USDA Natural Resources
Conservation Service

Ecological site R079XY123KS
Sand Floodplain

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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.

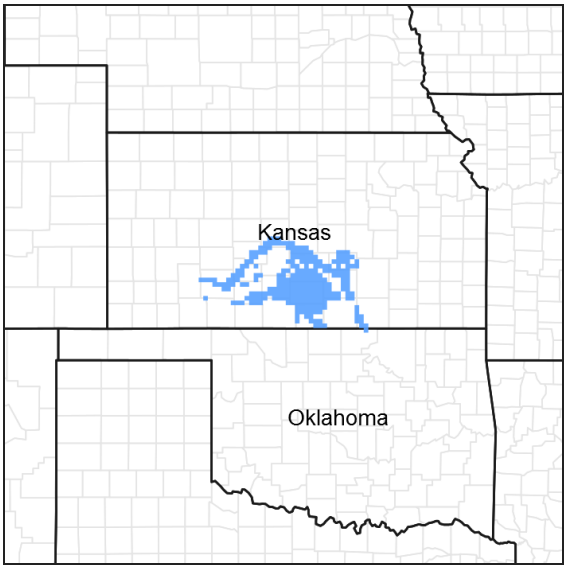


Figure 1. Mapped extent

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 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 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 Sand Floodplain (079XY123) ecological site was formerly named Sandy Lowland (R079XY023KS). This site occurs on nearly level to very gently undulating soils on floodplains and floodplain steps in river valleys. The Sand Floodplain is characteristic of soils with generally more than 70 percent sand in the surface. Soil surface texture ranges from fine sandy loam to loamy sand. Slope ranges from 0 to 3 percent.

Associated sites

R079XY113KS	**Loamy Floodplain** The Loamy Floodplain ecological site lies adjacent to and in conjunction with the Sand Floodplain site. This site occurs on floodplains and does not have a seasonal or perennial high water table (<6 feet from the soil surface).
R079XY132KS	**Subirrigated** The Subirrigated ecological site lies adjacent to and in conjunction with the Sand Floodplain site. This 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. The Subirrigated site is located on floodplains and interdunes. This 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	Not specified

Physiographic features

Most of MLRA 79 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 MLRA 79, Rattlesnake Creek flows north and the Little Arkansas River flows south into the Arkansas River.

The Sand Floodplain ecological site consists of very deep, moderately well to excessively drained soils formed in sandy alluvium. This site occurs on nearly level to very gently undulating floodplains. Runoff is negligible to very low and permeability is rapid.

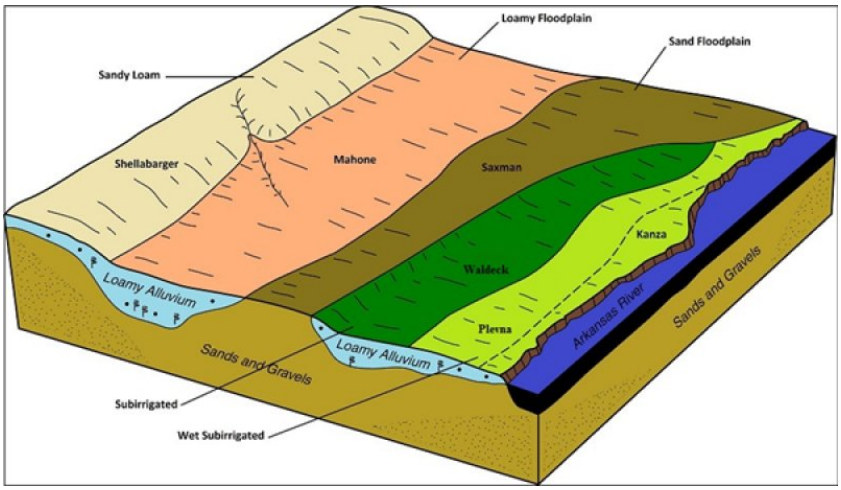


Figure 2. MLRA 79 ecological site block diagram.

Table 2. Representative physiographic features

Landforms	(1) Flood plain
Flooding frequency	Occasional to frequent
Elevation	503–792 m
Slope	0–3%
Ponding depth	0 cm
Water table depth	183 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)	183 days
Freeze-free period (average)	198 days
Precipitation total (average)	787 mm

Climate stations used

- (1) NORWICH [USC00145870], Norwich, KS
- (2) HUTCHINSON [USC00143929], Hutchinson, KS
- (3) KINGMAN [USC00144313], Kingman, KS
- (4) STERLING [USC00147796], Sterling, KS
- (5) WICHITA [USW00003928], Wichita, KS
- (6) HUDSON [USC00143847], Hudson, KS
- (7) HUTCHINSON 10 SW [USC00143930], Hutchinson, KS

- (8) KINSLEY 2E [USC00144333], Kinsley, KS

Influencing water features

Soils on the Sand Floodplain ecological site range from moderately well drained to excessively drained. The water table may enter the root zone during growing season wet cycles. These soils are subject to rare to frequent flooding.

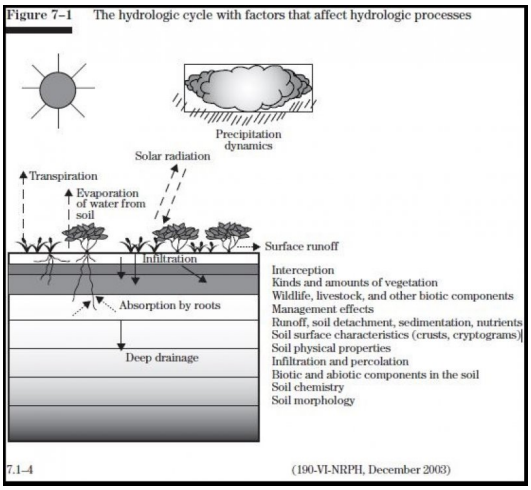


Figure 7. Fig.7-1 from National Range and Pasture Handbook.

Soil features

The soils representing the Sand Floodplain ecological site consist of very deep floodplain soils that have fine sandy loam or loamy sand surface textures and sandy subsoil textures. Soil in this site have a low to moderate available water capacity. The surface layer ranges from a depth of 3 to 17 inches thick.

The major soils common to this site are Lincoln and Saxman.

Figure 8. Typical Saxman soil profile.

Table 4. Representative soil features

Surface texture	(1) Loamy fine sand (2) Loamy sand (3) Fine sandy loam
Family particle size	(1) Sandy
Drainage class	Moderately well drained to somewhat excessively drained
Permeability class	Rapid

Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	8.13–17.53 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	4.5–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–25%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

This is a dynamic plant community resulting from the complex interaction of many ecological processes. Vegetation evolved on moderately deep to deep soils under diverse, fluctuating climatic conditions, was grazed by herds of large herbivores, and was periodically burned by intense wildfires.

The deep, sandy soils characteristic of this site absorb water rapidly. However, water-holding capacities are low and soil moisture tends to rapidly percolate through the profile. 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, so most precipitation enters the root profile, making this site productive. The Sand Floodplain site may flood three or more times per year. Seedheads of the major grasses often reach six to seven feet in height.

Fires of various intensity, frequency, and seasonality played an important role in ecological processes. Historically, fires were usually started by lightning and commonly occurred in spring and early summer months when thunderstorms were most prevalent. It is also recognized that early Native Americans often used fire to attract herds of herbivores, especially bison, and may have set fires on an annual basis. Because all of the dominant tallgrasses were rhizomatous, they were able to survive the ravages of intense wildfires and gain a competitive advantage in the plant community. In contrast, most trees and shrubs in this area were suppressed by fire and occurred only sparsely on protected areas. Growth of forbs, especially legumes, was usually enhanced following fires. After a fire there was usually a substantial increase in the abundance of annual forbs. Although temporary, the increase 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 herds moved through an area, grazing was probably intense but of short duration. As they 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 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 rain fell after a drought, annual forbs and grasses temporarily occurred in great abundance. As precipitation returned to normal or above-normal, the deeper-rooted grasses responded quickly to their production potentials.

State-and-Transition Diagram

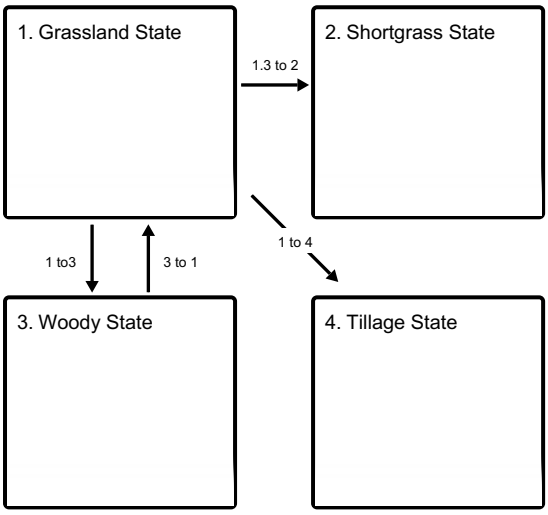
As utilization of the site for production of domestic livestock replaced that of roaming bison herds, its ecological dynamics were altered. The plant community changed from its original composition, usually in proportion to the season and intensity of grazing livestock. A combination of drought and overgrazing 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 for many years, even plants that initially increased were often replaced by even less desirable, lower-producing plants. In some areas plant cover was reduced to a mixture of native shortgrasses, annual grasses, and forbs.

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. Use of prescribed fire as a management tool was virtually eliminated for decades. In the absence of fire, there was a gradual increase of woody 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.

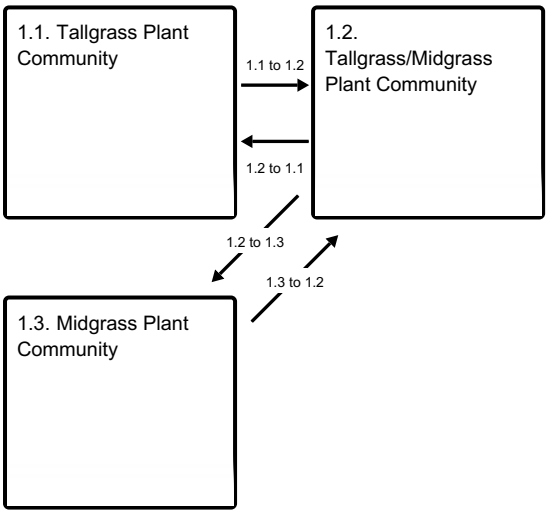
The following diagram illustrates some of the pathways that the vegetation on this site may take from the Reference Plant Community as influencing ecological factors change. There may be other states or plant communities not shown on the diagram, as well as noticeable variations within those illustrated.

State and transition model

Ecosystem states



State 1 submodel, plant communities



State 2 submodel, plant communities

2.1. Shortgrass Plant Community

State 3 submodel, plant communities

3.1. Shrub/Tree Plant Community

State 4 submodel, plant communities

4.1. Reseed Plant Community

4.2. Go-back Plant Community

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 Floodplain 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 Tallgrass/Midgrass Community is made up primarily of warm-season midgrasses, with an interspersed cool-season component and decreasing amounts of forbs and tallgrasses. The Midgrass-Shortgrass Plant Community is dominated by midgrasses, shortgrasses, and cool-season midgrasses.

Community 1.1
Tallgrass Plant Community

The interpretive plant community for this site is the Tallgrass Plant Community. This plant community 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, and Indiangrass. Common reed, eastern gamagrass, and prairie cordgrass will occur in the wetter areas. The major midgrass is little bluestem. Combined, these grasses will account for 60 percent of vegetation produced annually. Other prevalent midgrasses are Canada wildrye, sand lovegrass, composite dropseed, sand dropseed, and Scribner’s rosette grass. Scattered throughout are minor amounts of shortgrasses consisting of blue grama and hairy grama. The site supports a wide variety of forb species which are interspersed throughout the grass sward. Jersey tea is a low-growing shrub that occurs over the site. Unlike most shrubs, this plant is quite tolerant to fire. A few large clumps of Chickasaw plum and fragrant sumac may also be found. This can be maintained as 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. Because soils are susceptible to wind erosion, excessive grazing and trailing by livestock can have an impact on the stability. A lack of plant cover can lead to gully erosion during floods.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	2057	3200	4069
Forb	258	404	510
Shrub/Vine	207	319	404
Total	**2522**	**3923**	**4983**

Community 1.2
Tallgrass/Midgrass Plant Community

The composition of this plant community resembles that of the Tallgrass 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 sand bluestem and little 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, Florida paspalum, and composite dropseed. Other secondary grasses are Carolina crabgrass, red lovegrass, tumble windmillgrass, mat sandbur, buffalograss, blue grama, and Scribner's rosette grass. Combined, these secondary grasses comprise 20 to 30 percent of the total herbage produced annually. Forbs such as Maximilian sunflower, roundhead lespedeza, prairie bundleflower, and Maryland senna have been partially replaced by white sagebrush, Cuman ragweed, Fendler's aster, redroot buckwheat, and tenpetal blazingstar. Forbs produce 10 to 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 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 for grazing 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. Where this occurs, sand dropseed, Florida paspalum, and mat sandbur replace the taller grasses. In some areas this has lead to gully erosion following flooding. 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.

Community 1.3
Midgrass Plant Community

This plant community developed as a result of many years of continuous overgrazing. Midgrasses dominate the site and comprise 40 to 70 percent of the annual production. Most abundant midgrasses include sand dropseed, composite dropseed, sand lovegrass, Florida paspalum, and Scribner's rosette grass. Shortgrasses such as Carolina crabgrass, red lovegrass, tumble windmillgrass, purple threeawn, buffalograss, and blue grama produce 10 to 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 of sand bluestem, Indiangrass, and switchgrass consisting of three to five leaves will emerge in a prostate position rather than upright, allowing the plants to partially escape grazing. These tallgrass remnants respond favorably to periods of rest from grazing and may regain vigor in two to three years. This is not true for little bluestem. Because of its upright bunchgrass growth habit, extreme, and continuous overgrazing can almost eliminate it from the site. Forb production is quite variable and may range from 10 to 30 percent of the total vegetation, depending upon amounts and timing of rainfall and flooding. Perennial forbs include Carruth's sagewort, white sagebrush, redroot buckwheat, tenpetal blazingstar, bush morning-glory, and Cuman ragweed. Annual forbs common on the site include prairie sunflower, fourpoint evening-primrose, camphorweed, annual ragweed, and annual buckwheat. In some locations shrubs such as fragrant sumac and Chickasaw plum comprise 20 to 40 percent of the vegetation. Total annual production ranges from 1,500 to 3,500 pounds of air-dry vegetation per acre and averages about 2,200 pounds. Prescribed grazing with adequate rest and recovery periods during the growing season will shift this plant community to include more productive midgrasses. With continued management the taller grasses will gradually increase in abundance.

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, and no forage and animal balance for many extended grazing seasons. This type of management lasting for periods greater than ten 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 (>10 years) management that includes continuous, heavy use of the native vegetation; management that is void of a forage and animal balance; and 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, and Indiangrass). Implement prescription fires at a frequency of 6-8 years. Depending upon the level of woody vegetation encroachment, the fire return interval might need to be adjusted to two consecutive years of prescribed fires.

Conservation practices

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 have 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 Plant Community

This plant community developed as a result of many years of continuous overgrazing. Shortgrasses dominate the site and comprise 40 to 70 percent of annual production. The most abundant grasses include blue grama, sand dropseed, buffalograss, and mat sandbur. Remnant plants of sand bluestem, Indiangrass, and switchgrass are very

sparse and scattered. They persist in a low state of vigor, often being semi-dormant or dormant. Forb production is variable and may range from 30 to 60 percent. Perennial forbs include Carruth's sagewort, common yarrow, wavyleaf thistle, Canadian horseweed, and Cuman ragweed. Annual forbs include prairie sunflower, camphorweed, and annual ragweed. Total annual production ranges from 1,000 to 2,500 pounds of dry vegetation per acre and averages about 1,700 pounds. Where remnant tallgrasses persist, total rest from grazing or a prescribed grazing period can result in a significant increase in switchgrass, with lesser increases in sand bluestem and Indiangrass.

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 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 bases 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.

Community 3.1
Shrub/Tree Plant Community

This plant community is dominated by shrubs consisting primarily of Chickasaw plum, fragrant sumac, and smooth sumac. Roughleaf dogwood, golden currant, and sandbar willow occur in some locations. Trees, primarily eastern redcedar, have invaded and become established in isolated areas. Shrubs and trees combined may comprise 40-60 percent of the total vegetation. The spread of shrubs and trees results from the longtime absence of fire. Periodic burning tends to hinder the establishment of most of these woody species and favor forbs and grasses. In addition to the lack of fire, birds and small mammals are instrumental in distributing seed and accelerating the spread of shrubs and trees 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, red lovegrass, 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 retard herbage growth and provide a favorable habitat for seed germination and eventual establishment of many shrub species. The associated grasses in this situation are usually sand bluestem, little bluestem, Indiangrass, switchgrass, sedges, and Canada wildrye. Grass production is significantly reduced because of the shrub competition. Grass yields vary from 20-40 percent of the total vegetative production. Forbs generally produce 20-40 percent of the total. Major forbs include white sagebrush, Carruth's sagewort, redroot buckwheat, Cuman ragweed, camphorweed, and tenpetal blazingstar. Total annual production ranges from 1,200 to 3,000 pounds of air dry vegetation per acre and averages about 1,800 pounds. Usually a prescribed burning program accompanied by 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 woody species. Careful planning and execution of prescribed burning can result in brush control, reversal of grazing patterns, enhanced animal performance, and increased browse availability for deer. 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 white-tailed deer, benefit from the growth of shrubs for both food and cover. When wildlife populations are a desirable component, this should be a consideration in any brush management plan.

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 Plant 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 Plant 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 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 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 to 50 years of plant succession. Some go-back areas are invaded by trees and shrubs. The more common invaders 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, a change in plant composition, and the functional and structural groups have changed 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 to3
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 reductions 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 to 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, manage 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 equal 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 60%**			1233–2354	
	sand bluestem	ANHA	*Andropogon hallii*	336–1177	–
	switchgrass	PAVI2	*Panicum virgatum*	448–981	–
	little bluestem	SCSC	*Schizachyrium scoparium*	280–588	–
	Indiangrass	SONU2	*Sorghastrum nutans*	168–392	–
2	**Grasses Minor 10%**			101–392	
	sideoats grama	BOCU	*Bouteloua curtipendula*	17–101	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	11–101	–
	Canada wildrye	ELCA4	*Elymus canadensis*	56–101	–
	sand lovegrass	ERTR3	*Eragrostis trichodes*	11–101	–
3	**Grasses Minor 5%**			34–196	
	vine mesquite	PAOB	*Panicum obtusum*	0–67	–
	western wheatgrass	PASM	*Pascopyrum smithii*	34–67	–
	purpletop tridens	TRFL2	*Tridens flavus*	0–67	–
4	**Grasses Minor 5%**			11–196	
	blue grama	BOGR2	*Bouteloua gracilis*	0–67	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	11–67	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–67	–
5	**Grasses Minor 5%**			39–196	
	prairie threeawn	AROL	*Aristida oligantha*	0–39	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–39	–
	sedge	CAREX	*Carex*	17–39	–
	Schweinitz's flatsedge	CYSC3	*Cyperus schweinitzii*	6–39	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	6–39	–
	Florida paspalum	PAFL4	*Paspalum floridanum*	11–39	–
Forb					
6	**Forbs Minor 10%**			90–392	
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	11–50	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	11–50	–
	Texas croton	CRTE4	*Croton texensis*	11–50	–
	prairie sunflower	HEPE	*Helianthus petiolaris*	11–50	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	6–22	–
	lemon scurfpea	PSLA3	*Psoralidium lanceolatum*	0–22	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	6–22	–
	white heath aster	SYER	*Symphyotrichum ericoides*	6–22	–
	golden prairie clover	DAAU	*Dalea aurea*	0–22	–
	Illinois bundleflower	DEIL	*Desmanthus illinoensis*	6–22	–

	Engelmann's daisy	ENPE4	*Engelmannia peristenia*	6–22	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	6–22	–
Shrub/Vine					
7	**Trees, Shrubs, Cacti Minor 5%**			56–196	
	Jersey tea	CEHE	*Ceanothus herbaceus*	11–56	–
	common hackberry	CEOC	*Celtis occidentalis*	0–28	–
	eastern cottonwood	PODE3	*Populus deltoides*	0–28	–
	Chickasaw plum	PRAN3	*Prunus angustifolia*	11–28	–
	peachleaf willow	SAAM2	*Salix amygdaloides*	0–28	–
	sandbar willow	SAIN3	*Salix interior*	6–28	–
	black willow	SANI	*Salix nigra*	0–28	–
	American elm	ULAM	*Ulmus americana*	0–28	–
	soapweed yucca	YUGL	*Yucca glauca*	6–28	–
	sand sagebrush	ARFI2	*Artemisia filifolia*	0–28	–

Animal community

Wildlife

Because of the great variety of forbs and grasses found on the Sand Floodplain ecological site, it provides excellent wildlife habitat. This site frequently occurs in riparian areas and may contain wetland inclusions, which add to its attractive wildlife habitat. It is preferred habitat for white-tailed deer, wild turkey, quail, pheasant, squirrel, cottontail rabbit, and migrant waterfowl and mourning dove as well. Furbearers such as mink, raccoon, skunk, and opossum are common, as are coyotes and red fox. The site is especially valuable as winter cover for many of these same species including deer, pheasant, quail, and rabbit.

Songbirds are common to the site and may include scissortailed flycatchers, eastern and western kingbirds, brown thrasher, eastern bluebird, and red-winged blackbird, just to name a few. Hawks and owls commonly use this habitat, and an occasional bald eagle.

Some animals are important because of their threatened and endangered status and require special consideration. Please check the Kansas Department of Wildlife Parks and Tourism (KDWP&T) 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 Ecological Site Description. Because of this, a resource inventory is necessary to document plant composition and production. Proper interpretation of inventory data will permit the establishment of a safe initial stocking rate.

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

Initial stocking rates should be improved through the use of vegetation monitoring and actual use records that

include number and type of livestock, the timing and duration of grazing, and utilization levels. Actual use records over time will assist in making stocking rate adjustments based 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.

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 or 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 and 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).

The water table may occur <6 feet from the soil surface in the Saxman soil series. Please refer to the NRCS National Engineering Handbook Section 4 (NEH-4) for runoff quantities and hydrologic curves when making hydrology determinations.

Recreational uses

The Sand Floodplain ecological site is often used for outdoor recreational pursuits because of its plant and wildlife diversity. Big game such as white-tailed deer and wild turkey are abundant and commonly hunted on this site, along with a wide variety of small game such as pheasant, quail, rabbits, squirrels, and raccoons. In addition, this site provides opportunities for bird watching, hiking, outdoor/wildlife photography, and a variety of other outdoor activities. There are a wide variety of plants in bloom throughout the growing season that provide much aesthetic appeal to the landscape.

Wood products

Eastern redcedar may reach logging size.

Other products

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

Other information

Other uses of this site are limited because of the flooding and potential for high water table. Soil instability may be a consideration as well. These sites are often used as a source of sand and gravel extraction: where this occurs, floodplain management and erosion potential should be considerations.

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, 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 regard 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 04/25/2018 David Kraft, John Henry, Doug Spencer, Dwayne Rice/original authors 2/2005
Contact for lead author	Chris Tecklenburg chris.tecklenburg@ks.usda.gov
Date	04/25/2018
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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2. **Presence of water flow patterns:** There is little, if any, evidence of soil deposition or erosion. Water generally flows evenly over the entire landscape.

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3. **Number and height of erosional pedestals or terracettes:** There is no evidence of pedestaled plants or terracettes or the 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. Cover can be defined as live plants, litter, rocks, moss, lichens, etc.

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5. **Number of gullies and erosion associated with gullies:** None

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6. **Extent of wind scoured, blowouts and/or depositional areas:** There is no evidence of wind erosion creating bare areas or denuding vegetation.

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7. **Amount of litter movement (describe size and distance expected to travel):** Plant litter is distributed evenly throughout the site. During major flooding events, this site slows water flow and captures litter and sediment.

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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):** Plant canopy is large enough to intercept the majority of raindrops. A soil fragment will not “melt” or lose its structure when immersed in water for 30 seconds. There is no evidence of pedestaled plants or terracettes. Soil stability

scores will range from 4-6.

---

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** From Lincoln series description:

   A--0 to 28 cm (0 to 11 in); brown (7.5YR 5/3) loamy fine sand, brown (7.5YR 4/2) moist; weak fine and medium granular structure; soft, very friable; thin strata and masses of fine sand to loam; slightly effervescent; moderately alkaline; clear smooth boundary. Thickness is 15 to 38 cm (6 to 15 in).

---

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** There is no negative effect on water infiltration and/or runoff due to plant composition or distribution. Plant composition and distribution are adequate to prevent any rill formation and/or pedastalling. Interspacial distribution is consistent with expectation for the site.

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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 compacted soil layers due to cultural practices. Soil structure is conducive to water movement and root penetration.

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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 60% or 2100 lbs.: sand bluestem 300-1050, switchgrass 400-875, little bluestem 250-525, Indiangrass 150-350.

    Sub-dominant: Grasses minor 10% or 350 lbs.: prairie sandreed 10-90, Canada wildrye 50-90, sand lovegrass 10-90, sideoats grama 15-90.

    Other: Other grasses include three groups that each are minor 5% or 175 lbs.
    Forbs Minor 10% 350 lbs.

    Additional: Shrubs Minor 5% 175 lbs

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

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14. **Average percent litter cover (%) and depth (in):** 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):** 2250-4445 lbs/acre. Representative value is 3500 lbs/forage/acre. Below-normal precipitation during the

growing season expect 2250 lbs/forage/acre; and above-normal precipitation during the growing season expect 4445 lbs/forage/acre. If utilization has occurred, estimate the annual production removed or expected and include this amount when making the total site production estimate.

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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:** None.

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17. **Perennial plant reproductive capability:** The number and distribution of tillers or rhizomes is assessed relative to the expected production of the perennial, warm-season midgrasses and shortgrasses.
