



# Cost and Benefits of Best Management Practices to Control Nitrogen in the Upper and Middle Coastal Plain

## Introduction

State regulations require the agricultural community to reduce nitrogen loading into the Neuse River by 30 percent by 2003. Several tools or best management practices (BMPs) to keep nitrogen out of groundwater and surface waters are available to producers in the three regions of the Neuse River Basin. These include riparian buffers (both herbaceous and woody), nutrient management, controlled drainage, and a conservation tillage system that uses a cereal cover crop managed to reduce nitrogen loading of shallow groundwater. To accomplish the 30 percent reduction in nitrogen loading, producers must either participate in a collective local strategy or implement individually the BMPs that have been specified for each

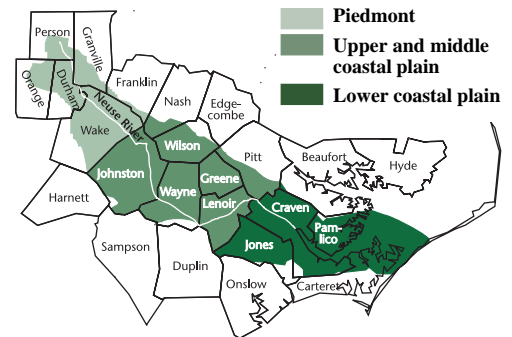


Figure 1. Counties in the Neuse River Basin

region of the Neuse River Basin (Table 1). As the table indicates, some BMPs work better in some areas than in others.

In the upper and middle coastal plain (Johnston, Greene, Lenoir, and parts of Wilson,

Table 1. BMPs by region in the Neuse River Basin and their effectiveness in nitrogen reduction

Design	Region			N-reduction <sup>d</sup>
	Piedmont	Upper and middle coastal plain	Lower coastal plain	
Trees 30 ft + grass 20 ft <sup>a</sup>	X	X		85%
Tree buffer $\geq$ 20 ft	X	X		75%
Shrub buffers $\geq$ 20 ft	X	X		75%
Grass buffers $\geq$ 30 ft	X	X		65%
Filter strips $\geq$ 20 ft <sup>b</sup>	X	X		40%
Nutrient management	X	X	X	Variable
Cover crop	X	X	X	5-15%
No-till or strip-till (corn only)	X			15%
Controlled drainage <sup>c</sup>		X	X	40%

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<sup>a</sup> The forested area is next to the stream, and the grass area is away from the stream.

<sup>b</sup> Only effective if the drainage area above the filter strip has greater than 1% but less than 10% slope. Filter strips must be planted with permanent vegetation (grass, legumes, and/or other forbs).

<sup>c</sup> Only effective if the slope in the channel is less than 1% and the water table can be kept within 36" of surface soil for 50% of field area.

<sup>d</sup> Reduction rates are based on research and approval of the Neuse Basin Oversight Committee.

Source: Based on decisions by the Neuse River Basin Oversight Committee.



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Nash, Wayne, and Pitt counties; Figure 1), the two practices that are most effective in reducing nitrogen losses into streams and ditches are riparian buffers and nutrient management (Table 1). Nonfertilized cereal cover crops, filter strips, and controlled drainage are less effective in this region than the other BMPs, but still can be used.

## Costs

Because producers must either install BMPs or join a collective local strategy with similar BMPs, it is essential to compare the costs of these practices with the payments offered by cost-share programs. Here is a look at the costs of buffers, nutrient management, and controlled drainage—the best options for upper and middle coastal plain producers.

**Riparian buffers.** The costs of riparian buffers include installation, maintenance, and cost of land. Installation expenses, such as seed and fertilizer, occur only in the first year. The other costs, such as land, labor, and some types of equipment, may occur yearly. Land costs recognize the loss of revenues from crop production when the land is switched into buffers. Equipment and labor costs occur during installation and when maintenance is performed. For example, to achieve maximum efficiency with a grass or shrub buffer, the vegetation should be managed so that a moderate vegetation height is maintained. Table 2 gives a summary of the costs for buffers and tells when they occur.

**Nutrient management.** Expenditures for nutrient management are assumed to be negligible. The North Carolina Department of Agriculture and Consumer Services will provide a free soil test, which is used to calculate nitrogen requirements. A nitrogen management plan in the Neuse River Basin should be based on Realistic Yield Expectations (RYEs). Calculating nitrogen needs from RYE depends on both the nitrogen requirements of the crop and the soil type. N.C. Cooperative Extension or the federal Natural Resources Conservation Service

**Table 2. Costs of a buffer (dollars per acre)**

Buffer type	Annual cost of land <sup>a</sup>	Establishment cost <sup>b</sup>	Annual maintenance cost
Forested buffer	\$70-\$630	\$70	\$2
Fescue + bahia <sup>c</sup> buffer	\$70-\$630	\$207	\$50
Switchgrass buffer	\$70-\$630	\$154	\$58
Shrub buffer	\$70-\$630	None	\$21

<sup>a</sup> Common rotations are corn-soybeans-tobacco, tobacco-wheat-soybeans, and corn-cotton-tobacco. Tobacco may be grown close to streams or ditches, in which case the loss of revenue from crop production is \$630/acre. With the reductions in tobacco quota, it is increasingly likely that the loss of revenue will be \$70/acre, which is the average gross margin of the non-tobacco crops.

<sup>b</sup> For the forested buffer, the establishment costs are those of planting or seeding loblolly pine. For the grass buffers, the establishment costs are those for hay and pasture but with a higher seeding rate. There is no installation cost for shrub buffers since shrubs will emerge when the buffer is not mowed. For details, see <http://www2.ncsu.edu/unity/lockers/users/g/gawossin/Papers/bmpecon.pdf>.

<sup>c</sup> The N.C. Conservation Reserve Enhancement Program (CREP) requirement is 50% warm-season grass. Fescue and bahia have similar maintenance requirements. For switchgrass, periodic burning is advised.

(NRCS) will verify your nutrient management plan at no charge to make sure that it meets NRCS and state standards. Nutrient management requires more time but likely will reduce fertilizer cost.

**Controlled drainage.** Controlled drainage consists of a surface drainage system of 3- to 5-foot-deep open ditches and a control structure installed in each field ditch or a larger structure placed in the collector canal. With controlled drainage, yield levels can be from 2 percent higher (soybeans and cotton) to 5 percent higher (corn) in the long run if the system is carefully monitored and controlled. For wheat and tobacco, no yield increases are expected (Table 3).

## Financial incentives for riparian buffers and controlled drainage

Cost-share programs have been established in North Carolina to offset some of the expenses of buffers. The N.C. Conservation Reserve Enhancement Program (CREP) appears to be the most economically viable program to help farmers use buffers to protect

**Table 3. Costs of controlled drainage (dollars per acre per year)**

Installation <sup>a</sup> .....	\$173
Annual maintenance <sup>b</sup> .....	\$3
Benefits from yield increases .....	\$1- \$6 <sup>c</sup>

<sup>a</sup> Control-structure costs consist of a riser, 24 in. @ \$460; 30 ft of pipe @ \$27.95/ft; and 4 cu yd (minimum order) of concrete @ \$108/cu yd. This structure serves 10 acres.

<sup>b</sup> For maintenance, calculate 1% of installation costs and 0.125 hr of labor @ \$8.50 per acre per year for inspection.

<sup>c</sup> We assumed a tobacco-wheat-soybean rotation (\$1/acre) and a tobacco-corn-Roundup Ready cotton rotation (\$6/acre).

the Neuse River Basin. Eligible land-owners may enroll in CREP contracts of 10, 15, or 30 years or of permanent duration. The payments include a 75 to 100 percent share of the installation costs, annual incentive payments of 70 to 100 percent of the annual rental rate for up to 15 years, a state bonus for a 30-year or permanent contract, and an additional bonus if trees are planted.

For controlled drainage, CREP offers a cost-share of 50 to 100 percent,

**Table 4. Farm economic profitability of buffers and controlled drainage in the upper and middle coastal area of the Neuse River Basin**

BMP	Net annual profit (dollars per acre) for the next 15 years		
	Permanent CREP contract	30-year CREP contract	15-year CREP contract
Forested buffer	\$63 to -\$497 <sup>a</sup>	\$40 to -\$520	\$23 to -\$537
Fescue-bahiagrass buffer/filter strip	-\$2 to -\$562	-\$23 to -\$583	-\$39 to -\$599
Switchgrass buffer/filter strip	-\$5 to -\$565	-\$26 to -\$586	-\$42 to -\$602
Shrub buffer	\$43 to -\$517	\$20 to -\$540	\$10 to -\$556
Controlled drainage	N/A <sup>b</sup>	N/A <sup>b</sup>	-\$5 to \$0

<sup>a</sup> The first profit figure is based on \$70/acre for loss of revenue from crop production; the second figure assumes \$630/acre for loss of revenue from crop production (Table 1).

<sup>b</sup> For controlled drainage, only a 15-year CREP contract is offered.

depending on approval by the Soil and Water Conservation District Board of Directors and the length of the contract.

Agricultural land near rivers, streams, drainage ditches, and wetlands is eligible for CREP. The land 1) must have been owned or farmed by the applicant for the previous 12 months, 2) must have been planted or considered planted to an agricultural commodity in 2 of the last 5 years, and 3) must be physically and legally capable of being planted in a normal manner. Landowners may enroll at any time through 2004. Evaluation of applications is noncompetitive. During the contract period, the cropland that has been

retired may not be grazed, harvested, or used in any commercial manner other than for hunting leases. Public access to the buffer land is not required.

### Long-term income

Buffers can provide income for many years. When comparing CREP opportunities with current crop options and other land uses, consider long-term income in CREP when deciding whether to install a buffer. By accounting for the value of future expenditures and receipts, we can calculate the net annual profit of a buffer (Table 4).

## Which BMPs pay off in the upper and middle coastal plain?

This comparison of possible BMPs shows that forested and shrub buffers with cost-sharing payments are financially viable for controlling nitrogen in the upper and middle coastal plain, but only if the buffer land currently is used for growing soybeans, corn, or wheat. By contrast, grass buffers are not profitable.

Here are additional conclusions about the BMPs:

- A forested buffer offers better financial opportunities than a shrub buffer.
- Cost-shared controlled drainage does not increase or reduce income.

## List of contacts

For more information about the N.C. Conservation Reserve Enhancement Program (CREP) or other state or federal cost-share programs, contact your local Soil and Water Conservation District; Farm Service Agency Office; or the N.C. Department of Environment and Natural Resources' Division of Soil and Water Conservation, David Williams, 1614 Mail Service Center, Raleigh, N.C. 27699-1614, e-mail: david.b.williams@ncmail.net or phone 919-715-6103.

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