Ecological site R111XE001OH
Mineral Muck

Last updated: 5/28/2020
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General information

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

MLRA notes

Major Land Resource Area (MLRA): 111X–Indiana and Ohio Till Plain

111E – Indiana and Ohio Till Plain, Eastern Part. Most of this area is in the Till Plains Section of the Central Lowlands Province of the Interior Plains. The northeast tip of the area is in the Southern New York Section of the Appalachian Highlands. The entire area has been glaciated. It is dominated by ground moraines that are broken in places by kames, lake plains, outwash plains, terraces, and stream valleys. Narrow, shallow valleys commonly are along the few large streams in the area. Elevation ranges from 580 to 1,400 feet (175 to 425 meters), increasing gradually from west to east. Relief is mainly a few meters, but in some areas hills rise as much as 100 feet (30 meters) above the adjoining plain.

The extent of the major Hydrologic Unit Areas (identified by four-digit numbers) that make up this MLRA is as follows: Scioto (0506), 33 percent; Muskingum (0504), 31 percent; and Western Lake Erie (0410), 28 percent; Upper Ohio (0503), 5 percent; and Southern Lake Erie (0411), 3 percent. The headwaters of many rivers in central Ohio, including the Vermillion, Black Fork, Sandusky, Little Scioto, and Olentangy Rivers, are in this MLRA.

This MLRA is underlain by late Devonian shale and sandstone. Surficial materials include glacial deposits of till, glaciolacustrine sediments, and outwash from Wisconsin and older glacial periods.

Classification relationships

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

USFS Ecological Regions (USDA, 2007):
Sections –Central Till Plains, Beech Maple (222H), Western Glaciated Allegheny Plateau (221F)

Subsections – Allegheny Plateau (221Fa), Bluffton Till Plains (222Ha), Miami-Scioto Plain – Tipton Till Plain (222Hb)

NatureServe Systems anticipated (NatureServe, 2011): Agriculture - Cultivated Crops and Irrigated Agriculture, Agriculture – Pasture/Hay, North-Central Interior Beech-Maple Forest, North-Central Interior Freshwater Marsh, Ruderal Forest, Ruderal Upland - Old Field

LANDFIRE Biophysical Settings anticipated (USGS, 2010): Central Interior and Appalachian Floodplain Systems, North-Central Interior Beech-Maple Forest

Ecological site concept

This site is a wetland site formed on deep, herbaceous organic soil parent material over either sandy or loamy (mineral) deposits in depressions on lake, outwash, and till plains. Disturbance to the site by fire was driven by the seasonal presence of water on the site. In the spring and early summer, the site is often ponded to a depth of 15

inches. The water table recedes as the summer progresses creating a much drier situation that increases the susceptibility of the site to fire. The seasonal flooding and relatively short fire return interval (~10 years or less) created a situation where the site is dominated by herbaceous vegetation.

The characteristic vegetation is herbaceous in nature, mostly dominated by tall prairie grass species, most notably big bluestem and switchgrass Sedge species are also common throughout the site and are the most abundant sub-dominant group of species. The influence of water via flooding and ponding along with fire maintain the herbaceous species dominance of the site. The absence of fire will lead this site to being converted to woodland and then potentially a closed canopy forest. The lack of fire will allow hydrophilic shrub species to get established, further altering the fire cycle. Continued absence of fire will have the site progress to a forest dominated by wetland tree species such as elm and ash. Currently, a large percentage of the site is in agricultural production, notably corn and soybean rotations, after the installation of drainage. These sites can be very productive, once drained, due in large part to the high amounts of organic matter.

Associated sites

R111XE002OH	**Limnic Muck** Underlain by coprogenous earth
R111XE003OH	**Deep Muck** Not underlain by mineral soil
F111XE501OH	**Till Depression** On till parent material

Similar sites

R111XE002OH	**Limnic Muck** Underlain by coprogenous earth
R111XE003OH	**Deep Muck** Not underlain by mineral soil
R111XE003OH	**Deep Muck** Soil parent material is outwash; site generally higher on the landscape; soils are mollisols.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Andropogon gerardii* (2) *Panicum virgatum*

Physiographic features

This site is located in Major Land Resource Area 111E - Indiana and Ohio Till Plain, Eastern Part. This site was formed on deep herbaceous organic material over sandy or loamy material. It is located in closed depressions on bogs and flood plains. Aspect is southeast. Slopes range from 0 to 2 percent

Table 2. Representative physiographic features

Landforms	(1) Bog (2) Flood plain
Flooding duration	Extremely brief (0.1 to 4 hours) to long (7 to 30 days)
Flooding frequency	None to frequent
Ponding duration	Very brief (4 to 48 hours) to long (7 to 30 days)
Ponding frequency	None to frequent
Elevation	183–305 m

Slope	0–2%
Ponding depth	0–38 cm
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation in this area is 35 to 41 (890 to 1,040 millimeters). Most of the rainfall occurs as convective thunderstorms during the growing season. About half or more of the precipitation occurs during the freeze-free period. Snowfall is common in winter. The average annual temperature is 48 to 52 degrees F (9 to 11 degrees C). The freeze-free period averages about 185 days and ranges from 165 to 205 days.

Table 3. Representative climatic features

Frost-free period (characteristic range)	143-149 days
Freeze-free period (characteristic range)	177-181 days
Precipitation total (characteristic range)	991-1,041 mm
Frost-free period (actual range)	131-153 days
Freeze-free period (actual range)	175-185 days
Precipitation total (actual range)	965-1,092 mm
Frost-free period (average)	144 days
Freeze-free period (average)	180 days
Precipitation total (average)	1,016 mm

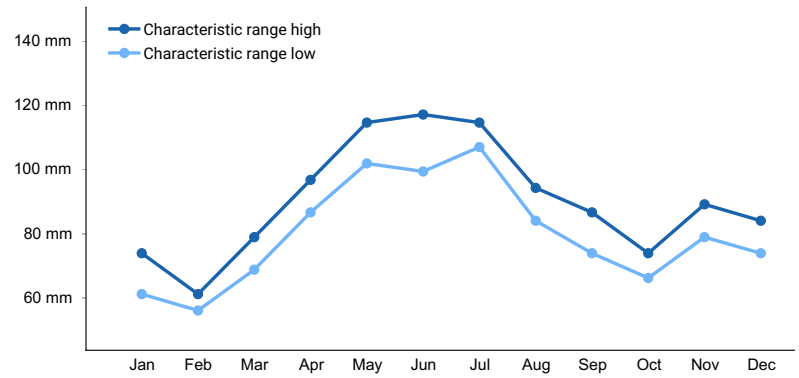

Figure 1. Monthly precipitation range

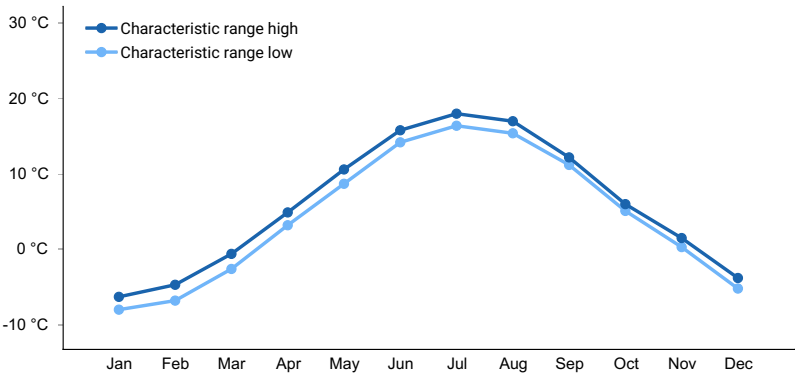

Figure 2. Monthly minimum temperature range

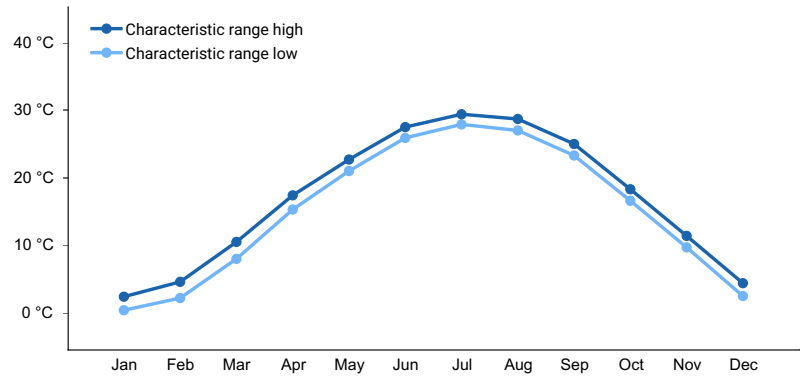

Figure 3. Monthly maximum temperature range

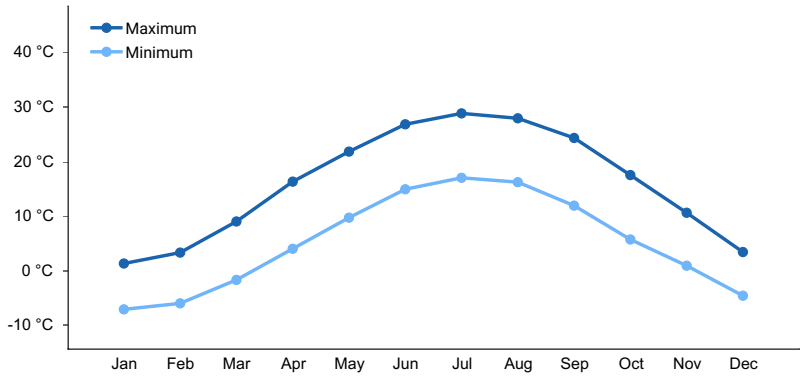

Figure 4. Monthly average minimum and maximum temperature

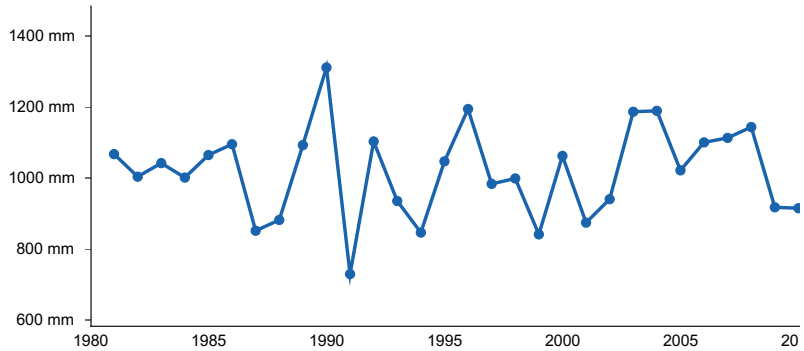

Figure 5. Annual precipitation pattern

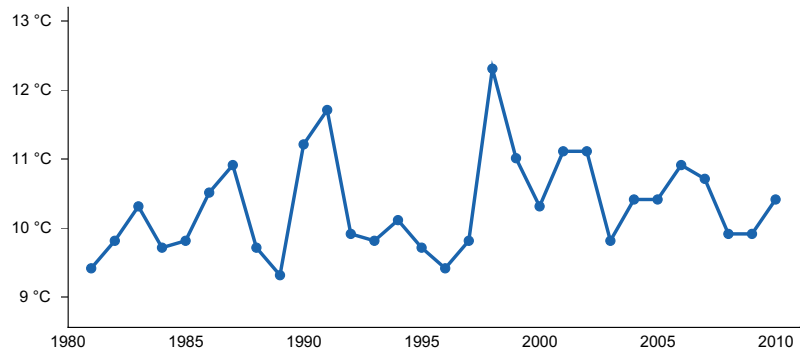

Figure 6. Annual average temperature pattern

Climate stations used

- (1) LANCASTER [USC00334403], Lancaster, OH
- (2) BUCYRUS [USC00331072], Bucyrus, OH
- (3) TIFFIN [USC00338313], Tiffin, OH

- (4) MANSFIELD LAHM MUNI AP [USW00014891], Mansfield, OH
- (5) CHIPPEWA LAKE [USC00331541], Medina, OH
- (6) CENTERBURG 2 SE [USC00331404], Centerburg, OH
- (7) COLUMBUS PORT COLUMBUS INTL AP [USW00014821], Columbus, OH

Influencing water features

These wetland systems are groundwater-dependent as well as being, generally, the lowest point in the landscape, making it a discharge depression. Water levels fluctuate seasonally, reaching their peak in spring and lows in late summer. Ponding can occur on the site, generally in the spring, to a depth of 15 inches and can have a very long duration (> 30 days). Water levels typically remain at or near the soil surface throughout the year.

The hydrogeographic model classification for this site is DEPRESSION: Muck, Ground Water Influenced; herbaceous. This site has a Cowardin Classification of PEM1Eg; it is a Palustrine system with persistent, emergent vegetation that is seasonally flooded/saturated on organic soil.

Soil features

The soil series associated with this site are: Wallkill, Linwood. They are very deep, very poorly drained, and moderate to rapid permeable soils, with slightly acidic soil reaction, that formed in herbaceous organic material.

Parent Materials Kind: Herbaceous organic material
Surface Texture: Silt loam
Subsurface Texture group: Loamy

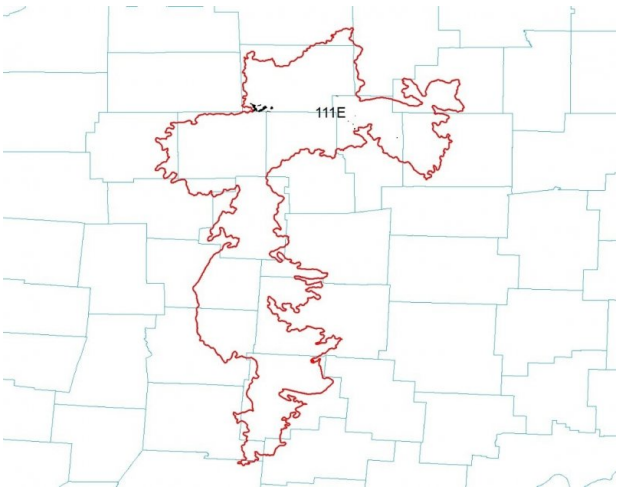

Figure 7. Location of mapunits in the MLRA

Table 4. Representative soil features

Parent material	(1) Organic material
Surface texture	(1) Silt loam
Drainage class	Very poorly drained
Permeability class	Moderate to rapid
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	19.56–33.78 cm
Calcium carbonate equivalent (Depth not specified)	0–15%

Electrical conductivity (Depth not specified)	0 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0
Soil reaction (1:1 water) (Depth not specified)	6.2–6.7
Subsurface fragment volume <=3" (Depth not specified)	2–7%
Subsurface fragment volume >3" (Depth not specified)	0–3%

Ecological dynamics

The historic plant community of the Mineral Muck ecological site is a mineral muck prairie. This site is characterized by the soil parent material being composed of herbaceous organic matter overlaying either sandy or loamy material. The plant community is dominated by tall-grass prairie species along with an assortment of tall sedge species. The site is located in closed depression areas principally associated with glacial lake plains, outwash plains, and till plains. Being the lowest portion, generally, of the local landscape, the site is dependent upon groundwater and its fluctuation, which reaches its peak in the spring and low in the late summer. This fluctuation and dominance of herbaceous species create a fire dependent system. Replacement fires about every decade and seasonal flooding worked in concert to drive the species dominance and richness of the site. Both mechanisms work in concert to inhibit the establishment and perpetuation of woody species.

State and transition model

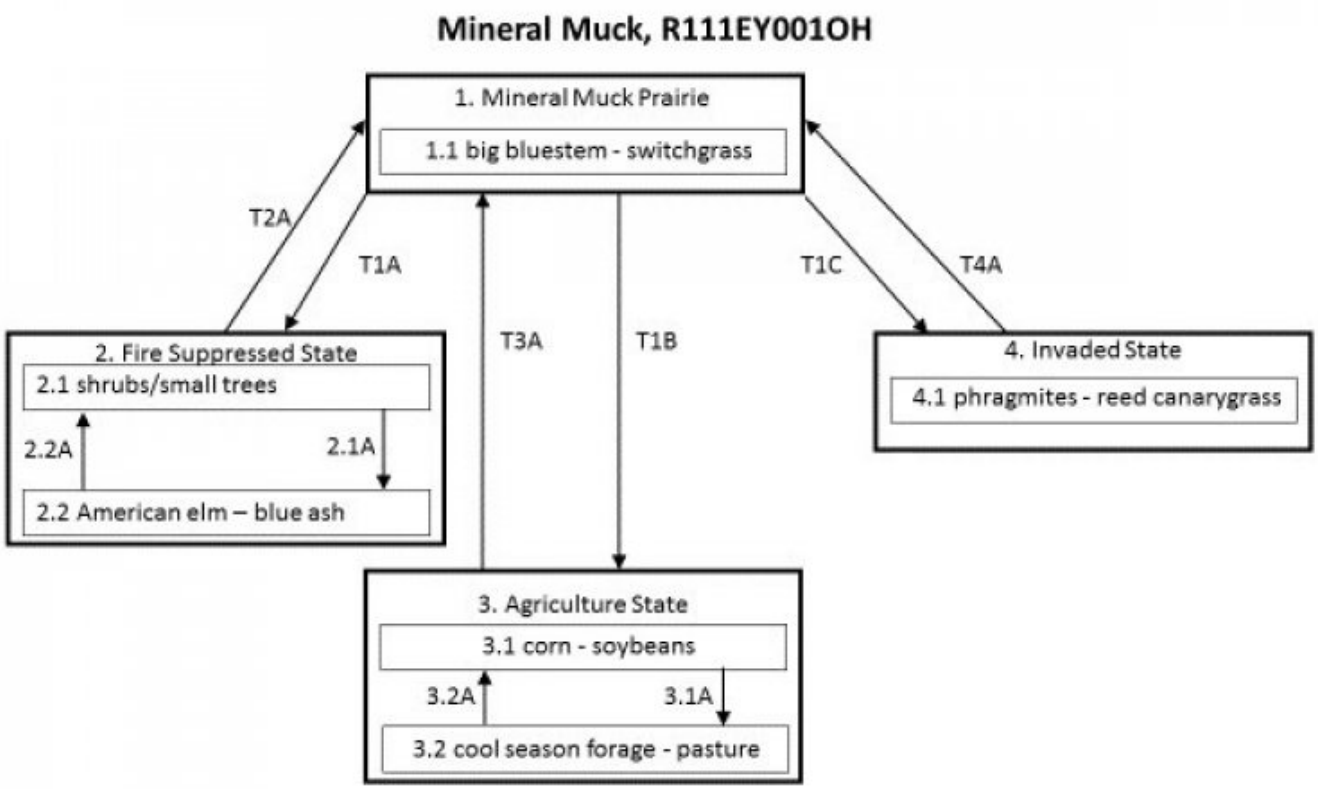

Figure 8. STM

Mineral Muck, R111EY001OH

Diagram Legend

T1A	No fire, no woody species management
T1B	Drainage, site preparation, planting, management
T1C	Invasion, no management
T2A	Tree removal, planting, fire
T3A	Drainage removal, planting, fire
T4A	Chemical/mechanical treatment of invasive species, fire
2.1A	No fire, no woody species management
2.2A	Tree removal, no fire
3.1A	Pasture/forage planting and maintenance
3.2A	Tillage/no-till planting and management of row crops.

Figure 9. Legend

State 1
Mineral Muck

This is the reference or diagnostic plant community for this site. In reference conditions, this site was dominated by tall prairie grasses specifically big bluestem and switchgrass. Sedge species were also a large component of this site. This state was maintained by nearly seasonal flooding and a fire frequency of 10 years. Absence of fire would transitions this state to the fire suppressed state, which is dominated by woody species. Shrub or tree removal and the application of fire would transition the site back to this state. Installation of drainage and agricultural practices would move this site to the agriculture state. Removal of the drainage system followed by planting of the appropriate species and the regular application of fire would move the site back to this state. Establishment of invasive, non-native species without management for their control could move the site to the invaded state. Chemical or mechanical treatment of the invasive, non-native species along with seeding, where needed, and then the regular application of fire could move the site back to this state.

Dominant plant species

- big bluestem (*Andropogon gerardii*), grass
- switchgrass (*Panicum virgatum*), grass

Community 1.1
big bluestem -switchgrass

This is the reference or diagnostic plant community for this site. In reference conditions, this site was dominated by tall prairie grasses specifically big bluestem and switchgrass. Sedge species were also a large component of this site.

Dominant plant species

- big bluestem (*Andropogon gerardii*), grass
- switchgrass (*Panicum virgatum*), grass

State 2
Fire Suppressed State

This state is characterized by a longer than normal fire return interval or the absence of fire as a disturbance agent. Absence of fire allows for a thick layer of leaf litter to accumulate which suppresses the production of the herbaceous species and helps to allow the woody species to establish and flourish. Similarly, the woody species that colonize this site are generally intolerant of fire. The seasonal flooding and fire work in concert to help prevent woody species establishment.

Community 2.1
shrubs / small trees

This phase is characterized by the establishment and dominance shrubby species and small trees. Common species include dogwood, white sweetmeadow, and willow species.

Dominant plant species

- dogwood (*Cornus*), shrub
- willow (*Salix*), shrub

Community 2.2
American elm - blue ash

This phase is characterized by the establishment and dominance tree species that convert the site to a forest. Common species include American elm and blue ash as dominant canopy level trees.

Dominant plant species

- American elm (*Ulmus americana*), tree
- blue ash (*Fraxinus quadrangulata*), tree

Pathway P2.1A
Community 2.1 to 2.2

Continued absence of fire and/or woody species management will move the site towards phase 2.2.

Pathway P2.2A
Community 2.2 to 2.1

Removal of most or all the trees without the application of fire will move the site towards phase 2.1.

State 3
Agricultural State

This site has largely been converted to agricultural use. Most of the historic acres are now in row crop agricultural use. Most common is a corn and soybean rotation of various types. A small portion of the site is now used to grow hay or cool season forage and used for grazing. The conversion of the site to agricultural use begins with the installation of a drainage system which most often employs either or both ditching and field tile.

Community 3.1
Row crops (corn -soybeans)

This phase is characterized by row crop agriculture of small grains, primarily corn and soybeans.

Community 3.2
cool season forage -pasture

This phase is characterized by forage or grazing agriculture. Different mixes of, generally, cool season grasses and forbs, largely clovers, are grown.

Pathway P3.1A
Community 3.1 to 3.2

Planting of cool season pasture/forage species and management to maintain them.

Pathway P3.2A
Community 3.2 to 3.1

Planting, either by conventional or no-till methods, of row crop. Management that keeps the site in row crop production

State 4
Invaded State

This site is characterized by the establishment of invasive species. Without management the invasive species can come to be the dominant species to the exclusion of nearly all other species.

Community 4.1
Invaded Community

This phase is characterized by the establishment and dominance of invasive species. The two most common for this site are phragmites and reed canarygrass. Most often only one of the two species will come to dominate the site.

Dominant plant species

- reed (*Phragmites*), grass
- reed canarygrass (*Phalaris arundinacea*), grass

Transition T1A
State 1 to 2

No fire or woody species management will transition this site towards the fire suppressed state. This will result in a loss of herbaceous species production and richness.

Transition T1B
State 1 to 3

The installation of drainage either through ditches, field tile, or both facilitates the start of the transition to the agriculture state. Planting and management of the selected crop complete the transition

Transition T1C
State 1 to 4

The establishment of invasive species without management, to include the use of fire, move the site towards the invaded state. This results in a loss in species richness of the site.

Restoration pathway R2A
State 2 to 1

Removal of trees and other woody species followed by planting the site to the desired species and the regular application of fire will help restore the site to state 1.

Restoration pathway R3A
State 3 to 1

Removal of drainage system, site preparation, tree planting, and regular application of fire.

Restoration pathway R4A
State 4 to 1

Chemical and mechanical treatment of the invasive species is the first restoration step. Sometimes biological treatment, to included grazing, can be helpful but is not common in this area. The reapplication of fire after seeding of the appropriate species.

Additional community tables

Inventory data references

Site concept developed through expert opinion, review of the literature, and field work.

Other references

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Approval

Chris Tecklenburg, 5/28/2020

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)	TYLER STAGGS
Contact for lead author	
Date	05/19/2024
Approved by	Chris Tecklenburg
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:**

17. **Perennial plant reproductive capability:**