

## **PhD Dissertation Defense**

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**Title:** An Economic Analysis Of The Potential ‘Voluntary’ Reductions Of Nutrients From Agriculture To The Chesapeake Bay From The Shenandoah Soil And Water Conservation District, Virginia

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### **ABSTRACT**

This study addresses the lack of an in-depth assessment of field-level costs for implementing agricultural best management practices (BMPs). An economic analysis of the potential contribution of ‘voluntary’ reductions of nutrients from agricultural non-point sources of pollution to the Chesapeake Bay originating in the Shenandoah Soil and Water Conservation District (Shenandoah SWCD), Virginia was conducted. The research had three high level objectives: 1) to assess the heterogeneity in costs of implementing BMPs at the field-level; 2) to estimate the magnitude of potential nutrient reductions possible from agriculture in the Shenandoah SWCD, Virginia based on the field-level cost analysis and Virginia’s trading program statutory requirements, *ceteris paribus*; and 3) to evaluate alternative scenarios of nutrient reduction based on the sensitivity of farmers to credit prices and allowable BMPs. The study considers the economic and physical factors associated with farms and builds on a vast base of literature on the physical aspects of non-point source pollution abatement.

The heterogeneity in costs of six BMPs applied in the Shenandoah SWCD over six years is analyzed. There is significant heterogeneity in field-level costs with the coefficient of variation ranging from 19 to 72 percent. The median cost for BMPs is found to be similar to the average cost used in other studies for evaluating nutrient credit markets. Therefore, fifty percent of the

time implementation costs exceed the average and farmers with those prospects are not be likely to participate in the market.

An analysis of the nutrient contributions from Shenandoah SWCD agriculture found that under current fixed nutrient prices, for those farmers that have installed baseline BMPs, an expected 12,960 pounds of nitrogen and 2,130 pounds of phosphorus would be reduced annually from trading. If all farms were to meet the baseline, as many as 632,220 pounds of nitrogen and 41,372 pounds of phosphorus are reduced in a given year. This represents from 0.5 to 22 percent of the current nitrogen load and 0.2 to 4 percent of the current phosphorus load. An analysis of trading using a wastewater treatment facility cost of implementation based price yields an additional four percent in nitrogen reduction and six percent in phosphorus reduction over the fixed price scenario. A third analysis using a stormwater management BMP implementation cost based credit price yields a 15 percent reduction in nitrogen and six percent reduction in phosphorus over the fixed price scenario. By not considering the heterogeneity in costs, previous economic assessments have greatly overestimated trading potential which is consistent with a lack of actual trading in the market.