United States Department of Agriculture
Natural Resources Conservation Service
Conservation Effects Assessment Project

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Summary of Findings

Assessment of the Effects of Conservation Practices on Cultivated Cropland in the Delaware River Basin

CONTENTS

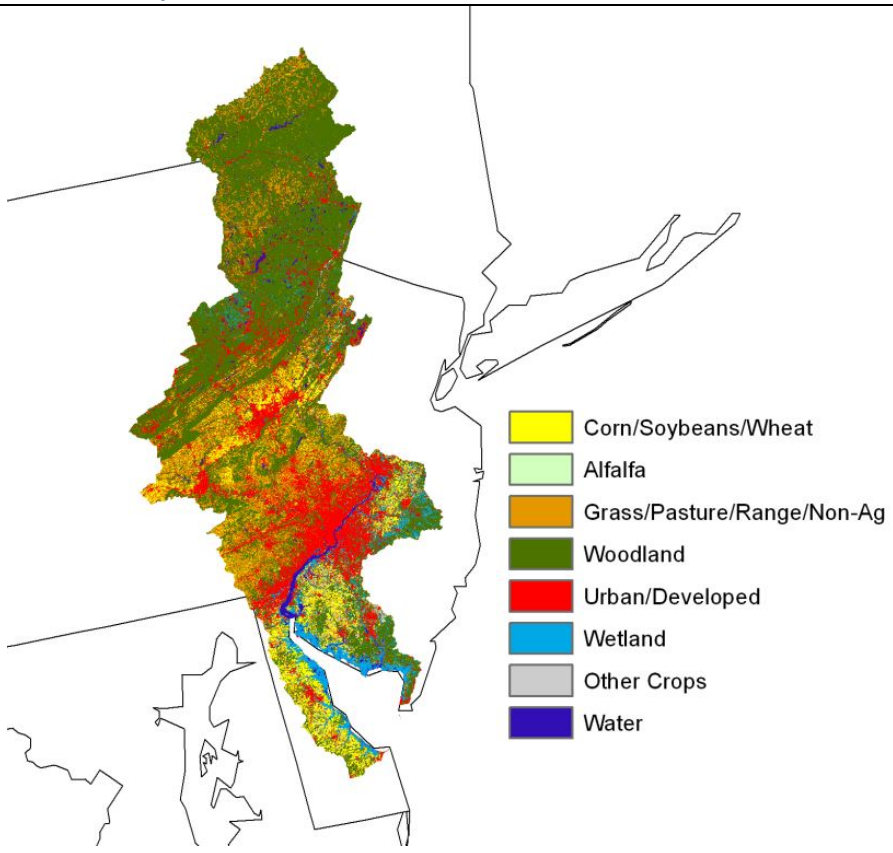
To view or download a PDF version of the full report, visit the NRCS Web site, http://www.nrcs.usda.gov, and follow links to Technical Resources / Natural Resources Assessment / CEAP

The U.S. Department of Agriculture's Conservation Effects Assessment Project (CEAP) has undertaken a series of studies designed to quantify the effects of conservation practices on cultivated cropland in the conterminous 48 States. One of these studies covers the Delaware River Basin.

The Delaware River Basin drains more than 13,600 square miles (8.7 million acres) in the northeastern United States. The river rises in New York State and also includes parts of Pennsylvania, New Jersey, Delaware, and Maryland before discharging into Delaware Bay and the Atlantic Ocean (fig. 1). The major metropolitan areas in the regions include Philadelphia and Allentown, PA; Trenton, NJ; and Wilmington, DE.

About 13 percent of the region is cultivated cropland, most of which is in the lower part of the basin. The main crops are corn, soybeans, and hay. Poultry and dairy are also important in the agricultural economy of the region.

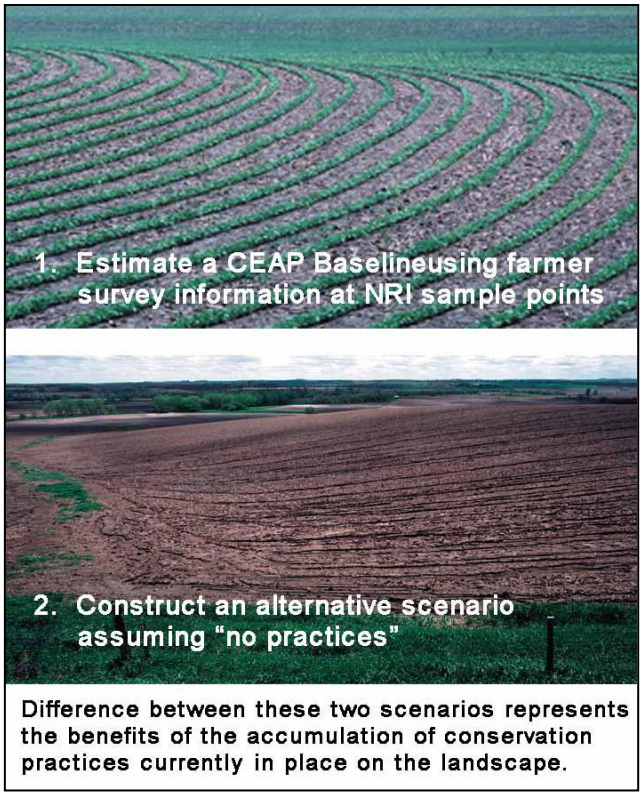
Figure 1. Location of and land cover in the Delaware River Basin



SOURCE: TEXAS AGRILIFE RESEARCH, TEXAS A&M UNIVERSITY (USDA-NASS DATA)

Study Methodology

The assessment uses a statistical sampling and modeling approach to estimate the effects of conservation practices. The National Resources Inventory (NRI), a statistical survey of conditions and trends in soil, water, and related resources on U.S. non-Federal land conducted by USDA's Natural Resources Conservation Service, provides the statistical framework for the study. Physical process simulation models were used to estimate the effects of conservation practices that were in use during the period 2003 to 2006. Information on farming activities and conservation practices was obtained primarily from a farmer survey conducted as part of the study. The assessment includes not only practices associated with Federal conservation programs but also the conservation efforts of States, independent organizations, and individual landowners and farm operators. The analysis assumes that structural practices (such as buffers, terraces, and grassed waterways) reported in the farmer survey or obtained from other data sources were appropriately designed, installed, and maintained.



Difference between these two scenarios represents the benefits of the accumulation of conservation practices currently in place on the landscape.

The national sample for the farmer survey consists of 18,700 sample points with 186 of these sample points located in the Delaware River Basin.

The modeling strategy for estimating the effects of conservation practices consists of two model scenarios that are produced for each sample point.

1. A baseline scenario, the "baseline conservation condition" scenario, provides model simulations that account for cropping patterns, farming activities, and conservation practices as reported in the NRI-CEAP Cropland Survey (2003–06) and other sources.

2. An alternative scenario, the "no-practice" scenario, simulates model results as if no conservation practices were in use but holds all other model inputs and parameters the same as in the baseline conservation condition scenario.

The effects of conservation practices are obtained by taking the difference in model results between the two scenarios. The need for additional conservation treatment was evaluated using a common set of criteria and protocols applied to all regions in the country to provide a systematic, consistent, and comparable assessment at the national level.

Study Findings

The findings summarized below represent conservation practices reported in the 2003–06 NRI-CEAP Cropland Survey.

Voluntary, Incentives-Based Conservation Approaches Are Achieving Results

Farmers have reduced sediment, nutrient, and pesticide losses from farm fields through conservation practice adoption throughout the Delaware River Basin, compared to losses that would be expected if no conservation practices were in use. Structural practices for controlling water erosion are in place on 48 percent of all cropped acres in the region, including 64 percent of highly erodible land. Forty-five percent of cropped acres meet criteria for mulch till, and 32 percent meet criteria for no-till. Ninety-five percent of cropped acres have structural or tillage and residue management practices, or both. Farmers meet criteria for good nitrogen management—appropriate rate, timing, *and* method of application—on only 11 percent of the cropped acres and good phosphorus management on 26 percent.

Conservation practice adoption—whether through Federal or State programs or through landowners' initiative—has reduced edge-of-field sediment and nutrient losses and sediment and nutrient loads, as shown in table 1.

Table 1. Reductions in edge-of-field sediment and nutrient losses from cropped acres, Delaware River Basin

Sediment loss	Nitrogen loss		Total phosphorus loss*
	Waterborne	With runoff	
44	34	33	41

*** Phosphorus lost to surface water, which includes sediment-attached and soluble phosphorus. Soluble phosphorus includes not only phosphorus in runoff but also leaching to loss pathways such as tile drains and natural seeps. Much of this lost phosphorus eventually returns to surface water.**

Opportunities Exist to Further Reduce Soil Erosion and Nutrient Losses from Cultivated Cropland

Despite the obvious progress, further reductions are possible. The need for additional conservation treatment in the region was determined by imbalances between the level of conservation practice use and the level of inherent vulnerability. Three levels of treatment need were estimated:

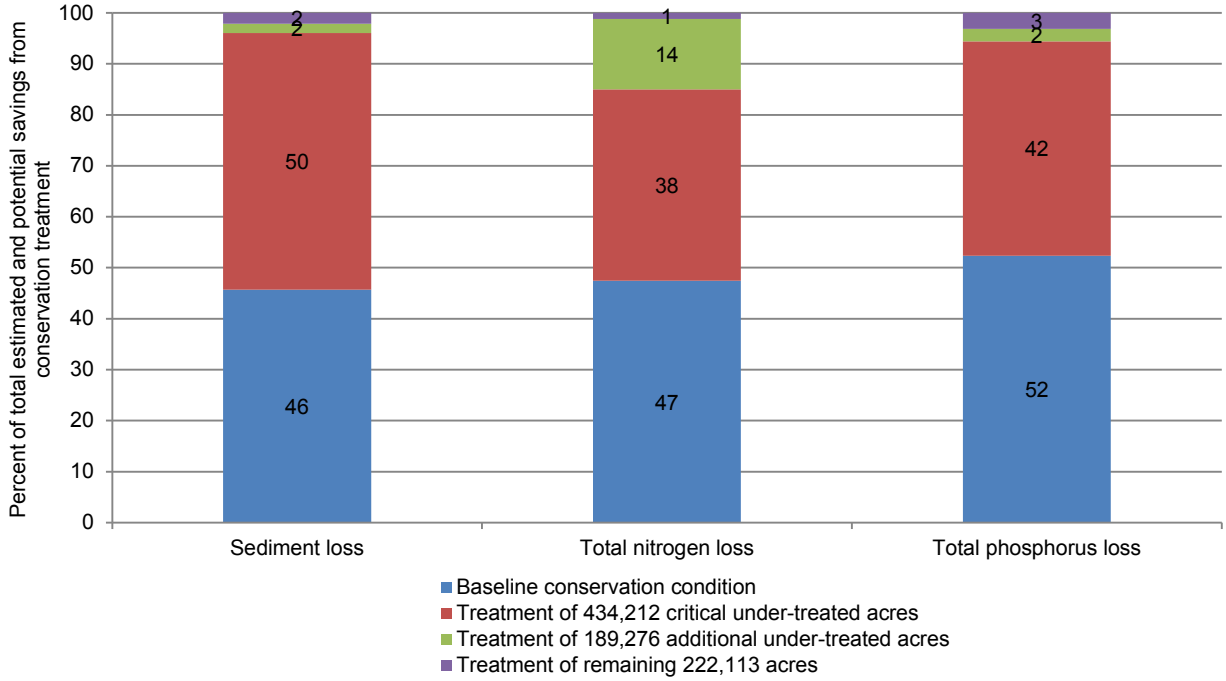
- **A high level of need** for conservation treatment exists where the loss of sediment and/or nutrients is greatest and where additional conservation treatment can provide the greatest reduction in agricultural pollutant loadings. *Some 434,000 acres—51 percent of the cropped acres in the region—have a high level of need for additional conservation treatment.*
- **A moderate level of need** for conservation treatment exists where the loss of sediment and/or nutrients is not as great and where additional conservation treatment has less potential for reducing agricultural pollutant loadings. *Approximately 189,000 acres—22 percent of the cropped acres in the region—have a moderate level of need for additional conservation treatment.*
- **A low level of need** for conservation treatment exists where the existing level of conservation treatment is adequate compared to the level of inherent vulnerability. *Approximately 222,000 acres—26 percent of the cropped acres in the region—have a low level of need for additional conservation treatment.*

Most cultivated cropland needs additional treatment to reduce sediment *and* nutrient losses. Of the 623,000 acres having a high or moderate level of need for additional treatment, significant further reductions in sediment and nutrient loss from baseline levels could be achieved through implementation of suites of conservation practices that include *both* erosion-control practices and nutrient management.

Comprehensive Conservation Planning is Needed, and Targeting Enhances Effectiveness and Efficiency

The edge-of-field reductions in sediment and nutrient loss shown in table 1 represent average annual declines in sediment and nutrient loss resulting from conservation practices in use during the period 2003 to 2006, when compared to the no-practice scenario. As a share of potential savings through full conservation treatment on all cropped acres, these reductions represent 46 percent of potential savings in sediment loss, 47 percent of potential savings in total nitrogen loss, and 52 percent of potential savings in total phosphorus loss (fig. 2). Use of additional erosion- and nutrient-control practices on the acres most prone to runoff or leaching and with low levels of conservation practice use could reduce most edge-of-field losses significantly, especially for sediment and phosphorus losses, also shown in figure 2. Treating the 26 percent of cropped acres that have a low level of need for additional conservation treatment would achieve little additional benefit.

Figure 2. Comparison of estimated edge-of-field savings for the region (total tons saved) due to practices in use in 2003-06 and *potential* savings with additional water erosion control and nutrient management treatment of cropped acres in the Delaware River Basin



Regional Comparisons

- The small number of CEAP sample points with data from the NRI-CEAP Cropland Study in the Delaware River Basin precluded (1) assessment of effects of cropland converted to long-term conserving cover, (2) estimates of the effects of conservation practices on reductions in sediment and nutrient loads to rivers and streams, and (3) estimates of reductions in instream loads. In this respect, the Delaware River Basin study differs from the other CEAP basin studies.

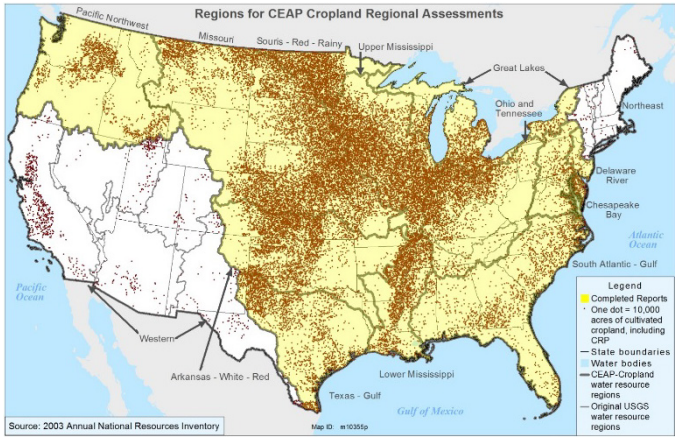
- The Delaware River Basin is by far the smallest of all the water resource regions covered in the CEAP cropland studies. It is about one-fourth the size of the next smallest basin, the Souris-Red-Rainy Basin.

- Cultivated cropland makes up only 13 percent of the area of the Delaware River Basin. This is similar to the extent of cropland in the adjacent Chesapeake Bay Region but considerably less than in most other regions. For example, cultivated cropland makes up more than half the area of the Upper Mississippi River Basin and at least 20 percent in the other basins in the Mississippi River drainage area.

- The percentage of high- and moderate-treatment-need cropland (73 percent) in the Delaware River Basin is high relative to most other regions in the CEAP Cropland study series.
- The percentage of cultivated cropland with some combination of structural practices for reducing soil erosion and reduced tillage practices is consistent with that in most other regions of the nation. Likewise, the percentage of cropland where good nutrient management practices are in use to reduce field-level losses of nitrogen and phosphorus is similar to that in other regions.

River Basin Cropland Modeling Study Reports The U.S. Department of Agriculture initiated the Conservation Effects Assessment Project (CEAP) in 2003 to determine the effects and effectiveness of soil and water conservation practices on agricultural lands. The CEAP report *Assessment of the Effects of Conservation Practices on Cultivated Cropland in the Delaware River Basin* is the eleventh in a series of studies covering the major river basins and water resource regions of the conterminous 48 United States. It was designed to quantify the effects of conservation practices commonly used on cultivated cropland in the Delaware Basin, evaluate the need for additional conservation treatment in the region, and estimate the potential gains that could be attained with additional conservation treatment. This series is a cooperative effort among USDA's Natural Resources Conservation Service, the National Agricultural Statistics Service (NASS), and the Agricultural Research Service, Texas AgriLife Research of Texas A&M University, and the University of Massachusetts Extension.

Upper Mississippi River Basin (draft released June 2010, revision completed July 2012)
Chesapeake Bay Region (March 2011)
Great Lakes Region (September 2011)
Ohio-Tennessee River Basin (February 2012)
Missouri River Basin (released August 2012)
Arkansas-White-Red River Basin (April 2013)
Lower Mississippi River Basin (August 2013)
Pacific Northwest Basin (June 2014)
South Atlantic-Gulf Basin (June 2014)
Souris-Red-Rainy Basin (August 2014)
Delaware River Basin (November 2014)
Texas Gulf Basin (forthcoming)



The Northeast and Western Water Resource Regions cannot be completed because there are too few National Resources Inventory sample points for reliable statistical estimation.