

Ecological site R061XS011SD Clayey-South (16-18" PZ)

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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.

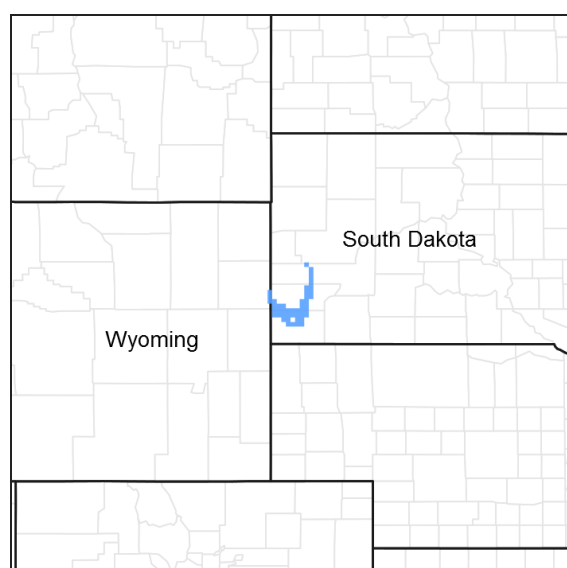


Figure 1. Mapped extent

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 called the red beds the "Race Track." 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 Clayey 16-18" PZ ecological site occurs throughout the southern portion of MLRA 61. It is located on upland landscapes and does not receive additional moisture from runoff or overflow. The typical slopes range from 5 to 30 percent. Soils are deep, (greater than 20 inches). The "A" horizon is 3 to 6 inches in depth and will have textures ranging from silty clay loam to clay. Subsurface textures also range from silty clay loam to clay.

The vegetation in the Reference State (1.0) consists of a mix of cool- and warm-season grasses, however, mid-statured cool-season grasses will be the dominant group. Western wheatgrass and green needlegrass are the dominant cool-season grasses, while buffalograss, blue grama, and sideoats grama are the dominant warm-season grasses. Forbs are common and diverse. Shrubs such as wild rose and Wyoming big sagebrush may be present in minor amounts. The Clayey 16-18" PZ site is susceptible to invasion of non-native, cool-season grasses.

Associated sites

R061XS012SD	Thin Upland-South (16-18" PZ) The Thin Upland 16-18" PZ ecological site is found on steeper slopes adjacent to the Clayey 16-18" PZ ecological site.
R061XY017SD	Shallow Clayey The Shallow Clay ecological site is found on ridge tops and steep slopes adjacent to the Clayey 16-18" PZ ecological site.
R061XY020SD	Overflow The Overflow ecological site is found on lower landscapes below the Clayey 16-18" PZ ecological site in flood plains and creek channels.
R061XS010SD	Loamy-South (16-18" PZ) The Loamy 16-18" PZ ecological site is found on the same landscape position adjacent to the Clayey 16-18" PZ ecological site.

Similar sites

R061XY020SD	Overflow The Overflow ecological site will have more big bluestem, and greater vegetative production than the Clayey 16-18" PZ ecological site.
R061XS010SD	Loamy-South (16-18" PZ) The Loamy 16-18" PZ ecological site will have less green needlegrass, more needle and thread, and more big bluestem than the Clayey 16-18" PZ ecological site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Pascopyrum smithii</i> (2) <i>Nassella viridula</i>

Physiographic features

The Clayey 16-18" PZ ecological site occurs on gently to steeply-sloping uplands.

Table 2. Representative physiographic features

Landforms	(1) Upland > Hill (2) Hogback (3) Plain
Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None
Elevation	2,900–4,000 ft
Slope	5–30%
Aspect	Aspect is not a significant factor

Climatic features

The climate in the southern LRU of 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 18 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 48 °F. January is the coldest month with average temperatures ranging from about 24 °F (Newcastle, WY) to about 27 °F (Hot Springs, SD). July is the warmest month with average temperatures ranging from about 72 °F (Rapid City, SD) to about 74 °F (Newcastle, WY). The range of average monthly temperatures between the coldest and warmest months is about 49 °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. Winds are generally stronger during the day than at night. 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)	109-113 days
Freeze-free period (characteristic range)	127-131 days
Precipitation total (characteristic range)	16-18 in
Frost-free period (actual range)	107-117 days
Freeze-free period (actual range)	125-136 days
Precipitation total (actual range)	16-18 in
Frost-free period (average)	111 days
Freeze-free period (average)	130 days
Precipitation total (average)	17 in

Climate stations used

- (1) EDMONT [USC00392557], Edgemont, SD
- (2) EDMONT 23 NNW [USC00392565], Custer, SD
- (3) HOT SPRINGS [USC00394007], Hot Springs, SD
- (4) RAPID CITY 4NW [USC00396947], Rapid City, SD
- (5) NEWCASTLE [USC00486660], Newcastle, WY

Influencing water features

No riparian areas or wetland features are directly associated with the Clayey 16-18" PZ ecological site.

Wetland description

Not Applicable.

Soil features

Soils common to the Clayey 16-18" PZ ecological site have a surface layer 3 to 6 inches thick that has a silty clay

loam to clay textures. Subsurface textures are also silty clay loam to clay. Slopes range from about 5 to 30 percent. The soils on this site are well drained and formed in residuum. The soils have a slow to very slow infiltration rate. Subsurface soil layers are nonrestrictive to water movement and root penetration.

This site typically should show slight to no evidence of rills, wind-scoured areas, or pedestalled plants. If present, water flow paths are broken, irregular in appearance, or discontinuous. The soil surface is stable and intact.

Major soils correlated to the Clayey 16-18" PZ ecological site; Kyle, Metre, Norrest, Nuncho, and Pierre.

These soils are mainly susceptible to water erosion. The hazard of water erosion increases on slopes greater than about 10 percent. Loss of 50 percent or more of the surface layer of the soils 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) Residuum
Surface texture	(1) Clay loam (2) Silty clay loam (3) Clay
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Very slow to slow
Soil depth	30–50 in
Surface fragment cover ≤3"	0–10%
Surface fragment cover >3"	0–3%
Available water capacity (0-40in)	4–6 in
Calcium carbonate equivalent (0-40in)	0–20%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0–2
Soil reaction (1:1 water) (0-40in)	6.1–8.4
Subsurface fragment volume ≤3" (Depth not specified)	0–30%
Subsurface fragment volume >3" (Depth not specified)	0–2%

Ecological dynamics

The Clayey 16-18" PZ ecological site developed under 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 will occur in the plant communities due to short-term weather variations, impacts of native and exotic plant and animal species, and management actions. While the following plant community descriptions specify more typical transitions between communities that will occur, 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.

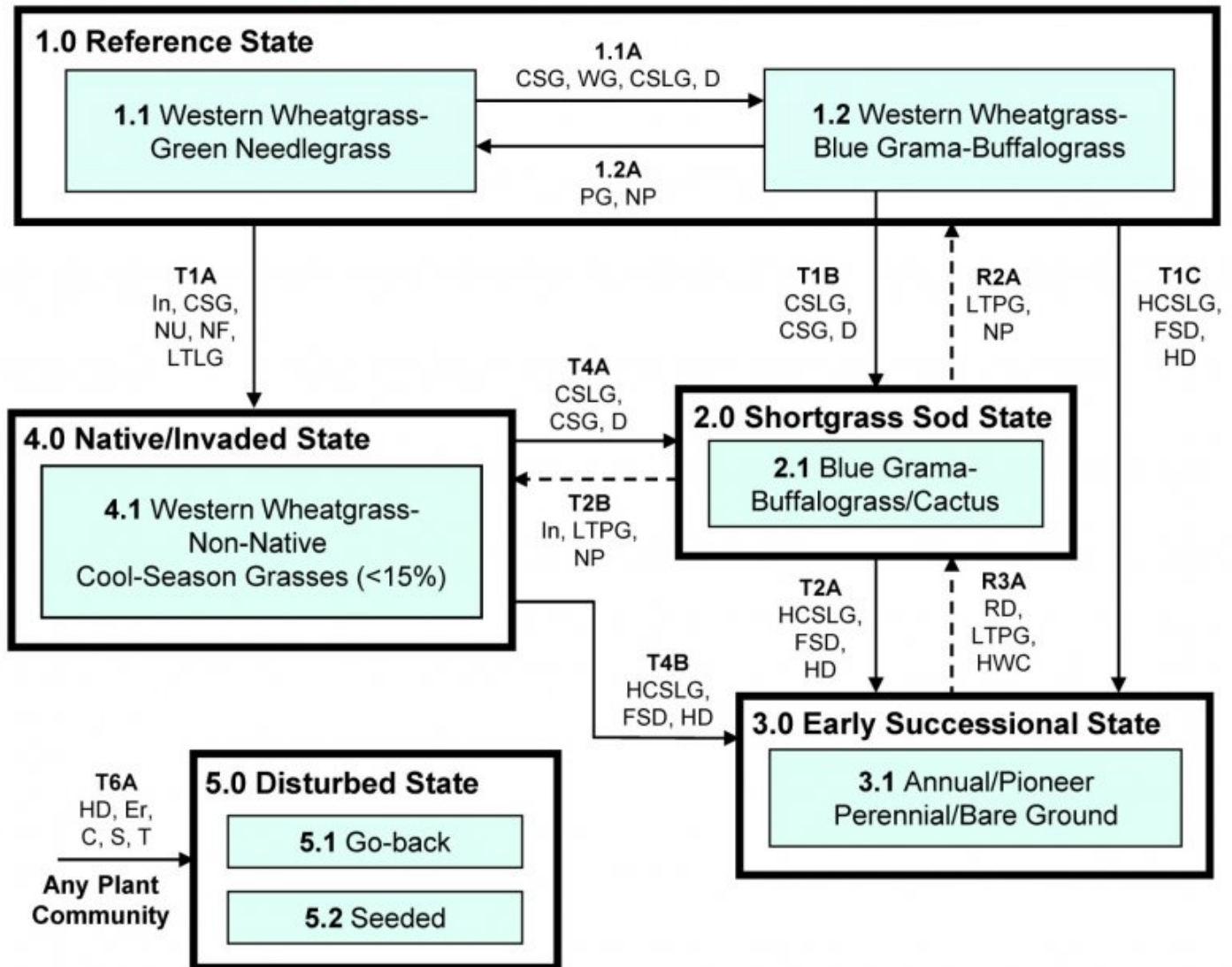
Continuous season-long grazing (during the typical growing season of May through October) or heavy continuous grazing (e.g., every spring or every summer at moderate to heavy stocking levels) without adequate recovery periods following grazing events causes departure from the Western Wheatgrass-Green Needlegrass Plant Community (1.1). Because of the predominance of non-native cool-season grasses, bluegrass, and potentially smooth brome will invade and eventually develop into a sod. Western wheatgrass will increase initially and then begin to decrease. Green needlegrass, big bluestem, and sideoats grama will decrease in frequency and production. Excessive defoliation can cause threeawn and annuals to increase and dominate the site. Extended periods of non-use or lack of fire will result in excessive litter and a plant community dominated by cool-season grasses such as green needlegrass, western wheatgrass, bluegrass, smooth brome, and cheatgrass.

Interpretations are primarily based on the Western Wheatgrass-Green Needlegrass 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.

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

Clayey 16-18" PZ – R061XS011SD 6/25/19



C – Cropping
 CSG – Continuous seasonal grazing
 CSLG – Continuous season-long grazing
 D – Drought
 Er – Erosion
 FSD – Frequent and severe defoliation
 HCSLG – Heavy continuous season-long grazing
 HD – Heavy disturbance
 WG – Winter grazing
 HWC – Herbaceous weed control
 In – Invasion of non-native cool-season grasses

LTLG – Long-term light grazing
 LTPG – Long-term prescribed grazing
 NF – No fire
 NP – Normal precipitation
 NU – No use
 PG – Prescribed grazing
 RD – Removal of disturbance
 S – Seeding
 T – Tillage
 --> Transition may not be rapid or feasible

Diagram Legend: Clayey 16-18" PZ - R061XS011SD

T1A	1.0 to 4.0	Invasion of non-native cool-season grasses; continuous seasonal grazing (summer); long-term light grazing; or non-use and no fire.
T1B	1.0 to 2.0	Continuous season-long grazing; continuous seasonal grazing; or heavy grazing in combination with drought.
T1C	1.0 to 3.0	Heavy, continuous season-long grazing; frequent and severe defoliation; or heavy disturbance.
T2A	2.0 to 3.0	Heavy, continuous season-long grazing; frequent and severe defoliation; or heavy disturbance.
T2B	2.0 to 4.0	Invasion of non-native cool-season grasses; long-term prescribed grazing with proper stocking rates, change in season of use, adequate time for plant recovery following grazing event; a return to normal precipitation patterns following drought. Transition may not be fast or feasible.
T4A	4.0 to 2.0	Continuous season-long grazing; continuous seasonal grazing; or heavy grazing in combination with drought.
T4B	4.0 to 3.0	Heavy, continuous season-long grazing; frequent and severe defoliation; or heavy disturbance.
T6A	Any Plant Community to 5.0	Heavy disturbance such as soil erosion; tillage; abandoned cropland; or tillage and seeding to introduced perennial forage crops.
R2A	2.0 to 1.0	Long-term prescribed grazing with proper stocking rates, change in season of use, adequate time for plant recovery following grazing events; a return to normal precipitation patterns following drought. This transition may not be fast or feasible.
R3A	3.0 to 2.0	Removal of disturbance coupled with long-term prescribed grazing including proper stocking rates, change in season of use, and adequate time for plant recovery following grazing events. Herbaceous weed control may be needed. Transition may not be fast or feasible.
1.1A	1.1 to 1.2	Continuous seasonal grazing (spring); late winter grazing; continuous season-long grazing; or heavy grazing in combination with drought.
1.2A	1.2 to 1.1	Prescribed grazing with proper stocking, change in season of use, adequate time for plant recovery following drought; a return to normal precipitation patterns following drought.

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) is dominated by cool-season grasses and subdominant warm-season grasses. Grazing or the lack of grazing, fire, and drought are the major drivers between plant communities. Continuous season-long grazing can push this state to a warm-season shortgrass-dominated State (2.0). Non-use, no fire, and invasion of non-native cool-season grasses will result in a transition to a Native/Invaded State (4.0).

Community 1.1

Western Wheatgrass-Green Needlegrass



Interpretations are based primarily on the Western Wheatgrass-Green Needlegrass Plant Community, which is also

considered to be Reference Plant Community (1.1). The potential vegetation is about 85 percent grasses or grass-like plants, 10 percent forbs, and 5 percent shrubs. The community is dominated by cool-season grasses and subdominant warm-season grasses. The major grasses include western wheatgrass, green needlegrass, big bluestem, and sideoats grama. Other grass and grass-like species include blue grama, buffalograss, needleleaf sedge, little bluestem, slender wheatgrass, and prairie Junegrass. 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.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1525	1966	2375
Shrub/Vine	65	150	250
Forb	110	172	250
Tree	0	12	25
Total	1700	2300	2900

Figure 9. Plant community growth curve (percent production by month).
SD6102, Black Hills Foot Slopes, cool-season dominant, warm-season sub-dominant. Cool-season dominant, warm-season sub-dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		3	10	23	34	15	6	5	4		

Community 1.2

Western Wheatgrass-Blue Grama-Buffalograss

This plant community evolved under continuous seasonal grazing (grazing at moderate to heavy stocking levels at the same time of year each year), continuous season-long grazing, or from over utilization during extended drought periods. The potential plant community is made up of approximately 78 percent grasses and grass-like species, 12 percent forbs, and 10 percent shrubs. Dominant grass and grass-like species include western wheatgrass, blue grama, green needlegrass, needleleaf sedge, sideoats grama, and buffalograss. Grasses of secondary importance include tall dropseed, big bluestem, and prairie junegrass. Forbs commonly found in this plant community include white sagebrush (cudweed sagewort), prairie coneflower, goldenrod, and western yarrow. When compared to the Western Wheatgrass-Green Needlegrass Plant Community (1.1), blue grama and buffalograss have increased. Green needlegrass and the production of mid- and tall warm-season grasses have decreased. 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. The hydrologic function of the site is beginning to be altered when this plant community phase is reached due to the shallow, compact nature of the roots of species such as blue grama, buffalograss, and needleleaf sedge.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1230	1503	1775
Forb	85	153	220
Shrub/Vine	85	135	185
Tree	0	9	20
Total	1400	1800	2200

Figure 11. Plant community growth curve (percent production by month).
SD6103, Black Hills Foot Slopes, cool-season/warm-season co-dominant. Cool-season, warm-season co-dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		3	10	20	28	21	10	5	3		

Pathway 1.1A

Community 1.1 to 1.2

Continuous seasonal grazing which includes grazing at moderate to heavy stocking levels at the same time of year each year; winter grazing that extends into the spring green-up; continuous season-long grazing; or a combination of disturbances such as extended periods of below average precipitation coupled with periodic heavy grazing will shift the Reference Plant Community (1.1) to the Western Wheatgrass-Blue Grama-Buffalograss Plant Community (1.2).

Pathway 1.2A

Community 1.2 to 1.1

Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing possibly including periodic rest; and a return to normal precipitation following drought will convert the Western Wheatgrass-Blue Grama-Buffalograss Plant Community (1.2) to the Western Wheatgrass-Green Needlegrass Plant Community (1.1).

Conservation practices

Prescribed Grazing

State 2

Shortgrass Sod State

This state occurs as a result of above recommended stocking levels, inadequate recovery periods between grazing events, or a combination of these disturbances. This state is dominated by warm-season grasses, with cool-season grasses being subdominant. The shallow, compact nature of the roots of the dominant species causes increased runoff and reduced infiltration. In addition, reduced shading due to a lesser amount of foliar cover causes increased soil temperatures and increased evaporation of the surface soil moisture. These conditions combine to cause the site to become more droughty, and thus reduce the opportunity for recruitment and establishment of the taller statured grasses. This state is relatively stable and resistant to change. Historically, rangeland mechanical treatment of this site has been an option used to improve forage production and plant species composition on rangeland. These mechanical treatments include such things as contour furrowing, contour pitting, terracing, chiseling, and disking. The purpose of the practice is to mechanically break up a sod-bound vegetative condition or compacted soils, resulting in less runoff and better infiltration. Many of these treatments were implemented during the 1930s through the 1970s with mixed results. This is primarily due to improper grazing management following the renovation practice. Another drawback in addition to the cost, is these practices result in a near-permanently roughed ground surface.

Community 2.1

Blue Grama-Buffalograss/Cactus

This plant community developed with continuous seasonal grazing (stocking levels above carrying capacity for extended portions of the growing season, and at the same time of year each year); continuous season-long grazing; or from over utilization during extended drought periods. The potential plant community is made up of approximately 70 percent grasses and grass-like species, 15 percent forbs, and 15 percent shrubs. Dominant grass and grass-like species include blue grama, buffalograss, and needleleaf sedge. Grasses of secondary importance include western wheatgrass, green needlegrass, sideoats grama, threeawn, cheatgrass and field brome, and possibly Kentucky bluegrass. Forbs commonly found in this plant community include white sagebrush (cudweed sagewort), goldenrod, scurfpea, Cumin ragweed, and western yarrow. Dominant shrubs include plains pricklypear, brittle cactus, and fringed sagewort. When compared to the Western Wheatgrass-Green Needlegrass Plant Community Phase (1.1), blue grama, needleleaf sedge, and buffalograss are dominant on this plant community. Cool-season grasses have decreased significantly. This vegetation state is very resistant to change. The

herbaceous species present are well adapted to grazing; however, composition can be altered through long-term prescribed grazing. This plant community is less productive than most other phases. The thick sod prevents other species from establishing. Lack of litter and reduced plant vigor causes higher soil temperatures, poor water infiltration rates, and high evapotranspiration which gives blue grama a competitive advantage over cool-season mid-grasses.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	770	1113	1455
Shrub/Vine	65	140	215
Forb	65	140	215
Tree	0	7	15
Total	900	1400	1900

Figure 13. Plant community growth curve (percent production by month). SD6104, Black Hills Foot Slopes, warm-season dominant, cool-season sub-dominant. Warm-season dominant, cool-season sub-dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		3	7	17	25	25	15	7	1		

State 3

Early Successional State

This state occurs as a result of extreme disturbance that typically removes most of the native species normally present on this site. Disturbance in the form of severe grazing over several years is the most typical. Occupation by black-tailed prairie dogs may also result in this transition. The dominant species present is highly variable, but the common characteristics include high amounts of bare ground, reduced soil aggregate stability, increased runoff, and increased erosion (including increased sediment loads in the runoff). Restoration of the ecological processes will be very difficult.

Community 3.1

Annual/Pioneer Perennial/Bare Ground

This plant community developed under continuous heavy grazing or other excessive disturbances (e.g., heavy use areas, livestock concentration areas, defoliation by rodents, etc.). The potential plant community is made up of approximately 60 to 80 percent grasses and grass-like species, 15 to 35 percent forbs, and 2 to 5 percent shrubs. The dominant grass is often threeawn. Other grasses may include cheatgrass, field brome, sedge, blue grama, sand dropseed, bluegrass, and western wheatgrass. The dominant forbs include fetid marigold, sweetclover, Cumin ragweed, white sagrbrush (cudweed sagewort), and other invader-like species. The dominant shrubs include fringed sagewort, broom snakeweed and cactus. A wide variety of other early successional plant species can occupy this site in varying amounts. This plant community is susceptible to invasion of Canada thistle and other non-native species because of the relatively high percent of bare ground. Compared to the Western Wheatgrass-Green Needlegrass Plant Community (1.1), threeawn, annual brome grasses, and percentage of bare ground has increased. Western wheatgrass, needlegrasses and other cool-season grasses have decreased as have the warm-season species including big bluestem, sideoats grama, and little bluestem. Plant diversity is low (plant richness may be high, but areas are often dominated by a few species). The ecological processes are difficult to restore because of the loss of plant diversity and overall soil disturbance. Soil erosion is potentially very high because of the bare ground and shallow rooted herbaceous plant community. Water runoff will increase, and infiltration will decrease due to animal related soil compaction and loss of root mass due to low plant diversity and vigor. This plant community will require significant economic inputs and time to move towards another plant community. This movement is highly variable in its succession. This is due to the loss of diversity (including the loss of the seed bank), within the existing plant community, and the plant communities on adjacent sites.

State 4
Native/Invaded State

The Native/Invaded State is dominated by native cool- and warm-season grasses, and subdominant non-native cool-season grasses. It can be found on areas that would appear to be properly managed with grazing and possibly prescribed burning. Extended periods of non-use and no fire, or long-term light grazing can result in the invasion and establishment of non-native cool-season grasses onto this site. If the native cool-season grasses decline a corresponding increase of non-native cool-season grasses can occur. The non-native cool-season grasses will include smooth brome, Kentucky bluegrass, cheatgrass, field brome, and possibly crested wheatgrass.

Community 4.1
Western Wheatgrass-Non-Native Cool-Season Grasses (<15%)

This plant community develops when non-native cool-season grasses, such as Kentucky bluegrass or smooth brome, invade and become established on the site. This may occur due to the sites close proximity to seed sources, expansion from road ditches, improved pastures, other invaded sites, or from contaminated hay. Repeated seasonal grazing (typically during the summer), or long-term light grazing, or extended periods of non-use and no fire, will allow these non-native cool-season grasses to increase in the plant community. Plant litter accumulates in large amounts when this community first develops. Litter buildup reduces mature native plant vigor and density, and seedling recruitment declines. Eventually litter levels become high enough that plant density decreases. Typically, rhizomatous grasses form small colonies because of a lack of tiller stimulation. The potential vegetation is about 85 percent grasses or grass-like plants, 10 percent forbs, and 5 percent shrubs. The community is dominated by cool-season grasses. The major grasses include western wheatgrass, green needlegrass, Kentucky bluegrass, and smooth brome. Other grass and grass-like species include big bluestem, blue grama, sideoats grama, needle and thread, slender wheatgrass, and needleleaf sedge. This plant community is resilient and well adapted to the Northern Great Plains climatic conditions. The non-native species typically do not increase to the point of dominance; however, their presence tends to reduce the overall diversity of the plant community. As such, this is a somewhat sustainable plant community in regard to site and soil stability, watershed function, and biologic integrity.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1440	1848	2250
Forb	100	158	215
Shrub/Vine	60	84	110
Tree	0	10	25
Total	1600	2100	2600

Figure 15. Plant community growth curve (percent production by month).
SD6002, Pierre Shale Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	23	34	15	6	5	4	0	0

State 5
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 successional. Infiltration, runoff, and soil erosion will vary depending on the vegetation present on the site. The Go-Back Plant Community (5.1) 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 (5.2) was typically tilled and then seeded to a perennial forage species or mix of species.

Community 5.1

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 threeawn, bluegrass, smooth brome, annual brome, broom snakeweed, sweetclover, and non-native thistles. Other plants that commonly occur on the site can include western wheatgrass, prickly lettuce, horseweed, mullein, kochia, foxtail, and sunflowers. Bare ground is prevalent due to the loss of organic matter and lower overall soil health.

Community 5.2

Seeded

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 T1B

State 1 to 2

Continuous summer seasonal grazing; long-term light grazing; or no use and no fire; and the invasion of non-native cool-season grasses will transition the Reference State (1.0) to the Native/Invaded State (4.0).

Transition T1C

State 1 to 3

Heavy, continuous season-long grazing; frequent and severe defoliation; or heavy disturbance will transition the Reference State (1.0) to the Early Successional State (3.0).

Transition T1A

State 1 to 4

Continuous summer seasonal grazing; long-term light grazing; or no use and no fire; and the invasion of non-native cool-season grasses will transition the Reference State (1.0) to the Native/Invaded State (4.0).

Transition T6A

State 1 to 5

Heavy disturbance including soil erosion; tillage; abandoned cropland; or seeding to improved pasture species; result in a transition to the Disturbed State (5.0).

Restoration pathway R2A

State 2 to 1

Long-term prescribed grazing including proper stocking levels, change in season of use, and adequate recovery time following grazing events, or periodic light to moderate stocking levels possibly including periodic rest may lead this plant community phase over a threshold to the Reference State (1.0). The transition will probably be to the Western Wheatgrass-Blue Grama-Buffalograss Plant Community (1.2), assuming adequate seed and vegetative sources are present. This could require significant time and inputs to achieve and, in the end, may not meet management objectives.

Conservation practices

Prescribed Grazing

Transition T2A

State 2 to 3

Heavy, continuous season-long grazing; or frequent severe defoliation; or heavy disturbance will likely move the Shortgrass Sod State (2.0) to the Early Successional State (3.0).

Transition T2B

State 2 to 4

Long-term prescribed grazing with proper stocking rates, change in season of use, adequate time for plant recovery following grazing events; and a return to normal precipitation patterns following drought will likely result in this transition from the Shortgrass Sod State (2.0). Due to the invasion of non-native cool-season perennial grasses the trajectory of this transition will be towards the Native/Invaded State (4.0). This transition may not be fast or feasible.

Conservation practices

Prescribed Grazing

Transition T6A

State 2 to 5

Heavy disturbance including soil erosion; tillage; abandoned cropland; or seeding to improved pasture species; result in a transition to the Disturbed State (5.0).

Restoration pathway R3A

State 3 to 2

Removal of disturbances coupled with long-term prescribed grazing with proper stocking rates, change in season of use, and adequate recovery time following grazing events may return the Early Successional State (3.0) to the Shortgrass Sod State (2.0). Herbaceous weed control may also be needed. This transition could require significant time and input to achieve and, in the end, may not meet management objectives.

Conservation practices

Prescribed Grazing
Herbaceous Weed Control

Transition T6A

State 3 to 5

Heavy disturbance including soil erosion; tillage; abandoned cropland; or seeding to improved pasture species; result in a transition to the Disturbed State (5.0).

Transition T4A

State 4 to 2

Continuous season-long grazing; continuous seasonal grazing; or heavy grazing in combination with drought will transition the Native/Invaded State (4.0) to the Shortgrass Sod State (2.0).

Transition T4B

State 4 to 3

Heavy, continuous season-long grazing; frequent and severe defoliation; or heavy disturbance will transition the Native/Invaded State (4.0) to the Early Successional State (3.0).

Transition T6A

State 4 to 5

Heavy disturbance including soil erosion; tillage; abandoned cropland; or seeding to improved pasture species; result in a transition to the Disturbed State (5.0).

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	Rhizomatous Wheatgrass			460–920	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	460–920	–
	thickspike wheatgrass	ELLAL	<i>Elymus lanceolatus ssp. lanceolatus</i>	0–230	–
2	Cool-Season Bunchgrass			345–690	
	green needlegrass	NAVI4	<i>Nassella viridula</i>	345–690	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	0–115	–
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	0–69	–
3	Tall Warm-Season Grasses			115–345	
	big bluestem	ANGE	<i>Andropogon gerardii</i>	46–230	–
	composite dropseed	SPCOC2	<i>Sporobolus compositus var. compositus</i>	0–69	–
4	Mid- Warm-Season Grasses			46–230	
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	46–230	–
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	0–115	–
5	Short Warm-Season Grasses			46–230	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	23–184	–
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	23–92	–
	threeawn	ARIST	<i>Aristida</i>	0–46	–
6	Other Native Grasses			46–115	
	Grass, perennial	2GP	<i>Grass, perennial</i>	0–92	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	23–69	–
	Cusick's bluegrass	POCU3	<i>Poa cusickii</i>	23–46	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0–23	–
7	Grass-likes			23–115	
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	23–115	–
	sedge	CAREX	<i>Carex</i>	0–69	–
8	Non-Native Cool-Season Grasses			0	
Forb					
9	Forbs			115–230	
	Forb, perennial	2FP	<i>Forb, perennial</i>	23–92	–
	American vetch	VIAM	<i>Vicia americana</i>	23–46	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	23–46	–
	desert biscuitroot	LOFO	<i>Lomatium foeniculaceum</i>	23–46	–
	dotted blazing star	LIPU	<i>Liatris punctata</i>	23–46	–
	beardtongue	PENST	<i>Penstemon</i>	23–46	–
	prairie clover	DALEA	<i>Dalea</i>	23–46	–
	upright prairie	RACO3	<i>Ratibida columnifera</i>	23–46	–

	upright prairie coneflower	FRCCO	<i>Rudbeckia hirta</i>	23–46	–
	scarlet beeblossom	GACO5	<i>Gaura coccinea</i>	23–46	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	23–46	–
	scurfpea	PSORA2	<i>Psoralea</i>	23–46	–
	prairie thermopsis	THRH	<i>Thermopsis rhombifolia</i>	23–46	–
	goldenrod	SOLID	<i>Solidago</i>	23–46	–
	white prairie aster	SYFA	<i>Symphyotrichum falcatum</i>	23–46	–
	leafy wildparsley	MUDI	<i>Musineon divaricatum</i>	23–46	–
	bellflower	CAMPA	<i>Campanula</i>	0–23	–
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	0–23	–
	western yarrow	ACMIO	<i>Achillea millefolium</i> var. <i>occidentalis</i>	0–23	–
	blacksamson echinacea	ECAN2	<i>Echinacea angustifolia</i>	0–23	–
	buckwheat	ERIOG	<i>Eriogonum</i>	0–23	–
	fleabane	ERIGE2	<i>Erigeron</i>	0–23	–
	bluebells	MERTE	<i>Mertensia</i>	0–23	–
	cinquefoil	POTEN	<i>Potentilla</i>	0–23	–
Shrub/Vine					
10	Shrubs			69–230	
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i>	0–69	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	23–69	–
	rose	ROSA5	<i>Rosa</i>	23–46	–
	pricklypear	OPUNT	<i>Opuntia</i>	23–46	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	0–46	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0–46	–
	rubber rabbitbrush	ERNA10	<i>Ericameria nauseosa</i>	0–23	–
Tree					
11	Trees			0–23	
	ponderosa pine	PIPO	<i>Pinus ponderosa</i>	0–23	–
	Rocky Mountain juniper	JUSC2	<i>Juniperus scopulorum</i>	0–23	–
	Tree	2TREE	<i>Tree</i>	0–23	–

Table 10. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	Rhizomatous Wheatgrass			270–630	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	270–630	–
	thickspike wheatgrass	ELLAL	<i>Elymus lanceolatus</i> ssp. <i>lanceolatus</i>	0–90	–
2	Cool-Season Bunchgrass			90–270	
	green needlegrass	NAVI4	<i>Nassella viridula</i>	90–270	–
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	0–36	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	0–36	–
3	Tall Warm-Season Grasses			0–90	

	composite dropseed	SPCOC2	<i>Sporobolus compositus</i> var. <i>compositus</i>	0–72	–
	big bluestem	ANGE	<i>Andropogon gerardii</i>	0–54	–
4	Mid- Warm-Season Grasses			18–144	
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	18–144	–
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	0–36	–
5	Short Warm-Season Grasses			180–270	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	90–270	–
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	36–144	–
	threeawn	ARIST	<i>Aristida</i>	0–72	–
6	Other Native Grasses			18–90	
	Grass, perennial	2GP	<i>Grass, perennial</i>	0–72	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	18–54	–
	Cusick's bluegrass	POCU3	<i>Poa cusickii</i>	0–18	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0–18	–
7	Grass-likes			36–180	
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	36–180	–
	sedge	CAREX	<i>Carex</i>	0–90	–
8	Non-Native Cool-Season Grasses			0	
Forb					
9	Forbs			90–216	
	Forb, perennial	2FP	<i>Forb, perennial</i>	18–54	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	18–54	–
	goldenrod	SOLID	<i>Solidago</i>	18–54	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	18–36	–
	desert biscuitroot	LOFO	<i>Lomatium foeniculaceum</i>	0–36	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	18–36	–
	scurfpea	PSORA2	<i>Psoralidium</i>	18–36	–
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	0–36	–
	western yarrow	ACMIO	<i>Achillea millefolium</i> var. <i>occidentalis</i>	18–36	–
	white prairie aster	SYFA	<i>Symphyotrichum falcatum</i>	18–36	–
	leafy wildparsley	MUDI	<i>Musineon divaricatum</i>	0–36	–
	prairie thermopsis	THRH	<i>Thermopsis rhombifolia</i>	0–36	–
	dotted blazing star	LIPU	<i>Liatris punctata</i>	0–18	–
	buckwheat	ERIOG	<i>Eriogonum</i>	0–18	–
	fleabane	ERIGE2	<i>Erigeron</i>	0–18	–
	blacksamson echinacea	ECAN2	<i>Echinacea angustifolia</i>	0–18	–
	scarlet beeblossom	GACO5	<i>Gaura coccinea</i>	0–18	–
	beardtongue	PENST	<i>Penstemon</i>	0–18	–
	prairie clover	DALEA	<i>Dalea</i>	0–18	–
	American vetch	VIAM	<i>Vicia americana</i>	0–18	–
	cinquefoil	POTEN	<i>Potentilla</i>	0–18	–
Shrub/Vine					

10	Shrubs			90–180	
	pricklypear	OPUNT	<i>Opuntia</i>	18–54	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	18–54	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0–54	–
	rose	ROSA5	<i>Rosa</i>	18–36	–
	rubber rabbitbrush	ERNA10	<i>Ericameria nauseosa</i>	0–36	–
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata ssp. wyomingensis</i>	0–18	–
Tree					
11	Trees			0–18	
	ponderosa pine	PIPO	<i>Pinus ponderosa</i>	0–18	–
	Rocky Mountain juniper	JUSC2	<i>Juniperus scopulorum</i>	0–18	–
	Tree	2TREE	<i>Tree</i>	0–18	–

Table 11. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	Rhizomatous Wheatgrass			14–140	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	14–140	–
	thickspike wheatgrass	ELLAL	<i>Elymus lanceolatus ssp. lanceolatus</i>	0–28	–
2	Cool-Season Bunchgrass			0–70	
	green needlegrass	NAVI4	<i>Nassella viridula</i>	0–70	–
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	0–14	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	0–14	–
3	Tall Warm-Season Grasses			0–28	
	composite dropseed	SPCOC2	<i>Sporobolus compositus var. compositus</i>	0–28	–
4	Mid- Warm-Season Grasses			0–70	
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	0–70	–
5	Short Warm-Season Grasses			210–560	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	140–490	–
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	70–140	–
	threeawn	ARIST	<i>Aristida</i>	14–98	–
6	Other Native Grasses			0–42	
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	0–28	–
	Grass, perennial	2GP	<i>Grass, perennial</i>	0–28	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0–14	–
7	Grass-Like			70–280	
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	70–280	–
	sedge	CAREX	<i>Carex</i>	0–70	–
8	Non-Native Cool-Season Grasses			14–98	
	cheatgrass	BRTE	<i>Bromus tectorum</i>	14–98	–
	Kentucky bluegrass	POPR	<i>Poa pratensis</i>	0–70	–
	crested wheatgrass	AGCR	<i>Agropyron cristatum</i>	0–70	–

	smooth brome	BRIN2	<i>Bromus inermis</i>	0–28	–
	field brome	BRAR5	<i>Bromus arvensis</i>	0–28	–
Forb					
9	Forbs			70–210	
	Forb, introduced	2FI	<i>Forb, introduced</i>	14–112	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	14–70	–
	goldenrod	SOLID	<i>Solidago</i>	14–70	–
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	14–56	–
	western yarrow	ACMIO	<i>Achillea millefolium</i> var. <i>occidentalis</i>	14–56	–
	scurfpea	PSORA2	<i>Psoralegium</i>	14–42	–
	white prairie aster	SYFA	<i>Symphyotrichum falcatum</i>	0–28	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	0–28	–
	prairie thermopsis	THRH	<i>Thermopsis rhombifolia</i>	0–28	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0–14	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	0–14	–
	buckwheat	ERIOG	<i>Eriogonum</i>	0–14	–
Shrub/Vine					
10	Shrubs			70–210	
	pricklypear	OPUNT	<i>Opuntia</i>	28–112	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	14–98	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0–56	–
	rose	ROSA5	<i>Rosa</i>	0–28	–
	rubber rabbitbrush	ERNA10	<i>Ericameria nauseosa</i>	0–28	–
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i>	0–14	–
Tree					
11	Trees			0–14	
	ponderosa pine	PIPO	<i>Pinus ponderosa</i>	0–14	–
	Rocky Mountain juniper	JUSC2	<i>Juniperus scopulorum</i>	0–14	–
	Tree	2TREE	<i>Tree</i>	0–14	–

Table 12. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	Rhizomatous Wheatgrass			315–735	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	315–735	–
	thickspike wheatgrass	ELLAL	<i>Elymus lanceolatus</i> ssp. <i>lanceolatus</i>	0–210	–
2	Cool-Season Bunchgrass			210–630	
	green needlegrass	NAVI4	<i>Nassella viridula</i>	210–630	–
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	0–42	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	0–42	–
3	Tall Warm-Season Grasses			0–105	
	big bluestem	ANGE	<i>Andropogon gerardii</i>	0–105	–

	composite dropseed	SPCOC2	<i>Sporobolus compositus</i> var. <i>compositus</i>	0–63	–
4	Mid- Warm-Season Grasses			21–105	
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	21–105	–
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	0–63	–
5	Short Warm-Season Grasses			21–105	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	21–105	–
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	0–63	–
	threeawn	ARIST	<i>Aristida</i>	0–42	–
6	Other Native Grasses			21–105	
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	21–63	–
	Grass, perennial	2GP	<i>Grass, perennial</i>	0–63	–
	Cusick's bluegrass	POCU3	<i>Poa cusickii</i>	0–21	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0–21	–
7	Grass-Likes			21–105	
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	21–105	–
	sedge	CAREX	<i>Carex</i>	0–63	–
8	Non-Native Cool-Season Grasses			210–525	
	Kentucky bluegrass	POPR	<i>Poa pratensis</i>	105–420	–
	smooth brome	BRIN2	<i>Bromus inermis</i>	0–210	–
	crested wheatgrass	AGCR	<i>Agropyron cristatum</i>	0–210	–
	cheatgrass	BRTE	<i>Bromus tectorum</i>	21–168	–
	field brome	BRAR5	<i>Bromus arvensis</i>	0–105	–
Forb					
9	Forb			105–210	
	Forb, introduced	2FI	<i>Forb, introduced</i>	21–105	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	0–63	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	21–63	–
	goldenrod	SOLID	<i>Solidago</i>	21–63	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0–42	–
	scurfpea	PSORA2	<i>Psoralegium</i>	21–42	–
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	21–42	–
	western yarrow	ACMIO	<i>Achillea millefolium</i> var. <i>occidentalis</i>	21–42	–
	white prairie aster	SYFA	<i>Symphyotrichum falcatum</i>	21–42	–
	leafy wildparsley	MUDI	<i>Musineon divaricatum</i>	0–21	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	0–21	–
	prairie clover	DALEA	<i>Dalea</i>	0–21	–
	desert biscuitroot	LOFO	<i>Lomatium foeniculaceum</i>	0–21	–
	dotted blazing star	LIPU	<i>Liatris punctata</i>	0–21	–
	fleabane	ERIGE2	<i>Erigeron</i>	0–21	–
	prairie thermopsis	THRH	<i>Thermopsis rhombifolia</i>	0–21	–
	American vetch	VIAM	<i>Vicia americana</i>	0–21	–
	cinquefoil	POTEN	<i>Potentilla</i>	0–21	–

Shrub/Vine				
10	Shrub			63–105
	pricklypear	OPUNT	<i>Opuntia</i>	21–42
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	21–42
	rose	ROSA5	<i>Rosa</i>	21–42
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0–42
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata ssp. wyomingensis</i>	0–21
	rubber rabbitbrush	ERNA10	<i>Ericameria nauseosa</i>	0–21
Tree				
11	Tree			0–21
	ponderosa pine	PIPO	<i>Pinus ponderosa</i>	0–21
	Rocky Mountain juniper	JUSC2	<i>Juniperus scopulorum</i>	0–21
	Tree	2TREE	<i>Tree</i>	0–21

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 Clayey 16-18" PZ ecological site provides upland grassland cover with an associated forb component. It was typically part of an expansive grassland landscape that included combinations of Loamy, Shallow, Stony Hills, Overflow, Subirrigated, and Terrace ecological sites.

This 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.

The majority of the Clayey 16-18" PZ ecological site has remained relatively intact and provides increasingly important habitat for grassland and shrub steppe nesting birds, small rodents, coyote, and a variety of reptiles, amphibians, and insects. Invasive species such as Kentucky bluegrass, smooth brome, and annual bromes have impacted the biological integrity of the site for some grassland birds. Changes in historic fire regime and domestic grazing have impacted the forb/shrub/grass percentages.

Grazing Interpretations:

The following list provides annual suggested initial stocking rates with average growing conditions. These are conservative estimates that should be used only as guidelines in the initial stages of conservation planning. Often, 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 carrying capacity estimates 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. With consultation of the land manager, more intensive grazing management may result in improved harvest efficiencies and increased carrying capacity.

The following initial suggested stocking rates are based on 912 lbs./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: Western Wheatgrass-Green Needlegrass (1.1)

Average Production (lbs./acre, air-dry): 2,300

Stocking Rate (AUM/acre): 0.63

Plant Community: Western Wheatgrass-Blue Grama-Buffalograss (1.2)

Average Production (lbs./acre, air-dry): 1,800

Stocking Rate (AUM/acre): 0.49

Plant Community: Blue Grama-Buffalograss/Cactus (2.1)

Average Production (lbs./acre, air-dry): 1,400

Stocking Rate (AUM/acre): 0.38

Plant Community: Western Wheatgrass-Non-Native Cool-Season Grasses (4.1)

Average Production (lbs./acre, air-dry): 2,100*

Stocking Rate (AUM/acre): 0.58*

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

* Total annual production and stocking rates are highly variable and will require on-site sampling.

Total annual production on-site 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 will likely be lacking protein to meet livestock requirements and added protein will allow 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 C 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 blue grama, buffalograss, 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 hunting, hiking, photography, bird watching, and other opportunities. 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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(2) fax: (202) 690-7442; or

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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
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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:** Rills should not be present.

-
2. **Presence of water flow patterns:** None, or barely visible and discontinuous.
-
3. **Number and height of erosional pedestals or terracettes:** Essentially, non-existent.
-
4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground less than 5 percent and patches less than 2 inches in diameter.
-
5. **Number of gullies and erosion associated with gullies:** Active gullies should not be present.
-
6. **Extent of wind scoured, blowouts and/or depositional areas:** None.
-
7. **Amount of litter movement (describe size and distance expected to travel):** Little to no plant litter movement. Plant litter remains in place and is not moved by erosional forces.
-
8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil aggregate stability rating 5 to 6, usually 6. Typically high root content, organic matter, and granular structure. Soil surface is very resistant to erosion.
-
9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface structure is typically subangular blocky parting to granular, and mollic (higher organic matter) colors of A-horizon about 4 to 7 inches deep. If conditions are other than this, refer to map unit component descriptions for component on which the site occurs.
-
10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Healthy, deep rooted native grasses enhance infiltration and reduce runoff.
-
11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction layer should be evident, but high clay content of B horizons could appear to be a compacted layer.
-
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: Wheatgrasses (mid, cool-season grasses) >
- Sub-dominant: Needlegrasses (mid and tall, cool-season bunchgrasses) >

Other: Tall, warm-season grasses = mid, warm-season grasses = short, warm-season grasses = forbs = shrubs > grass-like species

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

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little to no evidence of decadence or mortality. Bunch grasses have strong, healthy centers and shrubs are vigorous.
-
14. **Average percent litter cover (%) and depth (in):** 75 to 85 percent plant litter cover, roughly 0.5 to 1 inch depth. Litter cover is in contact with soil surface.
-
15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Ranges from 1,500 to 2,700 pounds/acre. Reference value is 2,100 pounds/acre (air-dry weight 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:** Refer to State and Local Noxious Weed List; also Kentucky bluegrass.
-
17. **Perennial plant reproductive capability:** All species exhibit high vigor relative to climatic conditions. Do not rate based solely on seed production. Perennial grasses typically have vigorous rhizomes or tillers.
-