USDA Natural Resources
Conservation Service

Ecological site R079XY115KS
Loamy Plains

Last updated: 9/21/2018
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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.

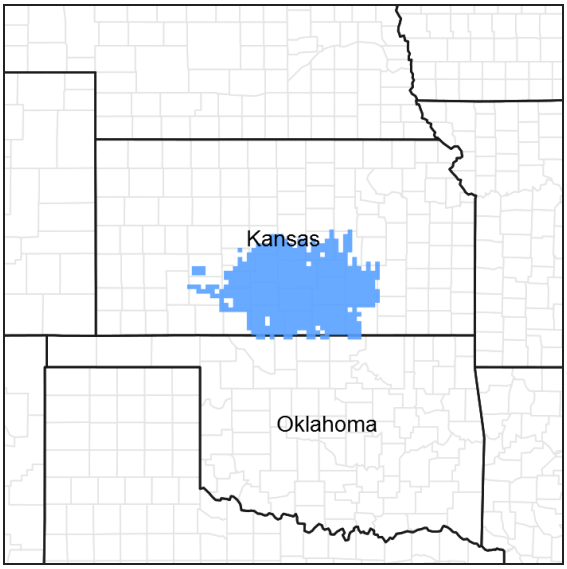


Figure 1. Mapped extent

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 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 wind erosion, 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 Loamy Upland R079XY015KS. The Loamy Plains ecological site is made up of moderately deep to deep, moderately well to well drained upland soils. This site has a silty or loamy surface texture and is non-calcareous to the surface. Generally, the Loamy Plains ecological site is located on paleoterraces and/or uplands with a slope range of 0 to 12 percent.

Associated sites

R079XY107KS	**Clayey Plains** The Clayey Plains ecological site is adjacent to and in conjunction with the Loamy Plains site. The Clayey Plains site is located on paleoterraces, on plains, and/or uplands. These soils have greater than 35 percent clay content greater than 10 inches from the surface.
R079XY112KS	**Limy Plains** The Limy Plains ecological site is adjacent to and in conjunction with the Loamy Plains site. The Limy Plains site is located on paleoterraces, on plains and/or uplands. The soils characteristic of this site are calcareous to the surface.

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. 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%, and Arkansas-Keystone (1106), 18%. 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 Loamy Plains ecological site consists of moderately deep to deep, moderately well to well drained upland soils. These soils formed in loamy alluvium or formed in residuum from siltstone. This site occurs on nearly level to gently sloping areas on paleoterraces on river valleys or uplands. Runoff is very low to medium and permeability is moderate to slow.

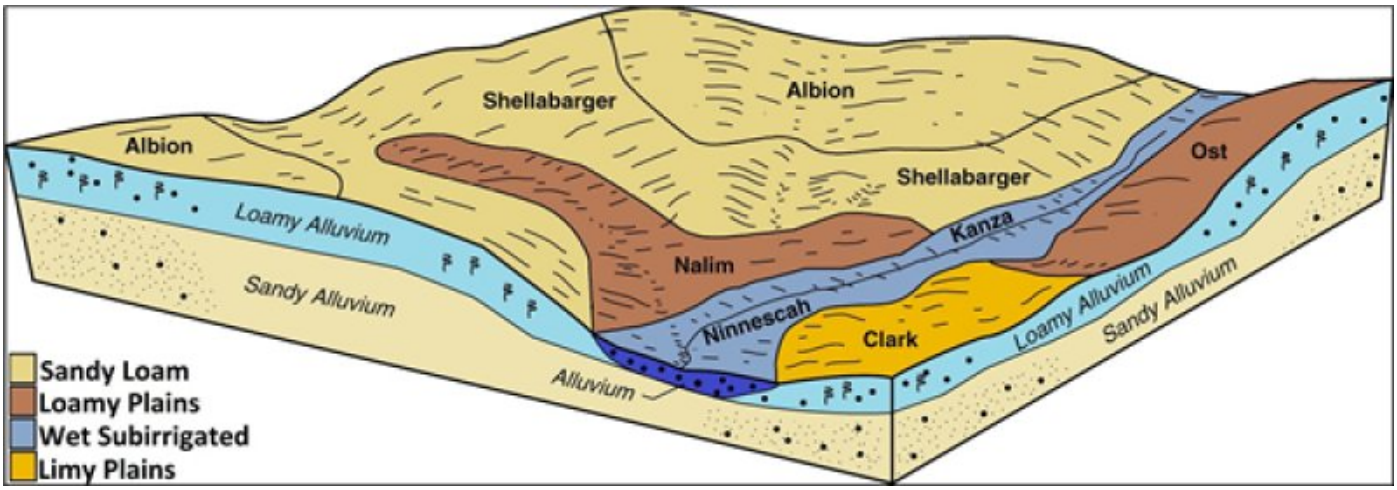


Figure 2. MLRA 79 ESD block diagram.

Table 2. Representative physiographic features

Landforms	(1) Paleoterrace
Flooding frequency	None
Ponding frequency	None
Elevation	1,650–2,600 ft
Slope	0–12%
Ponding depth	0 in
Water table depth	80 in

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 being the driest months and May and June being 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 data-set is from 1981-2010.

Table 3. Representative climatic features

Frost-free period (average)	179 days
Freeze-free period (average)	197 days
Precipitation total (average)	31 in

Climate stations used

- (1) GREENSBURG [USC00143239], Greensburg, KS
- (2) HUDSON [USC00143847], Hudson, KS
- (3) HUTCHINSON [USC00143929], Hutchinson, KS
- (4) KINGMAN [USC00144313], Kingman, KS
- (5) STERLING [USC00147796], Sterling, KS

- (6) WICHITA [USW00003928], Wichita, KS
- (7) HUTCHINSON 10 SW [USC00143930], Hutchinson, KS
- (8) KINSLEY 2E [USC00144333], Kinsley, KS
- (9) PRATT [USC00146549], Pratt, KS
- (10) WELLINGTON [USC00148670], Wellington, KS
- (11) NORWICH [USC00145870], Norwich, KS

Influencing water features

These soils have slow to moderate permeability, high available water capacity, and are moderately well to well drained. Erosion on this site by wind and water is a hazard if vegetation is severely overgrazed or mismanaged.

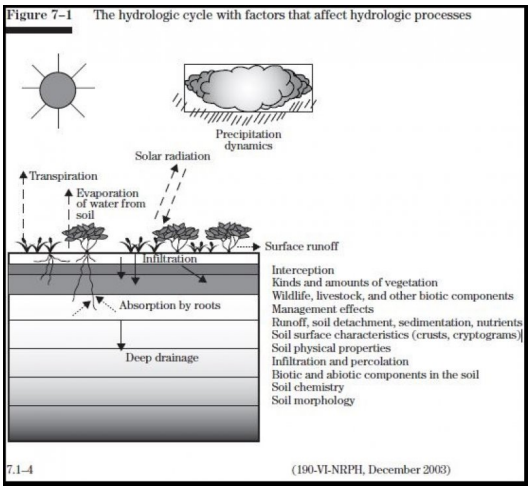


Figure 7. Fig.7-1 from National Range and Pasture Handbook.

Soil features

The soils representing the Loamy Plains ecological site consist of moderately deep to deep upland soils that have silty or loamy surface layers and silty or clayey subsoils. These soils are usually non-calcareous in the surface layer, but may be calcareous in the subsoil and substratum. Soil in this site are generally high in fertility and have a moderate to high available water capacity. The surface layer ranges from a depth of 5 to 15 inches thick.

The major soils common to this site are Farnum, Funmar, Nalim, Nashville, and Ost.

Figure 8. Nalim soil profile, Reno County, Kansas.

Table 4. Representative soil features

Surface texture	(1) Loam (2) Sandy loam (3) Clay loam

Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Slow to moderate
Soil depth	20–80 in
Surface fragment cover <=3"	0–1%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	6.2–11.4 in
Calcium carbonate equivalent (0-40in)	0–35%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	5.1–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–14%
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 soils representing the Loamy Plains ecological site have silty or loamy surfaces and are moderately well drained to well drained. Because of their high water-holding capacities, soil moisture tends to percolate at a moderately slow to moderate rate. The taller grasses that evolved and dominated the original plant community have deep, efficient root systems capable of utilizing moisture throughout most of the soil profile. There is almost no runoff from this site except during intense thunderstorms, so most precipitation enters the root profile, making this site productive. Seed heads of the major grasses often reach 5-6 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 migratory 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 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

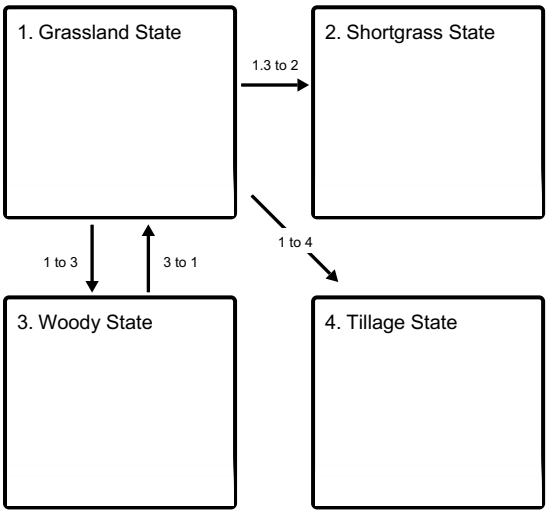
As utilization of the site for production of domestic livestock replaced that of roaming bison herds, its ecological dynamics were altered. The plant community changed from its original composition, usually in proportion to the season and intensity of grazing livestock. A combination of drought and overgrazing 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.

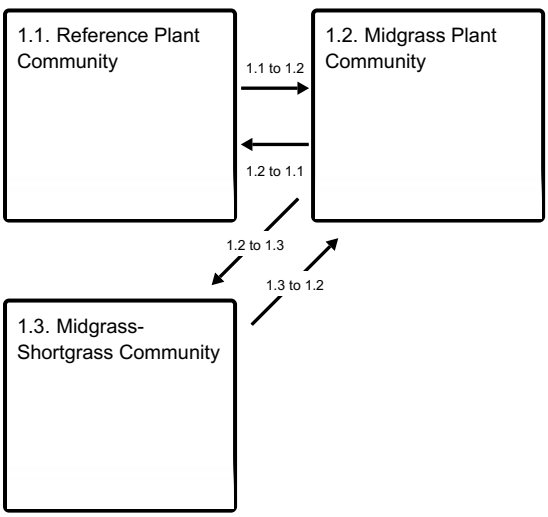
The following diagram illustrates some of the pathways that the vegetation on this site may take from the Reference Plant Community as influencing ecological factors change. There may be other states or plant communities not shown on the diagram, as well as noticeable variations within those illustrated.

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. Shrubs and/or Tree Community

State 4 submodel, plant communities

4.1. Reseed Community

4.2. Go-back 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 Loamy 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 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
Reference Plant Community

The interpretive plant community for this site is the Reference Plant Community, and represents the original plant community that existed prior to European settlement. The site is characterized as a grassland that is essentially free of trees and large shrubs. It is dominated by tall, warm-season grasses including big bluestem, switchgrass, and Indiangrass. The major midgrass is little bluestem. Combined, these grasses will account for 70 to 80 percent of vegetation produced annually on the Loamy Plains ecological site. Other prevalent grasses are sideoats grama, western wheatgrass, and blue grama. Eastern gamagrass is a fragile plant on this site and may disappear quickly with excessive or long-term continuous use. Scattered throughout are minor amounts of numerous mid- and shortgrasses. The site supports a wide variety of legume species, which are interspersed throughout the grass sward. The most abundant are slimflower scurfpea, Nuttall’s sensitive-briar, prairie bundleflower and blue wild indigo. Other important forbs include compassplant, white heath aster, dotted blazing star, pitcher sage, upright prairie coneflower, and Cuman ragweed. Leadplant and Jersey tea are low-growing shrubs that occur over the site. Unlike most shrubs, these plants are both quite tolerant to fire. Occasional clumps of coralberry and smooth sumac may be found on the exposures of steeper slopes. This is a stable plant community when adequately managed. A prescribed grazing program that incorporates periods of deferment during the growing season benefits the tallgrasses and even the more palatable forbs species. Soils are susceptible to excessive grazing and livestock trailing, which can quickly impact on the soil stability and lead to sheet and gully erosion. Long-term grazing can lead to the reduction of tallgrasses and palatable forbs on ridgetops as livestock often concentrate there.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2040	2890	4300
Forb	310	440	600
Shrub/Vine	50	70	100
Total	**2400**	**3400**	**5000**

Community 1.2
Midgrass Plant Community

This plant community developed as a result of many years of continuous overgrazing. Midgrasses dominate the site and comprise 50 to 60 percent of the annual production. Most abundant midgrasses include little bluestem, sideoats grama, western wheatgrass, and composite dropseed. Shortgrasses such as blue grama, hairy grama, buffalograss, tumble windmillgrass, and purple threeawn produce 10 to 15 percent of the vegetation. Five to 15 percent of remnant plants of big bluestem, Indiangrass, and switchgrass are commonly found scattered throughout the site. These plants are usually grazed repeatedly and remain in a low state of vigor. Of these remnants, big bluestem is generally the most abundant because it has rhizomes that can persist for many years in a weakened condition. When in this state, new growth consisting of three to five leaves will emerge in a prostrate rather than upright position. This allows the plants to partially escape grazing. These remnants respond favorably to periods of rest from grazing and may regain vigor in two to three years, thus regaining a significantly larger role in the plant community. Forb production is quite variable and may range from 15 to 30 percent of the total vegetation, depending on amounts and timing of rainfall events. Perennial forbs include white sagebrush, slimflower scrurfpea, Missouri goldenrod, Baldwin ironweed, white heath aster, and Cuman ragweed. In some locations shrubs such as smooth sumac, eastern redcedar, and coralberry comprise up to 10 percent of the vegetation. Total annual production ranges from 2,000 to 4,500 pounds of air-dry vegetation per acre and averages about 3,000 pounds. Prescribed grazing with adequate rest and recovery periods during the growing season will shift this plant community to include more productive tallgrasses. With continued management, the taller grasses will gradually increase in vigor and abundance, eventually dominating the landscape.

Community 1.3
Midgrass-Shortgrass Community

This plant community developed as a result of long-term, continuous overgrazing. Midgrasses dominate the site and comprise 40 to 55 percent of the annual production. Most abundant midgrasses include little bluestem, sideoats grama, western wheatgrass, and composite dropseed. Shortgrasses such as blue grama, hairy grama, buffalograss, tumble windmillgrass, and purple threeawn produce 20 to 30 percent of the vegetation. Remnant plants of big bluestem, Indiangrass, and switchgrass are commonly found only in protected locations. These plants are usually grazed repeatedly and remain in a low state of vigor. Of these remnants, big bluestem is generally the most abundant because it has rhizomes that can persist for many years in a weakened condition. These remnants respond favorably to periods of rest from grazing and may regain vigor in two to three years. With their numbers or the percentage of composition so reduced, however, it may take many years to regain a large role in the plant community. Forb production is quite variable and may range from 15 to 30 percent of the total vegetation depending on amounts and timing of rainfall events. Perennial forbs include white sagebrush, slimflower scrurfpea, Missouri goldenrod, Baldwin ironweed, white heath aster, Cuman ragweed, and annual ragweed. In some locations shrubs such as fragrant sumac, eastern redcedar, and coralberry comprise up to 15 percent of the vegetation. Total annual production ranges from 1,500 to 3,800 pounds of air-dry vegetation per acre and averages about 2,500 pounds. Prescribed grazing with adequate rest and recovery periods during the growing season will shift this plant community to include more productive tallgrasses. With continued management, the taller grasses will gradually increase in vigor and abundance and dominate the landscape.

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 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 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 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 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 sod grasses 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 presents a distinctive shortgrass aspect on the landscape. It is dominated by blue grama and buffalograss with notable amounts of western wheatgrass and sideoats grama present in a state of low vigor and production. Other grasses include annual bromes (Bromus spp.), little barley, composite dropseed, Kentucky bluegrass, prairie threeawn, and tumble windmillgrass. These species commonly account for 60 to 70 percent of the annual forage production. Like the desirable grasses, palatable legumes and other forbs have been reduced by many years of continuous grazing and competition. Prevalent broadleaf species in this situation include prairie

broomweed, annual ragweed, white sagebrush, Cuman ragweed, Baldwin ironweed, wavyleaf thistle, and curlycup gumweed. Forbs may comprise 20 to 30 percent of the total vegetation. This plant community often contains 15 to 20 percent woody species because of fewer or less intensive fires. Eastern redcedar, smooth sumac, fragrant sumac, and coralberry are the representative tree and shrubs which occur on the site. Leadplant and Jersey tea may still be found, but are generally much reduced from their prominence in the Reference Plant Community. Total annual production ranges from 1,000 to 2,600 pounds of air-dry vegetation per acre and averages about 1,900 pounds. Recovery of the tallgrasses, midgrasses, and associated forbs characteristic of the Reference Plant Community will require many years of careful management that includes prescribed grazing and extended periods of rest during the growing season. If remnant stands of the desired species are lacking, reseeding may be necessary for timely recovery. Prescribed burning can be a useful tool when used to strategically benefit the desired species, especially in the later stages of the recovery process.

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 bases 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 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
Shrubs and/or Tree Community

This plant community is dominated by shrubs consisting primarily of coralberry, fragrant sumac, and smooth sumac. Trees including osage orange (*Maclura pomifera*), honeylocust (*Gleditsia triacanthos*), and eastern redcedar have invaded and become established in some areas. Shrubs and trees may produce 40 to 60 percent of the total vegetation. The absence of fire allows shrubs and trees to spread because periodic burning tends to hinder their establishment and favor grasses and forbs. It is important to note, however, that not all unburned areas have woody plant problems, and the pace of woody encroachment varies considerably. Other than the lack of fire, factors that accelerate encroachment include seed availability in surrounding areas and the presence of numerous animals (mainly birds), which distribute seed over the site. In addition, woody encroachment may occur on areas subjected to long-term, continuous overgrazing. In these situations the associated grasses will usually consist of composite dropseed, purple lovegrass, Kentucky bluegrass, and Scribner’s rosette grass. Shrubs also will invade and spread on areas where both grazing and fire have been excluded for many years. Heavy accumulation of plant mulch and litter retards herbage growth and provides a favorable habitat for seed germination and establishment of many woody species. The associated grasses in this situation are usually big bluestem, little bluestem, Indiangrass, switchgrass, sedges, and Canada wildrye. Grass production is significantly reduced by competition forbs and woody species. Grass yields vary from 40 to 50 percent of the total vegetative production. Forbs often produce 15 to 20 percent of the total. Major forbs include white sagebrush, Cuman ragweed, Baldwin ironweed, and common yarrow. Total annual production ranges from 1,400 to 3,000 pounds of air-dry vegetation per acre and averages about 2,200 pounds. In this plant community, the amount of available forage is heavily dependent upon the predominant woody species and the kind(s) of livestock and/or wildlife utilizing the site. Normally a prescribed burning program accompanied by prescribed grazing will gradually return the plant community to one dominated by grasses and

forbs. Longer times will be needed where the tall- and midgrasses have been greatly reduced or eliminated. 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. Use of labeled herbicides as a brush management tool will usually be necessary to reduce populations of fire resistant species like osage orange and honeylocust and to accelerate the recovery of desired vegetative cover. Many species of wildlife, especially bobwhite quail and white-tailed deer, benefit from the growth of shrubs for both food and as cover. When wildlife populations are a desirable component, this should be 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 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 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 on 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 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 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 dominate 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, 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 (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Grasses Dominant 60%**			1130–2020	
	big bluestem	ANGE	*Andropogon gerardii*	500–1000	–
	little bluestem	SCSC	*Schizachyrium scoparium*	330–810	–
	Indiangrass	SONU2	*Sorghastrum nutans*	150–500	–
	switchgrass	PAVI2	*Panicum virgatum*	150–500	–
2	**Grasses Subdominant 23%**			400–800	
	sideoats grama	BOCU	*Bouteloua curtipendula*	100–340	–
	western wheatgrass	PASM	*Pascopyrum smithii*	100–340	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	50–170	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–135	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–135	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–135	–
	eastern gamagrass	TRDA3	*Tripsacum dactyloides*	0–50	–
3	**Grasses Trace 2%**			0–70	
	sedge	CAREX	*Carex*	0–20	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–20	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–20	–
	prairie threeawn	AROL	*Aristida oligantha*	0–15	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–15	–
Forb					
4	**Forbs Subdominant 13%**			135–440	
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	25–100	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	25–100	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	25–100	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	5–15	–
	silky sophora	SONU	*Sophora nuttalliana*	5–15	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	5–15	–
	white heath aster	SYER	*Symphyotrichum ericoides*	5–15	–
	prairie fleabane	ERST3	*Erigeron strigosus*	5–15	–
	Indian blanket	GAPU	*Gaillardia pulchella*	5–15	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	5–15	–
	prairie sunflower	HEPE	*Helianthus petiolaris*	5–15	–

	Berlandier's yellow flax	LIBE2	*Linum berlandieri*	5–15	–
	dotted blazing star	LIPU	*Liatris punctata*	5–15	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	5–15	–
	woolly plantain	PLPA2	*Plantago patagonica*	5–15	–
	greenthread	THELE	*Thelesperma*	0–10	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	0–10	–
	blackeyed Susan	RUHI2	*Rudbeckia hirta*	0–10	–
	pitcher sage	SAAZG	*Salvia azurea var. grandiflora*	0–10	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	0–10	–
	Illinois bundleflower	DEIL	*Desmanthus illinoensis*	0–10	–
	common yarrow	ACMI2	*Achillea millefolium*	0–10	–
Shrub/Vine					
5	**Shrubs Trace 2%**			20–70	
	leadplant	AMCA6	*Amorpha canescens*	10–25	–
	Jersey tea	CEHE	*Ceanothus herbaceus*	10–25	–
	American plum	PRAM	*Prunus americana*	0–10	–
	prairie rose	ROAR3	*Rosa arkansana*	0–10	–

Animal community

Because of the great variety of forbs and grasses found on this ecological site, it provides excellent habitat for ground-nesting birds including both the eastern and western meadowlark, small rodents such as the deer mouse and prairie vole, and other small furbearers when it is in good to excellent condition. Reptiles including various snakes, lizards, and the box turtle are commonly found. When in poor condition, black-tailed prairie dogs, small rodents such as thirteen-lined ground squirrels, and the black-tailed jackrabbit find this site to be preferred habitat. Hawks and owls, along with furbearers such as coyotes and badgers, are common predators.

This site was a historically preferred grazing location for bison, deer, elk, and pronghorn. Today’s big game would include the white-tailed deer and turkey along with some pronghorn. Upland game including bobwhite quail, greater prairie chicken, and the eastern cottontail are found on this site as well.

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 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%; ground water, 4.0% Livestock—surface water, 0.4%; ground water, 1.2% Irrigation—surface water, 0.7%; ground water, 80.6% Other—surface water, 2.0%; 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).

Recreational uses

This site provides opportunities for a variety of outdoor activities which might include bird watching, hiking, outdoor/wildlife photography, and hunting. A wide variety of plants are in bloom throughout the growing season, especially in those years with average and above-average rainfall, providing much aesthetic appeal to the landscape. This site is subject to both wind and water erosion when mismanaged. Vehicular traffic can lead to gully formation on steeper sites. This site is often an excellent site for deer and quail hunting.

Wood products

This site generally does not produce trees of sufficient size for commercial harvest.

Other products

Two shrubs, American 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 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 3-2-2017 David Kraft, John Henry, Doug Spencer and Dwayne Rice/original authors 2-15-2005.

Contact for lead author	State Rangeland Management Specialist for Kansas located in Salina 785-823-4500.
Date	12/21/2017
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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.

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.

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).

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

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.

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.

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

OSD:

Ap--0 to 15 cm (0 to 6 in.); grayish brown (10YR 5/2), interior, loam, very dark grayish brown (10YR 3/2), interior, moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots throughout; 23.0 percent clay; noneffervescent throughout (HCl, 1 normal); slightly acid, abrupt smooth boundary, trace fine gravel. (15 to 36 cm thick; 6 to 14 in. 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.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** There is no evidence of a compacted soil layer less than 6 inches from the soil surface. Soil structure is similar to that described in Indicator 9. Compacted physical features will include platy, blocky, dense soil structure over less dense soil layers, horizontal root growth, and increase 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: Group 1 Grasses Dominant 60% 2020 lbs. big bluestem 500-1000, little bluestem 330-810, Indiangrass 150-500, switchgrass 150-500.

    Sub-dominant: Group 2 Grasses Subdominant 23% 800 lbs. sideoats grama 100-340, western wheatgrass 100-340, composite dropseed 50-170, blue grama 0-135, buffalograss 0-135, Canada wildrye 0-135.

    Other: Group 3 Grasses Trace 2% 70 lbs.

    Additional: Forb Subdominant 13% 440 lbs. see functional/structural group sheet for specific forbs.
    Shrubs Trace 2% 70 lbs.

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

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14. **Average percent litter cover (%) and depth (in):** Plant litter is distributed evenly throughout the site. There is no restriction to plant regeneration due to depth of litter. When prescribed burning is practiced, there will be little litter the first half of the growing season.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** All species (e.g., native, seeded, and weeds) alive in the year of the evaluation, are included in the determination of total above ground production. Site potential (total annual production) ranges from 2,400 lbs in a below-average rainfall year and 5,000 lbs in an above-average rainfall year. The representative value for this site is 3,400 lbs

production per year.

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** There are no noxious weeds present. Invasive plants make up a small percentage of plant community, and invasive brush species are < 5% canopy.

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