Annual Progress Report on the Tar-Pamlico Agricultural Rule (15 A NCAC 02B.0256) A Report to the NC Environmental Management Commission From the Tar-Pamlico Basin Oversight Committee Crop Year 2010

Summary

The Tar-Pamlico Basin Oversight Committee (BOC) received and approved crop year (CY) 2010 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 Agriculture Rule and estimates further progress in decreasing nutrient losses. In CY2010, agriculture collectively achieved an estimated 52% reduction in nitrogen loss compared to the 1991 baseline, continuing to exceed the rule-mandated 30% reduction. This represents a 2% greater reduction compared to the 50% reduction reported in CY2009 as a result of best management practice (BMP) implementation and cropping shifts. All fourteen LACs 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 34% nitrogen loss reduction, and 10 of 14 LACs exceeded the 30% individually. Collective reductions have gradually increased in succeeding years, and by CY2007 only one LAC was shy of the 30% individually. In CY2008 all LACs exceeded the 30% nitrogen loss reduction goal and have continued to meet the goal in CY2010.

Scope of Report

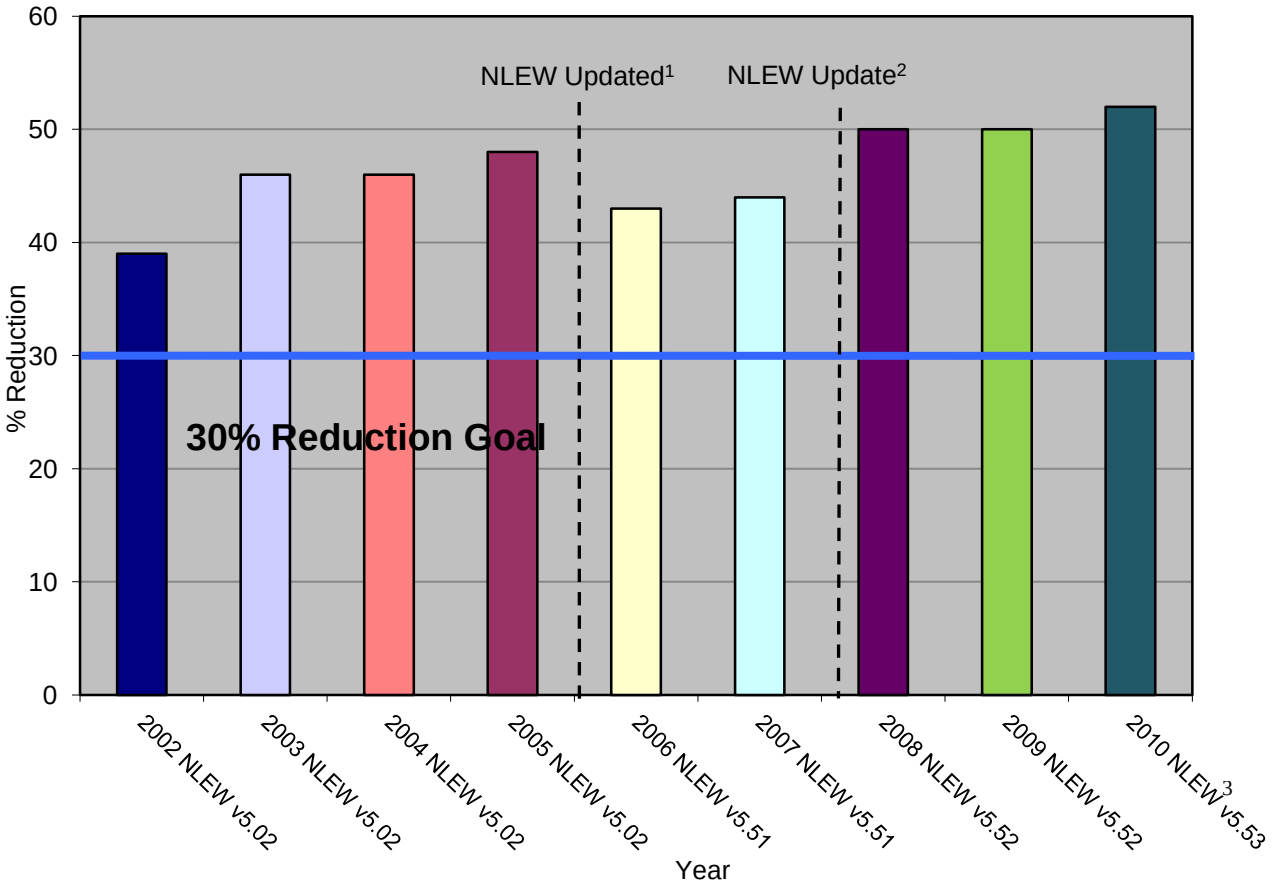
The estimates provided in this report represent whole-county scale calculations of nitrogen loss from cropland agriculture in the basin made by soil and water conservation district technicians using the 'aggregate' version of the Nitrogen Loss Estimation Worksheet, or NLEW, an accounting tool developed to meet the specifications of the Neuse Rule. The development team included interagency technical representatives of the NC Division of Water Quality (DWQ), 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 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.

Effect of NLEW Refinements on Annual Estimates

As noted figure 1, the NLEW software was 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 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 significant effects 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 2002 to 2010.

Figure 1. Collective Nitrogen Loss Reduction Percent 2002 to 2010, 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 updated to add a password to the buffer table.

The first revision 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 and

third revisions were minor software updates; the baseline was not recalculated because the effect on the percent nitrogen loss reduction was insignificant.

Current Status
Nitrogen Reduction from Baseline for CY2010

All fourteen LACs submitted their eighth annual report to the BOC in September 2011. For the entire basin, in CY2010 agriculture achieved a 52% reduction in nitrogen loss compared to the 1991 baseline. This is a 2% greater reduction as compared to the 50% nitrogen loss reduction in CY2009 resulting from BMP implementation and cropping shifts. This year all of the LACs achieved at least the 30% nitrogen loss reduction goal individually. Table 1 lists each county's baseline, CY2009 and CY2010 nitrogen (lbs/yr) loss values, along with nitrogen loss percent reductions from the baseline in CY2009 and CY2010.

Table 1. Estimated Reductions in Agricultural Nitrogen Loss from Baseline (1991) for CY2010 (NLEW v5.52) and CY2010 (NLEW v5.53), Tar-Pamlico River Basin

County	Baseline N Loss (lb)* NLEW v5.51	CY2009 N Loss (lb)* NLEW v5.52	2009 Reported N Loss (%) NLEW v5.52	CY2010 N Loss (lb)* NLEW v5.53	2010 Reported N Loss (%) NLEW v5.53
Beaufort	8,811,875	4,944,627	44%	5,081,141	42%
Edgecombe	5,103,502	3,332,444	35%	3,053,849	40%
Franklin	1,993,925	639,206	68%	556,448	72%
Granville	971,365	344,791	65%	418,580	57%
Halifax	2,819,301	1,449,612	49%	1,634,622	42%
Hyde	4,861,387	2,850,975	41%	2,822,212	42%
Martin	825,278	485,331	41%	470,744	43%
Nash	4,658,164	1,488,684	68%	1,640,068	65%
Person	168,038	82,829	51%	38,208	77%
Pitt	5,966,245	2,650,499	56%	1,946,405	67%
Vance	449,753	107,094	76%	123,570	73%
Warren	610,045	116,501	81%	146,126	76%
Washington	898,346	487,115	46%	548,183	39%
Wilson	780,741	379,478	51%	386,832	50%
Total	38,917,965	19,359,186	50%	18,866,988	52%

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 the combination of fertilization rate decreases, cropping shifts, BMP implementation and cropland attenuation shown in Table 2. 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 2. Factors that Influence Nitrogen Reduction by Percentage on Agricultural Lands, Tar-Pamlico River Basin

	CY2007 NLEW V5.51	CY2008 NLEW V5.52	CY2009 NLEW V5.52	CY2010 NLEW V5.53
BMP implementation	10%	10%	11%	12%
Fertilization Management	20%	21%	20%	20%
Cropping shifts	8%	10%	11%	13%
Reduction in cropland due to idle land	3%	4%	3.5%	3%
Reduction in cropland due to cropland conversion	2%	4%	3.5%	3%
Reduction in cropland due to development	1%	1%	1%	1%
TOTAL	**44%**	**50%**	**50%**	**52%**

BMP Implementation

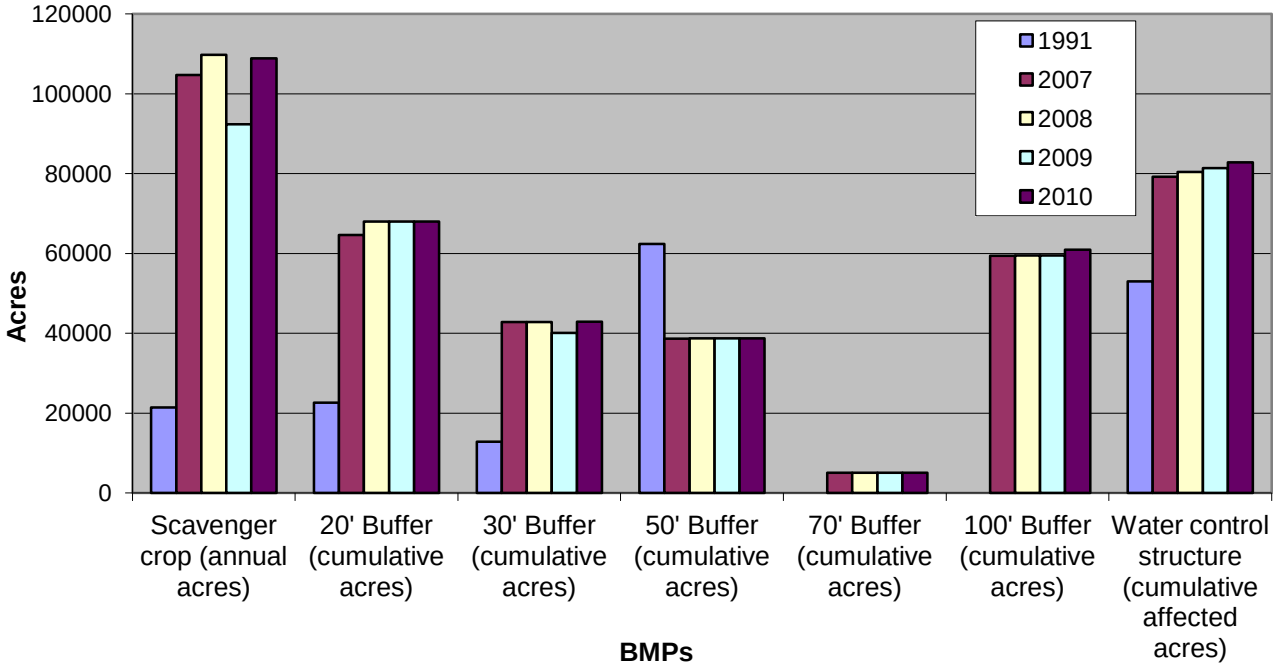
As illustrated in Figure 2, CY2010 yielded net increases in acres affected by water control structures, nutrient scavenger crops and 30' and 100' buffers, while acres of 20', 50' and 70' buffers held steady. The increase in water control structures & buffers were due to newly installed BMPs. A total of 13 water control structures effecting 1,496 acres were installed in CY2010. Approximately, 2,744 acres of 30' buffers and 1,502 acres of 100' buffers were added in CY2010.

In CY2007 it became possible to search the USDA-Natural Resources Conservation Service (NRCS) database in addition to the NCACSP database for BMPs installed by hydrologic unit code. This allowed for better accounting for practices installed using federal cost share programs. 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 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 total 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 From Baseline (1991) to 2007-2010, 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 3 identifies BMPs not accounted for in NLEW and tracks their implementation in the Basin since CY2005.

Increased implementation numbers are evident in CY2010 across all BMP types with the exception of sod-based rotation. Several practices increased in CY2010 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 the Agricultural Drought Response Program. The Soil and Water Conservation Commission earmarked a portion of the ACSP toward this project, and the Division 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 any applicant receiving funds for wells or ponds for pasture-based livestock watering to exclude livestock from streams and ponds. This resulted in a significant increase in BMP implementation to protect streams.

Table 3: Nutrient-Reducing Best Management Practices Not Accounted for In NLEW, 2007-2010, Tar-Pamlico River Basin*

	Units	2001	2007	2008	2009	2010
Diversion	Feet	176,797	359,656	388,920	389,861	390,046
Fencing (USDA Programs)	Feet	na	na	129,498	205,959	206,190
Field Border	Acres	118	420	471	539	934
Grassed Waterway	Acres	314	595	639	646	1,115
Livestock Exclusion	Feet	21,662	87,804	217,302	217,302	221,088
Sod Based Rotation	Acres	1,337	6,783	17,847	16,724	26,504
Conservation Tillage	Acres	936	23,568	31,421	33,905	35,946
Terraces	Feet	206,560	350,686	352,819	368,914	368,914

*Values represent active contracts in State and Federal cost share programs. The federal information was not included prior to CY2007.

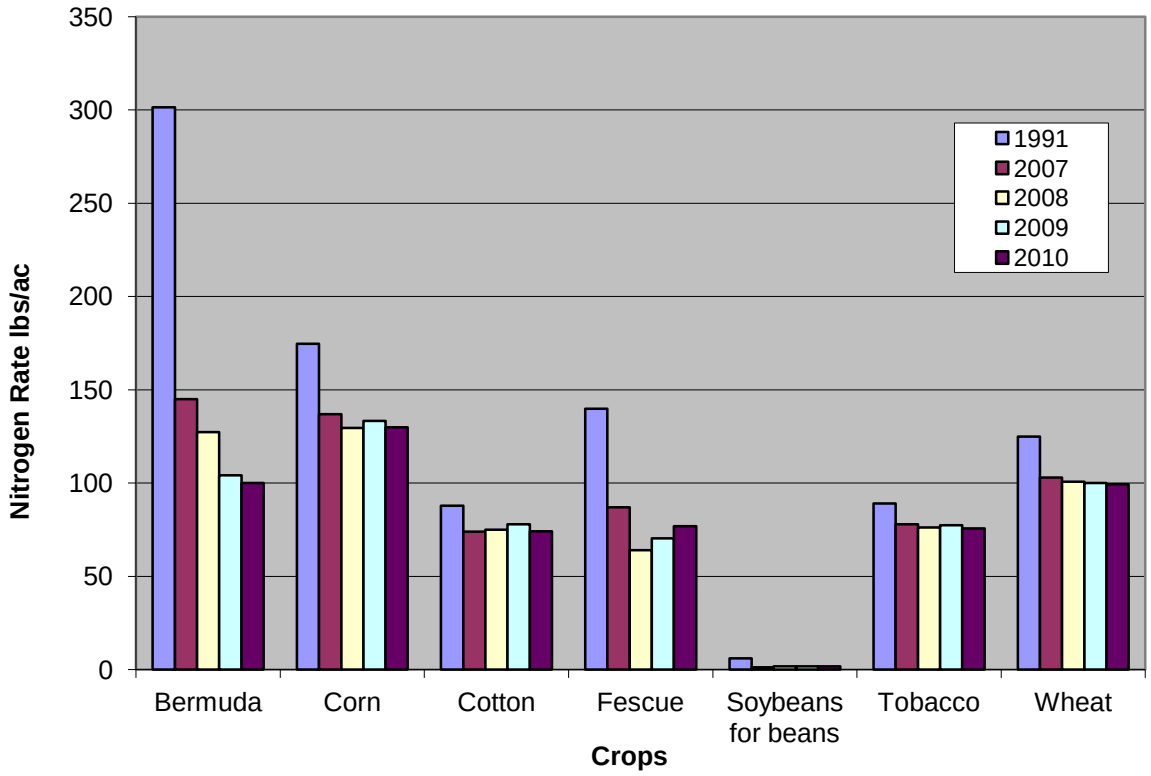
Fertilization Management

Both increased fertilizer cost and better nutrient management has 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 CY2010 nitrogen rates increased for fescue compared to CY2009, the rates for cotton, bermuda, corn, tobacco slightly decreased, while the rates for soybeans and wheat remained constant. Most pastures are under fertilized throughout the Tar-Pamlico basin. Some bermuda and fescue land is used for waste application, but due to the nitrogen concentrations of the waste and the amount of liquid being limited, actual waste applied does not have nitrogen applications 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

- Rising fertilizer costs and dwindling 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 Agricultural Crops for the Baseline (1991) and 2007-2010, Tar-Pamlico River Basin

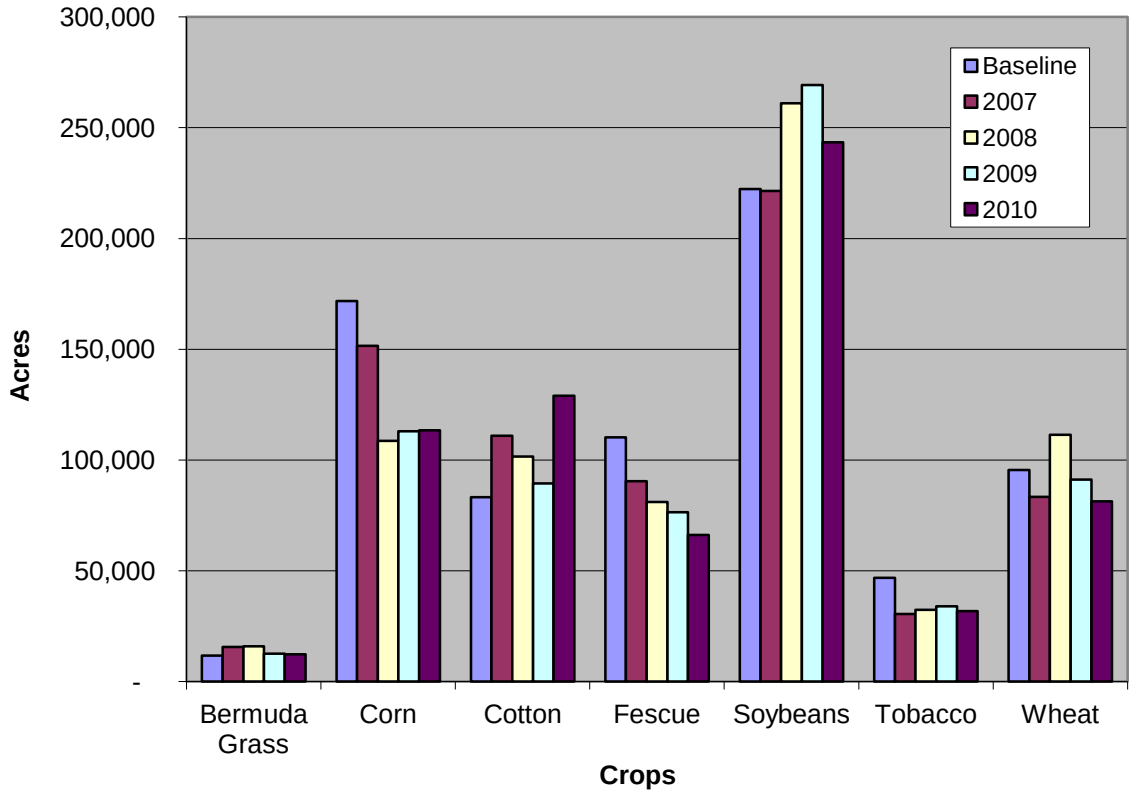


Cropping Shifts

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 and tobacco – have remained relatively stable, others show more volatility. Between CY2009 and CY2010, cotton showed the largest increase in acres while soybeans lost significant acreages. 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. Crop acreages are expected to fluctuate with the market yearly.

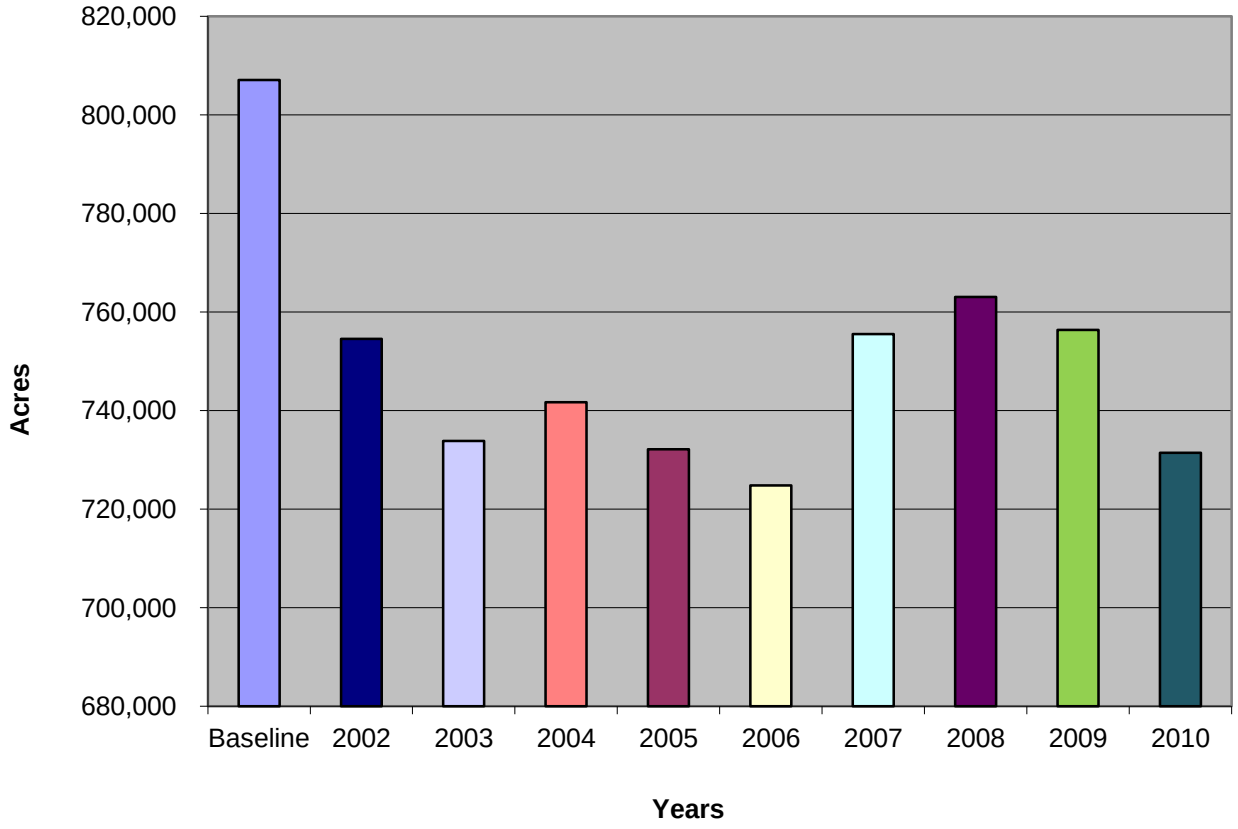
Figure 4. Acreage of Major Crops for the Baseline (1991) and 2007-2010, Tar-Pamlico River Basin



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 agronomic practices such as double cropping, 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 10,370 acres have been permanently lost to development and more than 31,500 acres have been converted to grass or trees since the baseline. For CY2010 it is estimated that there are approximately 30,500 idle acres and a total of 731,408 acres of cropland. These estimates come from the LAC members' best professional judgment, USDA-FSA records and county planning department data.

Figure 5. Total Planted Cropland Acres in the Tar-Pamlico River Basin, Baseline (1991) and 2002-2010



Phosphorus

Phosphorus Indicators for CY2010: The qualitative indicators included in Table 4 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. Table 4 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 CY2007 through CY2010. 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 4, the acres affected in the basin by vegetated buffers and water control structures have steadily increased over the past three years. It should also be noted that the soil test phosphorus median

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.

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 4 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 4. 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	2007	2008	2009	2010	91-10 % Change	2010 P Loss Risk +/-
Agricultural land	Acres	FSA	807,026	755,489	763,066	756,365	731,408	-9.37%	-
Cropland conversion (to grass & trees)	Acres	USDA-NRCS & NCACSP	660	20,754	31,110	31,168	31,596	5,156%	-
CRP / WRP (cumulative)	Acres	USDA-NRCS	19,241	34,614	38,375	38,967	41,833	117%	-
Conservation tillage	Acres	USDA-NRCS & NCACSP	41,415	66,079	31,421*	33,905*	35,946*	-13%*	-
Vegetated buffers (cumulative)	Acres	USDA-NRCS & NCACSP	50,836	210,488	214,043	211,360	215,606	324%	-
Water control structures (cumulative)	Acres Affected	USDA-NRCS & NCACSP	52,984	79,167	80,418	81,348	82,844	56%	-
Scavenger crop	Acres	LAC	13,272	120,565	109,741	92,376	108,888	720%	-
Animal waste P	lbs of P/ yr	NC Ag Statsics	13,597,734	14,626,960	14,560,934**	14,608,377**	15,202,037	12%	+
Soil test P median	mg/kg	NCDA&CS	83	89	89	84	86	3.6%	+

* 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. This represents only contracted acres, farmers are only able to contract acres once up to a set cap, but most continue the practice conservation tillage.
** 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 Quality.

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 will explore options for better conservation tillage tracking with the LACs and to receive PTAC approval. 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.

Rose Acres Farms

Rose Acre Farms received permit approval for 14 laying houses and 3 pullet houses with a total capacity of 4 million layers and 750,000 pullets in 2004. The facility has a current population of around 3.3 million layers and 600,000 pullets according to the April 2011 NCDWQ permit inspection. Since this facility was permitted after the baseline was established for the Tar Pamlico Nutrient Sensitive Waters Strategy and its proximity to the Pocosin Lakes National Wildlife Refuge (PLNWR), special studies were conducted by NCDWQ and the U.S. Fish and Wildlife Service (USFWS).

The results from the complete 5 year NCDWQ water quality study indicate higher nutrient concentrations after it became operational in 2006. The preliminary results of the USFWS-PLNWR investigation indicates increasing trends of wet and dry deposition of nitrogen indicative of local sources of emissions. The final report for the PLNWR study is expected in late 2011.

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 land based sources and uses as was recommended by the 2004 NPDES permit application Hearing Officers Report. These reviews may lead to recommendations in the future annual reports.

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.

Since 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.

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 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.

Recently, there has been an increased interest in the basin to use farms for renewable energy. Farms for both wind and solar energy production are in the initial planning stages and there has been increased interest in crops for biofuel generation as well. The effects on nutrient runoff are likely to depend on how total cropland acreage and total fertilizer inputs change. The BOC will continue to monitor the effects of renewable

energy generation on agriculture in the Tar-Pamlico basin as information becomes available.

Funding is an integral part in the success of this strategy. 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.