USDA Natural Resources Conservation Service

Ecological site R071XY052NE
Saline Subirrigated

Accessed: 05/17/2024

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): 071X–Central Nebraska Loess Hills

This PROVISIONAL ECOLOGICAL SITE has been developed to meet the standards established in the National Ecological Site Handbook. The information associated with this ecological site does not meet the Approved Ecological Site Description Standard, but it has been through a Quality Control and Quality Assurance processes to assure consistency and completeness. Further investigations, reviews and correlations are necessary before it becomes an Approved Ecological Site Description.

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. The predominate soil orders are mesic, udic Mollisols and Entisols, commonly represented by the Coly, Uly, Cozad, Hord, Hall and Holdredge soil series.
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 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 grass.
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/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.
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 red cedar as a windbreak component further facilitates invasion by this species.
While eastern red cedar 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 red cedar as a primary component has 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 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 cedars can also be controlled with fire, but requires the use of specially designed ignition and suppression techniques.
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.

Classification relationships

Major Land Resource Area 71 (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 Saline Subirrigated site is a run-on site where salts accumulate in the root zone. Salts or scabby spots are visible on the soil surface. It often occupies a position on the landscape between the Loamy Lowland site and the Wetland site.

Associated sites

R071XY028NE	**Loamy Lowland** Loamy lowland- This site is adjacent to but positioned above the Saline Subirrigated site.
R071XY044NE	**Wet Land** Wetland- Occupies a position adjacent to but below the Saline Subirrigated site.

Similar sites

R071XY024NE	**Subirrigated** Subirrigated- This site occupies a similar position on the landscape, but does not have visible surface salts.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Pascopyrum smithii* (2) *Panicum virgatum*

Physiographic features

The Saline Subirrigated site occurs on nearly level to moderately sloping floodplains and low terraces adjacent to streams and rivers, and may also occur on a Sand Hills interdune. This site receives runoff from areas higher on the landscape. The soils of this site are typically subject to rare flooding. Some soils in this site are not in positions that flood (interdune, plain).

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Stream terrace (3) Plain
Flooding duration	Extremely brief (0.1 to 4 hours) to brief (2 to 7 days)
Flooding frequency	None to rare
Ponding frequency	None
Elevation	497–937 m
Slope	0–2%
Ponding depth	0 cm
Water table depth	30–251 cm
Aspect	Aspect is not a significant factor

Climatic features

Annual precipitation averages around 26 inches per year. 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 (average)	137 days
Freeze-free period (average)	156 days

Precipitation total (average)	660 mm

Climate stations used

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

Influencing water features

This ecological site has a combination of physical and hydrological features that: 1) normally has partial growing-season groundwater within the root zone (2 feet to 3 feet), 2) allowing relatively free movement of water and air (aerobic conditions) throughout the upper half of the root zone, and 3) normally is not ponded or flooded during the growing-season in most years

Soil features

The feature common to all soils in this site are the moderate to strong saline-alkali soil condition. They are deep, and moderately well drained. The parent material is alluvium. The surface layer is from 6 to 12 inches thick, and ranges from silt loam to fine sandy loam.
The major soil series associated with this unit are Wood River, Gayville, Silver Creek, and Saltine.

Table 4. Representative soil features

Surface texture	(1) Sandy loam (2) Sandy clay loam (3) Fine sandy loam
Drainage class	Somewhat poorly drained to moderately well drained
Permeability class	Very slow to slow
Soil depth	15–30 cm

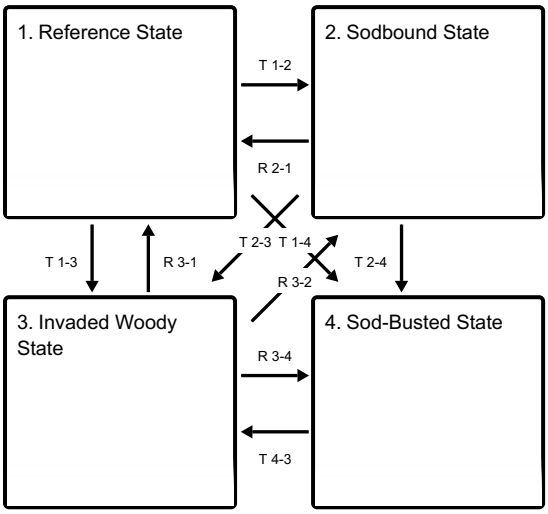
Ecological dynamics

Saline Subirrigated sites developed under Northern Great Plains climatic conditions, light to severe grazing by bison and other large herbivores, sporadic natural or man-caused wildfire, and other biotic and abiotic factors that typically influence soil/site development. This is a disturbance driven site, with the disturbances being herbivory, fire, and variable climate.
The State and Transition Model (STM) is depicted below, and is made up of a Reference State, a Sodbound State, an Invaded Woody State and a Sod-busted State. Each state represents the crossing of a major ecological threshold due to alteration of the functional dynamic properties of the ecosystem. The main properties observed to

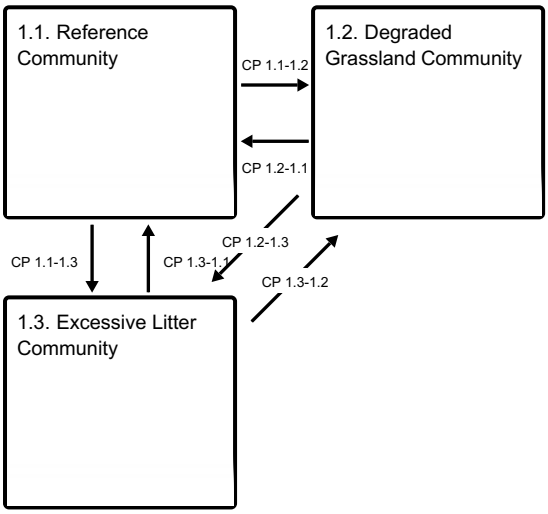
determine this change are the soil and vegetative communities, and the hydrological cycle.
Each state may have one or more vegetative communities that fluctuate in species composition and abundance within the normal parameters of the state. Within each state, communities may degrade or recover in response 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 states and communities are described individually in the following pages.

State and transition model

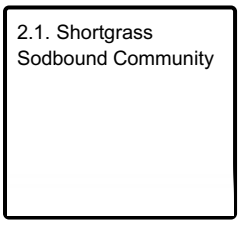
Ecosystem states



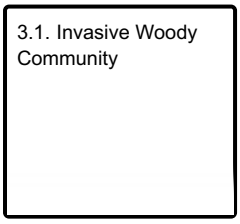
State 1 submodel, plant communities



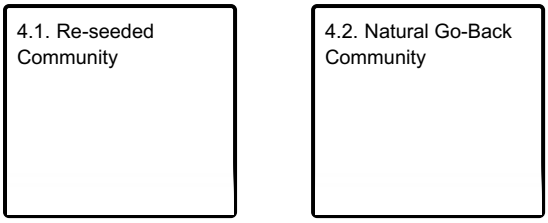
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



State 1
Reference State

This state describes the range of vegetative community phases that occur on the Saline Subirrigated site where the natural processes are mostly intact. The Reference Community is a representation of the native plant community phase that occupies a site that has been minimally altered by management. The Increased Shortgrass Community and the Heavy Litter community are the phases that result from management decisions that are unfavorable to a healthy Reference Community.

Community 1.1
Reference Community

The Reference Community Phase serves as a description of the native plant community that naturally occurs on the site when the natural disturbance regimes are intact, or closely mimicked by management practices. This phase is dynamic, with fluid relative abundance and spatial boundaries between the dominant structural vegetative groups. These fluctuations are primarily driven by different responses of the species to changes in precipitation timing and abundance, and fire and grazing events. This community is about 85 percent grasses,dominated by western wheatgrass and switchgrass. Other grasses, sedges and forbs make up the balance. Cudweed sagewort and Flodman thistle are two of the native forbs associated with the site.

Community 1.2
Degraded Grassland Community

The Degraded Grassland Community Phase describes an increase in the salt tolerant shortgrasses, with a corresponding decrease in the midgrasses. Switchgrass and western wheatgrass abundance declines significantly, with a corresponding loss in forage production. Sedges and inland saltgrass become the dominant species. In many communities, Kentucky bluegrass increases to the point of co-dominance.

Community 1.3
Excessive Litter Community

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

Pathway CP 1.1-1.2
Community 1.1 to 1.2

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

Pathway CP 1.1-1.3
Community 1.1 to 1.3

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

Pathway CP 1.2-1.1

Community 1.2 to 1.1

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

Pathway CP 1.2-1.3
Community 1.2 to 1.3

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

Pathway CP 1.3-1.1
Community 1.3 to 1.1

Re-introduction of the natural processes of herbivory and fire will allow the vegetation to return to the previous community.

Pathway CP 1.3-1.2
Community 1.3 to 1.2

Re-introduction of the natural processes of herbivory and fire will allow the vegetation to return to the previous community.

State 2
Sodbound State

This State results from management practices that degrade the vegetative community to the point that a threshold is crossed, requiring long-term management practices to return to the Reference State.

Community 2.1
Shortgrass Sodbound Community

The Shortgrass Sodbound Community is the primary community present in the Sodbound State. The midgrasses are not evident, and the community is dominated by salt tolerant shortgrasses. Forage production declines correspondingly, and a sod is formed. In the absence of the deeper rooted species, infiltration is reduced,runoff increases and the hydrology of the system is altered.

State 3
Invaded Woody State

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

Community 3.1
Invasive Woody Community

This community is dominated by the more salt tolerant woody species. Russian olive and eastern red cedar are the two primary species. Honey locust may also be present. Shading, the allelopathic influence from erc and competition for water severely limit forage production by any remaining grasses. As the woodies mature, they uptake large amounts of water. The hydrology of the system can be altered to the point that small streams and tributaries dry up, affecting the riparian and aquatic communities that are dependent on the waterflow.

State 4
Sod-Busted State

This threshold is crossed as a result of mechanical disturbance to facilitate production agriculture. If farming operations are suspended, the site can: be abandoned, which will result in the Natural Go-Back Community, or; be re-seeded to a desired perennial forage mixture, which is described as the Re-seeded Community. Permanent alterations of the soil community and the hydrological cycle make restoration to the original native Reference Community extremely difficult, if not impossible.

Community 4.1
Re-seeded Community

Native and introduced grasses and forbs are planted into the abandoned farmland.

Community 4.2
Natural Go-Back Community

Abandoned farmland is left to natural re-vegetation processes. The initial plant community is made up of grasses and forbs that naturally occur in disturbed sites, often initially weedy annuals.

Transition T 1-2
State 1 to 2

Long-term excessive livestock grazing or haying without adequate growing season rest will cause a major shift in the vegetative community. This shift and the resulting impacts on the systems hydrology will be extreme enough to cross the threshold to the Sodbound State. Prolonged drought can have a similar impacts.

Transition T 1-3
State 1 to 3

Disruption of the natural fire regime, and the introduction of exotic species such as Russian olive trees causes a major shift in the vegetative community. The resulting impacts to the system cross the threshold into the Invaded Woody State.

Transition T 1-4
State 1 to 4

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

Restoration pathway R 2-1
State 2 to 1

Development of a long-term management plan that includes an appropriate level of livestock grazing with adequate growing season rest, and strategically timed prescribed fire will return this state to the Reference State.

Transition T 2-3
State 2 to 3

Disruption of the natural fire regime and the introduction of exotic species can cause this state to shift to the Invaded Woody State.

Transition T 2-4
State 2 to 4

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

Restoration pathway R 3-1
State 3 to 1

Mechanical removal of the Russian olive is required, as it is a root-sprouter and not well controlled by fire. The stump must be chemically treated immediately after the tree is cut to prevent re-sprouting. ERC can be controlled by mechanical removal or prescribed fire. Development of a follow-up maintenance program including prescribed fire will be essential to prevent re-invasion.

Restoration pathway R 3-2
State 3 to 2

Mechanical removal of the Russian olive is required, as it is a root-sprouter and not well controlled by fire. The stump must be chemically treated immediately after the tree is cut to prevent re-sprouting. ERC can be controlled by mechanical removal or prescribed fire. Development of a follow-up maintenance program including prescribed fire will be essential to prevent re-invasion.

Restoration pathway R 3-4
State 3 to 4

Mechanical removal of the Russian olive is required, as it is a root-sprouter and not well controlled by fire. The stump must be chemically treated immediately after the tree is cut to prevent re-sprouting. ERC can be controlled by mechanical removal or prescribed fire. Development of a follow-up maintenance program including prescribed fire will be essential to prevent re-invasion.

Transition T 4-3
State 4 to 3

Mechanical removal of the Russian olive is required, as it is a root-sprouter and not well controlled by fire. The stump must be chemically treated immediately after the tree is cut to prevent re-sprouting. Erc can be controlled by mechanical removal or prescribed fire. Development of a follow-up maintenance program including prescribed fire will be essential to prevent re-invasion.

Additional community tables

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 for cattle, sheep, or horses. During the dormant period, the protein levels of the forage may be lower than the minimum needed to meet livestock (primarily cattle and sheep) requirements.

Wildlife Habitat Interpretations:
When the plant community structure of this tallgrass prairie site is maintained, this site provides excellent nesting areas for quail, pheasant, and prairie chickens, especially when it is associated with adjacent booming grounds. The variety of forbs, grasses, and insects on this site makes it a preferred feeding area for deer and birds. Numerous songbirds utilize this site for nesting and other activities.

Changes to the structure and species composition of the plant community in ways that reduce the availability of the food and cover that attracts these species to this site. However, some animal species favor alternative community phases/states.

In the absence of fire and grazing, excess litter buildup can occur on this site hindering the movement of young birds, especially quail and prairie chickens. Additionally, decreased forb abundance/diversity will result in an accompanying decrease in insects, a critical food source for young birds.

Numerous rodents and small animals utilize this site by taking advantage of the taller growing plants to visually shield them from predators.

Hydrological functions

Water and salinity are the primary factors limiting forage production on this site. This site is dominated by soils in hydrologic groups C and D. Infiltration is moderate and runoff potential for this site varies from moderate to high depending on soil hydrologic group and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where short grasses form a strong sod and dominate the site. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff. (Refer to NRCS Section 4, National Engineering Handbook (NEH-4) for runoff quantities and hydrologic curves).

Recreational uses

This site provides excellent hunting areas. This site attracts many different species of birds, and is popular for bird watching. The wide varieties of plants, which bloom from spring until fall, have an esthetic value that appeals to visitors.

Wood products

No appreciable volume of wood products is produced on this site.

Other products

None of major significance.

Other information

Revision Notes: “This PROVISIONAL ecological site concept has been QC’d and QA’d to ensure that the site meets the NESH standards for a provisional ecological site that provides basic compiled information in one location. This site should not be considered an Approved ESD until further data entry and editing is completed.

Inventory data references

The information in this ESD has been assembled from NRCS documents, personal communications and contributions from professional Range Management Specialists, Soil Scientists, Wildlife Biologists and Ecologists.

Other references

Facelli, J.M. and S. Pickett. Plant Litter: Its Dynamics and Effects on Plant Community Structure. Botanical review, Vol 57, No.1 (Jan.-Mar., 1991)pp. 1-32. Published by: Springer on behalf of New York Botanical Garden Press.

High Plains Regional Climate Center, University of Nebraska, 830728 Chase Hall, Lincoln, NE 68583-0728. (http://hpcc.unl.edu)

USDA, NRCS. National Water and Climate Center, 101 SW Main, Suite 1600, Portland, OR 97204-3224. (http://wcc.nrcs.usda.gov)

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

USDA, NRCS. National Soil Information System, Information Technology Center, 2150 Centre Avenue, Building A, Fort Collins, CO 80526. (http://nasis.nrcs.usda.gov)

USDA, NRCS. 2002. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

USDA, USFS. 1993. Fact Sheet ST-233 Russian-Olive.

USDA, USFS. 1993. Fact Sheet ST-327 Eastern Redcedar

Numerous County Soil Surveys

Contributors

Doug Whisenhunt

Acknowledgments

Site Development and Testing Plan:
Future work is needed to validate the information in this Provisional Ecological Site Description. Additional data collection and evaluation may also be needed to develop this ESD to the Approved, then Correlated level. This could include field activities to collect low, medium and high intensity sampling, soil correlations, and analysis of that data. Field reviews of the project plan should be done by soil scientists and vegetation specialists. A final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed to produce the final document.
Annual reviews of the Project Plan are to be conducted by the Ecological Site Technical Team. The project plan is: ES R071XY052NE- MLRA 71 -

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:**

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

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

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

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

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

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

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

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

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

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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

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

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

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

invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:

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17. **Perennial plant reproductive capability:**
