



Grazing Livestock and Water Quality

Forages, such as hay and pasture, are indigestible to humans. For generations, grazing animals have benefited mankind by their ability to convert forages into meat, milk, leather, and wool. However, poor grazing management can reduce animal production and degrade grasslands, riparian areas, and water resources.

How can livestock grazing affect soil and water quality?

Poor grazing management can result in contamination of surface and subsurface waters through bacterial contamination, nutrient over-enrichment, and soil erosion from pastures. Recent research on the effects of fertilizer, manure, and urine on nitrogen cycling provides some interesting information. In pastures receiving 180 to 223 pounds of nitrogen fertilizer per acre, the nitrogen that was returned to the soil surface as urine or manure ranged from 138 pounds per acre for beef steers to 268 pounds per acre for dairy cows. In grass-clover pastures receiving no nitrogen fertilizer, the value was slightly less at 118 pounds per acre. Considering that a manure pile covers less than 1 square foot and a urine spot covers 4 to 7 square feet, it is interesting to note that the soil under *each* dairy cow manure pile or urine spot receives the equivalent of 500 to 1,000 pounds of nitrogen per acre.

The nitrogen in urine is immediately available to the plants, and most plants are overwhelmed with the high concentration of this nutrient around a urine spot. Some of this nitrogen may be lost to the atmosphere. In contrast, the nitrogen in manure is released more slowly than the nitrogen in urine. The ability of plants to take up this much nitrogen is limited—they simply cannot use such heavy rates of nitrogen efficiently.

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Uncontrolled grazing presents other disadvantages, but the primary concern is the loss of vegetative cover due to frequent grazing, trampling, or grazing the plants too close to the soil. This often weakens root systems and exposes and compacts the soil. These degradations to soil quality can increase the soil erosion and nutrient losses from pastures and can, in turn, pollute surface waters.

Do you use best management practices to optimize farm sustainability and protect water quality?

Best management practices (BMPs) are recommended by local soil and water conservation districts, the U.S. Department of Agriculture - Natural Resources Conservation Service (USDA—NRCS), and the North Carolina Cooperative Extension Service to optimize farm sustainability and protect water quality. These agencies provide information and technical support to farm owners who want to implement BMPs such as critical area management, intensive grazing, and alternate water systems.

How can we help?

In recent years, we have learned a great deal about how to manage grazing lands to maximize environmental and economic benefits yet minimize negative impacts on natural resources. This publication can help you focus on how your management practices may affect the sustainability of your livestock operation and the quality of nearby surface waters such as creeks, streams, and rivers.

Each of the following sections deals with a different topic. Next to each topic is a question. You may want to refer to a farm plan or other documents that describe your grazing management. Your answers to the questions will help you to see where you may have potential problems.

- If you answer a question either a or b, you have a good grazing management plan.
- If you answer a question either c or d, you may want to consider management options to improve your grazing management and reduce negative impacts on natural resources.

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Grazing Management

1. How do you manage grazing on your pastures?

Planned grazing systems, also known as rotational grazing or management-intensive grazing, normally reduce the time that livestock spend in each pasture. This practice usually increases the nutritional value and the uniformity of the vegetation. As the nutritional value of the vegetation improves, nutrient cycling in these pastures is more rapid. Controlled

1. **Circle the answer that best indicates the number of pastures you have on your farm.**
 - a. 11 or more.
 - b. 7 to 10.
 - c. 4 to 6.
 - d. 1 to 3.

grazing allows some pastures to be grazed earlier in the spring and later in the fall, with forage availability that allows high nutrient intake and permits other pastures to rest and regrow. Some producers implement a controlled grazing program simply by closing gates and using separate pastures in sequence. Others use portable electric fences to make smaller pastures.

2. How do you manage forage growth on your pastures?

The date of grazing in relation to plant growth and the length of time animals graze a pasture can influence the types, diversity, and number of plants that grow there. Good grazing management optimizes animal production while maintaining long-term vegetative cover.

Knowing what forage is produced during different times of the year can help you manage forage availability more effectively so that you can improve animal performance. While animal performance is greatly affected by the animal's genetic potential, health, and living environment, it is also a result of how much forage the animal ate and how much nutrition was in the forage. You can manage your pasture to provide forage of high nutritional value when it is needed for peak lactation or optimal weight gain.

Intensively managed grazing, unlike continuous grazing, minimizes the development of bare areas in pastures that appear when portions of pastures are overgrazed. During uneven growth, some plants mature and lose their high nutritional characteristics, while others die from overgrazing. Under these pasture conditions, animal performance declines.



3. How do you manage your pastures during dry periods?

Throughout the year, dry periods can limit plant growth and the performance of grazed livestock. Managing pasture resources during these dry periods is critical. Farmers often can plan to conserve forage growth during periods of adequate moisture. Then, in dry periods, you can stretch the forage supply by carefully managing pasture or feeding hay, even though you may think your cows need more pasture.

2A. Circle the answer that best describes how much bare ground is in your pastures 2 to 4 weeks after grazing.

- a. Less than 5 percent bare ground.
- b. Between 5 and 15 percent.
- c. Between 15 and 50 percent.
- d. More than 50 percent.



2B. Circle the answer that best describes the condition of your pastures before grazing.

- a. More than 90 percent of pastures are of similar growth stage and of uniform quality.
- b. Between 75 and 90 percent are of similar growth stage and of uniform quality.
- c. Between 50 and 75 percent are of similar growth stage and of uniform quality.
- d. Less than 50 percent are of similar growth stage and of uniform quality.



3. Circle the answer that best describes your forage availability after several weeks without rain.

- a. Usually I can move animals to a pasture that has some fresh growth.
- b. I often supplement with hay before pastures become overgrazed.
- c. Most pastures are grazed shorter than is desirable before the rain comes, but most plants survive the drought.
- d. Pastures are grazed so short that many plants die before rain comes.

4. What grasses and legumes do you grow for forage?

Many farmers grow at least two species each of warm and cool season grasses and legumes, which can permit a longer grazing season and result in more profitable animal production. Because soil and moisture conditions vary in pastures, it is unlikely that a single species will fulfill all the forage needs of your livestock. For example, a well-managed farm grows cool season grasses such as orchardgrass, tall fescue, and bluegrass for 50 to 70 percent of their annual forage and warm season grasses such as bermudagrass, crabgrass, and sorghum sudangrass for the remaining 30 to 50 percent. Maintaining legumes in your pastures can reduce your nitrogen fertilization requirements and improve overall nutritional value of the forage.

5. How do you assess the condition of your pastures?

You can assess your pastures routinely to evaluate how well your grazing program is working. Taking the time to evaluate pastures regularly provides useful information for short-term management decisions about grazing pressure, fertility needs, short-term forage availability, or the need for hay production. It also can help you see how your management has influenced the pasture over time. Pasture evaluation can ultimately be as important as animal evaluation and may be even more important with respect to farm profitability.

Walk through your pastures and ask yourself the following questions:

- What changes in plant species have occurred since last season?
- Is the pasture density greater or less than last season?
- When sod is 2 inches tall, is there greater than 80 percent ground cover?
- Which weeds or brush are not controlled by grazing?
- Is the soil compacted or pugged because of closely grazed vegetation or animal loafing?
- Could a change in location of the water tank or mineral feeder or the shape of pasture alter the grazing pattern?
- Could more forage be produced through an application of fertilizer, a longer rest period, or more frequent movement of animals?
- Would haying earlier or using better grazing practices result in forage of better nutritional value?
- How do individual pastures rank in productivity?
- Which field areas dry out first, second, and last under drought conditions?
- When should I hay or graze to utilize the highest-quality forage plants?



4. Circle the answer that best describes the forage species that grow in your pastures.

- a. I have separate pastures of grass or grass-legume mixtures, which are composed of warm and cool season species.
- b. Most of my pastures have a mixture of warm- and cool-season species growing together.
- c. All of my pastures have the same primary grass species.
- d. I don't know what the grass species are in my pastures.



5. Circle the answer that best describes how often you assess the condition of your pastures.

- a. I check pastures at least once a week to observe conditions.
- b. I check pastures at least once every two weeks.
- c. I conduct a windshield survey once a month to check my pastures.
- d. I rarely check pasture conditions.

6. How do you harvest forage?

Farmers who use grazing animals to harvest the forage they grow can avoid the costs of buying expensive equipment and fuel. Grazing can increase the profitability of farm operations by reducing the dependence on harvest equipment. It is best to graze pastures and harvest hay only when pasture growth surpasses your need for stockpiling and grazing.

7. Do you have dedicated areas for feeding livestock?

Some farmers use a single location to feed animals hay or other supplements. Instead of using the same location each time, place feed at a different location within the pasture each day. Unrolling hay, perhaps under a single strand of electric fence, can allow you to feed efficiently and to distribute manure evenly within and across pastures. Rotate mineral feeders or external parasite treatment or control applicators to different locations within the pasture for each grazing period; locations should be away from the water site and the exit gate. This will force animals to spend time in multiple locations within the pasture.

Sometimes it may be beneficial to have a dedicated area for feeding, especially when pastures have been grazed down or during winter when pastures tend to be wet. During heavy rains, watering and feeding areas can contribute significant amounts of nitrogen, phosphorus, and sediment to groundwater, wetlands, and streams. In livestock feeding areas, it helps to establish a critical area or heavy use area to carefully manage rainwater and runoff and reduce the pollution potential. Decreased runoff will reduce the rate of erosion as well as the movement of sediment and dissolved and sediment-attached substances to downstream watercourses.

6. **Circle the answer that best describes when and which pastures you harvest for hay.**

- a. I harvest excess growth from pastures when I am unable to graze.
- b. I have hay land and also make hay on pastures.
- c. I cut hay on designated hay fields and do not harvest hay from pastures.
- d. I harvest large quantities of hay, and I feed it in concentrated areas.



7. **Circle the answer that best describes how you feed your livestock.**

- a. In several different locations to allow pastures to recover.
- b. In a heavily used area with measures to control mud and runoff.
- c. In designated feeding areas that become very muddy.
- d. In a heavily used area without any measures to control runoff.

Riparian Area Management

A riparian area is the ecosystem along a stream, ditch, creek, river, pond, or lake. Water quality is greatly influenced by the use, management, and condition of riparian areas. The primary concerns of riparian area management are how to limit livestock access and how to provide alternative water supplies.

8. Do you limit livestock access to riparian areas on your farm?

You can improve water quality by preventing livestock from standing or loafing in the water, walking down the banks, or depositing manure in the stream. This decreases the amount of sediment and manure entering surface water. This practice also prevents compaction of the soil by livestock and prevents degradation of vegetation and undergrowth. As a result, the soil absorbs more water and there is less runoff and erosion.

8. **Circle the answer that best describes the access your livestock have to riparian areas and the condition of those areas.**

- a. Animals never graze in riparian areas.
- b. Once or twice a year livestock graze in riparian areas without causing any permanent degradation.
- c. Livestock have frequent access to streams and cause some permanent damage.
- d. Livestock have frequent access to streams and cause severe, permanent damage to vegetation and streambanks.

9. Do you provide alternate water supplies for your livestock?

Placing water tanks away from streams will help keep livestock from streambanks and riparian areas. Having a water tank available reduces the amount of time that cattle spend in the stream by as much as 75 percent. If possible, provide fresh drinking water to animals in each pasture. Locating the water tanks away from the pasture gates and changing the location of the water tank for each grazing period will control the distribution of manure and urine. If a water tank cannot be placed in each pasture, consider options to minimize loafing by the herd following drinking. Hard-surfaced, narrow lanes leading to and from the tanks can help accomplish this goal.



9. **Circle the answer that best describes how you provide your livestock with water.**
- a. A water tank is located in each pasture as far away from streams as possible.
 - b. A few central water tanks serve multiple pastures.
 - c. Livestock have access to streams or creeks during the grazing season.
 - d. Livestock have year-round access to streams and creeks.

Nutrient Management

Fertilizing pastures can be very expensive. A rotational grazing program helps to minimize these costs by distributing manure from grazing animals more evenly over pastures rather than concentrating it in certain areas, such as around shade trees and water tanks. It is common to fertilize grazed pastures at a lower rate than hayland or other cropland because of the recycling of nutrients through the manure and urine of grazing animals. In addition, nutrients brought onto the farm as purchased feed can contribute additional nutrients via animal waste. In pasture-based farming systems, the products that are sold and exported from the farm—milk, meat, leather, and wool—represent a very small percentage of the total nutrients that were consumed by the animal during its production phase. For example, more than 90 percent of the nitrogen consumed by beef cattle is excreted in manure and urine, compared to 75 to 85 percent by dairy cattle. Other nutrients are excreted at similar levels. Only 4 to 24 percent of the total nitrogen consumed by animals leaves the farm in the form of livestock products.



REMINDER

If you circle c or d for any question, there may be an opportunity to improve grazing management on your farm.

10. Do you use manure effectively as a source of nutrients for forage species?

Cattle defecate up to 12 times per day and urinate eight or more times. One key to controlling nutrient distribution in pastures is to manage the deposition of manure and urine near shade, watering tanks, working facilities, feeding areas, lanes, and loafing areas.

For best use and control of animal manure, graze pastures for as short a period as possible—1 day or less. This practice promotes a more even distribution of manure over a larger area than long grazing cycles. In turn, short cycles allow nutrients to be recycled and reduce the need for fertilizer. Earthworms and dung beetles can improve nutrient cycling in pastures. These organisms can help increase infiltration, enhance vegetative growth, reduce runoff, and improve the nutrient and moisture filtering of the area.

11. Do you use soil tests to determine which nutrients your forage species need?

Nutrient management in grazing systems can reduce production costs and environmental impact. These impacts depend on the control of grazing patterns, loafing areas, and livestock drinking water locations. Testing the soil every 1 to 2 years will help you determine nutrient and lime requirements for optimal forage production. Pastures with shade or other potential loafing sites must be sampled so that the results fairly represent the pasture. When sampling, try to divide pastures according to slope, soil type, and animal grazing patterns.

RELATED PUBLICATIONS

- *Selected agricultural best management practices to control nitrogen in the Neuse River Basin*. Technical Bulletin 311. http://www.soil.ncsu.edu/lockers/Gilliam_J/BMPs/index.html
- *Southern Forages*. Second Edition. Potash and Phosphate Institute and the Foundation for Agronomic Research, 655 Engineering Drive, Suite 110, Norcross, GA 30092-2843

10. Circle the answer that best describes your grazing period.

- Less than 3 days.
- 3 to 6 days.
- 1 to 2 weeks.
- More than 2 weeks.

11. Circle the answer that best describes how often you have your pasture soil tested and how you use test results.

- Soil test areas are divided according to slope, soil type, and grazing pattern; I test every 2 years and generally follow recommendations.
- Soil test areas are divided according to slope, soil type, and grazing pattern; I test every 2 to 3 years.
- I soil test every 4 to 10 years.
- It has been more than 11 years since the last soil test.



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