Chapter 6
Maintaining Water Quality in Grazing Systems

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Introduction

Although the problems associated with small scale, agricultural livestock production do not receive as much attention as larger operations, small operations can have a substantial impact on rural environmental quality. Even livestock and poultry operations without concentrated animal housing and confinement can still be potential sources of pollutants. Small farms produce many of the same pollutants as their larger counterparts; runoff and soil erosion, animal waste, pesticides, fertilizers, and petroleum products to name a few. Most of these pollutants are classified as non-point source pollutants meaning their origin cannot be traced back to any particular point. While the quantities produced are often much smaller than large operations, usually there are many more small operations within in given area so the total pollutant loads may be equivalent. Therefore, efforts to protect and improve the quality of all of our natural resources need to focus on large and small operations with concentrated confinement and pasture systems.

Best Management Practices (BMPs)

Best Management Practices refers to a combination of practices determined to be effective economical approaches to preventing or reducing pollution generated by nonpoint sources. BMPs can be structural as in the construction of terraces, dams, pesticide mixing facilities, or fencing or they can be managerial like crop rotation, nutrient management, and conservation tillage. Both types of BMPs require good management to be effective in reducing the generation or delivery of pollutants from agricultural activities. Preventive practices such as these are the most practical approaches to reducing nonpoint source pollution. BMP's are refered to in almost every chapter of this manual. The color photo reference guide at the beginning of this manual depicts examples and provides brief explanations. Cooperative Extension, NRCS and local Soil and Water Conservation Councils can provide additional information and technical assistance on installing and implementing these practices.

Voluntary Implementation of Best Management Practices: The Practical Solution

1. Nutrient Management Plans for Pastures
    - -Manure or Commercial Fertilizer, mixture is probably ideal
    - -Soil Testing and follow recommendations: Over application costs you
    - -Spreader calibration and even distribution are important
2. Control Erosion in pastures: Sediment is number one pollutant in Georgia
    - -Grassed Waterways, Terraces, and Control of Gullies
3. Use stream side buffers or riparian zones: vegetation and residues trap nutrients and sediment
4. Cows in water are a direct source of pollution, trample vegetation, and increase erosion: keep them out or minimize congregation in streams or buffer zones
5. Pasture Management: Over seeding and no-till planting, proper herbicide use.

Factors controlling Non Point Source (NPS) Pollution

BMPs are used to reduce the effects of all forms of pollutants. They use a variety of mechanisms that result in varying degrees of effectiveness. All activities within a watershed affect NPS pollution but control of soil erosion is probably the best opportunity for preventing pollution since sediment is not only a pollutant itself, but also carries nutrients and pesticides with it. While soil erosion is a natural process, it is accelerated by any activity that disturbs the soil surface. The amount of soil erosion that occurs is related to five factors; the rainfall and runoff, the soil erodibility, the slope length and steepness, the cropping and management of the soil, and any support practices that are implemented to prevent erosion. The rainfall and soil factors are primarily functions of climate and geography that producers have little control over, however, man can manage to reduce the impact of these factors. For example, increasing the amount of rainfall that goes into the soil (infiltration) is an indirect means of reducing erosion as a certain rainfall will produce less runoff and corresponding erosion.

Nutrient Management Planning

The general content of this manual explains Nutrient Management in detail. This concept is just as important in pastures and grazing systems. In many cases these systems will be part of the farm's land application and waste management activities. Managing the amount, source, form, placement, and timing of nutrient applications are activities that will accomplish both crop production and water quality goals. This holds true for all nutrient sources including manure, organic wastes, chemical fertilizers, and crop residues. Whatever the approach, the important concept is that nutrient management, plans examine all nutrients to minimize loss of nutrients to surface runoff and leaching, to maintain soil quality, and to insure adequate soil fertility to meet the intended crop yield goals.

Runoff and Erosion Protection Measures

Essentially, any measure that increases the infiltration rate or water holding capacity of the soil, limits flow velocity, or increases the time that water remains of the soil surface will decrease runoff. Producers should also consider leaving critical areas out of production. Critical areas usually cannot be stabilized by ordinary conservation treatment and if left unmanaged can cause severe erosion problems. Examples of critical areas include dams, dikes, levees, cuts, fills, and denuded or gullied areas where vegetation is difficult to establish. These areas will become reoccurring problem spots if they are put into pasture or cropland. Instead, vegetation should be established and they should be left out of production.

A grassed waterway is a natural or constructed channel, usually broad and shallow, planted with perennial grasses to protect soils from erosion by concentrated flow. These waterways serve as conduits for transporting excess rainfall and diverted runoff from the fields or pastures without excessive soil erosion. Waterways prevent gully erosion in areas of concentrated flow. The vegetation also acts as a filter to remove suspended sediment and some nutrients. Grassed waterways require careful maintenance and periodic reshaping especially after large or intense storms. Performing this maintenance regularly is important as the concentrated flow conditions can lead to rapid gully formation if minor washouts are left unchecked.

The use of farm ponds is one final method of controlling farm runoff. A well-placed pond can collect all of the runoff from a farm and have a positive impact on water quality. It

acts as a detention basin by removing sediment and nutrients from the flow and reducing the volumes of flow occurring at peak conditions. It can also filter many nutrients if aquatic vegetation or fish are used. Finally, the pond can act as a buffer between the farm and the external environment. On poorly managed farms, the farm pond can collect and hold any pollutants produced within the farm watershed so that their impact can be reduced. On well managed farms, a healthy pond is indicative of a farmer that uses environmentally sound practices and causes little environmental degradation.

Filter strips and Riparian buffers

All streams, rivers, lakes, ponds, and other water bodies in Georgia are more sensitive to environmental pollutants than the land that surrounds them. By managing the area around these water bodies more intensively, many conditions that may lead to surface or groundwater contamination can be prevented. All potential agricultural pollutants, including pesticides, herbicides, fertilizers, manures, petroleum products, and sediment should be handled with extreme care around any water body. Stream channels and banks should be protected to prevent erosion. Often this can be accomplished using vegetation, however, at times structural measures such as rock riprap may need to be used. Generally, livestock access to water bodies should be controlled and limited to areas with dense vegetation, smooth stable slopes, and firm surfaces.

The area immediately surrounding a stream or lake can also be used to remove sediment or nutrients from runoff or groundwater before it reaches areas where it becomes a pollutant. Filter strips are strips of grass, shrubs, or other close growing vegetation intended to remove sediment or pollutants from runoff. They are normally planted in an area where water will pass over them as sheet flow. The vegetation slows the water, allowing solids to settle out and become trapped in the vegetation. The filtered nutrients and organic matter are biologically decomposed by plants and microorganisms. Filter strips have been found to reduce sediment, nitrogen, phosphorus, and fecal coliform in animal waste runoff and can be effective around feedlots, tilled fields, pastures, and any other pollutant sources.

Stream side forest buffers or riparian zones are areas of trees, woody shrubs and other vegetation, located adjacent to and up gradient from streams or other water bodies. They usually consist of natural vegetation that provides a filter for sediment and organic material that carries many pollutants. They also provide an area where nutrients may be utilized by vegetation and where chemical decomposition can take place. Riparian zones are not intended to serve as the only water quality practice or to replace erosion control but they do provide a final opportunity to improve water quality before it enters a stream. Research has indicated that riparian zones and filter strips are so effective that many State governments are now developing programs to purchase land around critical water bodies to establish riparian zones for water quality protection. While these BMP's require little maintenance once they are established, if the sediment loads entering the filter strip are heavy, you may have to periodically remove them and reestablish the vegetation.

Livestock Exclusion/ Alternate Watering Facilities

Animal access to surface waters and adjacent areas also represents possible sources of water contamination. Not only does the manure deposited directly in or adjacent to streams pollute the water, but the livestock also reduce stream-side vegetation by foraging or trampling and disturb sediment on the stream bank and bed. This increases erosion and

decreases the buffering capacity of the stream-side vegetation. Stream and waterways protection can be accomplished by limiting livestock access and stabilizing stream banks. Livestock exclusion is the use of fencing or other barriers to prevent cattle from having access to streams, rivers, and lakes. The primary mechanisms that this BMP are the elimination of manure and sediment deposited directly in the stream from animals and less transport through surface flow as a "buffer" zone is established. Vegetation or rip-rap established along the edges of the stream buffer the banks from channel erosion as well as the erosion caused by animal traffic. The main drawbacks of livestock exclusion are the costs associated with establishing and maintaining fences.

An alternative to building fences for total exclusion of livestock is the development of alternate watering facilities. Several research projects have recently documented improvements in water quality through simply supplying a watering tank or trough at selected locations away from the stream or water body that needs protection. When given a choice, cattle will usually drink from the closest source of water. Therefore, alternate water sources reduce the total amount of time cattle spend in the water and traveling to and from the water. One study showed that stream bank erosion was reduced by 77% and concentrations of total suspended solids, total nitrogen, ammonium, total phosphorus, and fecal coliform were reduced by 90%, 54%, 70%, 81%, and 51%, respectively, due to the installation of an off stream watering source. In other words, the results clearly indicated that off stream watering sources were an effective BMP.

General Pasture Management

There are several keys to maintaining adequate and sustainable pastures. Plant selection is critical as the plant must be adapted to both the soil and climate to insure adequate cover throughout the year. Determining proper stocking rates that will not damage the vegetative cover and result in increased soil erosion is also essential. Controlling animal traffic can help to prevent bare spots that could lead to the formation of rills and gullies. Weeds may be a problem in some pastures, however, proper grazing management and fertilization should reduce weed problems. When herbicides are necessary, use only labeled products at recommended rates. When pasture renovation becomes necessary, no-till or other conservation tillage practices that minimize erosion should be used.

Common sources of pollution from pastures include the "loafing" areas, outside areas near the barn or catchpen where the livestock gather or any other area of heavy animal traffic. Water runoff from these muddy areas is easily polluted from contact with waste and soil and contaminated with nutrients and suspended solids. Groundwater contamination is caused by nitrate leaching from the excessive manure deposited in the loafing areas. Diversion of upslope rain runoff, channeling of contaminated runoff into an impoundment or natural buffer strip, and locating loafing areas away from wells can reduce surface water and groundwater contamination. Use of geotextiles for erosion control, drainage, and stabilization in loafing areas also restricts ground water contamination, as well as stabilizes the soil and can reduce mastitis in dairy cows. Feed bins and watering sources can also be moved to different locations allowing the heavily trafficed areas to reestablish vegetation.

Georgia Farm*A*Syst Program

The Farmstead Assessment System (Farm*A*Syst) is a unique self-assessment tool that provides farmers and rural residents with the ability to identify and reduce drinking water and

groundwater contamination from agricultural non-point and point sources of pollution on their properties. While the program does create an awareness and concern about pollution risks, its ultimate goal is to aid individuals to voluntarily take actions to prevent pollution. Worksheets provide a systematic framework for evaluating relative pollution risks at a specific site and provide information on specific action plans and sources of technical, financial, and educational assistance. An index of Georgia Farm*A*Syst materials currently available online at: http://www.agp2.org.

Table 1 Best Management Practice Summary Guide.

BMP	Surface Water			Ground Water	
	Sediment	Soluble Pollutants	Adsorbed Pollutants	N Loss	Pesticide Loss
Soil testing/Plant analysis	0	++	+	++	+
Equipment Maintenance & Calibration	0	+	+	+	+
Application methods and timing	0	++	++	+	+
Nutrient Management Plans	+	++	++	++	0
Conservation Tillage	++	0	++	0	0
Critical Area Planting	++	+	+	0	0
Pasture Management	+	0	+	0	0
Irrigation Management	+	++	+	++	+
Contours and Terraces	++	+	++	-	-
Filter Strips	++	+	++	0	0
Grassed Waterways	+	0	+	0	0
Subsurface drainage	+	-	0	++	++
Water Control Structures	++	+	++	-	-
Waterbody Protection	++	+	++	0	0
Stream Buffers	++	+	++	+	0
Livestock Exclusion/Watering	++	++	++	0	0

KEY: ++ Medium to high effectiveness 0 Almost no effect
+ Low to Medium effectiveness - Could have detrimental effect

Note: BMPs are site specific in nature. These generalizations are not necessarily true under all conditions. Soluble pollutants dissolve in water like N. Phosphorus is a example of an absorbed pollutant that moves attached to sediment.