USDA Natural Resources Conservation Service

Ecological site R067AY150WY
Sandy (Sy)

Last updated: 9/07/2023
Accessed: 05/18/2024

General information

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

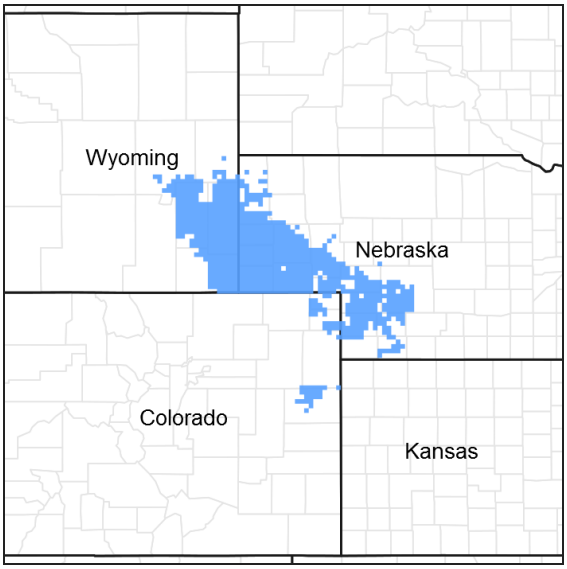


Figure 1. Mapped extent

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

MLRA notes

Major Land Resource Area (MLRA): 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.

Relationship to Other Classifications:

Natural Resource Conservation Service (NRCS) Classification Hierarchy (from highest to lowest unit):
Physiographic Division, Physiographic Province, Physiographic Section, Land Resource Region, Major Land Resource Area, Land Resource Unit
(Fenneman, 1946)

United States Forest Service (USFS) Classification Hierarchy (from highest to lowest unit):
Domain, Division, Province, Section, Subsection, Landtype Association, Landtype, Landtype Phase
(Cleland et al, 1997)

Revision Notes:

The Sandy 12-17 inch PZ site was developed by an earlier version of the Sandy (Sy) 12-17 inch Precipitation Zone ESD (2005, updated 2008). The earlier version of the Sandy 12-17 inch PZ ESD were based on input from NRCS (formerly Soil Conservation Service) and historical information obtained from the Sandy 12-14 Southern Plains (SP) and Sandy 15-17 SP Range Site Descriptions (1988). 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 Sandy site is a run-off site on slopes of less than six percent. The soil is deeper than 20 inches to bedrock, is not alkaline or saline, and does not have a high volume of coarse fragments on the surface. The surface and subsurface textures have a high degree of sand in the profile.

Associated sites

R067AY162WY	**Shallow (Sw)** This ecological site is commonly adjacent.

Similar sites

R067AY122WY	**Loamy (Ly)** The Loamy Ecological Site has loamy textures in the surface and subsurface soil profile.
R067AY152WY	**Sandy Lowland (SyL)** The Sandy Lowland Ecological Site is a run-on site.
R067AY162WY	**Shallow (Sw)** The Shallow Ecological Site has a root-restrictive layer within 20 inches of the soil surface.
R067AY104WY	**Clayey (Cy)** The Clayey Ecological Site has clayey textures in the soil surface and subsurface profile.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia filifolia* (2) *Artemisia cana*

Herbaceous	(1) *Hesperostipa comata* (2) *Calamovilfa longifolia*

Physiographic features

This site occurs on nearly level to slightly sloping toeslopes, footslopes, or backslopes of hills on the uplands or dissected plains. It also occurs on slightly sloping fans or on level terraces of the uplands or dissected plains.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Fan (3) Terrace
Runoff class	Very low to medium
Flooding frequency	None
Ponding frequency	None
Elevation	914–1,981 m
Slope	0–9%
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 (average)	103 days
Freeze-free period (average)	128 days
Precipitation total (average)	406 mm

Climate stations used

- (1) KIMBALL 2NE [USC00254440], Kimball, NE
- (2) CHEYENNE [USW00024018], Cheyenne, WY
- (3) SCOTTSBLUFF HEILIG AP [USW00024028], Scottsbluff, NE

- (4) BRIDGEPORT [USC00251145], Bridgeport, NE
- (5) HARRISBURG 12WNW [USC00253605], Harrisburg, NE
- (6) CHUGWATER [USC00481730], Chugwater, WY
- (7) OLD FT LARAMIE [USC00486852], Yoder, WY
- (8) PHILLIPS [USC00487200], LaGrange, WY
- (9) WHEATLAND 4 N [USC00489615], Wheatland, WY
- (10) OSHKOSH [USC00256385], Oshkosh, NE

Influencing water features

There are no water features of the ecological site.

Soil features

The soils on this site are typically deep to very deep, but includes moderately deep, well drained soils that formed from eolian deposits or alluvium; moderately deep soils formed from residuum derived from sandstone. They typically in the moderate to moderately rapid permeability class. The available water capacity is low to moderate. Available water is the portion of water in a soil that can be readily absorbed by plant roots. 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 sandy loam, loamy very fine sand, or very fine sandy loam, but may include sandy loam and loamy fine sand. The surface layer ranges from a depth of 5 to 12 inches thick. The subsoil is typically fine sandy loam, sandy loam, or loamy very fine sand, but may include very fine sandy loam. The subsoil typically contains less than 5 percent rock fragments, but this may range up to 35 percent in some soils. Soils in this site are typically leached of carbonates 8 to 30 inches or more; some soils may have carbonates at the surface. These soils are susceptible to erosion by wind if not covered. The potential for water erosion accelerates with increasing slope.

Surface soil structure is fine to medium granular, and the structure below the surface is subangular blocky and/or prismatic. 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 include: Aberone, Albinas, Alice, Anselmo, Ascalon, Ashollow, Bayard, Blanche, Bordeaux, Bresser, Busher, Chappell, Curabith, Jayem, Julesburg, Keeline, Mainter, Manter, Otero, Paoli, Phiferson, Sarben, Sidney, Turnercrest, Vetal, and Vonalee.

Other soil series that have been correlated to this site include: Chugcity, Claprych, Graystone, Greenhope, Hawksprings, and Sweatbee.

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 10.—Representative soil profile of Vonalee fine sandy loam. The argillic horizon is between depths of 12 centimeters (5 inches) and 46 centimeters (18 inches). The horizons below a depth of 46 centimeters (18 inches) contain calcium carbonate.

Figure 8. Vonalee sandy loam, Laramie County, WY (Western Part)

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Eolian deposits
Surface texture	(1) Fine sandy loam (2) Very fine sandy loam (3) Loamy very fine sand
Drainage class	Well drained
Permeability class	Moderate to moderately rapid
Soil depth	51–203 cm
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	11.18–19.3 cm
Calcium carbonate equivalent (0-101.6cm)	0–10%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	6.6–8.4
Subsurface fragment volume <=3" (0-101.6cm)	0–35%
Subsurface fragment volume >3" (0-101.6cm)	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/time controlled grazing strategies, and historical accounts.

The Sandy ecological site is characterized by four states: Reference, Sod-bound, Increased *Bare Ground*, and Tilled. The Reference State is characterized by cool-season mid bunchgrasses (needle and thread), warm-season mid rhizomatous grasses (prairie sandreed), and warm-season mid bunchgrass (little bluestem). Secondary grasses are warm-season tall bunchgrass (sand bluestem), and warm-season shortgrass (blue grama). Other grasses and grass-likes include western wheatgrass, Indian ricegrass, prairie Junegrass, sand dropseed, and threadleaf sedge. A minor component of forbs and shrubs are also present. The Sod-bound State is characterized by warm-season shortgrass (blue grama) and grasslikes (threadleaf sedge). The Increased *Bare Ground* State is characterized by annual grasses (sixweeks fescue), forbs (spreading buckwheat and annuals), and shrubs (broom snakeweed, and pricklypear). Invasives include cheatgrass.

As this site begins to deteriorate from a combination of frequent and severe grazing during the growing season, bunchgrasses such as needle and thread and green needlegrass decrease in both frequency and production. Grasses such as blue grama and threadleaf sedge increase. Under continued frequent and severe defoliation with no rest periods, rhizomatous wheatgrasses also begins to decrease. Forbs and shrubs such as curlycup gumweed, Cuman ragweed, hairy false goldenaster, spreading buckwheat, pricklypear, and broom snakeweed also increase. If continued, the plant community becomes sod-bound, and all mid-grasses can eventually be removed from the plant community. Over the long-term, this continuous use in combination with high stock densities results in a

broken sod, with areas of bare ground developing, and species such as broom snakeweed and annual bromes (cheatgrass), invading.

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).

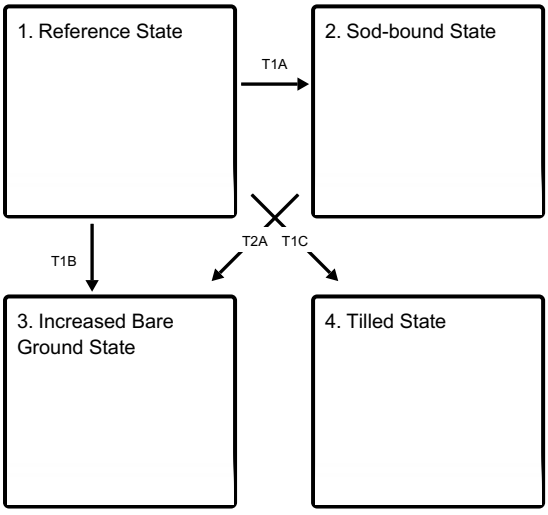
Today, livestock grazing, especially beef cattle has been a major influence on the ecological dynamics of the site. Grazing management, coupled with the effects of annual climatic variations, largely dictates the plant communities for the site.

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



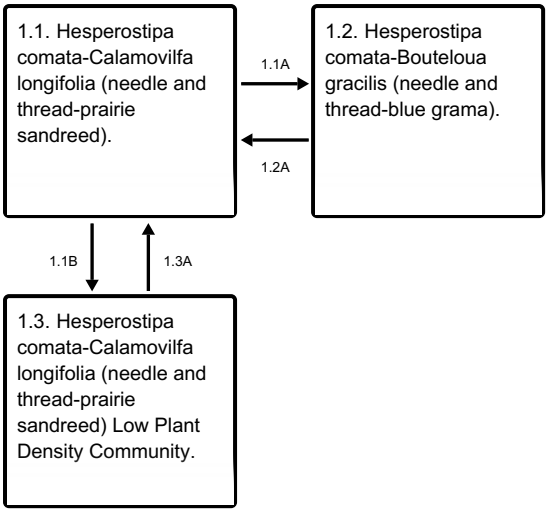
T1A - Excessive grazing. Lack of fire.

T1B - Excessive grazing. Lack of fire.

T1C - Mechanical tillage.

T2A - Excessive grazing. Lack of fire.

State 1 submodel, plant communities



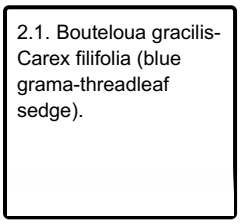
1.1A - Excessive grazing. Lack of fire.

1.1B - Non-use. Lack of fire.

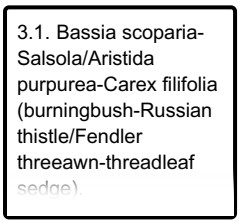
1.2A - Prescribed grazing. Prescribed fire.

1.3A - Prescribed grazing. Prescribed fire.

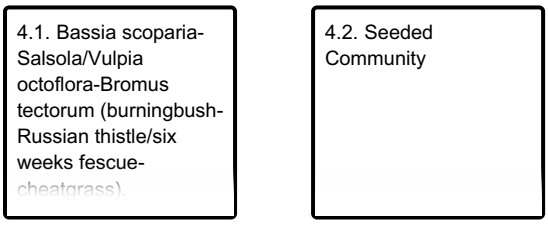
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



State 1
Reference State

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
- silver sagebrush (*Artemisia cana*), shrub
- needle and thread (*Hesperostipa comata*), grass
- prairie sandreed (*Calamovilfa longifolia*), grass

Community 1.1
Hesperostipa comata-Calamovilfa longifolia (needle and thread-prairie sandreed).

Figure 9. Sandy 12-17" PZ, Cheyenne 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 70 to 95 percent grasses and grass-likes, 5 to15 percent forbs, and 0 to15 percent woody plants. In the western portion of the MLRA, the plant community consists predominantly cool-season mid-grasses, with a significant component of warm-season mid-grasses. In the eastern portion of the MLRA, the plant community is predominantly warm-season with a significant cool-season component. This plant community is predominantly needle and thread, prairie sandreed, and little bluestem. Secondary grasses are sand bluestem, Indian ricegrass, blue grama, and western wheatgrass. Minor grasses and grasslikes that may occur include streambank (thickspike) wheatgrass, sideoats grama, prairie Junegrass, and sand dropseed. A variety of forbs such as scarlet globemallow, lemon scurfpea, prairie spiderwort, and purple prairie clover; half-shrubs such as silver- and sand sagebrush; and shrubs such as 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 1 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 and water cycles, and energy flow) are functioning properly. Infiltration rates are moderate, and soil erosion is low. Litter is properly distributed where vegetative cover is continuous. Decadence and natural plant mortality are low. This community is resistant to many disturbances except heavy, continuous grazing, tillage, or development into urban or other uses.

Dominant plant species

- silver sagebrush (*Artemisia cana*), shrub
- sand sagebrush (*Artemisia filifolia*), shrub
- needle and thread (*Hesperostipa comata*), 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
Hesperostipa comata-Bouteloua gracilis (needle and thread-blue grama).

The plant community has a reduced component of mid-grasses with an under-story of short sod-forming grasses. Dominant grasses include needle and thread, blue grama, and prairie sandreed. A cool-season/warm-season shift may occur depending upon the predominant season of use. Recurrent heavy, continuous grazing in the spring eventually reduces the cool-season grasses such as needle and thread and the rhizomatous wheatgrasses. Likewise, recurrent heavy, 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 is somewhat reduced amounts. The significant forbs include dotted gayfeather, white sagebrush, spiderworts, and upright prairie coneflower. Shrubs in this community include sand sagebrush, silver sagebrush, Arkansas rose, fringed sagewort, and broom snakeweed. 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. 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

- silver sagebrush (*Artemisia cana*), shrub
- sand sagebrush (*Artemisia filifolia*), shrub
- needle and thread (*Hesperostipa comata*), grass
- blue grama (*Bouteloua gracilis*), 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
Hesperostipa comata-Calamovilfa longifolia (needle and thread-prairie sandreed) Low Plant Density Community.

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 are 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. Much of the available nutrients are 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 slows nutrient recycling. Cool-season grasses, and pricklypear have typically increased. Blue grama is reduced. Dominant grasses include prairie sandreed, needle and thread, and western wheatgrass. Other species include sand dropseed and threadleaf sedge. Dominant forbs include annual sunflower and tenpetal blazingstar (also known as Mentzelia). Dominant shrubs include sand sagebrush, silver sagebrush, pricklypear and prairie (fringed) sagewort. 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, causing an erosion concern. In the 12 to 1 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 1,500 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.

Dominant plant species

- silver sagebrush (*Artemisia cana*), shrub

- sand sagebrush (*Artemisia filifolia*), shrub
- needle and thread (*Hesperostipa comata*), 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

Long-term, heavy, continuous grazing without adequate recovery between grazing events and lack of fire shifts this plant community toward 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 1.1B
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 impede energy flow. Initially, excess litter increases. Eventually, native plant density begins to decrease and annuals and introduced species may begin to invade. 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 this 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 toward the Reference Plant Community. This change can occur in a relatively short time frame with the return of these disturbances.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Sod-bound State

An ecological threshold has been crossed and a significant amount of production and diversity has been lost when compared to the Reference State. Significant biotic and soil changes have negatively impacted energy flow and nutrient and hydrologic cycles. This is a very stable state, resistant to change due to the high tolerance of blue grama and threadleaf sedge to grazing, the development of a shallow root system (aka root pan), and subsequent changes in hydrology and nutrient cycling. The loss of other functional/structural groups such as cool-season bunch

and rhizomatous grasses, forbs, and shrubs, reduces the biodiversity productivity of this site.

Dominant plant species

- silver sagebrush (*Artemisia cana*), shrub
- sand sagebrush (*Artemisia filifolia*), shrub
- blue grama (*Bouteloua gracilis*), grass
- threadleaf sedge (*Carex filifolia*), grass

Community 2.1
Bouteloua gracilis-Carex filifolia (blue grama-threadleaf sedge).

Initially, this plant community is dominated by sod-forming grasses and grasslikes, such as blue grama and threadleaf sedge, with remnants of mid-grasses such as prairie sandreed, sand dropseed, and some rhizomatous wheatgrass. Forbs include Cuman ragweed (western ragweed), lemon scurfpea, hairy false goldenaster, white sagebrush, and skeletonplant. Shrubs such as spreading buckwheat, broom snakeweed, fringed sagewort, and pricklypear continue to increase. Under long-term frequent and severe defoliation, blue grama and threadleaf sedge have become sod-bound in localized colonies and exhibit a mosaic appearance. Other minor grasses are sand dropseed, Fendler threeawn, and annuals. The mid-grasses and palatable forbs have been 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 inch 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

- silver sagebrush (*Artemisia cana*), shrub
- sand sagebrush (*Artemisia filifolia*), shrub
- blue grama (*Bouteloua gracilis*), grass
- threadleaf sedge (*Carex filifolia*), 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
Increased Bare Ground State

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. An ecological threshold has been crossed. The loss of organic matter and carbon reserves are resource concerns.

Dominant plant species

- silver sagebrush (*Artemisia cana*), shrub
- sand sagebrush (*Artemisia filifolia*), shrub
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- threadleaf sedge (*Carex filifolia*), grass
- burningbush (*Bassia scoparia*), other herbaceous
- Russian thistle (*Salsola*), other herbaceous

Community 3.1

Bassia scoparia-Salsola/Aristida purpurea-Carex filifolia (burningbush-Russian thistle/Fendler threeawn-threadleaf sedge).

The plant composition is made of annuals with a few species of perennial forbs and grasses that are very tolerant to frequent and severe defoliation. The dominant grasses include blue grama, threadleaf sedge, and Fendler threeawn. Annual grasses and forbs such as cheatgrass, sixweeks fescue, Russian thistle, and burningbush have increased or invaded. The dominant forbs include curlycup gumweed, Cuman (western) ragweed, and hairy false goldenaster. Broom snakeweed, spreading buckwheat, and pricklypear are increasing. 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 inch 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.

Dominant plant species

- silver sagebrush (*Artemisia cana*), shrub
- sand sagebrush (*Artemisia filifolia*), shrub
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- threadleaf sedge (*Carex filifolia*), 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

State 4
Tilled State

The Tilled State is the result of the site mechanical farming operations. An ecological threshold has been crossed due to complete removal of vegetation and of soil tillage. Physical, chemical, and biological soil properties have been dramatically altered. There is no restorative pathway known at this time.

Dominant plant species

- sixweeks fescue (*Vulpia octoflora*), grass
- cheatgrass (*Bromus tectorum*), grass
- burningbush (*Bassia scoparia*), other herbaceous
- Russian thistle (*Salsola*), other herbaceous

Community 4.1
Bassia scoparia-Salsola/Vulpia octoflora-Bromus tectorum (burningbush-Russian thistle/six weeks fescue-cheatgrass).

Go-back land is created when the soil is tilled or farmed (sodbusted) and abandoned. All of the native plants are eliminated, soil organic matter is reduced, soil structure is degraded, and a plowpan or compacted layer is formed. Residual synthetic chemicals often remain from past farming operations, and erosion processes may be active. Go-back land evolves through several plant communities beginning with an early annual plant community, which initiates the revegetation process. Plants such as Russian thistle, burningbush, sixweeks fescue, cheatgrass, and other annuals begin to establish. These plants give some protection from erosion and start to build minor levels of soil organic matter. Threeawn, sand dropseed, and several other early perennials can dominate the plant community for five to eight years or more. Eventually western wheatgrass, little bluestem, needle and thread, and other natives become re-established. Blue grama and threadleaf sedge are absent. Forbs can include annual sunflower, tenpetal blazingstar (Mentzelia), and Rocky Mountain beeplant. Where Go-back Land has eroded to parent material, the slow process of soil development and re-establishment of vegetation begins. This is a very slow process (100 years or more). A new eco-site may evolve depending upon the severity of soil and parent material

erosion, and parent material.

Dominant plant species

- sixweeks fescue (*Vulpia octoflora*), grass
- cheatgrass (*Bromus tectorum*), grass
- burningbush (*Bassia scoparia*), other herbaceous
- Russian thistle (*Salsola*), other herbaceous

Figure 16. 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

Community 4.2
Seeded Community

This plant community can vary considerably depending upon how eroded the soil was, the species seeded, the stand that was established, how long ago the stand was established, and the management of the stand since establishment. The Sandy Ecological Site has been converted to cropland in some areas.

Transition T1A
State 1 to 2

Long-term, heavy, continuous grazing and lack of fire shift this plant community across an ecological threshold toward the Sod-bound State. Biotic integrity and hydrologic function are impaired as a result of this transition.

Transition T1B
State 1 to 3

Long-term heavy, continuous, grazing and lack of fire shift this plant community across an ecological threshold toward the Increased *Bare Ground* State. Erosion and loss of organic matter and carbon reserves are concerns. Non-native exotic plants are likely to invade.

Transition T1C
State 1 to 4

Mechanical tillage of this ecological site causes an immediate transition across an ecological threshold to the Tilled State. This transition can occur from any plant community and is irreversible.

Transition T2A
State 2 to 3

Long-term heavy, continuous, grazing and lack of fire cause a shift across an ecological threshold to the Increase *Bare Ground* State. Erosion and loss of organic matter are resource concerns. Annual plants such as sixweeks fescue, 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"**			219–729	
	prairie sandreed	CALO	*Calamovilfa longifolia*	146–437	–
	little bluestem	SCSC	*Schizachyrium scoparium*	73–291	

	little bluestem	SCSC	*Schizachyrium scoparium*	73–291	–
	sand bluestem	ANHA	*Andropogon hallii*	0–219	–
2	**12"-14"**			219–583	
	needle and thread	HECO26	*Hesperostipa comata*	219–583	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–146	–
3	**12"-14"**			73–219	
	blue grama	BOGR2	*Bouteloua gracilis*	73–219	–
4	**12-14"**			73–146	
	thickspike wheatgrass	ELLA3	*Elymus lanceolatus*	0–146	–
	western wheatgrass	PASM	*Pascopyrum smithii*	73–146	–
5	**12"-14"**			73–146	
	Grass, perennial	2GP	*Grass, perennial*	0–73	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–73	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–73	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–73	–
	threeawn	ARIST	*Aristida*	0–29	–
6	**12"-14"**			0–146	
	threadleaf sedge	CAFI	*Carex filifolia*	0–146	–
	sedge	CAREX	*Carex*	0–73	–
9	**15"-17"**			252–841	
	prairie sandreed	CALO	*Calamovilfa longifolia*	168–504	–
	little bluestem	SCSC	*Schizachyrium scoparium*	84–336	–
	sand bluestem	ANHA	*Andropogon hallii*	0–252	–
10	**15"-17"**			252–673	
	needle and thread	HECO26	*Hesperostipa comata*	252–673	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–168	–
11	**15"-17"**			84–252	
	blue grama	BOGR2	*Bouteloua gracilis*	84–252	–
12	**15"-17"**			84–168	
	thickspike wheatgrass	ELLA3	*Elymus lanceolatus*	0–168	–
	western wheatgrass	PASM	*Pascopyrum smithii*	84–168	–
13	**15"-17"**			84–168	
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–84	–
	Grass, perennial	2GP	*Grass, perennial*	0–84	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–84	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–84	–
	threeawn	ARIST	*Aristida*	0–34	–
14	**15"-17"**			0–168	
	threadleaf sedge	CAFI	*Carex filifolia*	0–168	–
	sedge	CAREX	*Carex*	0–84	–
Forb					
7	**12"-14"**			73–219	
	Forb, perennial	2FP	*Forb, perennial*	0–73	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–29	–

	pussytoes	ANTEN	*Antennaria*	0–29	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–29	–
	milkvetch	ASTRA	*Astragalus*	0–29	–
	false boneset	BREU	*Brickellia eupatorioides*	0–29	–
	prairie clover	DALEA	*Dalea*	0–29	–
	larkspur	DELPH	*Delphinium*	0–29	–
	sanddune wallflower	ERCA14	*Erysimum capitatum*	0–29	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–29	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–29	–
	bush morning-glory	IPLE	*Ipomoea leptophylla*	0–29	–
	dotted blazing star	LIPU	*Liatris punctata*	0–29	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–29	–
	bractless blazingstar	MENU	*Mentzelia nuda*	0–29	–
	evening primrose	OENOT	*Oenothera*	0–29	–
	pincushion cactus	PEDIO	*Pediocactus*	0–29	–
	beardtongue	PENST	*Penstemon*	0–29	–
	sleeping popcornflower	PLSCH	*Plagiobothrys scouleri var. hispidulus*	0–29	–
	lemon scurfpea	PSLA3	*Psoralidium lanceolatum*	0–29	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–29	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–29	–
	veiny dock	RUVE2	*Rumex venosus*	0–29	–
	ragwort	SENEC	*Senecio*	0–29	–
	goldenrod	SOLID	*Solidago*	0–29	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–29	–
	spiderwort	TRADE	*Tradescantia*	0–29	–
	American vetch	VIAM	*Vicia americana*	0–29	–
15	**15"-17"**			84–252	
	Forb, perennial	2FP	*Forb, perennial*	0–84	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–34	–
	pussytoes	ANTEN	*Antennaria*	0–34	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–34	–
	milkvetch	ASTRA	*Astragalus*	0–34	–
	false boneset	BREU	*Brickellia eupatorioides*	0–34	–
	prairie clover	DALEA	*Dalea*	0–34	–
	larkspur	DELPH	*Delphinium*	0–34	–
	sanddune wallflower	ERCA14	*Erysimum capitatum*	0–34	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–34	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–34	–
	bush morning-glory	IPLE	*Ipomoea leptophylla*	0–34	–
	dotted blazing star	LIPU	*Liatris punctata*	0–34	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–34	–
	bractless blazingstar	MENU	*Mentzelia nuda*	0–34	–
	evening primrose	OENOT	*Oenothera*	0–34	–

	Indian breadroot	PEDIO2	*Pediomelum*	0–34	–
	beardtongue	PENST	*Penstemon*	0–34	–
	sleeping popcornflower	PLSCH	*Plagiobothrys scouleri var. hispidulus*	0–34	–
	lemon scurfpea	PSLA3	*Psoralidium lanceolatum*	0–34	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–34	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–34	–
	veiny dock	RUVE2	*Rumex venosus*	0–34	–
	ragwort	SENEC	*Senecio*	0–34	–
	goldenrod	SOLID	*Solidago*	0–34	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–34	–
	white heath aster	SYERE	*Symphyotrichum ericoides var. ericoides*	0–34	–
	spiderwort	TRADE	*Tradescantia*	0–34	–
	American vetch	VIAM	*Vicia americana*	0–34	–
Shrub/Vine					
8	**12-14"**			0–219	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–73	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–29	–
	sand sagebrush	ARFI2	*Artemisia filifolia*	0–29	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–29	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–29	–
	spreading buckwheat	EREF	*Eriogonum effusum*	0–29	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	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	–
	soapweed yucca	YUGL	*Yucca glauca*	0–29	–
16	**15"-17"**			0–252	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–84	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–34	–
	sand sagebrush	ARFI2	*Artemisia filifolia*	0–34	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–34	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–34	–
	spreading buckwheat	EREF	*Eriogonum effusum*	0–34	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	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	–
	soapweed yucca	YUGL	*Yucca glauca*	0–34	–

Animal community

Wildlife Interpretations

Reference Plant Community - Needle and Thread, Prairie Sandreed, Little Bluestem:

The predominance of grasses plus high forb diversity in this community favors large grazers such as pronghorn and elk. Suitable thermal and escape cover for mule deer is limited due to low shrub cover. White-tailed and black- tailed jackrabbit, badger, and coyote commonly use this community. The Reference Plant Community also provides habitat for a wide array of smaller mammals, so diverse prey populations are available for raptors such as ferruginous and Swainson's hawks. Birds such as Cassin's and Brewer's sparrow, chestnut collared longspur, lark bunting, western meadowlark, will utilize this community for nesting and foraging.

1.2 Community - Decreased Prairie Sandreed, Decreased Needle and Thread, Increased Blue Grama:

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 will also make significant use of this community. Pronghorn may forage in this community.

1.3 Community - Low Plant Density, Increased Litter, Decadent Plants, and Standing Dead Canopy:

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

2.1 Community - Blue Grama, Threadleaf Sedge, Spreading Buckwheat, Broom Snakeweed, and Pricklypear:

As these communities develop into an open landscape the wildlife species will shift from the Reference Plant Community species toward the typical shortgrass prairie species such as horned lark, killdeer, long-billed curlew, McCown's longspur, and ferruginous hawk.

3.1 Community – Threadleaf Sedge, Fendler Threeawn, Annuals, Cheatgrass, and Invasives:

Sparse vegetation and greater amounts of bare ground provide suitable habitat for prairie dogs, horned larks and McCown's longspurs. However, a lack of complex vegetation structure and residual cover makes this community poor habitat in general for most ground-nesting birds and big game species.

4.1 Community – Threeawn, Sand Dropseed, Annuals, Cheatgrass, and Invasives:

The wildlife species found here will be similar to the Increased *Bare Ground* Community.

Seeded Community (Adapted Seed Mixes):

Wildlife use of tilled and replanted fields is dependent upon the plant species used in the planted seed mix. Purpose of the seeding (i.e. reclamation, soil erosion control, livestock grazing, targeted wildlife species, etc.) affects the usability for wildlife. If wildlife use is a primary concern, then seed mixes must be formulated to meet species specific habitat requirements.

Grazing Interpretations

The following table is a guide to stocking rates for the plant communities described in the Sandy 12-17 inch PZ site. These are conservative estimates for initial planning. On-site conditions will vary, and stocking rates should be adjusted based on range inventories, animal kind/class, forage availability (adjusted for slope, 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, 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)
1,300 lbs. per acre X 25% 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:

1.2 PC - (900) (0.25)
2.1 PC - (500) (0.14)

15-17 Inch PZ
Reference PC – (1500) (0.41)
1.2 PC – (1100) (0.30)
2.1 PC – (600) (0.16)

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 development of 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 B, with localized areas in hydrologic group C. Infiltration potential for this site varies from moderately rapid to rapid, depending upon soil hydrologic group and ground cover. Runoff varies from low to moderate. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where short-grasses form a strong 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 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.

Recreational uses

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

Wood products

No appreciable wood products are present on the site.

Other products

Site Development & Testing Plan

The Sandy 12-17 inch PZ site was developed by an earlier version of the Sandy (Sy) 12-17 inch Precipitation Zone ESD (2005, updated 2008). The earlier version of the Sandy 12-17 inch PZ ESD were based on input from the Natural Resources Conservation Service (NRCS, formerly the Soil Conservation Service), and historical information obtained from the Sandy 12-14 Southern Plains (SP) and Sandy 15-17 SP Range Site Descriptions (1988). 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.

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, 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. Note: The lbs./ac in the Total Annual Production may need to be increased. It should be more productive than the "Loamy" ESD.

Each Alternative State/Community

Complete to Provisional level

Supporting Information (Site Interpretations, Assoc. & Similar Sites, Inventory Data References, Agency/State Correlation, 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, percentage of Litter)***
• Soil pedon descriptions collected on site****
*NRCS 528-Prescribed Grazing Standard job 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

Date Source: NRI
Number of Records: 28
Sample Period: 2006-2013
States: NE, WY
Counties: Banner, Morrill, Scotts Bluff (NE):
Goshen, Laramie, Platte (WY)

Date Source: 417s
Number of Records: 17
Sample Period: 1970-1986
States: NE, WY
Counties: Banner, Garden, Morrill, Scotts Bluff, Sioux (NE):
Goshen, Laramie (WY)

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 also were used to estimate data.

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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.

Author(s)/participant(s)	Dave Cook, Kristin Dickinson, George Gamblin, John Hartung, Andy Steinert, Nadine Bishop
Contact for lead author	
Date	11/03/2020
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None. Rills are not expected on the site.

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2. **Presence of water flow patterns:** Typically, none. Water flow patterns, if present, are associated with animal activity on slopes greater than 6 percent and will be very short, narrow, and disconnected.

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3. **Number and height of erosional pedestals or terracettes:** Typically, None.

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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 is 5 to 10 percent and scattered in patches less than 3 inches (7.62 cm) wide.

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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:** None, wind-scoured areas and depositional areas are not expected on this 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):** Soil aggregate stability ratings should typically be 5 to 6, normally 6. Surface organic matter adheres to the soil surface. Soil surface peds will typically retain structure indefinitely when dipped in distilled water.

   Surface erosion by water rarely occurs due to rapid infiltration, but 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.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Surface layer should be 5 to 12 inches (12.7-30.5 cm) thick. Soil colors vary with soil series from dark grayish brown, grayish brown, to brown (values of 4 to 5) when dry and dark grayish or very dark grayish brown (values of 3 to 4) when moist. Vonalee and Keeline soils are yellowish brown (5/4) dry and brown (4/3) moist. Structure typically is fine to medium granular.

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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 species (mid & tall rhizomatous and tufted perennial cool season grasses) with fine and coarse roots positively influences infiltration. The expected composition of the plant community is 70 to 95 percent perennial grasses and grass-likes, 5 to 15 percent forbs, and 0 to 15 percent shrubs.

    In the 12-14” PZ, the perennial grass and grass-like component is made up of tall, warm-season, rhizomatous grasses (10-35%); cool-season bunch grasses (15-40%); mid, warm season grasses (5-25%), short, warm-season grasses (5-15%); cool-season rhizomatous grasses (5-10%); and grass-likes (0-10%).

    In the 15-17” PZ, the perennial grass and grass-like component is made up of tall, warm-season, rhizomatous grasses (15-40%); cool-season bunch grasses (10-40%); mid, warm season grasses (5-25%), short, warm-season grasses (5-15%); cool-season rhizomatous grasses (5-10%); and grass-likes (0-10%).

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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.

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, C3, bunch grasses– 195-520 #/ac (15-40%), 1 species minimum
2. Native, C4, tall, rhizomatous grasses – 130-455 #/ac (10-35%), 1 species minimum

15-17" PZ: Community 1.1:
1. Native, C3, bunch grasses– 225-600 #/ac (15-40%), 1 species minimum
2. Native, C4, tall, rhizomatous grasses – 150-600 #/ac (10-40%), 1 species minimum

Sub-dominant: 12-14" PZ: Community 1.1:
3. Native, C4, mid-grasses – 65-325 #/ac (5-25%), 1 species minimum
4. Native, C4, short grasses – 65-195 #/ac (5-15%), 1 species minimum
5. Shrubs, cacti, vines – 13-195#/ac (1-15%), 1 species minimum
6. Native, Perennial and Annual Forbs – 65-195 #/ac (5-15%), 5 species minimum

15-17" PZ: Community 1.1:
3. Native, C4, mid-grasses – 75-375 #/ac (5-15%), 1 species minimum
4. Native, C4, short grasses – 75-225 #/ac (5-15%), 1 species minimum
5. Shrubs, cacti, vines – 15-225 #/ac (1-15%), 1 species minimum
6. Native, Perennial and Annual Forbs – 75-225 #/ac (5-15%), 5 species minimum

Other: Minor:
12-14" PZ: Community 1.1:
7. Native, C3, rhizomatous grasses – 65-130 #/ac (5-10%)
8. Grass-likes – 0-130 #/ac: (0-10%)

15-17" PZ: Community 1.1:
7. Native, C3, rhizomatous grasses – 75-150 #/ac (5-10%)
8. Grass-likes – 0-150 #/ac: (0-10%)

Additional: 12-14" PZ: Community 1.1:
12a. Relative Dominance:
Native, C3, bunch grasses = Native, C4, tall and mid grasses > Native, C4, Mid-grasses > C4, short grasses = Native, Perennial and Annual Forbs > or = Shrubs, cacti, vine > Native, C3, Rhizomatous Grasses > 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: 8

12d. Species number in Dominant and Sub-dominant F/S Groups: 10

15-17" PZ: Community 1.1:
12a. Relative Dominance:
Native, C3, bunch grasses = Native, C4, tall grasses > Native, C4, Mid-grasses = C4, short grasses = Native, Perennial and Annual Forbs > or = Shrubs, cacti, vine > Native, C3, Rhizomatous Grasses > 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: 8

12d. Species number in Dominant and Sub-dominant F/S Groups: 10

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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 50 to 70 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 40 to 50 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 in 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, 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.
