Do BMPs Really Work?
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The 1987 amendment to the Clean Water Act added a component requiring states to develop and implement programs to control nonpoint sources of pollution, or rainfall runoff from farm and urban areas, plus construction, forestry, and mining sites. For many years, Alabama's Soil and Water Conservation Districts (SWCDs) and USDA-Natural Resources Conservation Service (NRCS) have been working to control nonpoint source (NPS) pollution and with extra emphasis since 1987. This pollution is so named because it doesn't come from a single point, such as an industrial discharge pipe. NPS pollution isn't readily traced to a specific source. But it still contributes excess nutrients, pesticides, sediment, heavy metals, and toxic substances to our waters.

Sources of NPS pollution are many, but agriculture is often identified as a significant source. Because agriculture requires many acres, its potential impact on water quality is great.

The business of farming requires as much planning and organization as any other. Strategies to protect surface and ground water should be a part of those plans. NRCS conservation practices (often called Best Management Practices (BMPs)) can be implemented to ensure that landowners operate in a profitable yet environmentally friendly manner. A BMP is defined as: *any program, process, design criteria, operating method or device, which controls, prevents, removes, or reduces pollution*.

Marlon Cook, hydrogeologist with the Geological Survey of Alabama, tells about the nonpoint source study along Lightwood Knot Creek in Covington County, Alabama.

As an agency, NRCS is convinced that BMPs work, but is there proof? In a recent study, the Geological Survey of Alabama (GSA) collected data that proves that BMPs do indeed help control NPS pollution.

GSA applied for a grant to participate in the National Monitoring Program (NMP) on Lightwood Knot Creek in Covington County, Alabama. NMP is a program that allows long-term monitoring, installation of BMPs, and then post-BMP monitoring to ascertain the results. The monitoring program is a cooperative effort among several agencies to encompass the expertise needed to do the work. The Lightwood Knot Creek study was a seven-year study and the cooperating partners included the landowners, NRCS,

Alabama Department of Environment Management (ADEM), U.S. Environmental Protection Agency (EPA), and GSA. The NMP tries to address a particular type of land use. In the Lightwood Knot Creek watersheds, it was primarily poultry. All four of the watersheds studied had poultry on them, along with cattle in most watersheds, some row crops, and forestry. The grant was funded by EPA with Clean Water Act, Section 319 which provides demonstration funds in cooperation with ADEM.

GSA hydrogeologist Marlon Cook said, “The area of study in Covington County is infamous for high sedimentation rates and a lot of erosion. The goal of the Lightwood Knot Creek project was to demonstrate improvements in the quality of surface water in selected subwatersheds that occurred as a result of implementing appropriate BMPs.”

The first step to accomplish the goal was to determine the cause and the extent of nonpoint source pollution in the subwatersheds. To determine the needs, GSA and NRCS met with landowners, looked at the farming practices in the watershed, identified the major problems, and then started the monitoring process. The study was designed for paired watershed monitoring which allows comparisons between treated and controlled watersheds.

Surface-water quality monitoring started on April 1, 1996. The monitoring program included physical, geochemical, and biological characteristics of the project streams. Water samples were collected weekly along with other pertinent water-quality information. Concurrently, continuous water and sediment sampling equipment was installed at the sample sites. Initially, each site was fitted with an instrument house containing an automated water sampler and digital data logger, a primary in-stream device consisting of a corrugated steel culvert, a 15-inch Thelmar weir, and a modified Birbeck bedload sediment pit sampler and portable bedload monitoring device. According to Cook, “The set up on Lightwood Knot Creek included an electronic rain gauge and various monitoring probes hooked up to a data logger. The probes were attached in a pipe so that we knew how much water was flowing in the stream at any given time. We measured discharge, water level, conductivity, and temperature. Then we had a trap set up to monitor bedload movement. We collected data every 15 minutes for seven years.”

The primary contaminants identified during the pre-treatment phase of the project were excessive sedimentation, large nutrient loads (primarily nitrate), and excessive bacteria.

Once the pre-treatment data were collected, NRCS identified BMPs that would address the impaired water quality issues. Installation of BMPs began in May 1999. The BMPs implemented in the study consisted of 13 actions that changed the cattle feeding practices, limited cattle access to the streams, changed the method of dead bird disposal, changed the method of poultry litter storage, and controlled erosion. Areas that had little vegetation and were subject to erosion were seeded and planted to permanent grass. Seed and fertilizer were applied according to recommendations based on soil tests. Tifton bahaia was sown on pasture areas. Bermuda and Pensacola bahaia and brown top millet were sown on all slopes.

A head cutting gully caused by run off from the road was an area that needed treatment.

Five critical eroded areas, identified as primary sources for sediment, received treatment. A sediment retention structure was constructed in late July 1999 in a critical area in the headwaters of the stream. Steve Yelverton, Covington County District Conservationist with NRCS said, “This was a head cutting gully caused from a lot of run off from the road. It was contributing to the sediment loads. We decided to start as high up as possible to cut off the gully. We designed the sediment control basin to collect the water and the pipe lets the water down to a stable outlet to stop the head cut of the gully.”

A sediment control basin was constructed to control the gully erosion.

Three other critical areas were filled, smoothed, and seeded during July. One critical area had a series of steeply sloping, shallow,

north-south trending gullies that carried runoff from six chicken houses on the upland area near the northern watershed boundary. A broad, shallow waterway designed to direct and control runoff was constructed in this critical area in mid-July.

Cattle were fenced from the stream and a cattle crossing was installed.

In September 1999, fencing was installed to prevent cattle access to the stream. A stream crossing, which provided a hard surface for cattle and vehicle traffic, was constructed.

The procedure for disposing of dead birds was changed. The practice of underground disposal was terminated. The landowner built a poultry composter and dry stack structure. Dead birds were composted and the litter was stored in the dry stack until it was spread on the pasture and hayland according to NRCS specifications.

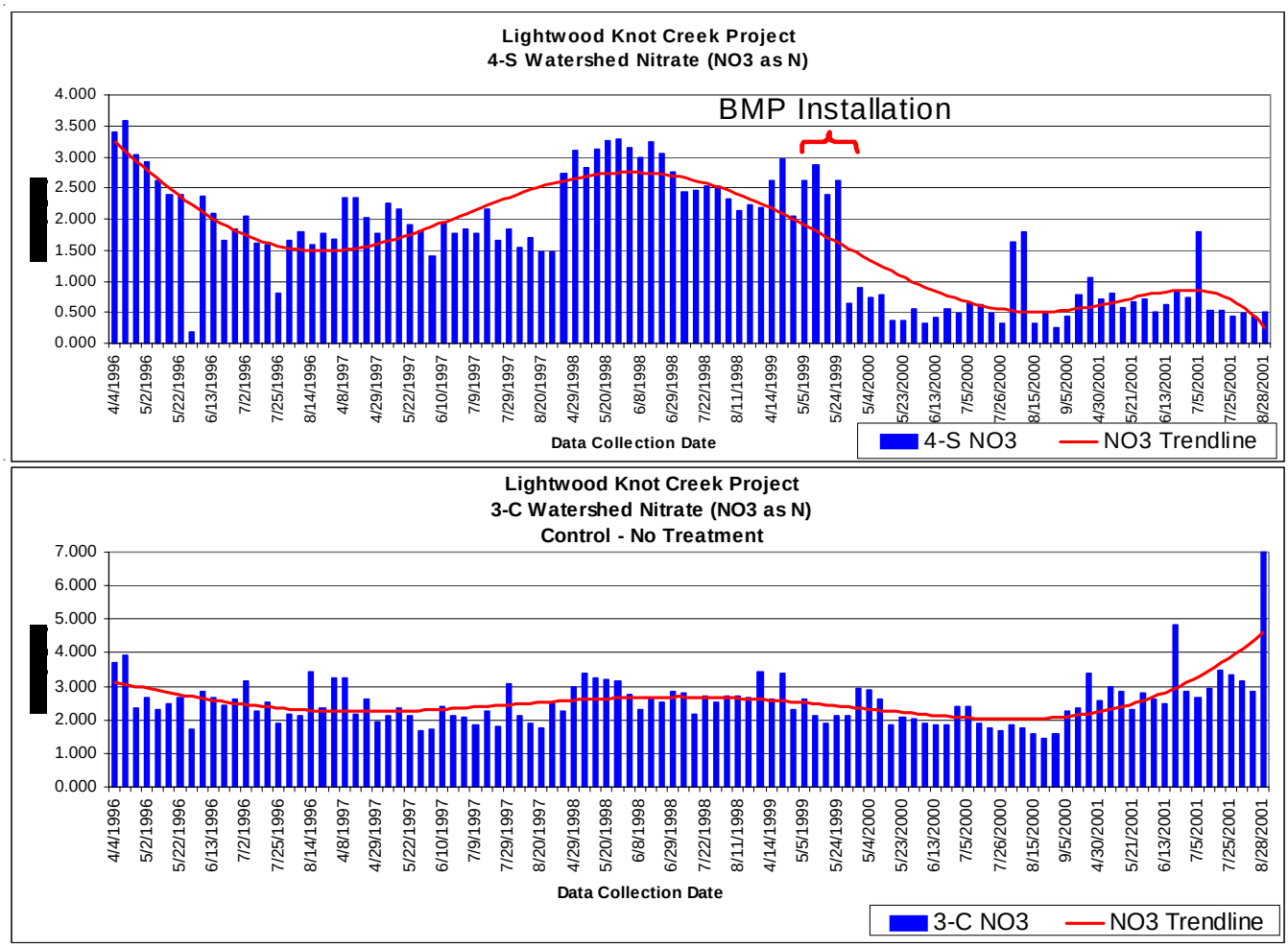
A combination composter/dry stack was constructed to handle disposal of dead birds and storage of litter until it could be land applied.

An existing pond (approximately 0.5 acre) constructed in 1990 to retain sediment and runoff from chicken houses was renovated. The capacity of the pond was increased from approximately 1.5 acre/feet to more than 4.0 acre/feet.

To more evenly distribute cattle manure, the landowner began rotational feeding of hay on relatively flat upland areas of the watershed.

Once the BMPs were installed, data were analyzed to determine the extent of change. Post-BMP analysis began in October 1999 and continued until the end of the project in October 2002. To track the changes, GSA used a system designed by the Water Quality Group at North Carolina State University (Grabow and others, 1998). The tests included a t-test and regression analysis.

The interpretation of analytical data collected from surface-water sites during the monitoring period from April 1996 through September 2002 indicates that land use and waste disposal in the area had harmful effects on surface-water quality. Waste products generated by poultry production and other less concentrated groups of animals, along with other land uses such as farming and timber harvesting that exposed erodable soils, contributed to the deterioration of water quality in the project area.



Graphics showing nitrate pre-data and post-data after installation of BMPs on the study site (4-S) The control data show little change (3-C)

Do BMPs really work? The proof is in the data. Installation of BMPs in the watershed resulted in substantial improvement. Extreme drought during the post BMP stage of the project had an effect on the assessment of water quality. However, using the paired monitoring design and statistical tests (T-test and Regression) (Grabow and others, 1998) has produced data that indicates that installation of best management practices do indeed have a positive impact on water quality. Results from the regression statistical analyses

indicate a 92 percent reduction in bedload sediment, 71 percent reduction in nitrate and an 11 percent reduction in fecal coliform bacteria in the study area. In the controlled watershed where nothing was done, the post-data are very similar to the pre-data.

The project results showed that stream water quality may be improved significantly by evaluating the sources and magnitudes of impairments and implementing appropriate BMPs to address nonpoint source pollution.

Perry Oakes, NRCS State Conservation Engineer, says, “NRCS and the Soil and Water Conservation Districts have known for years that conservation on the ground works to improve environmental conditions, but scientific proof on a watershed scale has been hard to come by. This study clearly shows that installation of conservation practices (BMPs) has dramatic, position results on the environment.”

Grabow, G. L., Spooner, Jean, Lombardo, L. A., Line, D. A., 1998, Detecting water quality changes before and after BMP implementation: use of a spreadsheet for statistical analysis: NWQEP Notes (Number 92), North Carolina State University.

Note: Statistical data provided by Geological Survey of Alabama

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