USDA Natural Resources Conservation Service

Ecological site R064XY048NE
Badlands Terrace

Last updated: 12/16/2024
Accessed: 05/13/2025

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.

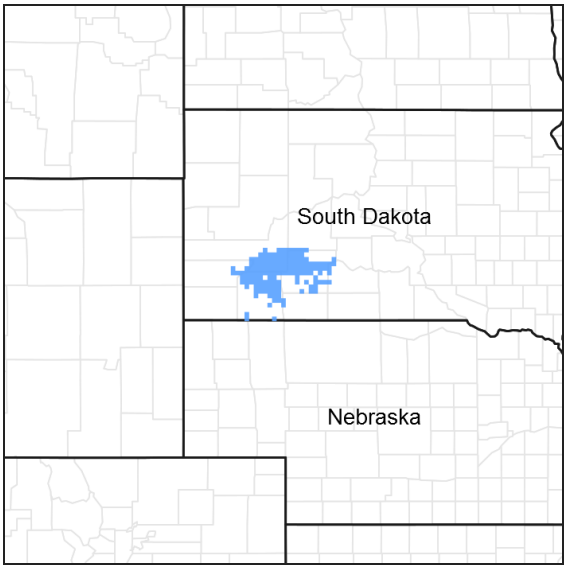


Figure 1. Mapped extent

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): 064X–Mixed Sandy and Silty Tableland and Badlands

The Mixed Sandy and Silty Tableland and Badlands (MLRA 64) is shared almost equally between South Dakota (42 percent) and Nebraska (41 percent). A small portion is in Wyoming (17 percent). The MLRA is 11,895 square miles. The towns of Kadoka and Pine Ridge, South Dakota; Chadron, Alliance, and Scottsbluff, Nebraska; and Lusk, Wyoming, are all within the boundaries of this MLRA.

The following areas of special interest are in this MLRA: Agate Fossil Beds National Monument, Chadron State Park, Fort Robinson State Park, and the Pine Ridge Indian Reservation; parts of the Oglala and Buffalo Gap National Grasslands, which are in the Nebraska National Forest; and nearly all of Badlands National Park. The Badlands are internationally renowned for their Oligocene vertebrate fossils.

The northern section of the MLRA consists of old plateaus and terraces that have been deeply eroded by wind, water, and time. The southern section consists of nearly level to broad intervalley remnants of smooth fluvial plains. These two sections are separated by the Pine Ridge escarpment. Elevations gradually increase from 2,950 to 5,073 feet from east to west. The main drainageway through the Badlands National Park is the White River. The headwaters of both the White and Niobrara Rivers are in MLRA 64. The Pine Ridge escarpment is at the northernmost extent of the Ogallala Aquifer.

Tertiary continental sediments consisting of sandstone, siltstone, and claystone underlie most of the area. Many of the bedrock units in the southern third of the MLRA are covered by loess. Soils range from shallow to very deep and from generally well drained to excessively drained. They are loamy or sandy. The Badlands consist of stream-laid layers of silt, clay, and sand mixed with layers of volcanic ash.

Average annual precipitation for the area is 14 to 20 inches. Most of the rainfall occurs as frontal storms in the spring and early summer. This area supports a mixture of short-, mid-, and tall-statured warm- and cool-season grasses. On the Pine Ridge Escarpment, these plants grow in association with ponderosa pine, Rocky Mountain juniper, western snowberry, skunkbush sumac, common chokecherry, and rose. Wyoming big sagebrush grows in minor amounts in the drier, far western portion of the MLRA; however, small remnant stands can be found in the eastern portion of the Oglala National Grassland in Nebraska.

Sixty percent of the MLRA is grassland, 11 percent of which is under Federal management. Twenty-two percent of the area is used as cropland, and 4 percent is forested. Major resource concerns include wind erosion, water erosion, and surface water quality (USDA, NRCS. 2006. Ag Handbook 296).

For development of ecological sites, MLRA 64 is divided into two precipitation zones (PZ): 14 to 17 inches per year and 17 to 20 inches per year. The wetter zone extends from the western end of the Pine Ridge Escarpment near Lusk, Wyoming, eastward along the escarpment through Nebraska and into the Big Badlands area of South Dakota. The drier zone extends from Wyoming eastward to Alliance and Oshkosh, Nebraska, south of the Pine Ridge Escarpment. MLRA 64 stops at the western edge of the Nebraska Sand Hills (MLRA 65).

A unique geologic area known as the Hartville Uplift is in the far southwest corner of the 14 to 17-inch precipitation zone. The Hartville Uplift is an elongated, north-northwest-oriented, broad domal arch of Laramide age (70–50 million years ago). It extends approximately 45 miles between Guernsey and Lusk, Wyoming, and is 15 miles wide at its widest point. Erosion has exposed a core of granite and Precambrian metasedimentary and metavolcanic rocks (Steele et al., 2018). In addition to the ecological sites in the 14 to 17inch precipitation zone of MLRA 64, three unique ecological site descriptions were developed to describe the soils and plant community dynamics that occur in the Hartville Uplift.

Classification relationships

USDA Land Resource Region G—Western Great Plains Range and Irrigated Region:
Major Land Resource Area (MLRA) 64—Mixed Sandy and Silty Tableland and Badlands

U.S. Environmental Protection Agency (EPA)
Level IV Ecoregions of the Conterminous United States:
High Plains—25:
Pine Ridge Escarpment—25a.
Flat to Rolling Plains—25d.
Pine Bluffs and Hills—25f.
Sandy and Silty Tablelands—25g.
Northwestern Great Plains—43:
White River Badlands—43h.
Keya Paha Tablelands—43i.

USDA Forest Service
Ecological Subregions: Sections and Subsections of Conterminous United States:
Great Plains and Palouse Dry Steppe Province—331:
Western Great Plains Section—331F:
Subsections:
Shale Scablands—331Fb.
White River Badlands—311Fh.
Pine Ridge Escarpment—311Fj.
High Plains—311Fk.
Hartville Uplift—311Fm.
Western Nebraska Sandy and Silty Tablelands—311Fn.
Keye Paha Tablelands—331Ft.

Powder River Basin Section—311G:
Subsection: Powder River Basin—311Ge.

Ecological site concept

The Badlands Terrace ecological site is throughout MLRA 64 but is specifically described for those areas where the soils are derived from parent material weathered from the White River Group of geological formations. The Badland Terrace site is on nearly level stream terraces and drainageways adjacent to overflow sites. This site rarely receives additional moisture from overflow but can receive runoff from adjacent upland sites.

The soils are very deep. They formed in sodium-enriched alluvium, which can be very dispersive. The surface layer is loam or silt loam 2 to 4 inches thick. The subsurface layer is also loam or silt loam and is not restrictive to water movement or root penetration.

The characteristic vegetation in the Reference State (1.0) consists of a mix of warm- and cool-season grasses. Warm-season grasses, including little bluestem and prairie sandreed, tend to be the dominant group. Rhizomatous wheatgrass and needlegrasses are the subdominant cool-season group. Forbs are common and diverse. Shrubs, such as silver sagebrush, rose, and western snowberry, are common. Plains cottonwood grows in scattered areas.

Associated sites

GX064X01X036	**Loamy 17-20" PZ** The Loamy 17-20” PZ ecological site is on landscapes above the Badlands Terrace site.
R064XY049NE	**Badlands Overflow** The Badlands Overflow ecological site is on lower landscapes adjacent to the stream channel.
GX064X01X015	**Loamy 14-17" PZ** The Loamy 14-17” PZ ecological site is on landscapes above the Badlands Terrace site.

Similar sites

R064XY049NE	**Badlands Overflow** The Badlands Overflow ecological site is adjacent to the stream channel below the Badlands Terrace site. The plant community will have switchgrass, less little bluestem, and higher forage production than the Badlands Terrace site.

Table 1. Dominant plant species

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

Physiographic features

The Badlands Terrace ecological site is in the eroded badlands on nearly level alluvial fans. It is on low terraces that receive runoff from adjacent slopes.

Figure 2. Badlands Overflow and Badlands Terrace complex in Pennington County, South Dakota.

Table 2. Representative physiographic features

Landforms	(1) Alluvial plain > Drainageway (2) Alluvial fan (3) Stream terrace
Runoff class	Low to medium
Flooding duration	Brief (2 to 7 days)
Flooding frequency	Rare
Ponding frequency	None
Elevation	884–1,524 m
Slope	0–3%
Water table depth	203 cm
Aspect	Aspect is not a significant factor

Climatic features

MLRA 64 has a continental climate consisting of cold winters and hot summers, low humidity, light rainfall, and ample sunshine. Extremes in temperature are common in some years. The climate results from MLRA 64 being near the geographic center of North America. There are few natural barriers on the Northern Great Plains. Air masses move freely across the plains and account for rapid changes in temperature.

Average annual precipitation ranges from 14 to 20 inches per year. The normal average annual temperature is about 47°F. January is the coldest month with average temperatures ranging from about 21 °F (Wood, SD) to about 25 °F (Hemingford, NE). July is the warmest month with temperatures averaging from about 70 °F (Keeline 3 W, WY: 1953–1986) to about 76 °F (Wood, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 55 °F. This large annual range attests to the continental nature of the climate of this area. Wind speed averages about 11 miles per hour annually, ranging from about 13 miles per hour during the spring to about 10 miles per hour during the summer. Daytime winds are generally stronger than nighttime winds. Occasionally, strong storms 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 continue to early or mid-September. Cool-season plants may green-up in September and October if adequate soil moisture is present.

Table 3. Representative climatic features

Frost-free period (characteristic range)	92-120 days

Freeze-free period (characteristic range)	119-139 days
Precipitation total (characteristic range)	406-483 mm
Frost-free period (actual range)	87-122 days
Freeze-free period (actual range)	110-149 days
Precipitation total (actual range)	381-508 mm
Frost-free period (average)	107 days
Freeze-free period (average)	130 days
Precipitation total (average)	432 mm

Climate stations used

- (1) HARRISON 20 SSE [USW00094077], Harrison, NE
- (2) ALLIANCE 1WNW [USC00250130], Alliance, NE
- (3) HARRISON [USC00253615], Harrison, NE
- (4) HEMINGFORD [USC00253755], Hemingford, NE
- (5) MARTIN [USC00395281], Martin, SD
- (6) WOOD [USC00399442], Wood, SD
- (7) LUSK 2 SW [USC00485830], Lusk, WY
- (8) CHADRON 3NE [USC00251578], Chadron, NE
- (9) INTERIOR 3 NE [USC00394184], Interior, SD
- (10) TORRINGTON 29N [USC00488997], Jay Em, WY

Influencing water features

The Badlands Terrace ecological site is adjacent to Badlands Overflow (R064XY049NE) sites along stream corridors and drainageways.

Stream Type: B6, C6 (Rosgen System)

Wetland description

Not Applicable.

Soil features

The soils of this site are very deep and well drained. They formed in sodium-enriched alluvium. These soils typically have dispersive characteristics due to the high content of sodium. This feature tends to cause the soils to be naturally erosive because the aggregate stability is low in the surface layer and all horizons lack structure. These soils have moderate or moderately slow permeability. The surface layer is loam or silt loam 2 to 4 inches in depth. Areas of this site receive additional water as runoff from adjacent slopes. Typically, available water capacity is high. This site shows slight to no evidence of rills, wind-scoured areas, or pedestalled plants. Water flow paths are broken, are irregular in appearance, or are discontinuous and have numerous debris dams or vegetative barriers. The soil surface is stable and intact. Subsurface soil layers are not restrictive to water movement and root penetration.

Soil Correlated to the Badlands Terrace Site: Interior, rarely flooded.

Where the Interior soil is frequently flooded, it is correlated to the Badlands Overflow (R064XY049NE) ecological site. Where it is poorly drained, it is correlated to the Wet Land (R064XY022NE) ecological site.

These soils are susceptible to water erosion. Headcuts may develop if adequate vegetative cover is not maintained or if a sinkhole occurs. They may also develop due to soil sloughing caused by piping as a result of natural features, such as animal burrows and root channels. A drastic loss of soil from the surface layer on this site can result in a shift in species composition and production.

More information regarding the soil is available in soil survey reports. Contact the local USDA Service Center for details specific to your area of interest, or go online to access USDA's Web Soil Survey.

Figure 9. The Interior soil in Sioux County, Nebraska. This soil profile illustrates the dynamics of deposition and downcutting on this ecological site.

Table 4. Representative soil features

Parent material	(1) Alluvium–calcareous siltstone
Surface texture	(1) Silt loam (2) Loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Soil depth	203 cm
Available water capacity (0-101.6cm)	20.32–22.86 cm
Calcium carbonate equivalent (0-101.6cm)	5–30%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	10–35
Soil reaction (1:1 water) (0-101.6cm)	7.4–9
Subsurface fragment volume <=3" (Depth not specified)	0–10%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

The most significant influence in the development of the Badlands Terrace ecological site are the episodes of geologic erosion on this and adjacent landscape positions in the White River Badlands. Due to the proximity of weathered and loose parent material, this site is constantly in flux.

The Great Plains climate plays an important role because the sporadic heavy rainfall causes fluctuating erosion and deposition on this site. Recent grazing or browsing patterns also effect the site, but only if it is stable long enough to

establish vegetation for an extended period of time. Although the following descriptions are typical of the transitions between communities, severe disturbances, such as periods of well-below average precipitation, can cause significant shifts in plant communities and species composition.

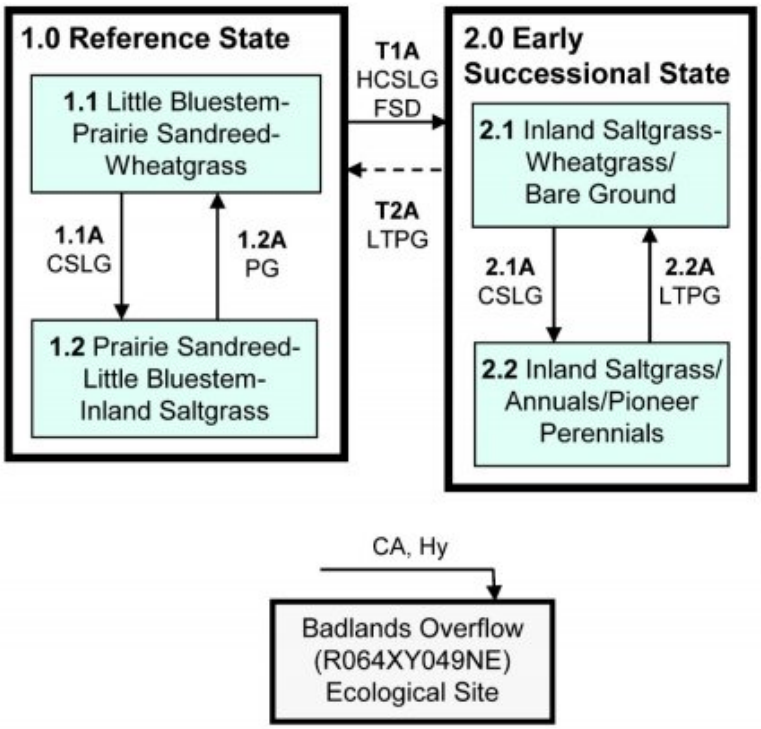
Continuous season-long grazing (during the typical growing season of May through October) or repeated seasonal grazing (e.g., every spring, every summer) without adequate recovery periods following each grazing occurrence cause the site to depart from the Little Bluestem-Prairie Sandreed-Wheatgrass Plant Community (1.1). Prairie sandreed and little bluestem initially increase but eventually decrease with continuous grazing. Grasses such as western wheatgrass and green needlegrass decrease in extent and production. Reduction of vegetative cover can result in rapid degeneration of the site. Headcuts and downcutting are relatively common. Channel aggradation can convert areas to the Badlands Overflow Ecological Site.

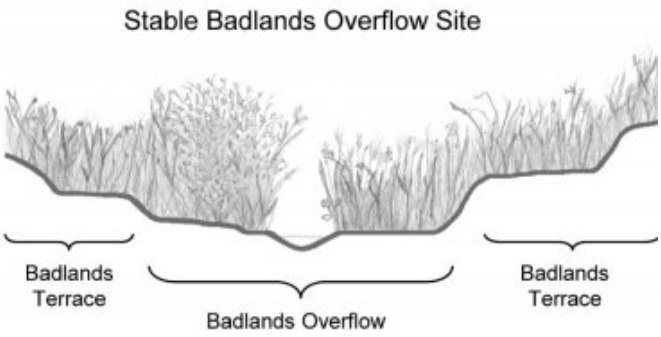
Interpretations are primarily based on the Little Bluestem-Prairie Sandreed-Wheatgrass Plant Community (1.1). The composition of the community was determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal-use pastures, and historical accounts were also used. Plant communities, states, transitional pathways, and thresholds were determined through similar studies and experience.

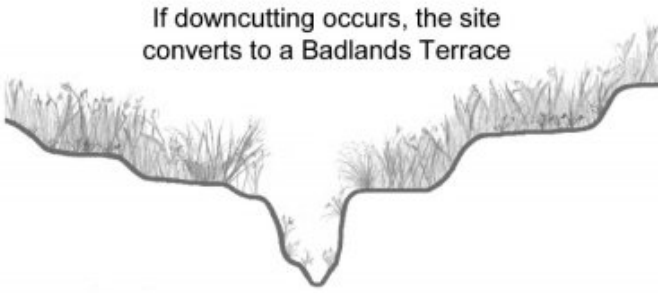
The following state-and-transition diagram illustrates the common plant communities on the site and the transition pathways between communities. The ecological processes are discussed in more detail in the plant community descriptions following the diagram.

State and transition model

Badlands Terrace – R064XY048NE 8/19/19







CA – Channel aggradation, deposition within channel and channel stabilization
CSLG – Continuous season-long grazing
FSD – Frequent and severe defoliation
HCSLG – Heavy, continuous season-long grazing
Hy – Increasing hydrologic function
LTPG – Long-term prescribed grazing
PG – Prescribed grazing

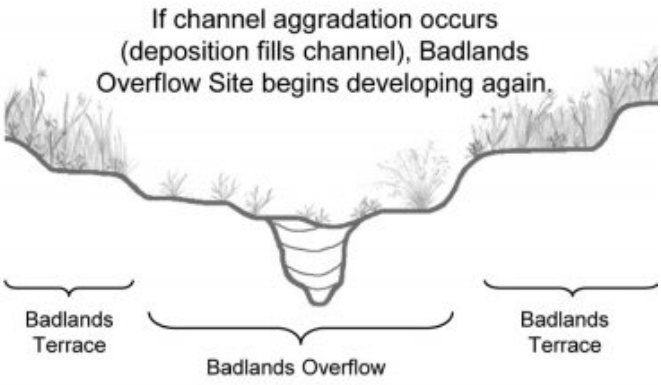


Diagram Legend - Badlands Terrace - R064XY048NE

T1A		Heavy, continuous season-long grazing or frequent and severe defoliation.
R2A		Long-term prescribed grazing with proper stocking rates, change in season of use, and adequate time for plant recovery. This transition may not be fast or feasible.
1.1A	**1.1 to 1.2**	Continuous season-long grazing without adequate time for plant recovery.
1.2A	**1.2 to 1.1**	Prescribed grazing with proper stocking, change in season of use, and adequate time plant for recovery.
2.1A	**2.1 to 2.2**	Continuous season-long grazing without adequate time for plant recovery.
2.2A	**2.2 to 2.1**	Long-term prescribed grazing with proper stocking, change in season of use, and adequate time for plant recovery.

State 1
Reference State

The Reference State represents the best estimate of the natural range of variability that dominated the dynamics in

this ecological site prior to European settlement. This site is dominated by warm- and cool-season grasses. In pre-European times, the primary disturbances included fire and grazing by large ungulates, small mammals, and insects. Favorable growing conditions occurred during the spring and the warm months of June through August. This state is in areas that have a history of proper grazing management, including adequate recovery periods between grazing events.

Community 1.1
Little Bluestem-Prairie Sandreed-Wheatgrass

Interpretations are based primarily on the Little Bluestem-Prairie Sandreed-Wheatgrass Plant Community, which is also considered the Reference Plant Community (1.1). This plant community evolved with grazing by large herbivores and occasional prairie fires. This plant community is typically derived from the Badlands Overflow site, where downcutting and entrenchment has dropped the water table and left the vegetation in a much drier terrace position. The potential vegetation is about 85 percent grasses and grass-like plants, 5 percent forbs, and 10 percent shrubs. Major grasses include little bluestem, prairie sandreed, western wheatgrass, and thickspike wheatgrass. Other grasses in this community include green needlegrass, needle and thread, and sideoats grama. Major forbs and shrubs include cudweed sagewort (white sagebrush), goldenrod, scurfpea, rose, silver sagebrush, and western snowberry. Plains cottonwood grow in scattered areas. This plant community is productive and diverse. The diversity in plant species allows for high drought tolerance. This plant community is a sustainable in regard to site stability, soil stability, watershed function, and biologic integrity as long as extreme erosion or deposition does not occur. This plant community is well adapted to the climatic conditions of the Northern Great Plains. Individual species can vary greatly in production depending on growing conditions (timing and amount of precipitation and temperature). Community dynamics, nutrient and water cycles, and energy flow function properly. Plant litter is properly distributed with very little movement offsite. Natural plant mortality is very low. Drought tolerance is high. Runoff from adjacent sites and the moderate or high available water capacity provide a favorable soil-water-plant relationship.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1726	2130	2522
Shrub/Vine	45	141	241
Forb	22	71	123
Tree	–	12	28
Total	**1793**	**2354**	**2914**

Figure 11. Plant community growth curve (percent production by month). NE6409, Pine Ridge/Badlands, warm-season dominant, cool-season sub-dominant. Warm-season dominant, cool-season sub-dominant, lowlands.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		3	8	18	27	23	12	6	3		

Community 1.2
Prairie Sandreed-Little Bluestem-Inland Saltgrass

This plant community results from continuous season-long grazing. Western wheatgrass or thickspike wheatgrass decrease in abundance, while prairie sandreed, little bluestem, and inland saltgrass increase. The potential vegetation is about 80 percent grasses or grass-like species, 10 percent forbs, and 10 percent shrubs. Other grasses and grass-like species include needle and thread, sideoats grama, and blue grama. Significant forbs include cudweed sagewort, heath aster, scurfpea, and western ragweed. The dominant shrubs include rose, silver sagebrush, and western snowberry. Production and diversity decline somewhat compared to the Little Bluestem-Prairie Sandreed-Wheatgrass Plant Community (1.1). Typically, more bare ground results from the erosion or deposition. The plant community is still relatively stable but is more prone to continued erosion.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1323	1735	2141
Forb	95	151	207
Shrub/Vine	39	121	207
Tree	–	10	22
Total	**1457**	**2017**	**2577**

Figure 13. Plant community growth curve (percent production by month). NE6409, Pine Ridge/Badlands, warm-season dominant, cool-season sub-dominant. Warm-season dominant, cool-season sub-dominant, lowlands.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		3	8	18	27	23	12	6	3		

Pathway 1.1A
Community 1.1 to 1.2

Continuous season-long grazing converts Plant Community 1.1 to the Prairie Sandreed-Little Bluestem-Inland Saltgrass Plant Community (1.2).

Pathway 1.2A
Community 1.2 to 1.1

Community Phase Pathway 1.2A Prescribed grazing that included proper stocking rates, change in season of use, and adequate time for plant recovery convert plant community 1.2 to the Little Bluestem-Prairie Sandreed-Wheatgrass Plant Community (1.1).

State 2
Early Successional State

The Early Successional State results from heavy, continuous season-long grazing; frequent and severe defoliation; or concentrated disturbance, such as rodent activity or heavy livestock use. In most cases, this phase is dominated by grazing-resistant grasses, pioneer perennials, and annual grasses and by forbs. The extent of bare ground is also much greater than in any other plant community phase. This state is at risk for further degradation or aggradation caused by water erosion.

Community 2.1
Inland Saltgrass-Wheatgrass/Bare Ground

This plant community results from heavy, continuous season-long grazing. Inland saltgrass increases significantly in abundance. Western wheatgrass or thickspike wheatgrass increase slightly in composition, while prairie sandreed and little bluestem decrease dramatically. Big bluestem and green needlegrass are not present. Other grasses and grass-like species include threeawn and needle and thread. Significant forbs include cudweed sagewort, curlycup gumweed, and heath aster. Shrubs of significance include silver sagebrush, rose, and small soapweed. Wyoming big sagebrush is significant in some areas in the western portions of MLRA 64. Potential vegetation is about 75 percent grasses or grass-like plants, 10 percent forbs, and 15 percent shrubs. Production and diversity decline considerably compared to the Little Bluestem-Prairie Sandreed-Wheatgrass Plant Community (1.1). Bare ground is evident and occupies 20 to 50 percent of the ground surface. The plant community has a greatly diminished effect on site stability, and future weather events determine site aggradation or degradation.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	527	953	1373
Shrub/Vine	17	95	174
Forb	17	67	118
Tree	–	6	17
Total	**561**	**1121**	**1682**

Figure 15. Plant community growth curve (percent production by month). NE6408, Pine Ridge/Badlands, lowland cool-season/warm-season co-dominant. Cool-season, warm-season co-dominant, lowland.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		5	12	20	25	19	11	5	3		

Community 2.2
Inland Saltgrass/Annuals/Pioneer Perennials

This plant community develops from continuous season-long grazing. The vegetation is mainly inland saltgrass and various annual and pioneer perennial grasses and forbs. Small amounts of western wheatgrass or thickspike wheatgrass typically remain in. Most other native species are either greatly diminished or absent. Silver sagebrush, rose, and broom snakeweed may survive under these extreme conditions. This plant community is susceptible to increased erosion because the vigor of most plants is reduced, and bare ground is prevalent. At times, however, the inland saltgrass, which is not grazed, can persist and stabilize the site.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	370	581	785
Forb	73	157	241
Shrub/Vine	6	43	84
Tree	–	4	11
Total	**449**	**785**	**1121**

Figure 17. Plant community growth curve (percent production by month). NE6409, Pine Ridge/Badlands, warm-season dominant, cool-season sub-dominant. Warm-season dominant, cool-season sub-dominant, lowlands.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		3	8	18	27	23	12	6	3		

Pathway 2.1A
Community 2.1 to 2.2

Continuous season-long grazing leads to the Inland Saltgrass/Annuals/Pioneer Perennials Plant Community (2.2).

Pathway 2.2A
Community 2.2 to 2.1

Long-term prescribed grazing that includes proper stocking, change in season of use, and adequate time for plant recovery may move plant community 2.2 toward the Inland Saltgrass-Wheatgrass/*Bare Ground* Plant Community (2.1). This pathway may take an extended period of time to achieve.

Transition T1A
State 1 to 2

Heavy, continuous season-long grazing or frequent and severe defoliation transition the Reference State (1.0) to the Early Successional State (2.0).

Restoration pathway R2A
State 2 to 1

Early Successional State 2.0 may transition to the Reference State (1.0) if the disturbance causing severe defoliation is removed and long-term prescribed grazing is initiated, including proper stocking, change in season of use, and an adequate rest period. This pathway takes an extended period of time and may not meet management objectives.

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	**Rhizomatous Wheatgrass**			235–706	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	235–706	–
	western wheatgrass	PASM	*Pascopyrum smithii*	235–706	–
2	**Cool-Season Bunchgrass**			118–353	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	118–235	–
	green needlegrass	NAVI4	*Nassella viridula*	118–235	–
3	**Tall- and Mid- Warm-Season Grasses**			471–1059	
	little bluestem	SCSC	*Schizachyrium scoparium*	235–588	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	235–588	–
	big bluestem	ANGE	*Andropogon gerardii*	0–118	–
4	**Other Native Grasses**			47–353	
	sideoats grama	BOCU	*Bouteloua curtipendula*	47–118	–
	blue grama	BOGR2	*Bouteloua gracilis*	24–118	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–118	–
	Grass, perennial	2GP	*Grass, perennial*	0–118	–
	saltgrass	DISP	*Distichlis spicata*	0–71	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–71	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–71	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–71	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–71	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–47	–
	threeawn	ARIST	*Aristida*	0–24	–
5	**Grass-Likes**			0–118	
	sedge	CAREX	*Carex*	0–118	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–47	–
6	**Non-Native Cool-Season Grasses**			–	
Forb					

7	**Forbs**			24–118	
	false boneset	BREU	*Brickellia eupatorioides*	0–71	–
	goldenrod	SOLID	*Solidago*	24–71	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	24–71	–
	scurfpea	PSORA2	*Psoralidium*	24–71	–
	Forb, perennial	2FP	*Forb, perennial*	24–71	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–47	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–47	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	24–47	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	24–47	–
	white heath aster	SYER	*Symphyotrichum ericoides*	24–47	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	24–47	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–47	–
	American vetch	VIAM	*Vicia americana*	24–47	–
	pussytoes	ANTEN	*Antennaria*	0–24	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–24	–
	deathcamas	ZIGAD	*Zigadenus*	0–24	–
	dotted blazing star	LIPU	*Liatris punctata*	0–24	–
	Forb, annual	2FA	*Forb, annual*	0–24	–
	vervain	VERBE	*Verbena*	0–24	–
Shrub/Vine					
8	**Shrubs**			47–235	
	silver sagebrush	ARCA13	*Artemisia cana*	0–141	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	24–118	–
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	0–118	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–71	–
	soapweed yucca	YUGL	*Yucca glauca*	0–71	–
	rose	ROSA5	*Rosa*	24–71	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–71	–
Tree					
9	**Trees**			0–24	
	plains cottonwood	PODEM	*Populus deltoides ssp. monilifera*	0–24	–
	Tree	2TREE	*Tree*	0–24	–

Table 10. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrass**			101–303	
	western wheatgrass	PASM	*Pascopyrum smithii*	101–303	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	101–303	–
2	**Cool-Season Bunchgrass**			101–202	

	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	101–202	–
	green needlegrass	NAVI4	*Nassella viridula*	20–101	–
3	**Tall- and Mid- Warm-Season Grasses**			504–1311	
	prairie sandreed	CALO	*Calamovilfa longifolia*	303–706	–
	little bluestem	SCSC	*Schizachyrium scoparium*	303–706	–
4	**Other Native Grasses**			40–404	
	saltgrass	DISP	*Distichlis spicata*	40–202	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	40–161	–
	blue grama	BOGR2	*Bouteloua gracilis*	40–161	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–101	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–101	–
	threeawn	ARIST	*Aristida*	0–61	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–61	–
	Grass, perennial	2GP	*Grass, perennial*	0–61	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–61	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–40	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–20	–
5	**Grass-Likes**			0–50	
	sedge	CAREX	*Carex*	0–61	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–40	–
6	**Non-Native Cool-Season Grasses**			20–61	
	cheatgrass	BRTE	*Bromus tectorum*	20–61	–
	field brome	BRAR5	*Bromus arvensis*	20–40	–
Forb					
7	**Forbs**			101–202	
	white sagebrush	ARLU	*Artemisia ludoviciana*	20–101	–
	white heath aster	SYER	*Symphyotrichum ericoides*	20–101	–
	Forb, annual	2FA	*Forb, annual*	0–101	–
	Forb, perennial	2FP	*Forb, perennial*	20–61	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	20–61	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–61	–
	goldenrod	SOLID	*Solidago*	20–61	–
	scurfpea	PSORA2	*Psoralidium*	20–61	–
	vervain	VERBE	*Verbena*	0–40	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–40	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–40	–
	pussytoes	ANTEN	*Antennaria*	0–40	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–40	–
	deathcamas	ZIGAD	*Zigadenus*	0–40	–
	dotted blazing star	LIPU	*Liatris punctata*	0–40	–
	American vetch	VIAM	*Vicia americana*	0–40	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–40	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–20	–

	false boneset	BREU	*Brickellia eupatorioides*	0–20	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–20	–
Shrub/Vine					
8	**Shrubs**			40–202	
	silver sagebrush	ARCA13	*Artemisia cana*	0–202	–
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	0–202	–
	soapweed yucca	YUGL	*Yucca glauca*	0–101	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	20–101	–
	rose	ROSA5	*Rosa*	20–101	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–61	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–61	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–40	–
Tree					
9	**Trees**			0–20	
	plains cottonwood	PODEM	*Populus deltoides ssp. monilifera*	0–20	–
	Tree	2TREE	*Tree*	0–20	–

Table 11. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrass**			112–336	
	western wheatgrass	PASM	*Pascopyrum smithii*	112–336	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	112–336	–
2	**Cool-Season Bunchgrass**			0–56	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–56	–
3	**Tall- and Mid- Warm-Season Grasses**			0–168	
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–112	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–112	–
4	**Other Native Grasses**			112–392	
	saltgrass	DISP	*Distichlis spicata*	112–336	–
	threeawn	ARIST	*Aristida*	0–56	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–34	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–34	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–22	–
	Grass, perennial	2GP	*Grass, perennial*	0–22	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–22	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–11	–
5	**Grass-Likes**			–	
6	**Non-Native Cool-Season Grasses**			11–56	
	cheatgrass	BRTE	*Bromus tectorum*	11–56	–
	field brome	BRAR5	*Bromus arvensis*	11–34	–
Forb					

7	**Forbs**			22–112	
	Forb, perennial	2FP	*Forb, perennial*	11–56	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–45	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–34	–
	goldenrod	SOLID	*Solidago*	0–34	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–34	–
	Forb, annual	2FA	*Forb, annual*	0–34	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–22	–
	scurfpea	PSORA2	*Psoralidium*	0–22	–
	vervain	VERBE	*Verbena*	0–11	–
	pussytoes	ANTEN	*Antennaria*	0–11	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–11	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–11	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–11	–
	deathcamas	ZIGAD	*Zigadenus*	0–11	–
Shrub/Vine					
8	**Shrubs**			22–168	
	silver sagebrush	ARCA13	*Artemisia cana*	11–112	–
	soapweed yucca	YUGL	*Yucca glauca*	0–56	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–56	–
	rose	ROSA5	*Rosa*	11–56	–
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	0–56	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–34	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–34	–
Tree					
9	**Trees**			0–11	
	plains cottonwood	PODEM	*Populus deltoides ssp. monilifera*	0–11	–
	Tree	2TREE	*Tree*	0–11	–

Table 12. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrass**			0–78	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–78	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–78	–
2	**Cool-Season Bunchgrass**			–	
3	**Tall and Mid- Warm-Season Grasses**			–	
4	**Other Native Grasses**			157–471	
	saltgrass	DISP	*Distichlis spicata*	157–392	–
	threeawn	ARIST	*Aristida*	0–118	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–39	–
	Grass, perennial	2GP	*Grass, perennial*	0–39	–
5	**Grass-Likes**			–	
6	**Non-Native Cool-Season Grasses**			0–39	
	cheatgrass	BRTE	*Bromus tectorum*	0–39	–
	field brome	BRAR5	*Bromus arvensis*	0–16	–
Forb					
7	**Forbs**			78–235	
	Forb, annual	2FA	*Forb, annual*	0–118	–
	Forb, perennial	2FP	*Forb, perennial*	0–118	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–78	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–24	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–8	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–8	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–8	–
Shrub/Vine					
8	**Shrubs**			8–78	
	silver sagebrush	ARCA13	*Artemisia cana*	8–78	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–39	–
	rose	ROSA5	*Rosa*	0–8	–
Tree					
9	**Trees**			0–8	
	plains cottonwood	PODEM	*Populus deltoides ssp. monilifera*	0–8	–
	Tree	2TREE	*Tree*	0–8	–

Animal community

Wildlife Interpretations:
MLRA 64 is in the drier areas of a northern mixed-grass prairie ecosystem in which sagebrush steppes to the west yield to grassland steppes to the east. Prior to European settlement, this ecosystem consisted of diverse grassland and shrubland habitats interspersed with varying densities of depressional, instream wetlands, and woody riparian corridors. These habitats provided critical life cycle components for many users. Many species of grassland birds, small mammals, reptiles, and amphibians and herds of roaming bison, elk, and pronghorn were among the inhabitants adapted to this semi-arid region. Roaming herbivores, as well as several species of small mammals and insect s, were the primary consumers linking the grassland resources to large predators, such as the wolf, mountain

lion, and grizzly bear, and to smaller carnivores, such as the coyote, bobcat, fox, and raptors. The prairie dog was once abundant and remains a keystone species within its range. The black-footed ferret, burrowing owl, ferruginous hawk, mountain plover, and swift fox are associated with prairie dog complexes.

Historically, the northern mixed-grass prairie was a disturbance-driven ecosystem in which fire, herbivory, and climate functioned as the primary disturbance factors, either singly or in combination. Following European settlement, livestock grazing, cropland conversion, elimination of fire, energy development, and other anthropogenic factors influenced species composition and abundance. Introduced and invasive species further affected plant and animal communities. The bison was a historical keystone species but has been extirpated in this area as a free-ranging herbivore. The loss of the bison and the reduction of prairie dog populations and fire as ecological drivers greatly influenced the character of the remaining native plant communities and altered wildlife habitats. Human development reduced habitat quality for area-sensitive species.

Within MLRA 64, the Badlands Terrace ecological site includes upland grassland cover with an associated forb and shrub component. It was typically part of an expansive grassland landscape that included combinations of Thin Breaks, Clayey, Claypan, Dense Clay, Loamy, Saline, Sandy, Shallow, Overflow, Subirrigated, and Overflow ecological sites.

Although this ecological site is primarily dominated by tall and medium warm- and cool-season grasses, it can support a shrub community composed of big sagebrush, silver sagebrush, rose, silver buffaloberry, and western snowberry. The presence or absence of this shrub component is an important factor influencing wildlife species composition.

Some areas of the site contain remnant stands of plains cottonwood and other trees. Multiple successional changes can occur as a result of stream channel aggradation and degradation. During periods of favorable climatic conditions in areas that are not significantly grazed, midgrass- and tallgrass-habitat provides denser cover and stabilizes the area along the stream channel. When present, seeps and springs provide vital water supply and localized wildlife habitat, especially for reptiles, amphibians, bats, and game species (both predators and prey).

This site provides habitat for mule deer and pronghorn antelope; grassland- and shrub-steppe-nesting birds; small mammals; mammalian predators; and a variety of reptiles, amphibians, and insects. Within the MLRA, this site provides important riparian habitat. The site also provides foraging and brood rearing habitat for upland game birds, such as the sharp-tailed grouse.

Little Bluestem-Prairie Sandreed-Wheatgrass (1.1)—This site is dominated by medium to tall warm- and cool-season grasses and has a shrub community that is generally dominated by big and silver sagebrush, rose, willow, western snowberry, and silver buffaloberry. The plant community favors grazers and mixed-feeders, such as mule deer and pronghorn antelope. As silver buffaloberry and other fruiting shrub increase in abundance, then species such as brown thrasher, Say’s phoebe, and loggerhead shrike may use this site. The complex diversity of plant structures provides habitat for a wide array of migratory and resident birds. Grasshopper sparrow, lark bunting, western meadowlark, and sharp-tailed grouse are common and benefit from the structure and composition of this plant community.

This site provides a diversity of grasses, forbs, and shrubs for small and large herbivores, including shrews, voles, mice, spotted ground squirrel, desert cottontail rabbit, white-tailed jackrabbit, black-tailed jackrabbit, mule deer, and antelope. Raptors, such as red-tailed hawk, ferruginous hawk, Swainson’s hawk, long-eared owl, and barn owl, may use this site. Insects, such as pollinators, play only a limited role in maintaining the forb community. They do, however, provide a significant forage base for birds and various bats, especially such species as the Western small-footed Myotis, the fringe-tailed Myotis, and the Townsend’s big-eared bat. Diverse prey populations are available for grassland raptors and mammalian predators, especially bobcat and mountain lion. Other mammalian predators using this plant community include the coyote, badger, spotted skunk, striped skunk, and to a lesser extent long-tailed weasel and least weasel.

This site provides foraging and brood rearing habitat for sharp-tailed grouse and fawning habitat for deer. The moderate stature of this plant community provides suitable thermal, protective and escape cover for small and large mammals. This plant community provides limited habitat for amphibians, mostly toads (i.e., Great Plains, Woodhouse’s, and Plains spade-foot). Prey abundance and shade opportunities may attract multiple reptile species such as gopher snake, milk snake, prairie rattlesnake, and western ornate box turtle along with lesser numbers of

various lizard species.

Prairie Sandreed-Little Bluestem-Inland Saltgrass (1.2)—Continuous season-long grazing results in the plant community becoming dominated by prairie sandreed and greater abundance of inland saltgrass. The mid-sized cool-season grass component is substantially reduced. However, the reduction of the cool-season mid-height grasses is offset by the increase in little bluestem. The increase in abundance of inland saltgrass does not appreciably change the wildlife community. Grassland nesting birds continue to use this site. Species favoring shorter grass, such as horned lark, lark bunting, and chestnut-collared longspur, increase in abundance. Fewer small mammals and large herbivores use the site. Raptor and mammalian predators continue to use the site. Sharp-tailed grouse may not fully use this site. The diversity and abundance of forbs increases, attracting pollinating insects and providing a forage source for birds and ungulates. Shrub diversity and abundance remain relatively unchanged. However, silver sagebrush and rose may increase in abundance, providing a substantial food source for numerous wildlife species, particularly sharp-tailed grouse, mule deer, and pronghorn antelope.

Inland Saltgrass-Wheatgrass/*Bare Ground* (2.1)—Heavy, continuous season-long grazing results in the plant community becoming dominated by inland saltgrass. The shift to medium cool-season grass and a higher incidence of inland salt grass does not significantly change the wildlife community. However, the decrease in forb diversity results in less use by pollinators and a decreased forage base for birds, bats, reptiles, amphibians, and small mammals. Use of this site by raptors and mammalian predators diminishes. Sharp-tailed grouse may not fully use the site. The diversity and abundance of shrubs remain relatively unchanged. However, silver sagebrush and rose may increase in abundance, providing a substantial food source for numerous wildlife species, particularly sharp-tailed grouse, mule deer, and pronghorn antelope.

Inland Saltgrass/Annuals/Pioneer Perennials (2.2)—This plant community develops under continuous season-long grazing of wheatgrass. The dominant vegetation includes inland saltgrass, pioneer annual grasses, forbs, invaders, and early successional biennial and perennial species. Plant species from adjacent ecological sites may become minor components of this plant community. The community is susceptible to invasion of annual bromegrasses, crested wheatgrass, and other nonnative species due to severe soil disturbances and relatively high percent of bare ground.

The hazard of soil erosion is high, impacting offsite aquatic habitats through increased runoff, nutrient, and sediment loads. Reduced surface cover, low plant density, low plant vigor, loss of root biomass, and soil compaction all contribute to decreased wildlife abundance and diversity.
Because secondary succession is highly variable, plant and wildlife species vary. This plant community provides habitat for generalist or early successional species.

Grazing Interpretations:
The following list suggests annual, initial stocking rates for average growing conditions. These estimates are conservative and should be used only as guidelines in the initial stages of conservation planning. Commonly, 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 estimates of carrying capacity 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. In consultation with the land manager, a more intensive grazing management program that results in improved harvest efficiencies and increased carrying capacity may be developed.

The following suggested initial stocking rates are based on 912 lb/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 or without calf, for one month.

Plant Community: Little Bluestem-Prairie Sandreed-Wheatgrass (1.1)
Average Production (lb/acre, air-dry): 2,100
Stocking Rate (AUM/acre): 0.58

Plant Community: Prairie Sandreed-Little Bluestem-Inland Saltgrass (1.2)
Average Production (lb/acre, air-dry): 1,800
Stocking Rate (AUM/acre): 0.49

*Plant Community: Inland Saltgrass-Wheatgrass/*Bare Ground* (2.1)
Average Production (lb/acre, air-dry): 1,000
Stocking Rate (AUM/acre): Variable

*Plant Community: Inland Saltgrass/Annuals/Pioneer Perennials (2.2)
Average Production (lb/acre, air-dry): 700
Stocking Rate (AUM/acre): Variable

Plant Community: All other plant communities identified in this document have variable annual production values and require onsite sampling to determine initial stocking rates.

* Total annual production and stocking rates are highly variable and require onsite sampling.

Total onsite annual production 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 for livestock. During the dormant period, the forage for livestock are likely lacking protein to meet livestock requirements. Added protein allows 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 herbage production on this site. The site is dominated by soils in hydrologic group B. Infiltration rate is moderate. Runoff potential for this site varies from moderate to high depending on soil hydrologic group, and ground cover. In many cases, areas that have greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An exception occurs where shortgrasses form a dense sod and dominate the site. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff. Refer to the USDA-NRCS National Engineering Handbook, Part 630, for hydrologic soil groups, runoff quantities, and hydrologic curves.)

Recreational uses

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

Wood products

No appreciable wood products are on this site.

Other products

Harvesting seeds of native plants can provide additional income on this site.

Other information

Revision Notes: “Previously Approved” Provisional
This Provisional ecological site description (ESD) has passed Quality Control (QC) and Quality Assurance (QA) to ensure the it meets the 2014 NESH standards for a Provisional ecological site description.

This ESD is an updated “Previously Approved” ESD that represented 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 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 may not contain all

tabular and narrative entries as required in the current “Approved” level of documentation, but it is expected that it will continue refinement toward an “Approved” status.

Site Development and Testing Plan
Future work, as described in an official project plan, is necessary to validate the information in this provisional ecological site description. The plan will include field activities for low-, medium-, and high-intensity sampling, soil correlations, and analysis of the data. Annual field reviews should be done by soil scientists and vegetation specialists. Final field review, peer review, quality control, and quality assurance reviews are required to produce the final document.

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: Stan Boltz, range management specialist (RMS), NRCS; Rick Peterson, RMS, NRCS; L Michael Stirling, RMS, NRCS; Kent Cooley, soil scientist, NRCS, and Wade Anderson, range professional/rancher.

Other references

Carey, Carol. 2004. Provided art work for State-and-Transition diagram.

Cleland, D.T., J.A. Freeouf, J.E. Keys, G.J. Nowacki, C.A. Carpenter, and W.H McNab. 2007. Ecological subregions: Sections and subsections of the conterminous United States. USDA Forest Service, General Technical Report WO-76D. https://www.fs.fed.us/research/publications/misc/73326-wo-gtr-76d-cleland2007.pdf (accessed 31 January 2019).

High Plains Regional Climate Center, University of Nebraska. 2018. http://www.hprcc.unl.edu/ (accessed 6 April 2018).

Steele, Ken, M.P. Fisher, and D.D. Steele. 2018. Fort Laramie and the Hartville Uplift. In: Geology of Wyoming. https://www.geowyo.com/fort-laramie--hartville-uplift.html (accessed 14 November 2018).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2018. Electronic field office technical guide. https://efotg.sc.egov.usda.gov (accessed 5 May 2018).

Soil Survey Staff. 2018a. Official soil series descriptions. USDA Natural Resources Conservation Service. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053587 (accessed 22 June 2018).

Soil Survey Staff. 2018b. Web Soil Survey. USDA Natural Resources Conservation Service. https://websoilsurvey.sc.egov.usda.gov/ (accessed 22 June 2018).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2003. National range and pasture handbook. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1043055.pdf (accessed 7 January 2018).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. Agriculture Handbook 296.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2012. National engineering handbook, part 630. Hydrology chapters from e-Directives. https://directives.sc.egov.usda.gov/viewerFS.aspx?hid=21422 (accessed 17 January 2018).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2013a. Climate data. National Water and Climate Center. http://www.wcc.nrcs.usda.gov/climate (accessed 30 May 2018).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2013b. National Soil Information System. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/geo/?cid=nrcs142p2_053552 (accessed 25 May 2018).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2017. National ecological site handbook, 1st edition. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcseprd1291232 (accessed 27 January 2018).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2018. The PLANTS database. National Plant Data Team, Greensboro, NC. http://plants.usda.gov (accessed 22 June 2018).

U.S. Environmental Protection Agency. 2018. EPA level III and level IV ecoregions of the conterminous United States. https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions-conterminous-united-states (accessed 26 April 2018).

Contributors

Rick L. Peterson
Stan C. Boltz

Approval

Suzanne Mayne-Kinney, 12/16/2024

Acknowledgments

This ecological site was reviewed and approved at the Provisional Level by David Kraft, Regional ESS, Salina, KS on 1/10/2019.

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 Faulkner, Emily Helms, John Hartung, Ryan Murray, George Gamblin, Rick Peterson, Nadine Bishop, Jeff Nichols
Contact for lead author	jeffrey.nichols@usda.gov
Date	12/12/2024
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** This site is a complex of stable and actively eroding areas. Rills will not be present in stable areas. Rills are common adjacent to areas of active erosion and found in conjunction with gullies (see indicator 5).

---

2. **Presence of water flow patterns:** Typically, none. When present, water flow patterns will be barely visible and discontinuous

---

3. **Number and height of erosional pedestals or terracettes:** None in the stable areas. Pedestals or terracettes will be evident in areas of active erosion.

---

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground ranges from 5 to 15 percent in stable areas. Bare ground patches are less than 3 inches (7.6 cm) in diameter.

---

5. **Number of gullies and erosion associated with gullies:** Gullies are common when there is active erosion within the landscape. Due to the high sodium content of the soils, sinkholes and/or natural piping can occur resulting in collapse of the soil structure and development of a headcut and gully. Significant alluvial deposition will occur in conjunction with the erosion, eventually reaching an equilibrium and stabilization.

---

6. **Extent of wind scoured, blowouts and/or depositional areas:** None. Wind scoured areas and areas of deposits from wind are not expected.

---

7. **Amount of litter movement (describe size and distance expected to travel):** Typically, none. Litter should fall in place. Slight amount of movement of the smallest size class litter is possible. Small woody debris should not move. Fine litter may move up to 12 inches. Numerous debris dams or vegetative barriers may be present.

---

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil stability ratings should typically be 3 to 4.

---

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should be 2 to 4 inches (5-10.25 cm) thick. Soil color is light gray when dry (values of 5 to 8) and brown when moist (values of 4-7). Structure typically is weak very thin platy structure in the A-horizon. Organic matter is typically very low in these soils.

---

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 and tall rhizomatous and tufted perennial cool season grasses) with fine and coarse roots positively influences infiltration.

    Relative composition is approximately 85 percent grasses or grass-like plants, 5 percent forbs, and 10 percent shrubs. The grass and grass-like component is composed of C3, rhizomatous grasses (10-30%), C4, mid-grasses (10-30%), C4, tall grasses (10-25%), C3, bunch grasses (5-15%), C4, short grasses (0-10%), and grass-likes (0-5%).

---

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. Compaction layers are not expected on this site. When dry, A-horizons can appear to be compacted as platy structure is common.

---

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: Phase 1.1
    1.Native, perennial, C3, rhizomatous grass, 210-630 #/ac, 10-30% (2 species minimum): western wheatgrass, thickspike wheatgrass.
    2. Native, perennial, C4, midgrass, 210-630 #/ac, 10-30% (two species minimum): little bluestem, sideoats grama, plains muhly.
    3. Native, perennial, C4, tallgrass, 210-525 #/ac, 10-25% (1 species minimum): big bluestem, prairie sandreed, switchgrass.

    Phase 1.2
    1. Native, perennial, C4, midgrass, 270-630 #/ac, 15-35% (two species minimum): little bluestem, sideoats grama, plains muhly, sand dropseed.
    2. Native, perennial, C4, tallgrass, 270-630 #/ac, 15-35% (1 species minimum): prairie sandreed.

    Sub-dominant: Phase 1.1
    1. Native, perennial, C3, bunchgrass, 105-210, 5-15% (2 species minimum) : green needlegrass, needle and thread, prairie Junegrass, Sandberg bluegrass.

    Phase 1.2
    1.Native, perennial, C3, rhizomatous grass, 90-270 #/ac, 5-15% (2 species minimum): western wheatgrass, thickspike wheatgrass.

    Other: Minor - Phase 1.1
    1. Shrubs, 42-210 #/ac, 2-10%: shrubs present will vary from location to location.
    2. Native, perennial, C4, shortgrass, 21-210 #/ac, 1-10%: blue grama, buffalograss, hairy grama, saltgrass.
    3. Native forbs , 21-105 #/ac 1-5%: forbs present will vary from location to location.
    4. Grass-likes, 0-105 #/ac, 0-5%: sedges.

    Minor - Phase 1.2
    1. Native, perennial, C3, bunchgrass, 90-180, 5-10%: green needlegrass, needle and thread, prairie Junegrass,

Sandberg bluegrass.
2. Shrubs, 26-180 #/ac, 2-10%: shrubs present will vary from location to location.
3. Native forbs , 90-180 #/ac, 5-10%: Forbs present vary from location to location.
4. Native, perennial, C4, shortgrass, 36-180 #/ac, 2-10%: blue grama, buffalograss, hairy grama, saltgrass, threeawn.
5. Grass-likes, 0-53 #/ac, 0-5%: sedges.
6. Non-native, annual, C3 grass, 18-54 #/ac, 1-3%: cheatgrass, field brome.

Trace - Phase 1.1
1. Deciduous trees, 0-21 #/ac, 0-1%: plains cottonwood.

Trace - Phase 1.2
1. Deciduous trees, 0-18 #/ac, 0-1%: plains cottonwood.

Additional: The Little Bluestem-Prairie Sandreed-Wheatgrass or Reference Community (1.1) consists of nine F/S groups. These groups, in order of relative abundance, are native, perennial, C3 rhizomatous grass; native, perennial, C4 midgrass; native, perennial, C4, tallgrass; native, perennial, C3, bunchgrass; native, perennial, C4 shortgrass; shrubs; native forbs; grass-likes; and trees.

The Prairie Sandreed-Little Bluestem-Inland Saltgrass Community (1.2) includes ten F/S groups. These groups are native, perennial, C4, midgrass; native, perennial, C4, tallgrass; native, perennial, C3, rhizomatous grass; native, perennial, C3, bunchgrass; shrubs; native forbs; native, perennial, C4, shortgrass; grass-likes; non-native, annual, C3 grass; and deciduous trees.

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Bunchgrasses have strong, healthy centers with few (less than 3 percent) dead centers. Shrubs may show some dead branches (less than 5 percent) as plants age.

---

14. **Average percent litter cover (%) and depth (in):** Litter cover is typically 50 to 70 percent, with the depth approximately 0.25 to 0.50 inch (0.65-1.3 cm).

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** The representative value (RV) for annual production is 2,100 pounds per acre on an air dry basis. Low and high production years should yield 1,600 and 2,600 pounds per acre respectively.

---

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:** No non-native invasive species are present. Annual bromes, Kentucky bluegrass, crested wheatgrass, and eastern red cedar are known invasives that have the potential to become dominant or co-dominant on this site. Consult the state noxious weed and state watch lists for potential invasive species. Note: species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants.

---

17. **Perennial plant reproductive capability:** All perennial species exhibit high vigor relative to recent weather conditions.

Perennial grasses should have vigorous rhizomes or tillers; vegetative and reproductive structures are not stunted. All perennial species should be capable of reproducing annually.
