USDA Natural Resources
Conservation Service

# Ecological site R061XN011SD
# Clayey-North (18-22" 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.

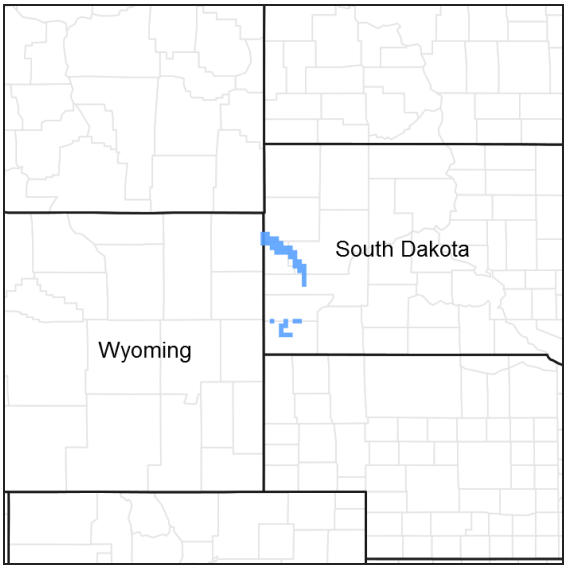


**Figure 1. Mapped extent**

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 in size. The towns of Spearfish, Sturgis, and Hot Springs, South Dakota and Newcastle and Sundance, Wyoming are all within the boundary of 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 located in MLRA 61. Devils Tower was our 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, so they dip away from the core of the mountains. The Lower Cretaceous Fall River and Lakota (Inyan Kara Group) sandstones that occur on the outside boundary of the area are referred to as the Dakota Hogback. The next geologic formation is the Triassic-aged red beds of the Spearfish shale which form a low valley. The “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 to flow through MLRA 61, near Hulett, Wyoming.

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

Annual precipitation is 16-22 inches. The majority of rainfall occurs early in the growing season with some high-intensity thunderstorms occurring 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 and 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 urban expansion, water quality, and wind and water erosion.

Of the total acreage making up MLRA 61, 54 percent is 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 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 18-22" PZ ecological site occurs throughout the northern portion of MLRA 61. It is located on upland landscapes and does not receive additional moisture from runoff or overflow. The typical slope range is from 5 to 30 percent. Soils are deep, (greater than 20 inches) with surface textures ranging from silty clay loam to clay, and 3 to 6 inches deep. Subsurface textures 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 rose, and Wyoming big sagebrush may be present in

minor amounts. The Clayey 18-22” PZ site is susceptible to invasion of non-native cool-season grasses.

## Associated sites

| | |
|---|---|
| R061XY017SD | **Shallow Clayey**<br>The Shallow Clay ecological site is found on ridge tops and steep slopes adjacent to the Clayey 18-22” PZ ecological site. |
| R061XY020SD | **Overflow**<br>The Overflow ecological site is found on lower landscapes below the Clayey 18-22” PZ ecological site in flood plains and creek channels. |
| R061XN010SD | **Loamy-North (18-22" PZ)**<br>The Loamy 18-22” PZ ecological site is found on the same landscape position adjacent to the Clayey 18-22” PZ ecological site. |
| R061XN012SD | **Thin Upland-North (18-22" PZ)**<br>The Thin Upland 18-22” PZ ecological site is found on steeper slopes adjacent to the Clayey 18-22” PZ ecological site. |

## Similar sites

| | |
|---|---|
| R061XN010SD | **Loamy-North (18-22" PZ)**<br>The Loamy 18-22” PZ ecological site will have less green needlegrass, more needle and thread, and more big bluestem than the Clayey 18-22” PZ ecological site. |
| R061XY020SD | **Overflow**<br>The Loamy Overflow ecological site will have more big bluestem, and greater vegetative production than the Clayey 18-22” PZ ecological site. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | Not specified |
| Shrub | Not specified |
| Herbaceous | (1) *Pascopyrum smithii*<br>(2) *Nassella viridula* |

## Physiographic features

The Clayey 18-22” PZ ecological site occurs on gently to steeply sloping uplands.

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Upland > Hill<br>(2) Hogback<br>(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 Northern Land Resource Unit (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. Annual precipitation ranges from 18 to 22 inches per year, with most falling during the growing season. Temperatures show a wide range between the summer and winter months and between daily maximums and minimums, due to the high

elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air outbreaks from Canada in winter 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 months, but most severely affect ranch operations during late winter and spring.

The average annual temperature is about 46°F. January is the coldest month with average temperatures ranging from about 26°F (Fort Meade, SD) to about 30°F (Spearfish, SD). July is the warmest month with temperatures averaging from about 75°F (Spearfish, SD) to about 69°F (Fort Meade, SD). The range of average monthly temperatures between the coldest and warmest months is about 45°F. Hourly winds are estimated to average about 11 miles per hour annually, ranging from about 13 miles per hour during the spring months to about 10 miles per hour during the summertime. Daytime winds are generally stronger than nighttime and occasional storms may 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. Green-up of cool-season plants may occur in September and October when adequate soil moisture is present.

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**Table 3. Representative climatic features**

| | |
|---|---|
| Frost-free period (characteristic range) | 113-118 days |
| Freeze-free period (characteristic range) | 136-148 days |
| Precipitation total (characteristic range) | 20-22 in |
| Frost-free period (actual range) | 112-119 days |
| Freeze-free period (actual range) | 134-153 days |
| Precipitation total (actual range) | 19-22 in |
| Frost-free period (average) | 116 days |
| Freeze-free period (average) | 143 days |
| Precipitation total (average) | 21 in |

## Climate stations used

- (1) BEAR RIDGE [USC00390554], Spearfish, SD
- (2) FT MEADE [USC00393069], Fort Meade, SD
- (3) RAPID CITY 4NW [USC00396947], Rapid City, SD
- (4) SPEARFISH [USC00397882], Spearfish, SD

## Influencing water features

No riparian areas or wetland features are directly associated with the Clayey 18-22” PZ ecological site.

## Wetland description

Not Applicable.

## Soil features

The common features of soils on this site are 3 to 6 inches thick silty clay loam to clay surface layers. Subsurface textures are silty clay loam to clay. Slopes range from about 5 to 30 percent. The soils in this site are well drained and formed in residuum. The soils have a slow to very slow infiltration rate. 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. Subsurface soil layers are nonrestrictive to water movement and root penetration.

Major soils correlated to the Clayey 18-22” PZ ecological site include, Cromack, Kyle, Norrest, Pierre, and Savo.

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 can be found in the various soil survey reports. Contact the local USDA Service Center for soil survey reports that include more details specific to your area of interest, or use the internet to access USDA’s Web Soil Survey.

**Table 4. Representative soil features**

| | |
|---|---|
| Parent material | (1) Residuum |
| Surface texture | (1) Clay loam<br>(2) Silty clay loam<br>(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 18-22” 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

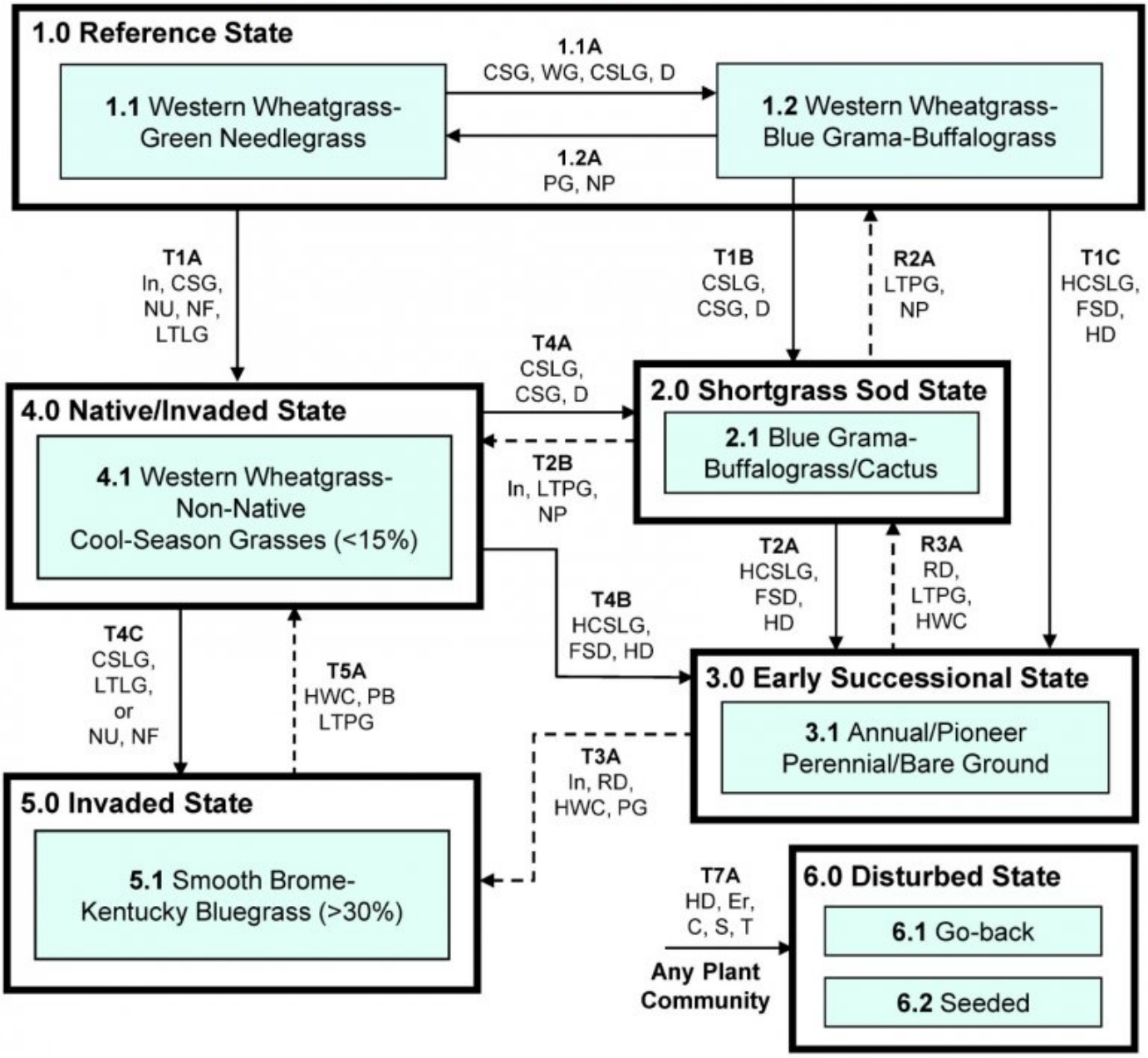
periods following grazing events causes departure from the Western Wheatgrass-Green Needlegrass Plant Community (1.1). Because of the predominance of non-native cool-season grasses, Kentucky bluegrass and potentially smooth brome will invade and eventually develop into a sod. Western wheatgrass will increase initially and then begin to decrease. Green needlegrass, big bluestem, sideoats grama, switchgrass, and Indiangrass 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 is a State-and-Transition diagram that illustrates the common plant communities that can occur on the site and the transition pathways between communities. The ecological processes will be discussed in more detail in the plant community descriptions following the diagram.

## State and transition model

# Clayey 18-22" PZ – R061XN011SD 6/19/19




**C** – Cropping
**CSG** – Continuous seasonal grazing
**CSLG** – Continuous season-long grazing
**D** – Drought
**Er** – Eroded
**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
**PB** – Prescribed burning
**PG** – Prescribed grazing
**RD** – Removal of disturbance
**S** – Seeding
**T** – Tillage
- - → Transition may not be rapid or feasible

**Diagram Legend: Clayey 18-22" PZ - R061XN011SD**

| | | |
|---|---|---|
| **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 levels, change in season of use, adequate time for recovery, and a return to normal precipitation patterns following drought. Transition may not be fast or feasible. |
| **T3A** | 3.0 to 5.0 | Removal of disturbance; herbaceous weed control; and prescribed grazing that includes proper stocking levels, change in season of use, and time for adequate plant recovery. The invasion of non-native cool-season perennial grasses will dictate the transition. 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. |
| **T4C** | 4.0 to 5.0 | Continuous season-long grazing; long-term light grazing; or long-term non-use and no fire. |
| **T5A** | 5.0 to 4.0 | Herbaceous weed control; possibly prescribed burning, followed by long-term prescribed grazing. Transition may not be fast or feasible. |
| **T7A** | From Any Plant Community to 6.0 | 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 levels, change in season of use, adequate time for plant recovery, and 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 levels, change in season of use, and adequate recovery periods following grazing event. 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 that continues into the early spring growing season; continuous season-long grazing; or heavy grazing in combination with drought. |
| **1.2A** | 1.2 to 1.1 | Prescribed grazing with proper stocking levels, change in season of use, adequate time for recovery, and 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 the 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. 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, switchgrass, Indiangrass, Columbia needlegrass, and little bluestem. 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 | 1890 | 2376 | 2830 |
| Forb | 130 | 202 | 300 |
| Shrub/Vine | 80 | 108 | 140 |
| Tree | 0 | 14 | 30 |
| **Total** | **2100** | **2700** | **3300** |

**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. Non-native grasses such as Kentucky bluegrass, cheatgrass, Canada bluegrass, and field brome will likely invade and possibly become somewhat prevalent in this plant community phase. 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 | 1210 | 1670 | 2120 |
| Forb | 95 | 170 | 250 |
| Shrub/Vine | 95 | 150 | 205 |
| Tree | 0 | 10 | 25 |
| **Total** | **1400** | **2000** | **2600** |

**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; continuous season-long grazing; or a combination of disturbances such as extended periods of below average precipitation coupled with periodic heavy grazing will shift this 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 with proper stocking levels, alternating season of use, and adequate recovery periods, or periodic light to moderate grazing possibly including periodic rest, and a return to normal precipitation following drought will convert this 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. Other 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, cheatgrass, 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 sagebrush (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 percent of bare ground have 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, timothy, 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), 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, 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 | 1615 | 2112 | 2600 |
| Forb | 115 | 180 | 250 |
| Shrub/Vine | 70 | 96 | 125 |
| Tree | 0 | 12 | 25 |
| **Total** | **1800** | **2400** | **3000** |

**Figure 15. 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 | | |

### State 5
### Invaded State

This state is the result of invasion and dominance of non-native cool-season grass species. This state is characterized by the dominance of smooth brome and Kentucky bluegrass. 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 impaired, resulting in a 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 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).

### Community 5.1
### Smooth Brome-Kentucky Bluegrass (>30%)

This plant community evolved under no use and no fire or heavy, continuous season-long grazing with no change in season of use, or long-term light grazing. This plant community is typically dominated by smooth brome and Kentucky bluegrass. This plant community is made up of approximately 85 percent grasses and grass-like species, 10 percent forbs, and 5 percent shrubs. Dominant grasses include Kentucky bluegrass and smooth brome. Western wheatgrass and some needlegrass may still be found in the plant community. Forbs commonly found in this plant community include white sagebrush (cudweed sagewort), goldenrod, scurfpea, and Cuman ragweed. Infiltration and runoff will be moderately reduced as will energy capture. Production can be relatively high however, the period that palatability is high is relatively short, as these cool-season species mature rapidly.

### State 6
### 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 (6.1) 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 (6.2) was typically tilled and then seeded to a perennial forage species or mix of species.

### Community 6.1
### 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 6.2
### 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 seasonal grazing (stocking levels above carrying capacity for extended portions of the growing season, and at the same time of year each year, typically beginning early in the season) or continuous season-long grazing will transition the Reference State (1.0) to the Shortgrass Sod State (2.0). This transition is most likely to occur from the Western Wheatgrass-Blue Grama-Buffalograss Plant Community (1.2).

## 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 Seral 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 T7A
## State 1 to 6

Heavy disturbance including soil erosion; tillage; abandoned cropland; or seeding to improved pasture species result in a transition to the Disturbed State (6.0).

## Restoration pathway R2A
## State 2 to 1

Long-term prescribed grazing with moderate stocking levels, change in season of use, and adequate recovery periods, or other grazing strategies intended to treat specific species dominance, or periodic light to moderate stocking levels possibly including periodic rest may lead the Shortgrass Sod State (2.0) over a threshold to the Reference State (1.0). The most likely transition will 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; frequent severe defoliation; or heavy disturbance will likely move the Shortgrass Sod State (2.0) to the Early Successional State (3.0).

## Transition T2A
## State 2 to 4

Long-term prescribed grazing with proper stocking levels, change in season of use, adequate time for recovery, and

a return to normal precipitation patterns following drought; and the invasion of non-native cool-season perennial grasses will transition the Shortgrass Sod State (2.0) towards the Native/Invaded State (4.0). This transition may not be fast or feasible.

**Conservation practices**

| |
|---|
| Prescribed Grazing |

### Transition T7A
### State 2 to 6

Heavy disturbance including soil erosion; tillage; abandoned cropland; or seeding to improved pasture species result in a transition to the Disturbed State (6.0).

### Restoration pathway R3
### State 3 to 1

Seeding of improved/selected varieties of native species may lead this plant community phase over a threshold to a plant community resembling a phase of the Reference State (State 1). If seed and/or reproductive propagules of native species are still present in sufficient amounts, long-term prescribed grazing may eventually lead this plant community phase over the threshold and result in a phase of the Reference State (State 1). This restoration pathway will likely take a long period of time, if attainable.

**Conservation practices**

| |
|---|
| Prescribed Grazing |

### Restoration pathway R3A
### State 3 to 2

Removal of disturbances coupled with long-term prescribed grazing with proper stocking levels, change in season of use, and adequate recovery time following grazing event 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 T3A
### State 3 to 5

Removal of disturbances; herbaceous weed control; followed by prescribed grazing that includes proper stocking, change in season of use, and deferment that provides time for adequate recovery: and the invasion of non-native cool-season perennial gasses will likely transition the Early Successional State (3.0) to the Invaded State (5.0). This transition may not meet management objectives.

**Conservation practices**

| |
|---|
| Prescribed Grazing |
| Herbaceous Weed Control |

### Transition T7A
### State 3 to 6

Heavy disturbance including soil erosion; tillage; abandoned cropland; or seeding to improved pasture species results in a transition to the Disturbed State (6.0).

### 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 T4C
### State 4 to 5

Continuous season-long grazing; or long-term light grazing will transition the Native/Invaded State (3.0) to the Invaded State (5.0). With extended periods of non-use and no fire, heavy litter layer build-up will favor cool-season non-natives grasses such as Kentucky bluegrass and other non-native species, will also transition the Native/Invaded State (4.0) to the Invaded State (5.0).

### Transition T7A
### State 4 to 6

Heavy disturbance including soil erosion; tillage; abandoned cropland; or seeding to improved pasture species results in a transition to the Disturbed State (6.0).

### Transition T5A
### State 5 to 4

Herbaceous weed control; followed by long-term prescribed grazing that includes proper stocking, change in season of use, and deferment that provides time for adequate recovery, or other grazing strategies intended to treat specific species dominance may transition the Invaded State (5.0) to the Native/Invaded State (4.0). 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 T7A
### State 5 to 6

Heavy disturbance including soil erosion; tillage; abandoned cropland; or seeding to improved pasture species results in a transition to the Disturbed State (6.0).

## 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** | | | 540–1080 | |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 540–1080 | – |

| | | | | | |
|---|---|---|---|---|---|
| | [illegible] | [illegible] | [illegible] | [illegible] | |
| | thickspike wheatgrass | ELLAL | *Elymus lanceolatus ssp. lanceolatus* | 0–405 | – |
| 2 | **Cool-Season Bunchgrass** | | | 405–810 | |
| | green needlegrass | NAVI4 | *Nassella viridula* | 405–810 | – |
| | Columbia needlegrass | ACNE9 | *Achnatherum nelsonii* | 0–135 | – |
| | slender wheatgrass | ELTR7 | *Elymus trachycaulus* | 27–135 | – |
| | needle and thread | HECOC8 | *Hesperostipa comata ssp. comata* | 0–54 | – |
| 3 | **Tall Warm-Season Grasses** | | | 135–405 | |
| | big bluestem | ANGE | *Andropogon gerardii* | 54–270 | – |
| | switchgrass | PAVI2 | *Panicum virgatum* | 0–135 | – |
| | composite dropseed | SPCOC2 | *Sporobolus compositus var. compositus* | 0–81 | – |
| 4 | **Mid- Warm-Season Grasses** | | | 54–270 | |
| | sideoats grama | BOCU | *Bouteloua curtipendula* | 54–270 | – |
| | little bluestem | SCSC | *Schizachyrium scoparium* | 0–135 | – |
| 5 | **Short Warm-Season Grasses** | | | 54–270 | |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 27–216 | – |
| | buffalograss | BODA2 | *Bouteloua dactyloides* | 27–108 | – |
| 6 | **Other Native Grasses** | | | 54–135 | |
| | Grass, perennial | 2GP | *Grass, perennial* | 0–108 | – |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 27–81 | – |
| | Cusick's bluegrass | POCU3 | *Poa cusickii* | 27–54 | – |
| | threeawn | ARIST | *Aristida* | 0–27 | – |
| | Sandberg bluegrass | POSE | *Poa secunda* | 0–27 | – |
| 7 | **Grass-likes** | | | 27–135 | |
| | needleleaf sedge | CADU6 | *Carex duriuscula* | 27–135 | – |
| | threadleaf sedge | CAFI | *Carex filifolia* | 0–81 | – |
| | sedge | CAREX | *Carex* | 0–81 | – |
| 8 | **Non-Native Cool-Season Grasses** | | | 0 | |
| **Forb** | | | | | |
| 9 | **Forbs** | | | 135–270 | |
| | Forb, perennial | 2FP | *Forb, perennial* | 27–108 | – |
| | American vetch | VIAM | *Vicia americana* | 27–54 | – |
| | white sagebrush | ARLU | *Artemisia ludoviciana* | 27–54 | – |
| | desert biscuitroot | LOFO | *Lomatium foeniculaceum* | 27–54 | – |
| | dotted blazing star | LIPU | *Liatris punctata* | 27–54 | – |
| | beardtongue | PENST | *Penstemon* | 27–54 | – |
| | prairie clover | DALEA | *Dalea* | 27–54 | – |
| | upright prairie coneflower | RACO3 | *Ratibida columnifera* | 27–54 | – |
| | scarlet beeblossom | GACO5 | *Gaura coccinea* | 27–54 | – |
| | scarlet globemallow | SPCO | *Sphaeralcea coccinea* | 27–54 | – |
| | scurfpea | PSORA2 | *Psoralidium* | 27–54 | – |
| | prairie thermopsis | THRH | *Thermopsis rhombifolia* | 27–54 | – |
| | goldenrod | SOLID | *Solidago* | 27–54 | – |

| | | | | | |
|---|---|---|---|---|---|
| | white prairie aster | SYFA | *Symphyotrichum falcatum* | 27–54 | – |
| | leafy wildparsley | MUDI | *Musineon divaricatum* | 27–54 | – |
| | bellflower | CAMPA | *Campanula* | 0–27 | – |
| | Cuman ragweed | AMPS | *Ambrosia psilostachya* | 0–27 | – |
| | western yarrow | ACMIO | *Achillea millefolium var. occidentalis* | 0–27 | – |
| | blacksamson echinacea | ECAN2 | *Echinacea angustifolia* | 0–27 | – |
| | buckwheat | ERIOG | *Eriogonum* | 0–27 | – |
| | fleabane | ERIGE2 | *Erigeron* | 0–27 | – |
| | four o'clock | MIRAB | *Mirabilis* | 0–27 | – |
| | bluebells | MERTE | *Mertensia* | 0–27 | – |
| | cinquefoil | POTEN | *Potentilla* | 0–27 | – |
| **Shrub/Vine** | | | | | |
| 10 | **Shrubs** | | | 81–135 | |
| | pricklypear | OPUNT | *Opuntia* | 27–54 | – |
| | prairie sagewort | ARFR4 | *Artemisia frigida* | 27–54 | – |
| | rose | ROSA5 | *Rosa* | 27–54 | – |
| | winterfat | KRLA2 | *Krascheninnikovia lanata* | 0–54 | – |
| | Shrub (>.5m) | 2SHRUB | *Shrub (>.5m)* | 0–54 | – |
| | rubber rabbitbrush | ERNA10 | *Ericameria nauseosa* | 0–27 | – |
| | Wyoming big sagebrush | ARTRW8 | *Artemisia tridentata ssp. wyomingensis* | 0–27 | – |
| **Tree** | | | | | |
| 11 | **Trees** | | | 0–27 | |
| | ponderosa pine | PIPO | *Pinus ponderosa* | 0–27 | – |
| | bur oak | QUMA2 | *Quercus macrocarpa* | 0–27 | – |

**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** | | | 300–700 | |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 300–700 | – |
| | thickspike wheatgrass | ELLAL | *Elymus lanceolatus ssp. lanceolatus* | 0–200 | – |
| 2 | **Cool-Season Bunch Grass** | | | 100–300 | |
| | green needlegrass | NAVI4 | *Nassella viridula* | 100–300 | – |
| | slender wheatgrass | ELTR7 | *Elymus trachycaulus* | 20–100 | – |
| | needle and thread | HECOC8 | *Hesperostipa comata ssp. comata* | 0–20 | – |
| | Columbia needlegrass | ACNE9 | *Achnatherum nelsonii* | 0–20 | – |
| 3 | **Tall Warm-Season Grasses** | | | 0–100 | |
| | composite dropseed | SPCOC2 | *Sporobolus compositus var. compositus* | 0–80 | – |
| | big bluestem | ANGE | *Andropogon gerardii* | 0–60 | – |
| 4 | **Mid- Warm-Season Grasses** | | | 20–160 | |
| | sideoats grama | BOCU | *Bouteloua curtipendula* | 20–160 | – |
| | little bluestem | SCSC | *Schizachyrium scoparium* | 0–40 | |

| | | | | | |
|---|---|---|---|---|---|
| | little bluestem | SCSC | *Schizachyrium scoparium* | 0–40 | – |
| 5 | **Short Warm-Season Grasses** | | | 200–300 | |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 100–300 | – |
| | buffalograss | BODA2 | *Bouteloua dactyloides* | 40–160 | – |
| 6 | **Other Native Grasses** | | | 20–100 | |
| | Grass, perennial | 2GP | *Grass, perennial* | 0–80 | – |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 20–60 | – |
| | threeawn | ARIST | *Aristida* | 0–40 | – |
| | Sandberg bluegrass | POSE | *Poa secunda* | 0–20 | – |
| | Cusick's bluegrass | POCU3 | *Poa cusickii* | 0–20 | – |
| 7 | **Grass-likes** | | | 40–200 | |
| | needleleaf sedge | CADU6 | *Carex duriuscula* | 40–200 | – |
| | threadleaf sedge | CAFI | *Carex filifolia* | 0–100 | – |
| | sedge | CAREX | *Carex* | 0–100 | – |
| 8 | **Non-Native Grasses** | | | 0 | |
| **Forb** | | | | | |
| 9 | **Forbs** | | | 100–240 | |
| | white sagebrush | ARLU | *Artemisia ludoviciana* | 20–60 | – |
| | goldenrod | SOLID | *Solidago* | 20–60 | – |
| | Forb, perennial | 2FP | *Forb, perennial* | 20–60 | – |
| | prairie thermopsis | THRH | *Thermopsis rhombifolia* | 0–40 | – |
| | upright prairie coneflower | RACO3 | *Ratibida columnifera* | 20–40 | – |
| | desert biscuitroot | LOFO | *Lomatium foeniculaceum* | 0–40 | – |
| | scarlet globemallow | SPCO | *Sphaeralcea coccinea* | 20–40 | – |
| | scurfpea | PSORA2 | *Psoralidium* | 20–40 | – |
| | Cuman ragweed | AMPS | *Ambrosia psilostachya* | 0–40 | – |
| | western yarrow | ACMIO | *Achillea millefolium var. occidentalis* | 20–40 | – |
| | white prairie aster | SYFA | *Symphyotrichum falcatum* | 20–40 | – |
| | leafy wildparsley | MUDI | *Musineon divaricatum* | 0–40 | – |
| | dotted blazing star | LIPU | *Liatris punctata* | 0–20 | – |
| | buckwheat | ERIOG | *Eriogonum* | 0–20 | – |
| | fleabane | ERIGE2 | *Erigeron* | 0–20 | – |
| | blacksamson echinacea | ECAN2 | *Echinacea angustifolia* | 0–20 | – |
| | scarlet beeblossom | GACO5 | *Gaura coccinea* | 0–20 | – |
| | beardtongue | PENST | *Penstemon* | 0–20 | – |
| | prairie clover | DALEA | *Dalea* | 0–20 | – |
| | American vetch | VIAM | *Vicia americana* | 0–20 | – |
| | cinquefoil | POTEN | *Potentilla* | 0–20 | – |
| **Shrub/Vine** | | | | | |
| 10 | **Shrubs** | | | 100–200 | |
| | pricklypear | OPUNT | *Opuntia* | 20–60 | – |
| | prairie sagewort | ARFR4 | *Artemisia frigida* | 20–60 | – |
| | Shrub (>.5m) | 2SHRUB | *Shrub (>.5m)* | 0–60 | – |

| | | | | | |
|---|---|---|---|---|---|
| | rose | ROSA5 | *Rosa* | 20–40 | – |
| | rubber rabbitbrush | ERNA10 | *Ericameria nauseosa* | 0–40 | – |
| | Wyoming big sagebrush | ARTRW8 | *Artemisia tridentata ssp. wyomingensis* | 0–20 | – |
| **Tree** | | | | | |
| 11 | **Trees** | | | 0–20 | |
| | ponderosa pine | PIPO | *Pinus ponderosa* | 0–20 | – |
| | Rocky Mountain juniper | JUSC2 | *Juniperus scopulorum* | 0–20 | – |
| | bur oak | QUMA2 | *Quercus macrocarpa* | 0–20 | – |

**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 | *Pascopyrum smithii* | 14–140 | – |
| | thickspike wheatgrass | ELLAL | *Elymus lanceolatus ssp. lanceolatus* | 0–28 | – |
| 2 | **Cool-Season Bunchgrass** | | | 0–70 | |
| | green needlegrass | NAVI4 | *Nassella viridula* | 0–70 | – |
| | slender wheatgrass | ELTR7 | *Elymus trachycaulus* | 14–70 | – |
| | needle and thread | HECOC8 | *Hesperostipa comata ssp. comata* | 0–14 | – |
| 3 | **Tall Warm-Season Grasses** | | | 0–70 | |
| | composite dropseed | SPCOC2 | *Sporobolus compositus var. compositus* | 0–28 | – |
| 4 | **Mid- Warm-Season Grasses** | | | 0–70 | |
| | sideoats grama | BOCU | *Bouteloua curtipendula* | 0–70 | – |
| | little bluestem | SCSC | *Schizachyrium scoparium* | 0–14 | – |
| 5 | **Short Warm-Season Grasses** | | | 210–560 | |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 140–490 | – |
| | buffalograss | BODA2 | *Bouteloua dactyloides* | 70–140 | – |
| 6 | **Other Native Grasses** | | | 0–70 | |
| | threeawn | ARIST | *Aristida* | 0–42 | – |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 0–28 | – |
| | Grass, perennial | 2GP | *Grass, perennial* | 0–28 | – |
| | Sandberg bluegrass | POSE | *Poa secunda* | 0–14 | – |
| 7 | **Grass-Like** | | | 70–280 | |
| | needleleaf sedge | CADU6 | *Carex duriuscula* | 70–280 | – |
| | threadleaf sedge | CAFI | *Carex filifolia* | 0–70 | – |
| | sedge | CAREX | *Carex* | 0–70 | – |
| 8 | **Non-Native Cool-Season Grasses** | | | 14–98 | |
| | cheatgrass | BRTE | *Bromus tectorum* | 14–98 | – |
| | Kentucky bluegrass | POPR | *Poa pratensis* | 0–70 | – |
| | smooth brome | BRIN2 | *Bromus inermis* | 0–70 | – |
| | timothy | PHPR3 | *Phleum pratense* | 0–70 | – |
| | crested wheatgrass | AGCR | *Agropyron cristatum* | 0–70 | – |

| | | | | | |
|---|---|---|---|---|---|
| | field brome | BRAR5 | *Bromus arvensis* | 0–28 | – |
| **Forb** | | | | | |
| 9 | **Forbs** | | | 70–210 | |
| | Forb, introduced | 2FI | *Forb, introduced* | 14–112 | – |
| | white sagebrush | ARLU | *Artemisia ludoviciana* | 14–70 | – |
| | goldenrod | SOLID | *Solidago* | 14–70 | – |
| | Cuman ragweed | AMPS | *Ambrosia psilostachya* | 14–56 | – |
| | western yarrow | ACMIO | *Achillea millefolium var. occidentalis* | 14–56 | – |
| | scurfpea | PSORA2 | *Psoralidium* | 14–42 | – |
| | prairie thermopsis | THRH | *Thermopsis rhombifolia* | 0–28 | – |
| | white prairie aster | SYFA | *Symphyotrichum falcatum* | 0–28 | – |
| | Forb, perennial | 2FP | *Forb, perennial* | 0–28 | – |
| | upright prairie coneflower | RACO3 | *Ratibida columnifera* | 0–14 | – |
| | scarlet globemallow | SPCO | *Sphaeralcea coccinea* | 0–14 | – |
| | buckwheat | ERIOG | *Eriogonum* | 0–14 | – |
| **Shrub/Vine** | | | | | |
| 10 | **Shrubs** | | | 70–210 | |
| | pricklypear | OPUNT | *Opuntia* | 28–112 | – |
| | prairie sagewort | ARFR4 | *Artemisia frigida* | 14–98 | – |
| | Shrub (>.5m) | 2SHRUB | *Shrub (>.5m)* | 0–56 | – |
| | rose | ROSA5 | *Rosa* | 0–28 | – |
| | rubber rabbitbrush | ERNA10 | *Ericameria nauseosa* | 0–28 | – |
| | Wyoming big sagebrush | ARTRW8 | *Artemisia tridentata ssp. wyomingensis* | 0–14 | – |
| **Tree** | | | | | |
| 11 | **Trees** | | | 0–14 | |
| | ponderosa pine | PIPO | *Pinus ponderosa* | 0–14 | – |
| | Rocky Mountain juniper | JUSC2 | *Juniperus scopulorum* | 0–14 | – |
| | bur oak | QUMA2 | *Quercus macrocarpa* | 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** | | | 360–840 | |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 360–840 | – |
| | thickspike wheatgrass | ELLAL | *Elymus lanceolatus ssp. lanceolatus* | 0–48 | – |
| 2 | **Cool-Season Bunchgrass** | | | 240–720 | |
| | green needlegrass | NAVI4 | *Nassella viridula* | 240–720 | – |
| | slender wheatgrass | ELTR7 | *Elymus trachycaulus* | 24–120 | – |
| | needle and thread | HECOC8 | *Hesperostipa comata ssp. comata* | 0–48 | – |
| | Columbia needlegrass | ACNE9 | *Achnatherum nelsonii* | 0–24 | – |
| 3 | **Tall Warm-Season Grasses** | | | 0–120 | |
| | big bluestem | ANGE | *Andropogon gerardii* | 0–120 | – |

| | | | | | |
|---|---|---|---|---|---|
| | composite dropseed | SPCOC2 | *Sporobolus compositus var. compositus* | 0–72 | – |
| 4 | **Mid- Warm-Season Grasses** | | | 24–120 | |
| | sideoats grama | BOCU | *Bouteloua curtipendula* | 24–120 | – |
| | little bluestem | SCSC | *Schizachyrium scoparium* | 0–72 | – |
| 5 | **Short Warm-Season Grasses** | | | 24–120 | |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 24–120 | – |
| | buffalograss | BODA2 | *Bouteloua dactyloides* | 0–72 | – |
| 6 | **Other Native Grasses** | | | 24–120 | |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 24–72 | – |
| | Grass, perennial | 2GP | *Grass, perennial* | 0–72 | – |
| | Cusick's bluegrass | POCU3 | *Poa cusickii* | 0–24 | – |
| | threeawn | ARIST | *Aristida* | 0–24 | – |
| | Sandberg bluegrass | POSE | *Poa secunda* | 0–24 | – |
| 7 | **Grass-Likes** | | | 24–120 | |
| | needleleaf sedge | CADU6 | *Carex duriuscula* | 24–120 | – |
| | sedge | CAREX | *Carex* | 0–72 | – |
| | threadleaf sedge | CAFI | *Carex filifolia* | 0–48 | – |
| 8 | **Non-Native Cool-Season Grasses** | | | 240–600 | |
| | Kentucky bluegrass | POPR | *Poa pratensis* | 120–480 | – |
| | smooth brome | BRIN2 | *Bromus inermis* | 0–240 | – |
| | timothy | PHPR3 | *Phleum pratense* | 0–240 | – |
| | cheatgrass | BRTE | *Bromus tectorum* | 24–192 | – |
| | field brome | BRAR5 | *Bromus arvensis* | 0–120 | – |
| | crested wheatgrass | AGCR | *Agropyron cristatum* | 0–120 | – |
| **Forb** | | | | | |
| 9 | **Forbs** | | | 120–240 | |
| | Forb, introduced | 2FI | *Forb, introduced* | 24–120 | – |
| | Forb, perennial | 2FP | *Forb, perennial* | 0–72 | – |
| | white sagebrush | ARLU | *Artemisia ludoviciana* | 24–72 | – |
| | goldenrod | SOLID | *Solidago* | 24–72 | – |
| | scurfpea | PSORA2 | *Psoralidium* | 24–48 | – |
| | Cuman ragweed | AMPS | *Ambrosia psilostachya* | 24–48 | – |
| | western yarrow | ACMIO | *Achillea millefolium var. occidentalis* | 24–48 | – |
| | white prairie aster | SYFA | *Symphyotrichum falcatum* | 24–48 | – |
| | upright prairie coneflower | RACO3 | *Ratibida columnifera* | 0–48 | – |
| | scarlet globemallow | SPCO | *Sphaeralcea coccinea* | 0–24 | – |
| | leafy wildparsley | MUDI | *Musineon divaricatum* | 0–24 | – |
| | prairie clover | DALEA | *Dalea* | 0–24 | – |
| | desert biscuitroot | LOFO | *Lomatium foeniculaceum* | 0–24 | – |
| | dotted blazing star | LIPU | *Liatris punctata* | 0–24 | – |
| | fleabane | ERIGE2 | *Erigeron* | 0–24 | – |
| | prairie thermopsis | THRH | *Thermopsis rhombifolia* | 0–24 | – |
| | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | American vetch | VIAM | *Vicia americana* | 0–24 | – |
| | cinquefoil | POTEN | *Potentilla* | 0–24 | – |
| **Shrub/Vine** | | | | | |
| 10 | **Shrubs** | | | 72–120 | |
| | pricklypear | OPUNT | *Opuntia* | 24–48 | – |
| | prairie sagewort | ARFR4 | *Artemisia frigida* | 24–48 | – |
| | rose | ROSA5 | *Rosa* | 24–48 | – |
| | Shrub (>.5m) | 2SHRUB | *Shrub (>.5m)* | 0–48 | – |
| | rubber rabbitbrush | ERNA10 | *Ericameria nauseosa* | 0–24 | – |
| | Wyoming big sagebrush | ARTRW8 | *Artemisia tridentata ssp. wyomingensis* | 0–24 | – |
| **Tree** | | | | | |
| 11 | **Trees** | | | 0–24 | |
| | ponderosa pine | PIPO | *Pinus ponderosa* | 0–24 | – |
| | Rocky Mountain juniper | JUSC2 | *Juniperus scopulorum* | 0–24 | – |
| | bur oak | QUMA2 | *Quercus macrocarpa* | 0–24 | – |

## 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 18-22” 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 provided 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 18-22” 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): 2,700
Stocking Rate (AUM/acre): 0.74

Plant Community: Western Wheatgrass-Blue Grama-Buffalograss (1.2)
Average Production (lbs./acre, air-dry): 2,000
Stocking Rate (AUM/acre): 0.55

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-Bluegrass (4.1)
Average Production (lbs./acre, air-dry): 2,400*
Stocking Rate (AUM/acre): 0.66*

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 for hydrologic soil groups, runoff quantities, and hydrologic curves, Part 630.)

## 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 native plant seed 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 ESD is an updated “Previously Approved” ESD that represented a first-generation tier of documentation that, prior to the release of the 2014 National Ecological Site Handbook (NESH), met all requirements as an “Approved” ESD as laid out in the 1997 National Range and Pasture Handbook (NRPH). The document fully described the reference state and community phase in the state-and-transition model. All other alternative states are at least described in narrative form. The “Previously Approved” ESD has been field-tested for a minimum of 5 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 continued refinement toward an “Approved” status is expected.

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

Stan C. Boltz
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.



## 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:** 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 5 to 8 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) > needlegrasses (mid and tall, cool-season bunchgrasses >

Sub-dominant: Tall, warm-season grasses >

Other: Mid, warm-season grasses = short, warm-season grasses = forbs > grass-likes species = 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 to no evidence of decadence or mortality. Bunch grasses have strong, healthy centers and shrubs are vigorous.

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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.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Ranges from 2,100 to 3,300 pounds/acre. Reference value is 2,700 pounds/acre (air-dry weight basis).

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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, smooth bromegrass.

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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.

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