

Impacts of Conservation Adoption on Cultivated Acres of Cropland in the Chesapeake Bay Region, 2003-06 to 2011

Executive Summary

Background on This Report

Historic levels of conservation implementation are achieving unprecedented results in the Chesapeake Bay region. Farmers, ranchers, and forestland owners voluntarily install or adopt conservation practices on their lands as part of comprehensive conservation planning, in partnership with USDA's Natural Resources Conservation Service (NRCS), soil and water conservation districts, state agencies, and private organizations. These voluntary and collaborative investments help support agricultural producers and rural economies, protect wildlife habitat, and improve water quality in the Chesapeake Bay region.

The Conservation Effects Assessment Project (CEAP) is a multi-agency USDA effort to quantify the environmental effects of the conservation practices adopted by producers. CEAP cropland reports integrate farmer surveys (conducted by NASS), natural resource information (land use and soils), and modeling to estimate the impact of conservation practices on nutrient and sediment loadings. The lead CEAP partners are USDA's Natural Resources Conservation Service (NRCS) and Agricultural Research Service (ARS) and Texas A&M AgriLife Extension Services.

NRCS released the first Chesapeake Bay region CEAP cropland assessment in March 2011, which relied on data gathered through farmer surveys conducted from 2003 to 2006. The first report demonstrated that conservation practices and systems were delivering benefits for the Bay watershed. The surveys informing for the first CEAP report were conducted too early to capture the growth in use of cover crops in the Bay watershed, and also did not capture the impact of accelerated conservation implementation made possible through the increased funding provided by State and Local partners, and by the Chesapeake Bay Watershed Initiative (CBWI), authorized in the 2008 Farm Bill.

There was considerable interest among Chesapeake Bay stakeholders in updating the 2011 report with new farmer surveys to evaluate the progress made by Bay farmers since 2006. NRCS conducted a new set of farmer surveys in late 2011, and also updated the CEAP models and improved soils and weather data. This is the first time NRCS has updated a CEAP cropland report for a particular region, allowing for comparison in conservation effects between two points in time. The results indicate that conservation planning and practice implementation being adopted by Chesapeake Bay farmers are producing substantial water quality benefits by reducing sediment and nutrient delivery to the Chesapeake Bay. Because NRCS conservation efforts complement those of private landowners, non-governmental organizations, other Federal, State, and local agencies working toward natural resources conservation and reduction of nutrient and sediment losses into the Chesapeake Bay, this report considers impacts of all conservation practices, regardless of NRCS involvement.

Cultivated Cropland Acres in the Chesapeake Bay Region Receiving Conservation Treatment Under USDA Programs. Data are broken out by program or initiative. Totals are not summed by year because the same acreage may be counted under multiple programs or initiatives and acres treated over multiple years were counted in each year of treatment. Treatment costs vary by acre and treatment applied.

Acres Receiving Federal Assistance	2003-06	2007	2008	2009	2010	2011
Chesapeake Bay Watershed Initiative	-	-	-	4,349	89,321	111,350
Conservation Reserve Program	36,337	20,083	11,481	5,939	5,050	4,057
Financial Assistance Programs	131,122	130,504	125,995	133,748	95,486	66,648
Conservation Technical Assistance	250,760	278,538	302,096	294,370	305,454	292,813

This report demonstrates substantial conservation practice adoption and improvement of conservation benefits between the 2003-06 and 2011 sampling periods. However, this report does not capture the full impact of the conservation partnership's focused conservation efforts in the Chesapeake Bay region since 2008, or the full impacts of the 2008 Farm Bill's financial contributions to the region. Since 2011, when the farmer survey informing this report was conducted, various Federal, State, and local agencies and entities in the District of Columbia and the six states in the Chesapeake Bay region have continued to work with farmers to accelerate conservation practice adoption. State and Federal programs have expanded incentives for cover crop adoption, manure incorporation, use of variable rate applications, side-dressing of nutrients, and other production techniques targeted at reducing losses of sediment and nutrients from farm fields. Based on the analyses in this report, we anticipate that the focused funding efforts will continue to accelerate conservation gains in the region.

Overview of Data Collection and Modeling

In March 2011, the NRCS released the "Assessment of the Effects of Conservation Practices on Cultivated Cropland in the Chesapeake Bay Region", the benchmark USDA NRCS CEAP report on the Chesapeake Bay region (USDA NRCS 2011). This report relied on data collected between 2003-06 and provides an historical point of reference by which to measure progress in conservation

adoption and conservation practice efficacy in the region. Due to stakeholder interest and an increased focus on farmer conservation adoption since the last survey was completed in 2006, NRCS prioritized a second assessment of the state of conservation practice adoption and achievements on cropped acres in the Chesapeake Bay region. Farmer surveys for this assessment were conducted in the fall of 2011.

The benchmark survey (2003-06), in combination with the resurvey in 2011, enables this report's statistically based identification and quantification of emergent trends in agricultural conservation impacts in the Chesapeake Bay region between 2003-06 and 2011. This is the first CEAP report in which a watershed is revisited for a second round of analyses. This study reports on changes in conservation adoption, estimates the impact of these changes on reduction of both edge-of-field losses and instream sediment and nutrient loads delivered to the Chesapeake Bay, and evaluates the need for additional conservation treatment on cropland in the region. The analyses reflect the environmental impact of management of the region's cropped acres, which makes up 10 percent of the Chesapeake Bay region (4.35 million acres). Changes in and impacts of agricultural conservation practices were isolated from other land use changes and impacts by holding other land uses (hay, pasture, urban point and non-point, forests, etc.) and their management constant at 2003-06 conservation levels for analyses of both the 2003-06 and 2011 data. Therefore, all changes in nutrient and sediment dynamics observed in the simulations comparing the 2003-06 baseline condition with the 2011 conservation condition are solely attributable to changes in agricultural practices. It is not the intent of this report to estimate progress toward the overall regional goals related to conservation practice changes on land uses other than cultivated cropland.

Simulation models were used to estimate the effects of conservation practices. During the interim between the publication of the original report in 2011 and this report, there have been numerous improvements and updates performed on the Agricultural Policy/Environmental eXtender (APEX) and Soil Water Assessment Tool (SWAT) simulation models, improvements in soils input data, increased weather data availability, and refinement of analytical techniques for evaluating the model results. The 2003-06 data was reanalyzed using the same model version and data interpretation used to analyze the 2011 data in order to allow the 2003-06 data to inform a baseline condition by which to assess changes between the two survey periods. The more robust approach used in this analysis produced results that differ from the results reported in the original USDA NRCS CEAP report for the Chesapeake Bay region (USDA NRCS 2011). Therefore, readers of both reports will notice differences in certain results, procedures, and interpretations.

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 NRCS, provides the statistical framework for the analyses. The same framework was used for both sets of data collections, although the data collection informing the 2003-06 conservation practice use assessment was part of a national survey and the data collection informing 2011 practice trends was collected in a regional survey. This statistical framework allows for comparison between the original survey and all resurveys, all of which represent the region and are not subject to bias due to land-use conversion at any sample point (i.e., conversion of cropland to urbanland).

Information on farming activities and conservation practices was obtained primarily from a farmer survey designed for CEAP by the USDA National Agricultural Statistics Service (NASS). Additional practice information was obtained from USDA Farm Services Agency, the USDA NRCS NRI, and USDA NRCS field office records. This assessment is not directly reflective of Federal conservation program benefits, as it includes impacts of the conservation efforts of local, State, and regional governmental agencies and independent organizations, as well as those of individual landowners and farm operators.

Farmer Survey Summary

A 2011 farmer survey obtained information on the extent of conservation practice used in the Chesapeake Bay region for the period 2009 to 2011. The most extensive change observed since the 2003-06 survey was the increased adoption of structural practices, conservation tillage, and cover crops. Nutrient management changes are best characterized as largely being maintained at 2003-06 conservation levels, with progress in some aspects countered by declines in others. While most acres have evidence of some nitrogen or phosphorus management, there is opportunity to enhance existing nutrient management practices on most acres, especially on those receiving manure. Consistent application of the 4Rs (*right* rate, *right* timing, *right* method, and *right* form) of nutrient application management across all crops in a rotation is still a priority need. Skilled management is required to shift conservation planning to match current production goals with soil types and effective nutrient application strategies. Maintaining production goals while adopting new nutrient management strategies increases management complexity and risk to the farmer. The 2003-06 survey data provides the baseline against which conservation gains could be measured; the following is an overview of key trends:

Changes in adoption of conservation tillage, structural practices, residue management, and cover crops on cultivated cropland in the Chesapeake Bay region, 2003-06 to 2011:

- Structural practices for controlling water erosion: *14 percentage point increase*, from 52 to 66 percent of cropped acres;
- Practices designed to trap sediment and nutrients at the edge-of-field: *17 percentage point increase*, from 14 percent to 31 percent of cropped acres;
- Some form of conservation tillage without any conventional tillage: *23 percentage point increase*, from 56 to 79 percent of cropped acres;
- Continuous No-till on all crops in a rotation: *16 percentage point increase*, from 38 to 54 percent of cropped acres; and

- Cover crops use at some point in rotation: *40 percentage point increase*, from 12 to 52 percent of cropped acres.

Changes in nitrogen management, including commercial fertilizer and manure applications on cultivated cropland in the Chesapeake Bay region, 2003-06 to 2011:

- Annual nitrogen application: *10 percent increase*, from 95.0 to 104.5 pounds per acre per year, including a *9 percent increase* in commercial fertilizer application (6.7 pound per acre per year increase) and a *13 percent increase* in manure nitrogen application (2.8 pound per acre per year increase).

On cropped acres receiving commercial nitrogen and/or manure based nitrogen in 2003-06 and 2011:

- Appropriate nitrogen application **rate** on **all crops** in rotation, including manure applications: *9 percentage point decline*, from 32 to 23 percent of cropped acres; appropriate nitrogen application **timing** on **all crops** in rotation, including manure applications: *14 percentage point decline*, from 50 to 36 percent of cropped acres; and appropriate nitrogen application **method** on **all crops** in rotation, including manure applications: *7 percentage point decline*, from 34 to 27 percent of cropped acres.
- Appropriate nitrogen application **rate** on **none of the crops** in rotation, including manure applications: *7 percentage point decline*, from 13 to 6 percent of cropped acres; appropriate **timing** on **none of the crops** in rotation, including manure applications: *maintained 2003-06 conservation level*, 11 percent of cropped acres for both 2003-06 and 2011; and appropriate nitrogen application **method** on **none of the crops** in rotation, including manure applications: *maintained 2003-06 conservation level*, 21 and 18 percent of cropped acres in 2003-06 and 2011, respectively.
- Appropriate **rate, timing, and method** of nitrogen application, including manure applications:
 - on **some, but not all crops** in rotation: *6 percentage point increase*, from 87 to 93 percent of cropped acres;
 - on **all crops** in the rotation: *6 percentage point decline*, from 13 to 7 percent of cropped acres.

Changes in phosphorus management, including commercial fertilizer and manure applications on cultivated cropland in the Chesapeake Bay region, 2003-06 to 2011:

- Annual phosphorus application: *6 percent increase*, from 23.8 to 25.2 pounds per acre per year, including a *5 percent increase* in commercial fertilizer application (1.0 pound per acre per year increase) and an *11 percent increase* in manure nitrogen application (0.4 pound per acre per year increase).

On cropped acres receiving commercial phosphorus and or manure based nitrogen between 2003-06 and 2011:

- Appropriate phosphorus application **rate** on **all crops** in rotation, including manure applications: *maintained 2003-06 conservation level*, 54 and 57 percent of cropped acres in 2003-06 and 2011, respectively; appropriate phosphorus application **timing** on **all crops** in rotation, including manure applications: *11 percentage point decline*, from 53 to 42 percent of cropped acres; and appropriate phosphorus application **method** on **all crops** in rotation, including manure applications: *maintained 2003-06 conservation level*, 42 and 37 percent of cropped acres in 2003-06 and 2011, respectively;
- Appropriate phosphorus application **timing** on **none of the crops** in rotation, including manure applications: *6 percentage point increase*, from 13 to 19 percent of cropped acres; appropriate phosphorus application **method** on **none of the crops** in rotation, including manure applications: *maintained 2003-06 conservation level*, 30 and 32 percent of cropped acres in 2003-06 and 2011, respectively; and
- Appropriate **rate, timing, and method** of phosphorus application, including manure applications:
 - on **some, but not all** crops in rotation: *maintained 2003-06 conservation levels*, 78 and 79 percent of cropped acres in 2003-06 and 2011, respectively; and
 - on **all** applications in the crop rotation: *maintained 2003-06 conservation levels*, 22 and 21 percent of cropped acres in 2003-06 and 2011, respectively.

Changes in manure management (with or without supplemental commercial nutrient inputs) on cultivated cropland in the Chesapeake Bay region, 2003-06 and 2011:

- Manure application rate: *25 percent increase*, from 12.6 to 16.8 tons per acre per year;
- Manure application at some point in the crop rotation: *10 percentage point increase*, from 38 to 48 percent of cropped acres;
- Manured acres applied with off-farm-sourced manure: *17 percentage point increase*, from 17 to 34 percent of manured cropped acres;
- Manured acres applied with purchased manure: *6 percentage point increase*, from 4 to 10 percent of manured cropped acres; and
- Management of manure as a nitrogen source on manured acres:
 - Appropriate application **rates** for **all crops** in rotation: *8 percentage point decline*, from 17 to 9 percent of manured cropped acres; appropriate application **timing** for **all crops** in rotation: *6 percentage point decline*, from 18 to 12 percent

of manured cropped acres; and appropriate application **method** on **all crops**: *6 percentage point decline*, from 22 to 16 percent of manured cropped acres;

- Appropriate application **rates** for **none of the crops** in rotation: *15 percentage point decline*, from 24 to 9 percent of manured cropped acres; appropriate application **timing** for **none of the crops** in rotation: *6 percentage point decline*, from 16 to 10 percent of manured cropped acres; and appropriate application **method** for **none of the crops** in rotation: *maintained 2003-06 conservation levels*, 16 and 17 percent of manured cropped acres in 2003-06 and 2011, respectively;
- Management of manure as a phosphorus source on manured acres:
 - Appropriate application **timing** for **none of the crops** in rotation: *12 percentage point increase*, from 16 to 28 percent of manured cropped acres; appropriate application **method** for **none of the crops** in rotation: *14 percentage point increase*, from 30 and 44 percent of manured cropped acres; and
 - Appropriate application **timing** for **all crops** in rotation: *maintained 2003-06 conservation level*, 16 and 13 percent of manured cropped acres in 2003-06 and 2011, respectively; appropriate application **method** on **all crops** in rotation: *7 percentage point decline*, from 28 to 21 percent of manured cropped acres.

Conservation Accomplishments

Compared to edge-of-field conservation accomplishments in the 2003-06 baseline condition, model scenarios suggest that practices adopted in the 2011 conservation condition have further reduced agricultural impacts in the Chesapeake Bay region. Specifically, compared to the 2003-06 baseline condition, the 2011 conservation condition has reduced:

- sediment loss from fields: *63 percent reduction*, from 5.1 to 1.9 tons per acre per year;
- acres with sheet and rill erosion greater than soil loss tolerance (T): *17 percentage point reduction*, from 28 to 11 percent of acres;
- nitrogen loss with surface runoff, including nitrogen attached to sediment and nitrogen in solution: *38 percent reduction*, from 15.7 to 9.7 pounds per acre per year;
- nitrogen loss in subsurface flows by leaching: *12 percent reduction*, from 25.9 to 22.9 pounds per acre per year;
- total phosphorus loss from fields: *44 percent reduction*, from 3.4 to 1.9 pounds per acre per year;
- acres losing soil organic carbon: *20 percentage point reduction*, from 66 to 46 percent of cropped acres; and
- soil carbon loss from fields: *50 percent reduction*, from 189 to 95 pounds per acre per year.

The comprehensive Avoid, Control, Trap (ACT) conservation system approach requires that all three aspects of the system be accommodated with appropriate and complementary conservation practice adoption. Nutrient applications and tillage management are necessary for crop production and even when appropriately applied will have losses of sediment and nutrients. Therefore losses that cannot be avoided with these management approaches should be controlled within the field with practices such as terraces, grassed waterways, or contouring. Some practices may serve the ACT strategy in multiple ways. For example, conservation tillage can both serve to avoid losses and control losses. Practices designed to trap sediment and nutrients at the edge-of-field (e.g., filter strips and buffers) are necessary for a complete approach to reducing the impacts of cultivated cropland on water quality. In the Chesapeake Bay region, achievements in nutrient management have largely come from the control and trap components of the ACT system. Future conservation practice success requires a renewed emphasis on the avoidance aspect of the system. Specifically, significant improvements can be realized with more focus on implementing the 4Rs of nutrient application. Key among these is timing, with a need to shift more nutrient applications to the time after crop has been planted, which matches nutrient application and availability temporally with nutrient demand.

The simulated change in nitrogen dynamics between the 2003-06 baseline condition and the 2011 conservation condition demonstrate the potential pitfalls of focusing on only one or two parts of the ACT strategy. Water erosion control practices were very effective at controlling and trapping sediment and nutrients on farm fields. The widespread adoption of structural erosion control practices, residue management practices, and reduced tillage slowed the flow of surface water runoff, allowing more sediment and nutrients to remain into the field, as well as allowing more water to infiltrate into the soil. This re-routing of surface water to subsurface flows redirects the soluble nitrogen into subsurface flows and may potentially extract additional nitrogen from the soil as the water filters through the soil profile. Although the 2011 conservation condition reduced nitrogen losses via subsurface flow by 12 percent on cropped acres as compared to the 2003-06 baseline condition, high losses of nitrogen in subsurface flows remain a challenge in the region.

Gains Related to Cover Crop and Winter Cover Use

In the context of this report, cover crops are considered a unique subset of winter cover. Cover crops are planted for agroecological purposes, including soil and nutrient conservation and soil health benefits. Cover crops are grown when principal crops are not growing (this typically includes, but is not limited to, winter months). Cover crops are not planted with the intent to harvest and are generally terminated by tillage or herbicide application prior to maturity. Winter cover includes crops (mostly small grains planted for spring harvest) that may be grazed and or harvested for grain, hay, or both.

In 2003-06, only 5 percent of cropped acres in the Chesapeake Bay region had cover crops planted every year and 88 percent of acres never had any cover crops planted. In 2011, 52 percent of acres had cover crops planted at least once every 4 years and 18 percent of

acres had cover crops planted every year. It was estimated that relative to the 2003-06 baseline condition, the increased annual use of cover crops in the 2011 conservation condition enhanced reduction in sediment loss by an average of 78 percent, surface loss of nitrogen by 35 percent, subsurface nitrogen loss by 40 percent, and total phosphorus loss by 30 percent. In the 2011 conservation condition, the average annual rate of carbon change due to annual application of cover crops improved by an average 148 percent as compared to carbon dynamics in the 2003-06 baseline condition. State incentive programs have been pivotal in the continued increases in cover crop adoption. For example, in 2011 Maryland farmers, supported through the state's Cover Crop Program, voluntarily planted nearly 430,000 acres to cover crops.

Winter cover adoption, other than cover crops, increased as well. In 2003-06 only 3 percent of cropped acres in the region were planted with winter cover annually, but by 2011 annual winter cover was grown on 17 percent of cropped acres. In 2003-06 winter cover was a part of crop rotations at least 1 out of every 4 years on only 47 percent of acres and by 2011, 65 percent of cropped acres in the region had the soil covered during at least one winter in a 4-year crop rotation. The increased use of winter annuals in the crop rotation may be attributed to market forces and the flexibility in cover crop programs, such as those which allow farmers to opt to manage their intended cover crop for grain harvest in return for a reduced or no cost share on the cover crop.

For 2011, a comparison between acres with no winter cover and those adopting some form of cover during the winter months for at least part of the crop rotation, show that winter cover adoption, solely or along with other conservation activities (table 2.4):

- reduced sediment losses by 37 percent;
- reduced surface losses of nitrogen by 28 percent;
- reduced subsurface losses of nitrogen by 18 percent;
- reduced total phosphorus losses by 29 percent; and
- reduced carbon losses by 46 percent.

Reductions in Conservation Treatment Needs

The conservation practices reported in the 2011 survey of the Chesapeake Bay region were compared to the conservation practice conditions reported in the 2003-06 survey to evaluate remaining conservation treatment needs. ***Acres with high potential benefits to water quality*** ("high conservation needs acres") are the most vulnerable of the acres, have the least conservation treatment, and have the highest losses of sediment and/or nutrients. ***Acres with moderate potential benefits to water quality*** ("moderate conservation needs acres") generally have lower levels of inherent vulnerability or have more existing conservation practices in use than do high conservation needs acres. For the purposes of this report, acres with ***currently low potential benefits to water quality*** ("low conservation needs acres") are considered to be sufficiently treated; combinations of conservation practices on these acres address all the inherent vulnerability factors that determine the potential for sediment and nutrient losses.

Simulations and analyses show conservation treatment needs for the Chesapeake Bay region were reduced between the 2003-06 baseline condition and the 2011 conservation condition, but opportunities for improvement remain on nearly half of the acres in the region:

- Cropped acres with ***high*** needs for additional conservation treatment for one or more resource concern: *15 percentage point decline*, from 19 to 4 percent of cropped acres;
- Cropped acres with ***moderate*** needs for additional conservation treatment for one or more resource concern: *maintained 2003-06 conservation levels*, at 40 and 42 percent of cropped acres in 2003-06 and 2011, respectively; and
- Cropped acres with adequate conservation treatment, or ***low*** needs for additional conservation treatment for one or more resources concern: *13 percentage point increase*, from 41 to 54 percent of acres.¹

Significant progress was made on adoption of complementary structural and vegetative practices, such as cover crops, edge-of-field filters, and buffers, all of which reduce sediment and nutrient losses associated with runoff. Under the 2011 conservation condition, only 15 percent of cropped acres were in need of additional treatments to prevent sediment loss and only 11 percent of acres required treatment for sheet and rill erosion to prevent exceedance of the soil loss tolerance (T). In the 2003-06 baseline condition, 42 percent of acres had additional need for erosion control treatment and 28 percent were in need of further treatment to prevent exceedance of T. In the 2011 conservation condition, only 3 percent of cropped acres had a high need for additional soil erosion control and 12 percent had a moderate need. Adoption of the complementary structural and vegetation practices also contributed to a shift in carbon trends on cropped acres in the Chesapeake Bay region, which were, on average, losing carbon in the 2003-06 baseline condition, but were, on average, maintaining carbon in the 2011 conservation condition. Conservation gains made largely via adoption of practices such as cover crops, conservation tillage, and high residue crop rotations require careful planning and persistence in order to maintain the levels of erosion reduction, sediment loss reduction, and carbon gain realized in 2011 conservation condition.

The greatest conservation need in the region in 2003-06 remained the greatest opportunity for increased conservation gains in 2011: adoption of consistent nutrient application management adhering to the 4R's: right rate, timing, method, and form of application. In some cases, only minor adjustments to an existing nutrient management plan are needed to bring the management up to current standards (590 practice code for Nutrient Management), while other acres require more extensive adjustments.

¹ Rounding causes apparent mathematical discrepancies.

As of 2011, most cropped acres had some nutrient application management practices in use, but 46 percent of cropped acres in the region would benefit from additional treatment to better prevent sediment, nitrogen, or phosphorus loss from fields. Although all acres with high needs for subsurface flow losses were treated in the 2011 conservation condition, 36 percent of cropped acres still needed conservation treatments to address nitrogen loss in subsurface flow pathways, most of which returns to surface water through drainage ditches, tile drains, natural seeps, and groundwater return flow. Adoption of erosion control prevention practices reduced acreage needing treatment for surface nitrogen losses from 35 to 14 percent of cropped acres between the 2003-06 baseline condition and 2011 conservation condition, respectively.

Effects of Conservation Treatment on Water Quality in the Chesapeake Bay

Reductions in edge-of-field losses translate into potential improvements in water quality in streams and rivers in the region. Transport of sediment and nutrients from farm fields to streams and rivers and ultimately into the Bay involves a variety of processes and time-lags. Nutrient and sediment dynamics at the edge-of-field do not directly or immediately relate to instream loads measured in rivers, streams, and the Bay, all of which may be impacted by storm events, tidal surges, and the legacy of past land use and management.

2011 Agricultural Achievements in Conservation

Relative to conditions simulated in the “no practice scenario”, in which no conservation practices were applied to cultivated cropland, the 2011 conservation condition reduced total loads *delivered from the edge-of-field to rivers and streams* by:

- 82 percent for sediment;
- 44 percent for nitrogen; and
- 75 percent for phosphorus.

As compared to the 2003-06 baseline condition, the 2011 conservation condition reduced delivery by:

- 60 percent for sediment;
- 20 percent for nitrogen; and
- 41 percent for phosphorus.

Sediment and nutrients being delivered to the Chesapeake Bay come from a variety of sources, including cultivated cropland, hayland, forestland, and urbanlands. This is not an assessment of overall progress in conservation on all acreage in the Chesapeake Bay. Rather, this report holds the sediment and nutrient contributions of all other land uses at their 2003-06 levels for all analyses, enabling an unencumbered comparison of gains made due to changes on cultivated cropland between the 2003-06 and 2011 surveys. Relative to the no practice scenario, the 2011 conservation condition reduced total loads *delivered to the Bay* (all sources – instream loads) by:

- 22 percent for sediment;
- 17 percent for nitrogen; and
- 21 percent for phosphorus.

As compared to the 2003-06 baseline condition, the 2011 conservation condition reduced delivery by:

- 8 percent for sediment;
- 6 percent for nitrogen; and
- 5 percent for phosphorus.

Targeting. Not all acres suffer the same losses and not all acres provide the same benefit from conservation treatment. Some acres are inherently more vulnerable, such as those that are highly erodible or have leaching-prone soils. These more vulnerable acres tend to lose more sediment and/or nutrients than do less vulnerable acres. Therefore greater per-acre benefits can be attained with focused comprehensive conservation treatment on these most vulnerable acres. One strategy of conservation treatment is to target the soils with the highest inherent erosion and leaching risks for enhanced treatment with a comprehensive conservation treatment plan. In the case of the Chesapeake Bay, the region as a whole has been targeted with an intensification of conservation practices and conservation programming, including the Chesapeake Bay Watershed Initiative. Analyses included in this report demonstrate that this regional targeting approach is working. However, while substantial progress has been achieved, there are still undertreated acres on which improved conservation practice adoption could make significant impacts on sediment and nutrient losses.