HYPOXIA IN THE GULF OF MEXICO: IMPLICATIONS AND STRATEGIES FOR IOWA

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SUMMARIES OF SESSIONS

Overview of Hypoxia Action Plan and Operating Plans
Darrell Brown, Chief, Coastal Management Branch, U.S. Environmental Protection Agency

The goal of reducing the size of the low-oxygen "dead zone" in the Gulf of Mexico to 2,000 square miles by 2015 probably will not be reached, but conditions need to start improving, says Brown, who coordinates hypoxia reduction efforts for the EPA.

"This is a complex problem that will require cooperation and action from a number of people at a number of levels," Brown said. "While we're trying to reduce the size of the hypoxic zone in the Gulf, we also want to improve the quality of the water throughout the 31 states in the watershed and make sure the communities and economic sectors are not harmed in the process."

Although hypoxia is a global problem with more than 400 eutrophic zones worldwide, the size of the Gulf's hypoxic area has more than doubled since annual measurements began in 1985. In 2008, the dead zone was about 8,000 square miles, larger than the state of Massachusetts. This tied the second-largest zone on record, which was 8,800 square miles in 2001. The long-term average is 5,300 square miles; the five-year average is 6,600 square miles.

Brown said studies show that five states in the Upper Mississippi River Basin, including Iowa, contribute about 75 percent of the excess nitrogen and phosphorous nutrients that flow into the Mississippi River and lead to a low-oxygen "dead zone" in the Gulf of Mexico every summer. He said research also shows that about half of the nitrogen is from corn-soybean production, and 37 percent of the phosphorus is from livestock pasture on agricultural lands.

The Mississippi River/Gulf of Mexico Watershed Nutrient Task Force was established in 1997 to understand the causes and effects of eutrophication in the Gulf of Mexico; coordinate activities to reduce the size, severity and duration; and mitigate the effects of hypoxia. The group released its 2001 Action Plan, which resulted in a 4-year reassessment of the science surrounding the issue. The 2008 Action Plan describes a national strategy to reduce, mitigate and control hypoxia in the Gulf of Mexico and improve water quality in the Mississippi River Basin. An Annual Operating Plan and Annul Report outline state-specific activities and tracks progress between reassessments.

Details of the plan are outlined at: http://www.epa.gov/msbasin/index.htm
Annual mapping of the distribution of hypoxia in the Gulf is conducted by the Louisiana Universities Marine Consortium. More information at:
http://www.gulfhypoxia.nethttp://www.gulfhypoxia.net

Water Implications of Biofuels Production in the U.S.: National Research Council, National Academy of Science Study Findings
Jerry Schnoor, Co-Director, Center for Global and Regional Environmental Research, University of Iowa

Water is a valuable commodity in ethanol production. Manufacturing ethanol in the Midwest may become trickier in the years to come. Like a drop in a pond, ethanol production can cause a ripple affect on Iowa's landscape.

According to Schnoor, Iowa's ethanol production is here to stay, but all factors need to be considered. Schnoor recently chaired a study for the National Research Council and National Academy of Sciences to find the implications of water on biofuels production in the United States.

Water is needed to grow corn and to produce ethanol. Where water comes from is as important as water quality in both the agriculture and ethanol industries, Schnoor said. The Upper Mississippi River valley is the biggest contributor of nutrients to Gulf hypoxia.

Schnoor said that in the future, corn yields will be key to ethanol demand. Under current production methods, more inputs will be needed to meet the federal mandate of 15 billion gallons of corn ethanol by 2015. He said that yields are not increasing fast enough to reach that mandate.

Corn uses high amounts of fertilizer, herbicides and pesticides compared to other plants that can be grown for ethanol production. Seeking sources other than corn for ethanol can lower nutrient and pesticide inputs and well as a reduce water and energy usage. Finding a sustainable way to produce ethanol, such as a dedicated energy crop like switchgrass, can return corn to the food supply and reduce the affects of hypoxia in the Gulf of Mexico.

Other information Schnoor presented from the report:

- One bushel of corn yields about 2.8 gallons of ethanol.
- A biorefinery that produces 100 million gallons of ethanol a year uses the equivalent of the water supply for a town of about 5,000 people.
- The ethanol industry is reducing its water use, but still requires 3 to 4 gallons of water to produce each gallon of ethanol. It is a water-intensive industry, but does not use more water relative to other industries; wastewater is the primary issue.
- For every gallon of ethanol produced, about 8 grams (the weight of three pennies) of excess nitrogen and 20 to 40 pounds of soil have been moved from agricultural lands where the corn was grown, to the Mississippi River.

The January 2008 report, Water Implications of Biofuels Production in the United States, is available from The National Academies Press, at:
http://www.nap.edu/catalog.php?record_id=12039

From the Cornbelt to the Gulf
Joan Nassauer, Professor of Landscape Architecture, School of Natural Resources and Environment, University of Michigan

Nassauer presented results from her study that offers projections of what Iowa's landscape could look like in the year 2025—with dramatic results. Nassauer and her research partners examined Walnut Creek Watershed in Story County and Buck Creek Watershed in Poweshiek County for plausible alternative landscape patterns and management practices.

They examined three scenarios using federal agricultural and environmental policies that could impact society and the environment in the most beneficial ways. The scenarios included a vision of the land based on: commodity production; improved water quality; and enhanced biodiversity. Using Geographic Information System (GIS) mapping photos, they developed pictures of what the land could look like in 2025 under these scenarios.

They then surveyed farmers and residents in the watersheds to learn their opinions. Farmers believed the scenario that reflected enhanced biodiversity was best for the future of the land and for agriculture.

Nassauer, with the help of the Center for Agricultural and Rural Development at Iowa State, conducted a statewide survey of more than 500 farmers in 2007 with similar results. Farmers were open and preferred an agricultural system that was sustainable, profitable, improved the quality of life and the environment. These results will be published in the near future.

Based on policy and landscape design, reducing nutrient loads in the Gulf of Mexico could be done in three ways: using fertilizer more efficiently, keeping nutrients on the land, or removing it to wetlands. After looking at their study, Nassauer concluded that improved water quality and enhanced biodiversity could be plausible if the right policy drivers are in place and that agricultural policy can help implement these systems.

Agency and NGO Reactions to the Hypoxia Action and Operating Plans: Panel Discussion

Dean Lemke, Iowa Department of Agriculture and Land Stewardship, is one of Iowa's representatives on the Mississippi River Gulf of Mexico Watershed Nutrient Task Force. He said that state-level strategies in the plan are new in 2008,and that they represent a road map for each state in reaching federal goals. He added that Iowa is taking the lead in a regional effort on nutrient reduce strategies.

Rich Leopold, director of the Iowa Department of Natural Resources, said he was more of "an impatient ecologist who wants to step on the gas and get going" with activities to reduce hypoxia in the Gulf of Mexico. He praised Iowa farmers who have adopted conservation tillage, but would still like to see less black soil exposed in the fall and spring, state policies to address issues faced by drainage districts in Iowa, and streambank stabilization and other technologies that would help slow the flow of water in Iowa's rivers.

Craig Cox, Midwest Vice President of the Environmental Working Group, said new studies are showing that reactive nitrogen plays a much bigger role in the environment than simply the creation of hypoxic zones. He said the technology makes it possible to reduce nitrogen in agricultural production systems, but that the problem lies with "institutional and policy inertia." He advocated targeting conservation practices in specific parts of the landscape, what he termed "precision conservation;" requiring conservation compliance as a prerequisite for receiving federal farm aid; and building a stronger network of technical assistance and scientific support for farmers.

Local Water Quality and Watersheds: Panel Discussion

Experience from the Raccoon and Des Moines Rivers TMDLs

Keith Schilling, who works with the Iowa Department of Natural Resources Geological Survey, described modeling work done in the Des Moines and Raccoon River watersheds. About 25 percent of the daily water samples taken in both watersheds exceed the federal Total Maximum Daily Load (TMDL) for nitrates at certain times during the year, requiring nitrate removal at the City of Des Moines Water Treatment Plant. He said various scenarios showed that reductions were possible in both watersheds, but would require major land use changes or major reductions in fertilizer use. In some cases, small changes by everyone in the watershed led to some of the biggest improvements in water quality.

Experience from the Cedar River TMDL

Jim Baker, professor emeritus from Iowa State University, discussed preliminary results of a study he helped conduct for the Iowa Department of Agriculture and Land Stewardship in the Cedar River watershed above Cedar Rapids. The study looked at the management practices (and costs) needed to reduce nitrate loadings by 35 percent. The watershed includes 3.5 million acres, 73 percent of which is used for row-crop production and two-thirds of which has tile drainage.

Some of the management practices considered were reducing fertilizer application (and the trade-offs in yield losses), timing of fall application of fertilizer, fall-planted cover crops, drainage water management and constructed wetlands. The benefits of conservation tillage and buffers were offset by other factors so were not considered.

He said that using a variety of practices could reduce nitrate losses by 35 percent, retain row-crop production and cost about $30 million per year in the watershed. "There are not very many win-win solutions for reaching these [nitrate reduction] goals and it will require considerable cost and effort," he said.

Ag Clean Water Alliance

Roger Wolf from the Iowa Soybean Association and **Chris Jones** from the Des Moines Water Works discussed Agriculture's Clean Water Alliance, an organization formed in 2000 to reduce nutrient losses from farm fields in the Raccoon River Watershed. The group includes ag retailers and coops in the watershed, farmers, researchers and the Iowa Soybean Association. Volunteers collect water samples and the alliance has set up real-time remote monitors. The group has looked at more than 40 tributaries in the watershed to identify "hot" spots and work with farmers in those areas to set up nutrient management plans. Recent projects include a constructed wetland in 2007 and a bioreactor to filter drainage tile water in 2008.

Nutrient Criteria and Its Connection to Local Water Quantity

Tom Wilton from the Iowa Department of Natural Resources explained the 1972 federal Clean Water Act and how it relates to Iowa. The state's 131 lakes have been monitored three times each summer season since 2000. He also discussed specific projects and water quality measurements at Lake Ahquabi State Park, the North Fork of the Maquoketa River in Dubuque County, and Springbrook Creek in Guthrie County.

Landscape Design in Iowa: Panel Discussion

Modeling and Monitoring to Assess Prairie Effectiveness in Water Quality Improvements
Sergey Rabotyagov, University of Washington, Seattle, talked about his project with **Keith Schilling** at the Neal Smith National Wildlife Refuge. More than 3,000 acres of prairie have been added at the refuge since 1993. Since the prairie installment, nutrient inputs have been monitored with a goal of reducing nitrogen loading within the watershed. Based on modeling, they predicted the cost-effectiveness of a reduction of nutrient application compared to an increase in prairie restoration. Results have shown a reduction of nitrogen application by 21 percent illustrating that prairie restoration improves water quality.

Mixed Perennial Landscapes: Diversity on Iowa's Land
Matt Liebman, the Henry A. Wallace Endowed Chair for Sustainable Agriculture at Iowa State University, said his perennial landscape research is on three scales: a plot study at the ISU agronomy research farm, watershed study at the Neal Smith National Wildlife Refuge and a landscape study in two Iowa counties. His goal is to show that perennials on Iowa's farmland help build and conserve soil, store carbon, help filter water, and aid in efficient nutrient cycling.

Integrated Drainage Wetland Systems
A study on integrated drainage and wetlands is being conducted at the Neal Smith National Wildlife Refuge by **Bill Crumpton** and **Matt Helmers**, Iowa State University. Crumpton talked about the project and findings using tile drainage and best field management practices for reducing nitrogen and phosphorus.

Least-Cost Control of Agricultural Nutrient Contributions to the Gulf of Mexico Hypoxic Zone
Cathy Kling, an economist with the Center for Agricultural and Rural Development (CARD) at Iowa State University, discussed the modeling system in a study about changing land use practices and their effect on water quality. The modeling system included an economic component to help determine the cost of adopting practices and profits from alternative crops. Using this type of model helps inform policy by addressing the "what if's" and the multitude of variables to quantify trade-offs between cost and pollution reductions.

Updates on Current Science of Nutrient Flows and Conservation Actions in Iowa: Panel Discussion

Dan Jaynes from the USDA-ARS National Soil Tilth Laboratory provided an overview of the historical trends and land use in Iowa related to water quality. He said that at the time the United States spent $400 million to build the Panama Canal, Iowans were making a similar investment (about $450 million) to build a tile drainage system throughout the state. As a result, Iowa lost 89 percent of its natural wetlands, but realized numerous benefits including greater trafficability of Iowa's streams and the ability to grow higher-yielding crops. He presented a case study of land use on a Story County farm from 1910, before drainage was installed, to 2008.

Matt Helmers, an agricultural engineer at Iowa State University, outlined various approaches by scientists to reduce nutrient losses in crop production systems and to slow the flow of water in order to help restore the natural hydrology once provided by Iowa's river systems. They include

- creating a better match between nutrient supply with crop needs, both rates and timing;
- increasing continuous living cover on the land to reduce soil erosion from surface runoff and increase water use during susceptible periods;
- optimizing drainage design and management;
- exploiting the interface between land and water, such as treating runoff before it enters downstream systems.

Discussion that followed pointed to difficulties in finding seed for cover crops and the need for research to develop a winter rye or wheat better suited following corn. They identified cover crops as the number one practice that could help reduce nutrients in water supplies.