

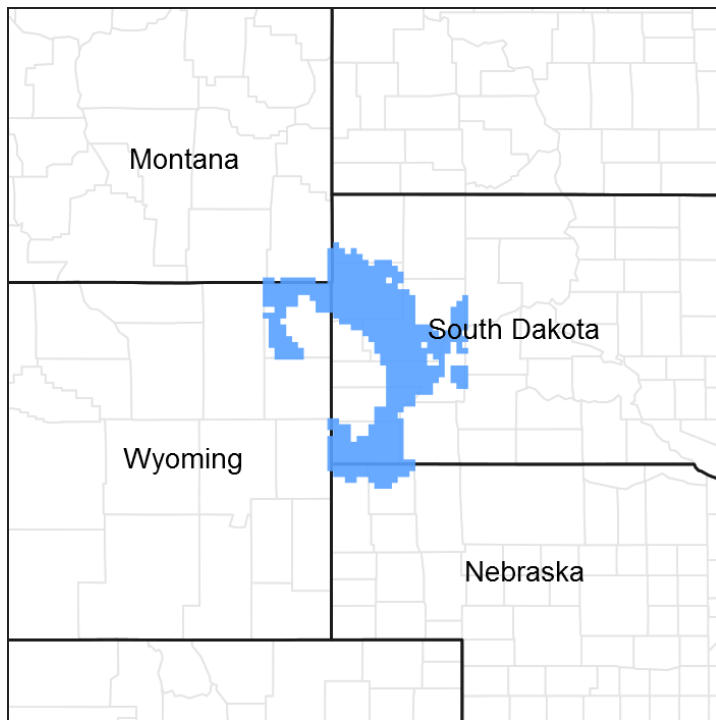
# Ecological site R060AY025SD Shallow Dense Clay

Last updated: 6/25/2024  
Accessed: 03/13/2026

---

## General information

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



**Figure 1. Mapped extent**

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

## MLRA notes

Major Land Resource Area (MLRA): 060A–Pierre Shale Plains

The Pierre Shale Plains (MLRA 60A) consists of approximately 10,150 square miles, the majority of which is in South Dakota (70 percent) and small portions are in Montana (2

percent), Nebraska (8 percent), and Wyoming (20 percent). It encircles the Black Hills (MLRA 62) and the Dakota Hogback (MLRA 61). MLRA 60A includes portions of the Oglala, Buffalo Gap, and Thunder Basin National Grasslands. It also includes small sections of the Pine Ridge Indian Reservation, Badlands National Park, and Black Hills National Forest. The Cheyenne and Belle Fourche Rivers flow through the MLRA.

MLRA 60A is in the unglaciated section of the Missouri Plateau, of the Great Plains Province of the Interior Plains. It is an area of old plateaus and terraces that have been deeply eroded. Cretaceous Pierre Shale underlies almost all of this MLRA. This is a marine sediment with layers of volcanic ash that has been altered to smectitic clay. These clays shrink as they dry and swell as they receive moisture. Soils are shallow to very deep and generally are well drained and clayey.

Elevations generally range from 2,620 to 3,610 feet throughout the MLRA, but can range up to 4,260 feet. The average annual precipitation for the western side of the MLRA is 13 to 16 inches, whereas the eastern side receives 16 to 18 inches. A suite of ecological sites has been written specifically for these two precipitation zones. The Locator Map shows the break between the two precipitation zones.

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

## **Classification relationships**

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

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

## **Ecological site concept**

The Shallow Dense Clay ecological site occurs throughout the MLRA. It is located on hills and ridges with slopes ranging from 3 to 50 percent. Soils are formed from dense clayey alluvium or residuum from soft shale. They are shallow, less than 20 inches deep. The surface layer is 2 to 5 inches thick and very clayey (>55 percent clay – 3.0 inch ribbon). When the soil is dry, cracks 1/2 inch to 2 inches wide and several feet long can extend to a depth below 20 inches. Permeability is very slow unless the soil is dry. Bare ground will be common.

Vegetation in the Reference State is dominated by cool-season rhizomatous wheatgrasses. Other grasses that may occur in minor amounts include green

needlegrass, blue grama, Sandberg bluegrass, and sedges. Dominant forbs will include biscuitroot, wild parsley, and western yarrow. Shrubs, primarily occurring in the western portions of the MLRA, include Wyoming big sagebrush, saltbush, and cactus.

## Associated sites

R060AY015SD	<b>Thin Claypan</b>
R060AY018SD	<b>Dense Clay</b>
R060AY026SD	<b>Saline Upland</b>
R060AY040SD	<b>Clayey 16-18" P.Z.</b>
R060AY011SD	<b>Clayey 13-16" P.Z.</b>

## Similar sites

R060AY018SD	<b>Dense Clay</b> Less steep slopes; higher production
-------------	---

**Table 1. Dominant plant species**

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Pascopyrum smithii</i> (2) <i>Elymus albicans</i>

## Physiographic features

This site typically occurs on slight to steeply sloping uplands.

**Table 2. Representative physiographic features**

Landforms	(1) Hill (2) Ridge
Flooding frequency	None
Ponding frequency	None
Elevation	2,500–4,300 ft
Slope	3–50%
Aspect	Aspect is not a significant factor

## Climatic features

The climate in this MLRA is typical of the drier portions of the Northern Great Plains,

where sagebrush steppes to the west yield to grassland steppes to the east. Annual precipitation for the entire MLRA ranges from 13 to 18 inches per year, with most occurring during the growing season. Temperatures show a wide range between summer and winter and between daily maximums and minimums, due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air masses from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Chinook winds may occur in winter and bring rapid rises in temperature. Extreme storms may occur during the winter, but the more severe occur during late fall, late winter, and spring.

The normal average annual temperature is about 46°F. January is the coldest month with average temperatures ranging from about 19°F (Moorcroft CAA, WY) to about 22°F (Belle Fourche, SD). July is the warmest month with temperatures averaging from about 70°F (Moorcroft CAA, WY) to about 72°F (Belle Fourche, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 51°F. Hourly winds are estimated to average about 11 miles per hour annually, ranging from about 13 miles per hour during the spring to about 10 miles per hour during the summer. Daytime winds generally are stronger than nighttime, and occasional strong storms may bring brief periods of high winds with gusts to more than 50 miles per hour.

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

**Table 3. Representative climatic features**

Frost-free period (characteristic range)	98-105 days
Freeze-free period (characteristic range)	123-129 days
Precipitation total (characteristic range)	15-18 in
Frost-free period (actual range)	76-108 days
Freeze-free period (actual range)	113-133 days
Precipitation total (actual range)	14-18 in
Frost-free period (average)	97 days
Freeze-free period (average)	124 days
Precipitation total (average)	16 in

### **Climate stations used**

- (1) WASTA [USC00398911], Owanka, SD
- (2) UPTON [USC00489205], Upton, WY

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

## Influencing water features

No significant water features influence this site.

## Wetland description

Not Applicable.

## Soil features

The soils in this site are well drained and formed in residuum weathered from clay shale. The clay surface layer is 2 to 5 inches thick. The soils have a very slow infiltration rate except after dry periods when initial uptake may be rapid due to cracking of the surface. When dry these soils crack. Wet surface compaction can occur with heavy traffic. This site typically should show slight to no evidence of rills, wind-scoured areas, or pedestalled plants. Water flow paths are broken, irregular in appearance, or discontinuous with numerous debris dams or vegetative barriers. The soil surface is stable and intact. Subsurface soil layers are restrictive to water movement and root penetration. Soils correlated to the Shallow Dense Clay Ecological Site include: Lismas, Louviers

These soils are susceptible to wind and water erosion. The hazard of water erosion increases on slopes greater than about 6 percent. More information can be found in the various soil survey reports. Contact the local USDA Service Center for soil survey reports that include more detail specific to your location.

**Table 4. Representative soil features**

Surface texture	(1) 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)	1.2–1.4 in

Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0–4 mmhos/cm
Sodium adsorption ratio (0-40in)	0–2
Soil reaction (1:1 water) (0-40in)	5.6–7.8
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

## Ecological dynamics

This site developed under Northern Great Plains climatic conditions, natural influences of large herbivores, occasional fire, and other biotic and abiotic factors that typically influence soil/site development. Changes will occur in the plant communities due to short-term weather variations, impacts of native and/or exotic plant and animal species, and management actions. While the following plant community descriptions describe more typical transitions between communities that will occur, severe disturbances, such as periods of well-below average precipitation, can cause significant shifts in plant communities and/or species composition.

Wyoming big sagebrush will be common in the western portion of this MLRA. Saltbush and inland saltgrass may occur on areas that are higher in salt content. These are typically drier areas in association with the Saline Upland ecological site (e.g., west of Highway 85 in Butte County, SD). There appears to be little vegetation shifts on this site, as the plant communities are stable.

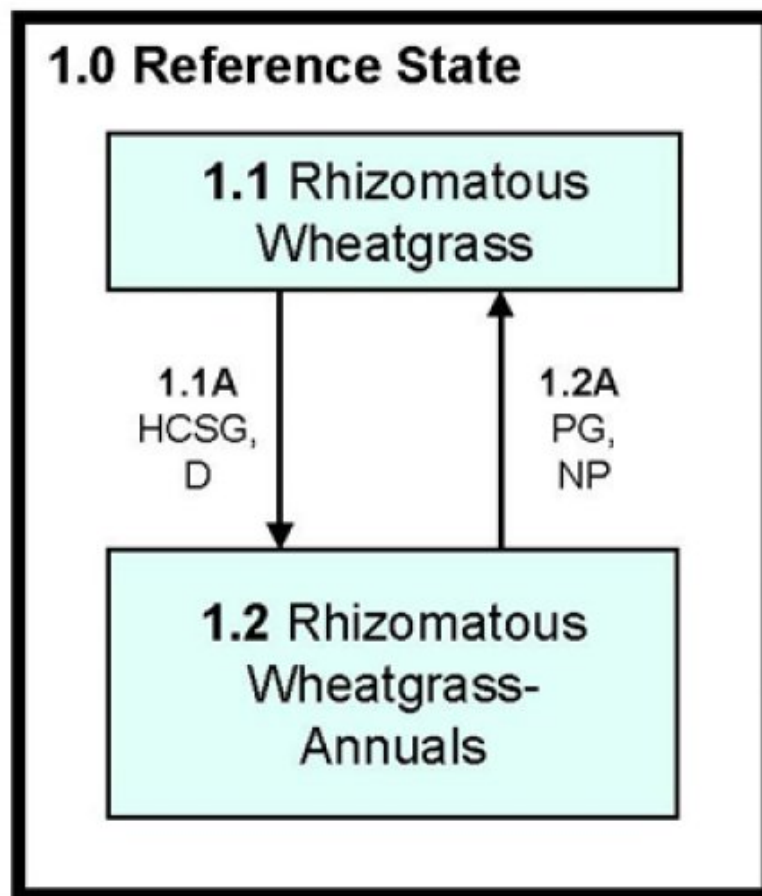
These soils are high in clay and have a low available water capacity. The shrink-swell potential is very high, resulting in cracks greater than 2 inches wide during dry periods. The native wheatgrasses, with their strong rhizomes and high drought tolerance, are able to thrive in these soils. Wheatgrasses dominate the site, and production is closely related to the vigor of the native wheatgrass.

The plant community upon which interpretations are primarily based is the Reference Plant Community (1.1). The Reference Plant Community has been determined by studying rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been used. Plant communities, states, transitional pathways, and thresholds have been determined through similar studies and experience.

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

## State and transition model

### Shallow Dense Clay– R060AY025SD 4/14/17



D – Drought  
HCSG – Heavy, continuous seasonal grazing  
NP – normal precipitation patterns  
PG – Prescribed grazing

Figure 8. Shallow Dense Clay - R060AY025SD

Diagram Legend - Shallow Dense Clay - R060AY025SD		
CP 1.1A	1.1 - 1.2	Heavy continuous seasonal grazing, above recommended stocking rates and without adequate rest and recovery and/or drought.
CP 1.2A	1.2 - 1.1	Prescribed grazing including change in season of use, proper stocking and adequate rest and recovery, normal precipitation following drought.

Figure 9. Shallow Dense Clay - R060AY025SD

## State 1 Reference State

This state represents what is believed to show the natural range of variability that dominated the dynamics in this ecological site prior to European settlement. This site, in Reference, is dominated by rhizomatous wheatgrass, and minor amounts of green needlegrass, sedges, forbs, and shrubs. Heavy grazing and/or drought will not significantly change the species composition but will cause a dramatic decrease in total annual production. Erosion of the surface horizon is also a likely outcome with heavy grazing. In pre-European times the primary disturbances included grazing by large ungulates, small mammals, and drought.

### Community 1.1 Rhizomatous Wheatgrass



Figure 10. Plant Community Phase 1.1

The plant community upon which interpretations are primarily based is the Rhizomatous Wheatgrass Plant Community. This is also considered the Reference Plant Community. The potential vegetation is about 80 to 90 percent grasses or grass-like plants, 5 to 10

percent forbs, and 5 to 10 percent shrubs. Cool-season grasses dominate the plant community. Major grasses include native wheatgrass such as western wheatgrass, Montana wheatgrass, and thickspike wheatgrass. Plant diversity is low because the site is dominated by native wheatgrasses. Other grasses and grass-like species occurring on the plant community may include green needlegrass, blue grama, native bluegrasses, buffalograss, and sedge. The dominant forbs include biscuitroot, wild parsley, scarlet globemallow, and western yarrow. Shrubs that may occur on the plant community include sagebrush, cactus, and saltbush. Community dynamics, nutrient cycle, water cycle, and energy flow are functioning at the site's potential. Plant litter is properly distributed with some movement off-site and natural plant mortality is low. As this plant community moves to the Rhizomatous Wheatgrass-Annuals Plant Community, one to possibly several intermediate stages can occur. Drought and moderate to heavy spring use will lower basal density of green needlegrass, and native wheatgrasses creating opportunities for invasive species such as sweetclover, annuals, and cactus.

**Table 5. Annual production by plant type**

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	320	764	1210
Forb	40	68	95
Shrub/Vine	40	68	95
<b>Total</b>	<b>400</b>	<b>900</b>	<b>1400</b>

**Figure 12. Plant community growth curve (percent production by month). SD6001, Pierre Shale Plains, cool-season dominant. Cool-season dominant..**

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

## Community 1.2 Rhizomatous Wheatgrass-Annuals

This plant community develops under droughty conditions, heavy spring grazing, or long-term heavy continuous grazing. The potential vegetation is made up of 75 to 95 percent grass, 5 to 15 percent forbs, and 0 to 10 percent shrubs. The grass component is almost entirely native wheatgrasses. Other perennial grasses are generally not found. Forbs found in this plant community include pennycress, annual mustards, curlycup gumweed, and sweet clover. Shrubs may include broom snakeweed and cactus. In the western portion of the MLRA, Wyoming big sagebrush and saltbush may persist. When compared to the Rhizomatous Wheatgrass Plant Community, annual and biennial forbs may occur. The vigor and basal density of the native wheatgrasses has been reduced. Production of cool-season grasses has been greatly reduced. Warm-season grasses, such as blue grama and buffalograss, will increase slightly. Green needlegrass and perennial forbs will

mostly disappear in this plant community. The plant diversity is low. Due to the low basal density, soil erosion hazards are moderately high. This plant community is resistant to change. Moving this plant community toward the Reference Plant Community (1.1) can be accomplished through prescribed grazing and favorable climatic conditions.

**Table 6. Annual production by plant type**

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	330	425	565
Forb	20	50	80
Shrub/Vine	0	25	55
<b>Total</b>	<b>350</b>	<b>500</b>	<b>700</b>

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

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

## Pathway 1.1A Community 1.1 to 1.2

Heavy, continuous seasonal grazing and/or drier precipitation cycles will move this plant community to the Rhizomatous Wheatgrass-Annuals Plant Community (1.2).

## Pathway 1.2A Community 1.2 to 1.1

With prescribed grazing and favorable climatic conditions, this plant community will move towards the Rhizomatous Wheatgrass Plant Community (1.1).

## Additional community tables

**Table 7. Community 1.1 plant community composition**

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Native Wheatgrasses</b>			540–720	
	Montana wheatgrass	ELAL7	<i>Elymus albicans</i>	360–720	–
	thickspike wheatgrass	ELLAL	<i>Elymus lanceolatus</i> ssp. <i>lanceolatus</i>	360–720	–
	western	DASM	<i>Desmodium smithii</i>	360–720	

	western wheatgrass	PASIM	<i>Pascopyrum striatum</i>	500-720	-
2	<b>Warm-Season Grasses</b>			45-90	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	27-90	-
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	0-45	-
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	0-45	-
3	<b>Cool Short Grasses/Grass-Likes</b>			0-45	
	plains reedgrass	CAMO	<i>Calamagrostis montanensis</i>	0-45	-
	sedge	CAREX	<i>Carex</i>	0-45	-
	squirreltail	ELEL5	<i>Elymus elymoides</i>	0-45	-
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	0-45	-
	Cusick's bluegrass	POCU3	<i>Poa cusickii</i>	0-45	-
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0-45	-
4	<b>Cool-Season Mid Grasses</b>			45-90	
	green needlegrass	NAVI4	<i>Nassella viridula</i>	45-90	-
<b>Forb</b>					
6	<b>Forbs</b>			45-90	
	leafy wildparsley	MUDI	<i>Musineon divaricatum</i>	0-45	-
	desert biscuitroot	LOFO	<i>Lomatium foeniculaceum</i>	0-45	-
	American bird's-foot trefoil	LOUNU	<i>Lotus unifoliolatus var. unifoliolatus</i>	0-45	-
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	0-45	-
	American vetch	VIAM	<i>Vicia americana</i>	0-45	-
	common yarrow	ACMI2	<i>Achillea millefolium</i>	0-27	-
	onion	ALLIU	<i>Allium</i>	0-27	-
	pussytoes	ANTEN	<i>Antennaria</i>	0-18	-
	milkvetch	ASTRA	<i>Astragalus</i>	0-18	-
	wavyleaf thistle	CIUN	<i>Cirsium undulatum</i>	0-18	-
	bastard toadflax	COMAN	<i>Comandra</i>	0-18	-
	sanddune wallflower	ERCAC	<i>Erysimum capitatum var. capitatum</i>	0-18	-
	bladderpod	LESQU	<i>Lesquerella</i>	0-18	-
	white heath aster	SYER	<i>Symphotrichum ericoides</i>	0-18	-
	bluebells	MERTE	<i>Mertensia</i>	0-18	-

	tufted evening primrose	OECAC2	<i>Oenothera caespitosa</i> <i>ssp. caespitosa</i>	0–18	–
	scarlet beeblossom	OESU3	<i>Oenothera suffrutescens</i>	0–18	–
	purple locoweed	OXLA3	<i>Oxytropis lambertii</i>	0–18	–
	phlox	PHLOX	<i>Phlox</i>	0–18	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0–18	–
	Missouri goldenrod	SOMI2	<i>Solidago missouriensis</i>	0–18	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	0–18	–
<b>Shrub/Vine</b>					
7	<b>Shrubs</b>			45–90	
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata</i> <i>ssp. wyomingensis</i>	0–90	–
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	0–45	–
	Gardner's saltbush	ATGA	<i>Atriplex gardneri</i>	0–45	–
	pricklypear	OPUNT	<i>Opuntia</i>	0–18	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	0–18	–

**Table 8. Community 1.2 plant community composition**

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Western Wheatgrass</b>			300–400	
	Montana wheatgrass	ELAL7	<i>Elymus albicans</i>	300–400	–
	thickspike wheatgrass	ELLAL	<i>Elymus lanceolatus</i> <i>ssp. lanceolatus</i>	300–400	–
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	300–400	–
2	<b>Warm-Season Grasses</b>			25–50	
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	0–25	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	5–25	–
3	<b>Cool Short Grasses/Grass-Likes</b>			0–25	
	plains reedgrass	CAMO	<i>Calamagrostis montanensis</i>	0–25	–

	sedge	CAREX	<i>Carex</i>	0–25	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	0–25	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	0–25	–
	Cusick's bluegrass	POCU3	<i>Poa cusickii</i>	0–25	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0–25	–
5	<b>Non-Native Grasses</b>			0–25	
	cheatgrass	BRTE	<i>Bromus tectorum</i>	0–25	–
<b>Forb</b>					
6	<b>Forbs</b>			25–75	
	sweetclover	MELIL	<i>Melilotus</i>	5–75	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	0–25	–
	field pennycress	THAR5	<i>Thlaspi arvense</i>	5–25	–
	American vetch	VIAM	<i>Vicia americana</i>	0–25	–
	mustard	BRASS2	<i>Brassica</i>	5–25	–
	curlycup gumweed	GRSQ	<i>Grindelia squarrosa</i>	5–25	–
	desert biscuitroot	LOFO	<i>Lomatium foeniculaceum</i>	0–25	–
	American bird's-foot trefoil	LOUNU	<i>Lotus unifoliolatus</i> var. <i>unifoliolatus</i>	0–25	–
	leafy wildparsley	MUDI	<i>Musineon divaricatum</i>	0–25	–
	common yarrow	ACMI2	<i>Achillea millefolium</i>	0–15	–
	onion	ALLIU	<i>Allium</i>	0–15	–
	pussytoes	ANTEN	<i>Antennaria</i>	0–10	–
	milkvetch	ASTRA	<i>Astragalus</i>	0–10	–
	wavyleaf thistle	CIUN	<i>Cirsium undulatum</i>	0–10	–
	bastard toadflax	COMAN	<i>Comandra</i>	0–10	–
	sanddune wallflower	ERCAC	<i>Erysimum capitatum</i> var. <i>capitatum</i>	0–10	–
	tufted evening primrose	OECAC2	<i>Oenothera caespitosa</i> ssp. <i>caespitosa</i>	0–10	–
	scarlet beeblossom	OESU3	<i>Oenothera suffrutescens</i>	0–10	–
	purple locoweed	OXLA3	<i>Oxytropis lambertii</i>	0–10	–
	phlox	PHLOX	<i>Phlox</i>	0–10	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0–10	–

	Missouri goldenrod	SOMI2	<i>Solidago missouriensis</i>	0–10	–
	bladderpod	LESQU	<i>Lesquerella</i>	0–10	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	0–10	–
	yellow salsify	TRDU	<i>Tragopogon dubius</i>	0–10	–
	white heath aster	SYER	<i>Symphotrichum ericoides</i>	0–10	–
	bluebells	MERTE	<i>Mertensia</i>	0–10	–
<b>Shrub/Vine</b>					
7	<b>Shrubs</b>			0–50	
	pricklypear	OPUNT	<i>Opuntia</i>	0–50	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	0–25	–
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata ssp. wyomingensis</i>	0–25	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	0–10	–
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	0–5	–
	Gardner's saltbush	ATGA	<i>Atriplex gardneri</i>	0–5	–

## Animal community

The following table lists annual suggested initial stocking rates with average growing conditions. These are conservative estimates that should be used only as guidelines in the initial stages of conservation planning. Often, the current plant composition does not entirely match any particular plant community (as described in this Ecological Site Description). Therefore, a resource inventory is necessary to document plant composition and production. More accurate carrying capacity estimates should eventually be calculated using the following stocking rate information along with animal preference data and actual stocking records, particularly when grazers other than cattle are involved. With consultation of the land manager, more intensive grazing management may result in improved harvest efficiencies and increased carrying capacity.

Plant Community = Rhizomatous Wheatgrass Plant Community (1.1)

Average Annual Production (lbs./ac, air-dry) = 900

Stocking Rate (AUM/ac) = 0.25

Plant Community = Rhizomatous Wheatgrass, Annuals Plant Community (1.2)

Average Annual Production (lbs./ac, air-dry) = 500

Stocking Rate (AUM/ac) = 0.14

\*Based on 912 lbs./acre (air-dry weight) per Animal Unit Month (AUM), and on 25 percent harvest efficiency of preferred and desirable forage species (refer to USDA NRCS,

National Range and Pasture Handbook).

Total annual production on-site may contain vegetation deemed undesirable or untargeted by the grazing animal. Therefore, AUM values may have been reduced to reflect only preferred or desirable forage species.

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

## **Hydrological functions**

Precipitation is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group D. Infiltration is very slow and runoff potential for this site varies from high to very high depending on slope and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An exception would be where short grasses form a strong sod. Normally areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

## **Recreational uses**

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

## **Other products**

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

## **Other information**

Revision Notes: "Previously Approved" Provisional

This Provisional ecological site concept has passed Quality Control (QC) and Quality Assurance (QA) to ensure that the site meets the 2014 NESH standards for a Provisional ecological site. This is an updated "Previously Approved" ESD which represents a first-generation tier of documentation that, prior to the release of the 2014 National Ecological Site Handbook (NESH), met all requirements as an "Approved" ESD as laid out in the 1997, rev.1, 2003 National Range and Pasture Handbook (NRPH). The document fully described the Reference State and Community Phase in the State-and-Transition model. All other alternative states are at least described in narrative form. The "Previously Approved" ESD has been field-tested for a minimum of five years and is a proven

functional document for conservation planning. The “Previously Approved” ESD does not contain all tabular and narrative entries as required in the current “Approved” level of documentation but it is expected that the “Previously Approved” ESD will continue refinement towards an “Approved” status.

#### Site Development and Testing Plan:

Future work, as described in a Project Plan, is needed to validate the information in this Provisional Ecological Site Description. This will include field activities to collect low-, medium-, and high-intensity sampling, soil correlations, and analysis of that data. Annual field reviews should be done by soil scientists and vegetation specialists. The final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed to produce the final document.

#### Non-discrimination Statement

In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, available online and at any USDA office, or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632- 9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: [program.intake@usda.gov](mailto:program.intake@usda.gov).

#### **Inventory data references**

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range trained personnel was also used. Those involved in developing this site description include: Stan Boltz, Range Management Specialist, NRCS; Cheryl Nielsen, Range Management Specialist, NRCS; Mike Stirling, Range Management Specialist, NRCS.

## **Other references**

EPA – Level III and Level IV Ecoregions of the Continental United States, (<https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions-continental-united-states>)

High Plains Regional Climate Center, University of Nebraska, (<http://www.hprcc.unl.edu/>). Accessed 02/27/17.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Official Soil Series Descriptions. Available online. Accessed 03/16/17.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online. Accessed 03/16/17.

USDA, NRCS. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.

USDA, NRCS. 2014. National Ecological Site Handbook, 1st Ed.

USDA, NRCS. National Water and Climate Center. (<http://www.wcc.nrcs.usda.gov/>). Accessed 02/27/17.

USDA, NRCS. 1997, rev. 1, 2003. National Range and Pasture Handbook.

USDA, NRCS. National Soil Information System, Information Technology Center. (<http://nasis.nrcs.usda.gov>)

USDA, NRCS. 2001. The PLANTS Database, Version 3.1 (<http://plants.usda.gov>). National Plant Data Center.

USDA, NRCS. Various Published Soil Surveys.

## **Contributors**

Stan Boltz

## **Acknowledgments**

ESD updated by Rick L. Peterson 4/14/17

MLRA 60A Provisional Level Quality Control (QC) Process 9/28/17

Ecological Site from MLRA 60A were Previously Approved ESDs and meet the

requirements as stated in the 2003 National Range and Pasture Handbook.

The Sites were updated to the Provisional Level by Rick L. Peterson, ESS, Rapid City, SSO in FY17.

The sites were reviewed by George Gamblin, RMS, Wheatland, WY and Mitch Faulkner, RMS, Belle Fourche, SD. Mitch Faulkner acted as the Provisional QC. The Sites were then reviewed and approved at the Provisional Level by David Kraft, Regional ESS, Salina, KS. Worked closely with Kent Cooley, Area SS, with MLRA key development and soils narratives

## Rangeland health reference sheet

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

Author(s)/participant(s)	Stan Boltz, Ryan Beer, Mitch Iverson, Thad Berrett, Cheryl Nielsen
Contact for lead author	stanley.boltz@sd.usda.gov, 605-352-1236
Date	06/04/2008
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

## Indicators

1. **Number and extent of rills:** Slight to none present. Usually not connected.

---

2. **Presence of water flow patterns:** Present especially on slopes greater than about 15%. Normally discontinuous and rarely connected. Length variable but generally no more than 2 to 4 feet.

---

3. **Number and height of erosional pedestals or terracettes:** Occasional pedestals, but few

exposed roots would occur.

---

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 5 to 40 percent is typical; the higher bare ground levels would appear during extended dry periods.

---
5. **Number of gullies and erosion associated with gullies:** None should be present. Some gullies may appear in concentrated flow/drainage areas on steeper slopes, but should be vegetated and not active in most years.

---
6. **Extent of wind scoured, blowouts and/or depositional areas:** None.

---
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.

---
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 3 or greater. Surface organic matter usually adheres to the soil surface. Soil surface fragments (peds) will typically retain structure at least for short periods when dipped in distilled water. Some fragments will dissolve in less than 1 minute.

---
9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should be 3 to 6 inches thick but with light to dark gray colors. Structure should typically be platy to subangular blocky or occasionally fine granular in the upper 1/2 inch.

---
10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Combination of shallow & deep-rooted species (mid rhizomatous, tufted perennial cool-season grasses, and short warm-season grasses) with fine & coarse roots positively influence infiltration. Infiltration is

not often affected by a change in plant composition as the rhizomatous species typically dominate.

---

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** A-horizon naturally has some platy structure. Compaction layers, if formed by management, do not typically persist. Compaction will be difficult to determine. Evidence of compaction can sometimes be confirmed by signs of recent concentration of livestock.
- 

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 >>

Sub-dominant: Short warm-season grasses = tall cool-season bunchgrasses = forbs = shrubs

Other:

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.
- 

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

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Production ranges from 400-1,400 lbs./acre (air-dry weight). Reference value production is 900 lbs./acre (air-dry weight).
- 

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**

---

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.
-