

Ecological site R075XY064NE Deep Depression

Last updated: 4/17/2025

Accessed: 06/14/2025

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.

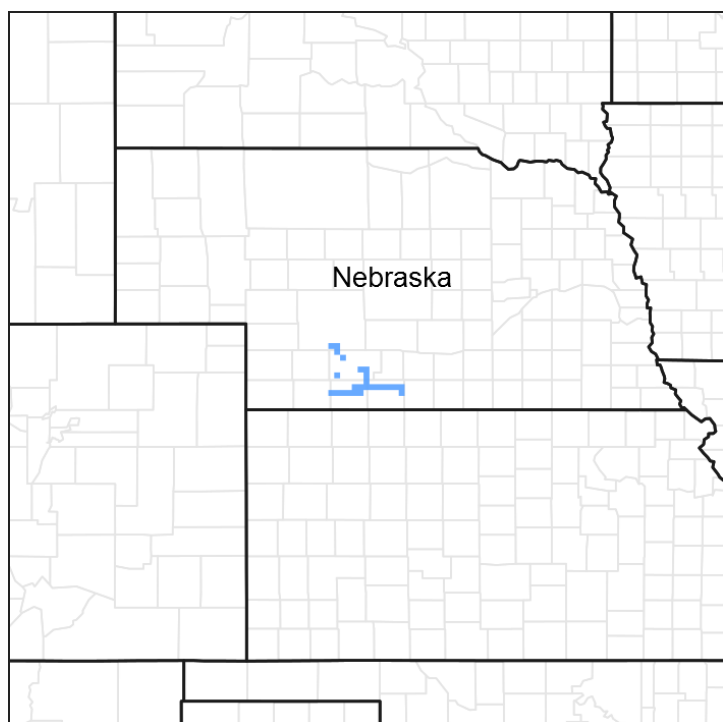


Figure 1. Mapped extent

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): 075X–Central Loess Plains

Named “The Central Loess Plains,” MLRA 75 is located primarily in south-central Nebraska, with about 10 percent lying in north-central Kansas. This approximately 5.3

million acre landscape covers all or parts of 21 counties: Gosper, Phelps, Kearney, Adams, Clay, Fillmore, York, Hall, Hamilton, Seward, Butler, Polk, Saline, Gage, Harlan, Franklin, Thayer, Nuckolls, and Webster in Nebraska, with a significant presence in Republic and Washington counties in Kansas. The northern border is defined by the Platte River. This MLRA is home to the unique ecological system called "The Rainwater Basin," which is comprised of a 24,000 acre network of wetlands and uplands that occupy portions of 13 of the northern counties and is internationally known for its significance to millions of migratory birds.

The landscape primarily consists of gently rolling plains, with a number of narrow, shallow stream valleys. The river valleys are broader, and most feature a number of terraces. The elevation in MLRA 75 ranges from nearly 2,600 feet to less than 1,100 feet above sea level. The local relief averages from 10 to 25 feet but may stretch to a maximum of 165 feet in some areas. The average annual precipitation ranges from 23 to 36 inches, and the number of freeze-free days range from 150 to 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 predominant soil orders in this geographic area are mesic, ustic Mollisols, commonly represented by the Geary, Hastings, Holder, Holdrege, Kenesaw, and Uly soil series. The matrix vegetation type is mixed-grass prairie, with big and little bluestem, switchgrass, Indiangrass, and sideoats and blue grama to make up the bulk of the warm-season species, while western wheatgrass is the dominant cool-season grass.

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

Wildlife flourishes in this combination of crop and grassland environment, with both mule and white-tailed deer being the most abundant wild ungulates. A variety of smaller species, including coyote, raccoon, opossum, porcupines, muskrat, beaver, squirrel, and mink thrive in the region, as well as several upland bird species. Grassland bird populations are somewhat limited by the lack of contiguous native prairie and fragmented habitat created by the farmland. The rivers, streams, and lakes harbor excellent fisheries, and an estimated tens of millions of migrating and local waterfowl use the wetland complexes. These complexes provide ideal habitat for a number of wading and shore bird species as well.

This landscape serves as a backdrop for a disturbance-driven ecosystem, evolving under the influences of herbivory, fire, and variable climate. Historically, these processes created a heterogeneous mosaic of plant communities and structure heights across the region. Any given site in this landscape experienced fire every 6 to 8 years. The fires were caused

by lightning strikes and also were set by native Americans, who used fire for warfare, signaling, and to refresh the native grasses. These people understood the value of fire as a tool, and that the highly palatable growth following a fire provided both excellent forage for their horses and attracted grazing game animals such as bison and elk.

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

Even as post-European settlement's alteration of the fire regime allows the expansion of the woody component of the native prairie, introduction of eastern redcedar (ERC) as a windbreak species further facilitates invasion by this species. While eastern red cedar is native to Nebraska, the historic population in MLRA 75 was limited to isolated pockets in rugged river drainages which were subsequently insulated from fire. Widespread plantings of windbreaks with eastern redcedar as a primary component have provided a seed source for the aggressive woody plant. The ensuing encroachment into the native grasslands degrades the native wildlife habit and causes significant forage loss for domestic livestock.

Since it is not a root sprouter, eastern red cedar is very susceptible to fire when under six feet tall. Management with prescribed fire is exceedingly effective if applied before this stage. Larger redcedars can also be controlled with fire, but successful application requires the use of specifically designed ignition and holding techniques.

Classification relationships

NRCS FOTG Section 1 - Nebraska Vegetation Zone 3.

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

Ecological site concept

The Deep Depression is an upland run-on basin on the landscape, with no outlet. This site is positioned below the Closed Upland Depression site and is home to more water tolerant vegetative communities.

Associated sites

R075XY062NE	Gravelly Hills This site is adjacent to and above the Deep Depression site. Characterized by Scott and Fillmore soils, with vegetation adapted to shorter periods of ponding.
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R075XY057NE	Clayey Plains This site occurs above the Deep Depression site and occupies a run-off position on the landscape.
R075XY058NE	Loamy Plains This site occurs above the Deep Depression site and occupies a run-off position on the landscape.

Similar sites

R075XY083NE	Saline Depression This site occupies the same landscape position as the Deep Depression site but the Saline Depression site has higher soil salinity.
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Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Typha latifolia</i>

Physiographic features

This site occurs in the bottom of playas and depressions of the uplands, and occasionally on a depression on a fan. It receives runoff from areas higher on the landscape and is ponded for periods of longer than 45 days during the growing season. It is not subject to flooding.

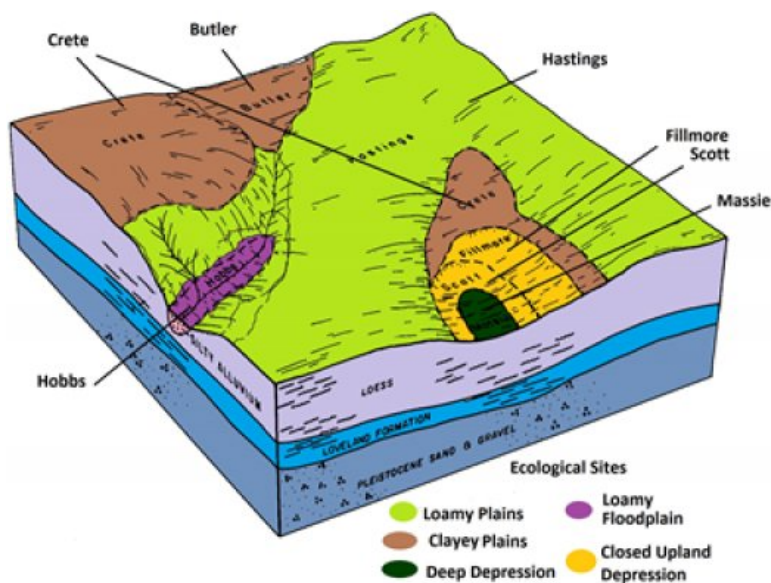


Figure 2. Block Diagram

Table 2. Representative physiographic features

Landforms	(1) Playa (2) Flood plain
Runoff class	Negligible
Flooding frequency	None
Ponding duration	Very long (more than 30 days)
Ponding frequency	Frequent
Elevation	1,130–2,770 ft
Slope	0–1%
Ponding depth	0–24 in
Water table depth	60–80 in
Aspect	Aspect is not a significant factor

Climatic features

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

Growth of native cool-season plants begin in early April and continues to about mid-June. Native warm-season plants begin growth in early June and continue to early August. Green up of cool-season plants may occur in September and October.

Table 3. Representative climatic features

Frost-free period (average)	155 days
Freeze-free period (average)	177 days
Precipitation total (average)	30 in

Climate stations used

- (1) YORK [USC00259510], York, NE
- (2) BELLEVILLE [USC00140682], Belleville, KS
- (3) AURORA [USC00250445], Aurora, NE
- (4) FRIEND 3E [USC00253065], Friend, NE
- (5) SUPERIOR 4E [USC00258320], Hardy, NE
- (6) GENEVA [USC00253175], Geneva, NE
- (7) MINDEN [USC00255565], Minden, NE
- (8) RED CLOUD [USC00257070], Red Cloud, NE
- (9) CLAY CTR [USC00251684], Saronville, NE
- (10) FAIRMONT [USC00252840], Fairmont, NE
- (11) HASTINGS 4N [USC00253660], Hastings, NE
- (12) HEBRON [USC00253735], Hebron, NE
- (13) OSCEOLA [USC00256375], Osceola, NE
- (14) RAGAN [USC00257002], Alma, NE
- (15) SURPRISE [USC00258328], Surprise, NE

Influencing water features

This site is a run-on wetland site but is independent of ground water influence.

Soil features

The soils in this site include a closed upland depression landform, very frequent ponding, low saturated hydraulic conductivity and slopes of 0 to 1 percent. The parent material is loess. The surface layer is typically silt loam or silty clay; and ranges from 2 to 17 inches thick.

Massie is the only major soils series correlated to this ecological site. 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.

Table 4. Representative soil features

Parent material	(1) Loess
Surface texture	(1) Silty clay loam (2) Loam (3) Silt loam
Family particle size	(1) Clayey
Drainage class	Very poorly drained
Permeability class	Very slow to moderately slow
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%

Available water capacity (0-40in)	5.6–8.2 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	5.6–7.8
Subsurface fragment volume <=3" (0-40in)	0%
Subsurface fragment volume >3" (0-40in)	0%

Ecological dynamics

These sites occur on depressional playas or swales on an upland position subject to ponding and evolved under a disturbance regime that included periods of sporadic but often intensive grazing by large transient herbivores, and occasional wildfires. They are often referred to as buffalo wallows. An estimated 90 percent of these sites have been lost, primarily due to draining and filling for agricultural use. The remaining 10 percent are deemed critical habitat for migrating waterfowl and shorebirds.

The length of time these areas hold water depends on the size of the drainage area; infiltration rate, type and amount of vegetative cover of surrounding soils; the frequency, intensity and total accumulation of rainfall; and the depth of the depression. Wind erosion can be a hazard if water drowns out the vegetation and then dries up leaving the soil surface bare.

This site occupies the deepest portion of the upland depressions or playas and is ponded to a minimum of 2 inches for at least 45 days during the growing season. Inundation is the driving force that controls vegetative dynamics of the site. Vegetation shifts as a result of climatic cycles. This site is rarely managed as a separate unit for livestock grazing. However, it is recognized as an important site for migratory waterfowl. In addition, many species of upland wildlife use this site as a seasonal water source.

Dominant species here include river bulrush, broadleaf cattail, narrowleaf cattail and slender bulrush. During drier periods and on mudflats, you find marsh spikerush, water knotweed, smartweeds, water hyssop, mud-plantains, common water plantain and shortbeak arrowhead. In the absence of a disturbance regime, the cattails and bulrushes become completely dominant, and create a homogenous vegetative community that has little wildlife value.

Deep Depressions almost always occur in conjunction with the Closed Upland Depressions site and the two sites are usually managed as one unit. Land managers have begun to introduce the natural processes of grazing and fire when and where possible to create open areas that allow seed bearing annuals to establish. These plants provide a critical food source for the millions of migratory birds that pass through the area annually. To facilitate reclamation of the more invaded sites, many managers have also begun using the more intensive practices of shredding, light disking and applying herbicides.

At one time, the larger playas on this site may have been a significant source of water for the transient herbivores and early Americans who followed these herds, as evidenced by the flint tools found on nearby higher landscapes.

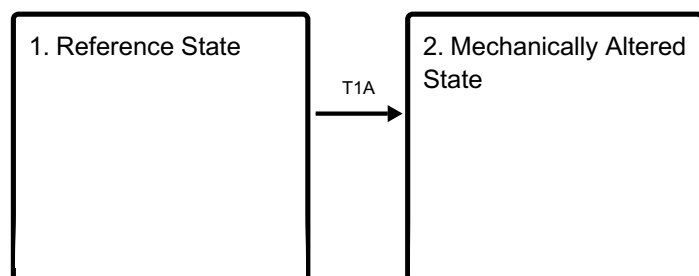
Growth of native cool-season plants begins about April 1 and continues to about June 15. Native warm-season plants begin growth about May 15 and continue to about August 15. Green up of cool-season plants may occur in September and October if adequate moisture is available.

Due to the small patch distribution of this site, and the degree of disturbance in the landscape, it has been difficult to locate examples and reliable descriptions of examples of the pre-European reference plant community. The reference community description has been determined by study of the best remaining examples of relic areas, areas protected from excessive disturbance, and expert opinions and historical accounts.

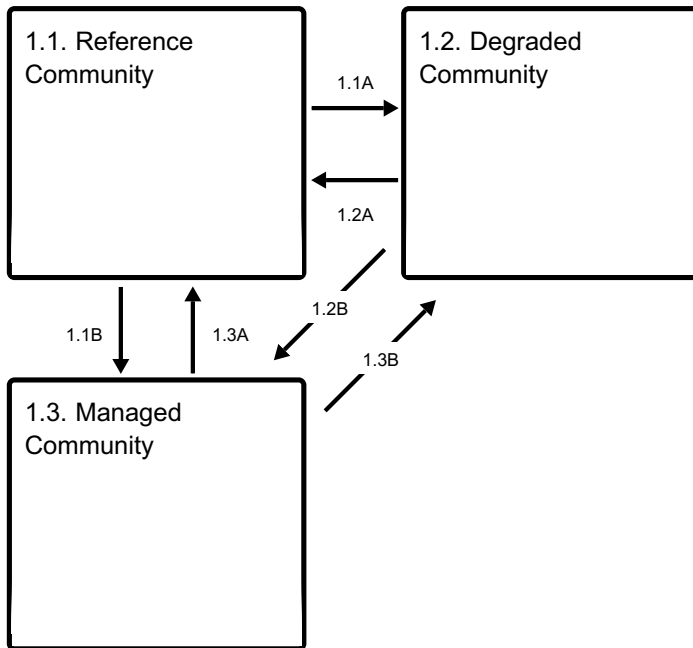
The following diagram illustrates the states and the plant communities within the states that can occur on the site. The transitions between the states, and between the communities are represented by the arrows. The processes that cause the fluctuation between the states and communities are discussed in more detail in the plant community descriptions following the diagram.

State and transition model

Ecosystem states



State 1 submodel, plant communities



State 1 Reference State

The Reference State is a dynamic state that encompasses the reference community, and the phases it may undergo in response to alterations in the environment. It serves as the base state for the subsequent states depicted in the model. In the absence of the historical primary intensive grazing bison and elk herds, and the disruption of the fire regime, land managers have intentionally engaged in practices to create and maintain a more disturbed phase within the reference state to achieve wildlife management goals. The Reference State of the Deep Depression site harbors the Shallow Cattail Marsh Phase as the Reference Phase, the Degraded Phase, and the Managed Phase. More severe disturbances, such as plowing, ditching or excavating can negatively impact the hydrological, soil and vegetative components of the system to the degree that they cross a threshold to a more degraded state.

Dominant plant species

- river bulrush (*Bolboschoenus fluviatilis*), other herbaceous
- broadleaf cattail (*Typha latifolia*), other herbaceous
- narrowleaf cattail (*Typha angustifolia*), other herbaceous
- slender bulrush (*Schoenoplectus heterochaetus*), other herbaceous

Community 1.1 Reference Community

The Reference Community is also known as a saturated soil community. Dominant species in the Reference Community are river bulrush, broadleaf cattail, narrowleaf cattail and slender bulrush. During drier periods species present include marsh spikerush, water knotweed, smartweeds, water hyssop, mud-plantains, common water plantain and

shortbeak arrowhead. Runoff as evidenced by patterns of rill, gully or other water flow is negligible due to the low slope gradient. Pedestalling of plants does not typically occur on this site, however mucking by excessive hoof traffic can create an effect which appears exaggerated, but similar to pedestalling.

Dominant plant species

- river bulrush (*Bolboschoenus fluviatilis*), other herbaceous
- broadleaf cattail (*Typha latifolia*), other herbaceous
- narrowleaf cattail (*Typha angustifolia*), other herbaceous
- slender bulrush (*Schoenoplectus heterochaetus*), other herbaceous

Community 1.2

Degraded Community

In the absence of the historical disturbance regimes, cattails and bulrushes dominate the community to the near exclusion of other species. Reed canarygrass will invade this phase during drier periods

Dominant plant species

- river bulrush (*Bolboschoenus fluviatilis*), other herbaceous
- narrowleaf cattail (*Typha angustifolia*), other herbaceous
- broadleaf cattail (*Typha latifolia*), other herbaceous
- slender bulrush (*Schoenoplectus heterochaetus*), other herbaceous

Community 1.3

Managed Community

Deep Depression sites are almost always managed in conjunction with Closed Upland Depressions. This vegetative community consists of a heterogenous mosaic of cattails, bulrushes, and numerous seed producing annual grasses and forbs.

Pathway 1.1A

Community 1.1 to 1.2

Lack of disturbance allows the Cattails and Bulrushes to dominate other species to the point of total exclusion. During drier periods, Reed Canarygrass invades.

Pathway 1.1B

Community 1.1 to 1.3

As a heterogenous mix of annual forbs provides better wildlife habitat for the waterfowl and shorebirds, wildlife managers are currently focusing efforts on creating and maintaining the Managed Community through introduction of disturbance. Appropriately timed intensive grazing, fire, shredding, disking and spraying are the primary management

practices currently implemented.

Pathway 1.2A

Community 1.2 to 1.1

If applied early enough in the degradation process, appropriately timed intensive livestock grazing and burning will facilitate return to the Reference Community.

Pathway 1.2B

Community 1.2 to 1.3

As a heterogenous mix of annual forbs provides better wildlife habitat for the waterfowl and shorebirds, wildlife managers are currently focusing efforts on creating and maintaining the Managed Community of these sites by introduction of disturbance. Appropriately timed intensive grazing, fire, shredding, disking and spraying are the primary management practices currently implemented.

Pathway 1.3A

Community 1.3 to 1.1

Lack of aggressive disturbance regimes, i.e., grazing and fire, will shift this community back to the previous community.

Pathway 1.3B

Community 1.3 to 1.2

Lack of aggressive disturbance regimes, i.e., grazing and fire, will shift this community back to the previous community.

State 2

Mechanically Altered State

This site has often been mechanically altered to either drain it to allow the land to be placed into production agriculture or excavated to increase the water holding capacity of the basin as a re-use pit. These actions disrupt the ecological balance of the site to a degree that forces the site across the state threshold to the mechanically altered state. The magnitude of disruption of the soil processes and the hydrological cycle make it unlikely that return to the reference state is possible.

Transition T1A

State 1 to 2

Mechanical alteration to either drain the site to allow the land to be placed into production agriculture or excavated to increase the water holding capacity of the basin as a re-use

pit.

Additional community tables

Animal community

GRAZING INTERPRETATIONS:

Historically these sites have not been utilized with any frequency due to the periods of long inundation, and livestock health issues related to grazing wet landscapes, i.e., foot rot and others. Recently, land managers have been using livestock grazing as a management tool to maintain a disturbance oriented vegetative community that provides better wildlife habitat for migratory birds. To effectively alter the existing vegetation, managers typically stock at 2 to 4 head per acre. The quantity of forage available is extremely variable, and more research needs to be completed before assigning final production values and stocking rates to these systems.

WILDLIFE INTERPRETATIONS:

Periodic events such as prolonged drought, wildfire, disease, or high insect numbers may alter plant community diversity and structure and associated wildlife species. During drier cycles, the Deep Depressions provide a water source for a number of wildlife species. Small mammal species thrive under these conditions, making these sites favorite hunting areas for predators including coyotes, short-eared owls, red-tailed hawks, and northern harriers. White-tailed and mule deer will both use these depressions for water when present, and as a food source, mainly utilizing the wide diversity of forbs.

These sites are also of critical importance to many species of water birds, especially when their inundated periods coincide with spring and fall migrations. Shorebirds take advantage of the abundant invertebrates such as fairy shrimp whose eggs can remain viable in the soil for up to 15 years until a rainfall event. Ducks, geese and cranes use these sites as roosting and feeding areas, taking advantage of a high energy food source supplied by seeds from wetland plants such as annual smartweed. Waterfowl will often winter on these sites until they freeze. Ring-necked pheasants may use the depressions for nesting, brood-rearing and roosting if adequate cover and forbs are present. In conjunction with Closed Upland Depressions, Deep Depressions also provide important breeding habitat for many species of amphibians during periods of inundation in the spring.

Hydrological functions

This ecological site occupies the lower levels of the deeper depressions or swales found on the nearly level uplands. Permeability is slow due to a compact clay layer. Most of the area around these depressions has been farmed because of the productivity of the adjacent soils and, as a result, are subject to sedimentation which can alter their hydrology. Pits are often dug in these sites in an attempt to enhance their water ponding capacity. This practice can be detrimental to the proper functioning of these systems, altering the hydrology to the extent that the beneficial plant community structure and

diversity is greatly diminished.

These sites are found in areas susceptible to drought and as a result offer an unpredictable yet highly important source of water for wildlife, especially waterfowl. The amount of water and length of inundation will also depend on the drainage area, the frequency of rainfall, and the depth of the depression.

Recreational uses

Because of the diversity of the flora and fauna associated with these sites, they are popular for hunting, bird watching, plant collecting, and a variety of other outdoor activities.

The site exhibits some visual contrast and present a panoramic view of the wide-open spaces cherished by many in the Great Plains states.

Wood products

This site is not an important wood producing site.

Other products

No other products are produced in quantity

Other information

Annual reviews of the Project Plan are to be conducted by the Ecological Site Technical Team. The project plan is ES R075XY049NE- MLRA 75 -

Inventory data references

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

Other references

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Contributors

Doug Whisenhunt
Nadine Bishop

Approval

Suzanne Mayne-Kinney, 4/17/2025

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	Kristin Dickinson, Acting State Range Management Specialist, kristin.dickinson@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 is typically less than 10 percent. Bare ground patches should be small, less than 2 inches (5 cm) in diameter and scattered across the site. After prolonged ponding, bare ground may approach 35 percent with patch sizes of 12 to 18 inches (30 to 45 cm). Bare ground is exposed mineral soil that is not 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/or depositional areas are not expected on this 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):** Soil stability ratings should typically be 5 to 6, normally 6. There is typically a high root content and organic matter in the soil surface

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should be a minimum of 7 inches (18 cm) thick. Soil colors range from very dark gray (10YR 3/1) to dark gray (10YR 4/1) to gray (10YR 5/1) when dry and black (10YR 2/1) to very dark gray (10YR 3/1) when moist. Soil structure is moderate medium granular in the upper A-horizon to weak coarse platy structure in lower A-horizon. A surface layer of partially decayed leaves and stems may be present. Soil is slightly hard and slightly to moderately acid. Redoximorphic features will be present. An E-horizon, which is pale due to significant leaching of mineral and/or organic content, will exist between the A- and B horizons.

See Official Soils Descriptions for additional details. The major soil series correlated to this site include Massie.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Relative composition will vary with the level and duration of inundation on the site. The Reference Community (1.1) will be dominated by forbs (80-100%). The Degraded Community (1.2) will be dominated by cattails and bulrushes. Infiltration is more dependent upon depth to and thickness of the clay layer present on this site than the plant community composition.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction layers are expected to occur on this site. When dry, upper horizons can be hard and appear to be compacted, but no platy structure will be present. Heavy traffic (livestock or vehicular) when these soils are wet can produce a compaction layer.
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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. Forbs: (perennial and annual) –90-95% (5 species min): Arrowhead, burreed, broadleaf cattail, narrowleaf cattail, water plantain, water knotweed, smartweeds, water hyssop, mud-plantains, common water plantain, shortbeak arrowhead, and other forbs that vary from location to location.

Phase 1.2:

1. Grass-likes – 40-50% (2 species minimum: river bulrush, slender bullrush, marsh spikerush, other grass-likes; 2. Forbs: (perennial and annual) – 40-50% (2 species min): Arrowhead, burreed, broadleaf cattail, narrowleaf cattail, water plantain, water knotweed, smartweeds, water hyssop, mud plantains, common water plantain, shortbeak arrowhead, and other forbs that vary from location to location.

Phase 1.3: 1. Annual grasses and forbs - 40-50% (5 species min).

Sub-dominant: Phase 1.1: 1. Grass-likes – 10-30% (2 species minimum: river bulrush, lender bullrush, marsh spikerush, other grass-likes.

Phase 1.3: 1. Perennial Forbs: (perennial and annual) – 20-30% (2 species min): Arrowhead, broadleaf cattail, narrowleaf cattail and other forbs that vary from location to location 2.

Grass-likes – 20-30% (2 species minimum: river bulrush, slender bullrush, marsh spikerush, other grass-likes.

Other: Minor - Phase 1.1: Grasses (annuals and perennials) - 0-10%: western wheatgrass, slender wheatgrass, foxtail barley, barnyard grass, scratch grass.

Trace - Phase 1.2: 1. Grasses (annuals and perennials) - 0-10%: western wheatgrass, slender wheatgrass, foxtail barley, barnyard grass, scratch grass.

Trace - Phase 1.3: 1. Perennial, native grasses: western wheatgrass, slender wheatgrass, foxtail barley,

Additional: The primary driver which determines the plant community phase is the depth and duration of inundation on the site. The Reference Community is dominated by fobs and grass-likes. The Degraded Community is dominated by forbs and grass-likes (primarily cattails and bulrushes). The Managed Community is a mosaic of cattails, bulrushes and seed producing annual grasses and forbs.

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. Plant mortality may increase to 10 to 15 percent following an extended ponding.
14. **Average percent litter cover (%) and depth (in):** Plant litter cover is evenly distributed throughout the site. Plant litter cover ranges from 80-100 percent at a depth of 0.5 to 1 inch (1.3 to 2.5 cm).
15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Annual production varies significantly with the plant community with production ranging from 9,100 to 12,350 pounds per acres for perennial dominant plant communities and 3,000 to 3,900 pounds per acre for moist soil annual communities.
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. Reed canary grass, narrowleaf cattail and river bulrush 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:** 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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