USDA Natural Resources
Conservation Service

Ecological site R079XY121KS
Sand Plains

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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.

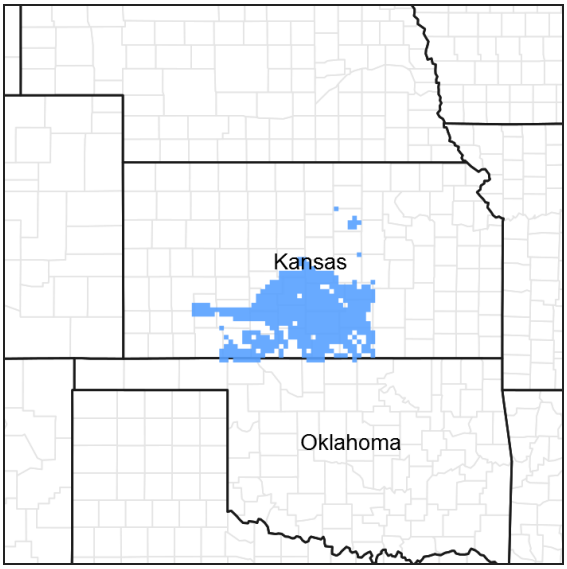


Figure 1. Mapped extent

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 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 are in this area.

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 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

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% 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.

Associated sites

R079XY103KS	**Choppy Sands** The Choppy Sands site is located adjacent to and in conjunction with the Sand Plains ecological site. This site is characterized by sandy soils, generally with greater than 70 percent sand. Sandy eolian sediments make up the parent material of this ecological site. The slopes are generally greater than 15 percent giving a short, steep, hummocky appearance.
R079XY122KS	**Sandy Loam** The Sandy Loam site is known to be found adjacent to and in conjunction with Sand Plains ecological site. This ecological site was formerly known as Sandy R079XY022KS. The Sandy Loam ecological site is made up of well drained and very deep (60 inches) soils. These soils have greater than 70% and less than 52% sand in the surface. Soils that make up the Sandy Loam ecological site have a sandy loam surface texture. Generally this site is located on paleoterraces (erosional remnant of a terrace) with a slope range of 0 to 15 percent.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

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. 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 Sand Plains ecological site consists of very deep, well drained sand or loamy sand-textured soils. These soils formed in sandy eolian deposits over alluvium on nearly level to moderately sloping dunes on paleoterraces on river valleys. Runoff is low or very low.

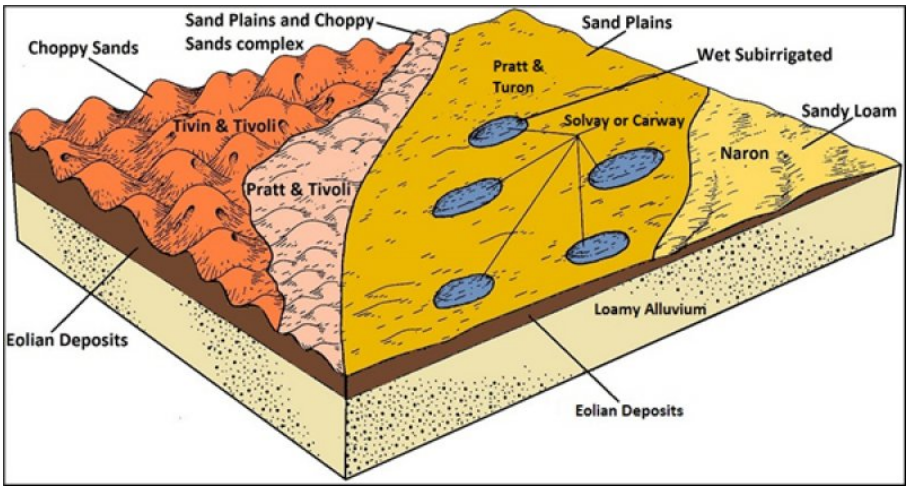


Figure 2. MLRA 79 Ecological Site block diagram.

Table 2. Representative physiographic features

Landforms	(1) Paleoterrace (2) Dune
Flooding frequency	None
Ponding frequency	None
Elevation	503–792 m
Slope	0–15%
Ponding depth	0 cm
Water table depth	0 cm

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 (average)	179 days
Freeze-free period (average)	197 days
Precipitation total (average)	787 mm

Climate stations used

- (1) GREENSBURG [USC00143239], Greensburg, KS
- (2) HUTCHINSON [USC00143929], Hutchinson, KS

- (3) STERLING [USC00147796], Sterling, KS
- (4) WELLINGTON [USC00148670], Wellington, KS
- (5) KINGMAN [USC00144313], Kingman, KS
- (6) PRATT [USC00146549], Pratt, KS
- (7) HUDSON [USC00143847], Hudson, KS
- (8) HUTCHINSON 10 SW [USC00143930], Hutchinson, KS
- (9) WICHITA [USW00003928], Wichita, KS
- (10) KINSLEY 2E [USC00144333], Kinsley, KS
- (11) NORWICH [USC00145870], Norwich, KS

Influencing water features

These soils are well drained. Available soil moisture is highly variable because of the texture of the subsoil. 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.

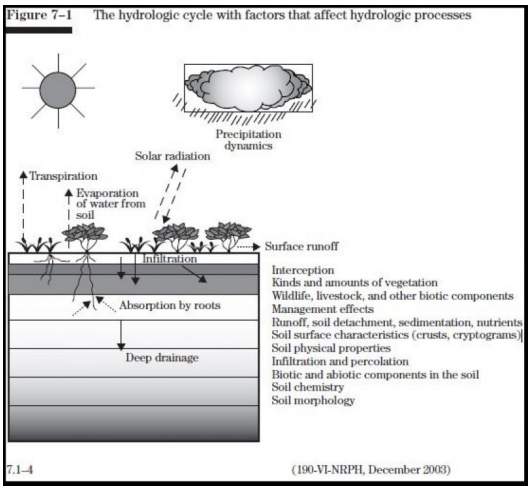


Figure 7. Fig.7-1 from National Range and Pasture Handbook.

Soil features

The soils representing the Sand Plains ecological site are well drained and very deep. The surface layer of the soils in this site consists primarily of fine sand or loamy sand. The depth of the surface layer ranges from 3 to 20 inches thick. The subsoil and underlying material have a similar texture as the surface layer, but have thin layers of higher clay content (lamellae) occurring within the subsoil. Sometimes these soils have contrasting loamy or clayey layers that may occur below 40 inches. The permeability drops to moderately slow in these contrasting layers. Soils in this site usually have low to moderate available water capacity. These soils are susceptible to erosion, primarily by wind. The potential for wind erosion increases with sandier surface textures and drier climates.

The major soils that characterize this site include Pratt and Turon.

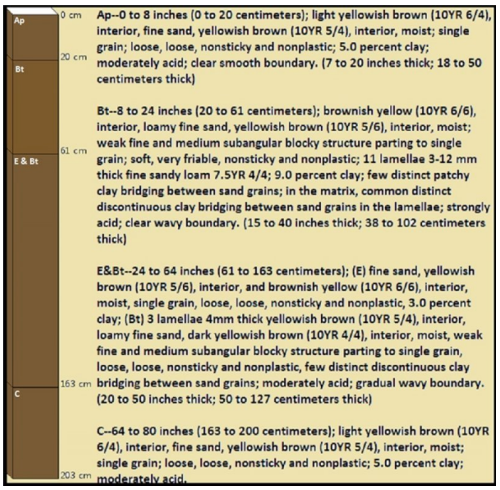


Figure 8. Official soils description for Pratt series.

Table 4. Representative soil features

Surface texture	(1) Sand (2) Loamy sand
Family particle size	(1) Sandy
Drainage class	Well drained
Permeability class	Rapid
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	8.38–22.35 cm
Calcium carbonate equivalent (0-101.6cm)	0–2%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	5.6–7.8
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

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

Although the deep, sandy soils characteristic of this site absorb water rapidly, their water-holding capacity is low and moisture tends to slowly percolate through the profile. As such, the taller grasses that evolved and dominated the original plant community have deep, efficient root systems capable of utilizing moisture throughout most of the profile. There is almost no runoff from this site and most precipitation that occurs enters the soil profile. Seed heads of the major grasses often reach six to seven feet in height. The subsoil has thin layers of higher clay content called lamella. These lamella help contribute to a productive ecological site.

The Sand Plains ecological site developed with occasional fires as an important part of ecological processes. Historically, fires were infrequent and were usually started by lightning during spring and early summer thunderstorms. It is also recognized that early Native Americans often used fire to attract herds of migratory herbivores, especially bison. These intentional fires probably occurred more frequently. Because all of the dominant tallgrasses were rhizomatous, they were able to survive the ravages of even intense wildfires and gain a competitive advantage in the plant community. In contrast, 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, but temporary, increase in the abundance of annual forbs that may have lasted 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 was probably intense but of short duration. As herds typically moved on 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 plant community's development. 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 dry period, 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 upon 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).

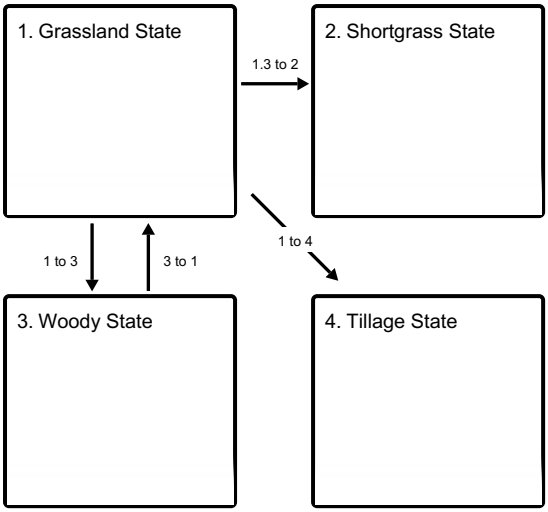
As utilization of the site for domestic livestock production replaced that of roaming bison herds, its ecological dynamics were altered and the plant community changed from its original composition. These changes were usually in proportion to grazing intensity and when the grazing season occurred. A combination of drought and overgrazing accelerated these changes because the taller grasses and forbs palatable to bison were equally relished and selected by cattle. When repeatedly grazed, 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 small blowouts.

The occurrence of wildfires and the impact that fire played in maintaining the plant community 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 locales shrubs and trees have spread to the point they have become the dominant influence in the plant community.

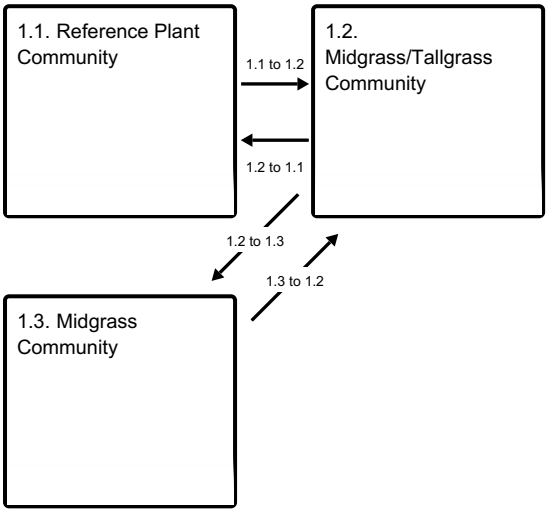
The following diagram illustrates some of the pathways that the vegetation on this site may take from the Reference Plant Community as influencing ecological factors change. There may be other states or plant communities not shown on the diagram.

State and transition model

Ecosystem states

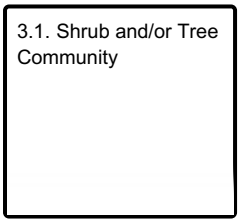


State 1 submodel, plant communities

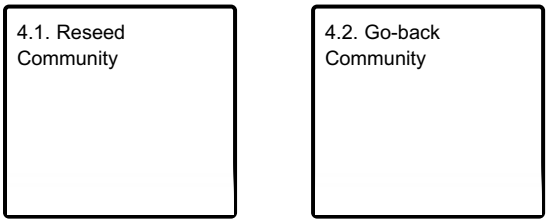


State 2 submodel, plant communities

State 3 submodel, plant communities



State 4 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 Sand Plains 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/Tallgrass community is made up primarily of warm-season midgrasses with an interspersed cool-season component and decreasing amounts of forbs and tallgrasses. The Midgrass Plant Community is dominated by less desirable midgrasses, shortgrasses, and cool-season midgrasses.

Community 1.1
Reference Plant Community

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 prairie sandreed. The major midgrass is little bluestem. Combined, these grasses will account for approximately 75 percent of vegetation produced annually. Other prevalent grasses are Canada wildrye, sand lovegrass, composite dropseed, sand dropseed, Scribner's rosette grass, and purple lovegrass. Scattered throughout are minor amounts of shortgrasses consisting of blue grama, hairy grama, and thin paspalum. The Sand Plains site supports a wide variety of legume species which are interspersed throughout the grass sward. The most abundant are roundhead lespedeza, slender lespedeza, sessileleaf tick trefoil, golden prairie clover, Virginia tephrosia, lemon scurfpea, and prairie bundleflower. Other important forbs include Maximilian sunflower, Missouri goldenrod, and Cuman ragweed. A few large clumps of Chickasaw plum and fragrant sumac may be found on the steeper-sloped exposures. This site can be maintained with a stable plant community when adequately managed. A prescribed grazing program that incorporates periods of deferment during the growing season benefits the tallgrasses and even the more palatable forb species. Soils are susceptible to wind erosion and excessive grazing and trailing by livestock can have an impact on their stability. A lack of plant cover can lead to the occurrence of small blowouts.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1440	2668	3475
Forb	263	314	880
Shrub/Vine	90	157	353
Total	**1793**	**3139**	**4708**

Community 1.2
Midgrass/Tallgrass Community

The composition of this plant community resembles that of the Reference Plant Community. Comparatively, there has been a slight decrease of the more palatable tallgrasses and forbs and a subsequent increase in midgrasses. The dominant grasses are little bluestem and sand bluestem with lesser amounts of switchgrass and Indiangrass. A number of midgrasses have increased in abundance as the taller grasses have been reduced by overgrazing. These include sand dropseed, sand lovegrass, purple lovegrass, thin paspalum and composite dropseed. Other secondary grasses are Carolina crabgrass, red lovegrass, tumble windmillgrass, mat sandbur, hairy grama, blue grama, and Scribner's rosette grass. Together, these secondary grasses comprise 20-30 percent of the total herbage produced annually. Forbs such as Maximilian sunflower, roundhead lespedeza, prairie bundleflower, Virginia tephrosia, and golden prairie clover have been partially 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. Chickasaw plum and fragrant sumac are common and usually found in small clumps or mottes. Shrubs usually will not comprise over 10 percent of the total production. 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 exists in a state of low vigor. This results in its gradual reduction in abundance over time. Even under moderate, continuous stocking, livestock tend to locate and severely overgraze the tops or crests of hills. Where this occurs sand dropseed, thin paspalum, and mat sandbur replace the taller grasses. In some areas this has lead to small blowouts. Total annual production ranges from 1400 to 3530 pounds of air-dry vegetation per acre and averages about 2330 pounds.

Community 1.3
Midgrass Community

This plant community developed as a result of many years of continuous overgrazing. Midgrasses dominate the site and comprise 50-60 percent of the annual production. Most abundant midgrasses include sand dropseed, composite dropseed, sand lovegrass, purple lovegrass, and Scribner's rosette grass. Shortgrasses such as Carolina crabgrass, red lovegrass, tumble windmillgrass, purple threeawn, hairy grama, and blue grama produce 10-15 percent of the vegetation. Remnant plants of sand bluestem, Indiangrass, switchgrass, and little bluestem, although sparse, are often found scattered throughout the site. These plants are usually grazed repeatedly and remain in a low state of vigor. Of these remnants, little bluestem is generally the most abundant. When in this state, new growth consisting of three to five leaves will emerge in a prostate rather than upright position, allowing it to partially escape grazing. These remnants respond favorably to periods of rest from grazing and may regain vigor in two to three years. Forb production is quite variable and may range from 10-30 percent of the total vegetation depending upon the amount and timing of rainfall. Perennial forbs include Carruth's sagewort, white sagebrush, redroot buckwheat, tenpetal blazingstar, Virginia tephrosia, and Cuman ragweed. Annual forbs common on the site include prairie sunflower, fourpoint evening-primrose, camphorweed, sleepingplant, annual ragweed, and annual buckwheat. In some locations shrubs such as fragrant sumac and Chickasaw plum comprise 15-20 percent of the total annual production. Total annual production ranges from 1,165 to 2,745 pounds of air-dry vegetation per acre and averages about 1,940 pounds.

Pathway 1.1 to 1.2
Community 1.1 to 1.2

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

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

Pathway 1.2 to 1.3
Community 1.2 to 1.3

The following describes the mechanisms of change from Plant Community 1.2 to Plant Community 1.3. Long term (>10years) management that includes continuous, heavy use of the native vegetation. Management is void of a forage and animal balance. Inadequate rest and recovery of native grasses during the growing season.

Pathway 1.3 to 1.2

Community 1.3 to 1.2

The following describes the mechanisms of change from Plant Community 1.3 to Plant Community 1.2. Management (approximately 10 years) that includes adequate rest and recovery of the key forage species in the Midgrass Community 1.2 (little bluestem, sand bluestem, switchgrass, Indiangrass). Implement prescription fires at a frequency of 6-8 years. Depending upon the level of woody vegetation encroachment, the fire return interval might require an adjustment to two consecutive years of prescribed fires.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Shortgrass State

With heavy, continuous grazing, blue grama and buffalograss 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 and runoff is increased due to the sod nature of the blue grama and buffalograss. 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 sodgrasses, there is a decrease in infiltration and interception and an increase in surface runoff (Thurow T., 2003).

Community 2.1
Shortgrass Community

This plant community is dominated by shortgrasses, which develops following many years of continuous, heavy grazing. It is generally associated with smaller pastures on farming-oriented enterprises. Such pastures are often used as holding areas in anticipation of seasonal wheat pasture or grazing of cropland aftermath. Major grasses are blue grama, hairy grama, Carolina crabgrass, thin paspalum, red lovegrass, sand dropseed, composite dropseed, and silver beardgrass. Annual grasses including Japanese brome, cheatgrass, tumble windmillgrass, prairie threeawn, purple threeawn, and witchgrass are common during seasons of normal or above-normal precipitation. Major forbs are camphorweed, Cuman ragweed, redroot buckwheat, plains snakecotton, firewheel, Rocky Mountain beeplant, Canadian horseweed, and ciliate goldenweed. In a few isolated areas overgrazed primarily by sheep, the resulting plant community is completely dominated by shortgrasses, as essentially all tall- and midgrasses have been eliminated. The major perennial grasses are blue grama, red lovegrass, little barley, and tumble windmillgrass. With normal or above normal precipitation numerous annual grasses including prairie threeawn, little barley, sixweeks fescue, and cheatgrass will occur. Although productivity is significantly reduced when compared to the Reference Plant Community, this plant community can be managed as a stable shortgrass community. Restoration to the grassland state would require high energy and economic inputs. At this time no site is known to occur in order to document a restoration pathway. Total annual production ranges from 1,165 to 2,350 pounds of air-dry vegetation per acre and averages about 1,700 pounds.

State 3
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% from a lack of fire according to a study from 1937 to 1969, in contrast to a 1% 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% to 36.7% (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% 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 tree 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.

Community 3.1
Shrub and/or Tree Community

This plant community is dominated by shrubs consisting primarily of Chickasaw plum, fragrant sumac, and smooth sumac. Sand sagebrush occurs in some locations in the extreme western portion of MLRA 79. Trees such as honeylocust and eastern redcedar 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 30-60 percent of the total vegetation. The spread of shrubs and trees results in the absence of fire. Periodic burning tends to hinder the establishment of most of these woody species and favor forbs and grasses. However, it should be pointed out that not all unburned areas have a woody plant problem. Birds and small mammals are instrumental in the distribution of seed and accelerating the spread of most shrubs common to this site. The speed of encroachment varies considerably and can occur on both grazed and non-grazed pastures. When encroachment occurs on areas that have been subjected to longtime continuous overgrazing, the associated grasses will usually consist of sand dropseed, sand lovegrass, purple lovegrass, Texas bluegrass, and Scribner’s rosette grass. When both grazing and fire have been excluded for many years, associated grasses generally are sand bluestem, little bluestem, Indiangrass, switchgrass, sedges, and Canada wildrye. Grass production is significantly reduced because of the shrub competition. Grass yields vary from 30-50 percent of the total vegetative production. Forbs generally produce 10-20 percent of the total. Major forbs include white sagebrush, Carruth’s sagewort, redroot buckwheat, Cuman ragweed, lemon scurfpea, camphorweed, and tenpetal blazingstar. 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 enough 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 both food and as cover. When wildlife populations are a desirable component, this should be a considered in any brush management plans.

State 4
Tillage State

The Tillage State consists 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 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).

Community 4.1
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 elm, common hackberry, eastern redcedar, and eastern cottonwood. Occasional burning is effective in controlling establishment of these woody plants.

Community 4.2
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 on 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 windmillgrass. 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 along with prescribed grazing management, other perennial grasses and forbs common in the Reference Plant Community return to the site. Blue grama is a shortgrass that is very common to the native plant communities on this site. However, it seldom occurs in go-back communities, even after 40-50 years of plant succession. Some go-back areas are invaded by trees and shrubs. The more common include elm, common hackberry, eastern redcedar, eastern cottonwood, and roughleaf dogwood. 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.

Transition 1.3 to 2
State 1 to 2

Long-term management (approximately 30 years) without a forage and animal balance and heavy, continuous grazing without adequate recovery periods between grazing events will convert the Grassland State to a Shortgrass State made up of blue grama and buffalograss sod. Drought in combination with this type of management will quicken the rate at which this transition occurs. Ecological processes affected are the hydrologic and nutrient cycles. There is an increase in evaporation rate, runoff, and in bulk density. There is a decrease in infiltration, plant composition change, and the functional and structural groups have shifted dominance. These are all examples of the soil and vegetation properties that have compromised the resilience of the Grassland State and therefore transitioned to a Shortgrass State.

Transition 1 to 3
State 1 to 3

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 dominate 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.

Transition 1 to 4
State 1 to 4

This transition is triggered by a management action as opposed to a natural event. Tillage or 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.

Restoration pathway 3 to 1
State 3 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 70%**			1233–2197	
	sand bluestem	ANHA	*Andropogon hallii*	785–1569	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–314	–
	switchgrass	PAVI2	*Panicum virgatum*	157–314	–
	little bluestem	SCSC	*Schizachyrium scoparium*	157–314	–
	Indiangrass	SONU2	*Sorghastrum nutans*	157–314	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–157	–
2	**Grasses Minor Component 10%**			157–314	
	sideoats grama	BOCU	*Bouteloua curtipendula*	78–157	–
	blue grama	BOGR2	*Bouteloua gracilis*	78–157	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	78–157	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	78–157	–
3	**Grasses Minor Component 5%**			28–157	

3	**Grasses Minor Component 5%**			28–157	
	sedge	CAREX	*Carex*	11–34	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	11–34	–
	sand lovegrass	ERTR3	*Eragrostis trichodes*	11–34	–
	thin paspalum	PASE5	*Paspalum setaceum*	11–34	–
	purpletop tridens	TRFL2	*Tridens flavus*	11–34	–
Forb					
4	**Forbs Minor Component 10%**			73–314	
	Illinois bundleflower	DEIL	*Desmanthus illinoensis*	6–39	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	17–34	–
	Virginia tephrosia	TEVI	*Tephrosia virginiana*	6–28	–
	purple prairie clover	DAPUP	*Dalea purpurea var. purpurea*	6–28	–
	roundhead lespedeza	LECA8	*Lespedeza capitata*	6–22	–
	common yarrow	ACMI2	*Achillea millefolium*	6–17	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	6–17	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	6–17	–
	partridge pea	CHFA2	*Chamaecrista fasciculata*	6–17	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	6–17	–
	stiff goldenrod	OLRI	*Oligoneuron rigidum*	6–17	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–11	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–11	–
	compassplant	SILA3	*Silphium laciniatum*	0–11	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	0–11	–
	hoary verbena	VEST	*Verbena stricta*	0–11	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–11	–
	spotted beebalm	MOPU	*Monarda punctata*	0–11	–
	Illinois ticktrefoil	DEIL2	*Desmodium illinoense*	0–11	–
	annual buckwheat	ERAN4	*Eriogonum annuum*	0–11	–
Shrub/Vine					
5	**Shrubs Minor Component 5%**			0–157	
	sand sagebrush	ARFI2	*Artemisia filifolia*	0–34	–
	American plum	PRAM	*Prunus americana*	0–34	–
	Chickasaw plum	PRAN3	*Prunus angustifolia*	0–34	–
	climbing rose	ROSE2	*Rosa setigera*	0–34	–
	soapweed yucca	YUGL	*Yucca glauca*	0–34	–

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% is from ground water sources, and 10% 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

The Sand Plains ecological 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, that 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 (Gleditsia triacanthos) and northern catalpa (Catalpa speciosa) post lots that were planted on this site, it produces no wood products.

Other products

Two shrubs, 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 was 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, 9/21/2018

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.

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Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	Chris Tecklenburg Revision 1-24-2018 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	01/24/2018
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** The sand and loamy sand 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).

---

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):** Pratt OSD:
   Ap--0 to 8 inches (0 to 20 centimeters); light yellowish brown (10YR 6/4), interior, fine sand, yellowish brown (10YR 5/4), interior, moist; single grain; loose, loose, nonsticky and nonplastic; 5.0 percent clay; moderately acid; clear smooth boundary. (7 to 20 inches thick; 18 to 50 centimeters thick)

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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.

---

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: 70% 1960 lbs. sand bluestem 700-1400, switchgrass 140-280, Indiangrass 140-280, little

bluestem 140-280, prairie sandreed 0-280, and Canada wildrye 0-140

Sub-dominant: Grasses-Minor: 10% 280 lbs. blue grama 70-140, sand dropseed 70-140, sideoats grama 70-140, and composite dropseed 70-140. Grasses-Minor 5% 140 lbs. purple tridens 10-30, sand lovegrass 10-30, thin paspalum 10-30, Scribner's rosette grass 10-30, and sedge 10-30

Other: Forbs-Minor: 10% 280 lbs. See functional/structural group sheet

Additional: Shrubs-Minor: 5% 140 lbs. All 0-30, Chickasaw plum, American plum, prairie rose, 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.

---

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 1,600 lbs in a below-average rainfall year and 4,200 lbs in an above-average rainfall year. The representative value for this site is 2,800 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.

---

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.
