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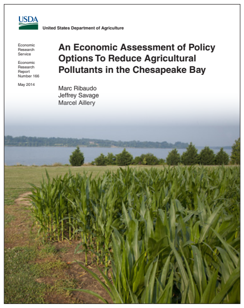

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An Economic Assessment of Policy Options To Reduce Agricultural Pollutants in the Chesapeake Bay

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What Is the Issue?

In 2010, the U.S. Environmental Protection Agency established limits for nutrient and sediment emissions from point (i.e., wastewater treatment plant) and nonpoint (i.e., agricultural runoff) sources to the Chesapeake Bay in the form of a Total Maximum Daily Load (TMDL). Agriculture is the largest single source of nutrient emissions in the watershed. The TMDL specifies that two issues facing agriculture need to be addressed if the TMDL's nutrient limits are to be met. First, farmers can increase their use of the most effective nutrient management practices, such as cover crops. Second, assuming animal numbers in the watershed do not change, reducing the amount of manure applied to farmland necessitates moving manure to areas with cropland that can safely receive manure nutrients as a substitute for commercial fertilizer. Both entail costs.

Different policy approaches can be used to achieve the nutrient limits of the TMDL, ranging from financial incentives to regulations. The cost of achieving water quality goals depends heavily on which policy choices are selected and how they are implemented.

What Did the Study Find?

Our assessment of policy instruments for achieving the TMDL goals on cropland in the Chesapeake Bay watershed includes performance-based regulations (emission limits), performance-based incentives (emission taxes), design-based standards (regulations on practices or inputs), and design-based incentives (payments for conservation practices). Our analysis focuses on the difference in costs between scenarios, rather than the absolute cost of any one policy scenario. These differences enable us to identify which policy design features lead to a more cost-effective solution.

Performance-based policies use measures of pollutant delivered to receiving waters as the basis for policy. The lowest cost ("optimal") option among all approaches meets TMDL goals by treating only 12 percent of the watershed's cropland—those acres that can reduce the most pollutants at the least cost. Performance-based policies are difficult to implement for nonpoint-source pollution because pollutant discharge cannot be easily measured and regulators lack the information necessary to set optimal performance goals.

An alternative is to focus on inputs and management practices, which are more easily observed by both resource management agencies and farmers. Practices can be required

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through regulation or encouraged through financial incentives. These ***design-based policies*** can be made more efficient through targeting. In particular, requiring best management practices—a combination of cover crops, nutrient management, and erosion controls—on land adjacent to water that also has a treatment need according to USDA's Natural Resources Conservation Service (NRCS) criteria met TMDL goals for a quarter of the cost of implementing the full suite of management practices on all cropland. Still, the most efficient design-based approach was 4-5 times more expensive than the optimal performance-based approach and treated more than twice as much land.

Another incentive system for Bay-area farmers to reduce their pollutant levels is the establishment of ***water quality trading***. Trading is already used by some States to enable wastewater treatment plants and other point sources to meet TMDL limits without costly upgrades. Trading also offers an economic incentive to farmers to implement water quality-improving practices they might not otherwise adopt. Trading program rules developed by Maryland, Pennsylvania, and Virginia all require that fields achieve a certain level of nutrient management before being able to generate credits, thus ensuring that abatement contributed by agriculture is "additional." However, requiring more of farmers in order to trade can discourage them from participating.

With a daily inventory of roughly 2.0 billion pounds of poultry, dairy, swine, and feedlot beef, ***animal agriculture is a significant source of nutrient loadings*** to the Bay, contributing an estimated 17 percent of the nitrogen entering the Bay and 26 percent of the phosphorus. Animal operations produce roughly 99,400 tons of recoverable manure nitrogen and 44,200 tons of recoverable manure phosphorus annually, which is often more than can be safely used by crops grown on the land managed by the livestock operation. Removing excess manure nutrients from farms in the Chesapeake Bay watershed and moving it to where it can be used efficiently costs an estimated $15 million to $27 million per year.

Manure hauling costs decrease with the ***willingness of crop producers to use manure***. An increase in the share of cropland using manure from 30 to 90 percent reduces hauling costs in the watershed about 15 percent. Education and technical/financial assistance for manure management could increase the willingness of crop producers to substitute manure for commercial fertilizers.

Using manure as an energy source could absorb some of the excess manure nutrients and reduce regional hauling costs if the economics are favorable and concerns over air quality are adequately addressed. However, demand for manure as an energy source could increase costs for crop producers who utilize manure as a nutrient source, either through higher manure prices or through the need to purchase inorganic fertilizers. Our findings suggest that the value of manure as a source of crop nutrients would exceed the reduction in hauling costs. But this negative impact on agriculture would have to be weighed against the benefits provided by local energy production.

How Was the Study Conducted?

To evaluate the costs of improved nutrient management on cropland, the study used data from NRCS's Conservation Effects Assessment Project (CEAP). Cropping practice data, simulated nutrient emissions to water (also from CEAP), and practice cost data from a number of sources were used to build a model to evaluate different policy scenarios for meeting TMDL goals, subject to policy constraints.

The CEAP data and the optimization model were also used to examine the implications of baseline choice in a point/nonpoint trading program. The data and model were used to estimate nitrogen abatement supply curves for different baseline assumptions. An offset demand curve for publicly owned wastewater treatment plants was estimated by the World Resources Institute using data from the Chesapeake Bay Program. To evaluate the cost of achieving a manure nutrient balance in the watershed, the study used an ERS optimization model of the Chesapeake Bay watershed that minimizes manure hauling and application costs and is based on a county-level dataset of manure nutrients and available cropland that NRCS developed from the 2007 Census of Agriculture.