

Ecological site R058DY017SD Shallow Clayey

Last updated: 7/18/2024
Accessed: 05/10/2025

General information

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

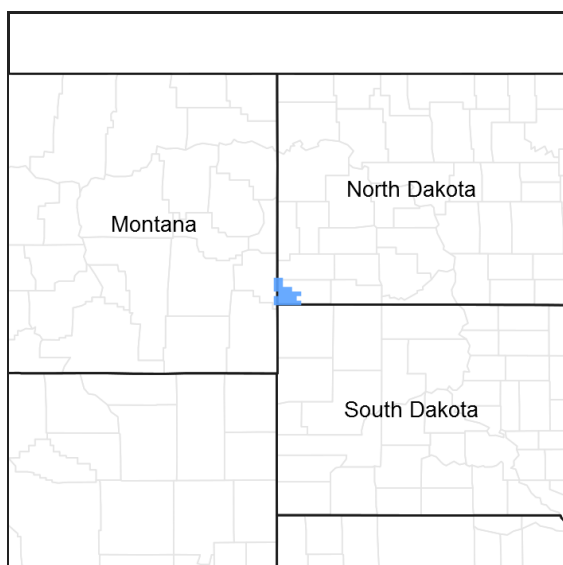


Figure 1. Mapped extent

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

MLRA notes

Major Land Resource Area (MLRA): 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 Shallow Clayey ecological site is found throughout MLRA 58D. It is located on upland landscapes and does not receive additional moisture from runoff or overflow. Slopes range from 8 to 40 percent. Soils are shallow (between 10 and 20 inches in depth) with a clay to silty clay surface layer. The surface layer is 3 to 4 inches thick. The texture of the subsurface layer's ranges from silty clay loam to clay.

The vegetation in the Reference State (1.0) is dominated by cool-season grasses and sub-dominant warm-season grasses. The major grasses include western wheatgrass, green needlegrass, and blue grama. Forbs are common and diverse. The significant shrubs found in this plant community include Wyoming big sagebrush and wild rose.

Associated sites

R058DY011SD	Clayey The Clayey ecological site is found on level to slightly sloping landscapes adjacent to, or down slope of, the Shallow Clayey ecological site.
R058DY012SD	Thin Loamy The Thin Loamy ecological site is found on similar landscapes adjacent to the Shallow Clayey ecological site.

R058DY013SD	Claypan The Claypan ecological site is found on nearly level landscapes down slope of the Shallow Clayey ecological site.
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Similar sites

R058DY011SD	Clayey The Clayey ecological site will have less warm-season grasses; and have greater vegetative production than the Shallow Clayey ecological site.
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Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Pascopyrum smithii</i> (2) <i>Nassella viridula</i>

Physiographic features

The Shallow Clayey ecological site occurs on moderate to steeply sloping uplands.

Table 2. Representative physiographic features

Landforms	(1) Upland > Hill (2) Upland > Ridge
Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None
Elevation	2,300–4,000 ft
Slope	8–40%
Water table depth	80 in
Aspect	Aspect is not a significant factor

Climatic features

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

The normal average annual temperature is about 44 °F. January is the coldest month with average temperatures ranging from about 12 °F (Marmarth, North Dakota) to about 20 °F (Baker, Montana). July is the warmest month with temperatures averaging from about 70 °F (Marmarth, North Dakota) to about 76 °F (Baker, Montana). The range of normal average monthly temperatures between the coldest and warmest months is about 55 °F. Wind speeds are estimated to average about 11 miles per hour (mph) annually, ranging from about 13 mph during the spring to about 10 mph during the summer. Daytime winds are generally stronger than nighttime winds. Strong storms may bring brief periods of high winds with gusts of more than 50 mph.

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

Table 3. Representative climatic features

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

Climate stations used

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

Influencing water features

No significant water features influence the Shallow Clayey ecological site.

Wetland description

Not Applicable.

Soil features

Soils common to the Shallow Clayey ecological site have a clay to silty clay surface layer that is 3 to 4 inches thick. Slopes range from 8 to 40 percent. Soils are shallow (between 10 and 20 inches in depth) and formed in residuum weathered from clayey shale. The texture of the subsurface layer's ranges from silty clay loam to clay. The soils in this site are well drained and have a very slow infiltration rate. A restrictive layer to water movement and root penetration occurs at 10 to 20 inches in depth.

This site 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.

Major Soils correlated to the Shallow Clayey ecological site include, Wayden and Yawdim.

These soils are mainly susceptible to water erosion. The hazard of water erosion increases on slopes greater than about 15 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) Residuum—clayey shale (2) Residuum—calcareous shale
Surface texture	(1) Clay (2) Silty clay
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Very slow
Soil depth	10–20 in
Surface fragment cover ≤3"	0%
Surface fragment cover >3"	0%
Available water capacity (0–40in)	3–5 in
Calcium carbonate equivalent (0–40in)	0–15%
Electrical conductivity (0–40in)	0–2 mmhos/cm
Sodium adsorption ratio (0–40in)	0
Soil reaction (1:1 water) (0–40in)	6.6–8.4
Subsurface fragment volume ≤3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The Shallow Clayey ecological site developed under Northern Great Plains climatic conditions; light to severe grazing by bison and other large herbivores; sporadic, natural or human-caused wildfire (often of light intensities); and other biotic and abiotic factors that typically influence soil and site development. Changes occur in the plant communities due to short-term weather variations, effects of native and exotic plant and animal species, and management actions. While 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 plant community upon which interpretations are primarily based is the Western Wheatgrass- Green Needlegrass/Shrubs Plant Community (1.1). This plant community has been determined by studying rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been used. Plant communities, states, transitional pathways, and thresholds have been determined through similar studies and experience.

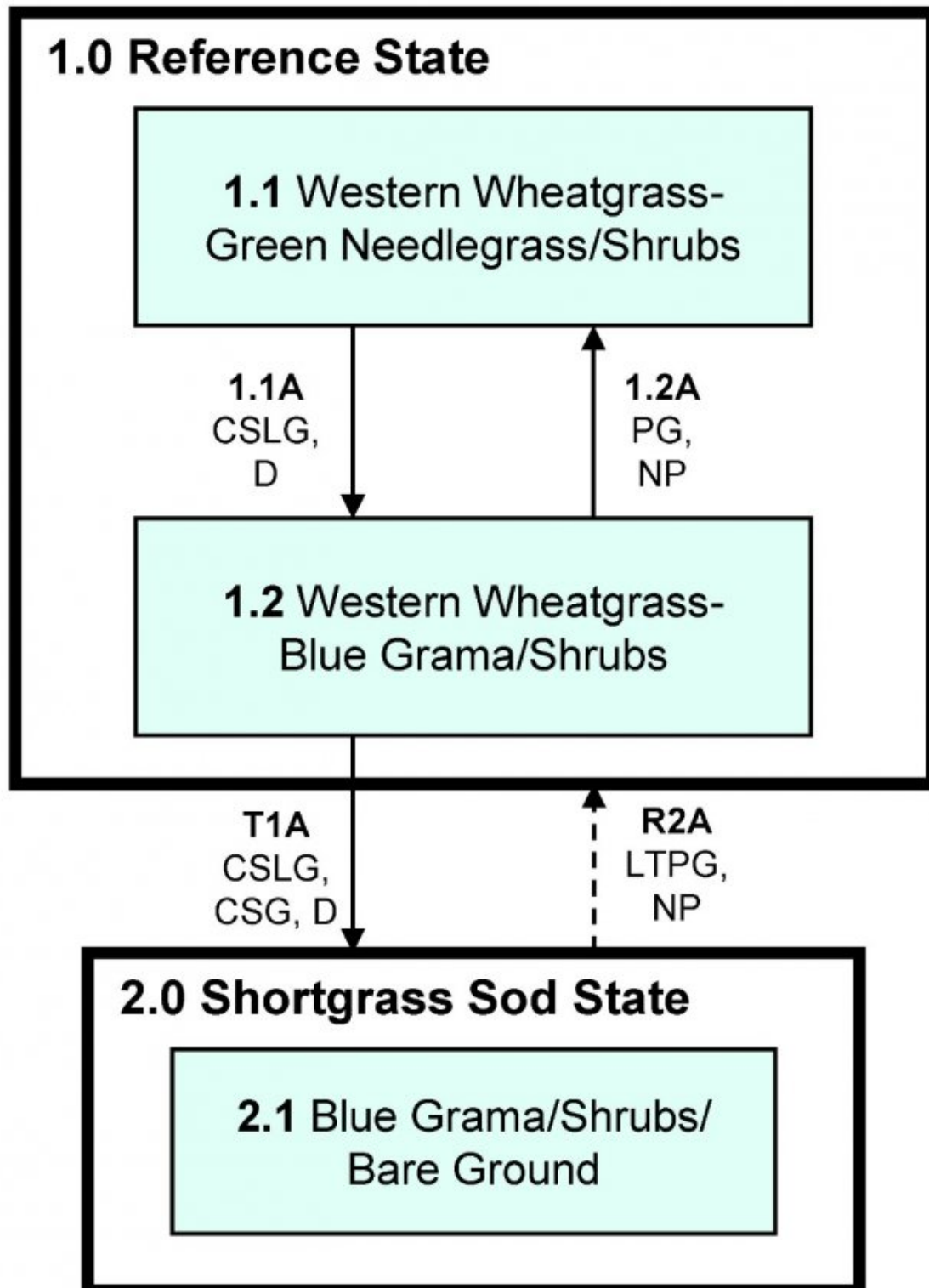
Continuous season-long grazing, or continuous seasonal (spring) grazing, without adequate recovery periods following each grazing occurrence causes this site to depart from the Western Wheatgrass-Green Needlegrass/Shrubs Plant Community (1.1). Blue grama will begin to increase. Western wheatgrass will increase initially and then begin to decrease. Green needlegrass will decrease in frequency and production. In time, heavy continuous grazing will likely cause upland sedges and blue grama to dominate. 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-Green Needlegrass/Shrubs Plant Community (1.1). Runoff increases and infiltration will decrease. Soil erosion will be minimal.

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

Shallow Clayey – R058DY017SD 1/15/2020



LTPG – Long-term prescribed grazing
NP – Return to normal precipitation patterns
PG – Prescribed grazing
-- ➔ Recovery may not be fast or feasible

Diagram Legend: Shallow Clayey - R058DY017SD

T1A	1.0 to 2.0	Continuous season-long grazing; continuous seasonal grazing (repeated spring grazing); or heavy grazing in combination with drought.
R2A	2.0 to 1.0	Long-term prescribed grazing including proper stocking rates, change in season of use, and adequate time for recovery; a return to normal precipitation patterns following drought. Transition may not be fast or feasible.
1.1A	1.1 to 1.2	Continuous season-long grazing; or heavy grazing in combination with drought.
1.2A	1.2 to 1.1	Prescribed grazing, including proper stocking rates, change in season of use, and adequate time for 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 this ecological site prior to European settlement. This site in the Reference State (1.0) is dominated by cool-season grasses with sub-dominant warm-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. Cool-season wheatgrasses and needlegrasses and taller warm-season grasses would have declined and a corresponding increase in short statured grass and grass-like species would have occurred. Today, a similar state can be found on areas that are properly managed with grazing and sometimes on areas receiving occasional short periods of rest.

Dominant plant species

- Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), shrub
- rose (*Rosa*), shrub
- western wheatgrass (*Pascopyrum smithii*), grass
- green needlegrass (*Nassella viridula*), grass
- blue grama (*Bouteloua gracilis*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- plains muhly (*Muhlenbergia cuspidata*), grass
- sideoats grama (*Bouteloua curtipendula*), grass
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- white prairie aster (*Symphyotrichum falcatum*), other herbaceous
- dotted blazing star (*Liatris punctata*), other herbaceous
- scurfpea (*Psoraleidium*), other herbaceous

Community 1.1

Western Wheatgrass-Green Needlegrass/Shrubs

The interpretive plant community for this site is the Western Wheatgrass-Green Needlegrass/Shrubs 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 or prescribed burning, and on areas receiving occasional short periods of deferment. Potential vegetation is about 85 percent grasses or grass-like plants, 5 percent forbs, and 10 percent shrubs. Major grasses include western wheatgrass, green needlegrass, and blue grama. Other grasses and grass-likes occurring on this plant community include little bluestem, plains muhly, and sideoats grama. Forbs commonly occurring include cudweed sagewort, white prairie aster, dotted gayfeather, purple prairie clover, and scurfpea. Shrubs commonly occurring include Wyoming big 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). Community dynamics, nutrient cycle, water cycle, and energy flow are functioning properly. Plant litter is properly distributed with very little movement offsite and natural plant mortality is very low. The diversity in plant species allows for high drought tolerance. Runoff from adjacent sites and moderate or high available water capacity provides a favorable soil-water-plant relationship.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	590	1020	1550
Shrub/Vine	55	90	125
Forb	55	90	125
Moss	0	0	0
Total	700	1200	1800

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

Western Wheatgrass-Blue Grama/Shrubs

This plant community develops under continuous season-long grazing by large herbivores. The potential vegetation is about 80 percent grass and grass-like species, 10 percent forbs, and 10 percent shrubs. The major grass and grass-like species include western wheatgrass, blue grama, buffalograss, and sedge. Other grasses occurring on this plant community include green needlegrass, sideoats grama, little bluestem, and needle and thread. Forbs commonly occurring include cudweed sagewort, goldenrod, western yarrow, white prairie aster, and scurfpea. Shrubs commonly found include Wyoming big sagebrush, fringed sagewort, and silver sagebrush. When compared to the Western Wheatgrass-Green Needlegrass/Shrubs Plant Community (1.1), blue grama and sedges have increased. Green needlegrass, little bluestem, and sideoats grama have decreased. Production of cool-season grasses has also been reduced. Non-native species such as cheatgrass, salsify, Kentucky bluegrass, and sweetclover will likely invade this plant community. This plant community is stable and protected from excessive erosion. The dominant herbaceous species are very adapted to grazing; however, the midgrass species and the more palatable forbs will decrease in the community through continuous seasonal grazing. This plant community tends to be resilient if disturbance is not long-term.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	520	737	1055
Shrub/Vine	40	90	140
Forb	40	68	95
Moss	0	5	10
Total	600	900	1300

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

Pathway 1.1A

Community 1.1 to 1.2

Continuous season-long grazing; or heavy grazing in combination with drought will lead the Reference Plant Community (1.1) to the Western Wheatgrass-Blue Grama/Shrubs Plant Community (1.2).

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 Western Wheatgrass-Blue Grama/Shrubs Plant Community (1.2) to the Western Wheatgrass-Green Needlegrass/Shrubs Plant Community (1.1).

Conservation practices

Prescribed Grazing

State 2

Shortgrass Sod State

The Shortgrass Sod State (2.0) is dominated by shortgrass species, and upland sedges. Clubmoss may also become common on this site. This State is the result of grazing management that does not provide adequate recovery time for tall and mid-statured warm- or cool-season grasses. 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

- Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), shrub
- silver sagebrush (*Artemisia cana*), shrub
- plains pricklypear (*Opuntia polyacantha*), shrub
- blue grama (*Bouteloua gracilis*), grass
- buffalograss (*Bouteloua dactyloides*), grass
- sedge (*Carex*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- prairie Junegrass (*Koeleria macrantha*), grass
- bluegrass (*Poa*), grass
- field brome (*Bromus arvensis*), grass
- scurfpea (*Psoraleidium*), other herbaceous
- white prairie aster (*Symphotrichum falcatum*), other herbaceous
- common yarrow (*Achillea millefolium*), other herbaceous
- scarlet globemallow (*Sphaeralcea coccinea*), other herbaceous
- prairie sagewort (*Artemisia frigida*), other herbaceous

Community 2.1

Blue Grama/Shrubs/Bare Ground

This plant community develops under long-term continuous season-long grazing; long-term continuous seasonal grazing with concentrated use in the early part of the growing season (as in calving/lambing pastures); or heavy grazing in combination with drought. It is made up of approximately 70 percent grasses and grass-like (primarily short, warm-season grasses), 10 percent forbs, 15 percent shrubs, and 0-5 percent clubmoss. The dominant grasses or grass-like include blue grama, buffalograss, and sedge. Other grasses may include western wheatgrass, prairie Junegrass, bluegrass, and annual brome. The dominant forbs include scurfpea, white prairie aster, western yarrow, and scarlet globemallow. The dominant shrubs are fringed sagewort, Wyoming big sagebrush, silver sagebrush, and plains pricklypear. Compared to the Western Wheatgrass-Green Needlegrass/Shrubs Plant Community (1.1), short grasses have increased, and the cool-season mid-grasses have diminished greatly. Some forbs and cactus have either increased or invaded the site. Plant diversity is low. This plant community is very stable. Generally, this plant community will require significant management inputs and time

to move it away from this plant community. Onsite soil erosion is low. Infiltration is low and runoff is high. Typically, the runoff is very clean but offsite areas can be significantly impacted due to the increased runoff.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	270	435	645
Shrub/Vine	55	105	155
Forb	25	45	65
Moss	0	15	35
Total	350	600	900

Figure 13. 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

Transition T1A State 1 to 2

Continuous season-long grazing, or continuous seasonal grazing (early spring), or heavy grazing in combination with drought will transition the Reference State (1.0) to the Shortgrass Sod State (2.0). This transition is most likely to originate from the Western Wheatgrass-Blue Grama/Shrubs Plant Community (1.2).

Restoration pathway R2A State 2 to 1

Long-term prescribed grazing, including proper stocking rates, change in season of use, and time for adequate plant recovery; and favorable climatic conditions; may facilitate this 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

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	Rhizomatous Wheatgrasses			300–480	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	300–480	–
	thickspike wheatgrass	ELLAL	<i>Elymus lanceolatus ssp. lanceolatus</i>	24–180	–
2	Cool-Season Bunchgrass			120–300	
	green needlegrass	NAVI4	<i>Nassella viridula</i>	120–300	–
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	12–60	–
	bluebunch wheatgrass	PSSP6	<i>Pseudoroegneria spicata</i>	0–60	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	0–60	–
3	Short-Warm Season Grasses			60–180	

	blue grama	BOGR2	<i>Bouteloua gracilis</i>	60–180	–
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	0–60	–
	saltgrass	DISP	<i>Distichlis spicata</i>	0–24	–
4	Mid- Warm-Season Grasses			12–120	
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	0–120	–
	plains muhly	MUCU3	<i>Muhlenbergia cuspidata</i>	12–120	–
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	0–120	–
5	Other Native Grasses			12–60	
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	12–60	–
	Grass, perennial	2GP	<i>Grass, perennial</i>	0–60	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0–36	–
6	Grass-Likes			12–60	
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	12–60	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–60	–
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	0–48	–
7	Non-Native Cool-Season Grasses			0	
Forb					
8	Forbs			60–120	
	Forb, native	2FN	<i>Forb, native</i>	12–60	–
	white prairie aster	SYFA	<i>Symphyotrichum falcatum</i>	12–36	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	12–36	–
	Missouri goldenrod	SOMI2	<i>Solidago missouriensis</i>	12–24	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	12–24	–
	purple prairie clover	DAPU5	<i>Dalea purpurea</i>	12–24	–
	leafy wildparsley	MUDI	<i>Musineon divaricatum</i>	12–24	–
	scarlet beeblossom	GACO5	<i>Gaura coccinea</i>	12–24	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	12–24	–
	scurfpea	PSORA2	<i>Psoralidium</i>	12–24	–
	American vetch	VIAM	<i>Vicia americana</i>	12–24	–
	desertparsley	LOMAT	<i>Lomatium</i>	12–24	–
	dotted blazing star	LIPU	<i>Liatris punctata</i>	12–24	–
	prairie thermopsis	THRH	<i>Thermopsis rhombifolia</i>	12–24	–
	purple locoweed	OXLA3	<i>Oxytropis lambertii</i>	0–12	–
	milkvetch	ASTRA	<i>Astragalus</i>	0–12	–
	spiny phlox	PHHO	<i>Phlox hoodii</i>	0–12	–
	textile onion	ALTE	<i>Allium textile</i>	0–12	–
	wavyleaf thistle	CIUN	<i>Cirsium undulatum</i>	0–12	–
	western yarrow	ACMIO	<i>Achillea millefolium</i> var. <i>occidentalis</i>	0–12	–
	pussytoes	ANTEN	<i>Antennaria</i>	0–12	–
	rush skeletonplant	LYJU	<i>Lygodesmia juncea</i>	0–12	–
	blacksamson echinacea	ECAN2	<i>Echinacea angustifolia</i>	0–12	–
	Nuttall's violet	VINU2	<i>Viola nuttallii</i>	0–12	–
	American bird's-foot trefoil	LOUNU	<i>Lotus unifoliolatus</i> var. <i>unifoliolatus</i>	0–12	–

	buckwheat	ERIOG	<i>Eriogonum</i>	0–12	–
Shrub/Vine					
9	Shrubs			60–120	
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i>	12–96	–
	Gardner's saltbush	ATGA	<i>Atriplex gardneri</i>	12–60	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0–60	–
	rose	ROSA5	<i>Rosa</i>	12–36	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	12–36	–
	silver sagebrush	ARCA13	<i>Artemisia cana</i>	12–24	–
	skunkbush sumac	RHTR	<i>Rhus trilobata</i>	0–24	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	12–24	–
	soapweed yucca	YUGL	<i>Yucca glauca</i>	0–12	–
	rubber rabbitbrush	ERNA10	<i>Ericameria nauseosa</i>	0–12	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0–12	–
Moss					
10	Mat-Forming Forbs			0	

Table 9. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	Rhizomatous Wheatgrasses			90–225	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	90–225	–
	thickspike wheatgrass	ELLAL	<i>Elymus lanceolatus</i> ssp. <i>lanceolatus</i>	0–45	–
2	Cool-Season Bunchgrass			18–90	
	green needlegrass	NAVI4	<i>Nassella viridula</i>	9–72	–
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	0–36	–
	bluebunch wheatgrass	PSSP6	<i>Pseudoroegneria spicata</i>	0–18	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	0–18	–
3	Short-Warm Season Grasses			180–315	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	135–270	–
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	18–90	–
	saltgrass	DISP	<i>Distichlis spicata</i>	0–36	–
4	Mid- Warm-Season Grasses			0–72	
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	0–45	–
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	0–45	–
	plains muhly	MUCU3	<i>Muhlenbergia cuspidata</i>	0–27	–
5	Other Native Grasses			9–45	
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	9–45	–
	Grass, perennial	2GP	<i>Grass, perennial</i>	0–36	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0–27	–
6	Grass-Likes			45–135	
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	27–135	–

	threadleaf sedge	CAFI	<i>Carex filifolia</i>	18–90	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–72	–
7	Non-Native Cool-Season Grasses			0–45	
	Kentucky bluegrass	POPR	<i>Poa pratensis</i>	0–45	–
	cheatgrass	BRTE	<i>Bromus tectorum</i>	0–45	–
	field brome	BRAR5	<i>Bromus arvensis</i>	0–18	–
	crested wheatgrass	AGCR	<i>Agropyron cristatum</i>	0–9	–
Forb					
8	Forbs			45–90	
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	9–45	–
	Forb, introduced	2FI	<i>Forb, introduced</i>	0–45	–
	scurfpea	PSORA2	<i>Psoralegium</i>	9–27	–
	western yarrow	ACMIO	<i>Achillea millefolium</i> var. <i>occidentalis</i>	9–27	–
	white prairie aster	SYFA	<i>Symphyotrichum falcatum</i>	9–27	–
	Forb, native	2FN	<i>Forb, native</i>	9–27	–
	Missouri goldenrod	SOMI2	<i>Solidago missouriensis</i>	9–27	–
	prairie thermopsis	THRH	<i>Thermopsis rhombifolia</i>	0–18	–
	pussytoes	ANTEN	<i>Antennaria</i>	0–18	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	9–18	–
	rush skeletonplant	LYJU	<i>Lygodesmia juncea</i>	0–9	–
	scarlet beeblossom	GACO5	<i>Gaura coccinea</i>	0–9	–
	purple locoweed	OXLA3	<i>Oxytropis lambertii</i>	0–9	–
	milkvetch	ASTRA	<i>Astragalus</i>	0–9	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0–9	–
	purple prairie clover	DAPU5	<i>Dalea purpurea</i>	0–9	–
	American bird's-foot trefoil	LOUNU	<i>Lotus unifoliolatus</i> var. <i>unifoliolatus</i>	0–9	–
	buckwheat	ERIOG	<i>Eriogonum</i>	0–9	–
	dotted blazing star	LIPU	<i>Liatris punctata</i>	0–9	–
	American vetch	VIAM	<i>Vicia americana</i>	0–9	–
	desertparsley	LOMAT	<i>Lomatium</i>	0–9	–
	leafy wildparsley	MUDI	<i>Musineon divaricatum</i>	0–9	–
	spiny phlox	PHHO	<i>Phlox hoodii</i>	0–9	–
	textile onion	ALTE	<i>Allium textile</i>	0–9	–
	wavyleaf thistle	CIUN	<i>Cirsium undulatum</i>	0–9	–
Shrub/Vine					
9	Shrubs			45–135	
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i>	9–90	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	9–45	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0–45	–
	silver sagebrush	ARCA13	<i>Artemisia cana</i>	9–36	–
	rubber rabbitbrush	ERNA10	<i>Ericameria nauseosa</i>	0–27	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0–27	–

	soapweed yucca	YUGL	<i>Yucca glauca</i>	0–27	–
	rose	ROSA5	<i>Rosa</i>	9–18	–
	skunkbush sumac	RHTR	<i>Rhus trilobata</i>	0–18	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	0–18	–
	Gardner's saltbush	ATGA	<i>Atriplex gardneri</i>	0–9	–
Moss					
10	Mat-Forming Forbs			0–9	
	lesser spikemoss	SEDE2	<i>Selaginella densa</i>	0–9	–

Table 10. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	Rhizomatous Wheatgrasses			6–48	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	6–48	–
	thickspike wheatgrass	ELLAL	<i>Elymus lanceolatus ssp. lanceolatus</i>	0–12	–
2	Cool-Season Bunchgrass			0–12	
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	0–12	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	0–6	–
3	Short-Warm Season Grasses			150–270	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	150–270	–
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	12–60	–
	saltgrass	DISP	<i>Distichlis spicata</i>	0–30	–
4	Mid- Warm-Season Grasses			0–30	
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	0–30	–
5	Other Native Grasses			6–30	
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	6–30	–
	Grass, perennial	2GP	<i>Grass, perennial</i>	0–30	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0–24	–
6	Grass-Likes			30–120	
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	18–90	–
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	12–60	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–30	–
7	Non-Native Cool-Season Grasses			12–60	
	Kentucky bluegrass	POPR	<i>Poa pratensis</i>	0–48	–
	cheatgrass	BRTE	<i>Bromus tectorum</i>	6–48	–
	field brome	BRAR5	<i>Bromus arvensis</i>	0–12	–
	crested wheatgrass	AGCR	<i>Agropyron cristatum</i>	0–6	–
Forb					
8	Forbs			30–60	
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	6–48	–
	Forb, introduced	2FI	<i>Forb, introduced</i>	0–30	–
	scurfpea	PSORA2	<i>Psoraleidum</i>	6–24	–
	white prairie aster	SYFA	<i>Symphyotrichum falcatum</i>	6–24	–

	western yarrow	ACMIO	<i>Achillea millefolium</i> var. <i>occidentalis</i>	6–18	–
	Forb, native	2FN	<i>Forb, native</i>	6–12	–
	pussytoes	ANTEN	<i>Antennaria</i>	0–12	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	6–12	–
	rush skeletonplant	LYJU	<i>Lygodesmia juncea</i>	0–6	–
	buckwheat	ERIOG	<i>Eriogonum</i>	0–6	–
	purple locoweed	OXLA3	<i>Oxytropis lambertii</i>	0–6	–
	milkvetch	ASTRA	<i>Astragalus</i>	0–6	–
	leafy wildparsley	MUDI	<i>Musineon divaricatum</i>	0–6	–
	spiny phlox	PHHO	<i>Phlox hoodii</i>	0–6	–
	wavyleaf thistle	CIUN	<i>Cirsium undulatum</i>	0–6	–
Shrub/Vine					
9	Shrubs			60–150	
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i>	6–60	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	6–60	–
	silver sagebrush	ARCA13	<i>Artemisia cana</i>	0–60	–
	soapweed yucca	YUGL	<i>Yucca glauca</i>	0–36	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	6–36	–
	rose	ROSA5	<i>Rosa</i>	6–30	–
	rubber rabbitbrush	ERNA10	<i>Ericameria nauseosa</i>	0–30	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0–30	–
	skunkbush sumac	RHTR	<i>Rhus trilobata</i>	0–12	–
Moss					
10	Mat-Forming Forbs			0–30	
	lesser spikemoss	SEDE2	<i>Selaginella densa</i>	0–30	–

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 Shallow Clay Ecological Site provides upland grassland cover with an associated forb and shrub component. It was typically part of an expansive grassland landscape that included combinations of Shallow Loamy, Claypan, Thin Loamy, Thin Claypan, Sandy, Sandy Claypan, Loamy, and Clayey 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 Shallow Clayey ecological site remains intact and provides increasingly important habitat for grassland and shrub steppe nesting birds, small rodents, coyotes, and a variety of reptiles, amphibians, and insects. Invasive species such as annual brome grasses and crested wheatgrass 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-Green Needlegrass/Shrubs (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 northern harrier, 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 squirrels, 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. Many wide-ranging predators utilize this plant community including 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.

Western Wheatgrass-Blue Grama/Shrubs (1.2): Resulting from continuous season-long grazing western wheatgrass and blue grama will dominate. The forb diversity has decreased. Species such as horned lark, upland sandpiper, and white-tailed jackrabbit will increase due to the decline 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 suitable thermal, protective, and escape cover. Predators utilizing this plant community include the coyote, American badger, red fox, and long-tailed weasel.

Blue Grama/Shrubs/Bare Ground (2.1): This plant community develops as a result of heavy continuous grazing of the western wheatgrass and blue grama community. This grazing action favoring species such as big sage brush and leads to increased bare ground. The loss of taller understory grasses limits this vegetative community for big sage brush associated species such as greater sage-grouse, Brewer's sparrow, and desert cottontail. Prey populations are limited reducing availability for grassland raptors such as golden eagle, ferruginous hawk, and Swainson's hawk.

Impairment of the ecological processes impacts offsite aquatic habitats through excessive runoff, nutrient, and sediment loads. Increased amount of bare ground causes elevated surface temperatures resulting from reduced cover and litter will greatly reduce habitat for most amphibian species, grassland birds, and mammals.

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-Green Needlegrass/Shrubs (1.1)
Average Production (lb/acre, air-dry): 1,200
Stocking Rate (AUM/acre): 0.33

Plant Community: Western Wheatgrass-Blue Grama/Shrubs (1.2)
Average Production (lb/acre, air-dry): 900
Stocking Rate (AUM/acre): 0.25

Plant Community: Blue Grama/Shrubs/*Bare Ground* (2.1)
Average Production (lb/acre, air-dry): 600*
Stocking Rate (AUM/acre): 0.16*

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

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

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

Hydrological functions

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

Recreational uses

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

Wood products

No appreciable wood products are typically present on this site.

Other products

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

Other information

Revision Notes: “Previously Approved” Provisional

This provisional ecological site description (ESD) has passed quality control (QC) and quality assurance (QA) to ensure the it meets the 2014 NESH standards for a provisional ecological site description.

This ESD is an updated “Previously Approved” ESD that represented a first-generation tier of documentation that, prior to the release of the 2014 National Ecological Site Handbook (NESH), met all requirements as an “Approved” ESD as laid out in the 1997 National Range and Pasture Handbook (NRPH). The document fully described the reference state and community phase in the state-and-transition model. All other alternative states are at least described in narrative form. The “Previously Approved” ESD has been field-tested for a minimum of 5 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 continued refinement toward an “Approved” status is expected.

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 (BIO), Bureau of Land Management (BLM); Stan Boltz, RMS, NRCS; Dave Dewald, Wildlife BIO, NRCS; Mitch Faulkner, RMS, NRCS; Jody Forman, RMS, NRCS; Dennis Froemke, RMS, NRCS; Tom Juntti, BIO, United States Forest Service (USFS); Cheryl Nielsen, RMS, NRCS; Jeff Printz, RMS, NRCS; Mike Stirling, RMS, NRCS; Dan Svingen, BIO, USFS; Darrell Vanderbusch, Soil Scientist, NRCS; Cindy Zachmeier, BIO, NRCS; and Tim Zachmeier, BIO, BLM.

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.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

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/arttrw/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. 2018. Official soil series descriptions. USDA Natural Resources Conservation Service. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053587 (accessed 20 December 2018).

Soil Survey Staff. 2018. Web Soil Survey. USDA Natural Resources Conservation Service. <https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx> (accessed 20 December 2018).

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. 2007. National engineering handbook, part 654. Rosgen Stream Classification Technique – Supplemental Materials, Technical Supplement 3E. <https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17833.wba> (accessed 4 March 2019).

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 24 September 2018).

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 27 December 2018).

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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Acknowledgments

This ecological site description was updated by Rick L. Peterson on January 15, 2020.

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.

Non-Discrimination Statement

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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.

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Date	05/07/2010
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Slight to none, typically on steeper slopes and discontinuous.

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2. **Presence of water flow patterns:** None, or barely visible and discontinuous with numerous debris dams when present.
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3. **Number and height of erosional pedestals or terracettes:** Few pedestalled plants typically on steeper slopes.
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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 0 to 15 percent is typical.
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5. **Number of gullies and erosion associated with gullies:** None should be present.
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6. **Extent of wind scoured, blowouts and/or depositional areas:** None.
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7. **Amount of litter movement (describe size and distance expected to travel):** Small size litter classes will generally move short distances, some medium size class litter will move very short distances. Litter debris dams are occasionally present.
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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.
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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should be 2 to 4 inches thick with light to dark brownish gray colors. Structure should typically be fine granular at least in the upper A-horizon.
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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Combination of shallow and deep rooted species (mid & tall rhizomatous and tufted perennial cool- and warm-season grasses) with fine and coarse roots positively influences infiltration.
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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 wheatgrass >> Mid/tall cool-season bunchgrasses >
- Sub-dominant: Short warm-season grasses >

Other: Mid warm-season grasses = Forbs = Shrubs > Grass-likes

Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little evidence of decadence or mortality. Bunch grasses have strong, healthy centers and shrubs are vigorous.
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14. **Average percent litter cover (%) and depth (in):**
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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Production ranges from 700-1,800 lbs./acre (air-dry weight). Reference value production is 1,200 lbs./acre (air-dry weight).
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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** State and local noxious weeds
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17. **Perennial plant reproductive capability:** All species exhibit high vigor relative to climatic conditions. Do not rate based solely on seed production. Perennial grasses should have vigorous rhizomes or tillers.
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