USDA Natural Resources Conservation Service

# Ecological site R063AY011SD
# Clayey

Accessed: 04/23/2024

## 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.

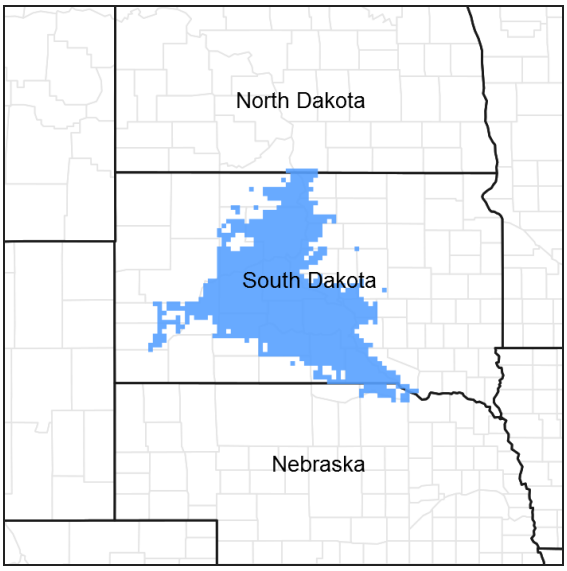



**Figure 1. Mapped extent**

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): 063A–Northern Rolling Pierre Shale Plains

MLRA 63A is approximately 10,160 square miles in size, the majority of which is in South Dakota and a very small portion in North Dakota. The MLRA extends west of the northern half of the South Dakota reach of the Missouri River. All five of the major rivers draining western South Dakota cross this area. From north to south, these are the Grand, Moreau, Cheyenne, Bad, and White Rivers.

Elevation range from 1,300 to 1,640 feet on the bottom land along the Missouri River to 1,640 to 2,950 feet on the shale plain uplands. Cretaceous Pierre Shale underlies almost all of this area. This is a marine sediment having layers of volcanic ash that has been altered to smectitic clays. These clays shrink as they dry and swell as they get wet. Tertiary and Quaternary river deposits, remnants of erosion from the Black Hills uplift, cap isolated highlands in this area. Deposits of alluvial sand and gravel occur on the valley floors adjacent to the major streams in the area. The average annual precipitation in this area is 15 to 20 inches.
The vegetation in this area is a transition from eastern tall grass prairie to a western mixed grass prairie, (USDA-NRCS, Ag Handbook 296).

## Classification relationships

Land Resource Region (LRR): G - Western Great Plains Range and Irrigated Region, Major Land Resource Area (MLRA): 63A Northern Rolling Pierre Shale Plains, (USDA-NRCS, Ag Handbook 296).

Level IV Ecoregions of the Conterminous United States, 2013: 43c – River Breaks and 43f – Subhumid Pierre Shale Plains.

## Ecological site concept

The Clayey Ecological site occurs throughout the MLRA and is the most common. It is located on upland landscapes and does not receive additional moisture from run off or overflow. Typical slopes range from 0 to 30 percent. Soils are deep with silty clay loam to clay surface texture 3 to 9 inches thick. The vegetation in reference 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, sideoats grama, little bluestem, blue grama and buffalograss are the dominant warm-season grasses. Forbs are common and diverse, shrubs are present but are in minor amounts.

## Associated sites

| | |
|---|---|
| R063AY010SD | **Loamy** |
| R063AY012SD | **Thin Upland** |
| R063AY017SD | **Shallow Clay** |
| R063AY021SD | **Clayey Overflow** |

## Similar sites

| | |
|---|---|
| R063AY021SD | **Clayey Overflow**<br>Clayey Overflow [more big bluestem; higher production] |
| R063AY010SD | **Loamy**<br>Loamy [less green needlegrass; more needleandthread] |

**Table 1. Dominant plant species**

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

## Physiographic features

This site occurs on nearly level to steeply sloping uplands.

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Terrace<br>(2) Fan<br>(3) Hill |
| Flooding frequency | None |
| Ponding frequency | None |
| Elevation | 1,600–2,700 ft |
| Slope | 0–30% |
| Water table depth | 80 in |
| Aspect | Aspect is not a significant factor |

## Climatic features

MLRA 63A is considered to have a continental climate – cold winters and hot summers, low humidity, light rainfall, and abundant sunshine. Extreme temperature fluctuations are also common. The climate is the result of this

MLRA’s location near the geographic center of North America. There are few natural barriers on the Northern Great Plains and air masses move freely across the plains and account for rapid changes in temperature.

Annual precipitation ranges from 16 to 20 inches per year. The average annual temperature is about 47°F. January is the coldest month with average temperatures ranging from about 11°F (Pollock, South Dakota (SD)), to about 22°F (Cedar Butte, SD). July is the warmest month with temperatures averaging from about 72°F (Pollock, SD), to about 76° F (Cedar Butte, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 58°F. This large annual range attests to the continental nature of this area's climate. Hourly winds are estimated to average about 11 miles per hour annually, ranging from about 13 miles per hour during the spring to about 10 miles per hour during the summer. Daytime winds are generally stronger than nighttime and occasional strong 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.

**Table 3. Representative climatic features**

| | |
|---|---|
| Frost-free period (average) | 130 days |
| Freeze-free period (average) | 151 days |
| Precipitation total (average) | 19 in |

## Climate stations used

- (1) COTTONWOOD 2 E [USC00391972], Kadoka, SD
- (2) KENNEBEC [USC00394516], Kennebec, SD
- (3) POLLOCK [USC00396712], Pollock, SD
- (4) CEDAR BUTTE 1NE [USC00391539], White River, SD

## Influencing water features

No riparian areas or wetland features are directly associated with this site.

## Soil features

The common features of soils in this site are the silty clay loam to clay textured subsoils and slopes of 0 to 30 percent. The soils in this site are moderately well to well drained and formed in shale and clayey alluvium. The silty clay to clay surface layer is 3 to 9 inches thick. The soils have a moderately slow to slow infiltration rate. When dry these soils crack. When the soils are wet, surface compaction can occur with heavy traffic. 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.
These soils are mainly susceptible to water erosion. The hazard of water erosion increases on slopes greater than about five 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/or production.
Soils correlated to the Clayey Ecological Site include: Kyle, Opal, Pierre and Promise
Access Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/) for specific local soils information.

**Table 4. Representative soil features**

| | |
|---|---|
| Surface texture | (1) Silty clay loam<br>(2) Silty clay<br>(3) Clay |
| Family particle size | (1) Clayey |
| Drainage class | Moderately well drained to well drained |

| | |
|---|---|
| Permeability class | Very slow to moderately slow |
| Soil depth | 20–80 in |
| Surface fragment cover <=3" | 0% |
| Surface fragment cover >3" | 0% |
| Available water capacity (0-40in) | 4–6 in |
| Calcium carbonate equivalent (0-40in) | 0–25% |
| Electrical conductivity (0-40in) | 0–8 mmhos/cm |
| Sodium adsorption ratio (0-40in) | 0–16 |
| Soil reaction (1:1 water) (0-40in) | 6.1–9 |
| Subsurface fragment volume <=3" (Depth not specified) | 0–13% |
| Subsurface fragment volume >3" (Depth not specified) | 0–6% |

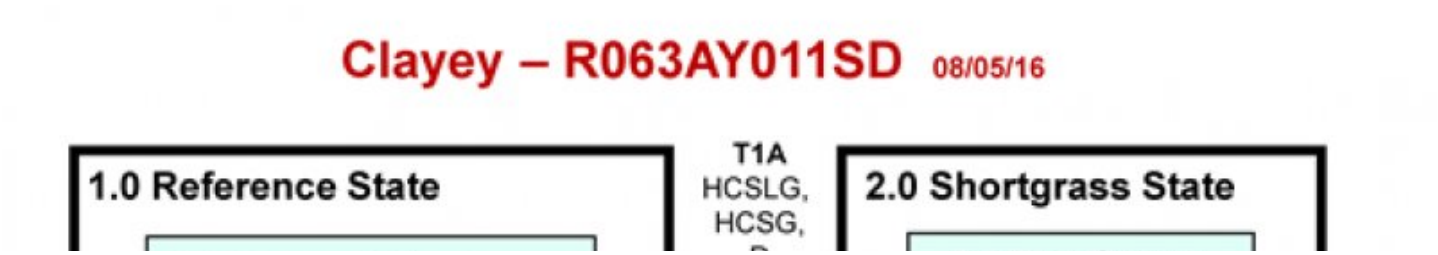
## Ecological dynamics

This site developed under Northern Great Plains climatic conditions, light to severe grazing by bison and other large herbivores, sporadic natural or man-caused wildfire (often of light intensities), and other biotic and abiotic factors that typically influence soil/site development. Changes will occur in the plant communities due to short-term weather variations, impacts of native and/or exotic plant and animal species, and management actions. While the following plant community descriptions describe more typical transitions that will occur, severe disturbances, such as periods of well below average precipitation, can cause significant shifts in plant communities and/or species composition. Continuous season-long grazing (during the typical growing season of May through October) and/or repeated seasonal grazing (e.g., every spring, every summer) without adequate recovery periods following each grazing occurrence causes this site to depart from the Western Wheatgrass-Green Needlegrass Plant Community. Blue grama and buffalograss will increase and eventually develop into a sod. Western wheatgrass will increase initially and then begin to decrease. Green needlegrass, needleandthread, porcupine grass, sideoats grama, big bluestem, and little bluestem will decrease in frequency and production. Excessive defoliation can cause threeawns and annuals to increase and dominate the site. Extended periods of nonuse and/or lack of fire will result in excessive litter and a plant community dominated by cool-season grasses such as western wheatgrass, bluegrass, and cheatgrass.

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



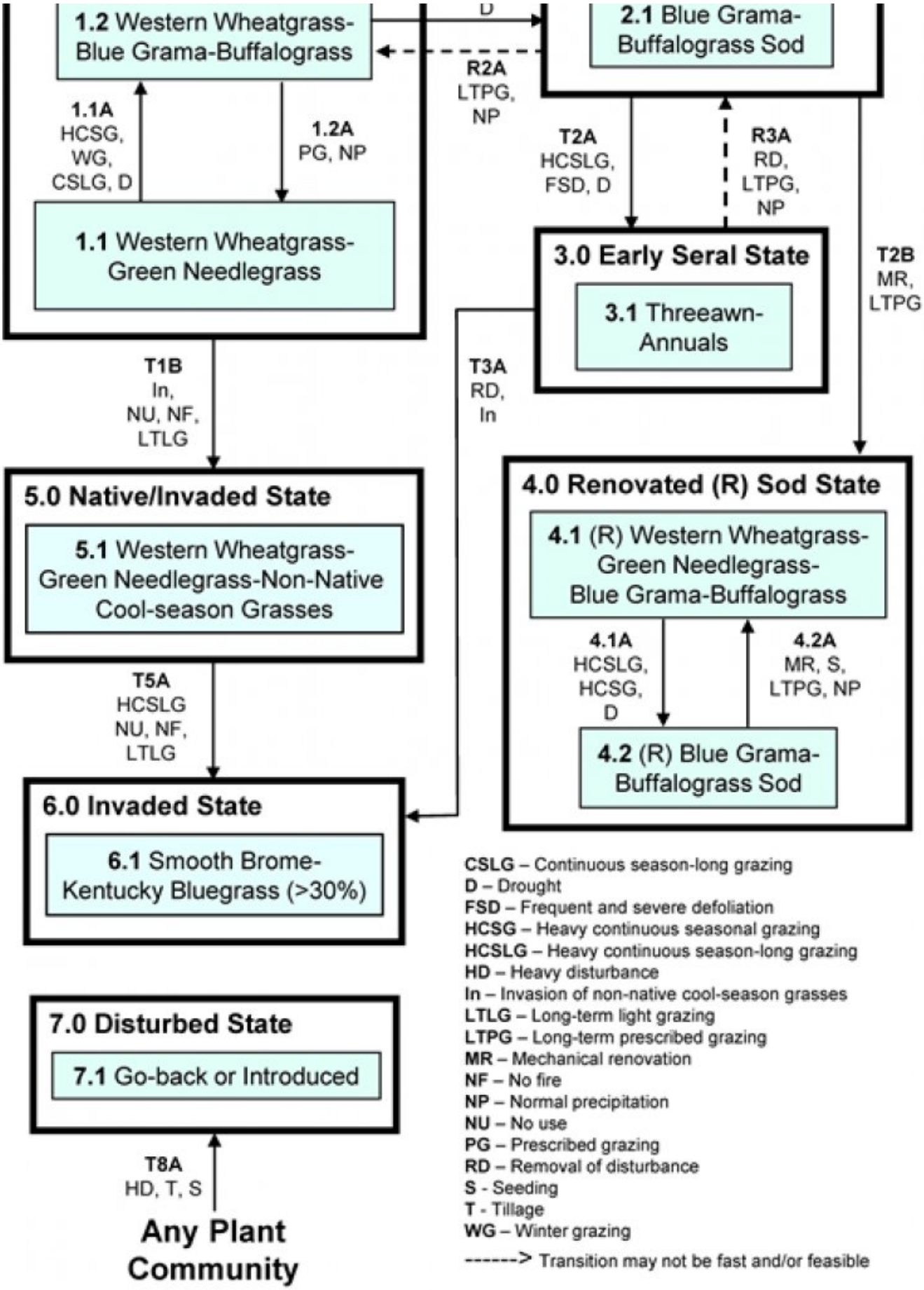



**Figure 6. Clayey - R063AY011SD**

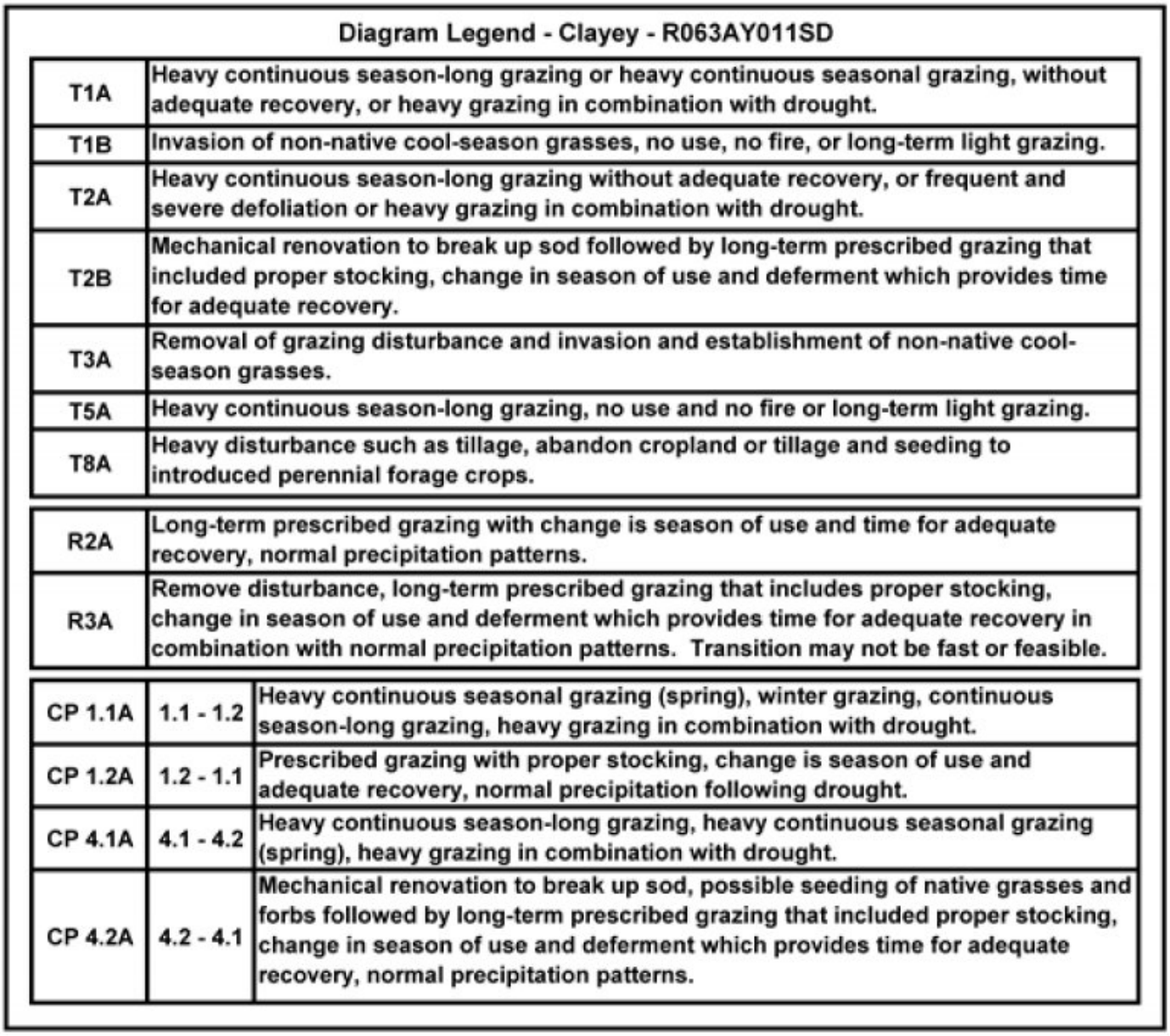


Diagram Legend - Clayey - R063AY011SD

| | |
|---|---|
| T1A | Heavy continuous season-long grazing or heavy continuous seasonal grazing, without adequate recovery, or heavy grazing in combination with drought. |
| T1B | Invasion of non-native cool-season grasses, no use, no fire, or long-term light grazing. |
| T2A | Heavy continuous season-long grazing without adequate recovery, or frequent and severe defoliation or heavy grazing in combination with drought. |
| T2B | Mechanical renovation to break up sod followed by long-term prescribed grazing that included proper stocking, change in season of use and deferment which provides time for adequate recovery. |
| T3A | Removal of grazing disturbance and invasion and establishment of non-native cool-season grasses. |
| T5A | Heavy continuous season-long grazing, no use and no fire or long-term light grazing. |
| T8A | Heavy disturbance such as tillage, abandon cropland or tillage and seeding to introduced perennial forage crops. |

| | |
|---|---|
| R2A | Long-term prescribed grazing with change is season of use and time for adequate recovery, normal precipitation patterns. |
| R3A | Remove disturbance, long-term prescribed grazing that includes proper stocking, change in season of use and deferment which provides time for adequate recovery in combination with normal precipitation patterns. Transition may not be fast or feasible. |

| | | |
|---|---|---|
| CP 1.1A | 1.1 - 1.2 | Heavy continuous seasonal grazing (spring), winter grazing, continuous season-long grazing, heavy grazing in combination with drought. |
| CP 1.2A | 1.2 - 1.1 | Prescribed grazing with proper stocking, change is season of use and adequate recovery, normal precipitation following drought. |
| CP 4.1A | 4.1 - 4.2 | Heavy continuous season-long grazing, heavy continuous seasonal grazing (spring), heavy grazing in combination with drought. |
| CP 4.2A | 4.2 - 4.1 | Mechanical renovation to break up sod, possible seeding of native grasses and forbs followed by long-term prescribed grazing that included proper stocking, change in season of use and deferment which provides time for adequate recovery, normal precipitation patterns. |

**Figure 7. Clayey - R63AY011SD**

## State 1
## Reference State

This 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 Reference, is dominated by cool-season grasses and sub-dominant warm-season grass. Grazing and the lack of grazing, fire and drought are the major drivers between plant communities. Depending on the season of use, continuous seasonal grazing can push this plant community to either a warm-season dominated or a cool-season dominated grassland. Non-use and no fire will result in heavy litter accumulations and the invasion of non-native cool-season grasses.

### Community 1.1
### Western Wheatgrass-Green Needlegrass

Interpretations are based primarily on the Western Wheatgrass-Green Needlegrass Plant Community (this is also considered to be the reference plant community). This plant community can be found on areas that are properly managed with grazing and/or prescribed burning and sometimes on areas receiving occasional short periods of rest. The potential vegetation is about 85 percent grasses or grass-like plants, 10 percent forbs, and 5 percent woody plants. The community is dominated by cool-season grasses. The major grasses include western wheatgrass, green needlegrass, needleandthread, and sideoats grama. Other grasses include blue grama, buffalograss, sedges, and porcupine grass. This plant community is extremely 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 regards to site/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 | 1660 | 2238 | 2795 |
| Forb | 120 | 187 | 275 |
| Shrub/Vine | 20 | 75 | 130 |
| **Total** | **1800** | **2500** | **3200** |

**Figure 9. Plant community growth curve (percent production by month). SD6301, Pierre Shale Plains, cool-season dominant.. Cool-season dominant on uplands..**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 4 | 12 | 25 | 36 | 10 | 5 | 4 | 4 | 0 | 0 |

## Community 1.2
## Western Wheatgrass-Blue Grama-Buffalograss

This plant community evolved under continuous seasonal grazing or from over utilization during extended drought periods. The potential plant community is made up of approximately 80 percent grasses and grass-like species, 10 percent forbs, and 10 percent shrubs. Dominant grasses include western wheatgrass, blue grama, and buffalograss. Grasses and grass-likes of secondary importance include sideoats grama, sedge, green needlegrass, and needleandthread. Forbs commonly found in this plant community include cudweed sagewort, prairie coneflower, and western yarrow. Shrub canopy ranges from 0 to 10 percent. When compared to the Western Wheatgrass-Green Needlegrass Plant Community, blue grama and buffalograss have increased. Green needlegrass and sideoats grama have decreased and production of mid and tall, warm-season grasses has also been reduced. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term.

**Table 6. Annual production by plant type**

| Plant Type | Low (Lb/Acre) | Representative Value (Lb/Acre) | High (Lb/Acre) |
|---|---|---|---|
| Grass/Grasslike | 1020 | 1614 | 2110 |
| Shrub/Vine | 90 | 143 | 195 |
| Forb | 90 | 143 | 195 |
| **Total** | **1200** | **1900** | **2500** |

**Figure 11. Plant community growth curve (percent production by month). SD6303, Pierre Shale Plains, cool/warm-season codominant.. Cool-season, warm-season codominant..**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 3 | 10 | 20 | 28 | 21 | 10 | 5 | 3 | 0 | 0 |

## Pathway 1.1A
## Community 1.1 to 1.2

Heavy continuous seasonal grazing (extended grazing at the same time of year each year), winter grazing that extends into the early growing season, continuous season-long grazing in combination with below normal precipitation will shift this community to the Western Wheatgrass-Blue Grama-Buffalograss Plant Community.

### Pathway 1.2A
### Community 1.2 to 1.1

Prescribed grazing, with proper stocking rates, change in season of use and adequate time for recovery will shift this plant community to the Western Wheatgrass-Green Needlegrass Plant Community (1.1). Return of normal precipitation patterns, could also help shift this plant community to the Western Wheatgrass-Green Needlegrass Plant Community (1.1).

## State 2
## Shortgrass State

The Shortgrass State is dominated by shortgrass species and upland sedges. This state is the result of grazing patterns that did not provide adequate recovery time for cool-season wheatgrass and needle grasses. The hydrologic function of this site is dramatically altered. Runoff is high and infiltration is low. This State is very resistant to change through grazing management alone.

### Community 2.1
### Blue Grama-Buffalograss Sod

This plant community evolved under heavy continuous season-long grazing or from over utilization during extended drought periods. The potential plant community is made up of approximately 80 percent grasses and grass-like species, 10 percent forbs, and 10 percent shrubs. Dominant grasses include blue grama and buffalograss. Grasses of secondary importance include sedge and western wheatgrass. Forbs commonly found in this plant community include wild parsley and scarlet globemallow. Shrub canopy ranges from 0 to 10 percent. When compared to the Western Wheatgrass/Green Needlegrass Plant Community, blue grama 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. Transitions or pathways leading to other plant communities are as follows: • Long-term prescribed grazing may potentially convert the plant community to the Western Wheatgrass/Blue Grama/Buffalograss Plant Community, assuming an adequate seed/vegetative source is present. This could require significant time and input to achieve. • Heavy continuous season-long grazing and/or frequent severe defoliation will likely move this plant community to the Threeawn/Annuals Plant Community.

**Table 7. Annual production by plant type**

| Plant Type | Low (Lb/Acre) | Representative Value (Lb/Acre) | High (Lb/Acre) |
|---|---|---|---|
| Grass/Grasslike | 500 | 934 | 1370 |
| Shrub/Vine | 50 | 83 | 115 |
| Forb | 50 | 83 | 115 |
| **Total** | **600** | **1100** | **1600** |

**Figure 13. Plant community growth curve (percent production by month). SD6305, Pierre Shale Plains, warm-season dominant.. Warm-season dominant, uplands..**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 2 | 5 | 15 | 25 | 30 | 15 | 7 | 1 | 0 | 0 |

## State 3
## Early Seral State

This state is the result of very heavy, concentrated disturbance such as concentrated rodent activity, or livestock concentration areas. This State can also develop as a result of invasion by highly competitive weed species such as Canada thistle, hound’s tongue, leafy spurge, or knapweeds. Extended periods of drought accompanied by heavy grazing can also push an ‘At Risk’ plant community phase to this state. In most cases, this phase is dominated by pioneer perennial and annual grass and forb species. Bare ground is also much higher than on any other plant

community phase.

### Community 3.1
### Threeawn-Annuals

This plant community developed under continuous heavy grazing or other excessive disturbances (e.g., livestock concentration, heavy use areas, defoliation by rodents, etc.) The potential plant community is made up of approximately 50 to 75 percent grasses and grass-like species, 10 to 25 percent forbs, and 5 to 25 percent shrubs. The dominant grasses include threeawn and annual bromegrasses. Other grasses and grass-likes may include little bluestem, blue grama, buffalograss, sedges, and western wheatgrass. The dominant forbs include fetid marigold, western ragweed, prostrate verbena, pussytoes, and other annual invader-like species. The dominant shrubs include fringed sagewort and cactus. Other plant species, from adjacent ecological sites, can become minor components of this plant community. This plant community is susceptible to invasion of Canada thistle and other nonnative species because of the relatively high percent of bare ground. Compared to the Western Wheatgrass-Green Needlegrass Plant Community, red threeawn, annual bromegrasses, and percent of bare ground has increased. Western wheatgrass, needlegrasses, and other cool-season grasses and grass-like species have decreased as have the warm-season species including big bluestem, sideoats grama, blue grama, and buffalograss. Plant diversity is low (plant richness may be high, but areas are often dominated by a few species). This plant community is difficult to return to the Western Wheatgrass-Green Needlegrass Plant Community 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. Mechanical renovation of this Plant Community is also an option to improve forage production, however, if the disturbances causing the transition to this plant community is not changed it will revert back to the original plant community. A separate Transition Pathway was not included in the State and Transition Model because these plant communities are relatively minor in occurrence and the end result are unpredictable.

**Table 8. Annual production by plant type**

| Plant Type | Low (Lb/Acre) | Representative Value (Lb/Acre) | High (Lb/Acre) |
|---|---|---|---|
| Grass/Grasslike | 305 | 472 | 740 |
| Shrub/Vine | 30 | 105 | 180 |
| Forb | 65 | 123 | 180 |
| **Total** | **400** | **700** | **1100** |

**Figure 15. Plant community growth curve (percent production by month). SD6303, Pierre Shale Plains, cool/warm-season codominant.. Cool-season, warm-season codominant..**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 3 | 10 | 20 | 28 | 21 | 10 | 5 | 3 | 0 | 0 |

### State 4
### Renovated (R) Sod State

The forage production potential of a shortgrass plant community can be quickly improved through mechanical renovation. Mechanical renovation creates microrelief that can restore, hydrologic function by increasing infiltration and decreasing runoff. These factors favor cool-season species such as western wheatgrass, green needlegrass, and a variety of forbs. With proper management after renovation, this plant community will have similar plant composition and growth curve characteristics of the Reference State (1.0). The main difference is the microrelief created by the renovation, and the alteration to the soil flora and fauna. Production could be higher, depending on the degree of mechanical alteration. Proper grazing management must be implemented to maintain this plant community.

### Community 4.1
### (R) Western Wheatgrass-Green Needlegrass-Blue Grama-Buffalograss

With proper management after renovation (R), this plant community will have very similar plant composition and growth curve characteristics of the Western Wheatgrass-Blue Grama-Buffalograss Plant Community (1.2). Production could be slightly higher, depending on the degree of mechanical alteration. Proper grazing management must be included and maintained in order to derive the benefits of renovation.

### Community 4.2
### (R) Blue Grama-Buffalograss Sod Plant Community

This plant community will be similar to the Blue Grama-Buffalograss Sod Plant Community (2.1) in most respects. The main difference is the microrelief created by the renovation. Depending on the renovation technique, the microrelief can remain on the landscape for many decades making vehicular travel across the landscape uncomfortable if not extremely difficult.

### Pathway 4.1A
### Community 4.1 to 4.2

Heavy continuous season-long grazing or heavy continuous seasonal grazing (spring grazing) or extended drought without change in grazing management can shift the renovated (R) Western Wheatgrass-Green Needlegrass-Blue Grama-Buffalograss Plant Community (4.1) to the (R) Blue Grama-Buffalograss Sod Plant Community (4.2).

### Pathway 4.2A
### Community 4.2 to 4.1

This plant community can be returned to (R) Western Wheatgrass-Green Needlegrass-Blue Grama-Buffalograss Plant Community Phase (4.1) through another mechanical renovation treatment, and possibly inter-seeding, followed by long-term prescribed grazing and normal precipitation patterns. The 2nd mechanical treatment may make travel across the landscape difficult for vehicles and livestock.

## State 5
## Native/Invaded State

This State has been invaded by Kentucky bluegrass and/or smooth brome but not at the levels where the plant community is dominated by these species. This State is ‘At Risk’ of transitioning to the Invaded State (6.0) which is dominated by smooth brome and/or Kentucky bluegrass. Prescribed burning and/or chemical herbicides, and targeted grazing can be used to reduce the amount of smooth brome and Kentucky bluegrass in the plant community but it will not be completely removed. At this point a restoration pathway to the Reference State does not exist.

### Community 5.1
### Western Wheatgrass-Green Needlegrass-Non-Native Cool-Season Grasses Plant Community

This plant community develops when Kentucky bluegrass or smooth brome become established on the site. This may occur due to close proximity to seed sources or expansion from road ditches, improved pastures or other invaded sites. No use and no fire or very light stocking rates for long periods of time 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 made up of 80 to 85 percent grass or grass-like plants, 5 to 10 percent forbs, and 5 percent shrubs. The dominate grasses will be western wheatgrass, needlegrasses and non-native cool-season grasses, primarily, smooth brome and/or Kentucky bluegrass. Warm-season grasses will include patches of little bluestem and sideoats grama. Forbs will be diverse but not dominant and some shrubs will persist. Forage production can be variable.

### State 6
### Invaded State

This state is the result of invasion and dominance of introduced species. This state is characterized by the dominance of Kentucky bluegrass and smooth brome, and an increasing thatch layer that effectively blocks introduction of other plants into the system. Plant litter accumulation tends to favor the more shade tolerant, introduced grass species. The nutrient cycle is also impaired, the result is typically a higher level of nitrogen which also favors the introduced species. Increasing plant litter decreases the amount of sunlight reaching plant crowns thereby shifting competitive advantage to shade tolerant, introduced grass species. Studies indicate that soil biological activity is altered, and this shift apparently exploits the soil microclimate and encourages growth of the introduced grass species. Once the threshold is crossed, a change in grazing management alone cannot cause a reduction in the invasive grass dominance. Preliminary studies would tend to indicate this threshold may exist when Kentucky bluegrass exceeds 30 percent of the plant community and native grasses represent less than 40 percent of the plant community composition. Plant communities dominated by Kentucky bluegrass have significantly less cover and diversity of native grasses and forb species (Toledo, D. et al., 2014).

### Community 6.1
### Smooth Brome-Kentucky Bluegrass (>30%) Plant Community

This plant community is dominated by Kentucky bluegrass or smooth brome and/or other non-native cool season grasses (30 percent or more of the PC). 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 made up of approximately 80 to 85 percent grasses and grass-like species, 5 to 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 cudweed sagewort, goldenrod, scurfpea, and western ragweed. Production will be significantly reduced when compared to the interpretive plant community. The period when palatability is high is relatively short, as Kentucky bluegrass and smooth brome matures rapidly. Energy capture is also reduced. Runoff is high and biological activity in the soil is likely reduced significantly in this phase.

### State 7
### Disturbed State

Any State or Plant Community Phase can transition to the Disturbed State (7.0). The two separate vegetative Plant Communities are highly variable in nature. They are derived through different management scenarios, and are not related successionally. Infiltration, runoff, and soil erosion varies depending on the vegetation present on the site.

### Community 7.1
### Go-back or Introduced Plant Communities

The Go-back plant community can be reached whenever severe mechanical disturbance occurs (e.g., tilled and abandoned land, either past or present). During the early successional stages, the species that mainly dominate 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 bromegrass, crested wheatgrass, buffalograss, broom snakeweed, sweetclover, and nonnative thistles. Other plants that commonly occur on the site include western wheatgrass, deathcamas, prickly lettuce, marestail, kochia, foxtail, and sunflowers. Bare ground is prevalent due to the loss of organic matter and lower overall soil health. The Introduced Plant Community is normally those areas seeded to pubescent or intermediate wheatgrass, alfalfa, crested wheatgrass, or other introduced species. Refer to the associated Forage Suitability Group description for adapted species.

### Transition 1A
### State 1 to 2

Heavy continuous season-long grazing (stocking above capacity and grazing most or all of growing season), heavy continuous seasonal grazing (grazing at the same time of year every year) will shift this plant community to the Shortgrass State (2.0). Drought will expedite the transition especially if stocking rates are not adjusted to current

conditions.

### Transition 1B
### State 1 to 5

Invasion of non-native cool-season grasses, no use and no fire and long-term light stocking will cause the Reference Plant Communities to transition to a Native/Invaded State (5.0). Forage production may not change significantly, however species diversity will become smaller and litter will increase.

### Transition 8A
### State 1 to 7

Heavy disturbance including tillage, abandoned cropland or seeding to improved pasture species result in a transition to the Disturbed State (7.0).

### Restoration pathway 2A
### State 2 to 1

Long-term prescribed grazing may potentially convert the plant community to the Western Wheatgrass-Blue Grama-Buffalograss Plant Community (1.2), assuming an adequate seed/vegetative source is present. This could require significant time and input to achieve and a return to normal precipitation patterns, in the end may not meet management objectives.

### Transition 2A
### State 2 to 3

Heavy continuous season-long grazing and/or frequent severe defoliation will likely move this plant community to the Early Seral State (3.0). Heavy grazing in combination with drought can also expedite this this transition.

### Transition 2B
### State 2 to 4

Mechanical renovation such as pitting, light disking, chiseling and possible inter-seeding in combination with long-term prescribed grazing will help improve the productivity of the site. This pathway will convert the plant community to the Renovated State (4.0).

### Transition 8A
### State 2 to 7

Heavy disturbance including tillage, abandoned cropland or seeding to improved pasture species result in a transition to the Disturbed State (7.0).

### Restoration pathway 3A
### State 3 to 2

After removing the disturbance that created the Early Seral State (3.0) and long-term prescribed grazing, including adequate rest periods, and normal precipitation patterns this plant community will transition back to the Shortgrass State (2.0) and possible through the successional stages eventually leading to the Western Wheatgrass-Blue Grama-Buffalograss Plant Community (1.2). Depending on the slope, aspect, and size, and if adequate perennial plants exist, this change can occur more rapidly but typically it will take an extended period of time and may not meet management objectives.

### Transition 3A
### State 3 to 6

If this plant community is invaded by non-native cool-season grasses and the disturbance causing the frequent defoliation is removed this plant community is likely to transition to the Invaded State (6.0).

### Transition 8A
### State 3 to 7

Heavy disturbance including tillage, abandoned cropland or seeding to improved pasture species result in a transition to the Disturbed State (7.0).

### Transition 8A
### State 4 to 7

Heavy disturbance including tillage, abandoned cropland or seeding to improved pasture species result in a transition to the Disturbed State (7.0).

### Transition 5A
### State 5 to 6

Heavy continuous season-long grazing, or no use and no fire, or long-term light grazing will cause a transition of the Native/Invaded State (5.0) to the Invaded State (6.0). The ecological threshold can be identified by the percentage of non-native cool-season species in the Plant Community. Preliminary studies would tend to indicate this threshold may exist when Kentucky bluegrass exceeds 30 percent of the plant community and native grasses represent less than 40 percent of the plant community composition (Toledo, D. et al., 2014). Smooth brome is assumed to follow a similar ecological threshold but is not documented scientifically.

### Transition 8A
### State 5 to 7

Heavy disturbance including tillage, abandoned cropland or seeding to improved pasture species result in a transition to the Disturbed State (7.0).

### Transition 8A
### State 6 to 7

Heavy disturbance including tillage, abandoned cropland or seeding to improved pasture species result in a transition to the Disturbed State (7.0).

## 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 | **Wheatgrass** | | | 875–1250 | |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 875–1250 | – |
| | slender wheatgrass | ELTR7 | *Elymus trachycaulus* | 0–125 | – |
| 2 | **Needlegrass** | | | 375–750 | |
| | green needlegrass | NAVI4 | *Nassella viridula* | 375–750 | – |
| | porcupinegrass | HESP11 | *Hesperostipa spartea* | 50–250 | – |
| | needle and thread | HECOC8 | *Hesperostipa comata ssp. comata* | 0–125 | – |
| 3 | **Tall/Mid Warm-season** | | | 250–375 | |
| | sideoats grama | BOCU | *Bouteloua curtipendula* | 125–375 | – |
| | big bluestem | ANGE | *Andropogon gerardii* | 0–250 | – |
| | little bluestem | SCSC | *Schizachyrium scoparium* | 0–125 | – |
| 4 | **Short Warm-season** | | | 75–250 | |

| | | | | | |
|---|---|---|---|---|---|
| | blue grama | BOGR2 | *Bouteloua gracilis* | 50–250 | – |
| | buffalograss | BODA2 | *Bouteloua dactyloides* | 25–125 | – |
| | threeawn | ARIST | *Aristida* | 0–75 | – |
| 5 | **Other Native Grasses** | | | 0–125 | |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 0–125 | – |
| | plains muhly | MUCU3 | *Muhlenbergia cuspidata* | 0–75 | – |
| | Grass, perennial | 2GP | *Grass, perennial* | 0–50 | – |
| 6 | **Grass-likes** | | | 25–125 | |
| | threadleaf sedge | CAFI | *Carex filifolia* | 25–75 | – |
| | needleleaf sedge | CADU6 | *Carex duriuscula* | 0–50 | – |
| | sun sedge | CAINH2 | *Carex inops ssp. heliophila* | 0–25 | – |
| **Forb** | | | | | |
| 8 | **Forbs** | | | 125–250 | |
| | Forb, native | 2FN | *Forb, native* | 0–75 | – |
| | false boneset | BREU | *Brickellia eupatorioides* | 0–75 | – |
| | white sagebrush | ARLU | *Artemisia ludoviciana* | 25–75 | – |
| | milkvetch | ASTRA | *Astragalus* | 0–50 | – |
| | dotted blazing star | LIPU | *Liatris punctata* | 25–50 | – |
| | desertparsley | LOMAT | *Lomatium* | 0–50 | – |
| | scurfpea | PSORA2 | *Psoralidium* | 25–50 | – |
| | upright prairie coneflower | RACO3 | *Ratibida columnifera* | 0–50 | – |
| | goldenrod | SOLID | *Solidago* | 25–50 | – |
| | scarlet globemallow | SPCO | *Sphaeralcea coccinea* | 25–50 | – |
| | white prairie aster | SYFA | *Symphyotrichum falcatum* | 25–50 | – |
| | American vetch | VIAM | *Vicia americana* | 25–50 | – |
| | wavyleaf thistle | CIUN | *Cirsium undulatum* | 0–50 | – |
| | prairie clover | DALEA | *Dalea* | 0–50 | – |
| | sanddune wallflower | ERCAC | *Erysimum capitatum var. capitatum* | 25–50 | – |
| | western yarrow | ACMIO | *Achillea millefolium var. occidentalis* | 0–50 | – |
| | textile onion | ALTE | *Allium textile* | 25–50 | – |
| | Cuman ragweed | AMPS | *Ambrosia psilostachya* | 0–50 | – |
| | leafy wildparsley | MUDI | *Musineon divaricatum* | 0–50 | – |
| | beardtongue | PENST | *Penstemon* | 0–25 | – |
| | spiny phlox | PHHO | *Phlox hoodii* | 0–25 | – |
| | pussytoes | ANTEN | *Antennaria* | 0–25 | – |
| | scarlet beeblossom | GACO5 | *Gaura coccinea* | 0–25 | – |
| | deathcamas | ZIGAD | *Zigadenus* | 0–25 | – |
| | American bird's-foot trefoil | LOUNU | *Lotus unifoliolatus var. unifoliolatus* | 0–25 | – |
| **Shrub/Vine** | | | | | |
| 9 | **Shrubs** | | | 25–125 | |
| | Shrub (>.5m) | 2SHRUB | *Shrub (>.5m)* | 0–50 | – |
| | prairie sagewort | ARFR4 | *Artemisia frigida* | 0–50 | – |

| | | | | | |
|---|---|---|---|---|---|
| | rose | ROSA5 | *Rosa* | 0–50 | – |
| | pricklypear | OPUNT | *Opuntia* | 0–25 | – |

**Table 10. Community 1.2 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Lb/Acre) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Wheatgrass** | | | 285–380 | |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 285–380 | – |
| | slender wheatgrass | ELTR7 | *Elymus trachycaulus* | 0–38 | – |
| 2 | **Needlegrass** | | | 95–285 | |
| | green needlegrass | NAVI4 | *Nassella viridula* | 95–285 | – |
| | needle and thread | HECOC8 | *Hesperostipa comata ssp. comata* | 19–95 | – |
| | porcupinegrass | HESP11 | *Hesperostipa spartea* | 0–95 | – |
| 3 | **Tall/Mid Warm-season** | | | 95–190 | |
| | sideoats grama | BOCU | *Bouteloua curtipendula* | 95–190 | – |
| | little bluestem | SCSC | *Schizachyrium scoparium* | 0–38 | – |
| | big bluestem | ANGE | *Andropogon gerardii* | 0–38 | – |
| 4 | **Short Warm-season** | | | 190–570 | |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 190–380 | – |
| | buffalograss | BODA2 | *Bouteloua dactyloides* | 95–190 | – |
| | threeawn | ARIST | *Aristida* | 0–95 | – |
| 5 | **Other Native Grasses** | | | 0–95 | |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 0–95 | – |
| | plains muhly | MUCU3 | *Muhlenbergia cuspidata* | 0–57 | – |
| | Grass, perennial | 2GP | *Grass, perennial* | 0–38 | – |
| 6 | **Grass-likes** | | | 95–190 | |
| | threadleaf sedge | CAFI | *Carex filifolia* | 95–190 | – |
| | needleleaf sedge | CADU6 | *Carex duriuscula* | 0–95 | – |
| | sun sedge | CAINH2 | *Carex inops ssp. heliophila* | 0–19 | – |
| 7 | **Non-native Grasses** | | | 0–380 | |
| | smooth brome | BRIN2 | *Bromus inermis* | 0–285 | – |
| | bluegrass | POA | *Poa* | 0–190 | – |
| | cheatgrass | BRTE | *Bromus tectorum* | 0–95 | – |
| **Forb** | | | | | |
| 8 | **Forbs** | | | 95–190 | |
| | sweetclover | MELIL | *Melilotus* | 0–190 | – |
| | yellow salsify | TRDU | *Tragopogon dubius* | 0–76 | – |
| | leafy wildparsley | MUDI | *Musineon divaricatum* | 0–57 | – |
| | scarlet globemallow | SPCO | *Sphaeralcea coccinea* | 0–57 | – |
| | white prairie aster | SYFA | *Symphyotrichum falcatum* | 0–57 | – |
| | white sagebrush | ARLU | *Artemisia ludoviciana* | 0–57 | – |
| | Forb, native | 2FN | *Forb, native* | 0–57 | – |
| | desertparsley | LOMAT | *Lomatium* | 0–57 | – |
| | Forb, introduced | 2FI | *Forb, introduced* | 0–38 | |

| | | | | | |
|---|---|---|---|---|---|
| | Forb, introduced | 2FI | *Forb, introduced* | 0–38 | – |
| | dotted blazing star | LIPU | *Liatris punctata* | 0–38 | – |
| | western yarrow | ACMIO | *Achillea millefolium var. occidentalis* | 0–38 | – |
| | textile onion | ALTE | *Allium textile* | 0–38 | – |
| | Cuman ragweed | AMPS | *Ambrosia psilostachya* | 0–38 | – |
| | pussytoes | ANTEN | *Antennaria* | 0–38 | – |
| | milkvetch | ASTRA | *Astragalus* | 0–38 | – |
| | false boneset | BREU | *Brickellia eupatorioides* | 0–38 | – |
| | wavyleaf thistle | CIUN | *Cirsium undulatum* | 0–38 | – |
| | prairie clover | DALEA | *Dalea* | 0–38 | – |
| | spiny phlox | PHHO | *Phlox hoodii* | 0–38 | – |
| | scurfpea | PSORA2 | *Psoralidium* | 0–38 | – |
| | upright prairie coneflower | RACO3 | *Ratibida columnifera* | 0–38 | – |
| | goldenrod | SOLID | *Solidago* | 0–38 | – |
| | American vetch | VIAM | *Vicia americana* | 0–38 | – |
| | deathcamas | ZIGAD | *Zigadenus* | 0–38 | – |
| | vervain | VERBE | *Verbena* | 0–19 | – |
| | beardtongue | PENST | *Penstemon* | 0–19 | – |
| | sanddune wallflower | ERCAC | *Erysimum capitatum var. capitatum* | 0–19 | – |
| | scarlet beeblossom | GACO5 | *Gaura coccinea* | 0–19 | – |
| | curlycup gumweed | GRSQ | *Grindelia squarrosa* | 0–19 | – |
| | American bird's-foot trefoil | LOUNU | *Lotus unifoliolatus var. unifoliolatus* | 0–19 | – |
| **Shrub/Vine** | | | | | |
| 9 | **Shrubs** | | | 95–190 | |
| | prairie sagewort | ARFR4 | *Artemisia frigida* | 0–95 | – |
| | pricklypear | OPUNT | *Opuntia* | 0–57 | – |
| | rose | ROSA5 | *Rosa* | 0–57 | – |
| | broom snakeweed | GUSA2 | *Gutierrezia sarothrae* | 0–38 | – |
| | Shrub (>.5m) | 2SHRUB | *Shrub (>.5m)* | 0–38 | – |

**Table 11. Community 2.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Lb/Acre) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Wheatgrass** | | | 55–165 | |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 55–165 | – |
| | slender wheatgrass | ELTR7 | *Elymus trachycaulus* | 0–11 | – |
| 2 | **Needlegrass** | | | 22–55 | |
| | needle and thread | HECOC8 | *Hesperostipa comata ssp. comata* | 22–55 | – |
| | porcupinegrass | HESP11 | *Hesperostipa spartea* | 0–22 | – |
| | green needlegrass | NAVI4 | *Nassella viridula* | 0–22 | – |
| 3 | **Tall/Mid Warm-season** | | | 0–55 | |
| | sideoats grama | BOCU | *Bouteloua curtipendula* | 0–55 | – |

| | | | | | |
|---|---|---|---|---|---|
| | little bluestem | SCSC | *Schizachyrium scoparium* | 0–11 | – |
| | big bluestem | ANGE | *Andropogon gerardii* | 0–11 | – |
| 4 | **Short Warm-season** | | | 495–660 | |
| | buffalograss | BODA2 | *Bouteloua dactyloides* | 275–385 | – |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 220–330 | – |
| | threeawn | ARIST | *Aristida* | 11–110 | – |
| 5 | **Other Native Grasses** | | | 0–55 | |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 0–55 | – |
| | plains muhly | MUCU3 | *Muhlenbergia cuspidata* | 0–33 | – |
| | Grass, perennial | 2GP | *Grass, perennial* | 0–22 | – |
| 6 | **Grass-likes** | | | 55–165 | |
| | threadleaf sedge | CAFI | *Carex filifolia* | 55–165 | – |
| | needleleaf sedge | CADU6 | *Carex duriuscula* | 0–55 | – |
| | sun sedge | CAINH2 | *Carex inops ssp. heliophila* | 0–22 | – |
| 7 | **Non-native Grasses** | | | 0–55 | |
| | smooth brome | BRIN2 | *Bromus inermis* | 0–55 | – |
| | cheatgrass | BRTE | *Bromus tectorum* | 0–55 | – |
| | bluegrass | POA | *Poa* | 0–55 | – |
| **Forb** | | | | | |
| 8 | **Forbs** | | | 55–110 | |
| | sweetclover | MELIL | *Melilotus* | 0–110 | – |
| | scarlet globemallow | SPCO | *Sphaeralcea coccinea* | 0–55 | – |
| | desertparsley | LOMAT | *Lomatium* | 0–44 | – |
| | Forb, introduced | 2FI | *Forb, introduced* | 0–44 | – |
| | Forb, native | 2FN | *Forb, native* | 0–33 | – |
| | leafy wildparsley | MUDI | *Musineon divaricatum* | 0–33 | – |
| | white sagebrush | ARLU | *Artemisia ludoviciana* | 0–33 | – |
| | curlycup gumweed | GRSQ | *Grindelia squarrosa* | 0–33 | – |
| | white prairie aster | SYFA | *Symphyotrichum falcatum* | 0–33 | – |
| | upright prairie coneflower | RACO3 | *Ratibida columnifera* | 0–33 | – |
| | goldenrod | SOLID | *Solidago* | 0–22 | – |
| | spiny phlox | PHHO | *Phlox hoodii* | 0–22 | – |
| | scurfpea | PSORA2 | *Psoralidium* | 0–22 | – |
| | yellow salsify | TRDU | *Tragopogon dubius* | 0–22 | – |
| | vervain | VERBE | *Verbena* | 0–22 | – |
| | deathcamas | ZIGAD | *Zigadenus* | 0–22 | – |
| | dotted blazing star | LIPU | *Liatris punctata* | 0–22 | – |
| | milkvetch | ASTRA | *Astragalus* | 0–22 | – |
| | American bird's-foot trefoil | LOUNU | *Lotus unifoliolatus var. unifoliolatus* | 0–22 | – |
| | western yarrow | ACMIO | *Achillea millefolium var. occidentalis* | 0–22 | – |
| | textile onion | ALTE | *Allium textile* | 0–22 | – |
| | Cuman ragweed | AMPS | *Ambrosia psilostachya* | 0–22 | – |

| | | | | | |
|---|---|---|---|---|---|
| | pussytoes | ANTEN | *Antennaria* | 0–22 | – |
| | wavyleaf thistle | CIUN | *Cirsium undulatum* | 0–22 | – |
| | prairie clover | DALEA | *Dalea* | 0–11 | – |
| | fetid marigold | DYPA | *Dyssodia papposa* | 0–11 | – |
| | sanddune wallflower | ERCAC | *Erysimum capitatum var. capitatum* | 0–11 | – |
| | scarlet beeblossom | GACO5 | *Gaura coccinea* | 0–11 | – |
| | beardtongue | PENST | *Penstemon* | 0–11 | – |
| | false boneset | BREU | *Brickellia eupatorioides* | 0–11 | – |
| | American vetch | VIAM | *Vicia americana* | 0–11 | – |
| **Shrub/Vine** | | | | | |
| 9 | **Shrubs** | | | 55–110 | |
| | prairie sagewort | ARFR4 | *Artemisia frigida* | 0–55 | – |
| | pricklypear | OPUNT | *Opuntia* | 11–55 | – |
| | broom snakeweed | GUSA2 | *Gutierrezia sarothrae* | 0–33 | – |
| | rose | ROSA5 | *Rosa* | 0–22 | – |
| | Shrub (>.5m) | 2SHRUB | *Shrub (>.5m)* | 0–22 | – |

**Table 12. Community 3.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Lb/Acre) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Wheatgrass** | | | 75–35 | |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 7–35 | – |
| 2 | **Needlegrass** | | | 0–35 | |
| | needle and thread | HECOC8 | *Hesperostipa comata ssp. comata* | 0–28 | – |
| | green needlegrass | NAVI4 | *Nassella viridula* | 0–7 | – |
| 3 | **Tall/Mid Warm-season** | | | 0–14 | |
| | sideoats grama | BOCU | *Bouteloua curtipendula* | 0–14 | – |
| | little bluestem | SCSC | *Schizachyrium scoparium* | 0–7 | – |
| 4 | **Short Warm-season** | | | 70–315 | |
| | threeawn | ARIST | *Aristida* | 70–245 | – |
| | buffalograss | BODA2 | *Bouteloua dactyloides* | 7–140 | – |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 7–140 | – |
| 5 | **Other Native Grasses** | | | 0–70 | |
| | Grass, perennial | 2GP | *Grass, perennial* | 0–70 | – |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 0–14 | – |
| | plains muhly | MUCU3 | *Muhlenbergia cuspidata* | 0–7 | – |
| 6 | **Grass-likes** | | | 14–35 | |
| | threadleaf sedge | CAFI | *Carex filifolia* | 14–35 | – |
| | needleleaf sedge | CADU6 | *Carex duriuscula* | 0–14 | – |
| | sun sedge | CAINH2 | *Carex inops ssp. heliophila* | 0–7 | – |
| 7 | **Non-native Grasses** | | | 0–56 | |
| | cheatgrass | BRTE | *Bromus tectorum* | 7–56 | – |
| | bluegrass | POA | *Poa* | 0–14 | – |

| | | | | | |
|---|---|---|---|---|---|
| | smooth brome | BRIN2 | *Bromus inermis* | 0–14 | – |
| **Forb** | | | | | |
| 8 | **Forbs** | | | 70–175 | |
| | sweetclover | MELIL | *Melilotus* | 0–70 | – |
| | Forb, introduced | 2FI | *Forb, introduced* | 0–70 | – |
| | fetid marigold | DYPA | *Dyssodia papposa* | 14–70 | – |
| | curlycup gumweed | GRSQ | *Grindelia squarrosa* | 0–35 | – |
| | Cuman ragweed | AMPS | *Ambrosia psilostachya* | 14–35 | – |
| | pussytoes | ANTEN | *Antennaria* | 0–35 | – |
| | white sagebrush | ARLU | *Artemisia ludoviciana* | 7–35 | – |
| | vervain | VERBE | *Verbena* | 14–35 | – |
| | Forb, native | 2FN | *Forb, native* | 0–21 | – |
| | western yarrow | ACMIO | *Achillea millefolium var. occidentalis* | 0–14 | – |
| | scarlet globemallow | SPCO | *Sphaeralcea coccinea* | 0–14 | – |
| | white prairie aster | SYFA | *Symphyotrichum falcatum* | 0–14 | – |
| | yellow salsify | TRDU | *Tragopogon dubius* | 0–7 | – |
| | spiny phlox | PHHO | *Phlox hoodii* | 0–7 | – |
| | upright prairie coneflower | RACO3 | *Ratibida columnifera* | 0–7 | – |
| | dotted blazing star | LIPU | *Liatris punctata* | 0–7 | – |
| | desertparsley | LOMAT | *Lomatium* | 0–7 | – |
| **Shrub/Vine** | | | | | |
| 9 | **Shrubs** | | | 35–175 | |
| | prairie sagewort | ARFR4 | *Artemisia frigida* | 14–105 | – |
| | broom snakeweed | GUSA2 | *Gutierrezia sarothrae* | 7–70 | – |
| | pricklypear | OPUNT | *Opuntia* | 7–70 | – |
| | rose | ROSA5 | *Rosa* | 0–7 | – |
| | Shrub (>.5m) | 2SHRUB | *Shrub (>.5m)* | 0–7 | – |

## Animal community

The following table lists 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). Because of this, 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.

Western Wheatgrass-Green Needlegrass Plant Community (1.1)
2500 lbs./acre, air-dry: 0.69 AUM/acre

Western Wheatgrass-Blue Grama-Buffalograss Plant Community (1.2)
1900 lbs./acre, air-dry: 0.52 AUM/acre

Blue Grama-Buffalograss Sod Plant Community (2.1)
1100 lbs./acre, air-dry: 0.30 AUM/acre

Threeawn-Annuals Plant Community (3.1)
700 lbs./acre, air-dry: 0.19 AUM/acre

Other Plant Community Phases have highly variable forage production levels. Actual on-site forage inventories will need to be conducted to determine average annual production and stocking rates.

*Based on 912 lbs./acre (air-dry weight) per Animal Unit Month (AUM), and on 25 percent harvest efficiency of preferred and desirable forage species (refer to USDA NRCS, National Range and Pasture Handbook).

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide yearlong forage. 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 group D, with localized areas in hydrologic group C. 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, and/or smooth bromegrass 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 Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

## Recreational uses

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

## Wood products

No appreciable wood products are typically present on this site.

## Other products

Seed harvest of native plant species can provide additional income on this site.

## Other information

Revision Notes: “Previously Approved Provisional
This Provisional ecological site concept has passed Quality Control (QC) and Quality Assurance (QA) to ensure that the site meets the 2014 NESH standards for a Provisional ecological site. This is an updated “Previously Approved” ESD which represents a first generation tier of documentation that prior to the release of the 2014 National Ecological Site Handbook (NESH), met all requirement as an Approved ESD as laid out in the 2003 National Range and Pasture Handbook (NRPH). The document fully describe 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 five years and is a proven functional document for conservation planning. The “Previously Approved” ESD does not contain all tabular and narrative entries as required in the current Approved level of documentation but it is expected that the “Previously Approved” ESD will continue refinement towards an Approved status.

Site Development and Testing Plan:
Future work, as described in a Project Plan, to validate the information in this Provisional Ecological Site Description is needed. This will include field activities to collect low, medium and high intensity sampling, soil correlations, and analysis of that data. Annual field reviews should be done by soil scientists and vegetation

specialists. A final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed 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: April Boltjes, Range Management Specialist (RMS), NRCS; Stan Boltz, RMS, NRCS; Kent Cooley, Soil Scientist, NRCS; Rick Peterson, RMS, NRCS; and L. Michael Stirling, RMS, NRCS.

20 SCS-RANGE-417's gathered from 1968-1986, in Campbell, Corson, Haakon, Jones, Lyman, Mellette, Stanley, Walworth, and Ziebach Counties, in South Dakota.

## Other references

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## Contributors

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## Acknowledgments

Rick L. Peterson Updated ESD 8/16/16

## 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 | stanley.boltz@sd.usda.gov |
| Date | 07/02/2007 |
| Approved by | Stan Boltz |
| Approval date | |
| Composition (Indicators 10 and 12) based on | Annual Production |

## Indicators

1. **Number and extent of rills:** Rills should not be present.

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2. **Presence of water flow patterns:** Barely observable.

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3. **Number and height of erosional pedestals or terracettes:** Essentially nonexistent.

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

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5. **Number of gullies and erosion associated with gullies:** Active gullies should not be present.

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

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7. **Amount of litter movement (describe size and distance expected to travel):** Little to no plant litter movement. Plant litter remains in place and is not moved by erosional forces.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability class usually 6. Typically, high root content, organic matter, and granular structure. Soil surface is very resistant to erosion.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Use soil series description for depth and color of A-horizon.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Healthy, deep rooted native grasses enhance infiltration and reduce runoff.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction layer should be evident. Somewhat restrictive layers of clayey texture can occur at depths of less than 14 inches.

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

    Dominant: Cool-season deep-rooted rhizomatous grasses >> cool-season bunchgrasses >

    Sub-dominant: tall/mid warm-season grasses >

    Other: short warm-season grasses = forbs > shrubs

Additional:

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.

14. **Average percent litter cover (%) and depth ( in):** 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):** Production ranges from 1,800-3,200 lbs./acre (air-dry weight). Reference value production is 2,500 lbs./acre (air-dry weight).

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.

17. **Perennial plant reproductive capability:** All species are capable of reproducing.