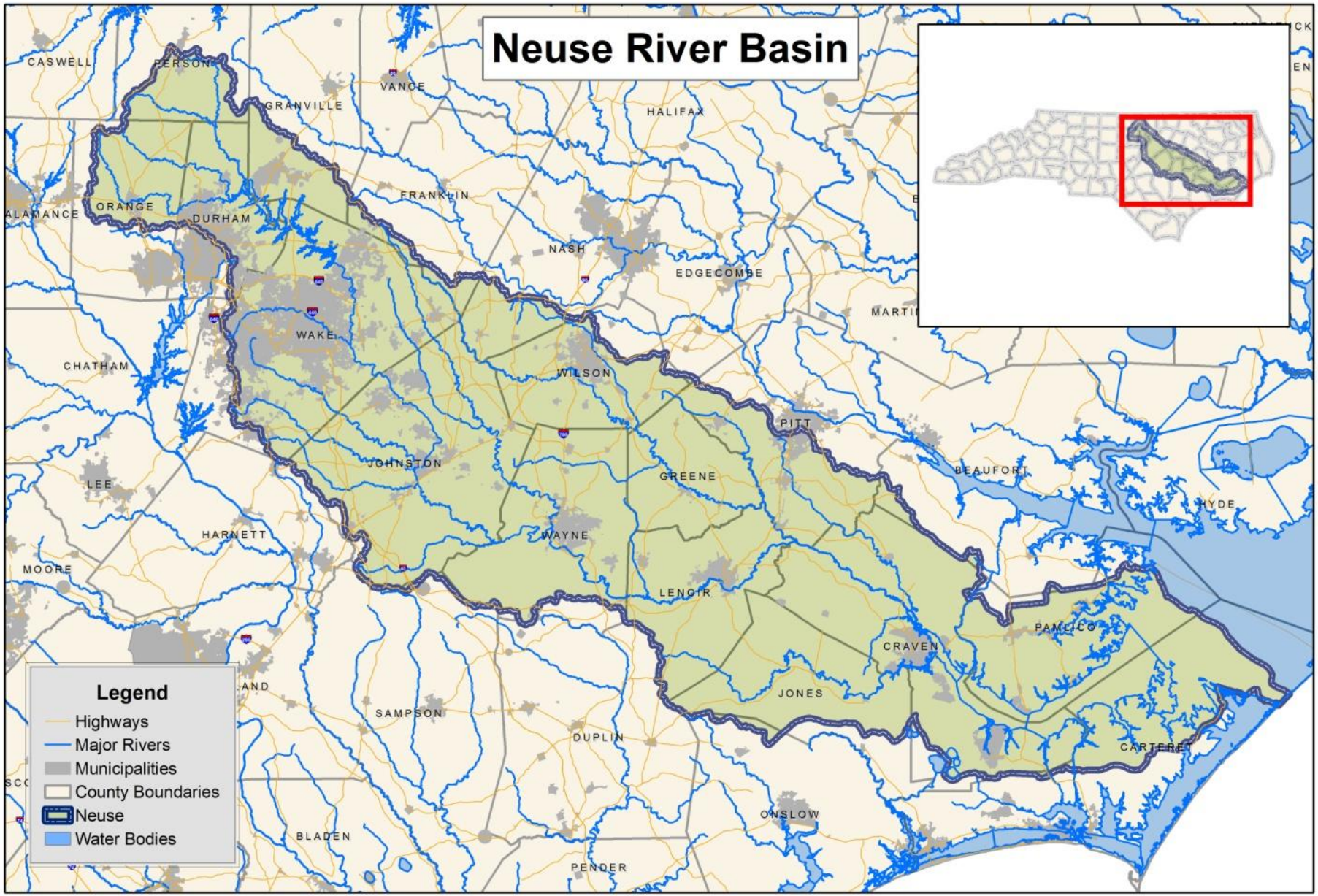
NCDA&CS

2014 Annual Progress Report (Crop Year 2013) on the Neuse Agricultural Rule (15 A NCAC 2B.0238)

A Report to the Environmental Management Commission from the Neuse Basin Oversight Committee: Crop Year 2013



Neuse Basin Oversight Committee

September 19, 2014

Summary

The Neuse Basin Oversight Committee (BOC) received and approved crop year (CY) 2013 annual reports estimating the progress from the seventeen Local Advisory Committees (LACs) operating under the Neuse Agriculture rule as part of the Neuse Basin Nutrient Management Strategy. This report demonstrates agriculture's ongoing collective compliance with the Neuse Agriculture Rule and estimates further producer progress in decreasing nutrients. In CY2013, agriculture collectively achieved an estimated 38% reduction in nitrogen loss from agricultural lands compared to the 1991-1995 baseline, continuing to exceed the rule-mandated 30% reduction. This represents a 7% decrease in reduction compared to the 45% reduction reported for CY2012. Fourteen of the seventeen LACs achieved their BOC mandated nitrogen loss reduction goal. Jones County achieved a 22% reduction and Pamlico County achieved a 26% reduction. Lenoir County increased nitrogen loss by 3% from the 1991-1995 baseline. The main reason for the decrease in percent nitrogen reduction in these counties is cropping shifts to crops with higher nitrogen demands and increased nitrogen application rates.

Rule Requirements and Compliance History

Effective December 1997, the rule provides for a collective strategy for farmers to meet the 30% nitrogen loss reductions within five years. A BOC and seventeen LACs were established to implement the Neuse Agriculture rule and to assist farmers with complying with the rule. In 2013 there were 3.25 full time soil and water conservation district employees that worked with Neuse LACs to assist with implementation of best management practices (BMPs) and to coordinate information for the annual reports. They were funded by the EPA 319 grant program, NC Agriculture Cost Share Program (NCACSP) technical assistance funds and county funds.

All seventeen Local Advisory Committees (LACs) met as required in 2013. The LACs submitted their first annual report to the BOC in May 2002. That report estimated a collective 38% reduction in nitrogen loss with 12 of the 17 LACs exceeding 30% individually. In 2003, all LACs achieved their BOC mandated reduction goal. All have continued to meet their goal annually with the exception of Lenoir, Jones, and Pamlico Counties. LACs use the Nitrogen Loss Estimation Worksheet (NLEW) to calculate their reductions. Adjustments are made to reflect the most up-to-date scientific research. These revisions lead to adjustments in both individual LAC and basinwide nitrogen loss reduction rates.

Neuse NSW Strategy

The Environmental Management Commission (EMC) adopted the Neuse nutrient strategy in December, 1997. The NSW strategy goal was to reduce the average annual load of nitrogen delivered to the Neuse River Estuary by 2003 from both point and non-point source pollution by a minimum of 30% of the average annual load from the baseline period (1991-1995). Mandatory nutrient controls were applied to addressing non-point source pollution in agriculture, urban stormwater, nutrient management, and riparian buffer protection.

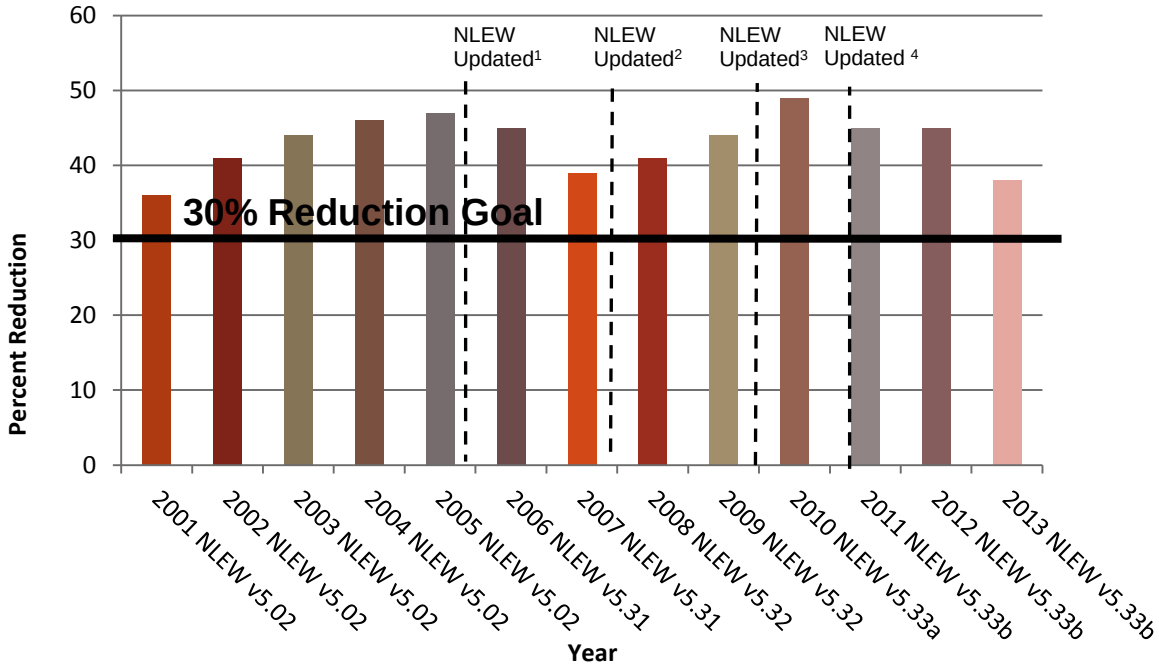
Scope of Report and Methodology

The estimates provided in this report represent whole-county scale calculations of nitrogen loss from cropland agriculture adjusted for acreage in the basin. These estimates were made by soil and water conservation district technicians using the 'aggregate' version of the Nitrogen Loss Estimation Worksheet, or NLEW, an accounting tool developed to meet the specifications of the Neuse Rule and approved by the EMC. The development team included interagency technical representatives of the NC Division of Water Resources (DWR), NC Division of Soil & Water Conservation (DSWC) and USDA-Natural Resources Conservation Service (NRCS) and was led by NC State University Soil Science Department faculty. The NLEW captures application of both inorganic and animal waste sources of fertilizer to cropland. It does not capture the effects of nitrogen applied to pastureland and NLEW is an "edge-of-management unit" accounting tool; it estimates changes in nitrogen loss from croplands, but does not estimate changes in nitrogen loading to surface waters.

Annual Estimates of Nitrogen Loss and the Effect of NLEW Refinements

As discussed below, the NLEW software is periodically revised to incorporate new knowledge gained through research and improvements to data. These changes have incorporated the best available data, but changes to NLEW must be considered when comparing nitrogen loss reduction in different versions of NLEW. Further updates in soil management units are expected as NRCS produces updated electronic soils data. The small changes in soil management units are unlikely to produce significant effects on nitrogen loss reductions. Figure 1 represents the annual percent nitrogen loss reduction from 2001 to 2013. In 2010 nitrogen reduction efficiencies assigned to buffers in NLEW were significantly decreased (see Table 1).

Figure 1. Collective Nitrogen Loss Reduction Percent 2001 to 2013, Neuse River Basin.



[1]Between CY2005 & CY2006 NLEW was updated to incorporate revised soil management units and buffer nitrogen reduction efficiencies were reduced.
[2]Between CY2007 & CY2008 NLEW was updated to incorporate revised soil management units and correct some realistic yield errors.
[3]Between CY2009 & CY2010 NLEW had an administration software update with no effect on accounting.
[4]In 2011 NLEW was updated to significantly decrease buffer nitrogen removal efficiencies based on the most current research; CY2010 and the baseline reductions were recalculated.

The first revision (v5.31) marked a significant change in the nitrogen reduction efficiencies of buffers so both the baseline and CY2005 were re-calculated based on the best available information. The second (v5.32) and third (v5.33a) revisions were minor updates of soil mapping units. In April of 2011 the NLEW Committee established further reductions (v5.33b) in nitrogen removal efficiencies for buffers based on additional research. Table 1 lists the changes in buffer nitrogen reduction efficiencies over time.

Table 1. Changes in Buffer Width Options and Nitrogen Reduction Efficiencies in NLEW

Buffer Width	NLEW v5.02 % N Reduction	NLEW v5.51 % N Reduction	NLEW v5.53b % N Reduction
20’	40% (grass)* 75% (trees & shrubs)*	30%	20%
30'	65%	40%	25%
50'	85%	50%	30%
70'	85%	55%	30%
100'	85%	60%	35%

**NLEW v5.02 - the vegetation type (i.e. trees, shrubs, grass) within 20' and 50' buffers determined reduction values. Based on research results, this distinction was dropped from subsequent NLEW versions.*

Current Status

Nitrogen Reduction from Baseline for 2013

All seventeen LACs submitted their thirteenth annual reports to the BOC for approval in September 2014. For the entire basin, in CY2013 agriculture achieved a 38% reduction in nitrogen loss compared to the 1991-1995 baseline. This percentage is lower than the reduction reported for CY2012. Table 2 lists each county's baseline, CY2012 and CY2013 nitrogen (lbs/yr) loss values, and nitrogen loss percent reductions from the baseline in CY2012 and CY2013.

Table 2. Estimated Reductions in Agricultural Nitrogen Loss from Baseline (1991-1995) for 2012 (NLEW v5.33b) and 2013 (NLEW v5.33b), Neuse River Basin

County	Baseline N Loss (lb)* NLEW v5.33b	CY2012 N Loss (lb)* NLEW v5.33b	CY2012 N Reduction (%)	CY2013 N Loss (lb)* NLEW v5.33b	CY2013 N Reduction (%)
Carteret	1,292,556	840,791	35%	801,645	38%
Craven	3,938,339	2,046,893	48%	2,211,033	44%
Durham	220,309	104,557	53%	97,972	56%
Franklin	219,209	50,995	77%	51,703	76%
Granville	193,197	101,675	47%	91,469	53%
Greene	4,195,637	2,260,901	46%	2,623,498	37%
Johnston	6,480,723	3,150,208	51%	3,098,625	52%
Jones	3,114,212	1,865,103	40%	2,417,288	22%
Lenoir	4,130,061	3,481,143	16%	4,234,342	-3%
Nash	1,203,439	393,303	67%	512,479	57%
Orange	565,454	276,838	51%	250,184	56%
Pamlico	2,562,212	1,884,166	26%	1,900,951	26%
Person	616,669	267,950	57%	258,126	58%
Pitt	3,232,893	1,715,544	47%	2,037,702	37%
Wake	1,434,433	395,898	72%	595,306	58%
Wayne	7,994,019	3,788,304	53%	4,209,418	47%
Wilson	3,275,828	1,963,589	40%	2,257,139	31%
Total	44,669,190	24,587,858	45%	27,648,880	38%

**Nitrogen loss values are for comparative purposes. They represent nitrogen that was applied to agricultural lands in the basin and neither used by crops nor intercepted by BMPs in a Soil Management Unit, based on NLEW calculations. This is not an in-stream loading value.*

Nitrogen loss reductions were achieved through a combination of fertilization rate decreases, cropping shifts, and BMP implementation. In addition to wet weather, the most significant factor this year is cropping shifts to wheat which requires higher nitrogen application rates than some other crops grown in the basin.

It should be noted that some counties' reductions decreased due to crop rotations and not a reduction in BMP implementation. Lenoir County's nitrogen reduction increased from baseline largely as a result of cropping shifts and increased nitrogen application rates due to wet weather. In addition, Lenoir County's cropland acres remain very close to baseline acres, as they have not lost many cropland acres to development or experienced much cropland conversion.

Jones, Lenoir, and Pamlico Counties are working to improve their reductions. Collectively in these three counties, 47,956 acres of corn, 10,244 acres of tobacco, and 42,856 acres of wheat were planted. This represents an increase of 7,098 acres of corn, 1,297 acres of tobacco, and 10,234 acres of wheat for these 3 counties from CY2012 to CY2013. Over the same period, cotton acres decreased by 10,227 and soybean acres decreased by 1,609. The local Soil and Water Conservation District Boards are working to meet their reduction by making nutrient reducing BMPs a higher priority in their annual ACSP strategy plan. The DSWC, LACs and additional stakeholders are working with others in the agricultural community in these counties to communicate the need for more BMP installation at existing commodity outreach events. The BOC will continue to focus its efforts to monitor these three counties' progress and encourage BMP implementation. The NLEW outputs and staff calculations estimate the factors that contributed to the nitrogen reduction by the percentages shown in Table 3.

*Table 3. Factors That Influence Nitrogen Reduction by Percentage on Agricultural Lands, Neuse River Basin**

Practice	CY2009 NLEW v5.32	CY2010 NLEW v5.33b	CY2011 NLEW v5.33b	CY2012 NLEW v5.33b	CY2013 NLEW v5.33b
BMP implementation	7%	6%	8%	8%	7%
Fertilization management	14%	12%	14%	10%	6%
Cropping shift	8%	17%	11%	14%	11%
Cropland converted to grass/trees	1.5%	1.5%	2%	2%	2%
Cropland lost to idle land	6.50%	5%	4%	4%	5%
Cropland lost to development	7%	6%	7%	7%	7%
Total	44%	49%	45%	45%	38%

**Percentages are based on a total of the reduction, not a year-to-year comparison.*

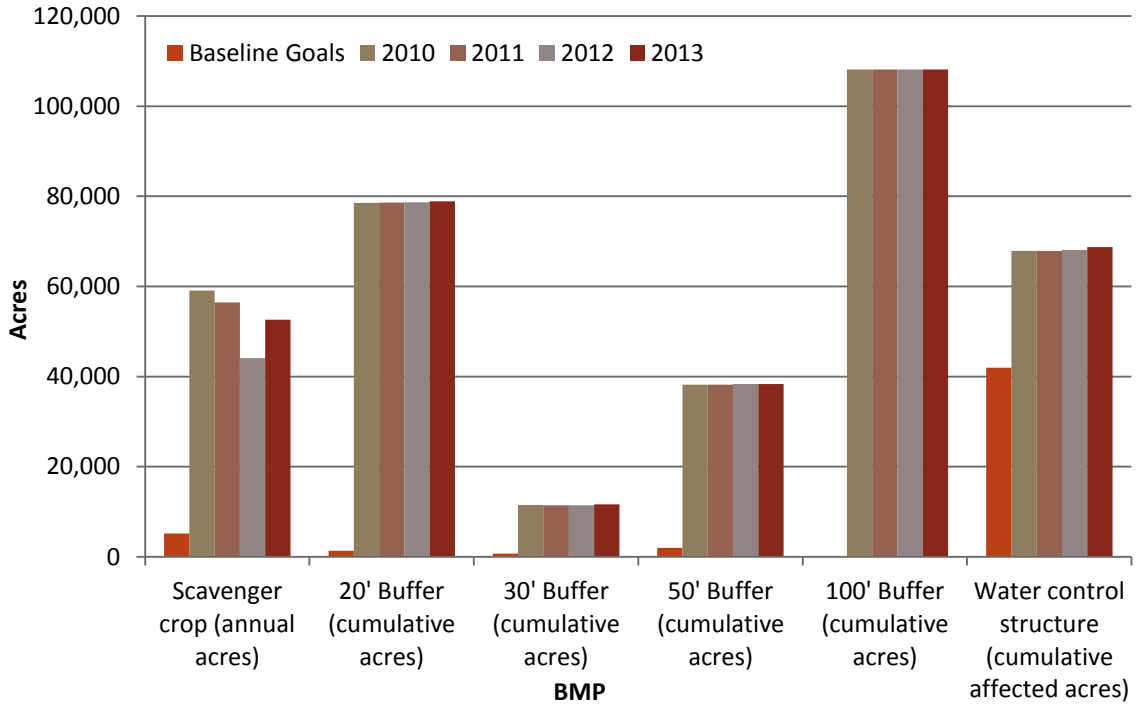
BMP Implementation

As illustrated in Figure 2, CY2013 BMP implementation yielded a net increase of 666 acres affected by water control structures, and a net increase of 10,166 nutrient scavenger crop acres, while 20 ft. buffers increased by 231 acres and 30 ft. buffers increased by 160 acres. Both 50 and 100 ft. buffer acres remained the same.

DSWC staff and district conservationists continue to make refinements to accounting as opportunities arise. BMP data is collected from state and federal cost share program active contracts, and in some cases BMPs that were installed without cost share funding. While there is some variability in the data reported, LACs are reporting data that is the best information currently available. As additional data becomes available, the LACs will review the sources and update their methodology for reporting if warranted.

It is estimated that over a third of cropland receives treatment from the installed BMPs, by comparing the acres of cropland to the acres of BMPs installed through federal, state and local cost share programs. BMP installation goals were set by the local nitrogen reduction strategies, which were approved by the EMC in 1999. The original proposed percent nitrogen loss reduction goals can be found in Figure 2. Agriculture exceeded all of the installed BMP goals in CY2008.

Figure 2: Nitrogen Reducing BMPs Installed on Agricultural Lands and the Approved Goals Baseline (1991-1995) and 2010-2013, Neuse River Basin



The acres of buffers listed represent actual acres. Acres affected by the buffer could be 5 to 10 times larger in the piedmont than the acreage shown above. [1]

[1] Bruton, Jeffrey Griffin. 2004. Headwater Catchments: Estimating Surface Drainage Extent Across North Carolina and Correlations Between Landuse, Near Stream, and Water Quality Indicators in the Piedmont Physiographic Region. Ph.D. Dissertation. Department of Forestry and Environmental Resources, North Carolina State University, Raleigh, NC 27606. http://www.lib.ncsu.edu/theses/available/etd-03282004-174056/

Additional Nutrient BMPs

Not all types of nutrient-reducing BMPs are tracked by NLEW. These include livestock-related nitrogen and phosphorus reducing BMPs, BMPs that reduce soil and phosphorus loss, and BMPs that do not have enough scientific research to support a nitrogen benefit. The BOC believes it is worthwhile to recognize these practices. Table 4 identifies BMPs not accounted for in NLEW and tracks their implementation in the basin since CY2009.

Increased implementation numbers are evident in CY2013 across all BMP types. Some of these BMPs will yield reductions in nitrogen loss that are not reflected in the NLEW accounting in this report but will benefit the estuary.

*Table 4: Nutrient-Reducing BMPs Not Accounted for in NLEW, 1996 to 2013, Neuse River Basin**

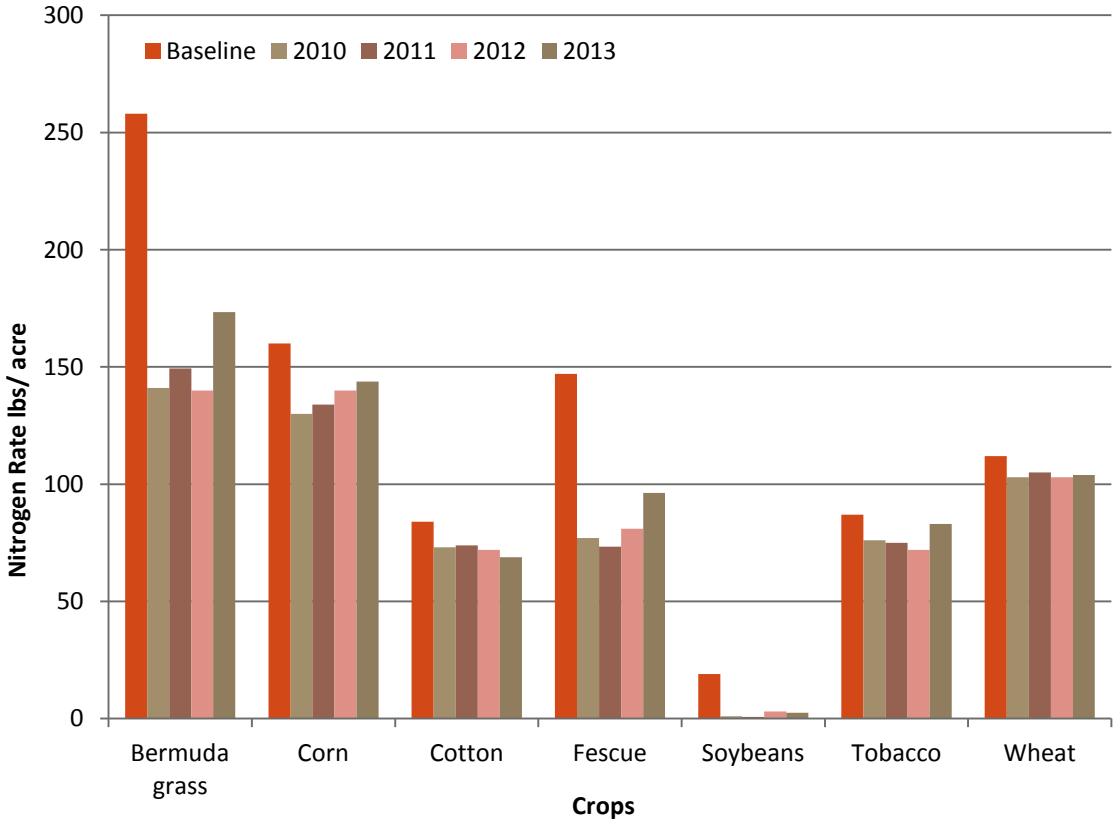
BMP	Units	1996-2009	2010	2011	2012	2013
Diversion	Feet	146,749	149,109	149,449	159,101	160,655
Fencing (USDA programs)	Feet	98,584	112,029	154,885	164,202	170,501
Field Border	Acres	3,265	3,300	3,337	5,190	5,211
Grassed Waterway	Acres	2,245	2,256	2,261	2,289	2,300
Livestock Exclusion	Feet	71,035	74,753	81,389	90,633	100,860
Sod Based Rotation	Acres	40,542	49,131	60,115	76,857	92,404
Tillage Management	Acres	24,011	30,945	34,072	44,011	48,649
Terraces	Feet	41,595	49,970	49,970	49,970	50,670

**Data provided using active contracts in State and Federal cost share programs.*

Fertilization Management

Fertilizer rates are revised annually by LACs using data from farmers, commercial applicators and state and federal agencies' professional estimates. Both increased fertilizer cost and better nutrient management have resulted in farmers in the Neuse River Basin reducing their fertilizer application from baseline levels. Figure 3 indicates that despite annual fluctuations, fertilization rates for all major crops in the basin have reduced from the baseline period. In CY2013 fertilizer rates increased for bermuda grass, corn, fescue, soybeans, tobacco and wheat, while cotton rates decreased slightly compared to CY2012. Figure 3 shows these corresponding application rates.

*Figure 3. Average Annual Nitrogen Fertilization Rate (lbs/ac) for Agricultural Crops for the baseline (1991-1995) and 2010-2013, Neuse River Basin**



Cropping Shifts

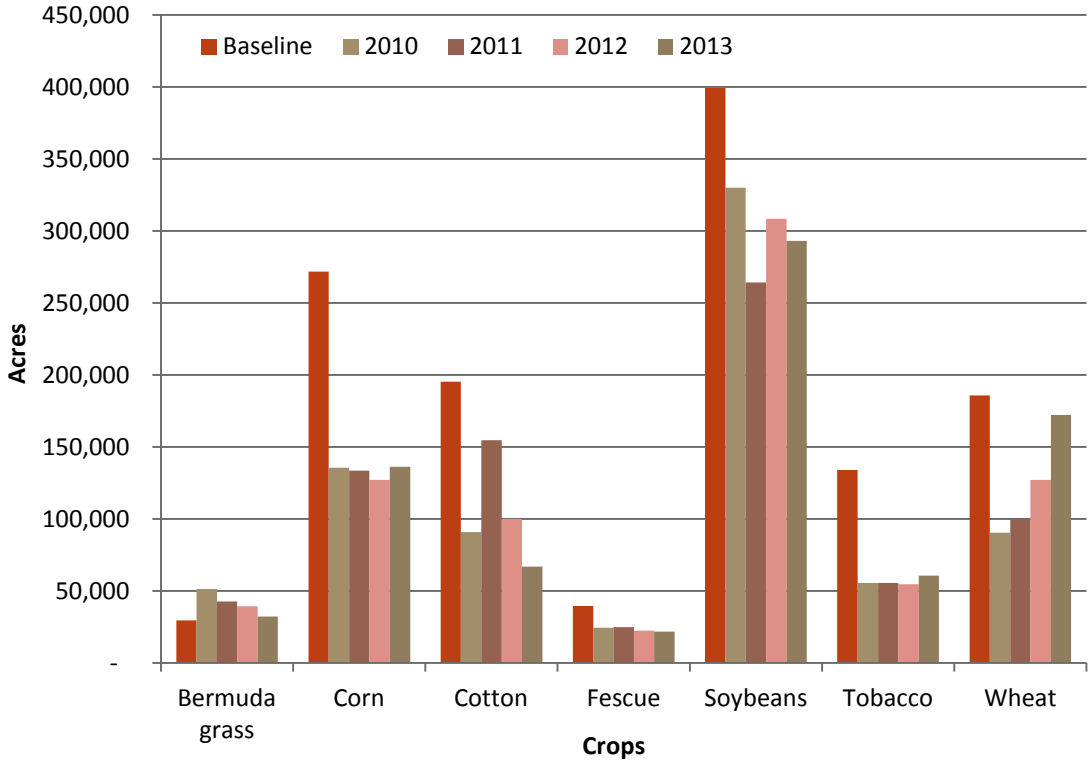
The LACs recalculate the cropland acreage annually by utilizing crop data reported by farmers to the Farm Service Agency. Because each crop type requires different amounts of nitrogen and uses applied nitrogen with a different efficiency rate, changes in the mix of crops grown can have significant impact on the cumulative yearly nitrogen loss reduction. The BOC anticipates that the basin will see additional crop shifts in the upcoming year based on lower commodity prices.

Figure 4 shows the crop acres and shifts for the last five years compared to the baseline. Corn, tobacco, and wheat acreages increased this year, while cotton and soybean acreage decreased. The remaining crops slightly decreased in acreage, but overall remained relatively consistent. A host of factors from individual to global determine crop choices.

Factors Identified by LACs Contributing to Reduced Nitrogen Rates

- Rising fertilizer costs and fluctuating farm incomes.
- Increased education and outreach on nutrient management (NC Cooperative Extension held 21 nutrient management training sessions, approximately 2,000 farmers and applicators received training.)
- Mandatory animal waste management plans
- The federal government tobacco quota buy-out reducing tobacco acreage.

Figure 4. Acreage of Major Crops for the Baseline (1991-1995) and 2010-2013, Neuse River Basin

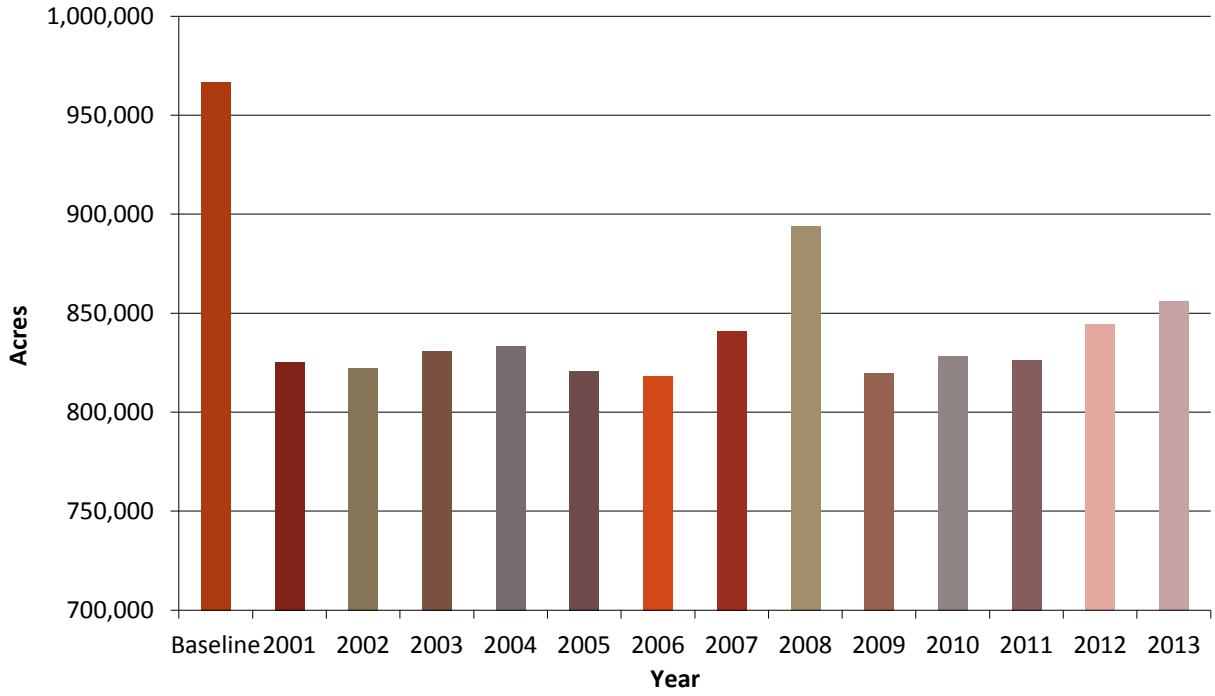


Land Use Change to Development, Idle Land and Cropland Conversion

The number of cropland acres will fluctuate every year in the Neuse River Basin. Each year, some cropland is permanently lost to development or converted to grass or trees. However, idle land is agricultural land that is currently out of production but could be brought back into production at any time. Cropland conversion and cropland lost to development is land taken out of agricultural production and is unlikely to be returned to production. Currently it is estimated that more than 72,723 acres have been lost to development, and more than 18,832 acres have been converted to grass or trees since the baseline. For CY2013 there are approximately 16,619 idle acres and a total of 855,862 acres of cropland. These estimates come from the LAC members' best professional judgment, USDA-Farm Service Agency (FSA) records and county planning departments. The total crop acres are obtained from USDA-FSA and NC Agricultural Statistics annual reports.

Cropland acres have dropped significantly from the baseline period, while CY2013 experienced an increase of over 11,486 acres from CY2012. Commodity prices for corn and tobacco increased from CY2012 to CY2013, and CY2013 prices for wheat and soybeans remained stable at relatively high levels, and this led to increased acres under production.

Figure 5. Total Cropland Acres in the Neuse River Basin, Baseline (1991-1995) and 2001-2012.



Looking Forward

The Neuse Basin Oversight Committee will continue to work with Local Advisory Committees and farmers to reduce nitrogen loss from agricultural lands in the Neuse River Basin. The BOC continues to encourage counties to implement additional BMPs to further reduce nitrogen loss. Funding is an integral part in the success. Without funding for the technicians, the annual progress reports would fall on the LACs without assistance to compile data and annual reports. Technicians are essential in promoting and assisting farmers with BMP installation. Farmers and agency staff personnel with other responsibilities serve on the LACs in a voluntary capacity.

Funding for technicians will expire on June 30, 2015. A more centralized approach to data collection and verification will be necessary. This approach will involve GIS analysis and more streamlined FSA acreage documentation. The LACs will be trained to handle the new workload to the best of their ability. Given that district staff has neither the time nor financial resources to synthesize county level data, however, this centralized approach will come at the expense of some local knowledge.

Basin Oversight Committee recognizes the dynamic nature of agricultural business.

- Changes in world economies, energy or trade policies.
- Changes in government programs (i.e., commodity support or environmental regulations)
- Weather (i.e., long periods of drought or rain)
- Scientific advances in agronomics (i.e., production of new types of crops or improvements in crop sustainability)
- Plant disease or pest problems (i.e., viruses or foreign pests)
- Urban encroachment (i.e., crop selection shifts as fields become smaller)
- Age of farmer (i.e, as retirement approaches farmers may move from row crops to cattle)

Additionally, the Division of Soil and Water Conservation no longer has the resources to fund a Neuse/Tar-Pamlico Basin Coordinator focused solely on coordinating agricultural rule implementation. This year the Division combined that position's job duties with another employee's current work plan, requiring changes in how reporting will be done and the amount of follow up and support available locally. Annual agricultural reporting is required by the rules; therefore continued funding for the Division's staff resources needed for the reporting is essential for compliance.

Further, there is no funding for NLEW updates, which are required when new data are developed through ongoing research or if soil map units are changed. Corn realistic yield expectations were updated in 2014 and need to be in a revised version of NLEW. Without funding these updates cannot be incorporated into the software.

The Neuse BOC will continue to monitor and evaluate crop trends. The current shift to and from crops with higher nitrogen requirements may continue to influence the yearly reduction. Additionally, if the workgroup is reconvened, members of the BOC plan to participate in a land accounting work group to assist in developing a more consistent land accounting framework.

Significant progress has been made in nitrogen loss reduction, and the agricultural community consistently reaches its 30% reduction goal. However, the overall 30% nitrogen loading reduction target for the Neuse River Estuary has not yet been reached. Nitrogen reduction values presented in this annual summary of agricultural reductions reflect "edge-of-management unit" calculations that contribute to achieving the overall 30% nitrogen loss reduction goal. Significant quantities of agricultural BMPs have been installed since the adoption and implementation of the nutrient management strategy, and agriculture continues to do its part towards achieving the overall goal of a 30% reduction of nitrogen delivered to the Neuse estuary. However, the measurable effects of these BMPs on overall in-stream nitrogen reduction may take years to develop due to the nature of non-point source pollution.