USDA Natural Resources Conservation Service

Ecological site HX074XY114
Loamy Terrace

Last updated: 10/04/2019
Accessed: 05/04/2024

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.

MLRA notes

Major Land Resource Area (MLRA): 074X–Central Kansas Sandstone Hills

Major Land Resource Area (MLRA) 74, Central Kansas Sandstone Hills, is entirely located in Kansas. It makes up about 8,365 square miles (21,675 square kilometers). The city of Salina and the towns of Concordia, Junction City, McPherson, and Newton are in this MLRA. Interstate Highways 70 and 135 meet in Salina, and Interstate 35 crosses the southern part of this area. Wilson and Kanopolis State Parks are in this area. McConnell Air Force Base is in the southern part of the area.

Following are the various kinds of land use in this MLRA: Cropland--private, 52 percent; Grassland--private, 38 percent, Federal, 2 percent; Forest--private, 3 percent; Urban development--private, 3 percent; Water--private, 1 percent; Other--private, 1 percent.

Most of MLRA 74 is in farms. More than one-half of the area is cropland. Winter wheat is the principal crop. Other small grains, grain sorghum, hay, and corn also are important crops. Some areas along the large rivers are irrigated. The crops grown in nonirrigated areas also are grown in irrigated areas, but more corn and less wheat are grown in the irrigated areas. More than one-third of the area supports native grasses grazed by cattle.

The major soil resource concerns are water erosion, maintenance of the content of organic matter and tilth of the soils, and soil moisture management. The resource concerns on pasture and rangeland are the productivity, health, and vigor of plants and the spread of noxious and invasive species.

Conservation practices on cropland generally include high-residue crops in the cropping system; systems of crop residue management, such as no-till and mulch-till; a combination of terraces and grassed waterways; contour farming; contour stripcropping; conservation crop rotations; and nutrient management. Conservation practices on rangeland generally include prescribed grazing, brush management, management of upland wildlife habitat, proper distribution of watering facilities, and control of noxious and invasive plant species.

Classification relationships

Major Land Resource Area (MLRA): 074X–Central Kansas Sandstone Hills

Ecological site concept

The Loamy Terrace ecological site is made up of alluvial soils which occur on risers and treads of stream terraces in river valleys. This site has very deep soils with silt loam to silty clay loam surface texture. The slopes range from 0 to 7 percent.

Associated sites

HX074XY115	**Loamy Hills** The Loamy Hills ecological site sits adjacent to and in conjunction with the Loamy Terrace ecological site. This site is made up of moderately deep to deep, moderately well to well drained upland soils. This site has a fine-silty and loamy surface texture and is noncalcareous to the surface. Generally, the Loamy Hills ecological site is located on uplands with a slope range of 0 to 16 percent.
HX074XY113	**Loamy Floodplain** The Loamy Floodplain ecological site sits adjacent to and in conjunction with the Loamy Terrace ecological site. The Loamy Floodplain ecological site was formerly known as Loamy Upland R074XY013KS. This site is made up of alluvial soils which occur on the floodplains of drainageways or river valleys. The Loamy Floodplain site has very deep soils with loamy to silty surface and subsurfaces. This site is occasionally or frequently flooded.

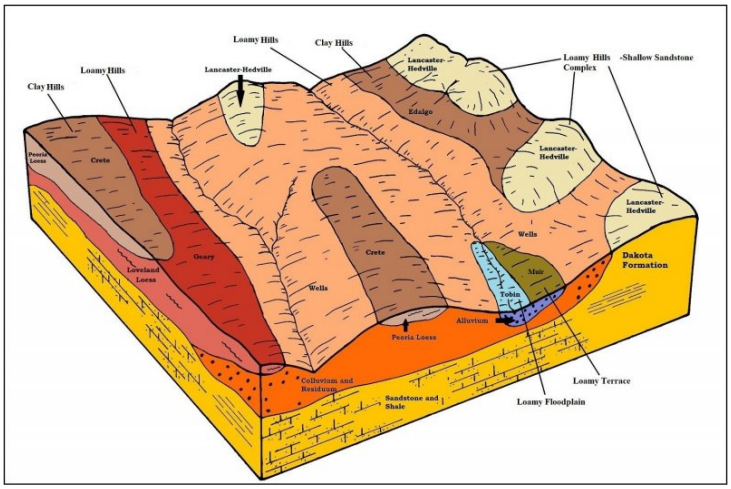


Figure 1. MLRA 74 ESD block diagram.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Andropogon gerardii* (2) *Schizachyrium scoparium*

Legacy ID

R074XY114KS

Physiographic features

The northwest half of MLRA 74 is in the Plains Border Section of the Great Plains Province of the Interior Plains. The northeast corner is in the Dissected Till Plains Section of the Central Lowland Province of the Interior Plains, and the rest of the area is in the Osage Plains Section of the same province and division. This area is an undulating to hilly dissected plain. Wide flood plains and terraces are along the larger rivers, and narrow bottom land is along the small streams. The elevation ranges from 1,310 to 1,640 feet (400 to 500 meters), increasing from east to west. Local relief is typically 65 to 130 feet (20 to 40 meters).

The extent of the major Hydrologic Unit Areas (identified by four-digit numbers) that make up this MLRA is as follows: Smoky Hill (1026), 47 percent; Middle Arkansas (1103), 22 percent; Kansas (1027), 11 percent; Republican (1025), 10 percent; and Neosho-Verdigris (1107), 10 percent. The Little Arkansas River forms the southwestern border of this area. From north to south, other rivers that cross the area include the Little Blue, Big Blue, Republican, Solomon, Salt, Saline, Cottonwood, Walnut, and Arkansas Rivers. The Solomon and Saline Rivers join the Smoky Hill River just south of Salina.

The Loamy Terrace ecological site is found on nearly level or gently sloping alluvial risers and treads of stream terraces. The site flooding frequency is none to rare. The Loamy Terrace site does receive some additional water in

the form of run-in from adjacent uplands.

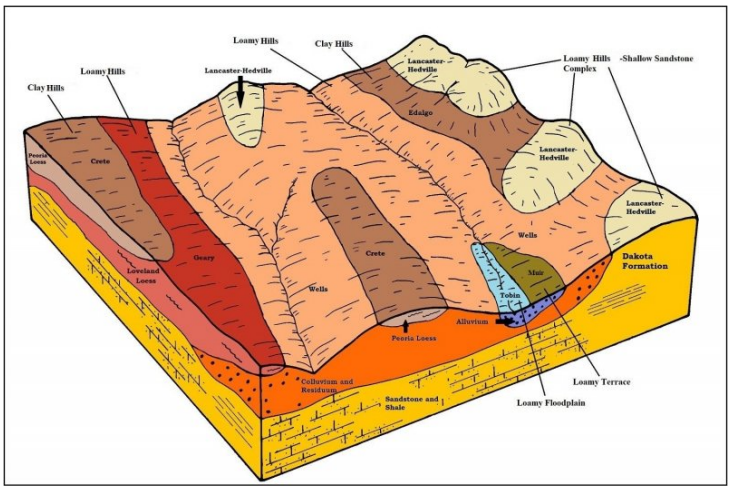


Figure 2. MLRA 74 ESD block diagram.

Table 2. Representative physiographic features

Geomorphic position, terraces	(1) Riser (2) Tread
Landforms	(1) River valley > Terrace
Runoff class	Low to high
Flooding duration	Very brief (4 to 48 hours)
Flooding frequency	None to rare
Ponding frequency	None
Elevation	300–600 m
Slope	0–7%
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation in MLRA 74 is 27 to 34 inches (680 to 860 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 averages 20 inches (50 centimeters). The average annual temperature is 54 to 57 degrees F (12 to 14 degrees C). The freeze-free period averages 185 days. 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 from this narrative and from the tables below derives from the Natural Resources Conservation Service (NRCS) National Water and Climate Center. The dataset is from 1981-2010. The climate data from the geographical extent of the ecological site could be different from the MLRA 74 data. The following climate stations listed are used to calculate the data for this ecological site.

Table 3. Representative climatic features

Frost-free period (characteristic range)	145-154 days
Freeze-free period (characteristic range)	178-189 days
Precipitation total (characteristic range)	737-787 mm
Frost-free period (actual range)	140-157 days
Freeze-free period (actual range)	172-191 days

Precipitation total (actual range)	711-838 mm
Frost-free period (average)	149 days
Freeze-free period (average)	183 days
Precipitation total (average)	762 mm

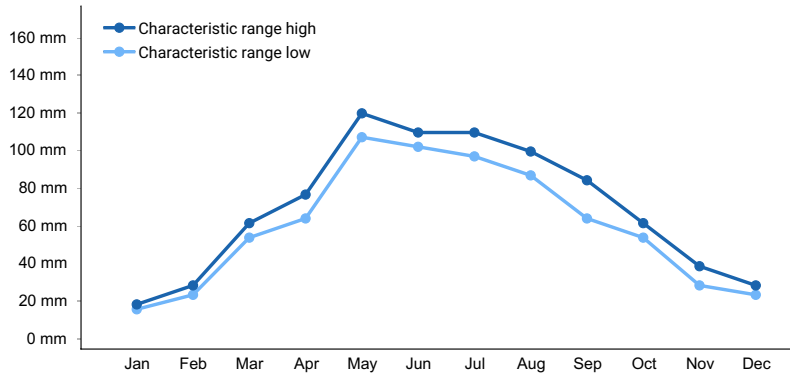


Figure 3. Monthly precipitation range

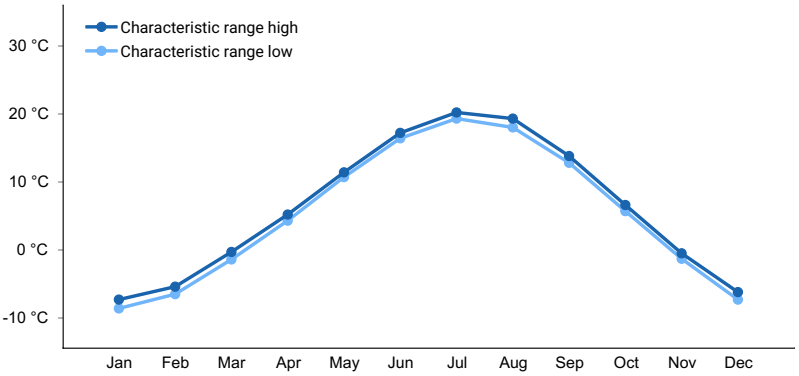


Figure 4. Monthly minimum temperature range

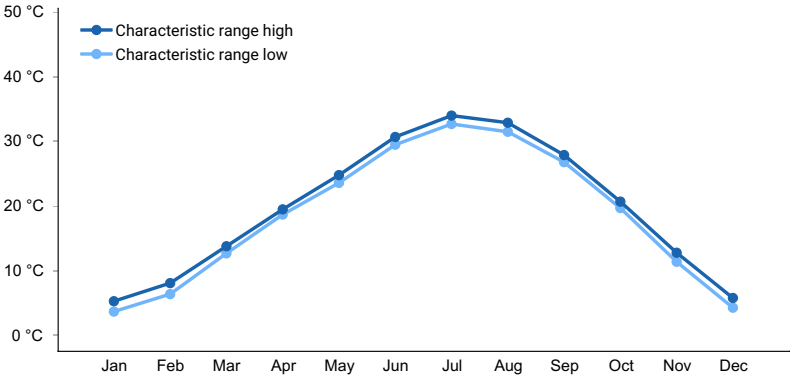


Figure 5. Monthly maximum temperature range

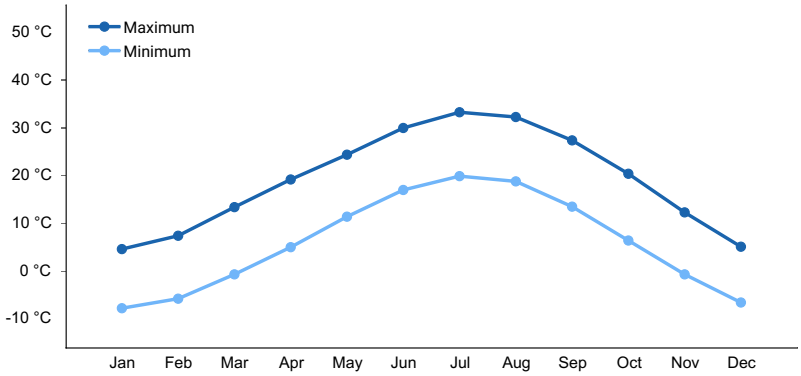


Figure 6. Monthly average minimum and maximum temperature

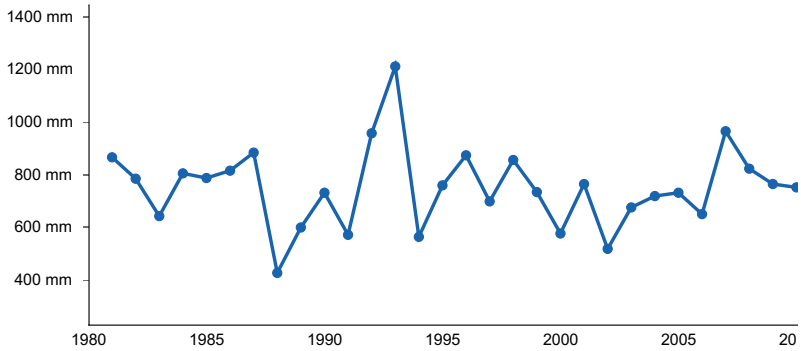


Figure 7. Annual precipitation pattern

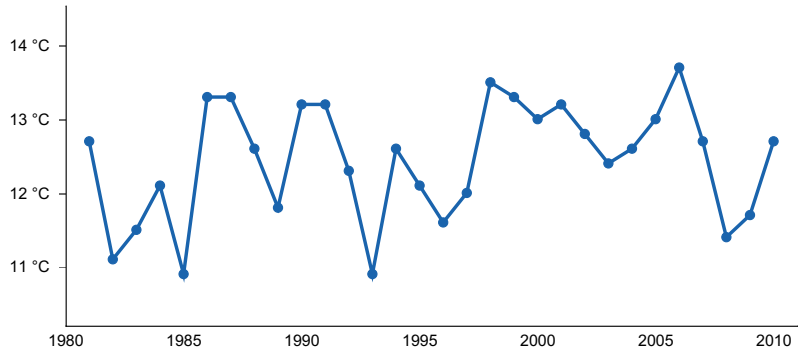


Figure 8. Annual average temperature pattern

Climate stations used

- (1) WASHINGTON [USC00148578], Washington, KS
- (2) BELLEVILLE [USC00140682], Belleville, KS
- (3) CONCORDIA MUNI AP [USW00013984], Concordia, KS
- (4) CONCORDIA 1 W [USC00141761], Concordia, KS
- (5) BELOIT [USC00140693], Beloit, KS
- (6) CLAY CTR [USC00141559], Clay Center, KS
- (7) ABILENE [USC00140010], Abilene, KS
- (8) MINNEAPOLIS [USC00145363], Minneapolis, KS
- (9) SALINA MUNI AP [USW00003919], Salina, KS
- (10) SMOLAN 1NE [USC00147551], Lindsborg, KS
- (11) KANOPOLIS LAKE [USC00144178], Ellsworth, KS
- (12) ELLSWORTH [USC00142459], Ellsworth, KS

Influencing water features

The soils representing the Loamy Terrace ecological site are rarely flooded. These soils are moderately well to well drained with a high available water capacity. Permeability of these soils is slow to moderate. The water table is

below the root zone of most range plants.

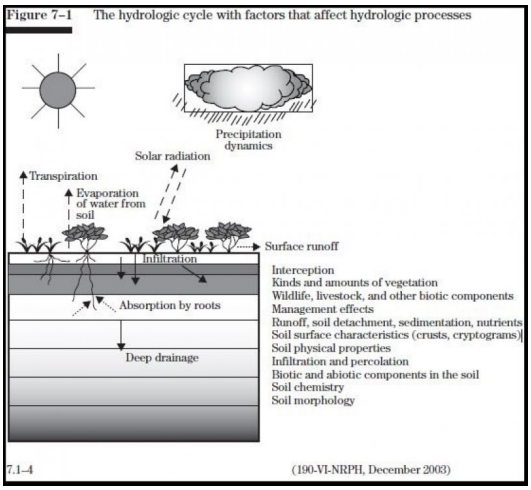


Figure 9. Fig. 7-1 from the National Range and Pasture Handbook.

Soil features

Major soils that characterize this site are Cozad, Detriot, and Muir. They are very deep, moderately well to well drained soils that formed in alluvium on stream terraces. The surface texture ranges from silt loam to silty clay loam. These soils generally have a low hazard of erosion. The frequency of flooding ranges from none to rare.

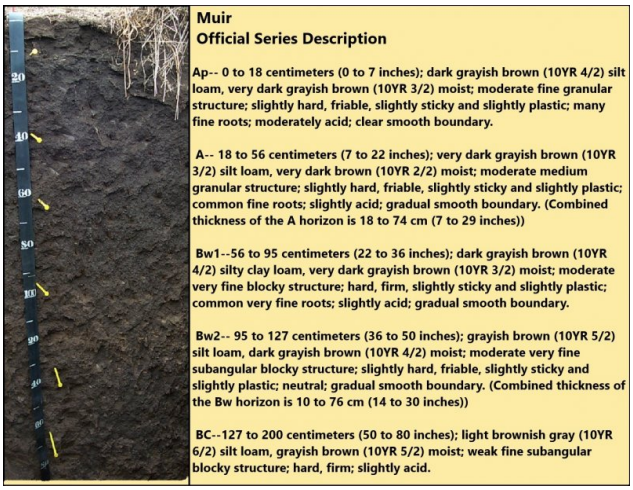


Figure 10. Muir typical soil profile and description. Photo taken in Clay County, Kansas.

Table 4. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Silt loam (2) Silty clay loam
Family particle size	(1) Fine-silty (2) Fine (3) Coarse-silty
Drainage class	Moderately well drained to well drained
Permeability class	Moderately slow to moderate
Soil depth	203 cm
Available water capacity (0-101.6cm)	14.99–23.37 cm

Calcium carbonate equivalent (0-101.6cm)	0–10%
Soil reaction (1:1 water) (0-101.6cm)	5.6–8.4

Ecological dynamics

The Loamy Terrace ecological site is a transitional area between the loamy floodplain of the valley floor below and the adjacent loamy hills above. A dynamic plant community evolved on the rarely flooded, deep, fertile soils lying on these terraces. Plants developed under diverse, fluctuating climatic conditions, were grazed by herds of large herbivores, and were periodically burned by intense wildfires. Plant life that evolved and dominated the original plant community was well adapted to these climatic, soil, and biological conditions.

The deep, fertile soils representative of this site have loamy or silty surfaces and sometimes receive extra moisture from adjacent upland slopes. The water table is not within reach of most range plants. These soils generally occur along the perimeter of nearby floodplains, usually adjacent to rivers or streams. A large percentage of this site is found along the major drainageways of this area including the Smoky Hill, Saline, Solomon, and Republican Rivers and their tributaries. The site may also occur along smaller drainageways on upland locations. The soil-plant moisture relationship is good and the site is potentially very productive.

The plant community developed with occasional fires as an important part of 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. Because all of the dominant tallgrasses were rhizomatous, they were able to survive even intense wildfires, thus gaining a competitive advantage in the plant community. By contrast, trees and shrubs were suppressed by fire over most of the site.

Grazing history had a major impact on the dynamics of the site. The vegetative community developed under a grazing regime that primarily consisted 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 moved to adjoining areas, the vegetation was afforded a period of recovery. This grazing system was altered during extended drought periods. Because of the proximity to streams, grazing animals utilized the site more intensively than during normal periods. Other grazing and feeding animals such as elk, deer, rabbits, rodents, and insects had secondary influences on the development of the plant community.

Variations in climate alone had only minor impacts on the plant community. Although fluctuations in precipitation directly influenced site productivity from year to year, plant community composition usually remained stable. Because available water capacity was high, the deeply-rooted tallgrasses benefited from moisture stored throughout the soil profile and, in some cases, from seasonally fluctuating water tables.

Flooding following intense thunderstorms was rare and periods of inundation only temporarily affected the dominant plant community. All major plants had rhizomes which facilitated their survival in the case of heavy storm runoff or flood events.

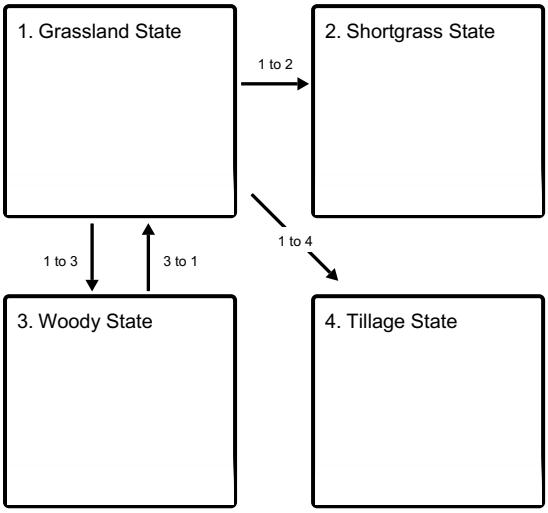
As utilization of the area for production of domestic livestock replaced roaming herds of bison, the ecological dynamics of the site were altered. Often the plant community changed from its original composition. Fencing enabled continuous grazing and, in many areas, this led to overgrazing and substantial changes in the vegetation. Alterations in the plant community were usually in proportion to the season and intensity of grazing. As taller grasses and forbs palatable to bison were equally relished and selected by cattle and other domestic livestock, repeated overgrazing weakened and gradually reduced their size and numbers. They were replaced by 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 their role in maintaining the plant community 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. In the absence of fire, there often was a rapid increase of shrub and tree species. In some locations these have spread to the point where 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



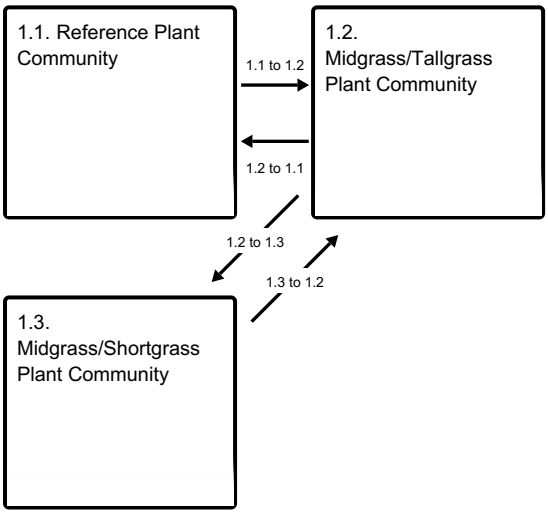
1 to 2 - Long-term heavy, continuous overgrazing, no rest and recovery

1 to 3 - Lack of fire and brush control

1 to 4 - Tillage by machinery

3 to 1 - Prescribed grazing, brush management, and prescribed burning

State 1 submodel, plant communities



1.1 to 1.2 - Continuous grazing without adequate rest and recovery

1.2 to 1.1 - Prescribed grazing that incorporates periods of deferment during the growing season

1.2 to 1.3 - Long-term (>20 years) continuous grazing with no rest and no recovery

1.3 to 1.2 - Prescribed grazing with adequate rest and recovery period during the growing season

State 2 submodel, plant communities

2.1. Shortgrass Plant Community

State 3 submodel, plant communities

3.1. Shrubs and/or Trees

State 4 submodel, plant communities

4.1. Reseed Community

4.2. Go-back Plant Community

State 1
Grassland State

The Grassland State defines the ecological potential and natural range of variability resulting from the natural disturbance regime of the Loamy Terrace ecological site. This state is supported by empirical data, historical data, local expertise, and photographs. It is defined by a suite of native plant communities that are a result of periodic fire, drought, and grazing. These events are part of the natural disturbance regime and climatic process. The Reference Plant Community consists of warm-season tall- and midgrasses, cool-season and sod-forming grasses, forbs, and shrubs. The Midgrass/Tallgrass 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/Shortgrass Plant Community is dominated by midgrasses, shortgrasses, and cool-season midgrasses.

Characteristics and indicators. Tallgrasses and midgrasses are dominant in the Grassland State.

Resilience management. Management strategies that will sustain this state include monitoring key forage species and providing a forage and animal balance.

Community 1.1
Reference Plant Community

Figure 11. Reference Plant Community in MLRA 74.

The interpretive plant community for this site is the Reference Plant Community. It represents the original plant community that existed prior to European settlement. The site is characterized as a grassland with only occasional trees and shrubs. It is dominated by warm-season tallgrasses including big bluestem, Indiangrass, switchgrass, and eastern gamagrass. All of these grasses and most of the dominant forbs have extensive rhizomes. These underground stems often form a dense, intertwined mass throughout the upper four or five inches of the soil profile. Combined these tallgrasses—along with the major midgrass little bluestem—will account for about 70 percent of the total vegetation produced annually. Other prevalent midgrasses and grass-like plants are sideoats grama, blue grama, buffalograss, western wheatgrass, composite dropseed, and several species of sedges. Only a trace amount of prairie cordgrass is present. The Loamy Terrace ecological site supports a wide variety of legume species interspersed throughout the grass sward. The most abundant are slimflower scurfpea, Nuttall's sensitive-briar, prairie bundleflower, and American licorice. Other important forbs include compassplant, white heath aster, dotted blazing star, pitcher sage, upright prairie coneflower, and Cuman ragweed. American plum, coralberry, and pricklypear may occur in scattered clumps on this site. This is a stable plant community when adequately managed. A prescribed grazing program that incorporates periods of deferment during the growing season benefits the tallgrasses and more palatable forbs. Soils are susceptible to excessive grazing and livestock trailing, which can quickly impact on the soil stability and lead to sheet and gully erosion. Long-term grazing can lead to the reduction of tallgrasses and palatable forbs. 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 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 5 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 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).

Resilience management. This is a stable plant community when adequately managed. A prescribed grazing program that incorporates periods of deferment during the growing season benefits the tall-grasses and even the more palatable forb species. Soils are susceptible to excessive grazing and livestock trailing which can quickly impact soil stability and lead to sheet and gully erosion. Long-term heavy, continuous grazing can lead to the reduction of the tall-grasses and palatable forbs on terraces as livestock often concentrate there.

Dominant plant species

- big bluestem (*Andropogon gerardii*), grass
- Indiangrass (*Sorghastrum nutans*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- switchgrass (*Panicum virgatum*), grass

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	3127	4691	6776
Forb	168	252	364
Shrub/Vine	67	101	146
Total	**3362**	**5044**	**7286**

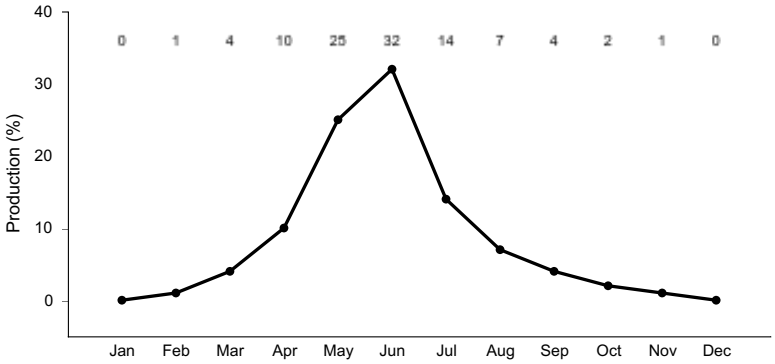


Figure 13. Plant community growth curve (percent production by month). KS7409, Reference Plant Community. Growth of warm-season grasses on this site typically begins during the period of May 1 to May 15 and continues until mid-September. As a general rule, 75 percent of total production is completed by mid-July. This varies only slightly from year to year depending on temperature and precipitation patterns. There are exceptions as big bluestem, eastern gamagrass, and prairie cordgrass will occasionally initiate spring growth as early as April 5 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 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)..

Community 1.2
Midgrass/Tallgrass Plant Community

Composition of this plant community is dominated by a mixture of tallgrasses and midgrasses. Compared with the Reference Plant Community, there has been a decrease in the more palatable tallgrasses and forbs and a subsequent increase in midgrasses. Although reduced by overgrazing, tallgrasses such as big bluestem, Indiangrass, and switchgrass remain dominant. The increased proportion of midgrasses include composite dropseed, little bluestem, western wheatgrass, and sideoats grama. Other secondary grasses that have increased are Texas bluegrass, Kentucky bluegrass, blue grama, and plains muhly. Combined, these plants now comprise 30 to 40 percent of the total herbage produced annually. Forbs such as Maximilian sunflower, wholeleaf rosinweed, compassplant, and prairie bundleflower have decreased and largely been replaced by white heath aster, white sagebrush, Cuman ragweed, Baldwin's ironweed, and Canada goldenrod. Forbs produce 10 to 20 percent of the total herbage. In some locations the Loamy Terrace ecological site supports an increasing amount of shrubs and trees. The common shrubs are American plum, roughleaf dogwood, smooth sumac, and coralberry. Common hackberry, American elm, Siberian elm, Osage-orange, and eastern redcedar are the major tree species that can be found invading the site. Shrubs and trees together can comprise 5 to 10 percent of the total production. Periodic rest and recovery from grazing pressure is necessary to maintain 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 vigor. When continued for many years, overgrazing results in a gradual reduction in their abundance. However, prescribed grazing that incorporates periods of rest and recovery during the growing season will improve the vigor and gradual recovery of the more palatable tallgrasses and forbs.

Resilience management. The plant community is relatively stable with moderate grazing unless adversely affected by drought or other major stress factors. With heavy, continuous overgrazing it can deteriorate to a Midgrass/Shortgrass community over a period of many years. However, with a significant component of tallgrass

remnants it can also be restored to near the Reference Plant Community in a few years by moderate grazing with use of timely rest periods during the growing season.

Dominant plant species

- little bluestem (*Schizachyrium scoparium*), grass
- sideoats grama (*Bouteloua curtipendula*), grass
- composite dropseed (*Sporobolus compositus var. compositus*), grass

Community 1.3
Midgrass/Shortgrass Plant Community

This plant community results from many years of overgrazing. The amount of tallgrasses has decreased significantly and the site is dominated by midgrasses and shortgrasses. Major midgrasses are little bluestem, composite dropseed, sideoats grama, and western wheatgrass. Shortgrasses include Kentucky bluegrass, Texas bluegrass, smooth bromegrass, buffalograss, and blue grama. Major forbs on the site are Cuman ragweed, Canada goldenrod, Missouri goldenrod, white sagebrush, white heath aster, and annual ragweed. In some locations the site supports an increasing amount of shrubs and trees. The most common shrubs are American plum, roughleaf dogwood, smooth sumac, and coralberry. American elm, eastern redcedar, and Osage-orange are the major trees found on the site. Shrubs and trees combined usually will not comprise over 10 percent of the total production. 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 a few years.

Resilience management. Remnant plants of big bluestem, Indiangrass, and switchgrass are commonly found only in protected locations. These plants are usually grazed repeatedly and remain in a low state of vigor. Of these remnants, big bluestem is generally the most abundant. It has rhizomes that can persist for many years in a weakened condition. When in this state of vigor, new growth consisting of three to five leaves will emerge in a prostrate position rather than upright. This allows the plants to partially escape grazing. These remnant plants respond favorably to periods of rest from grazing and may regain vigor in two to three years. However, if their numbers or percentage of composition is greatly reduced, it may take many years to regain a large role in the plant community. 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.

Dominant plant species

- little bluestem (*Schizachyrium scoparium*), grass
- composite dropseed (*Sporobolus compositus var. compositus*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- blue grama (*Bouteloua gracilis*), grass
- buffalograss (*Bouteloua dactyloides*), grass

Pathway 1.1 to 1.2
Community 1.1 to 1.2

These mechanisms include management controlled by repetitive heavy use, no rest or recovery of the key forage species, and no forage and animal balance for many extended grazing seasons. This type of management lasting for periods greater than 10 years will shift functional and structural plant group dominance toward a midgrass plant community.

Context dependence. Plant community composition shifts from tallgrass to midgrass dominant.

Pathway 1.2 to 1.1
Community 1.2 to 1.1

Causes of plant community shift include management (10-15 years) with adequate rest and recovery of the key forage species (big bluestem, switchgrass, Indiangrass, and little bluestem) within the Reference Plant Community .

If woody species are present, prescription fires every 6-8 years will be necessary for their removal and maintenance.

Conservation practices

Prescribed Burning
Prescribed Grazing

Pathway 1.2 to 1.3
Community 1.2 to 1.3

These mechanisms include management controlled by repetitive heavy use, no rest or recovery of the key forage species, and no forage and animal balance for many extended grazing seasons. This type of management lasting for periods greater than 20 years will shift functional and structural plant group dominance towards a Midgrass/Shortgrass Plant Community.

Pathway 1.3 to 1.2
Community 1.3 to 1.2

Causes of plant community shift include management (10-15 years) with adequate rest and recovery of the key forage species (little bluestem, sideoats grama, big bluestem, switchgrass, and Indiangrass) within the Midgrass/Tallgrass Plant Community. If woody species are present, prescription fires every 6-8 years will be necessary for their removal and maintenance.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Shortgrass State

With heavy, continuous grazing, blue grama and buffalograss will become the dominant species and have a sod-bound appearance. Unable to withstand the grazing pressure, only a remnant population of western wheatgrass remains.

Characteristics and indicators. The Shortgrass State is characterized with specific dynamic soil property changes. Changes between the Grassland State and the Shortgrass State has been documented. As plant community cover decreases from bunchgrasses to more of the sod grasses there is a decrease in infiltration and interception and an increase in surface runoff (Thurow, T., 2003).

Resilience management. This is a resistant and resilient state. Grazing management practice should include a forage and animal balance.

Dominant plant species

- blue grama (*Bouteloua gracilis*), grass
- buffalograss (*Bouteloua dactyloides*), grass

Community 2.1
Shortgrass Plant Community

Figure 14. MLRA 74 Shortgrass Plant Community.

This plant community is dominated by a mixture of shortgrasses and occurs after many years of continuous overgrazing. Usually pastures are small and associated with farming enterprises. In the past they were often used as holding areas in anticipation of seasonal wheat pasture or other cropland forages. Dominant grasses are blue grama, buffalograss, Carolina crabgrass, sideoats grama, composite dropseed, and western wheatgrass. Annual grasses including, Japanese brome, cheatgrass, little barley, tumblegrass, prairie threeawn, purple threeawn, and fall panicgrass are common during seasons of normal or above-normal precipitation. Major forbs are Cuman ragweed, Missouri goldenrod, crested pricklypoppy, hoary verbena, prairie broomweed, Baldwin's ironweed, and white sagebrush. A number of thistles both native and introduced are common in this plant community and may include such varieties as wavyleaf, yellowspine, tall, Canada, bull, and nodding pumeless thistles. Common shrubs found are American plum, smooth sumac, roughleaf dogwood, and coralberry. Areas that have experienced a major disturbance will generally support a large number of annual forbs. These may include snow on the mountain, cocklebur, annual ragweed, and common sunflower. Although productivity is significantly reduced when compared to the Reference Plant Community, this plant community can be managed as a stable shortgrass plant community. Restoration to a tallgrass plant community is not well documented. Further research and observations are necessary in order to understand restoration potential.

Resilience management. This is a resistant and resilient state. Grazing management practice should include a forage and animal balance.

Dominant plant species

- buffalograss (*Bouteloua dactyloides*), grass
- blue grama (*Bouteloua gracilis*), grass

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 will hinder the establishment of most woody species and favor forbs and grasses. However, it should be pointed out that not all unburned areas have a woody plant invasion. Birds, small mammals, and livestock are instrumental in the distribution of seed and accelerating the spread of most trees and shrubs common to this site. The speed of encroachment varies considerably and can occur on both grazed and non-grazed pastures. Many species of wildlife, especially bobwhite quail, turkey, and white-tailed deer, benefit from the growth of trees and shrubs for both food and cover. When management for specific wildlife populations is desirable, these options should be considered in any brush management plan.

Characteristics and indicators. Hydrologic function is affected by the amount of vegetative cover. Canopy interception loss can vary from 25.4 percent to 36.7 percent (Thurow and Hester, 1997). A small rainfall event is usually retained in the foliage and does not reach the litter layer at the base of the tree. Only when canopy storage is reached and exceeded does precipitation fall to the soil surface. Interception losses associated with the accumulation of leaves, twigs, and branches at the bases of trees are considerably higher than losses associated

with the canopy. The decomposed material retains approximately 40 percent of the water that is not retained in the canopy (Thurow and Hester, 1997). Soil properties affected include biological activity, infiltration rates, and soil fertility.

Resilience management. 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.

Community 3.1
Shrubs and/or Trees

This plant community is dominated by shrubs consisting primarily of American plum, coralberry, fragrant sumac, roughleaf dogwood, and smooth sumac. Trees including American elm, common hackberry, Osage-orange, Siberian elm, and eastern redcedar have invaded and become established in some areas. American plum, coralberry, roughleaf dogwood, and smooth sumac are generally the most abundant shrubs and often form low, dense thickets throughout the site. Shrubs and trees may produce 40 to 60 percent of the total vegetation. The spread of shrubs and trees results from the absence of fire. Periodic burning tends to hinder the establishment of most of these woody species and favor grasses and forbs. Not all unburned areas have a woody plant problem, however. The speed of woody encroachment varies considerably depending upon seed availability in surrounding areas. Numerous birds are instrumental in the distribution of seed and accelerating the spread of shrub and tree species over the site. Woody encroachment may also occur on areas subjected to longtime continuous overgrazing. In these situations the associated grasses will usually consist of composite dropseed, purple lovegrass, Kentucky bluegrass, smooth bromegrass, and Scribner’s rosette grass. Shrubs also will invade and spread on areas where both grazing and fire have been excluded for many years. Heavy accumulation of plant mulch and litter retards herbage growth and provides a favorable habitat for seed germination and establishment of many woody species. The associated grasses in this situation are usually big bluestem, little bluestem, Indiangrass, switchgrass, and a few sedges. Competition from forbs and woody species significantly reduces grass production which accounts for only 40 to 50 percent of total vegetative production. Forbs often produce up to 15 to 20 percent of the total and include white sagebrush, Cuman ragweed, Baldwin ironweed, and common yarrow. In this plant community, the amount of available forage is heavily dependent upon the predominant woody species and the kind(s) of livestock and wildlife utilizing the site. Usually a prescribed burning program accompanied by prescribed grazing will gradually return the plant community to one dominated by grasses and forbs. Longer periods will be needed where tall and midgrasses have been greatly reduced or eliminated. Special planning will be necessary to assure that sufficient amounts of fine fuel are available to carry fires with enough intensity to control woody species. Use of labeled herbicides as a brush management tool will usually be necessary to reduce populations of fire resistant species like Osage-orange and accelerate the recovery of the desired vegetative cover. Many species of wildlife, especially northern bobwhite quail and white-tailed deer, benefit from the growth of shrubs for both food and as cover. When wildlife populations are a desirable component, this should be considered in any brush management plan.

Resilience management. The shrub and tree plant community is sustained by the absence of fire and brush control.

Dominant plant species

- American elm (*Ulmus americana*), tree
- common hackberry (*Celtis occidentalis*), tree
- Osage-orange (*Maclura pomifera*), tree
- Siberian elm (*Ulmus pumila*), tree
- eastern redcedar (*Juniperus virginiana*), tree
- American plum (*Prunus americana*), shrub
- coralberry (*Symphoricarpos orbiculatus*), shrub
- roughleaf dogwood (*Cornus drummondii*), shrub
- fragrant sumac (*Rhus aromatica*), shrub
- smooth sumac (*Rhus glabra*), shrub

State 4
Tillage State

Extensive areas of the historic Loamy Terrace plant communities were plowed and converted to production of cultivated crops by the early European settlers and subsequent generations. In addition to destroying the original plant community, repeated tillage commonly resulted in major changes in soil conditions. Reductions in organic matter, mineral levels, soil structure, oxygen levels, and water-holding capacity, along with increased runoff/erosion and shifts in the populations of soil-dwelling organisms, were common on these sites. The extent of these changes depended upon duration of cropping as well as crops grown and other management practices. The Tillage State consists of abandoned cropland that has been naturally revegetated (go-back) or planted or 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).

Characteristics and indicators. This is an alternative state because 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. The Tillage State is a result of a land use management decision.

Community 4.1
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, 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 seed of additional plants such as eastern gamagrass, prairie bundleflower, and Maximilian sunflower were included in the mixture. When reseeded areas and areas supporting native rangeland exist in the same pasture, they seldom are grazed 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 productive when managed for hay production. Some seeded areas are invaded by trees and shrubs during the establishment period of the desired plants. These invader species commonly include Siberian elm, common hackberry, eastern redcedar, and roughleaf dogwood. Occasional burning is effective in controlling the establishment of these woody plants.

Resilience management. Following termination of cultivation, total annual production is quite variable and full recovery of the original plant community, including forbs and legumes, may take many decades. Additions of organic matter and minerals, deferred grazing, prescribed burning, and related management practices described for this ecological site can be beneficial to the rehabilitation.

Community 4.2
Go-back Plant Community

This plant community occurs on areas that were formerly farmed. When tillage operations were discontinued, the areas were allowed to revegetate or “go back” naturally. This was in contrast to artificial reseeding with a selected species or group of species. Go-back is a slow, gradual process that entails 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, Canadian horseweed, common sunflower, field horsetail, and golden tickseed. Gradually these are replaced by annual grasses including prairie threeawn, prairie cupgrass, little barley, Japanese brome, and cheatgrass. Usually plant succession will progress until the plant community is dominated by perennial grasses and grass-like plants including composite dropseed, foxtail barley, silver beardgrass, buffalograss, and Torrey’s rush. These plants can form a stable community. In time and 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 species include Siberian elm, common hackberry, eastern redcedar, and roughleaf dogwood. Occasional burning is effective in controlling these woody plants.

Resilience management. Following termination of cultivation, total annual production is quite variable and full recovery of the original plant community, including forbs and legumes, may take many decades. Additions of organic matter and minerals, deferred grazing, prescribed burning, and related management practices described earlier for this ecological site can be beneficial to the rehabilitation.

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.

Constraints to recovery. The ecological processes affected are the hydrologic and nutrient cycles. There are increases in evaporation rate, runoff, and bulk density. There is a decrease in infiltration, a change in plant composition, and the functional and structural groups have changed dominance. These are all examples of the soil and vegetation properties that have compromised the resilience of the Grassland State and therefore transitioned to a Shortgrass State.

Transition 1 to 3
State 1 to 3

Changes from a Grassland State to a Woody State lead to changes in hydrologic function, forage production, dominant functional and structural groups, and wildlife habitat. Understory plants may be negatively affected by trees and shrubs by reductions in light, soil moisture, and soil nutrients. Increases in tree and shrub density and size have the effects of reducing understory plant cover and productivity, and desirable forage grasses often are most severely reduced (Eddleman, 1983). As vegetation cover changes from grasses to trees, a greater proportion of precipitation is lost through interception and evaporation; therefore, less precipitation is available for producing herbaceous forage or for deep drainage or runoff (Thurow and Hester, 1997).

Constraints to recovery. Recovery is possible through management.

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.

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 3 to 1
State 3 to 1

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

many years after the tree has been cut. It also explains why runoff will not necessarily dramatically increase once juniper is removed. Rather, the water continues to infiltrate at high rates into soils previously ameliorated by junipers, thereby increasing deep drainage potential. In rangeland, deep drainage amounts can be 16 percent of the total rainfall amount per year (Thurow and Hester, 1997).

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tallgrass dominant 48%**			1793–2421	
	big bluestem	ANGE	*Andropogon gerardii*	1009–1681	–
	Indiangrass	SONU2	*Sorghastrum nutans*	336–757	–
	switchgrass	PAVI2	*Panicum virgatum*	280–504	–
	eastern gamagrass	TRDA3	*Tripsacum dactyloides*	56–196	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	22–112	–
	prairie cordgrass	SPPE	*Spartina pectinata*	0–101	–
2	**Midgrass subdominant 25%**			560–1261	
	little bluestem	SCSC	*Schizachyrium scoparium*	336–757	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	168–504	–
3	**Shortgrass minor 10%**			135–504	
	blue grama	BOGR2	*Bouteloua gracilis*	56–168	–
	buffalograss	BODA2	*Bouteloua dactyloides*	56–168	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	56–168	–
4	**Cool-season grass minor 10%**			224–504	
	western wheatgrass	PASM	*Pascopyrum smithii*	56–168	–
	Canada wildrye	ELCA4	*Elymus canadensis*	56–168	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	56–168	–
	sedge	CAREX	*Carex*	56–168	–
Forb					
5	**Forbs minor 5%**			106–252	
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	11–56	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	17–50	–
	compassplant	SILA3	*Silphium laciniatum*	11–34	–
	blue wild indigo	BAAUM	*Baptisia australis var. minor*	11–34	–
	purple prairie clover	DAPUP	*Dalea purpurea var. purpurea*	6–22	–
	Illinois bundleflower	DEIL	*Desmanthus illinoensis*	6–22	–
	dotted blazing star	LIPU	*Liatris punctata*	6–22	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	6–22	–

	pitcher sage	SAAZG	*Salvia azurea var. grandiflora*	6–22	–
	Baldwin's ironweed	VEBA	*Vernonia baldwinii*	6–22	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	6–22	–
	white heath aster	SYER	*Symphyotrichum ericoides*	6–17	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–17	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–17	–
	roundhead lespedeza	LECA8	*Lespedeza capitata*	6–17	–
	false gaura	STLI2	*Stenosiphon linifolius*	6–17	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–17	–
	aromatic aster	SYOB	*Symphyotrichum oblongifolium*	0–11	–
	velvety goldenrod	SOMO	*Solidago mollis*	0–11	–
	yellow sundrops	CASE12	*Calylophus serrulatus*	0–11	–
	bluejacket	TROH	*Tradescantia ohiensis*	0–11	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–11	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0–11	–
	western daisy fleabane	ERBE2	*Erigeron bellidiastrum*	0–11	–
Shrub/Vine					
6	**Shrubs and Cacti trace 2%**			0–101	
	pricklypear	OPUNT	*Opuntia*	0–34	–
	American plum	PRAM	*Prunus americana*	0–34	–
	coralberry	SYOR	*Symphoricarpos orbiculatus*	0–34	–

Animal community

Wildlife

Because of the great variety of forbs and grasses found on the Loamy Terrace ecological site, it provides excellent habitat for ground nesting birds including both the eastern and western meadowlark, the dickcissel, and grasshopper sparrow. Small rodents such as the deer mouse and prairie vole are abundant, and other small furbearers when the site is in good to excellent condition. Reptiles including various snakes, lizards, and the box turtle are commonly found on this site. Hawks and owls, along with furbearers such as coyotes and badgers, are common predators on this site.

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

Some animals are important because of their threatened and endangered status and require special consideration. Please check the Kansas Department of Wildlife and Parks and Tourism (KDWPT) 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 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

Following are the estimated withdrawals of freshwater by use in MLRA 74:
Public supply—surface water, 6.6%; ground water, 5.7%; Livestock—surface water, 0.3%; ground water, 4.2%; Irrigation—surface water, 70.7%; ground water, 0.5%; Other—surface water, 12.0%; ground water, 0.0%.

The total withdrawals average 210 million gallons per day (795 million liters per day). About 10 percent is from ground water sources, and 90 percent is from surface water sources. If moisture is carefully conserved, the moderate precipitation generally is adequate for crops and pasture. The surface water is generally suitable for most uses with appropriate treatment. Water is stored in reservoirs outside this area for public supply, industry, and irrigation within this area. Some in-stream diversions also are used.

Recreational uses

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

Wood products

Osage-orange (hedge) are often selected and harvested for fenceposts.

Other products

American plums are often harvested locally for use in making jellies and jams.

With the resurgence in traditional archery, Osage-orange is often prized for “billets” used by bowyers in making traditional longbows and recurved bows.

Other information

This is a good site, up out of the bottoms, for locating salt and oilers to benefit grazing distribution. Rare flooding is a hazard for development, but facilities such as working pens might be a consideration.

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.

Range Condition Guides and Technical Range Site Descriptions for Kansas, Loamy Terrace, USDA, Soil Conservation Service, March, 1967.

Range Site Description for Kansas, Loamy Terrace, USDA-Soil Conservation Service, September, 1985.

Ecological Site Description for Kansas, Loamy Terrace (R074XY014KS) located in Ecological Site Information System (ESIS), 2007.

References

Bestelmeyer, B., J.R. Brown, K.M. Havstad, B. Alexander, G. Chavez, and J.E. Herrick. 2003. Development and Use of State and Transition Models for Rangelands. Jornal of Range Management 56:114–126.

Bestelmeyer, B. and J.R. Brown. 2005. State-and-Transition Models 101: a Fresh Look at Vegetation Change.

Bestelmeyer, B.T., K. Moseley, P.L. Shaver, H. Sanchez, D.D. Briske, and M.E. Fernandez-Gimenez. 2010. Practical guidance for developing state-and-transition models. Rangelands 32:23–30.

Bestelmeyer, B.T., J.C. Williamson, C.J. Talbot, G.W. Cates, M.C. Duniway, and J.R. Brown. 2016. Improving the Effectiveness of Ecological Site Descriptions: General State-and-Transition Models and the Ecosystem Dynamics Interpretive Tool (EDIT). Rangelands 38:329–335.

Caudle, D., H. Sanchez, J. DiBenedetto, C. Talbot, and M. Karl. 2013. Interagency Ecological Site Handbook for Rangelands.

Comer, P.J., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003 (Date accessed). Ecological Systems of the United States: A Working Classification of U.S. Terrestrial Systems.

Herrick J. E., J.W. Van Zee, K.M. Havstad, L.M. Burkett, and W.G. Whitford. 2005. Monitoring Manual for Grassland, Shrubland, and Savanna Ecosystems. Volume 1: Quick Start.

Herrick, J.E., J.W. Van Zee, K.M. Havstad, L.M. Burkett, and W.G. Whitford. 2005. Monitoring Manual for Grassland, Shrubland, and Savanna Ecosystems. Volume II: Design, Supplimentary Methods, and Interpretation..

National Cooperative Soil Survey (NCSS). 2018 (Date accessed). National Cooperative Soil Characterization Database. https://ncsslabdatamart.sc.egov.usda.gov/.

National Oceanic and Atmospheric Administration (NOAA). 2018 (Date accessed). Climate Data 1980-2010. https://www.ncdc.noaa.gov/data-access/land-based-station-data/find-station.

Natural Resources Conservation Service. . National Ecological Site Handbook.

. 2018 (Date accessed). Web Soil Survey (SSS NRCS WSS). https://websoilsurvey.sc.egov.usda.gov/.

SSS NRCS OSD and . 2018 (Date accessed). Official Soil Series Descriptions. https://soilseries.sc.egov.usda.gov/osdname.aspx.

United States Department of Agriculture, . 2022. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin.

USDA, N. 2018 (Date accessed). The PLANTS Database. http://plants.usda.gov.

Other references

Brady, N, and R. Weil. 2008. The nature and properties of soils, 14th ed.

Bragg, T, and L. Hulbert. 1976. Woody plant invasion of unburned Kansas bluestem prairie. J. Range Management., 29:19-23.

Dyksteruis, E.J. 1958. Range conservation as based on sites and condition classes. J. Soil and Water Conserv. 13: 151-155.

Eddleman, L. 1983. Some ecological attributes of western juniper. P. 32-34 in Research in rangeland management. Agric. Exp. Stan. Oregon State Univ., Corvallis Spec. Rep. 682.

Hester, J.W. 1996. Influence of woody dominated rangelands on site hydrology and herbaceous production, Edwards Plateau, Texas. M.S. Thesis, Texas A&M University, College State, TX.

Holechek, J., R. Pieper, and C. Herbel. Range Management: principles and practices.—5th ed.

Kuchler, A. A new vegetation map of Kansas. Ecology (1974) 55: pp. 586-604.

Launchbaugh, J., C. Owensby. 1978 Kansas Rangelands, their management based on a half century of research. Bull. 622 Kansas Agricultural Experiment Station.

Moore, R., J. Frye, J. Jewett, W. Lee, and H. O'Connor. 1951. The Kansas rock column. Univ. Kans. Pub., State Geol. Survey Kans. Bull. 89. 132p.

National Climatic Data Center. Weather data. http://www.ncdc.noaa.gov/. Accessed online 04/05/2017.

Society for Rangeland Management. 1994. Rangeland cover types of the United States.

Sauer, Carl. 1950. Grassland climax, fire, and man. Journal of Rangeland Management: 3: 16-21.

Thurow, T., and J. Hester. 1997. How an increase or reduction in juniper cover alters rangeland hydrology. In: C.A. Taylor, Jr. (ed.). Proc. 1997 Juniper Symposium. Texas Agr. Exp. Sta. Tech. Rep. 97-1. San Angelo, TX: 4:9-22.

Unites States Department of Agriculture, Natural Resources Conservation Service. 1997. National range and pasture handbook, Chapter 7, rangeland and pastureland hydrology and erosion.

Waller, S., L. Moser, P. Reece., and G. Gates. 1985. Understanding grass growth.

Weaver, J., and F. Albertson. April 1940. Deterioration of midwestern ranges. Ecology, Vol. 21, No. 2. pp. 216-236.

Contributors

Chris Tecklenburg

Approval

David Kraft, 10/04/2019

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 11-27-2018 David Kraft, John Henry, Doug Spencer and Dwayne Rice/original authors 1-15-2005.
Contact for lead author	State Rangeland Management Specialist for Kansas.
Date	10/03/2019

Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** No natural rill formation common or part of the Loamy Terrace ecological site.

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

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

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Less than 5% bare ground is found on this site. It is the remaining ground cover after accounting for ground surface covered by vegetation (basal and canopy [foliar] cover), litter, standing dead vegetation, gravel/rock, and visible biological crust (e.g., lichen, mosses, algae).

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

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

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

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil surfaces may be stabilized by soil organic matter which has been fully incorporated into aggregates at the soil surface, adhesion of decomposing organic matter to the soil surface, and biological crusts. A soil stability kit will score a range from 5-6.

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

   Ap-- 0 to 18 centimeters (0 to 7 inches); dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; moderately acid; clear smooth boundary.

A-- 18 to 56 centimeters (7 to 22 inches); very dark grayish brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; slightly acid; gradual smooth boundary. (Combined thickness of the A horizon is 18 to 74 cm (7 to 29 inches))

---

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Functional and structural groups have not changed that inhibits the capture and storage of precipitation.

---

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).

---

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 Tallgrass dominant 48% 2160 lbs. big bluestem 900-1500, Indiangrass 300-675, switchgrass 250-450, eastern gamagrass 50-175, composite dropseed 20-100.

    Sub-dominant: Group 2 Midgrass subdominant 25% 1125 lbs. little bluestem 300-675, sideoats grama 150-450.

    Other: Group 3 Shortgrass minor 10% 450 lbs. buffalograss 50-150, blue grama 50-150, plains muhly 50-150.
    Group 4 Cool-season grass Minor 3% 80 lbs. Canada wildrye 20-40, western wheatgrass 20-40.

    Additional: Group 4 cool-season grasses 10% 450 lbs.; sedge 50-150, Scribner's rosette grass 50-150, Canada wildrye 50-150, western wheatgrass 50-150.
    Group 5 forbs minor 5% 225 lbs.
    Group 6 shrub trace 2% 90 lbs.

---

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.

---

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

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** All species (e.g., native, seeded, and weeds) alive in the year of the evaluation, are included in the determination of total above ground production. Site potential (total annual production) ranges from 3,000 lbs in a below-average rainfall year and 6,500 lbs in an above-average rainfall year. The representative value for this site is 4,500 lbs production per year.

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:** The number and distribution of tillers or rhizomes is assessed on perennial plants occupying the evaluation area. No reduction in vigor or capability to produce seed or vegetative tillers given the constraints of climate and herbivory.