Annual Progress Report on the Neuse Agricultural Rule (15 A NCAC 2B.0238) A Report to the NC Environmental Management Commission From the Neuse Basin Oversight Committee

Crop Year 2009

Summary

All seventeen Local Advisory Committees (LACs) met as required. The Neuse Basin Oversight Committee (BOC) received and approved crop year (CY) 2009 annual reports estimating the progress from the seventeen Local Advisory Committees (LACs) operating under the Neuse Agricultural rule as part of the Neuse Basin Nutrient Management Strategy. This report demonstrates ongoing collective compliance and estimates further producer progress in decreasing agricultural nutrient losses. Agriculture collectively achieved an estimated 44% reduction in nitrogen loss from agricultural lands compared to the 1991-1995 baseline, continuing to exceed the rule-mandated 30% reduction. This represents a 3% greater reduction compared to the 41% reduction reported in CY2008. In CY2009, there was an increase in acres affected by water control structures and an increase in 20' buffers that contributed to the change. All but one of the LACs achieved their BOC mandated nitrogen loss reduction goal. Lenoir County achieved a 17% nitrogen loss reduction, 13% short of their goal.

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 Agricultural rule and to assist farmers with complying with the rule. Currently there are five full time technicians that work with Neuse LACs to assist with implementation of best management practices (BMPs) and to coordinate information for the annual reports. They are funded by the EPA 319 grant program, NC Agriculture Cost Share Program (NCACSP) technical assistance funds and county funds.

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.

All seventeen LACs submitted their first annual report to the BOC in May 2002. That report estimated a collective 36% 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 County. 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.

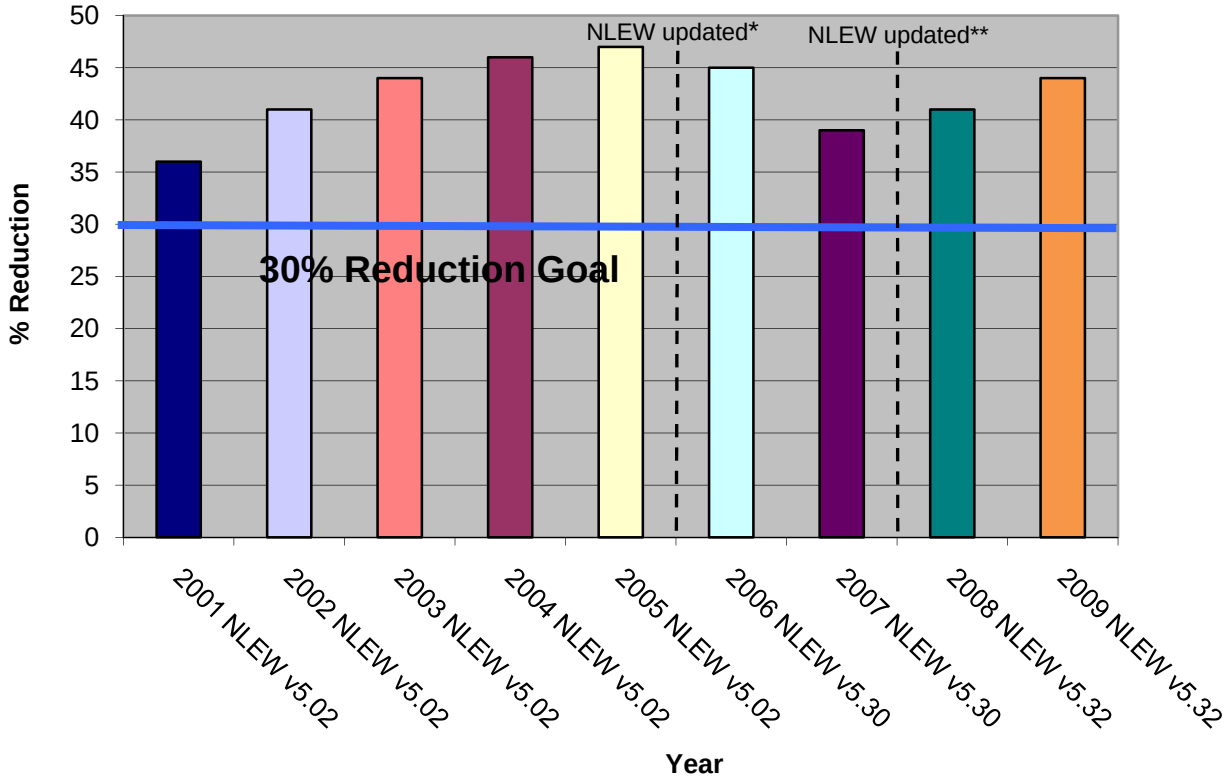
Scope of Report

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. The development team included interagency technical interests (NC Division of Water Quality (DWQ), 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. NLEW captures application of both inorganic and animal waste sources of fertilizer to cropland. It does not capture the effects of managed livestock on nitrogen movement, including pastured, confined, and non-commercial livestock. 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 N Loss and the Effect of NLEW Refinements

The NLEW software was revised to incorporate improvements preceding the reports for CY2006 and CY2008. These changes have incorporated the best available data, but considerations must be made when comparing nitrogen reduction loss in different versions of NLEW. Further updates in soil management units are expected as NRCS produces updated electronic soil data. The small changes in soil management units are unlikely to produce a significant effect on nitrogen loss reductions. Other updates may be made as further data on BMP efficiencies becomes available. Figure 1 represents the percent nitrogen loss reduction from 2001 to 2009.

Figure 1. Collective Nitrogen Loss Reduction Percent 2001 to 2009, Neuse River Basin.



*Between CY2005 and CY2006 NLEW was updated to incorporate revised soil management units and buffer nitrogen reduction efficiencies were reduced.

**Between CY2007 and CY2008 NLEW was updated to incorporate revised soil management units and correct some realistic yield errors.

The first revision included 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 revision was a minor update of soil mapping units; the baseline was not recalculated because the effect on the percent nitrogen loss reduction was minimal.

Current Status: Nitrogen Reduction from Baseline for 2009

All seventeen LACs submitted their ninth annual reports to the BOC for approval in September 2010. For the entire basin, in CY2009 agriculture achieved a 44% reduction in nitrogen loss when using NLEW v5.32 to compare CY2009 to the baseline (1991-1995). This is a 3% greater reduction as compared to the 41% in CY2008 which also used NLEW v5.32. Reductions in the nitrogen application rates to corn, tobacco and fescue, along with reductions in the acres of corn played a role in this change. In addition, better accounting for buffers and newly installed buffers and water control structures contributed to the change. This year all but one of the LACs achieved their nitrogen loss reduction goal established by the BOC; Lenoir County had a 17% reduction. Table 1 lists each county's baseline, its proposed reduction goal and nitrogen reduction from the baseline in CY2008 and CY2009.

Table 1. Estimated Reductions in Agricultural Nitrogen Loss from Baseline (1991-1995) for 2008 (NLEW v5.32) and 2009 (NLEW v5.32), Neuse River Basin

County	Baseline N Loss (lb)* NLEW v5.30	Proposed %	2008 N Loss (lb)* NLEW v5.32	2008 Reported N Loss (%) NLEW v5.32	2009 N Loss (lb)* NLEW v5.32	2009 Reported N Loss (%) NLEW v5.32
Carteret	1,274,541	>30%	569,957	55%	837,941	34%
Craven	3,893,265	>30%	2,342,967	39%	2,005,428	48%
Durham	167,317	>30%	65,766	61%	66,257	60%
Franklin	149,640	30%	54,406	64%	54,578	64%
Granville	156,004	21%	69,365	56%	69,876	55%
Greene	4,046,251	30%	2,377,817	41%	1,883,835	53%
Johnston	6,303,200	30%	4,234,463	33%	4,030,436	36%
Jones	2,898,537	>30%	1,743,958	40%	1,731,973	40%
Lenoir	4,008,721	>30%	3,124,539	22%	3,232,002	17%
Nash	1,115,518	30%	449,180	54%	418,876	62%
Orange	436,356	18%	211,864	51%	172,860	60%
Pamlico	2,393,849	>30%	1,641,593	31%	1,507,440	37%
Person	534,043	26%	351,523	34%	337,362	37%
Pitt	3,053,543	30%	1,793,690	41%	1,167,907	62%
Wake	1,219,036	30%	286,477	77%	237,917	80%
Wayne	7,786,992	30%	4,012,138	48%	3,921,165	50%
Wilson	2,614,048	>30%	1,409,395	46%	1,693,192	35%
Total	42,050,861		24,739,098	41%	23,369,045	44%

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.

It should be noted; some counties reductions decreased due to crop rotations not a reduction in BMP implementation.

Lenoir County, currently at a 17% reduction, will continue to work to improve their reductions in the upcoming years. Lenoir County currently has more acres of cropland and more acres of corn than in the baseline period, thus making it a challenge to meet the 30% reduction. The local Soil and Water Conservation District Board is working to meet their reduction by making nutrient reducing BMPs a higher priority in their annual ACSP strategy plan. The DSWC, LAC and additional stakeholders are working with others in the agricultural community in Lenoir County to communicate the need for more BMP installation at existing commodity outreach events.

Nitrogen loss reductions were achieved through a combination of fertilization rate decreases, cropping shifts, BMP implementation and cropland attenuation. The most significant factor this year, as in all years since the baseline, is due to fertilization management. The reduction in nitrogen application rates can be attributed to the increased cost of fertilizer, nutrient management training, and crop rotation. NLEW outputs and staff calculations estimate these factors contributed to the nitrogen loss in the following percent reduction shown in table 2.

Table 2. Factors That Influence Nitrogen Reduction by Percentage on Agricultural Lands, Neuse River Basin

	2006 NLEW v5.30	**2007 NLEW v5.30**	**2008 NLEW v5.32**	**2009 NLEW v5.32**
BMP implementation	8%	6%	5%	7%
Fertilization management	16%	10%	12%	14%
Cropping shift	5%	7%	10%	8%
Cropland converted to grass/trees	1%	2%	1%	1.5%
Cropland lost to idle land	10%	7%	6%	6.5%
Cropland lost to development	5%	7%	7%	7%
Total	45%	39%	41%	44%

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

BMP Implementation

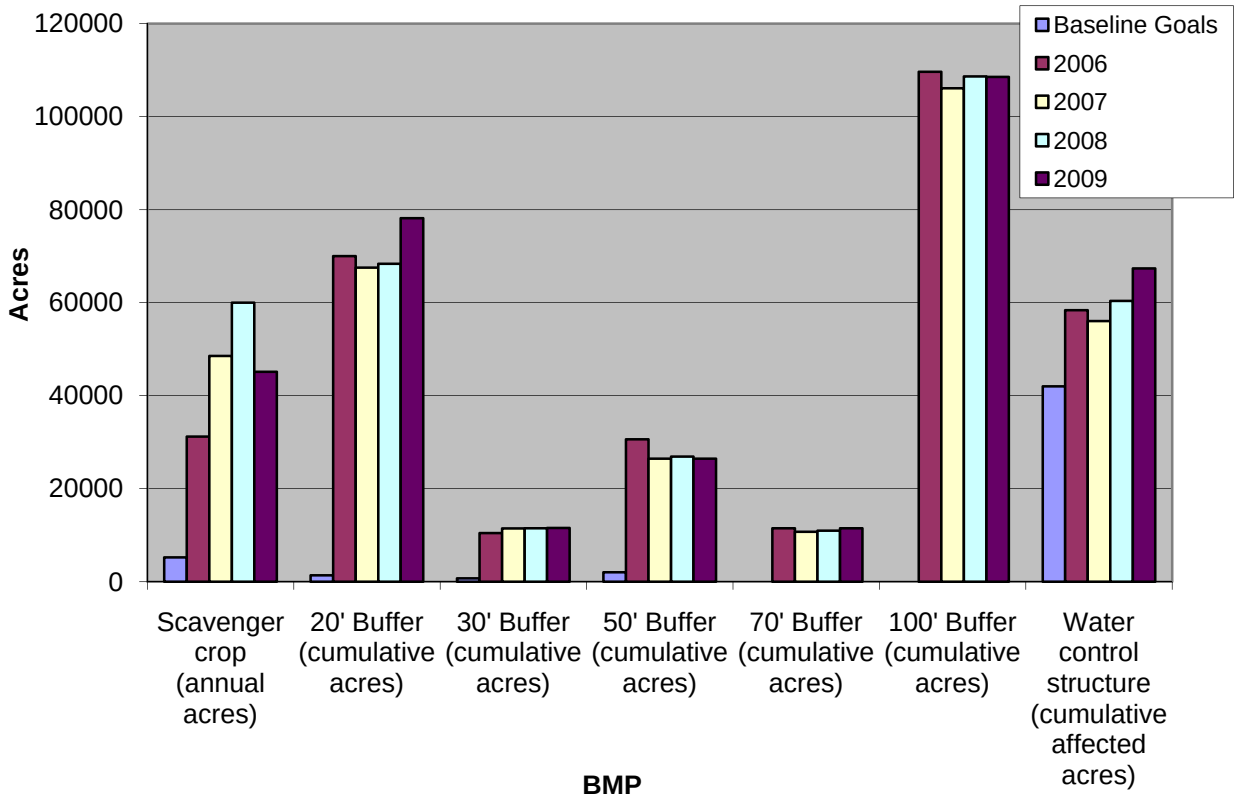
As illustrated in figure 2, CY2009 yielded net increases in buffers and acres treated by water control structures, all of which surpass the amount of acres in the baseline goal. The increase in buffers and water control structures this year was due to newly installed BMPs and better accounting for previously installed federal BMPs. There was also an increase in acres that are under water control in the lower basin this year. A total of 20 water control structures effecting 7,010 acres were installed.

DSWC staff and district conservationists continue to make refinements to the 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. In CY2007 it became possible to search the NRCS database for BMPs installed by hydrologic unit code. This allowed for better accounting for practices installed using federal cost share programs. 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.

To clarify the representation of buffer acres in Figure 2, from 2001 through 2006, the NLEW program captured buffers 50' and larger as one category. After the 2007 update, categories for 70' and 100' buffers were added. In CY2006 the buffers larger than 50' were redistributed into these new categories. During this time span, overall acres of buffers 50' and larger has increased.

It is estimated that over a third of enrolled croplands receive 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 2006-2008, Neuse River Basin



[1] * The acres of buffers listed represent actual acres. Acres affected by the buffer could be 5 to 10 times larger than the acreage shown above. (Bruton 2004)

[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 a scientifically proven nitrogen benefit. The BOC believes it is worthwhile to recognize these practices. Table 3 identifies BMPs not accounted for in NLEW and tracks their implementation in the basin since CY2005.

Increased implementation is evident in CY2009 across all BMP types. Several practices increased significantly due to the ability to query federal cost share databases by hydrologic unit code and additional NCACSP funds provided by the Drought Response Assistance Program. The federal information was not included prior to CY2007. These BMPs will yield reductions in nitrogen loss that are not reflected in the NLEW accounting in this report but will benefit the estuary.

In 2007, to assist farmers impacted by the record drought affecting much of North Carolina, the DSWC launched an agricultural drought response project. The Soil and Water Conservation Commission earmarked a portion of the Agriculture Cost Share Program toward this project. The DSWC received additional funding support through the Council of State Emergency Fund, the Tobacco Trust Fund Commission, and the General Assembly. Farmers could receive cost share assistance to restore pastures that were damaged by the drought, to drill new water supply wells for livestock or irrigation, to remove sediment accumulation from water supply ponds, and to convert to more efficient irrigation methods. The Soil and Water Conservation Commission required applicants receiving funds for wells or ponds for pasture-based livestock watering to exclude the livestock from streams and ponds. This resulted in a significant increase BMP implementation to protect streams. In CY2009 in the Neuse Basin, over 302 acres of pastures were renovated to reduce erosion, and 18 ponds were renovated to provide greater water storage and sediment trapping on farms.

Table 3: Nutrient-Reducing BMPs Not Accounted for in NLEW, 1996 to 2009, Neuse River Basin*

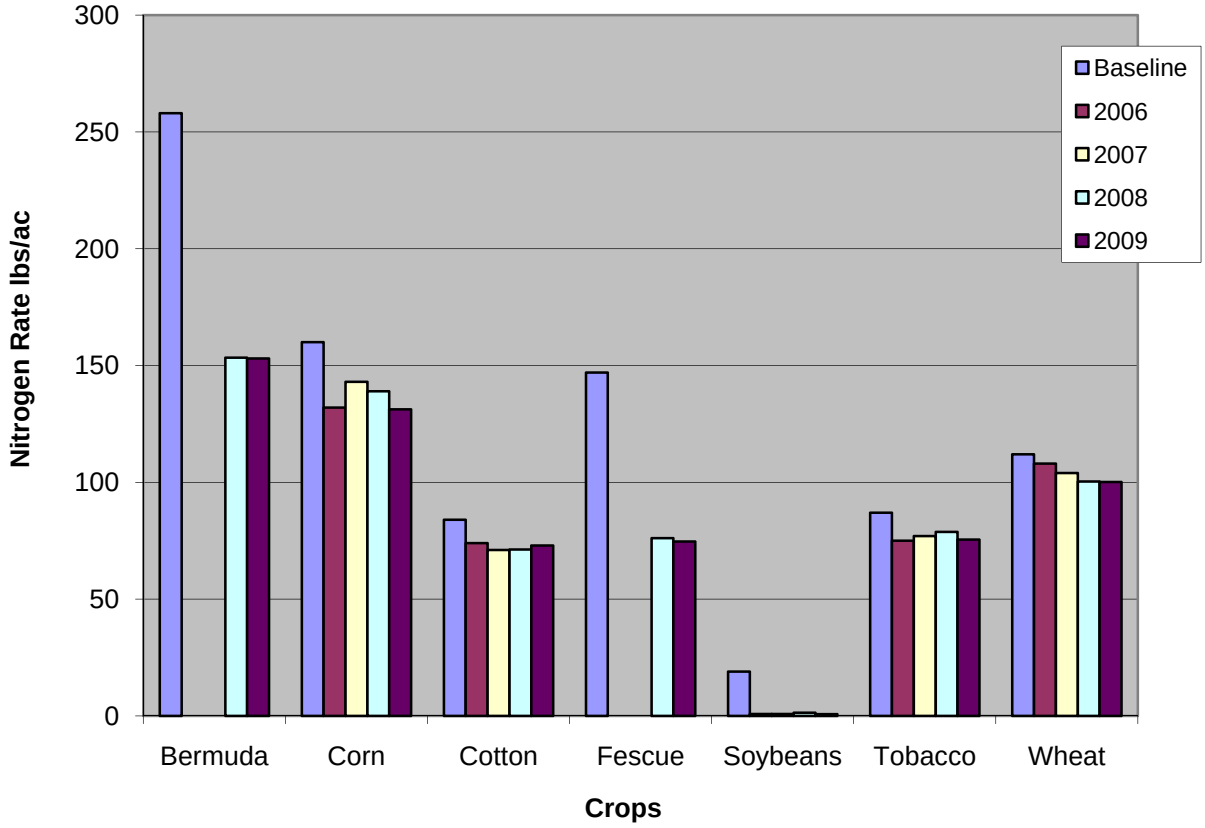
BMP	Units	1996-2006	2007	2008	2009
Diversion	Feet	130,901	132,864	139,492	146,749
Fencing (USDA programs)*	Feet	na	na	53,991	98,584
Field Border	Acres	610	648	823	3,265
Grassed Waterway	Acres	2,183	2,204	2,229	2,245
Livestock Exclusion	Feet	64,298	70,763	71,035	71,035
Sod Based Rotation	Acres	30	10,477	27,413	40,542
Tillage Management	Acres	14,508	14,788	20,586	24,011
Terraces	Feet	13,657	35,132	40,758	41,595

*Data provided using active contracts in State and Federal cost share programs. Some increases seen between CY2006 and CY2007 are due to the ability to search federal data bases for BMP data. This data was not previously included.

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 has resulted in farmers in the Neuse River Basin reducing their fertilizer application from baseline levels. Figure 3 indicates that fertilization rates for most major crops in the basin have reduced from the baseline period. In CY2009 fertilizer rates dropped for corn, tobacco and fescue, while cotton increased 2 lbs/ac compared to CY2008.

Figure 3. Average Annual Nitrogen Fertilization Rate (lbs/ac) for Agricultural Crops for the baseline (1991-1995) and 2006-2009, Neuse River Basin*



*Bermuda and fescue nitrogen rate data was added starting in CY2008.

Cropping Shifts

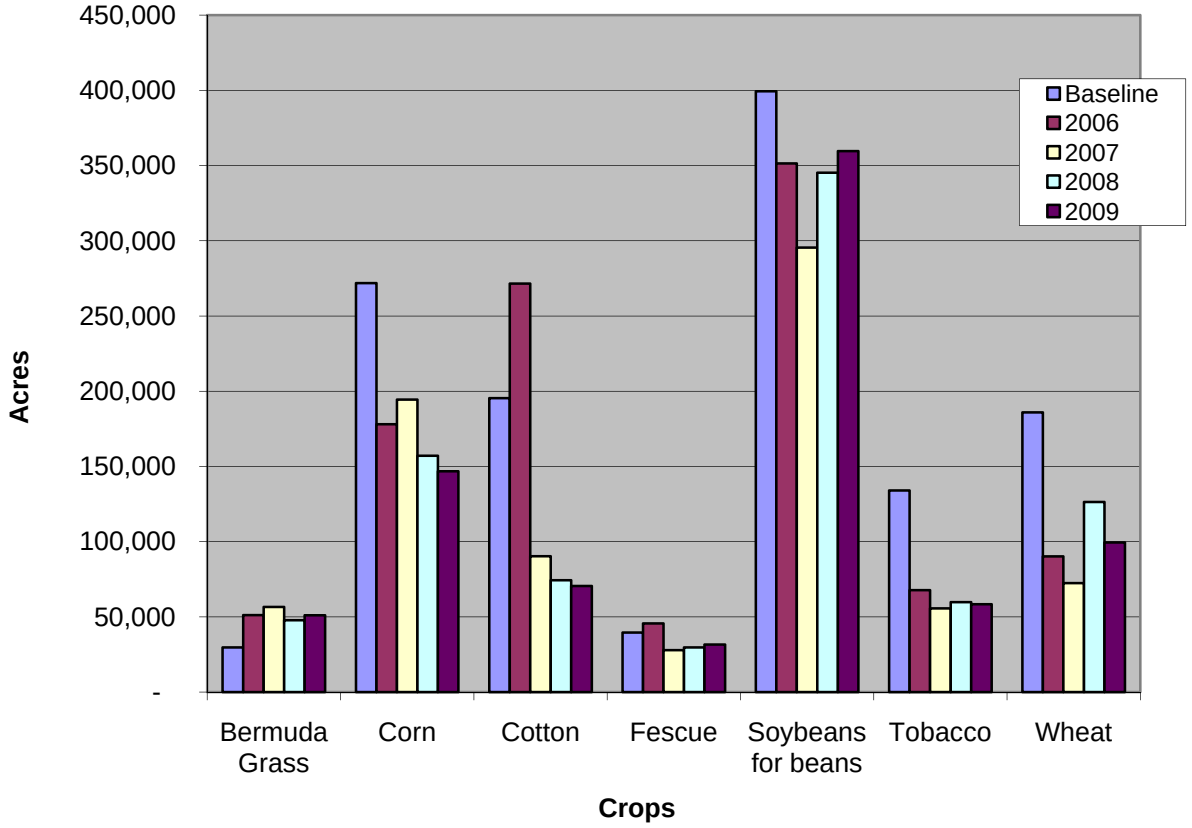
The LACs recalculate the cropland acreage annually by utilizing crop data reported by farmers to the Farm Service Agency. Because each crop type requires different amounts of nitrogen and uses applied nitrogen with a different efficiency rate, changes in the mix of crops grown can have significant impact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

Factors Identified by LACs Contributing to Reduced Nitrogen Rates

- Rising fertilizer costs and dwindling 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.
- Neuse and Tar-Pamlico Nutrient Strategies

Figure 4 shows the crop acres and shifts for the last four years compared to the baseline. Only bermuda grass acreage has increased since the baseline period, while all other crops have reduced. A host of factors from individual to global determine crop choices. One economic trend from the mid-90's through the early years of 2000 was the corn-to-cotton shift. This shift changed due to market conditions in CY2007. The future of this trend is uncertain as market forces play out. In CY2009 tobacco, wheat, corn and cotton acres dropped from CY2008 levels, while fescue, soybeans, and bermuda grass acres increased.

Figure 4. Acreage of Major Crops for the Baseline (1991-1995) and 2006-2009, Neuse River Basin



Land Use Change to Development, Idle Land and Cropland Conversion

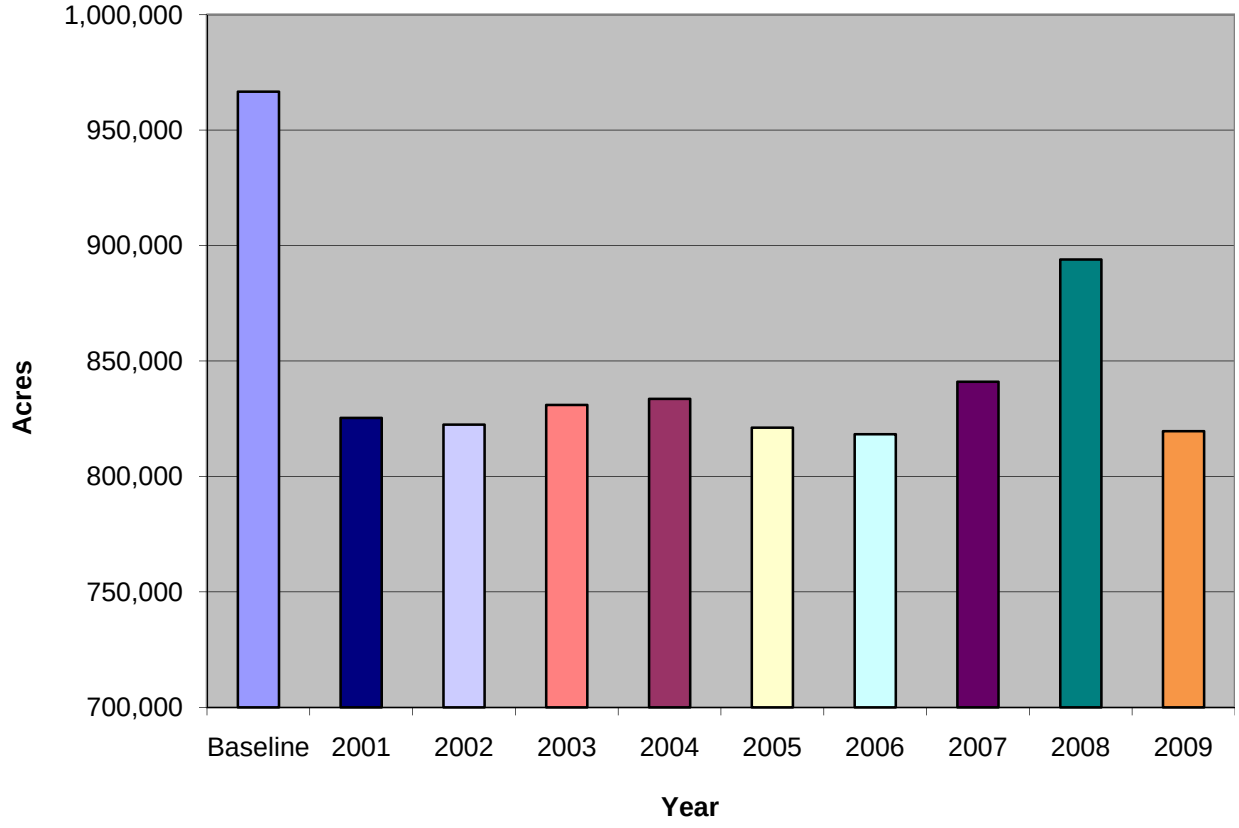
The number of cropland acres fluctuate every year in the Neuse River Basin. Each year, some cropland is permanently lost to development or converted to grass or trees. Idle land, however is agricultural land that is currently out of production but could be brought back into production at any time. Cropland 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 69,000 acres have been lost to development, and more than 15,000 acres have been converted to grass or trees since the baseline. For CY2009 there are approximately 63,845 idle acres and a total of 819,607 acres of cropland. These estimates come from the LAC members' best professional judgment, USDA-Farm Service Agency (FSA) records and county planning departments. Total crop acres are obtained from USDA-FSA and NC Agricultural Statistics annual reports.

The 2009 Neuse River Basin Action plan states the DWQ plans to reconvene the land accounting work group (which last met in 2007). The Land Accounting Workgroup will be comprised of DWQ and DSWC staff along with researchers from NC State and representatives with NC Farm

Bureau, North Carolina Department of Agriculture and Consumer Services and environmental stakeholders. The main objective is to develop recommendations for a comprehensive uniform land accounting framework to better track the conversion of agricultural land to other uses like development, conservation and mitigation projects. Members of the BOC plan to participate with the land use accounting work group to better quantify land use changes in the basin. Figure 5 shows the cropland acreages for the baseline and 2001-2009.

Cropland acres have dropped significantly from the baseline period, CY2009 shows a decrease from CY2008. This is likely due to cropland returning to idle land due to the economy and input prices.

Figure 5. Total Cropland Acres in the Neuse River Basin, Baseline (1991-1995) and 2001-2009.



Looking Forward

The Neuse Agricultural 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 and BMP installation responsibilities would fall on the LACs without assistance to compile data and annual reports. Farmers and agency staff personnel with other responsibilities serve on the LACs in a voluntary capacity. If funding for technician positions is not available, the LACs would have a difficult time meeting the workload requirements.

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

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)

Although significant progress has been made in nitrogen loss reduction by the agricultural community, the 30% nitrogen reduction target established by the General Assembly from all sources 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. 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.