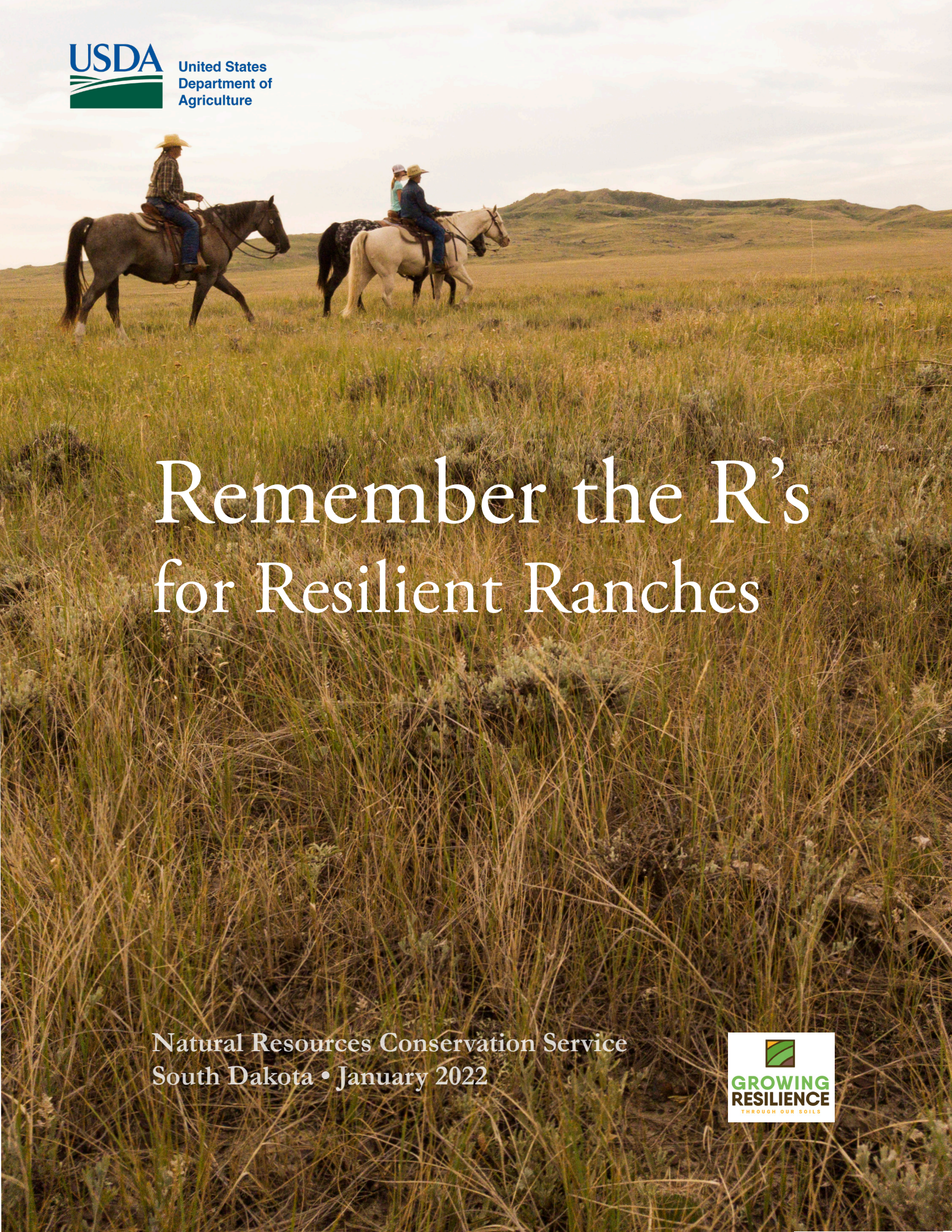

USDA United States Department of Agriculture

Remember the R's for Resilient Ranches

Natural Resources Conservation Service
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GROWING RESILIENCE THROUGH OUR SOILS

Remember the R's

for Healthier, Resilient Soils and Grazinglands

More than half of South Dakota ranchers practice at least a simple rotational grazing system, according to a 2018 rancher survey by South Dakota State University. Moving livestock to allow pastures to rest and recover is an important first step in sound grazing systems that produce more forage and productive grasslands.

Those who have been using sound grazing practices for years have discovered that using those practices also results in healthier grassland soils. Basic soil health principles used for croplands such as a diversity of plants and keeping roots growing are modeled after healthy grasslands development.

Rotational grazing, for instance, keeps pastures from being overgrazed, leaving enough grass cover to keep the soil armored. Just as importantly, live roots keep growing in the soil to feed microbes as pastures are rested and allowed to recover after grazing. The shorter term, more intense grazing encourages more even use of forages, resulting in more diversity of plant species– another important principle to follow in building healthy soils.

The bottom line: you can't build healthy grassland soils without applying sound grazing principles, nor can you get the most production from your grasses without applying the principles of soil health.

Remember the R's! Easy to remember grazing principles

One simple way to keep the best of the grazing principles in mind is to remember the r's. That includes **Rotate, Rest,** and **Recover,** along with proper stocking **Rates** and maintaining healthy **Root** systems.

Rotating pastures is the grazing management technique that enables pastures to be rested. This period of Rest after grazing, in turn, allows time for both plants and their roots to Recover. This recovery time promotes regrowth and natural diversity in grasslands.

Optimum stocking Rate matches the amount of expected forage to numbers of livestock, helping ensure grasses will not be overgrazed. Giving plant Roots time to recover after grazing is critical to long-term plant health, as well as to feeding soil microbes that build healthy soils able to infiltrate and hold rainfall.

Keep the R's in mind to set the framework for resilient soils, grasslands, and ranches!

A key to rotational grazing is leaving a healthy amount of grass—at least four inches, generally— after grazing to allow plants and roots to rest and recover, and feed microbes. This builds healthy soils with more organic matter, pore space, and water holding capacity, and more storage of carbon in the soil.

"We don't need to take all that grass off. One of our goals is to leave a minimum of a thousand pounds of grass per acre behind after grazing—leave that ground covered, leave that armor on the ground. We try to save every drop of rain we get. If you can cover your ground in a drought and leave it covered, as soon as it rains, within 30 to 45 days it's ready to go again. But if you bare the ground it may be three to five years before it recovers. Leaving enough forage after grazing to feed soil microbes is a big thing—that and letting our land rest. We might be grazing on a piece of land a week or sometimes only a day, but then we don't touch it for a full year so it has a lot of time to recover. Rest is important, but rest alone isn't the answer. You have to have enough moisture during that rest so the grass and roots can recover—there's no set or magic timeframe for how long it takes a pasture to recover."

—Pat Guptill
Quinn, SD

Rotate

Rotate pastures, time of year, and livestock type

If you want higher grassland production for years to come, more resilience in a drought, and diverse grasslands that infiltrate and store rainfall to build healthy soils, think rotation. It's the pathway to the rest and recovery both plants and their roots need to build both healthy grasslands and healthy soils.

The problem with season long grazing is the likelihood of overgrazing the plants livestock like most. Longstanding research shows 50 percent (%) of root growth stops when 60% of the leaf volume of plants are grazed, and all root growth stops when 80% of the plant is grazed. If a plant gets knocked down again and again in one season, it will eventually die, and other, less palatable plants move in. What you want instead is to offer plants the chance to rest and recover, pumping sugar downward to the roots, to feed the soil biology.

Most people think about rotating livestock through pastures, but rotating livestock types and season of use from one year to the next also deliver dividends. Goats and sheep like to browse; goats will eat the pigweeds, lambsquarter, and other broadleaf weeds that cattle don't like. Shifting the season of use is another crucial part of rotation.

Steps to Rotation

1) Complete an inventory of resources, and get help in developing a grazing plan.

2) Reach out to those with experience—NRCS, certified range managers, other producers.

3) Look for cost-sharing for developing the infrastructure you'll need—fences, water supplies, etc.

4) A combination of temporary and permanent fencing may be best.

5) A combination of temporary and permanent water supplies may work best.

6) Be realistic in setting goals for stocking rates, length of time for forage improvement, etc.

7) Aim to reduce duration of grazing and increase duration of rest.

8) Observe, observe, observe, and be ready to make changes to your plan.

Take Half, Leave Half

The widely used "take half, leave half" grazing rule of thumb's intent is to stop grazing before root growth is affected. It's based on grass weight, not height. It's the weight of the grass leaves from the ground surface to the top of the plant. "Take half"'equals the top two-thirds of the plant leaf growth, which often correlates to leaving 4"-5" residual plant height above ground. This photosynthesizes and drives plant growth.

"I was brought up with no other way of thinking but to rotate pastures and just learning how to read the grass. We try to rotate every two to six days, depending on pasture size and herd sizes. We watch how much is being grazed; we have a take half/leave half mentality, and that guides us on when it's time to move on. Those cows love to get to that fresh pasture and they get pretty used to rotating. If you're wondering if you should move them, they'll usually tell you because they'll be waiting for you at the gate."

– Britton Blair
Sturgis, SD

Britton Blair and his dad and uncle have seen significant changes in forage diversity, rainfall infiltration, and grassland resilience over the past 20 years by using more intense rotational grazing.

Rest

Aim to rest pastures much longer than you graze them

"We've got some very rough, marginal ground. We used to graze in 120-acre pastures, but we dropped that down to 40- and 20-acre paddocks to control the grazing more. I'm out in a pasture every day checking grasses to see when we should move—we try to leave anywhere from four to six inches of grass standing in the pasture every year. We graze a pasture once a year and then it rests for another year.

With the pastures resting all the time, in our last drought here, we had grass two to three feet tall where other pastures were six to eight inches tall around us. It's a lot of hard work and a lot of dedication, but in the long run it pays off big time because you'll have grass when you need it."
— Gene Ausland
Day County, SD

Think of your grasslands as your children. Both are ever changing and developing, and both need rest. Just as young children take naps to stay healthy, grasslands need rest after grazing to stay healthy. But their rest period is longer—a minimal 45 days, often 365 days or more. The goal is to allow all plants in the pasture to regrow and fully complete their growth cycle.

Think about elite athletes

Another way to think about resting your grasslands is to compare the rest they need to elite athletes. A marathon runner isn't going to run a race two days in a row. Race horse owners wouldn't think about running horses that soon, either.

Another analogy is with the boxer who keeps getting knocked down. If that boxer gets knocked down repeatedly, and gets up in an injured or weaker state each time, there comes a point he or she doesn't get up at all. Grasses react the same way—if they are grazed into the ground and then the new growth is nipped off again and again without a rest period, there aren't enough leaves to feed roots; roots stop growing and the plant doesn't survive, let alone thrive.

Babies, children, athletes — all of us — need rest to recover from activity or injury. Think of grasslands in the same way.

Rest requirements vary

The most common rest period is a year—once-through grazing followed by rest until the next year. Some systems are twice-through, where livestock graze only the top one-third to one-half of forage the first time through. Then comes a longer rest. In a twice-through management system, the second grazing event must be carefully monitored to ensure enough plant material is left after grazing to ensure roots and leaves continue to grow.

Consideration should be given to delaying turn in dates the year after a drought. Even with normal rainfall, full production wouldn't be expected the year following a drought, unless those pastures are very well managed.

Well managed pastures likely have healthy soils that promote rainwater infiltration and hold moisture. That's a direct contrast with continually grazed pastures. Pastures grazed all season long could take three to four years to get back to full production after a drought. The bottom line is it takes even more rest in a continually grazed pasture to recover from drought years.

Recover

Both plant leaves and roots need time to recover after grazing

There's a natural need for rest and recovery, whether it involves what people do to stay healthy or the steps grazing managers take for healthy grasslands and soils.

When you undergo a surgical procedure, your doctor will prescribe rest to help you recover. If you get too active too quickly, you're likely to aggravate your injury, have a setback and extend the recovery time. The same thing happens with plants that are grazed before they have time to fully recover.

When pastures are repeatedly grazed without time to fully recover, roots don't get the nutrients they need from photosynthesis, and they begin to shrink. As the roots are weakened, the plant is weakened. It's a downward spiral that results in eventual plant death or the plant being overtaken by less desirable species.

Recovered, Graze Ready

Ranchers and farmers with experience in rotational grazing learn to recognize when plants are fully recovered and ready to graze again. In general, that's when your desired grass species are at the 4½ leaf stage, and about 8 inches tall. How long that recovery takes depends on soils, soil moisture, time of year, species, how short it was grazed, and other factors.

Expect well-managed grasslands with healthy soils to recover more quickly than season-long grazed units with degraded soil structure.

It's just as important to allow roots time to recover after grazing, especially during a drought, as it is to give plant leaves time to regrow and recover.

Breaking a rule

In the spring, when plants are just beginning to grow, they're extremely susceptible to overgrazing. Grazing too hard, too short early in the year can set back growth for the entire season. So in most cases, you really want to avoid grazing hard in the spring. On the other hand, you can intentionally overgraze if you have unwanted species you want to try to push out while you encourage desirable species.

You may want to graze bromegrass and Kentucky bluegrass pastures hard early in the spring—they green up earlier than native cool season grasses. Then, rotate livestock out. The more open canopy and reduced competition can allow more desirable native, warm season species to grow and mature before they are grazed.

Recovery after a drought

Grasslands—the plants and the soils and biology below them—can be severely challenged with drought. They need more rest and recovery time than normal—don't expect full performance or production the year after a drought. It's more important than ever to rest pastures after a drought so you can keep plants taller, to develop deeper roots, and continue to recover.

"Rotational grazing has worked great for us. We've been doing daily moves, just trying to better manage what the cows are eating and manage the grass, give it an opportunity to recover. You see how the more you move the cows, the better the cows stay in condition, the better the grass and the ground stays in condition. It's enhanced our profitability.

– John Shubeck
Centerville, SD

Electric fences make daily cattle moves quick and easy on John Shubeck's farm.

Rate

Match livestock numbers to available forage for higher profits

One of the basics—some would argue the most important basic for a profitable grazing operation—is using a livestock stocking rate that matches the available forage in a pasture. Stocking rate—animals per acre or animal liveweight per acre—is the number of animals on the entire grazing unit for a certain period of time.

Figuring stocking rates doesn't have to be complex. You just need to recognize the capacity of the landscape to provide forage for the length of time you plan to graze, and how many animals will be grazing. It's also important to be ready to adapt with weather conditions. As you plan stocking rates, recognize all animals are not equal, nor are all landscapes.

Estimate the landscape's capacity

Go online to the NRCS Web Soil Survey, and in just a few clicks you can outline your land area, find the soil types, and get a rating for the pounds per acre that soil type could be expected to produce in a normal, favorable, or unfavorable (dry) year. Talk with NRCS. They can explain the differences in stocking rates, stock density, carrying capacity, and the other grazing concepts, and they'll help you develop an entire grazing management plan, if you request it, at no cost.

Calculate the stocking rate

Once you have an idea of your particular pasture's ability to produce forage, you can calculate the stocking rate that pasture can support. Stocking rate is generally calculated in animal unit months per acre. An animal unit month is the amount of forage required for a 1,000-pound cow with calf–up to weaning weight for one month. That cow and calf is an animal unit—a 1500-pound cow would be 1.5 animal units, 600-pound stockers are 0.6 animal units, and a sheep is about 0.2 animal units.

To calculate stocking rates, multiply total animal units by the length of your grazing season, and divide your acres of pasture by that figure. Example: You have 200 head of 1,000 lb. cows (200 animal units) x 6 months grazing season = 1,200 AUMs forage demand. 3,000 acres to meet that demand suggests that your land's carrying capacity should be at least 0.4 AUMs/acre to supply adequate forage for the 6-month grazing season. Depending on your location and climate, that scenario may or may not be workable– an NRCS conservation planner or rangeland specialist can help determine if you are working with realistic figures. If 0.4 AUMs per acre cannot be reasonably expected (from actual forage measurements or Web Soil Survey estimates), adjustments to planned animal numbers and/or planned duration of grazing should be made to safeguard the grassland resource.

Boost stocking rates and soil health with rotations

Ranchers have long known that season-long continuous grazing on a pasture can degrade the pasture, especially in a drought. A livestock performance simulation by South Dakota State University in 2018 showed, though, that multi-paddock grazing allows for much higher stocking rates without such serious degradation, because grazing on any one pasture is for a short time and adequate rest time is allowed for recovery before re-grazing.

The study shows that as stocking rates are increased, profitability of multiple paddock grazing in rotation— even with high costs to develop those systems—is significantly higher than from continuous grazing. Some ranchers have doubled stocking rates in 10 to 15 years by using temporary fencing and water with 2 to 3 day moves. They get a better look at their cows, the cows have new feed every few days, and their high density, low duration rotation offers more even grazing of all the plants in the pasture. In addition, that management approach develops plant diversity and feeds soil microbes, resulting in healthier soils that infiltrate rainfall, with more resiliency in a drought.

"We've gone from the original 15 pastures to 30 pastures ranging from 25 to 40 acres. When we're finished we'll have over 60 pastures. We'll have 50 miles of electric fence when we're all set up.

We've learned the optimum grazing time for us is three to five days, followed by 750 days of rest. We don't go back in the rest of that grazing season, or the next year, and then that third year, we try to shift the season of use.

It's worked for us. An NRCS inventory in 2007 showed our upland fields were producing 400 to 600 pounds per acre per year. Now, those same fields are producing 2,100 to 2,800 pounds per acre per year."

—Simone Wind
Newell, SD

Roots

There's a grazing line you shouldn't cross to keep roots healthy

There's a reason soil health specialists recommend you take a spade with you when you examine your pastures. Importantly, you need to see whether your soil has pore spaces that rapidly infiltrate and store rainwaters, or if it's compacted with a platy structure that slows water infiltration.

But you can also learn a lot by taking a close look at the root systems. That's because the grass you see—or don't see—above ground is directly reflected in the supporting root system below ground. Generally speaking, in healthy grasslands, the amount of biomass below ground is much greater than that above ground.

An important grazing fact many people don't know is that in most years, about one-half of a grass plant's roots die naturally. They have to be replaced by new roots; the speed and amount of new root growth is directly affected by how much of the plant's leaf volume has been removed. Go too far—graze too close and remove too much top growth—and the roots aren't replaced at all and the plant will eventually die.

The line you don't want to cross

If you move livestock out to leave about half the grass volume in a pasture—that usually means leaving at least 4 inches of grass height after grazing—root growth is largely unaffected and plants regrow fairly rapidly. Research shows when you leave 50% by weight (4 inches or more residual grass), less than 5% of the roots stop growing. But if you go just a little beyond that, and remove 60% of the top growth, you stop 50% of root growth. And if you remove 70% of the plant, you stop nearly 80% of root growth.

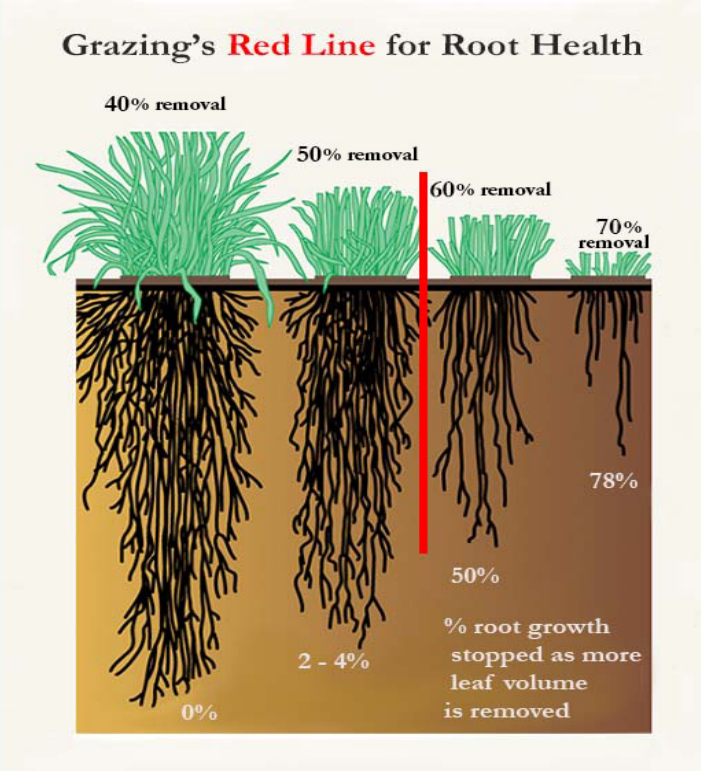
The line you don't want to cross—unless you intentionally want to reduce a grass like bluegrass in a pasture, is that 50% mark. That's where the take half, leave half saying comes from.

Roots key to water availability, soil health

Capturing and holding sunlight and water, and delivering nutrients to plants are arguably the most important things you can do to get productive grasslands. Healthy plant root systems make that happen. When you rotate pastures to allow enough leaf surface to capture sunlight and pump energy to the plant roots, those actively growing roots put out sugars and other root exudates that feed microbes in the soil. Those microbes and other soil biology make the glue that binds the soil together, forming soil aggregates with pore space that promotes infiltration and water holding capacity. Growing roots are crucial to developing healthy soils that absorb and hold water."

"We've really intensified our rotational grazing and use of cover crops. We get anywhere from 15 to 17 inches of rainfall a year on average. What we're striving for is to insulate ourselves and capture and hold as much of that moisture as possible. We're just trying to drought-proof the farm, improving the water infiltration and the holding capacity."

—Candice Olson-Mizera
McLaughlin, SD



The "take half, leave half" concept in grazing comes from research that shows root regrowth is curtailed as more than 50% of the plant leaf is removed by grazing.

Want more production and profit from your grasslands, with long-term resilience to drought? See your local conservation district or NRCS office for planning and financial assistance. The NRCS has local planners as well as regional rangeland management specialists with years of experience in developing sound grazing management plans. They can also point you to successful ranchers who have volunteered to mentor ranchers who want to do more to develop resilient soils and productive grasslands.

Find your USDA Service Center at http://offices.usda.gov

Good grassland management, with rotations, rest, recovery, proper stocking rates and attention to roots– builds pore space in soils that enhances water infiltration and water-holding capacity. That leads to higher forage production, higher soil organic matter, and more carbon stored in the soil. All good things!