USDA Natural Resources Conservation Service

Ecological site R060AY011SD
Clayey 13-16" P.Z.

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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

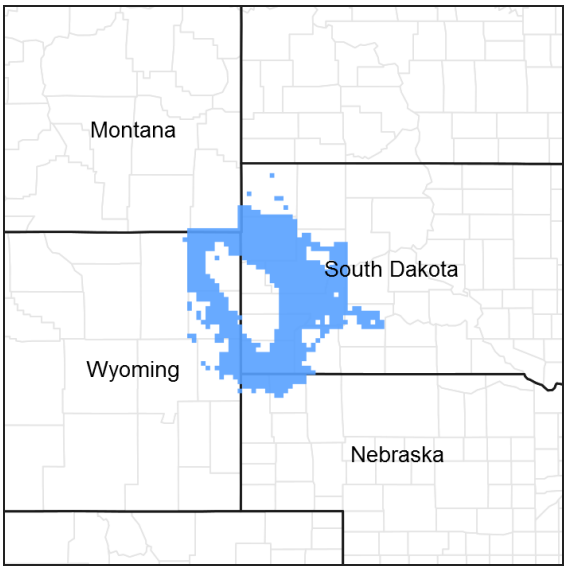


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 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) and the Dakota Hogback (MLRA 61). MLRA 60A includes portions of the Oglala, Buffalo Gap, and the 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 have 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 primarily are 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 Clayey 13-16” PZ ecological site occurs on the western side of the MLRA. Clayey sites are the most common ecological site in MLRA 60A. It is located on upland landscapes and does not receive additional moisture from runoff or overflow. Typical slopes range from 0 to 30 percent. Soils are deep with silty loam, silty clay loam, or silty clay surface textures 2 to 7 inches thick. The vegetation in the Reference State consists of a mix of cool- and warm-season grasses; however, mid-statured cool-season grasses will be the dominant group. Western and/or thickspike wheatgrass and green needlegrass are the dominant cool-season grasses, while little bluestem, blue grama, and buffalograss are the dominant warm-season grasses. Forbs are common and diverse. The dominant shrubs include Wyoming big sagebrush, winterfat, and rose. Wyoming big sagebrush is almost always present unless the site has burned within the last several decades.

Associated sites

R060AY010SD	**Loamy 13-16" P.Z.** The Loamy 13-16” PZ site can be found adjacent to this site.
R060AY012SD	**Thin Upland** The Thin Upland site will be found on steeper slopes adjacent to this site.
R060AY017SD	**Shallow Clay** The Shallow Clayey site can be located on steep slopes above this site.
R060AY018SD	**Dense Clay** The Dense Clay site can be found adjacent to and intermixed with this site.
R060AY021SD	**Clayey Overflow** The Clayey Overflow site will be found on drainageways adjacent to this site.

Similar sites

R060AY010SD	**Loamy 13-16" P.Z.** The Loamy 13-16” PZ site will have similar production with more needle and thread and less green needlegrass.
R060AY021SD	**Clayey Overflow** The Clayey Overflow site will have less green needlegrass, more needle and thread, and higher forage production.
R060AY018SD	**Dense Clay** The Dense Clay site will have green needlegrass and shortgrasses, and more rhizomatous wheatgrass.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata var. wyomingensis*

Herbaceous	(1) *Pascopyrum smithii* (2) *Nassella viridula*

Physiographic features

This site occurs on nearly level to steep uplands.

Table 2. Representative physiographic features

Landforms	(1) Fan (2) Plain (3) Hill
Flooding frequency	None
Ponding frequency	None
Elevation	762–1,311 m
Slope	0–30%
Water table depth	0 cm
Aspect	Aspect is not a significant factor

Climatic features

The climate in this MLRA is typically the drier portion of the Northern Great Plains, where sagebrush steppes to the west yield to grassland steppes to the east. Annual precipitation for the drier portion of the MLRA ranges from 13 to 16 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 permit 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 storms occur during 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)	128 days
Precipitation total (average)	381 mm

Climate stations used

- (1) MOORCROFT 3S [USW00024088], Moorcroft, WY
- (2) BELLE FOURCHE 22 NNW [USC00390565], Belle Fourche, SD
- (3) COLONY [USC00481905], Aladdin, WY
- (4) REDBIRD [USC00487555], Lance Creek, WY
- (5) EDGEMONT [USC00392557], Edgemont, SD

- (6) ALBION 1 N [USC00240088], Alzada, MT
- (7) UPTON [USC00489205], Upton, WY

Influencing water features

No significant water features influence this site.

Soil features

The soils in this site are well drained and formed in alluvium, colluvium, and residuum derived primarily from shale. The silty clay to silt loam surface layer is 2 to 7 inches thick. The soils have a moderately slow to slow infiltration rate. When dry these soils crack. When 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. Water flow paths are broken, irregular in appearance or discontinuous with numerous debris dams or vegetative barriers. The soil surface is stable and intact. Subsurface soil layers are non-restrictive to water movement and root penetration.

Major soils correlated to the Clayey 13-16” PZ site: Bidman, Bufton, Kyle, Norrest, Nunn, Pierre, Razor, Renohill, Rhoame, Savageton, Ulm, and Wyarno.

These soils are mainly susceptible to water erosion. The hazard of water erosion increases on slopes greater than about 5 percent. 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) Silt loam (2) Silty clay loam (3) Silty clay
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Very slow to moderately slow
Soil depth	51–203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	7.62–17.78 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Electrical conductivity (0-101.6cm)	0–8 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–13
Soil reaction (1:1 water) (0-101.6cm)	6.1–9
Subsurface fragment volume <=3" (Depth not specified)	0–13%
Subsurface fragment volume >3" (Depth not specified)	0–6%

Ecological dynamics

This site developed under Northern Great Plains climatic conditions, 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.

The western portion of this MLRA is located in the eastern extent of Wyoming big sagebrush. Wyoming big sage is an important habitat element for may obligate species, including the greater sage-grouse. It is also essential to maintaining native plants and limiting the invasion of exotic plants in sagebrush communities (Beck et al., 2010).

Non-native cool-season grasses, primarily annual brome species, and fire can dramatically alter the dynamics of this site. Fire return intervals have become more frequent with the introduction of annual bromes, and the use of prescribed burning has, and continues to be used, to increase herbaceous cover for grazing. Historically, Wyoming big sagebrush recovery from wildfire was extremely slow. It is a non-root sprouter and highly susceptible to fire injury and is likely to require well over 100 years to reach pre-burn sagebrush cover (Cooper et al., 2001). As a result many of the native plant communities on this site are at-risk of being converted to a Native/Invaded State.

The plant community upon which interpretations are primarily based is the Reference Plant Community (1.1). The Reference Plant Community has been determined by studying 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 communities, states, transitional pathways, and thresholds have been determined through similar studies and experience.

The following diagram illustrates the common plant communities and vegetation states commonly occurring on the site and the transition pathways between communities and states. The ecological processes are discussed in more detail in the plant community descriptions following the diagram.

State and transition model

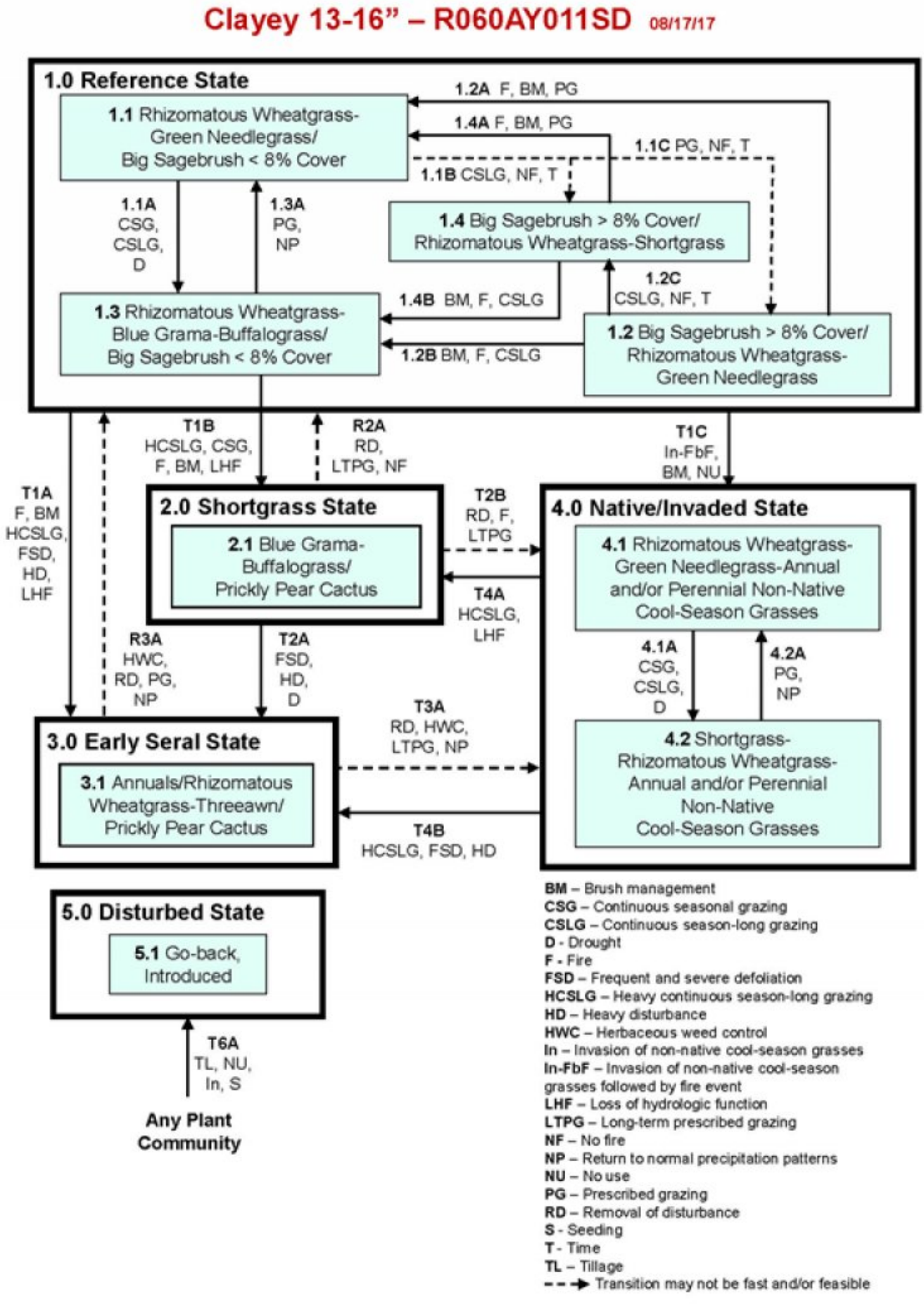


Figure 6. Clayey - 13-16" PZ - R060AY011SD.

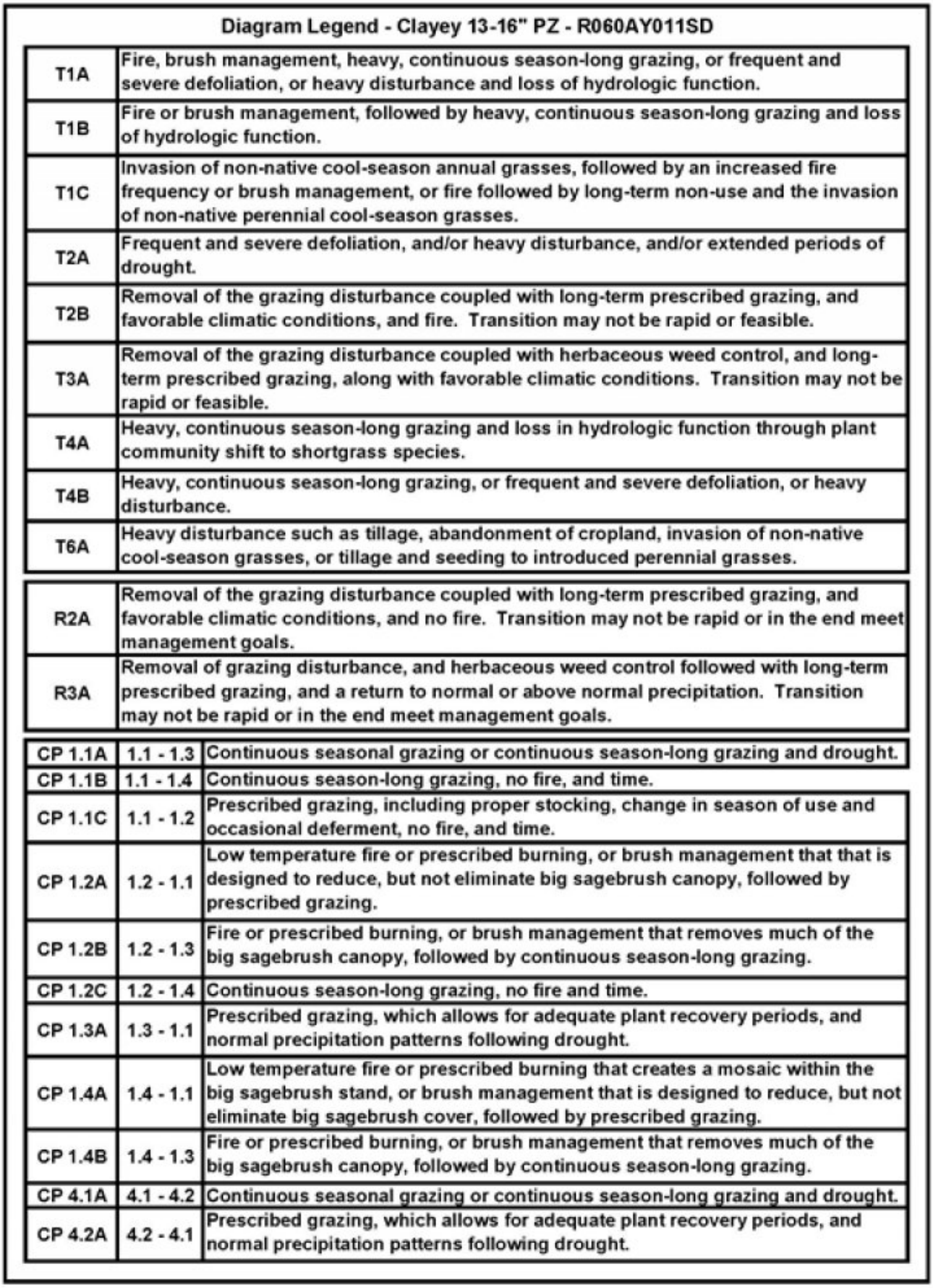


Diagram Legend - Clayey 13-16" PZ - R060AY011SD

T1A	Fire, brush management, heavy, continuous season-long grazing, or frequent and severe defoliation, or heavy disturbance and loss of hydrologic function.
T1B	Fire or brush management, followed by heavy, continuous season-long grazing and loss of hydrologic function.
T1C	Invasion of non-native cool-season annual grasses, followed by an increased fire frequency or brush management, or fire followed by long-term non-use and the invasion of non-native perennial cool-season grasses.
T2A	Frequent and severe defoliation, and/or heavy disturbance, and/or extended periods of drought.
T2B	Removal of the grazing disturbance coupled with long-term prescribed grazing, and favorable climatic conditions, and fire. Transition may not be rapid or feasible.
T3A	Removal of the grazing disturbance coupled with herbaceous weed control, and long-term prescribed grazing, along with favorable climatic conditions. Transition may not be rapid or feasible.
T4A	Heavy, continuous season-long grazing and loss in hydrologic function through plant community shift to shortgrass species.
T4B	Heavy, continuous season-long grazing, or frequent and severe defoliation, or heavy disturbance.
T6A	Heavy disturbance such as tillage, abandonment of cropland, invasion of non-native cool-season grasses, or tillage and seeding to introduced perennial grasses.

R2A	Removal of the grazing disturbance coupled with long-term prescribed grazing, and favorable climatic conditions, and no fire. Transition may not be rapid or in the end meet management goals.
R3A	Removal of grazing disturbance, and herbaceous weed control followed with long-term prescribed grazing, and a return to normal or above normal precipitation. Transition may not be rapid or in the end meet management goals.

CP 1.1A	1.1 - 1.3	Continuous seasonal grazing or continuous season-long grazing and drought.
CP 1.1B	1.1 - 1.4	Continuous season-long grazing, no fire, and time.
CP 1.1C	1.1 - 1.2	Prescribed grazing, including proper stocking, change in season of use and occasional deferment, no fire, and time.
CP 1.2A	1.2 - 1.1	Low temperature fire or prescribed burning, or brush management that that is designed to reduce, but not eliminate big sagebrush canopy, followed by prescribed grazing.
CP 1.2B	1.2 - 1.3	Fire or prescribed burning, or brush management that removes much of the big sagebrush canopy, followed by continuous season-long grazing.
CP 1.2C	1.2 - 1.4	Continuous season-long grazing, no fire and time.
CP 1.3A	1.3 - 1.1	Prescribed grazing, which allows for adequate plant recovery periods, and normal precipitation patterns following drought.
CP 1.4A	1.4 - 1.1	Low temperature fire or prescribed burning that creates a mosaic within the big sagebrush stand, or brush management that is designed to reduce, but not eliminate big sagebrush cover, followed by prescribed grazing.
CP 1.4B	1.4 - 1.3	Fire or prescribed burning, or brush management that removes much of the big sagebrush canopy, followed by continuous season-long grazing.
CP 4.1A	4.1 - 4.2	Continuous seasonal grazing or continuous season-long grazing and drought.
CP 4.2A	4.2 - 4.1	Prescribed grazing, which allows for adequate plant recovery periods, and normal precipitation patterns following drought.

Figure 7. Clayey 13-16" PZ - R060AY011SD.

State 1
Reference State

This State represents what is believed to show the natural range of variability that dominated the dynamics of the

ecological site prior to European settlement. This site in the Reference State (1.0), is dominated by cool-season grasses and subdominant warm-season grass. Shrubs, including Wyoming big sagebrush, are important components within this State. Grazing and the lack of grazing, fire, and drought are the major drivers between plant communities. Continuous season-long grazing can push this State to a warm-season shortgrass-dominated State. Invasion of non-native cool-season annual grasses and fire will result in a transition to a Native/Invaded State (4.0).

Community 1.1
Rhizomatous Wheatgrass-Green Needlegrass/Big Sagebrush < 8% Cover

Figure 8. Clayey 13-16" PZ - PCP 1.1.

The plant community upon which interpretations are primarily based is the Rhizomatous Wheatgrass-Green Needlegrass/Big Sagebrush < 8% Cover Plant Community (1.1). This is also considered the Reference Plant Community. This plant community can be found on areas that are properly managed with grazing and/or prescribed burning, and on areas receiving occasional short periods of deferment. The potential vegetation consists of about 80 to 90 percent grasses or grass-like plants, 5 to 10 percent forbs, and 5 to 10 percent shrubs. Cool-season grasses dominate this plant community. The major grasses are rhizomatous wheatgrass and green needlegrass. Other grasses and grass-like species include blue grama, buffalograss, Sandberg bluegrass, prairie Junegrass, and sedge. Significant forbs include scarlet globemallow, wild parsley, biscuitroot, golden pea, sego lily, deervetch, American vetch, and milkvetch. Dominant shrubs include Wyoming big sagebrush, winterfat, rose, Gardner's saltbush, and cactus. 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). The diversity in plant species allows for high drought tolerance. This is a healthy and sustainable plant community. Moderate or high available water capacity provides a favorable soil-water-plant relationship. Overall the interpretive plant community has the appearance of being extremely stable, diverse and productive. Plant litter is properly distributed with very little movement off-site, and natural plant mortality is low. Most plant species have a wide range of age classes represented and reproduction is not limited. Plant roots occupy most of the soil profile, which provides for soil stability and promotes infiltration.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	818	1705	2365
Forb	95	151	207
Shrub/Vine	95	151	207
Moss	–	10	22
Total	**1008**	**2017**	**2801**

Figure 10. 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

Community 1.2
Big Sagebrush > 8% Cover/Rhizomatous Wheatgrass-Green Needlegrass

This plant community develops from proper grazing use, and the absence of fire, for an extended period of time. It is made up of 70 to 80 percent cool-season midgrasses and warm-season shortgrasses, 5 to 10 percent forbs and 5 to 15 percent shrubs. The dominant grasses include rhizomatous wheatgrass, green needlegrass, blue grama and buffalograss. Forbs commonly found on this plant community include cudweed sagewort, scarlet globemallow, common yarrow, and scurfpea. Big sagebrush canopy typically ranges from 5 to 15 percent of the community. When compared to the Reference Plant Community (1.1), big sagebrush has increased. Production of cool-season grasses, particularly green needlegrass, has been reduced slightly. The sagebrush canopy protects the cool-season midgrasses, by making them less available for grazing. Under proper management, this plant community is stable and productive. The soil erosion is low to moderate. Infiltration and runoff are moderate.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	678	1273	1636
Shrub/Vine	247	359	476
Forb	84	135	185
Moss	–	27	56
Total	**1009**	**1794**	**2353**

Figure 12. 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

Community 1.3
Rhizomatous Wheatgrass-Blue Grama-Buffalograss/Big Sagebrush < 8% Cover

This plant community develops under continuous seasonal grazing (i.e., grazing an area during the same season every year), continuous season-long grazing or from over utilization during extended periods of drought. The potential vegetation is made up of approximately 70 to 85 percent grasses and grass-like species, 10 to 15 percent forbs, and 5 to 10 percent shrubs. The dominant grasses include blue grama, buffalograss, and western and/or thickspike wheatgrass. Other grasses may include green needlegrass, prairie Junegrass, and Sandberg bluegrass. Significant forbs include scarlet globemallow, wild parsley, biscuitroot, phlox, golden pea, deer vetch, asters, and milkvetch. The significant shrubs that occur include big sagebrush, cactus, broom snakeweed and rose. Big sagebrush canopy typically ranges from 5 to 10 percent. Compared to the Reference Plant Community (1.1), the shortgrass species, especially blue grama and buffalograss, have increased. The cool-season species, including rhizomatous wheatgrass and green needlegrass, have decreased in composition. Annual bromes, curlycup gumweed, sweet clover, and other annual grasses and forbs can invade the site. While plant diversity is relatively high, short grasses dominate the structure of the community. This plant community is resistant to change. The dominant herbaceous species are very adapted to grazing; however, the midgrass species and the more palatable forbs will decrease in the community through continuous seasonal grazing. If the herbaceous component is intact, it tends to be resilient if disturbance is not long-term. Because of the sod-forming habit of the dominant shortgrass species, water infiltration is low, and runoff is moderate to high. Typically runoff is very clean because of low potential for onsite soil erosion. However, offsite areas may be affected by increased runoff.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	527	1363	1737
Forb	174	224	280
Shrub/Vine	84	179	280
Moss	–	27	56
Total	**785**	**1793**	**2353**

Figure 14. 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

Community 1.4
Big Sagebrush > 8% Cover/Rhizomatous Wheatgrass-Shortgrass

Figure 15. Clayey 13-16" PZ - PCP 1.4.

This plant community is the result of continuous season-long grazing and the absence of fire. This plant community is made up of 65 to 80 percent cool-season midgrasses and warm-season shortgrasses, 5 to 10 percent forbs, and 15 to 25 percent shrubs. The dominant grasses include rhizomatous wheatgrass, green needlegrass, blue grama and buffalograss. Blue grama, buffalograss, prairie Junegrass and Sandberg bluegrass increase in the plant community. Annual brome, other annuals, and Kentucky bluegrass can invade the plant community. The sagebrush canopy protects the cool-season grasses, but this protection makes them less available for grazing. Under proper management, this plant community is stable. The soil erosion is low to moderate. Infiltration and runoff are moderate.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	381	480	622
Shrub/Vine	247	453	616
Forb	45	76	106
Total	**673**	**1009**	**1344**

Figure 17. Plant community growth curve (percent production by month). SD6004, Pierre Shale Plains, warm-season dominant, cool-season sub-dominant. Warm season dominant, cool-season sub-dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	18	25	25	15	7	0	0	0

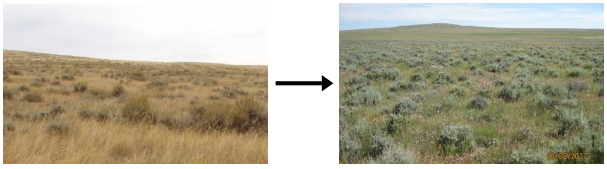
Pathway 1.1C
Community 1.1 to 1.2

Prescribed grazing, including proper stocking rates, change in season of use, occasional deferment, no fire, and an extended period of time will lead this plant community to the Big Sagebrush > 8% Cover/Rhizomatous Wheatgrass-Needlegrass Plant Community (1.2).

Pathway 1.1A
Community 1.1 to 1.3

Continuous seasonal grazing during the active growing period of cool-season plants, or continuous season-long grazing, or extended periods of drought will lead to the Rhizomatous Wheatgrass-Blue Grama-Buffalograss/Big Sagebrush < 8% Cover Plant Community (1.3).

Pathway 1.1B
Community 1.1 to 1.4



Rhizomatous Wheatgrass-Green Needlegrass/Big Sagebrush < 8% Cover

Big Sagebrush > 8% Cover/Rhizomatous Wheatgrass-Shortgrass

Continuous season-long grazing, no fire, and an extended period of time will lead to the Big Sagebrush > 8% Cover/Rhizomatous Wheatgrass-Shortgrass Plant Community (1.4).

Pathway 1.2A
Community 1.2 to 1.1

Low-temperature fire or prescribed burning that creates a mosaic within the big sagebrush stand, or brush management that is designed to reduce, but not eliminate big sagebrush cover, followed by prescribed grazing, will move this Plant Community toward the Rhizomatous Wheatgrass-Green Needlegrass/Big Sagebrush < 8% Cover Plant Community (1.1).

Pathway 1.2B
Community 1.2 to 1.3

Fire, prescribed burning or brush management that removes much of the big sagebrush canopy followed by continuous season-long grazing will move this Plant Community toward the Rhizomatous Wheatgrass-Blue Grama-Buffalograss/Big Sagebrush < 8% Canopy Plant Community (1.3).

Pathway 1.2C
Community 1.2 to 1.4

With continuous season-long grazing and no fire, this plant community, will in time move to the Big Sagebrush > 8% Cover/Rhizomatous Wheatgrass-Shortgrass Plant Community (1.4).

Pathway 1.3A
Community 1.3 to 1.1

Prescribed grazing, which allows for adequate plant recovery periods, and a return to normal precipitation patterns

will move this plant community to the Rhizomatous Wheatgrass-Green Needlegrass Plant/Big Sagebrush < 8% Cover Community (1.1). Periods of nonuse or deferment may be a management option to reach the Reference Plant Community (1.1).

Pathway 1.4A
Community 1.4 to 1.1

Big Sagebrush > 8% Cover/Rhizomatous Wheatgrass-Shortgrass

Rhizomatous Wheatgrass-Green Needlegrass/Big Sagebrush < 8% Cover

Low-temperature fire or prescribed burning that creates a mosaic within the big sagebrush stand, or brush management that is designed to reduce, but not eliminate, big sagebrush cover, followed by prescribed grazing, will move this Plant Community toward the Rhizomatous Wheatgrass-Green Needlegrass/Big Sagebrush < 8% Cover Plant Community (1.1).

Pathway 1.4B
Community 1.4 to 1.3

Fire or prescribed burning or brush management that removes much of the big sagebrush canopy, followed by continuous season-long grazing will move this Plant Community toward the Rhizomatous Wheatgrass-Blue Grama-Buffalograss/Big Sagebrush < 8% Canopy Plant Community (1.3).

State 2
Shortgrass State

The Shortgrass State is dominated by shortgrass species and upland sedges. The State is the result of fire, or heavy disturbance that removed much or all the big sagebrush, and grazing management that did not provide adequate recovery time for cool-season wheatgrasses and green needlegrass. The hydrologic function of this state is dramatically altered. Runoff is high and infiltration is low. This State is very resistant to change through grazing management alone.

Community 2.1
Blue Grama-Buffalograss/Pricklypear Cactus

This plant community develops under heavy continuous season-long grazing, and with continuous seasonal grazing with concentrated use in the early part of the growing season (as in calving/lambing pastures). Fire, sometime in the past, will have removed all or the majority of big sagebrush. It is made up of approximately 75 to 90 percent grasses (primarily short, warm-season grasses), 5 to 10 percent forbs, and 5 to 15 percent shrubs. The dominant grasses include blue grama and buffalograss. Other grasses may include rhizomatous wheatgrass, prairie Junegrass, threeawn, and annual brome. The dominant forbs include slimflower scurfpea, pussytoes, curlycup gumweed, and scarlet globemallow. The dominant shrub is plains pricklypear. Compared to the Reference Plant Community (1.1), shortgrasses have increased, and cool-season midgrasses have diminished greatly. Some forbs and cactus have either increased and/or invaded the site. This plant community is very stable. Generally, this plant community will require significant management inputs (e.g., high animal impact, long term prescribed grazing, favorable climatic conditions, etc.) and time to move it towards the Rhizomatous Wheatgrass-Blue Grama- Buffalograss/Big Sagebrush < 8% Cover Plant Community (1.3). On-site soil erosion is low. Infiltration is low, and runoff is high as the hydrologic function is altered. Typically runoff is low in suspended particles because of the low potential for on-site soil erosion. However, off- site areas can be significantly impacted due to the increased runoff.

Table 9. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	381	594	801
Shrub/Vine	34	73	112
Forb	34	54	78
Moss	–	8	17
Total	**449**	**729**	**1008**

Figure 19. Plant community growth curve (percent production by month). SD6005, Pierre Shale Plains, warm-season dominant. Warm-season dominant..

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

State 3
Early Seral State

The Early Seral State is dominated by weedy annuals, rhizomatous wheatgrass, threeawn and pricklypear cactus. This State is the result of fire, heavy disturbance such as, frequent and severe defoliation, and livestock concentration that removed big sagebrush coupled with grazing management that does not provide adequate recovery time for cool-season wheatgrasses and green needlegrass. The hydrologic function is also likely to be dramatically altered. Runoff is high and infiltration is low. This State is very resistant to change through grazing management alone.

Community 3.1
Annuals/Rhizomatous Wheatgrass-Threeawn/Pricklypear Cactus

This plant community developed under heavy, continuous season-long grazing and/or severe disturbance. The plant composition is made up of annuals with a few species of perennial forbs and grasses that are very tolerant to frequent and severe defoliation. The potential plant community is made up of approximately 60 to 80 percent grasses and grass-like species, 15 to 30 percent forbs and 5 to 20 percent shrubs. The dominant grasses include threeawn, sedge and cheatgrass. Other grasses may include blue grama, buffalograss, rhizomatous wheatgrass, and sixweeks fescue. The composition of forbs can be highly variable due to climatic conditions. Forbs commonly occurring include fetid marigold, horseweed, curlycup gumweed, western ragweed, pussytoes, prostrate verbena and other annual invader-like species. Other plant species, from adjacent ecological sites, can become minor components of this plant community. Compared to the Reference Plant Community (1.1), percent of bare ground has greatly increased which allows for invasion of Canada thistle and other non- native species. This plant community is resistant to change toward the Reference State (1.0) because of the loss of plant diversity and overall soil disturbance. It is very susceptible to invasion of non-native plant species. Soil erosion is potentially high because of the bare ground and shallow rooted herbaceous plant community. Water runoff will increase and infiltration will decrease due to animal related soil compaction and loss of root mass due to low plant diversity and vigor. This plant community will require significant economic inputs and time to move toward 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 site can be renovated to improve the production capability, however if management changes are not made the vegetation could revert back.

Table 10. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	342	522	701
Forb	73	157	241
Shrub/Vine	34	99	163
Moss	–	7	17
Total	**449**	**785**	**1122**

Figure 21. 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

State 4
Native/Invaded State

The Native/Invaded State is dominated by rhizomatous wheatgrass, green needlegrass, and non-native cool-season annual and/or perennial grasses. This State is the result of the invasion on non-native annual grasses and an increase in fire frequency that has permanently removed the big sagebrush component from the plant communities. This State can resemble the Reference State (1.0) except for the absence of big sagebrush and to what degree it is invaded by non-native cool-season grasses. This State is very resistant to change through grazing management alone.

Community 4.1
Rhizomatous Wheatgrass-Needlegrass-Annual and/or Perennial Non-Native Cool-Season Grasses

This plant community develops from the invasion of non-native cool-season annual grasses followed by an increase in fire events and/or brush management which permanently removes big sagebrush from the Plant Community. It is made up of 80 to 90 percent cool-season midgrasses and warm-season shortgrasses, 5 to 10 percent forbs and, 0 to 2 percent shrubs. The dominant grasses include rhizomatous wheatgrass, green needlegrass, annual bromegrass, blue grama, and buffalograss. Under long-term non-use Kentucky bluegrass and/or smooth brome may become the dominant grass species. Forbs commonly found on this plant community include cudweed sagewort, scarlet globemallow, common yarrow, and scurfpea. When compared to the Reference Plant Community (1.1), big sagebrush is absent and non-native cool-season grasses are the major drivers of the system. Production in wet years may be very similar or slightly higher than the Reference Plant Community but in dry years is will be much lower. Under proper management, this plant community is stable. The soil erosion is low to moderate. Infiltration and runoff is moderate.

Figure 22. 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

Community 4.2
Shortgrass-Rhizomatous Wheatgrass-Annual and/or Perennial Non-Native Cool-Season Grasses

This plant community develops from the invasion of non-native cool-season annual grasses followed by an increase in fire events and/or brush management which permanently removes big sagebrush from the Plant Community. It is made up of 80 to 90 percent warm-season shortgrasses and cool-season midgrasses, 5 to 10 percent forbs, and 0 to 2 percent shrubs. The dominant grasses and grass-like species include blue grama, buffalograss, threadleaf sedge, rhizomatous wheatgrass, green needlegrass, prairie Junegrass, Sandberg bluegrass, and annual

bromegrass. Under long-term non-use Kentucky bluegrass and/or smooth brome may invade. Forbs commonly found on this plant community include cudweed sagewort, scarlet globemallow, common yarrow, and scurfpea. When compared to the Reference Plant Community (1.1), big sagebrush is absent and non-native cool-season grasses are the major drivers of the system. Production in wet years may be similar to the Rhizomatous Wheatgrass-Blue Grama-Buffalograss/Big Sagebrush < 8% Cover Plant Community (1.3). Under proper management, this plant community is stable. The soil erosion is low to moderate. Infiltration and runoff is low to moderate.

Figure 23. Plant community growth curve (percent production by month). SD6104, Black Hills Foot Slopes, warm-season dominant, cool-season sub-dominant. Warm-season dominant, cool-season sub-dominant.

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

Pathway 4.1A
Community 4.1 to 4.2

Continuous seasonal grazing during the active growing period of cool-season plants or continuous season-long grazing and drought will lead to Plant Community Phase (4.2).

Pathway 4.2A
Community 4.2 to 4.1

Prescribed grazing, which allows for adequate plant recovery periods, and normal precipitation patterns following drought will move this plant community toward Plant Community Phase (4.1).

State 5
Disturbed State

The Disturbed State can be transitioned to from any plant community on this ecological site. The two separate vegetative plant communities are highly variable in nature. They are derived through different management scenarios, and are not related successionally. Infiltration, runoff, and soil erosion 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 severe mechanical disturbance (i.e., abandoned farmland) occurs. During the early successional stages, the species that mainly dominate are annual grasses and forbs, later replaced by both native and introduced perennials. The vegetation on this site varies greatly, sometimes dominated by three-awn, annual brome, crested wheatgrass, buffalograss, broom snakeweed, sweetclover, and non-native thistles. Other plants that commonly occur on the site include western wheatgrass, deathcamas, prickly lettuce, mare’s-tail, kochia, squirreltail, foxtail, and annual sunflower. If remnant populations are sufficient, rhizomatous wheatgrass can sometimes rapidly occupy this state. The Introduced Plant Community normally consists of those areas seeded to pubescent or intermediate wheatgrass, alfalfa, crested wheatgrass, or other introduced species. Refer to the associated Forage Suitability Group description in the Field Office Technical Guide (FOTG) for adapted species.

Transition T1B
State 1 to 2

Fire and/or brush management that removes the majority, or all of the big sagebrush, heavy continuous season-long grazing, or continuous seasonal grazing (early spring), and a loss of hydrologic function will transition this Plant Community to the Shortgrass State (2.0).

Transition T1A

State 1 to 3

The removal of the majority, or all of big sagebrush, with fire or brush management, followed by heavy continuous season-long grazing or frequent and severe defoliation, or heavy disturbance including livestock feeding areas, and the loss in hydrologic function will transition this State to the Early Seral State (3.0).

Transition T1C
State 1 to 4

Invasion of non-native cool-season annual or perennial grasses followed by fire will transition this State to the Native/Invaded State (4.0). The use of herbicides and/or prescribed burning for brush management, or Fire followed by a long period of non-use can also cause this transition.

Transition T6A
State 1 to 5

Heavy disturbance, including tillage, abandoned cropland, or seeding to improved pasture species, or long-term non-use and invasion of non- native cool-season grasses will result in a transition to the Disturbed State (5.0). This transition can occur from any plant community on this site.

Restoration pathway R2A
State 2 to 1

Removal of the grazing disturbance coupled with long-term prescribed grazing, and favorable climatic conditions, which allow for adequate plant recovery periods, and no fire, may cause a shift to the Shortgrass-Rhizomatous Wheatgrass/Big Sagebrush < 8% Cover Plant Community (1.3). This transition may not be rapid or in the end meet management goals.

Transition T2A
State 2 to 3

Frequent and severe defoliation, and/or heavy disturbance such as livestock feeding areas, and/or extended periods of drought will move this plant community to the Early Seral State (3.0).

Transition T2B
State 2 to 4

Removal of the grazing disturbance along with long-term prescribed grazing, and favorable climatic conditions, which allow for adequate plant recovery periods, and fire, may cause a shift to the Native/Invaded State (4.0). This transition my not be rapid or feasible.

Transition T6A
State 2 to 5

Heavy disturbance including tillage, abandoned cropland, or seeding to improved pasture species, or long-term non-use and invasion of non-native cool-season grasses will result in a transition to the Disturbed State (5.0). This transition can occur from any plant community on this site.

Restoration pathway R3A
State 3 to 1

Removal of grazing disturbance, and herbaceous weed control to address annual bromes and cactus followed with long-term prescribed grazing that incorporates proper stocking, change in season of use, and periodic deferment will potentially transition this Plant Community to the Reference State (1.0). A return to normal or above normal precipitation will help with this transition. This transition my not be rapid or in the end meet management goals.

Transition T3A

State 3 to 4

Removal of the grazing disturbance coupled with herbaceous weed control, and long-term prescribed grazing, along with favorable climatic conditions, which allow for adequate plant recovery periods, may shift this Plant Community to the Native/Invaded State (4.0). This transition may not be rapid or feasible.

Transition T6A
State 3 to 5

Heavy disturbance including tillage, abandoned cropland, or seeding to improved pasture species, or long-term non-use and invasion of non-native cool-season grasses will result in a transition to the Disturbed State (5.0). This transition can occur from any plant community on this site.

Transition T4A
State 4 to 2

Heavy, continuous season-long grazing and loss in hydrologic function due to a shift in the plant community to predominately shortgrass species will transition this Plant Community to the Shortgrass State (2.0).

Transition T4B
State 4 to 3

Heavy, continuous season-long grazing, or frequent and severe defoliation, or heavy disturbance including livestock feeding areas, will transition this State to the Early Seral State (3.0).

Transition T6A
State 4 to 5

Heavy disturbance, including tillage, abandoned cropland, or seeding to improved pasture species, or long-term non-use and invasion of non- native cool-season grasses will result in a transition to the Disturbed State (5.0). This transition can occur from any plant community on this site.

Additional community tables

Table 11. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrasses**			706–1009	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	706–1009	–
	western wheatgrass	PASM	*Pascopyrum smithii*	706–1009	–
2	**Cool-Season Mid Grasses**			504–807	
	green needlegrass	NAVI4	*Nassella viridula*	504–807	–
3	**Warm-Season Short Grasses**			101–303	
	blue grama	BOGR2	*Bouteloua gracilis*	40–202	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–101	–
4	**Warm-Season Mid Grasses**			22–168	
	sideoats grama	BOCU	*Bouteloua curtipendula*	22–168	–
5	**Other Native Grasses and Grass-Likes**			101–202	
	Grass, perennial	2GP	*Grass, perennial*	0–101	–
	big bluestem	ANGE	*Andropogon gerardii*	0–101	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–101	–

	sedge	CAREX	*Carex*	0–101	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–101	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–101	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–101	–
Forb					
7	**Forbs**			101–202	
	Forb, perennial	2FP	*Forb, perennial*	0–40	–
	scurfpea	PSORA2	*Psoralidium*	0–40	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–40	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	0–40	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–40	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–40	–
	aster	ASTER	*Aster*	0–20	–
	milkvetch	ASTRA	*Astragalus*	0–20	–
	false boneset	BREU	*Brickellia eupatorioides*	0–20	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–20	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–20	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	0–20	–
	dotted blazing star	LIPU	*Liatris punctata*	0–20	–
	desertparsley	LOMAT	*Lomatium*	0–20	–
	American bird's-foot trefoil	LOUNU	*Lotus unifoliolatus var. unifoliolatus*	0–20	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–20	–
	bluebells	MERTE	*Mertensia*	0–20	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–20	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0–20	–
	beardtongue	PENST	*Penstemon*	0–20	–
	spiny phlox	PHHO	*Phlox hoodii*	0–20	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–20	–
	American vetch	VIAM	*Vicia americana*	0–20	–
	deathcamas	ZIGAD	*Zigadenus*	0–20	–
	common yarrow	ACMI2	*Achillea millefolium*	0–20	–
	onion	ALLIU	*Allium*	0–20	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–20	–
	pussytoes	ANTEN	*Antennaria*	0–20	–
Shrub/Vine					
8	**Shrubs**			101–202	
	big sagebrush	ARTR2	*Artemisia tridentata*	67–202	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	11–101	–
	Gardner's saltbush	ATGA	*Atriplex gardneri*	0–40	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–40	–
	rose	ROSA5	*Rosa*	0–40	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–20	–

	pricklypear	OPUNT	*Opuntia*	0–20	–
Moss					
9	**Cryptogams**			0–20	
	lesser spikemoss	SEDE2	*Selaginella densa*	0–20	–

Table 12. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrass**			538–717	
	western wheatgrass	PASM	*Pascopyrum smithii*	448–717	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	90–269	–
2	**Cool Season Mid Grasses**			359–538	
	green needlegrass	NAVI4	*Nassella viridula*	359–538	–
3	**Warm Season Short Grasses**			269–448	
	buffalograss	BODA2	*Bouteloua dactyloides*	179–269	–
	blue grama	BOGR2	*Bouteloua gracilis*	179–269	–
4	**Warm Season Mid Grasses**			22–168	
	sideoats grama	BOCU	*Bouteloua curtipendula*	22–168	–
5	**Native Grasses and Grass-likes**			90–179	
	sedge	CAREX	*Carex*	36–126	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–90	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–90	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–90	–
	Grass, perennial	2GP	*Grass, perennial*	0–90	–
	threeawn	ARIST	*Aristida*	0–90	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–90	–
	dropseed	SPORO	*Sporobolus*	0–54	–
6	**Non-native Grasses**			0–90	
	cheatgrass	BRTE	*Bromus tectorum*	0–90	–
	Kentucky bluegrass	POPR	*Poa pratensis*	0–90	–
Forb					
7	**Forb**			90–179	
	sweetclover	MELIL	*Melilotus*	0–90	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–54	–
	common yarrow	ACMI2	*Achillea millefolium*	0–54	–
	American bird's-foot trefoil	LOUNU	*Lotus unifoliolatus var. unifoliolatus*	0–54	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–54	–
	prairie thermopsis	THRH	*Thermopsis rhombifolia*	0–36	–
	American vetch	VIAM	*Vicia americana*	0–36	–
	desertparsley	LOMAT	*Lomatium*	0–36	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–36	–
	mustard	BRASS2	*Brassica*	0–36	–

	Forb, perennial	2FP	*Forb, perennial*	0–36	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–36	–
	aster	ASTER	*Aster*	0–36	–
	scurfpea	PSORA2	*Psoralidium*	0–36	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–36	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	0–36	–
	bluebells	MERTE	*Mertensia*	0–18	–
	beardtongue	PENST	*Penstemon*	0–18	–
	spiny phlox	PHHO	*Phlox hoodii*	0–18	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–18	–
	milkvetch	ASTRA	*Astragalus*	0–18	–
	Forb, annual	2FA	*Forb, annual*	0–18	–
	onion	ALLIU	*Allium*	0–18	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–18	–
	pussytoes	ANTEN	*Antennaria*	0–18	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–18	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–18	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	0–18	–
	dotted blazing star	LIPU	*Liatris punctata*	0–18	–
	deathcamas	ZIGAD	*Zigadenus*	0–18	–
Shrub/Vine					
8	**Shrub/Vine**			269–448	
	big sagebrush	ARTR2	*Artemisia tridentata*	90–359	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	11–90	–
	pricklypear	OPUNT	*Opuntia*	0–90	–
	rose	ROSA5	*Rosa*	0–54	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–54	–
	Gardner's saltbush	ATGA	*Atriplex gardneri*	0–36	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–36	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–36	–
Lichen					
9	**Cryptogams**			0–54	
	lesser spikemoss	SEDE2	*Selaginella densa*	0–54	–

Table 13. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrasses**			448–628	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	448–628	–
	western wheatgrass	PASM	*Pascopyrum smithii*	448–628	–
2	**Cool-Season Mid Grasses**			90–179	
	green needlegrass	NAVI4	*Nassella viridula*	90–179	

	green needlegrass	NAVI4	*Nassella viridula*	90–179	–
3	**Warm Season Short Grasses**			538–897	
	blue grama	BOGR2	*Bouteloua gracilis*	359–538	–
	buffalograss	BODA2	*Bouteloua dactyloides*	179–359	–
4	**Warm Season Mid Grasses**			0–168	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–168	–
5	**Native Grasses and Grass-likes**			179–359	
	sedge	CAREX	*Carex*	90–269	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–179	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	36–179	–
	Sandberg bluegrass	POSE	*Poa secunda*	36–126	–
	Grass, perennial	2GP	*Grass, perennial*	0–90	–
	threeawn	ARIST	*Aristida*	0–90	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–90	–
	dropseed	SPORO	*Sporobolus*	0–54	–
	big bluestem	ANGE	*Andropogon gerardii*	0–36	–
6	**Non-native Grasses**			0–126	
	cheatgrass	BRTE	*Bromus tectorum*	0–90	–
	Kentucky bluegrass	POPR	*Poa pratensis*	0–90	–
Forb					
7	**Forbs**			179–269	
	sweetclover	MELIL	*Melilotus*	0–90	–
	American bird's-foot trefoil	LOUNU	*Lotus unifoliolatus var. unifoliolatus*	0–54	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–54	–
	Forb, perennial	2FP	*Forb, perennial*	0–54	–
	common yarrow	ACMI2	*Achillea millefolium*	0–54	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–54	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–54	–
	prairie thermopsis	THRH	*Thermopsis rhombifolia*	0–36	–
	American vetch	VIAM	*Vicia americana*	0–36	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–36	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–36	–
	scurfpea	PSORA2	*Psoralidium*	0–36	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–36	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	0–36	–
	aster	ASTER	*Aster*	0–36	–
	milkvetch	ASTRA	*Astragalus*	0–36	–
	mustard	BRASS2	*Brassica*	0–36	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–36	–
	dotted blazing star	LIPU	*Liatris punctata*	0–36	–
	desertparsley	LOMAT	*Lomatium*	0–36	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–36	–
	bluebells	MERTE	*Mertensia*	0–18	–

	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–18	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	0–18	–
	pussytoes	ANTEN	*Antennaria*	0–18	–
	onion	ALLIU	*Allium*	0–18	–
	false boneset	BREU	*Brickellia eupatorioides*	0–18	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–18	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0–18	–
	beardtongue	PENST	*Penstemon*	0–18	–
	spiny phlox	PHHO	*Phlox hoodii*	0–18	–
	deathcamas	ZIGAD	*Zigadenus*	0–18	–
	Forb, annual	2FA	*Forb, annual*	0–18	–
	fetid marigold	DYPA	*Dyssodia papposa*	–	–
Shrub/Vine					
8	**Shrubs**			90–269	
	big sagebrush	ARTR2	*Artemisia tridentata*	56–179	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–90	–
	pricklypear	OPUNT	*Opuntia*	0–54	–
	rose	ROSA5	*Rosa*	0–54	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–54	–
	Gardner's saltbush	ATGA	*Atriplex gardneri*	0–36	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	11–36	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–18	–
Moss					
9	**Cryptogams**			0–54	
	lesser spikemoss	SEDE2	*Selaginella densa*	0–54	–

Table 14. Community 1.4 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrasses**			112–252	
	western wheatgrass	PASM	*Pascopyrum smithii*	62–135	–
	thickspike wheatgrass	ELLA3	*Elymus lanceolatus*	28–112	–
	Montana wheatgrass	ELAL7	*Elymus albicans*	0–56	–
2	**Cool-Season Mid Grasses**			56–112	
	green needlegrass	NAVI4	*Nassella viridula*	50–101	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	10–50	–
3	**Warm-Season Short Grasses**			50–179	
	blue grama	BOGR2	*Bouteloua gracilis*	34–112	–
	buffalograss	BODA2	*Bouteloua dactyloides*	11–62	–
4	**Warm-Season Mid Grasses**			0–56	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–56	–
5	**Native Grasses and Grass-likes**			50–179	

	sedge	CAREX	*Carex*	50–151	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	6–22	–
	Sandberg bluegrass	POSE	*Poa secunda*	6–22	–
	Grass, perennial	2GP	*Grass, perennial*	0–22	–
	big bluestem	ANGE	*Andropogon gerardii*	0–11	–
	threeawn	ARIST	*Aristida*	0–10	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–10	–
	dropseed	SPORO	*Sporobolus*	0–10	–
6	**Non-Native Grasses**			50–101	
	cheatgrass	BRTE	*Bromus tectorum*	50–151	–
	Kentucky bluegrass	POPR	*Poa pratensis*	0–28	–
Forb					
7	**Forbs**			50–101	
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	10–50	–
	tarragon	ARDR4	*Artemisia dracunculus*	20–50	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	30–50	–
	milkvetch	ASTRA	*Astragalus*	0–30	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–30	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–30	–
	scurfpea	PSORA2	*Psoralidium*	0–30	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–20	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–20	–
	vervain	VERBE	*Verbena*	0–20	–
	false boneset	BREU	*Brickellia eupatorioides*	0–20	–
	pussytoes	ANTEN	*Antennaria*	0–20	–
	Forb, perennial	2FP	*Forb, perennial*	0–20	–
	common yarrow	ACMI2	*Achillea millefolium*	0–20	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–10	–
	mullein	VERBA	*Verbascum*	0–10	–
	dotted blazing star	LIPU	*Liatris punctata*	0–10	–
	goldenrod	SOLID	*Solidago*	0–10	–
Shrub/Vine					
8	**Shrubs**			353–555	
	big sagebrush	ARTR2	*Artemisia tridentata*	303–504	–
	prairie sagewort	ARFR4	*Artemisia frigida*	20–81	–
	pricklypear	OPUNT	*Opuntia*	20–50	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–34	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–30	–
	Subshrub (<.5m)	2SUBS	*Subshrub (<.5m)*	0–30	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–28	–
	rose	ROSA5	*Rosa*	0–20	–
	Gardner's saltbush	ATGA	*Atriplex gardneri*	0–17	–
Moss					

9	**Cryptograms**			0–20	
	lesser spikemoss	SEDE2	*Selaginella densa*	0–20	–

Table 15. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrasses**			37–110	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	37–110	–
	western wheatgrass	PASM	*Pascopyrum smithii*	37–110	–
2	**Cool Season Mid Grasses**			0–15	
	green needlegrass	NAVI4	*Nassella viridula*	0–15	–
3	**Warm Season Mid Grasses**			291–437	
	blue grama	BOGR2	*Bouteloua gracilis*	256–364	–
	buffalograss	BODA2	*Bouteloua dactyloides*	110–140	–
4	**Warm Season Mid Grasses**			0–15	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–15	–
5	**Native Grasses and Grass-likes**			110–219	
	threeawn	ARIST	*Aristida*	0–73	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–73	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	37–73	–
	Sandberg bluegrass	POSE	*Poa secunda*	15–52	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–37	–
	Grass, perennial	2GP	*Grass, perennial*	0–37	–
	dropseed	SPORO	*Sporobolus*	0–22	–
	big bluestem	ANGE	*Andropogon gerardii*	–	–
6	**Non-native Grasses**			0–110	
	cheatgrass	BRTE	*Bromus tectorum*	0–73	–
	Kentucky bluegrass	POPR	*Poa pratensis*	0–37	–
Forb					
7	**Forb**			37–73	
	sweetclover	MELIL	*Melilotus*	0–37	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–22	–
	Forb, annual	2FA	*Forb, annual*	0–22	–
	Forb, perennial	2FP	*Forb, perennial*	0–22	–
	common yarrow	ACMI2	*Achillea millefolium*	0–22	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–22	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–22	–
	American bird's-foot trefoil	LOUNU	*Lotus unifoliolatus var. unifoliolatus*	0–22	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–15	–
	dotted blazing star	LIPU	*Liatris punctata*	0–15	–
	desertparsley	LOMAT	*Lomatium*	0–15	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–15	–

	fetid marigold	DYPA	*Dyssodia papposa*	0–15	–
	aster	ASTER	*Aster*	0–15	–
	milkvetch	ASTRA	*Astragalus*	0–15	–
	mustard	BRASS2	*Brassica*	0–15	–
	prairie thermopsis	THRH	*Thermopsis rhombifolia*	0–15	–
	American vetch	VIAM	*Vicia americana*	0–15	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–15	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–15	–
	scurfpea	PSORA2	*Psoralidium*	0–15	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–15	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–8	–
	beardtongue	PENST	*Penstemon*	0–8	–
	spiny phlox	PHHO	*Phlox hoodii*	0–8	–
	bluebells	MERTE	*Mertensia*	0–8	–
	deathcamas	ZIGAD	*Zigadenus*	0–8	–
	onion	ALLIU	*Allium*	0–8	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–8	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	0–8	–
	pussytoes	ANTEN	*Antennaria*	0–8	–
	false boneset	BREU	*Brickellia eupatorioides*	–	–
Shrub/Vine					
8	**Shrubs**			37–110	
	prairie sagewort	ARFR4	*Artemisia frigida*	15–73	–
	pricklypear	OPUNT	*Opuntia*	11–52	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–37	–
	big sagebrush	ARTR2	*Artemisia tridentata*	6–37	–
	rose	ROSA5	*Rosa*	0–22	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–8	–
	Gardner's saltbush	ATGA	*Atriplex gardneri*	–	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	–	–
Moss					
9	**Cryptogams**			0–15	
	lesser spikemoss	SEDE2	*Selaginella densa*	0–15	–

Table 16. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrasses**			39–118	
	western wheatgrass	PASM	*Pascopyrum smithii*	39–118	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–39	–
2	**Cool Season Mid Grasses**			0–24	
	green needlegrass	NAVI4	*Nassella viridula*	0–24	

	green needlegrass	NAVI4	*Nassella viridula*	0–24	–
3	**Warm Season Short Grasses**			78–235	
	buffalograss	BODA2	*Bouteloua dactyloides*	39–157	–
	blue grama	BOGR2	*Bouteloua gracilis*	39–157	–
5	**Native Grasses and Grass-likes**			39–275	
	threeawn	ARIST	*Aristida*	39–157	–
	sedge	CAREX	*Carex*	16–78	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–39	–
	Grass, perennial	2GP	*Grass, perennial*	0–39	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–24	–
	dropseed	SPORO	*Sporobolus*	0–24	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–16	–
6	**Non-native Grasses**			39–118	
	cheatgrass	BRTE	*Bromus tectorum*	39–118	–
	Kentucky bluegrass	POPR	*Poa pratensis*	0–16	–
Forb					
7	**Forb**			78–235	
	Forb, annual	2FA	*Forb, annual*	0–78	–
	sweetclover	MELIL	*Melilotus*	0–78	–
	fetid marigold	DYPA	*Dyssodia papposa*	16–78	–
	mustard	BRASS2	*Brassica*	0–63	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–39	–
	Forb, perennial	2FP	*Forb, perennial*	0–39	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	8–39	–
	pussytoes	ANTEN	*Antennaria*	0–39	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	16–39	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–24	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	0–16	–
	aster	ASTER	*Aster*	0–16	–
	common yarrow	ACMI2	*Achillea millefolium*	0–16	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–8	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–8	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–8	–
	spiny phlox	PHHO	*Phlox hoodii*	0–8	–
	dotted blazing star	LIPU	*Liatris punctata*	0–8	–
Shrub/Vine					
8	**Shrubs**			39–157	
	pricklypear	OPUNT	*Opuntia*	28–118	–
	prairie sagewort	ARFR4	*Artemisia frigida*	16–118	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	8–78	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–24	–
	big sagebrush	ARTR2	*Artemisia tridentata*	0–8	–
	Gardner's saltbush	ATGA	*Atriplex gardneri*	–	–
	winterfat	KRLA2	*Krascheninnikovia lanata*		

	winterfat	KRLA2	*Krascheninnikovia lanata*	–	–
	rose	ROSA5	*Rosa*	–	–
Moss					
9	**Crytogams**			0–16	
	lesser spikemoss	SEDE2	*Selaginella densa*	0–16	–

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/Big Sagebrush < 8% Cover (1.1)
Average Annual Production (lbs./ac., air-dry) = 1800
Stocking Rate (AUM/ac) = 0.45*

Plant Community = Big Sagebrush > 8% Cover/Rhizomatous Wheatgrass-Green Needlegrass (1.2)
Average Annual Production (lbs./ac., air-dry) = 1600
Stocking Rate (AUM/ac) = 0.35*

Plant Community = Rhizomatous Wheatgrass-Blue Grama-Buffalograss/Big Sagebrush < 8% Cover (1.3)
Average Annual Production (lbs./ac., air-dry) = 1600
Stocking Rate (AUM/ac) = 0.40*

Plant Community = Big Sagebrush > 8% Cover/Rhizomatous Wheatgrass-Shortgrass (1.4)
Average Annual Production (lbs./ac., air-dry) = 900
Stocking Rate (AUM/ac) = Variable

Plant Community = Blue Grama-Buffalograss/Pricklypear Cactus (2.1)
Average Annual Production (lbs./ac., air-dry) = 650
Stocking Rate (AUM/ac) = 0.16*

Plant Community = Annuals/Rhizomatous Wheatgrass-Threeawn/Pricklypear Cactus (3.1)
Average Annual Production (lbs./ac., air-dry) = 700
Stocking Rate (AUM/ac) = Variable

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).

*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 groups C and D. Infiltration varies from very low to moderate, and runoff potential varies from moderate to very high

depending on soil hydrologic group, slope and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be high runoff when short grasses form a strong 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

Revision Notes: “Previously Approved” Provisional
This Provisional ecological site concept has passed Quality Control (QC) and Quality Assurance (QA) to ensure that the site meets the 2014 NESH standards for a Provisional ecological site. This is an updated “Previously Approved” ESD which represents a first-generation tier of documentation that, prior to the release of the 2014 National Ecological Site Handbook (NESH), met all 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.

Inventory data references

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range-trained personnel also were used. Those involved in developing this site description include: Everet Bainter, Range Management Specialist, NRCS; Stan Boltz, Range Management Specialist, NRCS; Brandon Brazee, Range Management Specialist, NRCS; Darrel DuVall, Range Management Specialist, NRCS; Jill Epley, Range Management Specialist, NRCS; Glen Mitchell, Range Management Specialist, NRCS; Cheryl Nielsen, Range Management Specialist, NRCS; Rick Peterson, Range Management Specialist, NRCS; Maxine Rasmussen, Range Management Specialist, NRCS; and Mike Stirling, Range Management Specialist, NRCS.

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ESD updated by Rick L. Peterson on 8/17/17

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	07/14/2008
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 10 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):** 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 3 to 6 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.

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

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

    Dominant: Rhizomatous wheatgrasses = mid cool-season bunchgrasses >>

    Sub-dominant: Mid warm-season grasses = short warm-season grass >

    Other: Forbs = shrubs > short cool-season bunchgrasses

    Additional:

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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 900-2,500 lbs./acre (air-dry weight). Reference value production is 1,800 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:** Perennial grasses should have vigorous rhizomes or tillers.
