

Ecological site R060AY043SD Shallow 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.

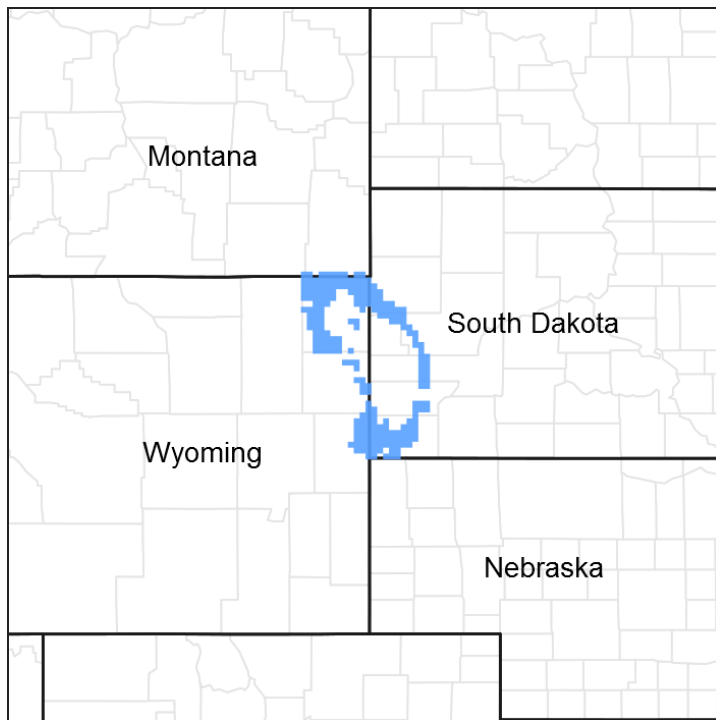


Figure 1. Mapped extent

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 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 have 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 Porous Clay ecological site occurs throughout the MLRA but is concentrated closer to the Black Hills. It is located on upland landscapes and does not receive additional moisture from runoff or overflow. Typical slopes range from 2 to 45 percent. The soil is shallow, less than 20 inches deep, with a clay surface texture 2 to 8 inches thick. The soil is derived from weathered shale and is non- calcareous. Shale chips are found throughout the soil profile (up to 35 percent by volume) and do not restrict root growth. Because the soil is weakly to strongly acid, bare ground or soft, unconsolidated shale fragments are common.

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. Little bluestem, prairie sandreed, and big bluestem are the dominant warm-season grasses. Western wheatgrass and green needlegrass are the dominant cool- season grasses. Yucca is common, as this site functions much like a sands site. Ponderosa pine, juniper, and/or bur oak are often associated with this site.

Associated sites

R060AY016SD	Very Shallow The Very Shallow site can be intermingled with the Shallow Porous Clay site. The eroded (gullied) phase of the Grummit soil is correlated to the Very Shallow site.
R060AY030SD	Porous Clay The Porous Clay site can be intermingled with the Shallow Porous Clay site.

Similar sites

R060AY030SD	Porous Clay The Porous Clay site will have a very similar plant community but with more production and less bare ground.
R060AY017SD	Shallow Clay The Shallow Clay site is located on similar landscape positions and the plant communities can look very similar. The Shallow Clay soils will be calcareous.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Schizachyrium scoparium</i> (2) <i>Carex inops</i> subsp. <i>heliophila</i>

Physiographic features

This site occurs on gently to moderately rolling uplands.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Ridge
Flooding frequency	None
Ponding frequency	None
Elevation	2,500–4,300 ft
Slope	3–60%

Aspect	Aspect is not a significant factor
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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) BELLE FOURCHE [USC00390559], Belle Fourche, SD
- (2) WASTA [USC00398911], Owanka, SD
- (3) MOORCROFT 3S [USW00024088], Moorcroft, WY
- (4) UPTON [USC00489205], Upton, WY
- (5) REDBIRD [USC00487555], Lance Creek, WY
- (6) ARDMORE 1 NW [USC00390236], Edgemont, SD

Influencing water features

No significant water features influence this site.

Wetland description

Not Applicable.

Soil features

The soils of this site are shallow (less than 20 inches to bedrock), well drained, and are moderately permeable. The soils are formed from acid material weathered from shale and contain many small (up to 35 percent by volume) shale fragments. Soil texture is clay. This site should show slight to no evidence of rills except on steeper slopes. 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. Wind and water erosion is a hazard.

Grummit is the only soil correlated to the Shallow Porous Clay site in MLRA 60A. Grummit is also correlated to the Very Shallow Ecological Site when the site is gullied.

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.



Figure 8. Grummit - Shallow Porous Clay - R060AY043SD

Table 4. Representative soil features

Surface texture	(1) Clay loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Moderate
Soil depth	10–20 in
Surface fragment cover ≤3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	3–5 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0–1
Soil reaction (1:1 water) (0-40in)	3.5–5.5
Subsurface fragment volume ≤3" (Depth not specified)	0–40%
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.

As this site deteriorates, species such as sedges, forbs, and blue grama will increase. Perennial grasses such as little bluestem, big bluestem, and rhizomatous wheatgrass will decrease in frequency and production. Dunes and/or rills 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, prairie cordgrass, and bare ground. The amount of deposition and the transport process 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. The ecological processes are discussed in more detail in the plant community descriptions following the diagram.

State and transition model

Shallow Porous Clay – R060AY043SD 7/31/17

This site can have a considerable amount of exposed shale.

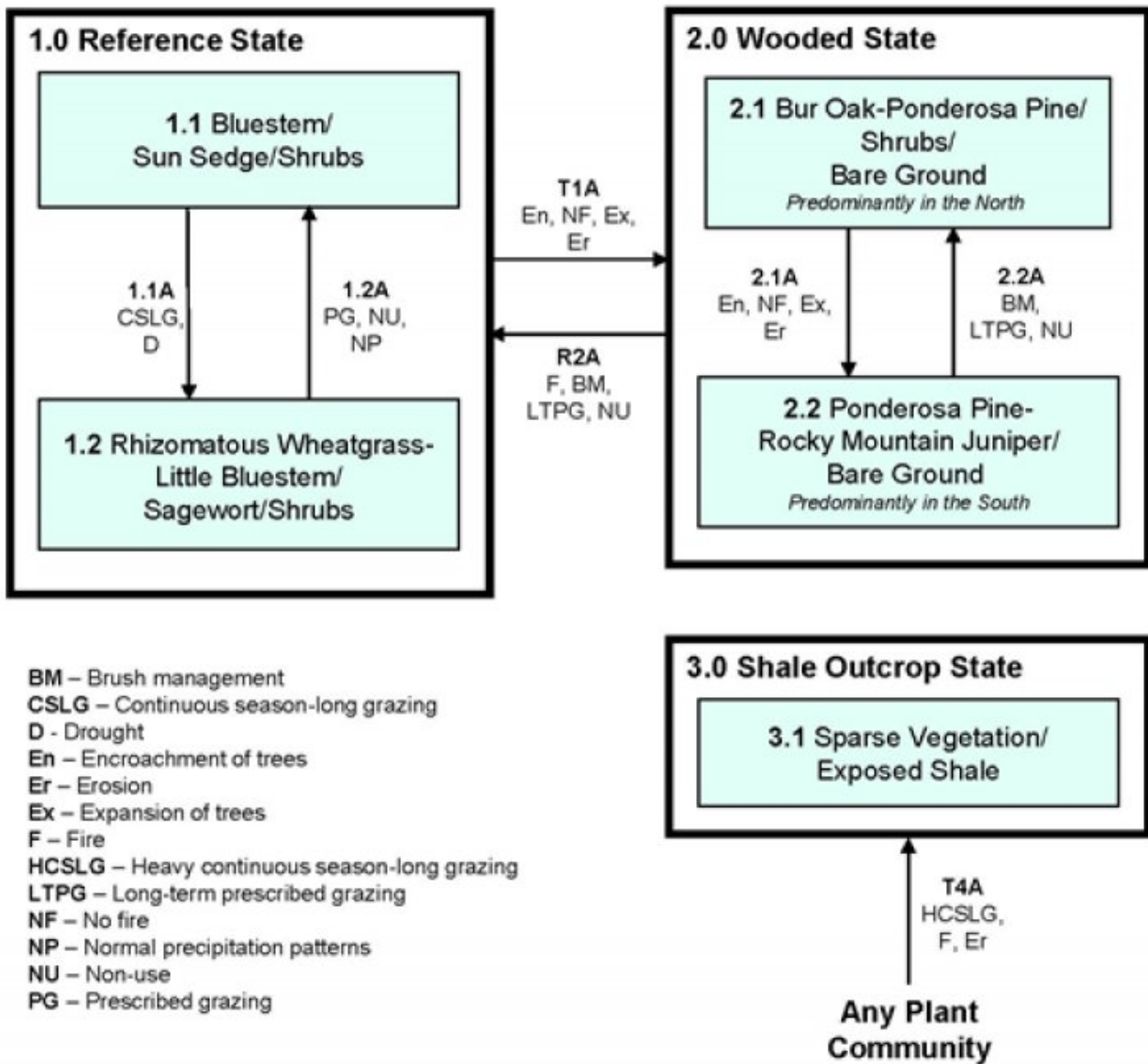


Figure 9. Shallow Porous Clay - R060AY043SD

Diagram Legend - Shallow Porous Clay - R060AY043SD		
T1A	Encroachment and/or expansion of bur oak and/or ponderosa pine, and/or juniper from adjacent sites, erosion, no fire.	
T4A	Heavy, continuous season-long grazing, fire, and erosion.	
R2A	Fire or prescribed burn followed by long-term prescribed grazing, possibly extended deferment, or non-use.	
CP 1.1A	1.1 - 1.2	Continuous season-long grazing without change in season of use or adequate time for recovery, drought.
CP 1.2A	1.2 - 1.1	Prescribed grazing with proper stocking, change in season of use, and adequate time for recovery, possible extended period of non-use, normal precipitation patterns following drought.
CP 2.1A	2.1 - 2.2	Encroachment and/or expansion of juniper species and/or ponderosa pine from adjacent sites, erosion, no fire.
CP 2.2A	2.2 - 2.1	Brush management, followed by long-term prescribed grazing with proper stocking, change in season of use, and adequate time for recovery, potential extended period of non-use.

Figure 10. Shallow Porous Clay - R060AY043SD

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 the Reference State, is dominated by warm-season grasses and sub-dominant cool-season grass. Shrubs are almost always present. Grazing, fire or lack of fire, erosion, and drought are the major drivers between plant communities.

Community 1.1 Bluestem/Sun Sedge/Shrubs



Figure 11. Shallow Porous Clay - PCP 1.1

The plant community upon which interpretations are primarily based is the Bluestem/Sun Sedge/Shrubs Plant Community. This is also considered the Reference Plant Community (1.1). Potential vegetation consists of about 70 to 80 percent grasses or grass-like plants, 10 to 20 percent forbs, and 1 to 10 percent woody plants. A mix of warm- and cool-season mid-grasses dominates. Major grasses and grass-like species include, big bluestem, little bluestem, sun sedge and rhizomatous wheatgrasses. Other grasses and grass-like species occurring include threadleaf sedge, blue grama, sideoats grama, and prairie sandreed. Forbs occurring in this plant community are cudweed sagewort, fringed sagewort, goldenpea, scurfpea, and western yarrow. Lead plant, rose, Wyoming big sagebrush, bur oak, ponderosa pine, and juniper may occur in this plant community. This plant community is stable and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high resistance to drought. This is a sustainable plant community (site/soil stability, watershed function, and biologic integrity). Occasionally this plant community will have areas influenced by natural geologic erosion and will exhibit considerable bare ground.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	605	800	885
Forb	95	105	205
Tree	0	25	55
Shrub/Vine	0	25	55
Total	700	955	1200

Figure 13. 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 1.2 Rhizomatous Wheatgrass-Little Bluestem/Sagewort/Shrubs



Figure 14. Shallow Porous Clay - PCP 1.2

This plant community develops under moderate, season-long grazing by livestock. Vegetation consists of about 60 to 80 percent grasses and grass like plants, 10 to 20 percent forbs, and 5 to 20 percent woody plants. Dominant grasses and grasslike species include rhizomatous wheatgrasses, little bluestem, sun sedge, and cheatgrass. Grasses and grass-likes of secondary importance include sideoats grama and threadleaf sedge. Forbs commonly found in this plant community include cudweed sagewort, western yarrow, hairy false goldenaster, goldenpea, biscuitroot, wild onion, and scarlet globemallow. Fringed sagewort is commonly found. Plains pricklypear and winterfat can also occur. Lead plant, rose, Wyoming big sagebrush, bur oak, ponderosa pine, and juniper may occur in this plant community. When compared to the Reference Plant Community (1.1), rhizomatous wheatgrasses and blue grama have increased. Big bluestem, sideoats grama, and prairie sandreed have decreased. Production of cool-season grasses has also been reduced. Cheatgrass (downy brome) can invade the plant community. Bare ground has also increased. This plant community is unstable and subject to wind and water erosion. The biotic integrity of this plant community is usually intact. However, it can be at risk depending on how far a shift has occurred in plant composition toward blue grama and cheatgrass. The watershed is usually functioning; however, it can become at risk when cheatgrass and bare ground increases.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	405	508	605
Forb	65	104	145
Tree	30	70	110
Shrub/Vine	0	18	40
Total	500	700	900

Figure 16. Plant community growth curve (percent production by month). SD6002, Pierre Shale Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	23	34	15	6	5	4	0	0

Pathway 1.1A Community 1.1 to 1.2



Bluestem/Sun Sedge/Shrubs



**Rhizomatous Wheatgrass-Little
Bluestem/Sagewort/Shrubs**

Continuous season-long grazing and extended periods of drought will convert the Reference Plant Community (1.1) to the Rhizomatous Wheatgrass-Little Bluestem/Sagewort/Shrubs Plant Community (1.2).

Pathway 1.2A Community 1.2 to 1.1



**Rhizomatous Wheatgrass-Little
Bluestem/Sagewort/Shrubs**



Bluestem/Sun Sedge/Shrubs

Prescribed grazing that includes proper stocking, change in season of use, and adequate time for recovery, possible an extended period of non-use, and a return to normal precipitation patterns will return this plant community to the Reference Plant Community (1.1).

State 2 Wooded State

This State is the result of encroachment and/or the expansion of trees on this site. The most common trees are bur oak, ponderosa pine, and Rocky Mountain juniper. Bur oak is common in the northern portion of the MLRA, but uncommon or non-existent in the southern portion. Ponderosa pine can be found on this site throughout the MLRA. Rocky Mountain juniper is most commonly found in the southern portion of the MLRA, but can

occur in the northern portion as well. The dynamics of this State are largely due to encroachment and/or expansion of trees, fire, and soil erosion. It is not fully understood whether erosion is the result of tree encroachment or vice versa. Livestock will congregate under the tree canopy during extreme weather (hot or cold) and will obviously have a detrimental impact on soil site stability. This Wooded State provides excellent habit for wildlife and is a good grazing resource; however, it is at-risk to severe erosion with improper management.

Community 2.1

Bur Oak-Ponderosa Pine/Shrubs/Bare Ground



Figure 17. Shallow Porous Clay - PCP 2.1

This Plant Community is most common in the northern portion of the MLRA where bur oak is commonly found. This plant community is the result of encroachment or expansion of bur oak and/or ponderosa pine from adjacent plant communities. Bur oak and ponderosa pine dominate this site. Vegetation consists of about 50 to 75 percent grasses and grass-like plants, 5 to 20 percent forbs, and 5 to 30 percent woody plants. The dominant grasses and grass-likes include little bluestem and sedges. Significant forbs include prairie coneflower, purple prairie clover and goldenpea. Leadplant, rose, and Wyoming big sage has decreased, but is still present. Considerable bare ground may be present under the tree canopy. Where severe erosion has created clay dunes or gullies they may be dominated by prairie sandreed or prairie cordgrass. This community has lost some of its value for grazing by wildlife and livestock. This plant community is susceptible to excessive erosion and excessive runoff due to the bare ground.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	260	350	435
Tree	20	75	130
Forb	20	62	105
Shrub/Vine	0	13	30
Total	300	500	700

Figure 19. 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

Community 2.2 Ponderosa Pine-Rocky Mountain Juniper/Bare Ground



Figure 20. Shallow Porous Clay - PCP 2.2

This Plant Community (PC) is most common in the southern portion of the MLRA where bur oak is uncommon or does not occur, or when pine and/or juniper become the dominant trees in PC 2.1. This plant community is the result of encroachment of ponderosa pine and/or juniper from adjacent plant communities. Ponderosa pine and juniper dominate this Plant Community Phase (PCP). Vegetation consists of about 50 to 75 percent grasses and grass-like plants, 5 to 20 percent forbs, and 5 to 30 percent woody plants. The dominant grasses and grass-likes include little bluestem and sedges. Significant forbs include prairie coneflower, purple prairie clover, and goldenpea. Leadplant, rose, and Wyoming big sage has decreased, but is still present. Considerable bare ground may be present under the tree canopy. Where severe erosion has created clay dunes or gullies,

they may be dominated by prairie sandreed or prairie cordgrass. This community has lost some of its value for wildlife and livestock. This plant community is susceptible to excessive erosion and excessive runoff due to the bare ground.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	260	350	435
Tree	20	75	130
Forb	20	62	105
Shrub/Vine	0	13	30
Total	300	500	700

Figure 22. 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

Pathway 2.1A Community 2.1 to 2.2



Bur Oak-Ponderosa
Pine/Shrubs/Bare Ground



Ponderosa Pine-Rocky
Mountain Juniper/Bare Ground

Encroachment and/or expansion of ponderosa pine and/or Rocky Mountain juniper, no fire, and erosion will shift this plant community to the Ponderosa Pine-Rocky Mountain Juniper/*Bare Ground* Plant Community (3.1). Once this plant community is established, erosion is highly likely to increase and expand.

Pathway 2.2A Community 2.2 to 2.1



Ponderosa Pine-Rocky
Mountain Juniper/Bare Ground



Bur Oak-Ponderosa
Pine/Shrubs/Bare Ground

Mechanical brush management to treat juniper and/or pine encroachment followed by long-term prescribed grazing that includes proper stocking, change in season of use, and adequate time for recover, and potentially extended periods of non-use will return this Plant Community to Plant Community Phase 2.1.

State 3

Shale Outcrop State

This State is the result of severe erosion. The site is very unstable and recovery to a vegetated state is highly unlikely within any predictable timeline. Runoff and sedimentation from this site can and will cause significant impacts to adjacent sites and infrastructure such as roads and culverts.

Community 3.1

Sparse Vegetation/Exposed Shale



Figure 23. Shallow Porous Clay - PCP 3.1

This Plant Community consists of sparse herbaceous or woody vegetation. Species with deep root systems can persist on this site in areas that are not directly affected by erosion or have stabilized.

Transition T1A

State 1 to 2

Encroachment and/or expansion of bur oak, ponderosa pine, juniper, no fire, and erosion will shift this plant community to the Wooded State (2.0). Once this plant community is established, erosion is likely to increase and expand.

Transition T4A

State 1 to 3

Heavy, continuous season-long grazing, fire, and erosion will shift any of the plant communities to the Shale Outcrop State (4.0).

Transition T4A

State 1 to 3

Heavy, continuous season-long grazing, fire, and erosion will shift any of the plant communities to the Shale Outcrop State (4.0).

Restoration pathway R2A

State 2 to 1

Fire or prescribed burning to remove woody vegetation followed by long-term prescribed grazing that includes proper stocking, change in season of use, and adequate time for recover will transition the Woody State (2.0) back to the Reference State (1.0). Extended periods of non-use may help this transition.

Transition T4A

State 2 to 3

Heavy, continuous season-long grazing, fire, and erosion will shift any of the plant communities to the Shale Outcrop State (4.0).

Transition T4A

State 2 to 3

Heavy, continuous season-long grazing, fire, and erosion will shift any of the plant communities to the Shale Outcrop State (4.0).

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	Rhizomatous Wheatgrasses			50–150	
	thickspike wheatgrass	ELLAL	<i>Elymus lanceolatus</i> ssp. <i>lanceolatus</i>	50–150	–
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	50–150	–
2	Little Bluestem			200–400	
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	200–400	–

3	Sun Sedge			150–300	
	sun sedge	CAINH2	<i>Carex inops ssp. heliophila</i>	150–300	–
4	Big Bluestem			50–150	
	big bluestem	ANGE	<i>Andropogon gerardii</i>	50–150	–
5	Native Grasses and Grass-likes			50–150	
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	0–100	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0–50	–
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	0–50	–
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	0–50	–
	prairie sandreed	CALO	<i>Calamovilfa longifolia</i>	0–50	–
	Dudley's rush	JUDU2	<i>Juncus dudleyi</i>	0–50	–
	Grass, perennial	2GP	<i>Grass, perennial</i>	0–50	–
	threeawn	ARIST	<i>Aristida</i>	0–50	–
Forb					
7	Forbs			100–200	
	tapertip hawksbeard	CRAC2	<i>Crepis acuminata</i>	0–50	–
	white prairie clover	DACA7	<i>Dalea candida</i>	0–50	–
	purple prairie clover	DAPU5	<i>Dalea purpurea</i>	0–50	–
	alpine golden buckwheat	ERFLF	<i>Eriogonum flavum var. flavum</i>	0–50	–
	desertparsley	LOMAT	<i>Lomatium</i>	0–50	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	0–50	–
	common yarrow	ACMI2	<i>Achillea millefolium</i>	0–50	–
	onion	ALLIU	<i>Allium</i>	0–50	–
	rosy pussytoes	ANRO2	<i>Antennaria rosea</i>	0–50	–
	twogrooved milkvetch	ASBI2	<i>Astragalus bisulcatus</i>	0–50	–
	aster	ASTER	<i>Aster</i>	0–50	–
	milkvetch	ASTRA	<i>Astragalus</i>	0–50	–
	bluebells	MERTE	<i>Mertensia</i>	0–50	–
	scarlet beeblossom	OESU3	<i>Oenothera suffrutescens</i>	0–50	–
	large Indian breadroot	PEES	<i>Pediomelum esculentum</i>	0–50	–

	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0–50	–
	stemless mock goldenweed	STAC	<i>Stenotus acaulis</i>	0–50	–
	prairie thermopsis	THRH	<i>Thermopsis rhombifolia</i>	0–50	–
	American vetch	VIAM	<i>Vicia americana</i>	0–50	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	0–25	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	0–25	–
	thistle	CIRSI	<i>Cirsium</i>	0	–
	sweetclover	MELIL	<i>Melilotus</i>	0	–
	Forb, annual	2FA	<i>Forb, annual</i>	0	–
Shrub/Vine					
8	Shrubs			0–50	
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0–50	–
	leadplant	AMCA6	<i>Amorpha canescens</i>	0–50	–
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata ssp. wyomingensis</i>	0–20	–
	blanketflower	GAAR	<i>Gaillardia aristata</i>	14	–
	prairie rose	ROAR3	<i>Rosa arkansana</i>	0–10	–
Tree					
9	Trees			0–50	
	juniper	JUNIP	<i>Juniperus</i>	0–50	–
	ponderosa pine	PIPO	<i>Pinus ponderosa</i>	0–50	–
	bur oak	QUMA2	<i>Quercus macrocarpa</i>	0–50	–

Table 10. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	Rhizomatous Wheatgrasses			70–140	
	thickspike wheatgrass	ELLAL	<i>Elymus lanceolatus ssp. lanceolatus</i>	70–140	–
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	70–140	–
2	Little Bluestem			35–105	
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	35–105	–
3	Sun Sedae			105–210	

	sun sedge	CAINH2	<i>Carex inops ssp. heliophila</i>	105–210	–
4	Big Bluestem			0–35	
	big bluestem	ANGE	<i>Andropogon gerardii</i>	0–35	–
5	Native Grasses and Grass-likes			70–245	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	35–105	–
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	35–70	–
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	35–70	–
	Dudley's rush	JUDU2	<i>Juncus dudleyi</i>	14–56	–
	Grass, perennial	2GP	<i>Grass, perennial</i>	0–35	–
	threeawn	ARIST	<i>Aristida</i>	0–35	–
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	0–35	–
	prairie sandreed	CALO	<i>Calamovilfa longifolia</i>	0–14	–
6	Non-native Grasses			0–56	
	cheatgrass	BRTE	<i>Bromus tectorum</i>	0–56	–
Forb					
7	Forbs			70–140	
	sweetclover	MELIL	<i>Melilotus</i>	0–70	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	0–50	–
	alpine golden buckwheat	ERFLF	<i>Eriogonum flavum var. flavum</i>	0–35	–
	Forb, annual	2FA	<i>Forb, annual</i>	0–35	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	0–35	–
	common yarrow	ACMI2	<i>Achillea millefolium</i>	0–35	–
	twogrooved milkvetch	ASBI2	<i>Astragalus bisulcatus</i>	0–35	–
	aster	ASTER	<i>Aster</i>	0–35	–
	milkvetch	ASTRA	<i>Astragalus</i>	0–35	–
	thistle	CIRSI	<i>Cirsium</i>	0–35	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0–35	–
	stemless mock goldenweed	STAC	<i>Stenotus acaulis</i>	0–35	–
	prairie thermopsis	THRH	<i>Thermopsis rhombifolia</i>	0–35	–
	American vetch	VIAM	<i>Vicia americana</i>	0–21	–
	tanartin	CRAC2	<i>Crepis acuminata</i>	0–21	–

	tufted hawksbeard	ORRO2	<i>Oreopsis acuminata</i>	0-21	-
	onion	ALLIU	<i>Allium</i>	0-21	-
	rosy pussytoes	ANRO2	<i>Antennaria rosea</i>	0-21	-
	desertparsley	LOMAT	<i>Lomatium</i>	0-21	-
	purple prairie clover	DAPU5	<i>Dalea purpurea</i>	0-21	-
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	0-20	-
	bluebells	MERTE	<i>Mertensia</i>	0-14	-
	scarlet beeblossom	OESU3	<i>Oenothera suffrutescens</i>	0-14	-
	large Indian breadroot	PEES	<i>Pediomelum esculentum</i>	0-14	-
	white prairie clover	DACA7	<i>Dalea candida</i>	0-14	-
Shrub/Vine					
8	Shrubs			0-35	
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata ssp. wyomingensis</i>	0-20	-
	leadplant	AMCA6	<i>Amorpha canescens</i>	0-14	-
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0-10	-
	prairie rose	ROAR3	<i>Rosa arkansana</i>	0-5	-
Tree					
9	Trees			35-105	
	juniper	JUNIP	<i>Juniperus</i>	0-70	-
	ponderosa pine	PIPO	<i>Pinus ponderosa</i>	0-70	-
	bur oak	QUMA2	<i>Quercus macrocarpa</i>	0-70	-

Table 11. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	Rhizomatous Wheatgrasses			10-50	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	10-50	-
	thickspike wheatgrass	ELLAL	<i>Elymus lanceolatus ssp. lanceolatus</i>	0-25	-
2	Little Bluestem			25-75	
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	25-75	-
3	Sun Sedge			50-100	

3	Sun Sedge			50-100	
	sun sedge	CAINH2	<i>Carex inops ssp. heliophila</i>	50-100	-
4	Big Bluestem			0-25	
	big bluestem	ANGE	<i>Andropogon gerardii</i>	0-25	-
5	Native Grasses and Grass-likes			50-200	
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	0-50	-
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	0-50	-
	prairie sandreed	CALO	<i>Calamovilfa longifolia</i>	0-50	-
	Dudley's rush	JUDU2	<i>Juncus dudleyi</i>	10-50	-
	Grass, perennial	2GP	<i>Grass, perennial</i>	0-25	-
	threeawn	ARIST	<i>Aristida</i>	10-25	-
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	0-25	-
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0-25	-
6	Non-native Grasses			10-50	
	cheatgrass	BRTE	<i>Bromus tectorum</i>	10-50	-
Forb					
7	Forbs			25-100	
	sweetclover	MELIL	<i>Melilotus</i>	0-75	-
	Forb, annual	2FA	<i>Forb, annual</i>	0-50	-
	thistle	CIRSI	<i>Cirsium</i>	0-50	-
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	0-30	-
	twogrooved milkvetch	ASBI2	<i>Astragalus bisulcatus</i>	0-25	-
	aster	ASTER	<i>Aster</i>	0-25	-
	milkvetch	ASTRA	<i>Astragalus</i>	0-25	-
	Forb, perennial	2FP	<i>Forb, perennial</i>	0-25	-
	common yarrow	ACMI2	<i>Achillea millefolium</i>	0-25	-
	purple prairie clover	DAPU5	<i>Dalea purpurea</i>	0-25	-
	alpine golden buckwheat	ERFLF	<i>Eriogonum flavum var. flavum</i>	0-25	-
	desertparsley	LOMAT	<i>Lomatium</i>	0-25	-
	large Indian breadroot	PEES	<i>Pediomelum esculentum</i>	0-25	-
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0-25	-
	stemless milk	STAC	<i>Stenotus acutis</i>	0-25	-

	stemless mock goldenweed	STAC	<i>Stenotus acaulis</i>	0-25	-
	prairie thermopsis	THRH	<i>Thermopsis rhombifolia</i>	0-25	-
	rosy pussytoes	ANRO2	<i>Antennaria rosea</i>	0-15	-
	bluebells	MERTE	<i>Mertensia</i>	0-10	-
	onion	ALLIU	<i>Allium</i>	0-10	-
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	0-10	-
	scarlet beeblossom	OESU3	<i>Oenothera suffrutescens</i>	0-5	-
	American vetch	VIAM	<i>Vicia americana</i>	0	-
	tapertip hawksbeard	CRAC2	<i>Crepis acuminata</i>	0	-
	white prairie clover	DACA7	<i>Dalea candida</i>	0	-
Shrub/Vine					
8	Shrubs			0-25	
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0-25	-
	leadplant	AMCA6	<i>Amorpha canescens</i>	0-5	-
Tree					
9	Trees			25-125	
	juniper	JUNIP	<i>Juniperus</i>	0-75	-
	ponderosa pine	PIPO	<i>Pinus ponderosa</i>	0-75	-
	bur oak	QUMA2	<i>Quercus macrocarpa</i>	10-75	-

Table 12. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	Rhizomatous Wheatgrasses			10-50	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	10-50	-
	thickspike wheatgrass	ELLAL	<i>Elymus lanceolatus ssp. lanceolatus</i>	0-25	-
2	Little Bluestem			25-75	
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	25-75	-
3	Sun Sedge			50-100	
	sun sedge	CAINH2	<i>Carex inops ssp. heliophila</i>	50-100	-
4	Big Bluestem			0-25	

	big bluestem	ANGE	<i>Andropogon gerardii</i>	0–25	–
5	Native Grasses and Grass-likes			50–200	
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	0–50	–
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	0–50	–
	prairie sandreed	CALO	<i>Calamovilfa longifolia</i>	0–50	–
	Dudley's rush	JUDU2	<i>Juncus dudleyi</i>	10–50	–
	Grass, perennial	2GP	<i>Grass, perennial</i>	0–25	–
	threeawn	ARIST	<i>Aristida</i>	10–25	–
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	0–25	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0–25	–
6	Non-native Grasses			10–50	
	cheatgrass	BRTE	<i>Bromus tectorum</i>	10–50	–
Forb					
7	Forbs			25–100	
	sweetclover	MELIL	<i>Melilotus</i>	0–75	–
	Forb, annual	2FA	<i>Forb, annual</i>	0–50	–
	thistle	CIRSI	<i>Cirsium</i>	0–50	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	0–30	–
	twogrooved milkvetch	ASBI2	<i>Astragalus bisulcatus</i>	0–25	–
	aster	ASTER	<i>Aster</i>	0–25	–
	milkvetch	ASTRA	<i>Astragalus</i>	0–25	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	0–25	–
	common yarrow	ACMI2	<i>Achillea millefolium</i>	0–25	–
	purple prairie clover	DAPU5	<i>Dalea purpurea</i>	0–25	–
	alpine golden buckwheat	ERFLF	<i>Eriogonum flavum var. flavum</i>	0–25	–
	desertparsley	LOMAT	<i>Lomatium</i>	0–25	–
	large Indian breadroot	PEES	<i>Pediomelum esculentum</i>	0–25	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0–25	–
	stemless mock goldenweed	STAC	<i>Stenotus acaulis</i>	0–25	–
	prairie thermopsis	THRH	<i>Thermopsis rhombifolia</i>	0–25	–

	rosy pussytoes	ANKO2	<i>Antennaria rosea</i>	0–15	–
	bluebells	MERTE	<i>Mertensia</i>	0–10	–
	onion	ALLIU	<i>Allium</i>	0–10	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	0–10	–
	scarlet beeblossom	OESU3	<i>Oenothera suffrutescens</i>	0–5	–
	American vetch	VIAM	<i>Vicia americana</i>	0	–
	tapertip hawksbeard	CRAC2	<i>Crepis acuminata</i>	0	–
	white prairie clover	DACA7	<i>Dalea candida</i>	0	–
Shrub/Vine					
8	Shrubs			0–25	
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0–25	–
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata ssp. wyomingensis</i>	0–10	–
	prairie rose	ROAR3	<i>Rosa arkansana</i>	0–10	–
	leadplant	AMCA6	<i>Amorpha canescens</i>	0–5	–
Tree					
9	Trees			25–125	
	juniper	JUNIP	<i>Juniperus</i>	5–75	–
	ponderosa pine	PIPO	<i>Pinus ponderosa</i>	5–75	–
	bur oak	QUMA2	<i>Quercus macrocarpa</i>	0–75	–

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/Sun Sedge/Shrubs (1.1)

Average Annual Production (lbs./ac, air-dry) = 1000

Stocking Rate (AUM/ac) = 0.27

Plant Community = Rhizomatous Wheatgrass-Little Bluestem/Sagewort/Shrubs (1.2)

Average Annual Production (lbs./ac, air-dry) = 700

Stocking Rate (AUM/ac) = 0.19

Plant Community = Bur Oak-Ponderosa Pine/Shrubs/*Bare Ground* (2.1)

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

Stocking Rate (AUM/ac) = Variable

Plant Community = Ponderosa Pine-Rocky Mountain Juniper/*Bare Ground* (2.2)

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

Stocking Rate (AUM/ac) = 0.14

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

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

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

Wildlife Interpretation

Bluestem/Sun Sedge Plant Community (1.1): The predominance of grasses in this plant community favors grazers and mixed-feeders, such as bison, elk, and antelope. Suitable thermal and escape cover for deer may be limited due to the low quantities of woody plants; however, topographical variations could provide some escape cover. When found adjacent to sagebrush dominated states, this plant community may provide brood rearing/foraging areas for sage grouse, as well as lek sites. Other birds that would frequent this plant community include western meadowlarks, horned larks, and golden eagles. Many grassland obligate small mammals would occur here.

Rhizomatous Wheatgrass-Little Bluestem/Sagewort/Shrubs Plant Community (1.2): This plant community may be useful for the same large grazers that would use the Reference Plant Community. However, the plant community composition is less diverse, and thus less apt to meet the seasonal needs of these animals. It may provide some foraging opportunities for sage grouse when it occurs proximally to woody cover. Good grasshopper habitat equals good foraging for birds.

Wooded State (2.0): These Plant Communities tend to have low level of diversity. Areas

of bare ground may provide leks for birds such as sage grouse. Trees on this state may provide thermal protection and escape cover for deer and other mammals, and acorns from bur oak provide food for many species of wildlife.

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group D. Infiltration is rapid during the initial stage of a rainfall event. The soil then becomes sealed and runoff becomes excessive. 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: Everet Bainter, Range Management Specialist, NRCS; Stan Boltz, Range Management Specialist, NRCS; Glen Mitchell, 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 C. Boltz

Rick L. Peterson

Acknowledgments

ESD Updated by Rick L. Peterson on 7/28/17

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, Mitch Iverson, Thad Berrett, Cheryl Nielsen
Contact for lead author	stanley.boltz@sd.usda.gov, 605-352-1236
Date	07/14/2008
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

- 1. Number and extent of rills:** Rills are common on this site, and are connected, beginning formation of small gullies. This occurs on areas where little to no vegetation is present (these areas are natural on this site to varying degrees).

- 2. Presence of water flow patterns:** Usually not evident.

- 3. Number and height of erosional pedestals or terracettes:** Pedestals are sometimes present, but not common. Vegetated areas adjacent to bare shale areas are sometimes elevated above shale.

- 4. Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Extremely variable. Bare soil under tree canopy does not count towards this bare ground value. This site naturally has relatively large areas

of bare shale in association with areas covered by vegetation. Vegetated areas would typically range from 20 to about 40 percent bare ground, while the areas of bare shale can be 100 percent bare ground.

5. **Number of gullies and erosion associated with gullies:** Some relatively shallow V-shaped drainages may appear in areas with rolling topography. Very shallow gullies are more likely to form where smaller particle size topsoil is present above shale beds.

6. **Extent of wind scoured, blowouts and/or depositional areas:** Relatively small blowouts can be present where smaller sized shale chips are dominant on the surface. These areas are typically less than 2 acres in size.

7. **Amount of litter movement (describe size and distance expected to travel):** Litter typically falls in place. Slight movement of smaller size class litter, typically where concentrated flow paths exist.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** On vegetated areas, soil aggregate stability ratings should typically be 5 or greater. Surface organic matter adheres to the soil surface. Soil surface fragments will typically retain structure for 1 minute or longer when dipped in distilled water.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** In vegetated areas where the A-horizon is present, it should be 2 to 6 inches thick with dark grayish brown colors when moist. Structure should typically be moderate fine granular 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.

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: Mid warm-season bunchgrasses >

Sub-dominant: Grass-likes > forbs > cool-season mid rhizomatous grasses = tall warm-season rhizomatous grasses >

Other: Short/mid warm-season rhizomatous grasses = shrubs = trees

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 700-1,200 lbs./acre (air-dry weight). Reference value production is 1,000 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.
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