USDA Natural Resources Conservation Service

Ecological site R106XY065NE
Wet Subirrigated

Last updated: 2/05/2019
Accessed: 05/18/2024

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%), and northeastern Kansas, (48%). The northern border is located on the north end of Saunders County, Nebraska, and the MLRA stretches into Douglas County, Kansas in the south. The Nebraska cities of Beatrice and Lincoln are the major population centers in the north, while Topeka and Lawrence in Kansas 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 ranging 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 23 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, and big and little bluestem, switchgrass, Indiangrass, sideoats, and blue grama make 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 by 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 Wet Subirrigated ecological site occupies a run-on landscape position in floodplains and drainageways. The slope is 0 to 5 percent, and there are no visible surface salts. The depth to the seasonably high water table ranges from the surface to 18 inches.

Associated sites

R106XY032NE	**Subirrigated** The Loamy Floodplain site often is adjacent to Wet Subirrigated.
R106XY067NE	**Saline Subirrigated** The Loamy Terrace site often is adjacent to but above the Wet Subirrigated.

Similar sites

R106XY032NE	**Subirrigated** The Subirrigated site often is adjacent to Wet Subirrigated, but the depth to water is 18 inches, and the vegetative community includes species not adapted to inundation.
R106XY067NE	**Saline Subirrigated** The Saline Subirrigated site has visible surface salts, and that plant community is dominated by salt-tolerant species. This site has lower vegetative production than Wet Subirrigated.

Table 1. Dominant plant species

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

Physiographic features

The Wet Subirrigated Site in found on very deep, poorly drained and very poorly drained soils formed in alluvium. These soils are on flood plains, low stream terraces, and alluvial fans in river valleys and in drainageways on uplands. Slope ranges from 0 to 5 percent.

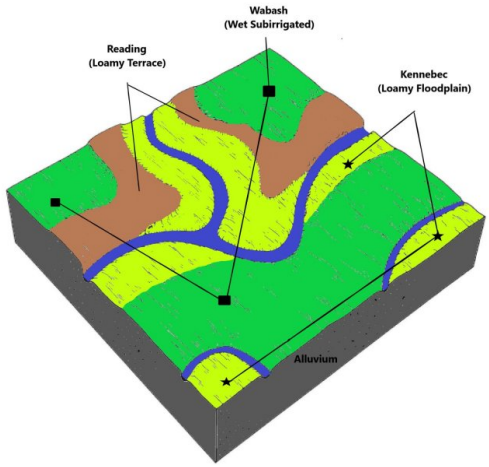


Figure 2.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Stream terrace
Runoff class	Negligible to low
Flooding frequency	None to very frequent
Ponding duration	Brief (2 to 7 days) to long (7 to 30 days)
Ponding frequency	Rare to frequent
Elevation	228–516 m
Slope	0–5%
Water table depth	0–91 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.

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

Climate stations used

- (1) SYRACUSE [USC00258395], Syracuse, NE
- (2) TECUMSEH 1S [USC00258465], Tecumseh, NE
- (3) PAWNEE CITY [USC00256570], Pawnee City, NE
- (4) AUBURN 5 ESE [USC00250435], Auburn, NE
- (5) VIRGINIA [USC00258875], Virginia, NE
- (6) WAHOO [USC00258905], Wahoo, NE
- (7) WEEPING WATER [USC00259090], Weeping Water, NE
- (8) FALLS CITY BRENNER FLD [USW00094957], Falls City, NE
- (9) ASHLAND NO 2 [USC00250375], Ashland, NE
- (10) BEATRICE 1N [USC00250622], Beatrice, NE
- (11) CRETE [USC00252020], Crete, NE
- (12) MEAD 6S [USC00255362], Ithaca, NE
- (13) RAYMOND 2NE [USC00257055], Raymond, NE
- (14) TABLE ROCK 4 N [USC00258410], Table Rock, NE
- (15) LINCOLN MUNI AP [USW00014939], Lincoln, NE
- (16) LINCOLN UNIV PWR PLT [USW00014971], Lincoln, NE

Influencing water features

This ecological site is directly influenced by the water table. While the proximity of the root zone to water ensures adequate hydration during the growing season, the duration of saturation also limits the plant community to more water tolerant species.

Wetland description

Wetland Description (Cowardin System)

System Subsystem Class
Palustrine N/A Emergent Wetland

Soil features

The soils associated with the Wet Subirrigated site are very deep, poorly and very poorly drained, and formed in alluvium. Positioned on floodplains, low stream terraces, alluvial fans, and upland drainageways, the slope of these soils ranges from 0 to 5 percent. The depth to the water table ranges from the surface, to approximately 18 inches. Flooding ranges from none, to very long periods of time.
The primary series correlated to this site are: Colo, Kezan, Wabash, and Zook.

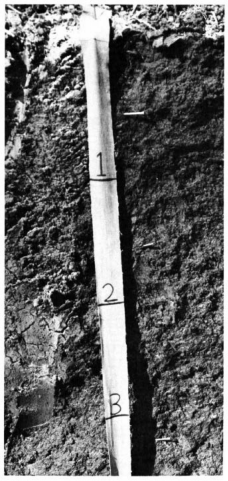


Figure 7. Wabash Series Profile

Table 4. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Silt loam (2) Silty clay (3) Silty clay loam
Drainage class	Poorly drained to very poorly drained
Permeability class	Very slow to moderate
Soil depth	0–203 cm
Available water capacity (0-101.6cm)	20.32–30.48 cm
Calcium carbonate equivalent (0-101.6cm)	2–6%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	5.9–7.6

Ecological dynamics

Wet Subirrigated 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, local hydrology, and variable climate. Changes occur in the plant communities due to weather variations, changes in the local hydrological cycle, impacts of native and/or exotic plant and animal species, and management actions.

The majority of this site has been impacted agricultural practices, both through soil disturbance and the accumulation of chemically contaminated run-off. A significant portion of the remaining acres have been degraded by 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 Degraded State, and a Sod-busted 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.

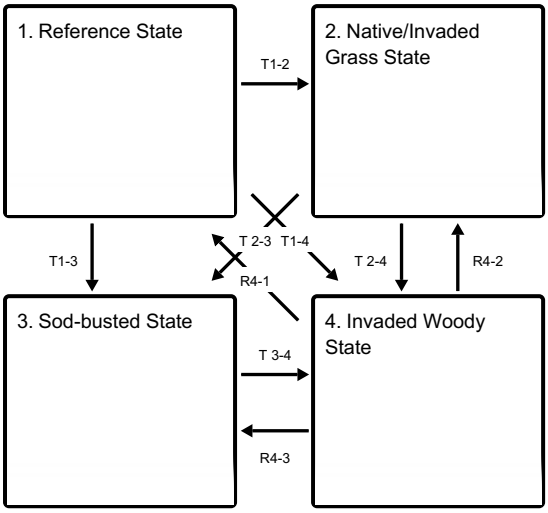
Interpretations are primarily based on the Reference State, and have been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics have been interpreted from heavily grazed to lightly 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.

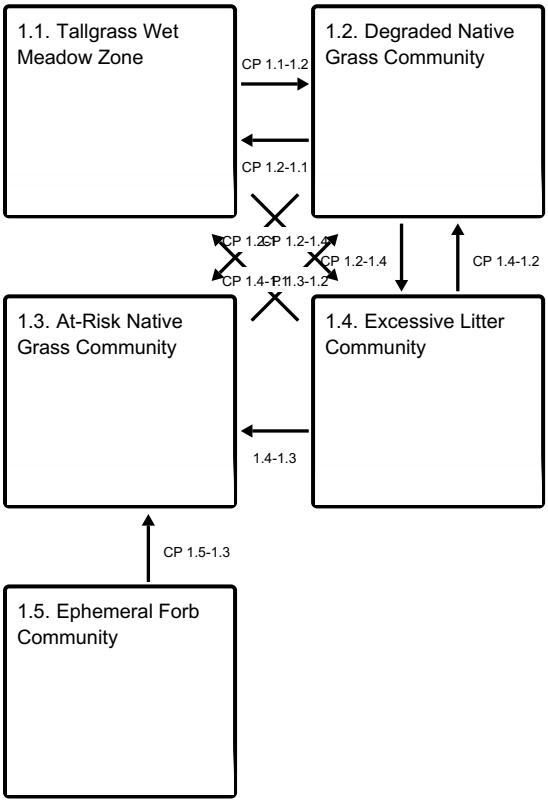
The following is a diagram illustrating the common plant communities that can occur on the site and the transition pathways between communities.

State and transition model

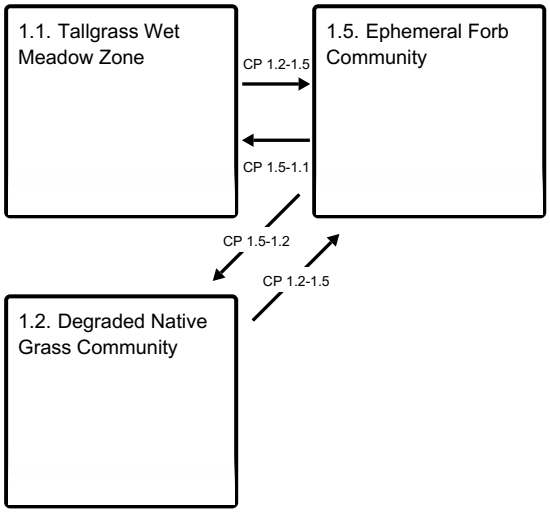
Ecosystem states



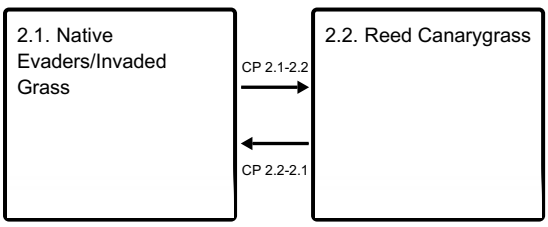
State 1 submodel, plant communities



Communities 1, 5 and 2 (additional pathways)



State 2 submodel, plant communities



State 3 submodel, plant communities

3.1. Re-Seeded Grass	3.2. Natural Reclamation

State 4 submodel, plant communities

4.1. Deciduous Woody Phase

State 1
Reference State

This state describes the range of vegetative community phases that occur on the Wet Subirrigated ecological 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. Due to differences in hydrology resulting in different periods and degrees of surface inundation, this site harbors a distinctive inclusion in some of the reference communities. The more water-tolerant vegetative community expressed in these inclusions can be described as a herbaceous wetland zone features, while the Tallgrass Wet Meadow Zone is comprised of more of the Tallgrass Prairie species. The boundary between the two communities is dynamic, and driven by local hydrology. 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 allow for increased soil moisture retention, vegetative production, and overall soil quality.

Community 1.1
Tallgrass Wet Meadow Zone

Figure 8. Tallgrass Wet Meadow-Reference Community

The Tallgrass Wet Meadow Zone 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, hydrology, and fire and grazing events. The potential vegetation consists of approximately 70-85 percent grasses and grass-like plants, 5-15 percent forbs, and 0-5 percent shrubs. Prairie cordgrass, big bluestem, Indiangrass, and switchgrass are the primary species in this community. Secondary species include little bluestem, sedges and Canada wildrye. The site also has a 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. The Reference State includes inclusions of a wetter environment, and a vegetative community that is more water tolerant than the Tallgrass Wet Meadow Zone. The primary grasses in this community are prairie cordgrass, and bluejoint. Sedges, rushes, bulrushes, and a variety of water tolerant forbs make up the remainder of the community, though some areas harbor deciduous tree communities. The boundary between the two communities is somewhat dynamic, and fluctuates as a result of changes in the local hydrology. Grazing during wet periods can cause excessive soil compaction, and lead to hummocking. The average annual vegetative production of the Tallgrass Wet Meadow Zone varies from 4,000 lbs per acre in the north, to 8,000 in the southern region.

Figure 9. Plant community growth curve (percent production by month). NE1068, MLRA 106 Warm-season. *Warm-season dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	18	30	22	12	6	2	0	0

Community 1.2
Degraded Native Grass Community

Prairie cordgrass, big bluestem, switchgrass, Indiangrass, and other desirable species lose productive capacity through loss of vigor and reproductive potential. Grazing-evasive warm-season and cool-season grasses such as little bluestem, sedges, and cool-season grasses increase. Bromegrass and Kentucky bluegrass begin to establish. Subirrigation of the deep-rooted tallgrasses on this site helps to sustain the reference plant community, but the degradation of the vegetative community is apparent. This community phase signals a significant loss of production. 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. This shift occurs is due to management strategies that include continuous season-long grazing with inadequate recovery periods. 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.

Community 1.3
At-Risk Native Grass Community

In this plant community, the more palatable warm-season tallgrasses have been reduced to remnant populations by continued defoliation during their critical growth periods. Grazing-evasive warm-season and cool-season grasses increase significantly. Sideoats grama, tall dropseed, smooth bromegrass, and Kentucky bluegrass become the dominant grasses. Tall fescue is an increaser in the south. The more palatable forbs give way to goldenrod, ironweed, Cuman ragweed, and other grazing-evasive species. On the wetter sites, reed canarygrass increases to near-dominance. 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. Hoof action may initiate the formation of a compacted soil layer. Total annual vegetative production will decline significantly. Without a management change, this community is at-risk to degrade to the Native/Invaded Grass State.

Figure 10. 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

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

Pathway CP 1.2-1.4
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 1.2-1.5
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

A shift from the Degraded Native Grass community toward the Reference communities 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

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 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

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

Prescribed Burning
Access Control
Prescribed Grazing

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
Access Control
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.

Conservation practices

Prescribed Burning
Access Control
Prescribed Grazing

Pathway 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 1.5-1.1
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

Prescribed Burning
Access Control
Prescribed Grazing

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

Prescribed Burning
Access Control
Prescribed Grazing

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 Reed Canarygrass communities are the components 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. Due to continued grazing pressure, reed canarygrass, Kentucky bluegrass, smooth bromegrass, (tall fescue in the south), dropseed, and gramma grasses have become the dominant plant species, with only trace remnants of the more palatable mid-warm-season grasses such as little bluestem. 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 and appropriately timed prescribed fire will favor any remnant mid- and tall warm-season grasses. Continued season-long grazing and high levels of herbivory will move this community towards the Reed Canarygrass phase.

Community 2.2
Reed Canarygrass

Figure 11. Reed Canarygrass Monoculture

This plant community contains predominately reed canarygrass and smooth bromegrass. Very few warm-season remnants are present. Production of reed canarygrass and smooth brome-dominated plant communities is highly variable, depending upon the percentages of composition present and outside inputs such as fertilizer and weed control. Tall fescue is often more common than smooth brome in the southern regions of the MLRA.

Figure 12. 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

Pathway CP 2.1-2.2
Community 2.1 to 2.2

This community will be converted to a Smooth Bromegrass/Reed Canarygrass 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.

Conservation practices

Prescribed Burning
Access Control
Prescribed Grazing
Herbaceous Weed Control

State 3
Sod-busted State

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

Community 3.1
Re-Seeded Grass

This plant community does not contain native remnants, and varies considerably depending upon 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 upon precipitation, management, and grass species seeded.

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 plowpan 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 upon 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 five feet, the threshold is crossed to the Invaded Woody State. 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 Deciduous Woody Phase.

Community 4.1
Deciduous Woody Phase

Figure 13. Invading Woody Species

Rough-leaved dogwood, honey locust, Siberian elm, cottonwood, ash, and willow are the primary invading species. Eastern redcedar is often present in this community as well. 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

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. The wetter sites are often ditched and drained, further altering the local hydrological cycle.

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 R4-1
State 4 to 1

Prescribed burning, wildfire, harvest, and brush management will move this state towards one of the herbaceous plant-dominated plant states. 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. Neither the Sod-busted State nor the Native/Invaded State can return to the Reference State through this process, as the native plant community, soils, and hydrological cycle have been too severely degraded. 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 mechanical removal, chemical spot treatments, or periodic prescribed burning is required to prevent a return to this state.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

Restoration pathway R4-2
State 4 to 2

Prescribed burning, wildfire, harvest, and brush management will move this state towards one of the herbaceous plant-dominated plant states. 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. Neither the Sod-busted State nor the Native/Invaded State can return to the Reference State through this process, as the native plant community, soils, and hydrological cycle have been too severely degraded. 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 mechanical removal, chemical spot treatments, or periodic prescribed burning is required to prevent a return to this state.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

Restoration pathway R4-3
State 4 to 3

Prescribed burning, wildfire, harvest, and brush management will move this state towards one of the herbaceous plant-dominated plant states. 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. Neither the Sod-busted State nor the Native/Invaded State can return to the Reference State through this process, as the native plant community, soils, and hydrological cycle have been too severely degraded. 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 mechanical removal, 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

Animal community

Animal Community
LIVESTOCK – GRAZING INTERPRETATIONS:
Grazing by domestic livestock, primarily cattle, is one of the primary uses of the native grasslands. During the dormant period, the protein levels of the forage may be lower than the minimum needed to meet livestock requirements. These sites are also hayed. Annual forage production of the Reference Community averages around 4,000 lbs./acre in the northern part of the MLRA, and 8,000 lbs./acre in the south.

WILDLIFE INTERPRETATIONS:

Major Land Resource Area (MLRA) 106 lies primarily within the tallgrass prairie ecosystem. 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 tallgrass 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 from this ecological site. 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, are also declining. In addition to free-ranging bison, extirpated species include pronghorn and wolves.

Historically, an ecological mosaic of the 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.
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.
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.

1. REFERENCE STATE: The predominance of tall grasses and forbs 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. The abundant prey base supports populations of Swainson’s hawk, short-eared and great horned owls, and other grassland raptors.
The grasses, forbs, and shrubs provide high nutrition levels for small and large herbivores including moles, mice, ground squirrels, 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.

Hydrological functions

The deep, poorly and very poorly drained soils of the Wet Subirrigated site place it in classes C and D of the hydrologic rating scale. The proximity of groundwater to the rooting zone during the growing season provides an abundance of water for the vegetative community. Production can be very high, but the degree of soil saturation can somewhat limit species diversity.

Recreational uses

This site provides hunting for upland game species and white-tailed deer, along with hiking, photography, and bird watching. The wide varieties of plants blooming from spring until fall have an aesthetic value that appeals to visitors.

Wood products

In the southern portion of MLRA 106, the Wet Subirrigated sites often have scattered populations of deciduous trees, including cottonwoods. These stands can provide firewood, select hardwood finishing lumber, and in some cases, the cottonwoods can be used to make pallets.

Other products

None of significance.

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

Information presented here has been derived from field observations by trained and experienced range and soils personnel.

Other references

Other References

Harms, R. 2009. Recovery Outline for the Salt Creek tiger beetle (Cicindela nevadica lincolniana). Available online. http://www.fws.gov/mountain-prairie/species/invertebrates/saltcreektiger/FinalRecoveryOutlineFeb2009.pdf. Accessed 1/02/2018.

High Plains Regional Climate Center, University of Nebraska. Available online. http://hpcc.unl.edu. Accessed 12/05/16.

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

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. Available online. http://digitalcommons.unl.edu/usgsstaffpub/162. Accessed 12/05/16.

Spomer, S. and L. Higley. 2001. The Salt Creek Tiger Beetle. Bio-graphica International. Available online. http://drshigley.com/lgh/sctb/default.htm. Accessed 1/02/2018.

U.S. Dept. of Agriculture. NRCS National Ecological Site Handbook. Available online. https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/soils/ref/?cid=nrcseprd1291232 Accessed January, 2014.

U.S. Dept. of Agriculture. NRCS National Engineering Handbook, Section 4. Available online. https://directives.sc.egov.usda.gov/viewerFS.aspx?hid=21422.
Accessed 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. Available online. 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. Available online. http://nasis.nrcs.usda.gov. Accessed 12/05/16.

USDA, NRCS. 2002. The PLANTS Database, Version 3.5. Available online. http://plants.usda.gov. Accessed 12/05/16.

USDA, NRCS Soil Surveys from: Butler, Saunders, Lancaster, Cass, Otoe, Nemaha, Johnson, Gage, Pawnee, Saline, Seward, Saunders and Richardson Counties in Nebraska; and Atchison, Brown, Doniphan, Douglas, Franklin, Jackson, Jefferson, Johnson, Leavenworth, Marshall, Nemaha, Osage, Pottawatomie, Shawnee, Wabaunsee, Washington, Wyandotte Counties in Kansas.

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:**

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

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

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

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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:**