USDA Natural Resources
Conservation Service

Ecological site R079XY107KS
Clayey 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.

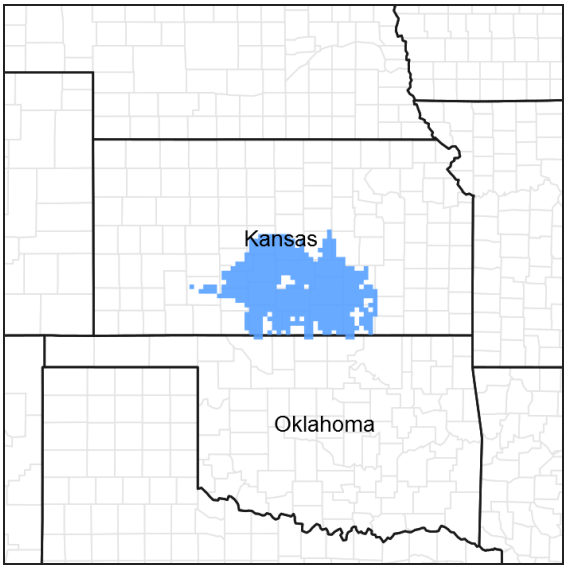


Figure 1. Mapped extent

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

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

Classification relationships

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

Ecological site concept

This ecological site was formerly known as Clay Upland R079XY007KS. The Clayey Plains ecological site is characterized by soils that are very deep, moderately well to well drained, and on paloeterraces in river valleys formed in alluvium. The slopes range from 0 to 6 percent. The surface texture is clay loam to silt loam with a clay increase of greater than 35 percent within 12 inches from the surface.

Associated sites

R079XY115KS	**Loamy Plains** The Loamy Plains site is located adjacent to and in conjunction with the Clayey Plains site. 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, this site is located on paleoterraces and/or uplands with a slope range of 0 to 12 percent.

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 this MLRA, Rattlesnake Creek flows north and the Little Arkansas River flows south into the Arkansas River.

The Clayey Plains ecological site consists of very deep, moderately well to well drained soils on paleoterraces in river valleys formed in alluvium. Runoff ranges from negligible to medium.

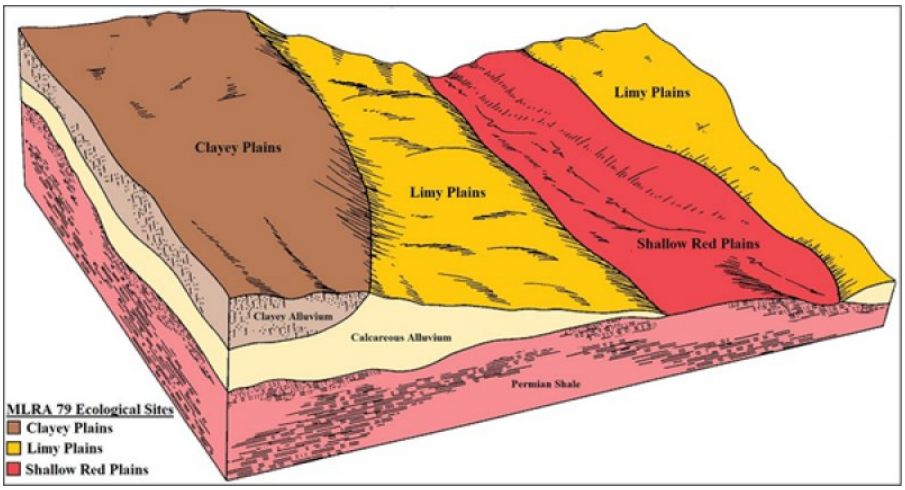


Figure 2. MLRA 79 Ecological Site block diagram.

Table 2. Representative physiographic features

Landforms	(1) Paleoterrace
Flooding frequency	None
Ponding frequency	None
Elevation	503–792 m
Slope	0–6%
Ponding depth	0 cm
Water table depth	203 cm
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation in MLRA 79 is 25 to 33 inches (635 to 840 millimeters). Most of the rainfall occurs as high-intensity, convective thunderstorms during the growing season. The maximum precipitation occurs from the middle of spring to early in autumn. The annual snowfall ranges from about 14 inches (35 centimeters) in the southern part of the area to 20 inches (50 centimeters) in the northern part. The average annual temperature is 55 to 57 degrees F (13 to 14 degrees C). The freeze-free period averages 197 days, increasing in length from northwest to southeast. Precipitation is usually evenly distributed throughout the year, with the exception of November through February as the driest months and May and June as the wettest months. Summer precipitation occurs during intense summer thunderstorms. The following weather data originated from weather stations chosen across the geographical extent of the ecological site, and will likely vary from the data for the entire MLRA. The climate data derives from the Natural Resources Conservation Service (NRCS) National Water and Climate Center. The dataset is from 1981-2010.

Table 3. Representative climatic features

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

Climate stations used

- (1) HUDSON [USC00143847], Hudson, KS
- (2) HUTCHINSON [USC00143929], Hutchinson, KS
- (3) HUTCHINSON 10 SW [USC00143930], Hutchinson, KS
- (4) KINSLEY 2E [USC00144333], Kinsley, KS

- (5) WICHITA [USW00003928], Wichita, KS
- (6) GREENSBURG [USC00143239], Greensburg, KS
- (7) KINGMAN [USC00144313], Kingman, KS
- (8) STERLING [USC00147796], Sterling, KS
- (9) NORWICH [USC00145870], Norwich, KS
- (10) PRATT [USC00146549], Pratt, KS
- (11) WELLINGTON [USC00148670], Wellington, KS

Influencing water features

These soils are moderately well drained to well drained. Water permeability is slow to very slow. Clayey Plains soils can retain large amounts of water which is tightly held by their clay particles. Consequently, water is not available in adequate amounts for plant growth during dry cycle stress periods and decreases total annual forage production during dry years.

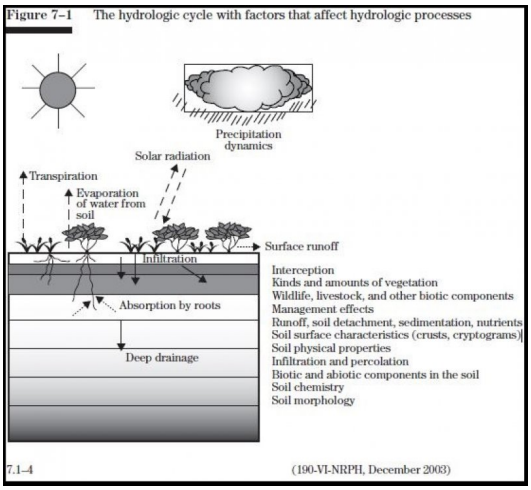


Figure 7. Fig.7-1 from National Range and Pasture Handbook.

Soil features

The Clayey Plains ecological site is characterized by soils that are very deep, moderately well to well drained soils on paleoterraces in river valleys formed in alluvium. Soils in this site are generally high in fertility and have a moderate to high available water capacity. The site has a clay loam to silt loam surface textures with a clay increase greater than 35% within 12 inches from the surface. The major soils common to this site are Taver, Tabler, Penalosa, and Blanket.

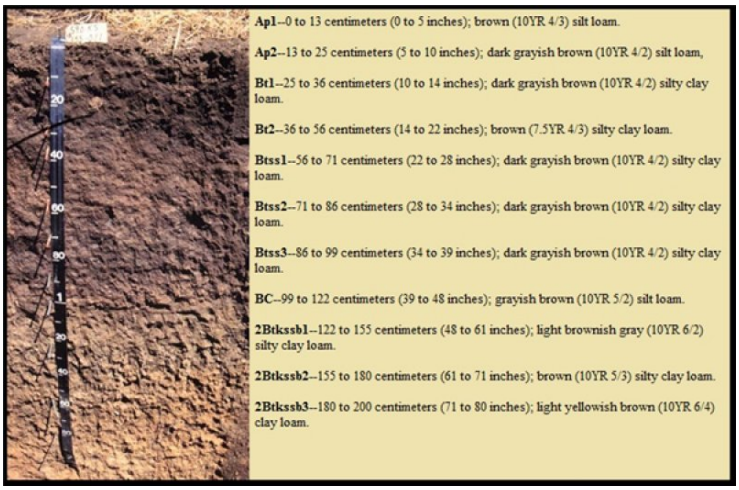


Figure 8. Penalosa soil profile.

Table 4. Representative soil features

Surface texture	(1) Loam (2) Silt loam (3) Clay loam
Family particle size	(1) Clayey
Drainage class	Moderately well drained to well drained
Permeability class	Slow to very slow
Soil depth	305 cm
Surface fragment cover <=3"	0–1%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	20.57–27.18 cm
Calcium carbonate equivalent (0-101.6cm)	0–10%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	5.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

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

The loamy to silty surface soils over clayey subsoils that are characteristic of this site absorb water slowly. Water-holding capacities are moderate to high, even though soil moisture tends to percolate slowly through the profile. The taller grasses that evolved and dominated the original plant community have root systems capable of utilizing moisture throughout most of the profile. Concentration of grass roots in the surface soil permits good oxygen and carbon dioxide exchange and efficient water uptake after precipitation events. Deeper roots that penetrate the clayey subsoil generally provide sufficient moisture to sustain limited plant growth during most dry periods. Runoff from this site is common once surface soils become saturated. The soil-plant moisture relationship is good and the site can be productive, except during periods of extended drought. Seed heads of the major grasses often reach four to five feet in height.

The Clayey Plains site developed with fires of various intensities, frequencies, and seasons of year playing important parts in ecological processes. Historically, wildfires were infrequent and commonly started by lightning. They often occurred in spring and early summer when thunderstorms were most prevalent, but also in late summer and fall during dry weather periods. It is also known that Native Americans often used fire in early spring to stimulate growth of fresh forage that would attract herds of migratory bison. These intentional fires probably occurred more frequently, even on an annual basis at some preferred hunting locations.

All of the dominant tallgrasses were rhizomatous, enabling them to survive very intense wildfires and gain a competitive advantage in the plant community. By contrast, most trees and shrubs were suppressed by fire and occurred very sparsely on protected areas. Growth of forbs, especially legumes, usually improved following a fire event. After a fire there was usually a substantial, but temporary (1-2 years), increase in the abundance of annual forbs as well.

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

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

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

As European settlers began utilizing the site for production of domestic livestock within fenced pastures in place of roaming bison herds, its ecological dynamics and physical aspects were altered. This caused the plant community to shift from its original composition. These changes were usually in proportion to the season and intensity of use by grazing livestock and were accelerated by a combination of drought and overgrazing. The taller grasses and forbs palatable to bison were equally selected and consumed by cattle. When repeatedly grazed by cattle throughout each growing season, these grasses were weakened and gradually replaced by the increase and spread of less-palatable midgrasses and forbs. Where the history of overgrazing by domestic livestock was more intense, even the plants that initially increased were often replaced by less desirable, lower-producing plants. In some areas plant cover was reduced to a mixture of native shortgrasses, annual grasses, and forbs.

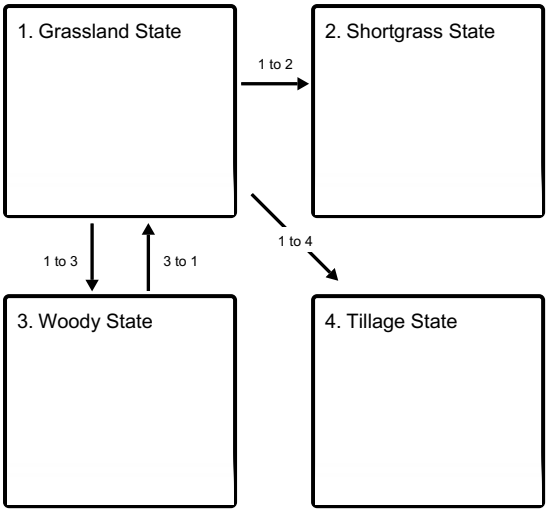
The frequency and role that fires played in maintaining the plant community was reduced with the advent of roads, cultivated fields, and fire suppression techniques developed by European settlers. Use of prescribed fire as a management tool, often limited as an option in modern societies, also diminished. In the absence of periodic, intense fires, there has been a gradual increase of woody species in many areas. In some areas shrubs and trees have invaded and encroached to the point they have become the dominant influence in the plant community.

The slightly to gently rolling topography characteristic of the Clayey Plains ecological site was attractive to European settlers who sought to build agrarian lifestyles. Extensive areas of this site were brought under cultivation and used to grow wheat, corn, and sorghum. Tillage and crop production caused total destruction of the original native plant community and often major degradation of the inherent structure and fertility of the surface soil layer. Many acres that were formerly used for cultivated crops have been reseeded or allowed to revegetate naturally.

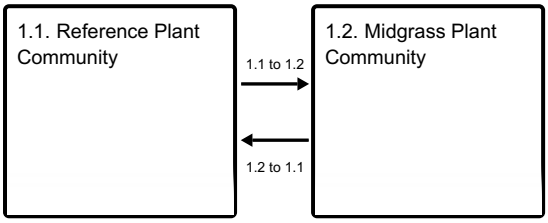
The following diagram illustrates the pathways that the vegetation on this site may take from the Reference Plant Community as influencing ecological factors change. There may be other states or plant communities not shown in the diagram as well as noticeable variations within those illustrated.

State and transition model

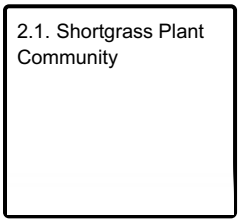
Ecosystem states



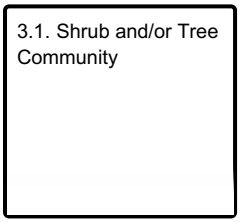
State 1 submodel, plant communities



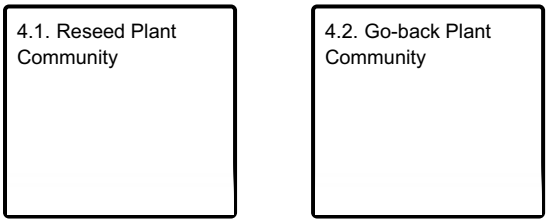
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



State 1
Grassland State

The Grassland State defines the ecological potential and natural range of variability resulting from the natural disturbance regime of the Clayey 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 Plant Community is made up primarily of warm-season midgrasses with an interspersed cool-

season component and decreasing amounts of forbs and tallgrasses.

Community 1.1
Reference Plant Community

The interpretive plant community for this site is the Reference Plant Community, which represents the original condition of the site prior to European settlement. Characterized as open grassland 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 65-75 percent of vegetation produced annually. Other prevalent midgrasses are sideoats grama, western wheatgrass, Canada wildrye, and composite dropseed. Scattered throughout are minor amounts of shortgrasses consisting of blue grama and buffalograss. The Reference Plant Community supports a wide variety of native legumes interspersed throughout the grass sward. The most abundant are groundplum milkvetch, violet prairie clover, slimflower scurfpea, and prairie bundleflower. Slimflower scurfpea may dominate the aspect of this site in late spring and early summer before it matures and breaks off at ground level to be rolled away by the wind. Other important forbs include Maximilian sunflower, dotted blazing star, upright prairie coneflower, Missouri goldenrod, and pitcher sage. Leadplant, also a legume, and Jersey tea are low-growing shrubs that occur over the site. Unlike most shrubs, these plants are both quite tolerant to fire. A few small clumps of smooth and fragrant sumac may be found at locations that partially escape the effects of intense fires. This is a stable plant community when grazing and fire are adequately managed. A prescribed grazing program that incorporates periods of deferment during the growing season benefits the tallgrasses and palatable forb species. Excessive grazing and livestock trailing can quickly impact soil stability and lead to sheet and gully erosion. Because this site often occurs on ridgetops and other high elevations on the landscape, it is preferred by grazing animals during the hot days of late summer to gain relief from heat and insects. Concentrated livestock use, such as winter feeding areas, can cause compaction of the wet clay soils and stress the dominant tallgrasses. Active growth of warm-season grasses on this site typically begins during the period of May 1 to May 15 and continues until mid September. As a general rule, 75 percent of total production is completed by mid-July. This varies only slightly from year to year depending on temperature and precipitation patterns. There are exceptions as big bluestem and eastern gamagrass will occasionally initiate spring growth in early April following mild winter temperatures. Also, it is not unusual for other warm-season grasses such as Indiangrass and little bluestem to have some new leaf growth arising from basal buds in late October following moderate fall temperatures. Cool-season grasses, sedges, and rushes generally have two primary growth periods, one in the spring (March through early June) and again in the fall (September and October). Some growth may occur in winter months during periods of unseasonably mild temperatures.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	2242	3256	4932
Forb	252	370	560
Shrub/Vine	45	73	112
Total	**2539**	**3699**	**5604**

Community 1.2
Midgrass Plant Community

This plant community developed as a result of many years of repeated, heavy grazing. Midgrasses dominate the site and comprise 40-50 percent of the annual production. Most abundant midgrasses include little bluestem, sideoats grama, western wheatgrass, composite dropseed, and purple lovegrass. Although tallgrasses have been reduced to a secondary component, they still contribute 20-35 percent of the total herbage production and maintain a visible presence in the community aspect. Shortgrasses such as blue grama, bufflograss, tumble windmillgrass, and prairie threeawn produce 10-15 percent of the vegetation. Although little bluestem is the predominant species, big bluestem, Indiangrass, and switchgrass plants with reduced vigor and stature are commonly found throughout the site. This plant community is relatively stable under long-term grazing unless negatively impacted by additional stresses like extended drought and extreme grazing pressure. While switchgrass may initially increase with heavy grazing on this site, it will eventually decrease along with big bluestem and Indiangrass. Unprotected plants are usually grazed repeatedly and remain in a low state of vigor. Of these remnants, big bluestem is generally the most

abundant, having rhizomes that can persist for many years in a weakened condition. In this stage, new growth will emerge as three to five prostate leaves, providing partial relief from grazing. These tallgrass remnants respond favorably to periods of rest from grazing and may regain enough vigor to produce viable seed heads with 2-3 years of careful grazing management. Forb production is quite variable and may range from 10-25 percent of the total vegetation depending on amounts and timing of rainfall events. Perennial forbs include white sagebrush, slimflower scurfpea, Missouri goldenrod, Baldwin ironweed, white heath aster, and Cuman ragweed. In some locations shrubs such as smooth sumac, fragrant sumac, and coralberry comprise up to 10 percent of the vegetation. Total annual production ranges from 1,750 to 4,000 pounds of air-dry vegetation per acre and averages about 2,650 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 to 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 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 (big 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

Brush Management
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 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

Developed after many years of continuous overgrazing, 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 productivity. Other grasses include Japanese brome, cheatgrass, composite dropseed, silver beardgrass, Kentucky bluegrass, prairie threeawn, and tumble windmillgrass. These species commonly account for 70-80 percent of the annual forage production. Like the desirable grasses, palatable legumes and other forbs have been reduced by continuous heavy grazing and competition over many years. Prevalent broadleaf species in this situation include annual ragweed, white sagebrush, Cuman ragweed, Baldwin ironweed, wavyleaf thistle, and curlycup gumweed. Forbs may comprise 20-30 percent of the total vegetation. Total annual production ranges from 1,150 to 2,650 pounds of air-dry vegetation

per acre and averages about 1,850 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 not present or located nearby as seed sources for reestablishment, interseeding measures may be necessary to create pioneer colonies for seed dispersal throughout the community. Prescribed burning can be a useful tool if used strategically to benefit the desired species, especially in the later stages of the recovery process, which may take more than a decade.

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 base of trees are considerably higher than losses associated with the canopy. The decomposed material retains approximately 40 percent of the water that is not retained in the canopy (Thurow and Hester, 1997). Soil properties affected include biological activity, infiltration rates, and soil fertility. Special planning will be necessary to assure that sufficient amounts of fine fuel are available to carry fires with enough intensity to control woody species. In some locations the use of chemicals as a brush management tool may be desirable to initiate and accelerate this transition. Birds, small mammals, and livestock are instrumental in the distribution of seed and accelerating the spread of most tree and shrubs common to this site. The speed of encroachment varies considerably and can occur on both grazed and non-grazed pastures. Many species of wildlife, especially bobwhite quail, turkey, and white-tailed deer benefit from the growth of trees and shrubs for both food and cover. When management for specific wildlife populations is desirable, these options should be considered in any brush management plan.

Community 3.1
Shrub and/or Tree Community

This plant community is dominated by shrubs consisting primarily of coralberry, fragrant sumac, and smooth sumac. Trees including osage orange, honeylocust, and eastern redcedar are common invaders that become established in some areas. Coralberry is generally the most abundant shrub and often forms low, dense thickets throughout the site. Shrubs and trees may produce 40-60 percent of the total vegetation. The spread of shrubs and trees results in the absence of fire because periodic burning tends to hinder establishment of most of these woody species and favor grasses and forbs. It should be noted, however, that not all unburned areas have a woody plant problem and that the speed of encroachment varies considerably, depending upon seed availability in surrounding areas and the presence of birds and small mammals that distribute seeds over the site. Long-term, continuous overgrazing can also lead to encroachment. In these situations the associated grasses will usually consist of composite dropseed, purple lovegrass, Kentucky bluegrass, and Scribner’s rosette grass. Shrubs and trees will also invade areas where both grazing and fire have been excluded for many years because the heavy accumulation of plant mulch and litter retards herbage growth and provides a favorable habitat for seed germination and establishment of many shrub species. The associated grasses in this situation are usually big bluestem, little bluestem, Indiangrass, switchgrass, sedges, and Canada wildrye. Grass production is significantly reduced by competition from forbs and woody species. Grass yields vary from 40-50 percent of the total vegetative production. Forbs often produce 15-20 percent of the total. Major forbs include white sagebrush, Cuman ragweed, Baldwin ironweed, and common yarrow. Total annual production ranges from 1,400 to 2,900 pounds of air-dry vegetation per acre and averages about 2,100 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. Usually a prescribed burning program accompanied with prescribed grazing will gradually return the plant community to one dominated by grasses and forbs. Special planning will be necessary to assure that sufficient amounts of fine fuel are available to carry fires with enough intensity to control 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 accelerate the recovery of desired vegetative cover. Many species of wildlife, especially bobwhite quail and white-tailed deer,

benefit from woody growth for both food and cover. Conversely, the presence of trees is considered detrimental to populations of greater prairie chickens. When management for specific wildlife populations is desirable, these options 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 land" or planted/seeded to grassland. Many reseeded plant communities were planted with a local seeding mix under the Conservation Reserve Program (CRP) or were planted to a monoculture of sideoats grama. Go-back communities are difficult to define due to the variability of plant communities that can exist. Many of these communities are represented by the genus Aristida (threeawns). This is an alternative state since the energy, hydrologic, and nutrient cycles are altered to that of the Reference State in its natural disturbance regime. Bulk density, aggregate stability, soil structure, and plant functional and structural groups are not fully restored to that of the Reference State. Mechanical tillage can destroy soil aggregation. Soil aggregates are an example of dynamic soil property change. Aggregate stability is critical for infiltration, root growth, and resistance to water and wind erosion (Brady and Weil, 2008).

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 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 and eastern redcedar. 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 on the size of the area, level of grazing management, and the proximity of the area to existing seed sources. In the initial stages of revegetation, the site is usually dominated by annual forbs such as annual ragweed, slender snakecotton, Canadian horseweed, prairie sunflower, common sunflower, Mexican-fireweed, camphorweed, and annual buckwheat. Gradually these are replaced by annual grasses including prairie threeawn, mat sandbur, tumblegrass, little barley, cheatgrass, and witchgrass. As plant succession progresses the plant community gradually becomes dominated by perennials. The major grasses include sand dropseed, composite dropseed, thin paspalum, purple lovegrass, red lovegrass, Scribner’s rosette grass, Carolina crabgrass, silver beardgrass, and tumble windmillgrass. Common forbs are Cuman ragweed, white sagebrush, Carruth’s sagewort, white heath aster, Missouri goldenrod, and sand milkweed. Combinations of these plants can form a stable community. In time along with prescribed grazing management, other perennial grasses and forbs common in the Reference Plant Community return to the site. Blue grama is a shortgrass that is very common to the native plant communities on this site. However, it seldom occurs in go-back communities, even after 40-50 years of plant succession. Some go-back areas are invaded by trees and shrubs. The more common include elm, 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 to 2
State 1 to 2

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

Transition 1 to 3
State 1 to 3

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

Transition 1 to 4
State 1 to 4

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

Restoration pathway 3 to 1
State 3 to 1

Restoration efforts will be costly, labor-intensive, and can take many years, if not decades, to return to a Grassland State. Once canopy levels reach greater than 20 percent, estimated cost to remove trees is very expensive and includes high energy inputs. The technologies needed in order to go from an Invaded Woody State to a Grassland State include but are not limited to: prescribed burning—the use of fire as a tool to achieve a management objective on a predetermined area under conditions where the intensity and extent of the fire are controlled; brush management—manipulating woody plant cover to obtain desired quantities and types of woody cover and/or to reduce competition with herbaceous understory vegetation, in accordance with overall resource management objectives; and prescribed grazing—the controlled harvest of vegetation with grazing or browsing animals managed with the intent to achieve a specified objective, such as 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 total 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 68%**			1345–2511	
	big bluestem	ANGE	*Andropogon gerardii*	785–1138	–
	switchgrass	PAVI2	*Panicum virgatum*	168–488	–
	little bluestem	SCSC	*Schizachyrium scoparium*	168–488	–
	Indiangrass	SONU2	*Sorghastrum nutans*	140–325	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	140–325	–
	eastern gamagrass	TRDA3	*Tripsacum dactyloides*	0–140	–
2	**Grasses-sub-dominant 15%**			280–555	
	blue grama	BOGR2	*Bouteloua gracilis*	112–325	–
	western wheatgrass	PASM	*Pascopyrum smithii*	112–325	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	45–163	–
3	**Grasses-minor 5%**			34–185	
	buffalograss	BODA2	*Bouteloua dactyloides*	11–84	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–45	–
	Canada wildrye	ELCA4	*Elymus canadensis*	11–34	–
	purple lovegrass	ERSP	*Eragrostis spectabilis*	0–34	–
	sedge	CAREX	*Carex*	11–34	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–22	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–22	–
Forb					
4	**Forbs-minor 10%**			78–370	
	groundplum milkvetch	ASCR2	*Astragalus crassicarpus*	6–28	–
	Illinois bundleflower	DEIL	*Desmanthus illinoensis*	6–28	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	6–28	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	6–28	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	6–28	–
	pitcher sage	SAAZG	*Salvia azurea var. grandiflora*	6–28	–
	compassplant	SILA3	*Silphium laciniatum*	6–28	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	0–11	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–11	–
	aromatic aster	SYOB	*Symphyotrichum oblongifolium*	0–11	–
	Baldwin's ironweed	VEBA	*Vernonia baldwinii*	0–11	–
	hoary verbena	VEST	*Verbena stricta*	0–11	–
	stiff goldenrod	OLRIR	*Oligoneuron rigidum var. rigidum*	0–11	–

	prairie groundsel	PAPL12	*Packera plattensis*	0–11	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–11	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–11	–
	dotted blazing star	LIPU	*Liatris punctata*	0–11	–
	green antelopehorn	ASVI2	*Asclepias viridis*	0–11	–
	blue wild indigo	BAAUM	*Baptisia australis var. minor*	0–11	–
	longbract wild indigo	BABRL2	*Baptisia bracteata var. leucophaea*	0–11	–
	purple prairie clover	DAPUP	*Dalea purpurea var. purpurea*	0–11	–
	Carolina larkspur	DECAV2	*Delphinium carolinianum ssp. virescens*	0–11	–
	common yarrow	ACMI2	*Achillea millefolium*	0–11	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–11	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–11	–
Shrub/Vine					
5	**Shrub-trace 2%**			0–73	
	leadplant	AMCA6	*Amorpha canescens*	0–73	–
	New Jersey tea	CEAM	*Ceanothus americanus*	0–73	–

Animal community

This site is good prairie wildlife habitat when maintained in good to excellent condition. It provides nesting sites for a number of ground nesting bird species including eastern and western meadowlarks, and the upland sandpiper. The greater prairie chicken often uses this site for booming grounds or “leks” where the males carry out their courtship displays, a truly unique spring prairie ritual.

Big game animals such as white-tailed deer, pronghorn, and the bison historically used this site commonly for grazing. The Clay Upland and associated Claypan site were favored by bison for “wallows” or depressions where they would roll in the dust or mud, as the season dictated, to try and rid themselves of flies and gnats that were a constant nuisance on the prairie. These depressions can still be seen on the prairie landscape.

Many small mammals, reptiles and amphibians are found on this site as well. Larger predators such as the coyote are attracted by these smaller animals as are avian predators such as hawks and owls.

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 www.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. Soils characterizing this site are somewhat poorly to well drained and have slow to very slow permeability.

Following are the estimated withdrawals of freshwater by use in MLRA 79:
public supply—surface water, 6.8% and ground water, 4.0%; livestock—surface water, 0.4% and ground water, 1.2%; irrigation—surface water, 0.7% and ground water, 80.6%; other—surface water, 2.0% and ground water, 4.3%.

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

Recreational uses

This site provides opportunities for a variety of outdoor activities which might include bird watching, hiking, outdoor/wildlife photography, and hunting. A wide variety of plants in bloom throughout the growing season provide much aesthetic appeal to the landscape, especially in those years with average and above-average rainfall. This site is subject to sheet erosion when mismanaged.

Wood products

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

Other products

Other products are generally not produced on this site.

Other information

Because of its landscape setting with broad vistas, this site may be attractive to many for homesites and other developments. However, the high clay content (high shrink-swell potential) of these soils can create foundation problems and severely limit their suitability for septic systems and access roads. The seasonal water table in winter and early spring is also a concern for dwellings with basements.

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

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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 3-16-2018 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	03/16/2018
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.

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

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

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

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

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

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

---

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil surfaces may be stabilized by soil organic matter which has been fully incorporated into aggregates at the soil surface, adhesion of decomposing organic matter to the soil surface, and biological crusts. A soil stability kit will score a range from 4-6.

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

   Ap1--0 to 13 centimeters (0 to 5 inches); brown (10YR 4/3) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots throughout; 21 percent clay; noneffervescent throughout (HCl, 1 normal); slightly acid; abrupt smooth boundary.

   Ap2--13 to 25 centimeters (5 to 10 inches); dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots throughout; 21 percent clay; noneffervescent throughout (HCl, 1 normal); slightly acid; abrupt smooth boundary. (Combined thickness of the Ap horizon ranges from 15 to 50 centimeters thick; 6 to 20 inches 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 68% 2240 lbs. big bluestem 700-1015, little bluestem 150-435, Indiangrass 125-290, switchgrass 150-435, sideoats grama 125-290, eastern gamagrass 0-125.

    Sub-dominant: Group 2 Grasses Subdominant 15% 495 lbs. blue grama 100-290, western wheatgrass 100-290, composite dropseed 40-145.

    Other: Group 3 Grasses minor 5% 165lbs.

    Additional: Forbs minor component 10%, 330 lbs. see functional/structural group sheet for specific forbs.
    Shrubs Trace 2% 65 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 2,265 lbs in a below-average rainfall year and 5,000 lbs in an above-average rainfall year. The representative value for this site is 3,300 lbs production per year.

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

---

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