Ecological site R075XY057NE
Clayey Plains

Accessed: 05/21/2024

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.

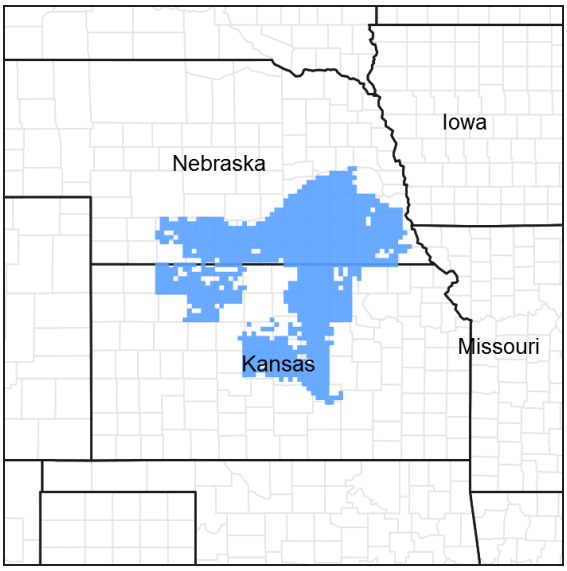


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 075X–Central Loess Plains

This approved ecological site description, Clayey Plains, has been developed to meet the standards established in the National Ecological Site Handbook. The information associated with the Clayey Plains ecological site meets the Approved Ecological Site Description Standard, and has been through a Quality Control and Quality Assurance processes to assure consistency and completeness. Further investigations, reviews, and correlations are necessary before it progresses to the Correlated level.

Named “The Central Loess Plains,” MLRA 75 is located primarily in south-central Nebraska, with about 10 percent lying in north-central Kansas. The approximately 5.3 million acre landscape covers all or parts of 21 counties: mainly Phelps, Kearney, Adams, Clay, Fillmore, York, Hamilton, Seward, Butler, Saline, Thayer, Nuckolls, and Webster in Nebraska, with a significant presence in Republic and Washington counties in Kansas. The physical appearance primarily consists of gently rolling plains, with a number of narrow, shallow stream valleys. The river valleys are broader, and most feature a number of terraces. The northern border is defined by the Platte River. This MLRA is home to the unique ecological system called “The Rainwater Basin,” which is comprised of a 24,000 acre network of wetlands and uplands that occupy portions of 13 of the northern counties.
The elevation in MLRA 75 ranges from nearly 2,600 feet to less than 1,100 feet above sea level. The local relief averages from 10 to 25 feet, but may stretch to a maximum of 165 feet in some areas.

The predominant soil orders in this geographic area are mesic, ustic Mollisols, commonly represented by the Geary, Hastings, Holder, Holdrege, Kenesaw, and Uly soil series.

Loess overlays the surface of almost all of the uplands in this MLRA. Alluvial clay, silt, sand, and gravel are deposited in the stream and river valleys, and can be extensive in the major drainages. Terraces are common in the valleys along the river systems.

The average annual precipitation ranges from 23 to 36 inches, and the number of freeze-free days range from 150 to 200.

The matrix vegetation type is mixed-grass prairie, with big and little bluestem, switchgrass, Indiangrass, and sideoats and blue grama to make up the bulk of the warm-season species, while western wheatgrass is the dominant cool-season grass.

Seventy two percent of the land in this MLRA has been broken out of native prairie and farmed; the land is primarily planted to corn, wheat, and grain sorghum, while only eighteen percent of the grasslands remain intact. Livestock grazing, primarily by cattle, is the main industry on these remnants. Irrigation of croplands uses over 90 percent of the total annual water withdrawal in this area.

Wildlife flourishes in this combination of crop and grassland environment, with both mule and white-tailed deer being the most abundant wild ungulates. A variety of smaller species, including coyote, raccoon, opossum, porcupines, muskrat, beaver, squirrel, and mink thrive in the region, as well as several upland bird species. Grassland bird populations are somewhat limited by the lack of contiguous native prairie and fragmented habitat created by the farmland.

The rivers, streams, and lakes harbor excellent fisheries, and an estimated tens of millions of migrating and local waterfowl use the wetland complexes. These complexes provide ideal habitat for a number of wading and shore bird species as well.

This landscape serves as a backdrop for a disturbance-driven ecosystem, evolving under the influences of herbivory, fire, and variable climate. Historically, these processes created a heterogeneous mosaic of plant communities and structure heights across the region. Any given site in this landscape experienced fire every 6 to 8 years. The fires were caused by lightning strikes and also were set by native Americans, who used fire for warfare, signaling, and to refresh the native grasses. These people understood the value of fire as a tool, and that the highly palatable growth following a fire provided both excellent forage for their horses, and attracted grazing game animals such as bison and elk.

Even as post-European settlement's alteration of the fire regime allows the expansion of the woody component of the native prairie, introduction of eastern redcedar (ERC) as a windbreak species further facilitates invasion by this species.
While eastern redcedar is native to Nebraska, the historic population in MLRA 75 was limited to isolated pockets in rugged river drainages which were subsequently insulated from fire. Widespread plantings of windbreaks with eastern redcedar as a primary component have provided a seed source for the aggressive woody plant. The ensuing encroachment into the native grasslands degrades the native wildlife habit and causes significant forage loss for domestic livestock. However, since it is not a root sprouter, eastern redcedar is very susceptible to fire when under six feet tall. Management with prescribed fire is exceedingly effective if applied before this stage.

Larger redcedars can also be controlled with fire, but successful application requires the use of specifically designed ignition and holding techniques.
Fragmentation of the native grasslands by conversion to cropland, transportation corridors, and other developments have effectively disrupted the natural fire regime of this ecosystem. This has allowed encroachment by native and introduced shrubs and trees into the remnants of the native prairie throughout the MLRA. Aggressive fire suppression policies have exacerbated this process to the point that shrub and tree encroachment is a major ecological issue in the majority of both native and re-seeded grasslands.

Classification relationships

NRCS FOTG Section 1 - Nebraska Vegetation Zone 3

Major Land Resource Area (MLRA): Major Land Resource Area (MLRA) 75 (USDA-Natural Resources Conservation Service, 2006)

Revision Notes:
Further work will be needed before this site is upgraded to the Correlated level.

Ecological site concept

The Clayey Upland is a non-effervescing run-off site normally occurring on less than 30 percent slopes. Surface textures range from silt loam to silty clay loam. The subsoil is silty clay and has greater than 45 percent clay.

Associated sites

R075XY049NE	**Closed Upland Depression** Closed Upland Depression: Located adjacent to Clayey Plains, but in a run-on landscape position. The vegetative communities are significantly different.
R075XY050NE	**Loamy Terrace** Loamy Terrace: Located below and adjacent to the Clayey Plains site.
R075XY058NE	**Loamy Plains** Loamy Plains: Often located adjacent to Clayey Plains, this site has coarser textured soils with a subsoil clay content of less than 45 percent. Runoff is typically lower and sites have more available soil moisture. Similar plant communities occur but plants that are better adapted to droughty conditions will be more prevalent on the Clayey site.
R075XY059NE	**Limy Loess Slopes** Limy Loess Slopes: This site is similar in soil texture to Loamy Plains, but effervesces in the top horizon of the profile, usually less than six inches. Clayey Plains has a greater subsoil clay content, and does not effervesce.

Similar sites

R075XY058NE	**Loamy Plains** Loamy Plains: Often located adjacent to Clayey Plains, this site has coarser textured soils with a subsoil clay content of less than 45 percent. Runoff is typically lower and sites have more available soil moisture. Similar plant communities occur but plants that are better adapted to droughty conditions will be more prevalent on the Clayey site.
R075XY059NE	**Limy Loess Slopes** Limy Loess Slopes: This site is similar in soil texture to Loamy Plains, but effervesces in the top horizon of the profile, usually less than six inches. Clayey Plains has a greater subsoil clay content, and does not effervesce.

Table 1. Dominant plant species

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

Physiographic features

This site occurs on plains on loess uplands and on terraces on river valleys. Slopes typically are nearly level to gently sloping but can range to moderately sloping. The frequency of flooding is none to rare.

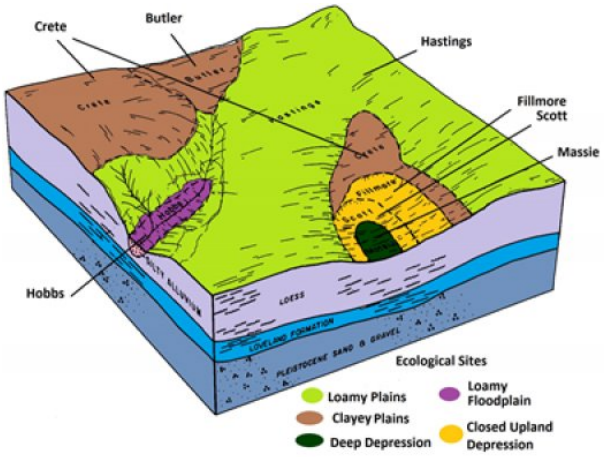


Figure 2. Clayey Plains Block Diagram

Table 2. Representative physiographic features

Landforms	(1) Plain (2) Terrace
Flooding frequency	None
Ponding frequency	None
Elevation	344–843 m
Slope	0–30%
Water table depth	203 cm
Aspect	Aspect is not a significant factor

Climatic features

Like most Great Plains landscapes, the climate in this MLRA is under the sway of the continental effect. This creates a regime of extremes, with summer highs often in the triple digits, and winter lows plunging well below zero. Blizzards can occur anytime between early fall and late spring, often dropping the temperature more than 50 degrees in just a few hours. These events can pile up several feet of snow, often driven by winds in excess of 50 miles an hour. The resulting huge snow drifts can cause serious hardship for livestock, wildlife and humans. Winters can be open, with bare ground for most of the season, or closed, with up to several feet of snow persisting until March. Most winters have a number of warm days, interspersed with dropping temperatures, usually associated with approaching cold fronts. Spring brings violent thunderstorms, hail and high winds. Tornadoes occur frequently. Daily winds range from an average of 14 miles per hour during the spring to 11 miles per hour during the late summer. Occasional strong storms may bring brief periods of high winds with gusts to more than 80 miles per hour. Growth of native cool season plants begin in early April and continues to about mid-June. Native warm season plants begin growth in early June, and continue to early August. Green up of cool season plants may occur in September and October.

Table 3. Representative climatic features

Frost-free period (average)	155 days
Freeze-free period (average)	177 days
Precipitation total (average)	762 mm

Climate stations used

- (1) AURORA [USC00250445], Aurora, NE
- (2) MINDEN [USC00255565], Minden, NE
- (3) RED CLOUD [USC00257070], Red Cloud, NE

- (4) HEBRON [USC00253735], Hebron, NE
- (5) OSCEOLA [USC00256375], Osceola, NE
- (6) RAGAN [USC00257002], Alma, NE
- (7) CLAY CTR [USC00251684], Saronville, NE
- (8) FAIRMONT [USC00252840], Fairmont, NE
- (9) HASTINGS 4N [USC00253660], Hastings, NE
- (10) SUPERIOR 4E [USC00258320], Hardy, NE
- (11) SURPRISE [USC00258328], Surprise, NE
- (12) YORK [USC00259510], York, NE
- (13) BELLEVILLE [USC00140682], Belleville, KS
- (14) FRIEND 3E [USC00253065], Friend, NE
- (15) GENEVA [USC00253175], Geneva, NE

Influencing water features

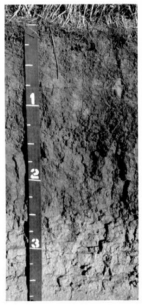
This site is an upland site and functions independently from ground and surface water features.

Soil features

This site consists of very deep, clayey soils. Surface textures range from silt loam to silty clay loam. The subsoil is silty clay and has more than 45 percent clay. These soils typically are not hydric. Depth to carbonates ranges from 24 to greater than 80 inches.

The Reference Plant Community should exhibit slight to no evidence of rills, wind-scoured areas, or pedestaled plants. Water flow paths, if any, are broken, irregular in appearance, or discontinuous with numerous debris dams or vegetative barriers. The soil surface is stable and intact. These soils are susceptible to erosion, primarily by water. The potential for soil erosion by water increases as the slope increases.
Wind-deposited Peorian Loess from the late Quaternary period is the parent material for these soils. There is ongoing discussion about whether the source of the loess is Tertiary siltstones, the Sandhills, Platte River sediments, or a combination of the above.

Major soil series correlated to this ecological site include: Crete and Butler.



Crete Series Profile

Figure 7. Crete Series Profile

Table 4. Representative soil features

Surface texture	(1) Silt loam (2) Silty clay loam
Family particle size	(1) Clayey
Drainage class	Somewhat poorly drained to moderately well drained
Permeability class	Very slow to slow

Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	12.7–22.86 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	5–8
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

Clayey Plains sites developed under Northern Great Plains climatic conditions, light to severe grazing by bison and other large herbivores, sporadic natural or man-caused wildfires, and other biotic and abiotic factors which typically influence soil/site development. This continues to be a disturbance-driven site, by herbivory, fire, and variable climate. Changes occur in the plant communities due to weather variations, impacts of native and/or exotic plant and animal species, and management actions.

One of the primary impacts to this site introduced by European-man is season-long continuous grazing by domestic livestock. This management practice causes the repeated removal of the growing point and excessive defoliation of the leaf area of individual tall warm-season grasses. The resulting reduction of the ability of the plants to harvest sunlight depletes the root reserves, subsequently decreasing the root mass. This negatively impacts the ability of the plants to compete for life-sustaining nutrients, resulting in declining vigor and eventual mortality. The space created in the vegetative community is then occupied by a species that evades the negative grazing impacts by a growing season adaptation (such as a cool season), a shorter structure, or a reduced palatability mechanism.

The State-and-Transition Model (STM) is depicted below, and is made up of a Reference State, a Native/Invaded State, a Sod-busted State, and an Invaded Woody State. Each state represents the crossing of a major ecological threshold due to alteration of the functional dynamic properties of the ecosystem. The main properties observed to determine this change are the soil and vegetative communities and the hydrological cycle.

Each state may have one or more vegetative communities which fluctuate in species composition and abundance within the normal parameters of the state. Within each state, communities may degrade or recover in response to natural and man-caused disturbances such as variation in the degree and timing of herbivory, presence or absence of fire, and climatic and local fluctuations in the precipitation regime.

Interpretations are primarily based on the Reference State, and have been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics have been interpreted from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts. Plant communities, states, transitional pathways, and thresholds have been determined through similar studies and experience.

Growth of native cool-season plants begins about April 1, and continues to about June 15. Native warm-season plants begin growth about May 15, and continue to about August 15. Green-up of cool-season plants may occur in September and October if adequate moisture is available.

The species distribution and abundance on this site are also influenced by the degree of inclination and aspect of

the local topography. Northern and eastern slopes typically are cooler and wetter, generally producing more biomass than the drier and warmer exposures. Severe inclines receive less grazing pressure than the more moderate slopes.

The following is a diagram illustrating the common plant communities that can occur on the site and the transition pathways between communities.

State and transition model

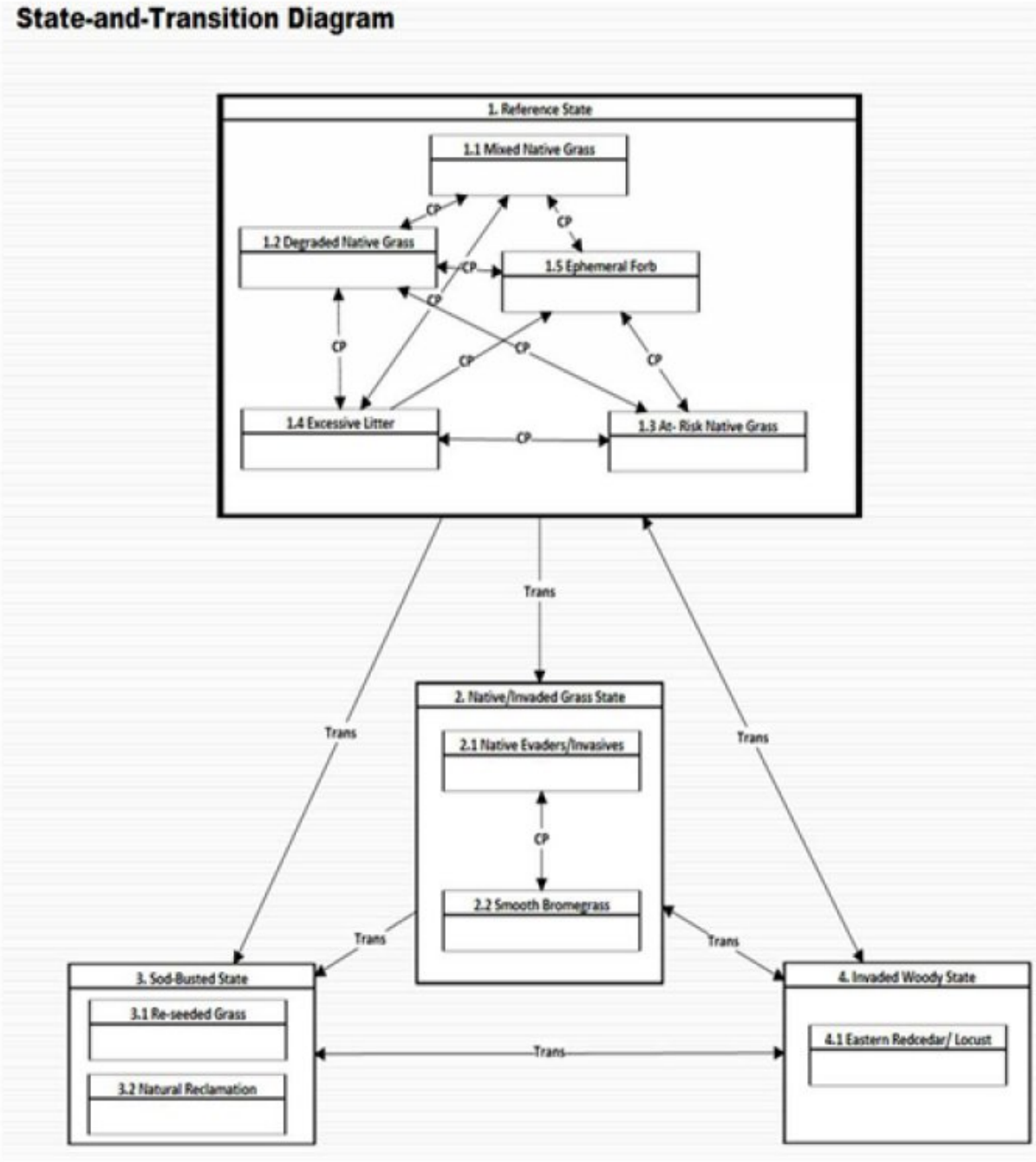


Figure 8. Clayey Upland STM

Diagram Legend

T 1-2	Long-term excessive livestock grazing or haying without appropriate growing-season rest periods; Extreme drought.
T 1,2-3	Mechanical disturbance of the soil to facilitate production agricultural practices. Permanent alterations to the soil properties and hydrological cycle make complete restoration to the Reference State unlikely.
T 1,2,3-4	Disruption of natural fire regime, planting of exotic and invasive native woody species.
R 4-1,2,3	Mechanical removal, immediate follow-up stump treatment of root-sprouting species, mechanical removal/application of prescribed fire for eastern red cedar. Development and implementation of a follow-up maintenance prescribed burn program.
CP 1.1-1.2: 1.2-1.3	Timing, frequency, and degree of herbivory/haying that negatively affects desirable mid-grass species; Long-term drought.
CP 1.1,1.2,1.3-1.4	Lack of natural disturbance, i.e. Herbivory and fire.
CP 1.1,1.2,1.3,1.4-1.5	A high-impact disturbance event or combination of events causing excessive defoliation of the vegetation, i.e. a growing season wildfire followed by a significant hailstorm, prolonged intensive grazing event, or long-term drought, etc.
CP 1.2-1.1: 1.3-1.2	Alter herbivory/haying regime to allow growing season rest of desirable mid-grass species; Return to normal precipitation regime
CP 1.4-1.1,1.2,1.3	Restoration of appropriate livestock grazing system; Application of strategically timed prescribed fire.
CP 1.5-1.1,1.2,1.3	Restoration occurs naturally once the disturbance event has subsided. Allowing rest during growing season will accelerate the recovery.
CP 2.1-2.2	Introduced grass seeding, excessive warm season grazing, inadequate growing season rest, multi season haying and nitrogen fertilizing in spring and/or fall.
CP 2.2-2.1	Restoration can be achieved by herbicide treatment and reseeding. If native remnants are present, appropriately timed prescribed fire and a follow up prescribed grazing program may achieve the desired results.

Figure 9. Clayey Upland Matrix

State 1
Reference State

This state describes the range of vegetative community phases that occur on the Clayey Plains site where the

natural processes are mostly intact. The Reference Community is a representation of the native plant community phase that occupies a site that has been minimally altered by management. The Degraded Native Grass, the At-Risk Native Grass, and the Excessive Litter Communities are the phases that result from management decisions that are unfavorable for a healthy Reference Community. The Ephemeral Forb Community is the result of a high intensity disturbance event. High perennial grass cover and production allows for increased soil moisture retention, vegetative production, and overall soil quality.

Community 1.1
Mixed Native Grass

Figure 10. Mixed Native Grass Community

The Mixed Native Grass Community serves as a description of the native plant community that naturally occurs on the site when the natural disturbance regimes are intact, or closely mimicked by management practices. This phase is dynamic, with fluid relative abundance and spatial boundaries between the dominant structural vegetative groups. These fluctuations are primarily driven by different responses of the species to changes in precipitation timing and abundance, and fire and grazing events. The potential vegetation consists of approximately 70-85 percent grasses and grass-like plants, 2-10 percent forbs, and 0-5 percent shrubs. Big bluestem, little bluestem, switchgrass, and Indiangrass are the primary species in this community. Secondary species include sideoats grama, blue grama, and composite dropseed. Western wheatgrass occurs as a secondary species in the western portion of the MLRA. The site has a very diverse forb population. This plant community is highly productive, diverse, and resistant to short term stresses such as drought and short periods of heavy stocking. The well-developed root systems support resiliency when allowed adequate recovery periods between grazing events. When exposed to long-term or frequent over-grazing events without adequate rest, this plant community will degrade. Total annual production ranges from 2,587 to 4,175 pounds of air dry vegetation per acre.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	2737	3419	4091
Forb	135	263	392
Shrub/Vine	28	112	196
Total	**2900**	**3794**	**4679**

Figure 12. Plant community growth curve (percent production by month). NE7501, Central Loess Plains, warm season dominant. Native warm-season dominant, MLRA 75.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	21	33	18	8	6	3	1	0

Community 1.2
Degraded Native Grass Community

Figure 13. Degraded Native Grass Community

Big and little bluestem are the dominant grasses. This is considered a declining community phase with a significant loss of production. This is due to continuous season-long grazing with inadequate recovery periods. Indiangrass has been significantly reduced, while the grazing-evasive warm-season and cool-season grasses increase. The composition of the forb component remains diverse, but the potential for encroachment by invasive woody species becomes more likely, due to fewer deep rooted species and a reduced fuel load to carry fire. While this plant community is less productive and less diverse than the representative plant community, it remains sustainable in regards to site/soil stability, watershed function, and biologic integrity. Total annual production ranges from 2,700 to 3,500 pounds of air dry vegetation per acre.

Figure 14. Plant community growth curve (percent production by month). NE7501, Central Loess Plains, warm season dominant. Native warm-season dominant, MLRA 75.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	21	33	18	8	6	3	1	0

Community 1.3
At-Risk Native Grass Community

Figure 15. At-Risk Community

In this plant community, the more palatable tall warm-season grasses have been reduced to remnant populations by continued defoliation during their critical growth periods. Grazing-evasive warm-season and cool-season grasses increase significantly. Bluegrass encroachment also occurs on flatter slopes. Soil health is affected by reduced efficiency in the nutrient, mineral, and hydrologic cycles as a result of decreases in plant litter and rooting depths.

Figure 16. Plant community growth curve (percent production by month). NE7502, Central Loess Plains, warm season at risk. Native warm-season at risk, reduced tall, warm-season grasses with increased cool-season grasses, MLRA 75.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	21	26	18	10	8	3	1	0

Community 1.4
Excessive Litter Community

The Excessive Litter Community Phase describes the response of the community to the removal of the natural disturbances of herbivory and fire. As the undisturbed duff layer deepens, infiltration of the precipitation is interrupted and evaporation increases significantly, simulating drought-like conditions.

Community 1.5
Ephemeral Forb Community

This community describes the flush of forbs that occurs in response to a major disturbance, or combination of disturbances. Growing season wildfire followed by hail, extreme prolonged drought, or extreme defoliation by herbivores are all examples of these disturbances. The native warm-season grasses re-establish dominance with-in a few years of the event.

Pathway CP 1.1-1.2
Community 1.1 to 1.2

Mixed Native Grass

Degraded Native Grass Community

A shift from the Mixed Native Grass to the Degraded Native Grass community occurs with continuous season long grazing and inadequate recovery periods during the growing season.

Pathway CP 1.1-1.4
Community 1.1 to 1.4

Prolonged interruption of the natural disturbances of herbivory and fire will result in conversion from this community to the Excessive Litter Community.

Pathway CP 1.1-1.5
Community 1.1 to 1.5

A high-impact disturbance event or combination of events causing excessive defoliation of the vegetation, i.e. a growing season wildfire followed by a significant hailstorm, or a prolonged intensive grazing event or long-term drought, etc.

Pathway CP 1.2-1.1
Community 1.2 to 1.1

Degraded Native Grass Community

Mixed Native Grass

A shift from the Degraded Native Grass community toward the Reference community can be achieved through prescribed grazing. Applying grazing pressure during the growth period of the undesirable cool season grasses, and allowing rest during the warm season growing season favors our desired species. This grazing regime will enable the deeply rooted tall warm season grasses to out compete the shallow rooted grazing evasive warm season and the cool season grasses. Appropriately timed prescribed fire will accelerate this process.

Conservation practices

Access Control
Prescribed Grazing

Pathway CP 1.2-1.3
Community 1.2 to 1.3

Degraded Native Grass Community

At-Risk Native Grass Community

Maintaining continuous season long grazing with inadequate recovery periods during the growing season further

degrades the site to the At-Risk Native Grass Community.

Pathway CP 1.2-1.4
Community 1.2 to 1.4

Prolonged interruption of the natural disturbances of herbivory and fire will result in conversion from this community to the Excessive Litter Community.

Pathway CP 1.2-1.5
Community 1.2 to 1.5

A high-impact disturbance event, or combination of events causing excessive defoliation of the vegetation, i.e. a growing season wildfire followed by a significant hailstorm, or a prolonged intensive grazing event, or long-term drought, etc.

Pathway CP 1.3-1.2
Community 1.3 to 1.2

At-Risk Native Grass Community

Degraded Native Grass Community

Reversing the downward trend to the previous community can be achieved with prescribed grazing early and late in the growing season to reduce undesirable cool season grasses. Targeting the peak growth period of cool season grasses with high intensity grazing events followed by rest will allow the tall native warm season grasses to rejuvenate. Appropriately timed prescribed fire will accelerate this process.

Conservation practices

Access Control
Prescribed Grazing

Pathway CP 1.3-1.4
Community 1.3 to 1.4

Interruption of the natural disturbances of herbivory and fire will result in conversion from this community to the Excessive Litter Community.

Pathway CP 1.3-1.5
Community 1.3 to 1.5

A high-impact disturbance event, or combination of events causing excessive defoliation of the vegetation, i.e. a growing season wildfire followed by a significant hailstorm, or a prolonged intensive grazing event, or long-term drought, etc.

Pathway CP 1.4-1.1
Community 1.4 to 1.1

Re-introduction of the natural processes of herbivory and fire will allow the vegetation to return to the previous community.

Pathway CP 1.4-1.2
Community 1.4 to 1.2

Re-introduction of the natural processes of herbivory and fire will allow the vegetation to return to the previous community.

Pathway CP 1.1-1.5
Community 1.4 to 1.5

A high-impact disturbance event, or combination of events causing excessive defoliation of the vegetation, i.e. a growing season wildfire followed by a significant hailstorm, or a prolonged intensive grazing event, or long-term drought, etc.

Pathway CP 1.5-1.1
Community 1.5 to 1.1

Restoration occurs naturally once the disturbance event has subsided. Allowing growing season rest will accelerate the recovery.

Pathway CP 1.5-1.2
Community 1.5 to 1.2

Restoration occurs naturally once the disturbance event has subsided. Allowing growing season rest will accelerate the recovery.

Pathway CP 1.5-1.3
Community 1.5 to 1.3

Restoration occurs naturally once the disturbance event has subsided. Allowing growing season rest will accelerate the recovery.

State 2
Native/Invaded Grass State

This state has been degraded from the Reference State and much of the native warm-season grass community has been replaced by less desirable plants. The loss of tall and mid- warm-season grasses has negatively impacted energy flow and nutrient cycling. Water infiltration is reduced due to the shallow root system and rapid runoff characteristics of the grazing-evasive plant communities. The Native Evaders/Invasives and the Smooth Bromegrass communities are the components of the Native/Invaded Grass State.

Community 2.1
Native Evaders/Invaded Grass

Figure 17. Native/Invaded Grass

This plant community represents a shift from the Reference State across a plant community threshold. With continued grazing pressure, blue grama, Kentucky bluegrass, and composite dropseed will become the dominant plant species, with only trace remnants of the more palatable tall and mid- warm-season grasses such as big and little bluestem. Composite dropseed is a grazing-evasive warm-season mid-grass with low palatability. Continuous and heavy grazing pressure will maintain this plant community in a sod-bound condition. Forb richness and diversity has decreased. With the decline and loss of deeper penetrating root systems, a compacted layer may form in the soil profile below the more shallow replacement root systems. Grazing management practices that allow for adequate periods of recovery between grazing events will favor mid and tall warm-season grasses. Appropriately timed prescribed fire will accelerate the restoration process. Total annual production ranges from 1,700 to 2,700 pounds of air dry vegetation per acre.

Figure 18. Plant community growth curve (percent production by month). NE7503, Central Loess Plains, warm season/cool season co-dominant. Native warm-season plant community encroached with cool-season grasses, MLRA 75.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	9	27	25	12	10	10	3	1	0

Community 2.2
Smooth Bromegrass

This plant community contains predominately smooth bromegrass but also contains some native warm-season grass remnants. Production of smooth bromegrass-dominated plant communities is highly variable, depending upon the percentages of composition present and outside inputs such as fertilizer and weed control. Production can range from 2,200 lbs./acre to 2,900 pounds/acre in normal years on rangelands with a smooth bromegrass component of 50 percent or more. Clipping or ocular estimates of production should be conducted to verify current annual production.

Figure 19. Plant community growth curve (percent production by month).

NE7504, Central Loess Plains, cool season dominant, warm season remnants. Cool season, smooth brome with native warm season remnants, MLRA 75.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	2	13	29	19	7	10	13	6	1	0

Pathway CP 2.1-2.2
Community 2.1 to 2.2

This community will be converted to a Smooth Bromegrass community through the following practices: introduced grass seeding, excessive warm season grazing, inadequate warm season rest, multi season haying and nitrogen fertilizing in spring and/or fall.

Pathway CP 2.2-2.1
Community 2.2 to 2.1

Restoration can be achieved by herbicide treatment and reseeding. If adequate native remnants are present, appropriately timed prescribed fire and a follow-up prescribed grazing program may achieve the desired results.

State 3
Sod-busted State

This threshold is crossed as a result of mechanical disturbance to facilitate production agriculture. If farming operations are suspended, the site can be abandoned, which will result in the Naturally Reclaimed Community, or be re-seeded to a desired perennial forage mixture, which is described as the Re-seeded Community. Permanent alterations of the soil community and the hydrological cycle make restoration to the original native Reference Community extremely difficult, if not impossible. Formation of a compacted plow pan in the soil profile is likely.

Community 3.1
Re-Seeded Grass

Figure 20. Seeded Pasture

This plant community does not contain native remnants, and varies considerably depending on the seed mixture, the degree of soil erosion, the age of the stand, nitrogen fertilizer use, and past grazing management. Prescribed grazing with adequate recovery periods will be needed to maintain productivity and desirable species. Native range and seeded grasslands are ecologically different, and should be managed separately. Factors such as functional group, species, stand density, and improved varieties all impact the production level and palatability of the seedings. Species diversity is often limited, and when grazed in conjunction with native rangelands, uneven forage utilization may occur. Total annual production during an average year varies significantly depending on precipitation, management and grass species seeded. Single species stands of Big bluestem, Indiangrass or Switchgrass or well managed cool season grasses/legume plantings with improved varieties yield 3000-4000 lbs/acre/year.

Community 3.2
Natural Reclamation

This plant community consists of annual and perennial weeds and less desirable grasses. These sites have been farmed and abandoned without being reseeded. Soil organic matter/carbon reserves are reduced, soil structure is changed, and a plow-pan or compacted layer can be formed which decreases water infiltration. Residual synthetic chemicals may remain from farming operations. In early successional stages, this community is not stable. Erosion is a concern. Total annual production during an average year varies significantly depending on the succession stage of the plant community and any management applied to the system.

State 4
Invaded Woody State

Once the tree canopy cover reaches 15 percent with an average tree height exceeding 5 feet, the threshold is crossed to the Invaded Woody State. The primary coniferous interloper is Eastern redcedar. Locust, elm and green ash number among the deciduous native trees, along with several exotic introduced species. These woody species are encroaching due to lack of prescribed fire and other brush management practices. Typical ecological impacts are a loss of native warm season grasses, degraded forage productivity and reduced soil quality. This state consists of the Eastern Red Cedar/Locust Community.

Community 4.1
Eastern Red Cedar/Locust

Figure 21. Eastern Red Cedar/Locust

This community has at least a 15 percent canopy of Eastern redcedar. Honey locust encroachment may occur as you move east within the MLRA, when brush management and prescribed burning is absent over an extended period of time. Generally this site is very conducive to cedar seedling invasion especially when adjacent to a seed source. Cedars will eventually dominate the site, resulting in a closed canopy, reduced forage production and limited livestock grazing and wildlife habitat value. Eastern redcedar control can usually be accomplished with prescribed burning while the trees are six foot tall or less and fine fuel production is over 1,500 pounds per acre. Trees of all heights can be controlled with the use of specifically adapted preparation, and ignition and holding techniques. Mechanical removal followed by a chemical treatment on stumps is effective on locust. Total annual production during an average year varies significantly, depending on the production level prior to encroachment and the percentage of canopy cover.

Figure 22. Plant community growth curve (percent production by month). NE7505, Central Loess Plains, woody encroachment. Woody plant encroachment with warm- and cool-season grasses MLRA 75.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	3	8	12	20	25	14	5	8	4	1	0

Transition T1-2

State 1 to 2

Heavy grazing without adequate recovery periods will cause this state to lose a significant proportion of tall and mid- warm-season grass species and cross a threshold to the Native/Invaded State. Water infiltration and other hydrologic functions will be reduced due to the root matting presence of sod-forming grasses. With the decline and loss of deeper penetrating root systems, soil structure and biological integrity are catastrophically degraded to the point that recovery is unlikely. Once this occurs, it is highly unlikely that grazing management alone will return the community to the Reference State.

Transition T1-3
State 1 to 3

The Reference State is significantly altered by mechanical tillage to allow the site to be placed into production agriculture. The disruption to the plant community, the soil and the hydrology of the system make restoration to a true reference state unlikely.

Transition T1-4
State 1 to 4

Disruption of the natural fire regime and the planting of invasive exotic and native woody species can cause this state to shift to the Invaded Woody State.

Transition T 2-3
State 2 to 3

The state is significantly altered by mechanical tillage to allow the site to be placed into production agriculture. The disruption to the plant community, the soil and the hydrology of the system make restoration to a true reference state unlikely.

Transition T 2-4
State 2 to 4

Disruption of the natural fire regime and the planting of invasive exotic and native woody species can cause this state to shift to the Invaded Woody State.

Transition T 3-4
State 3 to 4

Disruption of the natural fire regime and the planting of invasive exotic and native woody species can cause this state to shift to the Invaded Woody State.

Restoration pathway R 1,2,3
State 4 to 1

Prescribed burning, wildfire, harvest, and brush management will move this plant community toward one of the herbaceous plant dominated plant communities. The forb component of a site with heavy tree density or canopy cover will initially increase following tree removal through mechanical brush management treatments and prescribed fire. If re-sprouting brush such as Honey locust or Siberian elm is present, stumps must be chemically treated immediately after mechanical removal. Ongoing brush management such as hand cutting, chemical spot treatments or periodic prescribed burning is required to prevent a return to this state.

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	**Tall Warm Season Grasses**			1401–1905	
	big bluestem	ANGE	*Andropogon gerardii*	981–1457	–
	switchgrass	PAVI2	*Panicum virgatum*	196–437	–
	Indiangrass	SONU2	*Sorghastrum nutans*	196–437	–
2	**Mid Warm Season Grasses**			1059–1345	
	little bluestem	SCSC	*Schizachyrium scoparium*	785–1177	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	196–392	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	78–196	–
3	**Native Cool Season Grasses**			78–448	
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–78	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–78	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–78	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	39–78	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–78	–
	western wheatgrass	PASM	*Pascopyrum smithii*	0–78	–
4	**Short Warm Season Grasses**			78–196	
	blue grama	BOGR2	*Bouteloua gracilis*	0–196	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–121	–
5	**Other Native Grasses and Grass-Likes**			120–196	
	Grass, perennial	2GP	*Grass, perennial*	81–118	–
	sedge	CAREX	*Carex*	39–78	–
Forb					
6	**Forbs**			135–392	
	Forb, perennial	2FP	*Forb, perennial*	39–78	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–78	–
	compassplant	SILA3	*Silphium laciniatum*	0–78	–
	false boneset	BREU	*Brickellia eupatorioides*	0–78	–
	purple prairie clover	DAPUA	*Dalea purpurea var. arenicola*	0–78	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	0–78	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–78	–
	dotted blazing star	LIPU	*Liatris punctata*	0–78	–
	evening primrose	OENOT	*Oenothera*	0–78	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	0–78	–
	beardtongue	PENST	*Penstemon*	0–78	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–78	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–78	–
	azure blue sage	SAAZA	*Salvia azurea var. azurea*	0–78	–

	Baldwin's ironweed	VEBA	*Vernonia baldwinii*	0–78	–
	hoary verbena	VEST	*Verbena stricta*	0–78	–
	ragwort	SENEC	*Senecio*	0–39	–
	goldenrod	SOLID	*Solidago*	0–39	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–39	–
Shrub/Vine					
7	**Shrubs**			28–196	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	28–78	–
	leadplant	AMCA6	*Amorpha canescens*	0–78	–
	smooth sumac	RHGL	*Rhus glabra*	0–39	–
	prairie rose	ROAR3	*Rosa arkansana*	0–39	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–39	–

Animal community

LIVESTOCK – GRAZING INTERPRETATIONS:
This site is well adapted to managed grazing by domestic livestock. The predominance of herbaceous plants across all plant community phases best lends these sites to grazing by cattle but browsing livestock such as goats or sheep that will more heavily utilize invasive forbs and brush. Carrying capacity and production estimates are conservative estimates that should be used only as guidelines in initial stages of grazing lands planning.

Often, the plant community does not entirely match any particular plant community (as described in the ecological site description). Because of this, a resource inventory is necessary to document plant composition and production. Proper interpretation of this inventory data will permit the establishment of a safe, initial stocking rate for the type and class of animals and level of grazing management. Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide year-long forage for cattle, sheep, or horses. During the dormant period, the protein levels of the forage may be lower than the minimum needed to meet livestock (primarily cattle and sheep) requirements.

Suggested stocking rates (carrying capacity) for cattle under continuous season-long grazing under normal growing conditions are listed below:
-Mixed Native Grass: 3,500 lbs./acre production and 0.96 AUM/acre carrying capacity*
-Degraded Native Grass: 3,100 lbs./acre production and 0.85 AUM/acre carrying capacity*
-At-Risk Native Grass: 2,200 lbs./acre production and 0.60 AUM/acre carrying capacity*
-Smooth bromegrass: 2,600 lbs./ac and 0.71 AUM/acre with 50 percent or more bromegrass component
-Re-Seeded Grass (high managed/fertilized big bluestem or switchgrass single species plantings and smooth bromegrass/legume plantings): 3,500 lbs./acre production and 0.96 AUM/acre carrying capacity. Production for seeded pastures will increase with increased management and inputs such as nitrogen fertilizer, pasture plantings with improved varieties and rotational grazing.

*Continuous season-long grazing by cattle under average growing conditions, 25 percent harvest efficiency. Air-dry forage requirements based on 3 percent of animal body weight, or 912 lbs./AUM.

If grazing distribution problems occur, stocking rates must be reduced to maintain plant health and vigor. Carrying capacity and production estimates are conservative estimates that should be used only as guidelines in the initial stages of the conservation planning process. Utilizing a rotational grazing system that allows for adequate rest and recovery will increase plant vigor and carrying capacity. Often, the current plant composition does not entirely match any particular plant community (as described in this ecological site description). Because of this, a field visit is recommended to document plant composition and production. More precise carrying capacity estimates can be calculated based on actual site information along with animal preference data, particularly when livestock other than cattle are involved. With consultation of the land manager, more intensive grazing management may result in improved harvest efficiencies and increased carrying capacity.

WILDLIFE INTERPRETATIONS:
Major Land Resource Area (MLRA) 75 lies primarily within the loess mixed-grass prairie ecosystem mixed with tallgrass prairie in lower areas. Prior to European settlement, this area consisted of diverse grassland habitats interspersed with varying densities of depressional wetlands and limited woody riparian corridors. These habitats provided critical life cycle components for the grassland birds, prairie dogs and herds of roaming bison, elk, and pronghorn that historically occupied this landscape. Diverse populations of small mammals and insects provided a bountiful prey base for raptors and omnivores such as coyotes, foxes, raccoons and opossums. Native Americans, bobcats, wolves, and mountain lions occupied the apex predator niche. In addition, a wide variety of reptiles and amphibians thrived in this landscape.

The loess mixed-grass prairie was a disturbance-driven ecosystem with fire, herbivory and climate functioning as the primary disturbances. Following European settlement, elimination of fire, widespread conversion to cropland, and other sources of habitat fragmentation significantly altered the appearance and functionality of the entire ecosystem. The reduced stability of the system is reflected by major changes in the composition and abundance of the native flora and fauna. Introduced and invading species further degrade the ecological integrity of the plant and animal communities. Bison and prairie dogs were historically keystone species but free-roaming bison herds and nearly all prairie dogs have been extirpated. The loss of bison and fire as ecological drivers greatly influenced the character of the remaining native grasslands and the habitats that they provide. Fragmentation has reduced habitat quality for numerous area-sensitive species, as highlighted by the decline of the greater prairie chicken. Many grassland nesting bird populations such as dickcissel and Henslow's sparrow also are declining. In addition to free-ranging bison, extirpated species include pronghorn, wolves, and swift fox.

Historically, an ecological mosaic of Loamy Terrace Loamy Plains, Clayey Plains, Closed Upland Depression, Loamy Terrace, and Loamy Floodplain sites, provided habitat for species requiring unfragmented grasslands. Important habitat features and components found commonly or exclusively on modern day remnants include upland nesting habitat for grassland birds and game birds; nesting and escape cover for waterfowl; forbs and insects for brood-rearing habitat; and a forage source for small and large herbivores. Within MLRA 75, remaining Clayey Plains ecological sites provide grassland cover with an associated forb and limited shrub component.

Introduced species such as smooth bromegrass, reed canarygrass, Kentucky bluegrass, nodding plumeless thistle, and Canada thistle further degrade the biological integrity of many of these remnant prairies.

In this fragmented landscape, native grassland bird populations face increasing competition from the opportunistic European starlings and house sparrows, and are subject to nest parasitism from brown-headed cowbirds.

Tree encroachment creates habitat that favors generalist species such as American robin and mourning dove, and provides perches for raptors, increasing the predation mortality.

1. REFERENCE STATE: The predominance of tall and mid statured grasses plus a high diversity of forbs and shrubs in this community makes it ideal for grazers and mixed-feeders. Pollinating insects play a large role in maintaining the forb community and provide a food source for grassland birds and other grassland dependent species. The vegetative structural diversity provides habitat for reptiles, amphibians, and a wide array of native and introduced bird species including Henslow's sparrow, Western meadowlark, Northern bobwhite, and ringneck pheasants. The abundant prey base supports populations of Swainson’s hawk, burrowing, short-eared and great horned owls and other grassland raptors.
Western meadowlark and American crow over-winter in this habitat.

The diversity of grasses, forbs and shrubs provide high nutrition levels for small and large herbivores including moles, mice, ground squirrels, white-tailed jackrabbit, and whitetail deer. The structure of this plant community provides suitable thermal, protective and escape cover for small herbivores and grassland birds. Many wide-ranging predators utilize this plant community including coyote, badger, red fox and least and long-tailed weasels.

As the plant community degrades to more mid-grasses and fewer tall grasses, less winter and escape cover are provided. It also provides less cover for predators. As the plant community shifts from tall warm-season grasses to mid-height grasses, it favors grassland birds that prefer shorter vegetation. This structural community provides better habitat for greater prairie chicken, lark bunting, and lark sparrow populations. Habitat in plant community 1.3 is much the same as 1.2 but provides less winter protection because of the reduced plant height and cover.

2. NATIVE/INVADED STATE: Although the amount of Kentucky bluegrass in this plant community varies, the generally lower structure height favors the suite of grassland birds that prefer more visual space. Increased dominance by Kentucky bluegrass with lower plant diversity provides less habitat for ringneck pheasant, Northern bob-white and mixed-feeders, such as whitetail deer and small mammals. Insect populations are somewhat reduced but still play a large role in maintaining the forb community and provide a moderate forage supply for grassland birds and other species.

The reduced stature of this plant community still provides suitable thermal, protective and escape cover for small herbivores and grassland birds.

3. SODBUSTED STATE: Natural regeneration: as opportunistic disturbance-oriented species, Kentucky bluegrass and smooth bromegrass have become the prevalent grass species. The forb component exhibits lower diversity than the Reference State and shifts towards increaser/ introduced forbs including sweetclover, western yarrow, Cuman ragweed, Missouri goldenrod, hoary verbena and ironweed. Pollinator insect populations are still present, but experience a shift to generalist species.

Savannah sparrow, American robin, and western meadowlark are common birds that take advantage of the structure and composition of this plant community. The shorter stature of this plant community provides habitat for killdeer, horned lark, black-tailed jackrabbit (better suited to this plant community than white-tailed jackrabbit), and thirteen-lined ground squirrel. Prey populations are reduced and are more vulnerable to predation by raptors and mammalian predators. Burrowing owls may be associated with Richardson's ground squirrel or other mammal burrows. The short stature of this plant community does not provide suitable thermal/protective cover and escape cover.

4. INVADED WOODY STATE:
The Eastern Redcedar/Locust Community provides habitat niches for white-tailed deer, wild turkey, raccoon, and Cooper's and sharp-shinned hawks among other species.

Birds that are habitat generalists, such as the Bell's vireo, common yellowthroat, eastern kingbird, mourning dove, American goldfinch, northern bobwhite, field sparrow, solitary vireo, and pigmy nuthatch use woody cover for nesting, food, and breeding habitats.

While a woody component of the grassland provides specific short-term habitats for some species, an expansive forest component is very detrimental to grassland wildlife species diversity and abundance overall.

Hydrological functions

Water is the principal factor limiting forage production on this site. Runoff is expected to occur only during the most intense storms (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).
For the interpretive plant community, rills and gullies should not typically be present. Water flow patterns should be barely distinguishable if at all present. Pedestals are only slightly present in association with bunchgrasses such as little bluestem. Litter typically falls in place, and signs of movement are not common. Chemical and physical crusts are rare to non-existent. Cryptogamic crusts are present but only cover 1-2 percent of the soil surface. Overall this site has the appearance of being stable and productive.

Recreational uses

This site provides hunting opportunities for upland game species. The wide varieties of plants which bloom from spring until fall have an aesthetic value that appeals to visitors.

Wood products

No appreciable wood products are present on the site. Red cedar pulpwood can be utilized for veneer and/or cedar furniture.

Other products

No appreciable other products.

Other information

Site Development and Testing Plan: This ESD went through the approval process.
Annual reviews of the Project Plan are to be conducted by the Ecological Site Technical Team. The project plan is: ES R075XY057NE- MLRA 75 -

Inventory data references

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range trained personnel were also used. Those involved in developing this site include: Mike Kucera (State Resource Conservationist), Mitch Faulkner (Rangeland Management Specialist), Dana Larsen (State Rangeland Management Specialist), Chuck Markley (Resource Soil Scientist), Mark Willoughby (Resource Soil Scientist), and Doug Garrison (Resource Specialist), all in Nebraska; and David Kraft (State Rangeland Management Specialist) and William Wehmueller (Soil Scientist), both in Kansas. Doug Garrison, Dan Shurtliff, and Mike Kucera completed the initial soils correlation and provided some of the photos. The positions listed were those held by the individuals at the time the original ESD was written.

Other references

High Plains Regional Climate Center, University of Nebraska. (http://hpcc.unl.edu, accessed 12/05/16)

Johnsgaard, P.A. 2001. “The Nature of Nebraska.” University of Nebraska Press.

LaGrange, T.G. 2015. Final Report submitted to EPA for the project entitled: Nebraska’s Wetland Condition Assessment: An Intensification Study in Support of the 2011 National Survey (CD# 97714601), and the related project entitled: Nebraska's Supplemental Clean Water Act §106 Funds, as Related to Participation in National Wetland Condition Assessment (I – 97726201). Nebraska Game and Parks Commission, Lincoln.

Muhs, Daniel R., E. Bettis III, J. Aleinikoff, J. McGeehin, J. Beann, G. Skipp, B. Marshall, H. Roberts, W. Johnson, and R. Benton.
"Origin and paleoclimatic significance of late Quaternary loess in Nebraska: Evidence from stratigraphy, chronology, sedimentology, and geochemistry" (2008). USGS Staff -- Published Research. Paper 162.
http://digitalcommons.unl.edu/usgsstaffpub/162 Accessed 12/05/16.

U.S. Dept. of Agriculture. NRCS National Ecological Site Handbook. January, 2014.

U.S. Dept. of Agriculture. NRCS National Engineering Handbook, Section 4. August, 2011.

Personal communications with professional ecologists and wildlife experts.

Rolfsmeier, S.B. and G. Steinauer. 2010. "Terrestrial Ecological Systems and Natural Communities of Nebraska", (version IV)
Nebraska Natural Heritage Program.

USDA, NRCS. National Water and Climate Center, Portland, OR. http://wcc.nrcs.usda.gov Accessed 12/05/16.

USDA, NRCS.1997. National Range and Pasture Handbook .

USDA, NRCS. National Soil Information System, Information Technology Center, Fort Collins, CO.
http://nasis.nrcs.usda.gov Accessed 12/05/16.

USDA, NRCS. 2002. The PLANTS Database, Version 3.5 http://plants.usda.gov Accessed 12/05/16. National Plant Data Center, Baton Rouge, LA.

USDA, NRCS Soil Surveys from Gosper, Phelps, Kearney, Adams, Hamilton, Polk, York, Butler, Seward, Saline, Fillmore, Clay, Franklin, Webster, Nuckolls, Thayer and Jefferson counties in Nebraska, and Republic and Washington counties in Kansas.

Contributors

Doug Garrison, Dana Larsen, Mike Kucera
Revised By Doug Whisenhunt

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)	Pat Broyles,Mike Kucera, Dana Larsen
Contact for lead author	
Date	06/01/2004
Approved by	Nadine Bishop
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Few, if any. No active headcutting and sides are covered with vegetation.

---

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

---

3. **Number and height of erosional pedestals or terracettes:** No pedestaled plants or terracettes.

---

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 95% or more of the ground is covered by plant canopy, litter, and stones. When prescribed burning is practiced there is little litter the first half the growing season.

---

5. **Number of gullies and erosion associated with gullies:** Few, if any. No active headcutting and sides are covered with vegetation.

---

6. **Extent of wind scoured, blowouts and/or depositional areas:** Wind has not created, or enlarged, bare areas or denuded vegetation.

---

7. **Amount of litter movement (describe size and distance expected to travel):** Plant litter is distributed evenly throughout the site.

---

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

---

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** The topsoil layer has not been plowed or eroded.

---

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** No negative effect due to plant composition or distribution. No rill formation or plant pedestalling has occurred. Any alteration to infiltration or runoff is due to cultural practices.

---

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compacted soil layers due to cultural practices.

---

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: Warm Season (rhizomatous) - Big bluestem, Indiangrass, Switchgrass,

    Sub-dominant: Warm Season (bunchgrass) - Little bluestem, Sideoats grama, Blue grama
    Warm Season (narrow bladed) - Tall dropseed, Buffalograss, Perennial threeawns

    Other: Minor: Cool Season - Canada wildrye, Scribners panicum, Sedges, Western wheatgrass
    Minor: Cool-season - Canada wildrye, Scribner's rosette grass sedges, western wheatgrass
    Minor: Forbs (perennial) - compassplant, dotted gayfeather, heath aster, white sagebrush, slimflower scurfpea, purple prairie clover, Cuman ragweed, stiff sunflower
    Trace: Shrubs - leadplant, prairie rose

    Additional: Warm season rhizomatous grasses comprise 40% to 100% of the plant composition.

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** The vast majority of plants are healthy and vigorous.

---

14. **Average percent litter cover (%) and depth (in):** Plant litter is distributed evenly throughout. 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 the growing season.

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 2,587-4,175 pounds per acre.

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:** common sunflower, fall witchgrass, Kochia, tansymustard, Japanese brome, wild lettuce, mullein, windmill grass, Canada thistle, nodding plumeless thistle, cheatgrass, Cuman ragweed, eastern redcedar

17. **Perennial plant reproductive capability:** Desirable perennial plants are healthy. The vast majority of perennial plants have healthy rhizomes and/or stolons.