USDA Natural Resources Conservation Service

Ecological site R061XY003SD
Subirrigated

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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

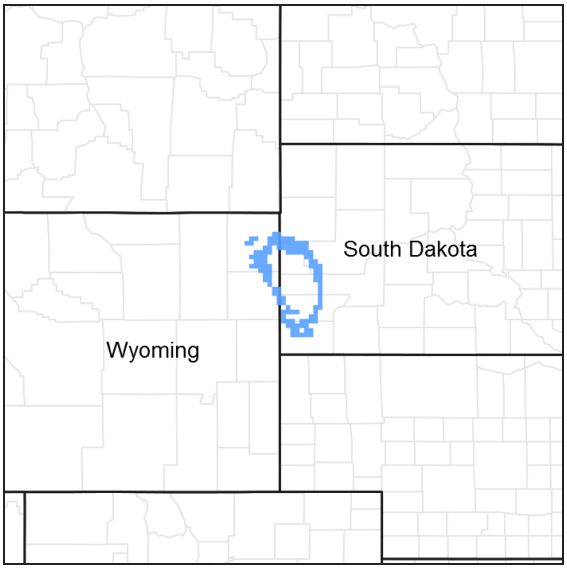

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 061X–Black Hills Foot Slopes

The Black Hills Foot Slopes (MLRA 61) is shared between Wyoming (WY) (58 percent) and South Dakota (SD) (42 percent). The MLRA is approximately 1,865 square miles. The towns of Spearfish, Sturgis, and Hot Springs, South Dakota, and Newcastle and Sundance, Wyoming, are all in this MLRA. Rapid City, South Dakota, is on the eastern edge of the MLRA. Wind Cave National Park, Devils Tower National Monument, and parts of Thunder Basin National Grassland and the Black Hills National Forest are also in MLRA 61. Devils Tower was the nation’s first National Monument, designated by President Theodore Roosevelt in 1906.

The Black Hills Foot Slopes consists of steeply dipping rocks circling the domed mountains of the Black Hills. As the mountains were uplifted, older sediments were tipped up and dipped away from the core of the mountains. The Lower Cretaceous Fall River and Lakota (Inyan Kara Group) sandstones, which are on the outside edge of the area, are referred to as the Dakota Hogback. The next geologic formation is the Triassic-aged red beds of the Spearfish shale. It forms a low valley. This “red valley” surrounds the Black Hills between the two ridges formed by the Inyan Kara (hogback) and Minnekahta Formations associated with the Black Hills (MLRA 62). The Lakota referred to the red valley as the “Big Racecourse or the Red Racetrack.” The red beds have gypsum and anhydrous layers. Ground water seepage can dissolve these layers, creating sinkholes on the surface.

The average elevation of MLRA 61 ranges from 2,950 to 3,940 feet with extremes to 5,580 feet. Slopes are

generally hilly; however, the interior red beds are nearly level to moderately sloping. The exterior hogback is steep, erosion-resistant rock. The Belle Fourche River is the only river flowing through MLRA 61. It passes through Hulett, Wyoming.

The dominant soil orders in this MLRA are Alfisols, Entisols, and Mollisols. The soils in the area predominantly have frigid or mesic soil temperature regimes and aridic or ustic soil moisture regimes. The soils are shallow to very deep, generally well drained, and loamy.

Average annual precipitation is 16 to 22 inches. The majority of rainfall occurs early in the growing season. Some high-intensity thunderstorms occur in mid-late summer. This MLRA supports open grassland, open ponderosa forest, and savanna-like vegetation. The grassland is characterized by native grasses, such as big bluestem, little bluestem, western wheatgrass, needle and thread, prairie dropseed, and green needlegrass. Bur oak grows throughout the northern area and can develop into nearly pure stands.

The major resource concerns are water quality, wind erosion, water erosion, and urban expansion.

MLRA 61 is 54 percent privately owned rangeland and 19 percent forest land. Federal lands make up 7 percent of the rangeland and 5 percent of the forest land. The remaining 15 percent of the MLRA is privately owned cropland and urban development (USDA-NRCS, 2006: Ag Handbook 296).

LRU notes

For development of ecological sites, MLRA 61 is divided into three precipitation zones (PZ).
The northern area (18–22” PZ) extends from just south of Rapid City, South Dakota, north to the Wyoming border.

The southern area (16–18” PZ) extends from Newcastle, Wyoming, south to Hot Springs, South Dakota, then north to just south of Rapid City.

The western area (16–20” PZ) is primarily located in Wyoming, extending from Newcastle in the south, to north of the Bear Lodge Mountains, then south through the gap between the Bear Lodge Mountains and the Black Hills.

One additional grouping of ecological sites represents sites that are common for the entire MLRA and do not have a precipitation zone designation.

The forest lands in MLRA 61 are represented by three forest ecological sites, which are currently correlated to MLRA 62 Black Hills.

Classification relationships

USDA Land Resource Region G—Western Great Plains Range and Irrigated Region:
Major Land Resource Area (MLRA) 61—Black Hills Foot Slopes

US Environmental Protection Agency (EPA)
Level IV Ecoregions of the Conterminous United States:
Black Hills Foothills—17a

USDA Forest Service
Ecological Subregions: Sections and Subsections of Conterminous United States:
Black Hills Coniferous Forest Province—M334:
Black Hills Foothills Subsection—M334Aa

Ecological site concept

The Subirrigated ecological site is found throughout MLRA 61. It is a run-in site located on nearly level alluvial fans, stream terraces, and floodplains. Slopes range from 0 to 4 percent. The soils are very deep and formed in loamy or sandy alluvium. The surface layer is 4 to 15 inches in depth with silt loam to fine sandy loamy textures. Soils are somewhat poorly drained, with moderate to slow permeability. The textures of the subsurface soils range from silty clay loam to sand. A seasonal water table occurs within 2 to 3 feet of the surface and significantly influences plant

species composition and productivity. The site is non-saline and non-alkaline.

Vegetation in the Reference State (1.0) is dominated by tall and mid-stature warm-season grasses. Forbs are common and diverse. Shrubs and trees can be scattered across the site.

Associated sites

R061XY020SD	**Overflow** The Overflow ecological site is found adjacent to a stream channel. It can also be adjacent to or immediately below the Subirrigated ecological site.
R061XY042SD	**Lowland** The Lowland ecological site is found on the low stream terrace immediately above the Subirrigated ecological site. The Lowland site is occasionally to rarely flooded.
R061XY022SD	**Loamy Terrace** The Loamy Terrace ecological site is found on the stream terrace above the Subirrigated ecological site. The Loamy Terrace site is rarely to very rarely flooded.
R061XY002SD	**Wet Land** The Wet Land ecological site is found adjacent to or intermixed with the Subirrigated ecological site.

Similar sites

R061XY020SD	**Overflow** The Overflow ecological site will have more cool-season grasses; scattered trees; and lower vegetative production than the Subirrigated ecological site.
R061XY042SD	**Lowland** The Lowland ecological site will have more cool-season grasses; trees and shrubs are common; and lower vegetative production than the Subirrigated ecological site.
R061XY002SD	**Wet Land** The Wet Land ecological site will have surface water present for a significant portion of the growing season; and more sedges, rushes, and other hydrophyte species than the Subirrigated ecological site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Andropogon gerardii* (2) *Panicum virgatum*

Physiographic features

The Subirrigated ecological site occurs on nearly level floodplains adjacent to streams, springs, and ponds. A water table generally occurs within reach of the plants for some portion of the growing season.

Table 2. Representative physiographic features

Landforms	(1) Valley > Flood plain (2) Valley > Stream terrace
Runoff class	Low to high
Flooding duration	Brief (2 to 7 days) to long (7 to 30 days)
Flooding frequency	Occasional to frequent
Ponding frequency	None
Elevation	2,900–4,000 ft
Slope	0–4%
Water table depth	24–80 in

Aspect	Aspect is not a significant factor

Climatic features

The climate in MLRA 61 is typical of the drier portions of the Northern Great Plains where sagebrush steppes to the west yield to grassland steppes to the east. Average annual precipitation ranges from 16 to 22 inches with most falling during the growing season. Temperatures show a wide range between summer and winter and between daily maximums and minimums. The wide range is due to the high elevation and dry air, which permit rapidly incoming and outgoing radiation. In winter, cold air outbreaks from Canada move rapidly from northwest to southeast and account for extreme minimum temperatures. Chinook winds may occur in the winter and bring rapid rises in temperature. Extreme storms may occur during the winter. They most severely affect ranch operations during late winter and spring.

The average annual temperature is about 47 °F. January and December are the coldest months with average temperatures ranging from about 23 °F (NNW of Edgemont, SD) to about 26 °F (Fort Meade, SD). July is the warmest month with average temperatures ranging from about 69 °F (Fort Meade, WY) to about 73 °F (Hot Springs, SD). The range of average monthly temperatures between the coldest and warmest months is about 47 °F. Wind speeds are estimated to average about 11 miles per hour annually, ranging from about 13 miles per hour during the spring to about 10 miles per hour during the summer. Daytime winds are generally stronger than nighttime winds. Occasionally, storms bring brief periods of high winds with gusts to more than 50 miles per hour.

Growth of cool-season plants begins in early to mid-March, slowing or ceasing in late June. Warm-season plants begin growth about mid-May and continue to early or mid-September. Cool-season plants may green-up in September and October if adequate soil moisture is present.

Table 3. Representative climatic features

Frost-free period (characteristic range)	96-117 days
Freeze-free period (characteristic range)	120-143 days
Precipitation total (characteristic range)	18-21 in
Frost-free period (actual range)	80-124 days
Freeze-free period (actual range)	115-157 days
Precipitation total (actual range)	16-22 in
Frost-free period (average)	107 days
Freeze-free period (average)	133 days
Precipitation total (average)	19 in

Climate stations used

- (1) BEAR RIDGE [USC00390554], Spearfish, SD
- (2) EDGEMONT [USC00392557], Edgemont, SD
- (3) EDGEMONT 23 NNW [USC00392565], Custer, SD
- (4) FT MEADE [USC00393069], Fort Meade, SD
- (5) HOT SPRINGS [USC00394007], Hot Springs, SD
- (6) RAPID CITY WFO [USC00396948], Rapid City, SD
- (7) RAPID CITY 4NW [USC00396947], Rapid City, SD
- (8) SPEARFISH [USC00397882], Spearfish, SD
- (9) DEVILS TWR #2 [USC00482466], Devils Tower, WY
- (10) HULETT [USC00484760], Hulett, WY
- (11) NEWCASTLE [USC00486660], Newcastle, WY
- (12) SUNDANCE [USC00488705], Sundance, WY
- (13) UPTON 14ENE [USC00489208], Newcastle, WY

Influencing water features

Riparian areas and wetland features can be directly associated with the Subirrigated ecological site.

Stream Type: B6, C6
(Rosgen System)

Wetland description

Not Applicable.

Soil features

Soils common to the Subirrigated ecological site are very deep and formed in loamy or sandy alluvium. Subsurface textures are course to moderately fine. Soils are somewhat poorly drained with moderate to slow permeability. Water holding capacity is high. These soils have a high-water table (2 to 3 feet from the surface) which keeps the rooting zone moist for a portion of the growing season. Salinity is none to slight and sodicity is typically none to slight. Subsurface soil layers are not restrictive to water movement or root penetration.

This site should show no evidence of rills, wind-scoured areas, or pedestalled plants. No water flow patterns are seen on this site. The soil surface is stable and intact.

Major Soils correlated to the Subirrigated ecological site include, Herdcamp, Higgins, Rapidcreek, and Sodawells.

The Local Phase is typically categorized as poorly or somewhat poorly drained and the Flooding ratings are typically occasional or frequently flooded.

Some of these soils with a frequently flooded Local Phase, and a Flooding rating of frequently are typically correlated to the Overflow ecological site (R061XY020SD).

These soils are mainly susceptible to water erosion. The hazard of water erosion increases where vegetative cover is not adequate. A drastic loss of the soil surface layer on this site can result in a shift in species composition and production.

More information regarding the soil is available in soil survey reports. Contact the local USDA Service Center for details specific to your area of interest, or go online to access USDA’s Web Soil Survey.

Table 4. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Silt loam (2) Fine sandy loam (3) Loam
Family particle size	(1) Loamy
Drainage class	Poorly drained to somewhat poorly drained
Permeability class	Slow to moderate
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	6–7 in
Calcium carbonate equivalent (0-40in)	5–30%

Electrical conductivity (0-40in)	0–4 mmhos/cm
Sodium adsorption ratio (0-40in)	0–5
Soil reaction (1:1 water) (0-40in)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–11%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The Subirrigated ecological site developed under the Northern Great Plains climatic conditions; light to severe grazing by bison and other large herbivores; sporadic, natural or human-caused wildfire (often of light intensities); and other biotic and abiotic factors that typically influence soil and site development. Changes occur in the plant communities due to short-term weather variations, effects of native and exotic plant and animal species, and management actions. Although the following plant community descriptions are typical of the transitions between communities, severe disturbances, such as periods of well below average precipitation and the introduction of non-native cool-season grasses, can cause significant shifts in plant communities and species composition.

Interpretations are primarily based on the Big Bluestem-Switchgrass-Indiangrass Plant Community (1.1). It has been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been used. Plant community phases, states, transitional pathways, and thresholds have been determined through similar studies and experience.

It may difficult to locate the Reference Plant Community (1.1) with the spread and establishment of non-native cool-season grasses in MLRA 61. The Native/Invaded State (2.0) is more representative to current conditions than the Reference State (1.0). Because of the persistence of non-native cool-season grasses, a restoration pathway to the Reference State (1.0) is not believed to be achievable.

The following state-and-transition diagram illustrates the common plant communities on the site and the transition pathways between communities. The ecological processes are discussed in more detail in the plant community descriptions following the diagram.

State and transition model

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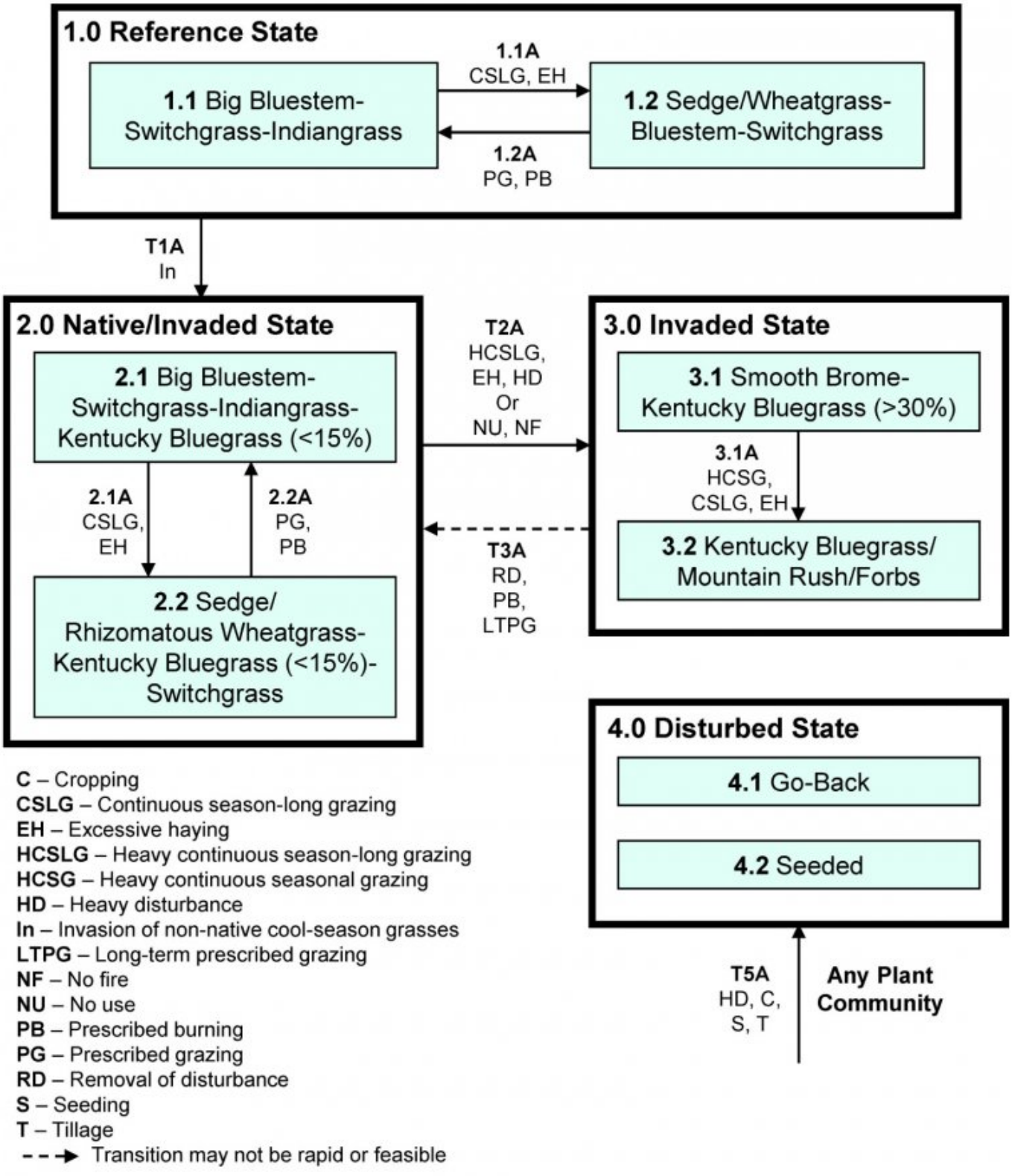

C – Cropping
CSLG – Continuous season-long grazing
EH – Excessive haying
HCSLG – Heavy continuous season-long grazing
HCSG – Heavy continuous seasonal grazing
HD – Heavy disturbance
In – Invasion of non-native cool-season grasses
LTPG – Long-term prescribed grazing
NF – No fire
NU – No use
PB – Prescribed burning
PG – Prescribed grazing
RD – Removal of disturbance
S – Seeding
T – Tillage
- - → Transition may not be rapid or feasible

Diagram Legend: Subirrigated - R061XY003SD

T1A	1.0 to 2.0	Invasion of non-native cool-season grasses.
T2A	2.0 to 4.0	Heavy, continuous season-long grazing; and/or excessive haying; heavy disturbance; or no use and no fire.
T3A	3.0 to 4.0	Removal of disturbance; long-term prescribed grazing with proper stocking, change in season of use, and deferment that provides time for adequate recovery; or Prescribed burning followed by prescribed grazing, may also be a management option to facilitate the transition. This transition may not be fast or feasible.
T5A	Any Plant Community to 4.0	Heavy disturbance such as tillage; cropping; abandoning cropland; tillage and seeding to introduced perennial forage crops.

1.1A	1.1 to 1.2	Continuous season-long grazing; and/or excessive haying.
1.2A	1.2 to 1.1	Prescribed grazing with proper stocking, change in season of use, adequate time for recovery. Possibly prescribed burning followed by prescribed grazing.
2.1A	2.1 to 2.2	Continuous season-long grazing; and/or excessive haying.
2.2A	2.2 to 2.1	Prescribed grazing with proper stocking, change in season of use, adequate time for recovery. Possibly prescribed burning followed by prescribed grazing.
3.1A	3.1 to 3.2	Heavy continuous grazing; and/or excessive haying.

State 1
Reference State

The Reference State represents what is believed to show the natural range of variability that dominated the dynamics of the ecological site prior to European settlement. This site in the Reference State (1.0) was typically dominated by warm-season grasses, with occasional shifts to a near co-dominance of cool- and warm-season grasses. In pre-European times, the primary disturbance mechanisms for this site in the reference condition included periods of below and above average precipitation, periodic fire, and herbivory by insects and large ungulates. Timing of fires and herbivory coupled with weather events dictated the dynamics that occurred within the natural range of variability. Today the primary disturbance is from a lack of fire and concentrated livestock grazing and excessive haying. Grasses that are desirable for livestock and wildlife can decline and a corresponding increase in less desirable grasses will occur. Today, a similar state will be difficult to find due to the predominance and invasiveness of non-native cool-season perennial gasses.

Community 1.1
Big Bluestem-Switchgrass-Indiangrass

Interpretations are based primarily on the Big Bluestem-Switchgrass-Indiangrass Plant Community. This is also considered to be Reference Plant Community (1.1). This community evolved with grazing by large herbivores, occasional prairie fires, and occasional to frequent flooding events. The potential vegetation was about 85 percent grass and grass-like species, 10 percent forbs, and 5 percent shrubs and trees by air-dry weight. The dominant grasses included big bluestem, switchgrass, and Indiangrass. Other grass and grass-like species that occurred

were sedges, little bluestem, porcupine grass, Canada wildrye, slender wheatgrass, and western wheatgrass. Common forbs were likely Maximilian sunflower, Rocky Mountain iris, Indian hemp, goldenrod, showy milkweed, gayfeather, black-eyed Susan, and American licorice. This site does not typically support a large amount of woody species, but rose, leadplant, and snowberry were the most common shrubs. This plant community is diverse, stable, and productive, and is well adapted to the Northern Great Plains. The high-water table supplies much of the moisture for plant growth. Community dynamics, nutrient cycle, water cycle, and energy flow are functioning properly. Plant litter is properly distributed with very little movement offsite and natural plant mortality is very low. The diversity in plant species allows for the variability of the water table. This is a sustainable plant community in terms of soil stability, watershed function, and biologic integrity.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	3735	4248	4700
Forb	220	360	550
Shrub/Vine	45	144	250
Tree	0	48	100
Total	**4000**	**4800**	**5600**

Figure 9. Plant community growth curve (percent production by month). SD6110, Black Hills Foot Slopes, lowland warm-season dominant. Warm-season dominant, lowland.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		2	8	15	21	26	15	8	5		

Community 1.2
Sedge/Wheatgrass-Bluestem-Switchgrass

This plant community evolved under heavy continuous grazing or from over utilization during extended drought periods. The potential plant community was made up of approximately 85 percent grasses and grass-like species, 10 percent forbs, and 5 percent shrubs. Dominant grass and grass-like species included sedges, slender wheatgrass, western wheatgrass, switchgrass, big bluestem, and little bluestem. Other grass and grass-like species included plains bluegrass, rushes, Indiangrass, Canada wildrye, and foxtail barley. Forbs commonly found in this plant community included white sagebrush (cudweed sagewort), goldenrod, and western yarrow. This plant community had similar plant composition to the Sedge/Rhizomatous Wheatgrass/Kentucky Bluegrass (<15%)-Switchgrass Plant Community (2.2) (refer to the plant composition tables). The main difference is that this plant community phase did not have the presence of non-native cool-season grasses such as Kentucky bluegrass and smooth brome. When compared to the Big Bluestem-Switchgrass-Indiangrass Plant Community (1.1), sedges, slender wheatgrass, and western wheatgrass increased. Big bluestem and Indiangrass decreased, and production of all tall warm-season grasses was reduced. This plant community was moderately resistant to change. The herbaceous species present were well adapted to grazing; however, species composition could be altered through long-term overgrazing. If the herbaceous component was intact, it tended to be resilient if the disturbance was not long-term.

Figure 10. Plant community growth curve (percent production by month). SD6107, Black Hills Foot Slopes, cool-season dominant, warm-season sub-dominant. Cool-season dominant, warm-season sub-dominant, lowland.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		5	13	20	25	18	11	5	3		

Pathway 1.1A
Community 1.1 to 1.2

Continuous season-long grazing without adequate recovery periods; or excessive haying, will convert this Plant Community to the Sedge/Wheatgrass-Bluestem-Switchgrass Plant Community (1.2).

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing that with proper stocking rates, change in season of use, and adequate time for plant recovery, will shift this plant community to the Big Bluestem-Switchgrass-Indiangrass Plant Community (1.1). Prescribed burning followed by prescribed grazing may also facilitate this plant community shift.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Native/Invaded State

The Native/Invaded represents the more common range of variability that exists with higher levels of grazing management but in the absence of periodic fire due to fire suppression. This state is dominated by cool- and warm-season grasses, it can be found on areas that are properly managed with grazing and prescribed burning, and sometimes on areas receiving occasional short periods of rest. Native warm- and cool-season species can decline and a corresponding increase in non-native cool-season grasses will occur. Non-Native cool-season grasses will make up less than 15 percent of total annual production. Preliminary studies tend to indicate that when Kentucky bluegrass exceeds 30 percent of the plant community and native grasses represent less than 40 percent of the plant community composition a threshold has been crossed to an Invaded State (3.0). These invaded plant communities that are dominated by Kentucky bluegrass will have significantly less cover and diversity of native grasses and forb species (Toledo, D. et al., 2014).

Community 2.1
Big Bluestem-Switchgrass-Indiangrass-Kentucky Bluegrass (<15%)

This plant community phase is similar to the Big Bluestem-Switchgrass-Indiangrass Plant Community (1.1), but it also contains minor amounts of non-native invasive grass species such as Kentucky bluegrass and smooth brome (up to about 15 percent by air-dry weight). The potential vegetation is about 85 percent grass and grass-like species, 10 percent forbs, and 5 percent shrubs by air-dry weight. The dominant grasses include big bluestem, switchgrass, and Indiangrass. Other grass and grass-like species that occur are sedges, little bluestem, porcupine grass, Canada wildrye, slender wheatgrass, and western wheatgrass. Common forbs are Maximilian sunflower, Indian hemp, goldenrod, showy milkweed, gayfeather, black-eyed Susan, and American licorice. This site does not typically support a large amount of woody species, but rose, leadplant, and snowberry are the most common shrubs. This plant community is resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high drought tolerance. This is a sustainable plant community in regard to site and soil stability, watershed function, and biologic integrity.

Figure 11. Plant community growth curve (percent production by month). SD6110, Black Hills Foot Slopes, lowland warm-season dominant. Warm-season dominant, lowland.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		2	8	15	21	26	15	8	5		

Community 2.2
Sedge/Rhizomatous Wheatgrass-Kentucky Bluegrass (<15%)-Switchgrass

This plant community is a result of continuous season-long grazing, or excessive haying. The potential plant community is made up of approximately 87 percent grasses and grass-like species, 10 percent forbs, and 3 percent shrubs. Dominant grass and grass-like species include sedges, slender wheatgrass, western wheatgrass, switchgrass, Kentucky bluegrass, big bluestem, and little bluestem. Other grass and grass-like species include plains bluegrass, rushes, Indiangrass, Canada wildrye, and foxtail barley. Forbs commonly found in this plant community include cudweed sagewort, goldenrod, and western yarrow. When compared to the Big Bluestem-

Switchgrass-Indiangrass Plant Community (1.1), sedges, slender wheatgrass, and western wheatgrass increase. Big bluestem and Indiangrass decrease, and production of all tall warm-season grasses is reduced. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2970	3580	4165
Forb	195	300	425
Shrub/Vine	35	80	125
Tree	0	40	85
Total	**3200**	**4000**	**4800**

Figure 13. Plant community growth curve (percent production by month). SD6107, Black Hills Foot Slopes, cool-season dominant, warm-season sub-dominant. Cool-season dominant, warm-season sub-dominant, lowland.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		5	13	20	25	18	11	5	3		

Pathway 2.1A
Community 2.1 to 2.2

Continuous season-long grazing without adequate recovery periods; or excessive haying, will convert this Plant Community to the Sedge/Rhizomatous Wheatgrass-Kentucky Bluegrass (<15%) Plant Community (2.2).

Pathway 2.2A
Community 2.2 to 2.1

Prescribed grazing with proper stocking rates, change in season of use, and adequate time for plant recovery, will shift this plant community to the Big Bluestem-Switchgrass-Indiangrass-Kentucky Bluegrass (<15%) Plant Community (2.1). Prescribed burning followed by prescribed grazing may also facilitate this plant community shift.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 3
Invaded State

The Invaded State is the result of invasion and dominance of non-native cool-season grass species. This state is characterized by the dominance of Kentucky bluegrass and smooth brome, and an increasing thatch layer that effectively blocks introduction of other plants into the system. Heavy grazing or long-term light grazing (understocked) will tend to result in an increase of smooth brome. Non-use and no fire will tend to benefit Kentucky bluegrass due to an increasing thatch layer that effectively blocks the introduction of other plants into the system. Plant litter accumulation tends to favor the more shade tolerant introduced grass species. The nutrient cycle is also impaired, and the result is typically a higher level of nitrogen which also favors the introduced species. Increasing plant litter decreases the amount of sunlight reaching plant crowns thereby shifting competitive advantage to shade tolerant introduced grass species. Studies indicate that soil biological activity is altered, and this shift apparently exploits the soil microclimate and encourages growth of the introduced grass species. Once the threshold is crossed, a change in grazing management alone cannot cause a reduction in the invasive grass dominance. Preliminary studies would tend to indicate this threshold may exist when Kentucky bluegrass exceeds 30 percent of

the plant community and native grasses represent less than 40 percent of the plant community composition. Plant communities dominated by Kentucky bluegrass have significantly less cover and diversity of native grasses and forb species (Toledo, D. et al., 2014). Once the Invaded State (3.0) is well established, even drastic events such as high-intensity fires driven by high fuel loads of litter and thatch are unlikely to result in more than a very short-term reduction of Kentucky bluegrass. Fire can reduce the dominance of Kentucky bluegrass, but due to the large amounts of rhizomes in the soil, there is little opportunity for the native species to establish and dominate before Kentucky bluegrass rebounds and again dominates the system.

Community 3.1
Smooth Brome-Kentucky Bluegrass (>30%)

This plant community phase is a result of extended periods of nonuse and no fire. It is characterized by a dominance of smooth brome and Kentucky bluegrass. The dominance is at times so complete that other species are difficult to find on the site. A thick duff layer also accumulates at or above the soil surface. Nutrient cycling is greatly reduced, and native plants have great difficulty becoming established. When dominated by smooth brome, infiltration is moderately reduced, and runoff is moderate. Production can be equal to or higher than the interpretive plant community. However, when dominated by Kentucky bluegrass, infiltration is greatly reduced, and runoff is high. Production in this case will likely be significantly less. In either case, the period that palatability is high is relatively short, as these cool-season species mature rapidly. Energy capture is also reduced. In addition to Kentucky bluegrass and smooth brome, other species that will be present at varying amounts can include redtop, timothy, and quackgrass. Native species such as western wheatgrass and green needlegrass may be present in minor amounts.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	3155	3717	4250
Forb	205	315	450
Shrub/Vine	40	126	215
Tree	0	42	85
Total	**3400**	**4200**	**5000**

Figure 15. Plant community growth curve (percent production by month). SD6106, Black Hills Foot Slopes, lowland cool-season dominant. Cool-season dominant, lowland.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		6	15	20	26	17	9	4	3		

Community 3.2
Kentucky Bluegrass/Mountain Rush/Forbs

This plant community is a result of heavy, continuous seasonal grazing or heavy, continuous season-long grazing. It is characterized by a dominance of Kentucky bluegrass, Baltic rush, and forbs. The dominance of Kentucky bluegrass is at times so complete that other species are difficult to find on the site. A relatively thick duff layer can sometimes accumulate at or above the soil surface. Nutrient cycling is greatly reduced, and native plants have great difficulty becoming established. Infiltration is greatly reduced, and runoff is high. Production will be significantly reduced when compared to the interpretive plant community (1.1). The period that palatability is high is relatively short as Kentucky bluegrass matures rapidly. Energy capture is also reduced. Biological activity in the soil is likely reduced significantly in this plant community.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2055	2565	3020
Forb	145	375	650
Shrub/Vine	0	45	95
Tree	0	15	35
Total	**2200**	**3000**	**3800**

Figure 17. Plant community growth curve (percent production by month). SD6106, Black Hills Foot Slopes, lowland cool-season dominant. Cool-season dominant, lowland.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		6	15	20	26	17	9	4	3		

Pathway 3.1A
Community 3.1 to 3.2

Heavy, continuous seasonal grazing; or continuous season-long grazing without adequate recovery periods; and excessive haying, will convert this Plant Community to the Kentucky Bluegrass/Mountain Rush/Forb Plant Community (3.2).

State 4
Disturbed State

This State can be transitioned to from any plant community. The two separate vegetative plant communities, Go-Back and Seeded, are highly variable in nature. They are derived through different management scenarios and are not related successionally. Infiltration, runoff, and soil erosion will vary depending on the vegetation present on the site. The Go-Back Plant Community (4.1) was previously tilled for crop production and then abandoned. The plant community that develops on this site will be greatly influenced by the plant communities that are located on adjacent land. The Seeded Plant Community (4.2) was typically tilled and then seeded to a perennial forage species or mix of species.

Community 4.1
Go-Back

The Go-back plant community can be reached whenever severe mechanical disturbance occurs (e.g., tilled and abandoned cropland). During the early successional stages, the species that mainly dominate the plant community are annual grasses and forbs, later being replaced by both native and introduced perennials. The vegetation on this site varies greatly, sometimes being dominated by bluegrass, smooth brome, timothy, annual brome, cinquefoil, and non-native thistles. Other plants that commonly occur on the site can include western wheatgrass, prickly lettuce, horseweed, foxtail, and sunflowers. Bare ground is prevalent due to the loss of organic matter and lower overall soil health.

Community 4.2
Seeded to Forage Species

The Seeded Plant Community is normally those areas seeded to pubescent or intermediate wheatgrass, alfalfa, switchgrass, or other forage species. For adapted species and expected production, refer to the USDA-NRCS eFOTG for the appropriate Forage Suitability Group description.

Transition T1A
State 1 to 2

Invasion of non-native cool-season grasses will transition the Reference State (1.0) to the Native/Invaded State

(2.0).

Transition T5A
State 1 to 4

Heavy disturbance including tillage; abandoned cropland; or seeding to improved pasture species result in a transition to the Disturbed State (4.0).

Transition T2A
State 2 to 3

Heavy, continuous season-long grazing; excessive haying; or heavy disturbance will transition the Native/Invaded State (2.0) to the Invaded State (3.0). Long-term non-use and no fire will also cause the Native/Invaded State (2.0) to transition to the Invaded State (3.0).

Transition T5A
State 2 to 4

Heavy disturbance including tillage; abandoned cropland; or seeding to improved pasture species result in a transition to the Disturbed State (4.0).

Transition T3A
State 3 to 2

Removal of disturbances; possibly prescribed burning to suppress non-native cool-season grass; and long-term prescribed grazing with proper stocking rates, change in season of use, and deferment that provides adequate recovery time. This may result in a transition from the Invaded State (3.0) to the Native/Invaded State (2.0). This will likely take a long period of time and recovery may not be attainable. Success depends on whether native reproductive propagules remain intact on the site.

Conservation practices

Prescribed Burning
Prescribed Grazing

Transition T5A
State 3 to 4

Heavy disturbance including tillage; abandoned cropland; or seeding to improved pasture species result in a transition to the Disturbed State (4.0).

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-Season Grasses**			1440–2880	
	big bluestem	ANGE	*Andropogon gerardii*	960–2160	–
	Indiangrass	SONU2	*Sorghastrum nutans*	144–960	–
	switchgrass	PAVI2	*Panicum virgatum*	144–960	–
	prairie cordgrass	SPPE	*Spartina pectinata*	48–480	–
	spiked muhly	MUGL3	*Muhlenbergia glomerata*	0–144	–
2	**Cool-Season Bunchgrass**			240–720	
		HESP11			

	porcupinegrass	HESP11	*Hesperostipa spartea*	96–384	–
	Canada wildrye	ELCA4	*Elymus canadensis*	96–384	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	48–240	–
	plains bluegrass	POAR3	*Poa arida*	48–144	–
	foxtail barley	HOJU	*Hordeum jubatum*	0–96	–
	fowl bluegrass	POPA2	*Poa palustris*	0–96	–
3	**Rhizomatous Wheatgrass**			48–240	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–240	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–96	–
4	**Mid- Warm-Season Grasses**			48–240	
	little bluestem	SCSC	*Schizachyrium scoparium*	48–240	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–240	–
5	**Other Native Grasses**			144–480	
	northern reedgrass	CASTI3	*Calamagrostis stricta ssp. inexpansa*	48–240	–
	bluejoint	CACA4	*Calamagrostis canadensis*	48–240	–
	Grass, perennial	2GP	*Grass, perennial*	0–240	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	48–144	–
	saltgrass	DISP	*Distichlis spicata*	0–96	–
6	**Grass-Likes**			240–720	
	clustered field sedge	CAPR5	*Carex praegracilis*	240–480	–
	Nebraska sedge	CANE2	*Carex nebrascensis*	0–336	–
	spike sedge	CANA2	*Carex nardina*	0–240	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–240	–
7	**Non-Native Cool-Season Grasses**			0	
Forb					
8	**Forbs**			240–480	
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	48–144	–
	Forb, native	2FN	*Forb, native*	48–144	–
	Indianhemp	APCA	*Apocynum cannabinum*	0–96	–
	sticky purple geranium	GEVI2	*Geranium viscosissimum*	0–96	–
	western dock	RUAQ	*Rumex aquaticus*	48–96	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	48–96	–
	purple prairie clover	DAPU5	*Dalea purpurea*	48–96	–
	Rocky Mountain iris	IRMI	*Iris missouriensis*	0–96	–
	scurfpea	PSORA2	*Psoralidium*	0–96	–
	showy milkweed	ASSP	*Asclepias speciosa*	48–96	–
	cinquefoil	POTEN	*Potentilla*	48–96	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	48–96	–
	dotted blazing star	LIPU	*Liatris punctata*	48–96	–
	goldenrod	SOLID	*Solidago*	48–96	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	48–96	–
	blackeyed Susan	RUHI2	*Rudbeckia hirta*	0–96	

	blackeyed Susan	RUHI2	*Rudbeckia hirta*	0–96	–
	blue-eyed grass	SISYR	*Sisyrinchium*	0–48	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–48	–
	stickseed	HACKE	*Hackelia*	0–48	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	0–48	–
	Canadian anemone	ANCA8	*Anemone canadensis*	0–48	–
	mint	MENTH	*Mentha*	0–48	–
	northern bedstraw	GABO2	*Galium boreale*	0–48	–
	palespike lobelia	LOSP	*Lobelia spicata*	0–48	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–48	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	0–48	–
	Virginia strawberry	FRVI	*Fragaria virginiana*	0–48	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–48	–
Shrub/Vine					
9	**Shrubs**			48–240	
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–240	–
	chokecherry	PRVI	*Prunus virginiana*	0–240	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–144	–
	leadplant	AMCA6	*Amorpha canescens*	0–144	–
	rose	ROSA5	*Rosa*	48–96	–
Tree					
10	**Trees**			0–96	
	willow	SALIX	*Salix*	0–96	–

Table 10. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-Season Grasses**			400–800	
	switchgrass	PAVI2	*Panicum virgatum*	120–800	–
	big bluestem	ANGE	*Andropogon gerardii*	80–600	–
	prairie cordgrass	SPPE	*Spartina pectinata*	40–200	–
	Indiangrass	SONU2	*Sorghastrum nutans*	0–40	–
2	**Cool-Season Bunchgrass**			200–600	
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	120–800	–
	plains bluegrass	POAR3	*Poa arida*	80–400	–
	foxtail barley	HOJU	*Hordeum jubatum*	40–320	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–200	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–120	–
	fowl bluegrass	POPA2	*Poa palustris*	0–80	–
3	**Rhizomatous Wheatgrass**			200–800	
	western wheatgrass	PASM	*Pascopyrum smithii*	120–800	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–200	–
4	**Mid- Warm-Season Grasses**			80–400	

	little bluestem	SCSC	*Schizachyrium scoparium*	80–400	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–80	–
5	**Other Native Grasses**			40–200	
	Grass, perennial	2GP	*Grass, perennial*	0–200	–
	northern reedgrass	CASTI3	*Calamagrostis stricta ssp. inexpansa*	0–80	–
	bluejoint	CACA4	*Calamagrostis canadensis*	0–80	–
	reed canarygrass	PHAR3	*Phalaris arundinacea*	0–80	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	40–80	–
	saltgrass	DISP	*Distichlis spicata*	0–40	–
6	**Grass-Like**			400–1200	
	Nebraska sedge	CANE2	*Carex nebrascensis*	80–600	–
	clustered field sedge	CAPR5	*Carex praegracilis*	80–400	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–200	–
	spike sedge	CANA2	*Carex nardina*	0–200	–
7	**Non-Native Cool-Season Grasses**			5–20	
	Kentucky bluegrass	POPR	*Poa pratensis*	200–800	–
	smooth brome	BRIN2	*Bromus inermis*	40–400	–
	timothy	PHPR3	*Phleum pratense*	0–400	–
	quackgrass	ELRE4	*Elymus repens*	0–200	–
	creeping bentgrass	AGST2	*Agrostis stolonifera*	0–200	–
Forb					
8	**Forbs**			200–400	
	white sagebrush	ARLU	*Artemisia ludoviciana*	40–120	–
	goldenrod	SOLID	*Solidago*	40–120	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	40–120	–
	Forb, native	2FN	*Forb, native*	40–120	–
	Forb, introduced	2FI	*Forb, introduced*	40–120	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	40–80	–
	Rocky Mountain iris	IRMI	*Iris missouriensis*	0–80	–
	showy milkweed	ASSP	*Asclepias speciosa*	40–80	–
	Indianhemp	APCA	*Apocynum cannabinum*	0–80	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–80	–
	cinquefoil	POTEN	*Potentilla*	40–80	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	0–40	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–40	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–40	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–40	–
	dotted blazing star	LIPU	*Liatris punctata*	0–40	–
	western dock	RUAQ	*Rumex aquaticus*	0–40	–
	scurfpea	PSORA2	*Psoralidium*	0–40	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	0–40	–
	sticky purple geranium	GEVI2	*Geranium viscosissimum*	0–40	–

Shrub/Vine					
9	**Shrubs**			40–120	
	rose	ROSA5	*Rosa*	40–80	–
	chokecherry	PRVI	*Prunus virginiana*	0–80	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–80	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–40	–
	leadplant	AMCA6	*Amorpha canescens*	0–40	–
Tree					
10	**Trees**			0–80	
	willow	SALIX	*Salix*	0–80	–

Table 11. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-Season Grasses**			0–210	
	big bluestem	ANGE	*Andropogon gerardii*	0–210	–
	switchgrass	PAVI2	*Panicum virgatum*	0–126	–
	prairie cordgrass	SPPE	*Spartina pectinata*	0–42	–
2	**Cool-Season Bunchgrass**			42–420	
	foxtail barley	HOJU	*Hordeum jubatum*	42–420	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–126	–
	plains bluegrass	POAR3	*Poa arida*	0–126	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–126	–
	fowl bluegrass	POPA2	*Poa palustris*	0–42	–
3	**Rhizomatous Wheatgrass**			0–210	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–210	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–84	–
4	**Mid- Warm-Season Grasses**			0–210	
	little bluestem	SCSC	*Schizachyrium scoparium*	0–210	–
5	**Other Native Grasses**			0–210	
	Grass, perennial	2GP	*Grass, perennial*	0–210	–
	reed canarygrass	PHAR3	*Phalaris arundinacea*	0–84	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–42	–
	saltgrass	DISP	*Distichlis spicata*	0–42	–
6	**Grass-Likes**			210–840	
	clustered field sedge	CAPR5	*Carex praegracilis*	84–420	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–210	–
	Nebraska sedge	CANE2	*Carex nebrascensis*	0–126	–
	spike sedge	CANA2	*Carex nardina*	0–84	–
7	**Non-Native Cool-Season Grasses**			1260–2520	
	Kentucky bluegrass	POPR	*Poa pratensis*	126–840	–
	smooth brome	BRIN2	*Bromus inermis*	630–840	–

	timothy	PHPR3	*Phleum pratense*	0–420	–
	quackgrass	ELRE4	*Elymus repens*	0–336	–
	creeping bentgrass	AGST2	*Agrostis stolonifera*	0–336	–
Forb					
8	**Forbs**			210–420	
	Forb, introduced	2FI	*Forb, introduced*	42–210	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	42–168	–
	goldenrod	SOLID	*Solidago*	42–168	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	42–168	–
	Forb, native	2FN	*Forb, native*	0–126	–
	showy milkweed	ASSP	*Asclepias speciosa*	42–126	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	42–126	–
	Indianhemp	APCA	*Apocynum cannabinum*	0–84	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–84	–
	cinquefoil	POTEN	*Potentilla*	42–84	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–42	–
	Rocky Mountain iris	IRMI	*Iris missouriensis*	0–42	–
	scurfpea	PSORA2	*Psoralidium*	0–42	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	0–42	–
	sticky purple geranium	GEVI2	*Geranium viscosissimum*	0–42	–
Shrub/Vine					
9	**Shrubs**			42–210	
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–210	–
	chokecherry	PRVI	*Prunus virginiana*	0–84	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–84	–
	rose	ROSA5	*Rosa*	42–84	–
Tree					
10	**Trees**			0–84	
	willow	SALIX	*Salix*	0–84	–

Table 12. Community 3.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-Season Grasses**			30–150	
	prairie cordgrass	SPPE	*Spartina pectinata*	30–150	–
2	**Cool-Season Bunchgrass**			30–300	
	foxtail barley	HOJU	*Hordeum jubatum*	30–300	–
	fowl bluegrass	POPA2	*Poa palustris*	0–30	–
3	**Rhizomatous Wheatgrass**			0–90	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–90	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–30	–
4	**Mid- Warm-Season Grasses**			0	

5	**Other Native Grasses**			0–150	
	Grass, perennial	2GP	*Grass, perennial*	0–150	–
	saltgrass	DISP	*Distichlis spicata*	0–90	–
	reed canarygrass	PHAR3	*Phalaris arundinacea*	0–60	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–30	–
6	**Grass-Likes**			150–750	
	clustered field sedge	CAPR5	*Carex praegracilis*	0–240	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–150	–
	spike sedge	CANA2	*Carex nardina*	0–60	–
7	**Non-Native Cool-Season Grasses**			750–1800	
	Kentucky bluegrass	POPR	*Poa pratensis*	600–1500	–
	creeping bentgrass	AGST2	*Agrostis stolonifera*	0–450	–
	smooth brome	BRIN2	*Bromus inermis*	30–450	–
	quackgrass	ELRE4	*Elymus repens*	0–360	–
	timothy	PHPR3	*Phleum pratense*	0–300	–
Forb					
8	**Forbs**			150–600	
	Forb, introduced	2FI	*Forb, introduced*	30–300	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	30–150	–
	goldenrod	SOLID	*Solidago*	30–150	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	30–150	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	30–150	–
	cinquefoil	POTEN	*Potentilla*	30–120	–
	Rocky Mountain iris	IRMI	*Iris missouriensis*	0–120	–
	showy milkweed	ASSP	*Asclepias speciosa*	30–90	–
	Forb, native	2FN	*Forb, native*	0–60	–
	Indianhemp	APCA	*Apocynum cannabinum*	0–60	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	0–60	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–60	–
	sticky purple geranium	GEVI2	*Geranium viscosissimum*	0–30	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–30	–
Shrub/Vine					
9	**Shrubs**			0–90	
	rose	ROSA5	*Rosa*	0–30	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–30	–
	chokecherry	PRVI	*Prunus virginiana*	0–30	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–30	–
Tree					
10	**Trees**			0–30	
	willow	SALIX	*Salix*	0–30	–

Animal community

Wildlife Interpretations:
MLRA 61 lies within the drier portion of the northern mixed-grass prairie ecosystem where sagebrush steppes to the west yield to grassland steppes to the east. Prior to European settlement, this area consisted of diverse grass- and shrubland habitats interspersed with varying densities of depressional instream wetlands and woody riparian corridors. These habitats provided critical life cycle components for many users. Many species of grassland birds, small mammals, reptiles, amphibians, and herds of roaming bison, elk, and pronghorn were among the inhabitants adapted to this semi-arid region. Roaming herbivores, as well as several small mammal and insect species, were the primary consumers linking the grassland resources to predators such as the gray wolf, mountain lion, and grizzly bear, and smaller carnivores such as the coyote, bobcat, fox, and raptors. The prairie dog was once abundant; however, the species remains a keystone species within its range. The black-footed ferret, burrowing owl, ferruginous hawk, mountain plover, and swift fox were associated with prairie dog complexes.

Historically, the northern mixed-grass prairie was a disturbance-driven ecosystem with fire, herbivory, and climate functioning as the primary disturbance factors either singly or in combination. Following European settlement, livestock grazing, cropland conversion, elimination of fire, energy development, and other anthropogenic factors influenced species composition and abundance. Introduced and invasive species further impacted plant and animal communities. The bison was a historical keystone species but had been extirpated in this area as a free-ranging herbivore. The loss of the bison and reduction of prairie dog populations and fire as ecological drivers greatly influenced the character of the remaining native plant communities and altered wildlife habitats. Human development has reduced habitat quality for area-sensitive species.

Within MLRA 61, the Subirrigated ecological site provides upland grassland cover with an associated forb component. It was typically part of an expansive grassland landscape that included combinations of Clayey, Loamy, Shallow, Stony Hills, Terrace, and Lowland ecological sites.

The Subirrigated site provides habitat for species requiring unfragmented grassland. Important habitat features, and components found commonly or exclusively on this site may include sharp-tailed grouse leks; upland nesting habitat for grassland birds, forbs and insects for brood habitat; and a forage source for small and large herbivores. Many grassland and shrub steppe nesting bird populations are declining. Extirpated species include free-ranging American bison, grizzly bear, gray wolf, black-footed ferret, mountain plover, Rocky Mountain locust, and swift fox.

Grazing Interpretations:
The following list suggests annual, initial stocking rates for average growing conditions. These estimates are conservative and should be used only as guidelines in the initial stages of conservation planning. Commonly, the current plant composition does not entirely match any particular plant community (as described in this ecological site description). Therefore, a resource inventory is necessary to document plant composition and production. More accurate estimates of carrying capacity should eventually be calculated using the following stocking rate information along with animal preference data and actual stocking records, particularly when grazers other than cattle are involved. In consultation with the land manager, a more intensive grazing management program that results in improved harvest efficiencies and increased carrying capacity may be developed.

The following suggested initial stocking rates are based on 912 lb/acre (air-dry weight) per animal-unit-month (AUM) with a 25 percent harvest efficiency of preferred and desirable forage species (refer to USDA-NRCS, National Range and Pasture Handbook). An AUM is defined as the equivalent amount of forage required by a 1,000-pound cow, with or without calf, for one month.

Plant Community: Big Bluestem-Switchgrass-Indiangrass (1.1)
Average Production (lb/acre, air-dry): 4,800
Stocking Rate (AUM/acre): 1.32

Plant Community: Sedge/Wheatgrass-Bluestem-Switchgrass (1.2)
Average Production (lb/acre, air-dry): 4,000
Stocking Rate (AUM/acre): 1.10

Plant Community: Big Bluestem-Switchgrass-Indiangrass-Kentucky Bluegrass (<15%) (2.1)
Average Production (lb/acre, air-dry): 4,800
Stocking Rate (AUM/acre): 1.32

Plant Community: Sedge/Rhizomatous Wheatgrass-Kentucky Bluegrass (<15%)-Switchgrass (2.2)
Average Production (lb/acre, air-dry): 4,000
Stocking Rate (AUM/acre): 1.10

Plant Community: Smooth Brome-Kentucky Bluegrass (>30%) (3.1)
Average Production (lb/acre, air-dry): 4,200*
Stocking Rate (AUM/acre): 1.15*

*Plant Community: Kentucky Bluegrass /Mountain Rush/Forbs (3.2)
Average Production (lb/acre, air-dry): 3,000*
Stocking Rate (AUM/acre): 0.82*

Plant Community: All other plant communities identified in this document have variable annual production values and require onsite sampling to determine initial stocking rates.

* Total annual production and stocking rates are highly variable and require onsite sampling.

Total onsite annual production may contain vegetation deemed undesirable or untargeted by the grazing animal. Therefore, AUM values may need to be reduced to reflect only preferred or desirable forage species.

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide yearlong forage for livestock. During the dormant period, the forage for livestock likely has insufficient protein to meet livestock requirements. Added protein allows ruminants to better utilize the energy stored in grazed plant materials. A forage quality test (either directly or through fecal sampling) should be used to determine the level of supplementation needed.

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic groups B and D. Infiltration and runoff potential for this site varies from moderate to high depending on soil hydrologic group, slope, and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where shortgrasses form a strong sod and dominate the site. Dominance by shortgrasses, bluegrass, or smooth brome will result in reduced infiltration and increased runoff. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff. Refer to the USDA-NRCS National Engineering Handbook, Part 630, for hydrologic soil groups, runoff quantities, and hydrologic curves.

Recreational uses

This site provides opportunities for hunting, hiking, photography, and bird watching. The wide variety of plants that bloom from spring until fall have an aesthetic value that appeals to visitors.

Wood products

No appreciable wood products are typically present on this site.

Other products

Harvesting the seeds of native plants can provide additional income on this site.

Other information

Revision Notes: “Previously Approved” Provisional
This provisional ecological site description (ESD) has passed quality control (QC) and quality assurance (QA) to ensure the it meets the 2014 NESH standards for a “Provisional” ecological site description.

This ecological site description (ESD) is an updated “Previously Approved” ESD that represented a first-generation

tier of documentation that met all requirements as an “Approved” ESD as laid out in the 1997 National Range and Pasture Handbook (NRPH). The requirements for approved status changed with the release of the 2014 National Ecological Site Handbook (NESH). The previously approved document fully described the reference state and community phase in the state-and-transition model. All other alternative states were at least described in narrative form. The “Previously Approved” ESD has been field-tested for a minimum of five years and is a proven functional document for conservation planning. The “Previously Approved” ESD may not contain all tabular and narrative entries as required in the current “Approved” level of documentation, but it is expected this ESD will continue refinement toward the current “Approved” status.

Site Development and Testing Plan
Future work, as described in an official project plan, is necessary to validate the information in this provisional ecological site description. The plan will include field activities for low-, medium-, and high-intensity sampling, soil correlations, and analysis of the data. Annual field reviews should be done by soil scientists and vegetation specialists. Final field review, peer review, quality control, and quality assurance reviews are required to produce the final document.

Inventory data references

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range-trained personnel were also used. Those involved in developing this site include: Stan Boltz, Range Management Specialist, NRCS; Cynthia Englebert, Range Management Specialist, Forest Service; George Gamblin, Range Management Specialist, NRCS; Ryan Murray, Range Management Specialist, NRCS; Cheryl Nielsen, Range Management Specialist, NRCS; L. Michael Stirling, Range Management Specialist, NRCS; Jim Westerman, Soil Scientist, NRCS.

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Contributors

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Rick L. Peterson

Approval

Suzanne Mayne-Kinney, 7/17/2024

Acknowledgments

All ecological sites were written to the Provisional Level by Rick L. Peterson, ESS, Rapid City, SSO in FY20.

The ESDs were reviewed for quality control by Emily Helms, John Hartung, Mitch Faulkner, and Ryan Murray.

All ecological sites were then reviewed and approved at the Provisional Level by David Kraft, Regional ESS, Salina, KS in September 2020.

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Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	Stan Boltz
Contact for lead author	Stan Boltz, stanley.boltz@sd.usda.gov, 605-352-1236
Date	09/30/2009
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None.

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2. **Presence of water flow patterns:** None.

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3. **Number and height of erosional pedestals or terracettes:** None.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is typically less than 5 percent.

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5. **Number of gullies and erosion associated with gullies:** None.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None.

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7. **Amount of litter movement (describe size and distance expected to travel):** Litter falls in place, and is in contact with the soil surface.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil aggregate stability ratings typically 5 to 6, normally 6. Surface organic matter adheres to the soil surface. Soil surface fragments will typically retain structure indefinitely when dipped in distilled water.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should be 10 to 30 inches thick with black to very dark gray colors when moist. Structure typically is medium to fine granular in the upper A-horizon.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Deep rooted species (mid and tall rhizomatous cool- and warm-season grasses and grass-likes) with fine and coarse roots positively influences infiltration.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None – when dry, B horizons can be hard and appear to be compacted, but no platy structure will be present.

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Tall, warm-season grasses >>

    Sub-dominant: Mid and tall, cool-season grasses > grass-like species >

    Other: Mid, warm-season grasses = forbs > shrubs

    Additional: Other grasses occur in other functional groups in minor amounts.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little evidence of decadence or mortality.

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14. **Average percent litter cover (%) and depth (in):** Litter cover 80 to 90 percent and in contact with soil surface.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Total annual production ranges from 4,000 to 5,600 pounds/acre, with the reference value being 4,800 pounds/acre (air-dry basis).

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** State and local noxious weeds, Kentucky bluegrass – Russian olive can dominate this site in localized areas.

17. **Perennial plant reproductive capability:** Perennial grasses and grass-likes should have vigorous rhizomes or tillers.