Annual Progress Report on Tar-Pamlico Agriculture Rule

A Report to the Water Quality Committee of the NC Environmental Management Commission from the Tar-Pamlico Basin Oversight Committee
Crop Year 2007

Summary
The Tar-Pamlico Basin Oversight Committee (BOC) received and approved the crop year (CY) 2007 annual reports estimating progress from the fourteen Local Advisory Committees (LACs) operating under the Tar-Pamlico Agriculture Rule as part of the Tar-Pamlico Basin nutrient strategy. Agriculture achieved an estimated 44% reduction in nitrogen loss basinwide compared to the 1991 baseline, which exceeds the rule-mandated 30% reduction. This represents a one percent increase in nitrogen loss reduction compared to the 43% nitrogen loss reduction reported in CY 2006. The contribution of fertilization management and the installation of best management practices (BMPs) are significant factors in the reported reduction. Because individual farmer's decisions on crop rotations are susceptible to yearly economic pressures, all LACs will continue to increase BMP implementation, ensure BMP maintenance, improve tracking, and monitor cropping changes. The local technician positions have been instrumental in providing information for this report, and will continue to play key roles in further implementation.

Rule History
In 2000, the non-point source section of the Tar-Pamlico nutrient strategy became regulatory with the adoption of rules by the Environmental Management Commission (EMC) addressing agriculture, urban stormwater, nutrient management, and riparian buffer protection. This rulemaking built on the precedent-setting Neuse effort three years earlier, which for the first time set regulatory reduction measures for nutrients on cropland acres in the state. The agriculture rule supports the overall goals of the Tar-Pamlico nutrient strategy to reduce nitrogen loading to the Pamlico estuary by 30% from 1991 levels and to limit phosphorus loading to 1991 levels.

Rule Requirements
Effective in September 2001, the Agriculture Rule requires a collective 30% reduction in nitrogen loading from the baseline year of 1991 by basin agricultural operations within five years (September 2006). Local Advisory Committees (LACs) were given two years to develop nitrogen strategies and report them to the Basin Oversight Committee (BOC). Phosphorus strategies shall be required to meet the "no increase" phosphorus goal within four years of November 2006 when the EMC approved a phosphorus accounting methodology.

The BOC is composed of ten individuals appointed by the Secretary of the Department of Environment and Natural Resources and representing a cross-section of agricultural, environmental, scientific, and water quality interests. Responsibilities of the BOC include

developing methods to track and account for nitrogen and phosphorus reductions, approving local reduction strategies, and presenting annual progress reports to the EMC.

Each of the fourteen county-level LACs is comprised of ten to fifteen individuals representing local agricultural agencies and farmers. The agencies include the Division of Soil and Water Conservation, North Carolina Department of Agriculture and Consumer Services, Natural Resources Conservation Service, North Carolina State University Cooperative Extension Service, and the Soil and Water Conservation Districts. Responsibilities of LACs include conducting farmer registration, developing local nitrogen and phosphorus strategies, providing annual progress reports, and ensuring maintenance of the goals once reached.

The LACs calculate the numbers that are included in their county reports by using a variety of resources. To determine cropland acreage, LACs utilize data from the Farm Service Agency, Agricultural Statistics Service, and local agencies' professional estimates. To obtain fertilizer application rates, LACs use data from commercial applicators, farmer surveys, and local agencies professional estimates. BMP data was collected from state and federal cost share programs. 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.

Implementation Resources

In 2002, the Division of Water Quality (DWQ) and DSWC staff obtained an EPA 319 grant for the partial funding of six new technician positions. Combining these resources with those remaining in the Neuse basin yielded a total of 8.5 positions covering all or portions of twenty-four counties. Currently 6.5 of these positions remain, funded by EPA 319 and technical assistance funds from the North Carolina Ag Cost Share funds. The technicians are instrumental in collecting and processing information for the annual reports. They will continue to play key roles in ongoing implementation. In 2003, the Division of Soil and Water Conservation also obtained a 319 grant for $500,000 to augment BMP cost share in the Tar-Pamlico Basin, and the technicians just completed work to implement BMPs with those funds in April of 2007.

Current Status

Nitrogen Reduction from the Baseline in CY 2007: CY 2007 marks the sixth annual report and covers implementation from 1992-2007. The BOC reported in CY 2006 that all but one county exceeded the individual 30% reduction goal, with a basinwide aggregate 43% reduction in nitrogen loss. Beaufort county achieved a 28% reduction due to a more than 10,000 acre increase in corn this year. With the aggregate 44% reduction reported for CY 2007, again all but one of the fourteen counties achieved a reduction equal to or greater than 30%. Table 1 provides nitrogen loss reductions by county and for the basin. The values in Table 1 represent the baseline, 2006 and 2007.

Table 1: Estimated Reductions in Agricultural Nitrogen Loss from Baseline for 2006, Tar-Pamlico River Basin

County	Baseline N Loss (lb)* NLEW v5.51	2006 N Loss (lb)* NLEW v5.51	2006 N Loss (%) NLEW v5.51	2007 N Loss (lb)* NLEW v5.51	2007 N Loss (%) NLEW v5.51
Beaufort	8,811,875	6,078,187	31%	6,370,998	***28%***
Edgecombe	5,103,502	3,599,230	***29%***	3,494,161	32%
Franklin	1,993,925	956,149	52%	689,289	65%
Granville	971,365	463,607	52%	496,216	49%
Halifax	2,819,301	1,521,569	46%	1,324,212	53%
Hyde	4,861,387	2,685,300	45%	2,614,856	46%
Martin	825,278	507,566	39%	503,767	39%
Nash	4,658,164	2,238,956	52%	1,876,285	60%
Person	168,038	84,125	50%	102,961	39%
Pitt	5,966,245	2,802,859	53%	3,079,246	48%
Vance	449,753	92,110	80%	83,120	82%
Warren	610,045	300,932	51%	238,376	61%
Washington	898,346	599,250	33%	545,619	39%
Wilson	780,741	381,272	51%	464,705	40%
Total	38,917,965	22,311,112	43%	21,883,811	44%

Bold italic = Loss reductions less than 30%.
*Nitrogen loss values are for comparative purposes. They represent fertilizer that was applied to agricultural lands in the basin and neither used by crops nor intercepted by BMPs at the edge of the management unit, based on NLEW calculations. This is not an in stream loading value.

Beaufort and Edgecombe counties, which are near their 30% reductions, will work to improve their reductions in upcoming years by promoting BMP implementation and fertilizer management. The Division of Soil and Water Conservation, Local Advisory Committees and technicians will lead an initiative to encourage more active participation and discussion on how to obtain further nutrient reductions by LACs during the next year.

Nitrogen loss reductions from agricultural land were achieved through a combination of fertilization rate decreases, cropping shifts, BMP implementation, and reduction in cropland acreage. The LACs revised nitrogen rates for CY 2007 reflecting the changes due to the impacts of the drought and crop loss. The values in Table 2 are based on NLEW version 5.02 results for 2003-2005, and these values can be used for comparisons among the years. The values for 2006-2007 are based on NLEW version 5.51, and therefore should not be compared to previous years in the table due to changes made in the software described above. Comparisons can be made between years with the same NLEW version. Staff estimates that these factors contributed in the following proportions:

Table 2: Nitrogen Reductions from the Baseline (1991) Level on Agricultural Lands, Tar-Pamlico River Basin

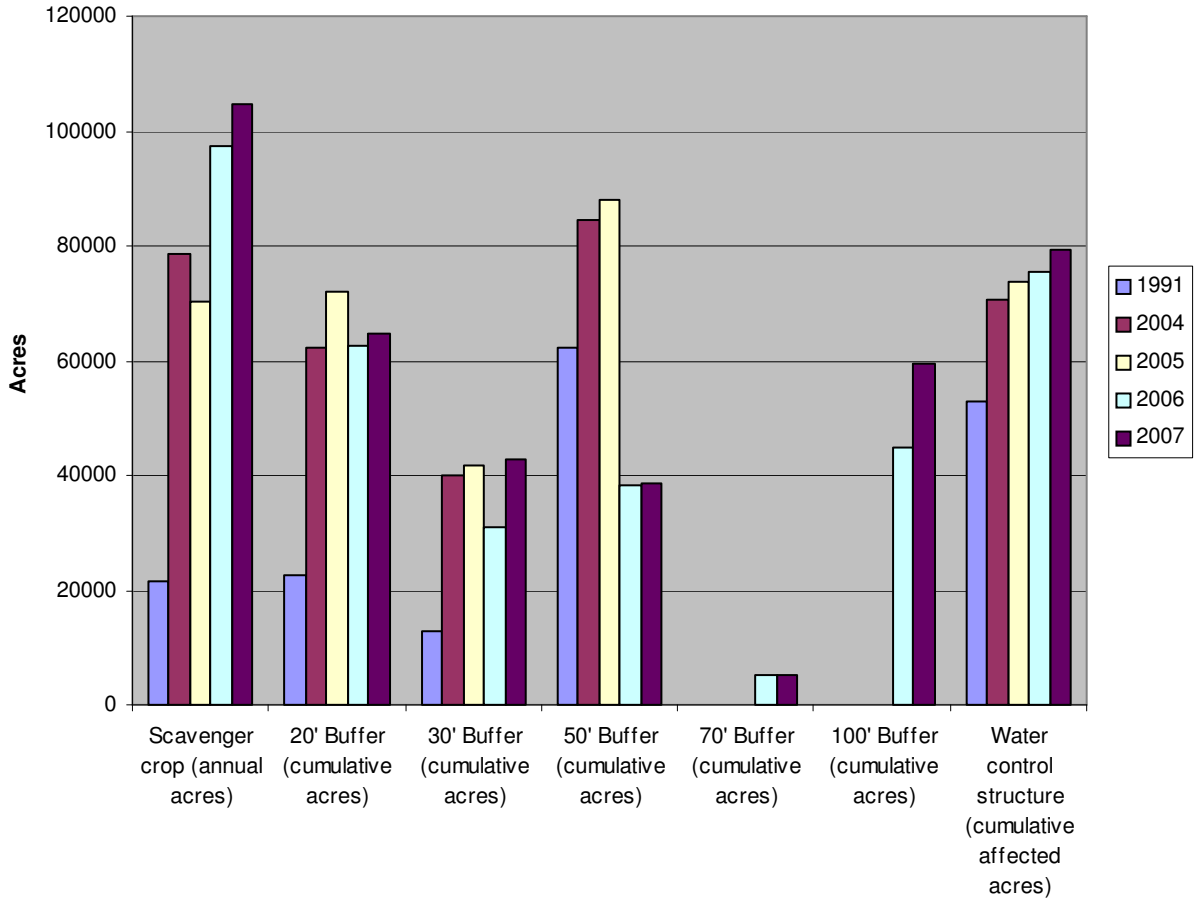
	2004 NLEW v5.02	2005 NLEW v5.02	2006 NLEW v5.51	2007 NLEW V5.51
BMP implementation	6.0%	10%	8%	10%
Fertilization Management	23%	21%	20%	20%
Cropping shifts	11%	10%	7%	8%
Reduction in cropland due to idle land	%	%	4%	3%
Reduction in cropland due to cropland conversion	%	%	3%	2%
Reduction in cropland due to development	%	%	1%	1%
TOTAL	**46%**	**48%**	**43%**	**44%**

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

BMP Implementation

In CY 2007, BMP implementation was the second most influential factor affecting nitrogen loss in the basin. Since 1991, the number of BMPs installed in the basin has steadily increased. The overall nitrogen loss reduction in the basin attributed to the use of BMPs is estimated to be 10% of the total 44% reduction. In CY 2006 NLEW version 5.51 accounts for additional widths of buffers, so there was some shifting of acres of buffers based on the previously reported widths. Previous years buffer data was not collected by widths greater than 50 feet. CY 2006 forward are the only years graphed under the 70 and 100 feet buffer widths in Figure 1. There was not significant decrease of the 50 feet wide buffers in 2006; these buffers were just separated into additional categories to reflect those with wider widths. The CY 2007 report contains previously unaccounted for buffers, the significant increase in some buffer widths were not acres installed only in CY 2007, but were acres installed since the baseline period. Figure 3 below illustrates the extent of BMP implementation from the NC Ag Cost Share Program (NCACSP) and federal cost share programs. Much of this was accomplished with assistance from cost share programs. It is important to recognize that cost share programs involve significant expenses to basin farmers, and many farmers also implement practices without cost share assistance. Currently there is not a way to quantify BMPs installed without program assistance, these are not included in the BMP data in Figure 1. The BOC recognizes farmers for their efforts, and hopes to better quantify BMP implementation outside of state and federal programs in future annual reports.

Figure 1. BMPs Installed in the Tar-Pamlico River Basin, 1991-2007



*Non-Credit BMPs: C*ertain practices on the landscape provide nitrogen reduction benefits that are difficult to quantify and that are not included in the estimates provided here. Such practices in Tar-Pamlico counties since 1991 include:

- A reduction in the number of confined animal operations in some counties.
- Closure of abandoned lagoons following shutdown of animal operations.
- For some animal operations, compliance with DWQ's non-discharge regulations involved removal of direct discharges to surface waters.
- Dry stack waste storage facilities installed for poultry litter through state and federal cost share programs.

In addition, many BMPs are not recognized for substantial nitrogen benefits but clearly reduce phosphorus and erosion losses and benefit water quality in other ways. Table 3 lists these other types of BMPs installed from 1992 to 2007 from NCACSP and federal cost share programs. Units of BMPs reported in this table are the actual BMP acreage or corresponding unit of measurement, not the acreage treated by these BMPs.

Table 3. Additional, Non-N Credit, BMPs Installed 1992 – 2007 (cumulative), Tar-Pamlico Basin

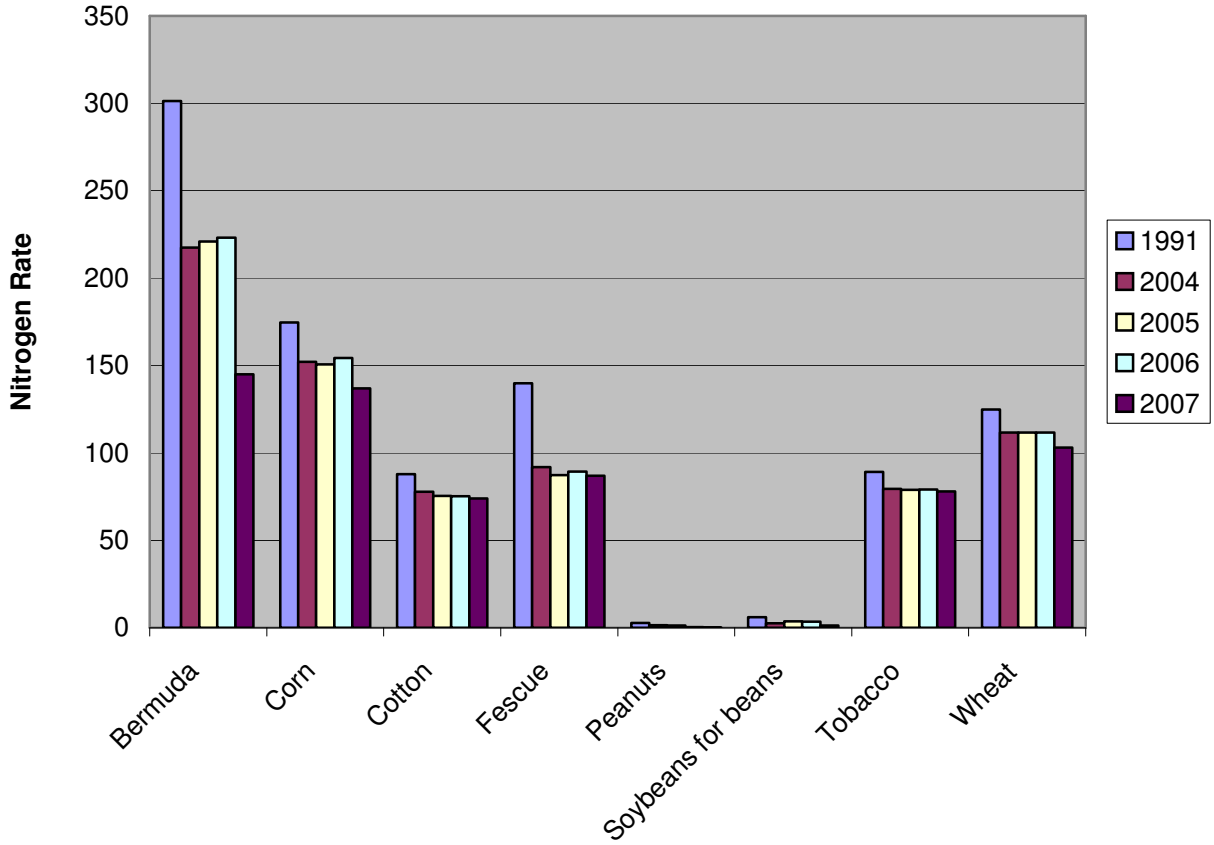
BMP	Units	2004	2005	2006	2007
Conservation tillage	Acres	70,341	70,291	29,021*	24,120*
Conservation tillage 3 Yr.	Acres	17,446	18,893	18,095	18,391
Diversion	Feet	338,800	349,956	350,456	359,656
Field border	Acres	301	259	270	420
Grassed waterway	Acres	526	448	553	595
Livestock exclusion	Feet	62,858	62,858	80,589	87,804
Long term no-till	Acres	3,881	3,935	4,107	23,568
Sod based rotation	Acres	3,149	3,686	4,051	6,783
Strip cropping	Acres	425	425	425	138
Terraces	Feet	444,394	444,394	444,394	350,686

* The acreage listed under conservation tillage category is decreasing, due to the removal of the annual conservation tillage best management practice from the NCACSP. However, many producers are continuing to use the conservation tillage practice through long term no-till contracts or without cost share assistance.

Fertilization Rate Decreases

Reductions in fertilizer application have played the greatest role in progress to date, comprising almost half of the total reduction. The most effective means of reducing nitrogen loss is through reduction of inputs and gains in use efficiencies. Increasing fertilizer costs and a growing understanding of optimum nutrient management have led to significant reductions in fertilization rates in the basin. Figure 2 illustrates how average nitrogen rates have decreased since the 1991 baseline. Original values were developed by the LACs and have been adjusted annually based on additional LAC input. The drought impacts and crop losses of CY 2007 significantly impacted nitrogen rates of some crops.

Figure 2. Acreage-Weighted Average Nitrogen Fertilization Rates by Crop, 1991-2007, Tar-Pamlico River Basin



Factors identified by LACs as contributing to reduced nitrogen rates include the following:

- Farmers face rising fertilizer costs and dwindling farm incomes.
- Agencies have responded with increasing education and outreach on nutrient management.
- Mandatory waste management plans have resulted in lower waste application rates.
- Changes in tobacco acreage due to federal government's tobacco quota buy-out
- Neuse and Tar-Pamlico agriculture rules.
- Recent drought reduced n-rate applications and timing on some crops.

In addition to the above factors contributing to the reduced nitrogen rates, it should also be noted that between January 2005 and December 2007, North Carolina Cooperative Extension staff held a total of twenty-one separate nutrient management training sessions throughout the Tar-Pamlico River Basin. Approximately two thousand farmers and fertilizer applicators attended these training sessions and received nutrient management training as required under the Tar-Pamlico Nutrient Management Rule (15A NCAC 2B.0257). Cooperative Extension staff plans to continue to hold a joint nutrient management training session annually to provide training to any new producers or applicators in the Tar-Pamlico and Neuse River Basins.

Cropping Shifts

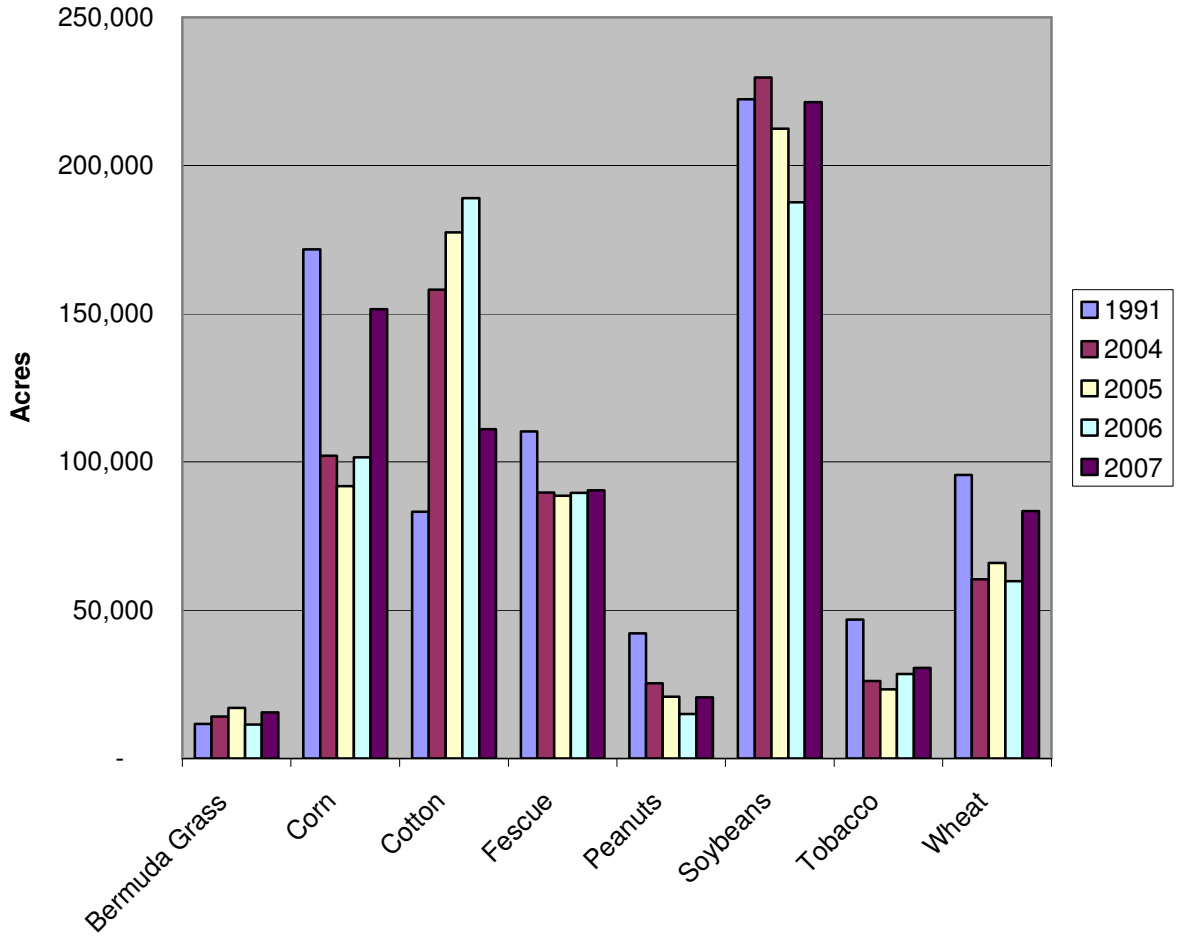
At 8% of the total 44% reduction, the overall effect from crop shifts is the third most influential factor affecting nitrogen loss in the basin in CY2007. Since different crops require different amounts of nitrogen and use applied nitrogen with different efficiencies, changes in the mix of crops grown affects nitrogen loss. A host of factors from individual to global influences determines crop choices.

The most significant crop shift affecting nitrogen loss after the baseline was a corn-to-cotton shift during the 1990's. During this period, corn decreased from 21% of all cropland in the basin to 12%, while cotton simultaneously increased from 10% of all cropland to 23%. Since cotton is fertilized at roughly half the nitrogen rate of corn (see figure 2) and both use nitrogen with similar efficiency, this yielded sizable decreases in basin nitrogen applied and lost by 2001.

Since 2001, the corn-to-cotton effect has partially reversed itself. However, a jump in soybean acres in 2003 contributed to an approximate 50% increase in the role of crop shift in the basin nitrogen loss reduction. This reduced the overall nitrogen loss in the basin, since soybeans receive little to no additional nitrogen, while almost all crops they replaced receive at least 80 pounds of nitrogen per acre.

In CY 2007, crops shifted again due to economic reasons, resulting in a 50,000-acre increase in corn (figure 3). However due to the significant BMP installation, the nitrogen reduction continues to remain well above the 30% mandated by the agriculture rule.

Figure 3. Acreage Changes of Major Crops, Tar-Pamlico River Basin, 1991-2007



The BOC anticipates that the basin will see additional crop shifts in upcoming years related to energy production, specifically for the creation of ethanol and biodiesel. The BOC will continue to monitor these types of crop shifts and their effect on nutrient loss reduction.

The Basin Oversight Committee believes that annual accounting will continue to reveal a degree of variability in nitrogen loss reduction in the basin over time. However, we also note that the business and science of agriculture are under perpetual change as a result of a great number of forces. These forces may include:

- Changes in world economies, energy or trade policies
- Government program changes, e.g. commodity supports or environmental regulations
- Weather – e.g., long periods of drought or rain, large-scale meteorological events
- Plant diseases or pest problems such as exotic pests or viruses
- Technology - new crops brought into production or changes in how crops are grown as a result of research and development

- Effects of other land uses
  - closing of an animal processing plant results in nearby contract growers depopulating houses and shifting crops and nutrient sources
  - large grain grower renting local farms moves to other crops or decreases farmed acreage as rental lands sell to development
  - new industries which may increase the demand for corn and soy crops
  - loss of agricultural land as the basin becomes more developed
- Age of farmer, i.e., approaching retirement farmer may move from row crop to cattle

Idle Land, Cropland Conversion and Land Use Changed to Development

In previous reports the idle land, cropland conversion and cropland lost to development had been combined into one percentage. The BOC felt it was important to distinguish each of these factors separately. Idle land is farm land not currently in production. This land 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.

Phosphorus

Technical Assistance Committee (PTAC) Findings: The Phosphorus Technical Assistance Committee'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."[1] 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.

In addressing the question of whether basin agricultural phosphorus losses have increased since 1991, the committee found that, "Although we cannot know with absolute certainty, we would conclude from this relative change assessment that no substantial increases in phosphorus loading from agricultural activities have occurred in the Tar-Pamlico River Basin relative to 1991 levels."(Johnson & Osmond 2005) Recognizing uncertainties associated with all metrics, the two primary measures of phosphorus inputs to the basin – crop acres and animal waste phosphorus – showed decreases and small increases, respectively. The main measure of residual phosphorus – soil P content – showed an increase through 1995 followed by a decrease through 2003. The amount of BMP implementation showed great increases in phosphorus

[1] Johnson, Amy M; Deanna L. Osmond. 2005. Accounting Method for Tracking Relative Changes in Agricultural Phosphorus Loading to the Tar-Pamlico River. Phosphorus Technical Advisory Committee, David Hardy, NCDA&CS; Rich Gannon & Keith Larick, NCDENR-DWQ; Steve Coffey, Vernon Cox & Natalie Jones, NCDENR-DSWC; Anne Coan NC Farm Bureau Federation; Joe Rudek NC Environmental Defense; Amy Johnson, Gene Kamprath & Deanna Osmond, NCSU; Lane Price, USDA-NRCS.

capture/retention over the time period, supporting the belief that losses may have decreased in the basin.

Management Implications: For accounting purposes, the committee identified a set of qualitative indicators that can be compared in future years to the baseline year, for positive or negative trends. The committee did not feel it appropriate to utilize this set of indicators in a quantitative summation of trend, but rather to monitor for any gross changes in agricultural status that would merit further attention by the BOC and EMC.

Phosphorus Indicators for CY 2007: The qualitative indicators included in Table 4 below show the relative changes in land use and management parameters and their relative effect on phosphorus loss risk in the basin. This table 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 CY 2004, CY 2005, CY 2006 and CY 2007. Most of the parameters indicate less risk of phosphorus loss.

Contributing to the reduced risk of phosphorus loss is the increase of nutrient reducing BMPs in the basin. As indicated in the table below, 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 median phosphorus soil test number reported for the basin fluctuates each year due to the nature of how the data is collected and compiled. The soil test phosphorus numbers are voluntarily reported to NCDA&CS and the number of samples collected each year varies. The soil test results from the NCDA&CS database represent whole county data and have not been aggregated for 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 Basin

Parameter	Units	Source	1991 Baseline	2004	2005	2006	2007	91-06 % Change	2007 P Loss Risk +/-
Agricultural land	Acres	FSA	807,026	742,015	732,139	724,778	755,489	-6%	-
Cropland conversion (to grass & trees)	Acres	USDA-NRCS & NCACSP	660	20,744	22,369	23083	20754	3045%	-
CRP / WRP (cumulative)	Acres	USDA-NRCS	19,241	27,109	25,921	30,768	34,614	80%	-
Conservation tillage	Acres	USDA-NRCS & NCACSP	41,415	362,102	362,102	362,102	66,079	60%	-
Vegetated buffers (cumulative)	Acres	USDA-NRCS & NCACSP	50,836	180,279	193,867	195,673	210,488	314%	-
Water control structures (cumulative)	Acres Affected	USDA-NRCS & NCACSP	52,984	71,204	75,980	75,641	79,167	49%	-
Scavenger crop	Acres	LAC	13,272	75,078	80,604	97,405	120,565	808%	-
Animal waste P	lbs of P/ yr	NC Ag Statsics	13,597,734	14,473,020	14,064,368	14,728,831	14,626,960	8%	+
Soil test P median	mg/kg	NCDA&CS	83	87	85	85	89	7%	+

Based on the PTAC's findings, the BOC recommended 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. With this expectation in mind, we feel reasonably confident that phosphorus losses will continue to improve over time.

Looking Forward

The BOC will continue to improve rule implementation, relying heavily on the basin technicians to work with the LACs and farmers. The BOC is focusing on a number of issues, including improving accounting of cropland acres that are converted to urban development.

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.

As discussed in the reduction in cropland acreage section above, the BOC plans to improve the estimation of each of the factors contributing to overall crop acreage decrease in future annual reports. The BOC, through the efforts of the LACs, also hopes to quantify the extent of unassisted BMP implementation in future years.

In large measure, the success of this program hinges on funding from various sources for BMP cost share, technical assistance to farmers, outreach information, development of accounting processes, and agency/technician positions to carry out these activities. Progress achieved to date has largely come through extensive efforts by existing agencies to provide & support outreach, technical assistance and existing cost share programs to their producers.

The BOC will also continue to examine the influence the 2008 Farm Bill as well as current federal litigation will have on data access from the Farm Service Agency (FSA). Currently with the 10 acres per tract minimum in the 2008 Farm Bill, it would eliminate many smaller tracts from reporting their crops. This change could amount to significant acreages that would not be reported. Also, recent federal litigation prohibits the FSA from releasing crop information. We are currently working with FSA state personnel to obtain CY 2008 reports in compliance with the restraints imposed by the federal litigation and court decisions.

In the summer of 2007, the Division of Water Quality concluded benthic data collection for the next Tar-Pamlico River Basinwide Water Quality Plan. The Basin Oversight Committee, the Division of Soil and Water Conservation and the local Soil and Water Conservation Districts will assist the Division of Water Quality as they draft the Tar-Pamlico River Basinwide Water Quality Plan in the next two years.