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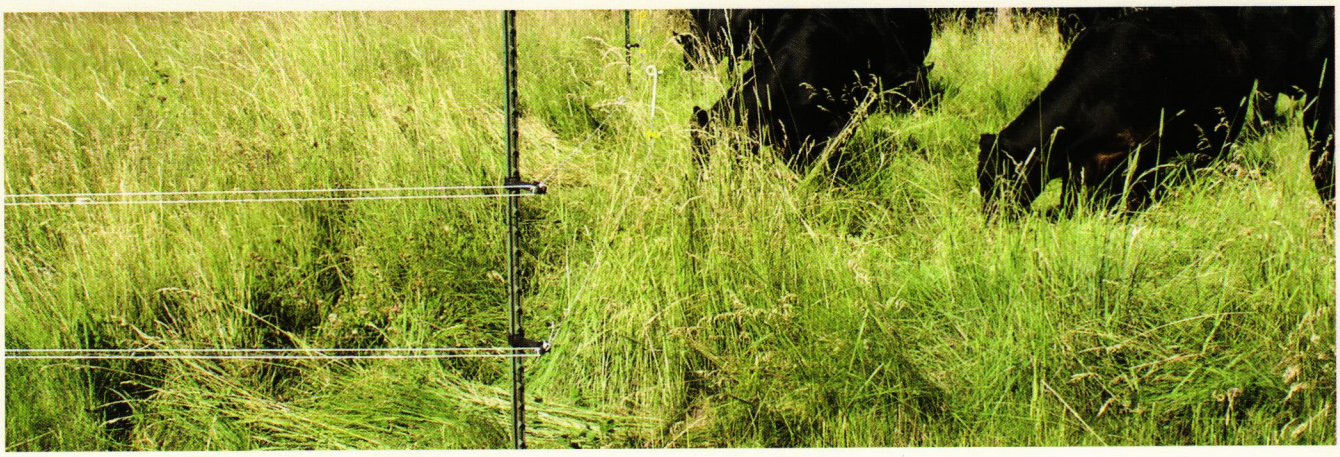
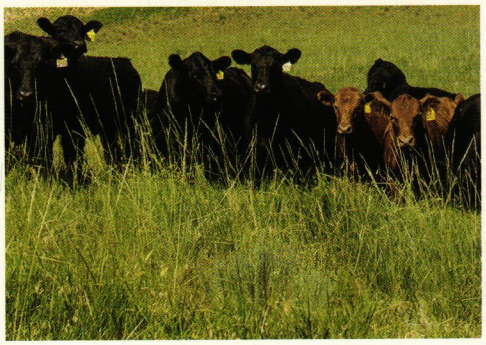
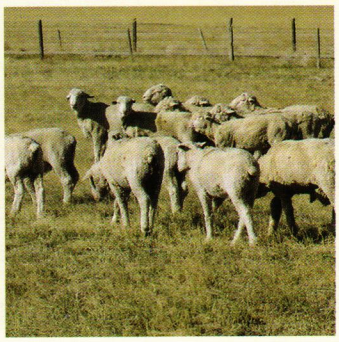
Grazing Management and Soil Health

Keys to Better Soil, Plant, Animal, and Financial Health







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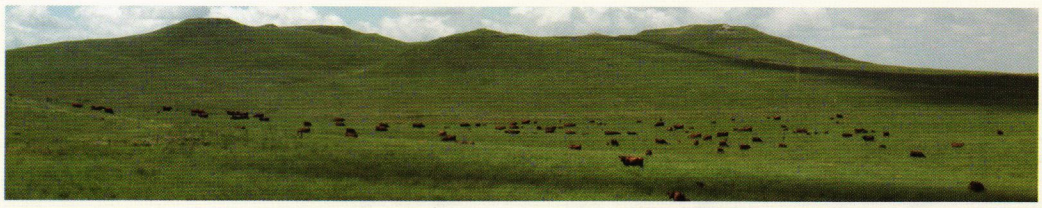
Natural Resources Conservation Service
February 2016

The Basics



Rangeland is land on which the native vegetation is predominantly grasses, grasslike plants, forbs, or shrubs. This land includes natural grasslands, savannas, shrub lands, most deserts, tundras, areas of alpine communities, coastal marshes, and wet meadows.

WHAT IS RANGELAND HEALTH?

Rangeland health is the degree to which the integrity of the soil, the vegetation, the water, and the air as well as the ecological processes of the rangeland ecosystem are balanced and sustained.

Soil is a dynamic resource that supports plants. It consists of mineral particles of different sizes (sand, silt, and clay), organic matter, and numerous species of living organisms. Soil has biological, chemical, and physical properties, some of which change in response to how the soil is managed.

WHAT IS SOIL HEALTH?

Soil quality is the capacity of a specific kind of soil to function within natural or managed ecosystem boundaries, sustain plant and animal productivity, maintain or enhance the quality of water and air, and support human health and habitation. Changes in the capacity of soil to function are reflected in soil properties that change in response to management or climate.

What Does Soil Health Affect on Rangeland?

- Plant production, reproduction, and mortality
- Erosion
- Water yields and water quality
- Wildlife habitat
- Carbon sequestration
- Vegetation changes
- Establishment and growth of invasive plants
- Rangeland health

How Are Soil Health and Rangeland Health Related?

Rangeland health and soil quality are interdependent. Rangeland health is characterized by the functioning of both the soil and the plant communities.

The capacity of the soil to function affects ecological processes, including the capture, storage, and redistribution of water; the growth of plants; and the cycling of plant nutrients. For example, increased physical crusting decreases the infiltration capacity of the soil and thus the amount of water available to plants. As the availability of water decreases, plant production declines, some plant species may disappear, and the less desirable species may increase in abundance. Changes in vegetation may precede or follow changes in soil properties and processes. Significant shifts in vegetation generally are associated with changes in soil properties and processes and/or the redistribution of soil resources across the landscape. In some cases, such as accelerated erosion resulting in a change in the soil profile, this shift may be irreversible, while in others, recovery is possible.

Why Is Soil Health so Important?

Changes in soil quality that occur as a result of management affect:

- the amount of water from rainfall and snowmelt that is available for plant growth;
- runoff, water infiltration, and the potential for erosion;
- the availability of nutrients for plant growth;
- the conditions needed for germination, seedling establishment, vegetative reproduction, and root growth; and
- the ability of the soil to act as a filter and protect water and air quality.

How Are Soil Health Indicators Integrated into Rangeland Assessments and Monitoring?

Ecological processes on rangeland are evaluated with soil and vegetation indicators. Evaluations made through assessment and monitoring provide information about the functional status of soil and rangeland. Soil quality indicators are properties that change in response to management, climate, or both and reflect the current functional status. Functions include maintaining soil and site stability; distributing, storing, and supplying water and plant nutrients; and maintaining a healthy plant community.

How Are Soil Health Indicators Used on Rangeland?

Assessment. Soil quality indicators are used to increase the value and accuracy of rangeland assessments and trend analysis. Assessments help to identify areas where problems occur and areas of special interest. Land managers can use this information and other inventory and monitoring data to make management decisions, which, in turn, affect soil quality. When assessments or comparisons are made, the rangeland ecological site description is used as the standard. For the soils associated with a given ecological site, the properties that change in response to management or climate are used as indicators of change.

Monitoring. Tracking trends in the functional status of the soil and the plant community helps to determine the success of the management practices or the need for additional management changes or adjustments. Regular measurement of soil quality indictors at the same location can detect changes over seasons or years and provide early warning of future vegetation changes.

Rangeland Health Indicators	Related Rangeland Soil Quality Information Sheet
Rills	Water Erosion
Waterflow Patterns	Infiltration, Water Erosion
Pedestals and/or Terracettes	Water Erosion, Wind Erosion
Bare Ground	Water Erosion, Wind Erosion
Gullies	Water Erosion
Wind-Scoured Areas	Wind Erosion
Litter Movement	Water Erosion, Wind Erosion
Soil Surface Resistance to Erosion	Physical and Biological Soil Crusts, Aggregate Stability
Soil Surface loss or Degradation	Water Erosion, Wind Erosion
Plant Community Composition and Distribution Relative to Infiltration and Runoff	Infiltration, Water Erosion
Compaction Layer	Compaction
Functional/Structural Groups	Soil Biota
Plant Mortality/Decadence	Soil Biota
Litter Amount	Organic Matter
Annual Production	
Invasive Plants	
Reproductive Capability or Perennial Plants	

How Do I Get More Information?

For additional information, refer to rangeland information sheet 2, "Indicators for Assessment and Monitoring." For soil quality information related to rangeland health indicators, refer to the rangeland soil quality information sheets listed in the adjacent table. Download the sheets from: http://soils.usda.gov/sqi.

unlock the SECRETS IN THE SOIL

Better Forage, Better Profit

Managing for better forage and an increased profit begins with establishing and implementing a rangeland management plan. A rangeland management plan allows land managers to evaluate, monitor and improve their land.

On grazing land, forage is the crop and animals are the harvesting and marketing mechanisms. Improving forage requires land managers to assess their ranch holistically—assessing plant and animal productivity, soil health, water and air quality.

Rangeland health, soil quality and the land manager's bottom line are interdependent. Soil quality is the capacity of soil to function within natural or managed ecosystem boundaries. Soil quality affects ecological processes, including the capture, storage and the redistribution of water, the growth of plants and the cycling of plant nutrients. In addition, better soil quality can improve drought and weed resistance.

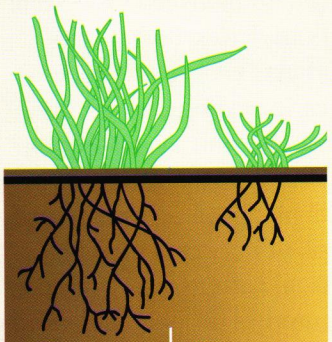
To improve rangeland health, land managers must manage for soil quality. As the soil improves, forage production will increase, leading to a better profit.

Four Natural Laws of Grazing Management

1 | Keep down the shoot, kill the root.

Roots anchor the plants to the soil, take up water and nutrients, and, if healthy, enable plants to survive stress from drought, cold, heat, and grazing. A basic problem facing livestock producers is not knowing how close to safely graze or mow plants and still obtain maximum productivity over an extended period.

A clipping study (Crider 1954) concluded that top growth of a grass plant is directly proportional to the root growth. About every year, one-third of the roots die and must be replaced. The amount of leaf volume removed has a direct effect on the growth of new roots. When excessive amounts of the top growth are removed, roots are not replaced and the grass eventually dies. If the leaf area is left at an optimum length, the roots will support more plant growth.



Percent Leaf Volume Removed	Percent Root Growth Stopped
10%	0%
20%	0%
30%	0%
40%	0%
50%	2 to 4%
60%	50%
70%	78%
80%	100%
90%	100%

Managing plants and root systems is key to more and better forage. To manage for plants and root systems, landowners should implement a prescribed grazing plan. The prescribed grazing plan should define the proper degree of grazing use for key forage species. It should also establish a grazing schedule. The schedule alternates two or more grazing units—deferring or resting rangeland in a planned sequence over a period of years.

2 | Nature does not like bare spots.

Bare ground is soil that is not protected by plants (including lichens and moss), litter, standing dead vegetation, gravel or rocks. Areas with high percentages of bare soil are at greater risk of runoff and erosion. Bare soil lacks protection from impacts of raindrops, detachment by wind, and temperature increases from exposure to the sun.

With continued overuse of native decreaser plants, increaser and invader plants can take over the rangeland over time. When this happens, droughts are much more severe and grass production declines. Practices that keep soil covered physically protect it from erosive forces that disrupt aggregation, while also building organic matter. Any practice that increases soil organic matter and biological activity improves aggregate stability. However, it can take several growing seasons or years for significant organic matter gains. In contrast, management activities that disturb soil and leave it bare can result in a rapid decline in soil organic matter, biological activity, and aggregate stability.

3 | Bare soils decrease moisture availability.

When rangeland is dominated by "increaser" and "invader" plants and more bare soil exists, runoff increases dramatically, less water goes into the soil, wind erosion increases, and water erosion increases due to the runoff from exposed soils. These issues result in a less productive range that is less resistant to drought and weeds.

During wind and water erosion, fine soil particles are washed or blown away while rocks and gravel accumulate at the surface. Soil organic matter is extremely low and the soil surface temperature is extremely high. These high temperatures create an environment that is hot and dry and not conducive to productive grass and "decreaser" plant establishment.

On the other hand, weeds with seed that can germinate quickly can increase dramatically on soil-depleted land. The land becomes less fertile and better adapted to weeds than to "decreaser" grasses—increasing drought severity and frequency

4 | If given a chance, nature would like to bring back best-adapted plants.

Nature will bring back the original, best adapted vegetation if two key elements exist:

- The line of no return has not been crossed.
- Landowners work with nature to give her a chance to do her job. Following a good grazing plan will increase profitability and the drought and weed resistance of the ranch. A good grazing plan considers two essential components: nutritional needs of the livestock and the health of the forage.

Applying Grazing Management Systems

Making Rangeland More Drought and Weed Resistant

Ranchers want to ensure that their land is healthy enough to resist droughts and weed infestations and to produce high quality forage. To accomplish this, ranchers need to ensure that their rangeland is able to take in as much moisture as possible.

For example, increased physical crusting decreases the infiltration capacity of the soil. This limits the amount of water that gets to the plants. As water availability decreases, plant production also declines. During this time, some plant species may disappear and less desirable species (i.e. weeds) may take over. Significant shifts in vegetation are generally associated with changes in soil properties and processes and/or the redistribution of soil resources across the landscape. In some cases, this shift may be irreversible, while in others, recovery is possible.

Conservation plans for grazing lands include decisions for manipulating the plant community to manage the soil, water, air, plant, and animal resources. These five resources are clearly related and respond to each other in an interactive mode.

On grazing lands, plants are directly affected by the soil, water, air, and animal resources. Animals are resources and tools used in managing the plant resource that, in turn, affect soil, water, and air. Therefore, proper use of the grazing and browsing animals in managing plant communities is basic to achieving the desired results of an ecologically sound grazing lands conservation plan.

A well designed system will provide for the health of the forages. It doesn't do one at the expense of the other. It does both. If you design grazing systems properly, it will provide the proper nutrition for grazing animals so that they have a high reproductive performance at the lowest cost.

There are FOUR basic keys to grazing management:

- stocking rate,
- livestock rotation,
- utilization rate,
- plant rest and recovery.

Stocking Rate

Stocking rate is defined as the number of animals on a given area of land over a certain period of time, generally calculated in Animal Days per Acre (AD/Ac). An Animal Day (AD) is the amount of forage required for one 1,000 lb. cow with calf for one day (see Figure 1), equivalent to 30 lbs. of air-dry forage. Livestock forage needs of different breeds, classes, and/or sizes are all compared to the equivalent of one cow/calf pair (see Table 1).

An Animal Unit Month (AUM) is the amount of forage required for one 1,000-pound cow with calf for one month. This is equivalent to 915 pounds of air-dry forage.

On any operation, it is critical that the stocking rate match the available forage. Failure to properly stock an operation can lead to over and/or under-grazing, neither of which provides favorable outcomes. Overgrazing can lead to significant long-term degradation and an overall reduction in pasture condition and potential yields. Effects from overgrazing can be long-lasting and difficult or impossible to rectify. Properly stocking grazing animals is critical to the long-term viability of any grazing operation.

Determining stocking rate is simply a matter of collecting information on overall pasture production and balancing the animal numbers with available forage. Since this is specific to your grazing land, you can request assistance from your local Natural Resources Conservation Service office to determine stocking rate.

Figure 1. Calculating AD and AD/Ac

Example Herd: 50 1,400-lb. cows with calves (50 pairs)

50 pairs × 1.4 AUE × 1 D = **70 ADs**

If 50 pairs can be supported on 20 acres for 10 days, the stocking rate is

70 ADs × 10 D = 700 ADs
700 ADs ÷ 20 Ac = **35 AD/Ac**

Table 1. Animal Unit Equivalent Comparisons

Class of Animal	Animal Unit Equivalent
1,000 lb. cow with calf	1.1
1,200 lb. cow with calf	1.3
1,400 lb. cow with calf	1.5
1,000 lb. cow, dry	.85
700 lb. steer or heifer	.70
Bull, mature (1,850 lbs.)	1.5
Horse, mature (1,200 lbs.)	1.25
Sheep, mature	.15
Goat, mature	.15

Stock Density vs. Stocking Rate

Stock density refers to the number of animals grazing a specific unit of area at a single point in time. Stock density is usually expressed in pounds of animals per acre. As the pounds per acre of livestock increases, stock density also increases. Many grazing operations do not adequately consider the impacts of stock density when planning and managing rotations. However, understanding the fundamentals of stock density is critical, especially on irrigated pasturelands.

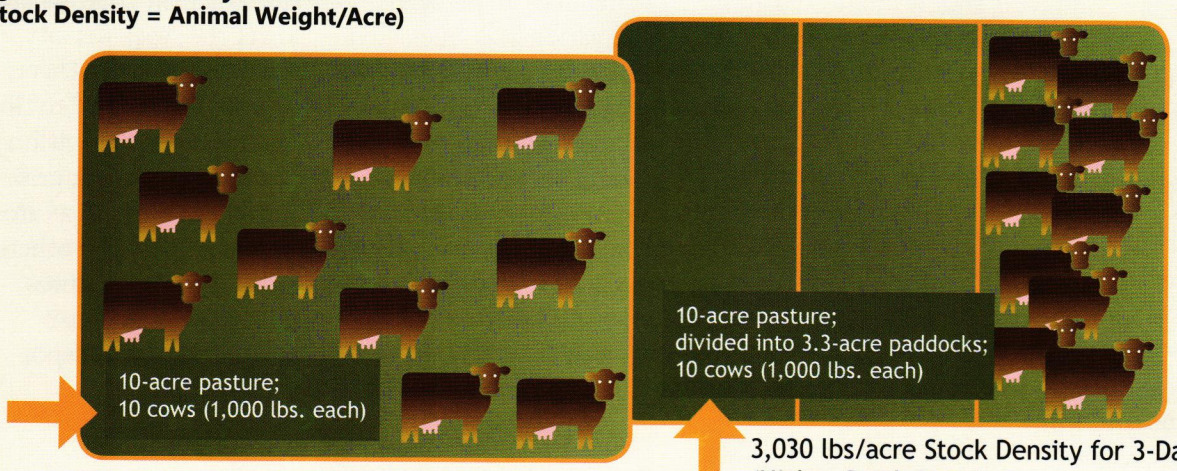
In general, increasing the stock density can yield significant benefits by improving how evenly pastures are grazed and reducing livestock grazing selectivity. As stock density increases, animals begin utilizing forage more uniformly with a reduced tendency to ignore some plants and over utilize others.

Properly stocking the areas to be grazed is critical to maintaining pasture productivity and animal health. Pasture sizes and stock densities must incorporate the size of the area to be grazed, the amount of grass that is available, the number of animals you plan to graze, and the duration each area is grazed.

Care should be taken when increasing livestock density because animals that are bunched more tightly together need to be monitored and moved more frequently to reduce the risk of removing too much plant material and reducing animal performance. To increase livestock density, existing pastures can be subdivided either with permanent or temporary fencing.

Most livestock operations that have increased their stock density and decreased the time spent grazing in each pasture or paddock have seen significant benefits in overall forage production.

Figure 2. Stock Density in Action
(Stock Density = Animal Weight/Acre)

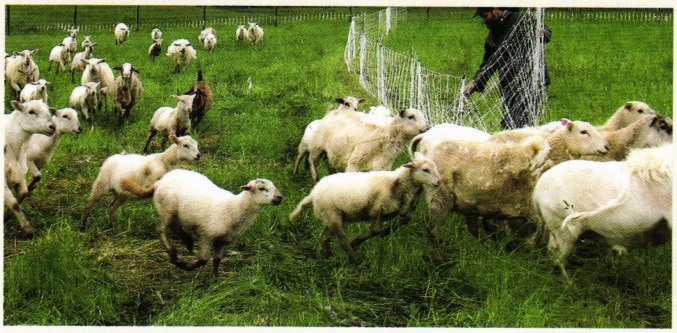


1,000 lbs/acre Stock Density for 10-Day Rotation
(Lower Stock Density)
10 x 1,000 lb. cow)/10 acres = 1,000 lbs/ac

3,030 lbs/acre Stock Density for 3-Day Rotation
(Higher Stock Density)
(10 x 1,000 lb cow)/3.3 acres = 3,030 lbs/ac

Rotation of Livestock

Rotation includes managing when you graze, how long you graze, and how long you allow the area that is grazed to rest and recover before the area is grazed again.



Livestock have a tendency to graze selectively, choosing their most favored species first and grazing them harder and more frequently while avoiding less desired species. This selective grazing is exacerbated when livestock have access to larger grazing areas and are not rotated frequently enough.

During the growing season, when a plant is grazed it can begin actively growing again almost immediately. As plants begin to regrow, they place a significant amount of their energy into leaf growth, which can slow down or even halt root growth if too much leaf area is removed. During the time when plants are just starting to regrow, livestock will often heavily target the plants due to their fresh, succulent growth. Grazing this fresh regrowth is extremely detrimental to plants and can cause roots to shrink and can eventually lead to plant death.

Grazing plants without providing opportunity for recovery is by definition overgrazing and is the primary reason that pasture conditions deteriorate. Animals overgraze preferred plants repeatedly, while ignoring less desirable plant species. Over time, less favorable plant species, such as less productive grasses and weedy species, are able to out-compete favored species for water and nutrients, causing changes in species composition and a reduction in the long-term productivity and palatability of the pasture. Many livestock operations could improve their forage productivity by simply rotating their livestock more frequently and providing previously grazed pastures or paddocks more rest and recovery.

Commonly, on many grazing operations, pasture productivity tends to decrease over time. Often, deteriorating pastures are then renovated (reseeded) or heavily fertilized. Pasture renovation is costly and time consuming and, under most circumstances, unnecessary if proper grazing management and livestock rotations are employed. In fact, if pastures are properly grazed, the pasture condition and productivity should actually increase over time, leading to long-term financial gains.

Utilization Rate (Grazing Intensity)

Utilization rate refers to grazing intensity and is a term often used to describe how heavily an area is grazed.

For example, if a plant is grazed as close to the ground as possible, the utilization rate would be 100 percent, whereas if the same plant was not grazed, its utilization rate would be 0 percent.

Most grazing experts tend to recommend the old standby of "take half, leave half," meaning when animals are allowed to graze, they should only be allowed to utilize half of the total plant biomass in a pasture. Ideally, every plant would be grazed to reduce its total volume by no more than 50 percent.

Grazing too hard and taking more than 50 percent (generally leaving plants shorter than 4 inches) stops all above- and below-ground plant growth for a period of time (Figure 3), thus slowing plant recovery and overall plant production. If plants are grazed less than 50 percent and are left taller after grazing, their root growth is largely unaffected and plant regrowth begins at a rapid pace.

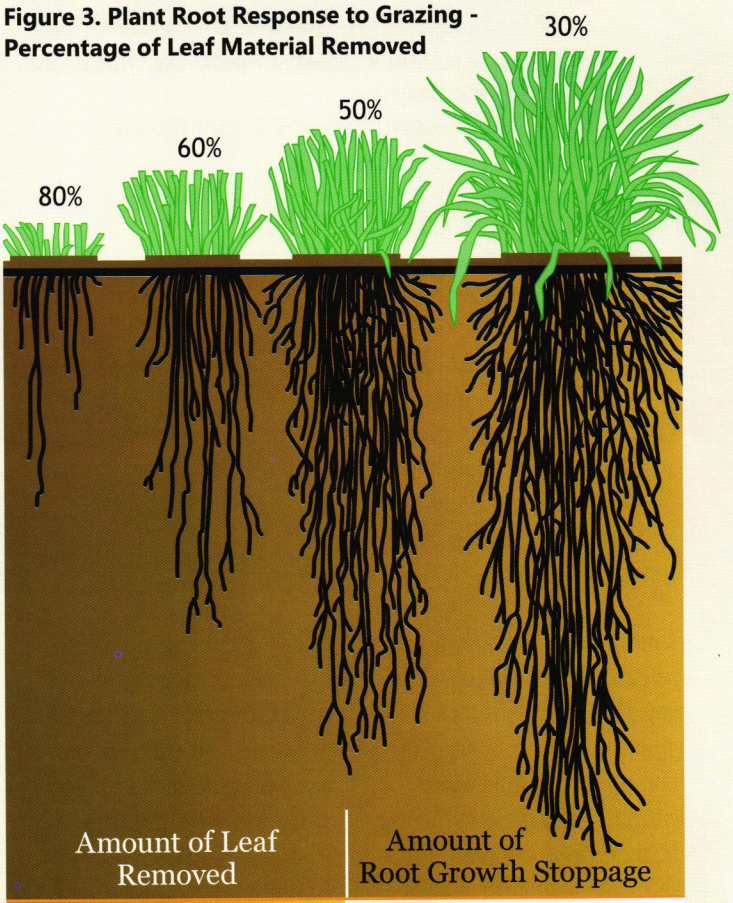
Although it may seem like common sense to graze plants short in order to extract the most amount of forage while grazing, this type of management ultimately reduces the total amount of forage produced on the pasture and can kill preferred forage species, allowing them to be replaced with less desirable plants. Keeping plants taller throughout the grazing season and rotating animals on a regular frequency allows plants to develop deeper roots, recover from grazing faster, and ultimately produce far more grass over the course of the season.

Lighter levels of use allow livestock to receive a diet balanced for protein and energy that is essential for livestock being finished on pasture. Don't be fooled into extracting the most possible grass out of each grazing event. Instead, manage your pastures so that they produce the most possible grass over the course of the growing season; you will end up far ahead in the long run.

"Take half, leave half" is a valuable and proven metric; however, in truth, utilization rates should vary based upon time of year, type of pasture, forage available, and overall management goals and expertise.

What does 50 percent utilization look like? Generally, during the growing season, when plants are actively growing, plants should never be grazed shorter than 4 to 6 inches. Obviously, it is unrealistic to expect every plant be grazed uniformly at a 50 percent level. In general, the larger the pasture and lower the stock density, the more variation there will be with regard to the grazing intensity within a pasture (think spot grazing where some areas are grazed heavily and others lightly). Large pastures with low stock density will have lots of spot

Figure 3. Plant Root Response to Grazing - Percentage of Leaf Material Removed



Amount of Leaf Removed	Amount of Root Growth Stoppage
10-40%	0%
50%	2-4%
60%	50%
70%	78%
80-90%	100%

If 80% of plant leaf material is removed, plant root growth can cease for 12 full days, which slows plant regrowth considerably (Dietz, 1989). If only 10% to 40% of plant leaf material is removed, plant root growth doesn't stop and the plant regrows faster and remains healthier.

grazing, whereas smaller pastures with higher stock density will be more uniformly grazed with less spot grazing. Increasing the uniformity of grazing patterns and reducing spot grazing will lead to higher grazing efficiencies, improvements in pasture and plant conditions, and an increase in financial returns.

SEASONAL GRAZING CHALLENGES

Spring grazing creates a new set of challenges. In the spring, plants are just beginning their seasonal growth and are extremely susceptible to overgrazing. Overgrazing plants in the spring can set back growth for the entire growing season. Many grazers make the mistake of grazing plants too hard or too early in the spring and the result is often a significant reduction in overall pasture yields over the course of the year.

Ideally, spring grazing should not begin until the grass has reached the four-leaf stage or about 8-inch minimum height—typically in early or mid-May.

Waiting to graze a field in the spring allows the plants to develop deeper roots that can better access water and nutrients in the soil profile. This also allows the plants to build more leaf area (think solar panels) to capture more sunlight and increase their rate of growth.

If early spring grazing is unpreventable, supplemental hay may need to be fed on the pasture to reduce the risks of overgrazing young plants. If a pasture is grazed early in the spring, make sure that the following year that same pasture is not grazed until later in the season. Another strategy for managing early spring grazing is to rotate animals quickly between pastures, utilizing less than 50 percent so as to avoid overgrazing. Finally, when grazing early in the season, always allow the pasture additional rest (≥40 days) before grazing again.

When grazing during the dormant season (November through February), utilization rates can be increased to 65 percent with at least 2 to 4 inches of grass remaining on average, depending on the species composition of the pasture. During the dormant season, plants are no longer actively growing and can tolerate heavier grazing pressures. However, care should be taken to ensure that plants are not grazed too severely, as doing so can harm plant growing points and weaken or kill plants.

Rest and Recovery

After being grazed, irrigated pastures should be allowed to rest for at least 30 to 60 days during the growing season. Dryland pastures and rangeland will require longer rest periods. The length of rest depends on many factors (season, weather, plant species, utilization rate, stocking rate, livestock class), so it will be up to the livestock manager to learn to recognize when plants have fully recovered and can be successfully grazed a second time. NRCS can help you consider your options and provide some helpful advice as you plan your rotations.

As a general rule, it is best to wait until your desirable grass species are at least 8 inches tall, which is typically after about 30 to 60 days for an irrigated pasture populated with tall-statured plants (i.e. orchard grass, tall fescue, meadow brome, etc.) during the growing season.

The adage "what you see above-ground is reflective of what is below" is very true—the amount of above ground leaf material indicates the health and size of the roots below ground. If plants are repeatedly grazed short without the opportunity for recovery, roots cannot be supplied with the nutrients they need and begin to shrink. As the roots are weakened, so too is the plant, reducing the plant's competitiveness for water and nutrients. This leads to plant death.

Allow for rest and recovery of your grasses and you will be rewarded with higher producing pastures and healthier, faster-gaining animals.

High Stock Density Grazing

High Stock Density (HSD) grazing is one of the most effective methods of grazing management.

HSD grazing takes on many forms and names: MOB grazing, Management Intensive Grazing (MIG), and others. Don't be confused with the names, as all of these forms of grazing model the same general themes of High Stock Density grazing and many of the points previously outlined in this document. The important thing to remember is that to implement any of these systems effectively and correctly, one must abide by the four keys to grazing management (stocking rate, livestock rotation, utilization rates, and rest/recovery).

High Stock Density grazing management involves concentrating animals into a smaller areas (often called paddocks), for a shorter amount of time (from 1-3 days, for example), and consuming 50 percent or less of available forage. In Montana, high stock density grazing is more common on irrigated or dryland pastures comprised mainly of tame grass species. Following grazing, long rest periods are provided (≥30 days) to allow plants to recover before being grazed again. By following a High Stock Density grazing system, the quality and amount of grass grown can increase substantially over time.

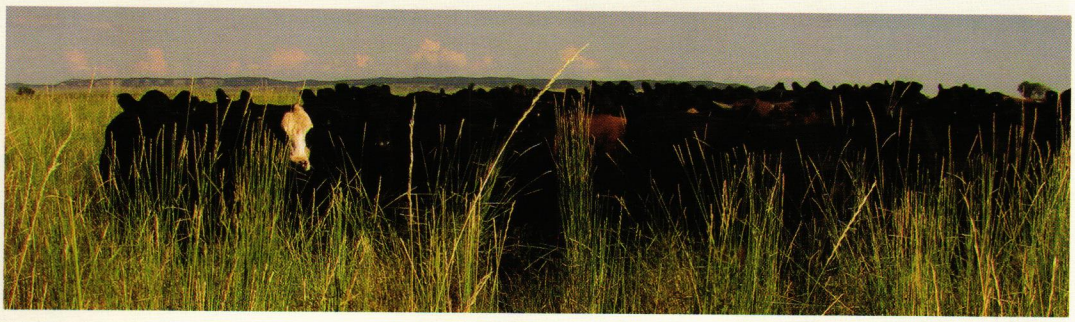
Key Points of a High Stock Density Grazing System

Utilization Rate:

High Stock Density systems only graze the top 1/3 to 1/2 of the plants. By grazing primarily the top growth, animals graze only the choicest portions of the plants, which leads to improved animal performance and increased rates of gain. Much of the plant material that is left is actually trampled and laid flat on the soil surface. At first glance, this may appear wasteful, but this trampling of material improves nutrient cycling and water retention. It also keeps the soil surface cooler, which reduces evaporation, and allows plants to focus on regrowth, instead of just basic survival. Soil organisms are provided the ideal environment, including food in the form of manure and grass residue that has been trampled. These soil organisms are an underground livestock herd and they are one of the key drivers fueling pasture recovery. Grazers using High Stock Density grazing have seen significant increases in yields (often doubling or tripling production) without the use of fertilizers or other costly, synthetic inputs.

Controlled Access and Improved Forage Utilization:

Livestock are controlled to improve utilization of plants and reduce both overgrazing and spot grazing. By restricting animals' access to the field, only portions of the field are grazed at any given time, allowing all the plants (including weeds) to be grazed more evenly while the remainder of the pastures are allowed to rest and recover. With High Stock Density grazing, animals become more competitive, and their behavior begins to change, causing a decrease in their selectiveness when grazing. They begin grazing all species more uniformly, which allows the higher yielding and favorable forage species to better compete and increase in density over weeds and less desirable plants. Animal performance may go down initially, but improve over time as animals adapt to the change. Grazers using High Stock Density grazing have seen significant reductions in weeds and an increase in desired plant species without the use of herbicides.



Smaller Paddocks:

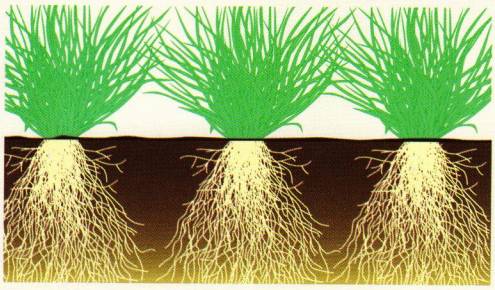
Concentrating animals into smaller paddocks results in manure piles closer together and more evenly distributed. Manure is free and valuable fertilizer. In a large, undivided field, manure piles tend to concentrate in select areas such as near water or loafing areas.

In a field that is subdivided, manure is evenly distributed and the entire field benefits from the free fertilizer.

Manure serves as natural fertilizer that helps feed the soil and improve fertility. Most High Stock Density grazers have eliminated the use of fertilizer from their pastures, while at the same time benefiting from an increase in forage production.

Longer Rest Periods:

Longer rest periods of 30+ days allow palatable, tall-statured grasses and legumes the opportunity to recover and increase in abundance. These plants increase in density because their root systems are able to access water and nutrients deeper in the soil profile and outcompete lower producing plants. Re-grazing of previously grazed pastures should not occur until the majority of the tall-statured grass species (orchard grass, tall fescue, meadow brome, etc.) have reached the four-leaf stage; normally about 8 inches tall. Grazers using High Stock Density grazing have seen the condition of their pastures improve over time as taller statured forage species have increased in abundance while short growing plants and undesirable weeds have decreased.



Extended Grazing Season:

Grazers using High Stock Density are able to improve efficiency of forage utilization across their entire grazing operation. This allows grazers to plan and allocate forages more accurately throughout the year. Some areas may be left ungrazed later in the growing season (often called stockpiling forage), to be grazed during the dormant season, thus allowing for a reduction in the amount of hay that needs to be fed.

In addition, when using High Stock Density systems, more forage can be produced, which helps extend the grazing season even longer. With a continual focus on improving pasture productivity long term, feeding areas and mineral supplements are rotated during the winter within and between pastures to spread nutrients, feed the soil, and better distribute animal impacts. Most High Stock Density grazers have cut weeks to months off of their winter feeding requirements. Reducing hay feeding time and costs can quickly improve financial gains.

High Stock Density grazing may not be right for everyone, but for most grazing operations, there are areas where they can make meaningful improvement.

Perhaps you can try High Stock Density grazing in a small area or for a certain time of the year. Perhaps some of your pastures could benefit from some additional cross-fencing to improve rotations. Are there ways that you could make simple changes to your rotations that could allow you to better accommodate the four keys to grazing management?

The end goal of grazing management should be to improve animal performance, increase plant productivity and associated soil health, reduce winter feeding and other input costs, and ultimately, to be more profitable. There are many methods that can be used to improve grazing management, and the key is to find a suitable method that works for you and improves the quality of life for you and/or your family.

When making improvements to grazing management, always consult the four keys to grazing management, as they are the cornerstone to effective grazing. If you are interested in High Stock Density grazing, NRCS can assist you with sizing your paddocks and managing your rotation, and hopefully reduce some of the risks of trying a new system of grazing.

Definitions

Aggregate - Soil aggregates are groups of soil particles that bind to each other more strongly than to adjacent particles. Aggregate stability refers to the ability of soil aggregates to resist disintegration when disruptive forces associated with tillage and water or wind erosion are applied.

Decreaser - Plant species of the original vegetation that will decrease in relative amount with continued overuse.

Increaser - Plant species of the original vegetation that increase in relative amount, at least for a time, under overuse.

Invader - Plant species that were absent in undisturbed portions of the original vegetation and will invade under disturbance or continued overuse.

Lichen - A composite organism that emerges from algae or cyanobacteria (or both) living among filaments of a fungus in a mutually beneficial (symbiotic) relationship.

Litter - A layer of slightly decomposed organic material on the surface of the soil.

Organic Matter - A reservoir of nutrients and water in the soil, which aids in reducing compaction and increasing water infiltration.

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   Office of the Assistant Secretary for Civil Rights
   1400 Independence Avenue, SW
   Washington, D.C. 20250-9410;
2) fax: (202) 690-7442; or
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SOIL HEALTH NUGGETS

There are some *amazing* things going on underground...

Here are some things you may not know...

1. There are more soil microorganisms in a teaspoon of healthy soil than there are people on the earth!

Millions of species and billions of organisms—bacteria, algae, microscopic insects, earthworms, beetles, ants, mites, fungi and more—represent the greatest concentration of biomass anywhere on the planet! Microbes, which make up only one half of one percent of the total soil mass, are the yeasts, algae, protozoa, bacteria, nematodes, and fungi that process organic matter into rich, dark, stable humus in the soil.

2. The best soil on most farms is found in the fence row.

These undisturbed remnants of what soil properties were once like is no surprise to farmers who have dug into that soil. It's crumbly, dark, and loose, and it's a model of soil structure and organic matter for farmers who are trying to make their soil healthier.

3. Tillage (or plowing) destroys the soil's structure!

Tillage destroys "aggregation" or the soil's structure – the habitat soil microorganisms depend upon to ensure critical soil functions like nutrient cycling. Tillage also reduces organic matter content and increases erosion, which reduces the sustainability of our food production system.

4. Tilling the soil up does NOT allow more water to soak into it.

Don't believe it? Fill two containers with untilled and tilled soil and simulate rainfall on them. Watch the water stand on top of the tilled sample, but soak down through the untilled sample. Or, give them the slake test (placing clods of untilled and tilled soils on wire mesh at the top of water filled jars). You'll find if you submerge tilled soil just below the surface it will soon collapse in a heap at the bottom of the jar, but untilled soil will still be intact for the most part even 24 hours later. Tilling soils causes pores to collapse and seal over, causing more rain to runoff than soak in.

unlock the SECRETS IN THE SOIL

5. OMG! Organic Matter (half) Gone!

The Morrow Plots on the campus of the University of Illinois indicate soil organic matter content in prairie grass borders was 5.5 to 6.5 percent in 1876. Less than half of that is left. That's the case with most prairie soils—oxidation of organic matter from tillage for row crops has reduced organic matter levels to between 2 - 3 percent today.

6. A farmer's favorite cocktail mix might not be what you think.

Innovative farmers are breathing new life into their soil by seeding a "cocktail mix" of 6-12 plants to get diversity above-ground, which creates much-needed diversity below the ground. Through that diversity, farmers are mimicking the soil-building and microbial-friendly conditions of the diverse native prairies.

7. If you want your soil to be healthy, you shouldn't see it very often.

That's because you want that soil to be covered all the time, preferably with living plants. Keeping the soil covered all the time makes perfect sense when you realize that healthy soils are full of life. The microorganisms living in the soil need food and cover to survive – just like other living creatures.

8. Roots of some plants can grow 3-feet deep in 60 days!

That's right, roots of daikon type radishes are a biological alternative to deep ripping to alleviate soil compaction. After radishes winter kill the channels created by the roots tend to remain open at the surface, improving infiltration, surface drainage and soil warming. The popular cover crop also is an excellent nitrogen scavenger.

9. What did President Thomas Jefferson know that we don't?

More than 200 years ago, Thomas Jefferson, a farmer and conservationist, used vetch, turnips, peas, and clover as cover crops and in rotation. He used these crops on his Virginia plantation to build soil that he knew was being depleted with his tobacco cash crop.

10 Multiple "bennies" through multiple species.

The below-ground synergy created by crop rotations and multi-species cover crops can actually accelerate biological time by increasing organic matter, allowing crops to flourish in dry times while monocultures struggle. And as an added bonus, diverse cover crop mixtures work together to crowd out weeds, improve nutrient cycling and reduce plant diseases.

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