

Ecological site F111XD024IN

Deep Restricted

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 generally formed on residuum weathered from limestone and shale overlain with till or loess. The depth to the restrictive layer is greater than 40 inches. Drainage is moderately well to well drained with slopes generally from 2-25%. The characteristic vegetation of this site is that of a forest comprised largely of fire sensitive, shade tolerant species. The dominant canopy level species include sugar maple, tulip-tree, and American beech. Gap phase regeneration is the most common disturbance dynamic on the site and allows these species to reach the canopy. Windthrow and ice storms are larger scale disturbance mechanisms, but they incur very infrequently. The site can be susceptible to the establishment and dominance of the understory by woody, invasive, non-native species. Most of this historically woodland site is now being used for agriculture to include hay, pasture, and row crops.

Associated sites

F111XD022IN	Shallow Restricted Located on adjacent landscape positions; depth to soil restrictive layer is less than 20 inches.
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F111XD023IN	Moderately Deep Restricted Located on adjacent landscape positions; depth to soil restrictive layer is 20 to 40 inches.
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Similar sites

F111XD010IN	Till Ridge Located on glacial till parent material; soils do not have a restrictive layer; site located on a concave landscape position.
F111XD014IN	Lacustrine Forest Located on glacial till parent material; soils do not have a restrictive layer; site located on a convex landscape position; soils are poorly to somewhat poorly drained.
F111XD005IN	Till Depression Located on glacial till parent material; soils do not have a restrictive layer; site located on a convex landscape position; soils are moderately well to well drained.
F111XD009IN	Wet Till Ridge Located on lacustrine parent material; soils are somewhat poorly to moderately well drained.

Table 1. Dominant plant species

Tree	(1) <i>Acer saccharum</i> (2) <i>Liriodendron tulipifera</i>
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This ecosite is found in unspecified landscape in MLRA 111D, Indiana and Ohio Till Plain, Western Part. It is classified as an upland site and was formed on residuum with lithic contact being greater than 40 inches deep. It is located on backslopes, footslopes, shoulders, and summits.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Till plain
Flooding frequency	None
Ponding frequency	None
Elevation	107–320 m
Slope	2–25%
Ponding depth	0 cm
Water table depth	61–91 cm
Aspect	W, NW, N, NE, E, SE, S, SW

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 (characteristic range)	134-151 days
Freeze-free period (characteristic range)	176-182 days

Precipitation total (characteristic range)	1,016-1,118 mm
Frost-free period (actual range)	133-159 days
Freeze-free period (actual range)	171-187 days
Precipitation total (actual range)	991-1,194 mm
Frost-free period (average)	146 days
Freeze-free period (average)	179 days
Precipitation total (average)	1,067 mm

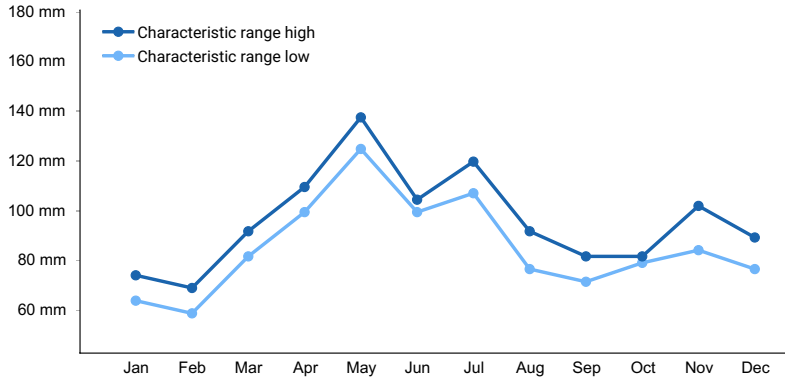


Figure 1. Monthly precipitation range

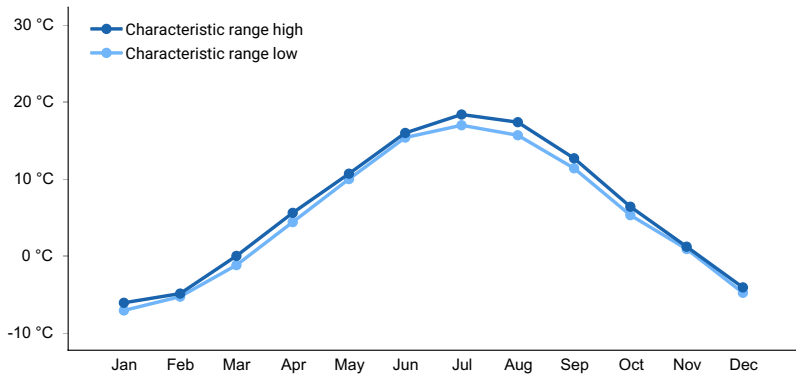


Figure 2. Monthly minimum temperature range

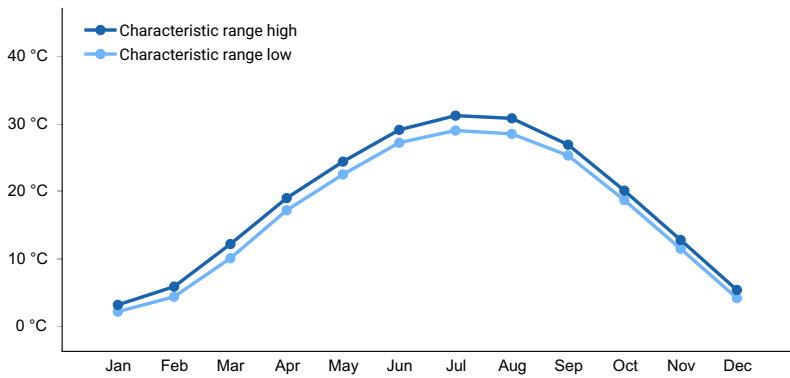


Figure 3. Monthly maximum temperature range

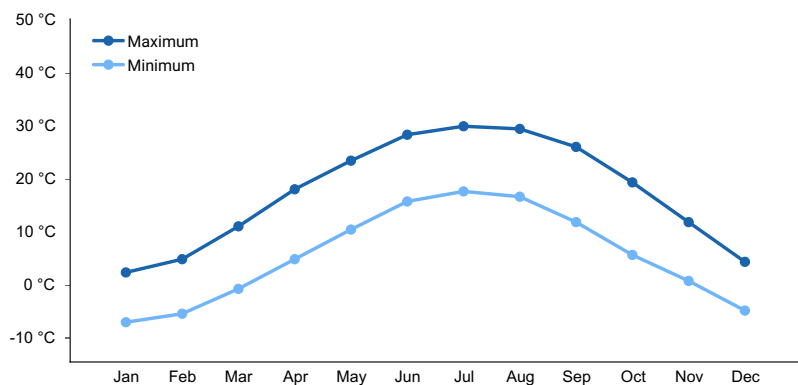


Figure 4. Monthly average minimum and maximum temperature

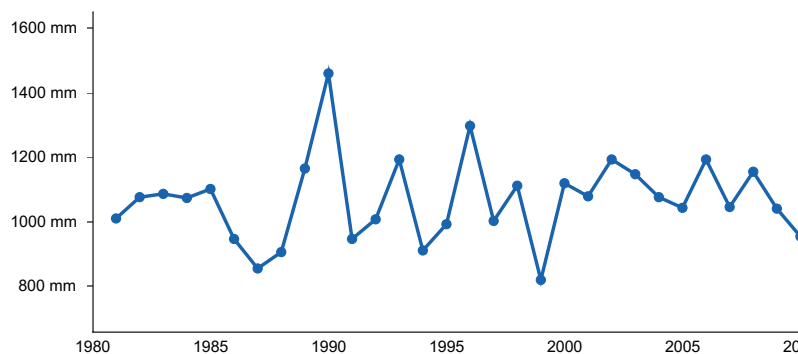


Figure 5. Annual precipitation pattern

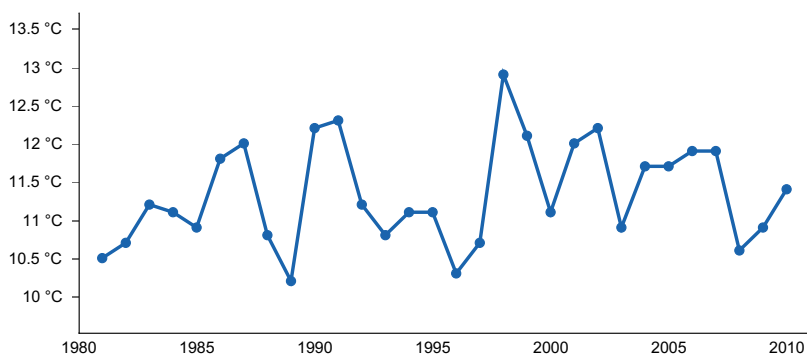


Figure 6. Annual average temperature pattern

Climate stations used

- (1) FRANKLIN [USC00332928], Franklin, OH
- (2) ROCKVILLE [USC00127522], Rockville, IN
- (3) FAIRFIELD [USC00332651], Hamilton, OH
- (4) TERRE HAUTE INDIANA ST [USC00128723], Terre Haute, IN
- (5) BOSWELL 4WNW [USC00120858], Fowler, IN
- (6) WILMINGTON 3 N [USC00339219], Wilmington, OH

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: Woolper, Switzerland, Pate, Morrisville, Loudon, Lawshe, Grayford, Carmel, Boston. They are deep to very deep, moderately well drained to well drained, and very slow to moderate permeable soils, with very strongly acidic to moderately alkaline soil reaction, that formed in Residuum from Calcareous shale, Limestone, Limestone and shale.

Table 4. Representative soil features

Parent material	(1) Residuum–calcareous shale
Surface texture	(1) Silt loam (2) Silty clay (3) Silty clay loam
Family particle size	(1) Clayey
Drainage class	Moderately well drained to well drained
Permeability class	Very slow to moderate
Soil depth	102–183 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	9.65–18.54 cm
Calcium carbonate equivalent (0-101.6cm)	0–13%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	5–7.3
Subsurface fragment volume <=3" (Depth not specified)	0–8%
Subsurface fragment volume >3" (Depth not specified)	0–13%

Ecological dynamics

The historic plant community of the Deep Restricted ecological site is a forest with the dominant species in the canopy being sugar maple, tulip-tree and beech. Canopy associates include white oak, shagbark hickory, hackberry and black walnut. This site is dominated by fire sensitive and shade tolerant species. Species with these characteristics make it to the canopy via gap-phase recruitment on a local scale. Since settlement, parts of this site has been converted to agricultural use with the majority being to grow hay or used as pasture. The areas still in natural vegetation are at risk of having their understory invaded and dominated by invasive species such as Asian honeysuckles and even Callery pear.

State and transition model

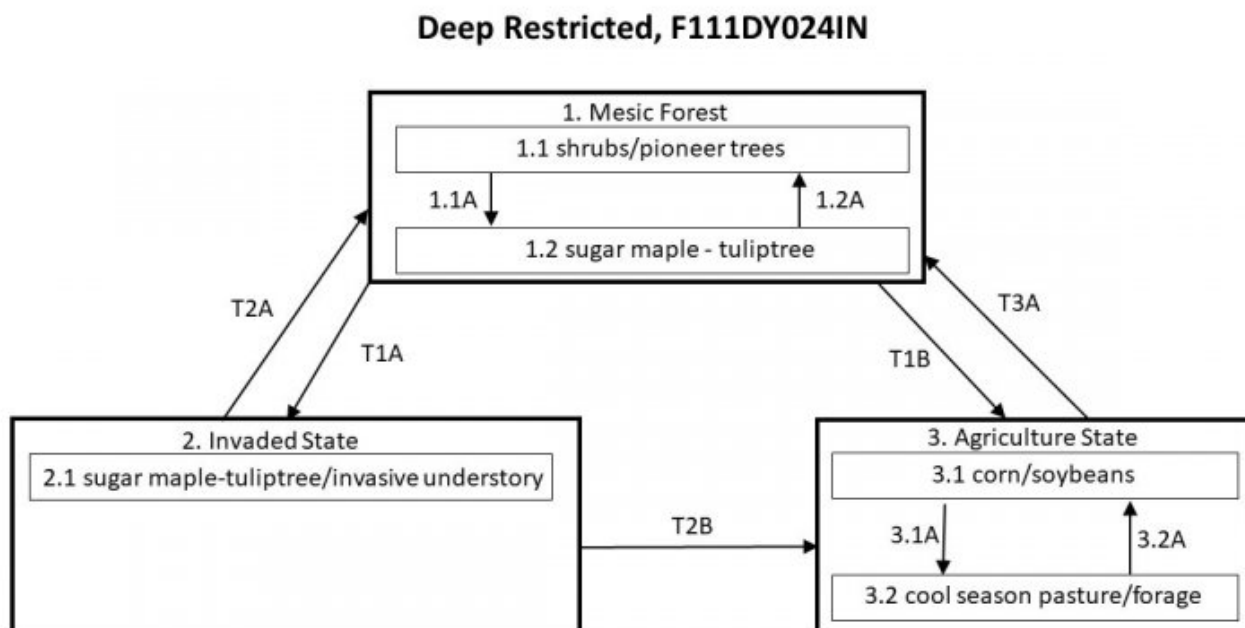


Figure 7. Deep Restricted

**Deep Restricted, F111DY024IN
Diagram Legend**

T1A	Invasive species establishment, no management
T1B	Remove woody species, drainage (if needed), site preparation, planting
T2A	Chemical/mechanical treatment of invasive species, timber stand improvements practices
T2B	Remove woody species, drainage (if needed), site preparation, planting
T3A	Drainage removal (if needed), planting, timber stand improvement practices
T3B	Drainage removal (if needed), planting, selective tree harvest
1.1A	Succession
1.2A	Disturbance that removes canopy trees
3.1A	Pasture/forage planting and management
3.2A	Conventional/no-till planting and management of row crops

Figure 8. Legend

**State 1
Mesic Forest**

This is the diagnostic plant community for this site. In reference condition, this site was dominated by sugar maple, beech, and tulip-tree. An earlier successional phase of this site is comprised largely of shrubs and pioneering species. Stand replacing events were very uncommon. Small gap disturbance was the most common disturbance event that allowed propagation of these species.

Community 1.1

shrubs/pioneer tree species

This phase is characterized by pioneering woody species that respond rapidly to increased light availability. Cover is generally very heavy, but not usually very tall. As time and succession progress, the trees become larger and less dense.

Community 1.2

sugar maple/beech

This phase is characterized by tree dominance, particularly sugar maple, tulip-tree, and beech. Additional canopy species include white oak, shagbark hickory, hackberry and black walnut.

Pathway CP 1.1-1.2

Community 1.1 to 1.2

Time and succession will move the site from this phase to the full expression of Community Phase 1.2

Pathway CP 1.2-1.1

Community 1.2 to 1.1

Disturbance, whether natural or as management, that removes a large portion of the trees will move the site towards phase 1.1

State 2

Invaded State

This state is characterized by the establishment and eventual dominance of invasive species in the understory. This greatly reduces the species richness and diversity of the site as a whole. Common invasives for this site include, but are not limited to, species of Asian bush honeysuckle, Callery pear, autumn olive and ailanthus.

Community 2.1

sugar maple/beech/basswood/invasives

This phase is characterized by the understory being dominated by woody, mostly non-native, invasive species.

State 3

Agriculture State

This state is characterized by the conversion of the site to agricultural use. Most common practice is a corn and soybean rotation of various types. A small portion of the historic acres are used for forage and pasture.

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 CP 3.1-3.2

Community 3.1 to 3.1

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

Pathway P3.1 **Community 3.1 to 3.2**

Establishment of forage species

Pathway P3.2 **Community 3.2 to 3.1**

Planting of row crops.

Transition T 1-2 **State 1 to 2**

Establishment of invasive species with not management to control them will move the site towards state #2.

Transition T 1-3 **State 1 to 3**

The site is converted to the Agriculture State (#3) after the woody species are removed, the crops planted, and implementation of agricultural practices. For this site, cool season forage and pasture is more common than row crop agriculture.

Restoration pathway R 2-1 **State 2 to 1**

Chemical and mechanical treatment of the invasive species. Planting of desired species may be needed if they are not enough left to recolonize the site.

Transition T 2-3 **State 2 to 3**

Removal off trees and other wood species. Install drainage system (if warranted), prepare the site for planting the agricultural crop, and regular agricultural practices.

Restoration pathway R 3-1 **State 3 to 1**

Removal of drainage system (if warranted), site preparation, and tree planting.

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	05/03/2024
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:**
-