

Technical Note

Range Technical Note No. 9

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Prescribed Grazing

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- A. SD-FS-67, Common Conservation Practices for Grazing Grasslands
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I. Introduction

This technical note is designed to serve as a guide for the development of prescribed grazing plans to meet common client objectives and provide the planner with information to design grazing plans that incorporate fundamental grazing management techniques that address the criteria of the prescribed grazing standard. When developing a prescribed grazing plan, the goals and objectives of the land manager, along with consideration of alternative management activities, should be primarily considered. The extent of the grazing operation that the grazing plan will include should primarily be based on landowner need and area of concern.

Determining Grazing Land Use Designations

When conservation planning on grazing lands it is important to determine whether the land use should be considered range or pasture. The pasture land use is primarily comprised of introduced or domesticated native forage species for the production of livestock. To be considered pasture, the field must have been seeded in the past to provide preferred forage for livestock grazing, receive periodic renovation, and periodically receive at least one of the cultural treatments defined below. Pasture land is not in rotation with crops.

1. Periodic Renovation includes techniques such as interseeding, prescribed fire, tillage such as light disking for stand enhancement, or the complete destruction of the existing pasture and re-establishment of adapted forage species. Interseeding pasture is only recommended east of the Missouri River, on all irrigated land, and within the Black Hills and surrounding foothills.
2. Periodic cultural treatments include one or more of the following activities and are applied across the entire field:
 - Fertilizer is applied at least once every three years on the entire field (minus any setback areas) OR the stand is comprised of 31 to 50% legumes by weight.
 - Mowing or clipping for stand enhancement to improve forage quality and palatability for livestock grazing purposes. This practice may or may not include removing mowed herbage as hay. Annual mowing or haying of the same field or parts of a field for hay production will be considered hayland (and hayland is considered cropland). This practice is not common in the Northern Great Plains and usually pertains to irrigated pasture.
 - Applying irrigation water to the entire field, minus any small areas that are unable to receive irrigation water.

In many cases field-wide herbicide treatment or spot spraying may be applied on grazinglands. This is considered a common and reoccurring practice, and on its own is not a periodic cultural practice used to determine if a land use should be identified as pasture. Conversely, periodic cultural treatments may also be completed on land that is considered range. Practices such as mowing, ripping, prescribed fire, and fertilizer application may be employed on range to manage the desired plant community, enhance productivity, or improve forage quality.

In most cases, grazing lands not able to be classified as pasture in South Dakota are considered range. Rangelands are a kind of land on which the historic climax vegetation was predominantly grasses, grass-like plants, forbs, and shrubs. Range also include land revegetated naturally or artificially to provide a plant cover that is managed like native vegetation.

The definitions above will be used to assist the client to designate land uses on grazing lands in South Dakota. South Dakota NRCS also uses the automated Range and Pasture Determination Tool as a guide to assist planners to determine the most accurate land use type.

II. Grazing Goals, Considerations, and Purposes

The kind of animal, animal number, grazing distribution, length of grazing and/or browsing periods and timing of use to grazed plants should be managed to provide sufficient plant recovery time to meet planned objectives. Providing plants planned periods of rest and recovery is important to maintain plant productivity and vigor. The recovery period of non-grazing can be provided for the entire year or during the growing season of key plants.

Effective grazing plans often include deferment (delay of grazing selected pastures or units to improve plant vigor or facilitate plant establishment) and/or rest (non-grazing period equal or greater than one year) should be planned for critical periods of plant needs. Adequate recovery periods for grazed plants cannot be attained with continuous, season-long grazing of a single pasture. Continuous use of a single pasture (field) for the entire growing season (April 1 through October 1) can be managed to provide adequate recovery periods of grazed plants on very large fields where livestock are either herded and/or redistributed by changing water locations within the pasture (turning water facilities on and off) thus ensuring adequate recovery periods as defined in Table 1 below. A very large field would roughly be where the distance to water is greater than one mile; however, this could be considerably larger on smooth terrain.

III. Utilization and Recovery

When two or more pastures are planned to be grazed only one time during the growing season, avoid beginning the grazing rotation in the same paddock each year. The intent is to change the time of year each year that any given paddock is grazed. On rangeland, alternate grazing periods from year-to-year to ensure that either cool season or warm season grasses receive deferment during the majority of their growing season. The growing season for cool season grasses is April 1 to June 30 (with regrowth occurring in September) and June 1 to August 31 for warm season grasses. On rangelands, provide a minimum of 45 consecutive days of rest during the growing season of the desired forage species. On pasturelands, provide a minimum of 30 consecutive days of rest during the growing season. Special use pastures such as monocultures of crested wheatgrass or big bluestem may be utilized during the same period year after year as part of a complimentary grazing system (i.e., crested wheatgrass calving pasture(s) followed by a rotation on rangeland).

When two or more pastures are planned to be grazed two or more times during a growing season, avoid beginning the grazing rotation in the same paddock(s) each year (except for special use pastures). Plan the recovery/rest periods so the grazed plants in each pasture will receive adequate time to replenish leaf area. Each pasture will be deferred for a minimum of 90 days during the growing season. Table 1 provides guidance in establishing the length of recovery periods when two or more pastures are planned to be grazed two or more times during a growing season.

Grazing periods should be kept as short as practical provided adequate recovery periods are maintained. Keeping the grazing periods as short as practical, especially during periods of fast plant growth, will minimize the opportunity for the grazing animals to graze plant regrowth prior to plant recovery.

These recovery guidelines will be used in the development of the initial prescribed grazing schedule. As the producer gains experience, grazing, and recovery periods may be adjusted to reflect actual growing conditions. The planner may adjust these grazing and recovery periods if previous experience on similar conditions warrants different grazing/recovery periods.

Livestock movements should be based on plant growth and utilization and not calendar dates. Calendar dates may be used as a guide when developing grazing schedules. See Chapter 5, Part 600.0500(e), of the National Range and Pasture Handbook, for additional information on prescribed grazing schedules.

In many cases the prescribed grazing sequence may need to be changed for short periods to take advantage of seasonal forages, such as crop aftermath, sweet clover, cheatgrass, and annual forages.

TABLE 1
RECOVERY PERIOD GUIDELINES WHEN PADDOCKS ARE PLANNED TO BE GRAZED TWO OR MORE TIMES DURING THE GRAZING PERIOD

Current/temporal utilization each occupation ^{1/}	Minimum Recovery Periods			
	<i>Fast growth</i> ^{3/}		<i>Slow growth</i> ^{3/}	
	Range	Pasture	Range	Pasture
West River				
10 to 20 percent	35 days	25 days	55 days	45 days
<i>20 to 30 percent</i> ^{2/}	<i>40 days</i>	<i>30 days</i>	<i>60 days</i>	<i>50 days</i>
30 to 40 percent	45 days	35 days	65 days	55 days
40 to 50 percent	50 days	40 days	70 days	60 days
East River				
10 to 20 percent	30 days	20 days	50 days	40 days
<i>20 to 30 percent</i> ^{2/}	<i>35 days</i>	<i>25 days</i>	<i>55 days</i>	<i>45 days</i>
30 to 40 percent	40 days	30 days	60 days	50 days
40 to 50 percent	45 days	35 days	65 days	55 days
Under drought conditions, recovery periods may need to be extended to 90 days or longer, or multiple occupations may not be possible.				

^{1/} Refers to utilization level of current standing vegetation; may be less than end-of-season utilization level.

^{2/} This is the recommended current/temporal utilization for paddocks being grazed more than one time during the growing season.

^{3/} Fast growth usually refers to grasses in a vegetative, pre-boot stage. Slow growth typically occurs once boot is detectable or evident.

Guidelines for Livestock Utilization

On rangelands, seasonal utilization of desirable grasses and grass-like species should not remove more than 50 percent by weight of the total current year's growth. Seasonal utilization is measured at the end of the growing season and is the percentage of the current year's production that was removed by the grazing animals. Table 2 can be utilized as a tool to help determine the percent of weight removed of common grasses by estimating the percent of the plant height removed.

On range and pasture lands, temporal utilization on desirable grasses and grass-like species should not remove more than 30 percent by weight of the total current year's growth. Temporal

utilization is the percentage of the current year's growth that is removed in any one grazing period. Temporal utilization is monitored in intensive grazing systems where pastures are grazed more than one time during the growing season. On rangeland, seasonal utilization requirements must still be followed on grazing systems where temporal utilization is monitored.

On pasturelands, the desired species should not be grazed closer than the minimum leaf lengths shown in Table 3. Grazing use should not be initiated on pastureland until the desired species has reached the minimum height shown in Table 3. To maintain the health and vigor of the desired species, they should attain the minimum leaf length shown in Table 3 before the first killing frost. On grazing systems where pastureland fields are grazed more than one time during the growing season, temporal utilization should not remove any more than 30 percent of the current year's growth during any one grazing period while still maintaining stubble height requirements found in Table 3.

TABLE 2. PERCENT WEIGHT REMOVED AS A RELATIONSHIP TO PERCENT HEIGHT REMOVED

SPECIES	PERCENT OF HEIGHT REMOVED													
	10	20	30	40	50	55	60	65	70	75	80	85	90	95
big bluestem	2	6	11	17	23	30	35	41	46	54	62	71	79	89
blue grama	2	4	6	9	13	15	17	20	25	28	35	42	53	75
buffalograss	2	5	7	11	18	21	32	35	38	45	53	62	71	77
crested wheatgrass	2	4	7	11	18	24	29	33	38	44	53	60	68	83
green needlegrass	2	4	6	11	16	20	25	30	36	44	52	61	71	85
Kentucky bluegrass	1	3	5	9	14	16	20	26	34	40	47	57	71	85
little bluestem	1	4	9	15	23	27	32	37	41	47	53	61	70	82
Needleandthread	1	2	4	6	10	12	15	19	24	29	36	46	56	73
ovalhead sedge (wetland)	2	5	9	13	18	21	26	31	39	46	54	62	73	86
prairie Junegrass	2	4	6	9	13	16	18	21	25	30	35	42	55	69
prairie sandreed	2	6	11	17	23	30	35	41	46	54	62	71	79	89
red threeawn	2	6	11	17	26	30	36	42	46	53	61	70	78	89
Sandberg bluegrass	1	2	4	8	11	14	16	19	24	30	37	46	56	75
sand dropseed	1	3	5	8	12	17	21	25	30	35	46	56	68	83
sideoats grama	1	3	5	9	14	18	23	27	32	39	47	56	66	80
slender wheatgrass	2	6	9	12	17	21	27	31	36	42	51	59	69	80
smooth brome	3	6	11	15	19	27	32	37	45	52	58	63	82	92
switchgrass	2	5	9	13	20	26	30	36	42	50	59	68	76	89
threadleaf sedge (upland)	2	4	6	10	15	17	21	27	34	41	48	59	73	86
western wheatgrass	2	6	11	17	26	32	37	44	50	58	66	74	82	91

To use this table, first calculate the percent of the height of the plant removed by grazing. Find this figure on the top line of the Table and then follow that column down to the appropriate species. This figure represents an estimate of the percent of the weight removed.

**TABLE 3. MINIMUM HEIGHT OF PASTURE SPECIES
FOR INITIATING AND TERMINATING GRAZING**

Species	BEGIN GRAZING		END GRAZING	
	Minimum and Optimum Height of Vegetative Growth in Inches	Approximate Date	Minimum Stubble Height in Inches	Minimum Regrowth Before Killing Frost in Inches
alfalfa	6 – 10	May 15	3	8
big & sand bluestem	8 – 14	July 1	6	6
creeping foxtail	8 – 10	May 7	3	6
crested wheatgrass	4 – 6	April 20	3	4
green needlegrass	6 – 8	May 15	3	5
Indiangrass	8 – 14	July 1	6	6
intermediate wheatgrass	8 – 14	May 15	4	6
Kentucky bluegrass	4 – 6	May 7	2	4
little bluestem	4 – 6	July 1	3	4
orchardgrass	6 – 10	May 15	4	6
pubescent wheatgrass	8 – 14	May 15	4	6
prairie sandreed	8 – 14	June 20	4	6
reed canarygrass	8 – 8	May 7	4	6
Russian wildrye	4 – 4	May 7	3	4
sideoats grama	4 – 6	June 20	2	4
slender wheatgrass	6 – 12	May 7	3	6
smooth brome	8 – 14	May 7	4	6
switchgrass	12 – 20	June 20	8	10
tall wheatgrass	8 – 14	May 7	4	6
timothy	6 – 10	June 1	3	5
western wheatgrass	6 – 10	May 15	4	5

- A. Recommended grazing heights for grass mixtures or grass legume mixtures should be for the dominant or desired species; B. Height is the average height when leaves are lifted in a vertical position; C) Jointed grasses such as smooth brome and intermediate wheatgrass should be grazed in the early boot stage, prior to seed set to trigger regrowth of basal sprouts; D) The last harvest of alfalfa should generally be made 35 to 45 days prior to the time the first hard freeze normally occurs; E) On pasture grazed during the dormant season, stubble height at the end of the grazing period is applicable; F) Approximate date is for continuous grazing and is highly dependent on present climatic conditions. Rotation grazing usually can begin seven or more days earlier in the season.

Degree of use on desirable browse (woody) species should not remove more than 65 percent by weight of the current years' growth. Degree of use on browse species is based on the amount of current years' growth removed. For methods of determining browse utilization, see the Interagency Technical Reference "Utilization Studies and Residual Measurements" which should be filed with the National Range and Pasture Handbook. Dormant season grazing utilization of desirable grasses and grass-like species should not remove more than 60 percent by weight of the total current year's growth.

Grazing prescriptions on rangeland that are designed to alter the present plant community through intensive grazing by livestock (i.e., suppression of invasive species) may require utilization levels above the guidelines listed above. In these cases, the desired degree of use of management species should be documented within the grazing plan and/or assistance notes. Other uses or goals (nesting habitat, winter cover, fuel accumulation for prescribed burning, etc.) for range and pasturelands may require that degree of use goals be adjusted to accommodate species or use requirements. Table 4 provides some recommended utilization levels. Keep in

mind that the proper placement and movement of supplemental feeds can be used as a method to distribute livestock throughout a field, but salt, minerals, creep feed, and other supplements should not be placed in the vicinity of livestock watering facilities. Improper placement can have negative impacts on the soil, water, air, plant, and animal resources.

TABLE 4. UTILIZATION GUIDELINES

Producer's goal	Seasonal utilization	Temporal utilization
Maintain or improve plant health and vigor on rangeland.	50 percent	30 percent
Maintain or improve forage quantity and quality on rangeland.	50 percent	30 percent
Provide or improve nesting cover for many grassland nesting birds on rangeland.	Generally 40 to 50 percent (Species dependent)	Generally 20 to 30 percent (Species dependent)
Maintain or improve forage quantity and quality on pastureland.	See Table 3 for minimum leaf lengths	30 percent
Intensive grazing systems.	50 percent	30 percent
Changing species composition on rangeland.	>60 percent on targeted species <30 percent on desired species	>60 percent on targeted species <30 percent on desired species
Dormant season grazing	60 percent	N/A

IV. Riparian Management

It is common for areas near streams and drainages to contain noticeable resource concerns due to livestock grazing duration, timing, and the location of reliable livestock water sources. A combination of management techniques can benefit these areas. 1.) Providing high quality and reliable water outside the riparian corridor is often considered to be a main component of any riparian grazing strategy. 2.) Supplements such as salt and mineral in the adjacent uplands further promote improved livestock distribution away from surface water areas. 3.) Monitoring grazing utilization levels in riparian area, regardless of management complexity, is often necessary. Stubble height remaining after grazing directly along stream banks where stream bank vegetation and surface water directly interact is considered to be an indicator of the effect of grazing management on the health and vigor of individual plants along the riparian area, and the ability of vegetation to protect the stream bank from moving water and to filter and trap sediments from overbank flow events. While precise stubble heights optimum for improving or maintaining desirable riparian conditions vary based on local environmental conditions (timing of use, stream attributes, etc.), herbaceous residual heights of 4 to 8 inches is commonly cited as adequate to protect stream bank soils and filter stream sediments.

Using a combination of livestock grazing techniques is usually effective for improvement of riparian areas. The following fundamentals can be used in combination or individually when designing a grazing plan that considers riparian areas.

- Avoid totally *excluding livestock grazing* from riparian areas as a general solution. Subirrigated and mesic sites associated with these areas can quickly become invaded

by invasive grasses such as Kentucky bluegrass when excessive plant litter buildup occurs. *Temporary grazing rest* (1-2 years), however, is a viable option to hasten stream bank recovery.

- *Continuous season-long* or annual hot season grazing usually results in livestock concentration directly on the riparian area and resource degradation. Depending on the producer's labor and management potential, a grazing scheme that reduces the amount of time spent grazing in a given pasture will provide improvement (such as *deferred rotational grazing management*). If smaller "riparian pastures" are developed, it is possible to implement short duration grazing during most seasons that ensures proper use and enough plant cover to protect stream banks.
- *Dormant (winter) grazing* can be a preferable option since stream banks are firm and the vegetation along the bank is of no higher preference than in the uplands. It is still important that proper grazing use by livestock is maintained as vegetation cover is required to help streambanks dissipate the energy of running water from spring storms and snow melt.
- *Fall Grazing* can be beneficial because as long as fall temperatures are cool enough, livestock tend to spend less time loafing in the stream channel. At this time stream banks are starting to become firm with the seasonal reduction of water flow, and vegetation is becoming dormant in these areas thus improving livestock distribution into the adjacent uplands. In systems where willow regeneration is a concern, fall grazing should be designed with short grazing periods to limit livestock use of shrubs. Proper use of vegetation along stream banks is important to provide bank protection during the spring runoff.
- *Spring grazing* that is limited to shorter durations can be beneficial because cooler temperatures and relatively high quality upland plants aid in livestock distribution. In addition, removing livestock well before the end of the riparian area growing season allows plants ample time to recover. During the spring, periods of high water flow is common and grazing these areas with small spring calves often causes this option to be less appealing to grazing managers. In addition, stream banks are soft and can be prone to compaction at this time.
- *Combining spring and fall grazing* has usually resulted in less improvement than spring or fall grazing on its own. This is mainly attributed to removal of fall riparian vegetation that results in abundant high quality forage along the stream in the spring, however this combination has the potential for improvement of riparian areas and increases the grazability of pastures where riparian areas are a concern.

V. Cover Crops

When cover crops are used for grazing, select species that will have desired forage traits, be palatable to livestock, and not interfere with the production of the subsequent crop. Grazing livestock on cropland by planting annual forages or cover crops can extend the grazing season, provide for early grazing before perennial vegetation is ready to be utilized, allow longer rest periods for grasslands, and provide the ability to grow more forage and reduce the amount fed feed. Utilizing livestock on cropland can also be advantageous for increasing biological activity. The majority of the nutrients that run through a ruminant animal are placed back onto the

ground from where they came. The grazing of slightly more mature material mixed with a lower carbon to nitrogen (C:N) ratio species can help increase soil organic matter and get the nutrients in a more available form for the next crop. Cover crop mixtures planted after small grain harvest can provide high quality forage late into the fall and provide a rest period for cool-season pasture or rangeland, if the weather conditions and soil moisture permits. The brassicas (such as turnip, radish, and canola) will typically stay green late into fall and early winter. In addition to late season quality forage, the brassicas are also known for their early canopy and residue cycling characteristics. Other cover crop mixtures can not only provide quality forage but also provide a substantial amount of dry matter production. Typically, mixtures that contain warm-season grasses such as sorghum, sudangrass, or millet produce some of the highest dry matter results.

Cover crops also need adequate growth available before grazing is initiated. Starting grazing heights will vary according to the species, but generally a minimum of six (6) inches of growth for most species is desirable. A cover crop should not be grazed any lower than three (3) inches. Grazing operations should not remove more than 50% of production by weight.

Livestock should not be left in any one area for a very long period. Ideally, livestock should be moved or allocated new forage every one to two days. Larger allotments can be utilized, but expect slightly less grazing efficiency and utilization. The grazed cover crop should be checked every day, whether moving the livestock or not as to make sure overgrazing is not occurring. The best utilization and control is achieved by strip grazing annual forages and cover crops. Strip grazing is allocating out a set amount of forage that you know will meet the needs of the livestock for a set time frame and still maintain the required plant residual after removing the livestock. Strip grazing allows for improved nutritional plant utilization and better uniform manure distribution.

If grazing highly digestible forages, add some roughage to slow the passage through the rumen enabling livestock to absorb nutrients. The best solution is to not select only highly digestible, high nitrogen forages for a cover crop when they may be grazed. These highly digestible forages move quite quickly through the livestock's digestive system when grazed alone. Ideally, planting a diverse mixture of forages, in balance, will provide both fiber and protein. Table 1 below can aid in selecting cover crops for grazing. Most cover crop species will meet the nutritional requirement needs of most livestock.

Grazing cover crops, in rare occasions, may result in potential health problems if not grazed correctly. Those problems may include nitrate poisoning, prussic acid poisoning, and bloat. In very rare occasions, oxalate poisoning, hemolytic anemia, glucosinolates, erucic acid, fog fever, ergot, grass tetany, and choking on tubers may occur. These problems can be avoided by proper grazing management. Some strategies to avoid animal health problems include: Introducing the grazing animal slowly to the new forage over 3 to 7 days, making sure the animals are full before turning into a cover crops mix, allowing the grazing animal access to dry material such as hay, planting a diverse mix of species, supplement with proper minerals and/or not grazing within 10 days after a killing frost on certain species (such as sudangrass).

Table 5. Cover Crops – Common Species and Properties

Cover Crop	Erosion Reduction	Increase soil organic matter	Capture, recycle, redistribute nutrients in the soil profile	Promote biological nitrogen fixation	Weed suppression	Provide supplemental hay	Provide supplemental grazing	Rooting Depth / Plant Water Use /1	Minimize / reduce soil compaction	Seed size (Large or Fine)	Crop Type and Seeding Dates /2/3	Full Seeding rate, lbs/acre /4	Seeding depth, inches	Salinity tolerance	C:N Ratio	Attract Beneficial Insects	Mycorrhizal fungi association
Alfalfa	G	G	G	Y	G	F	F	DH	G	F	CB	6.5	.25 - .75	P	L	Y	M
Alsike clover	G	F	G	Y	G	F	F	SL	P	F	CB	3	.25 - .75	P	L	Y	M
Annual Oregon ryegrass	F	G	G	N	F	G	G	MM	P	F	CG	15	.5-1.5	F	M	Y	L
Barley	G	G	F	N	G	F	F	MM	F	L	CG	50	.75 - 2	G	M	Y	M
Brassica hybrids	F	F	G	N	G	F	F	MM	G	F	CB	7	.25 - .5	G	L	Y	N
Buckwheat	/5	G	F	G	N	G	P	SL	P	F	WB	50	.5 - 1.5	P	L	Y	N
Canola	F	F	G	N	P-G**	F	F	MM	G	F	CB	5	.25 - .75	G	L	Y	N
Chickling vetch	G	F	G	Y	F	F	F	SL	F	L	CB	50	.5 - 1.5	P	L	Y	M
Common vetch	G	F	F	Y	P	F	F	SM	F	L	CB	25	.5 - 1.5	P	L	Y	M
Corn	G	G	G	N	P-G**	F	F	DH	G	L	WG	12	1-1.5	P	H	N	H
Cowpeas	P	P	F	Y	G	F	F	SL	F	L	WB	30	1 - 1.5	P	L	Y	M
Crimson clover	G	F	G	Y	G	G	G	SM	F	F	CB	15	.25-.75	P	L	Y	M
Dry beans	P	P	F	Y	G	F	F	SL	F	L	WB	30	1 - 1.5	P	L	Y	M
Ethiopian cabbage	F	F	G	N	F	F	F	MM	G	F	CB	5	.25-.75	G	L	Y	N
Flax	F	F	F	N	P	P	P	SM	P	F	CB	30	.25-.75	F	H	Y	H
Forage sorghum (includes sudan hybrids)	G	G	G	N	G	G	F	MM	G	L	WG	15	.5 - 1.5	F	M	Y	H
Grain sorghum	G	G	G	N	G	G	F	MM	G	L	WG	5	.5 - 1.5	F	M	Y	H
Hairy vetch	G	F	F	Y	P	F	F	SM	F	L	CB	15	.5 - 1.5	P	L	Y	M
Kale	F	F	G	N	G	F	F	MM	G	F	CB	4	.25 - .5	G	L	Y	N
Lacy Phacelia	G	G	G	N	G	P	P	DH	G	F	CB	4	.25 - .5	P	L	Y	M
Lentils	P	P	F	Y	P	F	F	SL	P	F	CB	30	1-1.5	P	L	Y	M
Millet	G	G	F	N	G	G	F	SL	F	F	WG	25	.25-.75	P	M	N	H
Mustard, oriental or brown	F	F	F	N	G	F	F	MH	F	F	CB	6	.25 - .75	P	M	Y	N
Mustard, tame yellow	F	F	F	N	G	F	F	MH	F	F	CB	12	.25 - .75	P	L	Y	N
Oats	G	G	F	N	F	G	F	MM	F	L	CG	70	.5 - 1.5	F	M	N	M
Peas	P	P	P	Y	F	G	F	SL	P	L	CB	70	1.5 - 3	P	L	Y	M
Radishes	P	P	G	N	G	P	G	DH	G	F	CB	8	.25 - .5	P	L	Y	N
Rapeseed	F	F	G	N	F	F	G	MM	G	F	CB	5	.25 - .75	G	L	Y	N
Red clover	G	F	G	Y	G	F	F	SL	P	F	CB	5	.25 - .75	P	L	Y	M
Safflowers	F	F	G	N	F	P	P	DM	F	L	WB	30	.5-1	F	M	Y	M
Soybeans	P	P	F	Y	P-G**	F	F	SM	P	L	WB	35	1-1.5	P	L	Y	M
Spring wheat	G	G	G	N	G	F	F	MH	F	L	CG	60	.5 - 1.5	F	M	Y	M
Sudangrass	G	G	G	N	G	G	G	MM	G	L	WG	20	.5 - 1.5	F	M	Y	H
Sugar beets	P	P	G	N	F	P	G	DH	G	F	CB	4	.25 - .5	G	L	N	N
Sunflowers	F	F	G	N	F	P	G	DM	F	L	WB	7	.5-1	F	M	Y	M
Sunn hemp	F	F	F	Y	G	P	P	DM	F	L	WB	15	1.5-2	P	L	Y	Y
Sweet clover	G	F	F	Y	F	P	F	MM	F	F	CB	4	.25 - 1	F	L	Y	M
Tall wheatgrass	G	G	G	N	G	G	G	DH	F	L	CG	13	.25 - 1	G	H	N	M
Teff grass	F	G	F	N	F	G	F	SM	P	F	WG	5	.13 - .25	P	M	N	N/A
Triticale	G	G	G	N	G	F	F	MH	F	L	CG	60	.5-1.5	G	M	Y	M
Turnips	P	P	G	N	G	P	G	DH	G	F	CB	4	.25-.5	P	L	Y	N
White clover	G	F	G	Y	G	F	F	SL	P	F	CB	1.5	.25 - .75	P	L	Y	M
Winter camelina	F	F	G	N	F	P	P	ML	G	F	CB	3	.25-.5	P	L	Y	N
Winter wheat or rye	G	G	G	N	G	F	F	MH	F	L	CG	60	.75 - 2	G	M	Y	M

<p>/1 Rooting Depth/Water Use</p> <p>SL= Shallow rooted/Low water use SM= Shallow rooted/Medium water use SH= Shallow rooted/High water use ML= Medium rooted/Low water use MM= Medium rooted/Medium water use MH= Medium rooted/High water use DL= Deep rooted/Low water use DM= Deep rooted/Medium water use DH= Deep rooted/High water use</p>	<p>/2 Crop types</p> <p>CG= cool season grass CB= cool season broadleaf WB= warm season broadleaf WG= warm season grass</p> <p>Shallow 6 - 18 inches Medium 18 - 24 inches Deep 24 + inches</p>	<p>Ratings</p> <p>L= Low G= Good M= Medium F= Fair H= High P= Poor Y= Yes N= No or None N/A= Not Available</p> <p>*Variable depending on seed size and row spacing. **Poor weed competitor, but herbicide-tolerant varieties are available.</p>
<p>/3 Seeding Dates</p> <p>April 1 through May 15 – predominantly cool-season species May 15 through August 1 – predominantly warm-season species August 1 through October 1 – predominantly cool-season species Seeding dates fluctuate annually. The dates listed above are averages that maybe changed 10 days in either direction depending on current climatic conditions.</p>	<p>/5 Buckwheat contamination</p> <p>To reduce chances of buckwheat contamination in wheat do not rotate to wheat for grain for 2 years</p>	
<p>/4 Full Seeding rates</p> <p>Multiply by the percent desired if mixtures are used.</p>		

VI. Animal Husbandry

During conservation planning activities consideration should be given to animal health and production. In addition to this, various tools and resources are available to assist conservation planners and clients to meet animal production objectives.

- Grazing should be applied in accordance with forage quality and quantity criteria that best meets the production requirements for the kind and/or class of animal. Fecal sampling and the Nutritional Balance Analyzer (NUTBAL) software are useful tools to monitor the nutritional status of grazing animals.
- Handling of animals should be in a manner producing the least amount of stress as possible. Refer to the publication “Stockmanship: A powerful tool for grazing land management” for low stress handling methods at: https://www.blm.gov/or/programs/nrst/files/Stockmanship_Book.pdf
- The use of wells, rural water, pipelines, and tanks should be encouraged as alternatives to surface water supplies (dams, streams, dugouts) thus reducing the impacts on water quality and improving animal performance.
- Many legumes can induce bloat in livestock. In general, pastures containing 50 percent or less of legumes will have a very low incidence of bloat. Certain legume species have a lower probability of inducing bloat.
- Dietary needs of livestock should be based on the National Research Council's Nutrient Requirement for Domestic Animals or similar scientific sources with appropriate adjustments made for increased energy demand required by browsing or grazing animals foraging for food including travel to and from pasture site.
- Wildlife, especially larger herbivores and species in great abundance (i.e. prairie dogs) if present, should be considered first when calculating a Forage-Animal Balance.

VII. Integrating Cropping Systems with Grazing Lands

Under Development. See [Range Technical Note No. 6. “Calculating Stocking Rates for Residues”](#) for more information.

VIII. Invasive Species Management- Managing Invasive Cool Season Grass in Native Grasslands

Operators managing native grazing lands should be proactive in the control and management of invasive cool season grasses. Kentucky bluegrass, smooth brome, crested wheatgrass and annual bromes compete with desirable forage, diminish infiltration, increase run-off, decrease forage production potential and increase risk of wild fire. The time to initiate action is before any one of these species alone or in combination make up 25% or more of total weight of all forage.

Management Actions for Control:

1. **Grazing** - Invasive cool season species are very palatable and favored by livestock in their vegetative stage. Managers wishing to place stress on these species should

target intense grazing with increased stock density early in the spring from initial green up until the boot stage. Increased stock density on smaller paddocks will allow livestock the opportunity to improve harvest efficiency. Target plants should be grazed in excess of 60% or less than 4 inches. Monitoring of native species is needed to ensure that livestock **are not excessively grazing (>30%)** desirable species at this same time. Paddocks should be allowed to recover from the grazing treatment from about mid-June (dormancy) until fall growth begins. A fall grazing treatment on these species beyond 60% (<4") in the fall will also greatly reduce its production the following year. Monitoring of native species is needed to ensure that livestock **are not** excessively grazing (>30%) desirable species at the same time.

2. **Fire** - Fire can be an effective tool in managing Kentucky bluegrass, and to a lesser degree smooth brome and crested wheatgrass. Kentucky bluegrass with its growing point near the crown, is difficult to manage through grazing alone, however a slow burning back fire can effectively damage the growing point. Prior year management is necessary in order to allow an accumulation of fuel to carry the fire through green and growing vegetation in the treatment year. Target species should be allowed adequate time and growth in the spring in order for the fire to be most effective. Late April into mid-May is the most effective time period in South Dakota for burning these species. Fire, though an effective tool, has not demonstrated long lasting benefits and re-application is suggested on a rotational basis of 2-4 years. Fire at this time of year may simultaneously increase production of native tall warm season grasses that respond favorably to early spring fire. Results of fire on annual brome are inconsistent.
3. **Herbicides** - Herbicide treatment can be an effective tool in controlling invasive grasses. Caution must be used to apply herbicides when target species are actively green and growing but when the desirable species are dormant. Fall application is suggested for best results. Refer to SDSU herbicide recommendations.
4. **Fire and Grazing** - Another option is to combine an early spring fire followed by late spring grazing. The advantage of this management is that plants struggling to recover from the fire will be even more susceptible to the effects of grazing during the initial green up period after the fire. Burned and grazed areas will require a recovery period during the remainder of growing season to allow desirable species to complete their growth cycle. This alternative could be applied on a rotational basis by paddock or even within a paddock by just burning targeted portions of a paddock.
5. **Mowing and Herbicide** - Mowing grasses in late summer to remove canopy followed by a late fall or early spring application may be a worthy consideration. The advantage is that the removal of the canopy will improve herbicide coverage. Extreme caution should be exercised to ensure that desirable species are fully dormant and target species are green and actively growing before applying herbicide.
6. **Fire and Herbicide** - Similar to mowing and herbicide, this strategy involves applying a very early spring fire followed by a herbicide treatment when target plants are green and actively growing but prior to the green up of desirable species.
7. **Integrate Grazing Land and Crop Land** - Perhaps the most feasible option that can also add profitability to an entire agricultural operation involves the integration of the

livestock enterprise with the cropping enterprise. This alternative would target the use of crop land as forage producing units during the summer period when invaded grasslands are largely dormant and of low nutritional value. Grazing would be started earlier in the spring (April and May) to utilize these species when they are at their nutritional peak and paddocks would be allowed to recover during the summer. Livestock would graze annual forages during the summer and return to paddocks in the fall to utilize additional invasive species. By gauging the recovery and increase in native species on these paddocks, eventually rotational grazing would again be utilized during the summer. This alternative also provides the benefit of allowing livestock to begin grazing earlier in the year, thereby reducing the amount of hay and other harvested forages needed. Additionally, diversifying the crop rotation will promote soil health, improve weed control, and increase yields on crop land.

The management and control of invasive cool-season grasses is challenging. Complete eradication is not likely, however providing continuous stress on these plants will reduce their impact over time. Land managers applying select alternatives or combinations of alternatives over many years and/or adopting these management practices permanently will improve native grassland plant communities.

IX. References

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X. Resources

South Dakota Section of the Society for Range Management: Available
<http://www.sdrangelands.com/>

South Dakota Grassland Coalition: Available <http://www.sdgrass.org/>

South Dakota State University Department of Natural Resource Management: Available
<https://www.sdstate.edu/natural-resource-management>

South Dakota State University Extension- IGrow: Available <http://igrow.org/>

South Dakota Department of Agriculture- Weed and Pest Control: Available
<http://sdda.sd.gov/ag-services/weed-and-pest-control/weed-pest-control/>

Appendix B

Example Drought Contingency Plan

Review previous 12 to 24 months of precipitation records and compare to the historic average for the nearest established climate station. Use local monthly precipitation records to compare monthly shortfall. Develop a marketing strategy plan that utilizes all possible marketing sources, price protection, and contracting possibilities in order to obtain flexibility in implementing this contingency plan.

Phase I is at the normal level of forage production, but plants can begin showing stress due to a lack of precipitation. Phase II corresponds to a drought risk level where resources (i.e., animal, forage, business, etc.) can be impaired without adjustments to management. Phase III corresponds to well-below average conditions or active drought. At this level, forage resources will be obviously reduced/stressed, and management changes will be needed to avoid detrimental effects to the ranch resources. This will likely include some level of destocking.

Phase I

Implement Phase I (Normal Phase) when plants begin to show signs of moisture stress and/or when stock dams are lower than expected for the time of year. This corresponds to approximately 95 percent of average precipitation, or when the critical spring period (April – June) is below average (or a combination of these). Typical Phase I actions include continuing observations relative to precipitation, production, and stock water levels. In the event of impending drought conditions, progressively cull early and remove 10 percent of the total herd during the first month of grazing (this can include animals you would likely cull later in the year). Phase I drought management action may need to be taken before spring or early summer growing season rainfall periods are complete. If conditions are rapidly deteriorating early in the growing season (April and May), forage production is likely to be reduced for the growing year.

Phase II

Implement Phase II when precipitation is limiting, plants are showing moisture stress, and stock dams are lower than expected for the time of year. In Phase II, twelve month precipitation is approximately 85 to 95 percent of average, the critical spring period is below average, or a combination of these two factors. Phase II action requires an immediate alleviation of drought-forage stress. This can include alternative management options (i.e., early weaning, herd consolidation, relocating animals, etc.) or cull early and remove 20 to 40 percent of the total herd (this can include animals you would likely cull later in the year) from grazing pasture or range as regrowth dictates (i.e., little or no regrowth in a 30-day recovery period for pastures in rotation). Routinely monitor conditions such as soil moisture and plant growth on a weekly basis.

Phase III

Implement Phase III (Drought Phase) when forages are suppressed and forage production is reduced due to drought conditions. Stock dams are likely to be below normal levels and other indications of drought are obvious. In Phase III, twelve month average is less than 85 percent of average, the critical spring period is well-below average, or a combination of these factors.

Phase III conditions require immediate management actions to conserve business, animal and forage resources. Overutilization during drought periods can set back forage resources for future growing seasons, lower diversity, increase potential invasive species, decrease soil moisture, decrease potential production, and increase erosion on grazing lands.

Recommended actions to be taken during this phase are: 1) measure remaining forage in all pastures, 2) combine remaining herds into one herd, and 3) allocate remaining forage in each pasture to the one herd. Graze each pasture this length of time it takes to utilize the remaining

grazable forage while keeping adequate cover for erosion control and plant health (adequate cover is considered to be roughly a minimum of 1,000 pounds of air-dry vegetative matter per acre).

Early culling and removal of 30%+ of the total herd will alleviate grazing stress on forages in drought (this includes the animals you already intend to cull but does not include animals culled or removed in Phase II in the same growing season). Early weaning of calves is an additional strategy that may be implemented. Consider removing the remaining livestock from pasture and range.

Monitor grazing lands frequently and ensure animals have access to dependable water.