USDA Natural Resources Conservation Service

Ecological site R072XY111KS
Sandy Plains

Accessed: 05/09/2024

General information

Approved. An approved ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model, enough information to identify the ecological site, and full documentation for all ecosystem states contained in the state and transition model.

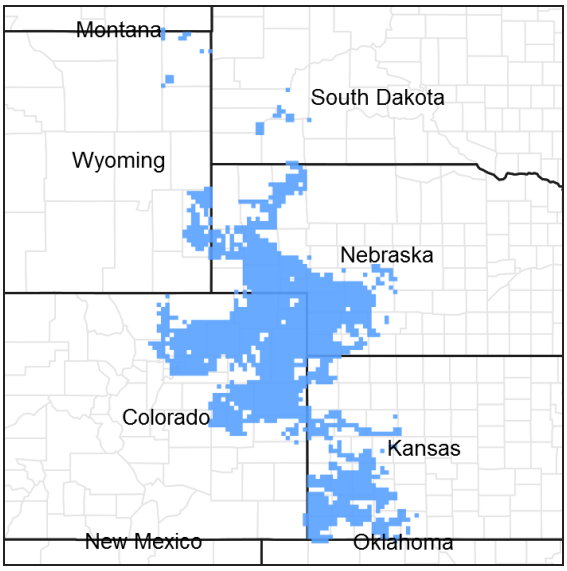


Figure 1. Mapped extent

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): 072X–Central High Tableland

Major Land Resource Area (MLRA) 72--Central High Tableland. This area is in Kansas (54 percent), Nebraska (25 percent), and Colorado (21 percent). A very small part of the area is in Wyoming. The area makes up about 34,550 square miles (89,535 square kilometers). It includes the towns of Garden City, Goodland, and Colby, Kansas; Imperial, North Platte, Ogallala, and Sidney, Nebraska; and Holyoke and Wray, Colorado. Interstate 70 bisects the area, and Interstates 76 and 80 follow the south side of the South and North Platte Rivers, respectively. The Cimarron National Grasslands occur in the southwest corner of the MLRA.

Classification relationships

Major land resource area (MLRA): 072-Central High Tableland

Ecological site concept

This site is characterized by sandy soils, generally with greater than 52 percent sand. Sandy eolian sediments make up the parent material of this ecological site. This site occurs on plains and tablelands. The textures for the surface of the components of this group are fine sandy loam, loamy sand, sandy loam, and loamy fine sand.

Associated sites

R072XY107KS	**Sandy Lowland** This site occurs on nearly level to moderately sloping floodplains and low terraces. The site is characterized by soils with greater than 55 percent sand in the surface. The soils characteristic of this site formed in sandy alluvium from mixed sources.
R072XY109KS	**Rolling Sands** This site occurs on rolling hills and has a sand and fine sand soil surface texture.
R072XY110KS	**Choppy Sands** This site is characterized by sandy soils, generally with greater than 52 percent sand. Sandy eolian sediments make up the parent material of this ecological site. This site occurs on hummocky upland dunes and stream terraces. Slopes are generally greater than 24 percent giving a short, steep, hummocky appearance.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Andropogon hallii* (2) *Calamovilfa longifolia*

Physiographic features

The Sandy Plains site occurs on nearly level to undulating topography with associated low sand dunes. The site is relatively smooth with loess-mantled plains that are dissected by several river valleys and are associated with gently sloping to steep breaks. The elevation median varies from 3,500 to 4,800 feet above mean sea level.

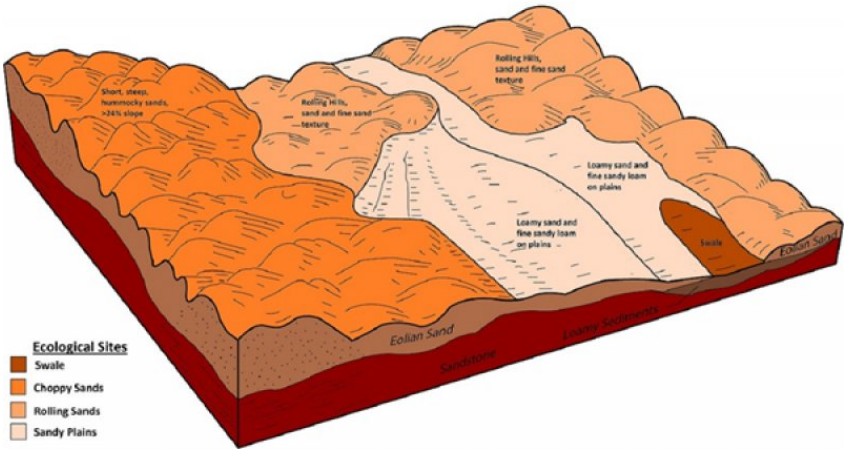


Figure 2. Sandy soils MLRA72 ESD block diagram

Table 2. Representative physiographic features

Landforms	(1) Sand sheet (2) Plain (3) Hill
Flooding frequency	None
Ponding frequency	None
Elevation	1,067–1,463 m
Slope	0–10%
Ponding depth	0 cm
Water table depth	152 cm

Climatic features

The average annual precipitation in this area is 14 to 25 inches (355 to 635 millimeters). It fluctuates widely from year to year. Most of the rainfall occurs as high-intensity, convective thunderstorms during the growing season. The maximum precipitation occurs from late spring through early autumn. Precipitation in winter occurs as snow. The annual snowfall ranges from about 16 inches (40 centimeters) in the southern part of the area to 35 inches (90 centimeters) in the northern part. The average annual temperature is 46 to 57 degrees F (8 to 14 degrees C). The freeze-free period averages 161 days and ranges from 135 to 210 days, increasing in length from northwest to southeast. Climate data comes from the Natural Resources Conservation Service (NRCS) National Water and Climate Center. The data set is from 1981-2010.

Table 3. Representative climatic features

Frost-free period (average)	142 days
Freeze-free period (average)	161 days
Precipitation total (average)	483 mm

Climate stations used

- (1) GARDEN CITY RGNL AP [USW00023064], Garden City, KS
- (2) SAINT FRANCIS [USC00147093], Saint Francis, KS
- (3) HAIGLER [USC00253515], Haigler, NE
- (4) MADRID [USC00255090], Madrid, NE
- (5) SIDNEY 6 NNW [USC00257830], Gurley, NE
- (6) HAYES CENTER 1NW [USW00024020], Hayes Center, NE
- (7) JOHNSON [USC00144114], Johnson, KS
- (8) YUMA [USC00059295], Yuma, CO
- (9) BIG SPRINGS [USC00250865], Big Springs, NE
- (10) IMPERIAL [USC00254110], Imperial, NE

Influencing water features

This ecological site is characterized by very deep sandy soils that are excessively drained.

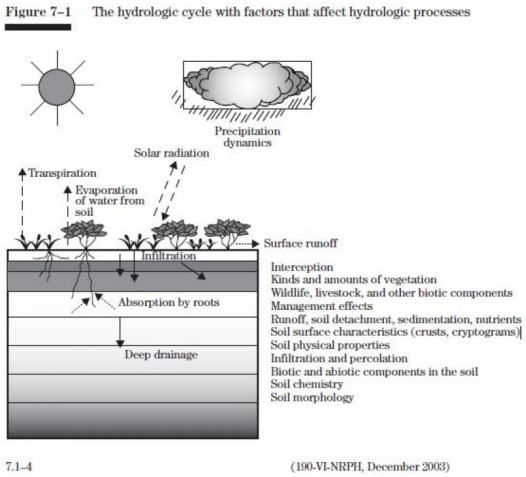


Figure 7. The Hydrologic Cycle NRPH

Soil features

The soil series making up this ecological site consists of very deep, well drained soils that have a parent material of eolian deposits. These soils are on sandsheets, interdunes, plains, and hillslopes on tablelands and have slopes of 0 to 10 percent.

The surface layer is represented by coarse to medium-textured soils. The underlying layers are represented by coarse to moderately fine-textured soils that range from 3 to 20 inches thick. Subsoil and underlying layers generally become heavier-textured. The content of organic matter generally is moderately low or moderate. These soils are highly susceptible to wind erosion when vegetative cover is opened. Roads, trails, pipeline, overgrazing, fire, and other disturbances can be the cause of severe wind erosion on this site.

The Reference Plant Community should portray slight to no evidence of rills. Water flow paths, if present, are broken, irregular in appearance, or discontinuous with numerous debris dams or vegetative barriers. Wind- scoured areas and pedestaled plants may exist in areas but should be minor. The soil surface is stable and intact. Sub-surface soil layers are non-restrictive to water movement and root penetration.

Major soil series correlated to this ecological site include: Ascalon, Busher, Dailey, Dunday, Haxtun, Jayem, Julesburg, Manter, Otero, Sarben, Satanta, Scoville, Vetal, Vona, and Woodly.

These attributes represent 0-40 inches in depth or to the first restrictive layer.

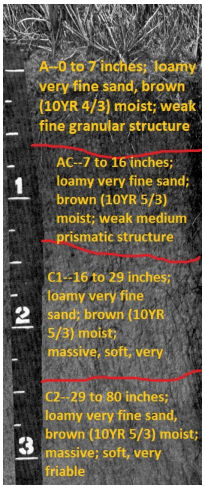


Figure 8. Sarben series profile Hayes Co. NE

Table 4. Representative soil features

Surface texture	(1) Fine sandy loam (2) Sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained to excessively drained
Permeability class	Moderate to rapid
Soil depth	51–203 cm
Surface fragment cover <=3"	0–7%
Surface fragment cover >3"	0–1%
Available water capacity (0-101.6cm)	7.87–19.05 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–1
Soil reaction (1:1 water) (0-101.6cm)	5.6–9
Subsurface fragment volume <=3" (Depth not specified)	0–7%

Subsurface fragment volume >3" (Depth not specified)	0–2%

Ecological dynamics

The plant community for this site is dynamic due to the complex interaction of many ecological processes. The interpretive plant community for this site is the Reference Plant Community. The Reference Plant Community has been determined by the study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing strategies. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts have also been used.

This ecological site is made up of a Grassland State, a Sod-bound State and a Tillage State. The Grassland State is characterized by non-broken land (no tillage), both warm and cool season, tall, mid and short bunchgrasses, sod-forming grasses, forbs, and shrubs. The Sod-bound State is dominated by shortgrass species that form dense sod. The Tillage State has been mechanically disturbed (broken) by equipment and includes either a variety of reseeded warm season bunch and sod forming grasses, or early successional plants to include the latter as well as annual grasses and forbs.

Vegetation changes are expected within this ecological site and will be dependent upon the site's geographical location inside Major Land Resource Area (MLRA) 72, the Central High Tablelands. Variation in precipitation east and west is not as affected as is temperature north and south. The northern part of MLRA 72 is characterized by cooler temperatures and a shorter growing season in respect to the southern end. As a result, cool season bunchgrasses and sod formers proliferate. Growth of native cool season plants begins about April 15, and continues to about June 15. Native warm season plants begin growth about May 15, and continue to about August 15. Green up of cool season plants may occur in September and October if adequate moisture is available (weather data from National Climate Data Center 1980-2010).

Fires are a part of the natural disturbance regime of this site. This site developed with occasional fires as part of the ecological processes. Historically, it is believed that the fires were infrequent, randomly distributed, and started by lightning at various times throughout the season when thunderstorms were likely to occur. It is also believed that pre-European inhabitants may have used fire as a management tool for attracting herds of large migratory herbivores (bison, elk, deer, and pronghorn). 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 in the semi-arid, High Plains area.

The degree of herbivory (feeding on herbaceous plants) has a significant impact on the dynamics of the site. Historically, periodic grazing by herds of large migratory herbivores was a primary influence. Secondary influences of herbivory by species such as prairie dogs, grasshoppers, gophers, and root-feeding organisms impacted the vegetation historically, and continue to this day.

The management of herbivory by humans through grazing of domestic livestock and/or manipulation of wildlife populations has been a major influence on the ecological dynamics of the site. This management, coupled with the High Plains climate, largely dictates the plant communities for the site.

Drought cycles have historically had a major impact upon the vegetation of this site. The species composition changes according to the duration and severity of the drought cycle. Initially, the shorter-rooted species die out and the deeper-rooted species persist. Eventually the opened up spaces will go through secondary succession as higher precipitation cycles return.

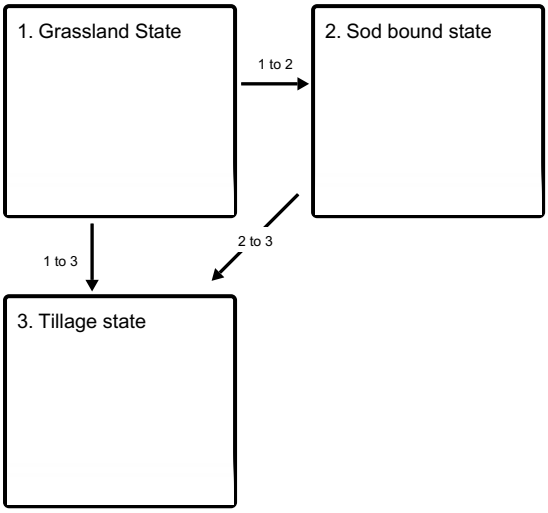
This site often occurs on the flat areas between the Rolling Dunes ecological site and adjacent to the Choppy Sands site. The flatter slopes of this site are preferred by livestock, which can lead to grazing distribution problems.

Water locations, salt placement, and other aids help to distribute grazing on this site. Other management techniques such as concentrated grazing and/or grazing systems can also help to distribute grazing more evenly.

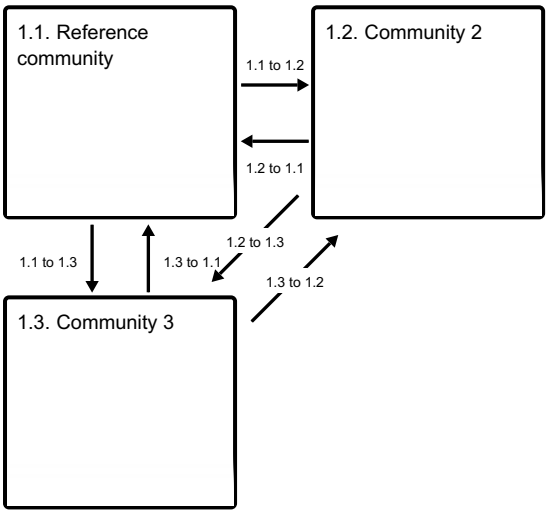
The general response of this site to heavy, long term continuous grazing is to gradually lose the vigor and reproductive potential of the tall and mid-grass species and shift the plant community toward short-grass and unpalatable species. The use of grazing management that includes needed distribution tools, a forage and animal balance, and adequate recovery periods during the growing season, helps to maintain and restore the reference plant community.

State and transition model

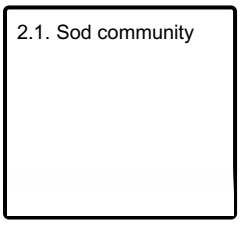
Ecosystem states



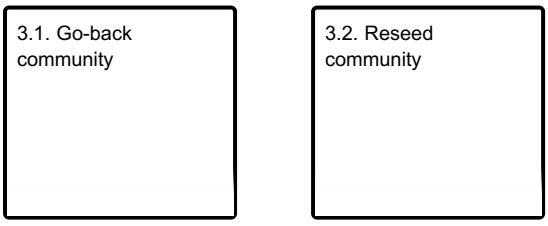
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1

Grassland State

The grassland state is supported by empirical data and is defined by three native plant communities that are a result of periodic fire, drought, and herbivore and ungulate grazers. These events are part of the natural disturbance regime and climatic process that contribute to the development of the site. The Reference Plant Community consists of tall, mid, short, warm and cool season grasses, forbs, and shrubs. Plant Community 1.2 is dominated by sand dropseed and blue grama in combination with a minor component (2-10 percent composition by weight) of reference community plant species. This plant community is vulnerable to exceeding the resilience limits of the Grassland State and transitioning to state 2. Plant Community 1.3 is vulnerable to exceeding the resilience limits of the Grassland State as well. This plant community is dominated (40-100 percent composition by weight) by Fendler threeawn and sand dropseed, while subdominant (10-40 percent composition by weight) species include annuals. More field investigations and evaluations are necessary to assess Plant Community 1.3 in regard to resilience and changes in vegetation, soil, and hydrology of the site. The following paragraphs are narratives for each of the described plant communities. These plant communities may not represent every possibility, but they probably are the most prevalent and repeatable plant communities that exist on this ecological site. The plant composition table shown below has been developed from the best available knowledge at the time of this revision. As more data is collected, some of these plant communities may be adjusted or removed and new ones may be added. None of these plant communities should necessarily be thought of as “Desired Plant Communities." According to the USDA NRCS National Range and Pasture Handbook, Desired Plant Communities will be determined by the decision-makers and will meet minimum quality criteria established by NRCS. The main purpose for including any description of a plant community here is to capture the current knowledge and experience at the time of this revision.

Community 1.1
Reference community

The Reference Plant Community serves as the basis for all other interpretations. The potential vegetation is about 85 percent grasses and grass-like plants, 10 percent forbs, and 5 percent shrubs. Sand bluestem, prairie sandreed, blue grama, and little bluestem make up approximately 43% of the total annual production and are considered the dominant species in this community. Subdominant species making up 26% of the plant community include switchgrass, needle and thread, Indiangrass, and sideoats grama. Another subdominant species group that makes up 13% of the plant community consists of sand dropseed, western wheatgrass, and buffalograss. The forb community is diverse and makes up approximately 10% of the total annual production per acre. Shrubs make up 5% of this community and can include leadplant, sand sagebrush, plains pricklypear, Chickasaw plum, American plum, western sandcherry, and soapweed yucca. This plant community is well adapted to the Northern Great Plains climatic conditions and is relatively resistant to many disturbances except prolonged heavy continuous grazing, sodbusting, and urban and other development. The diversity in plant species allows for high drought tolerance. Plant litter is uniformly distributed with very little movement off-site, and natural plant mortality is very low. This is a sustainable plant community in terms of soil stability, watershed function and biologic integrity. This plant community is diverse and productive. With proper management and adequate recovery periods, this community will remain diverse, productive, and functioning at a peak ecological level. Total annual production ranges from 900 to 2,500 pounds of air-dried vegetation per acre per year and will average 1,800 pounds.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	857	1715	2326
Forb	101	202	314
Shrub/Vine	50	101	163
Total	**1008**	**2018**	**2803**

Figure 10. Plant community growth curve (percent production by month). KS0012, Sand Bluestem, Little Bluestem, Prairie Sandreed Plant Community.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
			5	25	30	25	10	5			

Community 1.2
Community 2

This plant community evolves with continuous grazing. When compared to the reference plant community, sand bluestem, prairie sandreed, little bluestem, switchgrass, leadplant, and western sandcherry have decreased in frequency and production. Sand dropseed and blue grama are the dominant grass species. Sand dropseed, fendler threeawn, hairy false golden aster, croton, slimflower scurfpea, Cuman ragweed, stickleaf, heath aster, milkvetch, and cactus have increased. Soils that have a sandy loam or coarser subsoil will show an increase in sand sagebrush. Heavy, continuous spring grazing with summer deferment will reduce the cool season component (needle and thread, western wheatgrass, sun sedge) of this plant community and increase the warm season component. Heavy, continuous summer grazing with spring deferment will reduce the warm season component (sand bluestem, Indiangrass, prairie sandreed, switchgrass) of this plant community and can increase the cool season component. The risk of losing key tall warm season grasses, important forbs, and shrubs is a major concern. Prescription grazing that includes adequate recovery periods between grazing events will enable the land user to maintain the vegetation or move it toward the reference plant community. Heavy, continuous grazing will take this plant community past an ecological/economic threshold. Blue grama is increasing at the expense of the tall grasses and deep-rooted palatable shrubs. Water cycle, nutrient cycle, and energy flow are becoming impaired due to a shift in root structure and species composition. Less litter is being produced. Total annual production ranges from 600 to 1,800 pounds of air-dried vegetation per acre per year and will average 1,100 pounds.

Community 1.3
Community 3

This plant community develops with heavy, long term continuous grazing. Prolonged occupation by prairie dogs can attribute and quicken the rate of pathway to Community 1.3. Fendler threeawn is the dominant species. Sand dropseed may also be present in varying amounts. A number of annual plants, such as sixweeks fescue, Russian thistle, kochia, and annual bromes, will increase or invade. Field bindweed is often present on prairie dog towns. Litter levels are extremely low. The nutrient cycle, water cycle, and energy flow are greatly reduced. Erosion is occurring. Pedestalling is evident. Organic matter/carbon reserves are greatly reduced. Long term prescription grazing that allows for adequate recovery periods between each grazing event and a forage and animal balance will be needed to bring this community towards Community 1.2 or associated successional plant communities, assuming an adequate seed/vegetative source is available. Expect this transition to take greater than 20 years to accomplish. Total annual production ranges from 350 to 600 pounds of air-dried vegetation per acre per year depending on weather conditions and the plants, which are present.

Pathway 1.1 to 1.2
Community 1.1 to 1.2

This community pathway is driven by short term management (<10 years) devoid of a forage and animal balance, lack of prescription fires, and heavy continuous grazing without adequate recovery periods between grazing events. These drivers will convert the reference plant community to a community of sand dropseed and blue grama. Drought, in combination with this type of management or spring deferment and summer grazing, will quicken the rate at which the Reference Community pathways to Community Phase 1.2.

Pathway 1.1 to 1.3
Community 1.1 to 1.3

This community pathway is driven by extreme weather conditions and/or void of grazing management, short term management (<10 years) devoid of a forage and animal balance, lack of prescription fires, and very heavy continuous grazing without adequate recovery periods between grazing events. These drivers will convert the reference plant community to a community of fendler threeawn, sand dropseed, annual grasses, forbs, and remnant blue grama plants. Several years of extreme drought, in combination with this type of management and/or spring deferment and summer grazing, will quicken the rate at which the Reference Community pathways to Community Phase 1.3.

Pathway 1.2 to 1.1
Community 1.2 to 1.1

This community pathway is driven by management incorporating long-term (>10-20 years) prescription grazing that includes a forage and animal balance, prescription fires at a frequency of 1 in 10 years, and adequate rest and recovery periods of the dominant reference community species. This type of management will shift the plant community dominated by sand dropseed and blue grama to a community dominated by those species found in the Reference Plant Community.

Pathway 1.2 to 1.3
Community 1.2 to 1.3

Community Pathway 1.2 to 1.3 is driven by long term management (>20 years) without a forage and animal balance, an absence of prescription fires, and heavy continuous grazing without adequate recovery periods between grazing events. These drivers will convert Plant Community 1.2 to a community of red threeawn, sand dropseed, and annual grasses and forbs. Drought, in combination with this type of management will quicken the rate at which Community 1.2 pathways to 1.3.

Pathway 1.3 to 1.1
Community 1.3 to 1.1

This community pathway is driven by management that incorporates long-term prescription grazing (>40 years), a forage and animal balance, the use of prescribed fires, and adequate rest and recovery periods of the dominate Reference Plant Community species (if remnants remain) and/or the midgrasses in Plant Community 1.2. This type of management will favor Plant Community 1.1 (dependent upon the remnant amounts).

Pathway 1.3 to 1.2
Community 1.3 to 1.2

This community pathway is driven by management that incorporates long-term prescription grazing (>20 years), a forage and animal balance, the use of prescribed fires, and adequate rest and recovery periods of the dominant Reference Plant Community species (if remnants remain). This type of management will favor Plant Community 1.2 and 1.1 (dependent upon the remnant amounts).

State 2
Sod bound state

The reference grassland state ecosystem has been driven beyond the limits of ecological resilience and has crossed a threshold into the sod-bound state. The designation of the sod-bound state denotes changes in infiltration, runoff, bulk density and species composition. The ecosystem is affected by changes in soil properties, water movement and the plant community. These changes, in turn, affect the hydrologic functionality, biotic integrity, and soil and site stability of the ecological site. With long term, heavy, continuous grazing, blue grama will become the dominant species and have a sod bound appearance. Unable to withstand the grazing pressure, only a remnant population of western wheatgrass remains. Species diversity has been reduced further. Water infiltration is reduced due to the sod nature of the blue grama. Runoff is increased. Vegetation type affects the amount and structure associated cover, therefore the infiltration rate differs among vegetation types. The amount of cover, and hence the rate of infiltration, is usually greatest under trees and shrubs, followed in decreasing order by bunchgrass, shortgrass, and bare ground (Blackburn 1975; Thurow et al. 1986). Specific dynamic soil property changes between the grassland state and the sod-bound state has been documented. As plant community cover decreases from bunchgrasses to more of the sod grasses there is a decrease in infiltration and interception and an increase in surface runoff. There is no known timeframe or restoration pathway success from this state to the grassland state. Experience suggests that long-term prescription grazing to include a forage and animal balance, adequate recovery periods following each grazing event over long periods of time will gradually move this plant community toward the grassland state. This process is not well documented and may take greater than 40 years. This alternative state will be tested through long-term observation of ecosystem behavior and repeated application of conservation and restoration practices. This state should be re-evaluated and refined continually.

Community 2.1
Sod community

This plant community evolves with long term, heavy continuous grazing. Sodbound blue grama dominates this plant community. Sand dropseed, fendler threeawn, Louisiana sagewort, lupine, stickleaf, croton, hairy false goldenaster, locoweed, wormwood, fringed sage, and pricklypear cactus have increased. Sand sagebrush may increase on sandy loam or coarser subsoils. Sand bluestem, Indiangrass, switchgrass, leadplant, western sandcherry, and fourwing saltbush have been removed. Prairie sandreed and needle and thread may persist in remnant amounts. Western wheatgrass may be found in small depressions. This plant community is resistant to change due to the grazing tolerance of blue grama. A significant amount of production and diversity has been lost when compared to the Reference Community. The soil is protected from erosion by sodbound blue grama. However, the nutrient cycle, water cycle, community dynamics, and energy flow are all impaired due to the substantial increase of blue grama and loss of tall warm season grasses, nitrogen-fixing legumes, and shrubs. Blue grama provides this site with a unique feature in that the leaves on blue grama remain semi-dormant during drought periods, but resume growing each time adequate moisture is available during the growing season. Reseeding of blue grama is unlikely because young seedlings seldom survive the extended drought periods that are common on this site. Blue grama does maintain itself by tillering. This also provides blue grama with another unique feature of being able to withstand drought and heavy grazing use. Typically blue grama is a bunchgrass but quickly forms a sodbound condition when heavily grazed. It will take a very long time (>40 years) to restore this plant community back to the reference plant community with management. Total annual production ranges from 300 to 1,500 pounds of air-dried vegetation per acre per year and will average 850 pounds.

State 3
Tillage state

The Grassland State ecosystem has been driven beyond the limits of ecological resilience and has crossed a threshold into the Tillage State. The designation of the Tillage State denotes changes in infiltration, runoff, bulk density, aggregate stability, and species composition. The changes in inherent soil properties, water movement, and the plant community, affect changes in the ecosystem affecting the hydrologic functionality, biotic integrity, and soil and site stability. This group includes two separate vegetation states that are highly variable. They are derived through two distinct management scenarios, and are not related successionally. Infiltration, runoff and soil erosion varies depending on the vegetation present. The tillage state consist of abandoned cropland that has been naturally revegetated (go-back) or planted/seeded to grassland. Many reseeded plant communities were planted with a local seeding mix under the Conservation Reserve Program (CRP) or were planted to a monoculture of sideoats grama. Go-back communities are difficult to define due to the variability of plant communities that exist. Many of these communities are represented by the genus Aristida (three-awns). This is an alternative state because the ecological functions i.e. dynamic soil properties and plant communities are not fully restored to that of the reference state. Tillage can destroy soil aggregation. Soil aggregates are an example of dynamic soil property change. Aggregate stability is critical for infiltration, root growth, and resistance to water and wind erosion. (Brady and Weil, 2008) This alternative state should be tested through long-term observation of ecosystem behavior and repeated application of conservation and restoration practices. This state should be re-evaluated and refined continually.

Community 3.1
Go-back community

Generally land that has been used for purposes other than rangeland or hayland will start to revegetate when left undisturbed. The initial cover will primarily consist of kochia, pigweed, Russian thistle, witchgrass, and tumblegrass. The next succession of plants will be grasses such as sand dropseed, threeawns, and annuals. Eventually desirable warm and cool season grasses may come back if an adequate seed source is available. However, the time frame involved may prove to be too long, so a range seeding may better serve the needs of the landowner.

Community 3.2
Reseed community

This plant community can vary considerably depending on 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. Prescription grazing to include a forage and animal balance combined with adequate rest and recovery periods will be necessary to maintain and enhance productivity and desirable species. Selection of grass species by grazing animals on seeded rangeland sites can be significantly different from native range sites. Typically there is a reduced production level on seeded range site compared to native range site with similar

species composition. Species diversity is lower, forb species generally take longer to re-establish. Seeded rangeland should be managed separately due to the natural ecological differences.

Transition 1 to 2
State 1 to 2

The triggers for this transition are overgrazing, long term (>20 years) management without a forage and animal balance, heavy continuous grazing in the growing season and/or throughout the year, and inadequate recovery periods between grazing events. This type of management will convert the Grassland State to a state of blue grama sod. Blue grama is the dominant species, making up greater than 40 percent of the composition by weight. Drought, in combination with this type of management, will quicken the rate of state transition. The hydrologic cycle and soil function of the site are the ecological processes effected. Soil dynamic property changes include an increase bulk density and a decrease in aggregate stability.

Transition 1 to 3
State 1 to 3

This transition is triggered by a management action as opposed to a natural event. Mechanical tillage is the event that contributes directly to the loss of state resilience and is the result in a shift between the Grassland State and the Tillage State. Ecological structure and function has been compromised. Soil properties affected by tillage include: structure and aggregate stability, bulk density, nutrient availability, plant cover, hydrologic function, and temperature. This alternative state should be tested through long-term observation of ecosystem behavior and repeated application of conservation and restoration practices. This state should be re-evaluated and refined continually.

Transition 2 to 3
State 2 to 3

This transition is triggered by a management action as opposed to a natural event. Mechanical tillage is the event that contributes directly to the loss of state resilience and is the result in a shift between the Grassland State and the Tillage State. Ecological structure and function has been compromised. Soil properties affected by tillage include: structure and aggregate stability, bulk density, nutrient availability, plant cover, hydrologic function, and temperature. This alternative state should be tested through long-term observation of ecosystem behavior and repeated application of conservation and restoration practices. This state should be re-evaluated and refined continually.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Warm season Dominant 43%**			387–857	
	sand bluestem	ANHA	*Andropogon hallii*	168–336	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	112–224	–
	blue grama	BOGR2	*Bouteloua gracilis*	84–213	–
	little bluestem	SCSC	*Schizachyrium scoparium*	22–84	–
2	**Tall-mid warm-cool Subdominant 26%**			123–516	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	56–168	–
	switchgrass	PAVI2	*Panicum virgatum*	56–168	–
	Indiangrass	SONU2	*Sorghastrum nutans*	11–101	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–101	–
3	**Tall-short warm-cool season Subdominant 13%**			17–258	
	western wheatgrass	PASM	*Pascopyrum smithii*	11–112	–

	western wheatgrass	PASM	*Pascopyrum smithii*	11–112	
	sand dropseed	SPCR	*Sporobolus cryptandrus*	6–112	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–22	–
4	**Other grasses Minor 4%**			0–84	
	sedge	CAREX	*Carex*	0–45	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–22	–
	Fendler threeawn	ARPUL	*Aristida purpurea var. longiseta*	0–22	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–17	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–11	–
Forb					
5	**Forbs/Legumes Minor component 10%**			34–202	
	white sagebrush	ARLU	*Artemisia ludoviciana*	6–17	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	6–17	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	6–17	–
	dotted blazing star	LIPU	*Liatris punctata*	6–17	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	6–17	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	6–17	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	6–17	–
	annual buckwheat	ERAN4	*Eriogonum annuum*	0–11	–
	shaggy dwarf morning-glory	EVNU	*Evolvulus nuttallianus*	0–6	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–6	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–6	–
	false boneset	BREU	*Brickellia eupatorioides*	0–6	–
	Texas croton	CRTE4	*Croton texensis*	0–6	–
	silky prairie clover	DAVI	*Dalea villosa*	0–6	–
	Carolina larkspur	DECAV2	*Delphinium carolinianum ssp. virescens*	0–6	–
	winged buckwheat	ERAL4	*Eriogonum alatum*	0–6	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–6	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	0–6	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–6	–
	tenpetal blazingstar	MEDE2	*Mentzelia decapetala*	0–6	–
	evening primrose	OENOT	*Oenothera*	0–6	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0–6	–
	broadbeard beardtongue	PEAN4	*Penstemon angustifolius*	0–6	–
	lemon scurfpea	PSLA3	*Psoralidium lanceolatum*	0–6	–
Shrub/Vine					
6	**Shrubs Minor component 5%**			22–101	
	sand sagebrush	ARFI2	*Artemisia filifolia*	6–28	–
	American plum	PRAM	*Prunus americana*	0–28	–
	Chickasaw plum	PRAN3	*Prunus angustifolia*	0–28	–
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	6–28	–
	soapweed yucca	YUGL	*Yucca glauca*	6–28	–

	plains pricklypear	OPPO	*Opuntia polyacantha*	0–17	–
	leadplant	AMCA6	*Amorpha canescens*	6–17	–
	prairie rose	ROAR3	*Rosa arkansana*	0–6	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–6	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–6	–
	spreading buckwheat	EREF	*Eriogonum effusum*	0–6	–

Animal community

Wildlife Interpretations

The Sandy Plains ecological site is characterized by nearly level to undulating topography with associated low sand dunes. Much of this site has been converted to cropland resulting in fragmentation and loss of habitat. Historically, the predominance of grasses and forbs on this site supported grazers and mixed feeders such as bison, elk, mule deer, pronghorn, and a variety of grassland associated birds and small mammals. Due to the inherent heterogeneity of all landscape's, some areas were not grazed uniformly by these historic large herds of grazing animals. This type of grazing enhanced habitat for wildlife by creating a mosaic pattern, or patchiness, of vegetative structural diversity throughout the landscape. Wildlife native to the site depend upon a plant community diverse in species and structure. This need is evident in the variability of known habitat requirements of grassland-associated wildlife.

Sand sagebrush, western sandcherry, and leadplant may be present and locally abundant on this site. Sagebrush offers escape and thermal cover for several species of wildlife and a source of winter browse for other species. Tree encroachment can make this site generally unsuitable for prairie chickens and other ground-nesting birds that require large expanses of non-woody habitat. Woody species, such as those commonly established in tree plantings, provides habitat for mid-sized mammals such as raccoons, opossums, and striped skunks which can be detrimental to ground-nesting birds native to grassland habitats. The presence of trees can also increase the potential for nest parasitism by brown-headed cowbirds when adjacent to grasslands.

Periodic events such as prolonged drought, wildfire, disease, or high insect numbers will alter plant community diversity, structure, and affect associated wildlife species.

Reference Plant Community: sand bluestem, prairie sandreed, and blue Grama

The high diversity of grasses and forbs in this community provides habitat for a diverse group of insects. Areas with high forb diversity will generally support more insects such as the leaf-hoppers important to young grassland-nesting birds. Grasshoppers, associated with grasses, are a critical food source for birds in later stages of development. Plains garter snakes, western hognose snakes and six-lined racerunners are common reptiles on the site. Reference sites are in good condition with tall native warm season bunchgrasses, and openings at ground level offer excellent habitat for the greater prairie chicken. Burrowing mammals such as thirteen-lined ground squirrels and kangaroo rats are common. Several species of pocket mice are common and provide prey for raptors such as red-tailed hawks and great-horned owls throughout the year, and prey for northern harriers and rough-legged hawks during the winter. Small mammals also provide prey for coyotes and other predators.

Sand Dropseed and Blue Grama Plant Community

Areas with scattered growth of sand sagebrush offer nesting habitat for lark buntings and a winter food source for mule deer and pronghorn. Many of the same species of wildlife found in the Reference Plant Community are also found in this plant community, but in fewer numbers and with less diversity.

Blue Grama Sod Plant Community

Wildlife habitat value is generally low as the plant community is simplified as the structural height and diversity of the vegetative cover declines. Species such as lark sparrows, horned larks, jackrabbits, and black-tailed prairie dogs that favor sparse cover will likely increase due to the reduced cover. The period of high levels of nutrition for grazing animals such as deer is shortened considerably with a decrease in grass and forb diversity.

Fendler Threeawn, Annuals, Bare Ground Plant Community

The wildlife habitat value of this community depends on the dominant plant species present on the site. Cool and warm season annual grasses generally offer poor nesting habitat for ground-nesting birds. Communities dominated by broad-leaf annual or perennial forbs may provide brood-rearing habitat for prairie grouse and quail. Areas with abundant forbs attract species such as pronghorn that utilize greater amounts of forbs in their diet.

Go-back Land and Seeded Rangeland

The wildlife species expected on seeded rangeland and go-back land would be those listed for the plant community the seeding most resembles.

Grazing Interpretations

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

Calculating Safe Stocking Rates: Proper stocking rates should be incorporated into a grazing management strategy that protects the resource, maintains or improves rangeland health, and is consistent with management objectives. In addition to usable forage, safe stocking rates should consider ecological condition, trend of the site, past grazing use history, season of use, stock density, kind and class of livestock, forage digestibility, forage nutritional value, variation of harvest efficiency based on desirability preference of plant species and/or grazing system, and site graze ability factors (such as steep slopes, site inaccessibility, or distance to drinking water).

Often the current plant community does not entirely match any particular Community Phase as described in this Ecological Site Description. Because of this, a resource inventory is necessary to document plant composition and production. Proper interpretation of inventory data will permit the establishment of a safe initial stocking rate.

No two years have exactly the same weather conditions. For this reason, year-to-year and season-to season fluctuations in forage production are to be expected on grazing lands. Livestock producers must make timely adjustments in the numbers of animals or in the length of grazing periods to avoid overuse of forage plants when production is unfavorable and to make advantageous adjustments when forage supplies are above average.

Initial stocking rates should be improved through the use of vegetation monitoring and actual use records that include number and type of livestock, the timing and duration of grazing, and utilization levels. Actual use records over time will assist in making stocking rate adjustments based upon the variability factors.

Average annual production must be measured or estimated to properly assess useable forage production and stocking rates.

Hydrological functions

Water is the principal factor limiting forage production on this site. Infiltration and runoff potential for this site varies from high to moderate depending upon soil hydrologic group and ground cover. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff.

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

None noted.

Other information

Site Development and Testing Plan

Future work (for approved ESD) includes field visits to verify ES site concepts with field staff. Field staff include, but are not limited to project office leader, area soil scientist, state soil scientist, ecological site specialist, state rangeland conservationist, area rangeland management specialist, and local field personnel. Field visits are to be determined by spatial extent of the site as well as personal knowledge of the site. Activity during field visits will include, but are not limited to identifying the soil, landform, plant community, and verifying existing site concepts.

Inventory data references

Information presented here has been derived from NRCS clipping data, numerous ocular estimates, and other inventory data. Field observations from experienced range trained personnel were used extensively to develop this ecological site description. Specific data information is contained in individual landowner/user case files and other files located in county NRCS field offices.

Those NRCS individuals involved in developing the Sandy Plains ecological sites North and South in the early 2000s include from Nebraska: Carol Eakins, Chuck Markley, Jeff Nichols, and Mary Schrader; from Kansas: Joan Gienger, Ted Houser, Tim Watson, Amanda Shaw, Susan Francis, Jon Deege, and Robert Schiffner; from Colorado: Josh Saunders and Harvey Sprock.

Range Condition Guides and Technical Range Site Descriptions for Kansas, Sandy, USDA, Soil Conservation Service, August, 1967

Range Site Description for Kansas, Sandy, USDA-Soil Conservation Service, September, 1983

Range Site Description for Colorado, Sandy Plains, USDA-Soil Conservation Service, December 1975

Guide for determining range condition and suggestive initial stocking rates for Nebraska, Sandy, Vegetative Zone 1 and II, USDA-Soil Conservation Service, April 1983

Range Site Description for Nebraska, Sandy, USDA-Soil Conservation Service, August, 1981
Schacht, Walter H., Larsen, Dana. Section III

Range Sites, Sandy Range Site, The Board of Regents of the University of Nebraska, publication

Ecological Site Description for Kansas, Sandy North (R072XA022KS) and South (R072XB022KS), located in Ecological Site Information System (ESIS), 2007

Ecological Site Description for Colorado, Sandy Plains (R072XY023CO), located in Ecological Site Information System (ESIS)

Other references

Blackburn, W.H., 1975. Factors influencing infiltration and sediment production of
semiarid rangelands in Nevada. Water Resources Research 11, 929–937.

High Plains Regional Climate Center, University of Nebraska, 830728 Chase Hall, Lincoln, NE 68583-0728. (http://hpcc.unl.edu)

The nature and properties of soils, Nyle C. Brady, Ray R. Weil- 14th ed, 2008.

Thurow, T.L., Blackburn, W.H., Taylor Jr., C.A., 1986. Hydrological characteristics of

vegetation types as affected by livestock grazing systems, Edwards Plateau, Texas. Journal of Range Management 39, 505–509.

USDA, NRCS. National Water and Climate Center, 101 SW Main, Suite 1600, Portland, OR 97204-3224. (http://wcc.nrcs.usda.gov)

USDA, NRCS. National Range and Pasture Handbook, September 1997

USDA, NRCS. National Soil Information System, Information Technology Center, 2150 Centre Avenue, Building A, Fort Collins, CO 80526. (http://nasis.nrcs.usda.gov)

USDA, NRCS. 2002. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

MLRA 72 Workshop: Quality control review, comments and field verification of Ecological sites, Wray Colorado, April 26-27, 2016. Those individuals include from Colorado: Julie Elliot, Kimberly Diller, Clark Harshbarger, Kristi Gay, Josh Saunders, Tom Nadgwick, and Mike Moore; from Nebraska: Chuck Markley, Jeff Nichols, Kristin Dickinson, and Dan Shurtliff; from Kansas: David Kraft, Michelle Bush, Tom Cochran, Roger Tacha, Ted Houser, and Chris Tecklenburg (current ESI specialist MLRA72).

Quality assurance review: David Kraft (acting QA for region 5 and 9).

Contributors

Chris Tecklenburg

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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	07/06/2016
Approved by	David Kraft
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None

2. **Presence of water flow patterns:** Typically none to slight. If present, are broken, irregular in appearance or discontinuous with numerous debris dams or vegetative barriers.

3. **Number and height of erosional pedestals or terracettes:** Pedestalled plants caused by wind or water erosion would be minor.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 10% or less bare ground, with bare patches ranging from 3-5 inches in diameter. Prolonged drought or wildfire events will cause bare ground to increase upwards to >10% with bare patches ranging from 8-12 inches in diameter.

5. **Number of gullies and erosion associated with gullies:** There are no gullies present on this site.

6. **Extent of wind scoured, blowouts and/or depositional areas:** Minor wind scouring may occur on knolls. Wind erosior can occur with disturbances such as wildfire or extended drought.

7. **Amount of litter movement (describe size and distance expected to travel):** Litter should be uniformly distributed with little movement.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Plant canopy is sufficient to intercept the majority of raindrops. Soil organic matter is incorporated into aggregates at the surface, and/or adhesion of decomposing organic matter is present, and/or biological crusts are present on the surface. Soil stability scores will range from 4-6.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** SOM ranges from 2-4%. A-horizon ranges from 0-7 inches. Soils are very deep, very dark brown (10YR 2/2) moist; loamy sand; weak fine granular structure.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Diverse grass, forb, shrub canopy, and root structure reduces raindrop impact and slows overland flow, providing increased time for infiltration to occur. Extended drought and/or wildfire may reduce canopy cover and litter amounts, resulting in decreased infiltration and increased runoff on steeper slopes.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be**

mistaken for compaction on this site): There is no evidence of compacted soil layers due to animal impact or cultural practices.

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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: Warm season dominant 43%; sand bluestem > prairie sandreed > blue grama > little bluestem

    Sub-dominant: Tall mid warm cool season grasses 26%; switchgrass = needleandthread >> Indiangrass = switchgrass
    Tall short warm cool season 13%; sand dropseed = western wheatgrass >> buffalograss

    Other: Forbs-Legumes 10%; Shrubs 5%

    Additional: See functional/structural group sheet for this site.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** The majority of plants are alive and vigorous. Some mortality and decadence is expected for the site. This in part is due to drought, unexpected wildfire, or a combination of the two events. This would be expected for both dominant and subdominant groups.

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14. **Average percent litter cover (%) and depth (in):** 40-65% litter cover at 0.25-0.50 inch depth. Litter cover during and following drought can range from 20-30% and 5-15% following wildfire.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 900 lbs./ac. low precip years, 1800 lbs./ac. average precip years, 2500 lbs./ac. high precip years. After extended drought or the first growing season following wildfire, production may be significantly reduced by 500 lbs./ac. or more.

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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:** Invasive plants should not occur in Reference Plant Community. Following wildfire or extended drought, cheatgrass, Russian thistle, and kochia will invade assuming a seed source is available. Blue grama, sand dropseed, and Fendler threeawn are the major native (non-invasive) increasers on this site.

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17. **Perennial plant reproductive capability:** The only limitations are weather-related, wildfire, natural disease, and insects that may temporarily reduce reproductive capability.
