Ecological site HX074XY104
Clay Lowland

Last updated: 10/04/2019
Accessed: 05/15/2024

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 within 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 also 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 Clay Lowland ecological site was formerly known as Clay Lowland R074XY004KS. This site is made up of alluvial soils, which occur on the floodplains or low terraces of drainageways or river valleys. The Clay Lowland site has deep to very deep soils with silty clay loam, silty clay, and clay surface textures. This site is very rare to frequently flooded.

Associated sites

HX074XY114	**Loamy Terrace** The Loamy Terrace site sits adjacent to and in conjunction with the Clay Lowland ecological site. 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. This site has a slope that ranges from 0 to 7 percent.
HX074XY113	**Loamy Floodplain** The Loamy Floodplain ecological site sits adjacent to and in conjunction with the Clay Lowland 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.

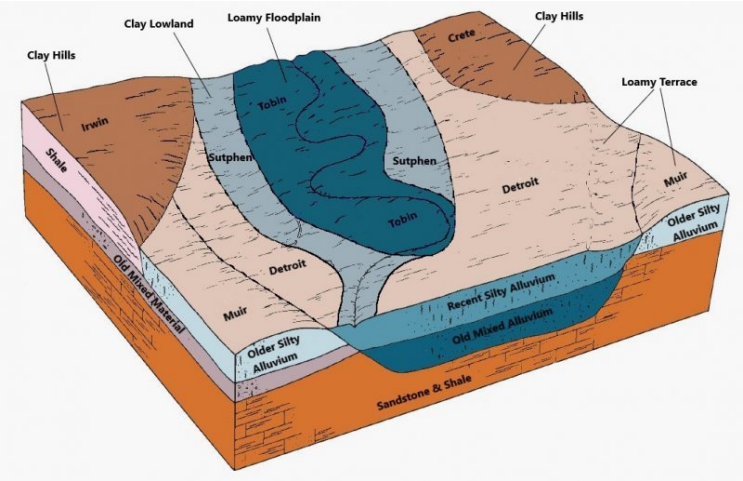


Figure 1. MLRA 74 ESD block diagram.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Andropogon gerardii* (2) *Spartina pectinata*

Legacy ID

R074XY104KS

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 are 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 Clay Lowland ecological site occurs on nearly level to concave flood plains and low terraces that are very rarely to frequently flooded. The soils are very deep with silty clay loam, silty clay, and clay surface textures.

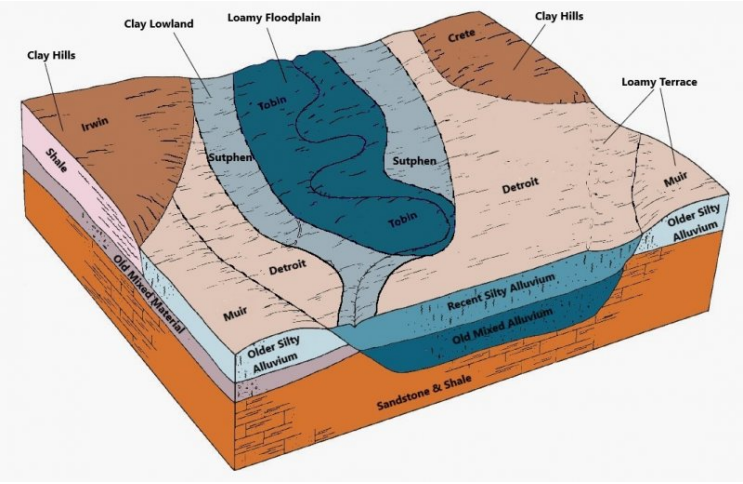


Figure 2. MLRA 74 ESD block diagram.

Table 2. Representative physiographic features

Landforms	(1) River valley > Flood plain (2) River valley > Terrace
Runoff class	Negligible to medium
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	Very rare to frequent
Ponding duration	Brief (2 to 7 days)
Ponding frequency	None to occasional
Elevation	300–600 m
Slope	0–2%
Water table depth	183 cm
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)	148-154 days
Freeze-free period (characteristic range)	178-191 days
Precipitation total (characteristic range)	737-813 mm

Frost-free period (actual range)	145-157 days
Freeze-free period (actual range)	175-193 days
Precipitation total (actual range)	711-838 mm
Frost-free period (average)	152 days
Freeze-free period (average)	185 days
Precipitation total (average)	787 mm

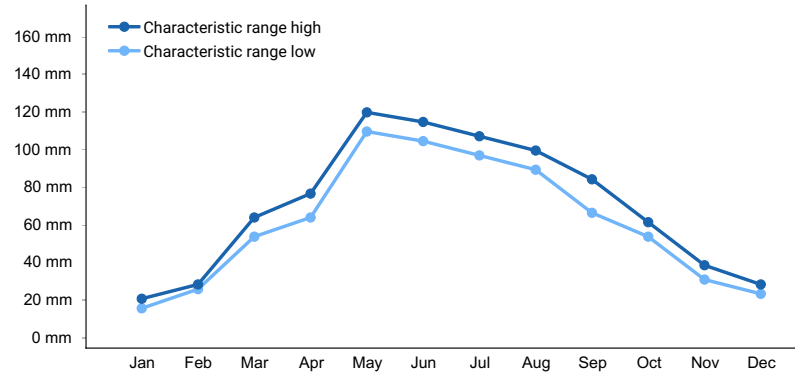


Figure 3. Monthly precipitation range

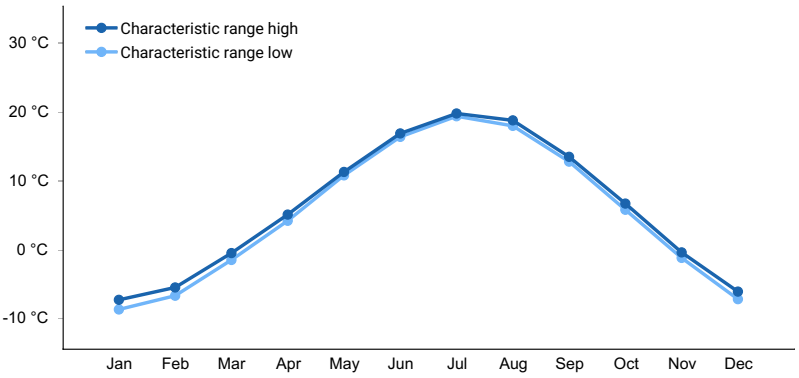


Figure 4. Monthly minimum temperature range

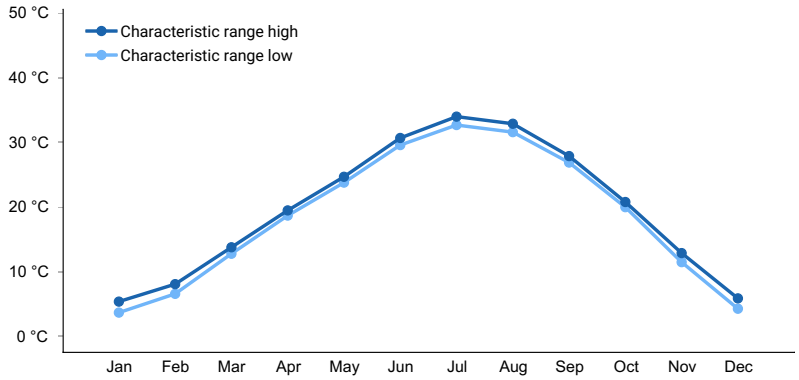


Figure 5. Monthly maximum temperature range

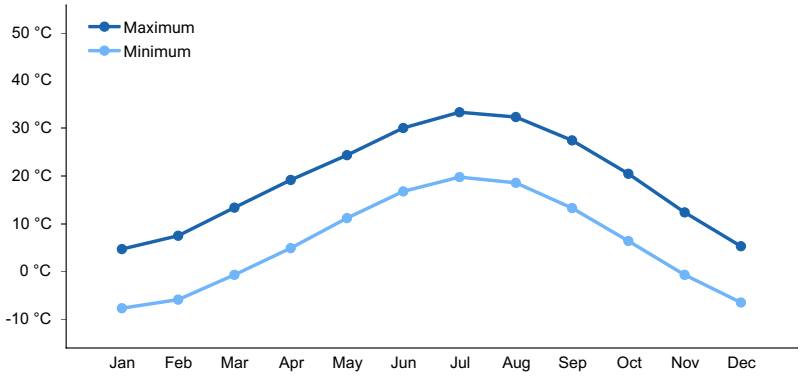


Figure 6. Monthly average minimum and maximum temperature

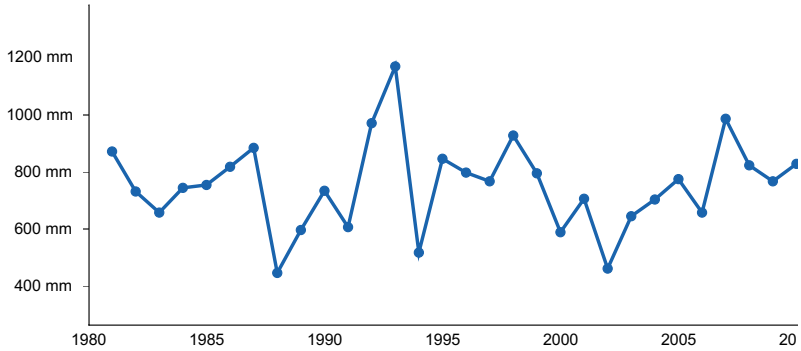


Figure 7. Annual precipitation pattern

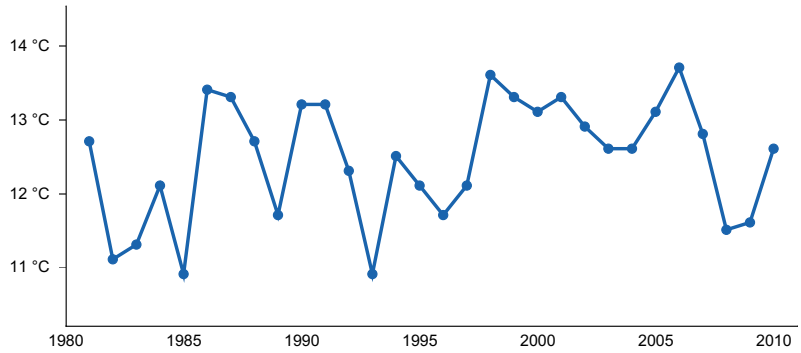


Figure 8. Annual average temperature pattern

Climate stations used

- (1) WASHINGTON [USC00148578], Washington, KS
- (2) 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

Clay lowland soils are very rarely to frequently flooded and also receive runoff from adjacent slopes. Surface runoff is very slow. Permeability is slow to very slow. Surface soils are frequently saturated with water prior to and during early spring growth periods. Ponding of water can be a problem under these conditions.

Soil inclusions with this wetland type may occur within this site.

Stream Types:
(Rosgen System) C6, F6, and E6 are potential stream types found on this site. The C6 stream type is slightly entrenched, meandering, silt-clay dominated, riffle-pool channel with a well-developed floodplain. The C6 stream type can be found in low relief basins typical of interior lowlands such as the Great Plains area. F6 stream types are entrenched, meandering, gentle gradient streams that are deeply incised in cohesive sediments of silt and clay. Characteristics of F6 streams include very high width/depth ratios, moderate sinuosity, and low to moderate meander width ratios. E6 stream types have channels with low to moderate sinuosity, gentle to moderately steep gradients, and very low width/depth ratios. E6 stream systems are very stable. Streambank disturbance through abuse or other disturbances within the watershed can lead to stream degradation and eventually to a change in the stream type to a less stable system.

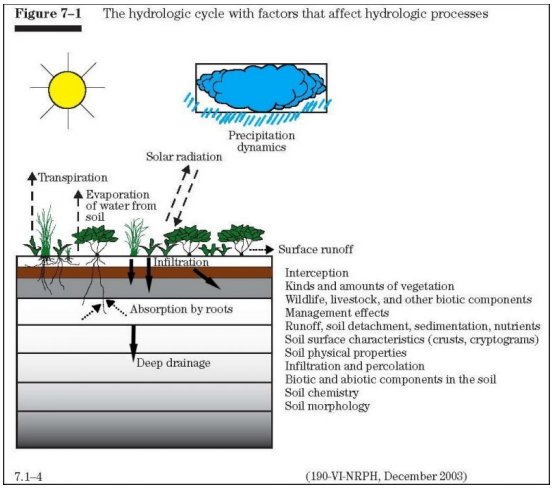


Figure 9. Fig. 7-1 from the National Range and Pasture Handbook.

Soil features

Soils found on this site are Sutphen and New Cambria. The moderately well drained alluvial soils of the Clay Lowland ecological site occur in the floodplain and low terrraces. They are very deep soils with silty clay loam, silty clay, and clay surface textures. Permeability is very slow to slow and the available water capacity is high. Locally, water tables may rise into the root zone during wetter periods on this site. The soils characteristically have a high shrink-swell potential which can cause large, deep cracks to develop in dry years. The Clay Lowland site is very rarely to frequently flooded.

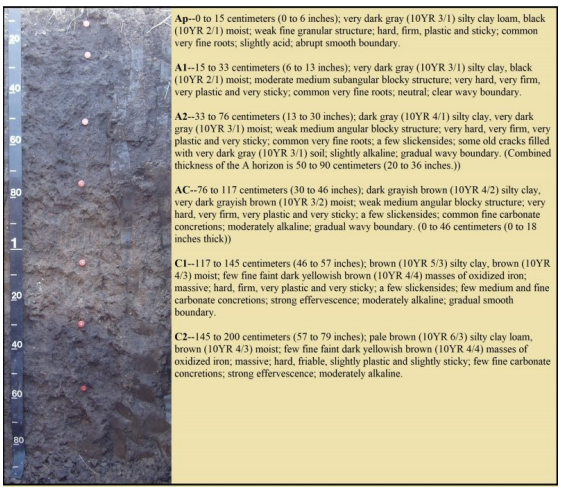


Figure 10. MLRA 74 Sutphen soil profile (Cloud County, Kansas) and description.

Table 4. Representative soil features

Parent material	(1) Alluvium

Surface texture	(1) Silty clay (2) Silty clay loam
Family particle size	(1) Fine
Drainage class	Moderately well drained
Permeability class	Very slow to slow
Soil depth	203 cm
Available water capacity (0-101.6cm)	11.18–22.1 cm
Calcium carbonate equivalent (0-101.6cm)	0–10%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–6
Soil reaction (1:1 water) (0-101.6cm)	6.1–8.4

Ecological dynamics

The Clay Lowland ecological site is a dynamic plant community due to the complex interaction of many ecological processes. The vegetation evolved on deep, clayey soils on lowlands that have a high shrink-swell potential and are very rare to frequently flooded. The site was exposed to a fluctuating climate, grazed by herds of large herbivores, and subjected periodically to intense wildfires. The plants that evolved and dominated the original plant community were well adapted to these climatic, soil, and biological conditions.

The very deep, clayey soils representative of this site often receive extra moisture from flood overflow or storm runoff from adjacent slopes. Surface soils are frequently saturated with water prior to and during early spring growth periods. Conversely, when dry, these soils develop deep (3 to 4 feet) cracks in the soil surface due to their high shrink-swell potential. These soils occur on broad, nearly level to concave bottomlands adjacent to rivers or streams and are located along major drainageways in the area including the Smoky Hill, Saline, Solomon, and Republican Rivers and their main tributaries. Occasional flooding and sediment deposition may occur in some locations from stream overflow. Scour erosion can be a potential hazard during major flood events, but the heavy mat of grasses and their rhizomatous root systems help to maintain a healthy floodplain. The soil-plant moisture relationship is mutually proficient and the site is very productive.

The plant community developed with occasional fires as an important part of the ecological processes. Historically, fires were usually started by lightning, typically during spring and early summer months when thunderstorms were most prevalent. It is also recognized that pre-European inhabitants often used fire to attract herds of migratory herbivores, especially bison. Because all of the dominate tallgrasses were rhizomatous, they were able to survive the ravages of even intense wildfires and gain a competitive advantage in the plant community. Trees and shrubs were suppressed by fire over most of the site. However, trees historically occurred in varying amounts on protected areas, generally along stream and river banks and in oxbows.

Grazing history had a major impact on the dynamics of the site. The vegetative community developed under a grazing regime that consisted primarily of periodic grazing by large herds of bison. As the herds moved through an area, grazing was probably intense. When herds moved to adjacent areas, grazed vegetation was afforded an extended period of rest and recovery during the growing season. However, this grazing regime was altered during extended periods of drought. Due to the proximity to streams, grazing animals are attracted to the Clay Lowland site. Utilization could be much more concentrated in dry times versus during normal periods of precipitation. 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. Fluctuations in precipitation directly influenced site productivity from year to year, but composition of the plant community usually remained stable. Available water capacity is high and the deep rooted tallgrasses benefit from moisture stored throughout the soil

profile and in some cases from seasonal water tables.

Flooding that results from intense thunderstorms is usually brief and inundation is temporary. All major plants have rhizomes which facilitate in their recovery from occasional siltation deposited during 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. The taller grasses and forbs palatable to bison were equally relished and selected by cattle and other domestic livestock. When repeatedly overgrazed, these grasses were weakened and gradually reduced in size and numbers. They were replaced by the increase and spread of less palatable midgrasses and forbs. Where the history of overgrazing by domestic livestock was more intense, even the plants that initially increased were often replaced by even less desirable and usually lower-producing plants.

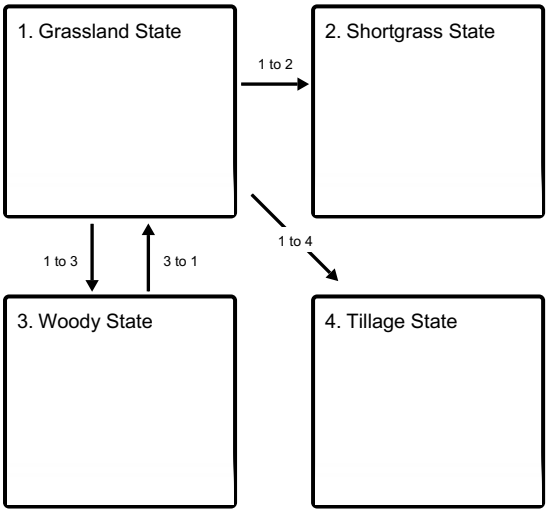
The frequency and role that fires played in maintaining the plant community was reduced with the advent of roads, cultivated fields, and fire suppression techniques developed by European settlers. Use of prescribed fire as a management tool has also diminished in some localities, especially surrounding 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 becoming 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 revegetate 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



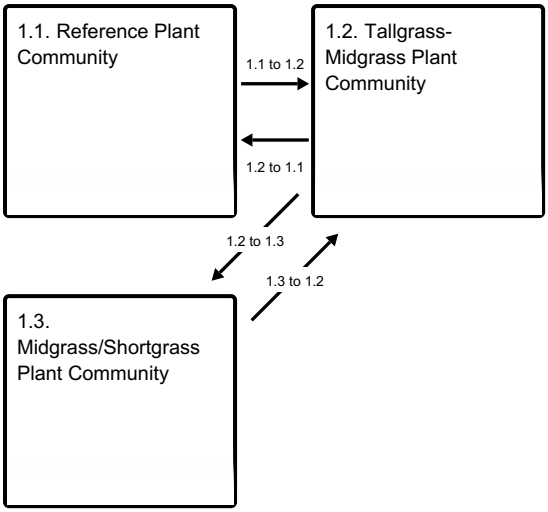
1 to 2 - Long-term, heavy, continuous overgrazing, no rest and recovery

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



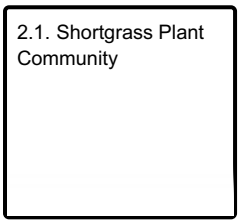
1.1 to 1.2 - Heavy, continuous grazing without adequate rest and recovery

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

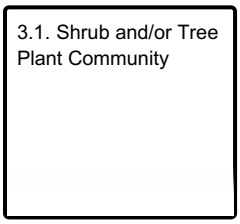
1.2 to 1.3 - Long-term (greater than 20 years) continuous grazing with no rest and no recovery

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

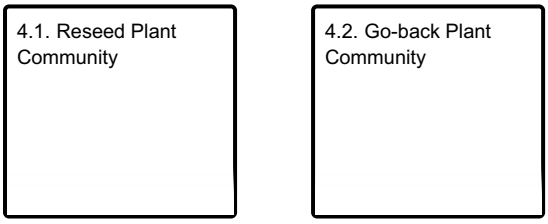
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



State 1
Grassland State

The Grassland State defines the ecological potential and natural range of variability resulting from the natural disturbance regime of the Clay Lowland 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 Tallgrass/Midgrass Plant Community is made up primarily of warm-season midgrasses, with an interspersed cool-season component and decreasing amounts of forbs and tallgrasses. The Midgrass/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. MLRA 74 Reference Plant Community.

The Reference Plant Community represents the original plant community that existed prior to European settlement. The site is characterized as a grassland with only occasional trees and large shrubs. It is dominated by tall, warm-season grasses including big bluestem, Indiangrass, switchgrass, eastern gamagrass, and prairie cordgrass. All of these grasses and most of the dominant forbs are strongly rhizomatous. These underground stems often form a dense, intertwined mass throughout the upper four or five inches of the soil profile. Combined, these tallgrasses will account for 75 to 85 percent of the total vegetation produced annually. Little bluestem and sideoats grama are the major midgrasses. Other prevalent midgrasses and grasslike plants are Canada wildrye, Virginia wildrye, western wheatgrass, marsh bristlegrass, composite dropseed, and several species of sedges and rushes. A number of forbs are found interspersed throughout the grass sward and include Maximilian sunflower, wholeleaf rosinweed, cup plant, Missouri goldenrod, Indianhemp, and prairie bundleflower. Plants found on wet sites (hydrophytes) that are associated with this site include those of emergent wetland inclusions (hydric soils) that often occur within Clay Lowland sites. Some of the more common species found might include broadfruit bur-reed, broadleaf cattail, river bulrush, field horsetail, arumleaf arrowhead, swamp milkweed, Pennsylvania smartweed, swamp smartweed, curly dock, devil’s beggartick, annual marshelder, rough barnyardgrass, and yellow nutsedge. False indigo bush and common buttonbush are shrubs that commonly occur in moist soil situations, often immediately adjacent to a stream or wetland area. Eastern cottonwood and common hackberry are the major trees in the broad bottomlands and are generally located along streambanks. Although the major portion of the site was dominated by herbaceous plants, isolated areas supported groves of trees. Protected by streams and rivers, some areas historically escaped the intensity of wildfires. These areas often developed a savannah plant community with an overstory of hardwood trees that may include eastern cottonwood, black willow, bur oak, American elm, green ash, and black walnut. Eastern cottonwood was usually the dominant tree and often formed large, single-species groves. The understory in these situations usually supported shade-tolerant, cool-season plants such as Canada wildrye, Virginia wildrye, Kentucky bluegrass, and sedges. This is a stable, resilient, and very productive plant community when adequately managed. A prescribed grazing program that incorporates periods of deferment during the growing season perpetuates the more palatable tallgrasses and forb species. In a number of locations this plant community is managed exclusively for hay production. Mowing tends to reduce the amount of switchgrass and prairie cordgrass plants and favor big bluestem, Indiangrass, and eastern gamagrass.

Resilience management. This is a stable plant community when grazing and fire are adequately managed. A prescribed grazing program that incorporates periods of deferment during the growing season benefits the tallgrasses and even the more palatable forb species. Excessive grazing and livestock trailing can quickly impact soil stability and lead to sheet erosion. Concentrated livestock use, such as winter feeding areas, can cause compaction of the wet, clay soils and stress the dominant tallgrasses.

Dominant plant species

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

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	3452	4932	7398
Forb	392	560	841
Shrub/Vine	78	112	168
Total	**3922**	**5604**	**8407**

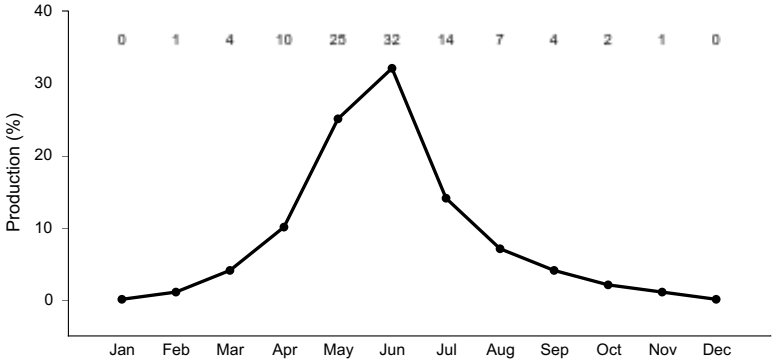


Figure 13. Plant community growth curve (percent production by month). KS7412, Reference Plant Community. Growth of warm-season grasses on this site typically begins during the period of May 1 to May 15 and continues until mid-September. As a general rule, 75 percent of total production is completed by mid-July. This varies only slightly from year to year depending 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'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 (Indian summers)..

Community 1.2
Tallgrass-Midgrass Plant Community

Figure 14. MLRA 74 Tallgrass-Midgrass Plant Community.

The composition of this plant community is dominated by a mixture of tall 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. Prairie cordgrass may even increase, especially on the wetter sites. The proportion of midgrasses, sedges, and rushes in the overall production of the site has increased. These include composite dropseed, little bluestem, western wheatgrass, marsh bristlegrass, and sideoats grama. Other secondary grasses that have potential to increase are Texas bluegrass, Kentucky bluegrass, vine mesquite, smooth bromegrass and sedges. Combined, these secondary 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 8 to 10 percent of the total herbage. In some locations the site supports an increasing amount of shrubs and trees. The most abundant shrubs are false indigo bush, common buttonbush, roughleaf dogwood, smooth sumac, and coralberry. Eastern cottonwood, black willow, and American elm are the major trees found on the site. Shrubs and trees usually comprise 5 to 10 percent of the total production.

Resilience management. Periods of deferment from grazing are essential to maintain the production of some of the major grasses found in this plant community. Eastern gamagrass and big bluestem are especially preferred and selectively grazed by cattle. When the site is grazed continuously throughout the growing season, these grasses are usually overgrazed and thus maintained in a lower state of plant health and vigor. When continued for many years, overgrazing results in the gradual reduction of those plants. 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.

Dominant plant species

- big bluestem (*Andropogon gerardii*), grass
- switchgrass (*Panicum virgatum*), grass
- prairie cordgrass (*Spartina pectinata*), grass
- little bluestem (*Schizachyrium scoparium*), 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 mid- and shortgrasses. Major midgrasses are composite dropseed, sand dropseed, silver beardgrass, purpletop tridens, sideoats grama, western wheatgrass, and marsh bristlegrass and smooth bromegrass. Shortgrasses include Kentucky bluegrass, Texas bluegrass, buffalograss, and blue grama. Major forbs on the site are Cuman ragweed, Canada goldenrod, Missouri goldenrod, white sagebrush, Carruth’s sagewort, white heath aster, annual marshelder, and annual ragweed. In some locations the site supports an increasing amount of shrubs and trees. The most common shrubs along drainageways are false indigo bush, common buttonbush, roughleaf dogwood, and coralberry. Eastern cottonwood, black willow, peachleaf willow, American elm, and osage orange are the major trees found on the site. Shrubs and trees usually will not comprise more than ten 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. These remnants 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, prairie cordgrass, eastern gamagrass, and switchgrass are only found in protected locations. These plants are usually grazed repeatedly and remain in a low state of health and 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, their numbers or percentage of composition is so 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

- composite dropseed (*Sporobolus compositus var. compositus*), grass
- silver beardgrass (*Bothriochloa laguroides*), grass
- purpletop tridens (*Tridens flavus*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- blue grama (*Bouteloua gracilis*), grass
- buffalograss (*Bouteloua dactyloides*), grass

Pathway 1.1 to 1.2
Community 1.1 to 1.2

Reference Plant Community

Tallgrass-Midgrass 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 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

Tallgrass-Midgrass Plant Community

Reference Plant Community

Causes of plant community shifts 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

Tallgrass/Midgrass Plant Community. If woody species are present, prescription fires every 6-8 years are 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 or the Shortgrass State has been documented. As plant community cover decreases from bunchgrasses to more of the sodgrasses there is a decrease in infiltration and interception and an increase in surface runoff (Thurow T., 2003).

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

Community 2.1
Shortgrass Plant Community

Figure 15. MLRA 74 Shortgrass Plant Community.

This plant community occurs following many years of continuous overgrazing and is dominated by a mixture of shortgrasses. Usually small and associated with farming enterprises, pastures were often used as holding areas in anticipation of seasonal wheat pasture or other cropland forages. Dominant grasses are blue grama, buffalograss, sideoats grama, composite dropseed, and western wheatgrass. Annual grasses including, Japanese brome, cheatgrass (*Bromus tectorum*), 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, hoary verbena, prairie broomweed, interior ironweed, and white sagebrush. A number of thistles, both, native and introduced are common in this plant community and may include wavyleaf, yellowspine, tall, Canada, bull, and nodding pumeless. 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 annuals. These may include barnyardgrass, snow on the mountain, rough cocklebur, annual ragweed, giant ragweed, annual marshelder, tall amaranth, curly dock, devil’s beggartick, and common sunflower. Although productivity is significantly reduced when compared to Reference Plant Community, this shortgrass can be managed as a stable plant community. Restoration to a tallgrass plant community in a reasonable period of time would require range seeding.

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

Dominant plant species

- blue grama (*Bouteloua gracilis*), grass
- buffalograss (*Bouteloua dactyloides*), grass
- composite dropseed (*Sporobolus compositus var. compositus*), grass
- western wheatgrass (*Pascopyrum smithii*), grass

State 3
Woody State

The Woody State is dominated by a shrub and 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 one 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 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
Shrub and/or Tree Plant Community

Shrubs and trees dominate this plant community and may produce 40 to 50 percent of the total vegetation. Major trees include eastern cottonwood, black willow, peachleaf willow, American elm, Siberian elm, common hackberry, and osage orange. More abundant shrubs are roughleaf dogwood, coralberry, smooth sumac, desert false indigo, and common buttonbush. The spread of these woody plants results from the absence of fire and may occur on the site regardless of grazing management. It is important to note, however, that not all unburned areas have a woody plant problem. Encroachment may occur on areas that have been overgrazed for years as well as on areas where both grazing and fire have been excluded. The speed and method of encroachment varies considerably but, under favorable conditions, can happen in a period as short as 20 to 30 years. Cottonwood, elm, and willow produce an abundance of seed that is distributed by wind over long distances. Common hackberry is spread by birds. Periodic burning tends to hinder the establishment of most of these woody species and favor forbs and grasses. Where woody plants have invaded overgrazed areas, the understory vegetation is generally dominated by plants such as Texas bluegrass, Kentucky bluegrass, smooth bromegrass, composite dropseed, purpletop tridens, marsh bristlegrass, sedges, white sagebrush, Baldwin's ironweed, and white heath aster. Where woody plants have encroached onto areas that have gone essentially ungrazed for many years, the understory consists largely of big

bluestem, Indiangrass, little bluestem, Virginia wildrye, Canada wildrye, sedges, prairie bundleflower, Canada goldenrod, and Maximilian sunflower. Herbage production is significantly reduced because of the tree and shrub competition for light and moisture. As such, grass yields vary from 30 to 40 percent of the total vegetative production and forbs generally produce 5 to 10 percent of the total. Usually a prescribed burning program accompanied by a plan of prescribed grazing will return the plant community to one dominated by grasses and forbs. Special planning will be necessary to assure that sufficient amounts of fine fuel are available to carry fires with enough intensity to control woody species. Use of additional brush management tools such as chemicals or mechanical methods may be necessary to initiate and accelerate this transition in some locations.

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

Dominant plant species

- eastern cottonwood (*Populus deltoides*), tree
- black willow (*Salix nigra*), tree
- American elm (*Ulmus americana*), tree
- Siberian elm (*Ulmus pumila*), tree
- common hackberry (*Celtis occidentalis*), tree
- roughleaf dogwood (*Cornus drummondii*), shrub
- coralberry (*Symphoricarpos orbiculatus*), shrub
- smooth sumac (*Rhus glabra*), shrub
- common buttonbush (*Cephalanthus occidentalis*), shrub

State 4
Tillage State

Extensive areas of the historic Clay Lowland 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 and 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 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. The Tillage State is a result of a land use management decision.

Community 4.1
Reseed Plant Community

This plant community occurs on areas that were formerly farmed and reseeded with a mixture of native species common in the Reference Plant Community. Most seeding mixtures consisted of a blend of grasses that include sand bluestem, Indiangrass, switchgrass, little bluestem, sideoats grama, blue grama, and western wheatgrass. In some locations, seeds 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 torevegetate 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, smooth bromegrass, 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 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 to reduce competition with herbaceous understory vegetation, in accordance with overall resource management objectives; and prescribed grazing—the controlled harvest of vegetation with grazing or browsing animals managed with the intent to achieve a specified objective. In addition, grazing at an intensity that will maintain enough cover to protect the soil and maintain or improve the quantity and quality of desirable vegetation. When a juniper tree is cut and removed, the soil structure and the associated high infiltration rate may be maintained for over a decade (Hester, 1996). This explains why the area near the dripline usually has substantially greater forage production for many years after the tree has been cut. It also explains why runoff will not necessarily dramatically increase once juniper is removed. Rather, the water continues to infiltrate at high rates into soils previously ameliorated by junipers, thereby increasing deep drainage potential. In rangeland, deep drainage amounts can be 16 percent of the total rainfall amount per year (Thurow and Hester, 1997).

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tallgrass dominant 71%**			2242–3979	
	big bluestem	ANGE	*Andropogon gerardii*	1009–1491	–
	prairie cordgrass	SPPE	*Spartina pectinata*	448–1065	–
	switchgrass	PAVI2	*Panicum virgatum*	280–639	–
	Indiangrass	SONU2	*Sorghastrum nutans*	280–639	–

	eastern gamagrass	TRDA3	*Tripsacum dactyloides*	84–213	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	11–67	–
2	**Midgrasses minor 7%**			140–392	
	little bluestem	SCSC	*Schizachyrium scoparium*	84–213	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	56–213	–
3	**Cool-season grasses minor 8%**			140–448	
	Canada wildrye	ELCA4	*Elymus canadensis*	22–112	–
	Virginia wildrye	ELVI3	*Elymus virginicus*	22–112	–
	western wheatgrass	PASM	*Pascopyrum smithii*	11–90	–
	wirestem muhly	MUFR2	*Muhlenbergia frondosa*	0–73	–
	field horsetail	EQAR	*Equisetum arvense*	0–34	–
	sedge	CAREX	*Carex*	0–34	–
4	**Shortgrasses trace 2%**			11–112	
	blue grama	BOGR2	*Bouteloua gracilis*	11–56	–
Forb					
5	**Forbs minor 10%**			118–560	
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	34–84	–
	stiff goldenrod	OLRI	*Oligoneuron rigidum*	11–56	–
	cup plant	SIPE2	*Silphium perfoliatum*	0–56	–
	white heath aster	SYER	*Symphyotrichum ericoides*	11–56	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	11–56	–
	wholeleaf rosinweed	SIIN2	*Silphium integrifolium*	11–56	–
	Illinois bundleflower	DEIL	*Desmanthus illinoensis*	11–56	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	11–56	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–28	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	6–22	–
	Baldwin's ironweed	VEBA	*Vernonia baldwinii*	0–22	–
	Indianhemp	APCA	*Apocynum cannabinum*	11–22	–
	swamp smartweed	POHY2	*Polygonum hydropiperoides*	0–11	–
	Pennsylvania smartweed	POPE2	*Polygonum pensylvanicum*	0–11	–
Shrub/Vine					
6	**Shrubs and Trees trace 2%**			28–112	
	coralberry	SYOR	*Symphoricarpos orbiculatus*	6–22	–
	common buttonbush	CEOC2	*Cephalanthus occidentalis*	6–22	–
	common hackberry	CEOC	*Celtis occidentalis*	0–22	–
	eastern cottonwood	PODE3	*Populus deltoides*	6–22	–
	green ash	FRPE	*Fraxinus pennsylvanica*	6–22	–
	false indigo bush	AMFR	*Amorpha fruticosa*	6–22	–

Animal community

Wildlife

This site is excellent wildlife habitat because of its plant diversity and its proximity to riparian areas. Besides

grassland, some areas are a mosaic of grass and woodlands or even riparian woodland, sometimes called gallery forest. Wetland inclusions also add to the diversity of this site.

This is a preferred site for popular big game species such as white-tailed deer and wild turkey. Because of the vegetative diversity and scattered wetlands, there are many small mammals such as raccoon, rabbit, squirrel, opossum, and mink. The bobcat and coyote are common predators. Songbird diversity is abundant. Migrating waterfowl are attracted to the wetlands that are interspersed throughout this site. Resident wood duck pairs are a common sight as are red-winged blackbirds and the sedge wren. All three species can be found nesting in this habitat. The riparian woodland is host to numerous bird species including the white-breasted nuthatch, tufted titmouse, the black-capped chickadee, and the great crested flycatcher. Tall cottonwood stands (30-40 feet) in riparian areas along streams are favorite roost sites for turkey, great blue heron, and the bald eagle. Chorus, cricket, and leopard frogs, several toad species, and a variety of snakes and other reptiles inhabit the site.

Grazing management that maintains plant vigor will provide quality habitat for wildlife. Maintenance and management of existing woody species will enhance wildlife diversity.

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, 6.5%; 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.

Flooding and soil permeability are factors influencing forage production on this site. New Cambria is a hydrologic

group C soil. Solomon and Sutphen are hydrologic group D soils. Infiltration rates are slow to very slow. Please refer to the NRCS National Engineering Handbook Section 4 (NEH-4) for runoff quantities and hydrologic curves when making hydrology determinations.

Recreational uses

This site is very desirable for outdoor recreational pursuits because of its plant and wildlife diversity. White-tail deer and wild turkey are abundant and commonly hunted on this site along with a wide variety of small game such as pheasant, quail, rabbits, squirrels, and raccoons. In addition, this site provides opportunities for bird watching, hiking, outdoor/wildlife photography, and a variety of other outdoor activities. There are a wide variety of plants in bloom throughout the growing season which provide much aesthetic appeal to the landscape. Recreation can be a high value use, but there are a number of site considerations because of the potential for flooding, slow permeability, and high shrink-swell potential of the soils on this site.

Wood products

In some locations there have been commercial harvests of eastern cottonwood and limited harvests of black walnut and bur oak. Some hardwoods are cut for firewood.

Other products

Woody shrubs and vines such as plum, currant, and grape are prized for jams and jellies. 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

If development is under consideration, site evaluations are very important because of the hazard of flooding, the high clay content of the soil, and associated shrink-swell potential. The potential for hydric soils or wetland inclusions may require a wetland determination as well.

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 74 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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Approval

David Kraft, 10/04/2019

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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 11-30-2018; 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	Chris Tecklenburg
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** No natural rill formation is common or part of the Clay Lowland 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.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Less than 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).

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

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

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

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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.

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

   Ap--0 to 15 centimeters (0 to 6 inches); very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak fine granular structure; hard, firm, plastic and sticky; common very fine roots; slightly acid; abrupt smooth boundary.

   A1--15 to 33 centimeters (6 to 13 inches); very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; moderate medium subangular blocky structure; very hard, very firm, very plastic and very sticky; common very fine roots; neutral; clear wavy boundary.

   A2--33 to 76 centimeters (13 to 30 inches); dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; weak medium angular blocky structure; very hard, very firm, very plastic and very sticky; common very fine roots; a few slickensides; some old cracks filled with very dark gray (10YR 3/1) soil; slightly alkaline; gradual wavy boundary. (Combined thickness of the A horizon is 50 to 90 centimeters (20 to 36 inches.))

   AC--76 to 117 centimeters (30 to 46 inches); dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak medium angular blocky structure; very hard, very firm, very plastic and very sticky; a few slickensides; common fine carbonate concretions; moderately alkaline; gradual wavy boundary. (0 to 46 centimeters (0 to 18 inches thick))

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Functional and structural groups are that of the Reference Plant Community (see functional and structural group worksheet). Note changes to plant communities if different than that of the functional and structural group worksheet.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** There is no evidence of a compacted soil layer less than 6 inches from the soil surface. Soil structure is similar to that described in Indicator 9. Compacted physical features will include platy, blocky, dense soil structure over less dense soil layers, horizontal root growth, and increase bulk density (measured by weighing a known volume of oven-dry soil).

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

    Dominant: Group 1 Tallgrass dominant 71% 3550 lbs; big bluestem 900-1330, prairie cordgrass 400-950, switchgrass 250-570, Indiangrass 250-570, eastern gamagrass 75-190, composite dropseed 10-60.

    Sub-dominant: None

    Other: Group 2 Midgrasses Minor 7% 350 lbs.; little bluestem 75-190, sideoats grama 50-190
    Group 3 Cool-season grasses Minor 8% 400 lbs,; Canada wildrye 20-100, Virginia wildrye 20-100, western wheatgrass 10-80, wirestem muhly 0-65, field horsetail 0-30, sedge 0-30.
    Group 5 Forbs Minor 10% 500 lbs

    Additional: Group 4 Shortgrass Trace 2% 100 lbs., blue grama 10-50, buffalograss 0-50
    Group 5 Forbs minor 10% 500 lbs.
    Group 6 Shrubs and Trees Minor 2% 100 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 3,500 lbs in a below-average rainfall year and 7,500 lbs in an above-average rainfall year. The representative value for this site is 5,000 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.

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.