USDA Natural Resources Conservation Service

Ecological site R079XY103KS
Choppy Sands

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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): 079X–Great Bend Sand Plains

MLRA 79 is located entirely in Kansas. It makes up about 7,405 square miles (19,185 square kilometers). Great Bend, Hutchinson, and Wichita are in this MLRA. U.S. Highways 50, 54, and 56 cross the area. The western part of McConnell Air Force Base and the Quivira National Wildlife Refuge is within MLRA 79.

Following are the various kinds of land use in this MLRA: Cropland-private, 67%; Grassland-private, 23%; Federal, 1%; Forest-private, 1%; Urban development-private, 5%; Water-private, 1%; Other-private, 2%.

Nearly all of this area is in farms or ranches. Most of the area is used as cropland. Cash-grain farming is the principal enterprise. Hard winter wheat is the major crop, but grain sorghum and alfalfa also are grown. The grassland in the area consists of sandy soils and steeply sloping areas. It supports native grasses grazed by beef cattle.

The major soil resource concerns are the hazards of wind and water erosion, maintenance of the content of organic matter in the soils, and soil moisture management. The major management concerns on grassland are plant health and vigor, and control of noxious and invasive weeds.

Conservation practices on cropland generally include high residue crops in the cropping system; systems of crop residue management, such as no-till and strip-till systems; conservation crop rotations; wind stripcropping; and nutrient and pest management. Conservation practices on rangeland generally include brush management, prescribed burning, control of noxious weeds, pest management, watering facilities, and proper grazing use.

Classification relationships

Major land resource area (MLRA): 079-Great Bend Sand Plains

Ecological site concept

The Choppy Sands ecological site is made up of well drained and very deep (60 inches) soils. These soils have more than 70 percent sand throughout the profile. There is none to very few lamellae (thin layers of higher clay content) in the soil profile. The Choppy Sands ecological site is characterized by a short, steep, and hummocky landform. Generally this site is located on strongly sloping to moderately steep dunes on paleoterraces (erosional remnant of a terrace) with slopes reaching 15 percent and greater.

Associated sites

R079XY121KS	**Sand Plains** The Sand Plains ecological site sits adjacent to and in conjunction with the Choppy Sands ecological site. This ecological site was formerly known as Sands R079XY021KS. The Sand Plains ecological site is made up of well drained and very deep (60 inches) soils. These soils have greater than 70 percent sand in the surface. Soils that make up the Sand Plains ecological site have a surface texture of fine sand or loamy sand. Generally this site is located on dunes on paleoterraces (erosional remnant of a terrace) with a slope range of 0 to 15 percent.
R079XY132KS	**Subirrigated** This site sits adjacent to and in conjunction with the Choppy Sands site. The Subirrigated ecological site is characterized by somewhat poorly drained soils that have a seasonal or perennial high water table greater than 2 feet and less than 6 feet from the surface. This site is located on floodplains and interdunes. The Subirrigated site occurs on level to nearly level eolian and alluvial lands usually adjacent to major streams.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Andropogon hallii* (2) *Schizachyrium scoparium*

Physiographic features

Most of this area is in the Plains Border Section of the Great Plains Province of the Interior Plains. The eastern third is in the Osage Plains Section of the Central Lowland Province of the Interior Plains. The undulating to rolling plains in this area generally have narrow valleys, but broad flood plains and terraces are along the Arkansas River and its larger tributaries. The elevation ranges from 1,650 to 2,600 feet (505 to 795 meters), increasing from east to west.

The extent of the major Hydrologic Unit Areas (identified by four-digit numbers) that make up this MLRA is as follows: Middle Arkansas (1103), 82 percent, and Arkansas-Keystone (1106), 18 percent. The Arkansas River bisects the northern part of this MLRA, and the Ninnescah River crosses the southern part. In this MLRA, Rattlesnake Creek flows north and the Little Arkansas River flows south into the Arkansas River.

The Choppy Sands ecological site occurs on uplands with strongly sloping to moderately steep somewhat unstable dunes, commonly known as sandhills. Unstable sand dunes with occasional “blowouts” do occur. Langdon, Tivin, and Tivoli are the soils that characterize this site. This site consists of very deep soils with fine sand and loamy fine sand surface layers and sandy subsoils. The Choppy Sands site is very permeable and produces little or no runoff. This site is subject to high evaporation and severe erosion by wind if the vegetative cover is reduced or absent due to grazing or wildfire. This site is very fragile. Heavy use areas and trailing due to recreational vehicles or grazing pressure can lead to the creation of blowouts.

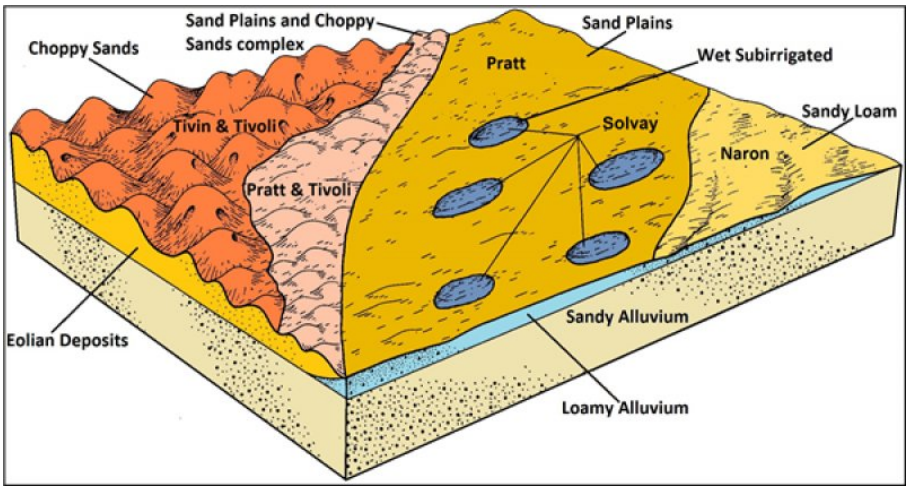


Figure 2.

Table 2. Representative physiographic features

Landforms	(1) River valley > Paleoterrace (2) River valley > Dune
Runoff class	Negligible to low
Flooding frequency	None
Ponding frequency	None
Elevation	503–792 m
Slope	1–30%
Water table depth	203 cm
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation in MLRA 79 is 25 to 33 inches (635 to 840 millimeters). Most of the rainfall occurs as high-intensity, convective thunderstorms during the growing season. The maximum precipitation occurs from the middle of spring to early in autumn. The annual snowfall ranges from about 14 inches (35 centimeters) in the southern part of the area to 20 inches (50 centimeters) in the northern part. The average annual temperature is 55 to 57 degrees F (13 to 14 degrees C). The freeze-free period averages 197 days, increasing in length from northwest to southeast.

Precipitation is usually evenly distributed throughout the year, with the exception of November through February as the driest months and May and June as the wettest months. Summer precipitation occurs during intense summer thunderstorms.

The following weather data originated from weather stations chosen across the geographical extent of the ecological site, and will likely vary from the data for the entire MLRA. The climate data derives from the Natural Resources Conservation Service (NRCS) National Water and Climate Center. The dataset is from 1981-2010.

Table 3. Representative climatic features

Frost-free period (characteristic range)	148-164 days
Freeze-free period (characteristic range)	185-195 days
Precipitation total (characteristic range)	686-813 mm
Frost-free period (actual range)	146-182 days
Freeze-free period (actual range)	184-202 days

Precipitation total (actual range)	660-813 mm
Frost-free period (average)	158 days
Freeze-free period (average)	191 days
Precipitation total (average)	737 mm

Climate stations used

- (1) NORWICH [USC00145870], Norwich, KS
- (2) HUTCHINSON [USC00143929], Hutchinson, KS
- (3) GREENSBURG [USC00143239], Greensburg, KS
- (4) KINGMAN [USC00144313], Kingman, KS
- (5) PRATT [USC00146549], Pratt, KS
- (6) STERLING [USC00147796], Sterling, KS
- (7) HUDSON [USC00143847], Hudson, KS
- (8) HUTCHINSON 10 SW [USC00143930], Hutchinson, KS
- (9) KINSLEY 2E [USC00144333], Kinsley, KS

Influencing water features

These soils are well drained. Available soil moisture is low to very low. Soil permeability is rapid, so this site produces little or no runoff. This site is subject to high evaporation and severe wind erosion if the vegetative cover is reduced or absent due to grazing or wildfire.

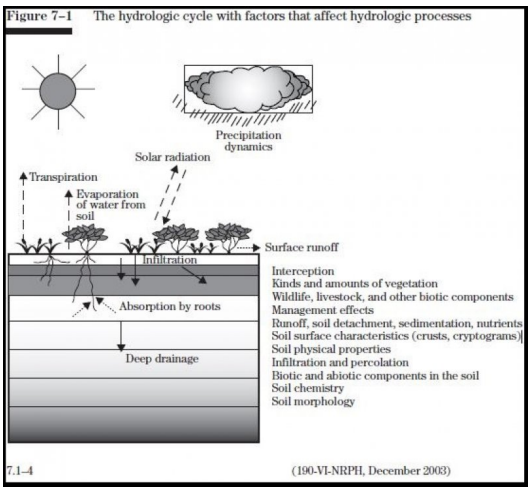


Figure 9.

Soil features

Langdon, Tivin, and Tivoli soils are found on this site. These soils are deep with a fine sand and loamy fine sand surface layer and sandy subsoils. They are excessively drained and the available water capacity is low to very low. These soils are highly susceptible to wind erosion if unprotected.

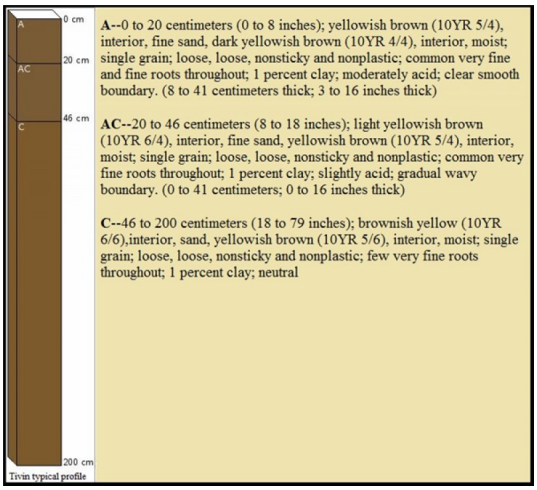


Figure 10.

Table 4. Representative soil features

Parent material	(1) Eolian sands
Surface texture	(1) Fine sand (2) Loamy fine sand
Drainage class	Somewhat excessively drained to excessively drained
Permeability class	Rapid
Soil depth	203 cm
Available water capacity (0-101.6cm)	3.81–15.75 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	5.1–7.8

Ecological dynamics

This is a dynamic plant community resulting from the complex interaction of many ecological processes. The vegetation evolved on fragile soils, under a diverse and fluctuating climate. Plants were grazed by herds of large herbivores and periodically subjected to intense wildfires.

Although the deep, sandy soils characteristic of the Choppy Sands ecological site absorb water rapidly, their water-holding capacity is low and moisture slowly percolates through the profile. The taller grasses that evolved and dominated the original plant community had deep, efficient root systems capable of utilizing moisture throughout most of the profile. Because there is almost no runoff from this site, most precipitation enters the root profile. The site has the potential to be productive. Seed heads of the major grasses often reach five to six feet in height.

This site developed with occasional fires as an important part of the ecological processes. Historically fires were infrequent and were usually started by lightning that may occur at any time during the year. They usually occurred in spring and early summer months when thunderstorms were most prevalent. It is also recognized that pre-European inhabitants often used fire to attract herds of migratory herbivores, especially bison. These intentional fires probably occurred more frequently than the natural disturbance frequency. All of the dominate tallgrasses were rhizomatous. This enabled them to survive the ravages of even intense wildfires and gave them a competitive advantage in the plant community. Most trees and shrubs were suppressed by fire and occurred only sparsely on protected areas. Growth of forbs, especially legumes, was usually enhanced following a fire event. After a fire there was usually a

substantial increase in the abundance of annual forbs. This increase was temporary, but may last for one to two years.

Grazing history had a major impact on the dynamics of the site. The vegetative community developed under a grazing regime that consisted primarily of periodic grazing by large herds of bison. As the herds moved through an area, grazing could be intense, but usually of short duration. Typically, as herds moved to adjacent areas, the vegetation was afforded a period of recovery. Other grazing and feeding animals such as deer, rabbits, insects, and numerous burrowing rodents had secondary influences on plant community development.

Variations in climate, especially drought cycles, also had a major impact upon the development of the plant community. Species composition fluctuated according to the duration and severity of droughts. During prolonged dry cycles many of the shallow-rooted plants died out and the production of deeper-rooted plants significantly decreased. When sufficient rainfall occurred following an extended period of dry years, annual forbs and annual grasses would temporarily occur in great abundance. As precipitation returned to normal or above normal, the deeper-rooted grasses responded quickly to production potentials.

Typically, growth of warm-season grasses on this site begins during the period of May 1 to May 15 and continues until mid-September. As a general rule, 70 percent of total production is completed by mid-July. This varies only slightly from year to year depending on temperature and precipitation patterns. Cool-season grasses generally have two short growing periods, one in the fall (September and October) and again in the spring (April, May, and June).

As utilization of the site for production of domestic livestock replaced that of roaming bison herds, the ecological dynamics were altered and the plant community changed from the original composition. These changes were usually in proportion to the season and intensity of grazing livestock. A combination of drought and overgrazing accelerated these changes. The taller grasses and forbs palatable to bison were equally relished and selected by cattle. When repeatedly grazed by cattle, these grasses were weakened and gradually replaced by the increase and spread of less palatable midgrasses and forbs. Where the history of overgrazing by domestic livestock was more intense, even the plants that initially increased were often replaced by even less desirable, lower-producing plants. In some areas plant cover was reduced to the point that the scouring action of wind erosion created blowouts of various sizes.

The occurrence of wildfires and the impact that fire played in maintaining the plant community was diminished with the advent of roads and cultivated fields, as did the use of prescribed fire as a management tool. In the absence of fire there has been a gradual increase of shrub species in many areas. In some areas shrubs and trees have spread to the point they have become the dominant influence in the plant community.

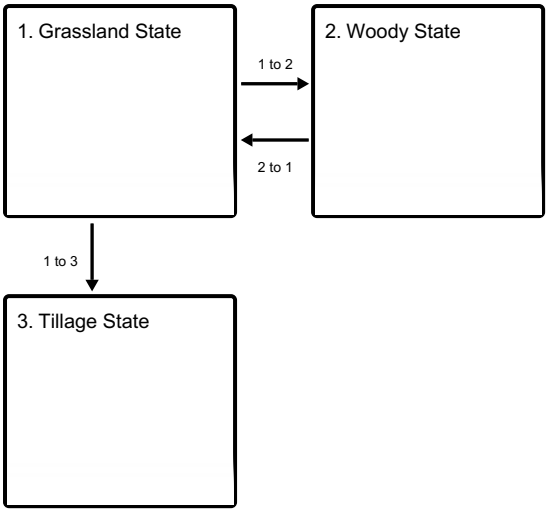
Blowouts can occur within any plant community on the Choppy Sands ecological site. It begins on areas where continuous overgrazing and/or trailing has reduced the protective plant cover to the point that the soil becomes subjected to wind erosion. Continued wind action will gradually result in scoured out areas, locally referred to as blowouts. These areas may range in size from a few square feet to several acres. The blowouts commonly begin on dune crests or on steeper side slopes.

A vegetative cover can often be established on smaller blowouts by management that provides adequate periods of grazing deferment during the growing season. Larger blowouts generally need more drastic measures to include long-term grazing deferment. This may entail fencing the entire blowout. Applying surface mulch may hasten recovery on larger, more severely impacted sites. Pioneer plants that occur in the initial stages of secondary plant succession include blowout grass, sand dropseed, giant sandreed, prairie threeawn, mat sandbur, purple sandgrass, winged pigweed, Drummond’s snakecotton, and sleepingplant. As these plants begin to stabilize the movement of sand particles other perennial plants become established. As plant succession progresses, tall- and midgrasses eventually return to the site.

The following diagram illustrates some of the pathways that the vegetation on this site may take from the Reference Plant Community as influencing ecological factors change. There may be other states or plant communities not shown on the diagram.

State and transition model

Ecosystem states

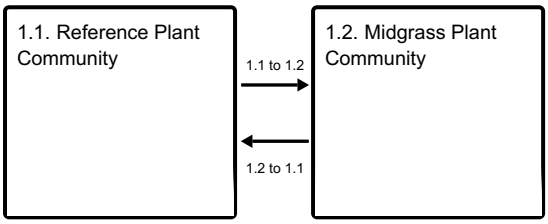


1 to 2 - Fire and mechanical control of woody encroachment is absent.

1 to 3 - Mechanical tillage

2 to 1 - Prescribed burning, brush management, and prescribed grazing are restoration practices that can restore state 2 to State 1.

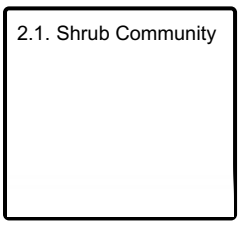
State 1 submodel, plant communities



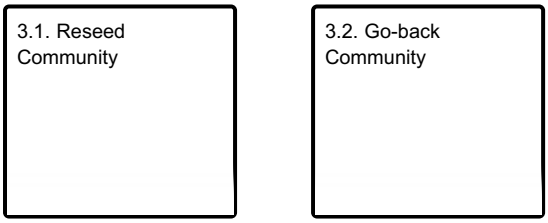
1.1 to 1.2 - Repetitive heavy use, no forage and animal balance, and no rest.

1.2 to 1.1 - Rest and recovery of the key forage species.

State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Grassland State

The Grassland State defines the ecological potential and natural range of variability resulting from the natural disturbance regime of the Choppy Sands ecological site. This state is supported by empirical data, historical data, local expertise, and photographs. It is defined by a suite of native plant communities that are a result of periodic fire, drought, and grazing. These events are part of the natural disturbance regime and climatic process. The Reference Plant Community consists of warm-season tall- and midgrasses, cool-season and sod-forming grasses, forbs, and

shrubs. The Midgrass community is made up primarily of warm-season midgrasses with an interspersed cool-season component and decreasing amounts of forbs and tallgrasses.

Characteristics and indicators. The Grassland State is dominant of tall- and midgrasses. Woody encroachment will be less than 15 percent canopy cover. This state has no indication of mechanical tillage in the soil profile or within the plant composition.

Resilience management. Providing a forage and animal balance, prescribed burning, brush management, and periodic rest during the growing season will help sustain this state and avoid a transition.

Dominant plant species

- sand bluestem (*Andropogon hallii*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- giant sandreed (*Calamovilfa gigantea*), grass
- switchgrass (*Panicum virgatum*), grass
- Indiangrass (*Sorghastrum nutans*), grass
- sand lovegrass (*Eragrostis trichodes*), grass

Community 1.1
Reference Plant Community

Figure 11. Reference Plant Community Reno, County Kansas.

Figure 12. This is an example of blowout on the Choppy Sands ecological site in Stafford, County Kansas.

The interpretive plant community for this site is the Reference Plant Community, which represents the original plant community that existed prior to European settlement. The site is characterized as a grassland, essentially free of trees and large shrubs. It is dominated by tall, warm-season grasses including sand bluestem, switchgrass, Indiangrass, and giant sandreed. The major midgrass is little bluestem. Combined, these grasses will account for 70-80 percent of the vegetation produced annually. Other prevalent midgrasses are Canada wildrye, sand

lovegrass, composite dropseed, sand dropseed, and purple lovegrass. Scattered throughout this plant community are minor amounts of shortgrasses such as blue grama, hairy grama, thin paspalum, and Carolina crabgrass. The site supports a wide variety of legume species, which are interspersed throughout the grass sward. The most abundant are roundhead lespedeza, slender lespedeza, sessile leaf tick trefoil, golden prairie clover, lemon scurfpea, silky sophora, and prairie bundleflower. Other important forbs include Maximilian sunflower, scaley blazing star, stiff goldenrod, and pitcher sage. Leadplant and Jersey tea are low-growing shrubs that occur over the site. Unlike most shrubs, these plants are both quite tolerant to fire. A few small clumps of Chickasaw plum and skunkbush may be found on the steeper slope exposures of dunes, where they partially escape the effects of intense fires. This is a stable plant community when adequately managed. A prescribed grazing program that incorporates periods of deferment during the growing season benefits the tallgrasses and the palatable forb species. Soils are susceptible to wind erosion and excessive grazing while livestock trailing can quickly have impact on soil stability and lead to an occurrence of small blowouts.

Resilience management. A prescribed grazing program that incorporates periods of deferment during the growing season benefits the tallgrasses and the palatable forb species.

Dominant plant species

- sand bluestem (*Andropogon hallii*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- giant sandreed (*Calamovilfa gigantea*), grass
- switchgrass (*Panicum virgatum*), grass
- Indiangrass (*Sorghastrum nutans*), grass
- sand lovegrass (*Eragrostis trichodes*), grass
- little bluestem (*Schizachyrium scoparium*), grass

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1625	2382	3138
Forb	168	280	504
Shrub/Vine	112	140	168
Total	**1905**	**2802**	**3810**

Figure 14. 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
Midgrass Plant Community

Figure 15. Midgrass Plant Community Reno, County Kansas.

This plant community developed as a result of many years of continuous overgrazing. Midgrasses dominate the site and comprise 60-70 percent of the annual production. The dominant midgrass is little bluestem. Sand dropseed, composite dropseed, sand lovegrass, purple lovegrass, and blowout grass can be found on the site. Shortgrasses such as Carolina crabgrass, red lovegrass, tumble windmillgrass, purple threeawn, hairy grama, and blue grama produce 10-15 percent of the vegetation. There are trace amounts of sand bluestem, switchgrass, Indiangrass, and giant sandreed. A number of midgrasses are dominant over the taller grasses and have been reduced by overgrazing. These include sand dropseed, sand lovegrass, purple lovegrass, thin paspalum, and composite dropseed. Forbs such as Maximilian sunflower, roundhead lespedeza, prairie bundleflower, and golden prairie clover have largely been replaced by white sagebrush, Cuman ragweed, Fendler's aster, redroot buckwheat, and tenpetal blazingstar. Forbs produce 10-12 percent of the total herbage. This site supports a few shrubs. Leadplant and Jersey tea may be scattered throughout the site. Chickasaw plum and skunkbush sumac are usually found in small clumps (motts). Shrubs usually will not comprise over 5 percent of the total annual production. Total annual production ranges from 1,500 to 3,000 pounds of air-dry vegetation per acre and averages about 2,000 pounds. Prescribed grazing that incorporates periods of deferment during the growing season will improve the vigor and gradual recovery of the more palatable tallgrasses and forbs.

Resilience management. Periods of deferment from grazing are essential in maintaining this as a stable plant community. Sand bluestem is preferred, and readily selected and grazed by cattle. When the site is grazed continuously throughout the growing season, sand bluestem is usually overgrazed and thus maintained in a state of low vigor. This results in a gradual reduction in abundance over time. Even under moderate continuous stocking, livestock can locate and severely overgraze the tops or crests of sand dunes. Where this occurs, sand dropseed, thin paspalum, and mat sandbur replace the taller grasses. In some areas this has lead to small blowouts.

Dominant plant species

- little bluestem (*Schizachyrium scoparium*), grass

Pathway 1.1 to 1.2
Community 1.1 to 1.2

Reference Plant Community **Midgrass Plant Community**

The following describes the mechanisms of change from Plant Community 1.1 to Plant Community 1.2. These mechanisms include management controlled by repetitive heavy use, no rest or recovery of the key forage species, no forage and animal balance for many extended grazing seasons. This type of management for periods greater than 10 years will shift functional and structural plant group dominance towards Plant Community 1.2.

Pathway 1.2 to 1.1

Community 1.2 to 1.1

Midgrass Plant Community

Reference Plant Community

The following describes the mechanisms of change from Plant Community 1.2 to Plant Community 1.1. Management (10-15 years) that includes adequate rest and recovery of the key forage species (sand bluestem, switchgrass, and Indiangrass) within the Reference Plant Community. If woody species are present, prescription fires every 6-8 years will be necessary for their removal and/or maintenance.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Woody State

This state is dominated by a shrub and/or tree plant community. The increase and spread of shrubs and trees results from an absence of fire. Woody plants can increase up to 34 percent from a lack of fire according to a study from 1937 to 1969, in contrast to a 1 percent increase on burned areas (Bragg and Hulbert, 1976). Periodic burning tends to hinder the establishment of most woody species and favors forbs and grasses. However, it should be pointed out that not all unburned areas have a woody plant invasion. Hydrologic function is affected by the amount of vegetative cover. Canopy interception loss can vary from 25.4 percent to 36.7 percent (Thurow and Hester, 1997). A small rainfall event is usually retained in the foliage and does not reach the litter layer at the base of the tree. Only when canopy storage is reached and exceeded does precipitation fall to the soil surface. Interception losses associated with the accumulation of leaves, twigs, and branches at the base of trees are considerably higher than losses associated with the canopy. The decomposed material retains approximately 40 percent of the water that is not retained in the canopy (Thurow and Hester, 1997). Soil properties affected include biological activity, infiltration rates, and soil fertility. Special planning will be necessary to assure that sufficient amounts of fine fuel are available to carry fires with enough intensity to control woody species. In some locations the use of chemicals as a brush management tool may be desirable to initiate and accelerate this transition. Birds, small mammals, and livestock are instrumental in the distribution of seed and accelerating the spread of most trees and shrubs common to this site. The speed of encroachment varies considerably and can occur on both grazed and non-grazed pastures. Many species of wildlife, especially bobwhite quail, turkey, and white-tailed deer benefit from the growth of trees and shrubs for both food and cover. When management for specific wildlife populations is desirable, these options should be considered in any brush management plan.

Characteristics and indicators. This state has a dominant woody canopy cover of greater than 20 percent.

Resilience management. Prescribed burning and mechanical brush control is necessary to maintain a Grassland State.

Dominant plant species

- eastern redcedar (*Juniperus virginiana*), tree
- honeylocust (*Gleditsia triacanthos*), tree
- Chickasaw plum (*Prunus angustifolia*), shrub
- skunkbush sumac (*Rhus trilobata*), shrub
- smooth sumac (*Rhus glabra*), shrub

Community 2.1
Shrub Community

Figure 16. Shrub plant community in Reno, County Kansas.

This plant community is dominated by shrubs consisting primarily of Chickasaw plum, skunkbush sumac, and smooth sumac. Sand sagebrush occurs in some locations in the extreme western portion of the Major Land Resource Area 79. Trees such as honeylocust (*Gleditsia triacanthos*) and eastern redcedar (*Juniperus virginiana*) have invaded and become established in isolated areas. Chickasaw plum is generally the most abundant shrub and typically forms large mottes or thickets scattered over the site. Shrubs and trees may produce 40-60 percent of the total vegetation. The spread of shrubs and trees results from the absence of fire. Periodic burning tends to hinder the establishment of most of these woody species and favor forb and grass species. However, not all unburned areas have a woody plant problem. The speed of encroachment varies considerably. Birds are instrumental in the distribution of seed and accelerating the spread of shrub and tree species over the site. Encroachment may be on areas subjected to long-term continuous overgrazing. In these situations the associated grasses will usually consist of sand dropseed, sand lovegrass, purple lovegrass, Texas bluegrass, and Scribner’s rosette grass. Shrubs also will invade and spread on areas where both grazing and fire have been excluded for many years. Heavy accumulations of plant mulch and litter retards herbage growth and provides a favorable habitat for seed germination and establishment of many shrub species. The associated grasses in this situation usually include sand bluestem, little bluestem, Indiangrass, switchgrass, sedges, and Canada wildrye. Grass production is significantly reduced because of the shrub competition. Grass yields vary from 40-50 percent of the total vegetative production. Forbs generally produce 15-20 percent of the total. Major forbs include white sagebrush, Carruth's sagewort, redroot buckwheat, Cuman ragweed, lemon scurfpea, camphorweed, and tenpetal blazingstar. Total annual production ranges from 1,000 to 2,500 pounds air dry vegetation per acre and averages about 1,500 pounds. Usually a prescribed burning program accompanied with prescribed grazing will gradually return the plant community to one dominated by grasses and forbs. Special planning will be necessary to assure that sufficient amounts of fine fuel are available to carry fires with the intensity to control the woody species. In some locations use of chemicals as a brush management tool will be necessary to initiate and accelerate this transition. Many species of wildlife, especially bobwhite quail and whitetail deer, benefit from the growth of shrubs for food and as cover. When wildlife populations are a desirable component, this should be considered in any brush management plans.

Resilience management. This plant community is maintained by a lack of fine fuel loads, prescribed fire, and mechanical brush control.

Dominant plant species

- honeylocust (*Gleditsia triacanthos*), tree
- eastern redcedar (*Juniperus virginiana*), tree
- Chickasaw plum (*Prunus angustifolia*), shrub
- sand dropseed (*Sporobolus cryptandrus*), grass
- sand lovegrass (*Eragrostis trichodes*), grass
- purple lovegrass (*Eragrostis spectabilis*), grass
- Texas bluegrass (*Poa arachnifera*), grass
- Scribner's rosette grass (*Dichanthelium oligosanthes var. scribnerianum*), grass

State 3
Tillage State

The Tillage State consists of abandoned cropland that has been naturally revegetated ("go-back land") 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 can exist. Many of these communities are represented by the genus Aristida (threeawns). This is an alternative state since the energy, hydrologic, and nutrient cycles are altered to that of the Reference State in its natural disturbance regime. Bulk density, aggregate stability, soil structure, and plant functional and structural groups are not fully restored to that of the Reference State. Mechanical 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).

Characteristics and indicators. Bulk density, aggregate stability, soil structure changes and plant functional and structural groups will distinguish this state from the others.

Resilience management. This state has no restoration pathways and will maintain in this state.

Community 3.1
Reseed Community

This plant community occurs on areas that were formerly farmed and reseeded with a mixture of native species common in the Reference Plant Community. Most seeding mixtures consisted of a blend of grasses that include sand bluestem, Indiangrass, switchgrass, little bluestem, sideoats grama, blue grama, and western wheatgrass. In some locations, seed of legumes and forbs such as prairie bundleflower and Maximilian sunflower were included in the mixture. Once these areas become fully established, production is comparable to that of the Reference Plant Community. Total annual production ranges varies according to the species planted, established plants, and years of establishment. When reseeded areas and areas supporting native rangeland exist in the same pasture, they seldom are utilized at the same intensity because domestic livestock usually prefer plants growing on the native rangeland areas. When feasible, reseeded plant communities should be managed as separate pastures or units. Some seeded areas are invaded by trees and shrubs during the establishment period of the desired plants. These invader species commonly include eastern redcedar and eastern cottonwood. Occasional burning is effective in controlling establishment of these woody plants.

Resilience management. This is a stable plant community when adequately managed. A prescribed grazing program that incorporates periods of deferment, during the growing season, benefits the reseeded grasses and the palatable forb species. Soils are susceptible to wind erosion and excessive grazing while livestock trailing can quickly have impact on soil stability and lead to an occurrence of small blowouts.

Community 3.2
Go-back Community

This plant community also occurs on areas that were formerly farmed. When tillage operations ceased, the areas were allowed to revegetate or “go back” naturally, in contrast to artificial reseeding to a selected species or group of species. The go-back process is a slow, gradual transformation that requires many years and many successional changes or stages in the plant community. The speed and extent of revegetation depends upon the size of the area, level of grazing management, and the proximity of the area to existing seed sources. In the initial stages of revegetation, the site is usually dominated by annual forbs such as annual ragweed, slender snakecotton, Canadian horseweed, prairie sunflower, common sunflower, Mexican fireweed, camphorweed, and annual buckwheat. Gradually these are replaced by annual grasses including prairie threeawn, mat sandbur, tumblegrass, little barley, cheatgrass, and witchgrass. As plant succession progresses the plant community gradually becomes dominated by perennials. The major grasses include sand dropseed, composite dropseed, thin paspalum, purple lovegrass, red lovegrass, Scribner’s rosette grass, Carolina crabgrass, silver beardgrass, and tumble windmill grass. Common forbs are Cuman ragweed, white sagebrush, Carruth’s sagewort, white heath aster, Missouri goldenrod, and sand milkweed. Combinations of these plants can form a stable community. In time, and with prescribed grazing management, other perennial grasses and forbs common in the Reference Plant Community return to the site. Some go-back areas are invaded by trees and shrubs. The more common include eastern redcedar and eastern cottonwood. Occasional burning is effective in controlling these woody plants. Total annual production varies by site. This depends upon seasonal precipitation and the stage of plant succession in the plant community.

Resilience management. This is a stable plant community when adequately managed. A prescribed grazing program that incorporates periods of deferment during the growing season benefits the native palatable go-back species and the palatable forb species. Soils are susceptible to wind erosion and excessive grazing while livestock trailing can quickly have impact on soil stability and lead to an occurrence of small blowouts.

Transition 1 to 2
State 1 to 2

Changes from a Grassland State to a Woody State lead to changes in hydrologic function, forage production, dominant functional and structural groups, and wildlife habitat. Understory plants may be negatively affected by trees and shrubs by a reduction in light, soil moisture, and soil nutrients. Increases in tree and shrub density and size have the effects of reducing understory plant cover and productivity, and desirable forage grasses often are most severely reduced (Eddleman, 1983). As vegetation cover changes from grasses to trees, a greater proportion of precipitation is lost throughout interception and evaporation; therefore, less precipitation is available for producing herbaceous forage or for deep drainage or runoff (Thurow and Hester, 1997). Tree and shrub establishment becomes increasingly greater while fine fuel loads decrease. As trees and shrubs increase at levels of greater than 20 percent canopy cover, the processes and functions that allow the Woody State to become resilient are active and dominant over the processes and systems inherent of the Grassland State. Using prescribed fire as a standalone management tool is unsuccessful to eradicate the trees and shrubs due to a lack of fine fuel loads.

Constraints to recovery. Canopy cover of woody vegetation is greater than 20 percent. The woody species competes with the native grass fine fuel loads that would naturally be capable to carry a fire and maintain the prairie ecosystem.

Transition 1 to 3
State 1 to 3

This transition is triggered by a management action as opposed to a natural event. Tillage, which is the process of breaking the ground with machinery for crop production, will move the Grassland State to a Tillage State. The resilience of the Reference State has been compromised by the fracturing and blending of the native virgin sod. The energy, hydrologic, and nutrient cycles are altered and vary from that of the Grassland State.

Constraints to recovery. The resilience of the Reference State has been compromised by the fracturing and blending of the native virgin sod.

Restoration pathway 2 to 1
State 2 to 1

Restoration efforts will be costly, labor-intensive, and can take many years, if not decades, to return to a Grassland State. Once canopy levels reach greater than 20 percent, estimated cost to remove trees is very expensive and includes high energy inputs. The technologies needed in order to go from an invaded Woody State to a Grassland State include but are not limited to: prescribed burning—the use of fire as a tool to achieve a management objective on a predetermined area under conditions where the intensity and extent of the fire are controlled; brush management—manipulating woody plant cover to obtain desired quantities and types of woody cover and/or to reduce competition with herbaceous understory vegetation, in accordance with overall resource management objectives; and prescribed grazing—the controlled harvest of vegetation with grazing or browsing animals managed with the intent to achieve a specified objective. In addition to grazing at an intensity that will maintain enough cover to protect the soil and maintain or improve the quantity and quality of desirable vegetation. When a juniper tree is cut and removed, the soil structure and the associated high infiltration rate may be maintained for over a decade (Hester, 1996). This explains why the area near the dripline usually has substantially greater forage production for many years after the tree has been cut. It also explains why runoff will not necessarily dramatically increase once juniper is removed. Rather, the water continues to infiltrate at high rates into soils previously ameliorated by junipers, thereby increasing deep drainage potential. In rangeland, deep drainage amounts can be 16 percent of the total rainfall amount per year (Thurow and Hester, 1997).

Conservation practices

Brush Management

Prescribed Burning
Prescribed Grazing

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Grasses Dominant 75%**			1121–2102	
	sand bluestem	ANHA	*Andropogon hallii*	560–1401	–
	little bluestem	SCSC	*Schizachyrium scoparium*	168–420	–
	Indiangrass	SONU2	*Sorghastrum nutans*	112–280	–
	switchgrass	PAVI2	*Panicum virgatum*	112–280	–
	giant sandreed	CAGI3	*Calamovilfa gigantea*	168–280	–
	sand lovegrass	ERTR3	*Eragrostis trichodes*	56–140	–
2	**Grasses Minor 10%**			34–280	
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	6–22	–
	witchgrass	PACA6	*Panicum capillare*	0–22	–
	thin paspalum	PASE5	*Paspalum setaceum*	6–22	–
	blowout grass	REFL	*Redfieldia flexuosa*	0–22	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–22	–
	giant dropseed	SPGI	*Sporobolus giganteus*	0–22	–
Forb					
3	**Forbs Minor 10%**			84–280	
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–22	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–22	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–22	–
	prairie sunflower	HEPE	*Helianthus petiolaris*	0–22	–
	camphorweed	HESU3	*Heterotheca subaxillaris*	0–22	–
	Virginia tephrosia	TEVI	*Tephrosia virginiana*	0–22	–
	James' prairie clover	DAJA	*Dalea jamesii*	0–22	–
	silky prairie clover	DAVIV	*Dalea villosa var. villosa*	0–22	–
	bractless blazingstar	MENUN	*Mentzelia nuda var. nuda*	0–22	–
	lemon scurfpea	PSLA3	*Psoralidium lanceolatum*	0–22	–
	queen's-delight	STSY	*Stillingia sylvatica*	0–11	–
	annual buckwheat	ERAN4	*Eriogonum annuum*	0–11	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	0–11	–
	flaxflowered ipomopsis	IPLOL	*Ipomopsis longiflora ssp. longiflora*	0–11	–
	roundhead lespedeza	LECA8	*Lespedeza capitata*	0–11	–
	tenpetal blazingstar	MEDE2	*Mentzelia decapetala*	0–11	–
	plains milkweed	ASPU	*Asclepias pumila*	0–11	–

	Texas croton	CRTE4	*Croton texensis*	0–11	–
Shrub/Vine					
4	**Shrubs and Cacti Minor 5%**			28–140	
	sand sagebrush	ARFI2	*Artemisia filifolia*	0–28	–
	pricklypear	OPUNT	*Opuntia*	0–28	–
	American plum	PRAM	*Prunus americana*	0–28	–
	Chickasaw plum	PRAN3	*Prunus angustifolia*	0–28	–
	soapweed yucca	YUGL	*Yucca glauca*	0–28	–

Animal community

Where good vegetative cover exists, upland game birds such as bobwhite quail and greater prairie chicken find this site to be suitable habitat. Big game animals such as white-tailed deer and wild turkey also utilize this rangeland habitat. Small birds like the western kingbird, grasshopper sparrow, and western meadowlark are commonly found. Small mammals such as the skunk, opossum, and cottontail are present. Soil properties on this site make it a preferred habitat for burrowing mammals such as the plains pocket gopher and badger, along with other small animals that might use the underground burrows as habitat. Predators such as foxes and coyotes are commonly found on this site, as are avian predators (e.g., hawks and owls). A variety of snakes including the bull snake and prairie rattlesnake, as well as lizards and the box turtle, frequent this site.

Maintaining good to excellent vegetative cover on this site is the key to providing good wildlife habitat. In some cases, development of wildlife watering facilities in areas that are remote to natural water sources is also necessary.

Some animals are important because of their threatened and endangered status and require special consideration. Please check the Kansas Department of Wildlife and Parks (KDWP) website at http://ksoutdoors.com for the most current listing for your county.

Grazing Interpretations

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 preference of plant species and/or grazing system, and site grazeability 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 ESD. 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 on 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 primary factor limiting forage production on this site. Infiltration rates are high and runoff potential is low for this site.

Following are the estimated withdrawals of freshwater by use in MLRA 79:
Public supply—surface water, 6.8% and ground water, 4.0%; Livestock—surface water, 0.4% and ground water, 1.2%; Irrigation—surface water, 0.7% and ground water, 80.6%; Other—surface water, 2.0% and ground water, 4.3%.

The total withdrawals average 740 million gallons per day (2,800 million liters per day). About 90 percent is from ground water sources, and 10 percent is from surface water sources. The source of water for crops and pasture is the moderate, somewhat erratic precipitation. In the northern part of the area, the Arkansas River is a potential source of irrigation water, but it currently is little used for this purpose. The Ninnescah River is another potential source of surface water in the area. Deep sand in the High Plains Ogallala aquifer yields an abundance of good-quality ground water. This aquifer provides water primarily for irrigation, but also for domestic supply and livestock in rural areas, and for industry and public supply in Wichita and in other towns or cities in the MLRA. The ground water in this aquifer has the lowest levels of total dissolved solids of any aquifer in Kansas, 340 parts per million (milligrams per liter).

Recreational uses

This site provides opportunities for bird watching, hiking, outdoor/wildlife photography, hunting, and a variety of other outdoor activities. There are a wide variety of plants in bloom throughout the growing season, especially in those years with average and above-average rainfall, and they provide much aesthetic appeal to the landscape. This site is highly prized for use by recreational vehicles, especially dune buggies. While this can be a high value use, there are a number of site considerations because of the fragile nature of the soils and potential for severe wind erosion.

Wood products

Other than a few honeylocust and northern catalpa (Catalpa speciosa) post lots that were planted on this site, it produces no wood products.

Other products

Chickasaw plum and golden currant are highly prized for making jellies and jams.

Other information

Site Development and Testing Plan

This site went through the approval process.

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.

NRCS contracted the development of MLRA 79 ESDs in 2005. Extensive review and improvements were made to those foundational ESDs in 2017-2018 which provided an approved product.

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Contributors

Chris Tecklenburg

Approval

David Kraft, 11/08/2018

Acknowledgments

The ecological site development process is a collaborative effort, conceptual in nature, dynamic, and is never considered complete. I thank all those who set the foundational work in the mid 2000s in regards to this ESD. I thank all those who contributed to the development of this site. In advance, I thank those who would provide insight, comments, and questions about this ESD in the future.

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)	Chris Tecklenburg Revision 3-27-2018 David Kraft, John Henry, Doug Spencer and Dwayne Rice Original Authors and date 2-15-2005
Contact for lead author	State Rangeland Management Specialist for Kansas located in Salina 785-823-4500.
Date	03/27/2018

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

Indicators

1. **Number and extent of rills:** The fine sand and loamy fine sand surface-textured soils that characterize this site have a low potential for rill formation, therefore no rills or active headcutting are present on the site.

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2. **Presence of water flow patterns:** There are no water flow patterns evidenced by litter, soil, or gravel redistribution, or pedestalling of vegetation or stones that break the flow of water as a result of overland flow.

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3. **Number and height of erosional pedestals or terracettes:** There is no evidence of pedestals or terracettes that would indicate the movement of soil by water and/or by wind on this site.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Less than 10% bare ground is found on this site. It is the remaining ground cover after accounting for ground surface covered by vegetation (basal and canopy {foliar cover}, litter, standing dead vegetation, gravel/rock, and visible biological crust (e.g., lichen, mosses, algae).

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5. **Number of gullies and erosion associated with gullies:** No evidence of accelerated water flow resulting in downcutting of the soil.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** No wind-scoured or blowout areas where the finer particles of the topsoil have blown away, sometimes leaving residual gravel, rock, or exposed roots on the soil surface. Also, there are no areas of redeposited soil onto this site from another site due to the wind, i.e., depositional areas.

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7. **Amount of litter movement (describe size and distance expected to travel):** No evidence of litter movement (i.e., dead plant material that is in contact with the soil surface).

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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 surfaces may be stabilized by soil organic matter which has been fully incorporated into aggregates at the soil surface, adhesion of decomposing organic matter to the soil surface, and biological crusts. A soil stability kit will score a range from 4-6.

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

   A--0 to 20 centimeters (0 to 8 inches); yellowish brown (10YR 5/4), interior, fine sand, dark yellowish brown (10YR 4/4),

interior, moist; single grain; loose, loose, nonsticky and nonplastic; common very fine and fine roots throughout; 1 percent clay; moderately acid; clear smooth boundary. (8 to 41 centimeters thick; 3 to 16 inches thick)

---

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Functional and structural groups are that of the Reference Plant Community (see functional and structural group worksheet). Note changes to plant communities if different than that of the functional and structural group worksheet.

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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):** There is no evidence of a compacted soil layer less than 6 inches from the soil surface. Soil structure is similar to that described in indicator 9. Compacted physical features will include platy, blocky, dense soil structure over less dense soil layers, horizontal root growth, and increased bulk density (measured by weighing a known volume of oven-dry soil).

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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: Grasses-Dominant: 75%, 1875 lbs. sand bluestem 500-1250, little bluestem 150-375, giant sandreed 150-250, switchgrass 100-250, Indiangrass 100-250, sand lovegrass 50-125.

    Sub-dominant: Grasses-Minor: 5% 125 lbs. blue grama 10-40, hairy grama 10-40, sideoats grama 10-40
    Grasses-Minor: 5% 125 lbs.

    Other: Forbs-Minor: 10% 250 lbs. See functional/structural group sheet

    Additional: Shrubs-Minor: 5% 125 lbs. All 0-25, Chickasaw plum, American plum, pricklypear, sand sagebrush, and yucca glauca

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Recruitment of plants is occurring and there is a mixture of many age classes of plants. The majority of the plants are alive and vigorous. Some mortality and decadence is expected for the site, 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):** Plant litter is distributed evenly throughout the site. There is no restriction to plant regeneration due to depth of litter. When prescribed burning is practiced, there will be little litter the first half of the growing season.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** All species (e.g., native, seeded, and weeds) alive in the year of the evaluation, are included in the determination of total above ground production. Site potential (total annual production) ranges from 1,700 lbs in a below-average rainfall year and 3,400 lbs in an above-average rainfall year. The representative value for this site is 2,500 lbs. production per year.

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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:** There are no noxious weeds present. Invasive plants make up a small percentage of plant community, and invasive brush species are < 5% canopy.

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17. **Perennial plant reproductive capability:** Plants on-site exhibit the required vigor and growth to be able to reproduce vegetatively or by seed. Current management activities do not adversely effect the capability of plants to reproduce.
