HEALTHY GRASSLANDS




SOUTH DAKOTA GRASSLAND COALITION

Healthy Grasslands
2nd Edition of South Dakota Grassland Coalition Publication 'Greener Pastures'

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CONTENTS

South Dakota Grassland Coalition Vision and Mission

OUR VISION
Grasslands for future generations.

OUR MISSION
To improve stewardship of grasslands through sustainable and profitable management.

ABOUT US
The South Dakota Grassland Coalition (SDGC) is a non-profit organization that seeks the voluntary improvement and protection of privately owned grasslands for the long-term needs of the resource and its various species. The Coalition goal is to provide local leadership and guidance in a cooperative effort, while providing the appropriate tools and training for grassland managers. Given the correct assistance, grassland managers will be better prepared to make cost-effective and environmentally sound management decisions.

South Dakota Grassland Coalition History

OUR HISTORY

The National Grazing Lands Initiative (NatGLC) was developed by professional range managers and private grassland producers in 1991, creating a platform to provide technical assistance to owners and operators of private grazing lands as a response to the 1985 Farm Bill.

In 1997, agency staffers and private ranchers in South Dakota pursued coordination with NatGLC for a statewide grazing organization on the heels of the success of the South Dakota Bootstraps program. While other states adopted names reflecting 'Grazing', the South Dakota founders decided early on that the South Dakota organization would not only focus on grazing, but would encompass all aspects of grassland management and in 1998 the grassroots, producer-led South Dakota Grassland Coalition was founded.

Original volunteers to the 7-member board of directors were Lavern Koch, New Underwood; Odeen "Skee" Rasmussen, Belvidere; Ron Ogren, Wessington Springs; Mark Sip, Geddes; Dave Fischbach, Faith; Larry Stomprud, Mud Butte; and Ron Mackaben, New Underwood. Since that time the board has grown to nine producer Directors and the Coalition has over 500 members throughout South Dakota and the surrounding region.

Partnerships have always been a key ingredient to the success of the South Dakota Grassland Coalition, and the Coalition prides itself on exploring any partnership that will benefit public and private grassland conservation and producer longevity through profitability of grassland products and services. Traditional partnerships with agencies such as NRCS have expanded into partnerships and cooperative projects with other federal agencies such as the USFWS and Joint Ventures, state agencies such as SD DENR, SD GFP, and SDSU Extension, and a variety of non-government (and sometimes non-traditional) organizations such as SD Cattlemen's Association, Ducks Unlimited, Pheasants Forever, the National Fish and Wildlife Foundation, National Audubon Society, World Wildlife Fund, The Nature Conservancy, and the Sand County Foundation through the annual SD Leopold Award.

To learn more about the SD Grassland Coalition, visit us at ***www.sdgrass.org***

SOUTH DAKOTA GRASSLAND COALITION

South Dakota Grassland Management Resources

First and foremost, the Coalition provides educational opportunities for producers and agency personnel alike. Among other base needs, grassland management requires knowledge of the whole system: soil, water and nutrients, plants, animals, and their interactions with one another. The Coalition has a wealth of informational tools available and is willingly prepared to share them with others seeking assistance.

Along with the National Resources Conservation Service (NRCS), South Dakota State University (SDSU) Extension, and private consultants, the Coalition offers assistance and information to individuals and groups who are interested in grassland management and are committed to improving South Dakota's grasslands. Many of these supporting agencies also offer grassland management education, technical assistance, and guidance.

Planning is the key to developing a holistic management approach to improving your grassland resources and your financial position. The complex nature of grasslands requires a holistic, integrated management approach. The Coalition supports workshops, tours, seminars, and other educational opportunities to help producers improve skills in decision making on various topics that include their quality of life, environmental stewardship, and creative ways to turn natural resources into financial capital while still protecting the integrity and longevity of those resources. If managed well, grass is a proven renewable and profitable resource, and the Coalition strives to help producers achieve balance between land health, profitability, and quality of life.

The Coalition, in partnership with ranchers across the state, has established a mentoring network to provide valuable hands-on learning experiences for both current and prospective grassland managers (see Mentoring and Education on page 35). Through mentorship by established producers, the mentee (you!) has the opportunity to see a system in operation and receive guidance from the mentor regarding success and challenges of the system.

Our flagship outreach effort is the South Dakota Grazing School. Here participants can learn through classroom and hands-on field instruction the foundational principles of setting goals, grassland ecology, grazing planning, drought planning, monitoring, and financial planning in an integrated setting with other producers and grassland managers from across the state.

Grassland Goods and Services

Grasslands, whether in the form of pastureland, rangeland, or various conservation program or habitat lands are important ecosystems that provide a variety of goods and services such as:

- forage for livestock
- wildlife habitat
- pollinator habitat
- plant diversity
- hydrologic function for ground water recharge
- nutrient cycling
- carbon storage
- water filtration and sediment capture
- soil conservation and soil building
- open space for aesthetic value

It is the responsibility of the grassland manager to apply the proper tools, techniques, and management to achieve the desired set of goods and services. The goods (e.g., livestock, hay, fee hunting) are supported by well-established economic markets while services (e.g., nutrient cycling, water quality) are generally supported by governmental conservation incentive programs.

The goal of the Coalition and its partners is to help you, the private grassland manager, understand the value of these goods and services and how to navigate the complex conservation policies surrounding incentivized conservation programs. Science and management must be at the heart of such policy debates. The Coalition is at the forefront in helping local, state, and federal agencies guide these important policy discussions to ensure grasslands continue to provide such goods and services in the future.

Why Grassland Management?

Traditional methods for grazing livestock have been in place for generations. As "tried and true" methods continue to work, new technologies and resources have become available that help maximize the health of the resources while maintaining overall productivity.

Grassland management involves more than simply moving livestock from one pasture to the next. Successful grassland managers are educated in grassland health and strive to improve their personal understanding of key grassland components such as:

- grassland plants
- soil quality
- water management-quantity and quality
- harvesting grassland resources
- animal nutrition
- modern technologies
- fencing
- livestock water development
- plant growth cycles and critical rest periods
- monitoring techniques
- drought planning

KNOWLEDGE IS POWER

"At first, we had a production approach to ranching," says Jim Faulstich, who ranches near Highmore, SD. "Now, we have shifted to a grassland management style that allows flexibility and considers all the resources – soil, water, air, plants, animals and people. Sure, the gross margin isn't always as high, but in the long run, the overall resources of the ranch and my business are healthier and more profitable."

Faulstich, a longtime member of the Coalition, has put his ranch where his words are. Using tools from many sources, including U.S. Department of Agriculture conservation programs, Faulstich has become a successful model of a grassland manager.

"I wish someone would have told me 30 years ago what I know now. I am the same person I was before … my stewardship ethics have not changed. What has changed … is my knowledge. With what I have learned and experienced through participating in project demonstrations, workshops, classes, site tours and more, I am confident my ranching decisions are in the best interests of everyone and everything … for the long term".

Faulstich concludes, "It's enjoyable not to live in fear of running out of forage which was the case a few years ago. With proper management of the resources and a drought plan, that fear shouldn't happen. This management style results in a good relationship with our banker who gives us unbelievable support."

Grassland Types in South Dakota

Native Grassland: These are grasslands that have *never been farmed*. In a perfect world native grasslands would support the full suite of native species including vegetation, mammals, birds, reptiles, insects, and soil biota. In reality, few have been managed well enough over time to have retained the full suite of biology, but many do retain a fairly intact and diverse native plant community. In South Dakota, these are often traditional pastures that occur in areas that are too rocky or steep to farm. It is important to note that just because a pasture is native, does not necessarily mean it's always *healthy*. Across South Dakota, native grasslands may be heavily invaded with non-native grasses such as smooth bromegrass, Kentucky bluegrass, crested wheatgrass, or cheatgrass. If an area still has scattered surface and sub-surface rocks it is likely that it was not tilled in the past and is a native grassland.

Go-back grassland: These are grasslands that were converted to farmland at some point in the past but have reverted back to grassland. Go-back grasslands may have been abandoned and thus passively returned to native and non-native species or may have been actively replanted to serve as pasture or hayland.

High-diversity native grassland reconstructions: These are areas where the intent is to permanently re-establish plant diversity and ecological function, including cool and warm season native grasses and flowering broadleaf plants. They can harbor as few as 30 and as many as 200 or more native plant species. These plantings are generally established and managed by agencies as conservation areas and often have excluded livestock in the management plan. However, in recent years conservation organizations have been experimenting with livestock integration as a management tool in these re-established grasslands. These grasslands focus on native species but they are not truly native grasslands as they are most often established on previously cropped ground.

Low-diversity native grassland plantings: These are areas where the intent is to establish a relatively temporary low-diversity native plant community that offers some wildlife cover and structure and overall conservation value. Generally, old CRP fields that have 1-5 species of warm or cool season native grasses would fall into this category.

Diverse native grassland plantings: These are an emerging segment of the grassland re-establishment matrix and are plantings that are generally in-between the other categories. These fields are often intended to be at least semi-permanent and include a greater degree of diversity of native grasses and flowering plants. While not as diverse as a full native grassland reconstruction in regard to structure and function, these plantings offer more than just a few grasses and may have from 10 to 20 or more native species, including at least a few native flowering plants. These fields are often associated with some sort of state or federal program (such as CRP) and are generally established for soil conservation, wildlife habitat, and pollinators.

Non-native or mixed grassland plantings: These are simply those areas planted into permanent or semi-permanent non-native grassy cover. They may be old CRP, pastures, hayfields, conservation plantings, or erosion control projects. While they are often managed well, these areas do not focus on native grassland species management.

Native Species

Native grassland species - grasses, forbs, legumes and some shrubs - are a vital part of South Dakota's livestock industry. Native species tend to be well adapted to the soils and climate of the specific area in which they grow, and are typically less susceptible to disease, pests, drought and other ailments that can sometimes affect introduced or tame planted species.

Livestock tend to graze on all types of species, not just grasses, at various times of the year. Therefore, certain shrubs not only provide livestock forage but also provide valuable services to the grassland community by providing structure, wildlife cover, and protection to other plants and the soil by capturing snow for insulation or by intercepting rainfall. Forbs (or broadleaf plants) can also provide a major part of livestock diets while providing flowers, nectar, and habitat for pollinating insects such as butterflies and bees. These plants also help 'complete' the grassland plant community and may serve critical functions in water and nutrient cycling. Therefore, a good mix of a variety of native species in your pasture can not only provide nutritious forage for livestock, but also greatly benefits other natural resources such as wildlife, soil health and the water cycle.

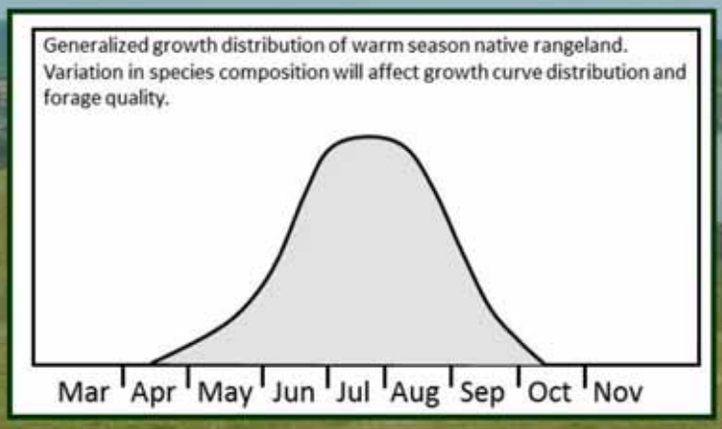
Native grassland species are often grouped according to their response to various disturbances such as grazing pressure, wildfires, and prolonged drought. Decreaser species tend to decrease in abundance with increased disturbance. Increaser species will initially increase in abundance, but will later decrease with increased disturbance. Invader species are those that are not typically found on a specific site, and will continually increase in abundance if disturbances continue for long periods of time. Good management is essential in order to keep the wide variety of species healthy and productive on native grasslands.

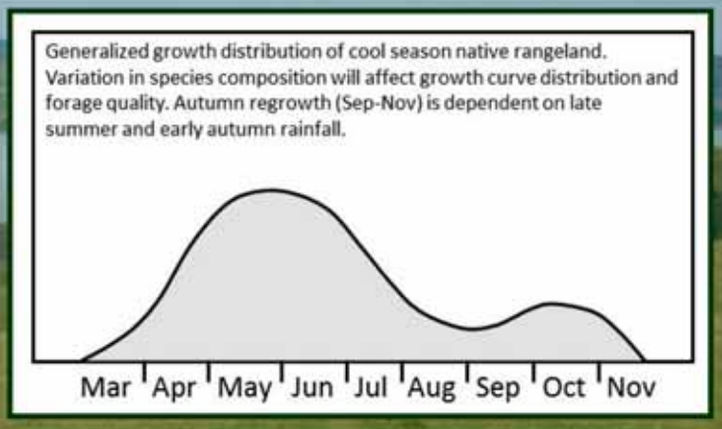
Warm and Cool Season Grasses

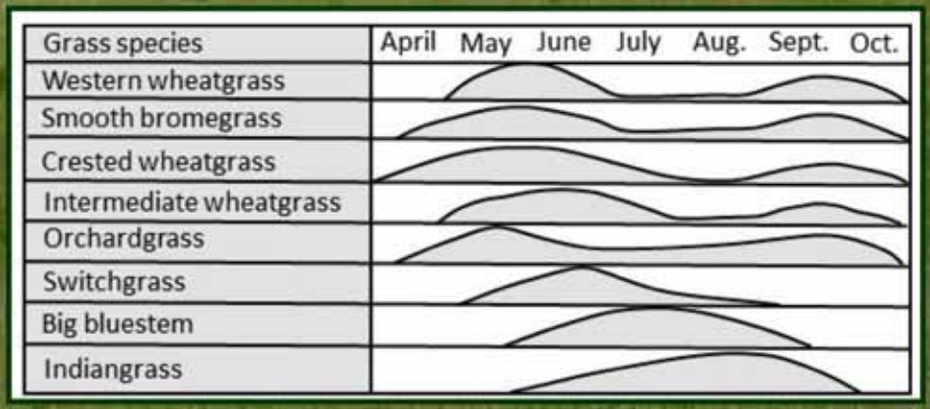
Grasses are often divided into two groups based on their season of growth. Cool season grasses grow in the early part of the growing season (spring and early summer), while warm season grasses grow later in the season (early summer to late summer). A mix of warm and cool season grasses is essential to a successful grazing management system due to differences in maturity rates and forage production. In much of South Dakota, healthy native grasslands will have a good natural mix of cool and warm season species.

Typical warm season grasses found in South Dakota are big bluestem, indiangrass, switchgrass, little bluestem, sideoats grama, and blue grama. Some examples of cool season grasses found in South Dakota are western wheatgrass (South Dakota's state grass), green needlegrass and needle-and-thread – all native to the land. More aggressive, introduced cool season species include smooth bromegrass, Kentucky bluegrass, crested wheatgrass, and cheatgrass. These grasses tend to be most productive in spring and fall and because they recover quite well from disturbance, can be highly invasive in many native pastures.

Depending on where you are in the state, your land may be dominated by either cool season grasses or by warm season grasses. Oftentimes improved grazing management (i.e., rotational grazing, changing season of use, etc.) can lead to an increase in the missing component. Sometimes achieving a mix of warm and cool season species may require seeding pastures or portions of pastures to the group that is not abundant. Use of prescribed burning can also improve your warm season grass populations in pastures.







Introduced Grasses and Forbs

While native grasslands contribute greatly to the integrity of the overall grassland community in South Dakota, the use of introduced grasses has proven a popular alternative for some producers. Typically, introduced grasses and forbs such as various bromegrasses, timothy, orchardgrass, ryes, alfalfas, and clovers, are managed as hay and forage crops. Unlike native grasslands, these grassland species are often managed as 'crops' and therefore the use of inputs such as fertilizers and chemicals is more prevalent.

While certainly not the case for all species, some introduced grasses and forbs can be highly invasive and can cause serious problems in native grassland communities if they are not managed properly. Examples of fairly invasive introduced grasses include species such as smooth bromegrass, crested wheatgrass, intermediate wheatgrass, Garrison creeping foxtail, and certain fescues. Examples of invasive forbs include legumes such as birdsfoot trefoil, sweetclover, and certain vetches.

While all introduced species pose a certain level of risk regarding invasion into native grasslands, some popular species of introduced grasses and forbs tend not to invade as readily and can be contained with typical haying or grazing management. A few examples of species that pose a minimal threat to healthy native grasslands include orchardgrass, annual rye grasses, and forbs such as red clover.

Replanting Cropland Back to Grassland

Understanding your forage needs. In order to make management decisions that will support your overall objectives, the first step is to identify what resources are currently available to help you reach those objectives, and what problems may need to be addressed. Completing a resource inventory that includes the species present and the available forage production will aid in selecting alternatives that will help you achieve your management goals.

Identifying the forage species and understanding the suitability of those species to your grazing animals will provide the information necessary to make sound decisions about grazing management. For example, the best way to extend your grazing season is to provide for both cool season and warm season forages. If the resource inventory indicates that some of both occur, but possibly not in sufficient quantities, a management system may be designed to enhance the element that is most needed to meet your goals.

Selecting species that are adapted to the area's climate and soils and that match your management needs based on goals and objectives is critical to long-term success. Consider factors that may affect production such as insects, soil types, and moisture requirements. Also consider non-grazing objectives such as habitat, escape cover, and food for wildlife. Building diversity into your resources by including native plants and selecting varying lifecycles also builds resiliency. Diversity allows for natural protection against disease and pests, provides for the needs of other beneficial insect and wildlife species, can extend the length of the grazing season, and can help mitigate drought, frost, and other climatic variables.

Preparing the ground. Planting cropland back to grassland takes some planning regarding previous herbicide use, soil fertility, and seed bed preparation. Adequate soil surface firmness and residue cover can protect the site against erosion and provide water storage for seedling growth. If land has been cropped for many years, it might be a good idea to plant cover crops for a few years to build carbon and cycle nutrients from lower in the soil profile to the rooting horizon. Seeding into previous crops like soybeans can provide a good seedbed.

General Principles of Grazing Management

Grazing involves a number of variables, including: carrying capacity of the land, type and distribution of the livestock, water distribution, and number of pastures. A combination of both proper grazing techniques and grassland management will improve harvest efficiency and lower production costs.

To develop a sound grazing management program, keep in mind these general principles:

- **Meet the nutritional needs of your livestock.** Livestock performance will differ depending on the quality of the plants being consumed. A healthy plant community will better meet the nutritional needs of the livestock. Allow enough grazing area for your herd, basing the pasture size on plant production capabilities. In addition to forage quality, each pasture must produce an adequate quantity of forage required by the grazing livestock.

- **Optimize forage yield, quality and persistence.** Plants need leaf surface area to capture the energy from sunshine and carbon dioxide to perform photosynthesis. By rotating livestock at the appropriate times, grasses are given the rest period needed to grow, build root reserves, and continue to thrive.

- **Protect and enhance the resource base.** Proper grazing management protects and promotes plant growth and vigor. Plants that are given sufficient rest periods become healthier over time and provide more nutrients to your livestock. Additionally, more desirable plants can thrive to provide more diversity.

- **Integrate knowledge and technology to develop a practical and economically viable management system.** Knowledge and technology equate to power. This power can provide a successful grazing system that operates efficiently, which means a healthier grassland, healthier cattle, and increased profit.

Grazing Systems

According to rangeland and pasture specialists, there are four basic types of grazing systems.

Continuous Grazing. This is a one-pasture system that allows livestock to continually graze one large section of land. Though requiring the least amount of management and keeping capital costs to a minimum, this system is also the least efficient in terms of resource use and profitability.

Deferred Rotational Grazing. A deferred rotational grazing system uses more than one pasture and rotates cattle from one pasture to the next at varying intervals. This allows the manager to defer grazing during important growing periods to allow plants to set seed without being grazed. Periodic deferments at the right time are just as effective as a full calendar year rest in many cases. However, costs for fencing and water may be higher than continuous grazing. Advantages include:

- improves grazing distribution
- increases plant vigor of key plant species
- increases habitat for ground nesting birds

Rest Rotational Grazing. A rest rotational grazing system uses more than one pasture and rotates cattle from one pasture to the next at varying intervals but has one or more pastures that do not get grazed for an entire year. Rest rotation grazing maximizes plant recovery for plant vigor and ensures maximum cover for wildlife. Advantages include adequate nesting habitat for ground nesting birds.

Management-Intensive Grazing. This system requires the greatest investment both financially and physically. Advantages include:

- heal disturbed sites and increase forage production
- higher stocking rates
- more even grazing and manure distribution
- reduced time checking livestock
- improve water cycle and biodiversity of your grasslands

Designing a Grazing Program

The development of a successful grazing management program begins with a mental inventory and an observation of what is happening that you would like to change. Next, consider what you are willing to do to make that change. And finally, how much time are you willing to devote to a new grazing management system?

Once you have answered the above questions, seek assistance from professionals or experienced private grazing managers to help you determine a direction and design a system that is in line with your goals. Once you have walked through this mental exercise, your mentor will also be able to help you utilize what you already have, such as natural sources of water and existing fence lines.

On any acreage there are several ways to set up a grazing management system. Working with you, your mentor or professional helper can start by simply drawing up options for pasture division and cattle distribution. Together, you'll consider the absolute number of acres needed to sustain your herd for a certain amount of time. Next is setting up a grazing schedule.

Producers also can utilize personal research (books, videos, the internet) to help determine a direction and system. Temporary fencing may be a good option for the first year, while the producer evaluates the effectiveness of the chosen system.

When developing a grazing schedule, there are multiple factors to consider. Knowing the growth cycles of the grasses present, when to graze, and how much of the plant should be grazed are key influencers of the schedule. These factors, along with monitoring your outcomes, are important steps toward success.

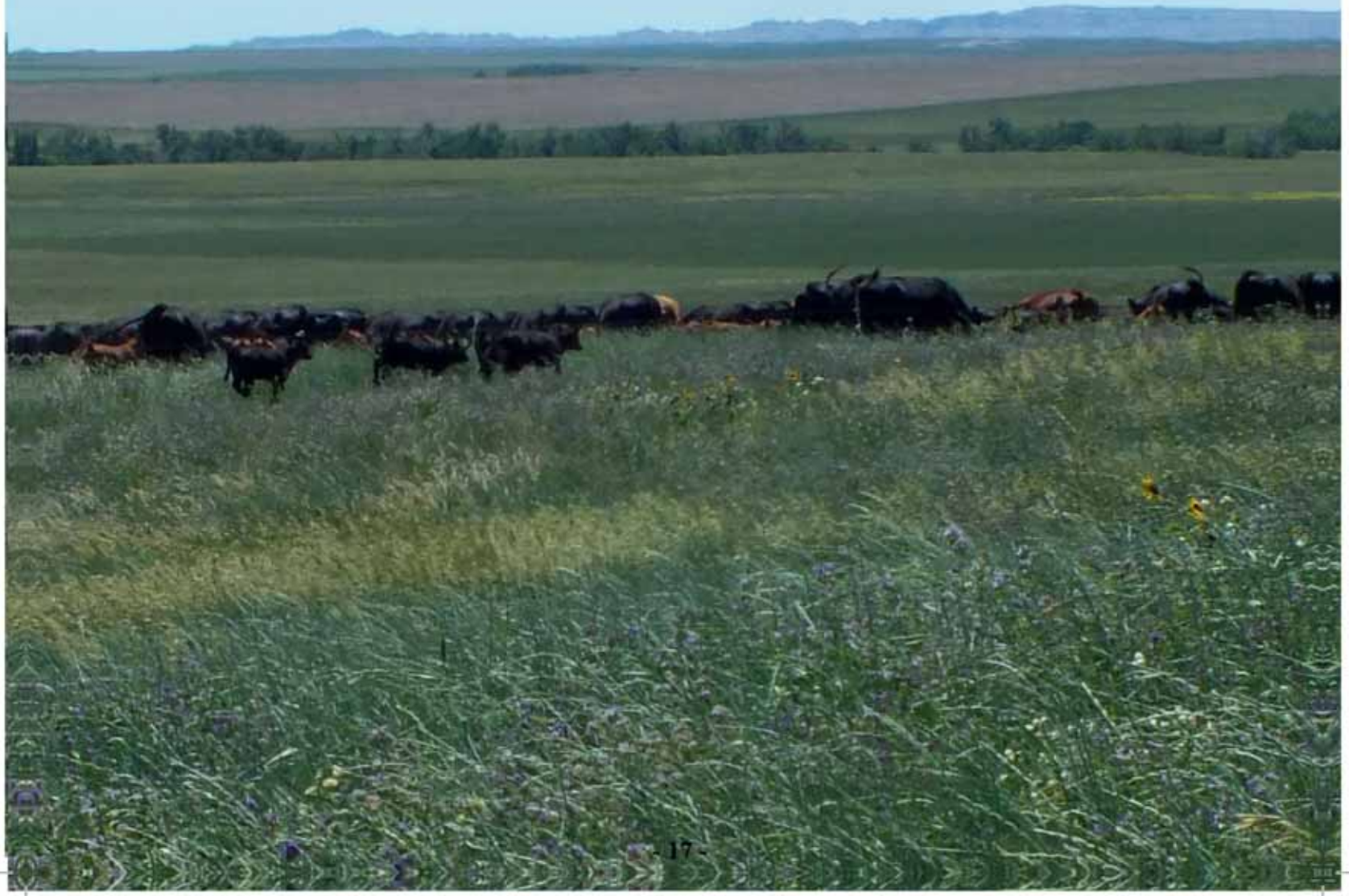
When to Graze / How Much to Graze?

While every grazing management system is unique, there are a few similarities between systems when determining when to graze. Consider each of the following factors to avoid overgrazing:

- design the system according to your management goals
- plan for unforeseen events such as drought, increased insect populations or wildfire
- plan the season of use according to plant life cycles and animal needs
- remember that spring moisture leaves plants more vulnerable and susceptible to trampling

Determining grazing tolerance for your program is site-specific. If you are utilizing existing grassland, refer back to your inventory and review the condition of your grassland. This will help determine the current health of the grasses and whether they need rest. If you're using converted farmland, be sure the newly planted species are established before you begin grazing.

Once you have assessed the health of the grassland, you can set a grazing level that is appropriate to your conditions. Remember to incorporate the assistance of a grazing professional or trusted mentor as your grazing plan evolves.



Haying and Mowing / Clipping

While grazing is the primary means of harvesting the majority of South Dakota's native grasslands, haying also plays an important role in native and tame grassland management. Haying impacts individual grassland species and grassland communities in ways that are both similar and different from grazing or fire. Similar to grazing, haying mechanically removes the targeted portion of the plant, which is often the majority of new and old growth to within a few inches of the soil surface. In addition, haying can mimic the 'biting' method of grazing by livestock such as sheep and goats, but is dissimilar to the 'tearing' of forage by animals such as cattle. Another key difference is that haying is generally uniform and non-selective, equally harvesting the entire grass crop.

Generally, the intention of hay harvest is to maximize one or more aspect of the grass crop such as volume or nutritional quality for future use as feed. In contrast, mowing or clipping is conducted without any intention of harvesting and is usually initiated to either stimulate growth of desirable species or to inhibit establishment of undesirable species such as noxious weeds.

Timing of harvest of native and/or tame grasslands can influence the diversity of the plant community. Well timed mid to late summer haying after plants have formed a bud or seed head has been credited with maintaining diverse native prairies. Impacts of early haying can improve or harm a plant community depending on the composition and diversity present at site. As an example, a producer may elect to hay a native warm season grass planting in May if the goal is to suppress an invasion of cool-season non-native smooth bromegrass. This might be poor timing if the intent is to encourage establishment of native cool-season green needlegrass.

Advantages:

- increased harvest efficiency
- residue removal when necessary
- maximum control of timing of removal
- maximize quantity/quality of hay crop
- store feed for later use
- late season can benefit native plant communities

Disadvantages:

- equipment and fuel expenses for harvest, handling, storage
- nutrient and residue removal
- soil compaction
- weather/precipitation damage
- grinding/mixing and other feed processing expenses
- consumption inefficiency

Swath / Bale Grazing

Grazing and mowing are both proven techniques for harvesting grassland biomass, and both have advantages and disadvantages in relation to timing, efficiency, and input expenses. Swath grazing and bale grazing are harvest systems that mesh haying and grazing techniques. Generally, the objective is to reduce labor and equipment expenses associated with baling, transporting, storing and feeding hay by allowing livestock to consume the hay crop in the field.

Swath grazing utilizes common haying equipment. Instead of baling the hay swath, the swath remains in the field where it cures, retaining its nutritional value. Managers then typically utilize temporary or movable fencing, such as electric polywire, to allow livestock access to the feed during winter months. Livestock are not allowed access to the entire swath field, rather a pre-determined number of swaths are allocated for the length of the feeding session, which may range from one half day to up to three days or more depending on the operation.

Bale grazing is similar to swath grazing in that the livestock consume the bale in the field. Managers utilizing this technique vary in their approach depending on the individual situation. Some bale grazers will leave the bales in the original field, with some opting to arrange the bales in such a manner to be able to efficiently incorporate temporary fences to allow access to one or more days of feed at a time. Others may choose to haul the bales to a pre-determined feeding location where the bales are then arranged for future feeding sessions.

Both swath grazing and bale grazing systems require additional management and labor associated with grazing the swath or bale. However, one could argue that it takes less time to move an electric fence than it does to start a tractor, get a bale, feed the cows, park the tractor, etc. Management of movable fence and access to water during winter months are challenges associated with both systems. While both systems can reduce typical equipment and labor expenses, livestock may not be as efficient in consuming the forage as they would otherwise be in a feeding situation. However, many swath and bale grazers associate the 'waste' with positive impacts to soils and nutrient cycling, including the manure deposited directly on the field saving expenses associated with artificial fertilizers or hauling manure from a livestock lot.

Hay Harvest Contracting

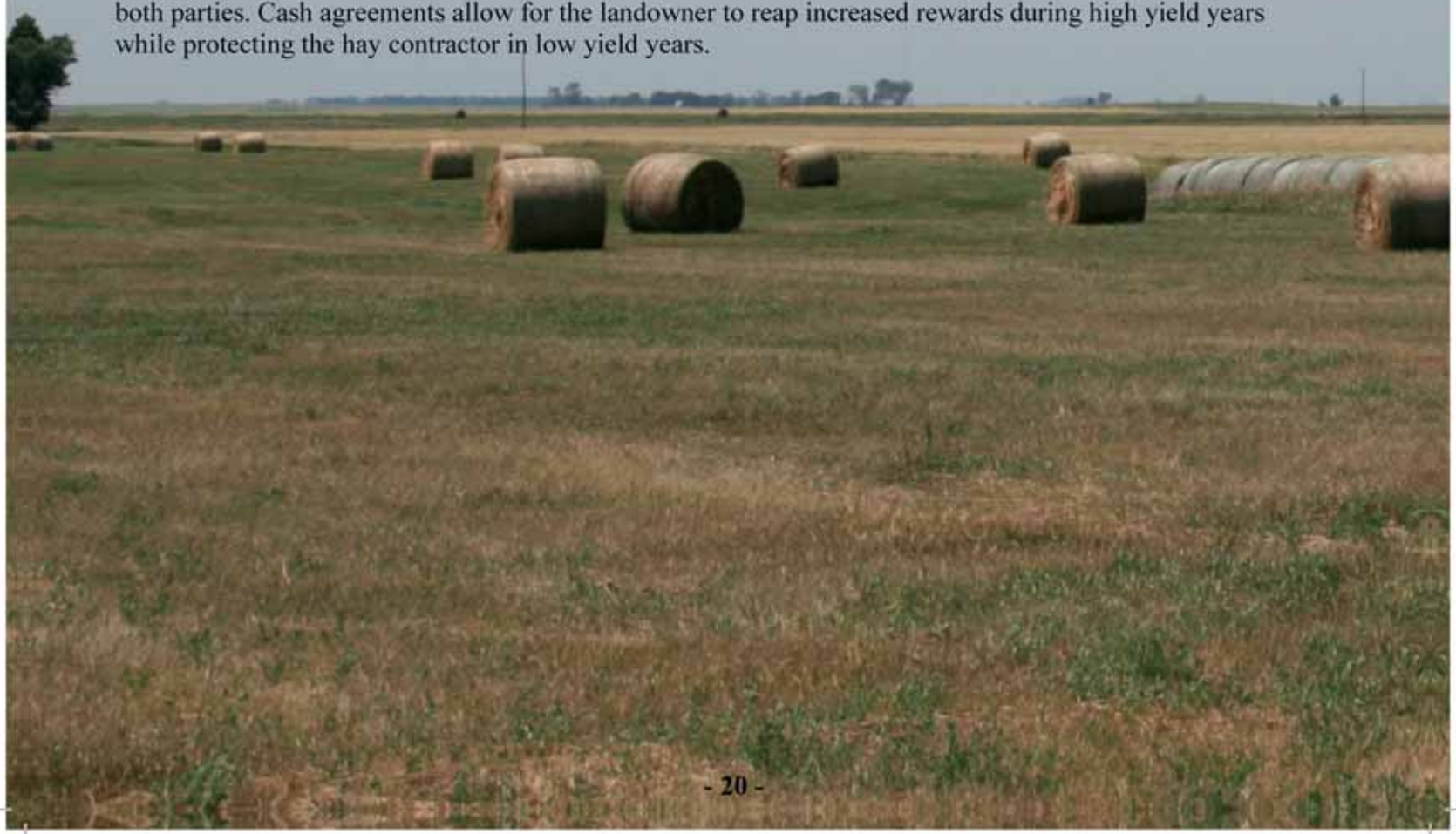
For those landowners who typically lease or harvest grasslands for hay, contracting for services is a learned business that can have local variations in how the grass and associated services are valued. For those who own grasslands not typically harvested for hay, contracting for services can be an intimidating endeavor, especially if one lacks the background knowledge necessary for estimating values.

Grass crop values are driven by supply and demand and can be impacted by local or regional factors such as drought, cattle markets, and the overall feed market. Therefore, determining a "fair" pricing system for mixed hay, CRP grass, prairie grass, or old field forage can be challenging.

Traditionally, hay crop harvest agreements are a per-acre cash basis or a crop sharing basis. In both systems, the individual harvesting the hay takes on all associated expenses. In a per-acre system, the landowners are paid a flat rate for the hay crop based on a pre-set dollar per-acre agreement regardless of the actual tonnage harvested. In the crop share system, the landowner and the harvester split the final crop on a pre-determined percentage. In this case, the harvester may have the option to purchase the landowners share of the crop.

Landowners that have no interest in physical retention of the hay crop also utilize cash-based contract agreements. These agreements are a hybrid between cash rent and share cropping and account for total hay value less the pre-determined value of the cost of production. This system encourages the hay contractor and landowner to discuss and agree upon an up-front fixed rate for harvest expenses, for which the hay contractor is fully reimbursed regardless of the value of the hay. After the crop is harvested and valued, the pre-determined harvest expense is subtracted and the harvester pays the landowner the remainder value and takes possession of the hay crop.

A cash agreement offers a great deal of appeal for landowners and hay contractors because it can reduce ambiguity in the relationship, therefore decreasing the risk of a contract being considered 'unfair' by one or both parties. Cash agreements allow for the landowner to reap increased rewards during high yield years while protecting the hay contractor in low yield years.



Fertilizing Grasslands

Grassland fertilization, like many other grassland management topics, is highly dependent on certain parameters such as soil type, vegetation type, and harvest methods.

Native plant communities that are appropriately grazed will not benefit from the addition of commercial fertilizers. These systems are resilient, and if balanced with the appropriate suite of native plants, generally have no need for additional nitrogen or other compounds, as these compounds are naturally cycled through the vegetation and the grazing animal. Further, addition of artificial or commercial fertilizers can encourage nitrogen-loving invasive species.

Cool season exotic grasses such as Kentucky bluegrass, smooth bromegrass, and intermediate wheatgrass can flourish under artificial fertilization, as can invasive broadleaf plants such as exotic thistles. For this reason alone, fertilizing native grasslands is generally discouraged among range managers.

It is difficult to quantify return on investment when fertilizing native grazing lands in general, as the harvest efficiency of livestock may serve as a limiting factor in recouping input expenses through additional forage consumption, even if an increase in pounds per acre is achieved.

In planted grassland systems, such as those managed exclusively as hayfields with a variety of tame and/or exotic species, fertilization can play a role in maintaining or increasing annual productivity as nutrients are continually removed from these systems. However, caution should be exercised and careful assessment of the weed community within the hayfield should be conducted prior to fertilization, as fertilizer can dramatically impact the ability of weeds to flourish, thus potentially negating any advantage that increased production might have.

Grazing Contracting

For those who own grasslands not typically grazed or for those looking for a better contract basis, there are several grazing contract options that can be explored.

Typically, grazing contracts are based on an annual cash per-acre rental system, where the livestock lessee pays the landowner a pre-determined per-acre price for access to the pasture for the grazing season. There are many variations of this model, and often per-acre prices are adjusted up or down depending on either the lessee's or the landowner's responsibilities toward pasture maintenance (fence, water, weeds) and livestock handling (rotation, health issues, supplemental feeding). Cash per-acre rental agreements can fluctuate dramatically based on other agricultural markets, such as crop and livestock value.

Generally, it is up to the lessee to stock the pasture with whatever livestock density he or she determines appropriate. Often, the carrying capacity of the pasture is greatly over-estimated and can lead to negative impacts to pasture health. This situation is the result of the lessee over-estimating carrying capacity to ensure a return on investment.

A lesser utilized system is one that accounts for the amount of grass harvested by the livestock, known as the Animal Unit Month, or AUM system. An AUM is equivalent to the amount of dry matter forage that a 1,000 lb cow would consume in 30 days. For example, if a 1,000 lb cow eats 2.6% of her body weight in dry matter forage in one day (26 lb) she would then consume 780 lb in a month. In the AUM system, the lessee pays the landowner for the AUMs that will be stocked during the duration of the grazing period. The system is designed to account for the total impact that livestock will have on the grass resource, and is meant to help managers avoid over-stocking the range by allowing for a system of pre-estimating both production and consumption and valuing them accordingly.

Growing in popularity is the per-head per-day method where a lessee pays a landowner a certain daily rental rate based on the number and size of cattle on the pasture. For example, if a 1,000 lb cow is 1 animal unit costing $2/day, a 1,500 lb cow will cost the lessee $3/day, normalizing the fee at $1 per every 500 lb. This system is basically the same as the AUM system, but most producers find it easier to understand. Because it is based on a daily rate, adjustments to the herd can quickly be re-calculated based on any given day.

Winter Grazing

The predominant factor in winter grazing is ensuring adequate forage availability while considering overall long-term range health and maintenance. When managed correctly, grazing winter range can be a viable option for controlling feed costs and ensuring herd health without negatively impacting rangelands. Therefore, winter grazing must be part of a 'planned' grazing approach.

Livestock intake needs may fluctuate based on the nutrient density of the available forages, and measurements of the forage production and quality of winter pastures is recommended for an accurate stocking plan. Forage degradation due to weather, breakage from wind, and compaction from snow can decrease available winter forage, so consideration for forage loss due to winter weather is critical if the range is to 'carry' the herd through the winter months.

It is possible to 'overgraze' winter rangelands, and careful planning is necessary. Overstocking winter range can lead to negative impacts to individual plants, potentially damaging the base of the plant and robbing it of vital nutrients for spring growth. Severe winter grazing can expose soil leading to future issues with invasive species, especially in dry regions. Overall, mismanagement of winter range can negatively affect animal health and future grassland production, leading to increased reliance on stored feeds and potential weed issues.

Managing herd size and matching it to pasture production is an important component to winter grazing. If stocking density is too high in relation to forage availability, feed supplementation may be necessary. The potential impacts on the range from concentrating animal activities through supplemental feeding should be continuously monitored. To protect the integrity of the range in these situations, reduced access to native pastures can minimize unnecessary damage. Finally, producers should make available a reliable source of water since it is the first limiting nutrient in an animal's diet.

Monitoring Success

While periodic monitoring is necessary for continued success, a thorough evaluation in the first few months will tell you a lot about grazing levels, benefits to livestock and livestock-to-acre ratio. By completing an early assessment, you'll be able to adjust necessary variables before getting too far into your program.

Once the initial evaluation is completed, you may set up a periodic monitoring program to determine progress. Scheduled maintenance will vary depending on the program, but is necessary for the success of all grazing management systems.

When assessing the condition of your land and livestock, be sure to make written notes and records of everything you evaluate, including precipitation levels, grazing dates for each unit, and condition of more sensitive areas such as stream banks. This will be helpful for future assessments and comparisons and may also give you insight into the trends of your grass species.

Invasive Species Management in Grasslands

Healthy grasslands are generally identified by the plant community. At the core of any plant community assessment is an inventory of native plants. When assessing a native plant community, you must consider both the number of native plants and the diversity of native plants. As an example, a native pasture might have thousands of individual grass plants. If all those individual plants only represent three species, you might have a lot of individual native plants but very little native diversity. This might be considered an unhealthy native grassland that could be subject to invasion.

Alternatively, if you have hundreds of individual native plants, but those plants are comprised of dozens of species, you might have a grassland with reasonable diversity, but is also suffering from poor reproduction or poor soil health with a lot of open space between plants. Again, this might be symptomatic of an unhealthy grassland that is ripe for invasion of non-native plants.

What is desirable in a native plant community are many robust individuals of various species competing amongst themselves for space on the landscape, thus leaving little opportunity for unwanted invasive species to enter the community. Ironically, grasslands that are resistant to invasion and those that are ripe for invasion are both the result of management decisions.

Once invaded, grasslands can shift dramatically toward dominance of exotic species and require an integrated approach to species control that considers all tools such as mechanical (cutting, burning), cultural (grazing), or chemical alternatives. Each of these tools may have positive and negative consequences, especially regarding the native plant community. In temporary or semi-permanent planted grassland systems or hayfields, unintended consequences of more aggressive techniques, such as chemical applications, are not as far reaching as those in diverse native systems. Work with a trusted local grassland expert to develop a management strategy for invasive species prevention and control in your grasslands.

Measuring Grassland Production

Assessing pasture forage production is a key step in planning harvest strategies and can also inform the manager on the status of wildlife habitat or other grassland values. Online resources, such as the free USDA Web Soil Survey, allow landowners to input the perimeters of a pasture or ranch while the program outputs production estimates based on soils and typical vegetation for the area.

Many producers prefer locally accurate information on their grassland production. One of the most reliable systems for measuring grassland production on the farm or ranch is to clip and weigh the vegetation. Tools such as clipping 'rings', charts, and tables, assist in estimating per-acre production. While important to establishment of base data, annual clipping can be time and labor intensive, thus most producers fail to follow through on long-term clipping to establish production estimates.

As an alternative, grassland managers have developed simplified tools that allow rapid estimation of forage production in grasslands without the need to continuously clip and weigh vegetation. One of these tools is the common 'grazing stick'.

While all grazing sticks are based on the same general principles, their use can be modified to fit local conditions. The grazing stick utilizes plant leaf height measurements in inches, estimating how many pounds of dry plant material are available per acre. The grazing stick includes simple math to determine herd size, stocking rates, and available grazing days. Producers interested in learning more about determining grassland production should work with a mentor or grazing professional to receive coaching and guidance.

Rotation
180 Day Grazing Period

No. of Pastures	Grazing Efficiency	Grazing Days	Rest Days
1	25%	180	0
2	30%	90	90
3	30%	60	120
4	35%	45	135
6	35%	30	150
8	35%	23	157
12	40%	15	165
16	40%	11	169

Estimated Air-dry Weight in pounds per inch*			Minimum
	Stand Density**		Stubble
Plant Community	Normal	Excellent	Height
Cool Season & Legume	150 - 250	250 - 350	4"
Cool Season Introduced	100 - 200	200 - 250	4"
Cool Season Native	150 -200	200 - 250	4"
Native Mixed Cool & Warm	100 - 200	200 - 300	4" to 6"
Warm Season Native	100 -250	250 - 350	6" to 8"

*Measure the average height in inches of the vegetative forage in the plant community, not seed head height.

** Stand density refers to the relative closeness of desirable plants. An excellent stand density will have a cover greater than 85% and be vigorous.

Estimating Livestock Consumption

When planning a grazing strategy, it is important to carefully assess goals and objectives and then match those goals and objectives with the appropriate livestock. It is critical that the manager understand that not all livestock are created equal. Not only can there be marked difference in species' grazing techniques regarding how they clip the vegetation and what types of forage, terrain, and cover they prefer, there can also be surprising differences between breeds and among individuals depending on experience, age and size.

At the base level, it is important to understand general consumption parameters. Generally, livestock forage consumption is based on a standard of a 1,000 lb cow, known technically as an 'animal unit'. Depending on certain factors such as age, nursing, or sex, a 1,000 lb animal will consume about 2% to 3% (20 – 30 lb) of its body weight in dry matter forage every day. Based on this standard, larger or smaller cattle and individuals of other species can be given a comparable animal unit ranking. For instance, a 1,500 lb cow would equal 1.5 animal units, whereas a typical ewe would be considered about 0.18 animal units. Stated another way, it takes six ewes to equal the forage consumption of a single 1,000 lb cow.

Grassland managers should monitor the condition of their land during and after livestock grazing to ensure that estimates are accurate.

Average Forage Intake (Air-dry basis)

Species	Animal Weight		Percent Intake		Pounds Forage Per Day	Pounds Forage Per Month
Sheep	130	X	.037	=	4.8	146
Sheep	200	X	.037	=	7.4	225
Yearling	650	X	.03	=	19.5	593
Yearling	850	X	.03	=	25.5	775
Cow	1000	X	.03	=	30	912
Cow	1200	X	.03	=	36	1094
Cow	1400	X	.03	=	42	1277
Cow	1600	X	.03	=	48	1459

Livestock Differences Explained

Not all animals graze the same. Bison, at one extreme, are uniquely adapted to North America's grasslands and can successfully graze in a variety of conditions and the harshest weather with little issue. Cattle have different forage needs, but can still utilize high lignin, mature feed with proper supplementation. Sheep tend to graze even more selectively, because they can move the upper and lower lip to bite, while cattle tend to sweep with their tongue and pull. Often, sheep will strip leaves from a plant, leaving the stalk, unless forced to consume it. At the far extreme, goats are able to browse on a wide variety of brush and weedy species, but require the highest feed quality to maintain condition. They can prove to be a valuable asset when trying to reduce woody vegetation or invasive broadleaf species in grasslands.

Water Quality

While producers have long acknowledged that access to water makes the difference between a profitable or unsuccessful operation, they are beginning to understand that water quality may be as important as water quantity. Studies have found that:

- cattle with access to clean water spend more time grazing and less time resting than those drinking from a pond
- calves gain up to a quarter pound more per day when cows have access to clean water
- cattle with access to clean water in tanks gain as much as a half pound more per day than do cattle drinking lower quality water from dugouts or ponds

Because water quality can affect production, it is important to consider water quality as well as quantity when planning a grazing system. Cattle with free access to water sources can quickly deteriorate the water quality through defecation, urination, bottom disturbance, and erosion of banks. To provide the herd with access to clean water consider:

- pumping water from streams, lakes and ponds into tanks
- using pipelines to make water available at several places in the pasture

Providing an adequate supply of clean water has additional benefits. Studies have shown that cattle spend 77% of their time grazing within 1,200 feet of their water source. Providing several sources of water scattered throughout the pasture promotes more uniform grazing and distribution of manure which:

- improves forage production
- increases the plant and wildlife diversity
- decreases the amount of sediment, nutrients and bacteria that wash into dams, dugouts, and streams
- ensures proper grazing and residual height of the grass, which is important for overall soil health, including future production, water infiltration, and grassland diversity

Managing Livestock Attractants Near Water

Placement of Water and Salt/Mineral Blocks
Proper placement of water and salt/mineral blocks can aid in distribution of livestock within a pasture. By controlling placement of these resources, you control animal behavior and patterns, reducing trampling due to congestion.

Depending on the topography of your land, place salt and mineral blocks away from water sources, sensitive riparian areas, areas of shade, pasture corners, or other areas where livestock tend to naturally gather to further distribute grazing and reduce stream bank erosion and pollution around natural water sources.

Grazing Riparian Areas
In the event that your pasture includes riparian areas such as streams, rivers, lakes or ponds you'll want to take special care of these habitats. A riparian area is the space immediately adjacent to the shore, where water and land interact. These areas usually include abundant plant life, including shrubs and trees, and are extremely important to water quality and wildlife health and diversity.

The health of riparian areas is crucial to the ecosystem and relies heavily on proper management. The care you place on your upland area should be integrated into the riparian area as well. The best way to manage a riparian area is to monitor cattle impacts and thus control the amount of time cattle have access to these areas. Encourage livestock to move away from these areas after a determined amount of time to give the area adequate rest time. Healthy riparian areas can tolerate managed grazing, but care should be taken that hoof action not compromise the integrity of the riparian area during periods when the soils are susceptible to damage. Once a riparian zone is damaged and erosion begins, recovery can be a very slow process.

Stable riparian areas are beneficial for many reasons including:

- protection of productive land
- reduction of sedimentation
- reduction of damage from high water flows
- retention of more water
- provide shade to livestock and wildlife

Drought Planning

A drought plan will be an essential component to your overall grazing plan as it provides guidance in making decisions during critical times when forage may be lacking. Generally, a drought plan will identify certain 'triggers', including calendar dates (that you determine) when critical management decisions are to be reviewed. For example, if you have not received adequate moisture by a pre-identified date, your drought plan may guide you through a destocking process in order to protect your grassland resources. Ultimately, a drought plan allows you to think clearly through action steps at a time when stress and emotion are elevated, resulting in a decision based on best business practices for your operation. Contact NRCS, SDSU Extension, or the Coalition for more information regarding drought planning.

Tools for the Planning Process

Precipitation records – keeping accurate monthly precipitation is helpful to knowing your trigger dates and how much rainfall you need to take action. Some options for obtaining precipitation records on your ranch include:

- placing a rain gauge at the headquarters or at pasture gates, if they are far from your headquarters, allows you to measure precipitation
- automated weather stations are commercially available and can give you instant access to data either through the internet or directly imported into your computer

Drought prediction – the NRCS has a drought prediction tool that uses a network of weather station information or information can be customized to your personal farm/ranch weather data to make estimates of forage production and stocking rates for the upcoming grazing season.

Trigger dates – these are calendar dates that you have determined to take action. Trigger dates include an evaluation of precipitation up to that time period, current market analysis, short-term future predictions, herd management options, and implications of pasture health once desired action is taken.

Drought Planning Continued

Drought mitigation strategies – flexibility in your herd is the key to a good drought plan.

- **Contract grazing** – yearlings or cow-calf pairs are a useful tool to allocate some of your annual forage resource to this enterprise so that when drought does occur you do not have to destock your main herd.
- **Yearlings -** including yearlings as one of your grazing enterprises allows the flexibility to avoid destocking the main herd when drought occurs.
- **Culling early** – instead of waiting to check pregnancy or cull the unwanted cows from the herd in the fall, do it sooner to save forage resources in the summer.
- **Early weaning** – once cows are weaned from their calves they consume much less forage. Calves can be sold or moved to a feedlot to reduce grazing pressure on pasture resources.
- **Purchase alternative feeds early in the season** – if you have an early enough warning prior to drought, you might be able to purchase or pre-contract lower price for hay or other alternatives before the laws of supply and demand cause the prices to increase as the drought intensifies.
- **Alternative forages** – you might be able to graze crop residues, cover crops, or use annual forages as an alternative to pasture if these are available in your area.
- **Move livestock to another location** – in some cases it might be worth the cost to haul the livestock to a non-drought location and custom feed until conditions improve at home. This might be an option if the genetics of your herd are important enough to not destock.

Fire as a Management Tool

Our native grasslands generally evolved with the three major influences of climate, grazing, and fire. While the impacts of climate can be somewhat mitigated, your operation is largely at the mercy of the weather. Grazing and fire on the other hand are largely under your control as a manager.

Well-timed fire provides several key services to native grasslands and native grassland plantings including:

- rejuvenation of the plant community
- improved grass and forb expression
- nutrient cycling
- increased pasture and grassland production
- increased seed volume and vigor
- increased wildlife habitat
- increased flowering, nectar, and pollinator habitat
- control of invasive species, including exotic grasses and woody shrubs and trees, decreased risk of wildfire

Even with all its practical benefits, fire can be challenging to implement. In addition, fire effects may be compromised in plant communities that contain invasive species that are either fire tolerant (such as leafy spurge) or even fire-loving (such as cheatgrass). Further, negative results from poorly timed or unwanted fire in the form of wildfires can have devastating short and long-term impacts to individual operations.

Fire is a tool that, when planned for and implemented appropriately, can have tremendous benefits to your grassland community. Seek professional assistance or guidance from individuals with local experience when considering the use of fire for your grassland management.

Wildlife

Good grassland management has many benefits for the land, livestock, and grassland managers. Good management is also valuable for native grassland dependent wildlife, including insects, amphibians, reptiles, birds, and small mammals. Healthy, diverse grassland communities that contain a variety of vegetative structure and species can meet the needs of grassland wildlife by providing nesting, foraging, and escape cover in close proximity. Not only will well-managed grasslands provide habitat for native wildlife; the presence of these often overlooked species are a great indicator of a well-managed (and likely profitable) grassland system.

Appropriate grazing and grassland management can provide key disturbances to stimulate plant diversity and vigor. For example, early season grazing and trampling can create open space for the flowering forbs necessary for insect habitat, which will in turn attract other wildlife. Rested areas of grasslands are also useful to wildlife, providing valuable nesting cover for many grassland birds, including game birds such as pheasants, ducks, and grouse. These rested areas also provide a great resource for producers in times of low forage availability, such as drought. However, resting grassland for many years reduces its wildlife value, due to simplification of the plant community and buildup of old plant material.

For these reasons, it is crucial to manage grasslands to provide a diversity of plant types and structures in grasslands so that livestock and wildlife alike will thrive.

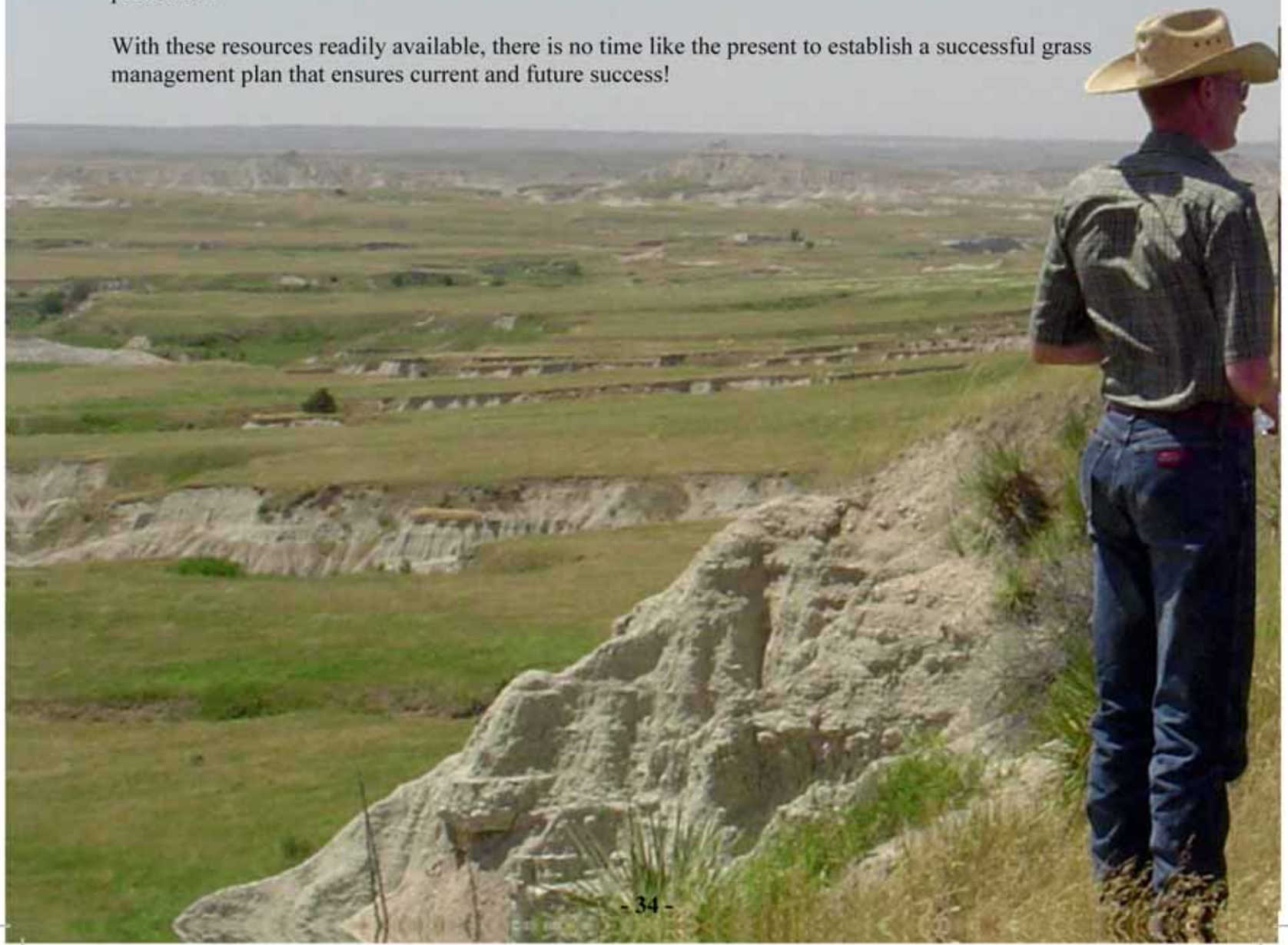
Managing and Protecting Grasslands for the Future

Grasslands are a valuable resource for South Dakota, and many of our core industries rely on the perpetuation of healthy grasslands for agriculture, recreation, and tourism. In addition, many other natural resources, such as wildlife and water quality are intrinsically tied to grassland health. Healthy grasslands serve as a model for soil health, and much can be learned about carbon sequestration, organic matter, and water infiltration through the careful study of the function of grassland systems.

While the majority of South Dakota's grasslands are managed for consumptive use under renewable and sustainable strategies such as haying and grazing, others are managed for non-consumptive uses such as hunting, recreation, or aesthetics.

Regardless of goals and objectives, many grassland landowners desire assistance with short and long-term grassland management goals. The South Dakota Grassland Coalition has strong ties to Federal, State, and local service providers as well as public institutions and private range consultants geared to assist the grassland manager. This network provides multiple educational opportunities, including mentorship and technical assistance by resource professionals. Certain partners can provide services that include planning, technical assistance, and cost-share with infrastructure such as fence and water systems, while others may provide a variety of short-term, long-term, and permanent options for grassland conservation and protection.

With these resources readily available, there is no time like the present to establish a successful grass management plan that ensures current and future success!



Mentoring and Education

We hope you have enjoyed this brief introduction to the various aspects of sound grassland management. We understand there is a great deal to consider in planning and implementation, and we know from experience that it can be overwhelming to tackle all aspects of grassland management at one time. We urge you to consider taking a step-by-step approach to grassland management.

The first step in that process is to get educated. You've taken a big step in reviewing this publication. Your next step is to expose yourself to a variety of grassland resources such as websites, books, articles, tours, seminars, events, and the like. Contrary to what you may believe, a great deal of grassland best management practices are not intuitive, they need to be taught and learned and exposure to a variety of sources will help you learn.

Finally, seek out one or more mentors who can help you on your journey toward improved grassland management. While not required, a good mentor should be someone who is local, knowledgeable, connected, innovative, willing to listen, and willing to share his or her successes and failures. The South Dakota Grassland Coalition is rich with such individuals in our leadership, our membership, and our partners.

Take some time to visit us at **WWW.SDGRASS.ORG** to get started on your journey.

Glossary

buffers – living filters. Most are relatively narrow strips of land featuring a permanent cover of plants, including grass, shrubs and/or trees. They protect elements of the natural environment, such as streams or lakes, or man-made structures such as buildings or roads, from damage.

carrying capacity – the maximum stocking rate possible without inducing permanent or long-term damage to vegetation or related resources. The rate may vary from year to year in the same area as a result of changes in forage production.

continuous grazing – a one-pasture system that allows livestock to continually graze on a large section of land.

cool season plants – plants that make most of their growth and flowers during spring and early summer, and then slow growth or become dormant during the hot part of summer, and may resume growth in the fall with the advent of cooler temperatures; has value in grazing management.

decreaser – plant species that is part of the natural vegetation that decreases in relative abundance with grazing pressure, fire, drought, or other continued disturbance.

deferment – a non-grazing period that encompasses the time from a key species breaking of dormancy in the spring until it sets seed later in the growing season.

diversity – a measure of the number of species and their relative abundance in a community; a variety of living things.

erosion – the detachment and movement of soil or rock fragments by water, wind, ice or gravity.

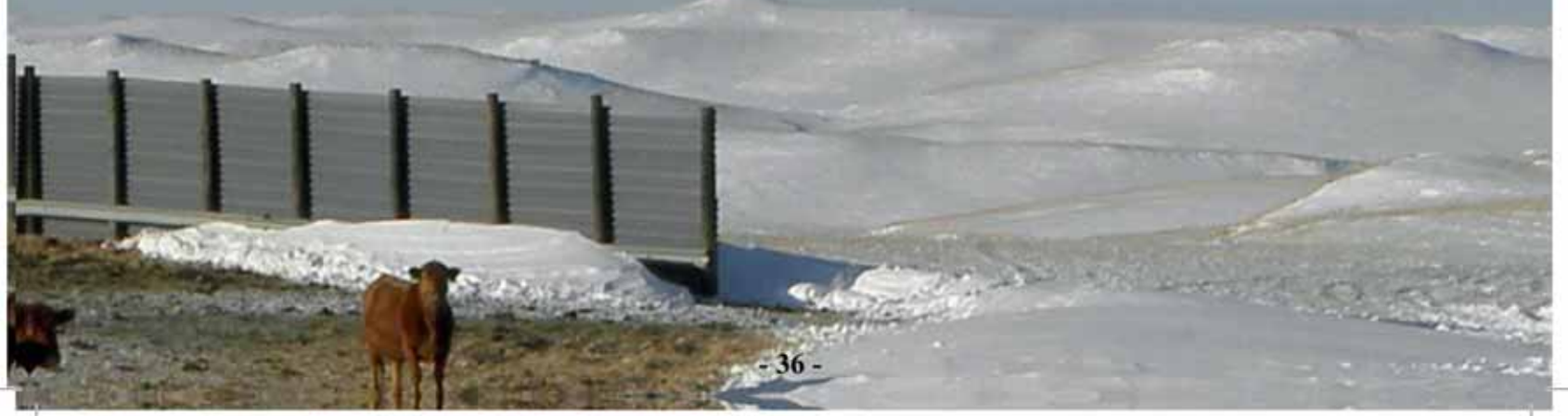
forage – browse and herbage that is available and acceptable food to grazing animals, or that can be harvested for feeding purposes.

grassland – any land on which grasses are the dominant plants; may be naturally occurring (native) or cultivated.

grazing management – manipulation of grazing and browsing animals to accomplish a desired result.

habitat – a place that provides the resources for a plant or animal to meet certain life needs, such as a prairie, marsh, or woodland.

harvest efficiency – the total percent of vegetation harvested by a machine or ingested by a grazing animal compared to the total amount of vegetation grown in the area in a given year.



Glossary Continued

increaser – plant species that is part of the natural vegetation and increases in relative abundance, at least for a time, under continued disturbances like grazing, fire, or drought.

introduced species – species that is not part of the natural fauna or flora of the area in question. In general, from a different continent.

livestock – domestic animals used for the production of goods and services.

management-intensive grazing – a grazing system that utilizes multiple pastures and frequent rotation of livestock, resulting in long rest periods for grasses and high forage production.

native species – species that is part of the natural fauna or flora of an area. In general, from the same continent.

overgrazing – grazing that exceeds the recovery capacity of the individual species or the plant community.

rest – a full calendar year period of no grazing.

riparian area – an area, zone and/or habitat adjacent to streams, lakes or other natural free water, which have predominant influence on associated vegetation or biotic communities.

rotational grazing – a grazing system that utilizes more than one pasture and rotates cattle from one pasture to the next at varying intervals.

shrub – a plant that has persistent, woody stems, a relatively low growth habit, and generally produces several shoots at the base instead of a single trunk. A shrub differs from a tree in its low stature and form. Maximum height is generally four meters.

stocking density/rate – the relationship between number of animals and area of land at any instant of time. (Also see carrying capacity.)

warm season plants – plants that make most or all of their growth during the late spring and summer, flowering in the summer or autumn; has value in grazing management.

weeds – plants that grow unabated, often introduced and aggressive competitors; are troublesome or have a negative impact in natural plant communities or crop land.

Contacts

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www.nrcs.usda.gov/wps/portal/nrcs/site/sd/home/

South Dakota State University (SDSU) Extension
154 Berg Agricultural Hall
Box 2207D
Brookings, SD 57007
iGrow.org

South Dakota State University- West River Ag Center
1905 Plaza Blvd
Rapid City, SD 57702-9302

Society of Range Management (SRM) – South Dakota Section
www.sdrangelands.com

South Dakota Game, Fish, and Parks – Wildlife Division
20641 SD Hwy 1806
Fort Pierre, SD 57532
www.gfp.sd.gov

South Dakota Game, Fish, and Parks – Habitat Pays
www.habitat.sd.gov

United States Fish and Wildlife Service – South Dakota Partners for Fish and Wildlife
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www.fws.gov/mountain-prairie/refuges/southdakotapfw.php

Credits

This booklet was funded in part by the USDA Natural Resources Conservation Service and a United States Environmental Protection Agency Clean Water Act Section 319 Grant awarded to the South Dakota Grassland Coalition through the South Dakota Department of Environment and Natural Resources.

Additional contributions from:

South Dakota Grassland Coalition
South Dakota Cattlemen's Association
South Dakota Stockgrowers Association
South Dakota Department of Agriculture
South Dakota State University Extension
South Dakota Association of Conservation Districts
South Dakota Department of Game Fish and Parks
South Dakota Department of Environment and Natural Resources
United States Fish and Wildlife Service (USFWS)
United States Environmental Protection Agency (EPA)
United States Department of Agriculture Natural Resources Conservation Service (NRCS)
United States Department of Agriculture Resource Conservation and Development (RC&D)

Photos courtesy of: NRCS, SDGC, SDSU