

Ecological site R111XD021IN

Dry Outwash Mollisol

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

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.

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.

111D – Indiana and Ohio Till Plain, Western Part. This MLRA occurs in two separate areas. One area is in the west-central part of Indiana (73 percent), and the other is in southwestern Ohio (27 percent). The MLRA makes up 5,355 square miles (13,880 square kilometers). It includes the towns of Crawfordsville, Delphi, Frankfort, Lafayette, and Liberty, Indiana, and Hamilton, Lebanon, Middletown, and Wilmington, Ohio. Interstates 65 and 74 cross the part of this area in Indiana, and Interstates 71 and 75 cross the part in Ohio. Shades and Turkey Run State Parks are in the part in Indiana, and Caesar Creek and Hueston Woods State Parks are in the part in Ohio. A small portion of the Wright-Patterson Air Force Base, in Ohio, is in the northern part of the area.

This area is in the Till Plains Section of the Central Lowland Province of the Interior Plains. It is dominated by loess hills and flats that are broken in places by moraines, kames, outwash plains, and stream terraces. Narrow, shallow valleys commonly are along the few large streams in the area. Elevation ranges from 530 to 1,050 feet (160 to 320 meters), increasing gradually from southwest to northeast. Relief is mainly a few meters, but in some areas hills rise as much as 100 feet (30 meters) above the adjoining plains.

The extent of the major Hydrologic Unit Areas (identified by four-digit numbers) that make up this MLRA is as follows: Wabash (0512), 68 percent; Great Miami (0508), 15 percent; Middle Ohio (0509), 14 percent; Scioto (0506), 2 percent; and Upper Illinois (0712), 1 percent. Wildcat Creek in Indiana and the Little Miami River in Ohio have been designated as National Wild and Scenic Rivers. Sugar Creek and Walnut Creek occur in the part of the area in northern Indiana, and the Whitewater River is in the part in southeastern Indiana. The Sevenmile, Fourmile, and Great Miami Rivers cross the part of the area in Ohio.

Most of the eastern part of this MLRA is underlain by Late Ordovician shale and limestone. The western part is underlain by shale, siltstone, sandstone, limestone, and dolostone ranging in age from Middle Pennsylvanian to Silurian. Surficial materials include glacial deposits of till, outwash, and lacustrine sediments from Wisconsin and

older glacial periods. A thin or moderately thick mantle of loess overlies much of the area.

Classification relationships

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

USFS Ecological Regions (USDA, 2007):

Sections –Central Till Plains, Beech Maple (222H), Interior Low Plateau-Shawnee Hills (223D), Interior Low Plateau-Bluegrass (223F), Central Till Plains-Oak Hickory (223G), Central Till Plains and Grand Prairies (251D)

Subsections -Bluffton Till Plains (222Ha), Miami-Scioto Plain-Tipton Till Plain (222Hb), Little Miami Old Drift Plain (222Hc), Mad River Interlobate Plains (222Hd), Crawford Uplands (223De), Crawford Escarpment (223Df), Northern Bluegrass (223Fd), Lower Wabash Alluvial Plain (223Gc), Southwest Indiana Glaciated Lowlands (223Ge), Eastern Grand Prairie (253Dd).

NatureServe Systems anticipated (NatureServe, 2011): Agriculture - Cultivated Crops and Irrigated Agriculture, Agriculture - Pasture/Hay, Allegheny-Cumberland Dry Oak Forest and Woodland, Central Interior Acidic Cliff and Talus, Central Interior Highlands Calcareous Glade and Barrens, Central Tallgrass Prairie, Clearcut - Grassland/Herbaceous, Introduced Upland Vegetation – Treed, Managed Tree Plantation, Mississippi River Riparian Forest, North-Central Interior and Appalachian Acidic Peatland, North-Central Interior Beech-Maple Forest, North-Central Interior Dry-Mesic Oak Forest and Woodland, North-Central Interior Dry Oak Forest and Woodland, North-Central Interior Floodplain, North-Central Interior Freshwater Marsh, North-Central Interior Maple-Basswood Forest, North-Central Interior Oak Savanna, North-Central Interior Wet Flatwoods, North-Central Interior Wet Meadow-Shrub Swamp, North-Central Oak Barrens, Northern Atlantic Coastal Plain Hardwood Forest, Ruderal Forest, Ruderal Upland - Old Field, South-Central Interior / Upper Coastal Plain Wet Flatwoods, South-Central Interior Large Floodplain, South-Central Interior Mesophytic Forest, South-Central Interior Small Stream and Riparian, Southern Appalachian Oak Forest, Southern Interior Low Plateau Dry-Mesic Oak Forest, Successional Shrub/Scrub

LANDFIRE Biophysical Settings anticipated (USGS, 2010): Allegheny-Cumberland Dry Oak Forest and Woodland, Bluegrass Savanna and Woodland, Central Interior and Appalachian Floodplain Systems, Central Interior and Appalachian Riparian Systems, Central Interior and Appalachian Shrub-Herbaceous Wetland Systems, Central Interior and Appalachian Swamp Systems, Central Interior Highlands Calcareous Glade and Barrens, Central Interior Highlands Dry Acidic Glade and Barrens, Central Tallgrass Prairie, Great Lakes Coastal Marsh Systems, Mississippi River Alluvial Plain Dry-Mesic Loess Slope Forest, North-Central Interior Beech-Maple Forest, North-Central Interior Dry-Mesic Oak Forest and Woodland, North-Central Interior Dry Oak Forest and Woodland, North-Central Interior Maple-Basswood Forest, North-Central Interior Oak Savanna, North-Central Interior Wet Flatwoods, Paleozoic Plateau Bluff and Talus, Pennyroyal Karst Plain Prairie and Barrens, South-Central Interior Mesophytic Forest, South-Central Interior/Upper Coastal Plain Flatwoods, Southern Appalachian Oak Forest, Southern Interior Low Plateau Dry-Mesic Oak Forest

Ecological site concept

This site is an upland site formed on glacial outwash and colluvium parent materials in soils that are well drained or drier. The soil surface color is relatively dark (3/2 Munsell or darker) and extends past 10 inches making the soils of this site taxonomically mollisols.

The characteristic vegetation of this site is of a tall grass prairie. The dominant grass species are big bluestem and little bluestem. Other species common on the site included side oats grama, needlegrass, and numerous aster and blazingstar species. Fire frequency, and to a lesser extent intensity, was the primary disturbance mechanism that led to the site being dominated by grass species historically. The accumulation of dried plant material allowed this site to carry fire well once started, whether that be by lightning strikes or fires set by Native Americans. Fires occurred every 5 years or sooner on this site. Longer intervals allowed for increased tree growth from oak ‘grubs’ primarily of black oak, but bur oaks and white oaks could also be present. Reduction or in most cases elimination of fire as converted most of the site that is still in natural vegetation to that of a woodland or forest dominated primarily by oak and hickory species. Grazing by ungulates had an effect on the productions and species diversity of this site, but the magnitude of the impact was less than that for prairies farther west. Since settlement, most of the site is being used for agriculture, primarily corn and soybean rotations.

Associated sites

F111XD017IN	Outwash Upland Located on adjacent landscapes; soils surface is 3/2 Munsell or lighter; soils are somewhat poorly to moderately well drained.
F111XD018IN	Dry Outwash Upland Located on adjacent landscapes; soils surface is 3/2 Munsell or lighter; soils are well to excessively drained.
R111XD019IN	Outwash Integrate Located on adjacent landscapes; soil surface color is 3/2 Munsell or darker and extends to 10 inches or less
R111XD020IN	Wet Outwash Mollisol Located on adjacent landscapes; soil surface color is 3/2 Munsell or darker and extends greater than 10 inches; soils are moderately well to excessively drained

Similar sites

R111XD012IN	Till Ridge Prairie Located on glacial till parent material and a concave landscape position; soils are 3/2 Munsell or darker to deeper than 10 inches and well drained.
R111XD020IN	Wet Outwash Mollisol Located on glacial till parent material and a convex landscape position; soils are 3/2 Munsell or darker to deeper than 10 inches.
R111XD026IN	Sand Dune Prairie Located on sandy parent material on a dune landscape position; soils are 3/2 Munsell or darker and the color extends deeper than 10 inches
R111XD001IN	Shallow Muck Located on organic parent material that extends to less than 51 inches.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Andropogon gerardii</i> (2) <i>Schizachyrium scoparium</i>

Physiographic features

This ecosite is found in outwash landscape in MLRA 111D: Indiana and Ohio Till Plain, Western Part. Soils on the site are loamy, deep, with relatively high drainage.

list of unique landform positions: Backslope, Footslope, Shoulder, Summit

Table 2. Representative physiographic features

Landforms	(1) Outwash plain (2) End moraine (3) Stream terrace
Flooding duration	Extremely brief (0.1 to 4 hours) to brief (2 to 7 days)
Flooding frequency	None to occasional
Ponding frequency	None
Elevation	341–1,250 ft
Slope	0–50%

Ponding depth	0 in
Water table depth	27–60 in
Aspect	SE, W

Climatic features

The average annual precipitation in this area is 36 to 43 inches (915 to 1,090 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 49 to 54 degrees F (10 to 12 degrees C). The freeze-free period averages about 200 days and ranges from 180 to 215 days.

Table 3. Representative climatic features

Frost-free period (average)	162 days
Freeze-free period (average)	184 days
Precipitation total (average)	42 in

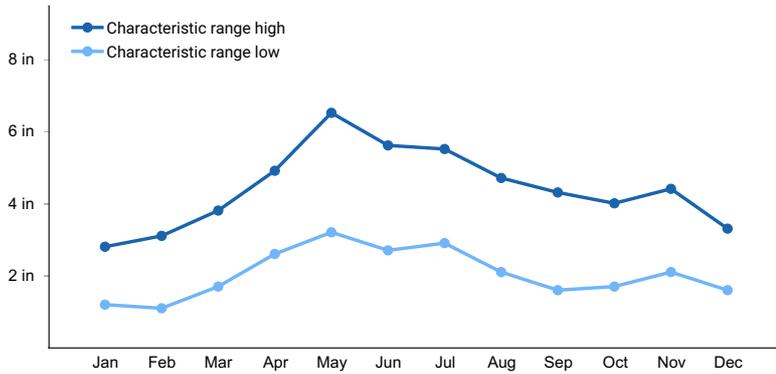


Figure 1. Monthly precipitation range

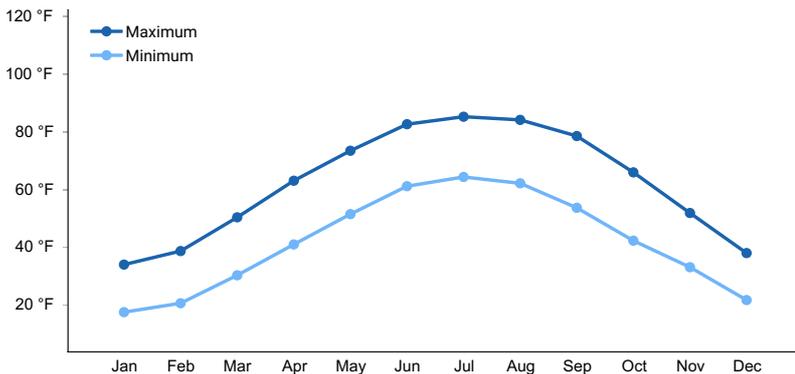


Figure 2. Monthly average minimum and maximum temperature

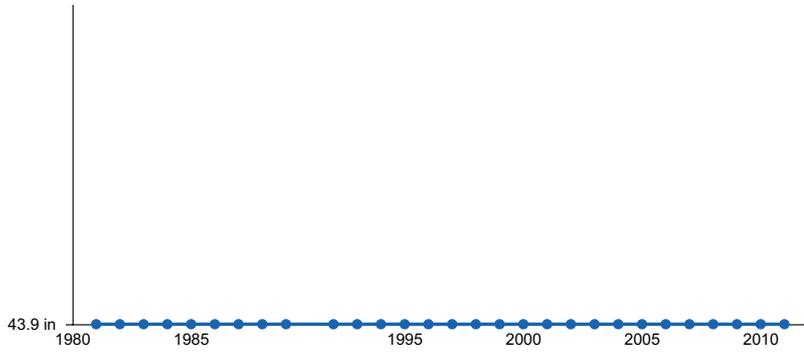


Figure 3. Annual precipitation pattern

Climate stations used

- (1) LAFAYETTE 8 S [USC00124715], Lafayette, IN
- (2) BOSWELL 4WNW [USC00120858], Fowler, IN
- (3) TERRE HAUTE INDIANA ST [USC00128723], Terre Haute, IN

Influencing water features

This ecological site is not influenced by wetland or riparian water features.

Soil features

The soil series associated with this site are: Wea, Waupecan, Warsaw, Troxel, Totanang, Tippecanoe, Shipshe, Rodman, Proctor, Plattville, Lorenzo, Foresman, Elston, Chetwynd, Carmi, Barce. They are deep to very deep, moderately well drained to excessively drained, and very slow to very rapid permeable soils, with strongly acidic to moderately alkaline soil reaction, that formed in Colluvium and Outwash.

Table 4. Representative soil features

Parent material	(1) Outwash–limestone and sandstone (2) Colluvium–dolomite
Surface texture	(1) Gravelly sandy loam (2) Coarse sandy loam (3) Loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to excessively drained
Permeability class	Very slow to very rapid
Soil depth	6–78 in
Surface fragment cover <=3"	0–3%
Surface fragment cover >3"	1–3%
Available water capacity (0-40in)	1.7–8.5 in
Calcium carbonate equivalent (0-40in)	0–40%
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	5.8–7.9

Subsurface fragment volume <=3" (Depth not specified)	1-35%
Subsurface fragment volume >3" (Depth not specified)	0-7%

Ecological dynamics

The historic plant community of the Dry Outwash Mollisol ecological site is a tallgrass prairie. This site is characterized by the dominance of tall prairie grass species, particularly big bluestem, little bluestem, and Indiangrass. This site was maintained by frequent fires, often with a return interval of no more than 5 years. Much less frequently, insect and small mammal herbivory would impact local composition and dominance of the species. The herbaceous cover on the site was high, often times 70-100%.

Since settlement, the majority of this site has been converted to agricultural use with the majority being in row crop agriculture.

State and transition model

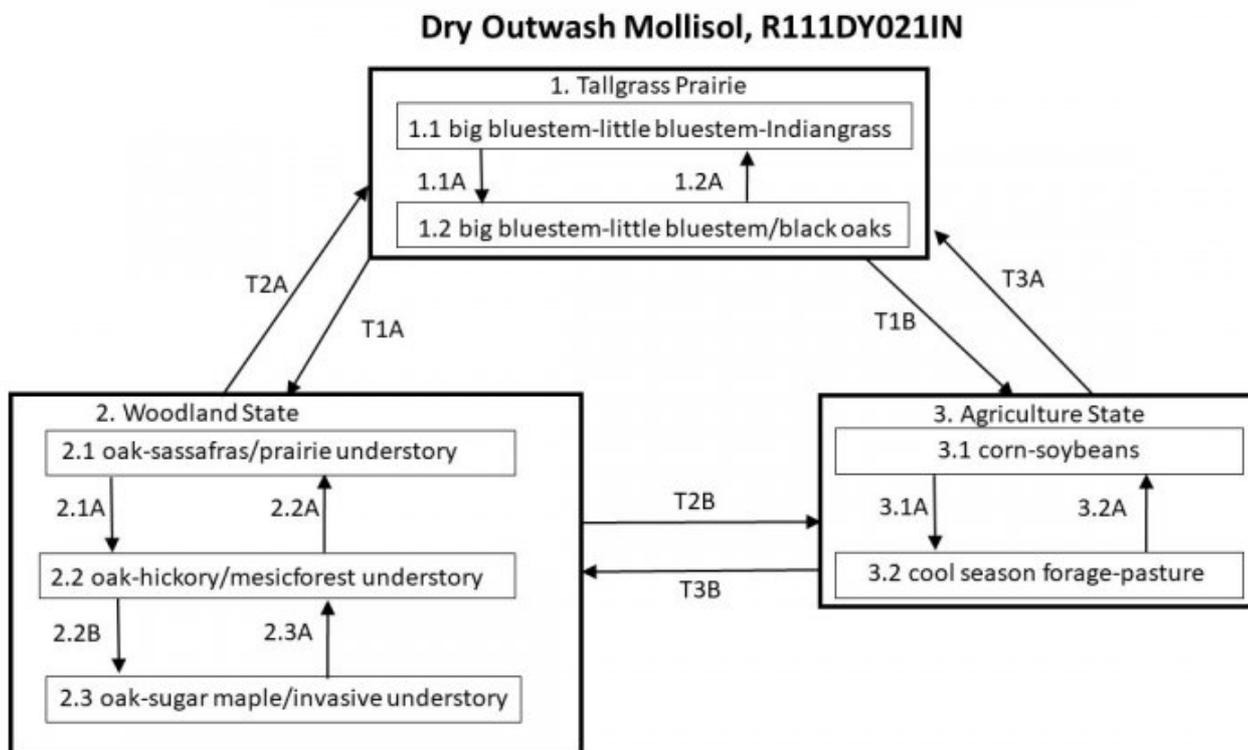


Figure 5. STM

Dry Outwash Mollisol, R111DY021IN
Diagram Legend

T1A	No woody species management, no fire
T1B	Site preparation, planting, management
T2A	Tree removal, planting, fire
T2B	Remove woody species, site preparation, planting, management
T3A	Site preparation, planting, management
T3B	Planting, timber practices, no fire
2.1A	No woody species management, no fire
2.2A	Selective tree harvest, timber stand improvement
2.2B	Establishment, no invasive species management
2.3A	Chemical/mechanical treatment of invasive species, timber stand improvement
3.1A	Pasture/forage planting and maintenance
3.2A	Tillage/no-till planting and management of row crops.

Figure 6. Legend

State 1
Tallgrass Prairie

This is the reference or diagnostic plant community for this site. In reference conditions, this site was dominated by prairie grass species. Dominant species include big bluestem, little bluestem, and Indiangrass. Fire was the main disturbance agent that maintained this site and occurred quite frequently, often with a return interval of 5 years or shorter. The removal of fire from the system and/or lack of woody species management would move this site toward state 2. Tillage of the site allows the site to be converted to cropland (state 3).

Community 1.1
big bluestem/little bluestem/Indiangrass

This phase is characterized by frequent fire events (1-5 years) that maintain herbaceous species dominance. Dominant species include big bluestem, little bluestem and Indiangrass. Secondary species are prairie dropseed and switchgrass.

Community 1.2
big bluestem/Indiangrass/black oaks

This phase is characterized by a longer fire return interval (5-20 years) than phase 1. Big bluestem, little bluestem, and Indiangrass, remain the dominant species, but the production is less as the thatch builds up. Likewise, fire has allowed for trees, mostly black oak, to get established or to grow from existing grubs.

Pathway CP 1.1-1.2
Community 1.1 to 1.2

Fire return intervals longer than 5 years or no wood species management will move this phase towards phase 1.2.

Pathway CP 1.2-1.1
Community 1.2 to 1.1

Woody species management or fire return intervals shorter than 5 years will move this phase towards community phase 1.1.

State 2

Woodland State

Absence of fire or lack of woody species management will move this site to a woodland state dominated by oak species, specifically black oak and white oak. The understory would contain many of the prairie species until the canopy closed. Woody understory species would include sassafras.

Community 2.1

oak/sassafras/prairie understory

This phase is characterized by the absence of fire. Trees, particularly oak species, have become the dominant growth form on the site. The understory still contains some prairie herbaceous species at the lower tree canopy levels, but they all disappear at the higher levels.

Community 2.2

oak/hickory/mesic forest understory

This phase is characterized by the absence of fire. Trees remain the dominant growth form. Hickory trees become present in the canopy. The understory is occupied mostly by mesic species.

Community 2.3

oak/maple/invasive understory

This phase is characterized by the absence of fire. Trees remain the dominant growth form. More shade tolerant species, particularly sugar maple, become common in the canopy. The understory has been invaded by non-native invasive species, particularly species of Asian bush honeysuckle.

Pathway CP 2.1-2.2

Community 2.1 to 2.2

No management and no fire.

Pathway P2.1-2.3

Community 2.1 to 2.3

Increase in invasive species.

Pathway CP 2.2-2.1

Community 2.2 to 2.1

Prescribed timber harvest and timber stand improvement practices.

Pathway CP 2.2-2.3

Community 2.2 to 2.3

Invasion of non-native invasive species in the understory and no invasive species management.

Pathway P2.3-2.1

Community 2.3 to 2.1

Control treatment of invasive species

Pathway CP 2.3-2.2

Community 2.3 to 2.2

Chemical or mechanical treatment of woody invasive species leads the site back to community phase 2.2.

State 3

Agriculture 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. Roughly 5% of the site is not used to grow hay or cool season forage and used for grazing.

Community 3.1

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 P3.1

Community 3.1 to 3.2

Planting of grass species for pasture/forage.

Pathway P3.2

Community 3.2 to 3.1

Establishment of row crops.

Transition T 1-2

State 1 to 2

No woody species management and/or no fire moves the site to the woodland state

Transition T 1-3

State 1 to 3

Tillage and seeding move the site to the agriculture state. Regular agricultural practices maintain the site.

Restoration pathway R 2-1

State 2 to 1

Remove all trees and woody vegetation, seeding, and fire restores the site to the reference state.

Transition T 2-3

State 2 to 3

Removal of the trees, tillage and planting of the crop move this site to the agriculture state.

Restoration pathway R 3-1

State 3 to 1

Site preparation, removal of drainage (if needed), seeding, and regular application of fire.

Restoration pathway R 3-2

State 3 to 2

Forestry planting/practice, no fire applied.

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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Contributors

Tyler Staggs

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	04/26/2024
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:**
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17. **Perennial plant reproductive capability:**
-