USDA Natural Resources Conservation Service

Ecological site R060AY030SD
Porous Clay

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General information

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

Figure 1. Mapped extent

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

MLRA notes

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

The Pierre Shale Plains (MLRA 60A) consists of approximately 10,150 square miles, the majority of which is in South Dakota (70 percent) and small portions are in Montana (2 percent), Nebraska (8 percent), and Wyoming (20 percent). It encircles the Black Hills (MLRA 62) and the Dakota Hogback (MLRA 61). MLRA 60A includes portions of the Oglala, Buffalo Gap, and Thunder Basin National Grasslands. It also includes small sections of the Pine Ridge Indian Reservation, Badlands National Park, and Black Hills National Forest. The Cheyenne and Belle Fourche Rivers flow through the MLRA.

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

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

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

Classification relationships

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

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

Ecological site concept

The Porous Clay ecological site occurs throughout the MLRA. It is located on upland landscapes and does not receive additional moisture from runoff or overflow. Typical slopes range from 2 to 30 percent. Soils are moderately deep to very deep, with a clay, clay loam, or parachannery clay surface texture. The soil is derived from weathered shale and is non-calcareous. Shale chips are found throughout the soil profile (greater than 50 percent by volume) and do not restrict root growth. Because the soil is slightly too strongly acid, areas of bare ground or soft, unconsolidated shale fragments can be present.

The vegetation in reference consists of a mix of cool- and warm-season grasses, however, the mid- to tall- warm-season grasses tend to be the dominant group. Prairie sandreed, little bluestem, prairie cordgrass, and big bluestem are the dominant warm-season grasses. Rhizomatous wheatgrasses are the dominant cool-season grasses. This site functions much like a Sands site.

Associated sites

R060AY043SD	**Shallow Porous Clay** Shallow Porous Clay is a shallow site that is often found adjacent to this site

Similar sites

R060AY043SD	**Shallow Porous Clay** Shallow Porous Clay has less production and less prairie sandreed; more tree encroachment; more sun sedge

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Amorpha canescens*
Herbaceous	(1) *Calamovilfa longifolia* (2) *Schizachyrium scoparium*

Physiographic features

This site occurs on gently to moderately rolling uplands.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Plain
Flooding frequency	None
Ponding frequency	None

Elevation	2,500–4,300 ft
Slope	2–30%
Aspect	Aspect is not a significant factor

Climatic features

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

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

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

Table 3. Representative climatic features

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

Climate stations used

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

Influencing water features

No significant water features influence this site.

Wetland description

Not Applicable.

Soil features

The soils of this site are parachannery clay loam textured surface soils and slopes of 2 to 30 percent. These soils are moderately deep to very deep, well drained, and have moderately rapid permeability. The soils are formed from acid material weathered from shale and contain many small shale fragments. Sub-surface soil texture is clay. This site should show slight to no evidence of rills. There may be some slight erosion due to wind, and some pedestalling of plants does occur. Water flow paths are broken, irregular in appearance, or discontinuous with numerous debris dams or vegetative barriers. Soil blowing is a severe hazard.

Soils correlated to the Porous Clay ecological site: Maggin, Paiges, Graner

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) Channery clay loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Moderately rapid
Soil depth	20–80 in
Surface fragment cover <=3"	0–25%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	2–3 in
Calcium carbonate equivalent (0-40in)	0–10%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	3.5–6
Subsurface fragment volume <=3" (Depth not specified)	40–70%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

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

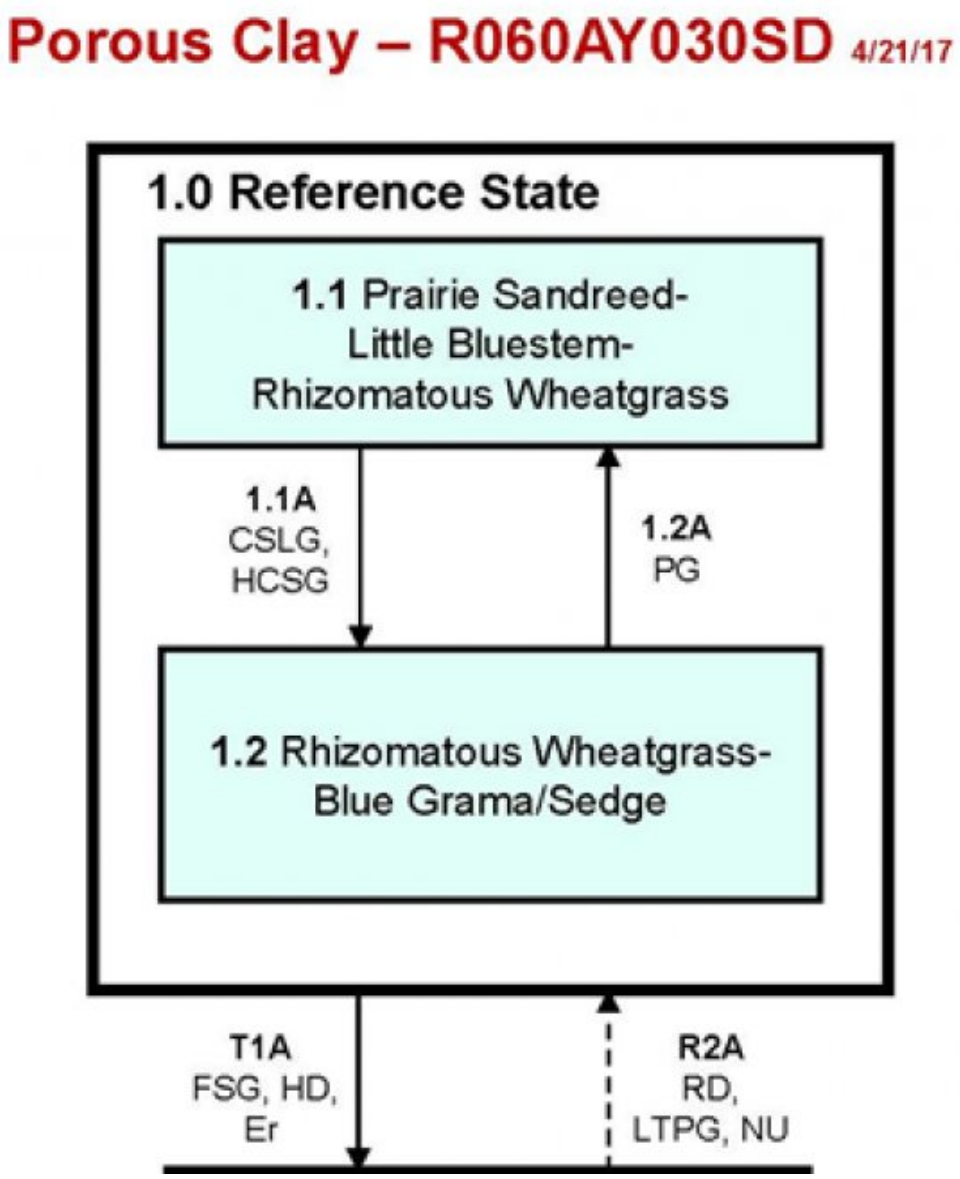
As this site deteriorates, species such as sedges, forbs, and blue grama will increase. Perennial grasses such as prairie sandreed, little bluestem, big bluestem, and rhizomatous wheatgrass will decrease in frequency and

production. Weathered shale dunes may form due to lack of ground cover. The various plant communities on this site are often all contained within a dune-like area under the same grazing management. Soil erosion and dune formation greatly influence the existing plant communities. Depositional areas tend to be dominated by prairie sandreed and bluestem, while the areas from which soil is transported tend to be characterized by sedge, rush, and bare ground. However, the amount of deposition and transport can alter the plant communities. The historic and recent grazing impacts will also influence the plant composition. Prairie sandreed is an important plant to this site. Prairie sandreed has large rhizomes that help hold and bind the soil. As the prairie sandreed decreases along with bluestem and wheatgrass, the hazard for wind erosion increases. Areas can become bare dune-like areas. Where this site occurs adjacent to ponderosa pine woodlands, encroachment of ponderosa pine, bur oak, and juniper may occur.

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

The following is a diagram that illustrates the common plant communities that can occur on the site and the transition pathways between communities and states. The ecological processes are discussed in more detail in the plant community descriptions following the diagram.

State and transition model



CSLG – Continuous season-long grazing without adequate recovery periods
Er – Erosion of soil surface
FSG – Frequent and severe grazing
HCSG – Heavy, continuous seasonal grazing without adequate recovery periods
HD – Heavy disturbance
LTPG – Long-term prescribed grazing, including adequate recovery opportunity and change in season of use
NU – No use
PG – Prescribed grazing with adequate recovery opportunity
RD – Removal of disturbance

Figure 8. Porous Clay - R060AY030SD

Diagram Legend - Porous Clay - R060AY030SD

T1A		Frequent and severe grazing, heavy disturbance, resulting in erosion of the soil surface. Erosion can be natural and not management-induced.
R2A		Removal of management-induced disturbance, long-term prescribed grazing with change in season of use with adequate recovery, and possibly extended periods of non-use. Recovery may not be fast and/or feasible.
CP 1.1A	1.1 - 1.2	Continuous season-long grazing without adequate recovery, or heavy continuous seasonal grazing.
CP 1.2A	1.2 - 1.1	Prescribed grazing including change in season of use, proper stocking and adequate time for rest and recovery.

Figure 9. Porous Clay - R060AY030SD

State 1
Reference State

This state represents what is believed to show the natural range of variability that dominated the dynamics in this ecological site prior to European settlement. This site, in reference, is dominated by a mix of warm-season mid- and tall-grasses, and rhizomatous wheatgrasses. Heavy grazing or heavy disturbance, will cause the plant community to transition to a community dominated by the upland sedges and bare ground. Severe erosion is a potential outcome with heavy grazing. In pre-European times the primary disturbances included grazing by large ungulates and small mammals, and drought. Favorable growing conditions occurred during the spring, and warm months of June

through August. Today a similar state can be found in areas where proper livestock use has occurred.

Community 1.1
Prairie Sandreed-Little Bluestem-Rhizomatous Wheatgrass

Figure 10. Plant Community Phase 1.1

The plant community upon which interpretations are primarily based is the Prairie Sandreed-Little Bluestem-Rhizomatous Wheatgrass Plant Community (1.1). This is also considered the Reference Plant Community. This plant community is about 75 to 85 percent grasses or grass- likes, 10 to 15 percent forbs, and 5 to 10 percent shrubs by weight. A mix of warm- and cool-season mid-grasses dominates this plant community. Major grasses include prairie sandreed, little bluestem, rhizomatous wheatgrasses, and sand or big bluestem. Other grasses occurring in this plant community include needle and thread, blue grama, sun sedge, threadleaf sedge, and prairie cordgrass. Forbs occurring in this plant community are cudweed sagewort, golden pea, scurfpea, and western yarrow. Significant shrubs include leadplant and rose. Overall this plant community has the appearance of being stable, diverse, and productive. Plant litter is properly distributed with very little movement off-site and natural plant mortality is very low. Most plant species have a wide range of age classes represented and reproduction is not limited. Plant roots occupy most of the soil profile, which provides for soil stability and promotes infiltration. Occasionally this plant community will have areas influenced by natural geologic erosion, and will exhibit characteristics similar to the Sedge/*Bare Ground* Plant Community Phase (PCP 2.1).

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	685	1200	1515
Forb	145	188	230
Shrub/Vine	70	112	155
Total	**900**	**1500**	**1900**

Figure 12. 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
Rhizomatous Wheatgrass-Blue Grama/Sedge

This plant community develops under moderate, season-long grazing by livestock. The plant community is about 70 to 80 percent grasses or grass-likes, 10 to 20 percent forbs, and 5 to 10 percent shrubs. Dominant grasses include rhizomatous wheatgrasses, blue grama, and sun sedge. Grasses of secondary importance include needle and thread, threadleaf sedge, Junegrass, and Sandberg bluegrass. Prairie sandreed and little bluestem are present in

low amounts. Forbs commonly occurring include cudweed sagewort, hairy false goldaster, goldenpea, biscuitroot, wild onion, scarlet globemallow, and pussytoes. Fringed sagewort, plains pricklypear, and fragile cactus can also occur. Leadplant and rose generally have declined in abundance. When compared to the Reference Plant Community (1.1), rhizomatous wheatgrasses and blue grama have increased. Prairie sandreed, sand or big bluestem, and little bluestem have decreased. Rhizomatous wheatgrasses exhibit lower vigor. Non-native annual grasses and forbs may invade the plant community, and bare ground also increases.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	475	698	920
Forb	85	134	185
Shrub/Vine	40	68	95
Total	**600**	**900**	**1200**

Figure 14. 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 season-long grazing will convert this plant community to the Rhizomatous Wheatgrass-Blue Grama/Sedge Plant Community (1.2). Heavy continuous seasonal grazing will also cause this shift to occur.

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing, including proper stocking rates, change in season of use, and adequate recovery, will convert this plant community to the Prairie Sandreed/Little Bluestem Plant Community.

State 2
Disturbed State

Typically this plant community is the result of frequent and severe grazing, or heavy disturbance, and erosion. This plant community is also found in areas that exhibit increased bare ground due to natural geologic erosion. These areas often occur adjacent to shale outcrops, or in association with the Shallow Porous Clay ecological site. Short grass and grass-like plants such as sun sedge, prairie Junegrass, Dudley’s rush, and bluegrass dominate this plant community. Annual grasses such as cheatgrass and annual forbs such as mustards may be common. Fragile cactus and plains pricklypear may also occur. The plant community is about 75 to 85 percent grass and grass-likes, 10 to 15 percent forbs, and 1 to 5 percent shrubs. When compared to the Reference Plant Community (1.1) the perennial tall- and mid-grasses have greatly decreased. Short grasses and sedges dominate the plant community. The dominant forbs are cudweed sagewort, mustards, yarrow, pussytoes, cactus, and golden pea. Bare ground has greatly increased, and large areas of no vegetation may be present.

Community 2.1
Sedge/Bare Ground

Typically this plant community is the result of frequent and severe grazing, or heavy disturbance, and erosion. This plant community is also found in areas that exhibit increased bare ground due to natural geologic erosion. These areas often occur adjacent to shale outcrops, or in association with the Shallow Porous Clay ecological site. Short grass and grass-like plants such as sun sedge, prairie Junegrass, Dudley’s rush, and bluegrass dominate this plant community. Annual grasses such as annual brome and annual forbs such as mustards may be common. Fragile

cactus and plains pricklypear may also occur. The plant community is about 75 to 85 percent grass and grass-likes, 10 to 15 percent forbs, and 1 to 5 percent shrubs. When compared to the Reference Plant Community (1.1) the perennial tall- and mid-grasses have greatly decreased. Short grasses and sedges dominate the plant community. The dominant forbs are cudweed sagewort, mustards, yarrow, pussytoes, cactus and golden pea. Bare ground has greatly increased, and large areas of no vegetation may be present.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	75	254	430
Forb	25	38	50
Shrub/Vine	0	8	20
Total	**100**	**300**	**500**

Figure 16. Plant community growth curve (percent production by month). SD6001, Pierre Shale Plains, cool-season dominant. Cool-season dominant..

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

Transition T1A
State 1 to 2

Frequent and severe grazing, or heavy disturbance, and soil surface erosion will convert this plant community to the Sedge/*Bare Ground* Plant Community (2.1).

Restoration pathway R2A
State 2 to 1

Removal of management-induced disturbances, in combination with long-term prescribed grazing, which may include extended periods of non-use, may convert this PCP to the Rhizomatous Wheatgrass-Blue Grama Plant Community (1.2). This transition may not be fast and/or feasible.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Prairie Sandreed**			300–450	
	prairie sandreed	CALO	*Calamovilfa longifolia*	300–450	–
2	**Little Bluestem**			300–450	
	little bluestem	SCSC	*Schizachyrium scoparium*	300–450	–
3	**Rhizomatous Wheatgrasses**			75–225	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	75–225	–
	western wheatgrass	PASM	*Pascopyrum smithii*	75–225	–
4	**Warm-Season Grasses**			75–375	
	big bluestem	ANGE	*Andropogon gerardii*	75–225	–
	sand bluestem	ANHA	*Andropogon hallii*	75–225	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–150	–
	switchgrass	PAVI2	*Panicum virgatum*	0–150	–

	prairie cordgrass	SPPE	*Spartina pectinata*	0–75	–
5	**Native Grasses and Grass-likes**			75–225	
	Grass, perennial	2GP	*Grass, perennial*	0–75	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–75	–
	needleleaf sedge	CADU6	*Carex duriuscula*	0–75	–
	threadleaf sedge	CAFI	*Carex filifolia*	0–75	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	15–75	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–75	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–75	–
	Dudley's rush	JUDU2	*Juncus dudleyi*	15–75	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	15–75	–
	Sandberg bluegrass	POSE	*Poa secunda*	15–75	–
	threeawn	ARIST	*Aristida*	0	–
Forb					
7	**Forbs**			150–225	
	large Indian breadroot	PEES	*Pediomelum esculentum*	0–45	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–45	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	0–45	–
	prairie thermopsis	THRH	*Thermopsis rhombifolia*	15–45	–
	American vetch	VIAM	*Vicia americana*	0–45	–
	Forb, perennial	2FP	*Forb, perennial*	0–45	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	15–45	–
	aster	ASTER	*Aster*	0–45	–
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	0–45	–
	white prairie clover	DACA7	*Dalea candida*	0–45	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–45	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–45	–
	desertparsley	LOMAT	*Lomatium*	0–45	–
	bluebells	MERTE	*Mertensia*	15–45	–
	dotted blazing star	LIPU	*Liatris punctata*	0–30	–
	alpine golden buckwheat	ERFLF	*Eriogonum flavum var. flavum*	0–30	–
	milkvetch	ASTRA	*Astragalus*	15–30	–
	common yarrow	ACMI2	*Achillea millefolium*	0–30	–
	stemless four-nerve daisy	TEAC	*Tetraneuris acaulis*	0–30	–
	onion	ALLIU	*Allium*	0–15	–
	field pussytoes	ANNE	*Antennaria neglecta*	0–15	–
	rosy pussytoes	ANRO2	*Antennaria rosea*	0–15	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0–15	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0	–
	thistle	CIRSI	*Cirsium*	0	–
	Forb, annual	2FA	*Forb, annual*	0	–
	goatsbeard	TRAGO	*Tragopogon*	0	–
Shrub/Vine					

Shrub/Vine					
8	**Shrubs**			75–150	
	leadplant	AMCA6	*Amorpha canescens*	15–45	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–45	–
	rose	ROSA5	*Rosa*	0–45	–
	soapweed yucca	YUGL	*Yucca glauca*	0–30	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–30	–

Table 9. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Prairie Sandreed**			0–45	
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–45	–
2	**Little Bluestem**			0–90	
	little bluestem	SCSC	*Schizachyrium scoparium*	0–90	–
3	**Rhizomatous Wheatgrasses**			180–360	
	western wheatgrass	PASM	*Pascopyrum smithii*	90–315	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	90–180	–
4	**Warm-Season Grasses**			18–90	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–45	–
	switchgrass	PAVI2	*Panicum virgatum*	0–45	–
	big bluestem	ANGE	*Andropogon gerardii*	0–27	–
	sand bluestem	ANHA	*Andropogon hallii*	0–27	–
	prairie cordgrass	SPPE	*Spartina pectinata*	0	–
5	**Native Grasses and Grass-likes**			135–360	
	blue grama	BOGR2	*Bouteloua gracilis*	90–225	–
	needleleaf sedge	CADU6	*Carex duriuscula*	18–90	–
	threadleaf sedge	CAFI	*Carex filifolia*	18–90	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	45–90	–
	Dudley's rush	JUDU2	*Juncus dudleyi*	18–72	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	9–45	–
	Sandberg bluegrass	POSE	*Poa secunda*	9–45	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–45	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–27	–
	threeawn	ARIST	*Aristida*	0–27	–
	Grass, perennial	2GP	*Grass, perennial*	0–18	–
6	**Non-native Grasses**			0–45	
	cheatgrass	BRTE	*Bromus tectorum*	0–45	–
	Kentucky bluegrass	POPR	*Poa pratensis*	0–45	–
Forb					
7	**Forbs**			90–180	
	prairie thermopsis	THRH	*Thermopsis rhombifolia*	9–36	–
	Forb, annual	2FA	*Forb, annual*	0–36	–

	white sagebrush	ARLU	*Artemisia ludoviciana*	9–36	–
	aster	ASTER	*Aster*	0–27	–
	thistle	CIRSI	*Cirsium*	0–27	–
	Forb, perennial	2FP	*Forb, perennial*	0–27	–
	common yarrow	ACMI2	*Achillea millefolium*	9–27	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–27	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–27	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	0–27	–
	goatsbeard	TRAGO	*Tragopogon*	0–27	–
	stemless four-nerve daisy	TEAC	*Tetraneuris acaulis*	0–18	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–18	–
	alpine golden buckwheat	ERFLF	*Eriogonum flavum var. flavum*	0–18	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–18	–
	dotted blazing star	LIPU	*Liatris punctata*	0–18	–
	desertparsley	LOMAT	*Lomatium*	0–18	–
	bluebells	MERTE	*Mertensia*	0–18	–
	onion	ALLIU	*Allium*	0–18	–
	field pussytoes	ANNE	*Antennaria neglecta*	0–18	–
	rosy pussytoes	ANRO2	*Antennaria rosea*	0–18	–
	milkvetch	ASTRA	*Astragalus*	9–18	–
	white prairie clover	DACA7	*Dalea candida*	0–9	–
	American vetch	VIAM	*Vicia americana*	0	–
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	0	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0	–
	large Indian breadroot	PEES	*Pediomelum esculentum*	0	–
Shrub/Vine					
8	**Shrubs**			45–90	
	soapweed yucca	YUGL	*Yucca glauca*	0–36	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–27	–
	rose	ROSA5	*Rosa*	0–27	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–27	–
	leadplant	AMCA6	*Amorpha canescens*	0	–

Table 10. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
2	**Little Bluestem**			0–15	
	little bluestem	SCSC	*Schizachyrium scoparium*	0–15	–
3	**Rhizomatous Wheatgrasses**			0–30	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–30	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–15	–
4	**Warm-Season Grasses**			0–9	

	sideoats grama	BOCU	*Bouteloua curtipendula*	0–9	–
	switchgrass	PAVI2	*Panicum virgatum*	0	–
	prairie cordgrass	SPPE	*Spartina pectinata*	0	–
	big bluestem	ANGE	*Andropogon gerardii*	0	–
	sand bluestem	ANHA	*Andropogon hallii*	0	–
5	**Native Grasses and Grass-likes**			90–180	
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	15–60	–
	needleleaf sedge	CADU6	*Carex duriuscula*	15–45	–
	threadleaf sedge	CAFI	*Carex filifolia*	15–45	–
	Dudley's rush	JUDU2	*Juncus dudleyi*	9–30	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–30	–
	Sandberg bluegrass	POSE	*Poa secunda*	6–24	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	3–15	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–15	–
	threeawn	ARIST	*Aristida*	0–15	–
	Grass, perennial	2GP	*Grass, perennial*	0–6	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0	–
6	**Non-native Grasses**			0–30	
	cheatgrass	BRTE	*Bromus tectorum*	0–24	–
	Kentucky bluegrass	POPR	*Poa pratensis*	0–9	–
Forb					
7	**Forbs**			30–45	
	goatsbeard	TRAGO	*Tragopogon*	0–15	–
	Forb, annual	2FA	*Forb, annual*	0–15	–
	Forb, perennial	2FP	*Forb, perennial*	0–15	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	3–15	–
	thistle	CIRSI	*Cirsium*	0–15	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–15	–
	common yarrow	ACMI2	*Achillea millefolium*	0–12	–
	prairie thermopsis	THRH	*Thermopsis rhombifolia*	3–12	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	0–9	–
	aster	ASTER	*Aster*	0–9	–
	alpine golden buckwheat	ERFLF	*Eriogonum flavum var. flavum*	0–9	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–6	–
	dotted blazing star	LIPU	*Liatris punctata*	0–6	–
	milkvetch	ASTRA	*Astragalus*	3–6	–
	stemless four-nerve daisy	TEAC	*Tetraneuris acaulis*	0–6	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–6	–
	onion	ALLIU	*Allium*	0–3	–
	field pussytoes	ANNE	*Antennaria neglecta*	0–3	–
	rosy pussytoes	ANRO2	*Antennaria rosea*	0–3	–
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	0	–

	white prairie clover	DACA7	*Dalea candida*	0	–
	desertparsley	LOMAT	*Lomatium*	0	–
	bluebells	MERTE	*Mertensia*	0	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0	–
	large Indian breadroot	PEES	*Pediomelum esculentum*	0	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0	–
	American vetch	VIAM	*Vicia americana*	0	–
Shrub/Vine					
8	**Shrubs**			3–15	
	skunkbush sumac	RHTR	*Rhus trilobata*	0–9	–
	rose	ROSA5	*Rosa*	0–9	–
	soapweed yucca	YUGL	*Yucca glauca*	0–6	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–6	–
	leadplant	AMCA6	*Amorpha canescens*	0	–

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 = Prairie Sandreed-Little Bluestem-Rhizomatous Wheatgrass (1.1)
Average Annual Production (lbs./ac, air-dry) = 1500
Stocking Rate (AUM/ac) = 0.41

Plant Community = Rhizomatous Wheatgrass-Blue Grama/Sedge (1.2)
Average Annual Production (lbs./ac, air-dry) = 900
Stocking Rate (AUM/ac) = 0.25

Plant Community = Sedge/*Bare Ground* (2.1)
Average Annual Production (lbs./ac, air-dry) = 300
Stocking Rate (AUM/ac) = 0.08

*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

B. Infiltration ranges from high to very high. Runoff potential for this site varies from medium 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 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.

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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 was also used. Those involved in developing this site description include: Everet Bainter, Range Management Specialist, NRCS; Stan Boltz, Range Management Specialist, NRCS; Glen Mitchell, Range Management Specialist, NRCS; Cheryl Nielsen, Range Management Specialist, NRCS.
Data Source Number of Records Sample Period State County
SCS-RANGE-417 3 1985 – 1986 WY Weston

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 04/23/17.

USDA, NRCS. Soil Survey Staff. Web Soil Survey. Available online. Accessed 04/23/17.

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 02/27/17.

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

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

USDA, NRCS. 2017. The PLANTS Database (http://plants.usda.gov, 2017). Available online. Accessed 4/3/17.

USDA, NRCS. Various Published Soil Surveys.

Contributors

Stan Boltz

Approval

Suzanne Mayne-Kinney, 6/25/2024

Acknowledgments

ESD updated by Rick L. Peterson, 4/24/17

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

Ecological Site from MLRA 60A were Previously Approved ESDs and meet the requirements as stated in the 2003 National Range and Pasture Handbook.

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

The sites were reviewed by George Gamblin, RMS, Wheatland, WY and Mitch Faulkner, RMS, Belle Fourche, SD.

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

Rangeland health reference sheet

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

Author(s)/participant(s)	Stan Boltz
Contact for lead author	stanley.boltz@sd.usda.gov, 605-352-1236
Date	11/30/2012
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None. Occasional small areas of exposed shale may occur in association with this site, and may exhibit rills, but these areas are not considered part of this site.

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2. **Presence of water flow patterns:** None, or barely visible and discontinuous.

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3. **Number and height of erosional pedestals or terracettes:** Some pedestalling of plants occurs on steeper slopes, but no evidence of recent erosion (exposed roots) should be present.

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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. Occasional small areas of exposed shale may occur in association with this site, but these areas are not considered part of this site.

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

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

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

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of**

values): Soil aggregate stability ratings should typically be 5 to 6, normally 6. Surface organic matter adheres to the soil surface. Soil surface fragments will typically retain structure indefinitely when dipped in distilled water.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should be 5 to 7 inches thick with mollic (dark) colors when moist. Structure typically is medium to coarse granular at least in the upper A-horizon.

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

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

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

    Dominant: Tall warm-season rhizomatous grasses > mid warm-season grasses >

    Sub-dominant: Mid cool-season rhizomatous grasses > forbs >

    Other: Short grass-likes > cool-season rhizomatous grasses = shrubs

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little evidence of decadence or mortality. Bunch grasses have strong, healthy centers and shrubs are vigorous.

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

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Production ranges from 900-1,900 lbs./acre (air-dry weight). Reference value production is 1,500 lbs./acre (air-dry weight).

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** State and local noxious weeds, Kentucky bluegrass, annual bromes.

17. **Perennial plant reproductive capability:** Perennial grasses should have vigorous rhizomes or tillers.