USDA Natural Resources
Conservation Service

Ecological site R106XY079NE
Shallow Sandy

Last updated: 2/05/2019
Accessed: 05/16/2024

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

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): 106X–Nebraska and Kansas Loess-Drift Hills

Named the “Nebraska and Kansas Loess-Drift Hills,” Major Land Resource Area (MLRA) 106 is divided almost evenly between southeastern Nebraska (52 percent), and northeastern Kansas, (48 percent). The northern border is located on the northern end of Saunders County, Nebraska, and the MLRA stretches into Douglas County, Kansas in the south. The cities of Beatrice and Lincoln are the major population centers in the north, while Topeka and Lawrence are the primary cities in the south. The approximately seven million-acre landscape covers all or parts of 30 counties between the two states. This dissected glacial drift plain primarily consists of broad, smooth ridgetops, and slopes that range from nearly level to steep. The elevation in MLRA 106 decreases from west to east, and ranges from nearly 1,650 feet to less than 790 feet above sea level. Stream valleys in this landscape are narrow and bordered by steep hills, with 10 to 20 feet of local relief. The river valleys are broader, and may drop up to over 160 feet below the adjacent hilltops. The Platte, Little Nemaha, and the North Fork of the Big Nemaha Rivers flow through the Nebraska side of the MLRA, while the Black Vermillion, the Soldier, and the Delaware Rivers are the major waterways on the Kansas side. The Big Blue River runs through both states, while the Salt Creek hydrologic system located near Lincoln, Nebraska provides habitat for the only known population of the Federally-listed endangered Tiger Salt Beetle.
The uplands are primarily comprised of glacial drift underlying a mantle of loess, while alluvial deposits are found in the stream and river valleys. Limestone and shale quarries are also located in MLRA 106. The predominant soil orders in this MLRA are mesic, udic, Mollisols, Alfisols, and Entisols. Loams and clays are the primary soil textures

in this landscape.
Sixty-two percent of the land in this MLRA has been broken out of native prairie and farmed, while only twenty three percent of the grasslands remain intact. Livestock grazing, primarily by cattle, is the main industry on these remnants. Corn, wheat, soybeans, and grain sorghum are the primary commodity crops, but a significant number of acres are also planted to alfalfa for harvest as hay.
With annual precipitation averaging from 40 inches in the southeast to 28 inches in the northwest, irrigation for crop production is not a critical factor in most years.
The historical matrix vegetation type is Tallgrass Prairie, with big and little bluestem, switchgrass, Indiangrass, sideoats, and blue grama making up the bulk of the warm-season species; western wheatgrass is the dominant cool-season grass in the north, tall fescue is in the south. Large- and small-patch vegetative communities are found primarily along the riparian zones, and on both upland and lowland saline sites. Woodlands make up about six percent of MLRA 106, consisting primarily of green ash, oak, hackberry, boxelder, and maple trees.
Wildlife flourishes in this combination of crop and grassland environments. In a landscape historically occupied by bison herds, white-tailed deer are now 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 do several upland bird species. Native grassland bird populations are somewhat limited by the lack of contiguous native prairie and the fragmented habitat created by the farmland.
The rivers, streams, and lakes harbor excellent fisheries, and 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 three to four 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. The indigenous inhabitants understood the value of fire as a tool, and that the highly palatable growth following a fire provided excellent forage for their horses and attracted grazing game animals such as bison and elk.
Land use patterns post-European settlement have greatly altered the historical fire regime, allowing the expansion of the woody component. Introduction of eastern redcedar (ERC) as a windbreak species further facilitates invasion by this species.
While eastern redcedar is native to the landscape, the historic population in MLRA 106 was limited to isolated pockets in rugged river drainageways that 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 reseeded grasslands.

Classification relationships

Major Land Resource Area (MLRA): 106 Major Land Resource Area (MLRA) (USDA-Natural Resources Conservation Service, 2006)

General information for MLRA 106:

Fenneman (1916) Physiographic Regions Division – Interior Plains
Province – Central Lowland
Section – Dissected Till Plains

USFS (2007) Ecoregions
Domain – Humid Temperate
Division – Prairie
Province – Prairie Parkland (Temperate)

Section – Central Dissected Till Plains (251C)

EPA Ecoregions (Omernik 1997)
I – Great Plains (9)
II – Temperate Prairies (9.2)
III – Western Corn Belt Plains (9.2.3)
IV – Loess and Glacial Drift Hills (47i)

Associated Counties
Nebraska: Butler, Cass, Gage, Jefferson, Johnson, Lancaster, Nemaha, Otoe, Pawnee, Richardson, Saline, Saunders, Seward

Kansas: Atchison, Brown, Doniphan, Douglas, Franklin, Jackson, Jefferson, Johnson, Leavenworth, Marshall, Nemaha, Osage, Pottawatomie, Shawnee, Wabaunsee, Washington, Wyandotte

Ecological site concept

The Shallow Sandy site is often steep, somewhat rocky, and intermixed with Loamy and Clayey Upland sites. The depth to the sandstone bedrock normally ranges from 6 to 20 inches. Due to the shallow soil, vegetative production is significantly reduced compared to the adjacent upland sites. The soils associated with this site are non-calcareous.

Associated sites

R106XY074NE	**Clayey Upland** The Clayey Upland site is often located adjacent to the Shallow Sandy site.
R106XY075NE	**Loamy Upland** The Loamy Upland site is often located adjacent to the Shallow Sandy site.

Similar sites

R106XY075NE	**Loamy Upland** Loamy Upland is often located adjacent to the Shallow Sandy site. Loamy Upland usually has a higher percentage of tallgrass species, and higher vegetative production than does the Shallow Sandy site.
R106XY074NE	**Clayey Upland** The Clayey Upland site is adjacent to the Shallow Sandy site, but tallgrass species dominate the mid-grasses, and production is normally higher on the Clayey Uplands.
R106XY077NE	**Shallow Limy** The Shallow Limy site is similar to the Shallow Sandy site in landscape position and vegetative production, but effervesces at or near the soil surface due to the calcareous nature of the limy soils.

Table 1. Dominant plant species

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

Physiographic features

The Shallow Sandy is an upland site that supplies run-off surface water to lower sites. Erosion can be a concern, particularly on sites with degraded vegetative communities.

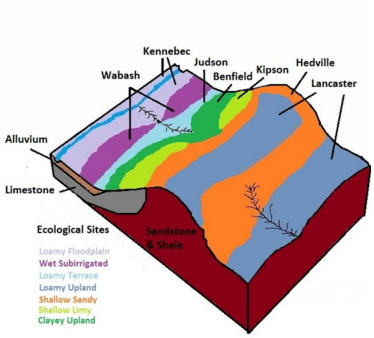


Figure 2.

Table 2. Representative physiographic features

Landforms	(1) Interfluve (2) Hill (3) Ridge
Runoff class	Medium
Elevation	228–516 m
Slope	3–30%
Water table depth	183 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.

About three-fourths of the precipitation falls as high-intensity, convective thunderstorms from late in spring through early in autumn.

The average annual precipitation gradient trends higher from northwest (28”) to southeast (40”), and the average annual temperature gradient trends higher from north (50°F) to south (55°F).

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 begins 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)	158 days
Freeze-free period (average)	179 days
Precipitation total (average)	838 mm

Climate stations used

- (1) PAWNEE CITY [USC00256570], Pawnee City, NE
- (2) CRETE [USC00252020], Crete, NE
- (3) TECUMSEH 1S [USC00258465], Tecumseh, NE
- (4) ASHLAND NO 2 [USC00250375], Ashland, NE
- (5) MEAD 6S [USC00255362], Ithaca, NE
- (6) RAYMOND 2NE [USC00257055], Raymond, NE
- (7) TABLE ROCK 4 N [USC00258410], Table Rock, NE
- (8) LINCOLN UNIV PWR PLT [USW00014971], Lincoln, NE
- (9) VIRGINIA [USC00258875], Virginia, NE
- (10) WAHOO [USC00258905], Wahoo, NE

Influencing water features

The vegetative communities on this site are not affected by the water table. Erosion can be a concern with a heavy precipitation event.

Soil features

The soils associated with the Shallow Sandy site are shallow and very shallow, somewhat excessively drained, moderately permeable soils on uplands. These soils formed in residuum weathered from non-calcareous sandstone. They have a loamy surface layer that may be cobbly or stony. The underlying substratum is a reddish brown sandstone. It is somewhat excessively drained with medium to rapid runoff. Saturated hydraulic conductivity is moderately high to high.
Hedville is the major soil series correlated to this site.

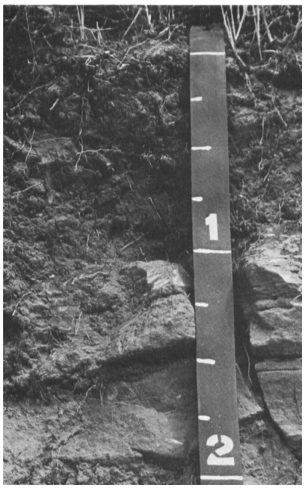


Figure 7.

Table 4. Representative soil features

Parent material	(1) Residuum–sandstone
Surface texture	(1) Loam (2) Fine sandy loam (3) Sandy loam
Drainage class	Somewhat excessively drained
Permeability class	Moderate
Soil depth	0–51 cm
Surface fragment cover >3"	5–35%
Available water capacity (0-101.6cm)	4.83–8.38 cm

Soil reaction (1:1 water) (0-101.6cm)	5.6–7.3

Ecological dynamics

Shallow Sandy ecological sites developed under Northern Great Plains climatic conditions, light to severe grazing by bison and other large herbivores, sporadic natural or human-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 settlers 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 warm-season tallgrasses. 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 following this section, and consists of a Reference State, a Native/Invaded 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 hydrologic 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 human-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 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 following is a diagram illustrating the common plant communities that can occur on the Shallow Sandy ecological site, and the transition pathways between communities.

State and transition model

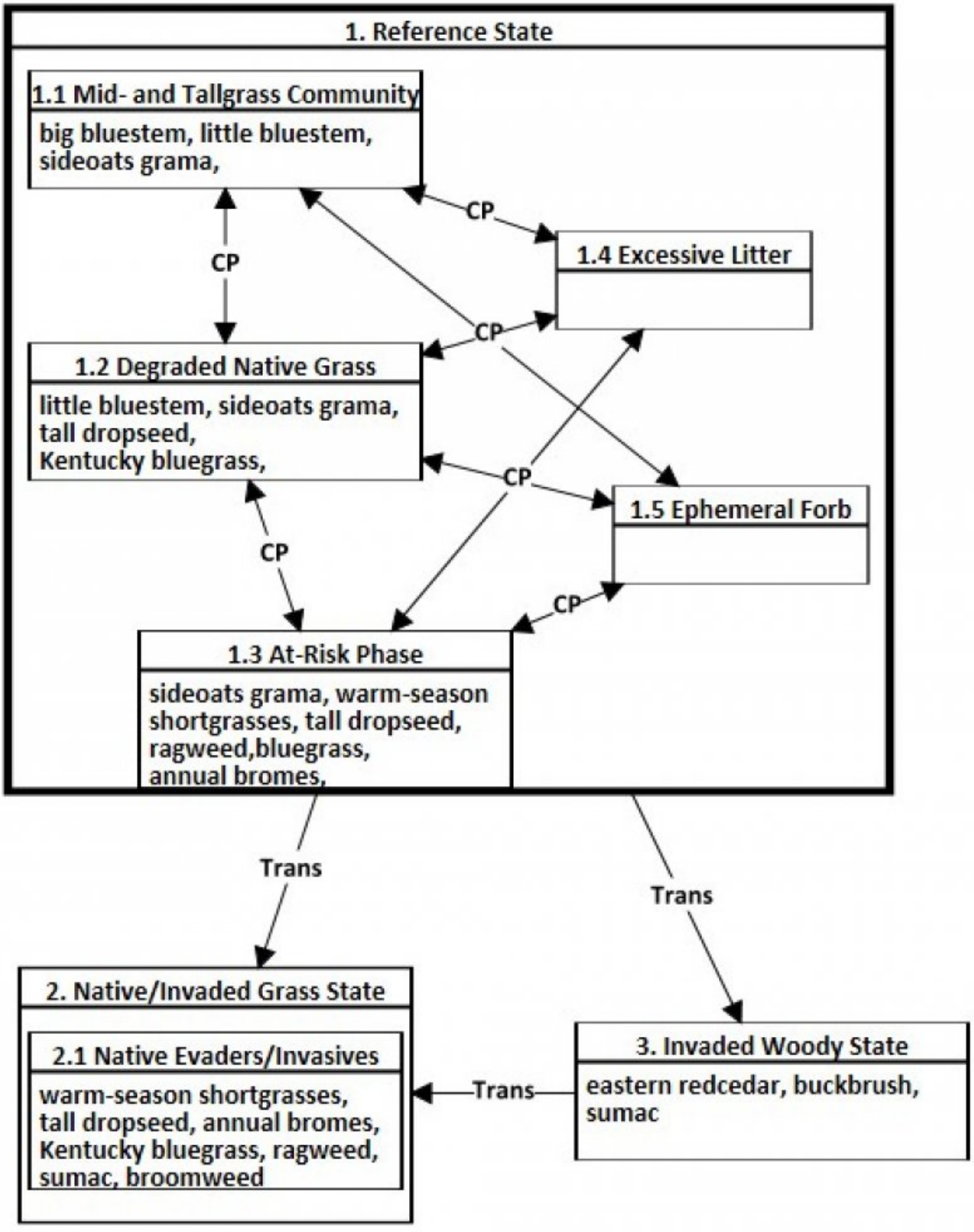


Figure 8. State and Transition Model

T 1-2	Long-term excessive livestock grazing or haying without appropriate growing season rest periods; extreme drought.
T 1-3; 3-2	Disruption of natural fire regime, planting of exotic and invasive native woody species facilitates crossing the threshold to the invaded woody state. This can be reversed by mechanical removal and immediate follow-up stump treatment of root-sprouting species. Development and implementation of a follow-up maintenance program, often requiring prescribed burning, is required to prevent re-invasion.
CP 1.1-1.2	Timing, frequency, and degree of herbivory/haying that negatively affects desirable tallgrass 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, 1.3-1.5	A high-impact disturbance event or combination of events causing excessive defoliation of the vegetation, e.g., 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 tallgrass species; return to normal precipitation regime.
CP 1.2-1.3	Continued management that includes timing, frequency, and degree of herbivory/haying that negatively affects desirable tallgrass species; long-term drought.
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.

Figure 9. Legend

State 1
Reference State

This state describes the range of vegetative community phases that occur on the Shallow Sandy 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 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
Mid and Tallgrass Community

Figure 10. Reference Community, Washington County, KS.

The Mid- and Tallgrass Community is comprised of mid- and tallgrass native prairie species. This 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 to fire and grazing events. The potential vegetation consists of approximately 80-90 percent grasses and grass-like plants, 5-10 percent forbs, and 0-10 percent shrubs. Big and little bluestem are the primary species in this community. Secondary species include western wheatgrass, Indiangrass, sideoats, and blue grama. The site has a moderately diverse forb population, dominated by Cuman ragweed and scurfpeas. This plant community is less productive than similar upland sites, and species diversity is somewhat limited as well. It is a resilient community, and resistant to short-term stresses such as drought and short periods of heavy stocking. The well-developed root systems support this resiliency when allowed adequate recovery periods between grazing events. When exposed to long-term or frequent overgrazing events without adequate rest, this plant community will degrade. The annual vegetative production of this community averages about 2,500 pounds per acre.

Figure 11. Plant community growth curve (percent production by month). NE1061, Mid and Tall Warm Season Grasses. This plant community is dominated by warm-season, tall and midgrasses in MLRA 106.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	25	35	20	10	5	0	0	0

Community 1.2
Degraded Native Grass Community

Figure 12. Degraded native grass community, Washington County

Big bluestem, little bluestem, and sideoats grama lose productive capacity through loss of vigor and reproductive potential. Switchgrass and Indiangrass are reduced to remnants. As growing season defoliation continues, the more grazing-evasive species such as blue and hairy grama, Kentucky bluegrass, western wheatgrass, and tall dropseed increase. This community phase signals a significant loss of production. The change is due to continuous season-long grazing with inadequate recovery periods. The composition of the forb component favors less palatable species, and the potential for encroachment by invasive woody species becomes more likely. Fewer high biomass-producing deep-rooted species result in a reduced fire-friendly fuel load. While this plant community is less productive and less diverse than the representative plant community, it remains sustainable in regards to site and soil stability, watershed function, and biologic integrity.

Community 1.3
At-Risk Native 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- and cool-season grasses increase significantly. Sideoats grama, tall dropseed, western wheatgrass, warm-season shortgrasses, and Kentucky bluegrass become dominant. Forb numbers increase, though diversity decreases. 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. This may result in formation of a compacted layer in the pockets of deeper soil, and total annual vegetative production declines significantly. Without a management change, this community is at-risk to degrade to the Native/Invaded Grass State.

Figure 13. Plant community growth curve (percent production by month). NE1069, MLRA 106 Warm/cool-season mix.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	1	4	10	23	26	17	8	6	4	1	0

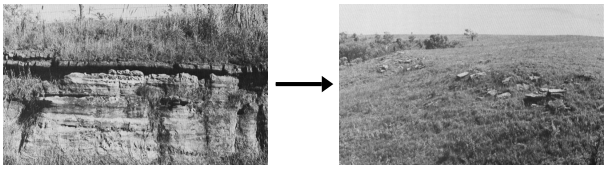
Community 1.4
Excessive Litter Community

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



Mid and Tallgrass Community

Degraded Native Grass Community

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

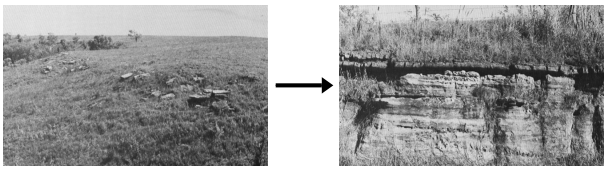
Pathway CP 1.1-1.4
Community 1.1 to 1.4

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

Mid and Tallgrass Community

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 more 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

Prescribed Burning
Access Control
Prescribed Grazing

Pathway CP 1.2-1.3
Community 1.2 to 1.3

Maintaining continuous season long grazing or haying with inadequate recovery periods during the growing season further degrades the site to the At-Risk 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

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

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

Pathway CP 1.3-1.5
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.

Conservation practices

Prescribed Burning
Prescribed Grazing

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 1.4-1.3
Community 1.4 to 1.3

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

Pathway CP 1.4-1.5
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.

Conservation practices

Access Control

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.

Conservation practices

Access Control

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.

Conservation practices

Access Control

State 2
Native/Invaded Grass State

The Native/Invaded Grass 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 are the primary component of the Native/Invaded Grass State.

Community 2.1
Native Evaders/Invaded Grass

This plant community represents a shift from the Reference State across a plant community threshold. With continued grazing pressure, annual bromes, blue and hairy grama, Kentucky bluegrass, and dropseed will become the dominant plant species, with only trace remnants of the more palatable warm-season grasses such as little bluestem and sideoats grama. Continuous and heavy grazing pressure will maintain this plant community in a sod-bound condition. Forb richness and diversity has decreased. In the areas with deeper soils, 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. Appropriately-timed prescribed fire and grazing management practices that allow for adequate periods of recovery between grazing events will favor mid- and tall warm-season grasses.

Figure 14. Plant community growth curve (percent production by month). NE1067, Nebraska and Kansas Loess Drift Hills. Invaded cool season dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	13	28	28	12	5	6	3	0	0

State 3
Invaded Woody State

The Invaded Woody State has a canopy of at least 15 percent wooded cover. In the absence of fire and brush management, this site is very conducive to cedar seedling invasion, especially when adjacent to a seed source. Total annual production during an average year varies significantly, depending upon the production level prior to encroachment and the percentage of canopy cover. Disruption of natural fire regime, planting of exotic and invasive native woody species facilitates crossing the threshold to the Invaded Woody State. This can be reversed by mechanical removal and immediate follow-up stump treatment of root-sprouting species. The Native/Invaded State cannot return to the Reference State through this process, as the native plant community, soils, and hydrologic cycle have been too severely degraded. Development and implementation of a follow-up maintenance program, often requiring prescribed burning, is necessary to prevent reinvasion.

Community 3.1
Invasive Woodies

Figure 15. Encroaching woodies, Washington County, KS.

This community has at least a 15 percent canopy of wooded cover. Sumac and bur oak are some of the deciduous invaders, while eastern redcedar is the primary evergreen encroacher. Cedars can eventually dominate the site, resulting in a closed canopy monoculture which drastically reduces forage production and has limited value for either livestock grazing or wildlife habitat. 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 upon the production level prior to encroachment and the percentage of canopy cover.

Transition T1-2
State 1 to 2

Heavy grazing or haying 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

Disruption of natural fire regime, planting of exotic and invasive native woody species facilitates crossing the threshold to the invaded woody state. This can be reversed by mechanical removal and immediate follow-up stump treatment of root-sprouting species. Development and implementation of a follow-up maintenance program, often requiring prescribed burning, is required to prevent re-invasion.

Transition T 2-3
State 2 to 3

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. For the sake of simplicity, only the arrow returning from this state is depicted in the state-and-transition model.

Restoration pathway R3-1
State 3 to 1

Disruption of natural fire regime, planting of exotic and invasive native woody species. This can be reversed in all states by mechanical removal, immediate follow-up stump treatment of root-sprouting species. Development and implementation of a follow-up maintenance prescribed burn program is necessary to prevent re-invasion. State two cannot go back to state 1 through this process.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

Restoration pathway R3-2
State 3 to 2

Disruption of natural fire regime, planting of exotic and invasive native woody species. This can be reversed in all states by mechanical removal, immediate follow-up stump treatment of root-sprouting species. Development and implementation of a follow-up maintenance prescribed burn program is necessary to prevent re-invasion. State two cannot go back to state 1 through this process.

Additional community tables

Animal community

A variety of small native rodents find refuge in the nooks and crannies formed by rocks. Inclusions of deep soil pockets, as well as scattered small caves and rock outcrops, make this a preferred den site for prairie predators such as coyotes and foxes as well as the badger. Reptiles, including lizards like the collared lizard and others such as the common bull snake, make this site their home.

The rough topography provided by this site offers protection for many wildlife species during severe weather periods. The native forb species found growing on this site provide a variety of desirable food for birds and small mammals.

Hydrological functions

The primary soil series associated with this site, Hedville, is a somewhat excessively drained soil with medium to

rapid runoff and moderate permeability. It is classified as a hydrologic group D soil. However, Hedville is most often found in a complex with other soils such as Lancaster, a hydrologic group B soil, or Edalgo, a hydrologic group C soil. This makes hydrology determinations for the site somewhat complex. Please refer to the NRCS National Engineering Handbook Section 4 (NEH-4) for runoff quantities and hydrologic curves when making hydrology determinations.

Recreational uses

Recreational Uses

The Shallow Sandy site provides for a variety of outdoor activities including bird watching, hiking, and outdoor/wildlife photography. There are a variety of flowering plants in bloom throughout the growing season that provide much aesthetic appeal to the landscape. Recreation can be a valued use, but there are site considerations such as the somewhat steep, rocky, rough terrain of the Shallow Sandy ecological site.

Wood products

No appreciable wood products are produced on this site.

Other products

None of consequence.

Other information

Site Development and Testing Plan:
Future work is needed to validate the information in this Provisional Ecological Site Description. Additional data collection and evaluation may also be needed to develop this ESD to the Approved, then Correlated level. This could include field activities to collect low-, medium-, and high-intensity sampling, soil correlations, and analysis of that data. Field reviews of the project plan should be done by soil scientists and vegetation specialists. A final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed to produce the final document.

Inventory data references

Historical data references are supplemented by expert opinion from resource professionals.

Other references

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Contributors

Doug Whisenhunt

Approval

David Kraft, 2/05/2019

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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)	
Contact for lead author	
Date	
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

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

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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:

    Sub-dominant:

    Other:

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

14. **Average percent litter cover (%) and depth (in):**

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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:**

17. **Perennial plant reproductive capability:**