From: Scott Phillips, U.S. Geological Survey Chesapeake Bay Coordinator

To: Maryland Senate Environment, Health and Education Committee and House Environment and Transportation Committee

Subject: Testimony for Maryland General Assembly Hearings on the Phosphorus Management Tool

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Thank you for the opportunity to explain how phosphorus from manure enters the Chesapeake Bay and affects water quality. The U.S. Geological Survey (USGS) works with partners to monitor rivers and explain water-quality conditions in the Bay watershed. Our role is to provide scientific results to states, and the U.S. Environmental Protection Agency (USEPA), to help them assess progress toward reducing nutrients and sediment for the Chesapeake Bay Total Maximum Daily Load (TMDL). Here is a summary of phosphorus results for Maryland and the Eastern Shore.

There is a lack of widespread improvement of phosphorus levels in Maryland's streams over the past decade. Monitoring results, based on samples collected from streams throughout Maryland, show that phosphorus concentrations have not improved at the majority of sites during 2003-12 (see map, fig. 1). The concentrations were predicted to have declined in response to management practices to reduce nutrients and sediment going to the Bay.

On the Eastern Shore the phosphorus levels have worsened over the past 10 years. In the Choptank River watershed, for example, where the USGS has the longest period of monitoring data, phosphorus concentrations have increased 48% over the last 10 years, and by 65% since 1985. The trends are worsening because phosphorus has accumulated in soils as a result of nutrient applications at levels in excess of what crops can use to grow.

The excess amount of phosphorus in soils comes primarily from manure. Agricultural operations contribute close to 100% of the phosphorus on the Eastern Shore; with manure being the largest source (see pie chart in fig. 2). Application of commercial fertilizer started about 1950 but began to decrease in the 1980s. However, poultry production has increased from less than 4 million broilers in 1919 to nearly 600 million in 2007, which results in a greater amount of manure being placed on the land. In addition, the numbers of livestock are likely to grow across the Bay watershed, so manure management will be of greater concern.

If the agricultural crops cannot use all of the nutrients in the manure and fertilizer, then excess phosphorus moves into nearby streams. The application of phosphorus to cropland typically exceeds the amounts that are used by crops. Phosphorus from manure and fertilizer applications has been accumulating in Eastern Shore soils for decades. The phosphorus in the

soil travels to streams during rain events and eventually flows to the tidal waters of Chesapeake Bay.

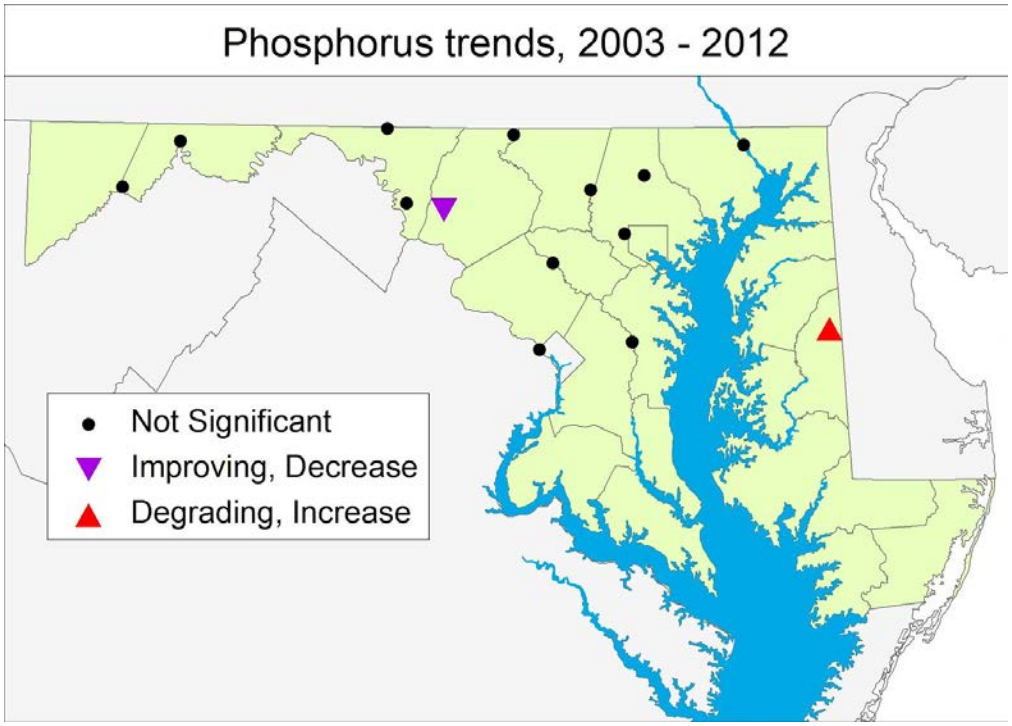
The Eastern Shore receives nearly twice the amount of phosphorus compared to other areas. The Eastern Shore makes up only 7 percent of the Bay watershed, but nearly twice as much phosphorous is applied to cropland (per area) on the Shore as compared to other regions of the Bay watershed. These disproportionately large loads of excess phosphorus (and nitrogen) contribute to poor water-quality conditions in the Chesapeake Bay and tidal rivers.

These scientific results provide implications for both preventing phosphorus from moving into streams and reducing its application onto lands:

(1) Most of the management practices applied to agricultural areas have been designed to control soil erosion, which prevents sediment and attached phosphorus from moving into streams. These practices, such as riparian forest buffers, no-till farming, and contour tillage, help retain phosphorus but do not decrease the amount in soils.

(2) The increasing amount of phosphorus in soils is due to past and present fertilizer and manure applications, and harms water-quality conditions on the Eastern Shore. The findings suggest that if the amount of phosphorus applied to the land remains the same or increases, water-quality conditions will likely get worse.

Fig 1: Map of phosphorus trends from 2003-12 in Maryland. Phosphorus trends have not improved at most sites, and trends in the Choptank River on the Eastern Shore have gotten worse.



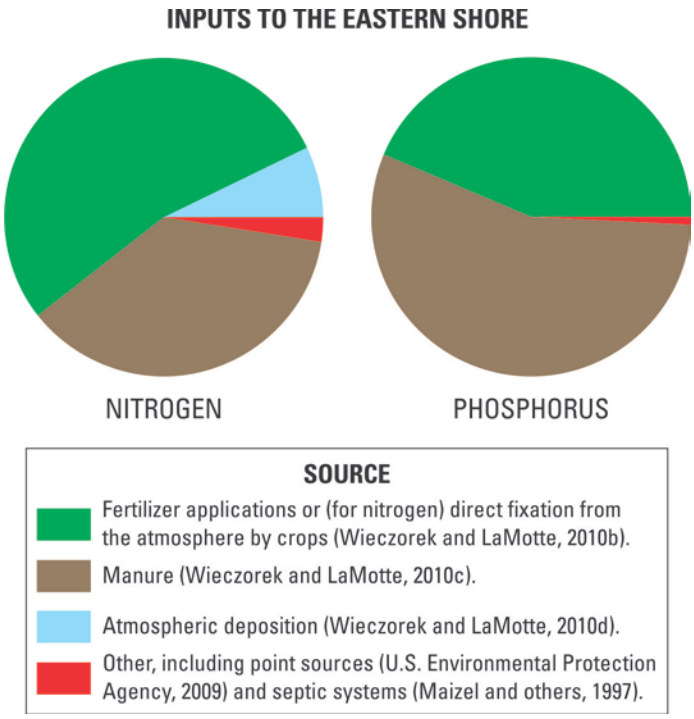


Figure 2: Sources of Nitrogen and Phosphorus applied to the Eastern Shore. The majority of phosphorus (pie chart on right) comes from manure.

Sources of Information

The majority of the results for this testimony were extracted from the draft USGS report "Understanding Nutrients in the Chesapeake Bay Watershed and Implications for Management and Restoration—the Eastern Shore" by Scott W. Ator and Judith M. Denver, USGS Circular 1406, in press (Expected to be released in March, 2015)

Annual updates of nutrient and sediment trends in the Chesapeake Bay watershed, Joel Blomquist and others, USGS, 2014: http://cbrim.er.usgs.gov/

New Insights: Science-based evidence of water quality improvements, challenges, and opportunities in the Chesapeake, 2014, by University of Maryland Center for Environmental Science (UMCES), USGS, and USEPA. http://ian.umces.edu/press/reports/publication/438/new_insights_science_based_evidence_of_water_quality_improvements_challenges_and_opportunities_in_the_chesapeake_2014-02-24