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WATER QUALITY ISSUES FACING AGRICULTURE AND RURAL COMMUNITIES

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Summary

American society expects agriculture to provide high-quality and moderately priced food and fiber in a manner that protects air, soil and water resources. While environmental policies and programs have been successful in reducing water pollution from point sources, agricultural non-point source pollution is still a major problem. Agricultural-environmental policies and traditional technologies have been effective in reducing water pollution from agriculture. Newer production technologies, such as precision farming and GMOs, incentive-based policies, such as tradable emission permits, and information management technologies, such as geographic information systems, global positioning systems, remote sensing and Internet-based decision support systems, offer significant potential for achieving further reductions in nonpoint source water pollution. Community-based decision-making is a promising framework for addressing and alleviating adverse impacts of animal feeding operations on water quality and the quality of life in rural communities.

Progress and Challenges

When the Clean Water Act was passed in 1972, there was grave concern about the poor quality of the Nation's water. Before the Act, untreated water from point sources, such as municipalities, businesses and industries, caused widespread pollution of lakes, rivers and coastal waters. The National Pollution Discharge Elimination System (NPDES), which the Act mandates, requires wastewater treatment facilities to obtain permits for emitting water pollutants. The Act reduced pollutant loading by billions of pounds and doubled the number of swimmable and fishable water bodies. Despite this progress, agriculture is still the leading source of water quality impairment in rivers and lakes and the third ranked source in estuaries.

The Clean Water Act and farm programs, such as conservation compliance, Conservation Reserve Program, Wetlands Reserve Program, and Environmental Quality Incentives Program, have provided technical and financial assistance for farmers who adopt conservation practices for reducing soil erosion and agricultural nonpoint source pollution. Adoption of traditional conservation technologies has significantly reduced agricultural nonpoint source pollution. These technologies include reduced and no tillage systems, terracing, contour farming, more efficient and timely application of fertilizers and pesticides and others. For example, from 1977 to 1992, sediment delivery from cropland to water bodies decreased by about 740 million tons, or 38 percent. The goal over the next five years is to achieve an additional 25 percent reduction in soil erosion on cropland.

States report that close to 40 percent of sampled water bodies are too polluted for fishing and swimming. A major source of water pollution is runoff from farms, pastures, urban areas, and timber harvesting and mining operations. In addition, the ecological integrity of aquatic ecosystems, such as wetlands, stream corridors and coastal areas, has been compromised by urbanization, drainage of wetlands, modification of rivers and runoff containing nutrients, pesticides and livestock wastes.

Progress made in controlling nonpoint source pollution from cropland has been partially offset by increased pollution from other sources. Prime examples include *Pfiesteria* outbreaks in mid-Atlantic coastal areas caused by breached animal waste lagoons, fish deaths from wastewater equipment failures in confined animal feeding operations in the Midwest, hypoxia (low concentrations of oxygen) in the Gulf of Mexico caused by nutrient loading in streams and rivers of the Mississippi and Missouri River Basins.

In the case of hypoxia, the problem is exacerbated by the fact that nutrient loads to the Mississippi River from agricultural, urban and other sources are causing ecological degradation in the Gulf of Mexico even though nutrient concentrations in the river are substantially below the maximum contaminant levels for drinking water. It appears that the water quality standard needed to protect ecosystems in the Gulf is more restrictive than the standard for drinking water. In the case of North Carolina, lagoons overflowed because they were not designed to handle the intensity of storm events that occurred in the region. In my own state of Missouri, animal waste equipment failures have resulted in numerous fish kills.

New Production Technologies

New and emerging production technologies have the potential to further reduce adverse water quality impacts of agricultural production. Research on site-specific farming indicates that it can increase farm profitability and reduce the risk of water pollution under certain conditions. Application of genetically modified organisms (GMOs) to agriculture has led to development of new varieties that are resistant to certain herbicides and pests. Pest resistance reduces the use of pesticides, which can generate significant water quality benefits particularly in areas where soil and weather conditions pose a high risk of pesticide contamination. Other traits achievable with GMOs, like increased drought tolerance, could have significant benefits in areas of the country where rainfall is low, costs of groundwater pumping are high and/or weather variability increases as a result of climate change. On the other hand, GMOs pose certain ethical issues and social and environmental risks that must be assessed.

Policy

In addition to the Clean Water Act, many other federal and state agricultural policies have stimulated the adoption of conservation technologies and cropping systems that increase soil and water conservation. Instrumental programs include conservation compliance, which eliminated inconsistencies between commodity and conservation programs, the Conservation Reserve Program, which idled millions of acres of highly erodible cropland, the Wetland Reserve Program, which stimulated conversion of cropland to wetland, and a wide range of technical and financial assistance programs.

While the soil and water quality benefits of these programs are indisputable, their cost effectiveness has been called into question. Some analysts contend that the public cost of these

programs has been very high, and that removal of the subsidies for practices that improve water quality cause farmers to abandon them. Practices that have economic and water quality benefits (so called win-win situations) are the most enduring.

Another debate swirls around whether regulations or subsidies are the best approach for controlling agricultural nonpoint source pollution. For the most part, a regulatory approach has been used to control point sources, like the NPDES permits mentioned earlier. Incentive-based programs, such as cost sharing of soil and water conservation practices, CRP and EQIP, help to control agricultural nonpoint source pollution. In contrast, the decision to issue rules implementing the Total Maximum Daily Load (TMDL) requirement of the Clean Water Act sets into motion a regulatory approach to controlling all sources of water pollution in a watershed.

A policy option for reducing water pollution that is receiving considerable attention is tradable emission permits (TEP), also known as nutrient trading. TEPs require the regulatory agency to set an upper limit on total emissions from all sources in a particular area, such as a watershed. A TMDL is such an upper limit. The agency then issues emission permits up to the limit. Permits can be traded among sources at a price determined by demand and supply conditions and other trading restrictions imposed by the agency. Since permits can be bought and sold, a point source can buy emission permits from a non-point source and vice versa. For example, an industry that is a point source would be willing to buy permits from a farm that is a nonpoint source when the cost of controlling the point source is higher than the cost of controlling the nonpoint source. TEPs are economically efficient because they minimize the cost of achieving a desired reduction in total emissions.

Another policy issue is the extent to which phased deregulation of agriculture will decrease the use of cropping systems and farming methods that contribute to nonpoint source pollution. Some policy analysts argue that price and income supports cause farmers to use crop rotations that have adverse environmental consequences. As subsidies are phased out, farmers might select crop rotations that are less harmful to the environment. We will have to wait and see whether this occurs.

Information Technologies and Rural Communities

Communities are becoming increasingly concerned about the adverse impacts of agriculturally related air and water pollution on quality of life. One way to address this issue is to adopt a collaborative, watershed-based decision-making approach. This form of decision-making brings watershed stakeholders together for the purpose of developing site-specific strategies for improving water quality in a manner that maintains or enhances economic viability.

Rapid advancements in information technologies make it possible for communities to synthesize and evaluate the information needed to protect water quality. Examples of these technologies include geographic information systems, global positioning systems, remote sensing and Internet-based decision-support systems. Information technologies allow users to visualize spatial relationships within a watershed that are critical in controlling water pollution. For example, the center that I co-direct has developed a decision support system for Saline County, Missouri that allows users to determine the proximity of existing animal feeding operations to residential areas, roads, public drinking water supplies, streams, and public facilities, as well as identify the most suitable areas for future animal feeding operations. Information technologies substantially enhance the capacity of rural communities to develop and

evaluate strategies that minimize the adverse impacts of agricultural production on human health and natural resources.

Future Prospects

While water quality problems in the US pale in comparison to those occurring in many other parts of the world, they are nonetheless significant for people, communities and ecosystems at risk from water pollution. Advancements in production and information management technologies are increasing our capacity to reduce such risk. The challenge before us is to use these technologies and advancements in scientific knowledge to reduce adverse impacts of food and fiber production on water quality, people and the sensitive ecosystems on which people depend.