USDA Natural Resources Conservation Service

Ecological site R060AY024SD
Shallow Loamy

Accessed: 05/17/2024

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.

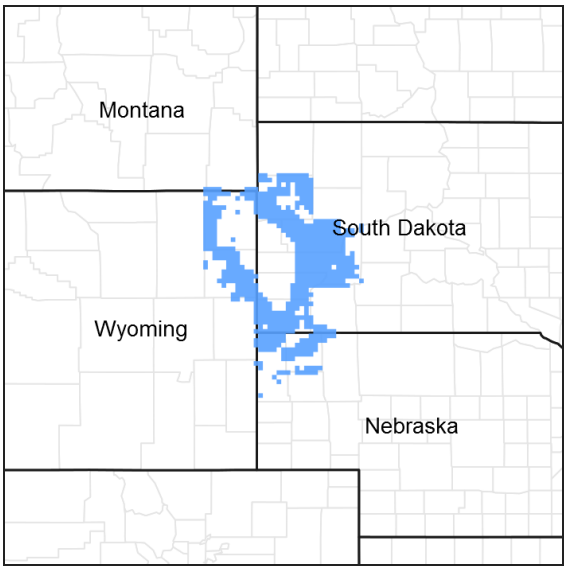

Figure 1. Mapped extent

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 located 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 Loamy ecological site occurs throughout the MLRA. It is located on hills, knolls, or ridges, and does not receive additional moisture from run off or overflow. Typical slopes range from 2 to 40 percent. Soils are shallow, between 10 and 20 inches deep, with clay loam to sandy clay loam surface textures, 2 to 9 inches thick. Soils are typically calcareous to the surface. The vegetation in the Reference State (1.0) consists of a mix of cool- and warm-season grasses. Little bluestem, sideoats grama, and blue grama are dominant. Cool- season grasses and grass-like species including needle and thread, rhizomatous wheatgrass, and threadleaf sedge, make up a significant portion of the composition. In the western portion of the MLRA, bluebunch wheatgrass may be equal to or exceed the amount of needlegrass. Forbs are common and diverse, and shrubs are present but are in minor amounts.

Associated sites

R060AY009SD	**Sandy** The Sandy site may be located adjacent to the Shallow Loamy site.
R060AY010SD	**Loamy 13-16" P.Z.** The Loamy 13-16 site may be located adjacent to the Shallow Loamy site.
R060AY012SD	**Thin Upland** The Thin Upland site may be located adjacent to the Shallow Loamy site.
R060AY041SD	**Loamy 16-18" P.Z.** The Loamy 16-18 site may be located adjacent to the Shallow Loamy site.

Similar sites

R060AY016SD	**Very Shallow** Lower production, lower diversity, more rocks on the surface
R060AY012SD	**Thin Upland** Deeper soils, more little bluestem, slightly higher production

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Schizachyrium scoparium* (2) *Bouteloua curtipendula*

Physiographic features

This site occurs on gently sloping to steep uplands.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Knoll (3) Ridge
Flooding frequency	None
Ponding frequency	None
Elevation	762–1,311 m
Slope	2–40%
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 (average)	115 days
Freeze-free period (average)	133 days
Precipitation total (average)	432 mm

Climate stations used

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

Influencing water features

No significant water features influence this site.

Soil features

The soils in this site are well to somewhat excessively drained and formed in soft siltstone, sandstone, mudstone, or shale. The loam to clay loam surface layer is 2 to 9 inches thick. Most soils are calcareous to the surface and some are gravelly or skeletal. The soils have a moderate infiltration rate. 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 debris dams or vegetative barriers. The soil surface is stable and intact. Sub-surface soil layers are restrictive to water movement and root penetration.

These soils are mainly susceptible to water erosion. The hazard of water erosion increases on slopes greater than about 15 percent. Very low to low available water capacity caused by the shallow rooting depth strongly influences the soil-water-plant relationship.

Soils correlated to Shallow Loamy in MLRA 60A: Blackhall, Cabbart, Dix, Eckley, Enning, Penrose, and Shingle.

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) Loam (2) Silt loam (3) Silty clay loam
Family particle size	(1) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderately slow to moderate
Soil depth	25–51 cm
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–20%
Available water capacity (0-101.6cm)	5.08–7.62 cm
Calcium carbonate equivalent (0-101.6cm)	0–40%
Electrical conductivity (0-101.6cm)	0–8 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	6.6–9
Subsurface fragment volume <=3" (Depth not specified)	0–15%
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.

Encroachment of Rocky Mountain juniper, eastern redcedar, and/or ponderosa pine may occur from adjacent sites, and can shift site characteristics. These shifts can alter the site dynamics and potential. These species may occur in small amounts on several plant communities.

The plant community upon which interpretations are primarily based is the Bluestem-Sideoats Grama-Needle and

Thread-Wheatgrass Community (1.1). This Plant Community Phase (PCP) is considered to be the Reference Plant Community. This 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

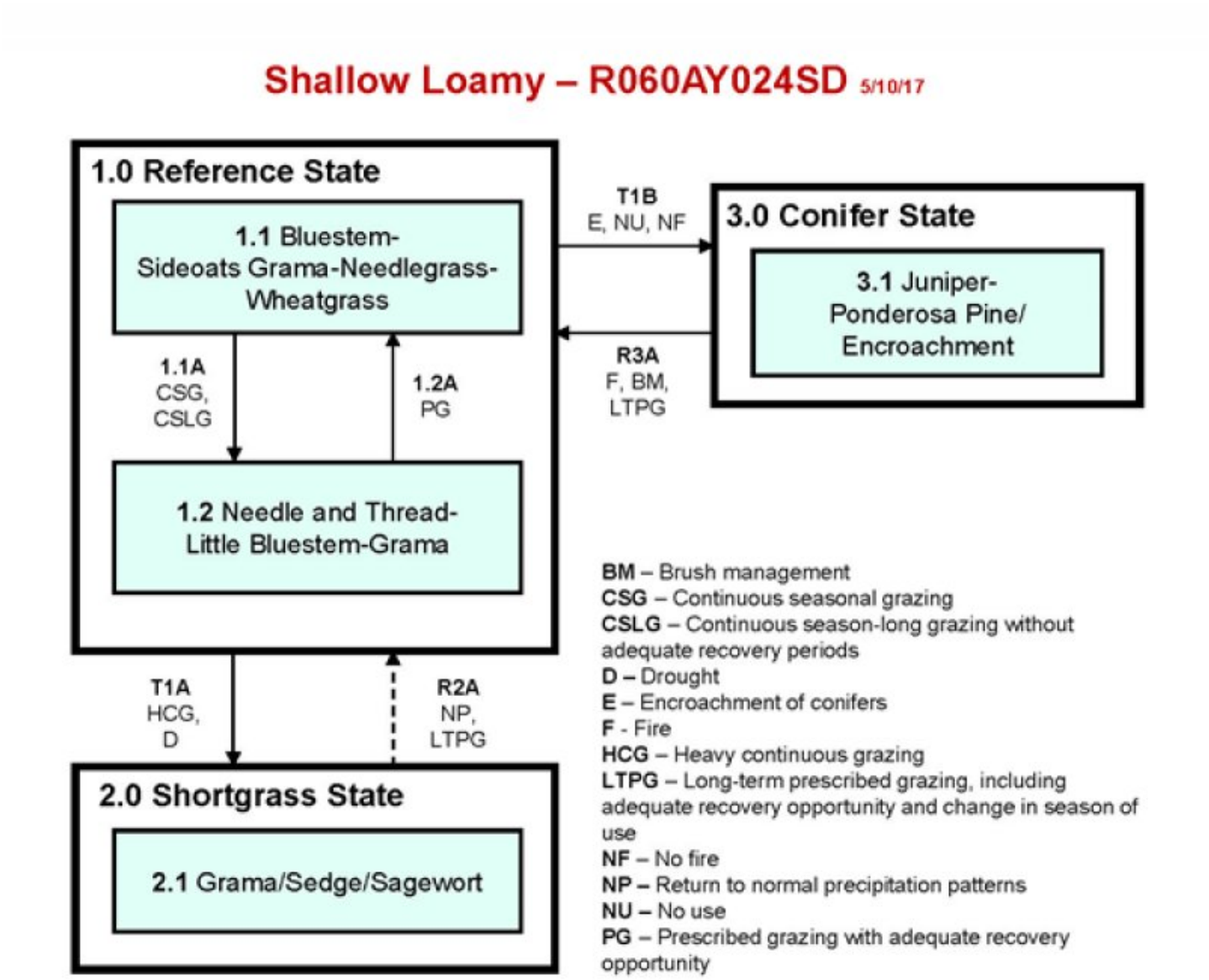

Figure 6. Shallow Loamy - R060AY024SD

Diagram Legend - Shallow Loamy - R060AY024SD

T1A	Heavy continuous grazing, drought.	
T1B	Encroachment of conifers, no use, no fire.	
R2A	Return of normal precipitation patterns followed by long-term prescribed grazing with proper stocking, change in season of use, and time for adequate recovery.	
R3A	Fire or mechanical brush management, followed by long-term prescribed grazing with proper stocking, change in season of use, and time for adequate recovery.	
CP 1.1A	1.1 - 1.2	Continuous seasonal grazing or continuous season-long grazing.
CP 1.2A	1.2 - 1.1	Prescribed grazing with proper stocking, change in season of use, and adequate time for recovery.

Figure 7. Shallow Loamy - R060AY024SD

State 1
Reference State

This state represents what is believed to represent the natural range of variability that dominated the dynamics in this ecological site prior to European settlement. This site is dominated by cool- and warm-season grasses. In pre-European times the primary disturbances included fire and grazing by large ungulates and small mammals. Favorable growing conditions occurred during the spring and the warm months of June through August. This State can be found on areas having a history of proper grazing management, including adequate recovery periods between grazing events.

Community 1.1
Bluestem-Sideoats Grama-Needlegrass-Wheatgrass

Figure 8. Plant Community Phase 1.1

The plant community upon which interpretations are primarily based is the Bluestem-Sideoats Grama-Needlegrass-Wheatgrass Plant Community (1.1). This is also considered to be the Reference Plant Community. This plant community can be found on areas that are properly managed with grazing and/or prescribed burning, and sometimes on areas receiving occasional short periods of deferment. The potential vegetation is about 80 to 90 percent grasses or grass-like plants, 5 to 10 percent forbs, and 2 to 10 percent shrubs. A mixture of cool- and warm-season grasses dominates the site. Major grasses include the sideoats grama, little bluestem, needle and thread, big bluestem, western wheatgrass, and blue grama. Other grasses and grass-likes occurring include hairy grama, plains muhly, and sedge. In the western portion of the MLRA, bluebunch wheatgrass may be equal to or exceed the amount of needlegrass. Significant forbs include purple coneflower and purple prairie clover. Shrubs occurring in this plant community include fringed sagewort and yucca, and Wyoming big sagebrush and winterfat are common on the western portion of the MLRA. This plant community is extremely resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high drought tolerance.

Community dynamics, nutrient cycle, water cycle, and energy flow are functioning properly. Plant litter is properly distributed with very little movement off-site and natural plant mortality is very 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	908	1350	1788
Shrub/Vine	28	94	163
Forb	73	118	163
Tree	–	8	17
Total	**1009**	**1570**	**2131**

Figure 10. 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

Community 1.2
Needle and Thread-Little Bluestem-Grama

This plant community evolved under continuous seasonal grazing or, in some cases, with patch grazing under continuous season-long grazing. Needle and thread, little bluestem, and blue grama are significant species in this plant community. Big bluestem and sideoats grama have decreased, while the shortgrasses and grass-likes, such as blue grama, hairy grama, and sedge have increased. Other grasses occurring in this plant community include western wheatgrass, prairie Junegrass, and prairie sandreed. Forbs commonly found in this plant community include purple coneflower, purple prairie clover, and dotted gayfeather. Significant shrubs include yucca, cactus, rose, and fringed sagewort, and Wyoming big sagebrush in the west. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	516	863	1317
Shrub/Vine	50	112	174
Forb	106	140	174
Tree	–	6	17
Total	**672**	**1121**	**1682**

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

Pathway 1.1A
Community 1.1 to 1.2

Continuous seasonal grazing or patch grazing under continuous season-long grazing will convert this plant community to the Needle and thread-Little Bluestem-Grama Plant Community (1.2).

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing will convert this plant community to the Bluestem-Sideoats Grama-Needlegrass-Wheatgrass Plant Community (1.1).

State 2
Shortgrass State

This state is dominated by shortgrass species, upland sedges, and fringed sagewort. It is the result of grazing practices that remove the mid-stature cool- and warm-season grasses, and provide a competitive advantage to shortgrasses and grass-like species that are grazing-resistant. Water infiltration has decreased and runoff has increased in this state. This state is very resilient and resistant to change.

Community 2.1
Blue Grama/ Sedge/Sagewort

This plant community evolves from heavy grazing over several years' time, and/or drought. Diversity is lost, as the short grasses become dominant in the plant community. The grazing tolerant blue or hairy grama, and threadleaf sedge have replaced little bluestem, western wheatgrass and green needlegrass. Sideoats grama and needle and thread remains in the plant community, but is less productive because of the grazing pressure. Because of the grazing pressure, threeawn, fringed sagewort, green sagewort, broom snakeweed, yucca, Hood's phlox, woolly plantain (woolly Indianwheat), pussytoes, western ragweed, and cactus become more prevalent in the plant community. This plant community is typically resistant to change. Runoff will increase and infiltration will decrease. Continued overuse results in an increase of bare ground and higher erosion potential.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	347	420	661
Shrub/Vine	22	69	118
Forb	22	71	118
Total	**391**	**560**	**897**

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

State 3
Conifer State

This State occurs when Rocky Mountain juniper, eastern red cedar and/or ponderosa pine encroach onto the site. As the juniper/pine become established, the herbaceous component declines and more bare ground is exposed. As bare ground increases juniper/pine establishes more readily. Grazing can contribute to this transition but it can also occur independently without human influence other than through fire suppression.

Community 3.1
Juniper-Ponderosa Pine Encroachment

This plant community more commonly occurs in the eastern, 16 to 18 inch precipitation zone of this MLRA. Historically, ponderosa pine and juniper were confined to rocky ridges and steep shallow slopes with rock outcrops, located adjacent to this ecological site. Currently, ponderosa pine and juniper are expanding onto this ecological

site due to the suppression of fire. Juniper/pine canopy is greater than 15 percent of mature trees. The understory is made up of about 60 to 85 percent grasses and grass-like species, 5 to 10 percent forbs, and 2 to 10 percent shrubs. Dominant grasses and grass-likes include needle and thread, little bluestem, sideoats grama, blue grama, and sedge. Grasses of secondary importance include Canada wildrye, green needlegrass, western wheatgrass, and big bluestem. As the canopy increases, warm-season grasses tend to decrease as the cool-season grasses initially increase. Forbs commonly found in this community include green sagewort, western yarrow, and pussytoes. Non-native species such as cheatgrass and bluegrass will tend to invade this plant community. The total annual herbaceous production (air-dry weight) of this plant community is about 1,000 lbs./acre, but it can vary greatly depending on the canopy cover of the overstory. When compared to the Bluestem-Sideoats Grama-Needlegrass-Wheatgrass Plant Community (1.1), ponderosa pine or juniper increases significantly. The grass component decreases dramatically as the buildup of pine and juniper needles increases. Annual herbaceous production also decreases significantly. While the juniper/pine canopy provides excellent protection from the weather for both livestock and wildlife, it is not capable of supporting large numbers of wildlife and livestock due to decreased production. This plant community is resistant to change. A significant reduction of juniper/pine can only be accomplished through brush management or fire. The vegetation in the understory is capable of enduring fire; however, very hot fires will have a detrimental effect to the plant community. Reclamation of juniper/pine dominated areas can be costly and prove to be temporary without proper management (i.e., prescribed burning and prescribed grazing).

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	639	995	1345
Tree	62	168	280
Forb	62	101	140
Shrub/Vine	22	81	140
Total	**785**	**1345**	**1905**

Figure 16. Plant community growth curve (percent production by month). SD6011, Pierre Shale Plains, heavy conifer canopy. Mature ponderosa pine/juniper overstory. .

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	3	7	11	24	27	12	5	4	3	2	1

Transition T1A
State 1 to 2

Heavy continuous grazing and/or drought will convert the plant community to the Grama/Sedge/Sagewort Plant Community (2.1).

Transition T1B
State 1 to 3

Encroachment, nonuse, and no fire will lead to a Juniper-Ponderosa Pine Plant Community (3.1). This occurs when this plant community is protected from natural fires, or controlled burning.

Restoration pathway R2A
State 2 to 1

Long-term prescribed grazing and a return to normal precipitation patterns may convert this plant community to the Needle and Thread-Little Bluestem-Grama Plant Community (1.2). This transition may not be fast or feasible.

Restoration pathway R3A
State 3 to 1

Prescribed burning or wildfire (hot fires) followed by long-term prescribed grazing will move this plant community towards the Needle and Thread-Little Bluestem-Grama Plant Community (1.2). Mechanical removal of juniper/pine followed by long-term prescribed grazing may allow the understory to develop and transition to the Needle and Thread-Little Bluestem-Grama Plant Community (1.2).

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	**Big Bluestem**			31–157	
	big bluestem	ANGE	*Andropogon gerardii*	31–157	–
2	**Little Bluestem**			78–314	
	little bluestem	SCSC	*Schizachyrium scoparium*	78–314	–
3	**Sideoats Grama**			157–314	
	sideoats grama	BOCU	*Bouteloua curtipendula*	157–314	–
4	**Western Wheatgrass**			34–235	
	western wheatgrass	PASM	*Pascopyrum smithii*	34–235	–
5	**Needlegrass**			78–314	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	78–235	–
	green needlegrass	NAVI4	*Nassella viridula*	0–78	–
6	**Short Warm-Season Grasses**			78–314	
	blue grama	BOGR2	*Bouteloua gracilis*	78–235	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–157	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–78	–
7	**Native Grasses and Grass-likes**			78–314	
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	45–157	–
	Grass, perennial	2GP	*Grass, perennial*	0–157	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–157	–
	sedge	CAREX	*Carex*	78–157	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–78	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–47	–
Forb					
9	**Forbs**			78–157	
	scurfpea	PSORA2	*Psoralidium*	16–78	–
	purple prairie clover	DAPU5	*Dalea purpurea*	47–78	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	47–78	–
	dotted blazing star	LIPU	*Liatris punctata*	16–78	–
	large Indian breadroot	PEES	*Pediomelum esculentum*	16–78	–
	spiny phlox	PHHO	*Phlox hoodii*	0–47	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	16–47	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	16–47	–
	milkvetch	ASTRA	*Astragalus*	0–47	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–47	–

	coneflower				
	goldenrod	SOLID	*Solidago*	16–47	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	16–31	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–31	–
	false boneset	BREU	*Brickellia eupatorioides*	0–31	–
	prairie clover	DALEA	*Dalea*	0–31	–
	buckwheat	ERIOG	*Eriogonum*	0–31	–
	Forb, perennial	2FP	*Forb, perennial*	0–31	–
	common yarrow	ACMI2	*Achillea millefolium*	0–31	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–31	–
	American bird's-foot trefoil	LOUNU	*Lotus unifoliolatus var. unifoliolatus*	0–31	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	16–31	–
	pussytoes	ANTEN	*Antennaria*	16–31	–
	beardtongue	PENST	*Penstemon*	0–31	–
	American vetch	VIAM	*Vicia americana*	0–31	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–16	–
	stemless four-nerve daisy	TEAC	*Tetraneuris acaulis*	0–16	–
Shrub/Vine					
10	**Shrubs**			31–157	
	Subshrub (<.5m)	2SUBS	*Subshrub (<.5m)*	0–78	–
	leadplant	AMCA6	*Amorpha canescens*	0–78	–
	prairie sagewort	ARFR4	*Artemisia frigida*	16–78	–
	big sagebrush	ARTR2	*Artemisia tridentata*	0–78	–
	saltbush	ATRIP	*Atriplex*	0–78	–
	creeping juniper	JUHO2	*Juniperus horizontalis*	0–78	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–78	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–78	–
	rose	ROSA5	*Rosa*	0–78	–
	soapweed yucca	YUGL	*Yucca glauca*	0–31	–
	pricklypear	OPUNT	*Opuntia*	0–31	–
Tree					
11	**Trees**			0–16	
	juniper	JUNIP	*Juniperus*	0–16	–
	ponderosa pine	PIPO	*Pinus ponderosa*	0–16	–

Table 10. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Big Bluestem**			11–56	
	big bluestem	ANGE	*Andropogon gerardii*	11–56	–
2	**Little Bluestem**			112–280	
	little bluestem	SCSC	*Schizachyrium scoparium*	112–280	–
3	**Sideoats Grama**			56–168	

3	**Sideoats Grama**			56–168	
	sideoats grama	BOCU	*Bouteloua curtipendula*	56–168	–
4	**Western Wheatgrass**			0–112	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–112	–
5	**Needlegrass**			112–280	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	112–280	–
	green needlegrass	NAVI4	*Nassella viridula*	0–34	–
6	**Short Warm-Season Grasses**			168–392	
	blue grama	BOGR2	*Bouteloua gracilis*	112–224	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	56–168	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–56	–
7	**Native Grasses and Grass-likes**			112–336	
	sedge	CAREX	*Carex*	112–224	–
	Grass, perennial	2GP	*Grass, perennial*	0–112	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–112	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–56	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–56	–
8	**Non-Native Grasses**			0–56	
	Kentucky bluegrass	POPR	*Poa pratensis*	0–56	–
	cheatgrass	BRTE	*Bromus tectorum*	0–34	–
Forb					
9	**Forbs**			112–168	
	white sagebrush	ARLU	*Artemisia ludoviciana*	22–78	–
	dotted blazing star	LIPU	*Liatris punctata*	22–78	–
	American bird's-foot trefoil	LOUNU	*Lotus unifoliolatus var. unifoliolatus*	11–56	–
	purple prairie clover	DAPU5	*Dalea purpurea*	34–56	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	34–56	–
	buckwheat	ERIOG	*Eriogonum*	11–56	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	11–56	–
	scurfpea	PSORA2	*Psoralidium*	11–56	–
	goldenrod	SOLID	*Solidago*	22–56	–
	white heath aster	SYER	*Symphyotrichum ericoides*	11–56	–
	American vetch	VIAM	*Vicia americana*	11–56	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	11–34	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–34	–
	spiny phlox	PHHO	*Phlox hoodii*	0–34	–
	large Indian breadroot	PEES	*Pediomelum esculentum*	11–34	–
	milkvetch	ASTRA	*Astragalus*	0–34	–
	Forb, perennial	2FP	*Forb, perennial*	0–34	–
	common yarrow	ACMI2	*Achillea millefolium*	0–34	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–22	–
	pussytoes	ANTEN	*Antennaria*	0–22	–

	false boneset	BREU	*Brickellia eupatorioides*	0–22	–
	prairie clover	DALEA	*Dalea*	0–22	–
	beardtongue	PENST	*Penstemon*	0–22	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0–22	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	0–22	–
	stemless four-nerve daisy	TEAC	*Tetraneuris acaulis*	0–22	–
Shrub/Vine					
10	**Shrubs**			56–168	
	prairie sagewort	ARFR4	*Artemisia frigida*	34–78	–
	big sagebrush	ARTR2	*Artemisia tridentata*	0–56	–
	saltbush	ATRIP	*Atriplex*	0–56	–
	creeping juniper	JUHO2	*Juniperus horizontalis*	0–56	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–56	–
	Subshrub (<.5m)	2SUBS	*Subshrub (<.5m)*	0–56	–
	leadplant	AMCA6	*Amorpha canescens*	0–56	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–56	–
	rose	ROSA5	*Rosa*	0–56	–
	soapweed yucca	YUGL	*Yucca glauca*	0–56	–
	pricklypear	OPUNT	*Opuntia*	0–22	–
Tree					
11	**Trees**			0–11	
	juniper	JUNIP	*Juniperus*	0–11	–
	ponderosa pine	PIPO	*Pinus ponderosa*	0–11	–

Table 11. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
2	**Little Bluestem**			0–28	
	little bluestem	SCSC	*Schizachyrium scoparium*	0–28	–
3	**Sideoats Grama**			0–56	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–56	–
4	**Western Wheatgrass**			0–28	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–28	–
5	**Needlegrass**			28–84	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	28–84	–
6	**Short Warm-Season Grasses**			112–252	
	blue grama	BOGR2	*Bouteloua gracilis*	84–168	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	28–84	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–56	–
7	**Native Grasses and Grass-likes**			84–252	
	sedge	CAREX	*Carex*	84–168	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–56	–

	sand dropseed	SPCR	*Sporobolus cryptandrus*	11–56	–
	Grass, perennial	2GP	*Grass, perennial*	0–56	–
	threeawn	ARIST	*Aristida*	11–56	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–17	–
8	**Non-Native Grasses**			11–56	
	cheatgrass	BRTE	*Bromus tectorum*	11–45	–
	Kentucky bluegrass	POPR	*Poa pratensis*	0–45	–
Forb					
9	**Forbs**			28–112	
	white sagebrush	ARLU	*Artemisia ludoviciana*	28–56	–
	dotted blazing star	LIPU	*Liatris punctata*	28–56	–
	goldenrod	SOLID	*Solidago*	17–39	–
	white heath aster	SYER	*Symphyotrichum ericoides*	17–39	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	11–39	–
	American vetch	VIAM	*Vicia americana*	6–28	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	17–28	–
	scurfpea	PSORA2	*Psoralidium*	6–28	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	17–28	–
	American bird's-foot trefoil	LOUNU	*Lotus unifoliolatus var. unifoliolatus*	6–28	–
	milkvetch	ASTRA	*Astragalus*	17–28	–
	purple prairie clover	DAPU5	*Dalea purpurea*	17–28	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	17–28	–
	buckwheat	ERIOG	*Eriogonum*	6–28	–
	Forb, perennial	2FP	*Forb, perennial*	0–28	–
	common yarrow	ACMI2	*Achillea millefolium*	0–28	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–17	–
	pussytoes	ANTEN	*Antennaria*	0–17	–
	spiny phlox	PHHO	*Phlox hoodii*	0–17	–
	woolly plantain	PLPA2	*Plantago patagonica*	6–17	–
	stemless four-nerve daisy	TEAC	*Tetraneuris acaulis*	0–17	–
	hoary verbena	VEST	*Verbena stricta*	0–17	–
	beardtongue	PENST	*Penstemon*	0–11	–
	prairie clover	DALEA	*Dalea*	0–11	–
Shrub/Vine					
10	**Shrubs**			28–112	
	prairie sagewort	ARFR4	*Artemisia frigida*	28–84	–
	pricklypear	OPUNT	*Opuntia*	6–56	–
	soapweed yucca	YUGL	*Yucca glauca*	6–56	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–28	–
	rose	ROSA5	*Rosa*	0–28	–
	big sagebrush	ARTR2	*Artemisia tridentata*	0–28	–
	Subshrub (<.5m)	2SUBS	*Subshrub (<.5m)*	0–28	–

	saltbush	ATRIP	*Atriplex*	0–17	–
	creeping juniper	JUHO2	*Juniperus horizontalis*	0–6	–

Table 12. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Big Bluestem**			0–67	
	big bluestem	ANGE	*Andropogon gerardii*	0–67	–
2	**Little Bluestem**			0–135	
	little bluestem	SCSC	*Schizachyrium scoparium*	0–135	–
3	**Sideoats Grama**			67–202	
	sideoats grama	BOCU	*Bouteloua curtipendula*	67–202	–
4	**Western Wheatgrass**			0–202	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–202	–
5	**Needlegrass**			67–202	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	67–202	–
	green needlegrass	NAVI4	*Nassella viridula*	0–67	–
6	**Short Warm-Season Grasses**			67–202	
	blue grama	BOGR2	*Bouteloua gracilis*	67–202	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–135	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–67	–
7	**Native Grasses and Grass-likes**			67–202	
	sedge	CAREX	*Carex*	67–202	–
	Grass, perennial	2GP	*Grass, perennial*	0–135	–
	threeawn	ARIST	*Aristida*	0–67	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–67	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–67	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–67	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–67	–
8	**Non-Native Grasses**			0–135	
	cheatgrass	BRTE	*Bromus tectorum*	0–135	–
	Kentucky bluegrass	POPR	*Poa pratensis*	0–135	–
Forb					
9	**Forbs**			67–135	
	scurfpea	PSORA2	*Psoralidium*	13–67	–
	purple prairie clover	DAPU5	*Dalea purpurea*	40–67	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	40–67	–
	dotted blazing star	LIPU	*Liatris punctata*	13–67	–
	large Indian breadroot	PEES	*Pediomelum esculentum*	13–67	–
	spiny phlox	PHHO	*Phlox hoodii*	0–40	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	13–40	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	13–40	–
	milkvetch	ASTRA	*Astragalus*	0–40	–

	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–40	–
	goldenrod	SOLID	*Solidago*	13–40	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	13–27	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–27	–
	false boneset	BREU	*Brickellia eupatorioides*	0–27	–
	prairie clover	DALEA	*Dalea*	0–27	–
	buckwheat	ERIOG	*Eriogonum*	0–27	–
	Forb, perennial	2FP	*Forb, perennial*	0–27	–
	common yarrow	ACMI2	*Achillea millefolium*	0–27	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–27	–
	American bird's-foot trefoil	LOUNU	*Lotus unifoliolatus var. unifoliolatus*	0–27	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	13–27	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–27	–
	beardtongue	PENST	*Penstemon*	0–27	–
	hoary verbena	VEST	*Verbena stricta*	0–27	–
	American vetch	VIAM	*Vicia americana*	0–27	–
	pussytoes	ANTEN	*Antennaria*	13–27	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–13	–
	stemless four-nerve daisy	TEAC	*Tetraneuris acaulis*	0–13	–
Shrub/Vine					
10	**Shrubs**			27–135	
	Subshrub (<.5m)	2SUBS	*Subshrub (<.5m)*	0–67	–
	prairie sagewort	ARFR4	*Artemisia frigida*	13–67	–
	big sagebrush	ARTR2	*Artemisia tridentata*	0–67	–
	saltbush	ATRIP	*Atriplex*	0–67	–
	creeping juniper	JUHO2	*Juniperus horizontalis*	0–67	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–67	–
	rose	ROSA5	*Rosa*	0–67	–
	soapweed yucca	YUGL	*Yucca glauca*	0–27	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–27	–
	pricklypear	OPUNT	*Opuntia*	0–27	–
Tree					
11	**Trees**			67–269	
	juniper	JUNIP	*Juniperus*	67–269	–
	ponderosa pine	PIPO	*Pinus ponderosa*	67–269	–

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-Sideoats Grama-Needlegrass-Wheatgrass Plant Community (1.1)
Average Annual Production (lbs./ac, air-dry) = 1400
Stocking Rate (AUM/ac) = 0.38

Plant Community = Needle and Thread-Little Bluestem-Grama Plant Community (1.2)
Average Annual Production (lbs./ac, air-dry) = 1000
Stocking Rate (AUM/ac) = 0.27

Plant Community = Blue Grama/Sedge/Sagewort Plant Community (2.1)
Average Annual Production (lbs./ac, air-dry) = 500
Stocking Rate (AUM/ac) = 0.14

Plant Community = Juniper-Pine Encroachment (3.1)
Average Annual Production (lbs./ac, air-dry) = 1200
Stocking Rate (AUM/ac) = Variable **

*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).
** Highly variable; stocking rate needs to be determined on site.

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 negligible (in concave areas) 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 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.

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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: 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; and Mike Stirling, Range Management Specialist, NRCS.

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Contributors

Stan Boltz

Acknowledgments

ESD updated by Rick L. Peterson, 5/11/17

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, 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	Stan Boltz
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 pedastalled 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.

---

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.

---

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should be 2 to 5 inches thick with light to dark brownish gray colors. Structure should typically be fine granular at least in the upper A-horizon.

---

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

---

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None – when dry, B horizons can be hard and appear to be compacted, but no platy structure will be present.

---

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Mid/tall warm-season grasses >

    Sub-dominant: Mid/tall cool-season bunchgrasses = short warm-season grasses = short cool-season grass-likes >

    Other: Forbs = 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 900-1,900 lbs./acre (air-dry weight). Reference value production is 1,400 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

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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.
