USDA Natural Resources Conservation Service

Ecological site R067AY146WY
Sands (Sa)

Last updated: 12/10/2024
Accessed: 05/12/2025

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.

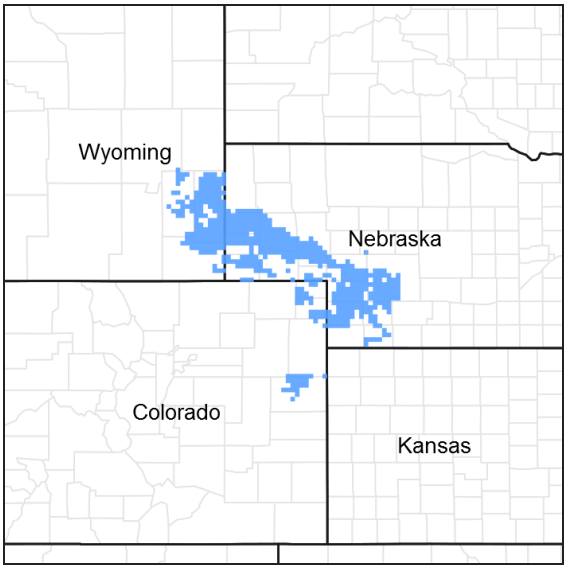


Figure 1. Mapped extent

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): 067A–Central High Plains, Northern Part

MLRA 67A-Central High Plains, Northern Part is located in southeastern Wyoming (58 percent), the southwestern portion of the Nebraska panhandle (38 percent), and extreme northeastern Colorado (4 percent). It is comprised of rolling plains, upland breaks, and river valleys. The major rivers are the North Platte and Laramie. The headwaters of these systems are in the Rocky Mountains. Other tributaries include Crow, Horse, and Lodgepole Creeks. This MLRA is traversed by Interstate 25 and Interstate 80, and by U.S. Highways 26, 30 and 85. Major land uses include rangeland (71 percent), cropland (21 percent), pasture and hayland (1 percent), urban (3 percent), and miscellaneous (4 percent). Cities in this area include Cheyenne, Torrington, and Wheatland, WY; and Kimball, Oshkosh, and Scottsbluff, NE. Land ownership is mostly private. Areas of interest include Scotts Bluff National Monument, Chimney Rock and Fort Laramie National Historic Sites; Hawk Springs, Lake Minatare, and Wildcat Hills State Recreation Areas; Ash Hollow and Guernsey State Parks.

The elevations in MLRA 67A range from approximately 3,300 to 6,200 feet. The average annual precipitation in this area ranges from 13 to17 inches per year, but may increase up to 18 inches per year, in localized areas. Precipitation occurs mostly during the growing season from rapidly developing thunderstorms. Mean annual air temperature ranges from 47 degrees Fahrenheit in the western part to 52 degrees Fahrenheit in the eastern part. Summer temperatures may exceed 100 degrees Fahrenheit. Winter temperatures may drop to sub-zero, and snowfall varies from 20 to 50 inches per year.

Classification relationships

MLRA 67A is in the Western Great Plains Range and Irrigation Land Resource Region. It is in the High Plains Section, of the Great Plains Province, of the Interior Plains (USDA, 2006). MLRA's can be defined by climate, landscapes, geology, and annual precipitation zones (PZ). Other features such as landforms, soil properties, and key vegetation further refine these concepts, and are described at the Ecological Site Description (ESD) level.

Revision Notes:

The Sands (Sa) 12-17 inch PZ ecological site was developed by an earlier version of the Sands (Sa) 12-17 inch Precipitation Zone ESD (2005, updated 2008). The earlier version of the Sands (Sa) 12-17 inch Precipitation Zone ESD was based on input from NRCS (formerly Soil Conservation Service) and historical information obtained from the Sands (Sa) Range Site Description (1988) and earlier (1970).This ESD meets the Provisional requirements of the National Ecological Site Handbook (NESH). This ESD will continue refinement towards an Approved status according to the NESH.

Ecological site concept

The Sands Ecological Site is a run-off site with soils that are a minimum of twenty inches deep. It is not saline or alkaline, and has no coarse fragments on the surface. The slopes are 6 to 24 percent, and the soil and subsurface textures have a sandy component.

Associated sites

R067AY102WY	**Choppy Sands (CS)** This ecological site is commonly adjacent.
R067AY150WY	**Sandy (Sy)** This ecological site is commonly adjacent.

Similar sites

R067AY150WY	**Sandy (Sy)** The Sandy Ecological Site occurs on slopes of less than 6 percent.
R067AY102WY	**Choppy Sands (CS)** The Choppy Sands Ecological Site occurs on slopes of greater than 24 percent and often has catsteps.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Yucca glauca* (2) *Artemisia filifolia*
Herbaceous	(1) *Andropogon hallii* (2) *Calamovilfa longifolia*

Physiographic features

This site occurs on undulating to rolling dunes and hills in dune fields. It also can occur on concave interdunes in the dune fields.

Table 2. Representative physiographic features

Landforms	(1) Dune (2) Hill
Runoff class	Negligible to low
Flooding frequency	None

Ponding frequency	None
Elevation	975–1,829 m
Slope	6–24%
Ponding depth	0 cm
Water table depth	203–508 cm
Aspect	Aspect is not a significant factor

Climatic features

Wide fluctuations in precipitation may occur from year to year, as well as occasional periods of drought (longer than one year in duration). Two-thirds of the annual precipitation occurs during the growing season from April to September. The mean annual air temperature (MAAT) ranges from 47 degrees Fahrenheit in the western part to 52 degrees Fahrenheit in the eastern part. Cold air outbreaks from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Chinook winds may also occur in winter and bring rapid rises in temperature. Extreme storms may occur during the winter, but most severely affect ranch operations during the late winter and spring months. High-intensity afternoon thunderstorms may arise in summer. Wind speed averages about 8 miles per hour, ranging from 10 during the spring to 7 during late summer. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 75 mph. The average length of the freeze-free period (28 degrees Fahrenheit) is 150 days from May 4 to October 1. The average frost-free period (32 degrees Fahrenheit) is 128 days from May 16 to September 21. Growing season increases from west to east (Wyoming to Nebraska). Growth of native cool-season plants begins about April 1 and continues to mid-June. Native warm-season plants begin growth about May 15 and continue to about August 15. Regrowth of cool-season plants occur in September in most years, depending upon moisture.

Table 3. Representative climatic features

Frost-free period (characteristic range)	85-117 days
Freeze-free period (characteristic range)	119-135 days
Precipitation total (characteristic range)	406-432 mm
Frost-free period (actual range)	84-123 days
Freeze-free period (actual range)	116-137 days
Precipitation total (actual range)	356-457 mm
Frost-free period (average)	103 days
Freeze-free period (average)	128 days
Precipitation total (average)	406 mm

Climate stations used

- (1) OSHKOSH [USC00256385], Oshkosh, NE
- (2) CHEYENNE [USW00024018], Cheyenne, WY
- (3) SCOTTSBLUFF HEILIG AP [USW00024028], Scottsbluff, NE
- (4) KIMBALL 2NE [USC00254440], Kimball, NE
- (5) PHILLIPS [USC00487200], LaGrange, WY
- (6) WHEATLAND 4 N [USC00489615], Wheatland, WY
- (7) BRIDGEPORT [USC00251145], Bridgeport, NE
- (8) HARRISBURG 12WNW [USC00253605], Harrisburg, NE
- (9) CHUGWATER [USC00481730], Chugwater, WY
- (10) OLD FT LARAMIE [USC00486852], Yoder, WY

Influencing water features

There are no water features associated with this ecological site.

Soil features

The soils on this site are typically very deep, but include moderately deep and deep, excessively drained soils that formed from eolian sands and moderately deep soils formed from residuum derived from sandstone. They typically are in a very rapid to rapid permeability class. The available water capacity is low to very low. The soil moisture regime is typically aridic ustic. The soil temperature regime is mesic.

The surface layer of the soils in this site are typically fine sand, loamy fine sand, or loamy sand, but may include sand and loamy sand. The surface layer ranges from a depth of 4 to 10 inches thick. The subsoil is typically fine sand or loamy fine sand but may include sand or loamy sand. Soils in this site are typically leached of free carbonates to a depth of 40 inches or more but can be at the surface or within 6 inches in some soils. These soils are susceptible to erosion by wind if not covered. The potential for water erosion accelerates with increasing slope.

Surface soil structure is granular or single grained, and structure below the surface is weak subangular blocky or single grained. Soil structure describes the manner in which soil particles are aggregated and defines the nature of the system of pores and channels in a soil.

Major soil series correlated to this ecological site: Dailey, Dunday, Dwyer, and Valent.

Other soil series that have been correlated to this site include: Dankworth, Orpha, and Tullock.

The attributes listed below represent 0-40 inches in depth or to the first restrictive layer.

Note: Revisions to soil surveys are on-going. For the most recent updates, visit the Web Soil Survey, the official site for soils information: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx.

Figure 9.—Representative soil profile of Valent loamy fine sand. No diagnostic horizons are present in this young soil.

Figure 8. Valent loamy fine sand, Laramie County, WY

Table 4. Representative soil features

Parent material	(1) Eolian sands
Surface texture	(1) Fine sand (2) Loamy fine sand (3) Loamy sand
Family particle size	(1) Sandy
Drainage class	Excessively drained
Permeability class	Rapid to very rapid
Soil depth	51–203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%

Available water capacity (0-101.6cm)	3.81–15.24 cm
Calcium carbonate equivalent (0-101.6cm)	0–10%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	6.6–7.8
Subsurface fragment volume <=3" (Depth not specified)	0–3%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The information in this ESD, including the State-and-Transition Model (STM) diagram, was developed using archeological and historical data, professional experience, and scientific studies. The information is representative of a dynamic set of plant communities that represent the complex interaction of several ecological processes. The plant composition has been determined by study of rangeland relic areas, areas protected from excessive disturbance, seasonal use pastures, short duration or time-controlled grazing strategies, and historical accounts.

The Sands ecological site is characterized by three states: Reference, Shrub, and Eroded. The Reference State is characterized by warm-season tall bunchgrass (sand bluestem), warm-season tall rhizomatous grasses (prairie sandreed), and cool-season mid- bunchgrasses (needle and thread). Secondary grasses are warm-season mid-bunchgrasses (little bluestem and switchgrass), cool-season mid- bunchgrass (Indian ricegrass), and warm-season shortgrass (blue grama). Other grasses and grass-likes include sand lovegrass, blowout grass, sandhill muhly, sand dropseed, prairie Junegrass, hairy grama, and threadleaf sedge. A minor component of forbs and shrubs are also present. The Shrub State is characterized by warm-season shortgrass (sandhill muhly and blue grama), grass-likes (threadleaf sedge), and shrubs (sand sagebrush). The Eroded State is characterized by annual forbs and grasses (burningbush, Russian thistle, Rocky Mountain beeplant, annual sunflower, sandbur, and cheatgrass), followed by early pioneer grasses (blowout grass, sand dropseed, Fendler threeawn), forbs (blazingstar, lemon scurfpea, and annual buckwheat), and shrubs (sand sagebrush and soapweed yucca).

As this site begins to deteriorate from frequent and severe grazing during the growing season, bunchgrasses such as sand bluestem, prairie sandreed, switchgrass, and needle and thread decrease in both frequency and production. Prairie sandreed may persist in remnant amounts protected by remaining shrubs. Key shrubs such as western sandcherry and prairie rose decrease in frequency and production. Purple prairie clover and other highly palatable forbs decrease. Sand sagebrush continues to increase with an understory of grasses such as blue grama, sandhill muhly, and sand dropseed. Under continued frequent and severe defoliation with no rest periods, mid-grasses are eventually removed from the plant community. Over the long-term, this continuous use, in combination with high stock densities, results in bare ground and active blowouts.

The degree of grazing has a significant impact on the ecological dynamics of the site. This region was historically occupied by large grazing animals, such as bison, elk, pronghorn, and mule deer. Grazing by these large herbivores, along with climatic and seasonal weather fluctuations, had a major influence on the ecological dynamics of the site. Deer and pronghorn are widely distributed throughout the MLRA. Secondary influences of herbivory by species such as prairie dogs and other small rodents, insects, and root-feeding organisms continues to impact the vegetation.

Historically, grazing patterns by herds of large ungulates were driven by water distribution, precipitation events, drought events, and fire. It is believed that grazing periods would have been shorter, followed by longer recovery periods. These large migrating herds impacted the ecological processes of nutrient and hydrologic cycles, by urination, trampling (incorporation of litter into the soil surface), and breaking of surface crust, (which increases water infiltration).

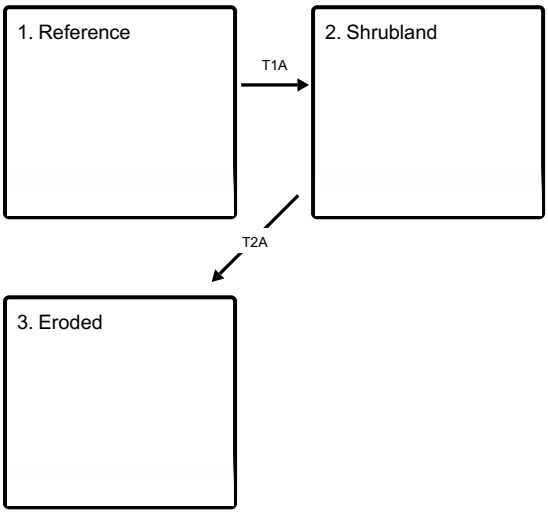
Today, livestock grazing, especially beef cattle has been a major influence on the ecological dynamics of the site. Grazing management, coupled with the effects of annual climatic variations, largely dictates the plant communities for the site.

Recurrent drought has historically impacted the vegetation of this region. Changes in species composition vary depending upon the duration and severity of the drought cycle and prior grazing management. Drought events since 2002 have significantly increased mortality of blue grama and buffalograss in some locales.

This site developed with occasional fire as part of the ecological processes. Historic fire frequency (pre-industrial) is estimated at 10 to14 years (Guyette, 2012), randomly distributed, and started by lightning at various times throughout the growing season. Early human inhabitants also were likely to start fires for various reasons (deliberate or accidental). It is believed that fires were set as a management tool for attracting herds of large migratory herbivores (Stewart, 2002). The impact of fire over the past 100 years has been relatively insignificant due to the human control of wildfires and the lack of acceptance of prescribed fire as a management tool.

State and transition model

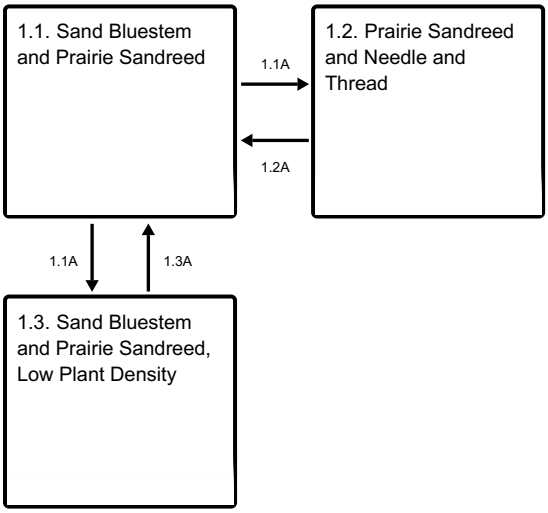
Ecosystem states



T1A - Excessive grazing. Lack of fire.

T2A - Excessive grazing. Lack of fire.

State 1 submodel, plant communities



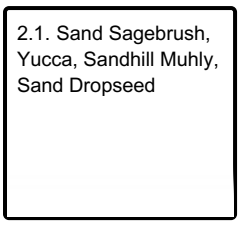
1.1A - Excessive grazing. Lack of fire.

1.1A - Non-use. Lack of fire.

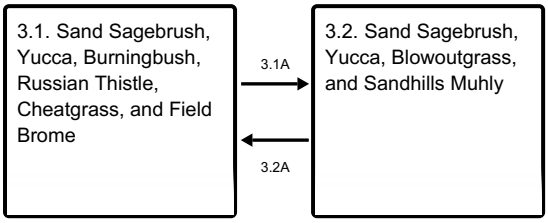
1.2A - Prescribed grazing. Prescribed fire.

1.3A - Prescribed grazing. Prescribed fire.

State 2 submodel, plant communities



State 3 submodel, plant communities



3.1A - Prescribed grazing.

3.2A - Excessive grazing.

State 1
Reference

The Reference state is characterized by three distinct plant community phases. The plant communities, and various successional stages between them, represent the natural range of variability within the Reference state.

Dominant plant species

- sand sagebrush (*Artemisia filifolia*), shrub
- soapweed yucca (*Yucca glauca*), shrub
- sand bluestem (*Andropogon hallii*), grass
- prairie sandreed (*Calamovilfa longifolia*), grass

Community 1.1
Sand Bluestem and Prairie Sandreed

Figure 9. Sands, Morrill County, NE

The Reference Plant Community is the interpretive plant community for this site. This community developed with grazing by large herbivores and is suited to grazing by domestic livestock. Historically, fires likely occurred infrequently, and were randomly distributed. This plant community can be found on areas where grazed plants receive adequate periods of recovery during the growing season. The potential vegetation is about 80 to 95 percent grasses and grass-likes, 0 to10 percent forbs, and 0 to10 percent woody plants. This plant community is

predominantly sand bluestem, prairie sandreed, and needle and thread. Secondary grasses are little bluestem, switchgrass, Indian ricegrass, and blue grama. Minor grasses and grass-likes that may occur include sand lovegrass, blowout grass, sandhill muhly, sand dropseed, prairie Junegrass, hairy grama, and threadleaf sedge. A variety of forbs such as dotted blazing star (also known as dotted gayfeather), scarlet globemallow, painted milkvetch, lemon scurfpea, prairie spiderwort, and purple prairie clover; veiny dock, prairie coneflower, ragwort, and beardtongue species. Shrubs such as silver- and sand sagebrush, prairie rose, and western sandcherry also occur. Plant diversity is high. In the 12 to 14 inch Precipitation Zone (PZ), the total annual production (air-dry weight) is about 1,300 pounds per acre during an average year, but ranges from about 750 pounds per acre in unfavorable years to about 1,750 pounds per acre in above-average years. In the 15 to 17 inch PZ, the total annual production (air-dry weight) is about 1,500 pounds per acre during an average year, but ranges from about 1,000 pounds per acre in unfavorable years to about 2,000 pounds per acre in above-average years. Community dynamics (nutrient cycle and water cycles and energy flow) are functioning properly. Infiltration rates are moderate, and soil erosion are low. Litter is properly distributed where vegetative cover is continuous. Decadence and natural plant mortality is low. This community is resistant to many disturbances except continuous grazing, tillage or development into urban or other uses.

Dominant plant species

- sand sagebrush (*Artemisia filifolia*), shrub
- soapweed yucca (*Yucca glauca*), shrub
- sand bluestem (*Andropogon hallii*), grass
- prairie sandreed (*Calamovilfa longifolia*), grass

Figure 11. Plant community growth curve (percent production by month). WY1104, 12-14SP upland sites w/ warm. 12-14" Precipitation Zone, Southern Plains (SP) with warm-season (grass) species.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	20	35	30	5	5	0	0	0

Community 1.2
Prairie Sandreed and Needle and Thread

The plant community has a reduced component of mid-grasses with an understory of short sod-forming grasses. Dominant grasses include prairie sandreed, needle and thread, and blue grama. A cool-season/warm-season shift may occur depending upon the pre-dominant season of use. Recurrent, continuous grazing in the spring eventually reduces the cool-season grasses such as needle and thread and Indian ricegrass. Likewise, recurrent, continuous grazing in the summer reduces the warm-season bunchgrasses such as little bluestem and sand bluestem. Prairie sandreed is present and distributed across the site in somewhat reduced amounts. The significant forbs include dotted gayfeather, cudweed sagewort, prairie spiderwort, upright prairie coneflower, and cuman ragweed. Shrubs in this community include Arkansas rose, soapweed yucca, and sand sagebrush. Compared to the Reference Plant Community, blue grama and threadleaf sedge have increased. All of the mid-grass species are present but in lesser amounts, especially the bunchgrasses. Plant diversity is moderate. In the 12 to 14 inch PZ, the total annual production (air-dry weight) is about 900 pounds per acre during an average year, but ranges from about 600 pounds per acre in unfavorable years to about 1,200 pounds per acre in above-average years. In the 15 to 17 inch PZ, the total annual production (air-dry weight) is about 1,100 pounds per acre during an average year, but ranges from about 750 pounds per acre in unfavorable years to about 1,450 pounds per acre in above-average years. Total aboveground biomass has been reduced. Reduction of rhizomatous wheatgrasses, nitrogen-fixing forbs, and increased warm-season shortgrasses have begun to alter the biotic integrity of this community. The water and nutrient cycles may be impaired. Nearly all plant species typically found in the Reference Plant Community are present and respond to changes in grazing management.

Dominant plant species

- sand sagebrush (*Artemisia filifolia*), shrub
- soapweed yucca (*Yucca glauca*), shrub
- prairie sandreed (*Calamovilfa longifolia*), grass
- needle and thread (*Hesperostipa comata*), grass

Figure 12. Plant community growth curve (percent production by month). WY1104, 12-14SP upland sites w/ warm. 12-14" Precipitation Zone, Southern Plains (SP) with warm-season (grass) species.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	20	35	30	5	5	0	0	0

Community 1.3
Sand Bluestem and Prairie Sandreed, Low Plant Density

This plant community developed under many years of non-use and lack of fire. Plant species resemble the Reference Plant Community; however, frequency and production is reduced. Eventually, litter levels can become high enough to cause decadence and mortality of the stand. Bunchgrasses typically develop dead centers, and rhizomatous grasses can form small decadent communities due to a lack of impact by grazing animals. A large amount of the available nutrients is tied up in standing dead plant material and increased amounts of litter. The semiarid environment and the absence of animal traffic to break down litter will slow nutrient recycling. Cool-season grasses and pricklypear have typically increased. Blue grama is reduced. Dominant grasses include prairie sandreed, needle and thread, and sand bluestem. Other species include sand dropseed and threadleaf sedge. Dominant forbs include annual sunflower and bractless blazingstar. Dominant shrubs include pricklypear, sageworts, and sand sagebrush. Invasive grasses such as cheatgrass tend to encroach under these conditions. Water flow patterns and pedestalling can become apparent. Infiltration is reduced and runoff is increased. In advanced stages of non-use or lack of fire, bare areas increase and cause an erosion concern. In the 12 to 14 inch PZ, the total annual production (air-dry weight) is about 1,000 pounds per acre during an average year, but ranges from about 650 pounds per acre in unfavorable years to about 1,350 pounds per acre in above-average years. In the 15 to 17 inch PZ, the total annual production (air-dry weight) is about 1,200 pounds per acre during an average year, but ranges from about 800 pounds per acre in unfavorable years to about 1,600 pounds per acre in above-average years.

Dominant plant species

- sand sagebrush (*Artemisia filifolia*), shrub
- soapweed yucca (*Yucca glauca*), shrub
- sand bluestem (*Andropogon hallii*), grass
- prairie sandreed (*Calamovilfa longifolia*), grass

Figure 13. Plant community growth curve (percent production by month). WY1101, 12-14SP Upland sites w/o warm seasons. 12-14" Precipitation Zone, Southern Plains (SP) without warm season (grass) species.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	25	40	15	5	10	0	0	0

Pathway 1.1A
Community 1.1 to 1.2

Continuous, heavy grazing without adequate recovery between grazing events and lack of fire shifts this plant community to the 1.2 Community. Drought accelerates this process. Biotic integrity and water and nutrient cycles may become impaired as a result of this community pathway.

Pathway 1.1A
Community 1.1 to 1.3

Non-use and lack of fire cause the Reference Plant Community to shift toward the 1.3 Community. Plant decadence and standing dead plant material impedes energy flow. Initially, excess litter increases. Eventually, native plant density begins to decrease and annuals and introduced species may begin to invade. The water and nutrient cycles are impaired as a result of this community pathway.

Pathway 1.2A

Community 1.2 to 1.1

Grazing that allows for adequate recovery between grazing events, proper stocking rates, and prescribed fire shift the 1.2 Community back to the Reference Plant Community.

Conservation practices

Prescribed Burning
Prescribed Grazing

Pathway 1.3A
Community 1.3 to 1.1

The return of grazing with adequate recovery and normal fire frequency shifts this plant community to the Reference Plant Community. This change can occur in a relatively short timeframe with the removal of these disturbances.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Shrubland

An ecological threshold has been crossed and a significant amount of production and diversity has been lost compared to the Reference state. Significant biotic and soil changes have negatively impacted energy flow and the nutrient and hydrologic cycles. Short, drought-tolerant grasses and shrubs dominate the plant community. Occasional mid-grasses may be found within the canopy of shrubs where they are protected from grazing. Understory plants may be negatively affected by shrubs, reducing the availability of light, soil moisture, and soil nutrients. As the size and density of shrubs increase, the cover and productivity of understory plants and fine fuel loads decrease. Prescribed fire can become an ineffective tool to decrease the shrubs due to the lack of fine fuel loads.

Dominant plant species

- sand sagebrush (*Artemisia filifolia*), shrub
- soapweed yucca (*Yucca glauca*), shrub
- sandhill muhly (*Muhlenbergia pungens*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass

Community 2.1
Sand Sagebrush, Yucca, Sandhill Muhly, Sand Dropseed

The dominant grasses are sandhill muhly, sand dropseed, and hairy grama. Other perennial grasses and grasslikes include blowout grass and upland sedges. Prairie sandreed and needle and thread are limited to areas protected from grazing. Significant forbs include lemon scurfpea, Cuman ragweed, annual sunflower, and bractless blazingstar. Significant shrubs include sand sagebrush, yucca, and pricklypear cactus. Other minor grasses are purple threeawn, and annuals. The mid-grasses and palatable forbs have been significantly reduced or eliminated. Plant diversity is very low. Energy flow and water and mineral cycles have been negatively affected. Litter levels are very low and unevenly distributed. In the 12 to 14 inch PZ, the total annual production (air-dry weight) is about 500 pounds per acre during an average year, but ranges from about 350 pounds per acre in unfavorable years to about 650 pounds per acre in above-average years. In the 15 to 17 inches PZ, the total annual production (air-dry weight) is about 600 pounds per acre during an average year, but ranges from about 400 pounds per acre in unfavorable years to about 800 pounds per acre in above-average years. This plant community is extremely resistant to change. Many plant species are missing and a seed source is not readily available. Also, sod-forming grasses tend to maintain themselves due to their resistance to any further overgrazing.

Dominant plant species

- sand sagebrush (*Artemisia filifolia*), shrub
- soapweed yucca (*Yucca glauca*), shrub
- sandhill muhly (*Muhlenbergia pungens*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass

Figure 14. Plant community growth curve (percent production by month). WY1104, 12-14SP upland sites w/ warm. 12-14" Precipitation Zone, Southern Plains (SP) with warm-season (grass) species.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	20	35	30	5	5	0	0	0

State 3
Eroded

Blowouts are present. This condition is not stable. It consists of bare areas that are continually eroded by wind. An ecological threshold has been crossed. Erosion and loss of organic matter are management concerns.

Dominant plant species

- sand sagebrush (*Artemisia filifolia*), shrub
- soapweed yucca (*Yucca glauca*), shrub
- cheatgrass (*Bromus tectorum*), grass
- field brome (*Bromus arvensis*), grass
- burningbush (*Bassia scoparia*), other herbaceous
- Russian thistle (*Salsola*), other herbaceous

Community 3.1
Sand Sagebrush, Yucca, Burningbush, Russian Thistle, Cheatgrass, and Field Brome

Production from this plant community phase can vary greatly, depending on the plant density and weather conditions in any year. There is an overstory of sand sagebrush. Annual grasses and forbs include cheatgrass, field brome, burningbush, Russian thistle, sunflower, pigweed, sixweeks fescue, and annual buckwheat. Total annual production varies from 0 to 200 pounds per acre (air-dry weight) per year. The hazard of soil erosion has increased due to the increase of bare ground. Runoff is typically high and infiltration is low. All ecological functions are impaired. Species diversity has substantially decreased. Production varies with the density and vigor of sand sagebrush.

Dominant plant species

- sand sagebrush (*Artemisia filifolia*), shrub
- soapweed yucca (*Yucca glauca*), shrub
- cheatgrass (*Bromus tectorum*), grass
- field brome (*Bromus arvensis*), grass
- burningbush (*Bassia scoparia*), other herbaceous
- Russian thistle (*Salsola*), other herbaceous

Figure 15. Plant community growth curve (percent production by month). WY1104, 12-14SP upland sites w/ warm. 12-14" Precipitation Zone, Southern Plains (SP) with warm-season (grass) species.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	20	35	30	5	5	0	0	0

Community 3.2
Sand Sagebrush, Yucca, Blowoutgrass, and Sandhills Muhly

This plant community occurs as the 3.1 community becomes vegetated. Plant composition consists of annuals with a few species of perennial forbs and grasses that are very drought tolerant. The dominant grasses include blowout grass and sandhill muhly. Annual grasses such as sandbur and stinkgrass have increased. The dominant forbs

include lemon scurfpea, Rocky Mountain beeplant, and annual sunflower. Prairie sandreed, hairy grama, and Arkansas rose eventually become more evident. Wind erosion continues to be a management concern. In the 12 to 14 inch precipitation zone, the total annual production (air-dry weight) is about 200 pounds per acre during an average year, but ranges from about 100 pounds per acre in unfavorable years to about 300 pounds per acre in above average-years. In the 15 to 17 inch precipitation zone, the total annual production (air-dry weight) is about 250 pounds per acre during an average year, but ranges from about 100 pounds per acre in unfavorable years to about 400 pounds per acre in above average-years. Soil erosion is still high compared to other potential plant communities because of the amount of bare ground. Infiltration is high only because of the soil texture. Runoff is high because of a lack of litter and living plants.

Dominant plant species

- sand sagebrush (*Artemisia filifolia*), shrub
- soapweed yucca (*Yucca glauca*), shrub
- blowout grass (*Redfieldia flexuosa*), grass
- sandhill muhly (*Muhlenbergia pungens*), grass

Figure 16. Plant community growth curve (percent production by month). WY1104, 12-14SP upland sites w/ warm. 12-14" Precipitation Zone, Southern Plains (SP) with warm-season (grass) species.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	20	35	30	5	5	0	0	0

Pathway 3.1A
Community 3.1 to 3.2

Prescribed grazing with adequate recovery opportunity between grazing events shifts this plant community toward the Early Perennials Community. Controlled animal impact together with an appropriate grazing prescription begin to heal blowouts.

Conservation practices

Prescribed Grazing

Pathway 3.2A
Community 3.2 to 3.1

Continuous, heavy grazing without adequate recovery opportunity between grazing events shifts this plant community back to the 3.1 Community. The hazard of wind erosion is a concern and blowouts can form as a result of this community pathway.

Transition T1A
State 1 to 2

Long-term heavy, continuous, grazing without adequate recovery periods between grazing events and lack of fire shifts this community across an ecological threshold toward The Shrub State. Biotic integrity and hydrologic function are impaired as a result of this transition.

Transition T2A
State 2 to 3

Long-term heavy, continuous, grazing and lack of fire cause a shift across an ecological threshold to the Eroded State. Severe soil erosion and loss of organic matter are concerns. Annual forbs and cheatgrass are likely to increase or invade as a result of this transition.

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**12"-14"**			437–874	
	sand bluestem	ANHA	*Andropogon hallii*	291–583	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	146–583	–
	switchgrass	PAVI2	*Panicum virgatum*	0–146	–
2	**12"-14"**			146–437	
	needle and thread	HECO26	*Hesperostipa comata*	146–437	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–146	–
3	**12"-14"**			73–291	
	little bluestem	SCSC	*Schizachyrium scoparium*	73–291	–
4	**12"-14"**			0–146	
	blue grama	BOGR2	*Bouteloua gracilis*	0–146	–
5	**12"-14"**			146–219	
	Grass, perennial	2GP	*Grass, perennial*	0–73	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–73	–
	sedge	CAREX	*Carex*	0–73	–
	sand lovegrass	ERTR3	*Eragrostis trichodes*	0–73	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–73	–
	sandhill muhly	MUPU2	*Muhlenbergia pungens*	0–73	–
	blowout grass	REFL	*Redfieldia flexuosa*	0–73	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–73	–
	threadleaf sedge	CAFI	*Carex filifolia*	0–29	–
8	**15"-17"**			504–1009	
	sand bluestem	ANHA	*Andropogon hallii*	336–673	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	168–673	–
	switchgrass	PAVI2	*Panicum virgatum*	0–168	–
9	**15"-17"**			168–504	
	needle and thread	HECO26	*Hesperostipa comata*	168–504	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–168	–
10	**15"-17"**			84–336	
	little bluestem	SCSC	*Schizachyrium scoparium*	84–336	–
11	**15"-17"**			0–168	
	blue grama	BOGR2	*Bouteloua gracilis*	0–168	–
12	**15"-17"**			168–252	
	Grass, perennial	2GP	*Grass, perennial*	0–84	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–84	–
	sedge	CAREX	*Carex*	0–84	–
	sand lovegrass	ERTR3	*Eragrostis trichodes*	0–84	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–84	–
	sandhill muhly	MUPU2	*Muhlenbergia pungens*	0–84	–
	blowout grass	REFL	*Redfieldia flexuosa*	0–84	–

	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–84	–
	threadleaf sedge	CAFI	*Carex filifolia*	0–34	–
Forb					
6	**12"-14"**			73–146	
	Grass, perennial	2GP	*Grass, perennial*	0–73	–
	snowball sand verbena	ABFR2	*Abronia fragrans*	0–29	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–29	–
	field sagewort	ARCA12	*Artemisia campestris*	0–29	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–29	–
	painted milkvetch	ASCEF	*Astragalus ceramicus var. filifolius*	0–29	–
	false boneset	BREU	*Brickellia eupatorioides*	0–29	–
	prairie clover	DALEA	*Dalea*	0–29	–
	larkspur	DELPH	*Delphinium*	0–29	–
	Chalk Hill hymenopappus	HYTE2	*Hymenopappus tenuifolius*	0–29	–
	bush morning-glory	IPLE	*Ipomoea leptophylla*	0–29	–
	flaxflowered ipomopsis	IPLO2	*Ipomopsis longiflora*	0–29	–
	manystem pea	LAPO2	*Lathyrus polymorphus*	0–29	–
	dotted blazing star	LIPU	*Liatris punctata*	0–29	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–29	–
	bractless blazingstar	MENU	*Mentzelia nuda*	0–29	–
	whitest evening primrose	OEAL	*Oenothera albicaulis*	0–29	–
	evening primrose	OENOT	*Oenothera*	0–29	–
	Indian breadroot	PEDIO2	*Pediomelum*	0–29	–
	beardtongue	PENST	*Penstemon*	0–29	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–29	–
	veiny dock	RUVE2	*Rumex venosus*	0–29	–
	ragwort	SENEC	*Senecio*	0–29	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–29	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–29	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	0–29	–
	ironweed	VERNO	*Vernonia*	0–29	–
13	**15"-17"**			84–168	
	Forb, perennial	2FP	*Forb, perennial*	0–84	–
	snowball sand verbena	ABFR2	*Abronia fragrans*	0–34	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–34	–
	field sagewort	ARCA12	*Artemisia campestris*	0–34	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–34	–
	painted milkvetch	ASCEF	*Astragalus ceramicus var. filifolius*	0–34	–
	false boneset	BREU	*Brickellia eupatorioides*	0–34	–
	prairie clover	DALEA	*Dalea*	0–34	–
	larkspur	DELPH	*Delphinium*	0–34	–

	Chalk Hill hymenopappus	HYTE2	*Hymenopappus tenuifolius*	0–34	–
	bush morning-glory	IPLE	*Ipomoea leptophylla*	0–34	–
	flaxflowered ipomopsis	IPLO2	*Ipomopsis longiflora*	0–34	–
	manystem pea	LAPO2	*Lathyrus polymorphus*	0–34	–
	dotted blazing star	LIPU	*Liatris punctata*	0–34	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–34	–
	bractless blazingstar	MENU	*Mentzelia nuda*	0–34	–
	whitest evening primrose	OEAL	*Oenothera albicaulis*	0–34	–
	evening primrose	OENOT	*Oenothera*	0–34	–
	Indian breadroot	PEDIO2	*Pediomelum*	0–34	–
	beardtongue	PENST	*Penstemon*	0–34	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–34	–
	veiny dock	RUVE2	*Rumex venosus*	0–34	–
	ragwort	SENEC	*Senecio*	0–34	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–34	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–34	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	0–34	–
	ironweed	VERNO	*Vernonia*	0–34	–
Shrub/Vine					
7	**12"-14"**			73–146	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–73	–
	sand sagebrush	ARFI2	*Artemisia filifolia*	0–73	–
	soapweed yucca	YUGL	*Yucca glauca*	0–73	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–29	–
	spinystar	ESVI2	*Escobaria vivipara*	0–29	–
	brittle pricklypear	OPFR	*Opuntia fragilis*	0–29	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–29	–
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	0–29	–
	prairie rose	ROAR3	*Rosa arkansana*	0–29	–
14	**15"-17"**			84–168	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–84	–
	sand sagebrush	ARFI2	*Artemisia filifolia*	0–84	–
	soapweed yucca	YUGL	*Yucca glauca*	0–84	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–34	–
	spinystar	ESVI2	*Escobaria vivipara*	0–34	–
	brittle pricklypear	OPFR	*Opuntia fragilis*	0–34	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–34	–
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	0–34	–
	prairie rose	ROAR3	*Rosa arkansana*	0–34	–

Animal community

Wildlife Interpretations:

Reference Plant Community - Sand Bluestem, Prairie Sandreed, Needle and thread:

The structural diversity in the plant community found on the Reference Plant Community is attractive to a number of wildlife species. Common bird species expected in the Reference Plant Community include Cassin's and Brewer's sparrow, chestnut collared longspur, lark bunting, western meadowlark, and ferruginous and Swainson's hawks. The combination of mid and tall grasses provides habitat for sharp-tailed grouse in the eastern portions of MLRA 67A.
White-tailed and black-tailed jackrabbit, badger, pronghorn, coyote, swift fox, plains pocket gopher, long-tailed weasel, and several species of mice are mammals that commonly use this plant community. Reptiles using this community include western rattlesnake, bullsnake, plains garter snake western hognose snake, racer, western box turtle, and six-lined racerunner.

1.2 Community - Decreased Sand Bluestem and Prairie Sandreed, Increased Sand Sagebrush:

The reduction in taller grasses in this community results in decreased use by lark buntings and western meadowlarks. Use by long-billed curlew increases, provided there is standing water within one-quarter mile. Killdeer, horned larks, and McCown's longspurs also make significant use of this community. Pronghorn may forage in this community.

1.3 Community - Increased Litter, Decadent Plants, Standing Dead Canopy:

This community has low habitat value for most wildlife species. Horned larks may nest in this community.

2.1 Community - Sand Sagebrush, Sandhill Muhly, Annual Forbs and Grasses:

This community provides limited foraging for antelope and other grazers. Ground-nesting birds that favor sparse vegetation may use this community. Long-billed curlews also use this community if standing water is nearby.

3.1 Community - Annual Grasses and Forbs, Sand Sagebrush, Cheatgrass, Increased Bare Ground, and Blowouts:

This community has low habitat value for most wildlife species. Horned larks may nest in this community. When Rocky Mountain beeplant is present, mourning doves use this plant community in the fall.

3.2 Community – Blowout Grass, Sand Dropseed, Annual Grasses and Forbs

This community has low habitat value for most wildlife species. Horned larks may nest in this community. When Rocky Mountain beeplant is present, mourning doves use this plant community in the fall.

Grazing Interpretations:

The following table is a guide to stocking rates for the plant communities described in the Sands site. These are conservative estimates for initial planning. On-site conditions vary, and stocking rates should be adjusted based on range inventories, animal kind/class, forage availability (adjusted for slope and distance to water), and the type of grazing system (number of pastures, planned moves, etc.), all of which is determined in the conservation planning process.

The following stocking rates are based on the total annual forage production in a normal year multiplied by 25 percent harvest efficiency of preferred and desirable forage species, divided by 912 pounds of ingested air-dry vegetation for an animal unit per month (Natl. Range and Pasture Handbook, 1997). An animal unit month (AUM) is defined as the amount of forage required by one mature cow of approximately 1,000 pounds weight, for one month.

Plant Community (PC) Production (total lbs. /acre in a normal year) and Stocking Rate (AUMs/acre) are listed below:
Example: Reference PC – (1300) (.36)
1300 lbs. per acre X 25 percent Harvest Efficiency = 325 lbs. forage demand for one month. Then, 325 lbs. per acre/912 demand per AUM =.36

Plant Community (PC) Production (lbs.ac), and Stocking Rate (AUM/Acre)

12-14 Inch PZ:

Reference PC - (1300) (0.36)
1.2 PC - (900) (0.25)
2.1 PC - (800) (0.22)

15-17 Inch PZ
Reference PC – (1500) (0.41)
1.2 PC – (1100) (0.30)
2.1 PC – (900) (0.25)

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangelands in this area provide year-long forage under prescribed grazing for cattle, sheep, horses, and other herbivores. During the dormant period, livestock may need supplementation based on reliable forage analysis.

An on-site inventory is required prior to developing a grazing plan.

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group A and B. Infiltration potential for this site varies from moderately rapid to very rapid depending upon soil hydrologic group and ground cover. Runoff is from low to moderate. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to to NRCS Section 4, National Engineering Handbook (USDA–NRCS, 1972–2012) for runoff quantities and hydrologic curves).

Rills and gullies should not typically be present. Water flow patterns should be barely distinguishable, if at all present. Pedestals are only slightly present in association with bunchgrasses. Litter typically falls in place, and signs of movement are not common. Chemical and physical crusts are rare to non-existent. Cryptogamic crusts are present, but only cover 1 to 2 percent of the soil surface.

The site should show slight to no evidence of rills or gullies. Water flow paths, if any, are broken, irregular in appearance or discontinuous. Wind-scoured areas are inherent to this site and some soil movement may be noticeable on various landscape positions. Overall, the soil surface should be stable and intact. Subsurface soil layers are non-restrictive to water movement and root penetration.

These soils are susceptible to wind erosion where vegetative cover is inadequate.

Recreational uses

This site provides opportunities for hunting, hiking, photography, bird watching, and other activities. The wide varieties of plants that bloom from spring until fall have an aesthetic value that appeals to visitors.

Wood products

No appreciable wood products are present on the site.

Other products

Site Development & Testing Plan

General Data (MLRA and Revision Notes, Hierarchical Classification, Ecological Site Concept, Physiographic, Climate, and Water Features, and Soils Data):

Updated. All “Required” items complete to Provisional level.

Community Phase Data (Ecological Dynamics, STM, Transition & Recovery Pathways, Reference Plant

Community, Species Composition List, and Annual Production Table):

Updated. All “Required” items complete to Provisional level.

Annual Production Table is from the “Previously Approved” ESD (2008).

The Annual Production Table and Species Composition List will be reviewed for future updates at Approved level.

Each Alternative State/Community:

Complete to Provisional level.

Supporting Information (Site Interpretations, Assoc. & Similar Sites, Inventory Data References, Agency/State Correlation, and References):

Updated. All “Required” items complete to Provisional level.

Wildlife Interpretations: Plant community names updated. Narrative is from “Previously Approved” ESD (2008). Wildlife species will need to be updated at the next Approved level.

Livestock Interpretations: Plant community names and stocking rates updated.

Hydrology, Recreational Uses, Wood Products, and Other Products carried over from previously “Approved” ESD (2008).

Plant Preferences tabled removed. Will be released as a technical guide notice by NE and WY state offices in the future.

Existing NRI or 417 Inventory Data References updated.

Reference Sheet:

Rangeland Health Reference Sheet carried over from previously “Approved” ESD (2008).
It will be updated at the next “Approved” level.

“Future work, as described in a project plan, to validate the information in this provisional ecological site description is needed. This will include field activities to collect low and medium intensity sampling, soil correlations, and analysis of that data. Annual field reviews should be done by soil scientists and vegetation specialists. A final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed to produce the final document.” (NI 430_306 ESI and ESD, April, 2015)

Inventory data references

Information presented here has been derived from data collection on private and federal lands using:
• Double Sampling (clipped 2 of 5 plots)*
• Rangeland Health**
• Soil Stability**
• Line Point Intercept : Foliar canopy, basal cover (forb, graminoid, shrub, subshrub, lichen, moss, rock fragments, bare ground, and percentage of litter)***
• Soil pedon descriptions collected on site****
*NRCS 528-Prescribed Grazing Standard jobs sheets.
*Interpreting Indicators of Rangeland Health, Version 4, 2005
*Monitoring Manual for Grassland, Shrubland and Savanna Ecosystems, Volume II, 2005
*Field Book for Describing and Sampling Soils, Version 3, 2012
NRI- Natural Resource Inventory data
SCS-RANGE-417 Production & Composition Record for Native Grazing Lands
Additional reconnaissance data collection using numerous ocular estimates and other inventory data; NRCS clipping data for USDA program support; and field observations from experienced range trained personnel.

Data Source: NRI
Number of Records: 6
Sample Period: 2006-2011
States: NE, WY
Counties: Morrill (NE);
Goshen, Laramie (WY)

Date Source: 417s
Number of Records: 7
Sample Period: 1970-1985
States: NE, WY
Counties: Garden, Morrill, Scotts Bluff (NE);
Goshen (WY)

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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.

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Date	11/23/2020

Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Typically, none. Rills may be present on slopes of 15 percent or greater. Rills will be short and disconnected.

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2. **Presence of water flow patterns:** Typically, none. Water flow patterns may be present on slopes of 15 percent or greater. When present, they will be no longer than 2 to 4 inches (5.1-10.1 cm), less than 6 inches (15.25 cm) wide, and discontinuous. Water flow patterns, when present, are often associated with animal activity.

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3. **Number and height of erosional pedestals or terracettes:** Typically, none. Bunch grasses may be slightly pedestalled (0.5 inch/1.25 cm) with no exposed roots. This would typically occur on north and west aspects of slopes exceeding 10 percent and where bunchgrasses are more common. Drought or wildfire can contribute to increased incidences of pedestalled plants.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is typically 15 to 20 percent or less. Bare ground patches are not connected and are less than 6 inches (15 cm) across, unless associated with disturbance such as burrowing animals. Multi-year drought and/or wildfire can increase bare ground to 25 to 30 percent for up to two years following the disturbance.

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5. **Number of gullies and erosion associated with gullies:** None. Gullies should not be present on this site.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** Typically, none. Occasional areas associated with concentrated animal activity (livestock trailing and burrowing animals) may exhibit wind scoured areas with accompanying deposition. These areas are typically are present on less than 1 percent of the site.

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7. **Amount of litter movement (describe size and distance expected to travel):** Litter should fall in place. Slight amount of movement of fine litter from water is possible, but not normal. Litter movement from wind is not expected.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Some series on this site typically have little organic matter in the surface horizon, and the structure is single grain sand. Soil aggregate stability will be difficult to measure on these soils, with stability ratings of 2 to 3.

   Surface erosion by water rarely occurs due to rapid infiltration, but the surface is susceptible to wind erosion when vegetative cover is reduced due to multi-year drought, wildfire, or multi-year heavy grazing.

   Biological crusts may be present (up to 10 percent of the surface) and serve to provide resistance to erosion.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** The surface layer ranges from 4 to 10 inches (10.1-25.4 cm) deep. Some soils have little organic matter in the A-horizon. Soil colors vary with soil series from grayish brown, pale brown, or dark grayish brown (values of 4 to 6) when dry and dark grayish brown or very dark grayish brown (values of 4 to 5) when moist. Structure in the soil surface can be granular parting to single grain to single grained.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** The functional/structural groups provide a combination of rooting depths and structure which positively influences infiltration. Combination of shallow and deep rooted with fine and coarse roots positively influences infiltration.

    The expected composition of the plant community is 80 to 95 percent perennial grasses and grass-likes, 0 to 10 percent forbs, and 0 to 10 percent shrubs.

    In the 12-14" PZ, the perennial grass and grass-like component is made up of tall, warm-season, rhizomatous grasses (30-60%); cool-season bunch grasses (10-35%); mid, warm season grasses (5-20%), short, warm-season grasses (5-15%); and grass-likes (0-5%).

    In the 15-17" PZ, the perennial grass and grass-like component is made up of tall, warm-season, rhizomatous grasses (30-60%); cool-season bunch grasses (10-35%); mid, warm season grasses (5-25%), short, warm-season grasses (5-15%); and grass-likes (0-5%)

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. A compaction layer should not be present on this site.

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

    Dominant: 12-14" PZ: Community 1.1:
    1. Native, C4, tall, rhizomatous grasses – 390-780 #/ac (30-60%): 2 species minimum

    15-17" PZ: Community 1.1:
    1. Native, C4, tall, rhizomatous grasses – 450-900 #/ac (30-60%): 2 species minimum

    Sub-dominant: 12-14" PZ: Community 1.1:
    2. Native, C3, bunch grasses – 130-390 #/ac (10-35%), 1 species minimum
    3. Native, C4, mid-grasses – 65-260#/ac (5-20%), 1 species minimum
    4. Native, C4, short grasses 65-195 #/ac (5-15%), 1 species minimum

    15-17" PZ: Community 1.1:
    2. Native, C3, bunch grasses– 150-525 #/ac (10-35%), 1 species minimum
    3. Native, C4, mid-grasses – 75-375 #/ac (5-15%)1 species minimum

    Other: 12-14" PZ: Community 1.1:
    Minor:
    5. Shrubs, cacti, vines – 65-130 #/ac (5-10%)
    6. Native, Perennial and Annual Forbs – 65-130 #/ac (5-10%)

7. Grass-0-55 #/ac: 0-65 #/ac (0-5%)

15-17" PZ Community 1.1:
4. Native, C4, short grasses – 75-225 #/ac (5-15%)
5. Shrubs, cacti, vines – 75-150 #/ac (5-10%)
6. Native, Perennial and Annual Forbs – 75-150 #/ac (5-10%)
7. Grass-likes – 0-75 #/ac: (0-5%)

Additional: 12-14” PZ: Community 1.1:
12a. Relative Dominance:
Native, C4, tall and mid grasses > Native, C3, bunch grasses > Native, C4, Mid-grasses > C4, short grasses > Native, Perennial and Annual Forbs = Shrubs, cacti, vines > Grass-likes.

12b. F/S Groups not expected for the site: Introduced annual grasses, perennial introduced and naturalized grasses, trees.

12c. Number of F/S Groups: 7

12d. Species number in Dominant and Sub-dominant F/S Groups: 5

15-17" PZ Community 1.1:
12a. Relative Dominance:
Native, C4, tall and mid grasses > Native, C3, bunch grasses > Native, C4, Mid-grasses = C4, short grasses > Shrubs, cacti, vines = Native, Perennial and Annual Forbs > Grass-likes.

12b. F/S Groups not expected for the site: Introduced annual grasses, perennial introduced and naturalized grasses, trees.

12c. Number of F/S Groups: 7

12d. Species number in Dominant and Sub-dominant F/S Groups: 5

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little evidence of decadence or mortality. Bunch grasses have strong, healthy centers with less than 3 percent mortality and shrubs have few dead stems. The exception is the potential of up to 10 percent mortality in the 15-17” PZ and up to 15 percent mortality in the 12-14” PZ of mid and short, warm-season bunch grasses during multi-year drought cycles.

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14. **Average percent litter cover (%) and depth (in):** Plant litter cover is evenly distributed throughout the site and is expected to be 40 to 60 percent. Litter depth is expected to be 0.25-0.50 inch (0.65-1.3 cm). Litter cover during and following drought can range from 30 to 40 percent and 5 to 15 percent following wildfire.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** In the 12-14” precipitation zone, annual production ranges from 750 to 1750 pounds per acres (air dry basis) Average annual production is 1,300 pounds per acre under normal precipitation and weather conditions.

    In the15-17” Precipitation Zone, annual production ranges from 1000 to 2000 pounds per acre (air dry basis). Average annual production is 1,500 pounds per acre under normal precipitation and weather conditions.

No significant reduction is expected the growing season following wildfire.

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Annual bromes, common mullein, crested wheatgrass, fringed sagewort, hairy gold aster, sand sagebrush (when at levels exceeding that expected in the reference state), and others as they become known.

    See:
    Colorado Department of Agriculture Invasive Species Website:
    https://www.colorado.gov/pacific/agconservation/noxious-weed-species
    Wyoming Weed and Pest Council Website: https://wyoweed.org/
    Nebraska Invasive Species website: https://neinvasives.com/plants.

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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.
