USDA Natural Resources
Conservation Service

Ecological site R060AY008SD
Sands

Last updated: 5/13/2019
Accessed: 05/02/2024

General information

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

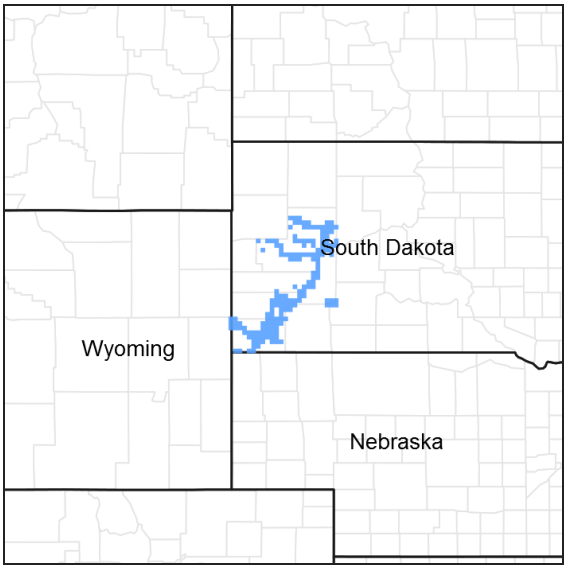

Figure 1. Mapped extent

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

MLRA notes

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

MLRA Notes:
The Pierre Shale Plains (MLRA 60A) consists of approximately 10,150 square miles, the majority of which is 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 Sands ecological site occurs throughout MLRA 60A. It is located on upland landscapes and does not receive additional moisture from run off or overflow. This site can have very complex slopes that typically range from 0 to 25 percent but can be as steep as 40 percent.
Soils are excessively drained and formed in eolian sand or sandy alluvium. The surface layer is 3 to 10 inches thick with a texture range of loamy fine sand to sand. The vegetation in the Reference Plant Community consists of a mix of cool- and warm-season grasses, however, tall- and mid-statured warm-season grasses tend to be the dominant group. Prairie sandreed, and big or sand bluestem, and little bluestem are dominant warm-season grasses, western wheatgrass, and needle and thread are dominant cool-season grasses. Forbs are common and diverse. Common shrubs include leadplant, silver or sand sagebrush, rose, and yucca. In the western portion of this MLRA, silver sagebrush will tend to occur on this site, whereas sand sagebrush will be most likely to occur on the eastern side.

Associated sites

R060AY009SD	**Sandy** More soil development, more wheatgrass and less bluestem, less slope

Similar sites

R060AY009SD	**Sandy** More western wheatgrass; less sand bluestem; less slope

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Andropogon hallii* (2) *Calamovilfa longifolia*

Physiographic features

This site occurs on dune fields or river terraces.

Table 2. Representative physiographic features

Landforms	(1) Dune (2) Stream terrace
Flooding frequency	None
Ponding frequency	None
Elevation	762–1,311 m
Slope	0–24%

Ponding depth	0 cm
Water table depth	0 cm
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 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 outbreaks 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 most severely affect ranch operations during late winter and spring. The normal average annual temperature is about 46°F. January is the coldest month with average temperatures ranging from about 19°F (Moorcroft CAA, Wyoming (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 are generally stronger than nighttime, and occasional strong storms may bring brief periods of high winds with gusts to more than 50 miles per hour. Growth of cool-season plants begins in early to mid-March, slowing or ceasing in late June. Warm-season plants begin growth about mid-May and can continue to early or mid-September. Green-up of cool-season plants may occur in September and October when adequate soil moisture is present.

Table 3. Representative climatic features

Frost-free period (average)	115 days
Freeze-free period (average)	133 days
Precipitation total (average)	432 mm

Climate stations used

- (1) WASTA [USC00398911], Owanka, SD
- (2) UPTON [USC00489205], Upton, WY
- (3) BELLE FOURCHE [USC00390559], Belle Fourche, SD
- (4) MOORCROFT 3S [USW00024088], Moorcroft, WY
- (5) REDBIRD [USC00487555], Lance Creek, WY
- (6) ARDMORE 1 NW [USC00390236], Edgemont, SD

Influencing water features

No significant water features influence this site.

Soil features

The soils in this site are excessively drained and formed in eolian sand or sandy alluvium. The surface layer is 3 to 10 inches thick. The texture of the profile ranges from loamy fine sand to fine sand. This site 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 vegetative barriers. The soil surface is stable and intact. 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.

Soils correlated to the Sands ecological site: Dailey, Dwyer, Valent

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) Fine sand
Family particle size	(1) Sandy
Drainage class	Somewhat excessively drained to excessively drained
Permeability class	Moderately rapid
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	5.08–11.18 cm
Calcium carbonate equivalent (0-101.6cm)	0–6%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	5.6–8.4
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 specify more typical transitions between communities that will occur, severe disturbances, such as periods of well-below average precipitation, can cause significant shifts in plant communities and/or species composition.
Blue grama, needle and thread, and sand dropseed increase as this site deteriorates from improper management. Species such as big or sand bluestem, little bluestem, and prairie sandreed will decrease in frequency and production.

The plant community upon which interpretations are primarily based is the Bluestem-Prairie Sandreed Plant Community (1.1). This Plant Community Phase (PCP) is considered to be the Reference Plant Community. 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.

The following is a diagram that illustrates the common plant communities that can occur 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

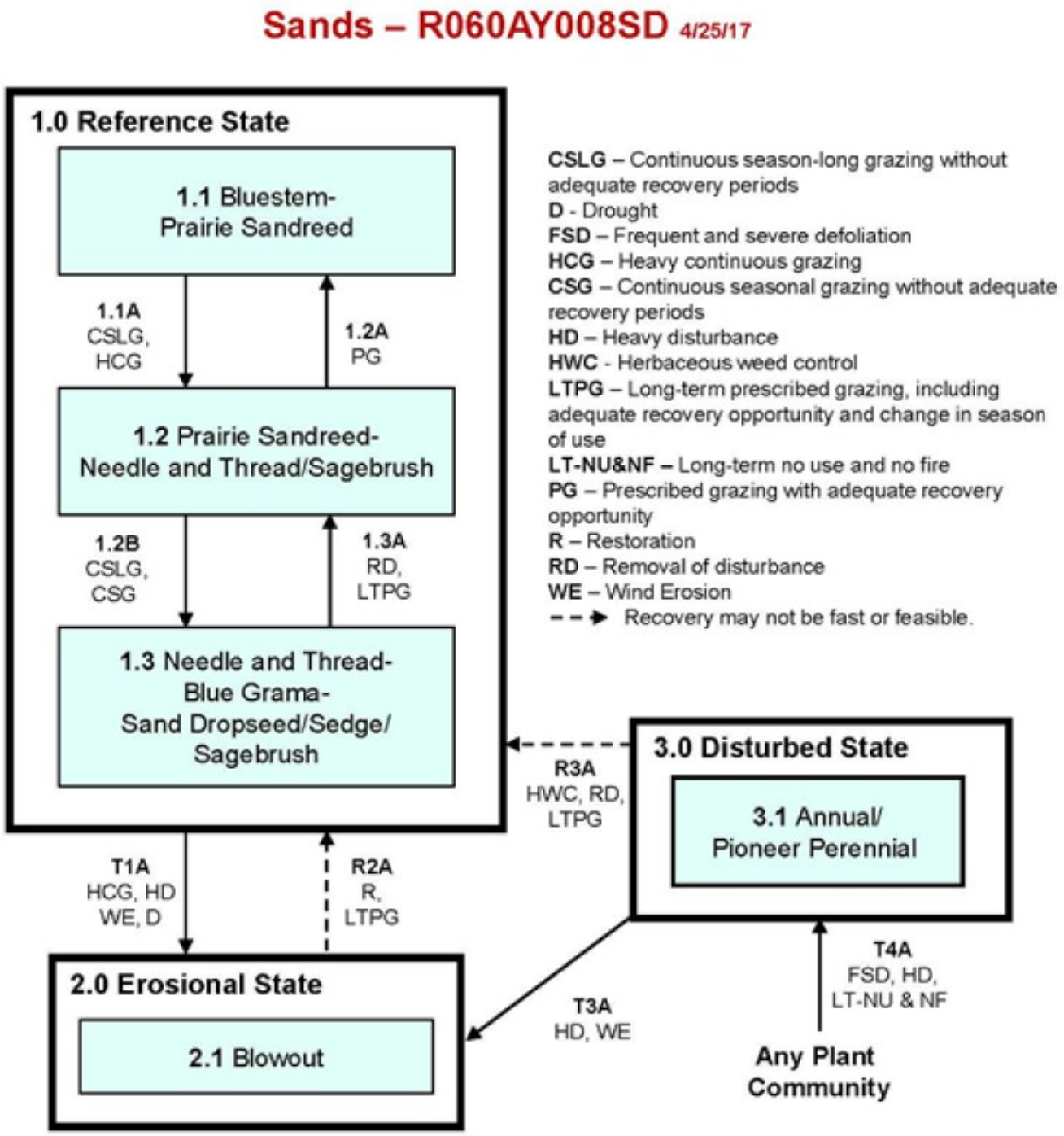

Figure 6. Sands - R060AY008SD

Diagram Legend - Sands - R060AY008SD

T1A		Heavy continuous grazing, heavy disturbance, drought, wind erosion.
T3A		Heavy disturbance or any disturbance resulting in an increase in bare ground, wind erosion.
T4A		Frequent and severe defoliation, heavy disturbance, or long-term non-use and no fire.
R2A		Restoration of blowout, including site stabilization, shaping, mulching, seeding followed by long-term prescribed grazing with change is season of use and time for adequate recovery.
R3A		Removal of management-induced disturbance, herbaceous weed control, followed by long-term prescribed grazing with change is season of use and time for adequate recovery.
CP 1.1A	1.1 - 1.2	Continuous season-long grazing or heavy continuous grazing.
CP 1.2A	1.2 - 1.1	Prescribed grazing with proper stocking, change is season of use and adequate time for recovery.
CP 1.2B	1.2 - 1.3	Continuous season-long grazing, or continuous seasonal grazing.
CP 1.3A	1.3 - 1.2	Removal of management-induced disturbance followed by long-term prescribed grazing with proper stocking, change is season of use and adequate time for recovery.

Figure 7. Sands - R060AY008SD

State 1
Reference State

This state represents what is believed to show the natural range of variability that dominated the dynamics of the ecological site prior to European settlement. This site, in reference, is dominated by warm-season grasses and sub-dominant cool-season grass. Grazing or the lack of grazing, fire, and wind erosion are the major drivers between plant communities.

Community 1.1
Bluestem-Prairie Sandreed

Figure 8. Plant Community Phase 1.1

The plant community upon which interpretations are primarily based is the Bluestem-Prairie Sandreed Plant Community (1.1). This is also considered the Reference Plant Community. This plant community occurs on areas that are properly managed with grazing and/or on areas receiving occasional short periods of non-use. This plant community consists chiefly of tall- and mid- warm-season grasses. Principal dominants are big or sand bluestem, prairie sandreed, little bluestem, and needle and thread. Grasses and grass-likes of secondary importance are sand

dropseed, blue and/or hairy grama, and upland sedge. Forbs and shrubs such as penstemon, gayfeather, leadplant, rose, and sand sagebrush or silver sagebrush, make up a significant percentage of the PCP. In the western portion of the MLRA, silver sagebrush will be more likely to occur on this site. This plant community is about 75 to 85 percent grasses, 5 to 15 percent forbs, and 2 to 10 percent shrubs by weight. This plant community is well adapted to the Northern Great Plains climatic conditions. 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. The diversity in plant species allows for high drought tolerance.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1317	1789	2247
Forb	101	213	336
Shrub/Vine	39	128	219
Total	**1457**	**2130**	**2802**

Figure 10. Plant community growth curve (percent production by month). SD6005, Pierre Shale Plains, warm-season dominant. Warm-season dominant..

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

Community 1.2
Prairie Sandreed-Needle and Thread/Sagebrush

This plant community developed under continuous season-long grazing. It is made up of a mixture of warm- and cool-season grasses. The dominant grasses include prairie sandreed and needle and thread. Other grasses may include blue grama, western wheatgrass, sand dropseed, and sedges. Forbs commonly found include dotted gayfeather, cudweed sagewort, green sagewort, western ragweed, annual eriogonum, scurfpea, and spiderwort. Dominant shrubs in this community include rose, cactus, yucca, leadplant, and sand sagebrush or silver sagebrush in the western portion of the MLRA. Compared to the Bluestem-Prairie Sandreed Plant Community, blue grama, sand dropseed, and annual forbs increase. Big or sand bluestem and little bluestem have decreased. Annual forbs invade the site. Plant diversity is high. This plant community is about 75 to 85 percent grasses, 5 to 15 percent forbs, and 2 to 15 percent shrubs by weight. This plant community is not resistant to change. Changes in climate, fire patterns, and/or grazing management can result in a shift to another plant community. This community is fairly resilient under normal disturbances because of the high diversity of plant species and the high amount of litter. Soil erosion is low. The water cycle is functioning because of the plant and litter cover on the soil surface. Infiltration is high because of soil texture and surface litter. Runoff is low.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	913	1188	1457
Shrub/Vine	28	123	224
Forb	67	146	224
Total	**1008**	**1457**	**1905**

Figure 12. Plant community growth curve (percent production by month). SD6003, Pierre Shale Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	20	28	21	10	5	3	0	0

Community 1.3
Needle and Thread-Blue Grama-Sand Dropseed/Sedge/Sagebrush

This plant community typically developed over a period of several years under long-term season long grazing with inadequate deferment during the growing season. Short, drought tolerant grasses dominate. Sagebrush, is also prevalent. Occasional mid-grasses may be found within the canopy of the shrubs where it is protected from grazing. The dominant grasses are sand dropseed, blue and/or hairy grama, and needle and thread. Other grasses and grass-likes present include western wheatgrass, prairie Junegrass, prairie sandreed, and sedge. The dominant forbs include western ragweed, tenpetal mentzelia, green sagewort, annual eriogonum, and annual sunflower. Other dominant shrubs include, cactus and yucca. Compared to the Bluestem-Prairie Sandreed Plant Community (1.1), sand dropseed, blue grama, and hairy grama have increased. Needle and thread and prairie sandreed are limited to areas in the sagebrush. Big or sand bluestem and little bluestem are absent. Annual forbs will begin to invade the site. The plant diversity and production has decreased compared to the PCP 1.1. This plant community is made up of about 65 to 80 percent grasses and grass-likes, 10 to 15 percent forbs, and 5 to 25 percent shrubs.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	532	731	930
Shrub/Vine	45	151	258
Forb	95	127	157
Total	**672**	**1009**	**1345**

Figure 14. Plant community growth curve (percent production by month). SD6004, Pierre Shale Plains, warm-season dominant, cool-season sub-dominant. Warm season dominant, cool-season sub-dominant.

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

Pathway 1.1A
Community 1.1 to 1.2

Continuous season-long grazing will convert this plant community to PCP 1.2. Continuous heavy grazing tends to accelerate this movement.

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing that included proper stocking rate, change in season of use, and adequate recovery will convert this plant community to the Bluestem-Prairie Sandreed Plant Community (1.1).

Pathway 1.2B
Community 1.2 to 1.3

Continuous season-long grazing, or continuous seasonal grazing (grazing at moderate rates at the same time every year) will move this plant community to the Needle and Thread-Blue Grama-Sand Dropseed/Sedge/Sagebrush Plant Community (1.3).

Pathway 1.3A
Community 1.3 to 1.2

With the removal of the disturbance and long-term prescribed grazing, this plant community will convert to the Prairie Sandreed-Needle And Thread/Sagebrush Plant Community (1.2). In areas with high amounts of sagebrush, brush control followed by prescribed grazing may be necessary.

State 2
Erosional State

This state can be reached from any other plant community with significant disturbances such as heavy grazing and repeated wildfire. Large areas of blowing sand result in movement and possible enlargement of the blowout. Evaporation and transpiration rates of the few existing plants are extremely high due to bare ground and lack of litter.

Community 2.1
Blowout Plant Community

This plant community is in a low successional stage from poor soil development, and sporadic herbivore use. Sandhill muhly and blowout grass are present due to their drought tolerance. Continuous grazing will only increase the size of the blowouts. This condition is not stable. It consists of bare areas that are continually eroded by wind.

State 3
Disturbed State

This state can be reached from any plant community through heavy disturbance or through non-use and no fire for extended periods of time.

Community 3.1
Annual/Pioneer Perennial

This plant community develops through excessive disturbance such as frequent and severe defoliation, areas with heavy traffic, etc. This site is highly variable, sometimes being dominated by native or non-native forbs. A number of species can occupy the plant community, including annual brome, sand dropseed, sedge, annual sunflower, green sagewort, western ragweed, annual eriogonum, cactus, and sand sagebrush. Compared to the interpretive plant community, the later seral stage grasses such as the bluestems and prairie sandreed are absent, and the forb and shrub component has increased. Bare ground has significantly increased. This plant community can also develop with long-term non-use and no fire (20 or more years). Plant litter accumulates in large amounts when this community first develops. Eventually litter levels become high enough that plants are crowded out and bare ground areas develop. Annual forbs and grasses commonly fill these bare ground areas. Typically bunchgrasses have developed dead centers and rhizomatous grasses form small colonies because of a lack of stimulation to tiller. With the increase in bare ground and the increase in annual species, this site is susceptible to wind erosion, which could lead to blowing and shifting sand.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	224	401	633
Forb	50	112	174
Shrub/Vine	6	47	90
Total	**280**	**560**	**897**

Transition T1A
State 1 to 2

Heavy continuous grazing or heavy disturbance in combination with drought and excessive wind erosion will transition the Reference State (1.0) to the Erosional State (2.0).

Transition T4A
State 1 to 3

Frequent and severe defoliation, heavy disturbance, or long-term non-use and no fire will convert the Reference State (1.0) plant communities to the Disturbed State (3.0).

Restoration pathway R2A
State 2 to 1

Restoration of the site which can include shaping, mulching, and potentially seeding, followed by long-term prescribed grazing. The grazing prescription may include extended periods of deferment or non-use to transition this plant community back to the Reference State (1.0). This restoration pathway may not be fast or in the end meet management goals

Transition T4A
State 2 to 3

Frequent and severe defoliation, heavy disturbance, or long-term non-use and no fire will convert the Erosional State (2.0) plant community to the Disturbed State (3.0).

Restoration pathway R3A
State 3 to 1

Removal of management-induced disturbance, possibly herbaceous weed control, and long-term prescribed grazing, including adequate rest periods, may return this plant community to the Reference State (1.0). This restoration pathway may not be fast or in the end meet management goals.

Transition T3A
State 3 to 2

Any disturbance resulting in an increase in bare ground will make this site susceptible to wind erosion and a transition to the Erosional State (2.0).

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Sand Bluestem**			426–852	
	sand bluestem	ANHA	*Andropogon hallii*	426–852	–
2	**Prairie Sandreed**			426–745	
	prairie sandreed	CALO	*Calamovilfa longifolia*	426–639	–
3	**Little Blustem**			106–426	
	little bluestem	SCSC	*Schizachyrium scoparium*	106–426	–
4	**Mid Cool-Season Grasses**			106–319	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	106–213	–
	western wheatgrass	PASM	*Pascopyrum smithii*	22–213	–
5	**Short Warm-Season Grasses**			43–213	
	blue grama	BOGR2	*Bouteloua gracilis*	21–213	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	21–106	–
6	**Native Grasses and Grass-Likes**			106–213	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	22–149	–
	sedge	CAREX	*Carex*	43–106	–
	switchgrass	PAVI2	*Panicum virgatum*	0–106	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–64	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–64	–

	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–64	
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–64	–
	Grass, perennial	2GP	*Grass, perennial*	0–64	–
	sand lovegrass	ERTR3	*Eragrostis trichodes*	0–43	–
	thin paspalum	PASE5	*Paspalum setaceum*	0–21	–
7	**Non-Native Grasses**			–	
	cheatgrass	BRTE	*Bromus tectorum*	–	–
Forb					
8				0–64	
	Forb, perennial	2FP	*Forb, perennial*	0–64	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–64	–
	bush morning-glory	IPLE	*Ipomoea leptophylla*	0–64	–
	blazing star	LIATR	*Liatris*	0–64	–
	prairie clover	DALEA	*Dalea*	0–64	–
	scurfpea	PSORA2	*Psoralidium*	0–64	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–64	–
	goldenrod	SOLID	*Solidago*	0–64	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–64	–
	spiderwort	TRADE	*Tradescantia*	0–43	–
	annual buckwheat	ERAN4	*Eriogonum annuum*	21–43	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	0–43	–
	tenpetal blazingstar	MEDE2	*Mentzelia decapetala*	21–43	–
	western marbleseed	ONBEO	*Onosmodium bejariense var. occidentale*	0–43	–
	beardtongue	PENST	*Penstemon*	0–43	–
	hoary puccoon	LICA12	*Lithospermum canescens*	0–43	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–43	–
	false boneset	BREU	*Brickellia eupatorioides*	0–43	–
	crested pricklypoppy	ARPO2	*Argemone polyanthemos*	0–21	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–21	–
Shrub/Vine					
9	**Shrubs**			43–213	
	leadplant	AMCA6	*Amorpha canescens*	21–106	–
	sicklepod	ARCA	*Arabis canadensis*	0–106	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–106	–
	sand sagebrush	ARFI2	*Artemisia filifolia*	0–106	–
	American plum	PRAM	*Prunus americana*	0–106	–
	chokecherry	PRVI	*Prunus virginiana*	0–106	–
	rose	ROSA5	*Rosa*	21–106	–
	soapweed yucca	YUGL	*Yucca glauca*	0–64	–
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	0–64	–
	Franklin's sandwort	ARFR	*Arenaria franklinii*	0–43	–
	pricklypear	OPUNT	*Opuntia*	0–43	–
	Subshrub (<.5m)	2SUBS	*Subshrub (<.5m)*	0–43	–

Table 10. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Sand Bluestem**			73–219	
	sand bluestem	ANHA	*Andropogon hallii*	73–219	–
2	**Prairie Sandreed**			364–583	
	prairie sandreed	CALO	*Calamovilfa longifolia*	364–583	–
3	**Little Bluestem**			0–146	
	little bluestem	SCSC	*Schizachyrium scoparium*	0–146	–
4	**Mid Cool-Season Grasses**			0–219	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	219–364	–
	western wheatgrass	PASM	*Pascopyrum smithii*	22–219	–
5	**Short Warm-Season Grasses**			102–291	
	blue grama	BOGR2	*Bouteloua gracilis*	73–219	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	29–117	–
6	**Native Grasses and Grass-Likes**			102–291	
	sand dropseed	SPCR	*Sporobolus cryptandrus*	29–146	–
	sedge	CAREX	*Carex*	73–117	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–44	–
	Grass, perennial	2GP	*Grass, perennial*	0–44	–
	thin paspalum	PASE5	*Paspalum setaceum*	0–29	–
	switchgrass	PAVI2	*Panicum virgatum*	0–15	–
	sand lovegrass	ERTR3	*Eragrostis trichodes*	0–15	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–15	–
7	**Non-native Grasses**			15–29	
	cheatgrass	BRTE	*Bromus tectorum*	15–29	–
Forb					
8	**Forb**			73–219	
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	29–117	–
	tarragon	ARDR4	*Artemisia dracunculus*	15–73	–
	goldenrod	SOLID	*Solidago*	0–73	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–73	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–58	–
	scurfpea	PSORA2	*Psoralidium*	0–44	–
	prairie clover	DALEA	*Dalea*	0–44	–
	annual buckwheat	ERAN4	*Eriogonum annuum*	15–44	–
	western marbleseed	ONBEO	*Onosmodium bejariense var. occidentale*	15–44	–
	Forb, perennial	2FP	*Forb, perennial*	0–44	–
	bush morning-glory	IPLE	*Ipomoea leptophylla*	0–44	–
	blazing star	LIATR	*Liatris*	0–29	–
	hoary puccoon	LICA12	*Lithospermum canescens*	0–29	–

	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–29	–
	false boneset	BREU	*Brickellia eupatorioides*	0–29	–
	beardtongue	PENST	*Penstemon*	0–29	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	0–15	–
	spiderwort	TRADE	*Tradescantia*	0–15	–
	crested pricklypoppy	ARPO2	*Argemone polyanthemos*	0–15	–
	tenpetal blazingstar	MEDE2	*Mentzelia decapetala*	0–15	–
Shrub/Vine					
9	**Shrubs**			29–219	
	silver sagebrush	ARCA13	*Artemisia cana*	15–146	–
	sand sagebrush	ARFI2	*Artemisia filifolia*	15–146	–
	rose	ROSA5	*Rosa*	29–87	–
	soapweed yucca	YUGL	*Yucca glauca*	0–73	–
	leadplant	AMCA6	*Amorpha canescens*	15–73	–
	prairie sagewort	ARFR4	*Artemisia frigida*	15–73	–
	pricklypear	OPUNT	*Opuntia*	15–73	–
	American plum	PRAM	*Prunus americana*	0–58	–
	chokecherry	PRVI	*Prunus virginiana*	0–58	–
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	0–44	–
	Subshrub (<.5m)	2SUBS	*Subshrub (<.5m)*	0–29	–

Table 11. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Sand Bluestem**			–	
	sand bluestem	ANHA	*Andropogon hallii*	–	–
2	**Prairie Sandreed**			50–151	
	prairie sandreed	CALO	*Calamovilfa longifolia*	50–151	–
3	**Little Bluestem**			0–30	
	little bluestem	SCSC	*Schizachyrium scoparium*	0–30	–
4	**Mid Cool-Season Grasses**			151–252	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	151–252	–
	western wheatgrass	PASM	*Pascopyrum smithii*	11–101	–
5	**Short Warm Season Grasses**			252–303	
	blue grama	BOGR2	*Bouteloua gracilis*	202–303	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	50–101	–
6	**Native Grasses and Grass-likes**			182–404	
	sand dropseed	SPCR	*Sporobolus cryptandrus*	101–202	–
	sedge	CAREX	*Carex*	50–151	–
	thin paspalum	PASE5	*Paspalum setaceum*	0–50	–
	Grass, perennial	2GP	*Grass, perennial*	0–30	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–30	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	–	–

	switchgrass	PAVI2	*Panicum virgatum*	–	–
	sand lovegrass	ERTR3	*Eragrostis trichodes*	–	–
7	**Non-native Grasses**			10–50	
	cheatgrass	BRTE	*Bromus tectorum*	10–50	–
Forb					
8	**Forb**			101–151	
	tarragon	ARDR4	*Artemisia dracunculus*	10–101	–
	scurfpea	PSORA2	*Psoralidium*	0–81	–
	goldenrod	SOLID	*Solidago*	10–81	–
	white heath aster	SYER	*Symphyotrichum ericoides*	10–81	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–50	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–50	–
	tenpetal blazingstar	MEDE2	*Mentzelia decapetala*	10–50	–
	annual buckwheat	ERAN4	*Eriogonum annuum*	20–50	–
	bush morning-glory	IPLE	*Ipomoea leptophylla*	0–30	–
	blazing star	LIATR	*Liatris*	0–20	–
	hoary puccoon	LICA12	*Lithospermum canescens*	0–20	–
	western marbleseed	ONBEO	*Onosmodium bejariense var. occidentale*	0–20	–
	beardtongue	PENST	*Penstemon*	0–20	–
	false boneset	BREU	*Brickellia eupatorioides*	0–20	–
	prairie clover	DALEA	*Dalea*	0–20	–
	Forb, perennial	2FP	*Forb, perennial*	0–20	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–20	–
	crested pricklypoppy	ARPO2	*Argemone polyanthemos*	0–10	–
	spiderwort	TRADE	*Tradescantia*	0–10	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	–	–
Shrub/Vine					
9	**Shrubs**			50–252	
	silver sagebrush	ARCA13	*Artemisia cana*	50–151	–
	sand sagebrush	ARFI2	*Artemisia filifolia*	50–151	–
	soapweed yucca	YUGL	*Yucca glauca*	10–101	–
	prairie sagewort	ARFR4	*Artemisia frigida*	10–81	–
	pricklypear	OPUNT	*Opuntia*	10–81	–
	rose	ROSA5	*Rosa*	20–50	–
	chokecherry	PRVI	*Prunus virginiana*	0–30	–
	leadplant	AMCA6	*Amorpha canescens*	0–30	–
	American plum	PRAM	*Prunus americana*	0–30	–
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	0–20	–
	Subshrub (<.5m)	2SUBS	*Subshrub (<.5m)*	0–20	–

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 = Bluestem-Prairie Sandreed (1.1)
Average Annual Production (lbs./ac, air-dry) = 1900
Stocking Rate (AUM/ac) = 0.52

Plant Community = Prairie Sandreed-Needle And Thread/Sagebrush (1.2)
Average Annual Production (lbs./ac, air-dry) = 1300
Stocking Rate (AUM/ac) = 0.36

Plant Community = Needle And Thread-Blue Grama-Sand Dropseed/Sedge/Sagebrush (1.3)
Average Annual Production (lbs./ac, air-dry) = 900
Stocking Rate (AUM/ac) = 0.25

Plant Community = Blowout (2.1)
Average Annual Production (lbs./ac, air-dry) = Variable, if any usable forage

Plant Community = Annual/Pioneer Perennial (3.1)
Average Annual Production (lbs./ac, air-dry) = 400
Stocking Rate (AUM/ac) = 0.11

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

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

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

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group A. Infiltration ranges from high to very high. Runoff potential for this site varies from very low to low 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 example of an exception would be where short grasses form a strong sod and dominate the site. Normally areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

Recreational uses

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

Other products

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

Other information

Revision Notes: “Previously Approved” Provisional
This Provisional ecological site concept has passed Quality Control (QC) and Quality Assurance (QA) to ensure that the site meets the 2014 NESH standards for a Provisional ecological site. This is an updated “Previously Approved” ESD which represents a first-generation tier of documentation that, prior to the release of the 2014 National Ecological Site Handbook (NESH), met all requirements as an “Approved” ESD as laid out in the 1997, rev.1, 2003 National Range and Pasture Handbook (NRPH). The document fully described the Reference State and Community Phase in the State-and-Transition model. All other alternative states are at least described in narrative form. The “Previously Approved” ESD has been field-tested for a minimum of five years and is a proven functional document for conservation planning. The “Previously Approved” ESD does not contain all tabular and narrative entries as required in the current “Approved” level of documentation but it is expected that the “Previously Approved” ESD will continue refinement 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.

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; Darrel DuVall, Range Management Specialist, NRCS; Jill Epley, Range Management Specialist, NRCS; Cheryl Nielsen, Range Management Specialist, NRCS; Rick Peterson, 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). Available online. Accessed 01/03/17

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

USDA, NRCS. Soil Survey Staff. Official Soil Series Descriptions. Available online. Accessed 03/20/17.

USDA, NRCS. Soil Survey Staff. Web Soil Survey. Available online. Accessed 03/20/17.

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

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

USDA, NRCS. National Water and Climate Center. (http://www.wcc.nrcs.usda.gov/). Available online. Accessed 04/22/17.

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. 2017. The PLANTS Database (http://plants.usda.gov, 2017). Available online. Accessed 3/3/17.

USDA, NRCS. Various Published Soil Surveys.

Contributors

Stan Boltz

Approval

David Kraft, 5/13/2019

Acknowledgments

ESD updated by Rick L. Peterson, 4/26/17

Rangeland health reference sheet

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

Author(s)/participant(s)	Stan Boltz, Thad Berrett, Cheryl Nielsen
Contact for lead author	stanley.boltz@sd.usda.gov, 605-352-1236
Date	06/27/2008
Approved by	Stan Boltz
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None.

2. **Presence of water flow patterns:** None.

3. **Number and height of erosional pedestals or terracettes:** Bunchgrasses may be pedestalled, but no exposed roots should be present.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 5 to 15 percent is typical.

5. **Number of gullies and erosion associated with gullies:** None should be present.

6. **Extent of wind scoured, blowouts and/or depositional areas:** Occasional areas associated with increased animal activity (e.g., rodent burrows, animal trailing) may exhibit small wind scoured areas, typically less than 10 feet in diameter.

7. **Amount of litter movement (describe size and distance expected to travel):** Litter should fall in place. Slight amount of movement of smallest size class litter is possible, but not normal.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Some series on this site typically have little organic matter in the surface horizon, and the structure is single grain sand. Soil aggregate stability will be difficult to measure on these soils. Surface organic matter should still adhere to the soil surface. Surface erosion by water rarely occurs due to rapid infiltration, but surface is susceptible to wind erosion if vegetative cover is reduced due to drought or heavy grazing. Biological crusts are often present (up to 10% of the surface) and serve to provide resistance to erosion. The dominant rhizomatous warm-season species are adapted to these coarse soils and when vigorous are vital in preventing erosion by wind.

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. Some soils (e.g., Zeona) have little organic matter in the A-horizon and dark grayish brown colors when moist, but possibly not mollic. Structure can be single grain to fine granular parting to single grain in the A-horizon.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Combination of shallow and deep rooted species (mid & tall rhizomatous and tufted perennial cool- and warm-season grasses) with fine and coarse roots positively influences infiltration. Infiltration is typically high due to the coarse nature of these soils.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None.

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: Tall warm-season rhizomatous grasses >>

Sub-dominant: Mid warm-season bunchgrass > forbs >

Other: Cool-season bunchgrasses = cool-season rhizomatous grasses = shrubs

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 1,300-2,500 lbs./acre (air-dry weight). Reference value production is 1,900 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.
