USDA Natural Resources
Conservation Service

Ecological site R060AY022SD
Loamy Terrace

Accessed: 05/18/2024

General information

Approved. An approved ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model, enough information to identify the ecological site, and full documentation for all ecosystem states contained in the state and transition model.

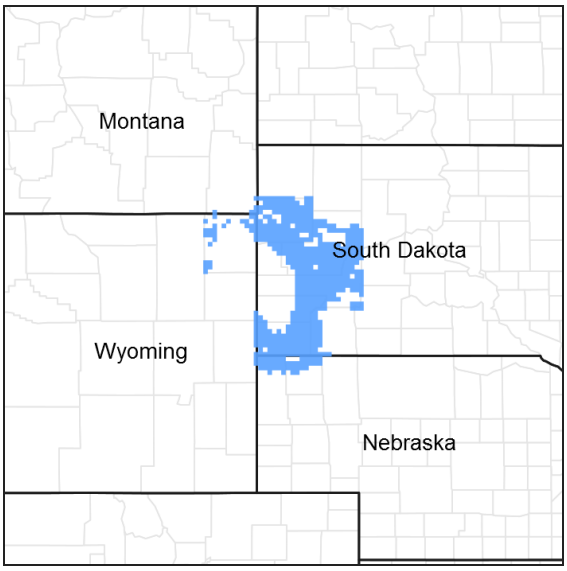

Figure 1. Mapped extent

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): 060A–Pierre Shale Plains

MLRA Notes:
The Pierre Shale Plains (MLRA 60A) consists of approximately 10,150 square miles, the majority of which is located in South Dakota (70 percent) and small portions are in Montana (2 percent), Nebraska (8 percent), and Wyoming (20 percent). It encircles the Black Hills (MLRA 62) and the Dakota Hogback (MLRA 61). MLRA 60A includes portions of the Oglala, Buffalo Gap, and Thunder Basin National Grasslands. It also includes small sections of the Pine Ridge Indian Reservation, Badlands National Park, and Black Hills National Forest. The Cheyenne and Belle Fourche Rivers flow through the MLRA.

MLRA 60A is in the unglaciated section of the Missouri Plateau, of the Great Plains Province of the Interior Plains. It is an area of old plateaus and terraces that have been deeply eroded. Cretaceous Pierre Shale underlies almost all of this MLRA. This is a marine sediment with layers of volcanic ash that has been altered to smectitic clay. These clays shrink as they dry and swell as they receive moisture. Soils are shallow to very deep and generally are well drained and clayey.
Elevations generally range from 2,620 to 3,610 feet throughout the MLRA, but can range up to 4,260 feet. The average annual precipitation for the western side of the MLRA is 13 to 16 inches, whereas the eastern side receives 16 to 18 inches. A suite of ecological sites has been written specifically for these two precipitation zones. The Locator Map shows the break between the two precipitation zones.

This area supports a mixed natural prairie vegetation consisting of both cool- and warm-season grasses and forbs. Wyoming big sagebrush occurs primarily in the drier western portion of the MLRA, however, small remnant stands can be found in the eastern portion. Dominant land uses of the area are primarily ranching and, to a lesser extent, farming. Major resource concerns to this MLRA are wind erosion and surface water quality.

Classification relationships

USDA - Land Resource Region G – Western Great Plains Range and Irrigated Region, Major Land Resource Area (MLRA) 60A – Pierre Shale Plains.

EPA - Level IV Ecoregions of the Continental United States: 43e – Sagebrush Steppe, 43g Semiarid Pierre Shale Plains, and 43k – Dense Clay Prairie.

Ecological site concept

The Loamy Terrace ecological site occurs throughout the MLRA. It is located on old, nearly level stream terraces adjacent to overflow and/or lowland sites. This site does not typically receive additional moisture from overflow, however, runoff from adjacent upland sites may provide some additional moisture. Soil surface layer is 5 to 20 inches thick with textures ranging from fine sandy loam to clay loam. This site can have similar vegetative characteristics as the overflow or lowland sites, especially when looking at the woody components. The regeneration of trees is unlikely to occur on the terrace landscape. Vegetation in the Reference State consists of a mix of cool- and warm-season grasses, however, mid-statured, cool-season grasses tend to be the dominant group. Rhizomatous wheatgrass and green needlegrass are the dominant cool-season grasses. Other grasses and grass-like included needle and thread, little bluestem, sideoats grama, blue grama, buffalograss, inland saltgrass, prairie sandreed, and sedges. Forbs are common and diverse. Silver sagebrush is almost always present, western snowberry and leadplant are common. In the western, 13 to 16 inch Precipitation Zone (PZ), greasewood is likely to occur on this site and can increase with heavy disturbance. Remnant trees can include green ash and plains cottonwood, but in minor amounts and little, if any, regeneration.

Associated sites

R060AY010SD	**Loamy 13-16" P.Z.** The Loamy 13-16” PZ will be located on upland landscapes adjacent to the terrace landscape.
R060AY020SD	**Loamy Overflow** The Loamy Overflow will be located lower in the landscape and within the floodplain.
R060AY041SD	**Loamy 16-18" P.Z.** The Loamy 16-18” PZ will be located on upland landscapes adjacent to the terrace landscape.

Similar sites

R060AY041SD	**Loamy 16-18" P.Z.** The Loamy 16-18" PZ will have few if any shrubs and lower production.
R060AY010SD	**Loamy 13-16" P.Z.** The loamy 13-16" PZ will have less shrubs and lower production.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia cana*
Herbaceous	(1) *Pascopyrum smithii* (2) *Nassella viridula*

Physiographic features

This site occurs on nearly level to gently sloping terraces, valleys, and uplands.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Terrace (3) Plain
Flooding duration	Very brief (4 to 48 hours)
Flooding frequency	None to very rare
Ponding frequency	None
Elevation	762–1,311 m
Slope	0–6%
Water table depth	107–203 cm
Aspect	Aspect is not a significant factor

Climatic features

The climate in this MLRA is typical of the drier portions of the Northern Great Plains, where sagebrush steppes to the west yield to grassland steppes to the east. Annual precipitation for the entire MLRA ranges from 13 to 18 inches per year, with most occurring during the growing season. Temperatures show a wide range between summer and winter and between daily maximums and minimums, due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air masses from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Chinook winds may occur in winter and bring rapid rises in temperature. Extreme storms may occur during the winter, but the more severe occur during late fall, late winter, and spring. The normal average annual temperature is about 46°F. January is the coldest month with average temperatures ranging from about 19°F (Moorcroft CAA, WY) to about 22°F (Belle Fourche, SD). July is the warmest month with temperatures averaging from about 70°F (Moorcroft CAA, WY) to about 72°F (Belle Fourche, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 51°F. 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 generally are 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 can 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)	115 days
Freeze-free period (average)	133 days
Precipitation total (average)	432 mm

Climate stations used

- (1) ARDMORE 1 NW [USC00390236], Edgemont, SD
- (2) BELLE FOURCHE [USC00390559], Belle Fourche, SD
- (3) WASTA [USC00398911], Owanka, SD
- (4) REDBIRD [USC00487555], Lance Creek, WY
- (5) MOORCROFT 3S [USW00024088], Moorcroft, WY
- (6) UPTON [USC00489205], Upton, WY

Influencing water features

Stream Type: B6, C6
(Rosgen System)

Soil features

The soils in this site are moderately well to well drained and formed in alluvium. The clay loam to fine sandy loam surface layer is 5 to 20 inches thick. The soils have a moderately slow to moderately rapid infiltration rate. This site should show no evidence of rills, wind-scoured areas, or pedestalled plants. Water flow patterns are broken, irregular in appearance, or discontinuous with numerous debris dams or vegetative barriers. The soil surface is stable and intact.

Soils correlated to the Loamy Terrace site: Bridgeport, Colombo, Owanka, and Swint.

Other soils that have multiple ecological site correlations including Loamy Terrace: Craft, Glenberg, Haverson, Lohmiller, and Rocky Point.

These soils are mainly susceptible to water erosion, but sandy textured surface soils are susceptible to wind erosion. The hazard of water erosion increases where vegetative cover is not adequate. A drastic loss of the soil surface layer on this site can result in a shift in species composition and/or production. More information can be found in the various soil survey reports. Contact the local USDA Service Center for soil survey reports that include more detail specific to your location.

Table 4. Representative soil features

Surface texture	(1) Sandy loam (2) Loam (3) Clay loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Moderately slow to moderate
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	15.24–17.78 cm
Calcium carbonate equivalent (0-101.6cm)	3–15%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–2
Soil reaction (1:1 water) (0-101.6cm)	6.1–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–10%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

This site developed under Northern Great Plains climatic conditions, natural influences of large herbivores, occasional fire, 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, can cause significant shifts in plant communities and/or species composition.

A high percentage of these areas have been tilled in the past, and have been planted to alfalfa for haying or are in a cropping system. They are also located in good winter livestock areas and are used as calving/feeding areas. Very few areas exist that have not had heavy soil disturbance.

Continuous, season-long grazing (during the typical growing season of May through October) and/or heavy, continuous grazing (e.g., every spring and/or every summer at moderate to heavy stocking levels) without adequate recovery periods following grazing events causes the departure from the Western Wheatgrass-Green Needlegrass/Shrubs Community Phase (1.1). Short grasses and grass-like species such as sedge, blue grama, and bluegrass will increase and eventually develop into a sod. Western wheatgrass will increase initially and then begin to decrease. Green needlegrass and sideoats grama will decrease in frequency and production. Extended periods of non-use and lack of fire will result in excessive litter and a plant community dominated by cool-season grasses such as western wheatgrass, green needlegrass, Kentucky bluegrass, and smooth brome. Remnant mature trees are randomly present across this site, but regeneration does not typically occur.

Interpretations are primarily based on the Reference Plant Community Phase (1.1). The Reference Plant Community Phase 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 are discussed in more detail in the plant community descriptions following the diagram.

State and transition model

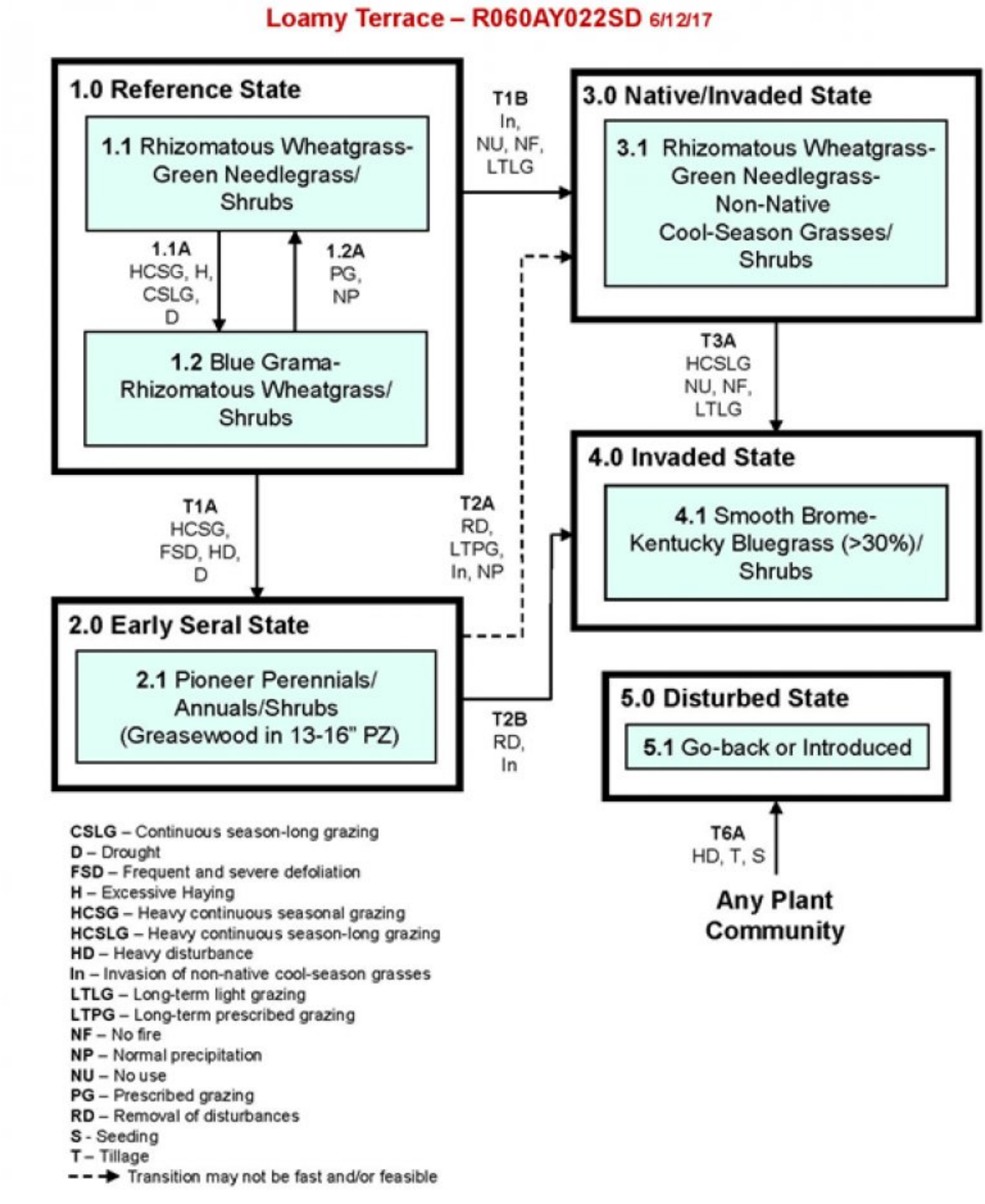

Figure 6. Loamy Terrace - R060AY022SD

Diagram Legend - Loamy Terrace - R060AY022SD	
T1A	Heavy continuous seasonal grazing, frequent and severe defoliation, heavy disturbance or grazing in combination with drought.
T1B	Invasion of non-native cool-season grasses, no use, no fire, or long-term light grazing.
T2A	Removal of grazing disturbance, long-term prescribed grazing, invasion and establishment of non-native cool-season grasses, return to normal precipitation patterns.
T2B	Removal of grazing disturbance and invasion and establishment of non-native cool-season grasses.
T3A	Heavy continuous season-long grazing, no use and no fire or long-term light grazing.
T6A	Heavy disturbance such as tillage, abandoned cropland or tillage, and seeding to introduced perennial forage crops.

CP 1.1A	1.1 - 1.2	Heavy, continuous seasonal grazing (spring or winter) or continuous seasonal grazing, without adequate recovery, grazing in combination with drought or excessive haying.
CP 1.2A	1.2 - 1.1	Prescribed grazing with proper stocking, change in season of use and adequate recovery, normal precipitation following drought.

Figure 7. Loamy Terrace - R060AY022SD

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 site is dominated by cool- and warm-season grasses. In pre-European times the primary disturbances included fire and grazing by large ungulates, small mammals, and insects. Favorable growing conditions occurred during the spring and the warm months of June through August. This State can be found on areas with a history of proper grazing management, including adequate recovery periods between grazing events.

Community 1.1
Rhizomatous Wheatgrass-Green Needlegrass/Shrubs

Figure 8. Plant Community Phase 1.1.

Figure 9. Plant Community Phase 1.1.

The plant community upon which interpretations are primarily based is the Rhizomatous Wheatgrass-Green Needlegrass/Shrubs Plant Community (1.1). This is also considered to be the Reference Plant Community. This plant community can be found on areas that are properly managed with prescribed grazing. The potential vegetation is about 75 to 85 percent grasses and grass-like plants, 5 to 10 percent forbs, 10 to 15 percent shrubs, and 0 to 2 percent trees. Major grasses include rhizomatous wheatgrasses and green needlegrass. Other grasses occurring on this community include prairie sandreed, needle and thread, blue grama, and sideoats grama. Major forbs include American vetch, purple prairie clover, cudweed sagewort, western yarrow, and sunflower. Major shrubs include silver sagebrush, western snowberry, chokecherry, and fringed sagewort. In the western portion of the MLRA (13 to 16 inch PZ), greasewood and Wyoming big sagebrush will occur in minor amounts. Scattered green ash and plains cottonwood may occur. This plant community is well adapted to the Northern Great Plains climatic conditions. Individual species can vary greatly in production depending on growing conditions (timing and amount of precipitation and temperature). Community dynamics, nutrient cycle, water cycle, and energy flow are functioning properly. Plant litter is properly distributed with very little movement off-site, and natural plant mortality is very low. The diversity in plant species allows for high drought tolerance. Run-off from adjacent sites and moderate or high available water capacity provides a favorable soil-water-plant relationship.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1524	2214	2881
Shrub/Vine	247	350	448
Forb	135	211	308
Tree	–	28	62
Total	**1906**	**2803**	**3699**

Figure 11. Plant community growth curve (percent production by month). SD6002, Pierre Shale Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

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

Community 1.2
Blue Grama-Rhizomatous Wheatgrass/Shrubs

This plant community can slowly develop from the adverse effects of continuous grazing without adequate recovery periods between each grazing event during the growing season, or change in season of use. Excessive haying will also cause this plant community shift. Recognition of this plant community will enable the land user to implement key management decisions before a significant ecological threshold is crossed. Blue grama and rhizomatous wheatgrasses are the dominant species. Green needlegrass has been greatly reduced. Forb species include western yarrow, asters, prairie coneflower, silverleaf scurfpea, wavyleaf thistle, and western salsify. Chokecherry

and plum are greatly reduced while other shrub species could show evidence of heavy browsing. In the western portion of the MLRA (13 to 16 inch PZ), greasewood will tend to increase in this plant community. This plant community is relatively stable and less productive than the Reference Plant Community (1.1). Reduction of litter and short plant heights result in higher soil temperatures, poor water infiltration rates, increased runoff, and high evapotranspiration rates. This plant community can occur throughout the site, on spot-grazed areas, and around water sources where season-long grazing patterns occur. Soil erosion will be minimal due to the sod forming habit of blue grama.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	482	753	1356
Shrub/Vine	39	67	95
Forb	39	67	95
Tree	–	9	22
Total	**560**	**896**	**1568**

Figure 13. Plant community growth curve (percent production by month). SD6003, Pierre Shale Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant.

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 (i.e. spring) grazing, continuous season-long grazing, excessive haying in combination with drought will convert this Plant Community Phase (PCP) to the Blue Grama-Rhizomatous Wheatgrass/Shrubs Plant Community (1.2).

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing with adequate recovery periods following each grazing event and proper stocking will shift this plant community back to the Rhizomatous Wheatgrass-Green Needlegrass/Shrubs (1.1). A return to normal precipitation patterns will aid in this community shift.

State 2
Early Seral State

This state is the result of heavy, concentrated disturbance such as rodent activity, or heavy use areas by livestock. 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 grasses, and forb species. Bare ground is also much higher than on any other plant community phase. In the western portion of this MLRA (13 to 16 inch PZ), greasewood is likely to increase significantly if it is located on adjacent sites.

Community 2.1
Pioneer Perennials/Annuals/Shrubs

This plant community develops under severe disturbance, heavy continuous grazing, and/or excessive defoliation. This can result from heavy livestock or wildlife concentration. The dominant vegetation includes pioneer annual grasses, forbs, invaders, and early successional biennial and perennial species. Grasses may include sixweeks fescue, smooth bromegrass, annual brome, blue grama, needle and thread, prairie Junegrass, and western

wheatgrass. The dominant forbs may include curlycup gumweed, lambsquarter, salsify, kochia, field bindweed, thistles, western ragweed, and other early successional species. Shrubs that may be present include prairie rose, fringed sagewort, and greasewood. Plant species from adjacent ecological sites may become minor components of this plant community. The community is susceptible to invasion of other non-native species due to the severe soil disturbances and the relatively high percentage of bare ground. This plant community is resistant to change, as long as soil disturbance or severe vegetation defoliation persists, thus holding back secondary plant succession. Soil erosion is potentially high. Reduced surface cover, low plant density, low plant vigor, loss of root biomass, and soil compaction, all contribute to decreased water infiltration, increased runoff, and accelerated erosion rates. Significant economic inputs, management, and time would be required to move this plant community toward a higher successional stage and a more productive plant community. Secondary succession is highly variable, depending upon availability and diversity of a viable seed bank of higher successional species within the existing plant community and neighboring plant communities. This plant community can be mechanically renovated and seeded to improve the production capability, but management changes would be needed in order to maintain the new plant community.

Figure 14. Plant community growth curve (percent production by month). SD6001, Pierre Shale Plains, cool-season dominant. Cool-season dominant..

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

State 3
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. The plant community in this State looks very similar to the Reference Plant Community (1.1) and it functions very much like the Reference State. It is ‘At Risk’ of transitioning to the Invaded State (4.0) which is dominated by smooth brome and/or Kentucky bluegrass.

Community 3.1
Rhizomatous Wheatgrass-Green Needlegrass-Non-Native Cool-Season Grasses/Shrubs

This plant community develops when Kentucky bluegrass and/or smooth brome invade and become established on the site. This is due to the close proximity to seed sources or expansion from road ditches, improved pastures, or other invaded sites. No use and no fire, or very light stock stocking rates for long periods of time, will allow these non-native, cool-season grasses to increase in the plant community. With non-use, 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 75 to 90 percent grasses or grass- like plants, 5 to 10 percent forbs, 5 to 15 percent shrubs, and 0 to 3 percent trees. The dominant grasses will be rhizomatous wheatgrass, green needlegrass, and non-native cool-season grasses, primarily, smooth brome and/or Kentucky bluegrass. Forbs will be diverse but not dominate. Shrubs and trees will occur in similar amounts as in Plant Community Phase (1.1).

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1205	1623	2191
Shrub/Vine	247	412	504
Forb	230	295	392
Tree	–	24	50
Total	**1682**	**2354**	**3137**

Figure 16. Plant community growth curve (percent production by month). SD6002, Pierre Shale Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

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

State 4
Invaded State

This state is the result of invasion of introduced cool-season grass species. This state is characterized by the dominance of Kentucky bluegrass and smooth brome, and an increasing thatch layer that effectively blocks introduction of other plants into the system. 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 to 35 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 4.1
Smooth Brome-Kentucky Bluegrass/Shrub

This plant community develops after an extended period of non-use and exclusion of fire. Eventually litter levels become high enough to reduce native grass vigor, diversity and density. Kentucky bluegrass dominates this plant community. Common forbs include sweetclover, cudweed sagewort, and goldenrod species. Shrubs such as western snowberry and/or silver sagebrush, along with remnant trees will persist in the plant community. This plant community is resistant to change without prescribed grazing and/or fire. The combination of both grazing and fire is most effective in moving this plant community toward the Reference State (1.0). Soil erosion is low. Runoff will typically be greater than in the Reference State. Once the advanced stage of this plant community is reached, time and external resources will be needed to see a recovery in the diversity of the site.

State 5
Disturbed State

Any plant community can transition to this State. The two Plant Communities, Go-Back and Introduced, are highly variable in nature. They are derived through different management scenarios, and are not related successionally. Infiltration, runoff, and soil erosion vary depending on the vegetation present on the site.

Community 5.1
Go-back or Introduced

The Go-back Plant Community can be reached whenever a 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 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, mares-tail, 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 T1A
State 1 to 2

Heavy, continuous seasonal grazing (i.e. early spring grazing), frequent and severe defoliation, heavy disturbance,

combined with drought will transition this state to the Early Seral State (2.0).

Transition T1B
State 1 to 3

Non-use and lack of fire for extended periods of time, long-term light grazing, and invasion of non-native cool-season grasses, will transition the Reference State to the Native/Invaded State (3.0).

Transition T6A
State 1 to 5

Heavy disturbance including tillage, abandonment of cropland, or seeding to improved pasture species result in a transition to the Disturbed State (5.0).

Transition T2A
State 2 to 3

If the disturbance causing severe defoliation is removed and long-term prescribed grazing is initiated, including adequate rest periods, and normal precipitation patterns return, this plant community may transition to the Native/Invaded State (3.0). With the presence of non-native, cool-season grasses in local plant communities, it is assumed the Early Seral State will be invaded, to a certain extent, by non-native cool- season grasses. Therefore, a restoration pathway to the Reference State (1.0) is unlikely. This pathway will take an extended period of time and may not in the end meet management objectives.

Transition T2B
State 2 to 4

If the disturbance causing the severe defoliation is removed and the plant community is invaded by non-native, cool-season grasses, this plant community is likely to transition to the Invaded State (4.0).

Transition T6A
State 2 to 5

Heavy disturbance including tillage, abandonment of cropland, or seeding to improved pasture species result in a transition to the Disturbed State (5.0).

Transition T3A
State 3 to 4

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 to the Invaded State (4.0). 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 to 35 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 T6A
State 3 to 5

Heavy disturbance including tillage, abandonment of cropland, or seeding to improved pasture species result in a transition to the Disturbed State (5.0).

Transition T6A
State 4 to 5

Heavy disturbance including tillage, abandonment of cropland, or seeding to improved pasture species result in a transition to the Disturbed State (5.0).

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Western Wheatgrass**			701–1121	
	western wheatgrass	PASM	*Pascopyrum smithii*	701–1121	–
2	**Needlegrass**			560–841	
	green needlegrass	NAVI4	*Nassella viridula*	420–560	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	140–280	–
3	**Short Warm-Season Grasses**			140–280	
	blue grama	BOGR2	*Bouteloua gracilis*	140–280	–
	buffalograss	BODA2	*Bouteloua dactyloides*	28–112	–
4	**Other Warm- Season Grasses**			56–420	
	big bluestem	ANGE	*Andropogon gerardii*	28–224	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	28–224	–
	switchgrass	PAVI2	*Panicum virgatum*	28–140	–
5	**Other Native Grasses**			140–420	
	prairie sandreed	CALO	*Calamovilfa longifolia*	140–420	–
	prairie dropseed	SPHE	*Sporobolus heterolepis*	56–140	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	28–84	–
	Grass, perennial	2GP	*Grass, perennial*	28–84	–
	saltgrass	DISP	*Distichlis spicata*	0–28	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–28	–
6	**Grass-Likes**			140–280	
	sedge	CAREX	*Carex*	140–280	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–28	–
Forb					
8	**Forbs**			140–280	
	white heath aster	SYER	*Symphyotrichum ericoides*	28–140	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	28–140	–
	mint	MENTH	*Mentha*	28–140	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	28–140	–
	scurfpea	PSORA2	*Psoralidium*	0–56	–
	common yarrow	ACMI2	*Achillea millefolium*	28–56	–
	purple prairie clover	DAPU5	*Dalea purpurea*	28–56	–
	American vetch	VIAM	*Vicia americana*	28–56	–
	goldenrod	SOLID	*Solidago*	28–56	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–28	–
	Forb, perennial	2FP	*Forb, perennial*	0–28	–
	larkspur	DELPH	*Delphinium*	0–28	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–28	–

	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	0–28	–
	onion	ALLIU	*Allium*	0–28	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–28	–
	groundplum milkvetch	ASCR2	*Astragalus crassicarpus*	0–28	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–28	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–28	–
	dotted blazing star	LIPU	*Liatris punctata*	0–28	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–28	–
	bluebells	MERTE	*Mertensia*	0–28	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0–28	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	0–28	–
Shrub/Vine					
9	**Shrubs**			280–420	
	silver sagebrush	ARCA13	*Artemisia cana*	28–280	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	28–280	–
	rose	ROSA5	*Rosa*	28–84	–
	prairie sagewort	ARFR4	*Artemisia frigida*	28–84	–
	big sagebrush	ARTR2	*Artemisia tridentata*	0–84	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–56	–
	American plum	PRAM	*Prunus americana*	28–56	–
	chokecherry	PRVI	*Prunus virginiana*	28–56	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–56	–
	leadplant	AMCA6	*Amorpha canescens*	0–56	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–28	–
	currant	RIBES	*Ribes*	0–28	–
	Subshrub (<.5m)	2SUBS	*Subshrub (<.5m)*	0–28	–
Tree					
10	**Trees**			0–56	
	boxelder	ACNE2	*Acer negundo*	0–28	–
	green ash	FRPE	*Fraxinus pennsylvanica*	0–28	–
	plains cottonwood	PODEM	*Populus deltoides ssp. monilifera*	0–28	–
	American elm	ULAM	*Ulmus americana*	0–28	–

Table 9. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Western Wheatgrass**			269–404	
	western wheatgrass	PASM	*Pascopyrum smithii*	269–404	–
2	**Needlegrass**			18–45	
	green needlegrass	NAVI4	*Nassella viridula*	18–45	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	9–27	–
3	**Short Warm-Season Grasses**			135–448	

	blue grama	BOGR2	*Bouteloua gracilis*	135–392	–
	buffalograss	BODA2	*Bouteloua dactyloides*	28–112	–
4	**Other Warm-Season Grasses**			9–45	
	sideoats grama	BOCU	*Bouteloua curtipendula*	9–45	–
	switchgrass	PAVI2	*Panicum virgatum*	0–18	–
	big bluestem	ANGE	*Andropogon gerardii*	0–18	–
5	**Other Native Grasses**			45–135	
	sand dropseed	SPCR	*Sporobolus cryptandrus*	18–90	–
	Grass, perennial	2GP	*Grass, perennial*	18–45	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	18–45	–
	saltgrass	DISP	*Distichlis spicata*	0–45	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	9–45	–
	prairie dropseed	SPHE	*Sporobolus heterolepis*	0–9	–
6	**Grass-Likes**			90–135	
	Kentucky bluegrass	POPR	*Poa pratensis*	0–90	–
	cheatgrass	BRTE	*Bromus tectorum*	9–45	–
Forb					
8	**Forbs**			45–90	
	white heath aster	SYER	*Symphyotrichum ericoides*	18–45	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	9–45	–
	scurfpea	PSORA2	*Psoralidium*	18–45	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	9–45	–
	tarragon	ARDR4	*Artemisia dracunculus*	9–27	–
	Forb, perennial	2FP	*Forb, perennial*	9–27	–
	common yarrow	ACMI2	*Achillea millefolium*	9–27	–
	groundplum milkvetch	ASCR2	*Astragalus crassicarpus*	9–27	–
	larkspur	DELPH	*Delphinium*	9–27	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	9–27	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	9–18	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–18	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	9–18	–
	goldenrod	SOLID	*Solidago*	0–18	–
	yellow salsify	TRDU	*Tragopogon dubius*	9–18	–
	American vetch	VIAM	*Vicia americana*	0–18	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0–9	–
	onion	ALLIU	*Allium*	0–9	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–9	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–9	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	0–9	–
	dotted blazing star	LIPU	*Liatris punctata*	0–9	–
Shrub/Vine					
9	**Shrubs**			45–90	

	silver sagebrush	ARCA13	*Artemisia cana*	9–45	–
	prairie sagewort	ARFR4	*Artemisia frigida*	18–45	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	9–45	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–45	–
	rose	ROSA5	*Rosa*	9–27	–
	big sagebrush	ARTR2	*Artemisia tridentata*	0–27	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–27	–
	American plum	PRAM	*Prunus americana*	0–18	–
	chokecherry	PRVI	*Prunus virginiana*	0–18	–
	currant	RIBES	*Ribes*	0–9	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–9	–
Tree					
10	**Trees**			0–18	
	Tree	2TREE	*Tree*	0–9	–
	boxelder	ACNE2	*Acer negundo*	0–9	–
	green ash	FRPE	*Fraxinus pennsylvanica*	0–9	–
	plains cottonwood	PODEM	*Populus deltoides ssp. monilifera*	0–9	–
	American elm	ULAM	*Ulmus americana*	0–9	–

Table 10. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Western Wheatgrass**			336–897	
	western wheatgrass	PASM	*Pascopyrum smithii*	336–897	–
2	**Needlegrass**			47–353	
	green needlegrass	NAVI4	*Nassella viridula*	24–235	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	24–118	–
3	**Short Warm-Season Grasses**			118–235	
	blue grama	BOGR2	*Bouteloua gracilis*	118–235	–
	buffalograss	BODA2	*Bouteloua dactyloides*	28–112	–
4	**Other Warm-Season Grasses**			24–118	
	switchgrass	PAVI2	*Panicum virgatum*	24–118	–
	big bluestem	ANGE	*Andropogon gerardii*	24–71	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–71	–
5	**Other Native Grasses**			118–353	
	prairie sandreed	CALO	*Calamovilfa longifolia*	47–188	–
	Grass, perennial	2GP	*Grass, perennial*	47–118	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	24–118	–
	prairie dropseed	SPHE	*Sporobolus heterolepis*	0–118	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–71	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–71	–
	saltgrass	DISP	*Distichlis spicata*	0–47	–
6	**Grass-Likes**			118–235	

6	**Grass-Likes**			118–235	
	sedge	CAREX	*Carex*	118–235	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–47	–
7	**Non-Native Grasses**			84–280	
	Kentucky bluegrass	POPR	*Poa pratensis*	84–224	–
	cheatgrass	BRTE	*Bromus tectorum*	47–168	–
	smooth brome	BRIN2	*Bromus inermis*	0–118	–
Forb					
8	**Forbs**			235–353	
	white heath aster	SYER	*Symphyotrichum ericoides*	47–118	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	24–118	–
	scurfpea	PSORA2	*Psoralidium*	24–118	–
	goldenrod	SOLID	*Solidago*	24–118	–
	Forb, perennial	2FP	*Forb, perennial*	47–118	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	24–118	–
	larkspur	DELPH	*Delphinium*	47–118	–
	dotted blazing star	LIPU	*Liatris punctata*	24–118	–
	tarragon	ARDR4	*Artemisia dracunculus*	24–94	–
	mint	MENTH	*Mentha*	0–71	–
	yellow salsify	TRDU	*Tragopogon dubius*	24–71	–
	American vetch	VIAM	*Vicia americana*	0–47	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–47	–
	bluebells	MERTE	*Mertensia*	0–47	–
	purple prairie clover	DAPU5	*Dalea purpurea*	24–47	–
	common yarrow	ACMI2	*Achillea millefolium*	0–47	–
	onion	ALLIU	*Allium*	0–24	–
	groundplum milkvetch	ASCR2	*Astragalus crassicarpus*	0–24	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–24	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–24	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	0–24	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0–24	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–24	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–24	–
Shrub/Vine					
9	**Shrubs**			353–471	
	silver sagebrush	ARCA13	*Artemisia cana*	118–353	–
	big sagebrush	ARTR2	*Artemisia tridentata*	0–235	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	47–235	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–118	–
	prairie sagewort	ARFR4	*Artemisia frigida*	47–118	–
	chokecherry	PRVI	*Prunus virginiana*	24–118	–
	currant	RIBES	*Ribes*	24–118	–
	rose	ROSA5	*Rosa*	24–71	–

	leadplant	AMCA6	*Amorpha canescens*	0–47	–
	American plum	PRAM	*Prunus americana*	24–47	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–45	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–24	–
	Subshrub (<.5m)	2SUBS	*Subshrub (<.5m)*	0–24	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–24	–
Tree					
10	**Trees**			0–47	
	Tree	2TREE	*Tree*	0–24	–
	boxelder	ACNE2	*Acer negundo*	0–24	–
	green ash	FRPE	*Fraxinus pennsylvanica*	0–24	–
	plains cottonwood	PODEM	*Populus deltoides ssp. monilifera*	0–24	–
	American elm	ULAM	*Ulmus americana*	0–24	–

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). Therefore, a resource inventory is necessary to document plant composition and production. More accurate carrying capacity estimates should eventually be calculated using the following stocking rate information along with animal preference data and actual stocking records, particularly when grazers other than cattle are involved. With consultation of the land manager, more intensive grazing management may result in improved harvest efficiencies and increased carrying capacity.

Plant Community = Rhizomatous Wheatgrass-Green Needlegrass/Silver Sagebrush (1.1)
Average Annual Production (lbs./ac, air-dry) = 2500
Stocking Rate (AUM/ac) = 0.68

Plant Community = Blue Grama-Rhizomatous Wheatgrass/Shrubs (1.2)
Average Annual Production (lbs./ac, air-dry) = 800
Stocking Rate (AUM/ac) = 0.22

Plant Community = Pioneer Perennials/Annuals/Shrubs (2.1)
Average Annual Production (lbs./ac, air-dry) = Variable **
Stocking Rate (AUM/ac) = Unknown

Plant Community = Rhizomatous Wheatgrass-Green Needlegrass-Non-Native Cool-Season Grasses/Silver Sagebrush (3.1)
Average Annual Production (lbs./ac, air-dry) = 2100
Stocking Rate (AUM/ac) = 0.57

Plant Community = Smooth Brome-Kentucky Bluegrass (>30%)/Shrubs (4.1)
Average Annual Production (lbs./ac, air-dry) = Variable **
Stocking Rate (AUM/ac) = Unknown

Plant Community = Go-back or Introduced (5.1)
Average Annual Production (lbs./ac, air-dry) = Variable **
Stocking Rate (AUM/ac) = Unknown

*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).
** Highly variable; stocking rate needs to be determined on-site.

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 herbage production on this site. The site is dominated by soils in hydrologic groups B and 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 exception would be where shortgrasses form a dense sod and dominate the site. Normally 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 opportunities for upland game species. The wide variety of plants which bloom from spring until fall have an aesthetic value that appeals to visitors.

Other products

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

Other information

Site Development and Testing Plan:
Future work, as described in a Project Plan, is necessary to upgrade this site to the Correlated level. This will include field activities to collect high-intensity sampling of vegetation, and analysis of that data. The final field review, peer review, quality control, and quality assurance reviews of the ESD will be required to produce the final “Correlated” document.

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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 description include: Stan Boltz, Range Management Specialist, NRCS; Darrel DuVall, Range Management Specialist, NRCS; Cheryl Nielsen, Range Management Specialist, NRCS; Rick Peterson, Range Management Specialist, NRCS; and Mike Stirling, Range Management Specialist, NRCS.

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Contributors

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Rick L. Peterson

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ESD updated by Rick L. Peterson, 05/24/17

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, Ryan Beer, Mitch Iverson, Thad Berrett, Cheryl Nielsen
Contact for lead author	stanley.boltz@sd.usda.gov, 605-352-1236

Date	06/04/2008
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):** 0 to 5 percent is typical.

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):** Litter should fall in place. 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 should 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 5 to 15 inches thick with mollic (dark) colors when moist. Structure typically is medium to fine granular 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- and warm-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: Mid cool-season rhizomatous grasses >

    Sub-dominant: Mid to tall cool-season bunchgrasses = tall warm-season rhizomatous grasses > shrubs >

    Other: Forbs

    Additional:

---

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.

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Production ranges from 1,700-3,300 lbs./acre (air-dry weight). Reference value production is 2,500 lbs./acre (air-dry weight).

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

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17. **Perennial plant reproductive capability:** All species exhibit high vigor relative to climatic conditions. Do not rate based solely on seed production. Perennial grasses should have vigorous rhizomes or tillers.
