USDA Natural Resources Conservation Service

Ecological site R063BY010SD
Loamy

Last updated: 9/27/2018
Accessed: 05/10/2025

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): 063B–Southern Rolling Pierre Shale Plains

MLRA Notes:
The Southern Rolling Pierre Shale Plains (MLRA 63B) is approximately 4,460 square miles in size. The majority of the MLRA is located in South Dakota (82 percent), and the remaining 18 percent is located in Nebraska. Interstate 90 crosses the northern portion through Chamberlin, SD. There are several American Indian Reservations, including the Lower Brule, Crow Creek, Santee, and Yankton Reservations.
This MLRA is an area of old plateaus and terraces that have been deeply eroded, with nearly level to rolling long slopes and well-defined dendritic drainage systems. The rivers and creek valleys have smooth floors and steep walls. The majority of the MLRA is located in the unglaciated section of the Missouri Plateau, Great Plains Province. The northeast corner of the MLRA, east of the Missouri River, is located in the glaciated section with higher areas having deposits of glacial drift. The southwestern tip is located in the High Plains Section.
Elevations range from 1,310 feet to 1,640 feet on the bottom lands along the Missouri River, and from 1,310 feet to 1,970 feet on the shale plains uplands.
The Missouri and Niobrara Rivers, and the confluence of the White and Missouri Rivers, occur within this MLRA. Lake Francis Case, Fort Randall Dam, and Lewis and Clark Lake are also within this MLRA’s borders.
Cretaceous Pierre Shale underlies most of the area. This is a marine sediment with layers of volcanic ash that has been altered to smectitic clays. These clays shrink as they dry and swell as they become wet, causing significant problems for road and structural foundations.

Younger Niobrara chalk occurs in the southern part of the MLRA. Alluvial sand and gravel underlie the valley floors along major streams.

Soils are shallow to very deep, generally well drained, and with loamy or clayey textures. Annual precipitation is 19 to 26 inches, mostly falling during the growing season, as frontal storms during the spring and convective thunderstorms in summer. The average annual temperature is 45°-50°F. The freeze-free period averages 165 days, and ranges from 145 to 185 days.

Vegetation is a transition between tall prairie grasses and mixed prairie grasses. Green needlegrass, porcupinegrass, western wheatgrass, and big bluestem are the major species. Little bluestem, buffalograss, sideoats grama, and sedges are dominant on the shallow soils. Buffaloberry, skunkbush sumac, and prairie rose are common on steep slopes along the major streams. Prairie cottonwood and a variety of willow species are common on flood plains along the major streams. Green ash, boxelder, chokecherry, bur oak, and buffaloberry occur in draws and narrow valleys. Encroachment of Rocky Mountain juniper and eastern redcedar on to the river breaks is becoming a concern.
The majority of the land is utilized for ranching (60 percent) and farming (27 percent). Major resource concerns for the area are the hazards of wind and/or water erosion, maintenance of the content of organic matter and soil productivity, and management of soil moisture.

Classification relationships

USDA - Land Resource Region G – Western Great Plains Range and Irrigated Region, Major Land Resource Area (MLRA) 63B – Southern Rolling Pierre Shale Plains (USDA-NRCS, Ag Handbook 296).

EPA - Level IV Ecoregions of the Continental United States:

Northwestern Glaciated Plains - 42f – Southern Missouri Coteau Slopes, 42g – Ponca Plains, 42h – Southern River Breaks, 42p – Holt Tablelands

North Western Great Plains - 43C – River Breaks, 43f – Subhumid Pierre Shale Plains, 43r – Niobrara River Breaks.

Ecological site concept

The Loamy ecological site occurs throughout MLRA 63B. It is located on upland landscapes and does not receive additional moisture from runoff or overflow. Typical slopes in this area range from 0 to 20 percent. Soils are deep, with surface textures of loam to silty clay loam 5 to 18 inches thick. Carbonates are typically below 20 inches of the surface. The vegetation in the Reference State (1.0) consists of a mix of cool- and warm-season grasses, however mid-statured cool-season grasses tend to be the dominant group. Western wheatgrass, green needlegrass, and needle and thread are the dominant cool-season grasses, while big bluestem, little bluestem, sideoats grama, blue grama, and buffalograss are the dominant warm-season grasses. Forbs are common and diverse, and shrubs are present, but occur in minor amounts.

Associated sites

R063BY011SD	**Clayey** The Clayey site can be located adjacent to the Loamy site.
R063BY012SD	**Thin Upland** The Thin Upland site can be located on steeper slopes adjacent to the Loamy site.
R063BY017SD	**Shallow Clay** The Shallow Clay site can be located on steeper slopes adjacent to the Loamy site.
R063BY021SD	**Clayey Overflow** The Clayey Overflow site can be located on drainageways adjacent to the Loamy site.

Similar sites

R063BY011SD	**Clayey** The Clayey site will have similar production with more green needlegrass and less needle and thread and big bluestem.
R063BY020SD	**Loamy Overflow** The Loamy Overflow site will have higher production with less needlegrass and more big bluestem.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Pascopyrum smithii* (2) *Andropogon gerardii*

Physiographic features

This site occurs on nearly level to steeply sloping uplands.

Table 2. Representative physiographic features

Landforms	(1) Stream terrace (2) Hill (3) Plain
Runoff class	Low to very high
Flooding frequency	None
Elevation	1,300–2,000 ft
Slope	0–20%
Water table depth	80 in
Aspect	Aspect is not a significant factor

Climatic features

MLRA 63B is considered to have a continental climate: cold winters and hot summers, low humidity, light rainfall, and ample sunshine. Extremes in temperature may also abound. 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 typically ranges from 19 to 24 inches per year. The average annual temperature is about 48°F. January is the coldest month with average temperatures ranging from about 15°F (Stephan, South Dakota (SD)), to about 22°F (Winner, SD). July is the warmest month with temperatures averaging from about 73°F (Stephan, SD), to about 76°F (Winner, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 56°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 (mph) annually, ranging from about 13 mph during the spring to about 10 mph 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 mph.

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. Greenup of cool-season plants may occur in September and October when adequate soil moisture is present.

Table 3. Representative climatic features

Frost-free period (characteristic range)	113-122 days
Freeze-free period (characteristic range)	130-154 days
Precipitation total (characteristic range)	21-24 in

Frost-free period (actual range)	110-126 days
Freeze-free period (actual range)	127-155 days
Precipitation total (actual range)	20-25 in
Frost-free period (average)	118 days
Freeze-free period (average)	141 days
Precipitation total (average)	23 in

Climate stations used

- (1) PICKSTOWN [USC00396574], Lake Andes, SD
- (2) LYNCH [USC00255040], Lynch, NE
- (3) NIOBRARA [USC00255960], Niobrara, NE
- (4) GANN VALLEY 4NW [USC00393217], Gann Valley, SD
- (5) STEPHAN 2 NW [USC00397992], Highmore, SD
- (6) WINNER [USC00399367], Winner, SD
- (7) WOOD [USC00399442], Wood, 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 loam to silty clay loam textured surface soils, with slopes ranging from 0 to 20 percent. The soils in this site are well-drained and formed in loess and alluvium. The surface layer is 5 to 18 inches thick. Subsurface soil textures are silty loam to clay loam. The soils have a moderate to slow infiltration rate. Some soils crack when dry. When these 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 non-restrictive 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.

Major soils correlated the Loamy ecological site include: Agar, Bazile, Keya, Lowry, McClure, Ree, Reliance, and Uly. Access Web Soil Survey http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm) for specific local soils information.

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Loess
Surface texture	(1) Loam (2) Silt loam (3) Silty clay loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Very slow to moderate
Soil depth	29–80 in
Surface fragment cover <=3"	0–5%

Available water capacity (0-40in)	5–8 in
Calcium carbonate equivalent (0-40in)	0–25%
Electrical conductivity (0-40in)	0–4 mmhos/cm
Sodium adsorption ratio (0-40in)	0–2
Soil reaction (1:1 water) (0-40in)	6.1–9
Subsurface fragment volume <=3" (Depth not specified)	0–34%
Subsurface fragment volume >3" (Depth not specified)	0–2%

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 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/or species composition.

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

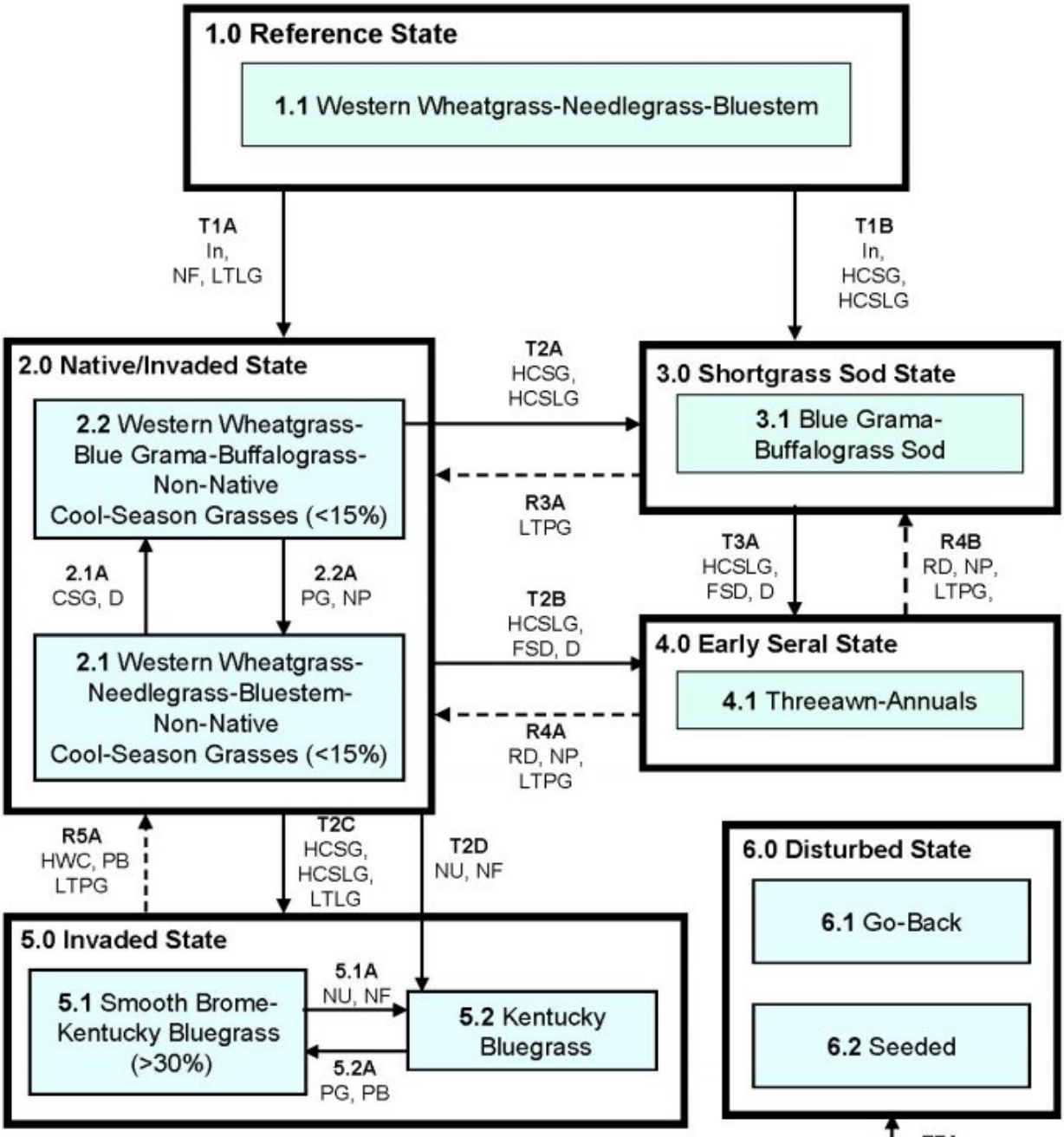
The Reference State may be difficult to locate in this MLRA with the introduction and spread of non-native cool-season grasses. Plant Community 2.1 is most similar to the Reference Plant Community, but a restoration pathway to the Reference State (1.0) is not believed to be achievable because of the persistence of non-native cool-season grasses.

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 grazing events will cause a departure from the Western Wheatgrass- Needlegrass-Bluestem Plant Community (1.1). Blue grama and buffalograss will increase and eventually develop into a sod. Western wheatgrass will increase initially and then begin to decrease. Green needlegrass, needle and thread, porcupinegrass, 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. The invasion of non-native cool-season grasses and extended periods of non-use and/or lack of fire will result in excessive litter and a plant community dominated by cool-season grasses such as green needlegrass, western wheatgrass, Kentucky bluegrass, smooth bromegrass, and annual brome.

The following is a diagram that illustrates the common plant community phases that can occur on the site and the transition pathways between communities and States. These are the most common plant community phases based on current knowledge and experience, and changes may be made as more data is collected. Narratives following the diagram contain more detail pertaining to the ecological processes.

State and transition model

Loamy – R063BY010SD 11/06/17



CSG – Continuous seasonal grazing
C - Cropping
D – Drought
Er - Eroded
FSD – Frequent and severe defoliation
HCSG – Heavy continuous seasonal grazing
HCSLG – Heavy continuous season-long grazing
HD – Heavy disturbance
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 and/or feasible

Diagram Legend - Loamy - R063BY010SD	
T1A	Invasion and establishment of non-native cool-season grasses, no fire, long-term light grazing.
T1B	Invasion and establishment of non-native cool-season grasses, heavy, continuous seasonal grazing, or heavy, continuous season-long grazing.
T2A	Heavy, continuous seasonal grazing, or heavy, continuous season-long grazing.
T2B	Heavy, continuous season-long grazing, frequent and severe defoliation, drought.
T2C	Heavy, continuous seasonal grazing, heavy, continuous season-long grazing, or long-term light grazing.
T2D	Non-use, no fire.
T3A	Heavy, continuous season-long grazing, frequent and severe defoliation, drought.
T7A	Heavy disturbance, soil erosion, cropping, tillage, seeding introduced grasses.
R3A	Long-term prescribed grazing. Transition may not be rapid or meet management goals.
R4A	Removal of grazing disturbance, long-term prescribed grazing, return to normal precipitation patterns. Transition may not be rapid or meet management goals.
R4B	Removal of grazing disturbance, long-term prescribed grazing, return to normal precipitation patterns. Transition may not be rapid or meet management goals.
R5A	Herbaceous weed control, prescribed burning, long-term prescribed grazing.
2.1A	Continuous season-long grazing (spring), drought.
2.2A	Prescribed grazing, return to normal precipitation patterns following drought.
5.1A	Non-use, no fire.
5.2A	Prescribed grazing, prescribed burning.

State 1
Reference State

This State represents what is believed to show the natural range of variability that dominated the dynamics in this ecological site prior to European settlement. This State was co-dominated by cool- and warm-season grasses. In pre-European times, the primary disturbance mechanisms for this site in the Reference condition included frequent fire and grazing by large herding ungulates. Timing of fires and grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Cool-season and taller warm-season grasses would have declined and a corresponding increase in short, warm-season grasses would have occurred. The Reference State can be difficult to find in this MLRA with the introduction and spread of non-native cool-season grasses. An alternate plant community phase dominated by tall and mid-warm-season grasses such as big bluestem, sideoats grama, and little bluestem may also have occurred in this State. This plant community phase could have occurred as a result of frequent spring fires or repeated high-intensity grazing in the early part of the growing season. As this community phase was not as common, it is not described in detail in this document.

Community 1.1
Western Wheatgrass-Needlegrass-Bluestem

Figure 8. Loamy - R063BY010SD - PCP 1.1.

Interpretations are based primarily on the Western Wheatgrass-Needlegrass-Bluestem Plant Community Phase (this is also considered to be the Reference Plant Community). The potential vegetation was about 80 percent

grasses or grass-like plants, 10 percent forbs, and 10 percent shrubs. The community was co-dominated by cool- and warm-season grasses. The major grasses included western wheatgrass, green needlegrass, big bluestem, porcupinegrass, needle and thread, Indiangrass, switchgrass, and sideoats grama. Other grass or grass-like species included blue grama, slender wheatgrass, plains muhly, prairie dropseed, and sedges. This plant community was resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allowed for high tolerance to drought. This was 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	1930	2550	3310
Shrub/Vine	135	225	345
Forb	135	225	345
Total	**2200**	**3000**	**4000**

Figure 10. 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 2
Native/Invaded State

This State represents the more common range of variability that exists with higher levels of grazing management, but in the absence of periodic fire followed by short-term intensive grazing. This State is dominated by native and non-native cool-season grasses, and native warm-season grasses. It 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. Native cool-season species can decline and a corresponding increase in short, warm-season grasses or non-native cool-season grasses will occur.

Community 2.1
Western Wheatgrass-Needlegrass-Bluestem-Non-Native Cool-Season Grasses (<15%)

This plant community phase is similar to the Western Wheatgrass-Needlegrass-Bluestem Plant Community (1.1), but it also contains minor amounts of non-native invasive grass species such as Kentucky bluegrass and smooth bromegrass (up to about 15 percent by air-dry weight). The potential vegetation is about 80 percent grasses or grass-like plants, 10 percent forbs, and 10 percent shrubs. The community is co-dominated by cool- and warm-season grasses. The major grasses include western wheatgrass, green needlegrass, big bluestem, porcupinegrass, needle and thread, Indiangrass, switchgrass, and sideoats grama. Other grass or grass-like species include blue grama, slender wheatgrass, plains muhly, prairie dropseed, and sedges. This plant community is resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high tolerance to drought. This is a sustainable plant community in regards to site/soil stability, watershed function, and biologic integrity.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1930	2550	3310
Shrub/Vine	135	225	345
Forb	135	225	345
Total	**2200**	**3000**	**4000**

Figure 12. 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

Community 2.2
Western Wheatgrass-Blue Grama-Buffalograss-Non-Native Cool-Season Grasses (<15%)

This plant community is a result of continuous seasonal grazing or from overutilization 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 of secondary importance include sideoats grama, little bluestem, green needlegrass, needle and thread, porcupinegrass, big bluestem, Kentucky bluegrass, smooth bromegrass, and sedge. Forbs commonly found in this plant community include white sagebrush (cudweed sagewort), prairie coneflower, and western yarrow. When compared to the Western Wheatgrass-Needlegrass-Bluestem Plant Community (1.1), 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 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1290	1955	2580
Shrub/Vine	105	173	260
Forb	105	173	260
Total	**1500**	**2301**	**3100**

Figure 14. 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 2.1A
Community 2.1 to 2.2

Continuous seasonal grazing, which includes grazing at moderate to heavy stocking levels at the same time of year each year, or a combination of disturbances, such as extended periods of below average precipitation coupled with periodic heavy grazing, will shift this community to the Western Wheatgrass Blue Grama-Buffalograss-Non-Native Cool-Season Grasses (<15%) Plant Community (2.2).

Pathway 2.2A
Community 2.2 to 2.1

Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing possibly including periodic rest and a return to normal precipitation patterns will convert this plant community to the Western Wheatgrass-Needlegrass-Bluestem-Non-Native Cool-Season Grasses (< 15%) Plant Community (2.1).

Conservation practices

Prescribed Grazing

State 3
Shortgrass Sod State

The Shortgrass Sod State is dominated by shortgrass species and upland sedges. This State is the result of grazing patterns that do not provide adequate recovery time for cool-season wheatgrasses and needlegrasses. 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 3.1
Blue Grama-Buffalograss Sod

This plant community evolved under heavy, continuous season-long grazing or from overutilization during extended drought periods. The potential plant community is made up of approximately 78 percent grasses and grass-like species, 15 percent forbs, and 8 percent shrubs. Dominant grasses typically include blue grama and buffalograss. Kentucky bluegrass may also be prevalent. Grasses of secondary importance include sedge and western wheatgrass. Forbs commonly found in this plant community include white sagebrush (cudweed sagewort), field sagewort (green sagewort), sweetclover, and western yarrow. When compared to the Western Wheatgrass-Needlegrass-Bluestem Plant Community (1.1), 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. This plant community is less productive than most other phases. The thick sod prevents other species from getting established. 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 most other grasses. Soil erosion will be minimal due to the sod-forming habit of blue grama and buffalograss.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1005	1275	1515
Forb	70	150	255
Shrub/Vine	25	75	130
Total	**1100**	**1500**	**1900**

Figure 16. 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 4
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. The percentage of bare ground is also much higher than on any other plant community phase.

Community 4.1
Threeawn-Annuals

This plant community developed under continuous heavy grazing or other excessive disturbances (e.g., heavy use 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 threeawn. Other grasses may include annual bromegrass (field brome and downy brome), sedge, blue grama, sand dropseed, Kentucky bluegrass, and western wheatgrass. The dominant forbs include fetid marigold, sweetclover, Cuman ragweed (western ragweed), white sagebrush (cudweed sagewort), and other invader-like species. The dominant shrubs include plains sagewort (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 non-native species because of the relatively high percentage of bare ground. Compared to the Western Wheatgrass-Needlegrass-Bluestem Plant Community (1.1), red threeawn, annual brome grasses, and percentage of bare ground has increased. Western wheatgrass, needlegrasses, and other cool-season grasses have decreased, as have the warm-season species including big bluestem, sideoats grama, little bluestem, plains muhly, and prairie dropseed. 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 caused by 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. This community can be renovated to improve the production capability; however, if management changes are not made, the vegetation could revert back to a threeawn/annual community.

Table 9. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	280	572	835
Forb	105	200	320
Shrub/Vine	15	28	45
Total	**400**	**800**	**1200**

Figure 18. 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 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/or Kentucky bluegrass. Heavy grazing or long-term light grazing (understocked) will tend to result in an increase of smooth bromegrass and or Kentucky bluegrass. 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, and the result is typically a higher level of nitrogen which also favors the introduced species. Increasing plant litter decreases the amount of sunlight reaching plant crowns, thereby shifting competitive advantage to shade-tolerant, introduced grass species. Studies indicate that soil biological activity is altered, and this shift apparently exploits the soil microclimate and encourages growth of the introduced grass species. Once the threshold is crossed, a change in grazing management alone cannot cause a reduction in the invasive grass dominance. Preliminary studies would tend to indicate this threshold may exist when Kentucky bluegrass exceeds 30 percent of the plant community and native grasses represent less than 40 percent of the plant community composition. Plant communities dominated by Kentucky bluegrass have significantly less cover and diversity of native grasses and forb species (Toledo, D. et al., 2014).

Community 5.1
Smooth Bromegrass-Kentucky Bluegrass (> 30%)

This plant community is a result of heavy, continuous seasonal grazing or heavy continuous season-long grazing. It is characterized by a dominance of smooth bromegrass and Kentucky bluegrass. The dominance is at times so complete that other species are difficult to find on the site. This plant community is typically dominated by smooth bromegrass. Infiltration and runoff will be moderately reduced as will energy capture. Production can be equal to or higher than the interpretive plant community (1.1), however the period that palatability is high is relatively short, as these cool-season species mature rapidly.

Table 10. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1495	2160	3095
Forb	105	180	275
Shrub/Vine	0	60	130
Total	**1600**	**2400**	**3500**

Figure 20. 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 5.2
Kentucky Bluegrass

This plant community is a result of extended periods of non-use and no fire, or long-term light grazing. It is characterized by a dominance of Kentucky bluegrass. The dominance is at times so complete that other species are difficult to find on the site. A relatively thick duff layer can sometimes accumulate at or above the soil surface. Nutrient cycling is greatly reduced and native plants have great difficulty becoming established. Infiltration is greatly reduced and runoff is high. Production will be significantly reduced when compared to the interpretive plant community (1.1). The period that palatability is high is relatively short, as Kentucky bluegrass matures rapidly. Energy capture is also reduced. Biological activity in the soil is likely reduced significantly in this plant community.

Table 11. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1070	1464	1735
Forb	30	96	180
Shrub/Vine	0	40	85
Total	**1100**	**1600**	**2000**

Figure 22. 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

Pathway 5.1A
Community 5.1 to 5.2

Non-use and no fire will convert this plant community to the Kentucky Bluegrass Plant Community (5.2).

Pathway 5.2A

Community 5.2 to 5.1

Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to heavy grazing and prescribed burning may convert this plant community to the Smooth Bromegrass-Kentucky Bluegrass Plant Community (5.1).

Conservation practices

Prescribed Grazing

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. The Go-Back (6.1) plant community 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 (6.2) plant community was typically tilled and then seeded to a perennial forage species or mix of species. Infiltration, runoff, and soil erosion will vary depending on the vegetation present on the site.

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 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, broom snakeweed, sweetclover, and non-native thistles. Other plants that commonly occur on the site can include western wheatgrass, prickly lettuce, mare’s-tail, 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 T1A
State 1 to 2

Invasion and spread of non-native cool-season grasses such as Kentucky bluegrass and smooth bromegrass, and disruption of natural disturbance regimes such as periodic fire followed by short-term high intensity grazing or long-term light grazing, will lead the Western Wheatgrass-Needlegrass-Bluestem Plant Community phase over a threshold to the Native/Invaded State (2.0).

Transition T1B
State 1 to 3

Heavy, continuous seasonal grazing (stocking levels well 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 heavy, continuous season-long grazing will convert the Reference State (1.0) to the Shortgrass Sod State (3.0). In addition, invasion of non-native grasses such as Kentucky bluegrass and smooth bromegrass, and disruption of natural disturbance regimes, such as periodic fire followed by short-term high intensity grazing, will exacerbate this transition.

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).

Transition T2A
State 2 to 3

Heavy, continuous seasonal grazing (stocking levels well 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 heavy, continuous season-long grazing will convert this plant community to the Shortgrass Sod State (3.0).

Transition T2B
State 2 to 4

Heavy, continuous season-long grazing or a combination of disturbances such as extended periods of below-average precipitation coupled with frequent and severe defoliation will shift this community to the Early Seral State (4.0).

Transition T2C
State 2 to 5

Heavy, continuous seasonal grazing (stocking levels well above carrying capacity for extended portions of the growing season, and at the same time of year each year, typically beginning after early cool-season grasses have reached boot stage), or heavy, continuous season-long grazing, or long-term light grazing will likely lead this State over a threshold to the Invaded State (5.0).

Transition T2D
State 2 to 5

Non-use and no fire for extended periods of time (typically for 10 or more years) will likely lead this State over a threshold resulting in a shift to the Kentucky Bluegrass Plant Community (5.2).

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 R3A
State 3 to 2

Long-term prescribed grazing (moderate stocking levels coupled with adequate recovery periods, or other grazing systems such as high- density, low-frequency intended to treat specific species dominance, or periodic light to moderate stocking levels, possibly including periodic rest) may lead this plant community over a threshold to the Native/Invaded State (2.0). This will likely take a long period of time, possibly up to 10 years or more, and recovery may not be attainable.

Transition T3A
State 3 to 4

Heavy, continuous season-long grazing and/or frequent severe defoliation or grazing during extended periods of drought will likely move this plant community to the Early Seral State (4.0).

Transition T7A

State 3 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 R4A
State 4 to 2

Removal of disturbance in combination with long-term prescribed grazing (moderate stocking levels coupled with adequate recovery periods, or other grazing systems such as high-density, low-frequency intended to treat specific species dominance, or periodic light to moderate stocking levels, possibly including periodic rest) and a return to normal precipitation patterns may lead this plant community over a threshold to the Native/Invaded State (2.0). This will likely take a long period of time, possibly up to 10 years or more, and recovery may not be attainable. Depending on the slope, aspect, and size, and if adequate perennial plants exist, this change can occur more rapidly.

Conservation practices

Prescribed Grazing

Restoration pathway R4B
State 4 to 3

Removal of disturbance in combination with long-term prescribed grazing (moderate stocking levels coupled with adequate recovery periods, or other grazing systems such as high-density, low-frequency intended to treat specific species dominance, or periodic light to moderate stocking levels, possibly including periodic rest) and a return to normal precipitation patterns may lead this plant community over a threshold to the Shortgrass Sod State (3.0). This will likely take a long period of time, possibly up to 10 years or more, and recovery may not meet management goals.

Transition T7A
State 4 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 R5A
State 5 to 2

Long-term prescribed grazing (moderate stocking levels coupled with adequate recovery periods, or other grazing systems such as high- density, low-frequency intended to treat specific species dominance, or periodic light to moderate stocking levels, possibly including periodic rest) may lead this plant community over a threshold to the Native/Invaded State (2.0). Herbaceous weed control (i.e., herbicide) and or prescribed burning may also be needed to suppress cool-season invasive grasses. This will likely take a long period of time, possibly up to 10 years or more, and recovery may not be attainable. Success depends on whether native reproductive propagules remain intact on the site.

Conservation practices

Prescribed Grazing

Transition T7A
State 5 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).

Additional community tables

Table 12. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			450–750	
	western wheatgrass	PASM	*Pascopyrum smithii*	300–750	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	30–300	–
2	**Needlegrass**			450–750	
	green needlegrass	NAVI4	*Nassella viridula*	150–750	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	60–600	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	60–600	–
3	**Tall Warm-Season Grasses**			450–750	
	big bluestem	ANGE	*Andropogon gerardii*	300–750	–
	switchgrass	PAVI2	*Panicum virgatum*	60–450	–
	Indiangrass	SONU2	*Sorghastrum nutans*	60–450	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–150	–
4	**Mid Warm-Season Grasses**			300–600	
	sideoats grama	BOCU	*Bouteloua curtipendula*	150–450	–
	little bluestem	SCSC	*Schizachyrium scoparium*	150–450	–
	prairie dropseed	SPHE	*Sporobolus heterolepis*	30–300	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	30–300	–
5	**Short Warm-Seasom Grasses**			30–150	
	blue grama	BOGR2	*Bouteloua gracilis*	30–150	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–120	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–90	–
	threeawn	ARIST	*Aristida*	0–30	–
6	**Other Native Grasses**			30–150	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–120	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	30–120	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–90	–
7	**Grass-Likes**			30–150	
	sedge	CAREX	*Carex*	30–150	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–120	–
Forb					
9	**Forb**			150–300	
	Forb, native	2FN	*Forb, native*	30–150	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	30–90	–
	scurfpea	PSORA2	*Psoralidium*	30–90	–
	goldenrod	SOLID	*Solidago*	30–90	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	30–60	–

	American vetch	VIAM	*Vicia americana*	30–60	–
	white heath aster	SYER	*Symphyotrichum ericoides*	30–60	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	0–60	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	30–60	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	30–60	–
	dotted blazing star	LIPU	*Liatris punctata*	30–60	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	30–60	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–60	–
	field sagewort	ARCA12	*Artemisia campestris*	0–60	–
	false boneset	BREU	*Brickellia eupatorioides*	30–60	–
	purple prairie clover	DAPU5	*Dalea purpurea*	30–60	–
	Illinois bundleflower	DEIL	*Desmanthus illinoensis*	0–60	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–30	–
	American bird's-foot trefoil	LOUNU	*Lotus unifoliolatus var. unifoliolatus*	0–30	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–30	–
	beardtongue	PENST	*Penstemon*	0–30	–
	groundplum milkvetch	ASCR2	*Astragalus crassicarpus*	0–30	–
	hoary verbena	VEST	*Verbena stricta*	0–30	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–30	–
Shrub/Vine					
10	**Shrubs**			150–300	
	leadplant	AMCA6	*Amorpha canescens*	30–150	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	30–120	–
	rose	ROSA5	*Rosa*	30–90	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–90	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–60	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–30	–
	smooth sumac	RHGL	*Rhus glabra*	0–30	–

Table 13. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			450–600	
	western wheatgrass	PASM	*Pascopyrum smithii*	300–600	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	30–300	–
2	**Needlegrass**			300–600	
	green needlegrass	NAVI4	*Nassella viridula*	150–600	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	60–450	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	60–450	–
3	**Tall Warm-Season Grasses**			450–600	
	big bluestem	ANGE	*Andropogon gerardii*	300–600	–
	switchgrass	PAVI2	*Panicum virgatum*	60–300	–
	Indiangrass	SONU2	*Sorghastrum nutans*	60–300	–
	composite dropseed	SPCOC2	*Sporobolus compositus var.*	0–150	–

	compositus dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–150	
4	**Mid Warm-Season Grasses**			300–600	
	sideoats grama	BOCU	*Bouteloua curtipendula*	150–450	–
	little bluestem	SCSC	*Schizachyrium scoparium*	150–450	–
	prairie dropseed	SPHE	*Sporobolus heterolepis*	30–300	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	30–300	–
5	**Short Warm-Season Grasses**			30–150	
	blue grama	BOGR2	*Bouteloua gracilis*	30–150	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–120	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–90	–
	threeawn	ARIST	*Aristida*	0–30	–
6	**Other Native Grasses**			30–150	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–120	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	30–120	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–90	–
7	**Grass-Likes**			30–150	
	sedge	CAREX	*Carex*	30–150	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–120	–
8	**Non-Native Grasses**			150–450	
	smooth brome	BRIN2	*Bromus inermis*	60–300	–
	Kentucky bluegrass	POPR	*Poa pratensis*	60–300	–
	brome	BROMU	*Bromus*	0–90	–
	crested wheatgrass	AGCR	*Agropyron cristatum*	0–60	–
Forb					
9	**Forb**			150–300	
	Forb, native	2FN	*Forb, native*	30–150	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	30–90	–
	scurfpea	PSORA2	*Psoralidium*	30–90	–
	goldenrod	SOLID	*Solidago*	30–90	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	30–60	–
	American vetch	VIAM	*Vicia americana*	30–60	–
	white heath aster	SYER	*Symphyotrichum ericoides*	30–60	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	0–60	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	30–60	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	30–60	–
	dotted blazing star	LIPU	*Liatris punctata*	30–60	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	30–60	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–60	–
	field sagewort	ARCA12	*Artemisia campestris*	0–60	–
	false boneset	BREU	*Brickellia eupatorioides*	30–60	–
	purple prairie clover	DAPU5	*Dalea purpurea*	30–60	–
	Illinois bundleflower	DEIL	*Desmanthus illinoensis*	0–60	–

	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–30	–
	American bird's-foot trefoil	LOUNU	*Lotus unifoliolatus var. unifoliolatus*	0–30	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–30	–
	beardtongue	PENST	*Penstemon*	0–30	–
	groundplum milkvetch	ASCR2	*Astragalus crassicarpus*	0–30	–
	hoary verbena	VEST	*Verbena stricta*	0–30	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–30	–
Shrub/Vine					
10	**Shrubs**			150–300	
	leadplant	AMCA6	*Amorpha canescens*	30–150	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	30–120	–
	rose	ROSA5	*Rosa*	30–90	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–90	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–60	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–30	–
	smooth sumac	RHGL	*Rhus glabra*	0–30	–

Table 14. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			345–690	
	western wheatgrass	PASM	*Pascopyrum smithii*	345–690	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–115	–
2	**Needlegrass**			23–230	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–230	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–230	–
	green needlegrass	NAVI4	*Nassella viridula*	23–230	–
3	**Tall Warm-Season Grasses**			23–230	
	big bluestem	ANGE	*Andropogon gerardii*	23–230	–
	Coulter's globemallow	SPCO2	*Sphaeralcea coulteri*	0–184	–
	switchgrass	PAVI2	*Panicum virgatum*	0–115	–
	Indiangrass	SONU2	*Sorghastrum nutans*	0–115	–
4	**Mid Warm-Season Grasses**			46–230	
	sideoats grama	BOCU	*Bouteloua curtipendula*	23–230	–
	little bluestem	SCSC	*Schizachyrium scoparium*	23–230	–
	prairie dropseed	SPHE	*Sporobolus heterolepis*	0–115	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–115	–
5	**Short Warm-Season Grasses**			230–460	
	blue grama	BOGR2	*Bouteloua gracilis*	115–460	–
	buffalograss	BODA2	*Bouteloua dactyloides*	23–230	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–115	–
	threeawn	ARIST	*Aristida*	0–69	–
6	**Other Native Grasses**			23–115	

	prairie Junegrass	KOMA	*Koeleria macrantha*	23–115	–
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–92	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–69	–
7	**Grass-Likes**			46–184	
	sedge	CAREX	*Carex*	46–184	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–115	–
8	**Non-Native Grasses**			115–345	
	Kentucky bluegrass	POPR	*Poa pratensis*	46–345	–
	crested wheatgrass	AGCR	*Agropyron cristatum*	0–115	–
	smooth brome	BRIN2	*Bromus inermis*	0–115	–
	brome	BROMU	*Bromus*	0–69	–
Forb					
9	**Forbs**			115–230	
	sweetclover	MELIL	*Melilotus*	0–115	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	23–92	–
	goldenrod	SOLID	*Solidago*	23–92	–
	white heath aster	SYER	*Symphyotrichum ericoides*	23–69	–
	Forb, introduced	2FI	*Forb, introduced*	23–69	–
	Forb, native	2FN	*Forb, native*	23–69	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	23–69	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	23–69	–
	field sagewort	ARCA12	*Artemisia campestris*	23–69	–
	scurfpea	PSORA2	*Psoralidium*	23–69	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	23–46	–
	dotted blazing star	LIPU	*Liatris punctata*	23–46	–
	yellow salsify	TRDU	*Tragopogon dubius*	23–46	–
	hoary verbena	VEST	*Verbena stricta*	0–46	–
	American vetch	VIAM	*Vicia americana*	0–46	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	23–46	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–23	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	0–23	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0–23	–
	beardtongue	PENST	*Penstemon*	0–23	–
	groundplum milkvetch	ASCR2	*Astragalus crassicarpus*	0–23	–
	false boneset	BREU	*Brickellia eupatorioides*	0–23	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–23	–
	Illinois bundleflower	DEIL	*Desmanthus illinoensis*	0–23	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–23	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	0–23	–
Shrub/Vine					
10	**Shrubs**			115–200	
	western snowberry	SYOC	*Symphoricarpos occidentalis*	23–92	–

	prairie sagewort	ARFR4	*Artemisia frigida*	23–69	–
	smooth sumac	RHGL	*Rhus glabra*	0–69	–
	rose	ROSA5	*Rosa*	23–46	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	23–46	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–46	–
	leadplant	AMCA6	*Amorpha canescens*	0–46	–

Table 15. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			15–150	
	western wheatgrass	PASM	*Pascopyrum smithii*	15–150	–
2	**Needlegrass**			0–60	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–60	–
	green needlegrass	NAVI4	*Nassella viridula*	0–45	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–15	–
3	**Tall Warm-Season Grasses**			0–45	
	big bluestem	ANGE	*Andropogon gerardii*	0–45	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–45	–
4	**Mid Warm-Season Grasses**			0–60	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–60	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–60	–
5	**Short Warm-Season Grasses**			300–675	
	blue grama	BOGR2	*Bouteloua gracilis*	225–600	–
	buffalograss	BODA2	*Bouteloua dactyloides*	30–225	–
	threeawn	ARIST	*Aristida*	0–120	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–75	–
6	**Other Native Grasses**			15–60	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–45	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	15–45	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–30	–
7	**Grass-Likes**			45–180	
	sedge	CAREX	*Carex*	45–180	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–75	–
8	**Non-Native Grasses**			0–375	
	Kentucky bluegrass	POPR	*Poa pratensis*	0–375	–
	crested wheatgrass	AGCR	*Agropyron cristatum*	0–75	–
	brome	BROMU	*Bromus*	0–75	–
	smooth brome	BRIN2	*Bromus inermis*	0–45	–
Forb					
9	**Forbs**			75–225	

	sweetclover	MELIL	*Melilotus*	0–150	–
	Forb, introduced	2FI	*Forb, introduced*	15–75	–
	field sagewort	ARCA12	*Artemisia campestris*	15–60	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	15–45	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	15–45	–
	goldenrod	SOLID	*Solidago*	15–45	–
	white heath aster	SYER	*Symphyotrichum ericoides*	15–45	–
	hoary verbena	VEST	*Verbena stricta*	0–45	–
	yellow salsify	TRDU	*Tragopogon dubius*	15–30	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	15–30	–
	scurfpea	PSORA2	*Psoralidium*	15–30	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	15–30	–
	Forb, native	2FN	*Forb, native*	0–30	–
	fetid marigold	DYPA	*Dyssodia papposa*	0–30	–
	dotted blazing star	LIPU	*Liatris punctata*	0–15	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–15	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–15	–
	American vetch	VIAM	*Vicia americana*	0–15	–
Shrub/Vine					
10	**Shrubs**			30–120	
	prairie sagewort	ARFR4	*Artemisia frigida*	15–75	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	15–45	–
	smooth sumac	RHGL	*Rhus glabra*	0–45	–
	rose	ROSA5	*Rosa*	15–30	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–30	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–15	–

Table 16. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			0–40	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–40	–
3	**Tall Warm-Season Grasses**			0–8	
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–8	–
5	**Short Warm-Season Grasses**			160–360	
	threeawn	ARIST	*Aristida*	120–280	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–80	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–80	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–40	–
6	**Other Native Grasses**			0–24	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–16	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var.*	0–8	–

			scribnerianum		
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–8	–
7	**Grass-Likes**			16–120	
	sedge	CAREX	*Carex*	16–120	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–40	–
8	**Non-Native Grasses**			40–160	
	brome	BROMU	*Bromus*	16–120	–
	Kentucky bluegrass	POPR	*Poa pratensis*	16–80	–
	crested wheatgrass	AGCR	*Agropyron cristatum*	0–24	–
	smooth brome	BRIN2	*Bromus inermis*	0–8	–
Forb					
9	**Forbs**			120–280	
	fetid marigold	DYPA	*Dyssodia papposa*	40–120	–
	sweetclover	MELIL	*Melilotus*	16–80	–
	Forb, introduced	2FI	*Forb, introduced*	16–80	–
	Forb, native	2FN	*Forb, native*	8–64	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	8–24	–
	field sagewort	ARCA12	*Artemisia campestris*	8–16	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	8–16	–
	goldenrod	SOLID	*Solidago*	0–16	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	8–16	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–16	–
	yellow salsify	TRDU	*Tragopogon dubius*	0–8	–
	hoary verbena	VEST	*Verbena stricta*	0–8	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–8	–
	scurfpea	PSORA2	*Psoralidium*	0–8	–
Shrub/Vine					
10	**Shrubs**			16–40	
	plains pricklypear	OPPO	*Opuntia polyacantha*	8–40	–
	prairie sagewort	ARFR4	*Artemisia frigida*	8–24	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–16	–

Table 17. Community 5.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			48–480	
	western wheatgrass	PASM	*Pascopyrum smithii*	48–480	–
2	**Needlegrass**			0–168	
	green needlegrass	NAVI4	*Nassella viridula*	0–168	–
3	**Tall Warm-Season Grasses**			0–72	
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–72	–
5	**Short Warm-Season Grasses**			0–72	

	buffalograss	BODA2	*Bouteloua dactyloides*	0–72	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–72	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–48	–
	threeawn	ARIST	*Aristida*	0–24	–
6	**Other Native Grasses**			0–72	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–72	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–72	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–48	–
7	**Grass-Likes**			0–96	
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–96	–
	sedge	CAREX	*Carex*	0–96	–
8	**Non-Native Grasses**			720–1680	
	smooth brome	BRIN2	*Bromus inermis*	600–1320	–
	Kentucky bluegrass	POPR	*Poa pratensis*	120–480	–
	crested wheatgrass	AGCR	*Agropyron cristatum*	0–480	–
	brome	BROMU	*Bromus*	24–240	–
Forb					
9	**Forbs**			120–240	
	sweetclover	MELIL	*Melilotus*	0–240	–
	Forb, introduced	2FI	*Forb, introduced*	0–144	–
	yellow salsify	TRDU	*Tragopogon dubius*	0–96	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–72	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–72	–
	goldenrod	SOLID	*Solidago*	0–72	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–48	–
	scurfpea	PSORA2	*Psoralidium*	0–48	–
	Forb, native	2FN	*Forb, native*	0–48	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–48	–
	hoary verbena	VEST	*Verbena stricta*	0–48	–
	American vetch	VIAM	*Vicia americana*	0–24	–
	field sagewort	ARCA12	*Artemisia campestris*	0–24	–
	dotted blazing star	LIPU	*Liatris punctata*	0–24	–
	American bird's-foot trefoil	LOUNU	*Lotus unifoliolatus var. unifoliolatus*	0–24	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–24	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–24	–
Shrub/Vine					
10	**Shrubs**			0–120	
	prairie sagewort	ARFR4	*Artemisia frigida*	0–72	–
	smooth sumac	RHGL	*Rhus glabra*	0–72	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–72	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–48	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–24	–

	rose	ROSA5	*Rosa*	0–24	–

Table 18. Community 5.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			0–160	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–160	–
3	**Tall Warm-Season Grasses**			0–80	
	big bluestem	ANGE	*Andropogon gerardii*	0–48	–
	Coulter's globemallow	SPCO2	*Sphaeralcea coulteri*	0–48	–
4	**Mid Warm-Season Grasses**			0–48	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–48	–
5	**Short Warm-Season Grasses**			0–320	
	blue grama	BOGR2	*Bouteloua gracilis*	0–320	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–80	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–48	–
	threeawn	ARIST	*Aristida*	0–32	–
6	**Other Native Grasses**			0–80	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–80	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–32	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–16	–
7	**Grass-Likes**			0–48	
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–48	–
	sedge	CAREX	*Carex*	0–48	–
8	**Non-Native Grasses**			480–1120	
	Kentucky bluegrass	POPR	*Poa pratensis*	400–1040	–
	smooth brome	BRIN2	*Bromus inermis*	0–160	–
	brome	BROMU	*Bromus*	16–160	–
	crested wheatgrass	AGCR	*Agropyron cristatum*	0–80	–
Shrub/Vine					
2	**Needlegrass**			0–240	
	green needlegrass	NAVI4	*Nassella viridula*	0–240	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–80	–
10	**Shrubs**			0–80	
	prairie sagewort	ARFR4	*Artemisia frigida*	0–48	–
	smooth sumac	RHGL	*Rhus glabra*	0–48	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–48	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–32	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–32	–
Forb					
9	**Forbs**			32–160	

	sweetclover	MELIL	*Melilotus*	0–160	–
	Forb, introduced	2FI	*Forb, introduced*	0–80	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–48	–
	goldenrod	SOLID	*Solidago*	0–48	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–48	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–32	–
	yellow salsify	TRDU	*Tragopogon dubius*	0–32	–
	hoary verbena	VEST	*Verbena stricta*	0–32	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–32	–
	field sagewort	ARCA12	*Artemisia campestris*	0–32	–
	Forb, native	2FN	*Forb, native*	0–32	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–16	–
	scurfpea	PSORA2	*Psoralidium*	0–16	–

Animal community

Grazing Interpretations:
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 ESD). 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.

The following 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. An AUM is defined as the equivalent amount of forage required by a 1,000-pound cow with calf up to 6 months of age for one month (refer to USDA NRCS, National Range and Pasture Handbook).

Plant Community: Western Wheatgrass-Needlegrass-Bluestem (1.1)
Average Annual Production (lbs./acres, air-dry): 3,000
Stocking Rate (AUM/acre): 0.82

Plant Community: Western Wheatgrass-Needlegrass-Bluestem-Non-Native Cool-Season Grasses (<15%) (2.1)
Average Annual Production (lbs./acres, air-dry): 3,000
Stocking Rate (AUM/acre): 0.82

Plant Community: Western Wheatgrass-Blue Grama-Buffalograss-Non-Native Cool-Season Grasses (<15%) (2.2)
Average Annual Production (lbs./acres, air-dry): 2,300
Stocking Rate (AUM/acre): 0.63

Plant Community: Blue Grama-Buffalograss Sod (3.1)
Average Annual Production (lbs./acres,air-dry): 1,500
Stocking Rate (AUM/acre): 0.41

Plant Community: Threeawn-Annuals (4.1)
Average Annual Production (lbs./acres, air-dry): 800
Stocking Rate (AUM/acre): 0.22

Plant Community: Smooth Bromegrass-Kentucky Bluegrass (5.1)
Average Annual Production (lbs./acres, air-dry): 2,400
Stocking Rate (AUM/acre): 0.66

Plant Community: Kentucky Bluegrass (5.2)
Average Annual Production (lbs./acres, air-dry): 1,600
Stocking Rate (AUM/acre): 0.44

Total annual production on-site may contain vegetation deemed undesirable or untargeted by the grazing animal. Therefore, AUM values may have been 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. 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 B, with localized areas in hydrologic group C. Infiltration and runoff potential for this site varies from moderate to high depending upon 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, Kentucky 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 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 varieties 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

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 National Ecological Site Handbook (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 NESH, met all requirements as an “Approved” ESD as laid out in the 1997, rev.1, 2003 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 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 toward an “Approved” status.

Site Development and Testing Plan:
Future work, as described in a Project Plan, is necessary to validate the information in this Provisional Ecological Site Description. 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. The final field review, peer review, quality control, and quality assurance reviews of the ESD will be

required to produce the final document.

Non-discrimination Statement
In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, available online and at any USDA office, or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632- 9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

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; and Dana Larsen, RMS, NRCS.

SCS-Range-417s (18) 1970-2006: Boyd, Buffalo, Gregory, Knox, Lyman and Tripp Counties, South Dakota.

Other references

EPA – Level III and Level IV Ecoregions of the Continental United States. https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions- continental-united-states. Available online. Accessed 08/30/17.

High Plains Regional Climate Center, University of Nebraska. http://www.hprcc.unl.edu/. Available online. Accessed 08/30/17.

Teledo, D., Sanderson, M., Spaeth, K., Hendrickson, J., Printz, J. 2014. Extent of Kentucky Bluegrass and Its Effect on Native Plant Species Diversity and Ecosystem Services in the Northern Great Plains of the United States. Invasive Plant Science and Management. 7(4):543-522. Weed Science Society of America.

USDA, NRCS. Electronic Field Office Technical Guide. https://efotg.sc.egov.usda.gov. Available online. Accessed 11/7/17

USDA, NRCS. Soil Survey Staff. Official Soil Series Descriptions. Available online. Accessed 08/30/17. USDA, NRCS. Soil Survey Staff. Web Soil Survey. Available online. Accessed 08/30/17.

USDA, NRCS. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. Ag Handbook 296.

USDA, NRCS. 2014. National Ecological Site Handbook, 1st Ed.

USDA, NRCS. 2012. National Engineering Handbook, Part 630. http://www.nrcs,usda.gov/. Hydrology Chapters from eDirectives, site available on line.

USDA, NRCS. National Water and Climate Center. http://www.wcc.nrcs.usda.gov/. Available online. Accessed

08/30/17.

USDA, NRCS. 1997, rev. 1, 2003. National Range and Pasture Handbook.

USDA, NRCS. National Soil Information System, Information Technology Center. http://nasis.nrcs.usda.gov.

USDA, NRCS. 2017. The PLANTS Database. http://plants.usda.gov. Available online. Accessed 08/30/17. USDA, NRCS.

Various Published Soil Surveys.

Contributors

Joyce Kammersell
Megan Baxter
Rick L. Peterson
Stan Boltz

Approval

David Kraft, 9/27/2018

Acknowledgments

ESD updated by Rick L. Peterson on 10/30/17
Editorial Review by Carla Green Adams.

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	02/20/2009
Approved by	Stan Boltz
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

---

2. **Presence of water flow patterns:** None, or barely visible and discontinuous.

---

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

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground typically less than 5 percent, and patches less than 2 inches in diameter.

5. **Number of gullies and erosion associated with gullies:** None should 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):** Slight amount of movement of smallest size class litter is possible, but not normal.

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

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should be 4 to 10 inches thick with mollic (dark) colors when moist. Structure typically is medium to fine granular at least in the upper A-horizon.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Combination of shallow and deep rooted species (mid & tall rhizomatous and tufted perennial cool-season grasses) with fine and coarse roots positively influences infiltration.

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

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) = mid and tall, cool-season bunchgrasses = tall, warm-season grasses >

    Sub-dominant: Mid, warm-season grasses >

    Other: Forbs = shrubs > short, warm-season grasses = grass-like species

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

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little evidence of decadence or mortality. Bunch grasses have strong, healthy centers and shrubs are vigorous.

14. **Average percent litter cover (%) and depth (in):** Litter cover about 80 to 90 percent, with depths about 0.5 to 1 inch.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Total annual production ranges from 2,200 pounds/acre to 4,000 pounds/acre, with the reference value being 3,000 pounds/acre (air-dry basis).

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

17. **Perennial plant reproductive capability:** Perennial grasses should have vigorous rhizomes or tillers.