USDA Natural Resources Conservation Service

Ecological site R058DY010SD
Loamy

Last updated: 7/18/2024
Accessed: 05/13/2025

General information

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

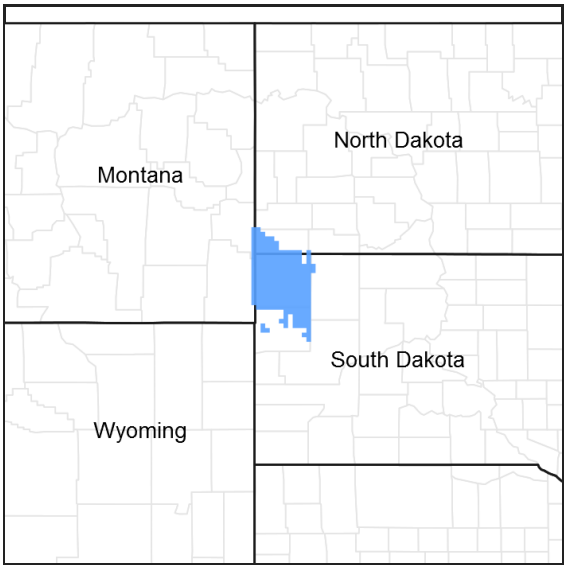


Figure 1. Mapped extent

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

MLRA notes

Major Land Resource Area (MLRA): 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 Loamy 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 1 to 12 percent. Soils are deep (greater than 20 inches) with a loam or fine sandy loam surface texture that is 10 to 20 inches thick. Occasionally carbonates will occur at or near the soil surface.

The vegetation in the Reference State (1.0) consists of a mix of cool- and warm-season grasses; however, mid-statured cool-season grasses will be the dominant group. Western wheatgrass, needle and thread, and green needlegrass are the dominant cool-season grasses, while blue grama, and sideoats grama are the dominant warm-season grasses. Forbs are common and diverse. Shrubs include Wyoming big sagebrush, leadplant, snowberry, winterfat, and rose.

Associated sites

R058DY009SD	**Sandy** The Sandy ecological site is be found adjacent to the Loamy ecological site.
R058DY011SD	**Clayey** The Clayey ecological site is found adjacent to the Loamy ecological site.

R058DY012SD	**Thin Loamy** The Thin Loamy ecological site is be found adjacent to or up-slope of the Loamy ecological site. Soils will be deep but will have a thin surface horizon.
R058DY020SD	**Loamy Overflow** The Loamy Overflow ecological site is be found adjacent to or down-slope of the Loamy ecological site.
R058DY024SD	**Shallow Loamy** The Shallow Loamy ecological site is be found adjacent to or up-slope of the Loamy ecological site.

Similar sites

R058DY013SD	**Claypan** The Claypan ecological site will have more blue grama, and cactus, and less vegetative production than the Loamy ecological site.
R058DY020SD	**Loamy Overflow** The Loamy Overflow ecological site will have less big sagebrush, less needle and thread, more big bluestem, and more vegetative production than the Loamy ecological site.
R058DY011SD	**Clayey** The Clayey ecological site will have more green needlegrass, and needle and thread will be a minor component when compared to the Loamy ecological site.

Table 1. Dominant plant species

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

Physiographic features

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

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Fan (3) Terrace
Runoff class	Medium to high
Flooding frequency	None
Ponding frequency	None
Elevation	701–1,219 m
Slope	1–12%
Water table depth	203 cm
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)	381-432 mm
Frost-free period (actual range)	93-115 days
Freeze-free period (actual range)	120-132 days
Precipitation total (actual range)	356-432 mm
Frost-free period (average)	104 days
Freeze-free period (average)	125 days
Precipitation total (average)	406 mm

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) REDIG 11 NE [USC00397062], Buffalo, SD
- (6) BUFFALO 13 ESE [USW00094081], Reva, SD
- (7) HOOVER [USC00393945], Newell, SD

Influencing water features

No significant water features influence the Loamy ecological site.

Soil features

Soils common to the Loamy ecological site have loam to fine sandy loam textured surface layers which are 10 to 20 inches thick. Soils are deep and formed in alluvium and residuum derived from sandstone and siltstone. The texture of the subsurface layer’s ranges from fine sandy loam to clay loam. The soils in this site are well drained and have a moderate to moderately slow infiltration rate. Subsurface soil layers are nonrestrictive to water movement and root penetration. Occasionally carbonates will occur at or near the surface on this site.

This site typically should show slight to no evidence of rills, wind-scoured areas, or pedestalled plants.
Water flow paths are typically not present, but when visible they are broken and irregular in appearance or discontinuous. The soil surface is stable and intact. These soils are mainly susceptible to water erosion.

Major Soil correlated to the Loamy ecological site include, Amor, Arnegard, Attewan, Boxwell, Chanta, Eapa, Kremlin, Marmarth, Morton, Reeder, Searing, Shambo, and Watrous.

The hazard of water erosion increases on slopes greater than about 10 percent. Loss of 50 percent or more of the surface layer of the soils on this site can result in a shift in species composition and vegetative production.

More information can be found in the various soil survey reports. Contact the local USDA Service Center for soil survey reports that include more detail specific to your 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 siltstone (2) Residuum–sandstone and siltstone
Surface texture	(1) Loam (2) Fine sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Soil depth	51–203 cm
Surface fragment cover <=3"	0–20%
Surface fragment cover >3"	0–25%
Available water capacity (0-101.6cm)	12.7–17.78 cm
Calcium carbonate equivalent (0-101.6cm)	0–20%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	6.1–9
Subsurface fragment volume <=3" (Depth not specified)	0–25%
Subsurface fragment volume >3" (Depth not specified)	0–20%

Ecological dynamics

The Loamy ecological site developed under the 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.

The western portion of 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-Needlegrass/Big Sagebrush < 8% Cover 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. Historical accounts have also 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-Needlegrass/Big Sagebrush < 8% Cover Plant Community (1.1). Blue grama will begin to increase. Western wheatgrass will increase initially and then begin to decrease. 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-Needlegrass/Big Sagebrush < 8% Cover Plant Community (1.1). Runoff increases and infiltration will decrease. Soil erosion will be minimal.

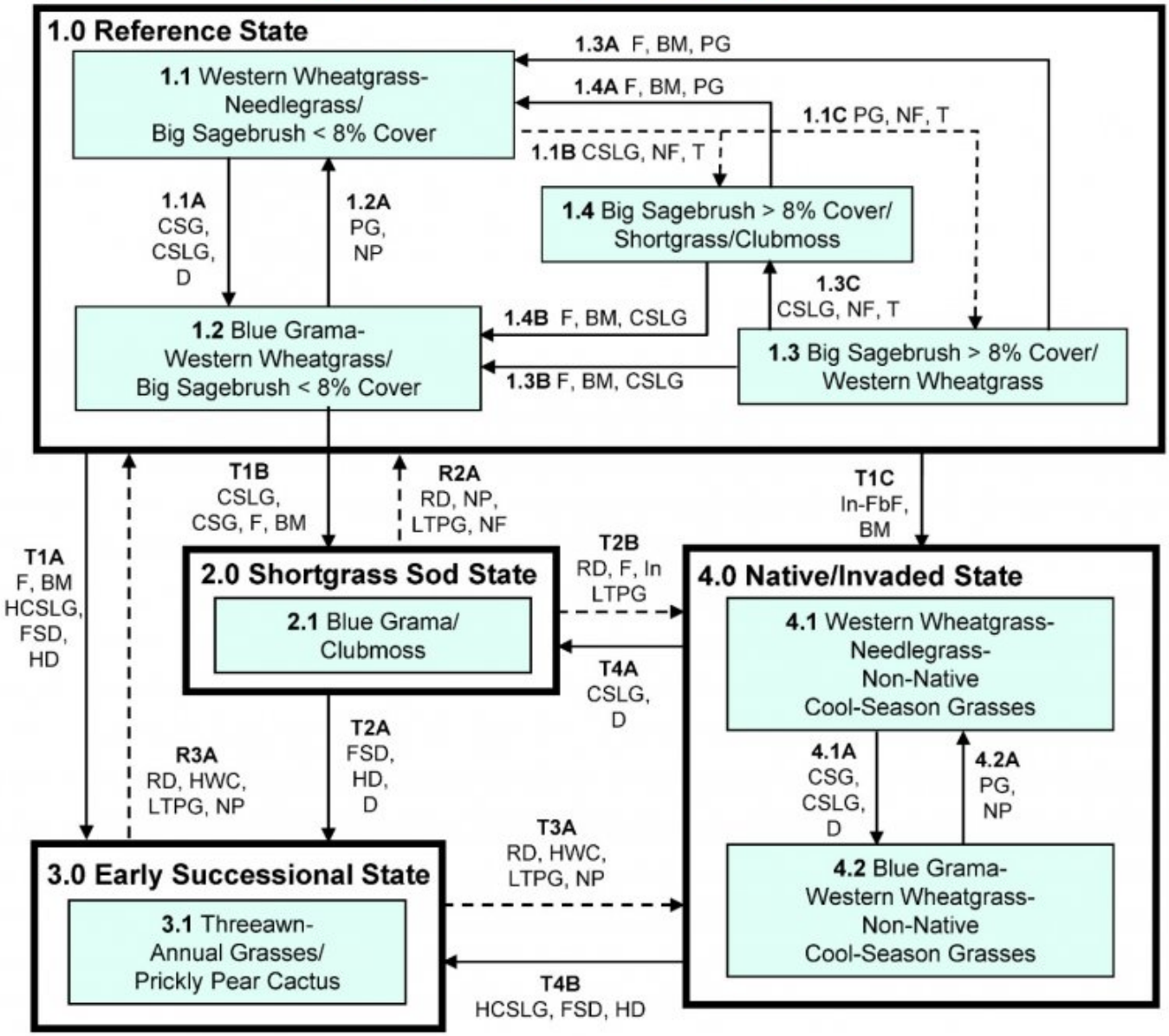
Extended periods of non-use will result in a plant community having high litter levels, which favors an increase in Kentucky bluegrass and smooth brome. Shrubs such as western snowberry and silver sagebrush will also typically increase.

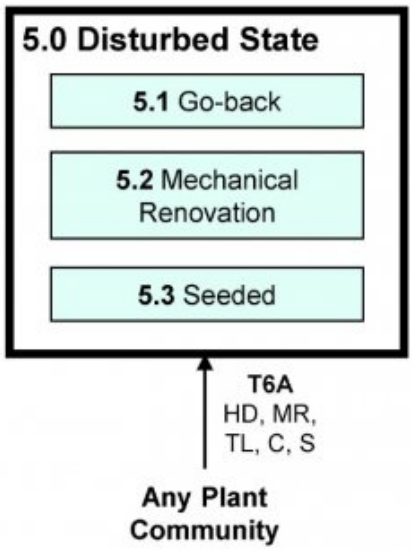
Historically, mechanical treatment was an option to improve forage production and plant species composition on rangeland on this site when the plant community became sod-bound. Mechanical treatments included contour furrowing, contour pitting, terracing, chiseling, and disking. These treatments were used to break up a sod-bound vegetative condition or compacted soils, resulting in less runoff and better infiltration. Many of these treatments were implemented from the 1930s through the 1970s but have not shown to have real long-term benefits for improving production. The lack of benefit is primarily due to improper grazing management following the renovation practice. Another drawback, in addition to the cost, is the practices result in a near permanently roughened ground surface.

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

Loamy – R058DY010SD 12/11/19





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
In-FbF – Invasion of non-native cool-season grasses followed by fire event
LTPG – Long-term prescribed grazing
MR – Mechanical renovation
NF – No fire
NP – Return to normal precipitation patterns
PG – Prescribed grazing
RD – Removal of disturbance
S – Seeding
T – Time
TL – Tillage
- - → Transition may not be fast and/or feasible

Diagram Legend: Loamy R058DY010SD

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 followed by fire event; 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 to 5.0	Heavy disturbance; mechanical range renovation; 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 1.4	Continuous season-long grazing; no fire; and time.
1.1C	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	Low temperature fire or prescribed burning; brush management that that is designed to reduce, but not eliminate big sagebrush canopy; prescribed grazing including proper stocking, change in season of use, and adequate time for recovery.
1.3B	1.3 to 1.2	Fire or prescribed burning; brush management that removes much of the big sagebrush canopy; continuous season-long grazing.
1.3C	1.3 to 1.4	Continuous season-long grazing; no fire; and time.
1.4A	1.4 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 including proper stocking, change in season of use, adequate time for recovery.
1.4B	1.4 to 1.2	Fire or prescribed burning; 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 periodic 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. Wyoming big sagebrush would likely be present but rarely exceeding 15 percent canopy cover. 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

- Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- western snowberry (*Symphoricarpos occidentalis*), shrub
- rose (*Rosa*), shrub
- western wheatgrass (*Pascopyrum smithii*), grass
- needle and thread (*Hesperostipa comata ssp. comata*), grass
- green needlegrass (*Nassella viridula*), grass
- blue grama (*Bouteloua gracilis*), grass
- sideoats grama (*Bouteloua curtipendula*), grass
- prairie Junegrass (*Koeleria macrantha*), grass
- buffalograss (*Bouteloua dactyloides*), grass
- sedge (*Carex*), grass
- American vetch (*Vicia americana*), other herbaceous
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- dotted blazing star (*Liatris punctata*), other herbaceous
- purple prairie clover (*Dalea purpurea*), other herbaceous
- white prairie aster (*Symphyotrichum falcatum*), other herbaceous

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

The interpretive plant community for this site is the Western Wheatgrass-Needlegrass/Big Sagebrush < 8% Cover 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 and occasional short periods of deferment. The potential vegetation is about 85 percent grasses or grass-like plants, 10 percent forbs, 5 percent shrubs, and 0 to 1 percent mat-forming forbs. Cool-season grasses dominate this plant community. The major grasses include western wheatgrass, needle and thread, and green needlegrass. Other grasses or grass-like species occurring on the site include blue grama, sideoats grama, prairie Junegrass, buffalograss, and upland sedge. Significant forbs include American vetch, cudweed sagewort, dotted gayfeather, white prairie aster, and purple prairie clover. The significant shrubs that occur include Wyoming big sagebrush, fringed sagewort, snowberry, silver sagebrush, and rose. 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 (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1457	2000	2656
Shrub/Vine	112	177	241
Forb	112	177	241
Moss	–	12	28
Total	**1681**	**2366**	**3166**

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 < 8% Cover

This plant community develops under continuous seasonal grazing (i.e., grazing an area during the same season every year); or continuous season-long grazing; or from over utilization during extended drought periods. The potential vegetation is made up of approximately 85 percent grasses and grass-like species, 10 percent forbs, 5 percent shrubs, and 0 to 3 percent mat-forming forbs. The dominant grasses include blue grama, buffalograss, and western wheatgrass. Other grasses or grass-like species may include sedge, needle and thread, green needlegrass, and prairie Junegrass. Significant forbs include cudweed sagewort, scurfpea, white prairie aster, and western yarrow. The dominant shrubs that occur include Wyoming big sagebrush, fringed sagewort, western snowberry, and cactus. Compared to the Western Wheatgrass-Needlegrass Big Sagebrush < 8% Cover Plant Community (1.1), the shortgrass species including blue grama, buffalograss, and sedge have increased. The cool-season species including western wheatgrass and needle and thread, 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 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 (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	712	1103	1597
Forb	62	135	207
Shrub/Vine	11	74	140
Moss	–	34	73
Total	**785**	**1346**	**2017**

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

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, needle and thread, green needlegrass, blue grama, and buffalograss. Forbs commonly found on this plant community include cudweed sagewort, common yarrow, dotted gayfeather, and scurfpea. Wyoming big sagebrush canopy cover can range from 8 to 15 percent. When compared to the Reference Plant Community (1.1), big sagebrush has increased. Production of cool-season grasses, particularly needle and thread, 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 (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	958	1380	1777
Shrub/Vine	185	334	504
Forb	90	143	196
Moss	–	48	101
Total	**1233**	**1905**	**2578**

Figure 13. 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 1.4
Big Sagebrush > 8% Cover/Shortgrass/Clubmoss

This plant community is the result of continuous season-long grazing and the absence of fire. This plant community is made up of 70 percent grasses and grass-likes, 10 percent forbs, and up to 20 percent shrubs. The dominant grasses include western wheatgrass, needle and thread, blue grama, Sandberg bluegrass and, prairie Junegrass. 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. This plant community differs from the Reference Plant Community (1.1) with the increase in big sagebrush cover and decrease in grasses and grass-like species. Runoff can be higher due to an increase in bare ground or the increase of clubmoss (lesser spikemos). 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	555	689	1026
Shrub/Vine	163	280	420
Moss	17	67	118
Forb	50	84	118
Total	**785**	**1120**	**1682**

Figure 15. 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 heavy grazing in combination with drought will lead to the Reference Plant Community (1.1) to the Blue Grama-Western Wheatgrass/Big Sagebrush < 8% Cover Plant Community (1.2).

Pathway 1.1C
Community 1.1 to 1.3

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

Conservation practices

Prescribed Grazing

Pathway 1.1B
Community 1.1 to 1.4

Continuous season-long grazing; no fire; and an extended period of time will lead the Reference Plant Community (1.1) to the Big Sagebrush > 8% Cover/Shortgrass/Clubmoss Plant Community (1.4).

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 Blue Grama-Western Wheatgrass/Big Sagebrush < 8% Cover Plant Community (1.2) to the Western Wheatgrass-Needlegrass/Big Sagebrush < 8% Cover 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 Plant Community (1.3) toward the Western Wheatgrass-Needlegrass/Big Sagebrush < 8% Cover 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, will move the Big Sagebrush > 5% Cover/Western Wheatgrass-Green Needlegrass Plant Community (1.3), to the Blue Grama-Western Wheatgrass/Big Sagebrush < 8% Cover Plant Community (1.2).

Conservation practices

Brush Management
Prescribed Burning

Pathway 1.3C
Community 1.3 to 1.4

With continuous season-long grazing and no fire, this plant community, will in time move to the Big Sagebrush > 8%

Cover/Shortgrass/Clubmoss Plant Community (1.4).

Pathway 1.4A
Community 1.4 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/Shortgrass/Clubmoss Plant Community (1.4) toward the Wheatgrass-Needlegrass/Big Sagebrush < 8% Cover Plant Community (1.1).

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

Pathway 1.4B
Community 1.4 to 1.2

Fire, prescribed burning, or brush management that removes much of the big sagebrush canopy, followed by continuous season-long grazing will move the Big Sagebrush > 8% Cover/Shortgrass/Clubmoss Plant Community (1.4) toward the Blue Grama-Western Wheatgrass/Big Sagebrush < 8% Canopy Plant Community (1.2).

Conservation practices

Brush Management
Prescribed Burning

State 2
Shortgrass Sod State

The Shortgrass Sod State (2.0) is dominated by shortgrass species, upland sedges and clubmoss (lesser spikemoss). This State is the result of grazing management that does 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

- prairie sagewort (*Artemisia frigida*), shrub
- yucca (*Yucca*), shrub
- blue grama (*Bouteloua gracilis*), grass
- buffalograss (*Bouteloua dactyloides*), grass
- sedge (*Carex*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- prairie Junegrass (*Koeleria macrantha*), grass
- cheatgrass (*Bromus tectorum*), grass
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- scurfpea (*Psoralidium*), other herbaceous
- woolly plantain (*Plantago patagonica*), 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, 10 percent forbs, 5 percent shrubs, and 1 to 5 percent

clubmoss (lesser spikemoss). The dominant grass and grass-like species include blue grama buffalograss, and upland sedge. Other grasses may include western wheatgrass, prairie Junegrass, and cheatgrass. The dominant forbs include cudweed sagewort, scurfpea, woolly Indianwheat, and western yarrow. The dominant shrubs include fringed sagewort and cactus. Compared to the Western Wheatgrass-Needlegrass/Big Sagebrush < 8% Cover Plant Community (1.1), Shortgrasses and sedge have increased, and the cool-season mid-grasses have diminished greatly. Non-palatable forbs, cactus, and clubmoss (lesser spikemoss) have increased, and non-native species have invaded the site. Plant diversity is low. Once clubmoss (lesser spikemoss) becomes well established it is very competitive with the native species on the plant community. This plant community is very stable. 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. Offsite areas can be significantly impacted due to the increased runoff from this plant community.

Table 9. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	364	646	925
Forb	39	112	185
Moss	39	90	140
Shrub/Vine	6	49	95
Total	**448**	**897**	**1345**

Figure 17. 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 or with grazing management that does not provide adequate recovery time for cool-season wheatgrasses and 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
- sixweeks fescue (*Vulpia octoflora*), grass
- prairie sagewort (*Artemisia frigida*), other herbaceous
- fetid marigold (*Dyssodia papposa*), other herbaceous
- Cuman ragweed (*Ambrosia psilostachya*), other herbaceous
- pricklypear (*Opuntia*), other herbaceous

Community 3.1
Threeawn-Annual Grasses/Prickly Pear Cactus

This plant community develops under heavy, continuous season-long grazing; or frequent and severe defoliation; or heavy disturbance such as livestock or wildlife concentration 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, and sixweeks fescue. The dominant forbs include fringed sagewort, fetid marigold, western ragweed, pussytoes, 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 Wheatgrass-Needlegrass/Big Sagebrush < 8% Cover Plant Community (1.1), red threeawn, annual brome grasses, 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 blue grama, sideoats 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 18. 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

The Native/Invaded State (4.0) is dominated by western wheatgrass, needlegrass, and non-native cool-season annual and perennial grasses. The Native/Invaded State 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

- western wheatgrass (*Pascopyrum smithii*), grass
- needle and thread (*Hesperostipa comata ssp. comata*), grass
- green needlegrass (*Nassella viridula*), grass
- field brome (*Bromus arvensis*), grass
- blue grama (*Bouteloua gracilis*), grass
- buffalograss (*Bouteloua dactyloides*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- smooth brome (*Bromus inermis*), grass

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

This plant community develops through the invasion of non-native cool-season annual and perennial grasses. Big Sagebrush is unlikely to persist in this plant community because of an increase in fire potential due to the increase in annual brome grasses. Grasses and grass-likes will make up 85 percent of the plant community, forbs 10 percent, and shrubs 5 percent. The dominant grasses include western wheatgrass, needle and thread, 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. When compared to the Reference Plant Community (1.1), big sagebrush is essentially absent and non-native cool-season grasses will make up to 15 percent (by air-dry weight) of the species composition. Vegetative production in wet years may be very similar or slightly higher than the Reference Plant Community (1.1) 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 are moderate.

Table 10. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1222	1601	1973
Forb	34	114	196
Shrub/Vine	90	143	196
Moss	–	47	101
Total	**1346**	**1905**	**2466**

Figure 20. 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, and annual brome grasses. Other species will include western wheatgrass, prairie Junegrass, and Sandberg bluegrass. 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 21. 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-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-Needlegrass-Non-Native Cool-Season Grasses Plant Community (4.1). Prescribed burning may be a management option to help accelerate the change.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 5
Disturbed State

Any plant community can transition to the Disturbed State (5.0). The three 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
- sweetclover (*Melilotus*), 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
Mechanical Renovation

This plant community is an altered plant community achieved through mechanical renovation. Renovation creates microrelief that alters the water cycle by increasing infiltration and decreasing runoff. The renovation reduces sod-bound conditions, increasing the vegetative production potential. These factors favor cool-season species such as western wheatgrass, green needlegrass, non-native cool-season grasses, and a variety of forbs. With proper management after renovation, this plant community will potentially have similar plant composition, growth curve characteristics, and forage production as the Reference Plant Community (1.1). Proper grazing management must be implemented to maintain this plant community.

Community 5.3
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 Loam 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

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).

Transition T1C
State 1 to 4

Invasion of non-native cool-season annual grasses followed by fire can remove all, or the majority of, Wyoming big sagebrush component from this site and transition the Reference State (1.0) to the Native/Invaded State (4.0). Wildfire or brush management targeting Wyoming big sagebrush and the invasion of non-native cool-season perennial grasses can also cause the transition from the Reference State (1.0) to the Native/Invaded State (4.0). If sagebrush does not occur on the site, long period of non-use will likely result in the transition to the Native/Invaded State (4.0).

Conservation practices

Brush Management

Transition T6A
State 1 to 5

Heavy disturbance including, mechanical renovation, 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 management induced disturbance coupled with long-term prescribed grazing, and favorable climatic conditions, which allow for adequate plant recovery periods, and no fire, may allow for a transition from 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 heavy grazing in combination with 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 management induced disturbance coupled with long-term prescribed grazing, and favorable climatic conditions, which allow for adequate plant recovery periods, and no fire, may allow for a transition from 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 T6A
State 2 to 5

Heavy disturbance including mechanical renovation, soil erosion, tillage, 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, may shift the Early Successional State (3.0) to the Native/Invaded State (4.0). This transition may not be rapid or meet management objectives.

Conservation practices

Prescribed Grazing
Herbaceous Weed Control

Transition T6A
State 3 to 5

Transition T6A: Heavy disturbance including mechanical renovation, soil erosion, tillage, 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; 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 mechanical renovation, soil erosion, tillage, abandonment of cropland, or seeding to improved pasture species will result in a transition to the Disturbed State (5.0).

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 Wheatgrass**			471–824	
	western wheatgrass	PASM	*Pascopyrum smithii*	471–824	–
	Montana wheatgrass	ELAL7	*Elymus albicans*	0–118	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–118	–
2	**Cool-Season Bunchgrass**			471–706	
	green needlegrass	NAVI4	*Nassella viridula*	235–588	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	118–353	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–118	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–47	–
3	**Other Native Grasses**			47–188	
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–118	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	24–71	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–47	–
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–47	–
4	**Tall and Mid- Warm-Season Grasses**			118–235	
	big bluestem	ANGE	*Andropogon gerardii*	0–235	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	24–118	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–118	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–71	–
5	**Short Warm-season**			118–235	
	blue grama	BOGR2	*Bouteloua gracilis*	71–235	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–118	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–118	–
6	**Grass-likes**			47–188	
	threadleaf sedge	CAFI	*Carex filifolia*	24–118	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	24–118	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–71	–
	needleleaf sedge	CADU6	*Carex duriuscula*	24–71	–
7	**Non-Native Cool-Season Grasses**			–	
Forb					
8	**Forbs**			118–235	
	Forb, native	2FN	*Forb, native*	0–118	–
	purple prairie clover	DAPU5	*Dalea purpurea*	24–71	–
	American vetch	VIAM	*Vicia americana*	24–71	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	24–71	–

	false boneset	BREU	*Brickellia eupatorioides*	0–71	–
	field sagewort	ARCA12	*Artemisia campestris*	24–47	–
	dotted blazing star	LIPU	*Liatris punctata*	24–47	–
	white heath aster	SYER	*Symphyotrichum ericoides*	24–47	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	24–47	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–47	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	0–47	–
	textile onion	ALTE	*Allium textile*	0–24	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–24	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–24	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–24	–
	beardtongue	PENST	*Penstemon*	0–24	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–24	–
	old man's whiskers	GETR	*Geum triflorum*	0–24	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–24	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–24	–
	littlepod false flax	CAMI2	*Camelina microcarpa*	0–24	–
	pussytoes	ANTEN	*Antennaria*	0–24	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–24	–
	groundplum milkvetch	ASCR2	*Astragalus crassicarpus*	0–24	–
	bastard toadflax	COMAN	*Comandra*	0–24	–
	bighead pygmycudweed	EVPR	*Evax prolifera*	0–24	–
Shrub/Vine					
9	**Shrubs**			118–235	
	leadplant	AMCA6	*Amorpha canescens*	0–118	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–118	–
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	0–118	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–71	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–71	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–71	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–47	–
	prairie rose	ROAR3	*Rosa arkansana*	0–47	–
	prairie sagewort	ARFR4	*Artemisia frigida*	24–47	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–24	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–24	–
Moss					
10	**Mat-Forming Forbs**			0–24	
	lesser spikemoss	SEDED	*Selaginella densa var. densa*	0–24	–

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**			135–336	
	western wheatgrass	PASM	*Pascopyrum smithii*	67–269	–
	Montana wheatgrass	ELAL7	*Elymus albicans*	0–27	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–27	–
2	**Cool-Season Bunchgrass**			27–135	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	13–108	–
	green needlegrass	NAVI4	*Nassella viridula*	13–67	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–27	–
3	**Other Native Grasses**			13–67	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–27	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–27	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	13–27	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–27	–
4	**Tall and Mid- Warm-Season Grasses**			0–40	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–40	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–13	–
5	**Short Warm-season**			269–471	
	blue grama	BOGR2	*Bouteloua gracilis*	202–404	–
	buffalograss	BODA2	*Bouteloua dactyloides*	67–202	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–13	–
6	**Grass-likes**			67–202	
	threadleaf sedge	CAFI	*Carex filifolia*	27–161	–
	needleleaf sedge	CADU6	*Carex duriuscula*	13–94	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	13–67	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–67	–
7	**Non-Native Cool-Season Grasses**			–	
Forb					
8	**Forbs**			67–202	
	sweetclover	MELIL	*Melilotus*	13–135	–
	Forb, native	2FN	*Forb, native*	0–67	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	13–54	–
	field sagewort	ARCA12	*Artemisia campestris*	13–54	–
	white heath aster	SYER	*Symphyotrichum ericoides*	13–40	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	13–40	–
	yellow salsify	TRDU	*Tragopogon dubius*	13–40	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	13–40	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	13–40	–
	woolly plantain	PLPA2	*Plantago patagonica*	13–27	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	13–27	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	13–27	–
	bastard toadflax	COMAN	*Comandra*	13–27	–
	bighead pygmycudweed	EVPR	*Evax prolifera*	0–27	–

	common pepperweed	LEDE	*Lepidium densiflorum*	0–27	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–13	–
	littlepod false flax	CAMI2	*Camelina microcarpa*	0–13	–
	dotted blazing star	LIPU	*Liatris punctata*	0–13	–
	false boneset	BREU	*Brickellia eupatorioides*	0–13	–
	American vetch	VIAM	*Vicia americana*	0–13	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–13	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–13	–
	pussytoes	ANTEN	*Antennaria*	0–13	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–13	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–13	–
	textile onion	ALTE	*Allium textile*	0–13	–
	old man's whiskers	GETR	*Geum triflorum*	–	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	–	–
	field cottonrose	LOAR5	*Logfia arvensis*	–	–
	fetid marigold	DYPA	*Dyssodia papposa*	–	–
	beardtongue	PENST	*Penstemon*	–	–
	groundplum milkvetch	ASCR2	*Astragalus crassicarpus*	–	–
Shrub/Vine					
9	**Shrubs**			13–135	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	0–67	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	13–67	–
	prairie sagewort	ARFR4	*Artemisia frigida*	13–54	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	13–40	–
	prairie rose	ROAR3	*Rosa arkansana*	13–40	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–27	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–27	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–13	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	–	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	–	–
	leadplant	AMCA6	*Amorpha canescens*	–	–
Moss					
10	**Mat-Forming Forbs**			0–67	
	lesser spikemoss	SEDE2	*Selaginella densa*	0–67	–

Table 13. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrass**			286–476	
	western wheatgrass	PASM	*Pascopyrum smithii*	286–476	–
	Montana wheatgrass	ELAL7	*Elymus albicans*	0–95	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–95	–
2	**Cool-Season Bunchgrass**			95–381	

2	**Cool-Season Bunchgrass**			95–381	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	38–191	–
	green needlegrass	NAVI4	*Nassella viridula*	38–191	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–19	–
3	**Other Native Grasses**			19–95	
	prairie Junegrass	KOMA	*Koeleria macrantha*	19–57	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–38	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–38	–
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–38	–
4	**Tall and Mid- Warm-Season Grasses**			0–95	
	big bluestem	ANGE	*Andropogon gerardii*	0–57	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–57	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–19	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–19	–
5	**Short Warm-season**			95–286	
	blue grama	BOGR2	*Bouteloua gracilis*	95–286	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–95	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–38	–
6	**Grass-likes**			57–286	
	threadleaf sedge	CAFI	*Carex filifolia*	19–191	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	19–152	–
	needleleaf sedge	CADU6	*Carex duriuscula*	19–95	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–38	–
7	**Non-Native Cool-Season Grasses**			–	
Forb					
8	**Forbs**			95–191	
	sweetclover	MELIL	*Melilotus*	0–95	–
	Forb, native	2FN	*Forb, native*	0–95	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	19–76	–
	field sagewort	ARCA12	*Artemisia campestris*	19–57	–
	white heath aster	SYER	*Symphyotrichum ericoides*	19–57	–
	Forb, introduced	2FI	*Forb, introduced*	0–57	–
	yellow salsify	TRDU	*Tragopogon dubius*	0–38	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	19–38	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–38	–
	field cottonrose	LOAR5	*Logfia arvensis*	0–38	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	19–38	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	19–38	–
	purple prairie clover	DAPU5	*Dalea purpurea*	19–38	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	19–38	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	19–38	–
	bighead pygmycudweed	EVPR	*Evax prolifera*	0–38	–

	common pepperweed	LEDE	*Lepidium densiflorum*	0–19	–
	American vetch	VIAM	*Vicia americana*	0–19	–
	bastard toadflax	COMAN	*Comandra*	0–19	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–19	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–19	–
	dotted blazing star	LIPU	*Liatris punctata*	0–19	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–19	–
	littlepod false flax	CAMI2	*Camelina microcarpa*	0–19	–
	pussytoes	ANTEN	*Antennaria*	0–19	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–19	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–19	–
	textile onion	ALTE	*Allium textile*	0–19	–
Shrub/Vine					
9	**Shrubs**			191–476	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	95–286	–
	prairie sagewort	ARFR4	*Artemisia frigida*	19–95	–
	silver sagebrush	ARCA13	*Artemisia cana*	19–95	–
	prairie rose	ROAR3	*Rosa arkansana*	19–57	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–57	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–38	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–38	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–19	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–19	–
	leadplant	AMCA6	*Amorpha canescens*	0–19	–
Moss					
10	**Mat-Forming Forbs**			0–95	
	lesser spikemoss	SEDE2	*Selaginella densa*	0–95	–

Table 14. Community 1.4 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrass**			22–112	
	western wheatgrass	PASM	*Pascopyrum smithii*	22–112	–
2	**Cool-Season Bunchgrass**			0–56	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–56	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–22	–
3	**Other Native Grasses**			0–34	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–22	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–22	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–11	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–11	–
4	**Tall and Mid- Warm-Season Grasses**			0–22	

	sideoats grama	BOCU	*Bouteloua curtipendula*	0–22	–
5	**Short Warm-Season Grasses**			56–168	
	blue grama	BOGR2	*Bouteloua gracilis*	56–168	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–34	–
6	**Grass-Likes**			34–168	
	threadleaf sedge	CAFI	*Carex filifolia*	11–112	–
	needleleaf sedge	CADU6	*Carex duriuscula*	11–56	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	11–56	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–11	–
7	**Non-Native Cool-Season Grasses**			56–168	
	cheatgrass	BRTE	*Bromus tectorum*	22–112	–
	Kentucky bluegrass	POPR	*Poa pratensis*	22–112	–
	smooth brome	BRIN2	*Bromus inermis*	0–56	–
	crested wheatgrass	AGCR	*Agropyron cristatum*	11–56	–
	field brome	BRAR5	*Bromus arvensis*	11–56	–
Forb					
8	**Forbs**			56–112	
	Forb, introduced	2FI	*Forb, introduced*	0–90	–
	sweetclover	MELIL	*Melilotus*	11–90	–
	field cottonrose	LOAR5	*Logfia arvensis*	11–56	–
	Forb, native	2FN	*Forb, native*	0–56	–
	field sagewort	ARCA12	*Artemisia campestris*	11–45	–
	bighead pygmycudweed	EVPR	*Evax prolifera*	11–34	–
	common pepperweed	LEDE	*Lepidium densiflorum*	0–34	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	11–34	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	11–34	–
	yellow salsify	TRDU	*Tragopogon dubius*	11–34	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–34	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	11–22	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	11–22	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	11–22	–
	white heath aster	SYER	*Symphyotrichum ericoides*	11–22	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	0–11	–
	pussytoes	ANTEN	*Antennaria*	0–11	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–11	–
	bastard toadflax	COMAN	*Comandra*	0–11	–
	textile onion	ALTE	*Allium textile*	0–11	–
Shrub/Vine					
9	**Shrubs**			168–392	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	112–224	–
	silver sagebrush	ARCA13	*Artemisia cana*	22–135	–
	prairie sagewort	ARFR4	*Artemisia frigida*	22–90	–

	plains pricklypear	OPPO	*Opuntia polyacantha*	0–56	–
	prairie rose	ROAR3	*Rosa arkansana*	0–34	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–34	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–22	–
Moss					
10	**Mat-Forming Forbs**			22–112	
	lesser spikemoss	SEDE2	*Selaginella densa*	22–112	–

Table 15. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrass**			9–90	
	western wheatgrass	PASM	*Pascopyrum smithii*	9–90	–
2	**Cool-Season Bunchgrass**			0–45	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–45	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–18	–
3	**Other Native Grasses**			9–27	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–18	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	9–18	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–18	–
4	**Tall and Mid- Warm-Season Grasses**			0–18	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–18	–
5	**Short Warm-Season Grasses**			224–493	
	blue grama	BOGR2	*Bouteloua gracilis*	179–404	–
	buffalograss	BODA2	*Bouteloua dactyloides*	45–179	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–9	–
6	**Grass-Likes**			90–179	
	threadleaf sedge	CAFI	*Carex filifolia*	45–135	–
	needleleaf sedge	CADU6	*Carex duriuscula*	18–90	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	18–90	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–45	–
7	**Non-Native Cool-Season Grasses**			9–45	
	cheatgrass	BRTE	*Bromus tectorum*	9–45	–
	field brome	BRAR5	*Bromus arvensis*	9–45	–
	Kentucky bluegrass	POPR	*Poa pratensis*	9–45	–
	smooth brome	BRIN2	*Bromus inermis*	0–45	–
	crested wheatgrass	AGCR	*Agropyron cristatum*	9–45	–
Forb					
8	**Forbs**			45–179	
	sweetclover	MELIL	*Melilotus*	9–135	–
	Forb, introduced	2FI	*Forb, introduced*	0–135	–
	field cottonrose	LOAR5	*Logfia arvensis*	0–45	–

	Forb, native	2FN	*Forb, native*	0–45	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	9–45	–
	field sagewort	ARCA12	*Artemisia campestris*	9–36	–
	bighead pygmycudweed	EVPR	*Evax prolifera*	0–27	–
	common pepperweed	LEDE	*Lepidium densiflorum*	9–27	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	9–27	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	9–27	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–18	–
	fetid marigold	DYPA	*Dyssodia papposa*	0–18	–
	white heath aster	SYER	*Symphyotrichum ericoides*	9–18	–
	textile onion	ALTE	*Allium textile*	0–18	–
	yellow salsify	TRDU	*Tragopogon dubius*	9–18	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	9–18	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	9–18	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	0–9	–
	pussytoes	ANTEN	*Antennaria*	0–9	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–9	–
	bastard toadflax	COMAN	*Comandra*	0–9	–
Shrub/Vine					
9	**Shrubs**			9–90	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	0–45	–
	prairie sagewort	ARFR4	*Artemisia frigida*	9–45	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	9–45	–
	prairie rose	ROAR3	*Rosa arkansana*	9–27	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	9–27	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–18	–
Moss					
10	**Mat-Forming Forbs**			45–135	
	lesser spikemoss	SEDE2	*Selaginella densa*	45–135	–

Table 16. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrass**			95–476	
	western wheatgrass	PASM	*Pascopyrum smithii*	95–381	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–95	–
	Montana wheatgrass	ELAL7	*Elymus albicans*	0–38	–
2	**Cool-Season Bunchgrass**			95–381	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	38–286	–
	green needlegrass	NAVI4	*Nassella viridula*	38–286	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–57	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–22	–

3	**Other Native Grasses**			0–57	
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–57	–
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–22	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–19	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–19	–
4	**Tall and Mid- Warm-Season Grasses**			0–95	
	big bluestem	ANGE	*Andropogon gerardii*	0–57	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–38	–
5	**Short Warm-season**			19–191	
	blue grama	BOGR2	*Bouteloua gracilis*	19–191	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–57	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–34	–
6	**Grass-likes**			191–286	
	needleleaf sedge	CADU6	*Carex duriuscula*	38–191	–
	threadleaf sedge	CAFI	*Carex filifolia*	38–191	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	38–191	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–95	–
7	**Non-Native Cool-Season Grasses**			476–762	
	bluegrass	POA	*Poa*	381–667	–
	cheatgrass	BRTE	*Bromus tectorum*	95–191	–
	field brome	BRAR5	*Bromus arvensis*	11–56	–
	smooth brome	BRIN2	*Bromus inermis*	0–56	–
	crested wheatgrass	AGCR	*Agropyron cristatum*	11–56	–
Forb					
8	**Forbs**			38–191	
	sweetclover	MELIL	*Melilotus*	19–152	–
	Forb, introduced	2FI	*Forb, introduced*	19–95	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	19–95	–
	white heath aster	SYER	*Symphyotrichum ericoides*	19–95	–
	yellow salsify	TRDU	*Tragopogon dubius*	19–95	–
	field sagewort	ARCA12	*Artemisia campestris*	19–57	–
	Forb, native	2FN	*Forb, native*	0–57	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	19–57	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	19–38	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	19–38	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–38	–
	common pepperweed	LEDE	*Lepidium densiflorum*	0–38	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–19	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–19	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–19	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–19	–
Shrub/Vine					

9	**Shrubs**			95–191	
	western snowberry	SYOC	*Symphoricarpos occidentalis*	19–152	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–57	–
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	0–57	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–38	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–38	–
	prairie rose	ROAR3	*Rosa arkansana*	0–19	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–19	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–19	–
Moss					
10	**Mat-Forming Forbs**			0–95	
	lesser spikemoss	SEDE2	*Selaginella densa*	0–95	–

Animal community

Wildlife Interpretations
MLRA 58D lies within the drier portion of the 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 Loamy ecological site provides upland grassland cover with an associated forb component. It was typically part of an expansive grassland landscape that included combinations of Clayey, 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 Loamy 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-Needlegrass/Big Sagebrush < 8% Cover (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, 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 the coyote, American badger, red fox, and long-tailed weasel. This plant community provides habitat for spade foot toad, Great Plains toad, bull snake, and western rattlesnake.

Blue Grama-Western Wheatgrass/Big Sagebrush < 8% Cover (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 (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.

Buffalograss/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 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, and 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 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.

Threeawn-Annual Grasses/Prickly Pear 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-Needlegrass/Big Sagebrush < 8% Cover (1.1)
Average Production (lb/acre, air-dry): 2,100
Stocking Rate (AUM/acre): 0.58

Plant Community: Blue Grama-Western Wheatgrass/Big Sagebrush < 8% Cover (1.2)
Average Production (lb/acre, air-dry): 1,200
Stocking Rate (AUM/acre): 0.33

Plant Community: Big Sagebrush > 8% Cover/Western Wheatgrass (1.3)
Average Production (lb/acre, air-dry): 1,700
Stocking Rate (AUM/acre): 0.47

Plant Community: Big Sagebrush > 8% Cover/Shortgrass/Clubmoss (1.4)
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): 800*
Stocking Rate (AUM/acre): 0.22*

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 groups B and C. Infiltration and runoff potential for this site varies from moderate to high depending on soil hydrologic group, slope, and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An 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; 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.

Other references

Beck, J.L., J.W. Connelly, C.L. Wambolt. 2010. Consequences of treating Wyoming big sagebrush to enhance wildlife habitats; Rangeland Ecology and Management 65:444–455, September 2012

Cleland, D.T., J.A. Freeouf, J.E. Keys, G.J. Nowacki, C.A. Carpenter, and W.H McNab. 2007. Ecological subregions: Sections and subsections of the conterminous United States. USDA Forest Service, General Technical Report WO-76D. https://www.fs.fed.us/research/publications/misc/73326-wo-gtr-76d-cleland2007.pdf (accessed 31 January 2019).

Cooper, S.V., P. Lesica, G.M. Kudray. 2001. Post-fire recovery of Wyoming big sagebrush steppe in central and southeastern Montana; Natural Resources and Environmental Issues, Volume 16; Shrublands: Wildlands and Wildlife Habitats, Article 12.

High Plains Regional Climate Center, University of Nebraska. 2018. http://www.hprcc.unl.edu/ (accessed 6 April 2018).

Innes, Robin J. 2019. Artemisia tridentata subsp. wyomingensis, Wyoming big sagebrush. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Missoula Fire Sciences Laboratory (Producer). Available: https://www.fs.fed.us/database/feis/plants/shrub/arttriw/all.html (accessed 9 December 2019).

Larson, G.E. and J.R. Johnson. 1999. Plants of the Black Hills and Bear Lodge Mountains. South Dakota State University, College of Agriculture and Biological Sciences and Agriculture Experiment Station, Bulletin 732, Brookings, SD.

Toledo, D., M. Sanderson, K. Spaeth, J. Hendrickson, and J. Printz. 2014. Extent of Kentucky bluegrass and its effect on native plant species diversity and ecosystem services in the Northern Great Plains of the United States. Invasive Plant Science and Management. 7(4):543–522. Weed Science Society of America.

Soil Survey Staff. 2019. Official soil series descriptions. USDA Natural Resources Conservation Service. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053587 (accessed 10 December 2019).

Soil Survey Staff. 2019. Web Soil Survey. USDA Natural Resources Conservation Service. https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx (accessed 10 December 2019).

U.S. Department of Agriculture, Natural Resources Conservation Service. 1997. National range and pasture handbook, rev. 1, 2003. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1043055.pdf (accessed 7 January 2018).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. Agriculture Handbook 296. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_050898.pdf (accessed 17 January 2018).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2012. National engineering handbook, part 630. Hydrology chapters from e-Directives. https://directives.sc.egov.usda.gov/viewerFS.aspx?hid=21422 (accessed 17 January 2018).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2014. National ecological site handbook, 1st ed. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcseprd1291232 (accessed 27 January 2018).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2018. Climate data. National Water and Climate Center. http://www.wcc.nrcs.usda.gov/ (accessed 2 December 2018).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2018. Electronic field office technical guide. https://efotg.sc.egov.usda.gov (accessed 11 December 2019).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2018. National Soil Information System,

Information Technology Center. http://nasis.nrcs.usda.gov (accessed 25 May 2018.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2018. PLANTS database. National Plant Data Team, Greensboro, NC. http://plants.usda.gov (accessed 11 December 2019).

U.S. Environmental Protection Agency. 2018. EPA level III and level IV ecoregions of the conterminous United States. https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions- conterminous-united-states (accessed 26 April 2018).

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Approval

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Acknowledgments

This ecological site description was updated by Rick L. Peterson on December 13, 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	05/06/2010
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):** Litter should fall in place. Slight amount of movement of smallest size class litter is possible, but not normal.

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

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should be 5 to 8 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/tall cool-season bunchgrasses >>

    Sub-dominant: Mid/tall warm-season grasses > short warm-season grass >

    Other: Forbs = Shrubs > Mid/short cool-season grasses = Grass-likes

    Additional: Due to differing root structure and distribution, Kentucky bluegrass and smooth bromegrass do not fit into reference plant community F/S groups.

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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 1,500-2,800 lbs./acre (air-dry weight). Reference value production is 2,100 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, annual bromes, Kentucky bluegrass, and smooth bromegrass.

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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.
