USDA Natural Resources
Conservation Service

Ecological site R063BY016SD
Very Shallow

Last updated: 9/11/2018
Accessed: 05/09/2024

General information

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

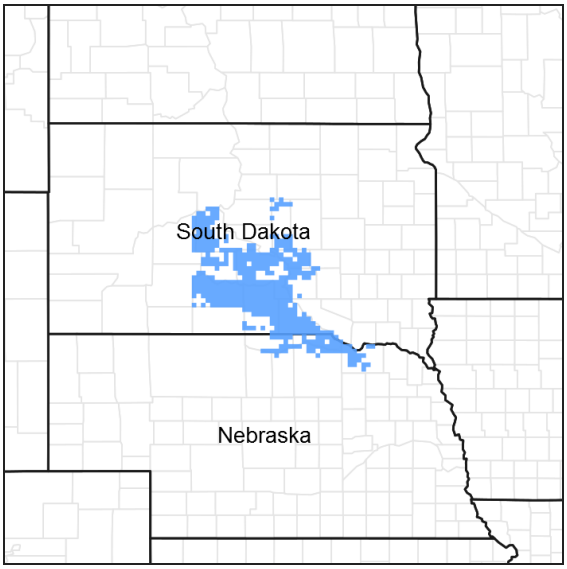

Figure 1. Mapped extent

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

MLRA notes

Major Land Resource Area (MLRA): 063B–Southern Rolling Pierre Shale Plains

MLRA Notes:
The Southern Rolling Pierre Shale Plains (MLRA 63B) is approximately 4,460 square miles in size. The majority of the MLRA is located in South Dakota (82 percent), and the remaining 18 percent is located in Nebraska. Interstate 90 crosses the northern portion through Chamberlin, SD. There are several Indian Reservations, including the Lower Brule, Crow Creek, Santee, and Yankton Reservations.
This MLRA is an area of old plateaus and terraces that have been deeply eroded, with nearly level to rolling long slopes and well-defined dendritic drainage systems. The rivers and creek valleys have smooth floors and steep walls. The majority of MLRA 63B is located in the unglaciated section of the Missouri Plateau, Great Plains Province. The northeast corner of the MLRA, east of the Missouri River, is located in the glaciated section with higher areas having deposits of glacial drift. The southwestern tip is located in the High Plains Section.
Elevations range from 1,310 feet to 1,640 feet on the bottom lands along the Missouri River, and from 1,310 feet to 1,970 feet on the shale plains uplands.
The Missouri and Niobrara Rivers, and the confluence of the White and Missouri Rivers, occur within this MLRA. Lake Francis Case, Fort Randall Dam, and Lewis and Clark Lake are also within the borders of MLRA 63B.
Cretaceous Pierre Shale underlies most of the area. This is a marine sediment with layers of volcanic ash that has been altered to smectitic clays. These clays shrink as they dry and swell as they become wet, causing significant problems for road and structural foundations.

Younger Niobrara chalk occurs in the southern part of the MLRA. Alluvial sand and gravel underlie the valley floors along major streams.

Soils in this MLRA are shallow to very deep, generally are well drained, and have loamy or clayey textures. Annual precipitation is 19 to 26 inches, mostly falling during the growing season, as frontal storms during the spring and convective thunderstorms in summer. The average annual temperature is 45°-50°F. The freeze-free period averages 165 days, and ranges from 145 to 185 days.

Vegetation in this ecological site consists of a transition between tall prairie grasses and mixed prairie grasses. Western wheatgrass, green needlegrass, porcupinegrass, and big bluestem are the major species. Little bluestem, buffalograss, sideoats grama, and sedges are dominant on the shallow soils. Buffaloberry, skunkbush sumac, and prairie rose are common on steep slopes along the major streams. Prairie cottonwood and a variety of willow species are common on flood plains along the major streams. Green ash, boxelder, chokecherry, bur oak, and buffaloberry occur in draws and narrow valleys. Encroachment of Rocky Mountain juniper and eastern redcedar onto the river breaks is becoming a concern.
The majority of the land is utilized for ranching (60 percent) and farming (27 percent). Major resource concerns for the area are the hazards of wind and water erosion, maintenance of the content of organic matter and soil productivity, and management of soil moisture.

Classification relationships

USDA - Land Resource Region G – Western Great Plains Range and Irrigated Region, Major Land Resource Area (MLRA) 63B – Southern Rolling Pierre Shale Plains (USDA-NRCS, Ag Handbook 296).

EPA - Level IV Ecoregions of the Continental United States:

Northwestern Glaciated Plains - 42f – Southern Missouri Coteau Slopes, 42g – Ponca Plains, 42h – Southern River Breaks, 42p – Holt Tablelands

North Western Great Plains - 43C – River Breaks, 43f – Subhumid Pierre Shale Plains, 43r – Niobrara River Breaks

Ecological site concept

The Very Shallow ecological site occurs throughout MLRA 63B. It is located on level to steep terraces or terrace remnants that cap ridges, crests, and upper slopes of undulating or rolling uplands. Slopes range from 0 to 60 percent. The soil formed in 3 to 10 inches of sand and gravel outwash. The surface texture consists of gravelly loam 0 to 6 inches in depth and the subsoil is very gravelly sand. The site is considered a run-off site and does not receive additional moisture from run-in or overflow. Vegetation in the Reference State consists primarily of cool-season needlegrasses, warm-season shortgrasses, and upland sedges. There also will be a diverse perennial forbs community, and several species of shrubs and half-shrubs.

Associated sites

R063BY012SD	**Thin Upland** The Thin Upland site will be found on steeper landscapes, downslope of the Very Shallow site.
R063BY024SD	**Shallow** The Shallow site can be found adjacent to or intermixed with the Very Shallow site.

Similar sites

R063BY024SD	**Shallow** The Shallow site will have shallow soils but slightly more little bluestem and big bluestem, and higher forage production than the Very Shallow site.
R063BY012SD	**Thin Upland** The Thin Upland site will have deep soils with more little bluestem and big bluestem, and higher forage production than the Very Shallow site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Hesperostipa comata var. comata* (2) *Nassella viridula*

Physiographic features

This ecological site occurs on moderately to steeply sloping uplands.

Table 2. Representative physiographic features

Landforms	(1) Terrace (2) Ridge (3) Hill
Runoff class	Low to high
Flooding frequency	None
Ponding frequency	None
Elevation	396–610 m
Slope	0–60%
Water table depth	203 cm
Aspect	Aspect is not a significant factor

Climatic features

MLRA 63B is considered to have a continental climate: cold winters and hot summers, low humidity, light rainfall, and ample sunshine. Extremes in temperature may also abound. The climate is the result of the location of this MLRA near the geographic center of North America. There are few natural barriers on the Northern Great Plains, and air masses move freely across the plains and account for rapid changes in temperature. Annual precipitation typically ranges from 18 to 25 inches per year. The average annual temperature is about 48°F. January is the coldest month with average temperatures ranging from about 15°F (Stephan, SD), to about 22°F (Winner, SD). July is the warmest month with temperatures averaging from about 73°F (Stephan, SD), to about 76°F (Winner, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 56°F. This large annual range attests to the continental nature of the climate of this area. Hourly winds are estimated to average about 11 miles per hour (mph) annually, ranging from about 13 mph during the spring to about 10 mph during the summer. Daytime winds are generally stronger than nighttime, and occasional strong storms may bring brief periods of high winds with gusts to more than 50 mph. 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 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)	113-122 days
Freeze-free period (characteristic range)	130-154 days
Precipitation total (characteristic range)	533-610 mm
Frost-free period (actual range)	110-126 days
Freeze-free period (actual range)	127-155 days
Precipitation total (actual range)	508-635 mm
Frost-free period (average)	118 days
Freeze-free period (average)	141 days

Precipitation total (average)	584 mm

Climate stations used

- (1) LYNCH [USC00255040], Lynch, NE
- (2) PICKSTOWN [USC00396574], Lake Andes, SD
- (3) NIOBRARA [USC00255960], Niobrara, NE
- (4) GANN VALLEY 4NW [USC00393217], Gann Valley, SD
- (5) WOOD [USC00399442], Wood, SD
- (6) STEPHAN 2 NW [USC00397992], Highmore, SD
- (7) WINNER [USC00399367], Winner, SD

Influencing water features

No riparian areas or wetland features are directly associated with this site.

Soil features

The common feature of the soils in the Very Shallow ecological site is the gravelly loam surface texture 0 to 6 inches in depth. The subsoil texture is very gravelly sand and restrictive to root penetration. Slopes range from 0 to 60 percent. The soils in this site are well to excessively well-drained and formed in sand and gravel outwash alluvium. The soils have a moderate to moderately rapid infiltration rate. This site should show no evidence of rills, wind-scoured areas, or pedestalled plants. If present, water flow paths are broken, irregular in appearance, or discontinuous. The soil surface is very unstable but intact.

The major soil correlated to the Very Shallow site is Schamber. Talmo is also correlated to the Very Shallow site, but is of limited extent in MLRA 63B.

These soils are mainly susceptible to water erosion. The hazard of water erosion increases on slopes greater than about 15 percent. Low available water capacity caused by the shallow rooting depth strongly influences the soil-water-plant relationship. Loss of the soil surface layer can result in a shift in species composition and/or production.

Access Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm) for specific local soils information.

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Outwash
Surface texture	(1) Loam
Family particle size	(1) Sandy
Drainage class	Well drained to excessively drained
Permeability class	Moderate to moderately rapid
Soil depth	0–15 cm
Surface fragment cover <=3"	5–28%
Surface fragment cover >3"	2–3%
Available water capacity (0-15.2cm)	5.08–7.62 cm
Calcium carbonate equivalent (0-15.2cm)	5–25%
Electrical conductivity (0-15.2cm)	0–2 mmhos/cm

Soil reaction (1:1 water) (0-15.2cm)	6.1–8.4
Subsurface fragment volume <=3" (Depth not specified)	22–41%
Subsurface fragment volume >3" (Depth not specified)	3–7%

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.

This ecological site is naturally resilient and quite resistant to change. Also, due to the relatively steep slopes and naturally low fertility of the soils, this site generally avoids more intensive disturbances such as farming. However, continuous season-long grazing (during the typical growing season of May through October) and/or repeated seasonal grazing (e.g., every spring, every summer) without adequate recovery periods following each grazing occurrence can cause this site to depart from the Needlegrass-Grama-Western Wheatgrass Plant Community (1.1). Sedges and gramas can increase and eventually develop into a sod, while many of the tall- and mid-statured grasses will decrease (e.g., little bluestem, green needlegrass, needle and thread, porcupinegrass, and western wheatgrass). Even with these disturbances, many of the tall- and mid-statured grasses will remain in the community at reduced levels, allowing recovery to occur once the disturbances are removed.

Interpretations are primarily based on the Needlegrass-Grama-Western Wheatgrass Plant Community. It has been determined by study of 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 community phases, states, transitional pathways, and thresholds have been determined through similar studies and experience.

The following is a diagram that illustrates the common plant community phases that can occur on the site and the transition pathways between communities. These are the most common plant community phases based on current knowledge and experience, and changes may be made as more data is collected. Narratives following the diagram contain more detail pertaining to the ecological processes.

State and transition model

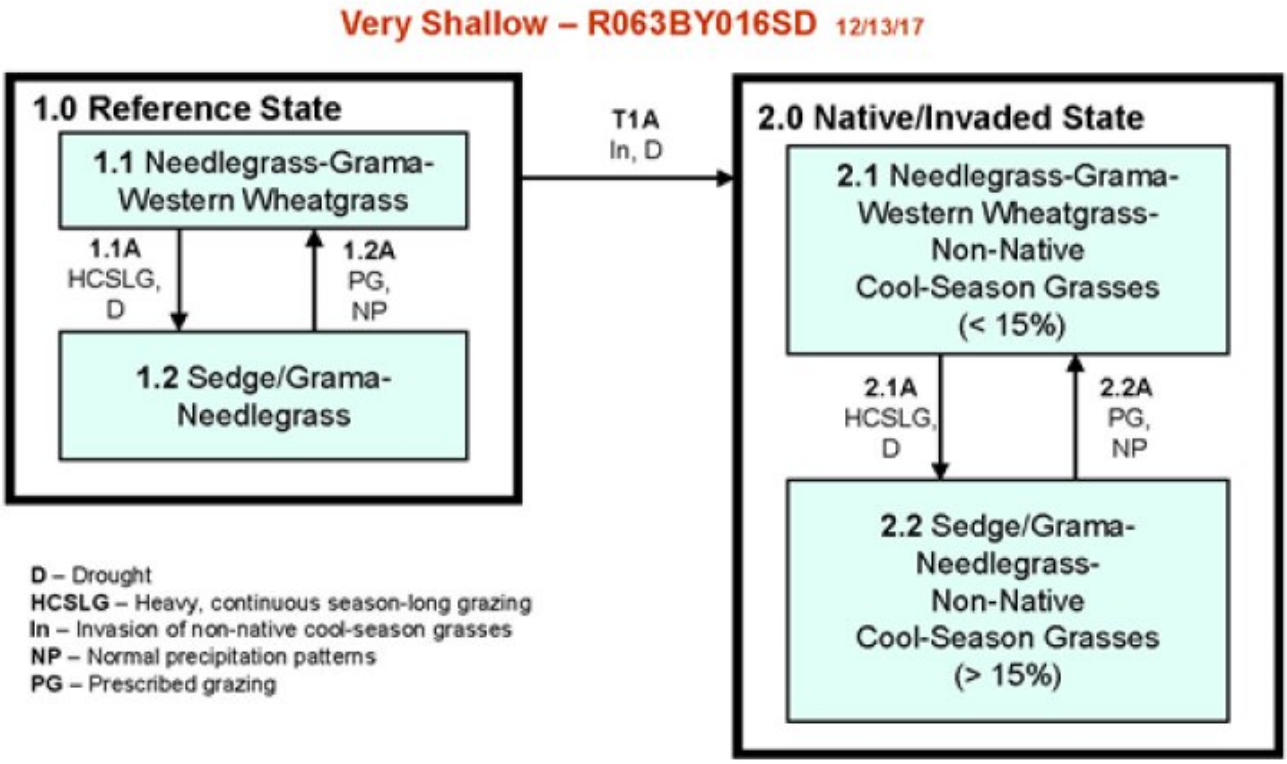

Diagram Legend - Very Shallow - R063AY016SD

T1A	Invasion of non-native cool-season grasses, and drought.	
CP 1.1A	1.1 - 1.2	Heavy, continuous season-long grazing in combination with drought.
CP 1.2A	1.2 - 1.1	Prescribed grazing with proper stocking, change in season of use, and adequate time for recovery, normal precipitation following drought.
CP 2.1A	2.1 - 2.2	Heavy, continuous season-long grazing in combination with drought.
CP 2.2A	2.2 - 2.1	Prescribed grazing with proper stocking, change in season of use, and adequate time for recovery, normal precipitation following drought.

State 1
Reference State

The Reference State represents the natural range of variability that dominates the dynamics of this site. This State is dominated by cool-season grasses, and warm-season grasses are subdominant. In pre-European settlement times, the primary disturbance mechanisms for this site in the Reference condition included grazing by large herding ungulates and fluctuations in levels of precipitation. Grazing, coupled with weather events, drive the dynamics that occurred within the natural range of variability. Today, this State can be found on areas that are properly managed with grazing and/or prescribed burning, and sometimes on areas receiving occasional short periods of rest. The dominant midgrass species can decline and a corresponding increase in short-statured species will occur.

Community 1.1
Needlegrass-Grama-Western Wheatgrass

Figure 8. Very Shallow - R063BY016SD - PCP 1.1.

The Needlegrass-Grama-Western Wheatgrass Plant Community Phase is the plant community upon which interpretations are primarily based. This is also considered to be the Reference Plant Community. This plant community can be found on areas that are properly managed with prescribed grazing that allows for proper utilization, changes in season of use, and adequate recovery periods following each grazing event. The potential vegetation consists of about 75 percent grasses or grass-like plants, 15 percent forbs, and 10 percent shrubs. Cool-season grass and grass-like species dominate this plant community, and warm-season grasses are subdominant. The major grass or grass-like species include needlegrasses (needle and thread, green needlegrass, and/or porcupinegrass), blue and/or hairy grama, western wheatgrass, threadleaf sedge, and needleleaf sedge. Other grasses occurring on the site include threeawn, plains muhly, little bluestem, and prairie Junegrass. The significant forbs include dotted gayfeather, hairy false goldenaster, purple coneflower, prairie clover, and stemless four-nerve daisy. Significant shrubs in the plant community are fringed sagewort, leadplant, rose, skunkbush sumac, and yucca. This plant community is resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term. This plant community is stable and protected from excessive erosion.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	964	1388	1659
Forb	78	168	286
Shrub/Vine	78	127	185
Total	**1120**	**1683**	**2130**

Figure 10. Plant community growth curve (percent production by month). SD6302, Pierre Shale Plains, cool-season dominant, warm-season subdominant.. Cool-season dominant, warm-season subdominant, uplands..

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

Community 1.2
Sedge/Grama-Needlegrass

This plant community can develop from the adverse effects of heavy, continuous grazing in conjunction with extended periods of below- average precipitation. Shortgrass and grass-like species increase to dominate the site and annual production decreases. Lack of litter and short plant heights result in higher soil temperatures, poor water infiltration rates, and higher evaporation, which gives blue grama and sedges a competitive advantage over cool- and warm-season midgrasses. Blue grama and threadleaf sedge are the dominant grass/grass-like species. Other grasses may include western wheatgrass, needle and thread, prairie Junegrass, and threeawn. Significant forbs include green sagewort, cutleaf ironplant, scurfpeas, white prairie aster, and woolly plantain. Common shrubs

include cactus, yucca, and fringed sagewort. Non-native species such as Kentucky bluegrass, cheatgrass, and field bromegrass may begin to invade this community. This plant community is relatively stable. The competitive advantage of blue grama and threadleaf sedge prevents other species from establishing. This plant community is less productive than the Needlegrass-Grama-Western Wheatgrass Plant Community (1.1). Runoff has increased and infiltration has decreased. Soil erosion does not increase substantially.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	572	925	1373
Forb	50	112	185
Shrub/Vine	50	84	123
Total	**672**	**1121**	**1681**

Figure 12. Plant community growth curve (percent production by month). SD6302, Pierre Shale Plains, cool-season dominant, warm-season subdominant.. Cool-season dominant, warm-season subdominant, uplands..

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

Heavy, continuous grazing (grazing the same area for extended portions of the growing season well above recommended stocking rates and without adequate recovery periods), especially when coupled with extended periods of below-average precipitation will convert the plant community to the Sedge/Grama-Needlegrass Plant Community (1.2).

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing (alternating season of use and providing adequate recovery periods) and a return to normal precipitation patterns will convert this plant community to the Needlegrass-Grama-Western Wheatgrass Plant Community (1.1).

Conservation practices

Prescribed Grazing

State 2
Native/Invaded State

This State has been invaded by smooth brome and/or Kentucky bluegrass but not at the levels where the plant community is dominated by these species. The plant communities in the Native/Invaded State will look very similar to the Reference State in species composition and production. Once non-native cool-season grasses become established in a plant community, it is highly unlikely that it can transition back to the Reference State (1.0).

Community 2.1
Needlegrass-Grama-Western Wheatgrass-Non-Native Cool-Season Grasses (< 15%)

This plant community is the result of invasion of non-native cool-season grasses. Fluctuations in precipitation cycles can facilitate the spread of these species, including, extended periods of below-average precipitation followed by a mild winter and/or a cool, wet springs. The potential vegetation is about 75 percent grasses or grass-like plants, 15 percent forbs, and 10 percent shrubs. Cool-season grass and grass- like species dominate this plant community, and warm-season grasses are subdominant. The major grass or grass-like species include needlegrasses (needle

and thread, green needlegrass, and/or porcupinegrass), blue and/or hairy grama, western wheatgrass, threadleaf sedge, and needleleaf sedge. Other grasses occurring on the site include threeawn, plains muhly, little bluestem, prairie Junegrass, and non-native species such as smooth brome, Kentucky bluegrass, cheatgrass, and/or field bromegrass. The significant forbs include dotted gayfeather, stemless four-nerve daisy, purple coneflower, prairie clover, and hairy false goldenaster. Significant shrubs are fringed sagewort, leadplant, rose, and yucca. This plant community is very similar to the Needlegrass-Grama-Western Wheatgrass Plant Community (1.1). The main difference is that this plant community will have a minor amount of non-native grasses, up to about 15 percent by weight. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term. This plant community is stable and protected from excessive erosion.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	964	1388	1659
Forb	78	168	286
Shrub/Vine	78	127	185
Total	**1120**	**1683**	**2130**

Figure 14. Plant community growth curve (percent production by month). SD6302, Pierre Shale Plains, cool-season dominant, warm-season subdominant.. Cool-season dominant, warm-season subdominant, uplands..

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

Community 2.2
Sedge/Needlegrass-Non-Native Cool-Season Grasses (> 15%)

This plant community can develop from the adverse effects of heavy, continuous season-long grazing in conjunction with extended periods of below-average precipitation. This plant community phase is further impacted by the invasion of non-native species such as cheatgrass, field bromegrass, smooth brome, and/or Kentucky bluegrass. Annual bromegrass and sedge will make up a bulk of the composition on this plant community phase. The dominant grass and grass-like species will include threadleaf sedge and/or needleleaf sedge, needlegrass (needle and thread, green needlegrass, and/or porcupinegrass), and cheatgrass and/or field bromegrass. Other grasses present include western wheatgrass, blue grama, threeawn, smooth brome, Kentucky bluegrass, hairy grama, and prairie Junegrass. Significant forbs include green sagewort, cutleaf ironplant, scurfpeas, white prairie aster, and woolly plantain. Common shrubs include cactus, yucca, and fringed sagewort. Lack of litter and short plant heights result in higher soil temperatures, poor water infiltration rates, and higher evaporation, which gives sedges and annual bromegrass a competitive advantage over cool- and warm-season midgrasses. This plant community is relatively stable. The competitive advantage of blue grama and threadleaf sedge prevents other species from establishing. This plant community is less productive than the Needlegrass-Grama-Western Wheatgrass Plant Community (1.1). Runoff has increased and infiltration has decreased. Soil erosion does not increase substantially.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	381	648	908
Forb	34	78	129
Shrub/Vine	34	58	84
Total	**449**	**784**	**1121**

Figure 16. Plant community growth curve (percent production by month).

SD6301, Pierre Shale Plains, cool-season dominant.. Cool-season dominant on uplands..

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

Pathway 2.1A
Community 2.1 to 2.2

Heavy, continuous season-long grazing (grazing the same area for extended portions of the growing season well above recommended stocking rates and without adequate recovery periods), especially when coupled with extended periods of below average precipitation will convert the plant community to the Sedge/Needlegrass-Non-Native Cool-Season Grasses (> 15%) Plant Community (2.2).

Pathway 2.2A
Community 2.2 to 2.1

Prescribed grazing (alternating season of use and providing adequate recovery periods), especially when coupled with a return to more normal precipitation cycles, can convert this plant community to the Needlegrass-Grama-Western Wheatgrass-Non-Native Cool-Season Grasses Plant Community (< 15%) (1.2).

Conservation practices

Prescribed Grazing

Transition T1A
State 1 to 2

Invasion of non-native species and fluctuations in precipitation cycles (typically extended periods of below-average precipitation) will cause a shift across a threshold from the Reference State (1.0) to the Native/Invaded State (2.0).

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Needlegrass**			336–588	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	168–420	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	84–336	–
	green needlegrass	NAVI4	*Nassella viridula*	84–336	–
2	**Short Warm-Season Grasses**			168–336	
	blue grama	BOGR2	*Bouteloua gracilis*	84–252	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	34–168	–
	threeawn	ARIST	*Aristida*	17–50	–
3	**Wheatgrass**			84–252	
	western wheatgrass	PASM	*Pascopyrum smithii*	84–252	–
4	**Mid Warm-Season Grasses**			50–168	
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	34–118	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–84	–
5	**Other Native Grasses**			17–84	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–67	–

	prairie Junegrass	KOMA	*Koeleria macrantha*	17–50	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–34	–
	fall rosette grass	DIWI5	*Dichanthelium wilcoxianum*	0–34	–
6	**Grass-likes**			84–168	
	threadleaf sedge	CAFI	*Carex filifolia*	34–135	–
	needleleaf sedge	CADU6	*Carex duriuscula*	17–84	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	0–67	–
7	**Non-Native Grasses**			–	
Forb					
8	**Forbs**			84–252	
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	17–50	–
	Forb, native	2FN	*Forb, native*	17–50	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	17–50	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	17–50	–
	bush morning-glory	IPLE	*Ipomoea leptophylla*	0–34	–
	dotted blazing star	LIPU	*Liatris punctata*	17–34	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	17–34	–
	false boneset	BREU	*Brickellia eupatorioides*	0–34	–
	field sagewort	ARCA12	*Artemisia campestris*	17–34	–
	purple prairie clover	DAPU5	*Dalea purpurea*	17–34	–
	white heath aster	SYER	*Symphyotrichum ericoides*	17–34	–
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	17–34	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	17–34	–
	American vetch	VIAM	*Vicia americana*	17–34	–
	white prairie clover	DACA7	*Dalea candida*	0–17	–
	milkvetch	ASTRA	*Astragalus*	0–17	–
	pussytoes	ANTEN	*Antennaria*	0–17	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–17	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–17	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–17	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–17	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–17	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0–17	–
	buckwheat	ERIOG	*Eriogonum*	0–17	–
Shrub/Vine					
9	**Shrubs**			84–168	
	leadplant	AMCA6	*Amorpha canescens*	17–50	–
	prairie sagewort	ARFR4	*Artemisia frigida*	17–50	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–34	–
	rose	ROSA5	*Rosa*	17–34	–
	snowberry	SYMPH	*Symphoricarpos*	17–34	–
	soapweed yucca	YUGL	*Yucca glauca*	17–34	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–17	–

	skunkbush sumac	RHTR	*Rhus trilobata*	0–17	–

Table 10. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Needlegrass**			56–168	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–168	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–168	–
	green needlegrass	NAVI4	*Nassella viridula*	0–168	–
2	**Short Warm-Season Grasses**			168–336	
	blue grama	BOGR2	*Bouteloua gracilis*	112–280	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	34–168	–
	threeawn	ARIST	*Aristida*	22–90	–
3	**Wheatgrass**			11–112	
	western wheatgrass	PASM	*Pascopyrum smithii*	11–112	–
4	**Mid Warm-Season Grasses**			0–56	
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–56	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–22	–
5	**Other Native Grasses**			11–45	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–34	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	11–22	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–11	–
	fall rosette grass	DIWI5	*Dichanthelium wilcoxianum*	0–11	–
6	**Grass-likes**			168–336	
	threadleaf sedge	CAFI	*Carex filifolia*	112–224	–
	needleleaf sedge	CADU6	*Carex duriuscula*	56–168	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	0–112	–
7	**Non-Native Grasses**			0–112	
	field brome	BRAR5	*Bromus arvensis*	0–112	–
	cheatgrass	BRTE	*Bromus tectorum*	0–112	–
	bluegrass	POA	*Poa*	0–34	–
Forb					
8	**Forbs**			56–168	
	white sagebrush	ARLU	*Artemisia ludoviciana*	11–56	–
	Forb, introduced	2FI	*Forb, introduced*	0–45	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	11–45	–
	field sagewort	ARCA12	*Artemisia campestris*	11–45	–
	Forb, native	2FN	*Forb, native*	11–34	–
	white heath aster	SYER	*Symphyotrichum ericoides*	11–34	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	11–22	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–22	–
	bush morning-glory	IPLE	*Ipomoea leptophylla*	0–11	–

	dotted blazing star	LIPU	*Liatris punctata*	0–11	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–11	–
	pussytoes	ANTEN	*Antennaria*	0–11	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–11	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–11	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–11	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–11	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–11	–
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–11	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	0–11	–
	American vetch	VIAM	*Vicia americana*	0–11	–
	buckwheat	ERIOG	*Eriogonum*	0–11	–
Shrub/Vine					
9	**Shrubs**			56–112	
	prairie sagewort	ARFR4	*Artemisia frigida*	11–56	–
	soapweed yucca	YUGL	*Yucca glauca*	11–34	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–22	–
	snowberry	SYMPH	*Symphoricarpos*	0–22	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–22	–
	leadplant	AMCA6	*Amorpha canescens*	0–11	–
	rose	ROSA5	*Rosa*	0–11	–

Table 11. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Needlegrass**			252–420	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	168–336	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	34–168	–
	green needlegrass	NAVI4	*Nassella viridula*	34–168	–
2	**Short Warm-Season Grasses**			168–336	
	blue grama	BOGR2	*Bouteloua gracilis*	84–252	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	34–168	–
	threeawn	ARIST	*Aristida*	17–50	–
3	**Wheatgrass**			84–252	
	western wheatgrass	PASM	*Pascopyrum smithii*	84–252	–
4	**Mid Warm-Season Grasses**			34–84	
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	34–84	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–34	–
5	**Other Native Grasses**			17–84	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–67	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	17–50	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–34	–

	fall rosette grass	DIWI5	*Dichanthelium wilcoxianum*	0–34	–
6	**Grass-likes**			84–168	
	threadleaf sedge	CAFI	*Carex filifolia*	34–135	–
	needleleaf sedge	CADU6	*Carex duriuscula*	17–84	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	0–67	–
7	**Non-Native Grasses**			84–252	
	smooth brome	BRIN2	*Bromus inermis*	34–135	–
	bluegrass	POA	*Poa*	17–135	–
	cheatgrass	BRTE	*Bromus tectorum*	34–101	–
	field brome	BRAR5	*Bromus arvensis*	34–101	–
Forb					
8	**Forbs**			84–252	
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	17–50	–
	Forb, native	2FN	*Forb, native*	17–50	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	17–50	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	17–50	–
	bush morning-glory	IPLE	*Ipomoea leptophylla*	0–34	–
	dotted blazing star	LIPU	*Liatris punctata*	17–34	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	17–34	–
	false boneset	BREU	*Brickellia eupatorioides*	0–34	–
	field sagewort	ARCA12	*Artemisia campestris*	17–34	–
	purple prairie clover	DAPU5	*Dalea purpurea*	17–34	–
	white heath aster	SYER	*Symphyotrichum ericoides*	17–34	–
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	17–34	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	17–34	–
	American vetch	VIAM	*Vicia americana*	17–34	–
	white prairie clover	DACA7	*Dalea candida*	0–17	–
	milkvetch	ASTRA	*Astragalus*	0–17	–
	pussytoes	ANTEN	*Antennaria*	0–17	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–17	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–17	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–17	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–17	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–17	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0–17	–
	buckwheat	ERIOG	*Eriogonum*	0–17	–
Shrub/Vine					
9	**Shrubs**			84–168	
	leadplant	AMCA6	*Amorpha canescens*	17–50	–
	prairie sagewort	ARFR4	*Artemisia frigida*	17–50	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–34	–
	rose	ROSA5	*Rosa*	17–34	–
	snowberry	SYMPH	*Symphoricarpos*	17–34	–
	soapweed yucca	YUGL	*Yucca glauca*	17–34	–

	soapweed yucca	YUGL	*Yucca glauca*	17–34	
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–17	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–17	–

Table 12. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Needlegrass**			39–157	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–157	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–157	–
	green needlegrass	NAVI4	*Nassella viridula*	0–157	–
2	**Short Warm-Season Grasses**			39–118	
	threeawn	ARIST	*Aristida*	16–94	–
	blue grama	BOGR2	*Bouteloua gracilis*	16–78	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–55	–
3	**Wheatgrass**			0–24	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–24	–
4	**Mid Warm-Season Grasses**			0–6	
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–6	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–6	–
5	**Other Native Grasses**			0–24	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–24	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–16	–
6	**Grass-likes**			118–235	
	threadleaf sedge	CAFI	*Carex filifolia*	78–157	–
	needleleaf sedge	CADU6	*Carex duriuscula*	39–118	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	0–78	–
7	**Non-Native Grasses**			78–235	
	field brome	BRAR5	*Bromus arvensis*	39–157	–
	cheatgrass	BRTE	*Bromus tectorum*	39–157	–
	bluegrass	POA	*Poa*	0–39	–
Forb					
8	**Forbs**			39–118	
	Forb, introduced	2FI	*Forb, introduced*	8–63	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	8–55	–
	field sagewort	ARCA12	*Artemisia campestris*	8–47	–
	white heath aster	SYER	*Symphyotrichum ericoides*	8–31	–
	Forb, native	2FN	*Forb, native*	0–16	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	8–16	–
	buckwheat	ERIOG	*Eriogonum*	0–8	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	0–8	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–8	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–8	–

	pussytoes	ANTEN	*Antennaria*	0–8	–
Shrub/Vine					
9	**Shrubs**			39–78	
	prairie sagewort	ARFR4	*Artemisia frigida*	16–63	–
	soapweed yucca	YUGL	*Yucca glauca*	8–39	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–31	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–24	–
	snowberry	SYMPH	*Symphoricarpos*	0–8	–

Animal community

Grazing Interpretations
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.

The following initial suggested stocking rates are based on 912 lbs./acre (air-dry weight) per Animal-Unit-Month (AUM), with a 25 percent harvest efficiency of preferred and desirable forage species (refer to USDA NRCS, National Range and Pasture Handbook). An AUM is defined as the equivalent amount of forage required by a 1,000 pound cow with calf up to 6 months of age for one month.

Plant Community: Needlegrass-Grama-Western Wheatgrass (1.1)
Average Annual Production (lbs./acre, air-dry): 1,500
Stocking Rate (AUM/acre): 0.41

Plant Community: Sedge/Grama-Needlegrass (1.2)
Average Annual Production (lbs./acre, air-dry): 1,000
Stocking Rate (AUM/acre): 0.27

Plant Community: Needlegrass-Grama-Western Wheatgrass-Non-Native Cool-Season Grasses (< 15%) (2.1)
Average Annual Production (lbs./acre, air-dry): 1,500
Stocking Rate (AUM/acre): 0.41

Plant Community: Sedge/Grama-Needlegrass-Non-Native Cool-Season Grasses (>15 %) (2.2)
Average Annual Production (lbs./acre, air-dry): 700
Stocking Rate (AUM/acre): 0.19

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

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

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group A. Infiltration is moderately slow and runoff potential for this site varies from high to very high depending on soil

hydrologic group, slope, and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for higher infiltration and lower runoff. An example of an exception would be where shortgrasses form a strong sod and dominate the site. Dominance by blue grama, buffalograss, and/or sedge will result in reduced infiltration and increased runoff. 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, hiking, photography, bird watching, and other opportunities. The wide varieties of plants that bloom from spring until fall have an aesthetic value that appeals to visitors.

Wood products

No appreciable wood products are typically present on this site.

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 toward an “Approved” status.

Site Development and Testing Plan:
Future work, as described in a Project Plan, is necessary 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 required to produce the final document.

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

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

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, available online and at any USDA office, or write a letter addressed to USDA and provide in the letter all of the

information requested in the form. To request a copy of the complaint form, call (866) 632- 9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

Inventory data references

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range-trained personnel were also used. Those involved in developing this site include: April Boltjes, Range Management Specialist (RMS), NRCS; Stan Boltz, RMS, NRCS; Rick Peterson, RMS, NRCS, and Dana Larsen, RMS, NRCS.

Other references

EPA – Level III and Level IV Ecoregions of the Continental United States. Available online. https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions- continental-united-states. Accessed 08/30/17.

High Plains Regional Climate Center, University of Nebraska. Available online. http://www.hprcc.unl.edu/. Accessed 10/30/17.

USDA, NRCS. Soil Survey Staff. Official Soil Series Descriptions. Available online. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053587. Accessed 12/5/17.

USDA, NRCS. Soil Survey Staff. Web Soil Survey. Available online. https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm. Accessed 12/5/17.

USDA, NRCS. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. Ag Handbook 296. Available online. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_050898.pdf. Accessed 12/5/17.

USDA, NRCS. 2014. National Ecological Site Handbook, 1st Ed. Available online. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcseprd1291232. Accessed 10/30/17.

USDA, NRCS. 2012. National Engineering Handbook, Part 630. Hydrology Chapters from eDirectives Available online. http://www.nrcs,usda.gov/. Accessed 10/30/17.

USDA, NRCS. National Water and Climate Center. Available online. http://www.wcc.nrcs.usda.gov/. Accessed 10/30/17.

USDA, NRCS. 1997, rev. 1, 2003. National Range and Pasture Handbook. Available online. https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17734.wba. Accessed 2/15/17.

USDA, NRCS. National Soil Information System, Information Technology Center. Available online. http://nasis.nrcs.usda.gov. Accessed 12/14/17.

USDA, NRCS. 2017. The PLANTS Database. Available online. http://plants.usda.gov. Accessed 12/14/17.

USDA, NRCS. Various Published Soil Surveys.

Contributors

Rick L. Peterson
Stan Boltz

Approval

David Kraft, 9/11/2018

Acknowledgments

ESD updated by Rick L. Peterson on 12/14/17.
Editorial Review by Carla Green-Adams.

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	Stan Boltz, stanley.boltz@sd.usda.gov, 605-352-1236
Date	02/20/2009
Approved by	Stan Boltz
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None on slopes of about 15% or less, slight to none and discontinuous on slopes greater than 15%.

2. **Presence of water flow patterns:** None on slopes of about 15% or less; barely visible and discontinuous with numerous debris dams on slopes greater than 15%.

3. **Number and height of erosional pedestals or terracettes:** Few pedastalled plants typically on steeper slopes.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is roughly 10 to 20 percent.

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

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

7. **Amount of litter movement (describe size and distance expected to travel):** Small size litter classes will generally move short distances, some medium size class litter will move very short distances. Litter debris dams are occasionally present.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil aggregate stability ratings should typically be 3 or greater. Surface organic matter 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):** A-horizon should be 3 to 6 inches thick with light to dark brownish gray colors, but not typically mollic. Structure should typically be weak fine granular at least in the upper A-horizon.

---

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

---

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None – very shallow to gravel, but no platy structure will be present.

---

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

    Dominant: Needlegrasses (cool-season bunchgrasses) >> short, warm-season grasses >

    Sub-dominant: Wheatgrass (mid, cool-season rhizomatous) = forbs >

    Other: Mid, warm-season grasses = grass-likes species = shrubs

    Additional: Other grasses in other functional groups oocur in minor amounts.

---

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):** Litter cover is roughly 40 to 50 percent, and is in contact with the soil surface. Litter depth is about 0.25 inches.

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Total annual production ranges from 1,000 to 1,900 pounds/acre, with the reference value being 1,500 pounds/acre (air-dry basis).

---

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not**

invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site: State and local noxious weeds.

---

17. **Perennial plant reproductive capability:** The droughty nature of the soils of this site causes plant stress even in typical precipitation patterns. Do not rate based solely on seed production.
