

Ecological site R071XY055NE Sands

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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.

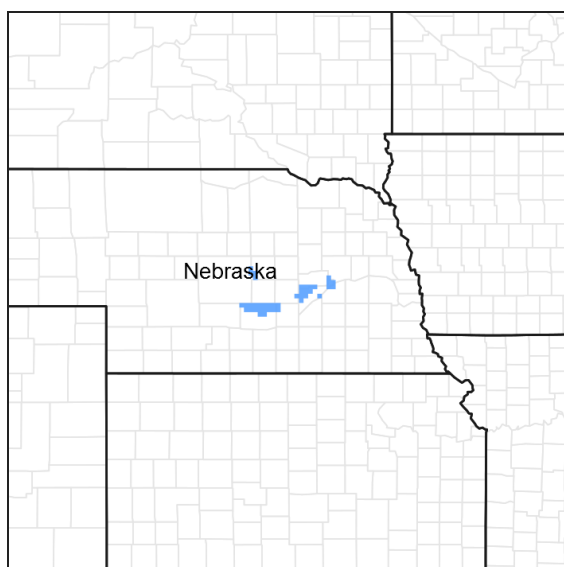


Figure 1. Mapped extent

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 (MLRA) 71. (USDA-Natural Resources Conservation Service, 2006)

Level IV Ecoregions of the Conterminous United States

Ecological site concept

The Sands site is positioned in a run-off position on a dunes, interdunes, or stream terraces. Sands sites occur on slopes greater than 3 percent. Soil textures are loamy fine sand, sandy loam, loamy sand, or sand. The soils have a dark colored surface horizon less than 10 inches thick. Catsteps are not evident on this site.

Associated sites

R071XY054NE	Sandy The Sandy ecological site is positioned lower on the landscape though often adjacent to the Sands site.
R071XY024NE	Subirrigated The Subirrigated ecological site is often adjacent to the Sands site and positioned lower on the landscape.

Similar sites

R071XY054NE	Sandy The Sandy ecological site occupies a lower landscape position with less steep slopes and higher vegetative production than the Sands site.
R071XY036NE	Loamy Upland The Loamy Upland ecological site is differentiated from the Sands site by its loamy, silty, or silty clay loam soil texture while soil textures on Sands sites are loamy fine sand, sandy loam, loamy sand, or sand.
R071XY037NE	Limy Upland The Limy Upland ecological site occurs on soils which have the presence of calcium carbonates in the surface layer which causes the soil to be effervescent whereas soils on the Sands site do not have carbonates at or near the soil surface.

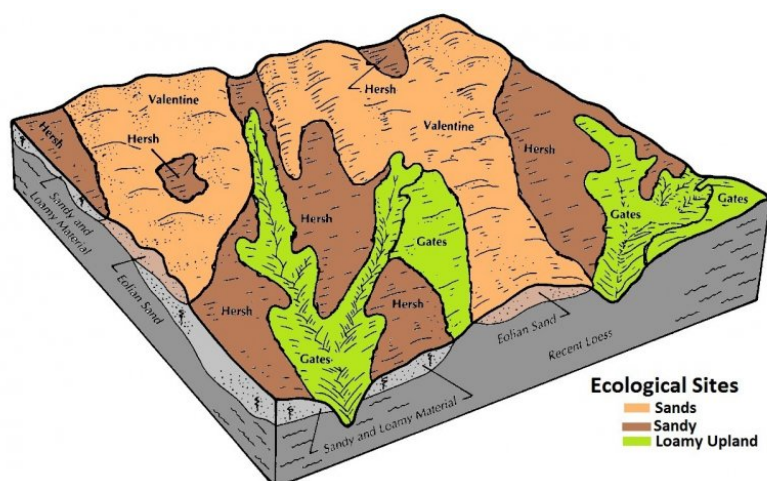


Figure 2. Block diagram

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Andropogon hallii</i> (2) <i>Calamovilfa longifolia</i>

Physiographic features

The Sands site occurs on nearly level to steep uplands of less than 24 percent without surface slip slopes known as “catsteps”. This site produces runoff to areas lower on the landscape. It is subject to erosion by water if the vegetative cover is reduced or absent by disturbance events. Livestock trailing on this site often leads to the formation of blowouts.

Table 2. Representative physiographic features

Landforms	(1) Dune (2) Interdune (3) Stream terrace
Runoff class	Negligible to low
Flooding frequency	None
Ponding frequency	None
Elevation	1,630–3,075 ft
Slope	3–24%
Water table depth	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.

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

Influencing water features

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

Soil features

The features common to all soils in this site are the sandy textured surface soils and slopes of 0 to 24 percent. The soils in this site are excessively drained and formed in eolian sand with a surface layer that is 2 to 9 inches thick. The subsurface texture ranges from loamy fine sand to fine sand.

The major soil series associated with this site is Valentine. More information can be found in the various soil survey reports. Contact the local USDA Service Center for soil survey reports that include more detail specific to your

location.



Figure 9. Valentine series profile

Table 4. Representative soil features

Parent material	(1) Eolian sands
Surface texture	(1) Fine sand (2) Loamy fine sand (3) Loamy sand
Family particle size	(1) Sandy
Drainage class	Excessively drained
Permeability class	Rapid
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	2–4.2 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	5.1–7.8
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

Historically, large areas of blowing sand resulted in the active movement of the sand dunes. Evaporation from the soil surface was extremely high due to the large areas of bare ground, lack of litter, and sparse plant populations. The transpiration rate of these sparse plant populations was also high due to the harsh soil environment. Occasional wildfires, severe grazing by transient bison herds, and drought contributed to the lack of stability of the sand dunes. This lack of stability caused the dunes to fluctuate through multiple stages of plant succession over the course of time. Early perennial plants such as sandhill muhly, blowout grass, and blowout penstemon were common

due to their ability to tolerate the movement of the sand and dry conditions. As these plants began to colonize and stabilize the moving sand, other perennials such as prairie sandreed, sand bluestem, hairy grama, lemon scurfpea, and rose slowly became evident on the site. Annual native plants such as sandbur, woolly Indianwheat, annual buckwheat, and annual sunflower eventually colonized the areas between the perennials.

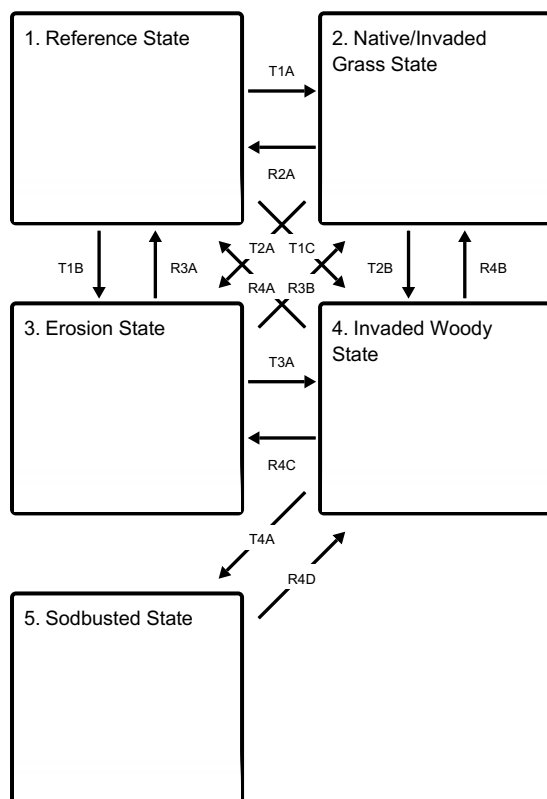
As this site deteriorates, prairie sandreed, sand dropseed, and blue grama increase and sand bluestem and switchgrass decrease. The site is extremely resilient and well adapted to the Central Great Plains climatic conditions. Species diversity fosters high tolerance to drought.

The reference plant community has been determined by study of rangeland relic areas, areas protected from excessive disturbance, seasonal use pastures, appropriately timed and controlled grazing, and historical accounts.

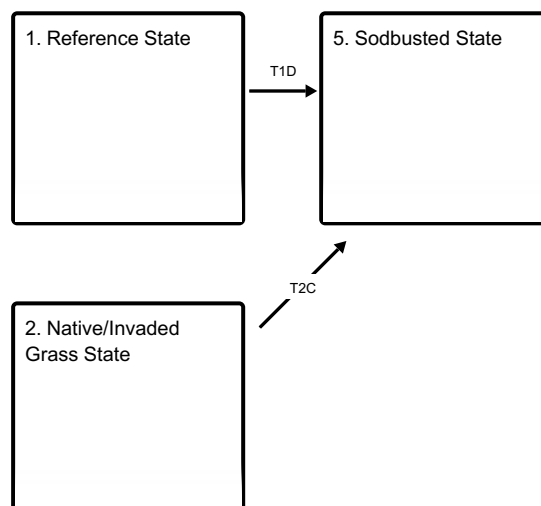
The State and Transition Model (STM) is depicted below, and includes a Reference State, a Native/Invaded Grass State, an Erosion State, an Invaded Woody State, and a Sodbusted State. Each state represents the crossing of a major ecological threshold due to the alteration of the functional dynamic properties 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. 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

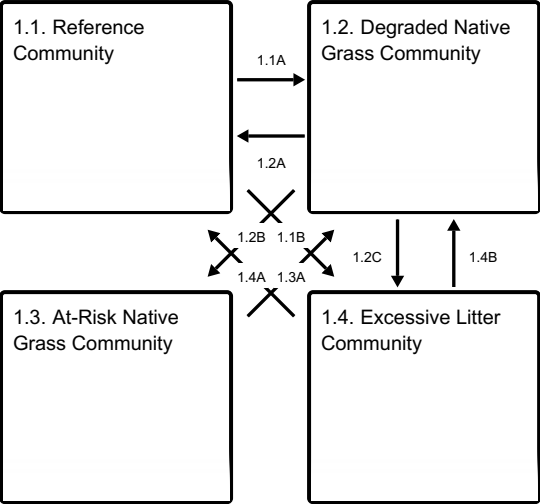
Ecosystem states



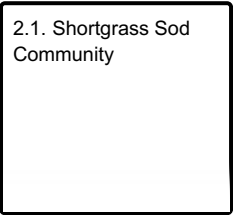
States 1, 5 and 2 (additional transitions)



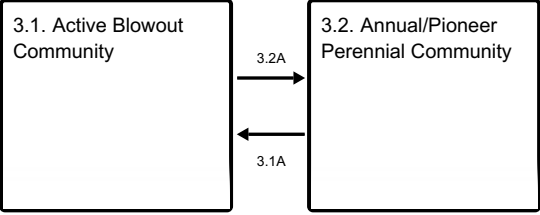
State 1 submodel, plant communities



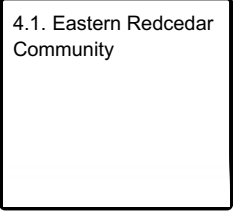
State 2 submodel, plant communities



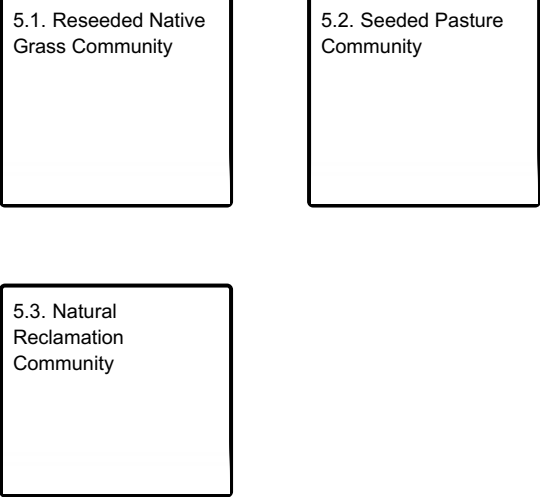
State 3 submodel, plant communities



State 4 submodel, plant communities



State 5 submodel, plant communities



State 1

Reference State

The Reference State describes the range of vegetative communities that occur on the Sandy site where the range of natural variability under historic conditions and disturbance regimes is mostly intact. The Reference State contains four community phases historically maintained by frequent fire and herbivory (grazing) with adequate recovery periods. High perennial grass cover and production facilitates increased soil moisture retention, high infiltrates rates, plant vigor, and overall soil quality.

Dominant plant species

- western sandcherry (*Prunus pumila* var. *besseyi*), shrub
- leadplant (*Amorpha canescens*), shrub
- prairie rose (*Rosa arkansana*), shrub
- Woods' rose (*Rosa woodsii*), shrub
- American plum (*Prunus americana*), shrub
- sand bluestem (*Andropogon hallii*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- prairie sandreed (*Calamovilfa longifolia*), grass
- switchgrass (*Panicum virgatum*), grass
- blue grama (*Bouteloua gracilis*), grass
- Cuman ragweed (*Ambrosia psilostachya*), other herbaceous
- field sagewort (*Artemisia campestris*), other herbaceous
- fourpoint evening primrose (*Oenothera rhombipetala*), other herbaceous
- dotted blazing star (*Liatris punctata*), other herbaceous
- scaly blazing star (*Liatris squarrosa*), other herbaceous
- white heath aster (*Symphyotrichum ericoides*), other herbaceous
- stiff goldenrod (*Oligoneuron rigidum*), other herbaceous
- Missouri goldenrod (*Solidago missouriensis*), other herbaceous

Community 1.1

Reference Community

The Reference Community serves as a description of the native plant community that naturally occurs on the site when the natural disturbance regimes are intact, or closely mimicked by management practices. Interpretations are primarily based on the Reference Community. This site evolved with grazing by large herbivores and is well suited for grazing by domestic livestock. This plant community can be found on areas that are managed with prescribed grazing and prescribed burning. The Reference Community consists chiefly of warm-season tall- and midgrasses. Principle dominants are sand bluestem, prairie sandreed, and little bluestem. Grasses of secondary importance are Indiangrass, needlegrasses, switchgrass, sand lovegrass, and hairy or blue grama. Sedges occur in the understory. Forbs and shrubs such as scaly and dotted blazing star, fourpoint evening primrose, heath aster, leadplant, rose, and western sandcherry are significant. This plant community is about 85 percent grasses, 10 percent forbs, and 5 percent shrubs by weight. This plant community is extremely resilient and well adapted to the Central Great Plains climatic conditions. The diversity in plant species allows for high drought tolerance. Moderate or high available water capacity provides a favorable soil-water-plant relationship. This is a sustainable plant community in terms of site and soil stability, hydrologic function, and biologic integrity. Rills and gullies should not typically be present. Water flow patterns should be barely distinguishable if at all present. Pedestals are only slightly present in association with bunchgrasses such as little bluestem. Litter typically falls in place, and signs of movement are not common. Natural plant mortality is low. Chemical and physical crusts are rare to non-existent. Overall, this site has the appearance of being very stable and productive.

Dominant plant species

- leadplant (*Amorpha canescens*), shrub
- western sandcherry (*Prunus pumila* var. *besseyi*), shrub
- prairie rose (*Rosa arkansana*), shrub
- Woods' rose (*Rosa woodsii*), shrub
- sand bluestem (*Andropogon hallii*), grass
- prairie sandreed (*Calamovilfa longifolia*), grass

- little bluestem (*Schizachyrium scoparium*), grass
- switchgrass (*Panicum virgatum*), grass
- Indiangrass (*Sorghastrum nutans*), grass
- dotted blazing star (*Liatris punctata*), other herbaceous
- scaly blazing star (*Liatris squarrosa* var. *glabrata*), other herbaceous
- white heath aster (*Symphyotrichum ericoides*), other herbaceous
- fourpoint evening primrose (*Oenothera rhombipetala*), other herbaceous

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2045	2417	2760
Forb	130	203	300
Shrub/Vine	25	80	140
Total	2200	2700	3200

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 Plants developed under grazing by domestic livestock. Plants resistant to grazing are maintaining themselves in this plant community. Most of the palatable plants from the Reference Community are present but occur in lesser amounts. Warm-season tall- and midgrasses still comprise a significant component of this plant community. Dominant grasses include little bluestem, switchgrass, and prairie sandreed. Grasses of secondary importance include sand bluestem, blue or hairy grama, and Scribner's rosettegrass. Forbs commonly found in this plant community include scaly and dotted blazingstar, fourpoint evening primrose, white heath aster, and goldenrod. Indiangrass, sand bluestem, and perennial forbs are present in lesser amounts as compared to the Reference Community. This plant community has higher overall production of shrubs as compared to the Reference Community. Excessive removal of forage will cause shrubs to increase further. Strong healthy root systems allow production on this plant community to increase with favorable precipitation. The ecological dynamics of this community contribute to optimum soil health, and drought resistance. These warm-season grasses cure well for winter forage stockpiling. This plant community has slightly less litter than the Reference Community. Though resistant to change, its resiliency depends on the type of management system implemented, and the intensity and duration of the disturbance.

Dominant plant species

- prairie sandreed (*Calamovilfa longifolia*), grass
- switchgrass (*Panicum virgatum*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- dotted blazing star (*Liatris punctata*), other herbaceous
- scaly blazing star (*Liatris squarrosa*), other herbaceous
- white heath aster (*Symphyotrichum ericoides*), other herbaceous
- Missouri goldenrod (*Solidago missouriensis*), other herbaceous
- stiff goldenrod (*Oligoneuron rigidum*), other herbaceous
- fourpoint evening primrose (*Oenothera rhombipetala*), other herbaceous

Figure 12. 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 1.3

At-Risk Native Grass Community

This plant community occurs under historic heavy grazing with continued seasonal grazing starting early in the growing season. It is a mix of warm-season and cool-season grasses, with an increase of forbs and shrubs. The percent ground cover and plant density increases from the Degraded Native Grass Community due to considerable encroachment by the sod-forming shortgrasses. The potential vegetation is about 60 percent grasses or grass-like plants, 25 percent forbs, and 15 percent shrubs. The dominant grasses include prairie sandreed, Kentucky bluegrass, blue grama, and sand dropseed. Other grasses present include little bluestem, switchgrass, and Scribner's rosettegrass. Major forbs include Cuman ragweed, with lesser amounts of field sagewort (green sagewort), fourpoint evening primrose, and dotted and scaly blazingstar. The dominant shrub is rose. There can be an increase in shrubs, especially western snowberry and American plum. There is a significant increase in cool-season plants such as Cuman ragweed and Kentucky bluegrass. With the exception of an increase in prairie sandreed, a decrease can occur in the warm-season mid- and tallgrasses such as sand bluestem, switchgrass, little bluestem. The soil surface has remained intact. Compared to the Reference Community, the total annual production is reduced by 25 to 35 percent, and plant diversity and amount of litter is lower. The community is considered stable but is at risk if a major shift in climatic conditions or overgrazing occurs. Resiliency is moderate depending on the intensity and duration of disturbance. Infiltration and runoff are not greatly affected because of the sandy nature of the soil.

Dominant plant species

- western snowberry (*Symphoricarpos occidentalis*), shrub
- American plum (*Prunus americana*), shrub
- prairie sandreed (*Calamovilfa longifolia*), grass
- blue grama (*Bouteloua gracilis*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass
- Cuman ragweed (*Ambrosia psilostachya*), other herbaceous
- field sagewort (*Artemisia campestris*), other herbaceous
- dotted blazing star (*Liatris punctata*), other herbaceous
- scaly blazing star (*Liatris squarrosa*), other herbaceous
- fourpoint evening primrose (*Oenothera rhombipetala*), other herbaceous

Figure 13. Plant community growth curve (percent production by month).
NE7136, Central NE Loess Hills, cool season/warm season co-dominant.
Cool-season grass and warm-season grass co-dominant.

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

Community 1.4

Excessive Litter Community

This plant community occurs after an extended period of lack of disturbance. Livestock grazing and fire have been eliminated. Litter amount has clearly increased and few or no sedges or shortgrasses are present. Much of the plant basal cover has been replaced by litter. Bunch grass plants tend to colonize by individual species and are very mature. These decadent plants tend to have dead centers, very few tillers for vegetative reproduction, and pedestalling. The potential vegetation is about 90 percent grasses or grass-like plants, 5 percent forbs, and 5 percent shrubs. The dominant grasses include sand bluestem, prairie sandreed, little bluestem, and needlegrasses. Other grasses present include sand dropseed, switchgrass, and prairie junegrass. The dominant forbs include Cuman ragweed and field sagewort (green sagewort) with less dominant forbs including blazingstar. The dominant shrubs are rose, leadplant, and western sandcherry. Plant diversity has decreased and native plants tend to occur in individual colonies. This plant community has a high amount of litter covering the soil between widely dispersed mature plants. This plant community will change rapidly with the return of periodic disturbance. Soil erosion is low,

and infiltration and runoff are not significantly different than the Reference Community.

Dominant plant species

- leadplant (*Amorpha canescens*), shrub
- western sandcherry (*Prunus pumila var. besseyi*), shrub
- Woods' rose (*Rosa woodsii*), shrub
- prairie rose (*Rosa arkansana*), shrub
- sand bluestem (*Andropogon hallii*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- prairie sandreed (*Calamovilfa longifolia*), grass
- needle and thread (*Hesperostipa comata*), grass
- porcupinegrass (*Hesperostipa spartea*), grass
- Cuman ragweed (*Ambrosia psilostachya*), other herbaceous
- field sagewort (*Artemisia campestris*), other herbaceous

Figure 14. 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

Pathway 1.1A

Community 1.1 to 1.2

Heavy grazing with inadequate rest periods will convert this plant community to the Degraded Native Grass Community. Continuous heavy grazing tends to accelerate this movement.

Pathway 1.1B

Community 1.1 to 1.4

Lack of disturbance causes Reference Community to shift to the Excessive Litter Community.

Pathway 1.2A

Community 1.2 to 1.1

Prescribed grazing can convert the plant community to the Reference Community.

Pathway 1.2B

Community 1.2 to 1.3

Heavy grazing with inadequate rest periods can convert this plant community to the At-Risk Native Grass Community. Continuous heavy grazing tends to accelerate this movement.

Pathway 1.2C

Community 1.2 to 1.4

Lack of disturbance can convert this plant community to the Excessive Litter Community.

Pathway 1.3A

Community 1.3 to 1.2

Prescribed grazing can convert the plant community to the Degraded Native Grass Community.

Pathway 1.4A

Community 1.4 to 1.1

Reintroduction of the natural processes of herbivory and fire will allow the vegetation to return to the previous community.

Pathway 1.4B
Community 1.4 to 1.2

Reintroduction of the natural processes of herbivory and fire will allow the vegetation to return to the previous community.

State 2
Native/Invaded Grass State

This state consists of the Shortgrass Sod Community which has deteriorated from the Reference State and consists of warm-season shortgrasses, sedges, and cool-season grasses. It may be invaded by introduced species such as smooth brome and Kentucky bluegrass. The loss of native warm-season functional groups, and increased bare soil will reduce forage productivity, soil moisture retention, organic matter, and plant vigor.

Dominant plant species

- rose (*Rosa*), shrub
- brittle pricklypear (*Opuntia fragilis*), shrub
- blue grama (*Bouteloua gracilis*), grass
- hairy grama (*Bouteloua hirsuta*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass

Community 2.1
Shortgrass Sod Community

This plant community occurs under heavy grazing and inadequate recovery periods. This may occur where too little time is allowed before areas are re-grazed, or in large pastures where animals graze individual plants repeatedly. It is made up of warm-season short grasses, and cool-season grasses and grass-likes. The dominant grass is blue grama. Other grasses or grass-likes include hairy grama, sedges, sand dropseed, prairie sandreed, and needle and thread. The major forbs include Cuman ragweed and annual sunflower, and the dominant shrubs are rose and cactus. Compared to the Reference Community, blue grama, hairy grama, sedges, ragweed, and rose have increased, while prairie sandreed, sand bluestem, and switchgrass have decreased or are absent. The plant diversity has decreased from that of the Reference Community. This plant community is resistant to change due to a lower percentage of bare ground. Under disturbance, this plant community is also highly resilient. The soil erosion is low. The water cycle is impaired because of the high density of short-rooted grasses which decreases infiltration.

Dominant plant species

- brittle pricklypear (*Opuntia fragilis*), shrub
- Woods' rose (*Rosa woodsii*), shrub
- prairie rose (*Rosa arkansana*), shrub
- blue grama (*Bouteloua gracilis*), grass
- hairy grama (*Bouteloua hirsuta*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass
- needle and thread (*Hesperostipa comata*), grass
- Cuman ragweed (*Ambrosia psilostachya*), other herbaceous
- common sunflower (*Helianthus annuus*), other herbaceous

Figure 15. Plant community growth curve (percent production by month). NE7138, Central NE Loess Hills, warm-season dominant. Warm-season grass dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	15	20	30	15	5	5	0	0

State 3

Erosion State

This state includes two community phases that have very little plant cover, few native warm- or cool-season grasses and few perennial forbs. The vegetation that is present consists of pioneer species. The majority of the plants are annual forbs with a lesser amount of short-lived perennial species. Erosion has occurred and may still be occurring. There is very little plant cover, little forage production, and poor soil quality.

Dominant plant species

- blowout grass (*Redfieldia flexuosa*), grass
- sandhill muhly (*Muhlenbergia pungens*), grass
- sand bluestem (*Andropogon hallii*), grass
- lemon scurfpea (*Psoralidium lanceolatum*), other herbaceous
- common sunflower (*Helianthus annuus*), other herbaceous

Community 3.1

Active Blowout Community

This plant community can be reached from any other plant community with significant disturbances such as heavy grazing. Large areas of blowing sand result in movement and possible enlargement of the blowout. Evaporation and transpiration of existing plants are extremely high due to bare ground, lack of litter, and few plants. Sandhill muhly and blowout grass are present due to their drought tolerance.

Dominant plant species

- blowout grass (*Redfieldia flexuosa*), grass
- sandhill muhly (*Muhlenbergia pungens*), grass
- lemon scurfpea (*Psoralidium lanceolatum*), other herbaceous

Community 3.2

Annual/Pioneer Perennial Community

As time elapses, sandhill muhly, blowout grass, and sand bluestem begin to colonize. Sandbur, lemon scurfpea, and annual sunflower begin to come in with prairie sandreed, hairy grama, and rose slowly becoming evident on this plant community.

Dominant plant species

- brittle pricklypear (*Opuntia fragilis*), shrub
- blowout grass (*Redfieldia flexuosa*), grass
- sandhill muhly (*Muhlenbergia pungens*), grass
- mat sandbur (*Cenchrus longispinus*), grass
- sand bluestem (*Andropogon hallii*), grass
- lemon scurfpea (*Psoralidium lanceolatum*), other herbaceous
- common sunflower (*Helianthus annuus*), other herbaceous

Pathway 3.2A

Community 3.1 to 3.2

With prescribed grazing, this plant community may move to the Annual/Pioneer Perennial Community.

Pathway 3.1A

Community 3.2 to 3.1

Heavy grazing or overgrazing will eventually shift Annual/Pioneer Perennials to the Active Blowout Community.

State 4

Invaded Woody State

This state includes one plant community that has been invaded by eastern redcedar. The woody species are present due to lack of prescribed fire and brush management. The sites typically have a loss of native warm-season grasses, reduced forage production, and reduced soil quality.

Dominant plant species

- eastern redcedar (*Juniperus virginiana*), tree
- Kentucky bluegrass (*Poa pratensis*), grass
- blue grama (*Bouteloua gracilis*), grass
- prairie sandreed (*Calamovilfa longifolia*), grass

Community 4.1

Eastern Redcedar Community

This plant community can develop whenever eastern redcedar is adjacent to the originating plant community, and encroachment occurs. This can occur in areas adjacent to a seed source, such as near windbreaks or adjacent to ponderosa pine woodlands. With prescribed burning, encroachment can be controlled. This plant community has a canopy cover of 15 percent or more mature trees. Total tree canopy cover can exceed 40 percent. The herbaceous component decreases proportionately in relation to the increase in canopy cover. This plant community is resistant to change. In higher canopy cover situations, the soil erosion will increase. The water cycle is also significantly altered under higher canopy cover. Infiltration is reduced because of interception of rainfall by the canopy. Runoff is not greatly increased, as the soil is still capable of absorbing the rainfall that reaches the soil surface.

Dominant plant species

- eastern redcedar (*Juniperus virginiana*), tree
- Kentucky bluegrass (*Poa pratensis*), grass
- prairie sandreed (*Calamovilfa longifolia*), grass
- blue grama (*Bouteloua gracilis*), grass

State 5

Sodbusted State

This threshold is crossed as a result of heavy sod disturbance, usually mechanical disturbance to facilitate production agriculture. If farming operations are suspended, the site can either be abandoned which will result in the Natural Reclamation Community or reseeded to a desired perennial forage mixture, which is described as the Reseeded Community.

Community 5.1

Reseeded Native Grass Community

The Reseeded Native Grass Community does not contain native remnants and has been seeded to a mixture of native grasses and forbs. The community 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. 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 5.2

Seeded Pasture Community

This plant 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 5.3

Natural Reclamation Community

This plant 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.

Transition T1A

State 1 to 2

Heavy grazing and improper rest periods can convert this plant state to the Native/Invaded Grass State. Continuous heavy grazing tends to accelerate this movement.

Transition T1B

State 1 to 3

Heavy grazing, prolonged drought, and soil disturbance can all cause the transition from the Reference State to Erosion State.

Transition T1C

State 1 to 4

Encroachment of eastern redcedar due to disruption of the fire regime and lack of mechanical treatment causes a transition to the Invaded Woody State.

Transition T1D

State 1 to 5

The site is significantly altered by mechanical tillage to allow the site to be placed into production agriculture. The disruption of the biotic community, soils, and hydrology of the system make restoration to the Reference State unlikely.

Restoration pathway R2A

State 2 to 1

With long-term prescribed grazing, including adequate recovery periods, this plant community will move to the Reference State. This change will require a long period of time and may be difficult to attain if the shortgrass sod is extensive.

Transition T2A

State 2 to 3

Heavy grazing and other disturbance causes transition from Native/Invaded Grass State to Erosion State.

Transition T2B

State 2 to 4

Encroachment of eastern redcedar due to disruption of the fire regime and lack of mechanical treatment causes a transition to the invaded woody state.

Transition T2C

State 2 to 5

The original state is significantly altered by mechanical tillage to allow the site to be placed into production agriculture. The disruption of the biotic community, soils, and hydrology of the system make restoration to the Native/Invaded State unlikely.

Restoration pathway R3A

State 3 to 1

Under long-term prescribed grazing (10+ years), including adequate rest periods, succession will progress leading to the Reference State. The slope, aspect, size, and relative abundance of perennial plants will influence the rate that change will occur.

Restoration pathway R3B

State 3 to 2

Under long-term prescribed grazing (10+ years), including adequate rest periods, succession will progress leading to the Native/Invaded Grass State. The slope, aspect, size, and relative abundance of perennial plants will influence the rate that change will occur.

Transition T3A

State 3 to 4

Encroachment of eastern redcedar due to disruption of the fire regime and lack of mechanical treatment causes a transition to the invaded woody state.

Restoration pathway R4A

State 4 to 1

Brush management and prescribed burning will restore the site to the Reference State.

Restoration pathway R4B

State 4 to 2

Adequate management that includes prescribed burning, brush management and prescribed grazing can restore this state to the previous state.

Restoration pathway R4C

State 4 to 3

Adequate management that includes prescribed burning, brush management and prescribed grazing can restore this state to the previous state.

Transition T4A

State 4 to 5

When woody species have encroached on land previously tilled and later removed from production agriculture, brush management and prescribed grazing will return the Invaded Woody State to the Sod-Busted State.

Restoration pathway R4D State 5 to 4

Adequate management that includes prescribed burning, brush management and prescribed grazing can restore this state to the previous state.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	Warm-Season Tallgrass			945–1350	
	sand bluestem	ANHA	<i>Andropogon hallii</i>	540–945	20–35
	prairie sandreed	CALO	<i>Calamovilfa longifolia</i>	540–810	20–30
	switchgrass	PAV12	<i>Panicum virgatum</i>	270–540	10–20
	Indiangrass	SONU2	<i>Sorghastrum nutans</i>	135–270	5–10
3	Warm-Season Midgrass			540–810	
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	405–675	15–25
	sand lovegrass	ERTR3	<i>Eragrostis trichodes</i>	135–270	5–10
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	0–135	0–5
4	Native Cool-Season Grass			270–540	
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	135–270	5–10
	porcupinegrass	HESP11	<i>Hesperostipa spartea</i>	135–270	5–10
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	27–81	1–3
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	27–81	1–3
	Scribner's rosette grass	DIOLS	<i>Dichanthelium oligosanthos var. scribnerianum</i>	27–81	1–3
2	Warm-Season Shortgrass			135–270	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	27–135	1–5
	hairy grama	BOHI2	<i>Bouteloua hirsuta</i>	0–135	0–5
	sandhill muhly	MUPU2	<i>Muhlenbergia pungens</i>	0–81	0–3
5	Grass-like			27–81	
	sedge	CAREX	<i>Carex</i>	27–81	1–3
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–27	–
Forb					
6	Forbs			135–270	
	Forb, perennial	2FP	<i>Forb, perennial</i>	27–54	1–2
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	0–54	0–2
	white heath aster	SYER	<i>Symphyotrichum ericoides</i>	0–54	0–2
	prairie spiderwort	TROC	<i>Tradescantia occidentalis</i>	0–54	0–2
	purple prairie clover	DAPU5	<i>Dalea purpurea</i>	0–54	0–2
	scarlet beeblossom	GACO5	<i>Gaura coccinea</i>	0–54	0–2

	hairy false goldenaster	HEVI4	<i>Heterotheca villosa</i>	0–54	0–2
	dotted blazing star	LIPU	<i>Liatris punctata</i>	0–54	0–2
	rush skeletonplant	LYJU	<i>Lygodesmia juncea</i>	0–54	0–2
	fourpoint evening primrose	OERH	<i>Oenothera rhombipetala</i>	0–54	0–2
	silverleaf Indian breadroot	PEAR6	<i>Pedimelum argophyllum</i>	0–54	0–2
	beardtongue	PENST	<i>Penstemon</i>	0–54	0–2
	slimflower scurfpea	PSTE5	<i>Psoralidium tenuiflorum</i>	0–54	0–2
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0–54	0–2
	Riddell's ragwort	SERI2	<i>Senecio riddellii</i>	0–27	0–1
	stiff goldenrod	OLRI	<i>Oligoneuron rigidum</i>	0–27	0–1
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	0–27	0–1
	yellow sundrops	CASE12	<i>Calylophus serrulatus</i>	0–27	0–1
	Missouri goldenrod	SOMI2	<i>Solidago missouriensis</i>	0–27	0–1
Shrub/Vine					
7	Shrubs			27–135	
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	27–81	1–3
	leadplant	AMCA6	<i>Amorpha canescens</i>	0–81	0–3
	pricklypear	OPUNT	<i>Opuntia</i>	0–54	0–2
	western sandcherry	PRPUB	<i>Prunus pumila var. besseyi</i>	0–27	0–1
	rose	ROSA5	<i>Rosa</i>	0–27	0–1

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 yearlong forage. During the dormant period, the forage for livestock will likely be lacking protein to meet livestock requirements and added protein will allow 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.

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 and provide 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. Normal rainfall is 18 to 25 inches per year. Valentine soils on this site are in Hydrologic Soil Group A (low runoff and high infiltration even when thoroughly wetted). Water transmission through Group A soils is normally greater than 0.30 inches per hour. Runoff is expected to occur only during the most intense storms (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

Recreational uses

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

Wood products

No appreciable wood products are present on the site.

Other products

Seed harvest of native plant species can provide additional income on this site.

Inventory data references

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range-trained personnel were also used. Those involved in developing this site include Dana Larsen, State Rangeland Management Specialist, NRCS; Chuck Markley, Resource Soil Scientist, NRCS., Neil Dominy, Resource Soil Scientist, NRCS.

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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.

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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.

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2. **Presence of water flow patterns:** Typically, none. Water flow patterns may occur on slopes exceeding 10 percent. Where they do occur, they are rare (less than 2 per 100 ft² or 9.3 m²), narrow (less than 6 inches wide), short (less than 1 foot or 0.3 m long), and disconnected, disrupted by perennial vegetation.
-
3. **Number and height of erosional pedestals or terracettes:** Bunch grasses may be slightly pedestalled (less than 0.5 inch or 1.3 cm) with no exposed roots; occurrence of pedestalled plants will average less than one per square meter. This typically will occur on south and west aspects where slopes exceed 10 percent. Drought or wildfire can contribute to increased incidences of 1 to 3 pedestalled plants per square meter.
-
4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground ranges from 5 to 10 percent. Bare ground should be small (less than 6 inches or 15 cm in diameter), are not connected, unless associated with disturbances such as those from burrowing animals. Multi-year drought may increase the amount of bare ground to 15 to 20 percent and bare ground may be increased by 10 percent during the two years following wildfire. 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).
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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:** Typically, none. Occasional areas associated with concentrated animal activity (livestock trailing and burrowing animals) may exhibit small wind scoured areas with accompanying deposition. These areas are typically less than 10 feet (3 meters) across and comprise less than 1 percent of the site.
-
7. **Amount of litter movement (describe size and distance expected to travel):** None. Litter movement is not expected on this site.
-
8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** This site has low organic matter in the surface horizon and the structure is single grain sand. Soil stability will be difficult to measure on these soils. Soil stability ratings of 2 to 3 are expected. Surface erosion by water rarely occurs due to rapid infiltration, but the surface is susceptible to wind erosion when vegetative cover is reduced due to multi-year drought, wildfire, or multi-year heavy grazing.
-
9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** The surface layer is 2 to 9 inches (5 to 23 cm) thick. Soils are predominantly loamy fine sand, fine sand, and sand. The surface layer is dark brown when moist (10 YR 3/3). Color of A1-horizon (0 to 4 cm) is light brownish gray (10 YR 6/2) and dark brown (10 YR 3/3) when moist. The soil structure is weak coarse granular. Organic matter is 0.5 to 1 percent.
-
10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Plant community composition of 75 to 85 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, mid-grasses (20-30%), native, perennial, warm-season, tall, rhizomatous grasses (35-50%), native, perennial, cool-season grasses (5-10%), native, perennial, warm-season, short grasses (5-10%), and grass-likes (1-5%).

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

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** 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, 945-1350 #/ac- 35-50%, (4 species min.): sand bluestem, Indiangrass, switchgrass, prairie sandreed.

Phase 1.2

1. Native, perennial, warm-season, midgrass (2 species min.): little bluestem, sand dropseed, sand lovegrass.

2. Native, perennial, cool-season grass: (3 species minimum): western wheatgrass, needle and thread, porcupinegrass, prairie Junegrass, Scribner's rosettegrass.

Phase 1.3

1. Native, perennial, cool-season grass: (3 species minimum): western wheatgrass, needle and thread, porcupinegrass, prairie Junegrass, Scribner's rosettegrass.

2. Native, perennial, warm-season shortgrass (2 species minimum): blue grama, hairy grama, sandhill muhly.

Sub-dominant: Phase 1.1

1. Native, perennial, warm-season, midgrass, 540-810 #/ac- 20-30%, (2 species min.): little bluestem, sand dropseed, sand lovegrass.

2. Native, perennial, cool-season grass, 270-540 #/ac, 10-20% (5 species minimum): western wheatgrass, needle and thread, porcupinegrass, prairie Junegrass, Scribner's rosettegrass.

Phase 1.2

1. Native, perennial, warm-season, tallgrass (2 species min.): sand bluestem, Indiangrass, switchgrass, prairie sandreed.

2. Native, perennial, warm-season shortgrass (2 species minimum): blue grama, hairy grama, sandhill muhly.

Phase 1.3

1. Native, perennial, warm-season midgrass (2 species min.): little bluestem, sand dropseed, sand lovegrass.

2. Native, perennial, warm-season tallgrass (1 species min.): sand bluestem, switchgrass, prairie sandreed.

Other: Minor - Phase 1.1

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

2. Native, perennial, warm-season shortgrass, 135-270 #/ac, 5-10%: blue grama, hairy grama, sandhill muhly.

3. Shrub, 27-135 #/ac, 1-5%: leadplant, pricklypear, western sandcherry, rose.

4. Grass-like, 27-81 #/ac, 1-3%: sedges.

Minor - Phase 1.2

1. Forb (perennial and annual): species present will vary from location to location.

2. Shrub: leadplant, pricklypear, western sandcherry, rose.

3. Grass-like: sedges.

Minor - Phase 1.3

1. Shrub: leadplant, pricklypear, western sandcherry, rose.

2. Forb (perennial and annual): species present will vary from location to location;.

3. Grass-like: sedges.

4. Non-native grasses.

Additional: The Reference Community (1.1) includes seven F/S Groups. These groups in order of 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; shrub; and grass-like.

The Degraded Native Grass Community (1.2) also includes seven F/S Groups. These groups are in order of abundance are native, perennial, warm-season midgrasses; native, perennial cool-season grasses; native, perennial, warm-season tallgrasses; native, perennial, warm-season shortgrasses; and grass-likes.

The At-Risk Native Grass Community includes 8 F/S groups. These groups in order of abundance are native, perennial, cool-season grass; native, perennial, warm-season shortgrass; native, perennial, warm-season midgrass; native, perennial, warm-season tallgrass; shrubs; forbs; grass-likes; non-native grass.

-
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 (less than 5 percent) dead branches 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 80 to 90 percent and at a depth of 0.25 inches (0.63 cm). Kentucky bluegrass excessive litter can negatively impact the functionality of this site.
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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) = 2,700 pounds per acre. Low production years = 2,200 pounds per acre. High production years = 3,200 pounds per acre.
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16. **Potential invasive (including noxious) species (native and non-native).** List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site: No non-native invasive species are present. Kentucky bluegrass, smooth brome, eastern redcedar, honey locust, musk thistle, common mullein, and sulphur cinquefoil 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. 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.
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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.
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