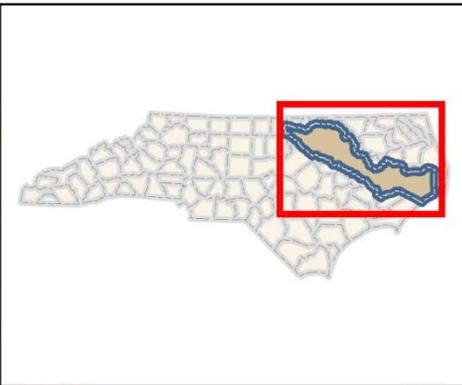


NCDA&CS

2014 Annual Progress Report (Crop
Year 2013) on the Tar-Pamlico
Agricultural Rule
(15 A NCAC 02B.0256)

A Report to the Environmental Management Commission from the Tar-Pamlico
Basin Oversight Committee: Crop Year 2013

Tar-Pamlico River Basin



Legend

- Highways
- Major Rivers
- Water Bodies
- Tar-Pamlico River Basin
- Municipalities
- County Boundaries



Tar-Pamlico Basin Oversight Committee
September 26, 2014



Summary

The Tar-Pamlico Basin Oversight Committee (BOC) received and approved crop year (CY) 2013 annual reports from the fourteen Local Advisory Committees (LACs) operating under the Tar-Pamlico Agriculture Rule as part of the Tar-Pamlico Basin Nutrient Management Strategy. The report demonstrates agriculture's ongoing collective compliance with the Tar-Pamlico Agriculture Rule and estimates further progress in decreasing nutrient losses. In CY2013, agriculture collectively achieved an estimated 43% reduction in nitrogen loss compared to the 1991 baseline, continuing to exceed the rule-mandated 30% reduction. This represents a 3% decrease in reduction compared to the 46% reduction reported for CY2012. Thirteen of the 14 LAC's exceeded the mandated 30% reduction goal. Funding remains limited and is essential for rule compliance. Without adequate funding the Division of Soil & Water Conservation and these 14 LACs will find it difficult to meet the reporting requirement on an annual basis.

Rule Requirements and Compliance History

Effective September 2001, the Tar-Pamlico Nutrient Sensitive Waters Management Strategy (NSW) provides for a collective strategy for farmers to meet the 30% nitrogen loss reduction and no-increase phosphorus goals within five years. A BOC and fourteen LACs were established to implement the rule and to assist farmers with complying with the rule. In CY2013 there were four full time technicians that work with LACs to coordinate information for the annual reports. They were funded by the EPA 319 grant program, NC Agriculture Cost Share Program (ACSP) technical assistance funds, and county funds.

All fourteen Local Advisory Committees (LACs) submitted their first annual report to the BOC in November 2003, which collectively estimated a 39% nitrogen loss reduction, and 10 of 14 LACs exceeded the 30% individually. Collective reductions had gradually increased in succeeding years, and by CY2007 only one LAC was shy of the 30% individually. All fourteen LACs met as required in 2014, and in CY2013 the collective reduction of 43% exceeded the mandated 30%, but one county fell below the 30% goal (Martin).

Tar-Pamlico NSW Strategy

The Environmental Management Commission (EMC) adopted the Tar-Pamlico nutrient strategy in 2000. The NSW strategy goal is to reduce the average annual load of nitrogen to the Pamlico estuary by 30% from 1991 levels and to limit phosphorus loading to 1991 levels. Mandatory controls were applied to addressing non-point source pollution in agriculture, urban stormwater, nutrient management, and riparian buffer protection. The management strategy built upon the precedent-setting Neuse River Basin effort established three years earlier, which for the first time set regulatory reduction measures for nutrients on cropland acres in the state.

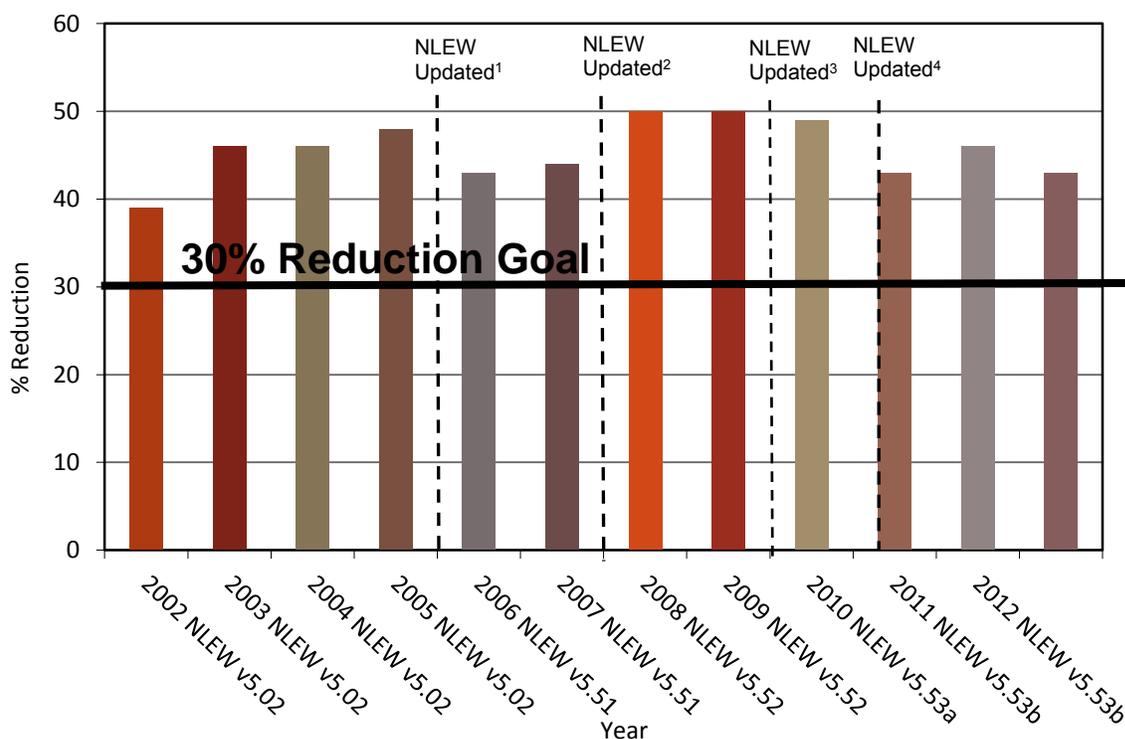
Scope of Report and Methodology

The estimates provided in this report represent whole-county scale calculations of nitrogen loss from cropland agriculture in the basin 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 for use in the Tar-Pamlico Basin. The development team included interagency technical representatives of the NC Division of Water Resources (DWR), NC Division of Soil and Water Conservation (DSWC), USDA-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 nitrogen applied to pastureland, and 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. An assessment method was developed for phosphorus, approved by the EMC, and is described later in the report.

Annual Estimates of N 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. In 2010 nitrogen reduction efficiencies assigned to buffers in NLEW were significantly decreased (see Table 1). Figure 1 represents the annual percent nitrogen loss reduction from 2002 to 2013.

Figure 1. Collective Nitrogen Loss Reduction Percent 2002 to 2012, Tar Pamlico River Basin.



¹Between CY2005 & CY2006 NLEW was updated to incorporate revised soil management units and buffer nitrogen reduction efficiencies were reduced.

²Between CY2007 & CY2008 NLEW was updated to incorporate revised soil management units and correct realistic yield errors.

³Between CY2009 & CY2010 NLEW was an administration software update with no effect on accounting.

⁴In 2011 NLEW was updated to significantly decrease buffer nitrogen removal efficiencies based on the most current research; CY2010 and the baseline reductions were recalculated to reflect changes in NLEW.

The first revision (v5.51) 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 (v5.52) and third (v5.53a) revisions were administrative along with minor updates of soil mapping units. In April of 2011 the NLEW Committee established further reductions (v5.53b) 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)	30%	20%
	75% (trees & shrubs)		
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 CY2013

All fourteen LACs submitted their tenth annual report to the BOC in September 2014. For the entire basin, in CY2013 agriculture achieved a 43% reduction in nitrogen loss compared to the 1991 baseline. This year 13 of the 14 LACs achieved the at-least 30% nitrogen loss reduction goal individually. 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) for CY2012 and CY2013, Tar-Pamlico River Basin

County	Baseline N Loss (lb) ¹ NLEW v5.53b	CY2012 N Loss (lb) ¹ NLEW v5.53b	CY2012 N Reduction (%) NLEW v5.53b	CY2013 N Loss (lb) ¹ NLEW v5.53b	CY2013 N Reduction (%) NLEW v5.53b
Beaufort	9,190,250	5,880,214	36%	6,244,198	32%
Edgecombe	5,037,628	3,182,967	37%	3,248,575	36%
Franklin	2,183,751	614,485	72%	638,918	71%
Granville	890,371	408,809	54%	418,951	53%
Halifax	2,806,652	1,557,924	44%	1,851,810	34%
Hyde	4,975,781	3,320,518	33%	3,482,142	30%
Martin	782,152	561,380	28%	588,851	25%
Nash	4,963,538	1,508,690	70%	1,761,548	65%
Person	153,228	52,240	66%	53,968	65%
Pitt	6,147,727	2,891,311	53%	3,710,806	40%
Vance	419,485	133,693	68%	164,303	61%
Warren	535,517	176,086	67%	197,299	63%
Washington	977,801	657,626	33%	653,424	33%
Wilson	890,961	469,373	47%	518,769	42%
Total	39,954,842	21,415,316	46%	22,937,873	43%

¹Nitrogen 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 the combination of fertilization rate decreases, cropping shifts, BMP implementation, and cropland attenuation. The most significant factor continues to be fertilization management. Martin County's individual nitrogen reduction fell back to levels reported in CY2011 and remained below the 30% goal, at 25%, due mostly to cropping shifts and the fact that the county has only reduced cropland acres by 2,261 from baseline. This county saw cotton decrease by 1,616 acres while corn and wheat, which require significant nitrogen inputs, increased by 627 and 1,574 acres, respectively. In addition, soybeans, which need no nitrogen application, increased by 838 acres. The Division of Soil and Water Conservation will focus its efforts to work with this LAC on their reduction. NLEW estimates these factors contributed to the total nitrogen loss reduction according to the percentages shown in Table 3.

*Table 3. Factors that Influence Nitrogen Reduction by Percentage on Agricultural Lands, Tar-Pamlico River Basin**

Factor	CY2010 NLEW v5.53b	CY2011 NLEW v5.53b	CY2012 NLEW v5.53b	CY2013 NLEW v5.53b
BMP implementation	9%	9%	10%	8%
Fertilization Management	23%	17%	17%	21%
Cropping shift	10%	8%	10%	6%
Cropland converted to grass/trees	3%	3%	5%	5%
Cropland lost to idle land	3%	4%	4%	1%
Cropland lost to development	1%	1%	1%	1%
TOTAL	49%	43%	46%	43%

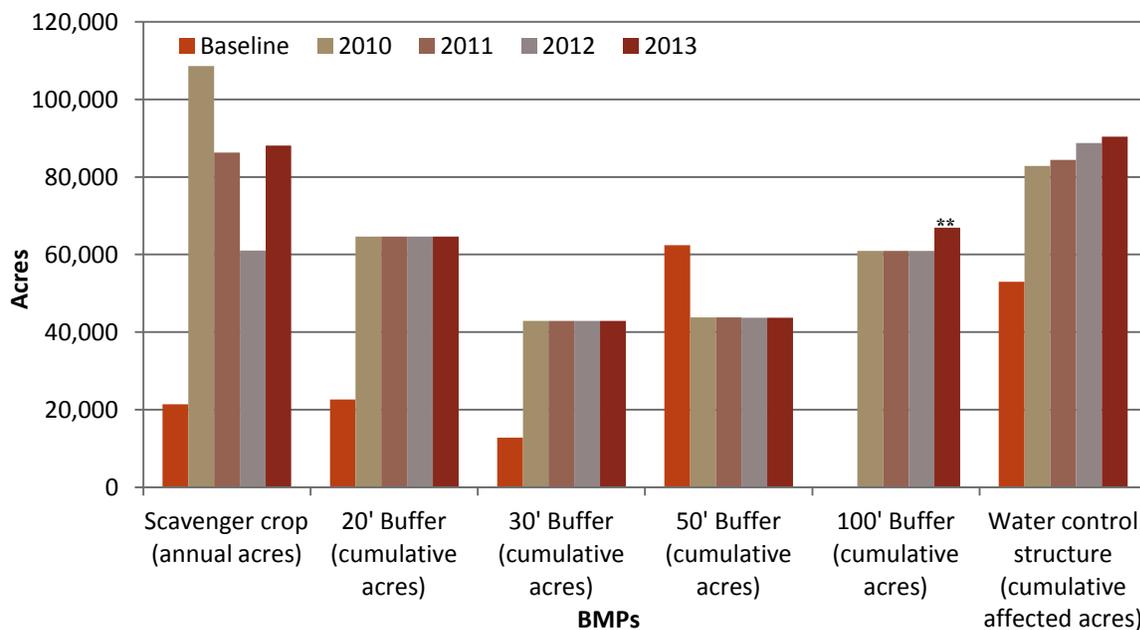
**Percentages are based on a total of the reduction, not a year-to-year comparison.*

BMP Implementation

As illustrated in Figure 2, CY2013 yielded a net increase of 1,601 acres affected by water control structures and an increase of 27,046 acres of nutrient scavenger crops, while buffer acres remained relatively steady. While there is the inherent opportunity for variability in the data reported, LACs are including data that is the best information currently available. As additional sound data sources become available, the LACs will review the sources and update their methodology for reporting if warranted.

Overall, the total acres of implementation of BMPs have increased since the baseline, as illustrated in Figure 2. Based on a comparison of the actual acres of BMPs installed through federal, state and local cost share programs to the total 716,289 cropland acres; over half of all reported cropland receives some kind of treatment by BMPs. However this treatment estimate does not take into account the entire drainage area treated by buffers in the piedmont which is generally 5 to 10 times higher than the actual acres of the buffer shown in Figure 2.¹

Figure 2: Nutrient Reducing BMPs Installed on Agricultural Lands for Baseline (1991) and 2010-2013, Tar-Pamlico 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 above¹

** A 6,000 acre addition to CY2013 has been made to 100 ft. buffers because Halifax LAC has mistakenly failed to report acreage in that category. The increase does not reflect actual buffer installation during CY2013, and future reports will accurately report these acres.

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 estimating 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 CY2010.

Increased implementation numbers are evident in CY2013 across all BMP types since the baseline. 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 Best Management Practices Not Accounted for In NLEW, 2010-2013, Tar-Pamlico River Basin**

BMP	Units	2010	2011	2012	2013
Diversion	Feet	390,046	394,461	398,291	425,596
Fencing (USDA Programs)	Feet	206,190	235,865	241,732	256,384
Field Border	Acres	934	1,001	1,264	1,284
Grassed Waterway	Acres	1,115	1,154	2,475	2,518
Livestock Exclusion	Feet	221,088	221,096	233,061	238,676
Sod Based Rotation	Acres	26,504	37,052	52,502	70,456
Tillage Management	Acres	35,946	40,612	46,808	52,185
Terraces	Feet	368,914	371,936	371,936	371,936

**Values represent active contracts in State and Federal cost share programs.*

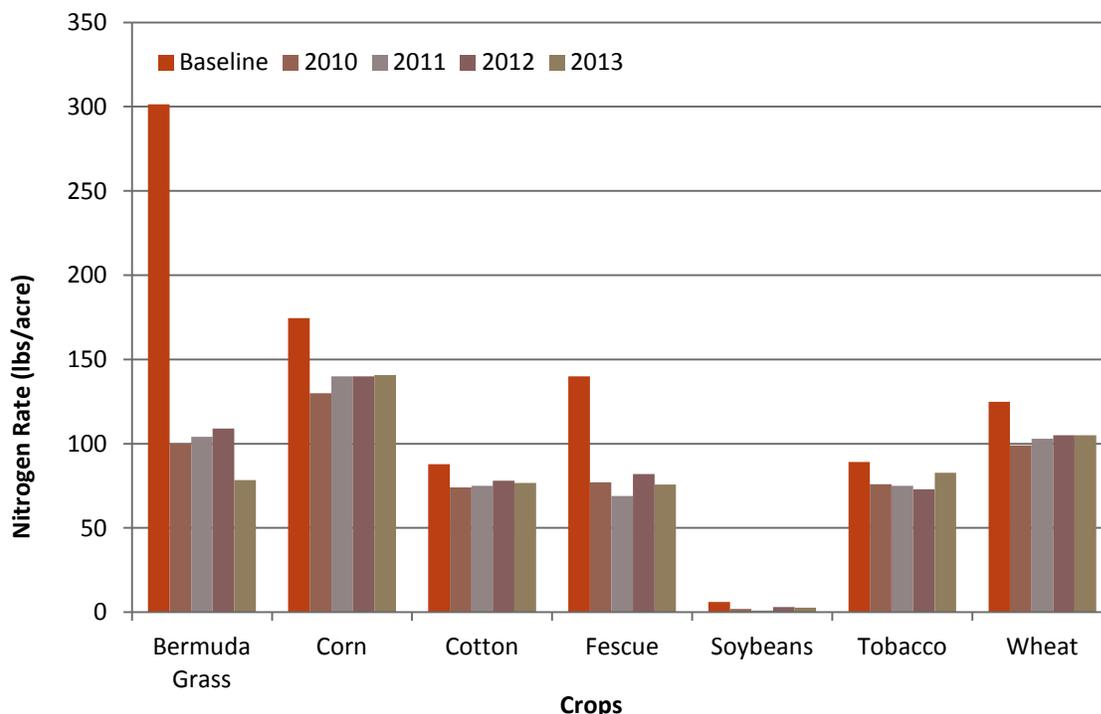
Fertilization Management

Both increased fertilizer cost and better nutrient management have resulted in farmers in the Tar-Pamlico River Basin reducing their nitrogen application from baseline levels. Figure 3 indicates that nitrogen rates for the major crops in the basin have reduced from the baseline period. In CY2013 nitrogen rates were stable for soybeans and wheat compared to CY2012, and increased for tobacco and slightly increased for corn. The rates for bermuda grass decreased significantly, and rates for cotton and fescue decreased by less than 5 lbs per acre this year. Most pastures are under-fertilized throughout the Tar-Pamlico basin. The pasture and hayland are typically not supplemented with inorganic fertilizers. Fertilizer rates are revisited annually by LACs using data from farmers, commercial applicators and state and federal agencies' professional estimates.

Factors Identified by LACs Contributing to Reduced Nitrogen Rates since the Baseline Year

- Rising fertilizer costs and fluctuating farm incomes.
- Increased education & outreach on nutrient management (NC Cooperative Extension holds an annual nutrient management training session, since 2004 approximately 2,000 farmers and applicators have received training.)
- Mandatory waste management plans
- The federal government tobacco quota buy-out reducing tobacco acreage.
- Neuse & Tar-Pamlico Nutrient Strategies.

Figure 3. Average Annual Nitrogen Fertilization Rate (lb/ac) for the Major Agricultural Crops for the Baseline (1991) and 2010-2013, Tar-Pamlico River Basin

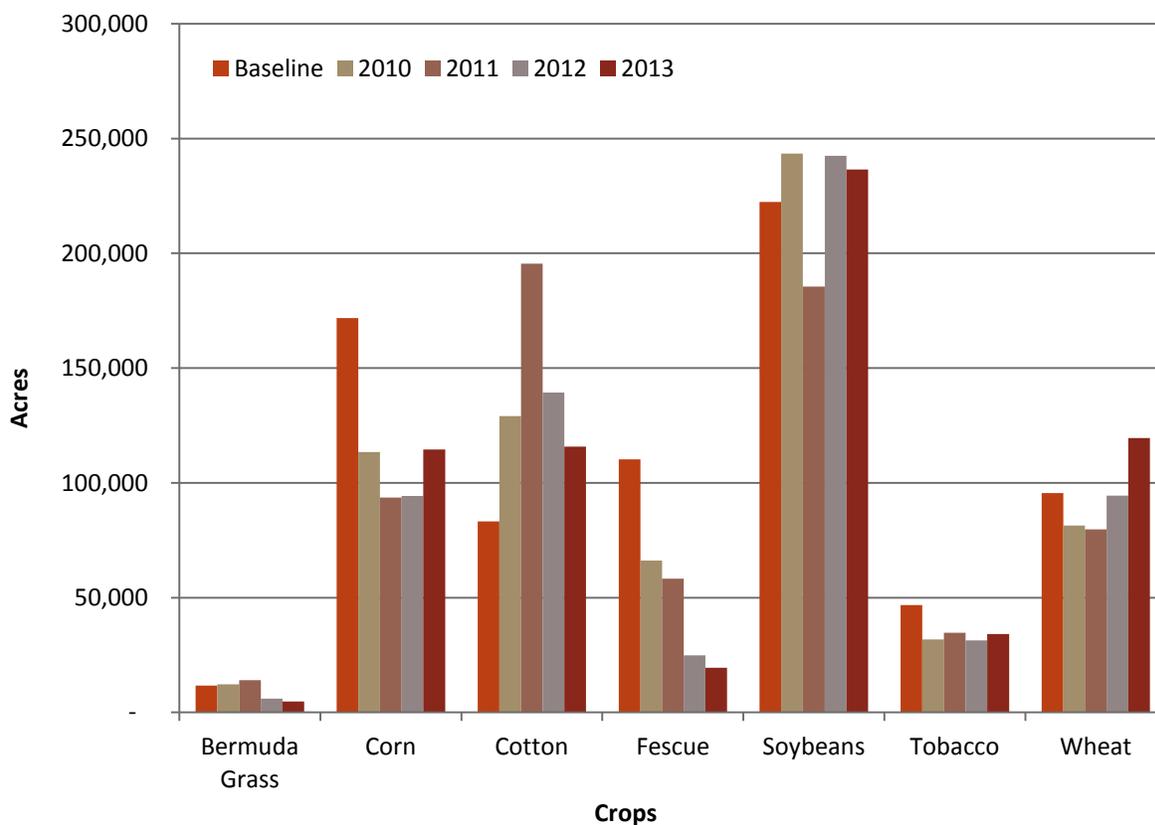


Cropping Shifts

The LACs calculated the cropland acreage by utilizing crop data reported by farmers to the USDA-Farm Service Agency. Each crop requires different amounts of nitrogen and use the nitrogen applied with different efficiency rates. Changes in the mix of crops grown can have a significant impact on the cumulative yearly nitrogen loss reduction.

Figure 4 shows crop acres and shifts for the last four years compared to the baseline. While some crops – bermuda grass and tobacco – have remained relatively stable, others show more volatility. In CY2013, cotton acreage continued a recent decline, while corn increased. From CY2010 to CY2013, fescue lost significant acreages in the piedmont. A host of factors from individual to global determine crop choices.

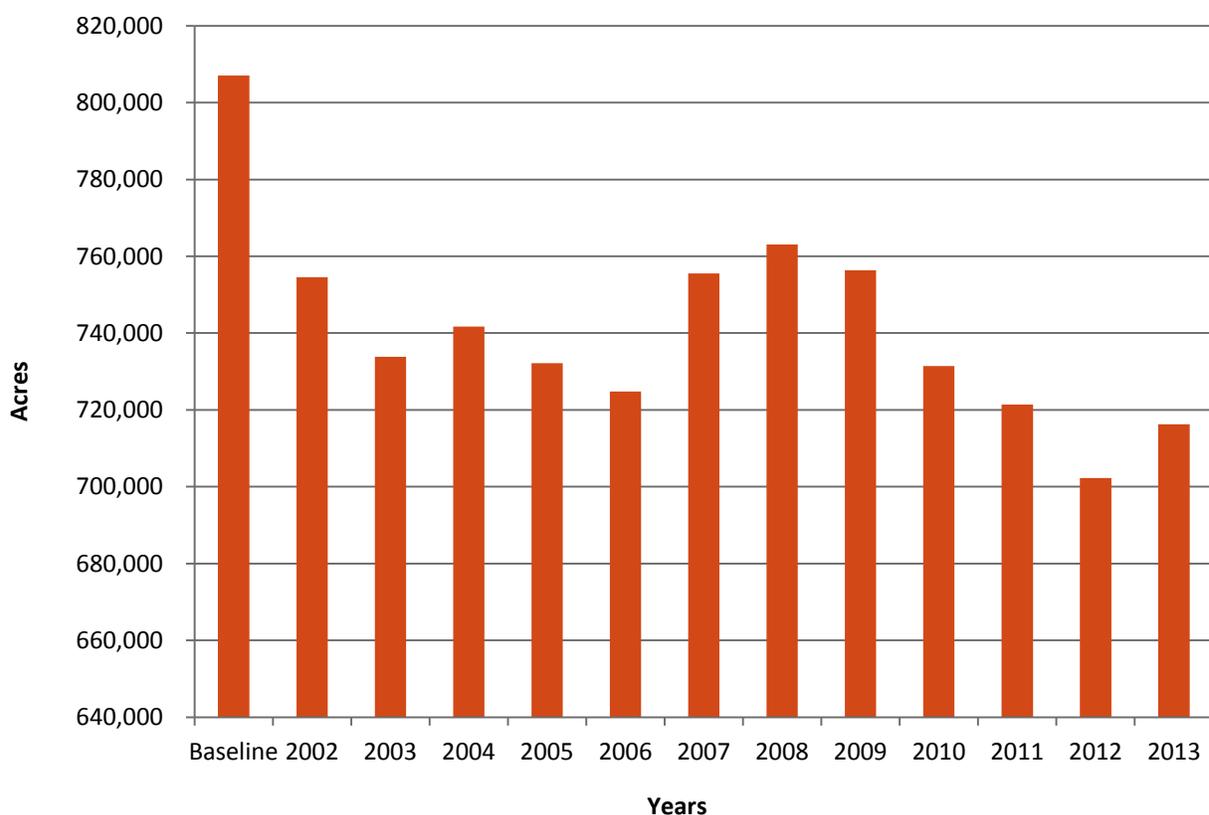
Figure 4. Acreage of Major Crops for the Baseline (1991) and 2010-2013, Tar-Pamlico River Basin



Land Use Change to Development, Idle Land and Cropland Conversion

The number of cropland acres fluctuates every year in the Tar-Pamlico River Basin due to cropland conversion, idle land and development. Each year, some cropland is permanently lost to development or converted to grass or trees and likely to be ultimately lost from agricultural production. Idle land is agricultural land that is currently out of production but could be brought back into production at any time. Currently it is estimated that approximately 11,605 acres have been permanently lost to development in the basin and more than 46,647 acres have been converted to grass or trees since the 1991 baseline. For CY2013 it is estimated that there are approximately 10,087 idle acres and a total of 716,289 total acres of cropland (see Fig. 5). These estimates come from the LAC members' best professional judgment, USDA-FSA records and county planning department data.

Figure 5. Total Cropland Acres in the Tar-Pamlico River Basin, Baseline (1991) and 2002-2013



Phosphorus

Phosphorus Indicators for CY2013: The qualitative indicators included in Table 5 show the relative changes in land use and management parameters and their relative effect on phosphorus loss risk in the basin. This approach was recommended by the Phosphorus Technical Advisory Committee (PTAC) in 2005 due to the difficulty of developing an aggregate phosphorus tool parallel to the nitrogen NLEW tool and was approved by the EMC. Table 5 builds upon the data provided in the 2005 PTAC report, which included all available data at the time ending with data from 2003. This report adds phosphorus indicator data for CY2010 through CY2013. Most of the parameters indicate less risk of phosphorus loss than in the baseline.

Contributing to the reduced risk of phosphorus loss is the increase of nutrient reducing BMPs in the basin.

As indicated in Table 5, the acres affected in the basin by water control structures have steadily increased over the past three years. It should also be noted that the soil test phosphorus median number reported for the basin fluctuates each year due to the nature of how the data is collected and compiled. The soil test phosphorus median numbers shown in Table 5 are generated by using North Carolina Department of Agriculture and Consumer Services (NCDA&CS) soil test laboratory results from voluntary soil testing and the data is reported by the NCDA&CS. The number of samples collected each year varies. The data does not include soil tests that were submitted to private laboratories. The soil test results from the NCDA&CS database represent data from entire counties in the basin, and have not been adjusted to include only those samples collected in the river basin area.

Phosphorous Technical Assistance Committee (PTAC)

The PTAC's overall purpose was to establish a phosphorus accounting method for agriculture in the basin. It determined that a defensible, aggregated, county-scale accounting method for estimating phosphorus losses from agricultural lands is not currently feasible due to "the complexity of phosphorus behavior and transport within a watershed, the lack of suitable data required to adequately quantify the various mechanisms of phosphorus loss and retention within watersheds of the basin, and the problem with not being able to capture agricultural conditions as they existed in 1991". The PTAC instead developed recommendations for qualitatively tracking relative changes in practices in land use and management related to agricultural activity that either increase or decrease the risk of phosphorus loss from agricultural lands in the basin on an annual basis.

Table 5. Relative Changes in Land Use and Management Parameters and their Relative Effect on Phosphorus Loss Risk in the Tar-Pamlico

Parameter	Units	Source	1991 Baseline	CY 2010	CY 2011	CY 2012	CY 2013	1991 - 2013 Change	CY2013 P Loss Risk +/-
Agricultural land	Acres	FSA	807,026	731,408	721,432	702,227	716,289	-13%	-
Cropland conversion (to grass & trees)	Acres	USDA-NRCS & NCACSP	660	31,596	31,631	42,330	46,647	6314%	-
CRP / WRP (cumulative)	Acres	USDA-NRCS	19,241	41,833	41,833	41,833	41,833	117%	-
Conservation Tillage *	Acres	USDA-NRCS & NCACSP	41,415	35,946	40,612	46,808	52,185	13.02%	-
Vegetated buffers (cumulative)	Acres	USDA-NRCS & NCACSP	50,836	215,606	227,528	212,212	218,236	317%	-
Water control structures (cumulative)	Acres Affected	USDA-NRCS & NCACSP	52,984	82,844	84,442	88,755	90,356	68%	-
Scavenger crop	Acres	LAC	13,272	108,888	86,283	73,177	92,269	451%	-
Animal waste P	lbs of P/ yr	NC Ag Statistics	13,597,734	15,202,037	16,695,543	16,561,052	16,880,526**	22%	+
Soil test P median	P Index	NCDA & CS	83	86	87	85	85	2.41%	+

* Conservation tillage is still being practiced on additional acres but this number only reflects active cost share contract acres, not acres where contracts have expired.

** Due to the delay in the 2012 Census of Agriculture release and the five-year program review the livestock county estimates are delayed until January 2015. Where animal waste P data has not been released, CY2012 numbers have been used.

Based on these findings, the BOC recommends that no additional management actions be required of agricultural operations in the basin at this time to comply with the “no net increase above the 1991 levels” phosphorus goal of the agriculture rule. The BOC will continue to track and report the identified set of qualitative phosphorus indicators to the EMC annually, and to bring any concerns raised by the results of this effort to the EMC’s attention as they arise, along with recommendations for any appropriate action. The BOC expects that BMP implementation will continue to increase throughout the basin in future years, and notes that BMPs installed for nitrogen, pathogen and sediment control often provide significant phosphorus benefits as well.

Looking Forward

The Tar-Pamlico BOC will continue to report on rule implementation, relying heavily on Soil and Water Conservation District staff to compile crop reports.

Because cropping shifts are susceptible to various pressures, the BOC is working with LACs in all counties to continue BMP implementation that provides for a lasting reduction in nitrogen loss in the basin while monitoring cropping changes.

The committee overseeing the development of NLEW has periodically reviewed BMP efficiencies credited by the nutrient accounting software. This review is part of the ongoing examination of practices utilized to assess agriculture's nutrient losses. 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.

Basin Oversight Committee recognizes the dynamic nature of agricultural business.

- Changes in the 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)

The BOC will continue to review data from all studies as they are completed and become available and will consider the results as they relate to nutrient loadings from land based sources and uses. This includes studies related to the 2004 NPDES permit issued to Rose Acre Farms.

Funding is an integral part in the success. Farmers and agency staff personnel with other responsibilities serve on the LACs in a voluntary capacity. Technicians are essential in promoting and assisting farmers with BMP installation. Additionally, without funding for the technicians, the annual progress reports would fall on the LACs without assistance to compile data and annual reports. Current funding for basin 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. Because district staff has neither the time nor financial resources to synthesize county level data, this centralized approach will come at the expense of some local knowledge. 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 these 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 remaining position is essential for compliance.