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The Iowa Nutrient Reduction Strategy to Address Gulf of Mexico Hypoxia

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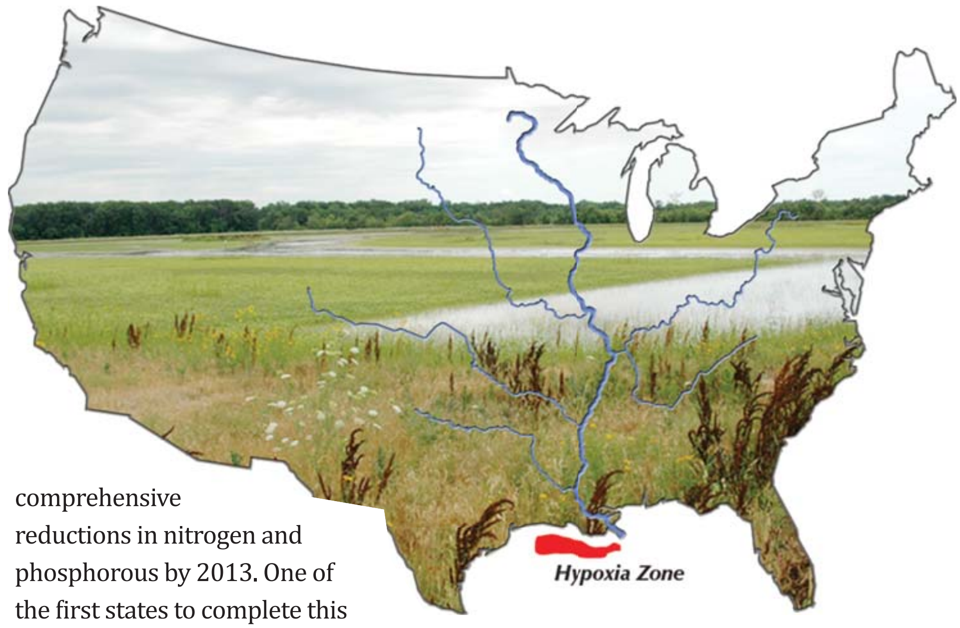

SINCE 1985, the size of the hypoxic zone in the Gulf of Mexico has been measured every July via a cruise on the *Pelican*, a ship operated by the Louisiana University Marine Consortium under the direction of Dr. Nancy Rabalais. The hypoxic zone, colloquially referred to as the "dead zone," is an area where nutrient-enriched waters coming from freshwater rivers and streams in the watershed cause excess growth of plants which, in turn, deplete oxygen levels as they decompose. The extent of oxygen depletion is nearly complete in that it creates unsuitable habitat for animals living in the region. The result of this year's annual cruise indicated an area of low oxygen level of about 5,800 square miles, an area roughly three times as large as the targeted goal. A significant source of the nutrients that flow into the Gulf originate from agricultural sources, specifically row crop land in the corn belt.

To address this environmental problem, the multistate and multiagency "Mississippi River/ Gulf of Mexico Watershed Nutrient Task Force" was created in 1997. Their mission is to understand the causes and effects of the hypoxic zone and to coordinate activities to address it. In their 2008 Action Plan *(http://1.usa.gov/GWPcxq)*, the Task Force called for the states in the Basin to develop strategies to achieve comprehensive reductions in nitrogen and phosphorous by 2013. One of the first states to complete this task was Iowa, in the form of the Iowa Nutrient Reduction Strategy *(http://bit.ly/QpKBYi)*. The bulk of the strategy document is a science assessment that contains a summary of the literature concerning the effectiveness of conservation practices, field scale estimates of the costs of these practices, and the spatial coverage of the practices needed to achieve water quality goals.

A Brief Summary of the Science Assessment

The science assessment was undertaken to identify the type and extent of conservation actions and coverage needed to achieve the target goal of reducing nitrogen export by about 40% and phosphorus by about 30% across Iowa's 21 million acres of cropland devoted to corn and soybean production. To do so, the authors needed to consider the baseline conditions (the extent of practices currently in place and a clear understanding of land use), understand the effectiveness of available conservation practices and land use changes in reducing nitrogen and phosphorus, estimate the coverage of these practices across the landscape needed to achieve the goal, and estimate the cost of implementing these actions. They identified three categories of nitrogen and phosphorus reduction practices: infield management practices, edge-of-field practices, and land-use changes. Infield management practices are actions that can be taken within a field

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Nutrient Reduction Strategy
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to reduce the loss of nutrients from that field. Commonly advised practices such as reducing nitrogen application rates, type, and timing fall into this category for nitrogen reduction and reduced tillage is a key option for phosphorus. The relatively new practice of planting cover crops is an effective infield management practice for both nutrients. Edge-of-field practices include buffers for phosphorus and wetlands targeted for water quality improvement for nitrogen. Bioreactors, an emerging technology to treat nitrogen, are also in this category. Finally, the planting of perennial crops for biofuels or the reintroduction of prairie plants on land previously planted in row crop are examples of land-use changes to reduce both nitrogen and phosphorus. Cost information on each of these options is provided. It is worth noting that in general, infield management actions are both less effective in reducing nutrient losses and less costly on a per acre basis than either edge-of-field practices or land-use changes (an important exception is cover crops which is an effective management option, but relatively costly).

To complete the assessment, the science team ventured beyond the costs and effectiveness of individual nutrient reduction practices by developing several scenarios of landscape scale changes that they predict would achieve the target nutrient reduction goals. While they emphasize that these scenarios are intended to be examples only, these scenarios are quite helpful for understanding the dimensions of the problem.

The data in this report, along with the distillation of the large agronomic literature and scenarios, provides a number of insights for policymakers and analysts.

Some Relevant Policy Questions Concerning the Nutrient Enrichment Problem and Hypoxia in the Gulf of Mexico

1. If broad implementation of effective land-use changes and practices were achieved, who would ultimately bear the cost? Would the cost be passed on to consumers in the form of higher prices? To other agricultural producers via higher input costs? To landowners in the form of lower land values?
2. What are the benefits associated with meeting the targeted nutrient reduction goals? Who would these benefits accrue to? Commercial fishermen in the Gulf? Recreational anglers in the Gulf? What does it mean for the overall health of the Gulf ecosystem and how valuable is that to society?
3. What about the benefits from improved water quality upstream—would meeting these goals mean that local water quality throughout the state would also be improved? How much is this worth? Who benefits?
4. Would the practices and land-use changes that would achieve the goals for hypoxia reduction in the Gulf generate other ecosystem services? Who would receive them and how much would they be worth? Could markets for other ecosystem services (such as greenhouse gases) help contribute to reducing the dead zone?
5. What are other states doing in their strategies? Are there lessons that can be learned from other states and/or other regions such as the Chesapeake Bay which suffers from similar nutrient problems? Are there lessons that can be learned from other countries who have experienced nutrient enrichment problems in their waters?
6. Are there other economics/policy questions about the dead zone that you would like to ask? If so, please send them to us via the "Ask an Ag Economist" link.

Four Takeaways for Policy Consideration

1. Low-cost infield options by themselves will not be adequate to meet the water quality goals of the Hypoxia Task Force. This message is clearly communicated via scenarios whereby all relevant corn and soybean acreage is individually treated with nitrogen management options such as reduced fertilizer, the use of nitrification inhibitors, movement of fall fertilizer application to spring, and cover crops on no-till acres. These and other options in this category achieve anywhere from almost no reduction to a maximum reduction of 9%. A similar pattern is true for the phosphorus management options (such as reduced tillage). Even the planting of cover crops on all corn and soybean acres across the entire state (an expensive proposition) is estimated to reduce nitrogen export by about 28%, well below the targeted 40%.
2. Reliance on previously used best management practices will also not be adequate. Historically, conservation practices such as no-till or reduced till, contour farming or terracing were designed to address soil erosion and, because phosphorus tends to move with soil, are often effective at retaining that nutrient. However, nitrogen moves with water, and practices that may be very effective for phosphorus can have little or no impact on nitrogen. This means that practices that are new to the Iowa landscape, such as bioreactors, cover crops, perennial crops, and more targeted wetlands will be needed.
3. Most of Iowa's extensive agricultural land must be treated if the targets are

to be met. A common rule of thumb often quoted in the agricultural conservation community is that 80%–90% of the benefits can be achieved by changing the behavior of 10%–20% of the actors. Unfortunately, the properties of nutrient flows, especially nitrogen, in this landscape where tile drains and ample rainfall prevail, mean that there are nitrogen flows from all agricultural land. While targeting of cost-effective practices to the locations they are most effective is clearly important, implementation of traditional conservation practices (best management practices) will not achieve the nitrogen reduction needed, both because many of those practices are targeted at soil erosion/phosphorus rather than nitrogen and because practices that achieve a greater per acre effectiveness than many of the traditional practices are needed.

4. Successful treatment of the land area to achieve the targeted nutrient reductions will be expensive. The scenarios identified by the science team have initial price tags ranging from $77 million to over $1.4 billion annually. Bear in mind, however, that the initial cost of implementing and maintaining these practices may be shifted to consumers in the form of higher prices; thus, the ultimate "burden" of these costs may not fall only on agricultural producers.

In summation, to successfully address the nutrient enrichment problem coming from Iowa's agricultural fields, a major change in the landscape will be needed. New practices and new crops will be needed, new land uses such as wetlands will have to be constructed in locations targeted to achieve nutrient cycling, and all of this will come at a cost. The Iowa Nutrient Reduction Strategy calls for voluntary approaches to achieving this landscape transformation, meaning that producers will have to willingly adopt practices that reduce their bottom line and/or for conservation programs to substantially increase their funding of programs. The Iowa Nutrient Reduction Strategy contains a plethora of useful information and the insights from many of the best scientists in agronomy, ecology, agricultural engineering, and hydrology. Nonetheless, many questions remain, particularly with respect to the implications for conservation and environmental policy. The attached box identifies a number of questions that will be discussed in future issues of the *Ag Policy Review,* particularly as new research becomes available that sheds light on these questions. ■

Ask an Ag Economist

If Iowa is the leader in corn production and has a poor corn crop, how can there be a bumper crop for the nation?

THE SIMPLE ANSWER IS ACREAGE: lots of corn acreage. Over the past five years, the United States has increased corn planting by over 10 million acres. Much of that acreage is outside the traditional Corn Belt, in places like the Northern Plains and the Southeast. While these acres don't tend to yield as much as Iowa's acres, they definitely add to the national total. For example, if those additional 10 million corn acres yield at 140 bushels per acre, that's an additional 1.4 billion bushels of corn for the United States. For Iowa, a good year of corn production would result in roughly 2.4 billion bushels of corn; and in a poor production year, like last year, Iowa produced only 1.88 billion bushels of corn. So when Iowa corn production falls short, the US total declines by about 0.6 billion bushels of corn. The increase in corn production outside the Corn Belt is more than enough to offset Iowa's loss and bring the US total corn production up to record levels. ■

Do you have a question for an Agricultural Economist?

The "Ask an Ag Economist" segment is where we invite readers to submit questions to us. We will periodically choose questions of general interest to respond to in future issues.

Questions can be submitted to us through our web site *(http://www.card.iastate.edu/ag_policy_review/ask_an_economist/).*