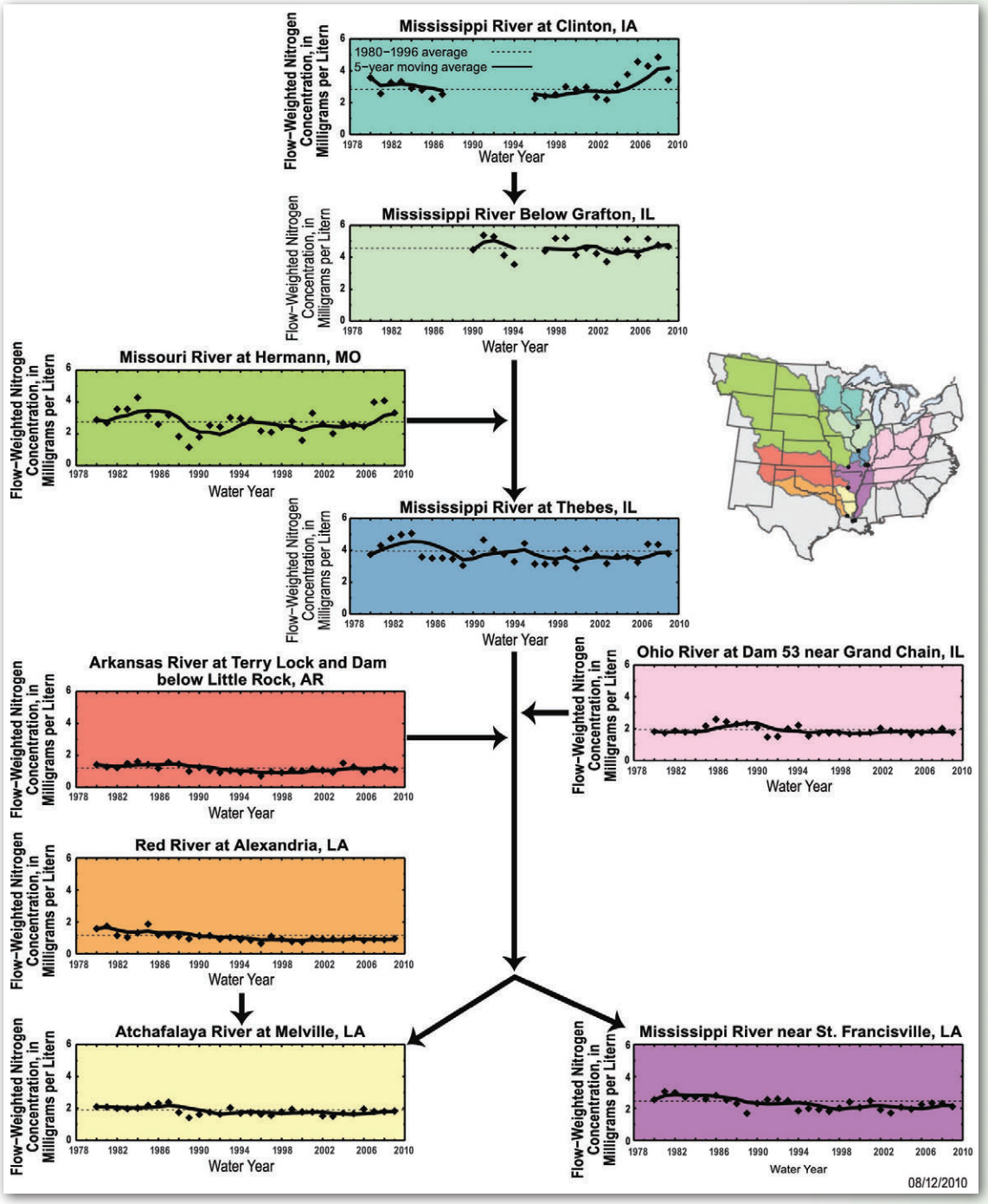
  Nutrient yield = nutrient flux ÷ watershed area

Nutrient fluxes at a river station are estimated using statistical models with data from a continuous streamflow record at a gaging station and water quality samples taken at or near the gaging station. The temporal resolution of flux estimates (annual, seasonal, or monthly flux estimates) are limited by the number of water quality samples collected during the year and changes in water quality conditions at the station (U.S. Geological Survey).

USGS

Annual Flow-Weighted Total Nitrogen Concentrations at the Nine Major Sub-basins

Flow-weighted concentrations account for variability in streamflow and are useful in evaluating changes over time within a river basin and making comparisons among different river basins. At the nine major sub-basins in the MARB, annual flow-weighted concentrations of TN in 2009 exceeded 3 milligrams per liter in the upper basin at Mississippi River at Clinton, Grafton, and Thebes and along the Missouri River at Hermann and were less than 2 milligrams per liter in the middle and lower basins at Ohio-Grand Chain, Arkansas-Little Rock, Red-Alexandria, Atchafalaya-Melville, and Mississippi-St.Francisville. The 5-year moving averages of annual flow-weighted concentrations of TN are similar to the 1980–1996 baseline period at seven of the nine sub-basins. Increases in the 5-year average of flow-weighted concentrations were observed at Missouri-Hermann and Mississippi-Clinton stations.



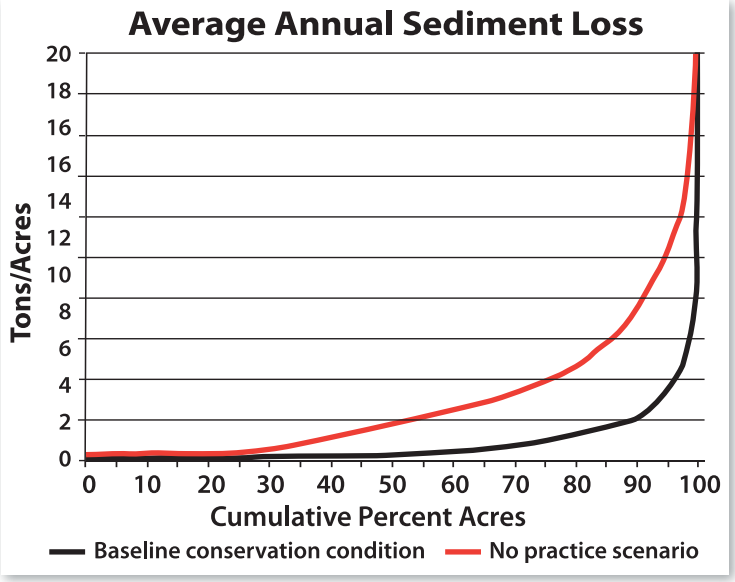
Flow-Weighted Nitrogen Concentration for Major Sub-Basins of the Mississippi and Atchafalaya River Basin.
Source: Aulenbach and others, 2010 (*http://water.usgs.gov/nasqan*)

Effects of Conservation Practices on Cropland in the Upper Mississippi River Basin

In June 2010, the U.S. Department of Agriculture (USDA)–Natural Resources Conservation Service (NRCS) released an assessment of the effects of conservation practices on cultivated cropland in the Upper Mississippi River Basin (UMRB). That assessment, part of the Conservation Effects Assessment Project, used the Agricultural Policy Extender model to simulate edge-of-field effects and the Hydrologic Unit Model of the United States/Soil and Water Assessment Tool to simulate instream effects of conservation practices. Subsequent reports in this series will cover the remaining river basins and water resource regions in the lower 48 states, including the remainder of the MARB.

Key findings from the *Assessment of the Effects of Conservation Practices on Cultivated Cropland in the* UMRB study include

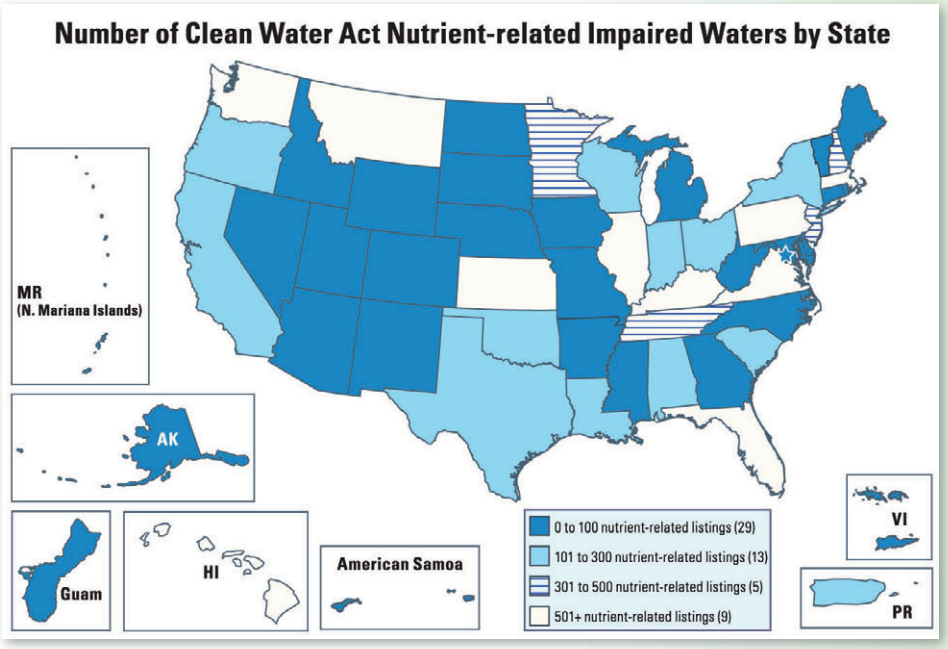
- The use of conservation practices on cultivated cropland in the UMRB is extensive. Farmers use structural practices, such as terraces, on 45 percent of the cropland, including 72 percent of the acreage of highly erodible cropland soils. They use some form of reduced tillage on at least one crop in the rotation on 95 percent of the cropland.
- Adoption of erosion-control practices has reduced edge-of-field sediment loss by 69 percent and instream sediment loads by 37 percent at Grafton, Illinois, just above the point where the Missouri River joins the Mississippi.
- Edge-of-field losses of TP have been reduced by 49 percent and in-stream phosphorus loads by 40 percent with conservation practice implementation. Edge-of-field losses of TN have been reduced by 18 percent and instream nitrogen loads by 21 percent with conservation practice implementation. Conservation practices also reduce the loss of pesticide residues from fields.
- Nitrogen losses through subsurface pathways have been reduced by only 5 percent because the erosion-control practices have re-routed surface water to subsurface water pathways. By encouraging water infiltration to decrease runoff, erosion-control practices have promoted the movement of soluble nitrogen through the soil.
- Suites of practices that include both erosion control and consistent nutrient management (rate, form, timing, and method) are required to simultaneously address soil erosion and loss of nitrogen through leaching.
- This chart contrasts the simulated current sediment loss rates (baseline conservation condition) with the rates that would be expected if conservation practices were not in place (no-practice scenario). It shows that, under baseline conservation, some 87 percent of cropland acres in the UMRB lose 2 tons of sediment or less annually, while under the no-practice scenario only 53 percent of the cropland acres would lose 2 tons of sediment or less per year.



Source: U.S. Department of Agriculture/Natural Resources Conservation Service

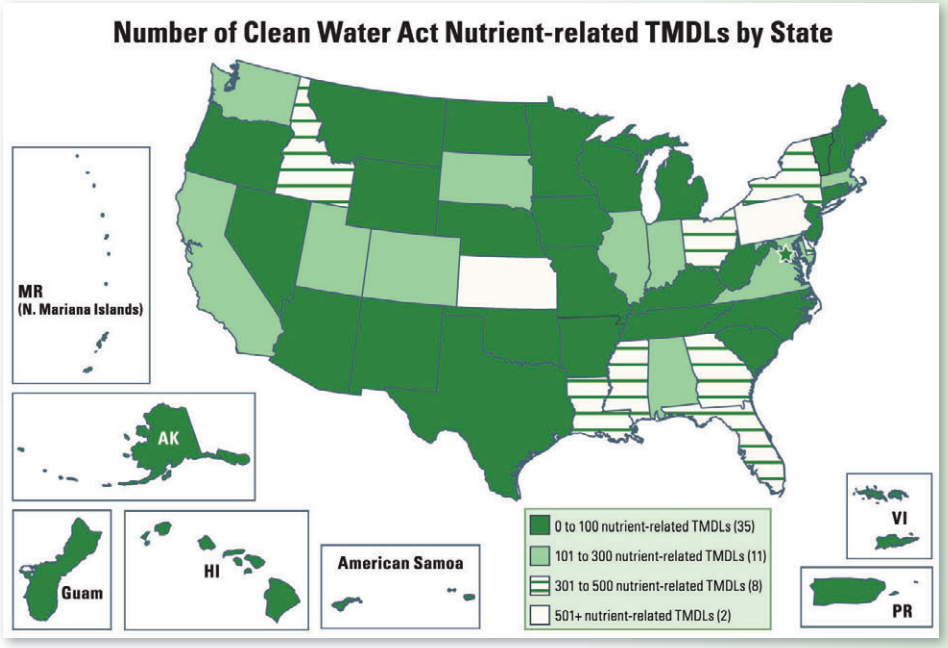
Status of Clean Water Act Impaired Waters and Total Maximum Daily Loads

Under section 303(d) of the Clean Water Act (CWA), states, territories, and authorized tribes are required, every 2 years, to develop lists of impaired waters that require total maximum daily loads (TMDLs). Impaired waters are those that do not meet applicable water quality standards (WQS). TMDLs are planning tools that identify the maximum amount of a pollutant that a waterbody can receive and still meet applicable WQS with a margin of safety, and allocate that amount to the point and nonpoint sources of that pollutant. The U.S. Environmental Protection Agency (EPA) provides oversight of section CWA 303(d) and is required to review and approve state-submitted lists of impaired waters and TMDLs; if EPA disapproves a list or TMDL, it must establish a new list or TMDL.



The number of nutrient-related impairments on state's most recent EPA-approved 303(d) lists nationally and for MARB states. *
Source: U.S. Environmental Protection Agency, ATTAINS, 2010

Over the past 2 decades, more than 13,000 nutrient-related impairments have been identified nationally on states' EPA-approved section 303(d) lists. The majority of those impairments (75 percent) are in MARB states. Almost half of the MARB states (15) have identified fewer than 100 nutrient-related impairments on their 303(d) lists. In general, states do not monitor and assess all their waterbodies during each 2-year 303(d) reporting cycle. As a result, states' 303(d) lists might not identify the full extent of nutrient-related impaired waters.



The number of EPA-approved nutrient-related TMDLs nationally and for MARB states.*
Source: U.S. Environmental Protection Agency, ATTAINS, 2010

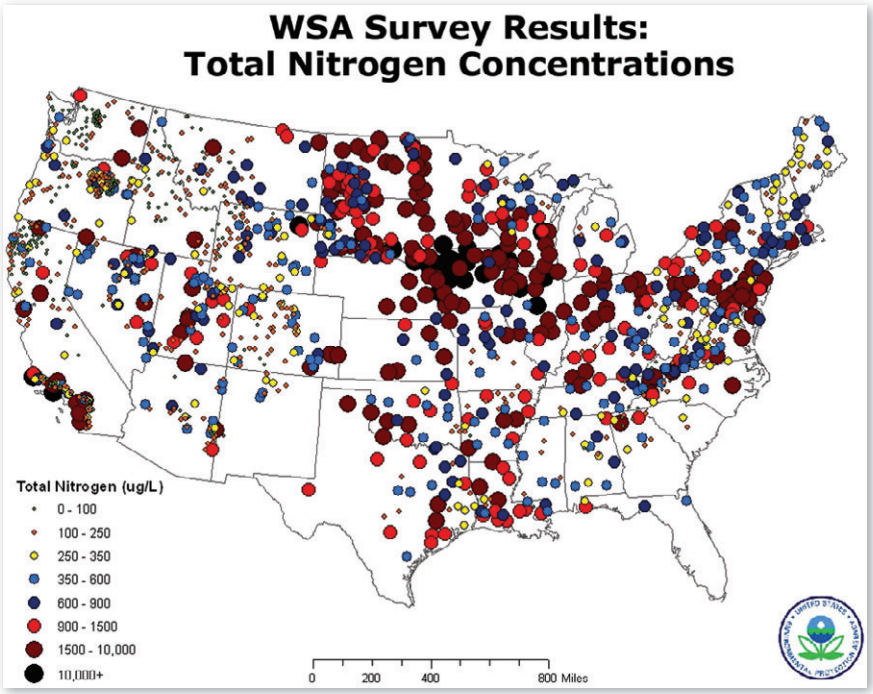
Over the past 2 decades, more than 6,000 TMDLs have been developed for nutrient-related impairments nationally. These impairments are no longer included on states' 303(d) lists because a TMDL effectively replaces the need for a listing. The majority (66 percent) of the nutrient-related TMDLs developed nationally are in MARB states. More than half of the MARB states (17) have developed fewer than 100 TMDLs for nutrient-related impairments. In general, the overall rate of TMDL production (i.e., TMDLs developed versus the number of TMDLs to be completed) for nutrient-related impairments is about equal at the national level and for all MARB states combined.

* For this analysis, nutrient-related 303(d) impairments are defined by the following impairment categories: algal growth, ammonia, noxious aquatic plants, nutrients, and organic enrichment/oxygen depletion.

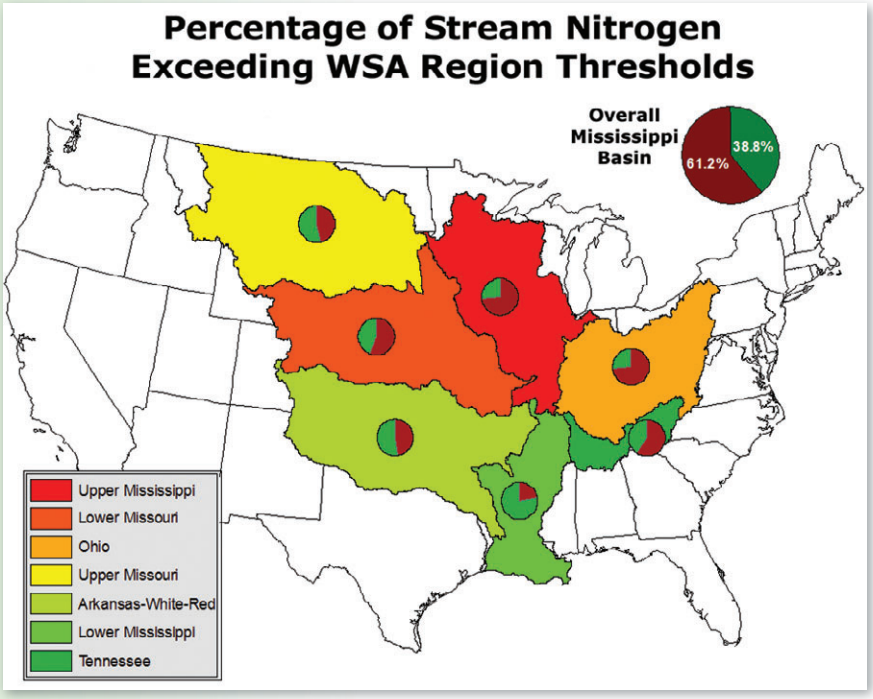
The Wadeable Streams Assessment in the MARB

EPA's Wadeable Streams Assessment (WSA) provides the first statistically defensible summary of the condition of the nation's streams and small rivers. Wadeable streams—streams, creeks, and small rivers that are shallow enough to be sampled using methods that involve wading into the water—represent a vital linkage between land and water. They typically include waters classified as first through fourth order in the Strahler Stream Order classification system.

TN and TP were collected as indicators of the health of the nation's streams. Nationwide, 43.3 percent of wadeable stream miles had low TN concentrations, while high nitrogen concentrations were found in 31.8 percent of stream miles. The results for TP are similar to those for nitrogen, with low concentrations in 48.8 percent of stream miles and high concentrations in 30.9 percent. Excess TN is the most pervasive stressor in wadeable streams for the nation overall, although it is not the most pervasive in each region.



Source: U.S. Environmental Protection Agency



Source: U.S. Environmental Protection Agency

Within the MARB, 61.2 percent of wadeable streams exceeded WSA region thresholds, while 38.8 percent did not.

Within the MARB, 22.4 percent of wadeable streams were characterized as being in good biological condition, 28.8 percent were in fair biological condition, and 48.8 percent were in poor biological condition.

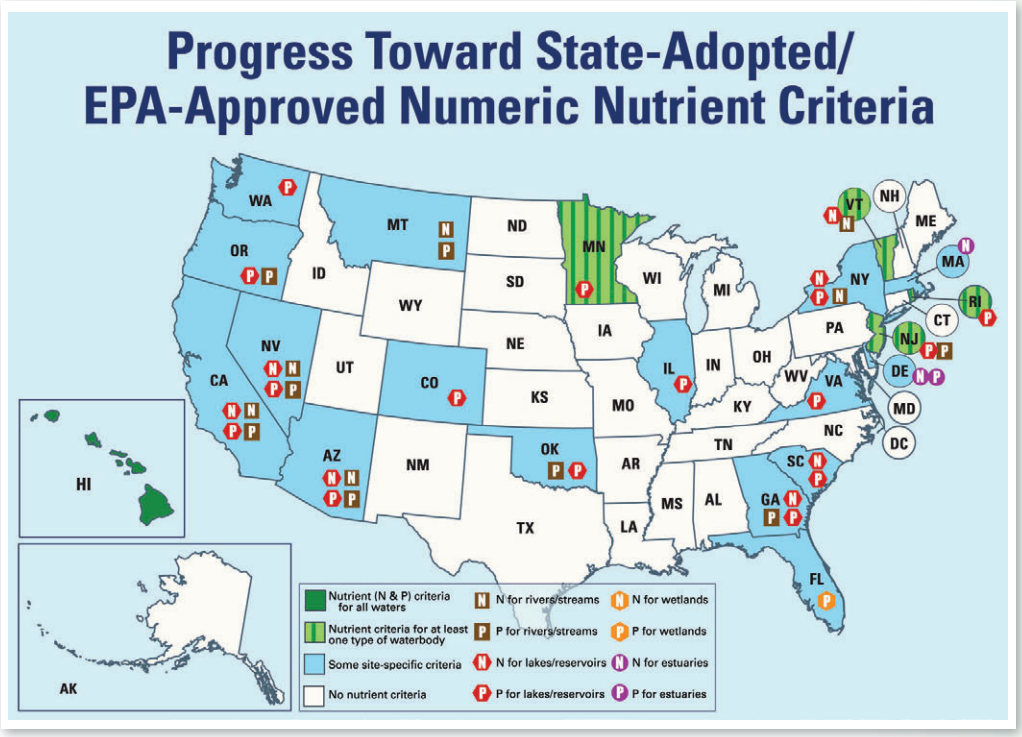
State Adoption of Numeric Nutrient Standards

WQS are the foundation for protecting the quality of the nation's surface waters and are the cornerstone of the water quality-based control program mandated by the CWA. All waters require WQS. EPA must approve state/tribal standards for them to be effective under the CWA. The standards describe the desired condition of a waterbody and consist of three principal elements: (1) the *designated uses* of the state's waters (e.g., fishing, aquatic life, drinking water); (2) *criteria* specifying the amounts of various pollutants, in either numeric or narrative form, that may be present in those waters without impairing the designated uses; and, (3) *antidegradation policies* providing for protection of existing water uses and limitations on degradation of high quality waters.

EPA recently published its first national report examining the progress made by states in adopting numeric nitrogen and phosphorus WQS for major waterbody types (lakes and reservoirs, rivers and streams, estuaries, and wetlands). The report, *State Adoption of Numeric Nutrient Standards 1998–2008*, categorizes the progress toward the adoption of nitrogen and phosphorus numeric nutrient criteria by states into four categories:

1. Nutrient criteria adopted for all waters
2. Nutrient criteria adopted for at least one waterbody type
3. Nutrient criteria adopted on a site-specific basis
4. No nutrient criteria yet adopted

It is encouraging that many states have made substantial progress in addressing nutrient pollution in their surface waters through the regulatory process, as the map below illustrates.



Source: U.S. Environmental Protection Agency

Success Stories

Throughout the MARB, nutrient-related water pollution significantly affects human health and aquatic life. Both governmental and nongovernmental groups and individuals are engaging in a wide variety of projects and programs to reduce nutrient pollution in the MARB. The stories that follow provide a sample of successful efforts aimed at addressing nutrient pollution and reducing the size of the hypoxic zone.

The GENERATIONS Program

MISSOURI

The GENERATIONS Program is an innovative partnership among the Future Farmers of America (FFA) and farmers, with support from the EPA's Gulf of Mexico Program through funds awarded to the Conservation Technology Information Center. It pairs the next generation of farmers and agricultural professionals with participating corn producers to collect cornstalk samples and test them for nitrate content. The producers are in the Little River Ditches Basin in five Bootheel counties (Dunklin, New Madrid, Pemiscot, Scott, and Stoddard), in southeast Missouri.

The nitrogen management practices of corn fields are assessed by measuring nitrate concentrations in the lower portion of cornstalks at the end of the growing season, before harvest. *End-of-season cornstalk testing* is a fertilizer management tool that producers can use in conjunction with soil maps, yield maps, varietal differences, and different forms of nitrogen fertilizer to help them ensure that they apply enough nitrogen at the right times to reach harvest goals and improve the profitability of their farming operations, while also minimizing nitrogen washing off the fields and impairing nearby or downstream water quality. The hypoxic zone in the Gulf of Mexico is a large-scale example of the impact that excessive nitrogen and phosphorus can have on downstream water bodies.

Missouri Department of Natural Resources

Cornstalk testing in Missouri.

FFA chapters will perform the cornstalk sampling on area farms by working directly with producers that sign up for the cornstalk sampling incentive at their county Soil and Water Conservation District (SWCD)/ USDA–NRCS centers. FFA students will collect and submit the samples to the University of Missouri Delta Research Center in Portageville, Missouri, for analysis, free of charge to the producer.

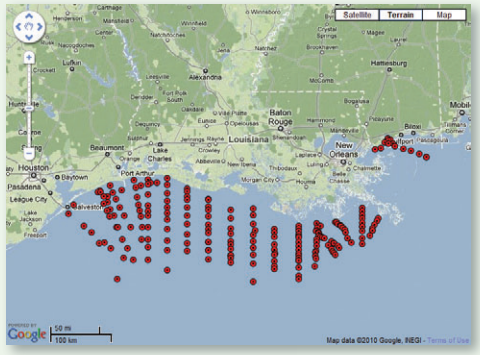
> "Cornstalk nitrate testing provides the producer with data to make sound decisions about next season's nitrogen application. We decided to participate in this program because it benefits the farmer economically, allows young people to learn from those in the business, and helps conserve water quality. With the corn harvest close at hand, corn growers have no time to waste in signing up."
>
> —David Dunn, Soil Testing Laboratory Supervisor at the Delta Research Center

For more information on the GENERATIONS Program, see: *www.ctic.org*

NOAA Expands Monitoring of Gulf Hypoxic Zone

Measuring the size of the hypoxic zone is key to assessing the progress of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force's *Gulf Hypoxia Action Plan 2008* and upstream nutrient reduction activities. Since 1985, this measurement has primarily been the result of a single NOAA-funded mid-summer survey cruise by the Louisiana Universities Marine Consortium. While the survey provides a critical long-term perspective on the size of the hypoxic zone, it is vulnerable to short-term weather changes that can temporarily affect the size of the zone. That is especially true of tropical storms, whose strong winds and waves mix the water column, aerate bottom waters, and can lead to an underestimate of the size of the hypoxic zone. This was seen in 2008, when Hurricane Dolly passed through the Gulf of Mexico during the time of the survey.

NOAA/National Coastal Data Development Center



Working with Google©, NOAA has developed a data viewer (still in its beta-testing version), available at *www.ncddc.noaa.gov/website/google_maps/Hypoxia/mapsHypoxia.htm*, to showcase the monitoring sites of summer hypoxia cruises.

In recognition of the need for expanded monitoring, NOAA and its partners developed the Gulf Hypoxia Monitoring Implementation Plan, which provides a multi-step approach to improved monitoring and includes detailed core monitoring requirements, details for expanded observing systems, and information gaps in our understanding of causes and impacts. In support of the plan, NOAA has expanded the number of Louisiana continental shelf-wide surveys to three through its NGOM Ecosystem and Hypoxia Assessment (NGOMEX) program. While the mid-summer survey will remain the primary measure to assess effectiveness of upstream nutrient reduction efforts in reducing the size of the hypoxic zone, the additional surveys by Texas A&M University will provide a more complete assessment on the size of the hypoxic zone. In addition, the University of Southern Mississippi (through support from the Northern Gulf Institute) has begun monthly surveys of the Mississippi Sound, east of the traditional area of the hypoxic zone, where hypoxia might be linked to nutrients from the Mississippi River. These surveys will coordinate closely with the NOAA Fishery Services' Southeast Area Monitoring and Assessment Program, which assesses dissolved oxygen during its summer groundfish survey, and the Northern Gulf Institute, which provides funding to monitor hypoxia east of the Mississippi River delta. Although additional efforts are required, this expansion in the number of Louisiana continental shelf-wide surveys and coordination with partner research and monitoring efforts represents a significant step forward for measuring the effectiveness of upstream nutrient management activities.

USGS

Environmental Leadership Program Pollution Prevention Award for Nutrient Reduction

NPS

Since the inception of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force and subsequent development of the *Action Plan for Reducing, Mitigating, and Controlling Hypoxia in the Northern Gulf of Mexico (2001)* and the *Gulf Hypoxia Action Plan 2008*, the Louisiana Department of Environmental Quality (LDEQ) has worked with Mississippi River industries and municipalities through the Nutrient Reduction Workgroup of the Louisiana Environmental Leadership Pollution Prevention Program (LAELP) to reduce nitrogen and phosphorus discharges. Such nitrogen and phosphorus reductions will help to reduce the size of the hypoxic zone and are consistent with Action Item 1 in the *Gulf Hypoxia Action Plan 2008*, which calls for development of nutrient-reduction strategies by the states in the MARB. LAELP is a voluntary program that works to improve the quality of Louisiana's environment through pollution prevention, community environmental outreach, and environmental management. By participating in the program, member industries and municipalities can submit qualified nitrogen and phosphorus reduction projects that meet the program goals, and, if chosen by the steering committee as an annual award winner, receive recognition at a ceremony co-hosted by the governor and LDEQ secretary.

Congratulations to NALCO Company of Garyville, a member of the LAELP Nutrient Reduction Workgroup, for receiving an Environmental Leadership Program Award in the Pollution Prevention category at the 2010 ELP Ceremony on March 24, 2010. Among NALCO's achievements recognized by the award is the reduction of nitrate compound concentration in its plant effluent by 50 percent. The company also achieved an additional 25 percent reduction with the installation of an online meter. NALCO's nitrate reductions help reduce nitrogen and phosphorus concentrations in the Mississippi River and hypoxia in the Gulf of Mexico.

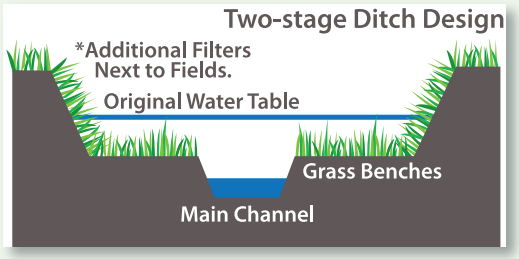
Louisiana Department of Environmental Quality

Receiving the award for NALCO was Plant Manager Carl Pasquarelli. Presenting the award was the Honorable Gordon Dove, Chair of the House Natural Resources and Environment Committee and Peggy Hatch, Secretary of the Department of Environmental Quality.

NALCO is the fifth river industry to receive a prestigious LAELP award for nutrient reduction to the Mississippi River.

Two-Stage Ditches Reduce Downstream Nutrient Transport

INDIANA



The Nature Conservancy

The concept of the two-stage ditch was developed by observing natural processes that form stable streams and rivers.

The Nature Conservancy (TNC) in Indiana has spearheaded two-stage ditch design, promotion, and studies, and installed several across the state. The two-stage ditch is a practice in which floodplain *benches* are constructed and then planted with grasses on either side of an existing flow channel in a ditch. During high-flow events, water moves across the benches, spreading out over a larger area, which reduces the flow velocity of the water, allowing sediments to settle out and nutrients and other pollutants to be partially taken up by the planted grasses. Additionally, when the floodplain benches are saturated, conditions are favorable for denitrification, which is the conversion of nitrate to nitrogen gas. That practice serves to create a more natural and stable stream environment within existing drainage ditches.

USDA NRCS

The two-stage ditch not only removes sediments and other pollutants, but allows for adequate drainage from surrounding agricultural fields. Because the floodplain benches spread the water out and slow water velocity, streambank erosion is substantially reduced compared to traditionally managed and designed ditch systems. The two-stage ditch reduces the amount of time and funding that many counties spend maintaining the ditches. It is expected that this innovative ditch design will require little or no traditional maintenance for 30+ years.

TNC, in studies with Notre Dame University, has examined overall water quality improvements achieved through two-stage ditch installation:

- **> 350%**—the amount of nitrogen removal achieved through two-stage ditch installation
- **43%**—the decrease in mean daily turbidity (i.e., the cloudiness of the water, caused by suspended particles) in the 2-year period post-construction
- **20%**—the total reduction in suspended particle export when compared to *typical* ditches, indicating that the two-stage ditch installation might provide significant reductions in sediment-borne phosphorus
- **53** tons—the amount of sediment removed annually in a newly constructed two-stage ditch section that is 0.4 mile in length

The two-stage ditch practice was adopted into the Field Office Technical Guide by the USDA's NRCS in Indiana, enabling it to be used in cost-share programs like the Environmental Quality Incentives Program (EQIP). In addition, CWA section 319 funding from EPA and the Indiana Department of Environmental Management helped to fund implementation. SWCDs are on board to install these practices. They are working with TNC and receiving funds through Clean Water Indiana, a funding source led by Indiana's State Soil Conservation Board and administered by the Indiana Department of Agriculture.

Developing and Implementing Nutrient Reduction Strategies in the Yazoo-Mississippi Delta

by Trey Cooke, Executive Director, Delta F.A.R.M. (Farmers Advocating Resource Management)

One stakeholder group has always perceived itself to be pro-active in its approach to natural resource concerns. Members of the group invest both time and money at a level that far exceeds that of other stakeholder groups. They invite state and federal natural resource agencies, regulators, and scientists to their homes and businesses to learn more about how they can be better stewards of our environment. They take what they learn and work to make a measurable difference in our world. But the efforts of the stakeholders often go unnoticed. What stakeholder group is this? The people who champion these efforts are the very people who many often blame for environmental problems—farmers.

Hopefully, there will be a day in the near future when farmers, and the agricultural industry as a whole, can get more credit for their intensity and desire to address various natural resource issues. That day could be coming very soon as farmers throughout the Mississippi River Basin, and especially in the Yazoo-Mississippi Delta, are making gains in addressing gulf hypoxia.

FWS

In early 2009, farmers from the Yazoo-Mississippi Delta and staff members of the Mississippi Department of Environmental Quality began to work together to develop a strategy to better manage nitrogen and phosphorus and reduce nutrient pollution in the watersheds in which they live and work and to reduce nutrient loading to the Mississippi River and the Gulf of Mexico. While the two groups took the lead, many other private, state, and federal natural resource agencies participated in developing a dynamic strategy (formally named *Delta Nutrient Reduction Strategies*) that farmers could quickly adopt. The strategy also incorporated a seemingly exhaustive monitoring program that could thoroughly document the benefits accrued through implementing the strategy.

Once the strategy was complete, it was not retired to a shelf. Rather, farmer-led groups like Delta Farmers Advocating Resource Management, the Mississippi Soil and Water Conservation Commission, and many others began raising money through private sources, corporations, and publicly awarded grants to implement the strategy. As the fall of 2010 approaches, an estimated $42 million was raised to implement the strategy over the next several years.

Together, the many groups who helped to establish the strategy began to work to make it a reality once funding was secured. They identified critical watersheds; selected conservation practices for installation that were both traditional and innovative; and identified farm cooperators who would agree to install selected practices. Other strategy components were initiated, including monitoring equipment installation, data collection, and education and outreach efforts. Within 12 months, the strategy was developed from scratch and wholesale implementation had begun.

The early success in developing and implementing the strategy is clearly marked by a wholesale investment by stakeholders in the region. By approaching nutrient reduction without regulatory overtones, key stakeholder groups like the farmers of the Yazoo-Mississippi Delta find the process much more approachable and less threatening. And without the support of dedicated stakeholders, it would be nearly impossible to raise enough capital to implement such a plan. Certainly, every stakeholder involved in the process was well aware that numeric nutrient WQS would be adopted in Mississippi in the near future. But rather than being forced to *comply* with regulation, they choose to be pro-active by helping define the most important question in nutrient criteria development: "What level of nutrient reduction can we feasibly achieve?"

The strategy is ecoregion-specific and will be validated through monitoring. The process used to develop the strategy has been, and will continue to prove to be, an extremely successful model. It is that process of inclusion and consensus-building that yields successful results.

OHIO

How Water Quality (Nutrient) Trading Enables Alpine Cheese Company to Improve Water Quality and Increase Economic Development in the Region

Milk house waste is exported into a nearby stream pre-construction.

Milk house tank installed to collect waste and it will be field applied.

The Alpine Cheese Company, in the Sugar Creek watershed of the Ohio River Basin, needed to expand its operation, but it was faced with $1 million of wastewater treatment upgrades to satisfy CWA permit requirements. Looking for a less costly, but environmentally acceptable, alternative, the Alpine Cheese Company collaborated with many partners to develop an innovative and successful water quality trading program with documented nutrient reduction results for the Sugar Creek watershed and the MARB.

The Partnership

- Beginning in 2005, Dr. Richard Moore, Professor, Ohio State University (OSU) School of Environment and Natural Resources and OSU Extension Specialist with the Ohio Agricultural Research and Development Center (OARDC), led development of the *Alpine Cheese Phosphorus Nutrient Trading Plan*, in consultation with the Holmes SWCD and the Ohio Environmental Protection Agency (Ohio EPA).
- Other essential partners included the Alpine Cheese Company, Ohio Department of Natural Resources (Ohio DNR), Ohio Farm Bureau, Ohio Department of Agriculture, and USDA–NRCS.

- This plan promoted grassroots participation, SWCD sustainability, and local economic development. Interestingly, a pre-existing relationship between Holmes SWCD and Amish dairy farmers proved to be pivotal to the program's success.

Program Elements

- Alpine Cheese Company provided $800,000 over 5 years for planning, technical assistance, outreach, and cost-share.
- OSU facilitated discussions between Ohio EPA, Ohio DNR, and others to propose innovative conservation measures and develop evaluation procedures acceptable to the farming community.
- Holmes SWCD served as the brokerage agency between Alpine Cheese Company and participating farmers.
- The plan estimated that conservation measures would reduce up to three times more nutrients than if equal funds were used for wastewater treatment upgrades.
- Dr. Moore's team at OARDC collected water quality samples at 56 biweekly *voluntary* sites, four monthly *required* sites, and three required biological monitoring sites pre- and post-implementation.

Feedlot pre-construction.

Environmental Results

- The nutrient reduction goal of the program was surpassed by 20 percent within the first 3 years of a 5-year plan.
- Twenty-five farmers installed 91 conservation measures that resulted in a 3,000-pound-per-year phosphorus reduction.

Feedlot post-construction.

Economic Results

- Holmes SWCD, as the brokerage agency, continues to benefit from increased financial stability. Because 70 percent of the credits have a lifespan of 15 years, the SWCD can anticipate benefiting from increased revenue as credits are maintained and sold.
- Farmers receive a premium for higher quality milk, and Alpine Cheese Company, in turn, can make more cheese per unit of higher quality milk and reduce waste.
- Alpine Cheese increased its demand for milk by 250,000 pounds per day making the daily total approximately 800,000 pounds; the company produces 13 million pounds of cheese annually.
- Approximately 12 new jobs were created with the cheese production expansion.

Photo Credits: Holmes SWCD, Ohio

AgBMP Loan Program Hits Milestone: 10,000th Loan Issued for Pollution Prevention and Reduction

Minnesota Department of Agriculture

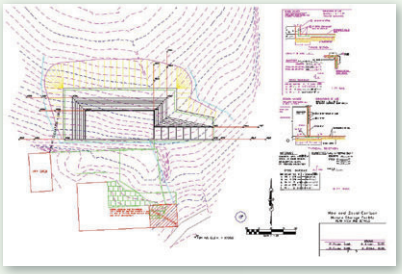
The Carlson's multi-generational farm family is all smiles with Minnesota's Commissioner of Agriculture at the 10,000th milestone celebration.

The Carlson dairy farm rests in the rolling hills of Minnesota's Goodhue County. Three generations of Carlsons have worked this farmland and built what is now a 140-cow dairy farm. As the dairy farm has grown, brothers Mike and Dave Carlson have taken advantage of the Agricultural Best Management (AgBMP) Loan Program through the Minnesota Department of Agriculture (MDA) to construct a manure storage basin. They knew this would eliminate their daily need to haul manure, prevent run-off, and help them use the nutrients more effectively. What they did not know is that their project would represent a milestone—the 10,000th AgBMP loan issued by MDA.

Minnesota Department of Agriculture

This completed manure runoff containment system solves a pollution problem and makes a family farm more sustainable.

Since its inception in 1995, the AgBMP Loan Program has provided low interest loans to individuals for agricultural best management practices. MDA has received a total of $62 million from EPA and the Minnesota Legislature for the program. The 10,000 completed loans have totaled almost $150 million. Minnesota Agriculture Commissioner Gene Hugoson says the AgBMP Loan Program has helped farmers and landowners address pollution problems in almost every Minnesota county. "The program provides a reliable and sustainable source of funds to tackle a variety of pollution problems," said Hugoson. "These loans have been used to properly manage manure, to purchase conservation tillage equipment, and for virtually any project that reduces water pollution."



Any Minnesota farmer or rural landowner is eligible to apply for an AgBMP loan. The maximum that can be borrowed is $100,000, amortized over 10 years, and the loans are typically financed at 3 percent interest. MDA works with counties, county SWCDs, and local water planners to develop applications, and convenes an advisory committee to review and rank the applications prior to fund allocation.

As of the end of FY 2010, AgBMP loans have provided financing for the successful implementation of:

- **1,890** agricultural waste management improvements, including replacement or upgrading of manure holding basins, pits, or tanks; enhancement of manure handling, spreading, or incorporation equipment; and feedlot improvements such as clean water diversions around feedlots or berms, and chutes to contain and direct contaminated runoff into holding basins

- **224** structural erosion control practices, including sediment control basins, waterways, terraces, diversions, buffer and filter strips, shoreline and stream bank rip-rapping, and cattle exclusions
- **3,204** conservation tillage practices, including seed bed preparation, planting, cultivation, and harvest equipment that leaves crop residues on the soil surface
- **4,218** sewage treatment system repairs or replacements

Over the past 5 years, the loan activity has increased from 600 projects per year to more than 800 projects per year at a statewide total of $13.6 million annually. It is expected that the level of activity will continue to increase as new lenders become more familiar with the loan process and environmental remediation efforts in Minnesota are intensified.

LOUISIANA

Mollicy Farms 16,000 Acres of Restored Bottomland Hardwood Overflow Swamp (and Nutrient Filter)

Sixteen thousand acres of Mississippi Valley bottomland hardwoods—cleared and drained many years ago—have been hydrologically restored and now serve as a substantial nutrient filter for Mississippi River overflow waters. The area, in northeastern Louisiana, has been replanted, largely through the work of the U.S. Fish and Wildlife Service. TNC is monitoring post-restoration habitat and water quality with funding from the LDEQ using EPA CWA section 319 nonpoint source funds. This is the largest single restoration of bottomland hardwoods in the history of the United States and occurs in a critical area of the MARB.

Steve Haase, The Nature Conservancy

The Ouachita River divides Mollicy farms on the left and the Upper Ouachita National Wildlife refuge on the right. Someday the left side will look like the right side.

Jay Harrod, The Nature Conservancy

Spring floods inundate, nourish, and restore bottomland hardwood habitat.

Multiple ecosystem and human health benefits have been achieved thanks to willing landowner participation. Local fish and wildlife habitat have been improved in concert with reductions in the nitrogen, phosphorus, and sediment loads conveyed to the gulf. The results, when available, will be shared with others in an effort to encourage similar hydrologic/habitat efforts to restore Mississippi Valley bottomland hardwoods, along with their nitrogen and phosphorus filtration values, in other parts of the MARB.

Mississippi River Basin Healthy Watershed Initiative

The USDA–NRCS launched the 4-year Mississippi River Basin Healthy Watersheds Initiative (MRBI) in 2010 to address agriculture-related nitrogen, phosphorus, and sediment loading in the MARB. The planned improvements will be accomplished through a conservation systems approach to managing and optimizing nitrogen and phosphorous within fields to minimize runoff and reduce downstream nitrogen and phosphorus loading. NRCS will provide producers with financial and technical assistance and a system of practices that will control soil erosion, improve soil quality, and provide wildlife habitat, while managing runoff and drainage water for improved water quality.

The twelve participating states are Arkansas, Illinois, Indiana, Iowa, Kentucky, Louisiana, Minnesota, Mississippi, Missouri, Ohio, Tennessee, and Wisconsin.

FY 2010 Highlights

- The Request for Proposals in the *Federal Register* closed on May 3, 2010. It announced the availability of up to $50 million in financial assistance for the Cooperative Conservation Partnership Initiative (CCPI), which includes components of the EQIP, the Wildlife Habitat Incentives Program (WHIP), and the Conservation Stewardship Program, and $25 million the Wetlands Reserve Enhancement Program (WREP).

Tim McCabe, USDA/NRCS

Water sampling in a stream in northeastern Iowa.

- NRCS received 105 CCPI proposals and 21 WREP proposal requesting $76 million ($66 million from CCPI and $10 million from WREP) for FY2010.
- The Secretary of Agriculture issued a press release on June 15, 2010, announcing $32 million in approved projects, consisting of 58 CCPI projects ($22.2 million) and 18 WREP projects ($9.8 million).
- In addition, $20 million of EQIP, WHIP, and WREP funds is being used to implement the National Migratory Bird Habitat Initiative. These funds will be used to increase shallow water areas and moist soil areas on agricultural wetlands (including rice fields and abandoned catfish ponds) and existing WREP easements for shorebirds, waterfowl, and neo-tropical migratory birds. This will provide direct benefits to the MRBI goals.
- NRCS has established a framework for watershed and edge-of-field monitoring, as well as an interim national standard for field/edge-of field monitoring. This approach will help NRCS better capture the environmental benefits and track progress by comparing the monitoring data with information acquired through the Conservation Effects Assessment Project.

Missouri Awarded Funding to Implement the Mississippi River Basin Healthy Watersheds Initiative

In 2010, the Missouri Department of Natural Resources Soil and Water Conservation Program coordinated development of USDA MRBI project proposals in Missouri, resulting in 12 projects being awarded $6 million in 2010 and $28.2 million in MRBI funds over the next 4 years. The numbers of MRBI projects awarded funding in Missouri, and the total amount of funding received, was much higher than that of any of the other 11 Mississippi River Basin states that were eligible for MRBI funding. The Missouri MRBI projects feature the following attributes:

- Voluntary implementation of conservation practices that avoid, control, and trap nitrogen and phosphorus runoff; improve wildlife habitat; and maintain agricultural productivity
- Adoption of *systems approaches* and *adaptive management* strategies for reducing nitrogen and phosphorus runoff
- Targeting of conservation practices and systems in critical watersheds
- Collaboration among federal, state, and local stakeholders
- Leveraging of federal MRBI funds with state and local funding
- Edge-of-field, small watershed, and large watershed monitoring to document reductions in nitrogen and phosphorus runoff

Charlie Rahm, USDA/NRCS

A grassed waterway system is one tool to prevent soil erosion by reducing water flow velocities.

USDA NRCS

Healthy riparian zones, which are the vegetated streambanks and wetlands adjacent to a river, provide essential ecosystem services including wildlife habitat, erosion and flood control, and sediment and nutrient trapping, in addition to providing aesthetic appeal.

Mississippi River Gulf of Mexico Watershed Nutrient Task Force

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