USDA Natural Resources Conservation Service

Ecological site R071XY028NE
Loamy Lowland

Last updated: 1/08/2025
Accessed: 05/10/2025

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.

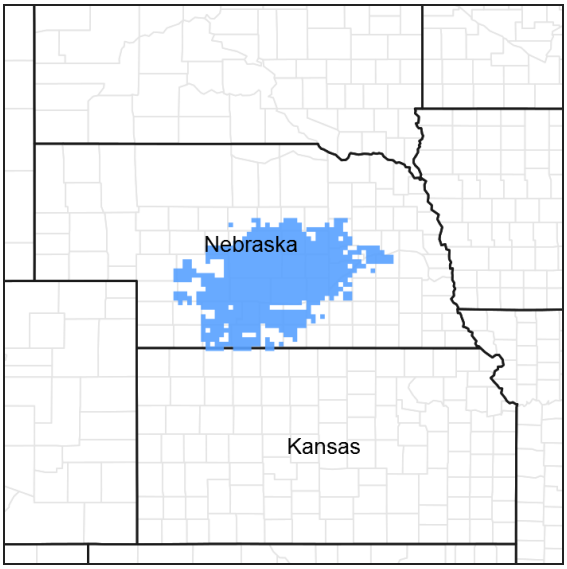


Figure 1. Mapped extent

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): 071X–Central Nebraska Loess Hills

MLRA 71 is named “The Central Nebraska Loess Hills” and is located exclusively in Nebraska. The approximately 5.3 million acre landscape covers all or parts of 21 counties, primarily Custer, Dawson, Buffalo, Sherman, Howard, Valley, Greeley, and Hall. The physical appearance of the landscape is dominated by loess hills dissected by the North, Middle, and South Loup Rivers and their tributaries. The Platte River defines the southern border. The elevation in MLRA 71 ranges from over 3,000 to less than 1,700 feet above sea level, with average local relief stretching from 20 to 200 feet. Average annual precipitation ranges from 21 to 26 inches, with the number of freeze-free days averaging around 200.

Loess overlays the surface of almost all of the uplands in this MLRA. Alluvial clay, silt, sand, and gravel are deposited in the stream and river valleys and can be extensive in the major drainages. Terraces are common in the valleys along the river systems. The predominate soil orders are mesic, udic Mollisols and Entisols, commonly represented by the Coly, Uly, Cozad, Hord, Hall, and Holdrege soil series.

The matrix vegetation type is mixed-grass prairie, with big and little bluestem, switchgrass, Indiangrass, and sideoats and blue grama making up the bulk of the warm-season species, while western wheatgrass is the dominant cool-season species. The primary large-patch vegetative component of the landscape is dominated by needle and thread, prairie sandreed, sand and little bluestem, and blue grama. The majority of the small-patch

communities are associated with upland playas and the wetter sites found along the floodplains.

Forty four percent of the land in this MLRA has been broken out of native prairie and farmed; mostly corn, alfalfa, and some soybeans, while 48 percent of the grasslands remain intact. Livestock grazing, primarily cattle, is a major industry here. Wildlife flourishes in this combination of crop and grassland environment, with both mule and white-tailed deer being the most abundant wild ungulate. A variety of smaller species, including coyote, raccoon, opossum, porcupines, muskrat, beaver, squirrel, and mink thrive in the region, as well as a suite of grassland and upland birds. The rivers, streams, and lakes harbor excellent fisheries.

This landscape developed under Northern Great Plains climatic conditions, light to severe grazing by bison and other large herbivores, and repeated natural or man-caused wildfire. Other biotic and abiotic factors also typically influence soil and site development. This is a disturbance driven ecosystem, evolving under the influences of herbivory, fire, and variable climate. Historically, these processes created a heterogenous mosaic of plant communities and structure heights across the region. Any given site in this landscape experienced fire every 7 to 9 years. The fires were caused both by lightning strikes, and were set by native Americans, who used fire for warfare, signaling, and to refresh the native grasses. These people understood the value of fire as a tool, and that the highly palatable growth following a fire provided both excellent forage for their horses and attracted grazing game animals such as bison and elk.

Fragmentation of the native grasslands by conversion to cropland, transportation corridors, and other development by European man has effectively disrupted the natural fire regime of this ecosystem. This has allowed encroachment by native and introduced shrubs and trees into the remnants of the native prairie throughout the MLRA. Aggressive fire suppression policies have exacerbated this process to the point that shrub and tree encroachment is a major ecological issue in the majority of both native and re-seeded grasslands.

Even as post European settlement's alteration of the fire regime allows the expansion of the woody component of the native prairie, introduction of eastern redcedar as a windbreak component further facilitates invasion by this species. While eastern redcedar is native to Nebraska, the historic population in MLRA 71 was limited to isolated pockets in rugged river drainages that were subsequently insulated from fire, or non-existent. Widespread plantings of windbreaks with eastern redcedar as a primary component has established 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 eastern redcedars can also be controlled with fire but requires the use of specially designed ignition and suppression techniques.

Classification relationships

Major Land Resource Area (MLRA: Major Land Resource Area 71. (USDA-Natural Resources Conservation Service, 2006)

Level IV Ecoregions of the Conterminous United States

Ecological site concept

This ecological site occupies a run-on position on the landscape but is not influenced by the water table. There are no visible salts on the site, and the soil texture is other than sandy loam, loamy sand, or sand.

Associated sites

R071XY036NE	**Loamy Upland** The Loamy Upland ecological site is positioned upslope and adjacent to Loamy Lowland sites.
R071XY037NE	**Limy Upland** The Limy Upland ecological site is positioned upslope and adjacent to Loamy Lowland sites.
R071XY024NE	**Subirrigated** The Subirrigated ecological site is often positioned downslope and adjacent to Loamy Lowland sites.

Similar sites

R071XY036NE	**Loamy Upland** The Loamy Upland ecological site is similar to the Loamy Lowland site but is positioned upslope from Loamy Lowland sites.
R071XY024NE	**Subirrigated** The Subirrigated ecological site is directly impacted by a high water table whereas Loamy Lowland sites are not.

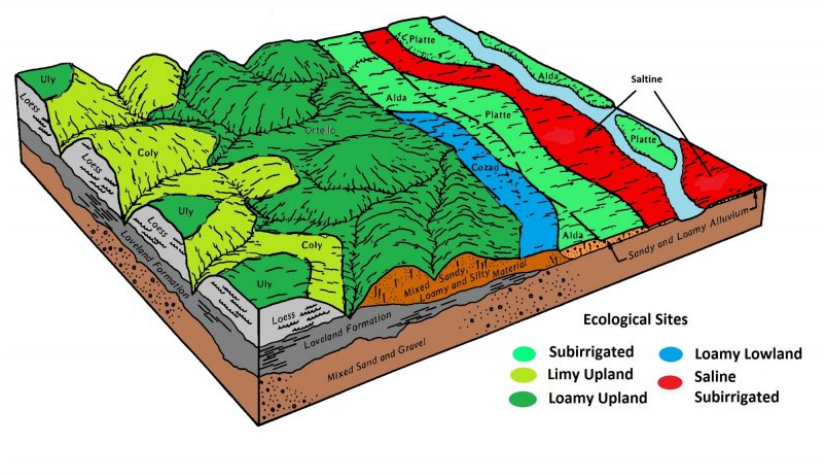


Figure 2. Block diagram

Table 1. Dominant plant species

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

Physiographic features

This site occurs on lowland areas that receives runoff from areas higher on the landscape. Flooding is none to rare.

Table 2. Representative physiographic features

Landforms	(1) Stream terrace (2) Drainageway (3) Flood plain
Runoff class	Negligible to medium
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	None to occasional
Ponding frequency	None
Elevation	1,630–3,075 ft
Slope	0–7%
Water table depth	48–80 in
Aspect	Aspect is not a significant factor

Climatic features

Annual precipitation ranges from 22 to 26 inches per year. Winds are estimated to average about 14 miles per hour annually. Occasional strong storms may bring brief periods of high winds with gusts to more than 60 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 if soil moisture conditions are favorable.

Table 3. Representative climatic features

Frost-free period (characteristic range)	120-131 days
Freeze-free period (characteristic range)	135-154 days
Precipitation total (characteristic range)	23-26 in
Frost-free period (actual range)	115-140 days
Freeze-free period (actual range)	134-165 days
Precipitation total (actual range)	23-27 in
Frost-free period (average)	127 days
Freeze-free period (average)	147 days
Precipitation total (average)	25 in

Climate stations used

- (1) ANSELMO 2 SE [USC00250245], Anselmo, NE
- (2) BROKEN BOW 2 W [USC00251200], Broken Bow, NE
- (3) CENTRAL CITY [USC00251560], Central City, NE
- (4) GOTHENBURG [USC00253365], Gothenburg, NE
- (5) KEARNEY 4 NE [USC00254335], Kearney, NE
- (6) NORTH LOUP [USC00256040], North Loup, NE
- (7) RAVENNA [USC00257040], Ravenna, NE
- (8) BURWELL [USC00251345], Burwell, NE
- (9) CANADAY STEAM PLT [USC00251450], Lexington, NE
- (10) COMSTOCK [USC00251835], Comstock, NE
- (11) MASON CITY [USC00255250], Mason City, NE
- (12) OVERTON 3 W [USC00256439], Overton, NE
- (13) STAPLETON 5W [USC00258133], Stapleton, NE
- (14) GRAND ISLAND AP [USW00014935], Grand Island, NE
- (15) ARNOLD [USC00250355], Arnold, NE
- (16) LOUP CITY [USC00254985], Loup City, NE
- (17) OCONTO [USC00256167], Oconto, NE
- (18) SAINT PAUL [USC00257515], Saint Paul, NE
- (19) TAYLOR [USC00258455], Taylor, NE

Influencing water features

This site occurs in areas that recieve runoff from areas higher on the landscape. Most soils included in this site are not influenced by a seasonally high water table but a few soils have a water table within the root zone during a portion o the growing season.

Soil features

These very deep soils are located on terraces or high floodplains. They receive extra water from runoff from adjoining uplands. They are rarely flooded. Textures are primarily loamy and silty, but sandy textures may occur in the lower part of the root zone. Free water is usually very deep but may be present in the lower part of some profiles during part of the growing season. Organic matter is generally moderate in the surface layer. These soils are susceptible to wind erosion where vegetative cover is inadequate. Silt deltas may form in areas adjacent to higher lying soils.

The major soil series correlated to this site are Cozad, Gosper, Hall, Hord, and Detroit. More information can be

found in the various soil survey reports. Contact the local USDA Service Center for internet links to soil survey data that includes more details specific to your location.

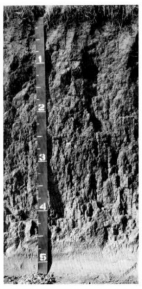


Figure 9. Hord series profile

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Loess
Surface texture	(1) Silt loam (2) Loam (3) Fine sandy loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Moderately slow to moderate
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	5.9–9.1 in
Calcium carbonate equivalent (0-40in)	0–10%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0–1
Soil reaction (1:1 water) (0-40in)	6.1–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–19%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

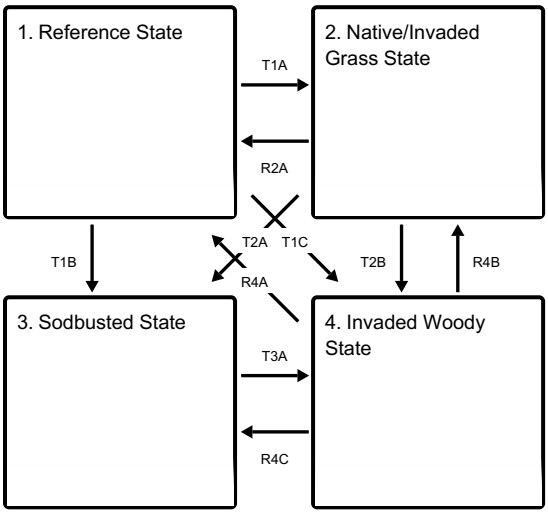
Loamy Lowland sites developed under Central Great Plains climatic conditions, light to severe grazing by bison and other large herbivores, sporadic natural or man-caused wildfire, and other biotic and abiotic factors that typically influence soil and site development. This is a disturbance driven site, with the disturbances being herbivory, fire, and variable climate. The landscape position and association with streams make this site somewhat less

susceptible to fire, which allowed woody species to become more abundant than less sheltered sites in the MLRA.

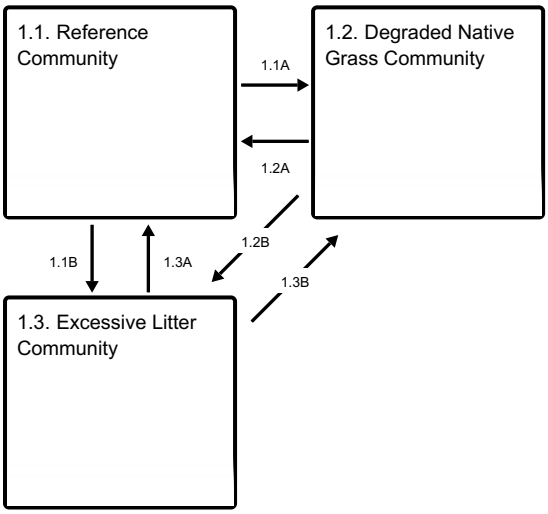
The State and Transition Model (STM) is depicted below, and is made up of a Reference State, a Native/Invaded Grass State, an Invaded Woody State, and a Sodbusted State. Each state represents the crossing of a major ecological threshold due to alteration of the functional dynamic properties of the ecosystem. The primary properties observed to determine this change are soil stability, vegetative communities, and the hydrologic cycle. Each state may have one or more plant communities that 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. Periodic flooding and deposition events can cause a wide variability in plant communities and production on this site. The processes that cause the movement between the states and communities are discussed in more detail in the state and community descriptions following the diagram.

State and transition model

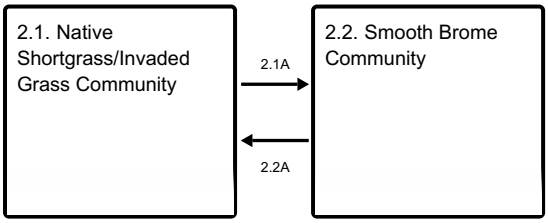
Ecosystem states



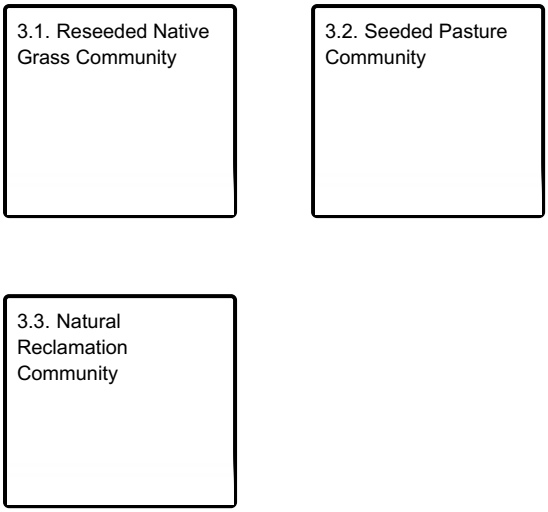
State 1 submodel, plant communities



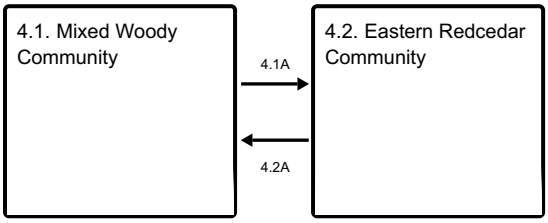
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



State 1
Reference State

The Reference State describes the range of vegetative community phases that occur on the Loamy Lowland site where the range of natural variability under historic conditions and disturbance regimes is 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 Community and the Excessive Litter Community are the phases that result from management decisions that are unfavorable to a healthy Reference Community. High perennial grass cover and production allows for increased soil moisture retention, vegetative production, and overall soil quality.

Dominant plant species

- big bluestem (*Andropogon gerardii*), grass
- sideoats grama (*Bouteloua curtipendula*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- little bluestem (*Schizachyrium scoparium*), grass

Community 1.1
Reference Community

The Reference Community Phase serves as a description of the native plant community that naturally occurs on the site when the natural disturbance regimes are intact, or closely mimicked by management practices. This phase is dynamic, with fluid relative abundance and spatial boundaries between the dominant structural vegetative groups. These fluctuations are primarily driven by different responses of the species to changes in precipitation timing and abundance, and fire and grazing events. This community averages 85 to 90 percent grasses and grass-like plants, 5 to 10 percent forbs, and 0 to 5 percent shrubs. The plant community is dominated by warm-season grasses with a lesser component of cool-season grasses. The major grasses include big bluestem, little bluestem, and western wheatgrass. Other grasses and grass-likes include switchgrass and sedges. Forbs are diverse and include sunflowers, goldenrods, and native legume species. Woody species included in the plant community are western snowberry and rose. The potential for tree encroachment is high. The Reference Community should exhibit slight to no evidence of rills, wind scoured areas, or pedestalled plants. Water flow paths, if any, are broken, irregular in appearance or discontinuous with numerous debris dams or vegetative barriers. The soil surface is stable and intact. Sub-surface soil layers are non-restrictive to water movement and root penetration. This is a sustainable

plant community in regard to site and soil stability, watershed function, and biologic integrity. This plant community is productive and diverse. This diversity in plant species results in high drought tolerance and the ability to withstand other short-term environmental stressors such as short-term heavy grazing or several years of non-use by grazing animals. Plant health and vigor can be maintained by implementing prescribed grazing with adequate recovery periods between grazing events. The total annual production ranges from 3,000 to 4,500 pounds of air dry vegetation per acre with a representative value of 3,750 pounds per acre.

Dominant plant species

- big bluestem (*Andropogon gerardii*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- western wheatgrass (*Pascopyrum smithii*), grass

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2815	3375	3910
Forb	185	281	400
Shrub/Vine	0	94	190
Total	**3000**	**3750**	**4500**

Figure 11. Plant community growth curve (percent production by month). NE7137, Central NE Loess Hills, warm-season dominant, cool-season sub-dominant. Warm-season grass dominant with cool-season plants sub-dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	8	15	24	23	15	5	5	0	0

Community 1.2
Degraded Native Grass Community

The Degraded Native Grass Community describes a significant shift in the vegetative community. Western wheatgrass increases, while there is a loss in the composition and production of big bluestem and little bluestem. Other grasses and grass-likes in this community include sideoats grama, blue grama, and sedges. The forb composition remains diverse and includes both annual and perennial sunflowers, white sagebrush, and goldenrod. Woody species included in the plant community are western snowberry and rose. The potential is high for tree encroachment or regeneration. This plant community is less productive and the diversity of grasses is lower than the representative plant community. This site remains a sustainable plant community in regard to site and soil stability, watershed function, and biologic integrity. The total annual production ranges from 2,200 to 3,200 pounds of air dry vegetation per acre with a representative value of 2,700 pounds per acre.

Dominant plant species

- western snowberry (*Symphoricarpos occidentalis*), shrub
- sideoats grama (*Bouteloua curtipendula*), grass
- blue grama (*Bouteloua gracilis*), grass
- western wheatgrass (*Pascopyrum smithii*), grass

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2070	2430	2760
Forb	130	200	300
Shrub/Vine	0	70	140
Total	**2200**	**2700**	**3200**

Figure 13. Plant community growth curve (percent production by month). NE7141, Central NE Loess Hills, lowland cool season/warm season co-dominant. Cool-season and warm-season grasses co-dominant, lowland sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	12	20	25	19	11	5	3	0	0

Community 1.3
Excessive Litter Community

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

Dominant plant species

- big bluestem (*Andropogon gerardii*), grass
- little bluestem (*Schizachyrium scoparium*), grass

Pathway 1.1A
Community 1.1 to 1.2

Long-term excessive livestock grazing without adequate growing season rest will cause the Reference Community to shift to the Degraded Native Grass Community. Prolonged periods of drought will have the same affect.

Pathway 1.1B
Community 1.1 to 1.3

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

Pathway 1.2A
Community 1.2 to 1.1

Management practices that include an appropriate stocking rate and alteration of the grazing and haying regime to provide adequate growing season rest will allow recovery to the Reference Community. In the case of prolonged drought, return to the normal precipitation cycle will allow return of the Reference Community.

Pathway 1.2B
Community 1.2 to 1.3

Interruption of the natural disturbances of herbivory and fire will result in conversion from the Degraded Native Grass Community to the Excessive Litter Community.

Pathway 1.3A
Community 1.3 to 1.1

Reintroduction of the natural processes of herbivory and fire will allow the vegetation to return to the Reference Community.

Pathway 1.3B
Community 1.3 to 1.2

Reintroduction of the natural processes of herbivory and fire will allow the vegetation to return to the Degraded Native Grass Community.

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 warm-season, tall- and midgrasses has negatively impacted energy flow and nutrient cycling. Water infiltration is reduced due to the shallow root system and rapid runoff characteristics of invaded grazing-evasive plant communities.

Dominant plant species

- blue grama (*Bouteloua gracilis*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- Cuman ragweed (*Ambrosia psilostachya*), other herbaceous
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- hoary verbena (*Verbena stricta*), other herbaceous

Community 2.1
Native Shortgrass/Invaded Grass Community

The Native Shortgrass/Invaded Grass Community develops as a result of continuous heavy grazing without adequate recovery periods. Western wheatgrass and big bluestem have decreased. There is an increase in the sod forming grasses, blue grama, and Kentucky bluegrass. The potential is high for woody plant encroachment. Kentucky bluegrass and ragweed will begin to dominate the plant community with continued heavy grazing use. Production and diversity have declined compared to the Reference Plant Community. Dominant forbs include ragweed, scurfpeas, cudweed sagewort, and verbenas. The loss of warm-season, tall- and midgrasses have negatively impacted energy flow and nutrient cycling. Water infiltration will be reduced due to the shallow root system and rapid runoff characteristics of sod-forming communities. The total annual production ranges from 1,500 to 2,500 pounds per acre of air dry vegetation per acre with a representative value of 1,650 pounds per acre.

Dominant plant species

- blue grama (*Bouteloua gracilis*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- Cuman ragweed (*Ambrosia psilostachya*), other herbaceous
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- hoary verbena (*Verbena stricta*), other herbaceous

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1155	1350	1480
Forb	165	250	415
Shrub/Vine	0	50	85
Total	**1320**	**1650**	**1980**

Figure 15. Plant community growth curve (percent production by month). NE7140, Central NE Loess Hills, cool-season dominant, warm-season sub-dominant. Cool-season grasses dominant, warm-season grasses subdominant, lowland.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	8	25	30	15	10	2	5	0	0

Community 2.2
Smooth Brome Community

The Smooth Brome Community contains predominately smooth bromegrass but may also contains native warm-season grass remnants. Production on smooth brome dominated plant communities are highly variable depending

on the percent composition present and outside inputs such as fertilizer and weed control. Production can range from 2,500 lbs per acre to 3,000 pounds per acre with a representative value of 2,750 lbs per acre on rangelands with a smooth brome component of 50 percent or more. Clipping or ocular estimates of production should be conducted to verify current annual production. Prescribed grazing, prescribed burning, or the use of herbicide treatments at critical time periods can reduce the smooth brome component in the plant community.

Dominant plant species

- smooth brome (*Bromus inermis*), grass
- Kentucky bluegrass (*Poa pratensis*), grass

Pathway 2.1A
Community 2.1 to 2.2

The shift from the Native Shortgrass/Invaded Grass Community to the Smooth Brome Community occurs with the following actions: introduced grass seeding, excessive summer grazing, inadequate rest during the summer, and multi-season haying. Nitrogen fertilization in spring or fall will also promote cool-season grasses such as smooth brome and reduce the amount of native grasses. Smooth brome and other non-native native plants are predominant and there is limited plant species diversity.

Pathway 2.2A
Community 2.2 to 2.1

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

State 3
Sodbusted State

The Sodbusted State is a result of mechanical disturbance to facilitate production agriculture. If farming operations are suspended, the site can be abandoned or seeded to a perennial grass mixture. When tilled and abandoned the Natural Reclamation Community will result. When seeded the resulting community will be the Reseeded Native Grass Community or the Seeded Pasture Community depending upon the type of seeding implemented. Permanent alterations of the soil community and the hydrological cycle make restoration to the original native Reference Community extremely difficult, if not impossible.

Community 3.1
Reseeded Native Grass Community

The Reseeded Native Grass Community does not contain native remnants and will vary considerably depending on the extent of soil erosion, the kind of species seeded, the quality of the stand that was established, how long ago the stand was established, and the management of the stand since establishment. Prescribed grazing with adequate recovery periods will be needed to maintain productivity and desirable species. There are several factors that make seeded rangeland a different grazing resource than native rangeland. Factors such as species selected, stand density, improved or selected varieties, and harvest efficiency all impact the production level and palatability. Species diversity on seeded rangeland is often lower and native forb species generally take longer to establish. This results in uneven utilization when both seeded and native rangelands are in the same grazing unit. Therefore, the seeded rangeland should be managed as a separate grazing unit if possible unless intensive grazing management methods are used.

Community 3.2
Seeded Pasture Community

The Seeded Pasture Community does not contain native remnants and will vary considerably depending on the extent of soil erosion, the species seeded, the quality of the stand that was established, how long ago the stand was established, and the management of the stand since establishment. There are several factors that make seeded pasture a different grazing resource than native rangeland and land seeded to a rangeland grass mixture. Factors such as species selected, stand density, improved varieties, and harvest efficiency all impact the production level

and palatability. Species diversity on seeded pasture is often limited to a few species. When seeded pasture and native rangelands or seeded pasture and seeded rangeland are in the same grazing unit, uneven forage utilization will occur. Improve forage utilization by managing this community separately from native rangelands or land seeded to native grass species. Total annual production during an average year varies significantly depending on the level of management and grass species seeded. Improved varieties of warm-season or cool-season grasses are recommended for forage purposes. Single species stands of big bluestem, Indiangrass, switchgrass, or well managed cool-season grasses and legume plantings with improved varieties will yield 4,000 to 5,000 pounds per acre with an average of 4,500 pounds per acre annually.

Community 3.3
Natural Reclamation Community

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

State 4
Invaded Woody State

The Invaded Woody State is a result of the disruption of the natural fire regime, and lack of management in response to an increase in woody species. The native component of woody species increases, as do invading introduced exotic species. Once the canopy cover reaches 15 percent with an average tree height exceeding 5 feet, the threshold is crossed to the Invaded Woody State.

Dominant plant species

- eastern redcedar (*Juniperus virginiana*), tree
- green ash (*Fraxinus pennsylvanica*), tree
- honeylocust (*Gleditsia triacanthos*), tree
- sideoats grama (*Bouteloua curtipendula*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- Kentucky bluegrass (*Poa pratensis*), grass

Community 4.1
Mixed Woody Community

The Mixed Woody Community can occur whenever this site is near a seed source for eastern redcedar and typically develops after some amount of deciduous canopy exists, providing a suitable microclimate for the establishment of the evergreen. In the absence of fire, eastern redcedar will continue to increase in size, and in the process, change the microclimate (soil moisture) so that it becomes less suitable for the deciduous trees. This plant community is the beginning stage of this transformation, and typically will have numerous immature eastern redcedar under the deciduous tree canopy. The herbaceous and shrub understory begin to decline rapidly.

Dominant plant species

- honeylocust (*Gleditsia triacanthos*), tree
- eastern redcedar (*Juniperus virginiana*), tree
- western snowberry (*Symphoricarpos occidentalis*), shrub
- sideoats grama (*Bouteloua curtipendula*), grass
- blue grama (*Bouteloua gracilis*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- Kentucky bluegrass (*Poa pratensis*), grass

Community 4.2

Eastern Redcedar Community

The Eastern Redcedar Community develops when brush management, timber harvest, prescribed burning, grazing by browsing animals, or wildfire is absent from the site over an extended period of time. Generally, this site is susceptible to eastern redcedar seedling encroachment. The percent composition of the species normally does not exceed 5 percent of the plant community when fire is regularly present in the ecosystem. With the absence of fire, brush management, and browsing by animals the steady encroachment of eastern redcedar occurs with the resulting loss of the herbaceous plant community as tree density and canopy cover increases. Soil erosion underneath a closed tree canopy can be high. Eastern redcedar control can usually be effectively accomplished with a prescribed burn while the trees are six foot tall or less and fine fuel production is over 1500 pounds per acre. Honeylocust encroachment may occur as you move south and east within the MLRA. Mechanical removal followed by a chemical treatment on stumps is effective on honeylocust.

Dominant plant species

- honeylocust (*Gleditsia triacanthos*), tree
- eastern redcedar (*Juniperus virginiana*), tree
- western snowberry (*Symphoricarpos occidentalis*), shrub
- sideoats grama (*Bouteloua curtipendula*), grass
- blue grama (*Bouteloua gracilis*), grass
- Kentucky bluegrass (*Poa pratensis*), grass

Pathway 4.1A
Community 4.1 to 4.2

The Mixed Woody Community will shift to the Eastern Redcedar Community in the absence of fire and/or brush management to remove eastern redcedar which encroach due to the microclimate provided by deciduous canopy.

Pathway 4.2A
Community 4.2 to 4.1

Brush management and/or prescribed burning will shift the Eastern Redcedar Community to the Mixed Woody Community.

Transition T1A
State 1 to 2

Continuous heavy grazing without adequate recovery periods will cause a significant loss of warm-season tall- and midgrass species and the plant community will cross a threshold to the Native/Invaded Grass State. Once this occurs it will require considerable time and expense to return this site to a more productive plant community. Water infiltration and other hydrologic functions will be reduced due to the root matting presence of sod-forming grasses.

Transition T1B
State 1 to 3

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

Transition T1C
State 1 to 4

Disruption of the natural fire regime, lack of brush management, and the introduction of exotic tree species such as Russian olive causes a major shift in the vegetative community. The resulting impacts to the system cause it to cross the threshold from the Reference State to the Invaded Woody State.

Restoration pathway R2A
State 2 to 1

Development of a long-term management plan that includes an appropriate level of livestock grazing with adequate growing season rest, and strategically timed prescribed fire will return the Native/Invaded Grass State to the Reference State. This restoration may take many years to be achieved.

Transition T2A
State 2 to 3

The Native/Invaded Grass State has been significantly altered by mechanical tillage to allow the site to be placed into production agriculture. The disruption to the plant community, soil and hydrology of the system make restoration unlikely.

Transition T2B
State 2 to 4

Disruption of the natural fire regime and the introduction of exotic species can cause a shift from the Native/Invaded Grass State to the Invaded Woody State.

Transition T3A
State 3 to 4

Encroachment of woody species, no grazing, and no fire will cause the Sodbusted State to transition to the Invaded Woody State.

Restoration pathway R4A
State 4 to 1

Prescribed burning, wildfire, timber harvest, and brush management will move this plant community toward one of the herbaceous dominated plant communities. The forb component of a site with heavy tree density or canopy cover will initially increase following brush management and prescribed fire.

Restoration pathway R4B
State 4 to 2

Prescribed burning, wildfire, timber harvest, and brush management will move this plant community toward one of the herbaceous dominated plant communities. The forb component of a site with heavy tree density or canopy cover will initially increase following brush management and prescribed fire.

Restoration pathway R4C
State 4 to 3

Prescribed burning, wildfire, timber harvest, and brush management will move this plant community toward one of the herbaceous dominated plant communities. The forb component of a site with heavy tree density or canopy cover will initially increase following brush management and prescribed fire.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Warm-Season Tallgrasses**			1125–1685	
	big bluestem	ANGE	*Andropogon gerardii*	938–1313	25–35
	switchgrass	PAVI2	*Panicum virgatum*	188–375	5–10
	Indiangrass	SONU2	*Sorghastrum nutans*	0–375	0–10
2	**Warm-Season Midgrasses**			750–1313	

	little bluestem	SCSC	*Schizachyrium scoparium*	563–938	15–25
	sideoats grama	BOCU	*Bouteloua curtipendula*	188–375	5–10
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–188	0–5
3	**Native Cool-Season Grasses**			375–938	
	western wheatgrass	PASM	*Pascopyrum smithii*	375–750	10–20
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–188	0–5
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–188	0–5
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–188	0–5
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–188	0–5
4	**Warm-Season Shortgrasses**			0–188	
	blue grama	BOGR2	*Bouteloua gracilis*	0–188	0–5
5	**Grass-likes**			0–188	
	sedge	CAREX	*Carex*	0–188	0–5
Forb					
7	**Forbs**			188–375	
	Forb, annual	2FA	*Forb, annual*	0–75	0–2
	Forb, perennial	2FP	*Forb, perennial*	0–75	0–2
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–75	0–2
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–75	0–2
	pussytoes	ANTEN	*Antennaria*	0–75	0–2
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–75	0–2
	false boneset	BREU	*Brickellia eupatorioides*	0–75	0–2
	purple prairie clover	DAPU5	*Dalea purpurea*	0–75	0–2
	common sunflower	HEAN3	*Helianthus annuus*	0–75	0–2
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	0–75	0–2
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	0–75	0–2
	dotted blazing star	LIPU	*Liatris punctata*	0–75	0–2
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–75	0–2
	scurfpea	PSORA2	*Psoralidium*	0–75	0–2
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–75	0–2
	goldenrod	SOLID	*Solidago*	0–75	0–2
	white heath aster	SYER	*Symphyotrichum ericoides*	0–75	0–2
	hoary verbena	VEST	*Verbena stricta*	0–75	0–2
Shrub/Vine					
8	**Shrubs**			0–188	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–75	0–2
	leadplant	AMCA6	*Amorpha canescens*	0–75	0–2
	rose	ROSA5	*Rosa*	0–75	0–2
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–75	0–2
	coralberry	SYOR	*Symphoricarpos orbiculatus*	0–75	0–2

Table 9. Community 1.2 plant community composition

				Annual Production	Foliar Cover

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Warm-Season Midgrasses**			270–810	
	little bluestem	SCSC	*Schizachyrium scoparium*	135–405	5–15
	sideoats grama	BOCU	*Bouteloua curtipendula*	135–270	5–10
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–135	0–5
2	**Native Cool-Season Grasses**			270–675	
	western wheatgrass	PASM	*Pascopyrum smithii*	270–675	10–25
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–54	0–2
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–54	0–2
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–54	0–2
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–54	0–2
3	**Warm-Season Shortgrasses**			270–405	
	blue grama	BOGR2	*Bouteloua gracilis*	270–405	10–15
4	**Warm-Season Tallgrasses**			135–405	
	big bluestem	ANGE	*Andropogon gerardii*	135–270	5–10
	switchgrass	PAVI2	*Panicum virgatum*	0–135	0–5
	Indiangrass	SONU2	*Sorghastrum nutans*	0–54	0–2
5	**Grass-likes**			0–135	
	sedge	CAREX	*Carex*	0–135	0–5
6	**Non-Native Grasses**			0–270	
	smooth brome	BRIN2	*Bromus inermis*	0–270	0–10
	Kentucky bluegrass	POPR	*Poa pratensis*	0–270	0–10
	cheatgrass	BRTE	*Bromus tectorum*	0–54	0–2
Forb					
7	**Forbs**			135–270	
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–54	0–2
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–54	0–2
	pussytoes	ANTEN	*Antennaria*	0–54	0–2
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–54	0–2
	false boneset	BREU	*Brickellia eupatorioides*	0–54	0–2
	purple prairie clover	DAPU5	*Dalea purpurea*	0–54	0–2
	common sunflower	HEAN3	*Helianthus annuus*	0–54	0–2
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	0–54	0–2
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	0–54	0–2
	blazing star	LIATR	*Liatris*	0–54	0–2
	white heath aster	SYER	*Symphyotrichum ericoides*	0–54	0–2
	hoary verbena	VEST	*Verbena stricta*	0–54	0–2
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–54	0–2
	scurfpea	PSORA2	*Psoralidium*	0–54	0–2
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–54	0–2
	goldenrod	SOLID	*Solidago*	0–54	0–2
Shrub/Vine					

Shrub/Vine					
8	**Shrubs**			0–135	
	leadplant	AMCA6	*Amorpha canescens*	0–54	0–2
	rose	ROSA5	*Rosa*	0–54	0–2
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–54	0–2
	coralberry	SYOR	*Symphoricarpos orbiculatus*	0–54	0–2

Table 10. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Non-Native Grasses**			413–743	
	smooth brome	BRIN2	*Bromus inermis*	0–743	0–45
	Kentucky bluegrass	POPR	*Poa pratensis*	413–743	25–45
	cheatgrass	BRTE	*Bromus tectorum*	0–83	0–5
2	**Short Warm Season Grasses**			330–495	
	blue grama	BOGR2	*Bouteloua gracilis*	330–495	20–30
3	**Mid Warm Season Grasses**			0–248	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–83	0–5
	little bluestem	SCSC	*Schizachyrium scoparium*	0–83	0–5
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–83	0–5
4	**Native Cool Season Grasses**			83–165	
	western wheatgrass	PASM	*Pascopyrum smithii*	83–165	5–10
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–83	0–5
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–33	0–2
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–33	0–2
5	**Tall Warm Season Grasses**			0–83	
	big bluestem	ANGE	*Andropogon gerardii*	0–50	0–3
	switchgrass	PAVI2	*Panicum virgatum*	0–33	0–2
6	**Grass-likes**			0–83	
	sedge	CAREX	*Carex*	0–83	0–5
Forb					
7	**Forbs**			165–413	
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	165–330	10–20
	pussytoes	ANTEN	*Antennaria*	0–33	0–2
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–33	0–2
	false boneset	BREU	*Brickellia eupatorioides*	0–33	0–2
	purple prairie clover	DAPU5	*Dalea purpurea*	0–33	0–2
	common sunflower	HEAN3	*Helianthus annuus*	0–33	0–2
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	0–33	0–2
	dotted blazing star	LIPU	*Liatris punctata*	0–33	0–2
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–33	0–2
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–33	0–2
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–33	0–2

	coneflower				
	goldenrod	SOLID	*Solidago*	0–33	0–2
	white heath aster	SYER	*Symphyotrichum ericoides*	0–33	0–2
	hoary verbena	VEST	*Verbena stricta*	0–33	0–2
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–33	0–2
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	0–33	0–2
Shrub/Vine					
8	**Shrubs**			0–83	
	rose	ROSA5	*Rosa*	0–33	0–2
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–33	0–2
	coralberry	SYOR	*Symphoricarpos orbiculatus*	0–33	0–2

Animal community

LIVESTOCK - Grazing Interpretations:
Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide year-long forage for cattle, sheep, goats, and horses. During the dormant period, the forage for livestock will likely be lacking protein to meet livestock requirements, and added protein allows ruminants to better utilize the energy stored in grazed plant materials. A forage quality test (either directly or through fecal sampling) should be used to determine the level of supplementation needed.

The following table lists annual, suggested initial stocking rates with average growing conditions. These are conservative estimates that should be used only as guidelines in the initial stages of conservation planning. Often, the current plant composition does not entirely match any particular plant community (as described in this ecological site description). Because of this, a field visit is recommended in all cases to document plant composition and production. More precise carrying capacity estimates should eventually be calculated using the following stocking rate information along with animal preference data and actual stocking records, particularly when grazers other than cattle are involved. With consultation of the land manager, more intensive grazing management may result in improved harvest efficiencies and increased carrying capacity.

Plant Community - Production - AUM/ac*
Community 1.1, Reference Community: 3,750 lbs./acre, 1.03 AUM/acre
Community 1.2, Degraded Native Community: 2,700 lbs./acre, 0.74 AUM/acre
Community 2.1, Native Shortgrass/Invaded Grass Community: 1,650 lbs./acre, 0.45 AUM/acre
Community 2.2, Smooth Brome Community (dryland, unfertilized, >50% of plant composition): 2,750 lbs./acre, 0.75 AUM/acre

* Based upon the following conditions: continuous season-long grazing by cattle under average growing conditions, 25 percent harvest efficiency. Air dry forage requirements based on 3 percent of animal body weight, or 912 lbs/AU/month (refer to USDA NRCS, National Range and Pasture Handbook).

WILDLIFE INTERPRETATIONS:
Major Land Resource Area (MLRA) 71 lies primarily within the Mixed-grass prairie ecosystem. Though European settlers have converted about half of this landscape to farmland, a significant portion of the prairie is still intact. This area still consists of diverse grassland habitats interspersed with varying densities of depressional wetlands and limited woody riparian corridors. These habitats historically provided critical life cycle components for the grassland birds, prairie dogs, and herds of roaming bison, elk, and pronghorn. Bobcats, wolves, and mountain lions occupied the apex predator niche. Diverse populations of small mammals and insects still provide a bountiful prey base for raptors and omnivores such as coyotes, foxes, raccoons, and opossums. In addition, a wide variety of reptiles and amphibians thrive in this landscape.

The Mixed-grass prairie was a disturbance-driven ecosystem with fire, herbivory, and climate functioning as the primary disturbances. Following European settlement, elimination of fire, overgrazing, and some habitat fragmentation significantly altered the appearance and functionality of the entire ecosystem. Bison and prairie dogs were historically keystone species, but free-roaming bison herds have been extirpated in this region. 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.

Historically, an ecological mosaic of the sites provided habitat for species requiring unfragmented grasslands. Most of these important habitat features and components are intact, providing 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.

Disruption of the natural fire regime and lack of appropriate grazing management are the greatest threats to the ecosystem dynamics today. Tree and shrub encroachment from lack of fire creates habitat that favors generalist species such as American robin and mourning dove, and provides perches for raptors, increasing the predation mortality on native bird populations. Introduced species such as smooth brome, Kentucky bluegrass, nodding plumeless thistle (musk thistle), and Canada thistle further degrade the biological integrity of many areas of the prairie.

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group B, with localized areas in hydrologic group C. Infiltration rate is moderate to slow. Runoff potential for this site varies from moderate to high, depending on soil hydrologic group, slope, and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where rhizomatous grasses form a strong sod and dominate the site. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

Recreational uses

This site provides hunting, hiking, photography, bird watching, and other opportunities. The wide varieties of plants that bloom from spring until fall have an aesthetic value that appeals to visitors.

Wood products

Local or individual firewood can be utilized from this site.

Other products

None noted.

Inventory data references

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range-trained personnel were also used.
Data Source Number of Records Sample Period State County
SCS-RANGE-417 2 200 NE Valley

Field Offices:
Albion, Broken Bow, Burwell, Central City, Fullerton, Grand Island, Greeley, Kearney, Lexington, Loup City, North Platte, Ord, St. Paul, Thedford

Other references

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

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

LaGrange, T.G. 2015. Final Report submitted to EPA for the project entitled: Nebraska’s Wetland Condition

Assessment: An Intensification Study in Support of the 2011 National Survey (CD# 97714601), and the related project entitled: Nebraska's Supplemental Clean Water Act §106 Funds, as Related to Participation in National Wetland Condition Assessment (I – 97726201). Nebraska Game and Parks Commission, Lincoln.

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

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

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

Personal communications with professional ecologists and wildlife experts.

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

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

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

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

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

USDA, NRCS, various published soil surveys.

Contributors

Dana Larsen
Doug Whisenhunt
Nadine Bishop

Approval

Suzanne Mayne-Kinney, 1/08/2025

Acknowledgments

Many thanks to the soils, local practitioner, and state technical teams for your input and expertise, as well as to the editor.

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)	Jeff Nichols, Nadine Bishop

Contact for lead author	jeffrey.nichols@usda.gov
Date	11/30/2024
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None. Rills are not expected on this site.

2. **Presence of water flow patterns:** None. Water flow patterns are not expected on this site.

3. **Number and height of erosional pedestals or terracettes:** None. Pedestals and terracettes are not expected to occur on this site.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground ranges up to 10 percent. Bare ground patches should be less than 2 inches (5 cm) in diameter and scattered across the site. Bare ground is exposed mineral soil that is not covered by vegetation (basal and/or foliar canopy), litter, standing dead vegetation, gravel/rock, and visible biological crust (e.g., lichen, mosses, algae).

5. **Number of gullies and erosion associated with gullies:** None. Gullies are not expected on this site.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None. Wind scoured and depositional areas are not expected on this site.

7. **Amount of litter movement (describe size and distance expected to travel):** Fine litter may move short distances (less than 6 inches or 15 cm) following a significant run-off event; as interspaces are small, there is no difference between litter movement in interspaces and under canopy. Coarse litter generally does not move.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil stability ratings will be 5 to 6, typically 6. Interspaces are quite small and there should be no difference between interspaces and under canopy. High root content and organic matter will be present in the soil surface.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should range from 5 to 14 inches (12.7 to 35.6 cm). The A-horizon is gray (10YR 5/1) to very dark brown (10YR 2/2) moist with weak fine to medium granular structure.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Plant community composition of 80 to 90 percent perennial grasses and grass-likes, 5 to 10 percent forbs, and 5 to 10 percent shrubs will optimize infiltration on the site. The grass and grass-like component is made up of native, perennial, warm-season, tallgrasses (30-45%), native, perennial, warm-season, midgrasses (20-35%), native, perennial, cool-season grasses (10-20%), native, perennial, warm-season, shortgrasses (0-5%), and grass-likes (0-5%).

    Infiltration can be adversely impacted by the invasion of Kentucky bluegrass, smooth brome, and trees when present above 10 percent (subdominant designation).

---

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. No compaction layers occur naturally 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: Phase 1.1
    1. Native, perennial, warm-season tallgrass, 1125-1685 #/ac, 30-45%, (2 species min.): big bluestem, Indiangrass, switchgrass.

    2. Native, perennial, warm-season midgrass, 750-1313 #/ac, 20-35%, (2 species min.): little bluestem, sideoats grama, composite (tall) dropseed.

    Phase 1.2
    1. Native, perennial, warm-season midgrass - 270-810 #/ac- 10-30%, (2 species min.): little bluestem, sideoats grama, composite (tall) dropseed.

    2. Native, perennial, cool-season grass - 270-675 #/ac (10-25%): western wheatgrass, needle and thread, porcupinegrass, prairie Junegrass, Scribner’s rosette grass.

    Phase 1.3
    1. Native, perennial, warm-season, tallgrass (2 species minimum): big bluestem, Indiangrass, switchgrass.

    2. Native, perennial, cool-season grass (2 species minimum): western wheatgrass, needle and thread, porcupinegrass, prairie Junegrass, Scribner’s rosette grass.

    Sub-dominant: Phase 1.1
    1. Native, perennial cool-season grass, 375-938 #/ac, 10-25%, (1 species minimum): western wheatgrass, needle and thread, porcupinegrass, prairie Junegrass, Scribner’s rosette grass.

    Phase 1.2
    1. Native, perennial, warm-season tallgrass -135-405 #/ac- 5-15%, (1 species min.): big bluestem, Indiangrass, switchgrass.

    2. Native, perennial, warm-season shortgrass - 270-405 #/ac - 10-20% (1 species min.): blue grama, buffalograss.

    Phase 1.3
    1. Native, perennial, warm-season, midgrass (2 species min.): little bluestem, sideoats grama, composite (tall) dropseed.

    2. Grass-likes (1 species minimum): sedges.

Other: Minor - Phase 1.1
1. Native forb (perennial and annual), 188-375, 5-10%: Species will vary from location to location.

2. Native, perennial, warm-season shortgrass, 0-188, 0-5%: blue grama.

3. Grass-like, 0-188, 0-5%: sedges.

4. Shrub, 0-188, 0- 5%: leadplant, rose, western snowberry, coralberry.

Minor - Phase 1.2
1. Native forb (perennial and annual), 135-270 #/ac, 5-10%: species present will vary from location to location.

2. Non-native grass, 0-270 #/ac, 0-10%: smooth brome, Kentucky bluegrass, cheatgrass.

3. Grass-like, 0-135 #/ac, 0-5%: sedge.

4. Shrub, 0-135 #/ac, 0-5%: rose, western snowberry, coralberry.

Minor - Phase 1.3
1. Native, perennial, warm-season shortgrass: blue grama.

2. Native forb (perennial and annual): species will vary from location to location.

3. Shrub: leadplant, rose, western snowberry, coralberry.

Additional: The Reference Community (1.1) includes seven F/S Groups. These groups in order of expected abundance are native, perennial, warm-season tallgrass; native perennial, warm-season midgrass; native, perennial cool-season grass; native forb (perennial and annual); native, perennial, warm-season shortgrass; grass-like; and shrub.

The Degraded Native Grass Community (1.2) includes eight F/S Groups. These groups in order of expected abundance are native, perennial, warm-season midgrass; native, perennial cool-season grass; native, perennial, warm-season tallgrass; native perennial, warm-season shortgrass; native forbs; perennial, non-native grasses; grass-likes; and shrubs.

The Excessive Litter Community (1.3) includes seven F/S Groups. These groups in order of expected abundance are native, perennial, warm-season tallgrass; native, perennial cool-season grass; native perennial, warm-season midgrass; grass-likes; native, perennial, warm-season shortgrass; native forbs, and shrubs.

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** A few (less than 3 percent) dead centers may occur in bunchgrasses. Shrubs may show some dead branches (less than 5 percent) as plants age.

---

14. **Average percent litter cover (%) and depth (in):** Plant litter cover is evenly distributed throughout the site and is expected to be 90 to 95 percent and at a depth of 0.75 inches (1.9 cm). Kentucky bluegrass excessive litter or tree encroachment can negatively impact the functionality of this site.

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Production is shown in air-dry values. The Representative Value (RV) = 3,750 pounds per acre. Low

production years = 3,000 pounds per acre. High production years = 4,500 pounds per acre.

---

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** No non-native invasive species are present. Kentucky bluegrass, smooth brome, Caucasian bluestem, eastern redcedar, honey locust, nodding plumeless thistle (musk thistle), Canada thistle, common mullein, and Sericea lespedeza are known invasives that have the potential to be dominant or co-dominant on the site. Consult the state noxious weed and state watch lists for potential invasive species on each ecological site. NOTE: Invasive plants (for the purposes of the IIRH protocol) are plant species that are typically not found on the ecological site or should only be in trace or minor categories under the natural disturbance regime and have the potential to become a dominant or codominant species on the site if their establishment and growth are not actively controlled by natural disturbances or management interventions. Species listed characterize degraded states AND have the potential to become a dominant or co-dominant species.

---

17. **Perennial plant reproductive capability:** All perennial species exhibit high vigor relative to climatic conditions. Perennial grasses should have vigorous rhizomes or tillers; vegetative and reproductive structures are not stunted. All perennial species should be capable of reproducing annually.
