USDA Natural Resources Conservation Service

Ecological site R079XY132KS
Subirrigated

Last updated: 9/21/2018
Accessed: 05/13/2025

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.

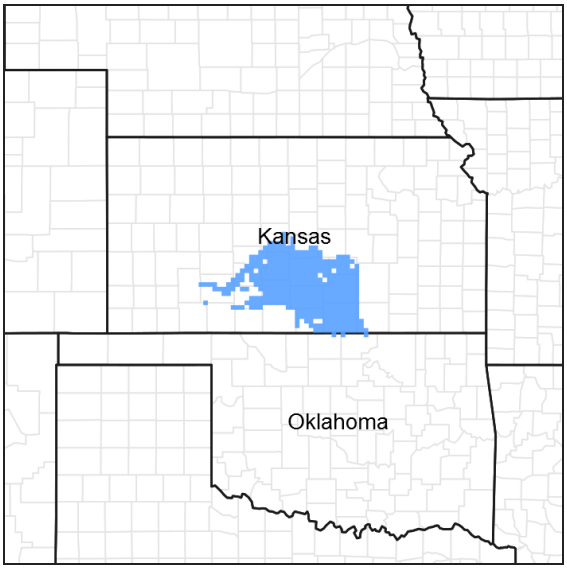


Figure 1. Mapped extent

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 contained 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 percent; Grassland-private, 23 percent; Federal, 1 percent; Forest-private, 1percent; Urban development-private, 5 percent; Water-private, 1percent; Other-private, 2 percent.

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

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

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

Classification relationships

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

Ecological site concept

The Subirrigated ecological site is characterized by somewhat poorly drained soils that have a seasonal or perennial high water table greater than 2 feet and less than 6 feet from the surface. This site is located on floodplains and interdunes. The Subirrigated site occurs on level to nearly level eolian and alluvial lands, usually adjacent to major streams.

Associated sites

R079XY103KS	**Choppy Sands** The Choppy Sands ecological site sits adjacent to and in conjunction with the Subirrigated site. The Choppy Sands site is characterized by soils with >70% sand throughout the profile. This site has >15% slopes, short, steep, hummocky landform with no lamellae in the profile.
R079XY113KS	**Loamy Floodplain** The Loamy Floodplain site occurs adjacent to and in conjunction with the Subirrigated ecological site. This site occurs on floodplains. The water table is generally >6 feet from the surface. This site is well drained.
R079XY123KS	**Sand Floodplain** The Sand Floodplain ecological site occurs adjacent to and in conjunction with the Subirrigated site. This site occurs on floodplains. Soils that characterize this site do not have a seasonal or perennial high water table (<6 feet from the surface) and have >70% sand in the surface.
R079XY133KS	**Wet Subirrigated** The Wet Subirrigated ecological site sits adjacent to and in conjunction with the Subirrigated site. This site occurs on floodplains and interdunes. This site is characteristic of poorly drained soils that have a seasonal or perennial high water table <2 feet from the surface.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Andropogon gerardii* (2) *Tripsacum dactyloides*

Physiographic features

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

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

The Subirrigated ecological site consists of deep to very deep, somewhat poorly drained soils. These soils formed in alluvium of eolian deposits over alluvium. This site occurs on nearly level dunes and interdunes on paleoterraces in river valleys. Runoff is low to negligible, and permeability is rapid to moderately slow.

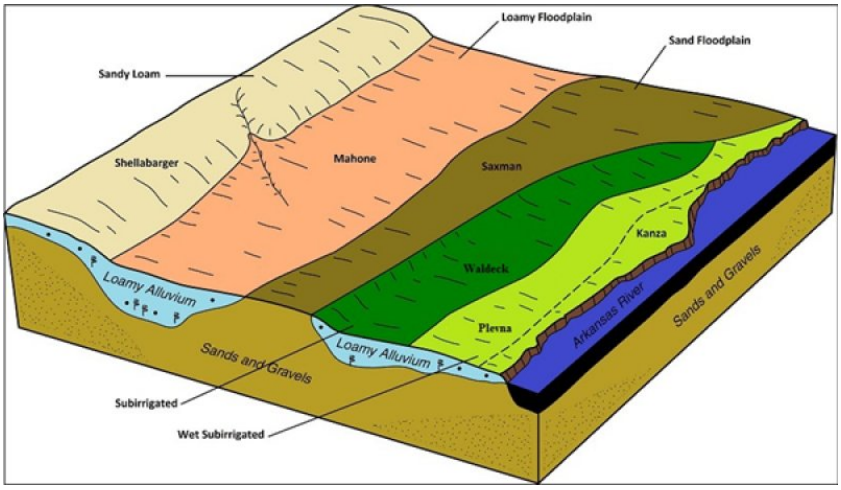


Figure 2.

Table 2. Representative physiographic features

Landforms	(1) River valley > Flood plain (2) River valley > Interdune
Runoff class	Negligible to low
Flooding duration	Brief (2 to 7 days)
Flooding frequency	None to frequent
Ponding frequency	None
Elevation	503–792 m
Slope	0–3%
Water table depth	61–183 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 data originated from weather stations chosen across the geographical extent of the ecological site, and will likely vary from the data for the entire MLRA. The climate data derives from the Natural Resources Conservation Service (NRCS) National Water and Climate Center. The dataset is from 1981-2010.

Table 3. Representative climatic features

Frost-free period (characteristic range)	148-166 days
Freeze-free period (characteristic range)	186-196 days
Precipitation total (characteristic range)	711-813 mm
Frost-free period (actual range)	146-182 days

Freeze-free period (actual range)	184-203 days
Precipitation total (actual range)	686-813 mm
Frost-free period (average)	159 days
Freeze-free period (average)	193 days
Precipitation total (average)	762 mm

Climate stations used

- (1) PRATT [USC00146549], Pratt, KS
- (2) HUDSON [USC00143847], Hudson, KS
- (3) HUTCHINSON [USC00143929], Hutchinson, KS
- (4) HUTCHINSON 10 SW [USC00143930], Hutchinson, KS
- (5) STERLING [USC00147796], Sterling, KS
- (6) WICHITA [USW00003928], Wichita, KS
- (7) KINGMAN [USC00144313], Kingman, KS
- (8) KINSLEY 2E [USC00144333], Kinsley, KS
- (9) NORWICH [USC00145870], Norwich, KS

Influencing water features

Influencing water features on this ecological site include a seasonal or perennial water table that occurs between 2 and 6 feet from the surface. This water table influences the kinds and amounts of vegetation, and the management of the site, making it distinctive from other ecological sites.

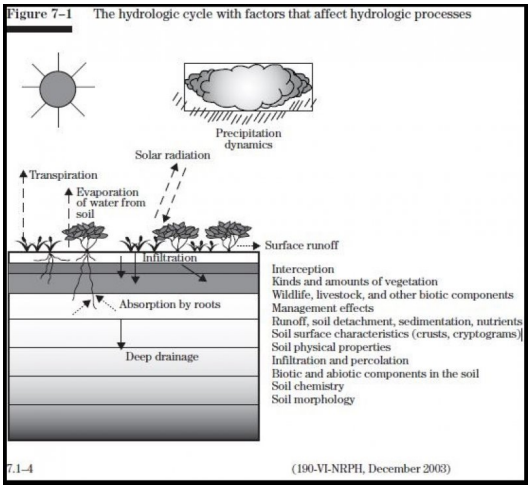


Figure 9.

Soil features

Soils on this site are characterized as deep and loamy with a seasonal or perennial water table that occurs between 2 and 6 feet from the surface. These soils occur on interdunes or flood plains, and formed in alluvium or in eolian deposits over alluvium. Surface soils and subsoils will range from sands to clay loams. Permeability ranges from rapid to moderately slow. In some local areas, they are moderately sodic.

The major soils common to this site include Dillwyn, Imano, Platte, Solvay, Waldeck, Willowbrook, and Zenda.

Figure 10.

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Eolian deposits
Surface texture	(1) Clay loam (2) Fine sandy loam (3) Loamy fine sand
Family particle size	(1) Loamy
Drainage class	Somewhat poorly drained
Permeability class	Moderately slow
Soil depth	203 cm
Available water capacity (0-101.6cm)	9.4–27.43 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–10
Soil reaction (1:1 water) (0-101.6cm)	5.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–5%

Ecological dynamics

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

The deep alluvial or eolian soils representative of this site generally occur on broad, nearly level floodplains usually adjacent to rivers or streams. The site may also occur along narrow drainways, on areas containing perennial seeps or springs, or on interdunes. The major influence for plant adaptation and growth is the presence of a permanent water table that generally varies to a depth of two to four feet. Occasional flooding may occur in some locations from stream overflow. The plants that evolved and dominated the original plant community were adapted to these soil conditions and benefited from the dependable source of moisture. The available water capacity of this site is high. The Subirrigated ecological site can be very productive.

The plant community developed with occasional fires as an important element of the ecological processes. Historically fires were usually started by lightning during 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. These intentional fires probably occurred more frequently, even on an annual basis. Because all of the dominant tallgrasses were rhizomatous and soil conditions were usually moist, these plants could survive the ravages of even intense wildfires. This gave them a competitive advantage in the plant community. In contrast, most trees and shrubs were suppressed by fire and occurred only sparsely on protected areas, generally along stream banks.

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 they moved on to other 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 had only minimal impact upon the development of the plant community due to the ever-present water table. The deeper-rooted major grasses would continue to benefit from the water table even during periods of extended drought. Occasional flooding that resulted from intense thunderstorms was usually brief in duration and the resulting inundation only temporarily affected major plants. Several of the tallgrasses, especially eastern gamagrass, prairie cordgrass, and common reedgrass had extensive rhizomes, which enabled them to endure and recover from occasional siltation deposited during flood events.

Typically, growth of warm-season grasses on this site begins during the period of April 25 to May 10 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. Cool-season grasses, sedges, and rushes generally have two primary growth periods, one in the fall (September and October) and again in the spring (April, May, and June).

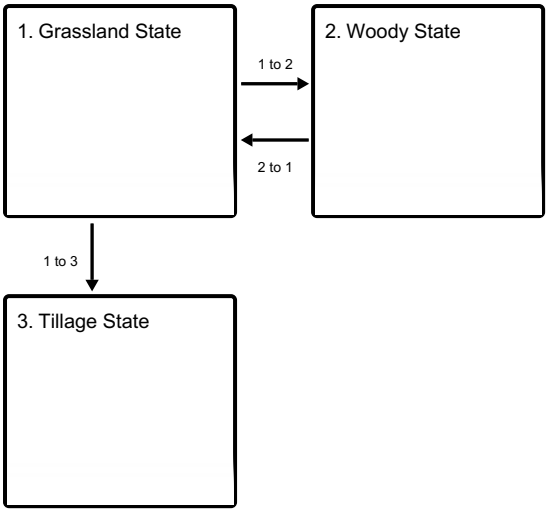
As utilization of the area for production of domestic livestock replaced that of roaming bison herds, the ecological dynamics of the site were altered. In many areas the plant community changed from its original composition. Fencing enabled continuous grazing that in many areas led to overgrazing and accelerated changes in the vegetation. Alterations in the plant community were usually in proportion to when grazing occurred as well as its intensity. The taller grasses and forbs palatable to bison were equally relished and selected by cattle and other domestic livestock. When repeatedly overgrazed, these grasses were weakened and gradually diminished in the plant community. They were replaced by the increase and spread of less palatable midgrasses and forbs. Where the history of overgrazing by domestic livestock was more intense, even the plants that initially increased were often replaced by even less desirable, and usually lower-producing plants.

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, often not an option in modern communities, also diminished. The absence of fire has contributed to a gradual increase of shrub and tree species in many areas. In some locations shrubs and trees have spread to the point they have become a major influence in the plant community.

Some areas of the site that were formerly “broken out” and farmed for many years have since been returned to the production of native plant communities. Portions of these areas were reseeded and established to a prescribed mixture of plants. Other areas were allowed to reestablish naturally without the benefit of seeding, and are in various stages of plant succession.

State and transition model

Ecosystem states

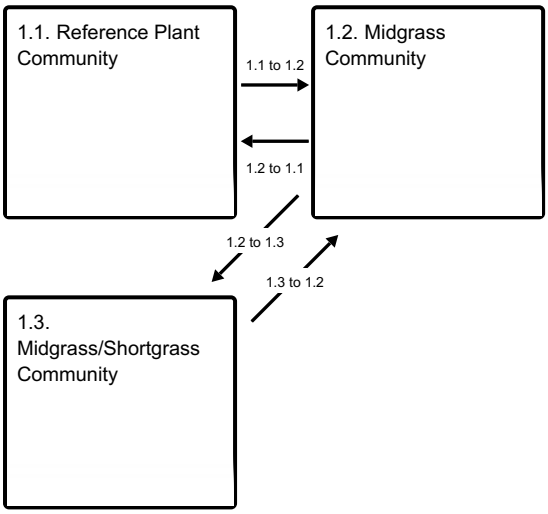


1 to 2 - Lack of fire, fire frequency, and timing.

1 to 3 - Mechanical tillage

2 to 1 - Brush management, prescribed burning, prescribed grazing.

State 1 submodel, plant communities



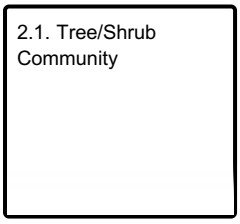
1.1 to 1.2 - Repetitive heavy use, no forage and animal balance, and no rest or recovery.

1.2 to 1.1 - Livestock grazing

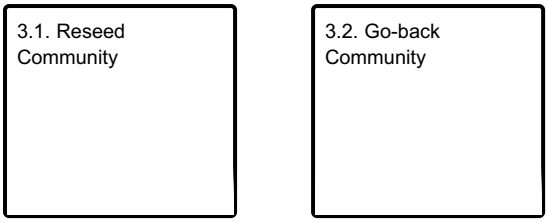
1.2 to 1.3 - Heavy use of vegetation, no forage and animal balance, and inadequate rest and recovery of key forage species.

1.3 to 1.2 - Prescribed grazing and burning.

State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Grassland State

The Grassland State defines the ecological potential and natural range of variability resulting from the natural disturbance regime of the Subirrigated ecological site. This state is supported by empirical data, historical data, local expertise, and photographs.

Characteristics and indicators. The Grassland State 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. The Midgrass Plant Community is dominated by less desirable midgrasses, shortgrasses, and cool-season midgrasses.

Resilience management. Management that includes a forage and animal balance and a prescribed burning program should sustain this state and prevent a transition.

Dominant plant species

- big bluestem (*Andropogon gerardii*), grass
- little bluestem (*Schizachyrium*), grass
- composite dropseed (*Sporobolus compositus var. compositus*), grass

Community 1.1
Reference Plant Community

The interpretive plant community for this site is the Reference Plant Community. This represents the original plant community that existed prior to European settlement. The site is characterized as a grassland essentially free of trees and large shrubs. It is dominated by tall, warm-season grasses including big bluestem, Indiangrass, switchgrass, eastern gamagrass, and prairie cordgrass. Another tallgrass, common reedgrass, occasionally forms large colonies on deep, sandy alluviums adjacent to streams. Combined these tallgrasses will account for 60 to 65 percent of the total vegetation produced annually. Other prevalent grasses and grass-likes are Canada wildrye, Virginia wildrye, western wheatgrass, little bluestem, marsh bristlegrass, composite dropseed, and several species of sedges and rushes. The two major forbs found interspersed throughout the grass sward are Maximilian sunflower and prairie bundleflower. Other important forbs include Canada goldenrod, pitcher sage, white heath aster, white sagebrush, American licorice, and roundhead lespedeza. Desert false indigo, common buttonbush, and roughleaf dogwood are shrubs that occur in sparse amounts over the site. Eastern cottonwood and black willow are the major trees. Eastern cottonwood may be found as isolated plants scattered over the site, or it may form small groves. Black willow is generally located along drainageways.

Resilience management. This is a stable, resilient, and very productive plant community when adequately managed. A prescribed grazing program that incorporates periods of deferment during the growing season perpetuates the more palatable tallgrasses and forb species. In a number of locations this plant community is managed exclusively for the production of native hay, sometimes referred to as prairie hay. Mowing tends to reduce the amount of switchgrass and prairie cordgrass plants and favor big bluestem, Indiangrass, and eastern gamagrass. Growth of warm-season grasses on this site typically begins during the period of April 25 to May 10 and continues until late September. As a general rule, 75 percent of total production is completed by mid-July. This varies only slightly from year to year depending upon temperature and precipitation patterns. There are exceptions as big bluestem, eastern gamagrass, and prairie cordgrass will occasionally initiate spring growth as early as April 1 following mild winter temperatures. Also, it is not unusual for other warm season grasses, such as Indiangrass, 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 fall (September and October) and again in the spring (April, May, and June). Some growth may occur in winter months during periods of unseasonably warm temperatures (Indian summers).

Dominant plant species

- big bluestem (*Andropogon gerardii*), grass
- eastern gamagrass (*Tripsacum dactyloides*), grass
- switchgrass (*Panicum virgatum*), grass
- Indiangrass (*Sorghastrum nutans*), grass
- prairie cordgrass (*Spartina pectinata*), grass

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	4483	5380	6277
Forb	841	1009	1177
Shrub/Vine	280	336	392
Total	**5604**	**6725**	**7846**

Community 1.2
Midgrass Community

The composition of this plant community is dominated by a mixture of midgrasses and tallgrasses. Compared with the Reference Plant Community, there has been a decrease of the more palatable tallgrasses and forbs and a subsequent increase in midgrasses. Although reduced by overgrazing, tallgrasses such as big bluestem, Indiangrass, switchgrass, and prairie cordgrass remain dominant. The proportion of midgrasses, sedges, and rushes in the overall production of the site has increased. These include composite dropseed, little bluestem, western wheatgrass, marsh bristlegrass, Torrey’s rush, and chairmaker’s threesquare. Other secondary grasses that have increased are Texas bluegrass, alkali sacaton, vine mesquite, and sedges. Combined, these secondary plants now comprise 30 to 40 percent of the total herbage produced annually. Forbs such as Maximilian sunflower and prairie bundleflower have decreased and largely been replaced by white heath aster, white sagebrush, Cuman ragweed, interior ironweed, and Canada goldenrod. Forbs produce 8 to 10 percent of the total herbage. In some locations the site supports an increasing amount of shrubs and trees. The most abundant shrubs are desert false indigo, common buttonbush, roughleaf dogwood, Great Plains false willow, and coralberry. Eastern cottonwood, black willow, American elm, and Russian olive are the major trees found on the site. Shrubs and trees usually will not comprise over 5 percent of the total production.

Resilience management. Periods of deferment from grazing are essential in maintaining the production of some of the major grasses found in this plant community. Eastern gamagrass and big bluestem are especially preferred and selectively grazed by cattle. When the site is grazed continuously throughout the growing season, these grasses are usually overgrazed and thus maintained in a lower state of plant vigor. Continued for many years, overgrazing results in a gradual reduction in the abundance of these grasses. Total annual production ranges from 4,000 to 6,000 pounds of air-dry vegetation per acre and averages about 5,000 pounds. Prescribed grazing that incorporates periods of deferment during the growing season will improve the vigor and gradual recovery of the more palatable tallgrasses and forbs.

Dominant plant species

- composite dropseed (*Sporobolus compositus var. compositus*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- marsh bristlegrass (*Setaria parviflora*), grass

Community 1.3

Midgrass/Shortgrass Community

This plant community results from many years of overgrazing. The amount of tallgrasses has decreased significantly and the site is dominated by mid- and shortgrasses. Major midgrasses are composite dropseed, Madagascar dropseed, sand dropseed, silver beardgrass, sideoats grama, western wheatgrass, and marsh bristlegrass. Short grasses include Kentucky bluegrass, Texas bluegrass, Texas dropseed, buffalograss, and inland saltgrass. Grasslike plants such as chairmaker's threesquare, Baltic rush, Torrey's rush, frimby, and sedges have increased, and may comprise 10 to 20 percent of the plant community in some locations. Major forbs on the site are Cuman ragweed, Canada goldenrod, Missouri goldenrod, white sagebrush, Carruth's sagewort, white heath aster, swamp smartweed, swamp milkweed, swamp verbena, annual marshelder, and annual ragweed. In some locations the site supports an increasing amount of shrubs and trees. The most abundant shrubs are desert false indigo, common buttonbush, rough leaf dogwood, Great Plains false willow, and coralberry. Eastern cottonwood, black willow, peachleaf willow, American elm, eastern redcedar, and Russian olive are the major trees found on the site. Both eastern redcedar and Russian olive were introduced to the area through shelterbelt and windbreak plantings. Shrubs and trees usually will not comprise over 10 percent of the total production.

Resilience management. Remnant plants of big bluestem, Indiangrass, switchgrass, prairie cordgrass, eastern gamagrass, and Maximilian sunflower are often found scattered throughout the site. These plants are usually grazed repeatedly and maintained in a low state of vigor. They respond favorably to periods of rest from grazing during the growing season and often regain vigor in one to two years. Total annual production ranges from 3,000 to 5,000 pounds of air-dry vegetation per acre and averages about 4,000 pounds.

Dominant plant species

- composite dropseed (*Sporobolus compositus var. compositus*), grass
- Madagascar dropseed (*Sporobolus pyramidatus*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass
- silver beardgrass (*Bothriochloa laguroides*), grass
- sideoats grama (*Bouteloua curtipendula var. curtipendula*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- marsh bristlegrass (*Setaria parviflora*), grass

Pathway 1.1 to 1.2
Community 1.1 to 1.2

The following describes the mechanisms of change from Plant Community 1.1 to Plant Community 1.2. These mechanisms include management controlled by repetitive heavy use, no rest or recovery of the key forage species, no forage and animal balance for many extended grazing seasons. This type of management for periods greater than 10 years will shift functional and structural plant group dominance toward 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, Indiangrass, and switchgrass) within the Reference Plant Community. If woody species are present, prescription fires every 6-8 years will be necessary for their removal and/or maintenance.

Conservation practices

Prescribed Burning
Prescribed Grazing

Pathway 1.2 to 1.3
Community 1.2 to 1.3

The following describes the mechanisms of change from Plant Community 1.2 to Plant Community 1.3. Long term (>10 years) management that includes continuous, heavy use of the native vegetation; management that is void of

a forage and animal balance; and inadequate rest and recovery of native grasses during the growing season.

Pathway 1.3 to 1.2
Community 1.3 to 1.2

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

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

State 2
Woody State

The Woody State is dominated by a shrub and/or tree plant community.

Characteristics and indicators. 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 1percent 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.

Resilience management. This state is sustained by a lack of fire and brush management.

Community 2.1
Tree/Shrub Community

Trees and shrubs dominate this plant community and may produce 40 to 50 percent of the total vegetation. Major trees include eastern cottonwood, black willow, peachleaf willow, American elm, Siberian elm, common hackberry, eastern redcedar, and Russian olive. More abundant shrubs are roughleaf dogwood, coralberry, Great Plains false willow, desert false indigo, and common buttonbush. These woody plants spread in the absence of fire and may do so regardless of grazing management. However, not all unburned areas have a woody plant problem. Encroachment may occur on areas that have been overgrazed for years as well as where both grazing and fire have been excluded. The speed and method of encroachment varies considerably. Cottonwood and willow produce an abundance of seed that is distributed long distances by wind. Russian olive and eastern redcedar are spread by birds. Periodic burning tends to hinder the establishment of most of these woody species and favor forbs and grasses. Where woody plants have invaded overgrazed areas, understory vegetation is generally dominated by

plants such as Texas bluegrass, Kentucky bluegrass, composite dropseed, marsh bristlegrass, chairmaker's threesquare, sedges, white sagebrush, interior ironweed, and white heath aster. Where woody plants have encroached onto nonutilized areas, the understory consists largely of big bluestem, Indiangrass, prairie cordgrass, Canada wildrye, chairmaker's threesquare, sedges, prairie bundleflower, and Maximilian sunflower. Herbage production is significantly reduced because of tree and shrub competition. Grass yields vary from 30 to 40 percent of the total vegetative production. Forbs generally produce 5 to 10 percent of the total. Total annual production is variable and more data collection is necessary in order to display estimates.

Resilience management. Usually a prescribed burning program, accompanied by prescribed grazing, will return the plant community to one dominated by grasses and forbs. Special planning will be necessary to assure that sufficient amounts of fine fuel are available to carry fires with enough intensity to control the woody species. In some locations use of chemicals or mechanical methods as a brush management tools may be necessary to initiate and accelerate this transition.

Dominant plant species

- eastern cottonwood (*Populus deltoides*), tree
- black willow (*Salix nigra*), tree
- peachleaf willow (*Salix amygdaloides*), tree
- American elm (*Ulmus americana*), tree
- Siberian elm (*Ulmus pumila*), tree
- common hackberry (*Celtis occidentalis*), tree
- eastern redcedar (*Juniperus virginiana*), tree
- Russian olive (*Elaeagnus angustifolia*), tree
- roughleaf dogwood (*Cornus drummondii*), shrub
- coralberry (*Symphoricarpos orbiculatus*), shrub
- willow (*Salix*), shrub
- false indigo bush (*Amorpha fruticosa*), shrub
- common buttonbush (*Cephalanthus occidentalis*), shrub

State 3
Tillage State

The Tillage State consists of abandoned cropland that has been naturally revegetated (go-back) or planted/seeded to grassland.

Characteristics and indicators. 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 or other species. 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).

Resilience management. This state should incorporate prescribed grazing and prescribed burning management strategies.

Community 3.1
Reseed Community

This plant community occurs on areas that were formerly farmed. When farming operations ended, the area was seeded and established to a mixture of plants. These were usually native species common in the Reference Plant Community. Most seeding mixtures consisted of a blend of grasses that included big bluestem, Indiangrass, switchgrass, and little bluestem. In some locations eastern gamagrass, prairie bundleflower, and Maximilian sunflower were included in the mixture.

Resilience management. Once seeded areas become fully established, production is comparable to that of the

Reference Plant Community. Total annual production is variable. Sufficient data does not exist to give estimates at this time. When reseeded areas and areas supporting native rangeland exist in the same pasture, they seldom are utilized at the same intensity. There is usually a preference by domestic livestock for plants on the native rangeland areas. When feasible, reseeded plant communities should be managed as separate pastures or units. These areas are generally excellent when managed for hay production. Some seeded areas are invaded by trees and shrubs while desired plants are becoming established. These invader species commonly include Siberian elm, common hackberry, eastern redcedar, eastern cottonwood, black willow, roughleaf dogwood, and Great Plains false willow. Occasional burning will effectively control their establishment.

Community 3.2
Go-back Community

This plant community occurs on areas that were formerly farmed. When tillage operations were abandoned, the area was allowed to revegetate or “go back” naturally. This was in contrast to artificially reseeding with a selected species or group of species. Go-back is a slow, gradual process that requires many years and many successional changes or stages in the plant community.

Resilience management. The speed and extent of revegetation depends on the size of the area, history 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, Canadian horseweed, common sunflower, Mexican-fireweed, annual marshelder, and golden tickseed. Gradually these are replaced by annual grasses including prairie threeawn, prairie cupgrass, little barley, cheatgrass, and bearded sprangletop. Usually, plant succession will progress until the plant community is dominated by perennial grasses and grasslike plants including composite dropseed, alkali sacaton, foxtail barley, marsh bristlegrass, silver beardgrass, inland saltgrass, Texas dropseed, buffalograss, Torrey’s rush, and chairmaker’s threesquare. 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. Some go-back areas are invaded by trees and shrubs. The more common include Siberian elm, common hackberry, eastern redcedar, eastern cottonwood, black willow, roughleaf dogwood, and Great Plains false willow. Occasional burning is effective in controlling these woody plants. Total annual production is variable and sufficient data does not exist to give estimates at this time.

Transition 1 to 2
State 1 to 2

Changes from a Grassland State to a Woody State lead to changes in hydrologic function, forage production, dominant functional and structural groups, and wildlife habitat. Understory plants may be negatively affected by trees and shrubs by a reduction in light, soil moisture, and soil nutrients. Increases in tree and shrub density and size have the effects of reducing understory plant cover and productivity, with desirable forage grasses often being 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.

Constraints to recovery. A closed canopy cover and lack of fine fuel loads could potentially preclude recovery of the former state.

Transition 1 to 3
State 1 to 3

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.

Constraints to recovery. 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 2 to 1
State 2 to 1

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

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Grasses Dominant 63%**			2802–4237	
	big bluestem	ANGE	*Andropogon gerardii*	1121–2018	–
	eastern gamagrass	TRDA3	*Tripsacum dactyloides*	560–1681	–
	switchgrass	PAVI2	*Panicum virgatum*	504–1009	–
	Indiangrass	SONU2	*Sorghastrum nutans*	336–673	–
	prairie cordgrass	SPPE	*Spartina pectinata*	336–673	–
2	**Grasses Minor 10%**			112–673	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–50	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–50	–
	Canada wildrye	ELCA4	*Elymus canadensis*	11–50	–
	Virginia wildrye	ELVI3	*Elymus virginicus*	11–50	–
	vine mesquite	PAOB	*Panicum obtusum*	0–50	–
	western wheatgrass	PASM	*Pascopyrum smithii*	22–50	–
	Texas bluegrass	POAR	*Poa arachnifera*	6–50	–
	little bluestem	SCSC	*Schizachyrium scoparium*	22–50	–
	marsh bristlegrass	SEPA10	*Setaria parviflora*	11–50	–
	alkali sacaton	SPAI	*Sporobolus airoides*	0–50	–

	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	11–50	–
3	**Grasses Minor 5%**			0–336	
	sedge	CAREX	*Carex*	0–67	–
	flatsedge	CYPER	*Cyperus*	0–67	–
	scouringrush horsetail	EQHY	*Equisetum hyemale*	0–67	–
	mountain rush	JUARL	*Juncus arcticus ssp. littoralis*	0–67	–
	chairmaker's bulrush	SCAM6	*Schoenoplectus americanus*	0–67	–
4	**Grasses Trace 2%**			0–135	
	buffalograss	BODA2	*Bouteloua dactyloides*	0–34	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–34	–
	saltgrass	DISP	*Distichlis spicata*	0–34	–
	marsh muhly	MURA	*Muhlenbergia racemosa*	0–34	–
Forb					
5	**Forb Sub-dominant 15%**			336–1009	
	Illinois bundleflower	DEIL	*Desmanthus illinoensis*	56–135	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	56–135	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	56–135	–
	wholeleaf rosinweed	SIIN2	*Silphium integrifolium*	56–135	–
	Canada goldenrod	SOCA6	*Solidago canadensis*	11–45	–
	pitcher sage	SAAZG	*Salvia azurea var. grandiflora*	11–45	–
	hoary verbena	VEST	*Verbena stricta*	11–45	–
	sessileleaf ticktrefoil	DESE	*Desmodium sessilifolium*	11–45	–
	blue wild indigo	BAAUM	*Baptisia australis var. minor*	11–45	–
	nineanther prairie clover	DAEN	*Dalea enneandra*	11–45	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	11–45	–
	whorled milkweed	ASVE	*Asclepias verticillata*	0–11	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–11	–
	Indianhemp	APCA	*Apocynum cannabinum*	0–11	–
	showy prairie gentian	EUEXR	*Eustoma exaltatum ssp. russellianum*	0–11	–
	stenosiphon	STENO2	*Stenosiphon*	0–11	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–11	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	0–11	–
	Baldwin's ironweed	VEBA	*Vernonia baldwinii*	0–11	–
	grooved flax	LISU4	*Linum sulcatum*	0–11	–
	swamp smartweed	POHY2	*Polygonum hydropiperoides*	0–11	–
Shrub/Vine					
6	**Shrub Minor 5%**			56–336	
	false indigo bush	AMFR	*Amorpha fruticosa*	11–56	–
	willow baccharis	BASA	*Baccharis salicina*	11–56	–
	common buttonbush	CEOC2	*Cephalanthus occidentalis*	11–56	–
	eastern cottonwood	PODE3	*Populus deltoides*	11–56	–
	peachleaf willow	SAAM2	*Salix amygdaloides*	11–56	–
	black willow	SANI	*Salix nigra*	11–56	–

Animal community

The great plant diversity associated with the subirrigated site, wetland inclusions, and the fact that it frequently occurs in riparian areas makes this site excellent wildlife habitat. It is characterized by scattered willow and cottonwood trees and occasional mottes of low brush, which create a preferred habitat for white-tailed deer, wild turkey, bobwhite quail, pheasant, fox squirrel, and eastern cottontail. Furbearers such as mink, raccoon, skunk, and opossum are common, as are predators such as the bobcat, coyote, and red fox. When in good to excellent condition, the site is especially valuable as winter cover for many of these same species.

A variety of birds are common to the site and include scissortailed flycatchers, eastern and western kingbirds, brown thrasher, mourning dove, and redwinged blackbird. Hawks and owls commonly use this habitat and bald eagles are occasional visitors. Waterfowl are commonly seen during their spring and fall migrations.

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

Grazing Interpretations

Calculating Safe Stocking Rates: Proper stocking rates should be incorporated into a grazing management strategy that protects the resource, maintains or improves rangeland health, and is consistent with management objectives. In addition to usable forage, safe stocking rates should consider ecological condition, trend of the site, past grazing use history, season of use, stock density, kind and class of livestock, forage digestibility, forage nutritional value, variation of harvest efficiency based on preference of plant species, and/or grazing system, and site grazeability factors (such as steep slopes, site inaccessibility, or distance to drinking water).

Often the current plant community does not entirely match any particular Community Phase as described in this ESD. Because of this, a resource inventory is necessary to document plant composition and production. Proper interpretation of inventory data will permit the establishment of a safe initial stocking rate.

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

Initial stocking rates should be improved through the use of vegetation monitoring and actual use records that include number and type of livestock, the timing and duration of grazing, and utilization levels. Actual use records over time will assist in making stocking rate adjustments based on the variability factors.

Average annual production must be measured or estimated to properly assess useable forage production and stocking rates.

Hydrological functions

The Subirrigated site has a high water table which normally varies from 2 to 4 feet below the soil surface. Runoff potential for this site is negligible to low.

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 (also called 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 is very desirable for outdoor recreational pursuits because of its plant and wildlife diversity. Big game, white-tail deer and wild turkey are abundant and commonly hunted along with a wide variety of small game such as pheasant, quail, rabbits, squirrels, and raccoons. In addition, there are ample opportunities for bird watching, hiking, outdoor/wildlife photography, and a variety of other outdoor activities. A wide variety of plants bloom throughout the growing season and provide much aesthetic appeal to the landscape. Recreation can be a high value use, but the excessive wetness due to the prevalent high water table is a significant site consideration.

Wood products

Eastern cottonwood has been commercially harvested in some locations within the Subirrigated ecological sites.

Other products

The presence of abundant soil moisture makes this site especially vulnerable to several invasive woody plant species such as Russian olive, multiflora rose, and saltcedar on more saline soils. An extra effort should be made to eradicate any known plantings of these three species near subirrigated sites. These species have been recognized as invasive and are no longer recommended for woody plantings. Extra care should also be taken in the planning and design of any woody plantings adjacent to or near this site. Only those woody species native to the area should be considered for plantings.

Other information

Site Development and Testing Plan
This site went through the approval process.

Inventory data references

Information presented here has been derived from NRCS clipping data, numerous ocular estimates and other inventory data. Field observations from experienced range trained personnel were used extensively to develop this ecological site description.

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

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Contributors

Chris Tecklenburg

Approval

David Kraft, 9/21/2018

Acknowledgments

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Rangeland health reference sheet

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

Author(s)/participant(s)	Chris Tecklenburg revision 02/09/2018 David Kraft, John Henry, Doug Spencer, Dwayne Rice original 2/2005
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Date	02/09/2018
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

3. **Number and height of erosional pedestals or terracettes:** There is no evidence of pedestaled plants or terracettes or the site.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Less than 5% bare ground is found on this site. Cover can be defined as live plants, litter, rocks, moss, lichens, etc.

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

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

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

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Plant canopy is large enough to intercept the majority of raindrops. A soil fragment will not “melt” or lose its structure when immersed in water for 30 seconds. There is no evidence of pedestaled plants or terracettes. Soil stability scores will range from 5-6.

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

   Ap--0 to 15 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak granular structure; soft, very friable; slight effervescence; moderately alkaline; gradual smooth boundary. (10 to 20 inches thick)

   AC--15 to 24 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; few faint brown mottles in lower 2 inches; weak medium granular structure; slightly hard, very friable; slight effervescence; moderately alkaline; gradual smooth boundary. (0 to 15 inches thick)

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

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** There is no evidence of compacted soil layers due to cultural practices. Soil structure is conducive to water movement and root penetration.

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Grasses dominant 63%: big bluestem 1000-1800, eastern gamagrass 500-1500, Indiangrass 300-600, prairie cordgrass 300-600, switchgrass 450-900.

    Sub-dominant: A variety of forbs make up 15% of the plant community.

    Other: Other grasses Minor component 10%, 100-600 lbs.
    Grasses Minor 5% sedges and rushes, 0-300
    Grasses Trace 2%, 120 lbs.

    Additional: Shrubs Minor 5%, 50-300.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** The majority of plants are alive and vigorous. Some mortality and decadence is expected for the site. This in part is due to drought, unexpected wildfire or a combination of the two events. This would be expected for both dominant and sub-dominant 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):** 5,000-7,000 lbs/acre. Representative value is 6,000 lbs/forage/acre. Below normal precipitation during the growing season expect 5,000 lbs/forage/acre and above normal precipitation during the growing season expect 7,000 lbs/forage/acre. If utilization has occurred, estimate the annual production removed or expected and include this amount when making the total site production estimate.

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** None.

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