USDA Natural Resources Conservation Service

Ecological site R064XY112WY
Gravelly Hartville Uplift

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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.

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 consists of 11,895 square miles. The towns of Kadoka and Pine Ridge, South Dakota; Chadron and Alliance, 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 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 17 inch precipitation zone of MLRA 64, three unique ecological site descriptions were developed to describe the soils and plant community dynamics 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—331Fh.
Pine Ridge Escarpment—331Fj.
High Plains—331Fk.
Hartville Uplift—331Fm.
Western Nebraska Sandy and Silty Tablelands—331Fn.
Keye Paha Tablelands—331Ft.
Powder River Basin Section—331G:
Subsection: Powder River Basin—331Ge.

Ecological site concept

The Gravelly HU ecological site is in the Hartville Uplift (HU) area of southeast Wyoming. The site is typically on late Pleistocene or early Holocene terraces, benches, and hillslopes. Slopes range from 0 to 60 percent. The soils formed in alluvium and colluvium derived from sedimentary, metamorphic, and igneous rock. Soils are greater than 20 inches in depth. The surface layer is sandy loam to very gravelly sandy loam and is up to 10 inches thick. The subsurface layers are typically skeletal and include up to 60 percent coarse gravel, pebbles, cobbles, and stone. Some soils can be highly calcareous to the surface. This site does not receive additional moisture from run off or overflow.

Vegetation of this ecological site consists of a mix of cool- and warm-season grasses. Little bluestem, sideoats grama, and blue grama are the dominant warm-season grasses. Cool-season grasses and grass-like species include needle and thread, bluebunch wheatgrass, and threadleaf sedge. Forbs are common and diverse. Yucca is present at almost all locations.

Associated sites

R064XY011NE	**Sandy 14-17" PZ** The Sandy 14-17” PZ ecological site is on less sloping landscapes adjacent to or downslope from the Gravelly HU site.
GX064X01X015	**Loamy 14-17" PZ** The Loamy 14-17” PZ ecological site is on less sloping landscapes adjacent to or downslope from the Gravelly HU site.

Similar sites

R064XY037NE	**Thin Upland** The Thin Upland ecological site is in landscape positions similar to those of the Gravelly HU site, but the soils are not as skeletal. The plant community has more little bluestem, less yucca, and higher forage production than the Gravelly HU site.
R064XY162WY	**Shallow Hartville Uplift** The Shallow HU ecological site is in landscape positions similar to those of the Gravelly HU site, but the soils are less than 20 inches deep and contain fewer rocks. The plant community has less little bluestem and considerably less forage production than the Gravelly HU site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Yucca glauca*
Herbaceous	(1) *Schizachyrium scoparium* (2) *Hesperostipa comata ssp. comata*

Physiographic features

The Gravelly HU site is on nearly level terraces and benches and on steeply sloping hillslopes.

Table 2. Representative physiographic features

Landforms	(1) Upland > Terrace (2) Upland > Bench (3) Upland > Hillslope
Runoff class	Low to high
Flooding frequency	None
Ponding frequency	None
Elevation	1,372–1,554 m
Slope	0–60%
Water table depth	203 cm
Aspect	Aspect is not a significant factor

Climatic features

►Climate 14-17” Hartville Uplift◄
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 17 inches per year. The normal average annual temperature is about 46 °F. January is the coldest month with average temperatures ranging from about 24 °F (Lusk 2 SW, WY) to about 26 °F (Hemingford, NE). July is the warmest month with average temperatures ranging from about 69 °F (Lusk 2 SW, WY) to about 73 °F (Hemingford, NE). The range of normal average monthly temperatures between the coldest and warmest months is about 50 °F. This large annual range attests to the continental nature of the

climate of this area. Wind speeds are estimated to average about 11 miles per hour annually, ranging from about 13 miles per hour during the spring to about 10 miles per hour during the summer. Daytime winds 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. Growth of warm-season plants begins about mid-May and continues 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)	85 days
Freeze-free period (characteristic range)	108-114 days
Precipitation total (characteristic range)	356-432 mm
Frost-free period (actual range)	85 days
Freeze-free period (actual range)	107-116 days
Precipitation total (actual range)	356-432 mm
Frost-free period (average)	85 days
Freeze-free period (average)	111 days
Precipitation total (average)	381 mm

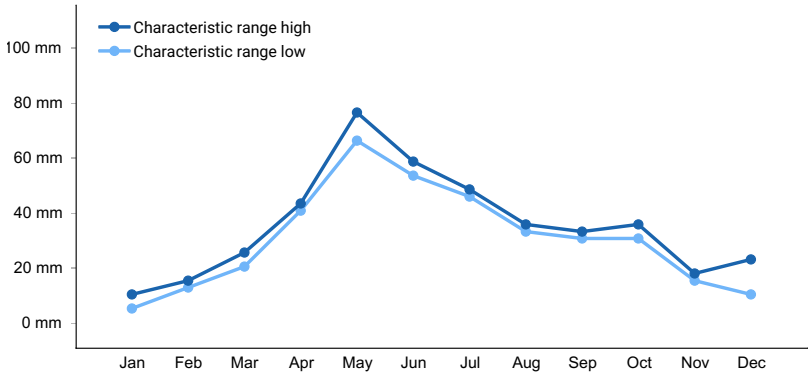


Figure 1. Monthly precipitation range

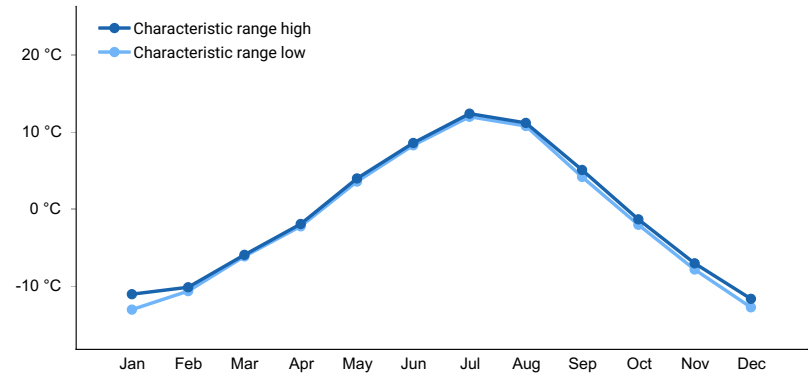


Figure 2. Monthly minimum temperature range

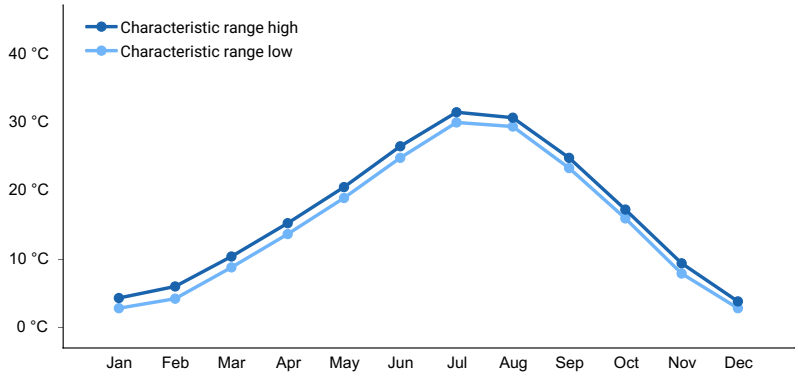


Figure 3. Monthly maximum temperature range

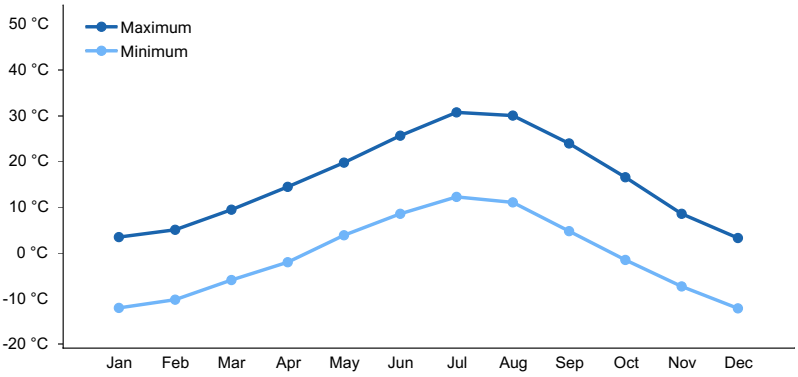


Figure 4. Monthly average minimum and maximum temperature

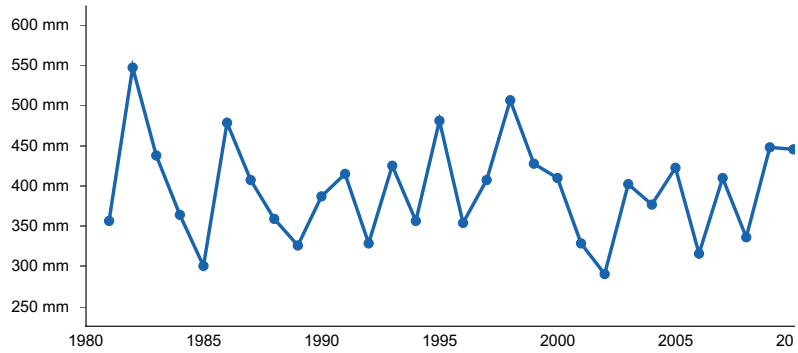


Figure 5. Annual precipitation pattern

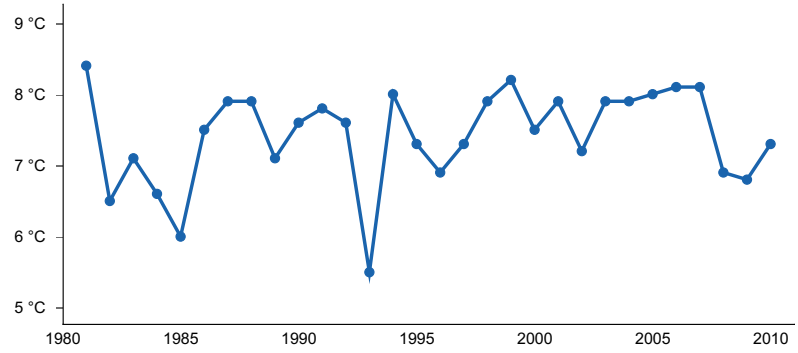


Figure 6. Annual average temperature pattern

Climate stations used

- (1) GLENDO 6NE [USC00483936], Glendo, WY
- (2) LUSK 2 SW [USC00485830], Lusk, WY
- (3) OLD FT LARAMIE [USC00486852], Yoder, WY

Influencing water features

No riparian or wetland features are directly associated with the Gravelly HU ecological site.

Soil features

The soils are commonly sandy loam to very gravelly sandy loam having slopes of 0 to 60 percent. The soils are deep (greater than 20 inches in depth) and are well drained or somewhat excessively drained. They formed in alluvium and colluvium derived from sedimentary, metamorphic, and igneous rock. The surface layer is 0 to 10 inches thick and has a rapid infiltration rate. These soils can be calcareous to the surface; however, carbonates are not always distinguishable in the surface layer. The subsurface layers are typically skeletal and include up to 60 percent coarse gravel, pebbles, cobbles, and stone. The subsoil ranges from very gravelly sandy loam to very cobbly sandy loam.

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 with numerous debris dams or vegetative barriers. The soil surface is stable and intact. Subsurface soil layers do not restrict water movement or root penetration.

Major Soils Correlated to the Gravelly Ecological Site in the Hartville Uplift: Brownrigg, Cascajo, Dix, Nidix, and Willowman.

Water erosion is the main hazard affecting the soils. Low available water capacity caused by the large amount of gravelly and stone in the rooting zone strongly influences the soil-water-plant relationship.

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.

Table 4. Representative soil features

Parent material	(1) Alluvium–igneous, metamorphic and sedimentary rock (2) Colluvium–igneous, metamorphic and sedimentary rock
Surface texture	(1) Loam (2) Very fine sandy loam (3) Sandy loam (4) Very gravelly sandy loam
Family particle size	(1) Loamy-skeletal
Drainage class	Well drained to excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	51–152 cm
Surface fragment cover <=3"	15–40%
Surface fragment cover >3"	5–15%
Available water capacity (0-101.6cm)	2.54–10.92 cm
Calcium carbonate equivalent (0-101.6cm)	10–40%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–3
Soil reaction (1:1 water) (0-101.6cm)	6.6–8.4
Subsurface fragment volume <=3" (0-101.6cm)	15–40%

Subsurface fragment volume >3" (0-101.6cm)	0–30%

Ecological dynamics

The Gravelly HU ecological site developed under Northern Great Plains climatic conditions; light to severe grazing by bison and other large herbivores; sporadic, natural or human-caused wildfire (often of light intensities); and other biotic and abiotic factors that typically influence soil and site development. Changes occur in the plant communities due to short-term weather variations, effects of native and exotic plant and animal species, and management actions. Although the following plant community descriptions are typical of the transitions between communities, severe disturbances, such as periods of well below average precipitation and the introduction of non-native cool-season grasses, can cause significant shifts in plant communities and species composition.

On the Hartville Uplift, the Gravelly ecological site tends to be very droughty due to the large amount of rock in the soil profile. The moisture received by the soil is readily available for plant growth. The soil, however, tends to dry out very quickly as the local weather pattern becomes drier, which happens later in the year.

This site is susceptible to invasion by non-native, annual, cool-season grasses if the extent of bare ground is increased by management or extended periods of drought. Currently, annual brome grasses are not sufficiently dominant to drive the plant community dynamics.

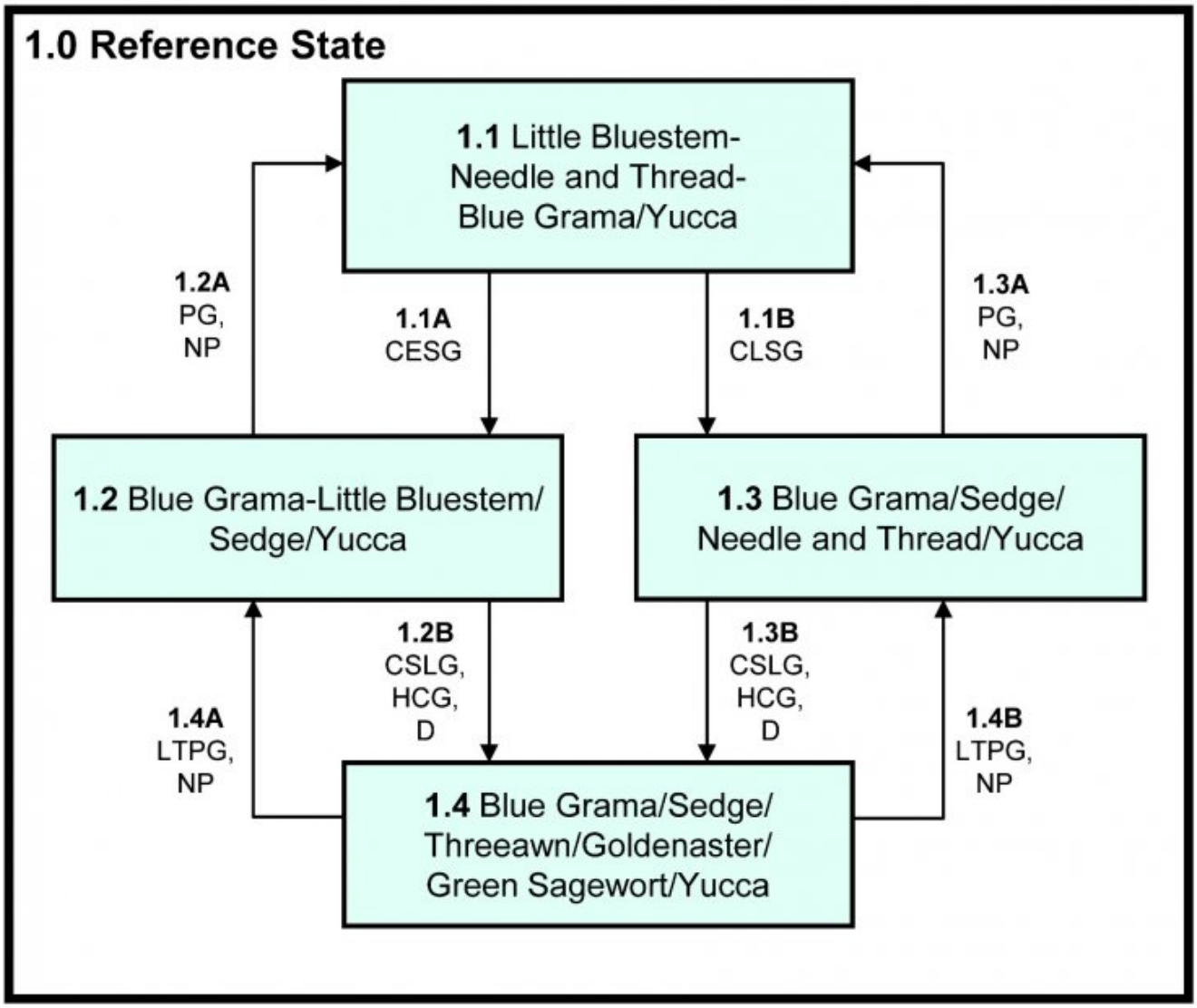
Continuous season-long grazing (during the typical growing season of May through October) or repeated seasonal grazing (e.g., every spring, every summer) without adequate recovery periods following each grazing occurrence causes this site to depart from the Little Bluestem-Needle and Thread-Blue Grama/Yucca Plant Community (1.1).

Interpretations are primarily based on the Little Bluestem-Needle and Thread-Blue Grama/Yucca Plant Community (1.1). The community was determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Also studied were trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts. 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 the communities. The ecological processes are discussed in more detail in the plant community descriptions following the diagram.

State and transition model

Gravelly HU – R064XY112WY 12/27/18



CESG – Continuous early seasonal grazing (spring)
CLSG – Continuous late seasonal grazing (summer)
CSLG – Continuous season-long grazing
D – Drought
HCG – Heavy continuous grazing
LTPG – Long-term prescribed grazing
NP – Return to normal precipitation patterns
PG – Prescribed grazing

Diagram Legend: Gravelly HU - R064XY112WY

1.1A	1.1 to 1.2	Continuous early-season grazing (from green-up through spring) without change in season of use.
1.1B	1.1 to 1.3	Continuous late-season grazing (during summer) without change in season of use.
1.2A	1.2 to 1.1	Prescribed grazing that includes proper stocking rates, change in season of use, and adequate time for rest and recovery following grazing; and a return to normal precipitation patterns.
1.2B	1.2 to 1.4	Continuous season-long grazing that does not allow adequate time for rest and recovery following grazing; or heavy continuous grazing in combination with drought.
1.3A	1.3 to 1.1	Prescribed grazing that includes proper stocking rates, change in season of use, and adequate time for rest and recovery following grazing; and a return to normal precipitation patterns.
1.3B	1.3 to 1.4	Continuous season-long grazing that does not allow adequate time for rest and recovery following grazing; or heavy continuous grazing in combination with drought.
1.4A	1.4 to 1.2	Long-term prescribed grazing that includes proper stocking rates, change in season of use, and adequate time for rest and recovery following grazing; and a return to normal precipitation patterns. Extended periods of non-use may also be needed.
1.4B	1.4 to 1.3	Long-term prescribed grazing that includes proper stocking rates, change in season of use, and adequate time for rest and recovery following grazing; and a return to normal precipitation patterns. Extended periods of non-use may also be needed.

State 1
Reference State

The Reference State (1.0) represents the best estimate of the natural range of variability that dominated the dynamics of the Gravelly HU ecological site prior to European settlement. This site, in the Reference State, is dominated by warm-season grasses, cool-season grass, and grass-like species. Forbs are common and diverse. Shrubs species vary depending on precipitation and slope aspect, but yucca is present in almost all locations. Ponderosa pine and Rocky Mountain juniper may occur in limited numbers on this site. Grazing and drought are the major drivers between plant communities.

Dominant plant species

- little bluestem (*Schizachyrium scoparium*), grass
- needle and thread (*Hesperostipa comata ssp. comata*), grass
- blue grama (*Bouteloua gracilis*), grass
- threadleaf sedge (*Carex filifolia*), grass
- hairy grama (*Bouteloua hirsuta*), grass
- plains muhly (*Muhlenbergia cuspidata*), grass
- wheatgrass (*Agropyron*), grass
- dotted blazing star (*Liatris punctata*), other herbaceous
- hairy false goldenaster (*Heterotheca villosa*), other herbaceous
- phlox (*Phlox*), other herbaceous
- groundsel (*Roldana*), other herbaceous
- purple prairie clover (*Dalea purpurea*), other herbaceous
- yucca (*Yucca*), other herbaceous

Community 1.1
Little Bluestem-Needle and Thread-Blue Grama/Yucca

Figure 7. Gravelly HU, Community 1.1, Platte Co., Wyoming

Figure 8. Gravelly HU, Community 1.1, Platte Co., Wyoming

Interpretations are based primarily on the Little Bluestem-Needle and Thread-Blue Grama/Yucca Plant Community. This is also considered to be the Reference Plant Community (1.1). This plant community is in areas that are properly managed for grazing and receive occasional short periods of rest. The potential vegetation is about 80 percent grasses or grass-like plants, 15 percent forbs, and 5 percent shrubs and trees. A mixture of cool- and warm-season grasses dominates the site. The major grasses and grass-like plants include little bluestem, needle and thread, blue grama, and threadleaf sedge. Other grasses include hairy grama, plains muhly, and wheatgrass. Significant forbs include dotted gayfeather, hairy goldenaster, phlox, groundsel, and purple prairie clover. The dominant shrub in this plant community is yucca. A few areas have a ponderosa pine or Rocky Mountain juniper. This plant community is extremely resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for moderate to high drought tolerance. Community dynamics, nutrient cycle, water cycle, and energy flow function properly. Plant litter is properly distributed with very little movement off-site. Natural plant mortality is very low.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	426	528	622
Forb	95	118	140
Shrub/Vine	11	24	39
Tree	–	3	11
Total	**532**	**673**	**812**

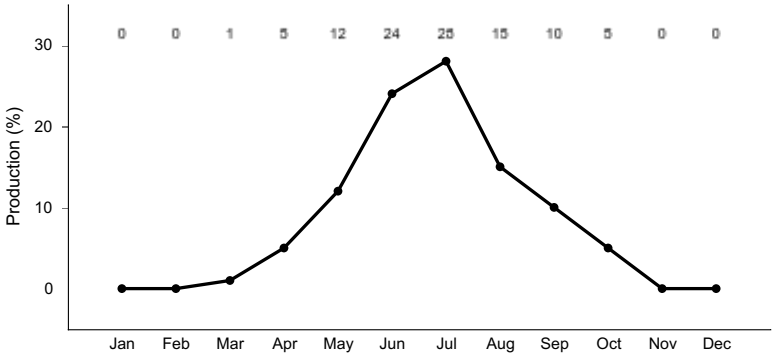


Figure 10. Plant community growth curve (percent production by month). WY6404, Pine Ridge/Badlands, warm-season dominant, cool-season subdominant. Hartville Uplift, warm-season dominant, cool-season subdominant.

Community 1.2
Blue Grama-Little Bluestem/Sedge/Yucca

This plant community evolved under long-term, continuous, early-season grazing from early green-up through the spring growing season. As a result, the extent of cool-season bunch grasses and wheatgrasses is less than in the reference community and the extent of warm-season grasses is greater. The potential vegetation is about 85 percent grasses or grass-like plants, 10 percent forbs, and 5 percent shrubs and trees. Warm-season grasses dominate the site. Blue grama and little bluestem are significant species in this plant community. Needle and thread and wheatgrasses are decreased in extent, and short grasses and grass-like plants, such as blue grama, hairy grama, and sedge, are increased. Commonly forbs in this plant community include hairy goldenaster, phlox, and groundsel. The extent of yucca is the same or higher than in the reference community. Plant community 1.2 is moderately resistant to change. The herbaceous species 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 except to long-term disturbance. The diversity in plant species allows for moderate drought tolerance.

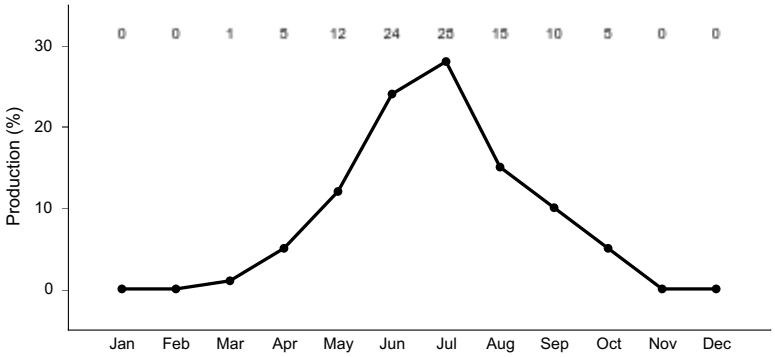


Figure 11. Plant community growth curve (percent production by month). WY6404, Pine Ridge/Badlands, warm-season dominant, cool-season subdominant. Hartville Uplift, warm-season dominant, cool-season subdominant.

Community 1.3
Grama/Sedge/Needle and Thread/Yucca

This plant community evolved under long-term continuous late-season grazing during the late spring and summer growing season. As a result, the extent of warm-season bunch grasses is decreased and the extent of short, warm-season grasses is increased. The potential vegetation is about 85 percent grasses or grass-like plants, 10 percent forbs, and 5 percent shrubs and trees. Warm-season grasses dominate the site. Blue grama and threadleaf sedge are significant species in this plant community. Needle and thread and wheatgrasses persist in the plant community. The short grasses and grass-like plants are increased in extent compared to the reference community. Common forbs in this plant community include hairy goldenaster, phlox, green sagewort, and groundsel. The extent of yucca remains the same or increases slightly. This plant community is moderately resistant to change. The herbaceous species 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 except to long-term disturbance. The diversity in plant

species allows for moderate drought tolerance.

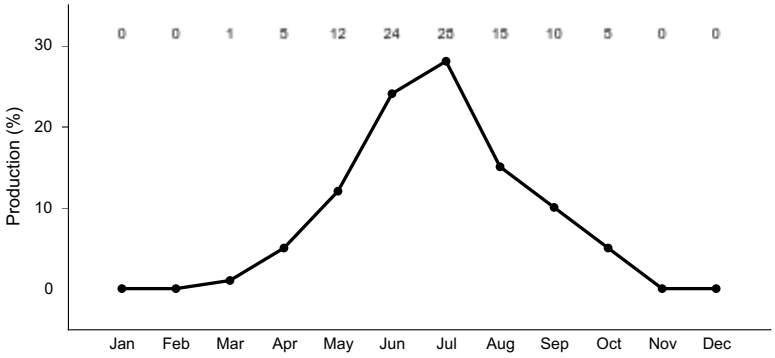


Figure 12. Plant community growth curve (percent production by month). WY6404, Pine Ridge/Badlands, warm-season dominant, cool-season subdominant. Hartville Uplift, warm-season dominant, cool-season subdominant.

Community 1.4
Blue Grama/Sedge/Threeawn/Goldenaster/Green Sagewort/Yucca

This plant community evolves from continuous season-long grazing or from heavy continuous grazing in combination with drought. Shortgrasses and grass-like species are dominant in the plant community. The grazing tolerant blue grama and hairy grama and sedges replace, for the most part, little bluestem, needle and thread, and wheatgrasses. Because of grazing pressure, threeawn, green sagewort, broom snakeweed, goldenaster, and weedy annuals are prevalent in plant community 1.4. Non-native species, such as cheatgrass, can potentially invade this plant community. This plant community is typically resistant to change. Runoff is increased, and infiltration is decreased. Continued overuse results in considerable bare ground and high erosion potential. Some species compositions are not drought tolerant.

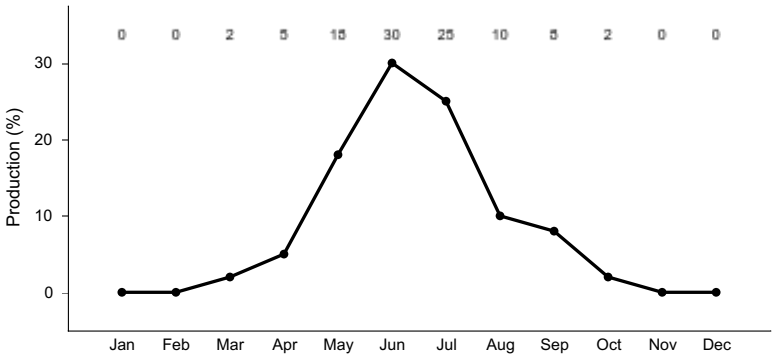


Figure 13. Plant community growth curve (percent production by month). WY6403, Pine Ridge/Badlands, cool-season/warm-season codominant. Hartville Uplift - Cool-season/warm-season codominant.

Pathway 1.1A
Community 1.1 to 1.2

Continuous early-season grazing (from early green-up through spring) without change in season of use converts plant community 1.1 to the Blue Grama-Little Bluestem/Sedge/Yucca Plant Community (1.2).

Pathway 1.1B
Community 1.1 to 1.3

Continuous late-season (summer) grazing without change in season of use converts plant community 1.1 to the Blue Grama/Sedge/Needle and Thread/Yucca Plant Community (1.3).

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing that includes proper stocking rates, change in season of use, and adequate time for plant recovery following grazing in combination with a return to normal precipitation patterns convert plant community 1.2 to the Little Bluestem-Needle and Thread-Blue Grama/Yucca Plant Community (1.1).

Conservation practices

Prescribed Grazing

Pathway 1.2B
Community 1.2 to 1.4

Continuous season-long grazing without change in season of use or adequate time for plant recovery following grazing; or heavy, continuous grazing in combination with drought convert plant community 1.2 to the Blue Grama/Sedge/Threeawn/Goldenaster/Green Sagewort/Yucca Plant Community (1.4).

Pathway 1.3A
Community 1.3 to 1.1

Prescribed grazing that includes proper stocking rates, change in season of use, and adequate time for plant recovery following grazing; and a return to normal precipitation patterns convert plant community 1.3 to the Little Bluestem-Needle and Thread-Blue Grama/Yucca Plant Community (1.1).

Conservation practices

Prescribed Grazing

Pathway 1.3B
Community 1.3 to 1.4

Continuous season-long grazing without change in season of use or adequate time for plant recovery following grazing; or heavy continuous grazing in combination with drought convert plant community 1.3 to the Blue Grama/Sedge/Threeawn/Goldenaster/Green Sagewort/Yucca Plant Community (1.4).

Pathway 1.4A
Community 1.4 to 1.2

Long-term prescribed grazing that includes proper stocking rates, change in season of use, and adequate time for plant recovery following grazing; and a return to normal precipitation patterns convert plant community 1.4 to the Blue Grama-Little Bluestem/Sedge/Yucca Plant Community (1.2). Extended periods of non-use may also be needed to achieve recovery.

Conservation practices

Prescribed Grazing

Pathway 1.4B
Community 1.4 to 1.3

Long-term prescribed grazing that includes proper stocking rates, change in season of use, and adequate time for plant recovery following grazing; and a return to normal precipitation patterns convert plant community 1.4 to the Blue Grama/Sedge/Needle and Thread/Yucca Plant Community (1.3). Extended periods of non-use may also be needed to achieve recovery.

Conservation practices

Prescribed Grazing

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall & Mid Warm-Season Grasses**			202–303	
	little bluestem	SCSC	*Schizachyrium scoparium*	168–235	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	34–67	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–34	–
2	**Cool-Season Rhizomatous Grasses**			54–135	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	34–67	–
	western wheatgrass	PASM	*Pascopyrum smithii*	13–67	–
3	**Cool-Season Bunchgrasses**			67–135	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	67–101	–
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	0–34	–
4	**Short- Warm-Season Grasses**			67–101	
	blue grama	BOGR2	*Bouteloua gracilis*	67–101	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–34	–
5	**Other Native Grasses & Grass-Likes**			67–135	
	threadleaf sedge	CAFI	*Carex filifolia*	34–67	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	7–34	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–34	–
	Fendler threeawn	ARPUL	*Aristida purpurea var. longiseta*	7–34	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	7–34	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	7–34	–
	sedge	CAREX	*Carex*	0–34	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–13	–
6	**Non-Native Cool-Season Grasses**			–	
	cheatgrass	BRTE	*Bromus tectorum*	–	–
	field brome	BRAR5	*Bromus arvensis*	–	–
	crested wheatgrass	AGCR	*Agropyron cristatum*	–	–
Forb					
7	**Forbs**			101–135	
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	7–34	–
	ragwort	SENEC	*Senecio*	7–34	–
	spiny phlox	PHHO	*Phlox hoodii*	7–34	–
	Forb, perennial	2FP	*Forb, perennial*	0–34	–
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–13	–
	lemon scurfpea	PSLA3	*Psoralidium lanceolatum*	7–13	–
	dotted blazing star	LIPU	*Liatris punctata*	7–13	–
	field sagewort	ARCA12	*Artemisia campestris*	0–13	–
	pussytoes	ANTEN	*Antennaria*	7–13	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	7–13	–

	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	7–13	–
	primrose	PRIMU	*Primula*	0–13	–
	milkvetch	ASTRA	*Astragalus*	0–13	–
	beardtongue	PENST	*Penstemon*	7–13	–
	sandwort	ARENA	*Arenaria*	7–13	–
	buckwheat	ERIOG	*Eriogonum*	0–13	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–13	–
	stiff greenthread	THFI	*Thelesperma filifolium*	0–7	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–7	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–7	–
Shrub/Vine					
8	**Shrubs**			13–34	
	black sagebrush	ARNO4	*Artemisia nova*	0–34	–
	soapweed yucca	YUGL	*Yucca glauca*	7–34	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–34	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–13	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–13	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–13	–
Tree					
9	**Trees**			0–7	
	ponderosa pine	PIPO	*Pinus ponderosa*	0–7	–
	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	0–7	–

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 MLRA 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 insects, 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, species composition and abundance were influenced by livestock grazing, cropland conversion, elimination of fire, energy development, and other anthropogenic factors. 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 Gravelly HU ecological site provides upland grassland cover with an associated forb and shrub component. The site was typically part of an expansive grassland landscape that included combinations of Badlands, Thin Breaks, Clayey, Claypan, Dense Clay, Loamy, Saline, Sandy, Overflow, Subirrigated, and Terrace ecological sites.

The Gravelly HU ecological site provided habitat for species requiring unfragmented grassland. Important habitat features and components that are commonly or exclusively on this site include leks for sharp-tailed grouse; upland nesting habitat for grassland birds; forbs and insects for brood habitat; and a forage source for small and large herbivores. Many grassland and shrub steppe nesting bird populations are declining. Extirpated species include free-ranging American bison, grizzly bear, gray wolf, black-footed ferret, mountain plover, Rocky Mountain locust, and swift fox.

The majority of the Gravelly HU ecological site remains intact and provides increasingly important habitat for grassland and shrub steppe nesting birds, small rodents, coyote, and a variety of reptiles, amphibians, and insects. Invasive species, such as cheatgrass and field brome, have impacted the biological integrity of the site for some grassland birds. Changes in historic fire regime and domestic grazing have impacted the relative extent of forbs, shrubs, and grasses.

Little Bluestem-Needle and Thread-Blue Grama/Yucca (1.1).—The predominance of grasses in this community favors herbivores. Insects, including pollinators, play a role in maintaining the forb community and provide a forage base for grassland birds and other species. The structural diversity of plant populations provides habitat for a wide array of migratory and resident birds. Grasshopper sparrow, chestnut-collared longspur, Sprague's pipit, horned lark, lark bunting, and sharp-tailed grouse are common and benefit from the structure and composition this plant community provides. Diverse prey populations are available for grassland raptors, such as ferruginous hawk, Swainson's hawk, golden eagle, and prairie falcon.

The diversity of grasses, grass-like plants, and forbs provides high nutrition levels for small and large herbivores, including voles, mice, spotted ground squirrel, white-tailed jackrabbit, black-tailed jackrabbit, deer, and pronghorn. This plant community provides habitat for amphibians and reptiles, such as the gopher snake, milk snake, and prairie rattlesnake.

►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-Needle and Thread-Blue Grama/Yucca Plant Community (1.1)
Average Production (lb/acre, air-dry): 600
Stocking Rate (AUM/acre): 0.16

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 likely has insufficient 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 groups B and C. Localized areas are in hydrological group D. Infiltration varies from moderately slow to moderate and runoff varies from low to high depending on slope and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An exception would be where short grasses form a 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 opportunities for hunting upland game species. The wide variety of plants which bloom from spring until fall have an aesthetic value that appeals to visitors.

Wood products

No appreciable wood products are present on this site.

Other products

Harvesting the 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 standards in the 2014 National Ecological Site Handbook 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 was 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; George Gamblin, RMS, NRCS; Rick Peterson, RMS, NRCS; and Kent Cooley, conservation soil scientist, NRCS.

Other references

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).

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.
High Plains Regional Climate Center, University of Nebraska. 2018. http://www.hprcc.unl.edu/ (accessed 6 April 2018).

Soil Survey Staff. 2018. Official soil series descriptions. USDA Natural Resources Conservation Service. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053587 (accessed 20 December 2018).

Soil Survey Staff. 2018. Web Soil Survey. USDA Natural Resources Conservation Service. https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx (accessed 20 December 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. 1997. National range and pasture handbook, rev. 1, 2003. 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. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_050898.pdf (accessed 17 January 2018).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2007. National engineering handbook, part 654. Rosgen Stream Classification Technique – Supplemental Materials, Technical Supplement 3E. https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17833.wba (accessed 4 March 2019).

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. 2014. National ecological site handbook, 1st Ed. 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. Climate data. National Water and Climate Center. http://www.wcc.nrcs.usda.gov/ (accessed 20 December 2018).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2018. Electronic field office technical guide. https://efotg.sc.egov.usda.gov (accessed 20 December 2018).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2018. National Soil Information System, Information Technology Center. http://nasis.nrcs.usda.gov (accessed 25 May 2018).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2018. PLANTS database. National Plant Data Team, Greensboro, NC. http://plants.usda.gov (accessed 27 December 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).

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Acknowledgments

This provisional ecological site description was updated by Rick L. Peterson and George Gamblin on December 27, 2018.

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)	
Contact for lead author	
Date	05/13/2025
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

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

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

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

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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

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:

    Sub-dominant:

    Other:

Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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:**

17. **Perennial plant reproductive capability:**