USDA Natural Resources Conservation Service

Ecological site R075XY064NE
Deep Depression

Accessed: 05/03/2024

General information

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

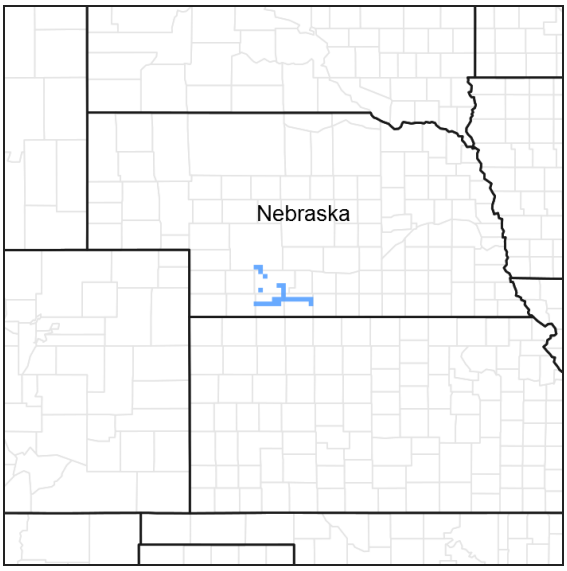


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 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. The approximately 5.3 million acre landscape covers all or parts of 21 counties: mainly Phelps, Kearney, Adams, Clay, Fillmore, York, Hamilton, Seward, Butler, Saline, Thayer, Nuckolls, and Webster in Nebraska, with a significant presence in Republic and Washington counties in Kansas. The physical appearance 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 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.
The elevation in MLRA 75 ranges from nearly 2,600 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 predominate soil orders in this geographic area are mesic, ustic Mollisols.

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 average annual precipitation ranges from 23 to 36 inches, and the number of freeze-free days range from 150

to 200.

The matrix vegetation type is mixed-grass prairie, with big and little bluestem, switchgrass, Indiangrass, and sideoats and blue grama 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.

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 redcedar is native to Nebraska, the historic population in MLRA 75 was limited to isolated pockets in rugged river drainages that were subsequently insulated from fire . Widespread plantings of windbreaks with eastern redcedar as a primary component have provided a seed source for the aggressive woody plant. The ensuing encroachment into the native grasslands degrades the native wildlife habit and causes significant forage loss for domestic livestock. However, since it is not a root sprouter, eastern redcedar is very susceptible to fire when under six feet tall. Management with prescribed fire is exceedingly effective if applied before this stage.

Larger redcedars can also be controlled with fire, but successful application requires the use of specifically designed ignition and holding techniques.
Fragmentation of the native grasslands by conversion to cropland, transportation corridors, and other developments have effectively disrupted the natural fire regime of this ecosystem. This has allowed encroachment by native and introduced shrubs and trees into the remnants of the native prairie throughout the MLRA. Aggressive fire suppression policies have exacerbated this process to the point that shrub and tree encroachment is a major ecological issue in the majority of both native and re-seeded grasslands.

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)

Revision Notes:
A PROVISIONAL ECOLOGICAL SITE is a conceptual grouping of soil map unit components within a Major Land Resource Area (MLRA) based on the similarities in response to management. Although there may be wide variability in the productivity of the soils grouped into a Provisional Site, the soil vegetation interactions as expressed

in the State and Transition Model are similar and the management actions required to achieve objectives, whether maintaining the existing ecological state or managing for an alternative state, are similar. Provisional Sites are likely to be refined into more precise group during the process of meeting the APPROVED ECOLOGICAL SITE DESCRIPTION criteria

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

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

Similar sites

R075XY083NE	**Saline Depression** Saline Depression- Similar landscape position to the Deep Depression site, but has higher soil salinity.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Typha latifolia*

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.

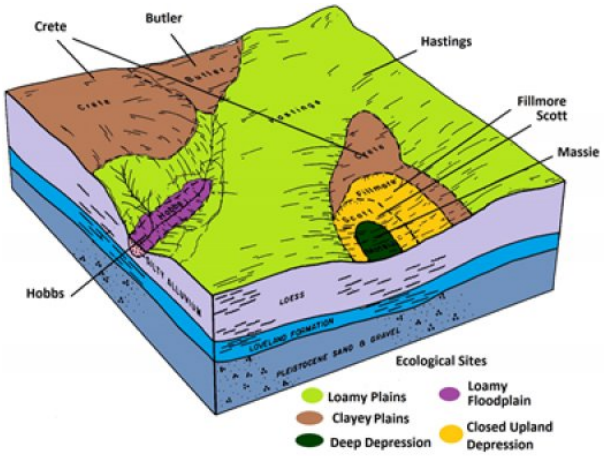


Figure 2. Block Diagram

Table 2. Representative physiographic features

Landforms	(1) Depression (2) Playa
Ponding duration	Long (7 to 30 days) to very long (more than 30 days)
Ponding frequency	Frequent
Elevation	469–753 m
Slope	0–1%
Ponding depth	0–61 cm
Water table depth	152–203 cm
Aspect	Aspect is not a significant factor

Climatic features

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

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

Table 3. Representative climatic features

Frost-free period (average)	155 days
Freeze-free period (average)	177 days
Precipitation total (average)	762 mm

Climate stations used

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

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.

Major soils series correlated to this ecological site include: Massie.

Table 4. Representative soil features

Surface texture	(1) Sandy clay loam (2) Sandy loam
Drainage class	Very poorly drained
Soil depth	203 cm
Available water capacity (0-101.6cm)	23.88–30.73 cm
Calcium carbonate equivalent (0-101.6cm)	0–3%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	5.6–7.5

Ecological dynamics

Plant Communities
Ecological Dynamics of the Site
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.

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.

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.

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 waterplantain 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, and 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.

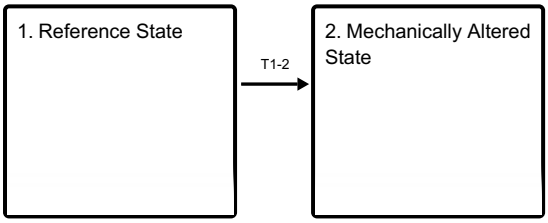
Growth of native cool season plants begins about April 1, and continues to about June 15. Native warm season plants begin growth about May 15, and continue to about August 15. Green up of cool season plants may occur in September and October if adequate moisture is available.

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.

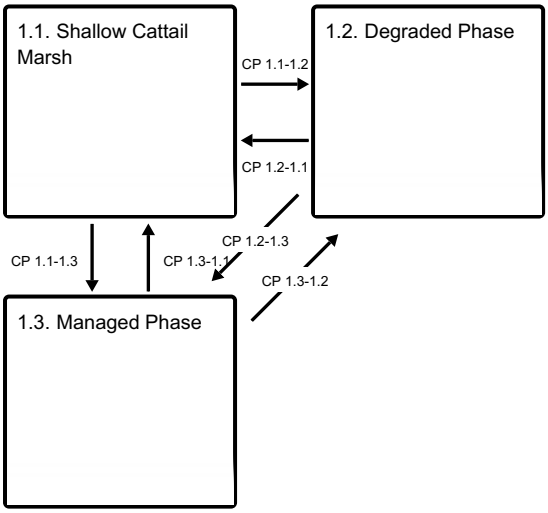
The following diagram illustrates the states and the plant communities within the states that can occur on the site. The transitions between the states, and between the communities are represented by the arrows.
The processes that cause the fluctuation between the states and communities are discussed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

Community 1.1
Shallow Cattail Marsh

Dominant species in the Shallow Cattail Marsh Community are river bulrush, broadleaf cattail, narrowleaf cattail and slender bulrush. During drier periods you will find species like marsh spikerush, water knotweed, smartweeds, water hyssop, mud-plantains, common waterplantain and shortbeak arrowhead

Community 1.2
Degraded Phase

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

Community 1.3
Managed Phase

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 CP 1.1-1.2
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 CP 1.1-1.3
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 Phase of these sites through introducing disturbance. Appropriately timed intensive grazing, fire, shredding, disking and spraying are the primary management practices currently implemented.

Pathway CP 1.2-1.1
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 Phase.

Pathway CP 1.2-1.3
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 Phase of these sites through

introducing disturbance. Appropriately timed intensive grazing, fire, shredding, disking and spraying are the primary management practices currently implemented.

Pathway CP 1.3-1.1
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 CP 1.3-1.2
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 T1-2
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

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. Whitetail 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.

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, mangers 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.

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

Revision Notes: “This PROVISIONAL ecological site concept has gone through the Quality Control and Quality Assurance processes to ensure that it meets the NESH standards for a provisional ecological site. This site should not be considered an Approved ESD until further data entry and editing is completed.
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.

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Contributors

Doug Whisenhunt

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

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

Indicators

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

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

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

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

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

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

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

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

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

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

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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):**

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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:

    Sub-dominant:

    Other:

    Additional:

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

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

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

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

17. **Perennial plant reproductive capability:**