NCDA&CS

2013 Annual Progress Report 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 2012

Summary

The Tar-Pamlico Basin Oversight Committee (BOC) received and approved crop year (CY) 2012 annual reports from the fourteen Local Advisory Committees (LACs) operating under the Tar-Pamlico Agricultural Rule as part of the Tar-Pamlico Basin Nutrient Management Strategy. The report demonstrates agriculture's ongoing collective compliance with the Tar-Pamlico Agricultural Rule and estimates further progress in decreasing nutrient losses. In CY2012, agriculture collectively achieved an estimated 46% reduction in nitrogen loss compared to the 1991 baseline, continuing to exceed the rule-mandated 30% reduction. This represents a 3% increase in reduction compared to the 43% reduction reported for CY2011. Thirteen of the 14 LAC's exceeded the mandated 30% reduction goal.

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. Currently there are five full time technicians that work with LACs to coordinate information for the annual reports. They are funded by the EPA 319 grant program, NC Agriculture Cost Share Program (ACSP) technical assistance funds, and county funds.

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.

All fourteen 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. In CY2008 all LACs individually exceeded the 30% nitrogen loss reduction goal and have continued to do so through CY2010. In CY2012 the collective reduction of 46% exceeded the mandated 30%, but one LAC fell below the 30% goal (Martin).

Scope of Report and Methodology

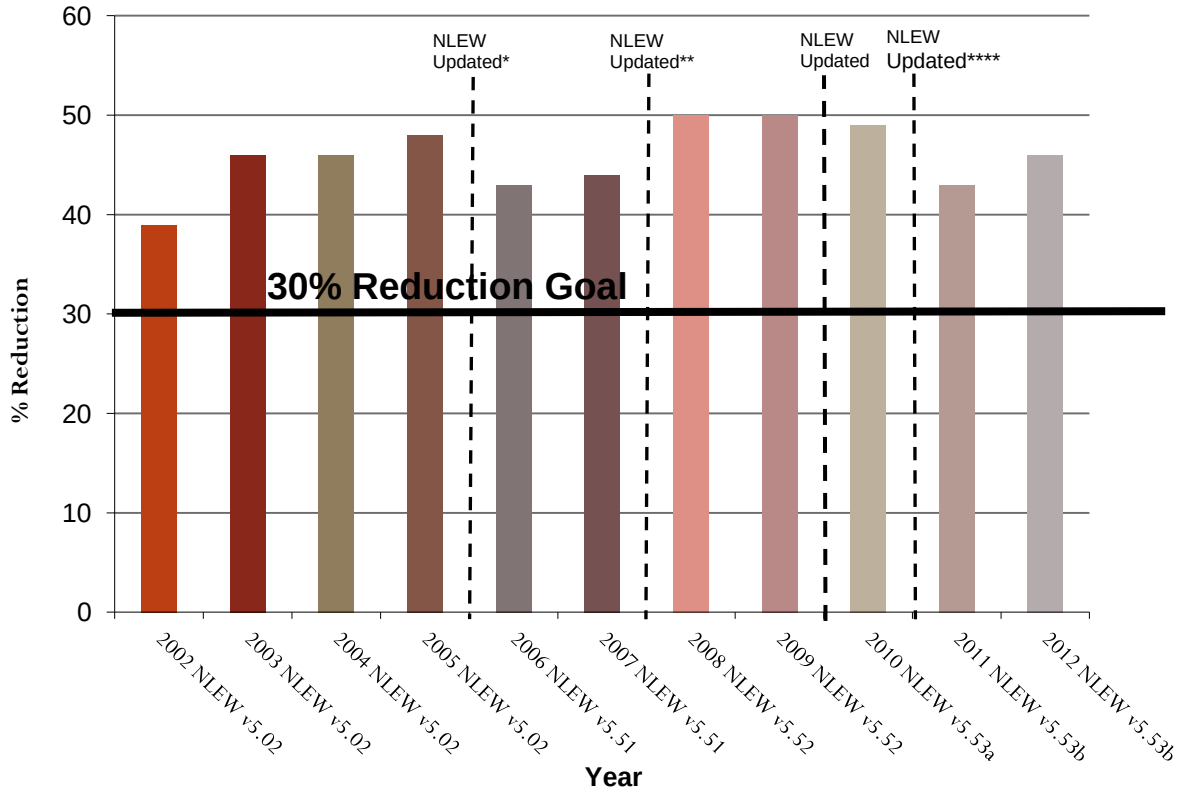
The estimates provided in this report represent whole-county scale calculations of nitrogen loss from cropland agriculture in the basin made by soil and water conservation district technicians using the 'aggregate' version of the Nitrogen Loss Estimation Worksheet, or NLEW, an accounting tool developed 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 2012.

Figure 1. Collective Nitrogen Loss Reduction Percent 2002 to 2012, Tar Pamlico 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 was an administration software update with no effect on accounting.*
[4]*In 2011 NLEW was updated to significantly decrease buffer N removal efficiencies; 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 N removal efficiencies for buffers based on additional research. Table 1 lists the changes in buffer N 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%
20'	75% (trees & shrubs)	n/a	n/a
30'	65%	40%	25%
50'	85%	50%	30%
70'	n/a	55%	n/a
100'	n/a	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.*

Since the release of the CY2010 Report to the EMC, baseline and CY2010 values have been recalculated to reflect the most recent decrease in N removal efficiencies of buffers in NLEW. This resulted in a decreased estimate of percent N removed from agricultural loss for CY2010 to 49%, down from the reported 52%.

Current Status

Nitrogen Reduction from Baseline for CY2012

All fourteen LACs submitted their ninth annual report to the BOC in September 2012. For the entire basin, in CY2012 agriculture achieved a 46% 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, CY2011 and CY2012 nitrogen (lbs/yr) loss values, and nitrogen loss percent reductions from the baseline in CY2011 and CY2012.

Table 2. Estimated Reductions in Agricultural Nitrogen Loss from Baseline (1991) for CY2011 and CY2012, Tar-Pamlico River Basin

County	Baseline N Loss (lb)[1] NLEW v5.53b	CY2011 N Loss (lb)[1] NLEW v5.53b	CY2011 N Reduction (%) NLEW v5.53b	CY2012 N Loss (lb)[1] NLEW v5.53b	CY2012 N Reduction (%) NLEW v5.53b
Beaufort	9,190,250	6,014,967	35%	5,880,214	36%
Edgecombe	5,037,628	3,651,075	28%	3,182,967	37%
Franklin	2,183,751	798,686	63%	614,485	72%
Granville	890,371	449,968	49%	408,809	54%
Halifax	2,806,652	2,199,533	22%	1,557,924	44%
Hyde	4,975,781	3,289,265	34%	3,320,518	33%
Martin	782,152	595,684	24%	561,380	28%
Nash	4,963,538	1,547,934	69%	1,508,690	70%
Person	153,228	52,799	66%	52,240	66%
Pitt	6,147,727	2,646,294	57%	2,891,311	53%
Vance	419,485	165,056	61%	133,693	68%
Warren	535,517	148,874	72%	176,086	67%
Washington	977,801	674,271	31%	657,626	33%
Wilson	890,961	545,946	39%	469,373	47%
Total	39,954,842	22,780,352	43%	21,397,420	46%

[1] *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.*

Martin County's individual nitrogen reduction showed improvement from the previous reporting period, but stayed below the 30% goal, at 28%, due mostly to cropping shifts. This county saw cotton decrease by 1,858 acres while corn and wheat, which require significant nitrogen inputs, increased by 73 and 84 acres, respectively. In addition, soybeans and peanuts, which need no nitrogen application, increased by 1,199 acres. The Division of Soil and Water Conservation will focus its efforts to work with this LAC on their reduction.

Halifax County's nitrogen reduction increased from 22% to 44% due to a reduction of 10,858 acres of cotton, which required 85 lbs of Nitrogen per acre, and an increase of 4,081 acres of soybeans, which required no Nitrogen input.

Nitrogen loss reductions were achieved through the combination of fertilization rate decreases, cropping shifts, BMP implementation and cropland attenuation shown in Table 3. The most significant factor continues to be fertilization management. NLEW estimates these factors contributed to the total nitrogen loss reduction in the following manner:

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

Factor	CY2009 NLEW v5.52	CY2010 NLEW v5.53b	CY2011 NLEW v5.53b	CY2012 NLEW v5.53b
BMP implementation	11%	9%	9%	10%
Fertilization Management	20%	23%	17%	14%
Cropping shift	11%	10%	8%	10%
Cropland converted to grass/trees	3.50%	3%	3%	5%
Cropland lost to idle land	3.50%	3%	4%	4%
Cropland lost to development	1%	1%	1%	1%
TOTAL	50%	49%	43%	44%

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

BMP Implementation

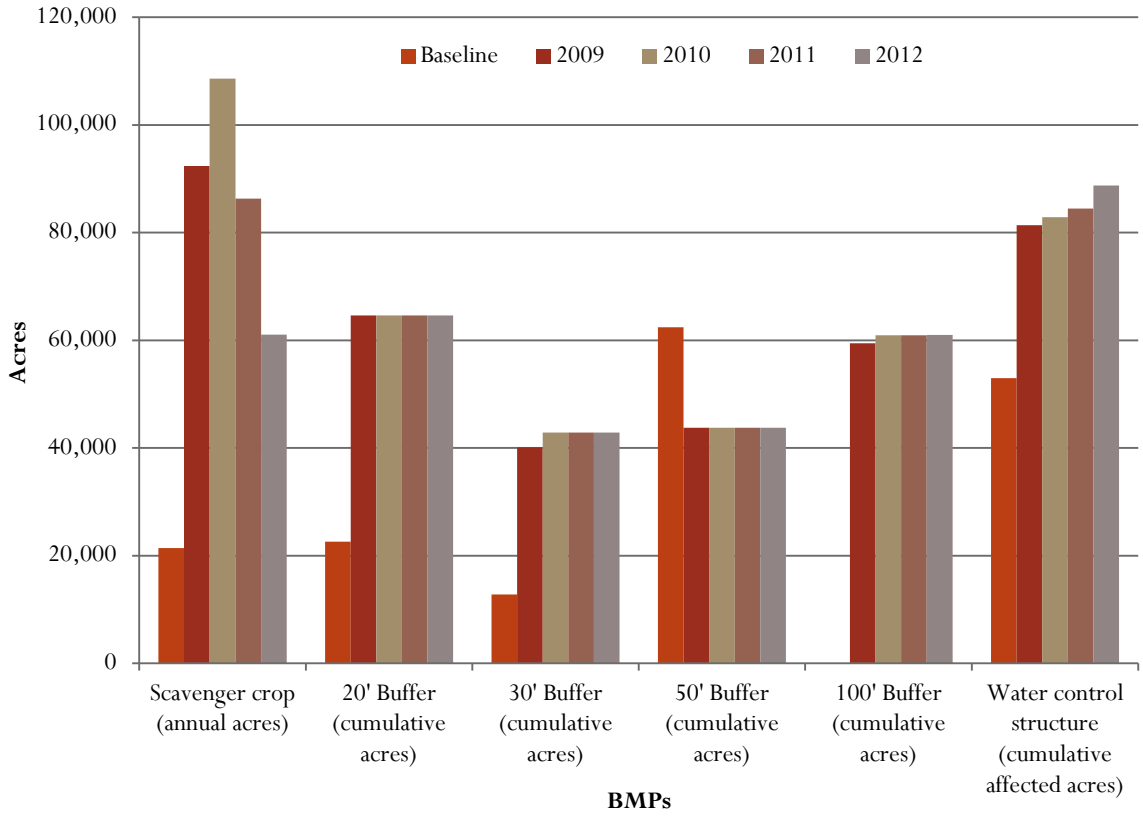
As illustrated in Figure 2, CY2012 yielded a net increase of 4,313 acres affected by water control structures and a decrease of 25,260 acres of nutrient scavenger crops, while buffer acres remained relatively steady.

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 702,227 cropland acres; over half of all reported croplands receive 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. (Bruton 2004)[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/**

*Figure 2: Nutrient Reducing BMPs installed on Agricultural Lands for Baseline (1991) and 2009-2012, Tar-Pamlico River Basin**



**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.*

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 CY2005.

Increased implementation numbers are evident in CY2012 across all BMP types since the baseline. 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, 2009-2012, Tar-Pamlico River Basin**

BMP	Units	2009	2010	2011	2012
Diversion	Feet	389,861	390,046	394,461	398,291
Fencing (USDA Programs)	Feet	205,959	206,190	235,865	241,732
Field Border	Acres	539	943	1,001	1,264
Grassed Waterway	Acres	646	1,115	1,154	2,475
Livestock Exclusion	Feet	217,302	221,088	221,096	233,061
Sod Based Rotation	Acres	16,724	26,504	37,052	52,502
Tillage Management	Acres	33,905	35,946	40,612	46,808
Terraces	Feet	368,914	369,914	371,936	371,936

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

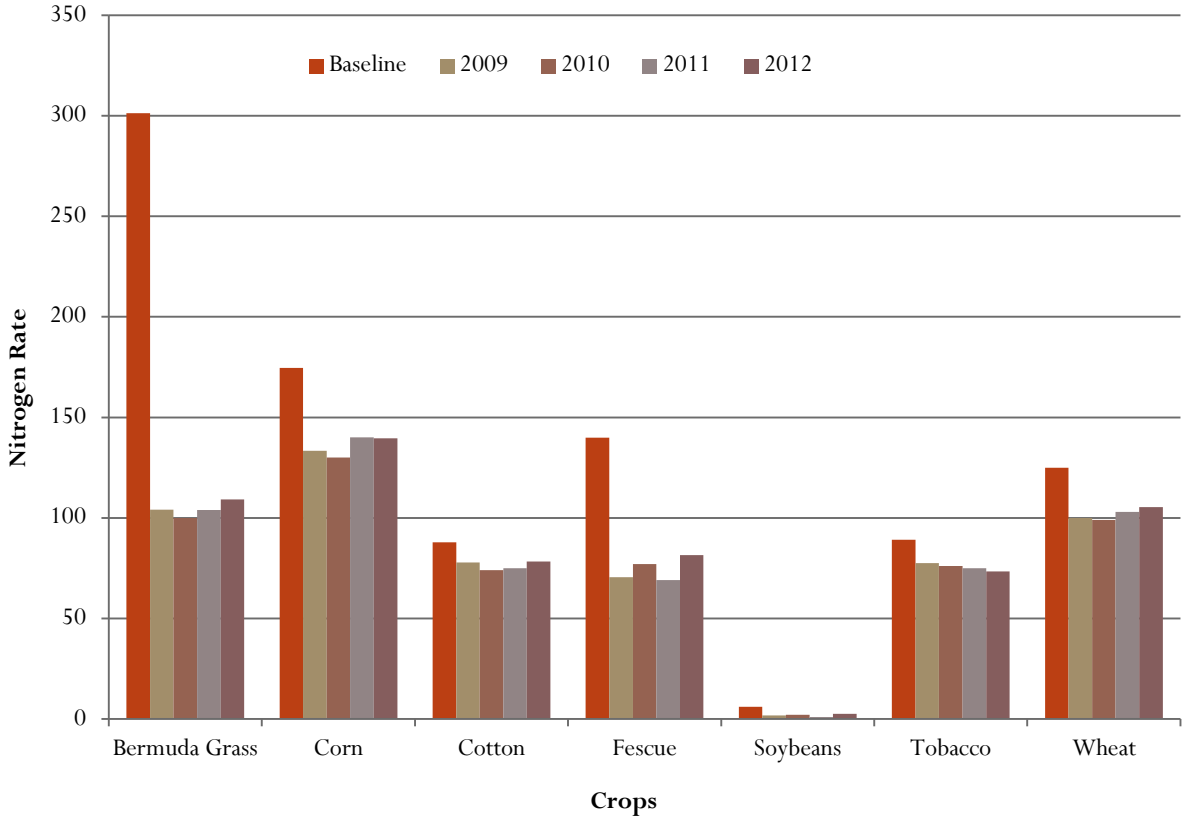
Fertilization Management

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 CY2012 nitrogen rates were stable for corn compared to CY2011, and slightly decreased for tobacco. The rates for bermuda grass, cotton, fescue, soybeans, and wheat increased by less than 5 lbs per acre this year. Most pastures are under--fertilized throughout the Tar-Pamlico basin. Some bermuda grass and fescue land is used for waste application, but due to the nitrogen concentrations of the waste and the amount of liquid, actual waste applied does not have nitrogen application rates as high as the agronomic rates for the grasses. 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 2009-2012, Tar-Pamlico River Basin

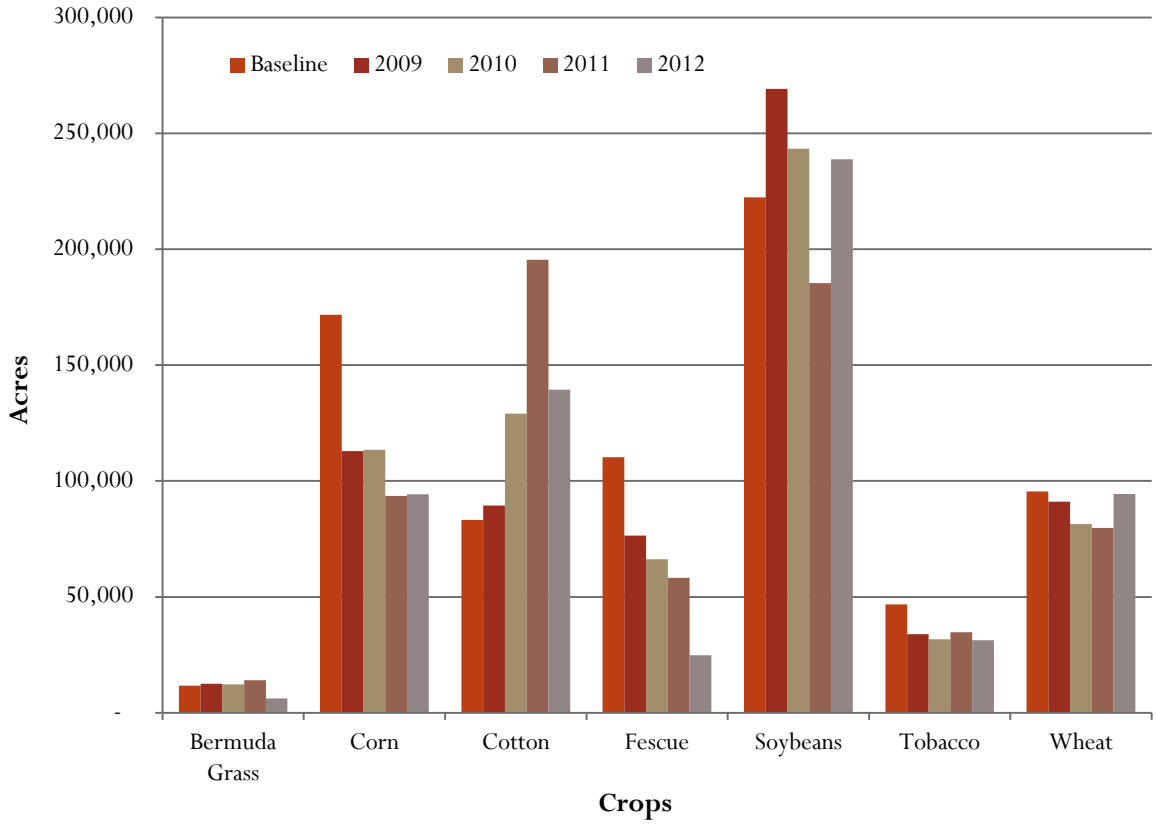


Cropping Shifts

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, tobacco, and wheat – have remained relatively stable, others show more volatility. In CY2012, cotton acreage reduced to a more typical amount, and soybeans increased to a normal level. From CY2009 to CY-2012, fescue has lost significant acreages. A host of factors from individual to global determine crop choices.

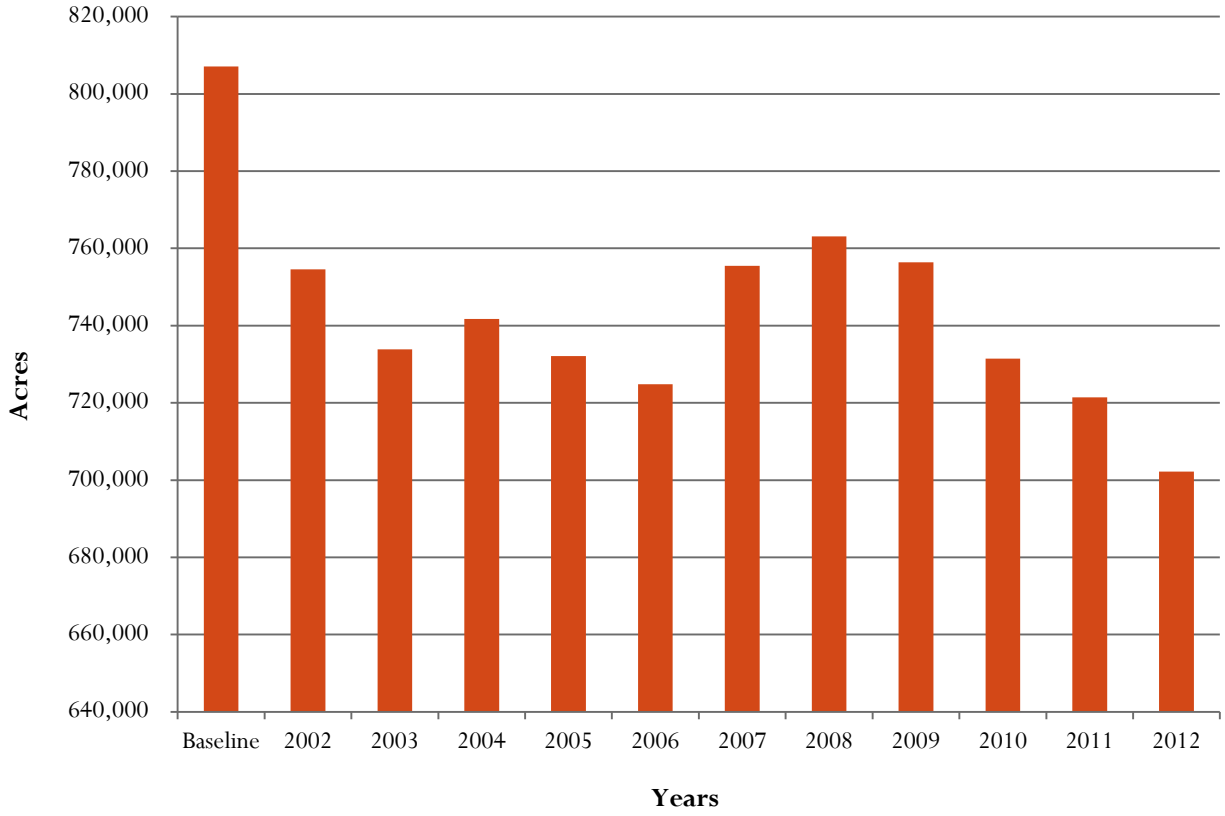
Figure 4. Acreage of Major Crops for the Baseline (1991) and 2009-2012, Tar-Pamlico River Basin



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 11,464 acres have been permanently lost to development in the basin and more than 42,330 acres have been converted to grass or trees since the 1991 baseline. For CY2012 it is estimated that there are approximately 37,124 idle acres and a total of 702,227 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 2002-2012



Phosphorus

Phosphorus Indicators for CY2012: 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 CY2009 through CY2012. Most of the parameters indicate less risk of phosphorus loss than in the baseline.

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.

Contributing to the reduced risk of phosphorus loss is the increase of nutrient reducing BMPs in the basin. As indicated in Table 6, 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 6 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.

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 2009	CY 2010	CY 2011	CY 2012	'91 - '12 Change	CY2012 P Loss Risk +/-
Agricultural land	Acres	FSA	807,026	756,365	731,408	721,432	702,227	-13%	-
Cropland conversion (to grass & trees)	Acres	USDA-NRCS & NCACSP	660	31,168	31,596	31,631	42,330	6314%	-
CRP / WRP (cumulative)	Acres	USDA-NRCS	19,241	38,967	41,833	41,833	41,833	117%	-
Conservation Tillage (cumulative)	Acres	USDA-NRCS & NCACSP	41,415	33,905*	35,946	40,612	46,808	13.02%	-
Vegetated buffers (cumulative)	Acres	USDA-NRCS & NCACSP	50,836	211,360	215,606	227,528	212,212	317%	-
Water control structures (cumulative)	Acres Affected	USDA-NRCS & NCACSP	52,984	81,348	82,844	84,442	88,755	68%	-
Scavenger crop	Acres	LAC	13,272	92,376	108,888	86,283	73,177	451%	-
Animal waste P	lbs of P/ yr	NC Ag Statistics	13,597,734	14,608,377**	15,202,037	16,695,543	16,561,052	22%	+
Soil test P median	mg/kg	NCDA&CS	83	84	86	87	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 reporting protocol of the National Agricultural Statistics Service some of the numbers were not available for 2009. The additional numbers were derived from the NCDA&CS Emergency Program and the Division of Water Resources.*

Based on the 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 improve rule implementation, relying heavily on the basin technicians to work with the LACs and farmers.

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 been reviewing 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. Any recommended changes from the NLEW committee will be incorporated into nutrient accounting in future crop years.

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.

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)

Funding is an integral part in the success of this strategy. Without funding for the technicians, the annual progress reports would fall on the LACs without assistance to compile data and annual reports. In addition, technicians are needed for BMP installation. 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 Division of Soil and Water Conservation no longer has the resources available to synthesize county level data for this report, thus putting the development of future annual reports in jeopardy. This reporting is required by the rules, therefore funding is essential for compliance.