United States Department of Agriculture

Assessment of the Effects of Conservation Practices on Cultivated Cropland in the South Atlantic Gulf Basin - Summary of Findings

National Resources Conservation Service
Conservation Effects Assessment Project

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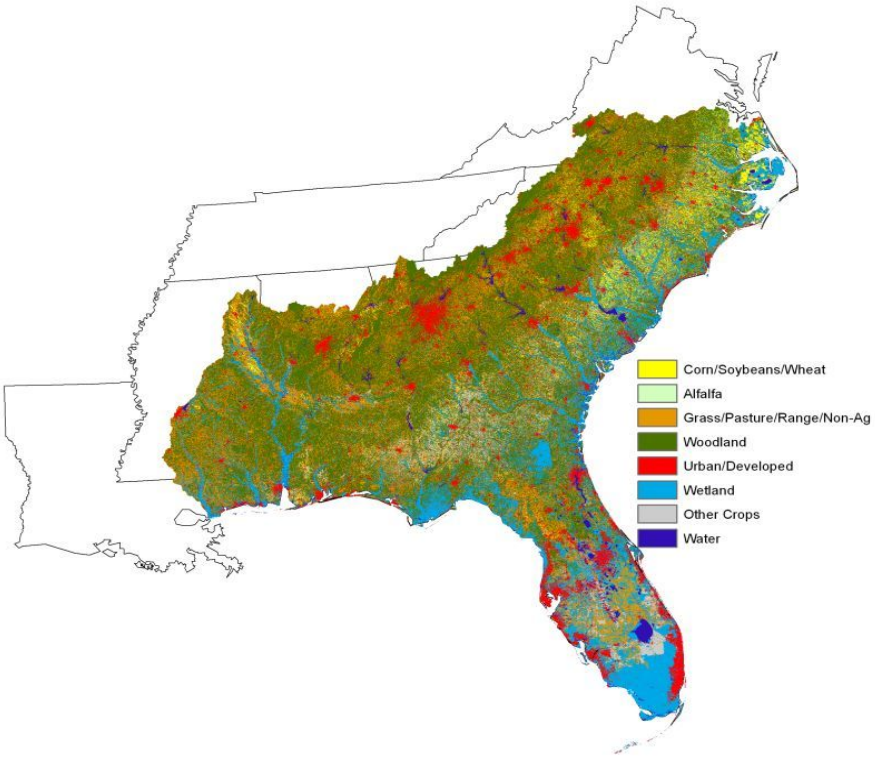
The U.S. Department of Agriculture's Conservation Effects Assessment Project (CEAP) has undertaken a series of studies designed to quantify the effects of conservation practices on cultivated cropland in the conterminous 48 States. The seventh study in this series is on the South Atlantic Gulf Basin.

The South Atlantic Gulf Basin is the drainage for the area that borders the Atlantic Ocean south of the Chesapeake Bay watershed and that borders the Gulf of Mexico east of the Mississippi River Basin. It covers about 277,000 square miles (177 million acres) and includes all of Florida and South Carolina; most of North Carolina, Georgia, and Alabama; large parts of Virginia and Mississippi; and small parts of Louisiana and Tennessee (fig. 1).

About 9 percent of the land area is cultivated cropland, including land enrolled in the General Signup of the Conservation Reserve Program. The main crops are soybeans, corn, cotton, and hay. In 2007, the region produced more than 78 percent of the U.S. peanut crop, 63 percent of the national tobacco crop, and 17 percent of the national cotton crop.

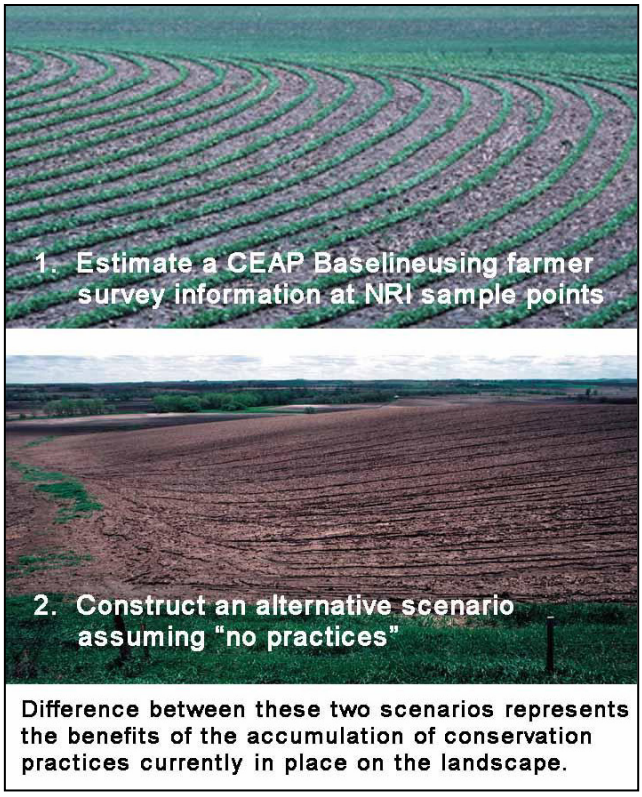
Figure 1. *Location of and land cover in the South Atlantic Gulf Basin*



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 968 of these sample points located in the South Atlantic Gulf Basin. This sample size is sufficient for reliable and defensible reporting at the regional scale and for large watersheds within the region, but is generally insufficient for assessments of smaller areas.

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 the baseline conservation condition, using 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 South Atlantic Gulf 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 36 percent of all cropped acres in the region, including 65 percent of highly erodible land. Forty-six percent of cropped acres meet criteria for mulch till, and 35 percent meet criteria for no-till. Ninety-three 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 16 percent of the cropped acres and good phosphorus management on 12 percent.

Conservation practice adoption on cropped acres—whether through Federal or State programs or through landowners' initiative—has reduced wind erosion by 24 percent and edge-of-field waterborne sediment losses by 56 percent, nitrogen loss with runoff by 34 percent, nitrogen loss through leaching by 15 percent, and total phosphorus loss by 36 percent (table 1).

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

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 soil 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 6.7 million 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 4.1 million acres—31 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 soil vulnerability. *Approximately 2.4 million acres—18 percent of the cropped acres in the region—have a low level of need for additional conservation treatment.*

Of the 10.8 million 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 soil erosion control and nutrient management. Table 1 also shows potential for further reductions (beyond 2003–06 baseline levels) in *edge-of-field* sediment, nitrogen, and phosphorus losses through comprehensive conservation treatment of high- and moderate-treatment-need cropland (table 1). *The most critical conservation concern in this region is the need for complete and consistent use of nutrient management—appropriate rate, form, timing,* and *method of application of nitrogen and phosphorus—to reduce excessive nitrogen leaching and phosphorus runoff.*

Table 1. Comparison of baseline (200306) reductions in edge-of-field sediment and nutrient loss from cropped acres, to potential for further reductions beyond baseline levels through comprehensive conservation treatment of high- and moderate-treatment-need cropland, South Atlantic Gulf Basin

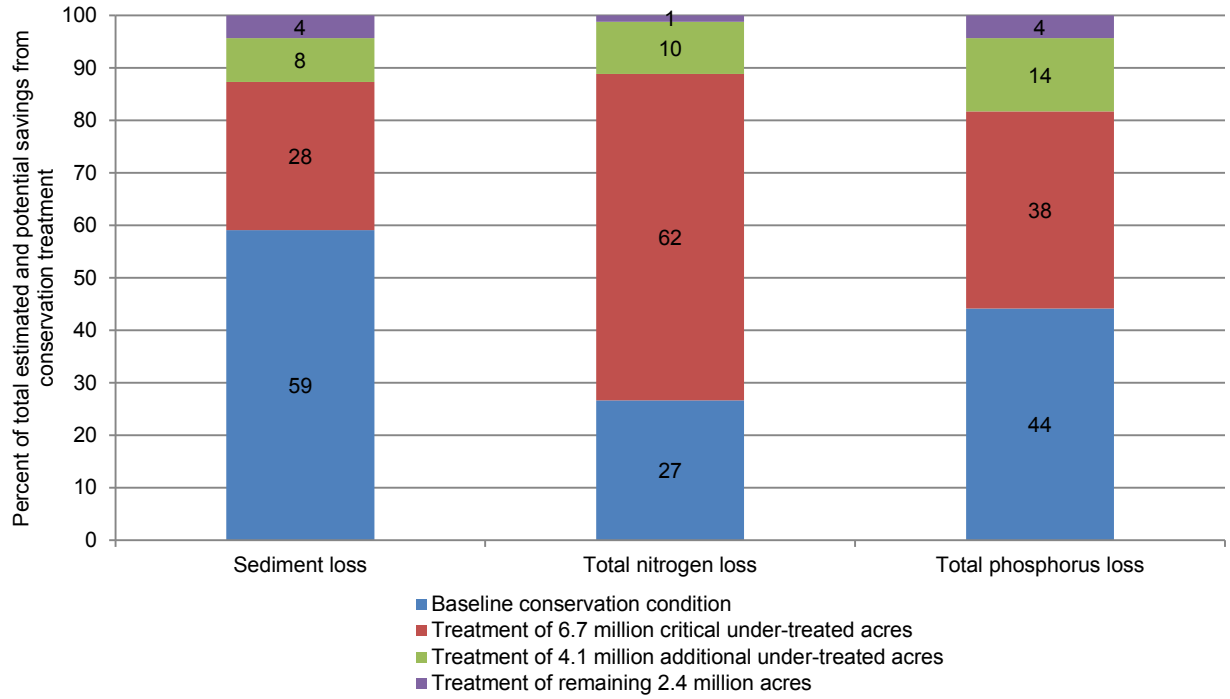
Reductions	Sediment		Nitrogen		Phosphorus*
	Windborne	Waterborne	With runoff	Through leaching	
	Percent reduction				
Baseline (2003-06)	24	56	34	15	36
Potential	10	77	51	47	67

*** Phosphorus lost to surface water 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.**

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 (total tons saved) through full conservation treatment on all cropped acres, these reductions represent about 59 percent of potential reductions in sediment loss, 27 percent of potential reductions in nitrogen loss, and 44 percent of potential reductions in phosphorus loss (figure 2). Significant additional per-acre reductions in sediment and nutrient losses could be achieved by focusing on the 10.8 million high- and moderate-treatment-need cropland acres. Use of additional erosion- and nutrient-control practices on acres that have a high need for additional treatment—acres most prone to runoff or leaching and with low levels of conservation practice use—can reduce most edge-of-field losses by about twice as much or more compared to treatment of acres with a moderate or low level of need. Treating the 18 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 200306 and *potential* savings with additional water erosion control and nutrient management treatment of cropped acres in the South Atlantic Gulf Basin**



Conservation Practice Effects on Water Quality

Cultivated cropland makes up only about 9 percent of the land base of the region but contributes 27 percent of the loadings of sediment, 30 percent of the nitrogen, and 30 percent of the phosphorus to rivers and streams in the region. Urban point and nonpoint sources also make up about 9 percent of the land base and account for equivalent contributions of sediment and nutrient delivered to rivers and streams, but account for a higher proportion of phosphorus loads.

Additional conservation treatment of the 10.8 million high- and moderate-treatment-need cropland acres would reduce annual sediment *delivery from cultivated cropland* to rivers and streams by 72 percent from baseline levels, nitrogen delivery by 38 percent, and phosphorus delivery by 62 percent (table 2). Because of the extent of loadings from other sources, this level of conservation treatment would reduce instream loads delivered to the Ocean and the Gulf *from all sources* by 6 percent for sediment, 12 percent for nitrogen, and 18 percent for phosphorus (table 3).

Table 2 shows the effect of conservation practices on loads delivered to rivers and streams from cultivated cropland (baseline reductions) to estimates of potential reductions in loadings through additional conservation treatment of (1) the 6.7 million high-treatment-need cropland acres and (2) all 10.8 million high- *and* moderate-treatment-need acres in the region. Table 3 shows the effect of those practices on total instream loads *from all sources* delivered from the South Atlantic Gulf Basin to the Atlantic Ocean and the Gulf of Mexico. (Loadings from the other 91 percent of the land area are assumed to remain unchanged in the model simulation of treatment scenarios.)

Table 2. Comparison of baseline (2003-06) reductions in sediment and nutrient loadings delivered to rivers and streams *from cultivated cropland*, to estimated reductions from additional conservation treatment of the 6.7 million acres of high-treatment-need cropland and from additional conservation treatment of the 10.8 million acres of high- *and* moderate-treatment-need cropland, South Atlantic Gulf Basin

Reduction	Sediment	Nitrogen	Phosphorus
	Percent reduction		
Baseline	**24**	**5**	**6**
High-treatment-need cropland only	**52**	**32**	**42**
High- *and* moderate-treatment-need cropland	**72**	**38**	**62**

Table 3. Comparison of baseline (2003-06) reductions in sediment and nutrient instream loadings *from all sources* delivered to the Atlantic Ocean and Gulf of Mexico, to estimated reductions from additional conservation treatment of the 6.7 million acres of high-treatment-need cropland and from additional conservation treatment of the 10.8 million acres of high- *and* moderate-treatment-need cropland, South Atlantic Gulf Basin

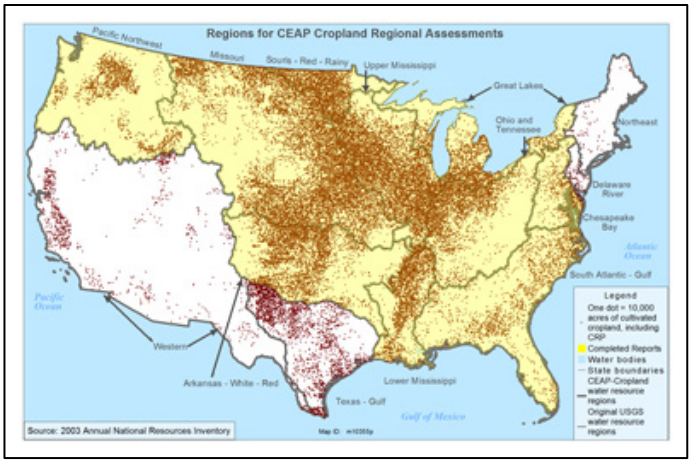
Reduction	Sediment	Nitrogen	Phosphorus
	Percent reduction		
Baseline	**2**	**1**	**2**
High-treatment-need cropland only	**4**	**10**	**13**
High- *and* moderate-treatment-need cropland	**6**	**12**	**18**

Regional Comparisons

- The South Atlantic Gulf Basin is larger than all other water resource regions of the United States except for the Missouri River Basin and is about the same size as the Pacific Northwest Basin.
- Cultivated cropland makes up only 9 percent of the land area of the South Atlantic Gulf Basin. This is similar to the extent of cropland in the Pacific Gulf Basin and the 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.
- No-till and structural practices to control soil erosion are in use on a slightly smaller percentage of cropped acres in the South Atlantic Gulf Basin than in most other regions. However, more than 90 percent of cultivated cropland acres have reduced tillage or structural practices in place, about the same as in most other regions.
- Estimated reductions in edge-of-field waterborne sediment and nutrient loss due to conservation practice use are lower in the South Atlantic Gulf Basin than in most other regions.
- More than 80 percent of cultivated cropland in the South Atlantic Gulf Basin has a high or moderate need for additional conservation treatment, a higher percentage than in most other regions. This percentage is similar to the percentage of high- and moderate-treatment need cropland in the adjacent Lower Mississippi River Basin.
- Like most of the water resource regions in the more humid East and South, the principal conservation concern in the South Atlantic Gulf Basin is the loss of nutrients—nitrogen in subsurface flows and phosphorus in runoff.

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 South Atlantic Gulf Basin* is one 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 Lower Mississippi River 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 and Agricultural Research Service, Texas AgriLife Research of Texas A&M University, and the University of Massachusetts.

Upper Mississippi River Basin (draft released June 2010, revision completed July 2012)
Chesapeake Bay Region (released March 2011)
Great Lakes Region (released September 2011)
Ohio-Tennessee River Basin (released 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)
Texas Gulf Basin
Souris-Red-Rainy Basin
Delaware River Basin



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