USDA Natural Resources Conservation Service

Ecological site HX074XY115
Loamy Hills

Last updated: 10/04/2019
Accessed: 05/11/2025

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.

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 Hills ecological site was formerly known as Loamy Upland R074XY015KS. 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 non-calcareous to the surface. Generally, the Loamy Hills ecological site is located on uplands with a slope range of 0 to 16 percent.

Associated sites

HX074XY130	**Shallow Sandstone** The Shallow Sandstone sites sits adjacent to and in conjunction with the Loamy Hills ecological site. This site is characterized by the Hedville soil which is shallow to very shallow. Many areas of exposed sandstone rock are evident on the higher elevations. This soil formed in residuum weathered from noncalcareous sandstone. This site is found on uplands that are moderately to strongly sloping with a loamy surface layer that may be cobbly.
HX074XY107	**Clay Hills** The Clay Hills ecological site sits adjacent to and in conjunction with the Loamy Hills ecological site. This site is made up of very deep to moderately deep, moderately well to well drained upland soils. This site has a loamy to silty surface (7 to 14 inches) over clayey subsoils and is non-calcareous to the surface. The clay content in the soil is approximately greater than 45 percent at depths less than 14 inches. Generally, the Clay Hills ecological site is located on uplands with a slope range of 0 to 40 percent.

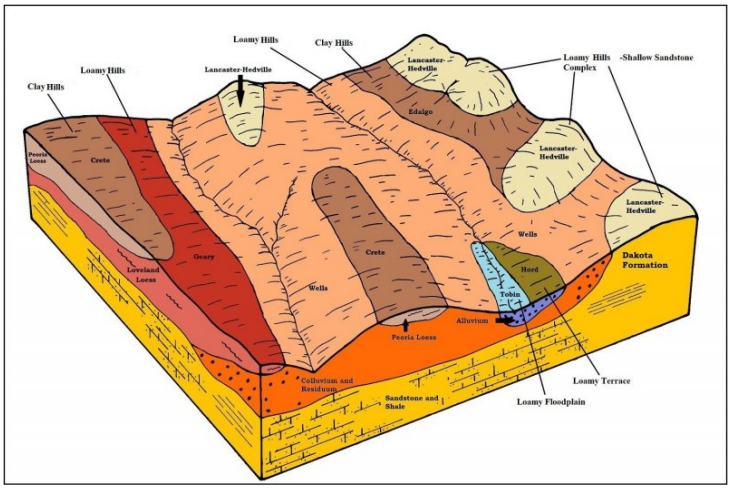


Figure 1. MLRA 74 ESD block diagram.

Table 1. Dominant plant species

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

Legacy ID

R074XY115KS

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.
Elevation is generally 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 Hills ecological site is situated on nearly level to moderately steep uplands. The soils that make up this site are very deep to moderately deep located on uplands.Runoff is low or medium.

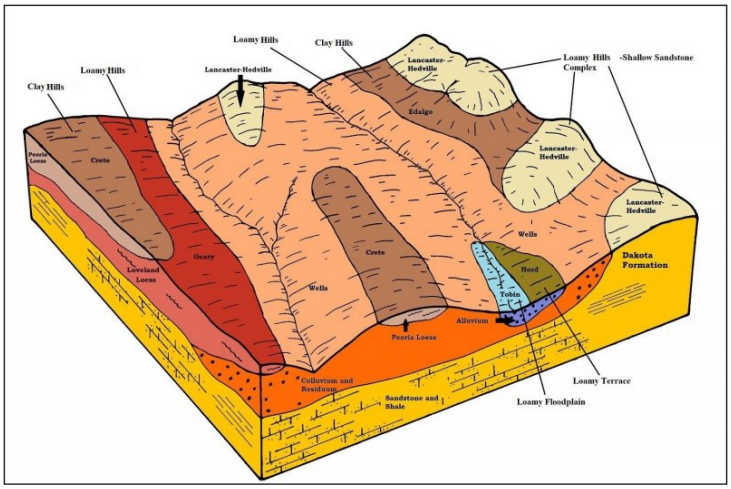


Figure 2. MLRA 74 ESD block diagram.

Table 2. Representative physiographic features

Hillslope profile	(1) Summit (2) Shoulder (3) Backslope
Landforms	(1) Upland
Runoff class	Low to high
Elevation	1,300–1,640 ft
Slope	0–16%
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 being the driest months and May and June being the wettest months. Summer precipitation occurs during intense summer thunderstorms. The following weather data originated from weather stations chosen across the geographical extent of the ecological site, and will likely vary from the data for the entire MLRA. The climate data 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)	149-154 days
Freeze-free period (characteristic range)	178-191 days
Precipitation total (characteristic range)	29-32 in
Frost-free period (actual range)	145-157 days

Freeze-free period (actual range)	175-193 days
Precipitation total (actual range)	28-33 in
Frost-free period (average)	152 days
Freeze-free period (average)	185 days
Precipitation total (average)	31 in

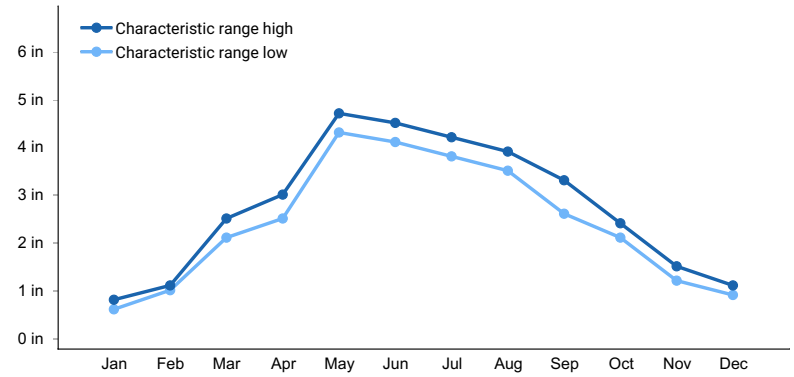


Figure 3. Monthly precipitation range

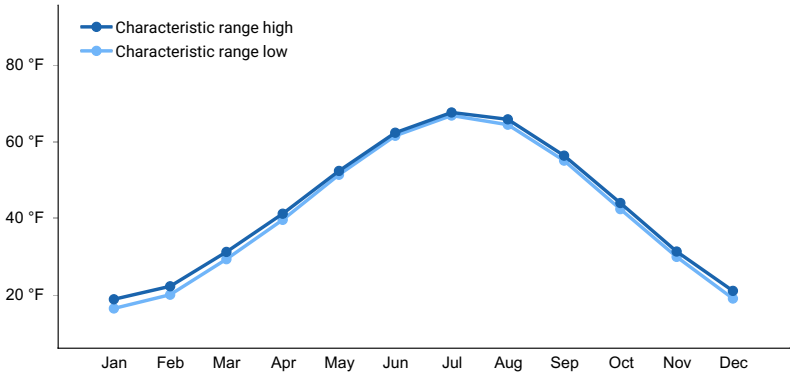


Figure 4. Monthly minimum temperature range

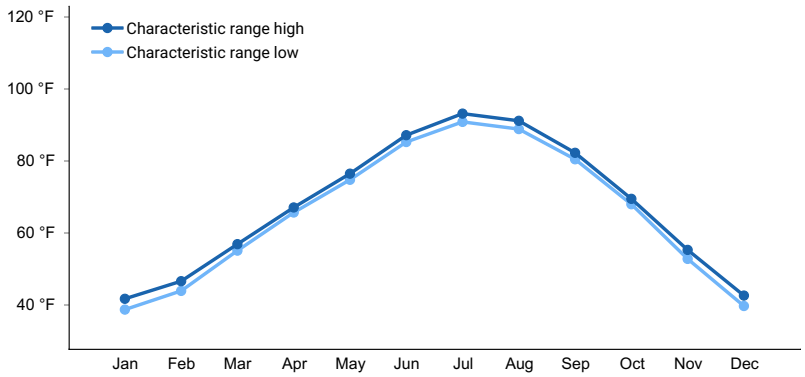


Figure 5. Monthly maximum temperature range

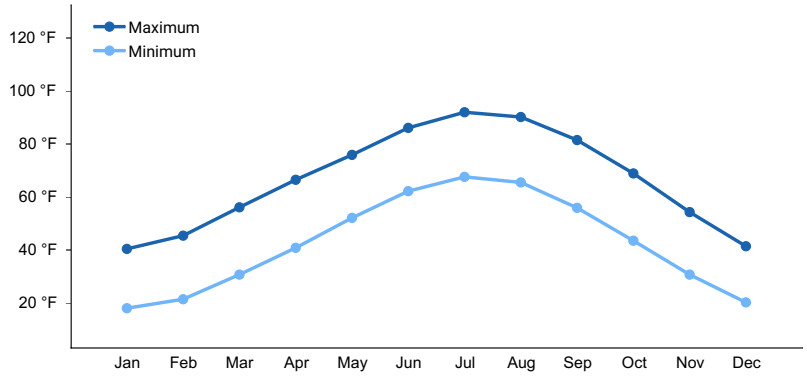


Figure 6. Monthly average minimum and maximum temperature

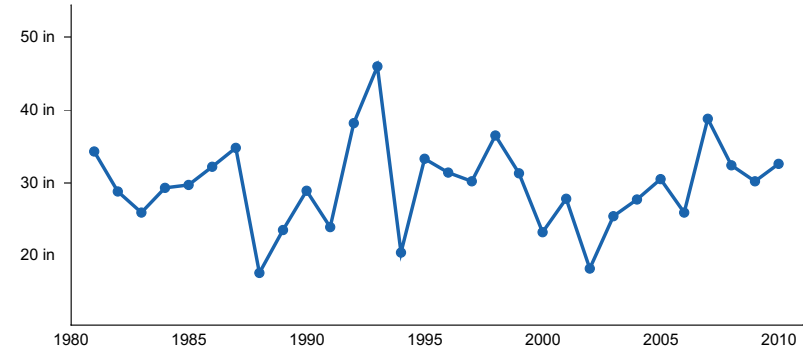


Figure 7. Annual precipitation pattern

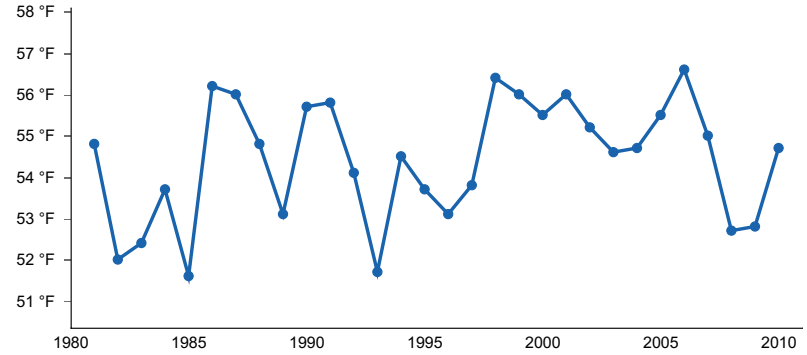


Figure 8. Annual average temperature pattern

Climate stations used

- (1) WASHINGTON [USC00148578], Washington, KS
- (2) CONCORDIA MUNI AP [USW00013984], Concordia, KS
- (3) CONCORDIA 1 W [USC00141761], Concordia, KS
- (4) CLAY CTR [USC00141559], Clay Center, KS
- (5) MINNEAPOLIS [USC00145363], Minneapolis, KS
- (6) SALINA MUNI AP [USW00003919], Salina, KS
- (7) SMOLAN 1NE [USC00147551], Lindsborg, KS
- (8) KANOPOLIS LAKE [USC00144178], Ellsworth, KS
- (9) MCPHERSON [USC00145152], McPherson, KS

Influencing water features

Soils on the Loamy Hills ecological site are well drained, have slow to moderate permeability, and a high available water capacity. Erosion on this site by wind and water is a hazard if the vegetation is severely overgrazed or mismanaged.

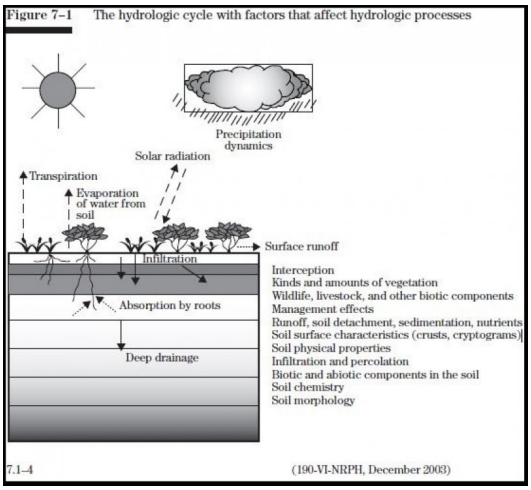


Figure 9. Fig. 7-1 from the National Range and Pasture Handbook.

Soil features

The soils representing the Loamy Hills ecological site are Geary, Lancaster, Longford, and Wells. They are very deep to moderately deep upland soils with 14 inches or more of silty or loamy surfaces and silty or clayey subsoils. These soils are well drained and are usually noncalcareous in the surface layer. Some soils may be calcareous in the subsoil and substratum. The soils that represent the Loamy Hills ecological site are generally high in fertility.

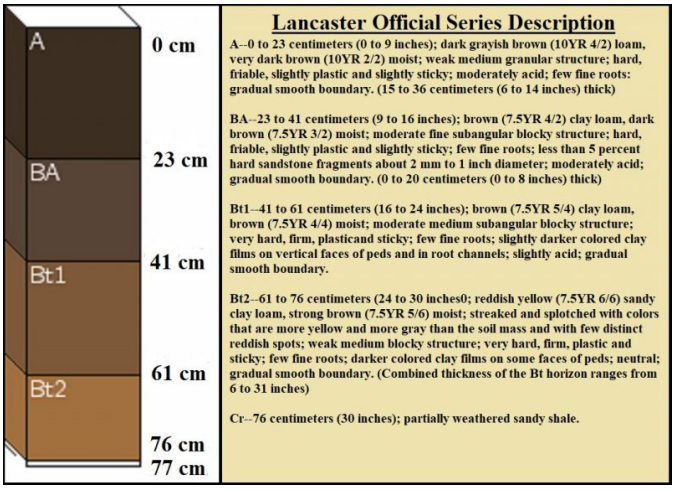


Figure 10. Lancaster official series description.

Table 4. Representative soil features

Parent material	(1) Residuum–sandstone and shale (2) Loess
Surface texture	(1) Loam (2) Silt loam (3) Silty clay loam
Family particle size	(1) Fine-loamy (2) Fine-silty (3) Fine
Drainage class	Well drained
Permeability class	Slow to moderate
Soil depth	20–80 in
Surface fragment cover <=3"	0–6%
Surface fragment cover >3"	0–3%

Available water capacity (0-40in)	4.8–12.3 in
Calcium carbonate equivalent (0-40in)	0–2%
Soil reaction (1:1 water) (0-40in)	5.6–8.4

Ecological dynamics

The Loamy Hills ecological site in MLRA 74 consist of dynamic plant communities resulting from the complex interaction of many ecological factors and processes. The vegetation evolved on moderately deep to very deep, moderately well drained to somewhat excessively drained, and loamy or clayey soils under a diverse, fluctuating climate. Plants were historically grazed by herds of large herbivores and periodically subjected to intense wildfires.

The original plant community developed with fires of various intensities and frequencies during different seasons of the year playing an important part in ecological processes. Historically, wildfires started by lightning often occurred in spring and early summer months when thunderstorms were prevalent, but also in late summer and fall during dry weather periods. It is also recognized that early Native Americans often used fire to attract herds of migratory herbivores,especially bison.

The dominant tall grasses were rhizomatous, enabling them to survive the ravages of even intense wildfires and, thus, gain a competitive advantage in the plant community. In contrast, most trees and shrubs were suppressed by fire and occurred only sparsely on protected areas. Growth of perennial forbs, and especially legumes, were usually enhanced following a fire event. After an intense fire there was usually a substantial, but short term, increase in the abundance of annual forbs as well.

Grazing history has 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. When herds moved to adjacent areas, grazed vegetation was afforded an extended period of rest and recovery during the growing season. Other grazing and feeding animals such as elk, pronghorns, deer, rabbits, insects, and numerous burrowing rodents had secondary influences on plant community development.

Variations in climate, especially a pattern of annual late summer drought and long-term drought cycles spanning several years, also had a major impact upon plant community development. Species composition fluctuated according to the duration and severity of long-term droughts. During prolonged dry cycles, many of the weaker, shallow-rooted plants died and production of deeper-rooted plants significantly decreased. When sufficient rainfall occurred following an extended dry period, annual forbs and annual grasses would temporarily occur in abundance. When precipitation returned to normal or above normal, the deeper-rooted grasses and forbs responded and returned to their production potentials.

Typically, growth of warm-season grasses in MLRA 74 begins during the period of May 1 to May 15 and continues until mid-September. Generally, 70 percent of total production is completed by mid-July. This varies only slightly from year to year depending on temperature and precipitation patterns. Cool-season grasses generally have two short growing periods, one in the fall (September and October) and again in the spring (April, May and June).

As European settlers began utilizing the area for production of domestic livestock within fenced pastures in place of roaming bison herds, the ecological dynamics and physical aspects were altered, and the plant community shifted from its original composition. These changes were usually in proportion to the season and intensity of the use by livestock and were accelerated by a combination of drought and overgrazing. Taller grasses and forbs more palatable to bison were
similarly selected and consumed by cattle and horses. Those palatable species were repeatedly grazed throughout the growing season, thus weakening them. Over time, they were gradually replaced by the increase and spread of less palatable species. Where the history of overuse by domestic livestock was more intense, even the plants which initially increased were often replaced by less desirable and lower-producing plants. In some instances, production and plant diversity was reduced to a mixture of mid- and shortgrasses, annual grasses, and unpalatable forbs.

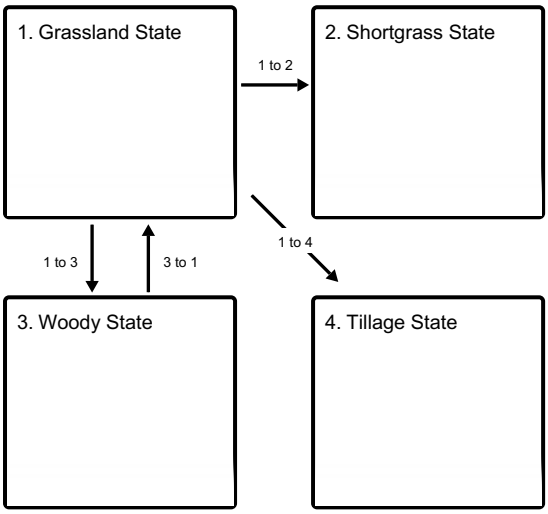
The frequency and role that fires played in maintaining the plant community was reduced with the advent of roads, cultivated fields, and fire suppression techniques developed by European settlers. Use of prescribed fire as a management tool has also diminished in some localities, especially surrounding population centers. In the absence of periodic, intense fire, there has often been a gradual increase in woody species. In some areas, shrubs and trees have encroached to the point of being the dominant influence in the plant community.

The gently rolling topography of this ecological site was attractive to European settlers who sought to create agrarian lifestyles. Some areas of this site were brought under cultivation and used to grow wheat, corn, sorghum, and other crops. Tillage and crop production caused the destruction of the original native plant community and often major degradation of the inherent structure and fertility of the surface soil layer. Many acres that were formerly used for cultivated crops have been reseeded or allowed to re-vegetate through natural succession.

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

State and transition model

Ecosystem states



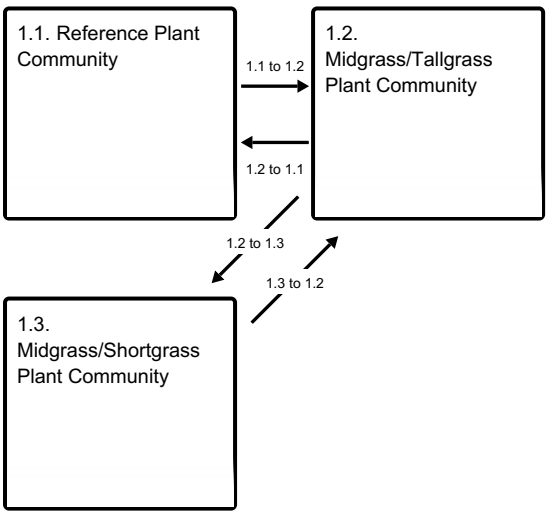
1 to 2 - Long-term, heavy, continuous overgrazing, no rest and recovery

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 Hills 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 coolseason 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 Migrasses 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.

Dominant plant species

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

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, and 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, switchgrass, and Indiangrass. The major midgrass is little bluestem. Combined, these grasses account for 70 to 80 percent of vegetation produced annually. Other prevalent grasses are eastern gamagrass, sideoats grama, western wheatgrass, and blue grama. Eastern gamagrass is a fragile plant on this site and may disappear quickly with excessive or long-term, heavy continuous use. Scattered throughout this site are minor amounts of numerous mid- and shortgrasses. The Reference Plant Community supports a wide variety of legume species, which are interspersed throughout the grass sward. The most abundant are slimflower scurfpea, Nuttall's sensitivebriar, prairie bundleflower, and blue wild indigo. Other important forbs include compassplant, white heath aster, dotted blazing star, pitcher sage, upright prairie coneflower, and Cuman ragweed. Leadplant and Jersey tea are low growing shrubs that occur over the site. Unlike most shrubs, these plants are both quite tolerant to fire. Occasional clumps of coralberry and fragrant sumac may be found on the steeper slope exposures. Growth of warm-season grasses on this site typically begins during the period of May 1 to May 15 and continues until mid September. As a general rule, 75 percent of total production is completed by mid-July. This varies only slightly from year to year depending on temperature and precipitation patterns. There are exceptions as big bluestem and eastern gamagrass will occasionally initiate spring growth as early as April 5 following mild winter temperatures. Also, it's 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 referred to as Indian summers. Total annual production ranges from 2800 to 5800 pounds of air-dry vegetation per acre and averages about 4000 pounds.

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 ridgetops as livestock often concentrate there.

Dominant plant species

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

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2460	3520	5100
Forb	280	400	580
Shrub/Vine	60	80	120
Total	**2800**	**4000**	**5800**

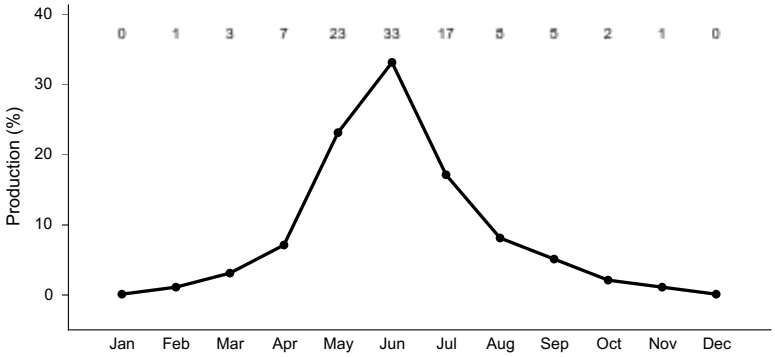


Figure 13. Plant community growth curve (percent production by month). KS7406, Loamy Upland.

Community 1.2
Midgrass/Tallgrass Plant Community

Figure 14. Midgrass/Tallgrass Plant Community in MLRA 74.

This plant community developed as a result of years of overgrazing. Although the tallgrasses, big bluestem, Indiangrass, and switchgrass, only make up 20 to 30 percent of the site's production, they tend to dominate the visual aspect of the site. Midgrasses are the primary producers and make up 40 to 50 percent of the production. The dominant midgrass is little bluestem. Other prominent midgrasses are sideoats grama, western wheatgrass, and composite dropseed. Shortgrasses such as blue grama, hairy grama, buffalograss, tumble windmillgrass, purple threeawn, and prairie threeawn produce 10 to 15 percent of the vegetation. Annuals, such as crabgrass and foxtail begin expressing themselves. Forb production is quite variable and may range from 10 to 25 percent of the total vegetation depending on amounts and timing of rainfall events. Perennial forbs include white sagebrush, slimflower scurfpea, Missouri goldenrod, Baldwin ironweed, white heath aster, and Cuman ragweed. In some locations shrubs such as fragrant sumac, eastern redcedar, and coralberry comprise up to 10 percent of the vegetation. Total annual production ranges from 2400 to 5000 pounds air-dry vegetation per acre and averages about 3500 pounds.

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

Figure 15. Midgrass/Shortgrass Plant Community in MLRA 74.

This plant community developed as a result of long-term, heavy, continuous overgrazing. Midgrasses dominate the site and comprise 40 to 55 percent of the annual production. Most abundant midgrasses include little bluestem, sideoats grama, western wheatgrass, and composite dropseed. Short grasses such as blue grama, hairy grama, buffalograss, tumble windmillgrass, Kentucky bluegrass, and purple threeawn produce 20 to 30 percent of the vegetation. Annuals such as crabgrass and foxtail will begin expressing themselves. Forbs production is quite variable and may range from 15 to 30 percent of the total vegetation depending on amounts and timing of rainfall events. Perennial forbs include white sagebrush, slimflower scurfpea, Missouri goldenrod, Baldwin ironweed, white heath aster and Cuman ragweed. In some locations shrubs such as fragrant sumac, eastern red cedar and coralberry comprise up to 15 percent of the vegetation.

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 prostate 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, their numbers or percentage of composition is greatly reduced that 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
- sideoats grama (*Bouteloua curtipendula*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- composite dropseed (*Sporobolus compositus var. compositus*), grass
- buffalograss (*Bouteloua dactyloides*), grass
- blue grama (*Bouteloua gracilis*), grass

Pathway 1.1 to 1.2
Community 1.1 to 1.2

Reference Plant Community

Midgrass/Tallgrass Plant Community

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

Midgrass/Tallgrass Plant Community

Reference Plant Community

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/or maintenance.

Conservation practices

Prescribed Burning
Prescribed Grazing

Pathway 1.2 to 1.3
Community 1.2 to 1.3

Midgrass/Tallgrass Plant Community

Midgrass/Shortgrass Plant Community

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

Midgrass/Shortgrass Plant Community

Midgrass/Tallgrass Plant Community

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/or 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

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

Community 2.1
Shortgrass Plant Community

Figure 16. Shortgrass Plant Community in MLRA 74.

This plant community presents a distinctive shortgrass aspect on the landscape. It is dominated by blue grama and buffalograss with notable amounts of western wheatgrass and sideoats grama present in a state of low vigor and production. Other grasses include annual bromes (Bromus spp.), composite dropseed, Kentucky bluegrass, prairie threeawn, and tumble windmillgrass. These species commonly account for 60 to 70 percent of the annual forage production. Like the desirable grasses, the palatable legumes and other forbs have been reduced by continuous grazing and competition over many years. Prevalent broadleaf species in this situation include prairie broomweed, annual ragweed, white sagebrush, Cuman ragweed, Baldwin ironweed, wavyleaf thistle, and curlycup gumweed. Forbs may comprise 20 to 30 percent of the total vegetation. This plant community often contains 15 to 20 percent woody species as a result of fewer fires and more opportunities for their encroachment. Eastern redcedar, smooth

and/or fragrant sumac, and coralberry are representative shrubs which occur on this site. Leadplant and Jersey tea may still be found, but are generally much reduced from their prominence in the Reference Plant Community.

Resilience management. Recovery of the tallgrasses, midgrasses, and associated forbs characteristic of the Reference Plant Community will require many years of careful management that includes prescribed grazing and extended periods of rest during the growing season. If remnant stands of the desired species are not located nearby as seed sources for reestablishment, interseeding measures may be necessary to create pioneer colonies for seed dispersal throughout the community. Prescribed burning can be a useful tool when used to strategically benefit the desired species, especially in the later stages of the recovery process.

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% from a lack of fire according to a study from 1937 to 1969, in contrast to a 1% increase on burned areas (Bragg and Hulbert, 1976). Periodic burning 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% to 36.7% (Thurow and Hester, 1997). A small rainfall event is usually retained in the foliage and does not reach the litter layer at the base of the tree. Only when canopy storage is reached and exceeded does precipitation fall to the soil surface. Interception losses associated with the accumulation of leaves, twigs, and branches at the bases of trees are considerably higher than losses associated with the canopy. The decomposed material retains approximately 40% of the water that is not retained in the canopy (Thurow and Hester, 1997). Soil properties affected include biological activity, infiltration rates, and soil fertility.

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.

Dominant plant species

- Osage-orange (*Maclura pomifera*), tree
- honeylocust (*Gleditsia triacanthos*), tree
- eastern redcedar (*Juniperus virginiana*), tree
- coralberry (*Symphoricarpos orbiculatus*), shrub
- fragrant sumac (*Rhus aromatica*), shrub
- smooth sumac (*Rhus glabra*), shrub

Community 3.1
Shrubs and/or Trees

This plant community is dominated by shrubs consisting primarily of coralberry, fragrant sumac and smooth sumac (*Rhus glabra*). Trees including osage orange (*Maclura pomifera*), honeylocust (*Gleditsia triacanthos*), and eastern redcedar have invaded and become established in some areas. Coralberry is generally the most abundant shrub and often forms low, dense thickets throughout the site. Shrubs and trees may produce 40 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 grass and forb species. However, not all unburned areas

have a woody plant problem. The speed of woody encroachment varies considerably, depending on 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, sedges, and Canada wildrye. Grass production is significantly reduced by competition forbs and woody species. Grass yields vary from 40 to 50 percent of the total vegetative production. Forbs often produce 15 to 20 percent of the total. Major forbs include white sagebrush, Cuman ragweed, Baldwin ironweed, and common yarrow. In this plant community, the amount of available forage is heavily dependent upon the predominant woody species and the kind(s) of livestock and/or wildlife utilizing the site. Usually a prescribed burning program accompanied with prescribed grazing will gradually return the plant community to one dominated by grasses and forbs. Longer periods will be needed where the tall and midgrasses have been greatly reduced or eliminated. Special planning will be necessary to assure that sufficient amounts of fine fuel are available for carrying the intensive fires necessary to control woody species. Use of labeled herbicides as a brush management tool will usually be necessary to reduce populations of fire resistant species like osage orange and honeylocust and accelerate the recovery of desired vegetative cover. Many species of wildlife, especially bobwhite quail and whitetail deer, benefit from the growth of shrubs for both food and as cover. When wildlife populations are a desirable component, this should be considered in any brush management plans.

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

Dominant plant species

- Osage-orange (*Maclura pomifera*), tree
- honeylocust (*Gleditsia triacanthos*), tree
- eastern redcedar (*Juniperus virginiana*), tree
- coralberry (*Symphoricarpos orbiculatus*), shrub
- fragrant sumac (*Rhus aromatica*), shrub
- smooth sumac (*Rhus glabra*), shrub

State 4
Tillage State

Extensive areas of the historic Loamy Hills 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/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 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 is a result of a land use management decision.

Community 4.1

Reseed Community

This plant community occurs on areas that were formerly farmed and reseeded with a mixture of native species common in the Reference Plant Community. Most seeding mixtures consisted of a blend of grasses that include sand bluestem, Indiangrass, switchgrass, little bluestem, sideoats grama, blue grama, and western wheatgrass. In some locations, seed of legumes and forbs such as prairie bundleflower and Maximilian sunflower were included in the mixture. Once these areas become fully established, production is comparable to that of the Reference Plant Community. Total annual production ranges varies according to the species planted, established plants, and years of establishment. When reseeded areas and areas supporting native rangeland exist in the same pasture, they seldom are utilized at the same intensity because domestic livestock usually prefer plants growing on the native rangeland areas. When feasible, reseeded plant communities should be managed as separate pastures or units. Some seeded areas are invaded by trees and shrubs during the establishment period of the desired plants. These invader species commonly include elm, common hackberry, eastern redcedar, and eastern cottonwood. Occasional burning is effective in controlling establishment of these woody plants.

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.

Community 4.2
Go-back Plant Community

This plant community also occurs on areas that were formerly farmed. When tillage operations ceased, the areas were allowed to revegetate or “go back” naturally in contrast to artificial reseeding to a selected species or group of species. The go-back process is a slow, gradual transformation that requires many years and many successional changes or stages in the plant community. The speed and extent of revegetation depends on the size of the area, level of grazing management and the proximity of the area to existing seed sources. In the initial stages of revegetation the site is usually dominated by annual forbs such as annual ragweed, slender snakecotton, Canadian horseweed, prairie sunflower, common sunflower, Mexican fireweed, camphorweed, and annual buckwheat. Gradually these are replaced by annual grasses including prairie threeawn, mat sandbur, tumblegrass, little barley, cheatgrass, and witchgrass. As plant succession progresses the plant community gradually becomes dominated by perennials. The major grasses include sand dropseed, composite dropseed, thin paspalum, purple lovegrass, red lovegrass, Scribner’s rosette grass, Carolina crabgrass, silver beardgrass, and tumble windmillgrass. Common forbs are Cuman ragweed, white sagebrush, Carruth’s sagewort, white heath aster, Missouri goldenrod, and sand milkweed. Combinations of these plants can form a stable community. In time with prescribed grazing management, other perennial grasses and forbs common in the Reference Plant Community return to the site. Blue grama is a shortgrass that is very common to the native plant communities on this site. However, it seldom occurs in go-back communities, even after 40 to 50 years of plant succession. Some go-back areas are invaded by trees and shrubs. The more common include elm, common hackberry, eastern redcedar, eastern cottonwood, and roughleaf dogwood. Occasional burning is effective in controlling these woody plants. Total annual production varies by site. This depends on seasonal precipitation and the stage of plant succession in the plant community.

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 is an increase in evaporation rate, runoff, and in bulk density. There is a decrease in infiltration, a change in plant

composition, and the functional and structural groups have changed dominance. These are all examples of the soil and vegetation properties that have compromised the resilience of the Grassland State and therefore transitioned to a Shortgrass State.

Transition 1 to 3
State 1 to 3

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

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

				Annual Production	Foliar Cover

Group	Common Name	Symbol	Scientific Name	(Lb/Acre)	(%)
Grass/Grasslike					
1	**Warm-season tallgrasses dominant 48%**			1370–1920	
	big bluestem	ANGE	*Andropogon gerardii*	1000–1600	–
	switchgrass	PAVI2	*Panicum virgatum*	150–400	–
	Indiangrass	SONU2	*Sorghastrum nutans*	150–400	–
	eastern gamagrass	TRDA3	*Tripsacum dactyloides*	50–200	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	20–75	–
2	**Warm-season midgrasses subdominant 35%**			600–1400	
	little bluestem	SCSC	*Schizachyrium scoparium*	500–1000	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	100–600	–
	prairie threeawn	AROL	*Aristida oligantha*	0–20	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–20	–
3	**Warm-season shortgrasses minor 2.5%**			40–100	
	blue grama	BOGR2	*Bouteloua gracilis*	20–50	–
	buffalograss	BODA2	*Bouteloua dactyloides*	20–50	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–20	–
4	**Cool-season grasses minor 2.5%**			50–100	
	western wheatgrass	PASM	*Pascopyrum smithii*	50–100	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	10–40	–
	Canada wildrye	ELCA4	*Elymus canadensis*	20–40	–
	sedge	CAREX	*Carex*	10–30	–
	Torrey's rush	JUTO	*Juncus torreyi*	0–20	–
Forb					
5	**Forbs minor 10%**			200–400	
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	20–60	–
	compassplant	SILA3	*Silphium laciniatum*	10–50	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	20–50	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	20–40	–
	Baldwin's ironweed	VEBA	*Vernonia baldwinii*	10–40	–
	pitcher sage	SAAZG	*Salvia azurea var. grandiflora*	10–40	–
	tall blazing star	LIAS	*Liatris aspera*	0–40	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–40	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	0–40	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–30	–
	silky sophora	SONU	*Sophora nuttalliana*	0–30	–
	blacksamson echinacea	ECANA	*Echinacea angustifolia var. angustifolia*	0–30	–
	white heath aster	SYER	*Symphyotrichum ericoides*	10–30	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–30	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	10–30	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–20	–
	eastern daisy fleabane	ERAN	*Erigeron annuus*	0–20	–

	prairie spiderwort	TROC	*Tradescantia occidentalis*	0–20	–
	stiffstem flax	LIRI	*Linum rigidum*	0–20	–
	greenthread	THELE	*Thelesperma*	0–20	–
	prairie sunflower	HEPE	*Helianthus petiolaris*	0–20	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0–20	–
Shrub/Vine					
6	**Shrubs trace 2%**			20–80	
	leadplant	AMCA6	*Amorpha canescens*	15–75	–
	Jersey tea	CEHE	*Ceanothus herbaceus*	5–25	–
	coralberry	SYOR	*Symphoricarpos orbiculatus*	0–20	–
	fragrant sumac	RHARS	*Rhus aromatica var. serotina*	0–15	–
	smooth sumac	RHGL	*Rhus glabra*	0–15	–
	prairie rose	ROAR3	*Rosa arkansana*	0–10	–

Animal community

Wildlife

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

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

Some animals are important because of their threatened and endangered status and require special consideration. Please check the Kansas Department of Wildlife and Parks 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, and/or grazing system, and site grazeability factors (such as steep slopes, site inaccessibility, or distance to drinking water).

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

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

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

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

Hydrological functions

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, 70.8%; 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/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 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

There are commonly no wood products from this site.

Other products

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

Other information

Site Development and Testing Plan

This site went through the approval process.

Inventory data references

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

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

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Contributors

Chris Tecklenburg

Approval

David Kraft, 10/04/2019

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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.

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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 10-24-2018 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 Hills ecological site.

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

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

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):** Lancaster OSD:

   A--0 to 23 centimeters (0 to 9 inches); dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium granular structure; hard, friable, slightly plastic and slightly sticky; moderately acid; few fine roots: gradual smooth boundary. (15 to 36 centimeters (6 to 14 inches) thick)

   BA--23 to 41 centimeters (9 to 16 inches); brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate fine subangular blocky structure; hard, friable, slightly plastic and slightly sticky; few fine roots; less than 5 percent hard sandstone fragments about 2 mm to 1 inch diameter; moderately acid; gradual smooth boundary. (0 to 20 centimeters (0 to 8 inches) thick)

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).

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

    Dominant: Group 1 Tallgrass dominant 48% 1920 lbs. big bluestem 1000-1600, switchgrass 150-400, Indiangrass 150-400, eastern gamagrass 50-200, composite dropseed 20-75.

    Sub-dominant: Group 2 Midgrass subdominant 35% 1400 lbs. little bluestem 500-1000, sideoats grama 100-600, prairie threeawn 0-20, purple threeawn 0-20.

    Other: Group 3 Shortgrass trace 2.5% 100 lbs. buffalograss 20-40, blue grama 20-40, hairy grama 5-15.
    Group 4 Cool-season grass Minor 3% 80 lbs. Canada wildrye 20-40, western wheatgrass 20-40.

    Additional: Group 5 forbs minor 10% 400 lbs.
    Group 6 shrub trace 2% 80 lbs. leadplant 15-75 lbs. Jersey tea 5-25 lbs. fragrant sumac 0-15 lbs. smooth sumac 0-15 lbs. prairie rose 0-10 lbs. coralberry 0-10 lbs.

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

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

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** All species (e.g., native, seeded, and weeds) alive in the year of the evaluation, are included in the determination of total above ground production. Site potential (total annual production) ranges from 2,800 lbs in a below-average rainfall year and 5,800 lbs in an above-average rainfall year. The representative value for this site is 4,000 lbs production per year.

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

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17. **Perennial plant reproductive capability:** 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.