USDA Natural Resources Conservation Service

Ecological site R058DY013SD
Claypan

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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.

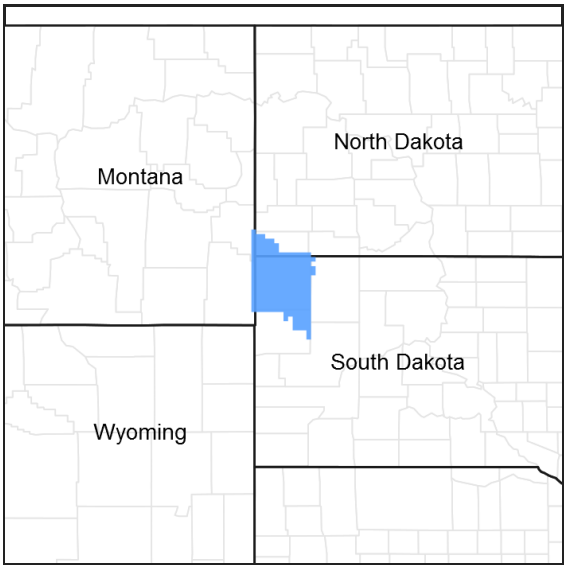


Figure 1. Mapped extent

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): 058D–Northern Rolling High Plains, Eastern Part

The Northern Rolling High Plains, Eastern Part (MLRA 58D) is shared between South Dakota (65 percent), Montana (21 percent), and North Dakota (14 percent). The MLRA is approximately 2,755 square miles. The small towns of Buffalo and Camp Crook, South Dakota, and Marmarth, North Dakota, are all within the boundary of this MLRA, and Baker, Montana, is on the northern most edge. Portions of the Little Missouri National Grassland and Custer National Forest are also in the MLRA. Portions of the Little Missouri River and the headwaters of major tributaries that eventually form the Grand and Moreau Rivers in South Dakota are also in this area.

The Northern Rolling High Plains, Eastern Part consists of Cretaceous marine and continental sediments of shale, siltstone, and sandstone. The continental and marine Hell Creek Formation is under approximately 85 percent of the MLRA, and the Fox Hills Sandstone forms the southern boundary of the MLRA. Tertiary deposits are in scattered areas throughout the MLRA. These deposits consist of the Paleocene Ludlow and Tongue River Formations, the Oligocene White River Group, and the Miocene Arikaree Group. These Tertiary deposits are resistant and positioned above the Cretaceous beds. Ponderosa pine growing in areas of these Tertiary formations further distinguishes these formations from the other formations in the MLRA. Pleistocene and Holocene river sand and gravel deposits are also on the valley floors and on the terraces along the larger rivers in the area. A large Quaternary eolian deposit is directly south of the town of Buffalo.

The average elevation of MLRA 58D ranges from 2,300 feet to 4,000 feet, increasing gradually from east to west. Harding Peak is the highest point at 4,019 feet. In places, flat-topped, steep-sided buttes rise sharply above the gently rolling plains below.

The dominant soil orders in this MLRA are Alfisols, Entisols, Inceptisols, and Mollisols. The soils in the area dominantly have a frigid soil temperature regime, an ustic soil moisture regime that borders on aridic, and mixed mineralogy. They are shallow to very deep, generally well drained, and loamy or clayey.

Annual precipitation is 14 to 17 inches and can fluctuate widely from year to year. Most rainfall occurs early in the growing season. Some high-intensity thunderstorms occur mid to late summer. The native vegetation in this MLRA consists primarily of grasses and forbs with a small component of trees and shrubs along streams. Ponderosa pine grow on the upper slopes and on the top of some of the higher buttes. Open grasslands are characterized by western wheatgrass, green needlegrass, blue grama, and buffalograss. Wyoming big sagebrush grows on clayey soils in the western part of the MLRA.

More than four-fifths of the MLRA is privately owned ranches running cattle, sheep, or both. Less than 5 percent of the area is federally owned. The major resource concerns are water quality, wind erosion, and water erosion (USDA, NRCS. 2006. Ag Handbook 296).

Classification relationships

USDA
Land Resource Region G—Western Great Plains Range and Irrigated Region:
Major Land Resource Area (MLRA) 58D—Northern Rolling High Plains, Eastern Part.

US Environmental Protection Agency (EPA)
Level IV Ecoregions of the Conterminous United States:
Northwestern Great Plains—43:
Forested Buttes—43d.
Sagebrush Steppe—43e.

USDA Forest Service
Ecological Subregions: Sections and Subsections of Conterminous United States:
Great Plains - Palouse Dry Steppe Province—331:
Missouri Plateau Section—331M.
Sagebrush Steppe Subsection—334Mi.

Ecological site concept

The Claypan ecological site is found throughout MLRA 58D. It is located on upland landscapes and does not receive additional moisture from runoff or overflow. Typical slopes range from 0 to 9 percent. Soils are deep (greater than 20 inches) with a silt loam to fine sandy loam surface textures that are 2 to 6 inches thick. At about 5 to 15 inches below the surface, there is a hard clayey or clay loam Btn horizon having round-topped or “bun shaped” columnar or prismatic structure. These subsoils are high in sodium.

The vegetation in the Reference State (1.0) is dominated by cool-season grasses with short warm-season grasses being subdominant. The major grasses include western wheatgrass and blue grama. Forbs are common and diverse. Shrubs include Wyoming big sagebrush, fringed sagewort, saltbush, and silver sagebrush.

Associated sites

R058DY011SD	**Clayey** The Clayey ecological site is found adjacent to or intermixed with the Claypan ecological site.
R058DY015SD	**Thin Claypan** The Thin Claypan ecological site is be found adjacent to or intermixed with the Claypan ecological site.

R058DY020SD	**Loamy Overflow** The Loamy Overflow ecological site is found on stream channels and floodplains on landscapes below the Claypan ecological site.

Similar sites

R058DY011SD	**Clayey** The Clayey ecological site will have more western wheatgrass, more green needlegrass, and more vegetative production than the Claypan ecological site.
R058DY010SD	**Loamy** The Loamy ecological site will have more green needlegrass, more western wheatgrass, and more vegetative production than the Claypan ecological site.
R058DY020SD	**Loamy Overflow** The Loamy Overflow will have more big bluestem, more western wheatgrass, and greater vegetative production that the Claypan ecological site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Pascopyrum smithii* (2) *Bouteloua gracilis*

Physiographic features

The Claypan ecological site occurs on nearly level to moderately steep uplands.

Table 2. Representative physiographic features

Landforms	(1) Terrace (2) Plain (3) Flat
Runoff class	Low to medium
Flooding frequency	None
Ponding frequency	None
Elevation	2,300–4,000 ft
Slope	0–9%
Water table depth	80 in
Aspect	Aspect is not a significant factor

Climatic features

The climate in MLRA 58D is typical of the drier portions of the Northern Great Plains where sagebrush steppes to the west yield to grassland to the east. Average annual precipitation ranges from 14 to 17 inches with most falling in the early growing season. Some high intensity, convective thunderstorms occur in the summer. Precipitation in winter occurs as snow. Temperatures show a wide range between summer and winter and between daily maximums and minimums. This wide range is due to the high elevation and dry air, which permit rapid incoming and outgoing radiation. Outbreaks of cold air from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Extreme storms may occur during the winter but have the most severe effect on ranching operations during late winter and in spring.

The normal average annual temperature is about 44 °F. January is the coldest month with average temperatures ranging from about 12 °F (Marmarth, North Dakota) to about 20 °F (Baker, Montana). July is the warmest month with temperatures averaging from about 70 °F (Marmarth, North Dakota) to about 76 °F (Baker, Montana). The range of normal average monthly temperatures between the coldest and warmest months is about 55 °F. Wind

speeds are estimated to average about 11 miles per hour (mph) annually, ranging from about 13 mph during the spring to about 10 mph during the summer. Daytime winds are generally stronger than nighttime winds. Strong storms may bring brief periods of high winds with gusts of more than 50 mph.

Growth of cool-season plants begins in early to mid-March, slowing or ceasing in late June. Warm-season plants begin growth about mid-May and continue to early or mid-September. Cool-season plants may green-up in September and October if adequate soil moisture is present.

Table 3. Representative climatic features

Frost-free period (characteristic range)	97-111 days
Freeze-free period (characteristic range)	121-129 days
Precipitation total (characteristic range)	15-17 in
Frost-free period (actual range)	93-115 days
Freeze-free period (actual range)	120-132 days
Precipitation total (actual range)	14-17 in
Frost-free period (average)	104 days
Freeze-free period (average)	125 days
Precipitation total (average)	16 in

Climate stations used

- (1) BAKER 1 E [USC00240412], Baker, MT
- (2) LADNER 9SW [USC00394671], Camp Crook, SD
- (3) CAMP CROOK [USC00391294], Camp Crook, SD
- (4) BUFFALO ASOS [USW00094037], Buffalo, SD
- (5) BUFFALO 13 ESE [USW00094081], Reva, SD
- (6) REDIG 11 NE [USC00397062], Buffalo, SD
- (7) HOOVER [USC00393945], Newell, SD

Influencing water features

No significant water features influence the Claypan ecological site.

Soil features

Soils common to the Claypan ecological site will have silt loam to fine sandy loam surface textures that are 2 to 6 inches thick. The soils are moderately deep to deep with slopes ranging from 0 to 9 percent. At about 5 to 15 inches below the surface, there is a hard clayey or clay loam Btn horizon having round-topped or “bun shaped” columnar or prismatic structure. These subsoils are high in sodium. Soils are formed in alluvium and residuum derived from shale and sandstone. They are well drained and have a very slow infiltration rate.

This site should show slight to no evidence of rills or wind-scoured areas. Water flow paths are broken, irregular in appearance, or discontinuous with numerous debris dams or vegetative barriers.

Major Soil correlated to the Claypan ecological site include, Archin, Daglum, Gerdrum, and Parchin

These soils are mainly susceptible to water erosion.

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 area of interest, or use the internet to access USDA’s Web Soil Survey.

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone and shale (2) Residuum–sandstone and shale
Surface texture	(1) Fine sandy loam (2) Silt loam (3) Loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Very slow
Soil depth	20–80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	4–5 in
Calcium carbonate equivalent (0-40in)	0–20%
Electrical conductivity (0-40in)	0–16 mmhos/cm
Sodium adsorption ratio (0-40in)	0–20
Soil reaction (1:1 water) (0-40in)	5.6–9
Subsurface fragment volume <=3" (Depth not specified)	0–15%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The Claypan ecological site developed under Northern Great Plains climatic conditions; light to severe grazing by bison and other large herbivores; sporadic, natural or human-caused wildfire (often of light intensities); and other biotic and abiotic factors that typically influence soil and site development. Changes occur in the plant communities due to short-term weather variations, effects of native and exotic plant and animal species, and management actions. Although the following plant community descriptions are typical of the transitions between communities, severe disturbances, such as periods of well below average precipitation and the introduction of non-native cool-season grasses, can cause significant shifts in plant communities and species composition.

MLRA 58D is located in the eastern extent of Wyoming big sagebrush range. 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).

Wyoming big sagebrush distribution in the northern Great Plains is limited by the relative lack of winter precipitation and relatively greater summer precipitation that favors grass growth. Snow accumulation and spring snowmelt are important in sagebrush ecosystems for recharging moisture deep in the soil profile, even on warm, dry sites (Innes, Robin J. 2019).

Wyoming big sagebrush recovery is extremely slow following wildfire. 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).

The plant community upon which interpretations are primarily based is the Western Wheatgrass-Blue Grama/Big Sagebrush Plant Community (1.1). This 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.

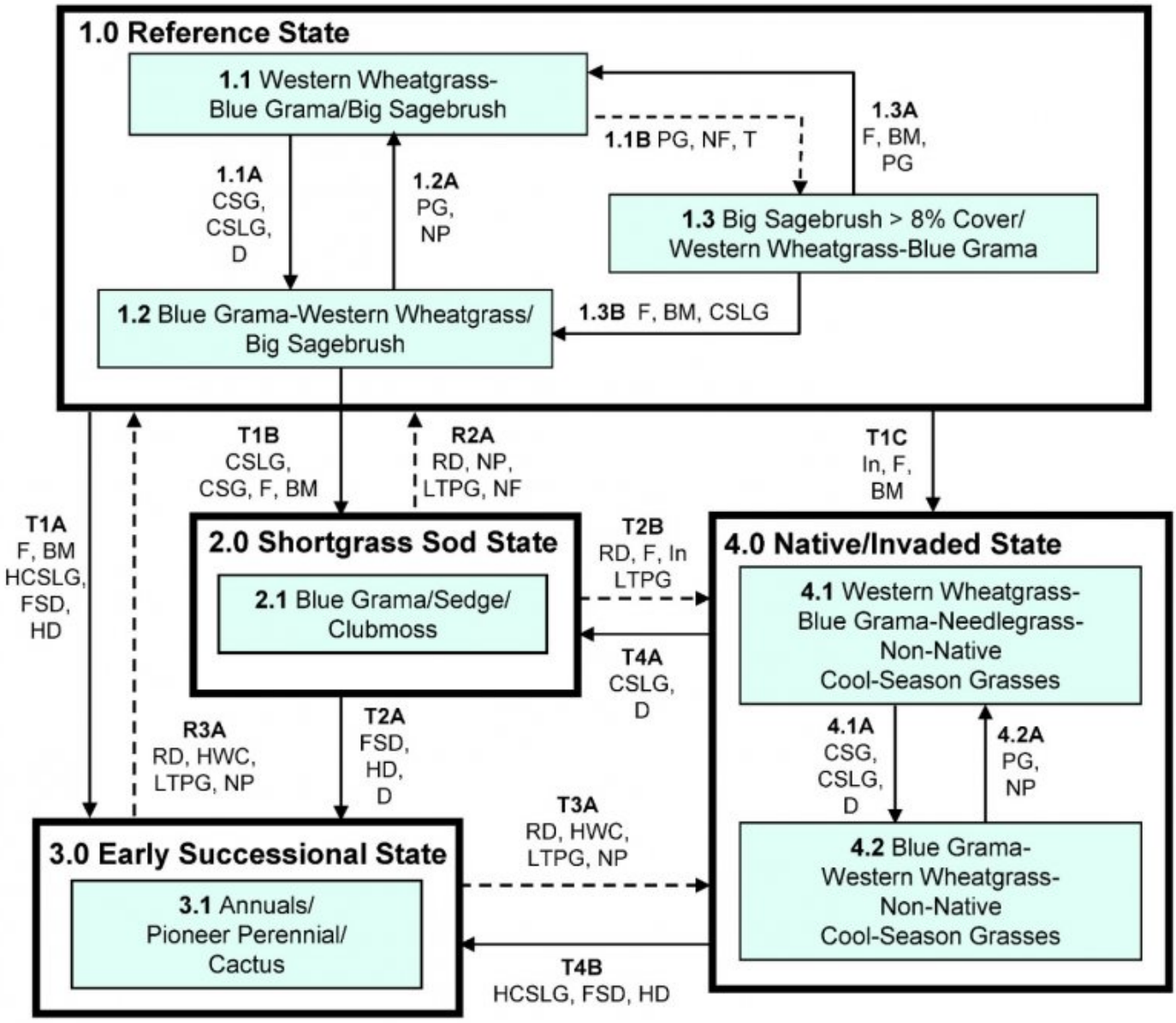
Heavy continuous grazing or continuous seasonal (spring) grazing, without adequate recovery periods following each grazing occurrence causes this site to depart from the Western Wheatgrass-Blue Grama/Big Sagebrush Plant Community (1.1). Blue grama will begin to increase. Western wheatgrass will increase initially and then begin to decrease. Green needlegrass will decrease in frequency and production. In time, heavy continuous grazing will likely cause upland sedges and blue grama to dominate and club moss to increase. This resulting plant community is relatively stable and the competitive advantage prevents other species from establishing. This plant community is less productive than the Western Wheatgrass-Blue Grama/Big Sagebrush Plant Community. Runoff increases and infiltration will decrease. Soil erosion will be minimal.

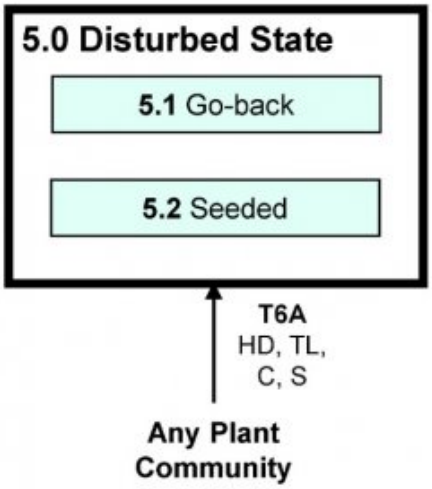
This site is susceptible to the invasion on non-native cool-season grasses.

The following state-and-transition diagram illustrates the common plant communities 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

Claypan – R058DY013SD 12/19/19





BM – Brush management
C – Cropping
CSG – Continuous seasonal grazing
CSLG – Continuous season-long grazing
D – Drought
F – Fire
FSD – Frequent and severe defoliation
HCSLG – Heavy continuous season-long grazing
HD – Heavy disturbance
HWC – Herbaceous weed control
In – Invasion of non-native cool-season grasses
LTPG – Long-term prescribed grazing
NF – No fire
NP – Return to normal precipitation patterns
NU – No use
PG – Prescribed grazing
RD – Removal of disturbance
S – Seeding
T – Time
TL – Tillage
- - → Transition may not be fast and/or feasible

Diagram Legend: Claypan R058DY013SD

T1A	1.0 to 3.0	Fire; brush management; heavy, continuous season-long grazing; frequent and severe defoliation; or heavy disturbance.
T1B	1.0 to 2.0	Continuous season-long grazing; continuous seasonal grazing; fire; or brush management.
T1C	1.0 to 4.0	Invasion of non-native cool-season annual grasses; fire; brush management.
T2A	2.0 to 3.0	Frequent and severe defoliation; heavy disturbance; heavy grazing in combination with drought.
T2B	2.0 to 4.0	Removal of management induced disturbance; invasion of non-native grasses; long-term prescribed grazing; fire. Transition may not be rapid or feasible.
T3A	3.0 to 4.0	Removal of management induced disturbance; herbaceous weed control; and long-term prescribed grazing; a return to normal precipitation patterns following drought. Transition may not be rapid or feasible.
T4A	4.0 to 2.0	Continuous season-long grazing; heavy grazing in combination with drought.
T4B	4.0 to 3.0	Heavy, continuous season-long grazing; frequent and severe defoliation; heavy disturbance.
T6A	From Any Plant Community	Heavy disturbance; abandonment of cropland; tillage; cropping; tillage and seeding to introduced perennial grasses.

R2A	2.0 to 1.0	Removal of management induced disturbance; long-term prescribed grazing, and favorable climatic conditions, and no fire. Transition may not be rapid or in the end meet management goals.
R3A	3.0 to 1.0	Removal of management induced disturbance; herbaceous weed control; long-term prescribed grazing; and a return to normal precipitation following drought. Transition may not be rapid or in the end meet management goals.

1.1A	1.1 to 1.2	Continuous seasonal grazing; continuous season-long grazing; heavy grazing in combination with drought.
1.1B	1.1 to 1.3	Prescribed grazing including proper stocking, change in season of use, and adequate time for recovery; no fire; and time.
1.2A	1.2 to 1.1	Prescribed grazing, including proper stocking, change in season of use, adequate time for recovery; a return to normal precipitation patterns following drought.
1.3A	1.3 to 1.1	Fire, or prescribed burning, or brush management that removes much of the big sagebrush canopy; prescribed grazing including proper stocking, change in season of use, and adequate time for recovery.
1.3B	1.3 to 1.4	Fire, or prescribed burning, or brush management that removes much of the big sagebrush canopy; continuous season-long grazing.
4.1A	4.1 to 4.2	Continuous seasonal grazing; continuous season-long grazing; heavy grazing in combination with drought and drought.
4.2A	4.2 to 4.1	Prescribed grazing, including proper stocking; change in season of use, and adequate time for plant recovery; a return to normal precipitation patterns following drought.

State 1
Reference State

The Reference State (1.0) 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. In pre-European times, the primary disturbance mechanisms included frequent fire and grazing by large herding ungulates. Timing of fires and grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Taller cool-season wheatgrasses and needlegrasses would have declined and a corresponding increase in short statured grass and grass-like species would have occurred. Today, a similar state can be found on areas that are properly managed with grazing and sometimes on areas receiving occasional short periods of rest.

Dominant plant species

- big sagebrush (*Artemisia tridentata*), shrub
- winterfat (*Krascheninnikovia*), shrub
- saltbush (*Atriplex*), shrub
- western wheatgrass (*Pascopyrum smithii*), grass
- blue grama (*Bouteloua gracilis*), grass

- needle and thread (*Hesperostipa comata ssp. comata*), grass
- prairie Junegrass (*Koeleria macrantha*), grass
- buffalograss (*Bouteloua dactyloides*), grass
- sedge (*Carex*), grass
- scarlet globemallow (*Sphaeralcea coccinea*), other herbaceous
- prairie coneflower (*Ratibida*), other herbaceous
- prairie clover (*Dalea*), other herbaceous
- American vetch (*Vicia americana*), other herbaceous

Community 1.1
Western Wheatgrass-Blue Grama/Big Sagebrush

The interpretive plant community for this site is the Western Wheatgrass-Blue Grama/Big Sagebrush Plant Community. This is also considered to be Reference Plant Community (1.1). This plant community can be found on areas that are properly managed with grazing, possibly prescribed burning, and sometimes on areas receiving occasional short periods of deferment. The potential vegetation is about 80 percent grasses or grass-like plants, 10 percent forbs, 10 percent shrubs, and 0-1 percent mat-forming forbs. Cool-season grasses dominate this plant community. The major grasses include western wheatgrass and blue grama. Other grasses or grass-likes occurring on the site include needle and thread, prairie Junegrass, buffalograss, and sedge. Significant forbs include scarlet globemallow, prairie coneflower, prairie clover, and American vetch. The significant shrubs that occur include big sagebrush, winterfat, and saltbush. 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 stable, diverse, and productive. Plant litter is properly distributed with very little movement offsite and natural plant mortality is very low.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	770	1148	1625
Shrub/Vine	65	140	215
Forb	65	105	145
Moss	0	7	15
Total	**900**	**1400**	**2000**

Figure 9. Plant community growth curve (percent production by month). SD5802, Northern Rolling High Plains, cool-season dominant, warm-season subdominant. Cool-season dominant, warm-season subdominant..

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-Western Wheatgrass/Big Sagebrush

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 drought periods. The potential vegetation is made up of approximately 80 percent grasses and grass-like species, 10 percent forbs, 10 percent shrubs, and 0-3 percent mat-forming forbs. The dominant grasses include blue grama and western wheatgrass. Other grasses or grass-likes may include sedge, buffalograss, needle and thread, and prairie Junegrass. Significant forbs include cudweed sagewort, scarlet globemallow, scurfpea, and western yarrow. The dominant shrubs that occur include big sagebrush, cactus, rose, and fringed sagewort. Compared to the Western Wheatgrass-Blue Grama/Sagebrush Plant Community (1.1), the shortgrass species including blue grama and sedge have increased. The cool-season species including western wheatgrass and green needlegrass have decreased in composition. Annual bromes, curlycup gumweed, sweetclover, and other annual grasses and forbs can invade the site. This plant

community can occur in a mosaic with patchy, slightly used areas occurring adjacent to and intermingled with this plant community. This plant community is somewhat resistant to change. The dominant herbaceous species are very adapted to grazing; however, the mid-grass species and the more palatable forbs will decrease. 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 shortgrass species, water infiltration is lower, and runoff is moderate to high. Typically, the runoff is very clean because of the low potential for onsite soil erosion. However, offsite areas may be affected by increased runoff.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	510	810	1305
Shrub/Vine	45	100	155
Forb	45	75	105
Moss	0	15	35
Total	**600**	**1000**	**1600**

Figure 11. Plant community growth curve (percent production by month). SD5803, Northern Rolling High Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant, uplands..

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
Big Sagebrush > 8% Cover/Western Wheatgrass-Blue Grama

This plant community develops from proper grazing use, the absence of fire, and an extended period of time. It is made up of 75 grasses and grass-like species, 10 percent forbs, 15 percent shrubs, and 1 to 3 percent mat-forming forbs. The dominant grasses include western wheatgrass, and blue grama. Other grasses or grass-likes may include sedge, buffalograss, needle and thread, and prairie Junegrass. The common forbs include cudweed sagewort, western yarrow, and scurfpea. Wyoming big sagebrush canopy cover typically ranges from 1 to 8 percent. 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. Annual brome, other annuals, and Kentucky bluegrass can invade the plant community. Under proper management, this plant community is stable and productive. The soil erosion is low to moderate. Infiltration and runoff are moderate. Snow catch by the big sagebrush can increase available soil moisture.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	620	876	1310
Shrub/Vine	115	210	325
Forb	55	90	125
Moss	10	24	40
Total	**800**	**1200**	**1800**

Figure 13. Plant community growth curve (percent production by month). SD5803, Northern Rolling High Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant, uplands..

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

Continuous seasonal grazing (early spring); continuous season-long grazing, or grazing for extended periods of time during the actively growing period of the dominant grasses without adequate recovery periods; or heavy grazing in combination with drought will lead to the Reference Plant Community (1.1) to the Blue Grama-Western Wheatgrass/Big Sagebrush Plant Community (1.2).

Pathway 1.1B
Community 1.1 to 1.3

Prescribed grazing, including proper stocking rates, change in season of use, occasional deferment, no fire, and an extended period of time will lead the Western Wheatgrass-Blue Grama/Big Sage Brush Plant Community (1.1) to the Big Sagebrush > 8% Cover/Western Wheatgrass-Blue Grama Plant Community (1.3).

Conservation practices

Prescribed Grazing

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing with proper stocking rate, change in season of use, and adequate time for plant recovery; and a return to normal precipitation patterns following drought will convert the Buffalograss-Blue Grama-Western Wheatgrass/Big Sagebrush Plant Community (1.2) to the Western Wheatgrass-Blue Grama/Big Sagebrush Plant Community (1.1).

Conservation practices

Prescribed Grazing

Pathway 1.3A
Community 1.3 to 1.1

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 the Big Sagebrush > 8% Cover/Western Wheatgrass-blue grama Plant Community (1.3) toward the Western Wheatgrass-Blue Grama/Big Sagebrush Plant Community (1.1).

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

Pathway 1.3B
Community 1.3 to 1.2

Fire, or brush management that removes most of the big sagebrush, followed by continuous season-long grazing, the Big Sagebrush > 8% Cover/Western Wheatgrass-Blue Grama Plant Community (1.3), will in time move to the Blue Grama-Western Wheatgrass/Big Sagebrush Plant Community (1.2).

Conservation practices

Brush Management

State 2
Shortgrass Sod State

The Shortgrass Sod State is dominated by shortgrass species, upland sedges and clubmoss. This State is the result of grazing management that did not provide adequate recovery time for cool-season wheatgrasses and 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.

Dominant plant species

- silver sagebrush (*Artemisia cana*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- yucca (*Yucca*), shrub
- blue grama (*Bouteloua gracilis*), grass
- sedge (*Carex*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- prairie Junegrass (*Koeleria macrantha*), grass
- buffalograss (*Bouteloua dactyloides*), grass
- cheatgrass (*Bromus tectorum*), grass
- common pepperweed (*Lepidium densiflorum*), other herbaceous
- curlycup gumweed (*Grindelia squarrosa*), other herbaceous
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- sweetclover (*Melilotus*), other herbaceous
- common yarrow (*Achillea millefolium*), other herbaceous

Community 2.1
Blue Grama/Clubmoss

This plant community develops under continuous season-long grazing, or with continuous seasonal grazing with concentrated use in the early part of the growing season (as in calving/lambing pastures). It is made up of approximately 80 percent grasses and grass-like species, 5 percent forbs, 10 percent shrubs, and 1 to 8 percent mat-forming forbs. The dominant grasses and grass-likes species include blue grama and sedge. Other grasses may include western wheatgrass, prairie Junegrass, buffalograss, and cheatgrass. The dominant forbs include common pepperweed, curlycup gumweed, cudweed sagewort, sweetclover, and western yarrow. The dominant shrubs include silver sagebrush, fringed sagewort, and cactus. Compared to the Western Wheatgrass/Blue Grama/Sagebrush Plant Community (1.1), blue grama and sedge have increased, and the cool-season mid-grasses have diminished greatly. Non-palatable forbs and cactus have increased, and non-native species have invaded the site. Plant diversity is low. This plant community is very stable. Generally, this plant community will require significant management inputs (i.e., high animal impact, long-term prescribed grazing, favorable climatic conditions, etc.,) and time to move it towards the Reference State (1.0). Onsite soil erosion is low. Infiltration is low and runoff is high. Typically, the runoff is very clean because of the low potential for onsite soil erosion. However, offsite areas can be significantly impacted due to the increased runoff.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	355	567	780
Shrub/Vine	30	70	110
Moss	5	32	60
Forb	10	32	50
Total	**400**	**701**	**1000**

Figure 15. Plant community growth curve (percent production by month). SD5804, Northern Rolling High Plains, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant, uplands..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	18	24	25	15	7	1	0	0

State 3
Early Successional State

The Early Successional State (3.0) is dominated by weedy annuals, threeawn, wheatgrass, and pricklypear cactus. This State is the result of heavy disturbance such as frequent and severe defoliation, heavy livestock concentrations 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.

Dominant plant species

- threeawn (*Aristida*), grass
- field brome (*Bromus arvensis*), grass
- blue grama (*Bouteloua gracilis*), grass
- buffalograss (*Bouteloua dactyloides*), grass
- sedge (*Carex*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- thickspike wheatgrass (*Elymus lanceolatus*), grass
- sixweeks fescue (*Vulpia octoflora*), grass
- prairie sagewort (*Artemisia frigida*), other herbaceous
- fetid marigold (*Dyssodia papposa*), other herbaceous
- Cuman ragweed (*Ambrosia psilostachya*), other herbaceous
- pussytoes (*Antennaria*), other herbaceous
- prostrate verbena (*Verbena officinalis var. prostrata*), other herbaceous

Community 3.1
Annuals/Pioneer Perennial/Cactus

This plant community develops under heavy, continuous season-long grazing, or frequent and severe defoliation or heavy disturbance such as livestock feeding areas. The potential plant community is made up of approximately 70 percent grasses and grass-like species, 25 percent forbs, and 5 percent shrubs. The dominant grasses include threeawn and annual brome grasses. Other grasses may include blue grama, buffalograss, sedges, western wheatgrass, thickspike wheatgrass, and sixweeks fescue. The dominant forbs include fringed sagewort, fetid marigold, 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. This plant community is susceptible to invasion of Canada thistle and other non-native species because of the relatively high percentage of bare ground. Compared to the Western Wheatgrass-Blue Grama Plant Community (1.1), red threeawn, annual brome grasses, cactus, and the percentage of bare ground has increased. Wheatgrasses, needlegrasses, and other cool-season grasses and grass-like species have decreased, as have the warm-season species including sideoats grama, blue grama, and buffalograss. Many annual and perennial forbs, including native and non-native species, have invaded the site. This plant community is resistant to change back to a higher successional plant community because of the loss of plant diversity and overall soil disturbance. It is very susceptible to invasion of non-native plant species. The potential for soil erosion is very high because of the bare ground and shallow-rooted herbaceous plant community. Water runoff will increase, and infiltration will decrease due to animal-related soil compaction and loss of root mass due to low plant diversity and vigor. This plant community will require significant economic inputs and time to move toward another plant community. This movement is highly variable in its succession.

Figure 16. Plant community growth curve (percent production by month). SD5804, Northern Rolling High Plains, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant, uplands..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	18	24	25	15	7	1	0	0

State 4
Native/Invaded State

This State is dominated by western wheatgrass, blue grama, needlegrass, and non-native cool-season annual and perennial grasses. The Native/Invaded State (4.0) can resemble the Reference State (1.0) in species composition and vegetative production except that it is invaded by non-native cool-season grasses. Big Sagebrush is unlikely to persist in this State (4.0) because of an increase in the fire potential due to annual brome grasses.

Dominant plant species

- cheatgrass (*Bromus tectorum*), grass
- field brome (*Bromus arvensis*), grass
- smooth brome (*Bromus inermis*), grass
- crested wheatgrass (*Agropyron cristatum*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- green needlegrass (*Nassella viridula*), grass
- blue grama (*Bouteloua gracilis*), grass
- buffalograss (*Bouteloua dactyloides*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- scarlet globemallow (*Sphaeralcea coccinea*), other herbaceous
- common yarrow (*Achillea millefolium*), other herbaceous
- scurfpea (*Psoralidium*), other herbaceous

Community 4.1
Western Wheatgrass-Blue Grama-Needlegrass-Non-Native Cool-Season Grasses

This plant community will look much like the Reference Plant Community (1.1), other than the non-native cool-season annual and perennial grasses that have invaded the plant community. Cheatgrass, field brome, smooth brome, or crested wheatgrass will make up to 15 percent (by air-dry weight) of the species composition. Cool-season midgrasses will make up approximately 85 percent of the plant community, warm-season shortgrasses account for approximately 10 percent, and forbs and shrubs are about 5 percent. The dominant grasses include western wheatgrass, green needlegrass, annual bromegrass, blue grama, and buffalograss. Under long-term non-use, Kentucky bluegrass and smooth brome may become the dominant grass species. Forbs commonly found on this plant community include cudweed sagewort, scarlet globemallow, common yarrow, and scurfpea. Production in wet years may be very similar or slightly higher than the Reference Plant Community (1.1), but in dry years will be much lower. Under proper management, this plant community is productive and stable. The soil erosion is low to moderate. Infiltration and runoff are moderate.

Figure 17. Plant community growth curve (percent production by month). SD5801, Northern Rolling High Plains, cool-season dominant.. Cool-season dominant, uplands..

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

Community 4.2
: Blue Grama-Western Wheatgrass- Non-Native Cool-Season Grasses

This plant community develops from continuous seasonal or continuous season-long grazing and the invasion of non-native cool-season grasses. Species composition is made up of 85 percent warm-season shortgrasses and cool-season mid-grasses, 10 percent forbs, and approximately 5 percent shrubs. The dominant grasses and grass-like species include blue grama, buffalograss, threadleaf sedge, western wheatgrass, prairie Junegrass, Sandberg bluegrass, cheatgrass, and field brome. Under long-term non-use, Kentucky bluegrass and smooth brome may invade. Forbs commonly found on this plant community include cudweed sagewort, scarlet globemallow, common yarrow, and scurfpea. Under proper management, this plant community is stable. The soil erosion is low to moderate. Infiltration and runoff are moderate.

Figure 18. Plant community growth curve (percent production by month). SD5803, Northern Rolling High Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant, uplands..

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 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 the Western Wheatgrass-Blue Grama-Needlegrass-Non-Native Cool-Season Grasses Plant Community (4.1) to the Blue Grama-Western Wheatgrass-Non-Native Cool-Season Grasses Plant Community (4.2).

Pathway 4.2A
Community 4.2 to 4.1

Prescribed grazing, including proper stocking, change in season of use, and adequate plant recovery periods; and normal precipitation patterns following drought will move this plant community (4.2) toward the Western Wheatgrass-Green Needlegrass-Annual and Perennial Non-Native Cool-Season Grasses Plant Community (4.1). Prescribed burning may be a management option to help accelerate the change.

Conservation practices

Prescribed Grazing

State 5
Disturbed State

Any plant community can transition to the Disturbed State (5.0). The two separate vegetative plant communities found in this State are highly variable in nature. They are derived through different management scenarios and are not related successionally. Infiltration, runoff, and soil erosion vary depending upon the vegetation present on the site.

Dominant plant species

- broom snakeweed (*Gutierrezia sarothrae*), shrub
- threeawn (*Aristida*), grass
- dropseed (*Sporobolus*), grass
- field brome (*Bromus arvensis*), grass
- crested wheatgrass (*Agropyron cristatum*), grass
- smooth brome (*Bromus inermis*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- squirreltail (*Elymus elymoides*), grass
- foxtail barley (*Hordeum jubatum*), grass
- sweetclover (*Melilotus*), other herbaceous
- deathcamas (*Zigadenus*), other herbaceous
- prickly lettuce (*Lactuca serriola*), other herbaceous
- Canadian horseweed (*Conyza canadensis*), other herbaceous
- forage kochia (*Bassia prostrata*), other herbaceous
- common sunflower (*Helianthus annuus*), other herbaceous

Community 5.1
Go-back

The Go-back plant community can be reached whenever severe mechanical disturbance occurs (e.g., tilled and abandoned cropland). During the early successional stages, the species that mainly dominate are annual grasses

and forbs, later replaced by both native and introduced perennials. The vegetation in this plant community can vary greatly, sometimes it is dominated by threeawn, dropseed, annual brome, crested wheatgrass, smooth brome, broom snakeweed, sweetclover, and non-native thistles. Other plants that commonly occur on the site can include western wheatgrass, deathcamas, prickly lettuce, mare's tail, kochia, squirreltail, foxtail, and annual sunflower. Bare ground is prevalent due to the loss of organic matter and lower overall soil health.

Community 5.2
Seeded

The Seeded Plant Community normally includes those areas seeded to pubescent or intermediate wheatgrass, crested wheatgrass, alfalfa, or other forage species. For adapted species, refer to the USDA-NRCS e-FOTG for the appropriate Forage Suitability Group description.

Transition T1B
State 1 to 2

Fire or brush management that removes the majority, or all the big sagebrush, continuous season-long grazing, or continuous seasonal grazing (early spring), will transition the Reference State (1.0) to the Shortgrass Sod State (2.0). This transition is most likely to occur from Plant Community 1.2.

Conservation practices

Brush Management
Prescribed Burning

Transition T1A
State 1 to 3

The removal of the majority, or all big sagebrush, with fire or brush management, followed by heavy, continuous season-long grazing; frequent and severe defoliation; or heavy disturbance including livestock feeding areas will transition the Reference State (1.0) to the Early Successional State (3.0).

Conservation practices

Brush Management
Prescribed Burning

Transition T1C
State 1 to 4

Invasion of non-native cool-season annual and perennial grasses followed by fire will transition the Reference State (1.0) is State to the Native/Invaded State (4.0). The use of herbicides or prescribed burning for brush management, or wildfire followed by a long period of non-use can also cause this transition.

Conservation practices

Prescribed Burning

Transition T6A
State 1 to 5

Heavy disturbance including tillage, abandonment of cropland, 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 the Shortgrass Sod State (2.0) to the Reference State (1.0). This transition may not be rapid or in the end meet management goals.

Conservation practices

Prescribed Grazing

Transition T2A
State 2 to 3

Frequent and severe defoliation, or heavy disturbance such as livestock feeding areas, and extended periods of drought will move the Shortgrass Sod State (2.0) to the Early Successional 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 from the Shortgrass Sod State (2.0) to the Native/Invaded State (4.0). This transition my not be rapid or feasible.

Conservation practices

Prescribed Burning
Prescribed Grazing

Transition T6A
State 2 to 5

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

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 the Early Successional State (3.0) 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.

Conservation practices

Prescribed Grazing
Herbaceous Weed Control

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 the Early Successional State (3.0) to the Native/Invaded State (4.0). This transition may not be rapid or feasible.

Conservation practices

Prescribed Grazing
Range Planting
Herbaceous Weed Control

Transition T6A
State 3 to 5

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

Transition T4A
State 4 to 2

Continuous season-long grazing or heavy grazing in combination with drought will transition the Native/Invaded State (4.0) to the Shortgrass Sod State (2.0).

Transition T4B
State 4 to 3

Heavy, continuous season-long grazing, or frequent and severe defoliation, or heavy disturbance including livestock feeding areas, will transition the Native/Invaded State (4.0) to the Early Successional State (3.0).

Transition T6A
State 4 to 5

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

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrass**			350–560	
	western wheatgrass	PASM	*Pascopyrum smithii*	280–490	–
	Montana wheatgrass	ELAL7	*Elymus albicans*	28–140	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	28–140	–
2	**Short-Warm Season Grasses**			70–280	
	blue grama	BOGR2	*Bouteloua gracilis*	70–210	–
	buffalograss	BODA2	*Bouteloua dactyloides*	28–140	–
	saltgrass	DISP	*Distichlis spicata*	0–70	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–70	–
	tumblegrass	SCPA	*Schedonnardus paniculatus*	0–14	–
3	**Cool-Season Bunchgrass**			70–210	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	70–210	–
	green needlegrass	NAVI4	*Nassella viridula*	14–42	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	14–42	–
4	**Other Native Grasses**			14–112	
	Sandberg bluegrass	POSE	*Poa secunda*	14–70	–

	Sandberg bluegrass	POSE	*Poa secunda*	14–70	
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–42	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	14–28	–
	Cusick's bluegrass	POCU3	*Poa cusickii*	0–28	–
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–28	–
5	**Warm-Season Grasses**			14–42	
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–28	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–28	–
6	**Native Annual Grasses**			14–28	
	sixweeks fescue	VUOC	*Vulpia octoflora*	14–28	–
7	**Grass-Likes**			70–140	
	needleleaf sedge	CADU6	*Carex duriuscula*	42–140	–
	threadleaf sedge	CAFI	*Carex filifolia*	14–70	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–42	–
	rush	JUNCU	*Juncus*	0–28	–
8	**Non-Native Cool-Season Grasses**			0	
Forb					
9	**Forbs**			70–140	
	Forb, native	2FN	*Forb, native*	14–56	–
	scurfpea	PSORA2	*Psoralidium*	14–42	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	14–42	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	14–42	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–28	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–28	–
	milkvetch	ASTRA	*Astragalus*	0–28	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	14–28	–
	Nuttall's violet	VINU2	*Viola nuttallii*	14–28	–
	prairie clover	DALEA	*Dalea*	0–28	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–28	–
	rosy pussytoes	ANRO2	*Antennaria rosea*	0–28	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	14–28	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	14–28	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	14–28	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	14–28	–
	woolly plantain	PLPA2	*Plantago patagonica*	14–28	–
	American vetch	VIAM	*Vicia americana*	0–28	–
	bighead pygmycudweed	EVPR	*Evax prolifera*	14–28	–
	desertparsley	LOMAT	*Lomatium*	14–28	–
	cinquefoil	POTEN	*Potentilla*	0–14	–
	onion	ALLIU	*Allium*	0–14	–
	tiny trumpet	COLI2	*Collomia linearis*	0–14	–
	spiny phlox	PHHO	*Phlox hoodii*	0–14	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–14	–

	littlepod false flax	CAMI2	*Camelina microcarpa*	0–14	–
Shrub/Vine					
10	**Shrubs**			70–210	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	28–140	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–70	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–42	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–42	–
	prairie sagewort	ARFR4	*Artemisia frigida*	14–42	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	14–42	–
	saltbush	ATRIP	*Atriplex*	14–42	–
	prairie rose	ROAR3	*Rosa arkansana*	0–28	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–28	–
	brittle pricklypear	OPFR	*Opuntia fragilis*	14–28	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–28	–
	spinystar	ESVIV	*Escobaria vivipara var. vivipara*	0–14	–
Moss					
11	**Mat-Forming Forbs**			0–14	
	lesser spikemoss	SEDE2	*Selaginella densa*	0–14	–

Table 10. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrass**			100–200	
	western wheatgrass	PASM	*Pascopyrum smithii*	100–200	–
	Montana wheatgrass	ELAL7	*Elymus albicans*	0–80	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–80	–
2	**Short-Warm Season Grasses**			150–300	
	blue grama	BOGR2	*Bouteloua gracilis*	150–250	–
	buffalograss	BODA2	*Bouteloua dactyloides*	50–150	–
	saltgrass	DISP	*Distichlis spicata*	0–80	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–80	–
	tumblegrass	SCPA	*Schedonnardus paniculatus*	0–20	–
3	**Cool-Season Bunchgrass**			50–100	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	50–100	–
	green needlegrass	NAVI4	*Nassella viridula*	0–10	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–10	–
4	**Other Native Grasses**			20–100	
	Sandberg bluegrass	POSE	*Poa secunda*	10–80	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	10–40	–
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–20	–
	Cusick's bluegrass	POCU3	*Poa cusickii*	0–10	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–10	

	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–10	–
5	**Warm-Season Grasses**			0–20	
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–10	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–10	–
6	**Native Annual Grasses**			10–30	
	sixweeks fescue	VUOC	*Vulpia octoflora*	10–30	–
7	**Grass-Likes**			50–150	
	needleleaf sedge	CADU6	*Carex duriuscula*	50–100	–
	threadleaf sedge	CAFI	*Carex filifolia*	10–80	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–30	–
	rush	JUNCU	*Juncus*	0–20	–
8	**Non-Native Cool-Season Grasses**			0	
Forb					
9	**Forbs**			50–100	
	white sagebrush	ARLU	*Artemisia ludoviciana*	10–40	–
	scurfpea	PSORA2	*Psoralidium*	10–40	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	10–40	–
	Forb, native	2FN	*Forb, native*	10–30	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	10–30	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	10–30	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	10–20	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–20	–
	rosy pussytoes	ANRO2	*Antennaria rosea*	0–20	–
	milkvetch	ASTRA	*Astragalus*	0–20	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	0–20	–
	Nuttall's violet	VINU2	*Viola nuttallii*	0–20	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–20	–
	bighead pygmycudweed	EVPR	*Evax prolifera*	10–20	–
	desertparsley	LOMAT	*Lomatium*	10–20	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	10–20	–
	woolly plantain	PLPA2	*Plantago patagonica*	10–20	–
	onion	ALLIU	*Allium*	0–10	–
	tiny trumpet	COLI2	*Collomia linearis*	0–10	–
	spiny phlox	PHHO	*Phlox hoodii*	0–10	–
	cinquefoil	POTEN	*Potentilla*	0–10	–
	American vetch	VIAM	*Vicia americana*	0–10	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–10	–
	littlepod false flax	CAMI2	*Camelina microcarpa*	0–10	–
	prairie clover	DALEA	*Dalea*	0–10	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–10	–
Shrub/Vine					
10	**Shrubs**			50–150	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	20–80	–

	silver sagebrush	ARCA13	*Artemisia cana*	10–80	–
	brittle pricklypear	OPFR	*Opuntia fragilis*	10–50	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	10–50	–
	prairie sagewort	ARFR4	*Artemisia frigida*	20–50	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	10–50	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–30	–
	prairie rose	ROAR3	*Rosa arkansana*	0–20	–
	saltbush	ATRIP	*Atriplex*	0–10	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–10	–
	spinystar	ESVIV	*Escobaria vivipara var. vivipara*	0–10	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–10	–
Moss					
11	**Mat-Forming Forbs**			0–30	
	lesser spikemoss	SEDE2	*Selaginella densa*	0–30	–

Table 11. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrass**			60–300	
	western wheatgrass	PASM	*Pascopyrum smithii*	60–240	–
	Montana wheatgrass	ELAL7	*Elymus albicans*	0–96	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–96	–
2	**Short-Warm Season Grasses**			120–300	
	blue grama	BOGR2	*Bouteloua gracilis*	60–240	–
	buffalograss	BODA2	*Bouteloua dactyloides*	24–144	–
	saltgrass	DISP	*Distichlis spicata*	12–96	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–84	–
	tumblegrass	SCPA	*Schedonnardus paniculatus*	0–12	–
3	**Cool-Season Bunchgrass**			24–120	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	24–120	–
	green needlegrass	NAVI4	*Nassella viridula*	0–12	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–12	–
4	**Other Native Grasses**			24–60	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–24	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	12–24	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–12	–
	Cusick's bluegrass	POCU3	*Poa cusickii*	0–12	–
5	**Warm-Season Grasses**			0–24	
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–12	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–12	–
6	**Native Annual Grasses**			0–12	
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–12	–

7	**Grass-Likes**			120–180	
	needleleaf sedge	CADU6	*Carex duriuscula*	60–180	–
	threadleaf sedge	CAFI	*Carex filifolia*	24–120	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–36	–
	rush	JUNCU	*Juncus*	0–24	–
8	**Non-Native Cool-Season Grasses**			0–60	
	Kentucky bluegrass	POPR	*Poa pratensis*	0–60	–
	cheatgrass	BRTE	*Bromus tectorum*	0–60	–
	smooth brome	BRIN2	*Bromus inermis*	0–60	–
	crested wheatgrass	AGCR	*Agropyron cristatum*	0–60	–
Forb					
9	**Forbs**			60–120	
	white sagebrush	ARLU	*Artemisia ludoviciana*	12–48	–
	scurfpea	PSORA2	*Psoralidium*	12–48	–
	Forb, native	2FN	*Forb, native*	12–48	–
	Forb, introduced	2FI	*Forb, introduced*	12–36	–
	woolly plantain	PLPA2	*Plantago patagonica*	12–36	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	12–36	–
	bighead pygmycudweed	EVPR	*Evax prolifera*	12–36	–
	desertparsley	LOMAT	*Lomatium*	12–24	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–24	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–24	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	12–24	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	12–24	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	12–24	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–24	–
	rosy pussytoes	ANRO2	*Antennaria rosea*	0–24	–
	field cottonrose	LOAR5	*Logfia arvensis*	0–24	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–12	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–12	–
	tiny trumpet	COLI2	*Collomia linearis*	0–12	–
	spiny phlox	PHHO	*Phlox hoodii*	0–12	–
	onion	ALLIU	*Allium*	0–12	–
	littlepod false flax	CAMI2	*Camelina microcarpa*	0–12	–
	milkvetch	ASTRA	*Astragalus*	0–12	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	0–12	–
	Nuttall's violet	VINU2	*Viola nuttallii*	0–12	–
	prairie clover	DALEA	*Dalea*	0–12	–
	cinquefoil	POTEN	*Potentilla*	0–12	–
	American vetch	VIAM	*Vicia americana*	0–12	–
Shrub/Vine					
10	**Shrubs**			120–300	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp.*	60–180	–

			wyomingensis		
	silver sagebrush	ARCA13	*Artemisia cana*	12–120	–
	prairie sagewort	ARFR4	*Artemisia frigida*	12–48	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	12–48	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–36	–
	brittle pricklypear	OPFR	*Opuntia fragilis*	12–36	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–36	–
	prairie rose	ROAR3	*Rosa arkansana*	0–24	–
	saltbush	ATRIP	*Atriplex*	0–24	–
	spinystar	ESVIV	*Escobaria vivipara var. vivipara*	0–12	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–12	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–12	–
Moss					
11	**Mat-Forming Forbs**			12–36	
	lesser spikemoss	SEDE2	*Selaginella densa*	12–36	–

Table 12. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrass**			0–70	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–56	–
	Montana wheatgrass	ELAL7	*Elymus albicans*	0–35	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–35	–
2	**Short-Warm Season Grasses**			175–315	
	blue grama	BOGR2	*Bouteloua gracilis*	140–280	–
	buffalograss	BODA2	*Bouteloua dactyloides*	35–140	–
	saltgrass	DISP	*Distichlis spicata*	7–70	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–56	–
	tumblegrass	SCPA	*Schedonnardus paniculatus*	0–21	–
3	**Cool-Season Bunchgrass**			0–35	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–35	–
4	**Other Native Grasses**			14–70	
	Sandberg bluegrass	POSE	*Poa secunda*	7–70	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	7–35	–
6	**Native Annual Grasses**			7–35	
	sixweeks fescue	VUOC	*Vulpia octoflora*	7–35	–
7	**Grass-Likes**			70–140	
	needleleaf sedge	CADU6	*Carex duriuscula*	35–105	–
	threadleaf sedge	CAFI	*Carex filifolia*	14–70	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–21	–
	rush	JUNCU	*Juncus*	0–14	–
8	**Non-Native Cool-Season Grasses**			7–35	
	Kentucky bluegrass	POPR	*Poa pratensis*	7–35	–

	cheatgrass	BRTE	*Bromus tectorum*	7–35	–
	smooth brome	BRIN2	*Bromus inermis*	0–35	–
	crested wheatgrass	AGCR	*Agropyron cristatum*	7–35	–
Forb					
9	**Forbs**			14–49	
	white sagebrush	ARLU	*Artemisia ludoviciana*	7–35	–
	scurfpea	PSORA2	*Psoralidium*	0–28	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	7–28	–
	field cottonrose	LOAR5	*Logfia arvensis*	0–28	–
	Forb, introduced	2FI	*Forb, introduced*	7–21	–
	woolly plantain	PLPA2	*Plantago patagonica*	7–21	–
	bighead pygmycudweed	EVPR	*Evax prolifera*	7–21	–
	desertparsley	LOMAT	*Lomatium*	0–14	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–14	–
	milkvetch	ASTRA	*Astragalus*	0–14	–
	rosy pussytoes	ANRO2	*Antennaria rosea*	0–14	–
	Forb, native	2FN	*Forb, native*	0–14	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–14	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–14	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–14	–
	tiny trumpet	COLI2	*Collomia linearis*	0–7	–
	spiny phlox	PHHO	*Phlox hoodii*	0–7	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–7	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	0–7	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–7	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–7	–
	littlepod false flax	CAMI2	*Camelina microcarpa*	0–7	–
	cinquefoil	POTEN	*Potentilla*	0–7	–
Shrub/Vine					
10	**Shrubs**			35–105	
	silver sagebrush	ARCA13	*Artemisia cana*	0–56	–
	prairie sagewort	ARFR4	*Artemisia frigida*	14–56	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	35–56	–
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	0–56	–
	brittle pricklypear	OPFR	*Opuntia fragilis*	7–56	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	7–35	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–21	–
	prairie rose	ROAR3	*Rosa arkansana*	0–7	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–7	–
	spinystar	ESVIV	*Escobaria vivipara var. vivipara*	0–7	–
Moss					
11	**Mat-Forming Forbs**			7–56	
	lesser spikemoss	SEDE2	*Selaginella densa*	7–56	–

Animal community

Wildlife Interpretations
MLRA 58D lies within the drier portion of northern mixed-grass prairie ecosystem where sagebrush steppes to the west yield to grassland steppes to the east. Prior to European settlement, this area consisted of diverse grass- and shrubland habitats interspersed with varying densities of depressional instream wetlands and woody riparian corridors. These habitats provided critical life cycle components for many users. Many species of grassland birds, small mammals, reptiles, amphibians, and herds of roaming bison, elk, and pronghorn were among the inhabitants adapted to this semi-arid region. Roaming herbivores, as well as several small mammal and insect species, were the primary consumers linking the grassland resources to predators such as the gray wolf, mountain lion, and grizzly bear, and smaller carnivores such as the coyote, bobcat, fox, and raptors. The prairie dog was once abundant; however, the species remains a keystone species within its range. The black-footed ferret, burrowing owl, ferruginous hawk, mountain plover, and swift fox were associated with prairie dog complexes.

Historically, the northern mixed-grass prairie was a disturbance-driven ecosystem with fire, herbivory, and climate functioning as the primary disturbance factors either singly or in combination. Following European settlement, livestock grazing, cropland conversion, elimination of fire, energy development, and other anthropogenic factors influenced species composition and abundance. Introduced and invasive species further impacted plant and animal communities. The bison was a historical keystone species but had been extirpated in this area as a free-ranging herbivore. The loss of the bison and reduction of prairie dog populations and fire as ecological drivers greatly influenced the character of the remaining native plant communities and altered wildlife habitats. Human development has reduced habitat quality for area-sensitive species.

Within MLRA 58D, the Claypan ecological site provides upland grassland cover with an associated forb component. It was typically part of an expansive grassland landscape that included combinations of Loamy, Shallow Loamy, Shallow Clayey, Thin Loamy, Claypan, Sands, Sandy, Sandy Claypan, and Thin Claypan ecological sites.

This site provided habitat for species requiring unfragmented grassland. Important habitat features, and components found commonly or exclusively on this site may include sharp-tailed grouse leks; upland nesting habitat for grassland birds, forbs and insects for brood habitat; and a forage source for small and large herbivores. Many grassland and shrub steppe nesting bird populations are declining. Extirpated species include free-ranging American bison, grizzly bear, gray wolf, black-footed ferret, mountain plover, Rocky Mountain locust, and swift fox.

The majority of the Claypan ecological site has remains intact and provides increasingly important habitat for grassland and shrub steppe nesting birds, small rodents, coyote, and a variety of reptiles, amphibians, and insects. Invasive species such as annual bromegrasses and crested wheat have impacted the biological integrity of the site for some grassland birds such as greater sage-grouse. Changes in historic fire regime and domestic grazing have impacted the forb/shrub/grass percentages. Greater sage-grouse and Brewer’s sparrow benefit when big sagebrush increases.

Western Wheatgrass-Blue Grama/Big Sagebrush (1.1): The predominance of grasses plus high diversity of forbs and shrubs in this community favors grazers and mixed-feeders, such as deer and pronghorn. Insects, such as pollinators, play a large role in maintaining the forb community and provide a forage base for grassland birds and other species. The complex plant structural diversity provides habitat for a wide array of migratory and resident birds.

Brewer’s and grasshopper sparrow, lark bunting, western meadowlark, greater sage-grouse, and sharp-tailed grouse are common and benefit from the structure and composition this plant community provides. This site provides important breeding habitat for the loggerhead shrike. This site provides excellent nesting and brood rearing habitat for greater sage-grouse and sharp-tailed grouse. Diverse prey populations are available for grassland raptors such as ferruginous hawk, Swainson’s hawk, golden eagle, and prairie falcon.

The diversity of grasses, forbs, and shrubs provide high nutrition levels for small and large herbivores including voles, mice, least chipmunk, thirteen lined ground squirrel, white-tailed jackrabbit, and deer. This ecological site provides excellent wintering habitat for pronghorn. The moderate stature of this plant community provides suitable thermal, protective, and escape cover for small herbivores and grassland birds. Predators utilizing this plant community include coyote, American badger, red fox, and longtailed weasel. This plant community provides habitat

for spade foot toad, Great Plains toad, bull snake, and western rattlesnake.

Blue Grama-Western Wheatgrass/Big Sagebrush (1.2): Resulting from continued heavy continuous season-long grazing without adequate recovery periods between grazing events or increased fire frequency, blue grama, and western wheatgrass will dominate. The forb diversity has decreased. A shift to shorter plant structure will favor prairie dog expansion and associate species such as ferruginous hawk, burrowing owl, tiger salamander, and swift fox. Species such as the horned lark, long-billed curlew, upland sandpiper, and white-tailed jackrabbit will increase due to the loss of big sagebrush. Density of species such as Brewer's sparrow, greater sage-grouse, as well as, desert cottontail will greatly decline. However, this plant community may provide areas suitable for lek site development.

The short stature of this plant community limits thermal, protective, and escape cover. Predators utilizing this plant community include the coyote, American badger, red fox, and long-tailed weasel.

Big Sagebrush > 8% Cover/Western Wheatgrass-Blue Grama (1.3): This plant community develops after an extended fire free period favoring species such as big sage brush. This increases habitat diversity and quality for species such as greater sage-grouse, Brewer's sparrow, and desert cottontail. This site provides excellent habitat for wintering pronghorn and greater sage-grouse. Chestnut-collared longspur may decrease with the increase of big sagebrush while vesper sparrow, and western meadowlark, are still common. Prey populations are available for grassland raptors such as golden eagle, ferruginous hawk, Swainson's hawk, and northern harrier. Predators utilizing this plant community include coyote, American badger, red fox, and long-tailed weasel.

Blue Grama/Clubmoss (2.1): This plant community develops under continuous seasonal grazing or from over utilization during extended drought periods. The forb diversity has decreased. A shift to short plant structure will favor prairie dog expansion with prairie dog town sites and associate species such as ferruginous hawk and burrowing owl. Species such as the horned lark, long-billed curlew, upland sandpiper, and white-tailed jackrabbit will increase due to the loss of big sagebrush. Species such as Brewer's sparrow, greater sage-grouse, as well as, desert cottontail will rarely use this site.

The short stature of this plant community limits thermal, protective, and escape cover. Prey populations are reduced but are more vulnerable to predation by raptors and mammalian predators. Predators utilizing this plant community include the coyote, American badger, red fox, and long-tailed weasel.

Extreme impairment of the ecological processes impacts offsite aquatic habitats through excessive runoff, nutrient, and sediment loads. Elevated surface temperatures resulting from reduced cover and litter will greatly reduce habitat for most amphibian species, grassland birds, and mammals.

Annual/Pioneer Perennial/Cactus (3.1): This plant community develops under severe disturbance or excessive defoliation. The dominant vegetation includes pioneer annual grasses, forbs, invaders, and early successional biennial and perennial species. Plant species from adjacent ecological sites may become minor components of this plant community. The community is susceptible to invasion of annual bromegrasses, crested wheatgrass, and other nonnative species due to severe soil disturbances and relatively high percent of bare ground.

Soil erosion is potentially high, impacting offsite aquatic habitats through increased runoff, nutrient, and sediment loads. Reduced surface cover, low plant density, low plant vigor, loss of root biomass, and soil compaction, all contribute to decreased wildlife abundance and diversity.

Since secondary succession is highly variable plant and wildlife species will vary. This plant community provides habitat for generalist or early successional species.

Grazing Interpretations
The following list suggests annual, initial stocking rates for average growing conditions. These estimates are conservative and should be used only as guidelines in the initial stages of conservation planning. Commonly, 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 estimates of carrying capacity 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. In consultation with the land manager, a more intensive grazing management program that results in

improved harvest efficiencies and increased carrying capacity may be developed.

The following suggested initial stocking rates are based on 912 lb/acre (air-dry weight) per animal-unit-month (AUM) with a 25 percent harvest efficiency of preferred and desirable forage species (refer to USDA-NRCS, National Range and Pasture Handbook). An AUM is defined as the equivalent amount of forage required by a 1,000-pound cow, with or without calf, for one month.

Plant Community: Western Wheatgrass-Blue Grama/Big Sagebrush (1.1)
Average Production (lb/acre, air-dry): 1,400
Stocking Rate (AUM/acre): 0.38

Plant Community: Blue Grama-Western Wheatgrass/Big Sagebrush (1.2)
Average Production (lb/acre, air-dry): 1,000
Stocking Rate (AUM/acre): 0.27

Plant Community: Big Sagebrush > 8% Cover/Western Wheatgrass-Blue Grama (1.3)
Average Production (lb/acre, air-dry): 1,200
Stocking Rate (AUM/acre): 0.33

Plant Community: Blue Grama/Clubmoss (2.1)
Average Production (lb/acre, air-dry): 700*
Stocking Rate (AUM/acre): 0.19*

Plant Community: All other plant communities identified in this document have variable annual production values and require onsite sampling to determine initial stocking rates.

* Total annual production and stocking rates are highly variable and require onsite sampling.

Total onsite annual production may contain vegetation deemed undesirable or untargeted by the grazing animal. Therefore, AUM values may need to be reduced to reflect only preferred or desirable forage species.

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide yearlong forage for livestock. During the dormant period, the forage for livestock likely has insufficient protein to meet livestock requirements. Added protein allows ruminants to better utilize the energy stored in grazed plant materials. A forage quality test (either directly or through fecal sampling) should be used to determine the level of supplementation needed.

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group D. Infiltration and runoff potential for this site varies from moderate to high depending on soil hydrologic group, slope, and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where shortgrasses form a strong sod and dominate the site. Normally areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff. Refer to the USDA-NRCS National Engineering Handbook, Part 630, for hydrologic soil groups, runoff quantities, and hydrologic curves.

Recreational uses

This site provides opportunities for hunting upland game species. The wide variety of plants that bloom from spring until fall have aesthetic value that appeals to visitors.

Wood products

No appreciable wood products are typically present on this site.

Other products

Harvesting the seeds of native plants can provide additional income on this site.

Other information

Revision Notes: “Previously Approved” Provisional
This provisional ecological site description (ESD) has passed quality control (QC) and quality assurance (QA) to ensure it meets the 2014 NESH standards for a “Provisional” ecological site description.

This ecological site description (ESD) is an updated “Previously Approved” ESD that represented a first-generation tier of documentation that met all requirements as an “Approved” ESD as laid out in the 1997 National Range and Pasture Handbook (NRPH). The requirements for approved status changed with the release of the 2014 National Ecological Site Handbook (NESH). The previously approved document fully described the reference state and community phases in the state-and-transition model. All other alternative states were 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 may not contain all tabular and narrative entries as required in the current “Approved” level of documentation, but it is expected this ESD will continue refinement toward the current “Approved” status.

Site Development and Testing Plan
Future work, as described in an official project plan, is necessary to validate the information in this provisional ecological site description. The plan will include field activities for low-, medium-, and high-intensity sampling, soil correlations, and analysis of the data. Annual field reviews should be done by soil scientists and vegetation specialists. Final field review, peer review, quality control, and quality assurance reviews are required to produce the final document.

Inventory data references

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range-trained personnel were also used. Those involved in developing this site description include: Ryan Beer, Range Management Specialist (RMS), NRCS; Chuck Berdan, Biologist, Bureau of Land Management (BLM); Stan Boltz, RMS, NRCS; Dave Dewald, Wildlife BIO, NRCS; Mitch Faulkner, RMS, NRCS; Jody Forman, RMS, NRCS; Dennis Froemke, RMS, NRCS; Tom Juntti, BIO, United States Forest Service (USFS); Cheryl Nielsen, RMS, NRCS; Jeff Printz, RMS, NRCS; Mike Stirling, RMS, NRCS; Dan Svingen, BIO, USFS; Darrell Vanderbusch, Soil Scientist, NRCS; Cindy Zachmeier, BIO, NRCS; and Tim Zachmeier, BIO, BLM.

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Contributors

Stan Boltz
Travis Patient
Rick L. Peterson

Approval

Suzanne Mayne-Kinney, 7/18/2024

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This ecological site description was updated by Rick L. Peterson on December 19, 2019.

The ESDs were available for QC review by Mark Hayek, Emily Helms, Ryan Beer, and Mitch Faulkner.

All ecological sites were then reviewed and approved at the Provisional Level by David Kraft, Regional ESS, Salina, KS in September 2020.

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	Stan Boltz, Ryan Beer, Mitch Iverson, Thad Berrett, Cheryl Nielsen
Contact for lead author	stanley.boltz@sd.usda.gov, 605-352-1236
Date	07/23/2009
Approved by	Suzanne Mayne-Kinney
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 15 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 2 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.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None – natural pan appears at roughly 5 to 15 inches with “biscuit-top” appearance at top of pan.

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 cool-season bunchgrasses = short warm-season grasses >

    Other: Forbs > shrubs

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 900-2,000 lbs./acre (air-dry weight). Reference value production is 1,400 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

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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.
