

Ecological site R111XD027IN Sand Dune

Last updated: 5/28/2020
Accessed: 05/04/2024

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.

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 form on sandy, wind and water deposited, parent materials. It is located on the summits, shoulders, and steep back slopes of dune topography. The soils of the site somewhat coarser textured, very deep, and well drained to excessively well drained. The characteristic vegetation of this site is that of a dry sand savanna that is somewhat of a transition between the adjacent oak woodlands and dry tall-grass prairie. The relatively sparse trees are dominated mostly by black oak, but white oak was also common. Fire frequency and intensity were the principle drivers that maintained the site. Frequent low intensity ground fires kept the tree species from becoming more dominant and allowed the herbaceous species to be co-dominant on the site. The herbaceous species that are most common are those found in dry tall grass prairies such as little bluestem, big bluestem, and diverse assemblage of prairie forb species. An increase in the fire return interval allows this site to transition to a woodland state by allowing more trees to reach maturity. Currently, the majority of this site is in the agriculture state and mostly used for corn and soybean production.

Associated sites

| | |
|-------------|---|
| F111XD025IN | Sandy Interdune Located on an interdune landscape position (footslopes and toeslopes). |
| R111XD026IN | Sand Dune Prairie Located on dune landscape position; soil surface color is 3/2 Munsell or darker and extends for more than 10 inches; soils are mollisols. |

Similar sites

| | |
|-------------|--|
| R111XD006IN | Mollic Till Depression Located on glacial till parent material; site is located on a concave landscape position; soil surface color is 3/2 Munsell or darker to less than 10 inches. |
| R111XD011IN | Mollic Till Ridge Located on glacial till parent material; site is located on a convex landscape position; soil surface color is 3/2 Munsell or darker to less than 10 inches. |
| R111XD019IN | Outwash Integrate Located on outwash parent material; soil color is 3/2 Munsell or darker to less than 10 inches. |

Table 1. Dominant plant species

| | |
|------------|---|
| Tree | (1) <i>Quercus velutina</i> |
| Shrub | Not specified |
| Herbaceous | (1) <i>Schizachyrium scoparium</i> (2) <i>Hesperostipa spartea</i> |

Physiographic features

This ecosite is found in unspecified landscape in MLRA 111D: Indiana and Ohio Till Plain, Western Part. This site was formed from Eolian sand deposits. It is located on the summits, shoulders, and backslopes. The water table depth is greater than 60 inches.

Table 2. Representative physiographic features

| | |
|--------------------|-----------|
| Landforms | (1) Dune |
| Flooding frequency | None |
| Ponding frequency | None |
| Elevation | 104–381 m |
| Slope | 0–30% |
| Ponding depth | 0 cm |
| Water table depth | 152 cm |
| 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 (characteristic range) | 131-148 days |
|--|--------------|

| | |
|--|--------------|
| Freeze-free period (characteristic range) | 171-187 days |
| Precipitation total (characteristic range) | 991-1,092 mm |
| Frost-free period (actual range) | 108-159 days |
| Freeze-free period (actual range) | 169-189 days |
| Precipitation total (actual range) | 991-1,118 mm |
| Frost-free period (average) | 135 days |
| Freeze-free period (average) | 179 days |
| Precipitation total (average) | 1,041 mm |

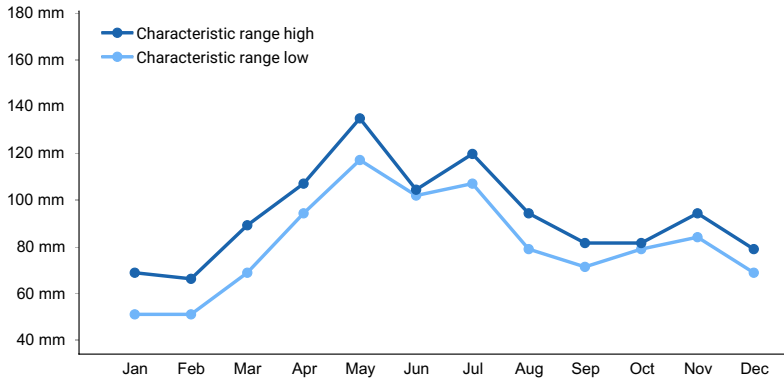


Figure 1. Monthly precipitation range

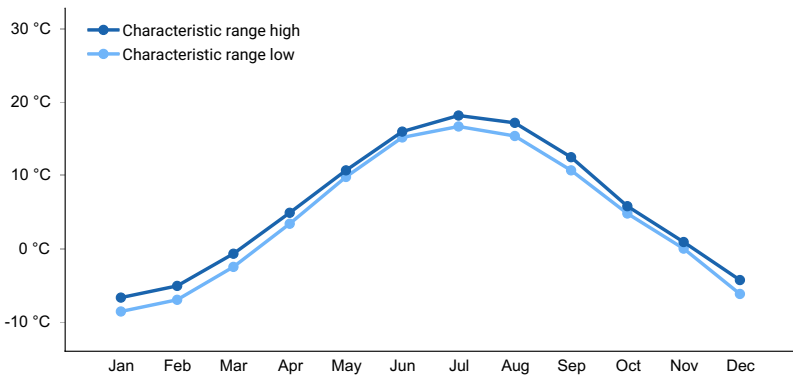


Figure 2. Monthly minimum temperature range

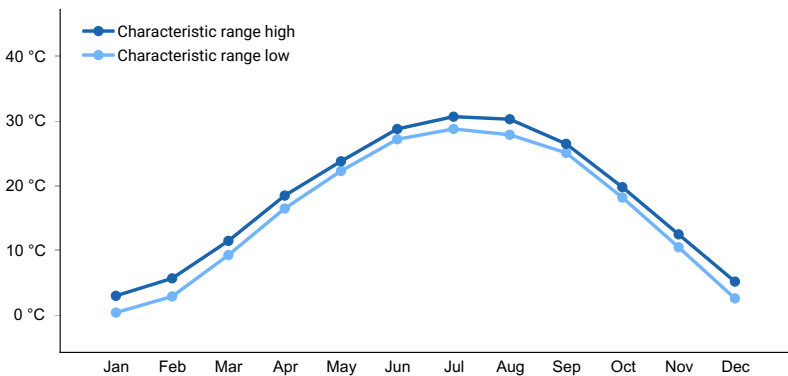


Figure 3. Monthly maximum temperature range

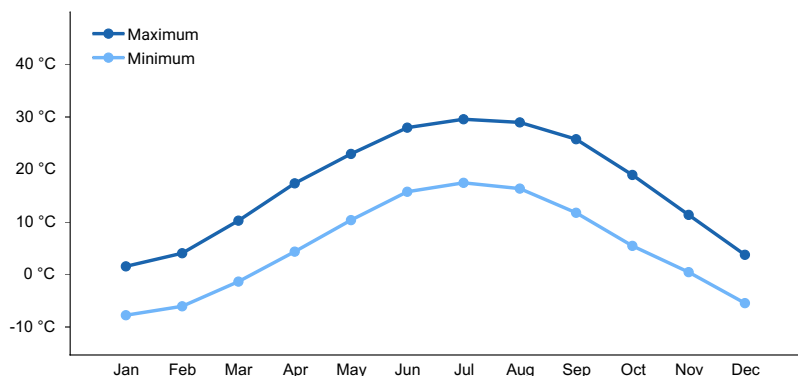


Figure 4. Monthly average minimum and maximum temperature

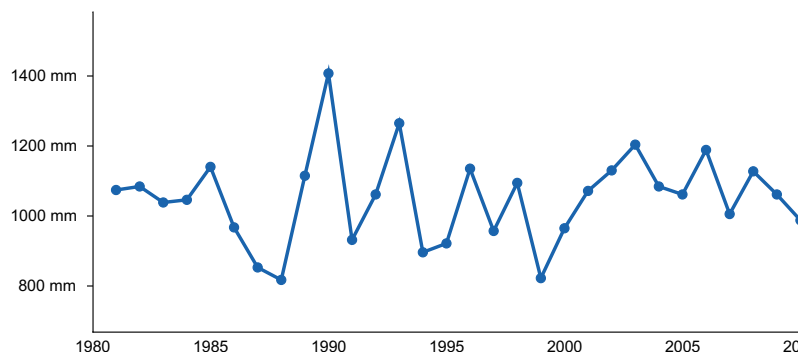


Figure 5. Annual precipitation pattern

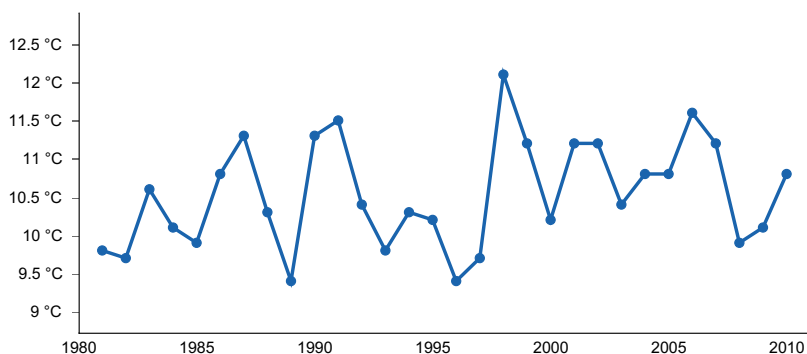


Figure 6. Annual average temperature pattern

Climate stations used

- (1) ATTICA 2E [USC00120331], Attica, IN
- (2) TERRE HAUTE INDIANA ST [USC00128723], Terre Haute, IN
- (3) FAIRFIELD [USC00332651], Hamilton, OH
- (4) WABASH [USC00129138], Wabash, IN
- (5) BOSWELL 4WNW [USC00120858], Fowler, IN
- (6) JAMESTOWN 2 E [USC00124356], Lizton, IN
- (7) 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: Princeton, Chelsea, Alvin. They are very deep, well drained to excessively drained, and moderate to rapid permeable soils, with very strongly acidic to neutral soil reaction, that formed in Eolian deposits and Eolian sands.

Table 4. Representative soil features

| | |
|--|--|
| Parent material | (1) Eolian deposits (2) Eolian sands |
| Surface texture | (1) Fine sand (2) Loamy fine sand (3) Sandy loam |
| Family particle size | (1) Sandy |
| Drainage class | Well drained to excessively drained |
| Permeability class | Moderate to rapid |
| Soil depth | 203 cm |
| Surface fragment cover <=3" | 0% |
| Surface fragment cover >3" | 0% |
| Available water capacity (0-101.6cm) | 5.33–17.53 cm |
| Calcium carbonate equivalent (0-101.6cm) | 0% |
| Electrical conductivity (0-101.6cm) | 0 mmhos/cm |
| Sodium adsorption ratio (0-101.6cm) | 0 |
| Soil reaction (1:1 water) (0-101.6cm) | 5.3–6.7 |
| Subsurface fragment volume <=3" (Depth not specified) | 2–7% |
| Subsurface fragment volume >3" (Depth not specified) | 0% |

Ecological dynamics

The historic plant community of the Sand Dune ecological site is a dry sand savanna. This site is characterized by the ebb and flow of the co-dominant tall grass prairie species and oak species, primarily black oak. This dynamic was driven by the fire frequency and intensity.

The canopy tree cover varied from about 5 to 60 percent and dominated by black oak. Other prominent tree species include white oak, black cherry, and hickory species. The ground layer is dominated by graminoids with the most common species being little bluestem, porcupine grass, and big bluestem.

Ground fires was the most common disturbance for this site. These frequent, but lower intensity fires, in conjunction with wind throw would maintain the function of the site. Replacement fires would have occurred roughly every 200 years.

Since settlement, the majority of this site has been converted to agricultural use with the majority being row crop agriculture. The most common practice involves grain rotations between corn and soybeans, with occasionally wheat being planted

State and transition model

Sandy Dune, R111DY027IN

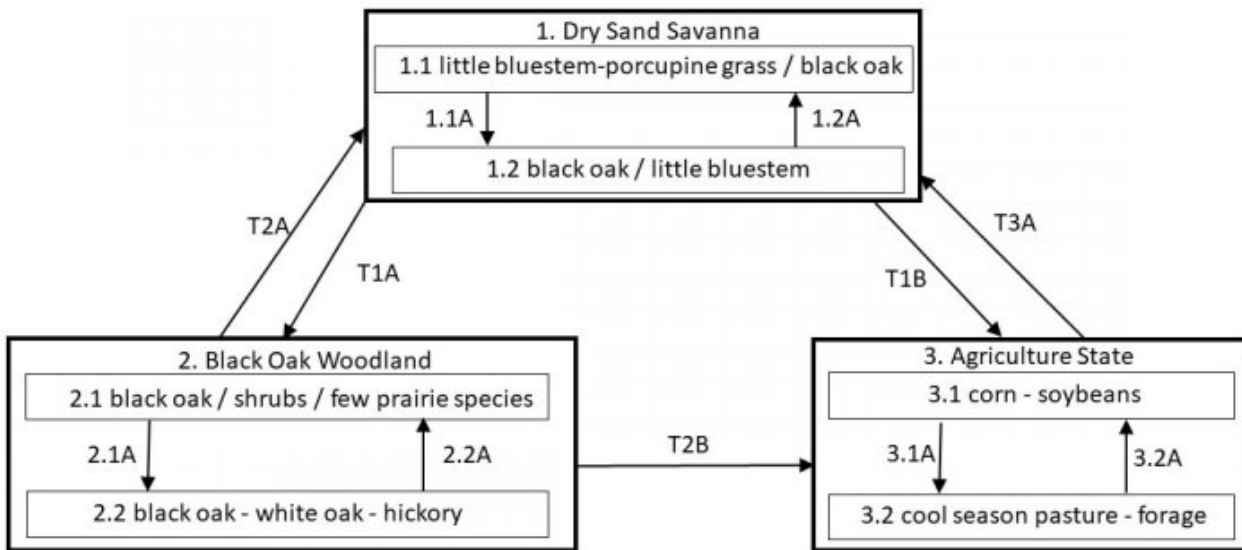


Figure 7. R111DY027IN

Sandy Dune, R111DY027IN

Diagram Legend

| | |
|------|--|
| T1A | Increased fire absence, no woody species management |
| T1B | Remove woody species, site preparation, planting |
| T2A | Remove canopy trees, increase fire frequency/intensity, planting |
| T2B | Remove woody species, site preparation, planting |
| T3A | Planting, fire |
| 1.1A | Succession, increase in fire return interval |
| 1.2A | More frequent/intense fire |
| 2.1A | Lack of fire, no woody species management |
| 2.2A | Tree removal, fire |
| 3.1A | Pasture/forage planting and management |
| 3.2A | Conventional/no-till planting and management of row crops |

Figure 8. Legend

State 1 Dry Sand Savanna

This site has largely been converted to agricultural use. Roughly 75% 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 1.1

little bluestem/black oak/porcupine grass

This phase is characterized by recent or frequently occurring ground fires that shift the co-dominance towards the herbaceous species. Longer fire return intervals will move this towards phase 2.

Community 1.2 black oak/little bluestem

This phase is characterized by protection from or longer time since the last fire. Trees and herbaceous species are co-dominant during this phase. More frequent/intense fire will shift this phase back to phase 1. Increased fire absence and no woody species management will move this site toward State 2, characterized by the marked increase in shrubs.

Pathway CP 1.1 -1.2 Community 1.1 to 1.2

Lack of fire.

Pathway CP 1.2 - 1.1 Community 1.2 to 1.1

Natural fire regime and/or removal of trees.

State 2 Black Oak Woodland

Absence of fire and/or lack of woody vegetation management will move this site to the black oak woodland state. This state is characterized by an increase in tree canopy (61-100%) concomitant with shrub species becoming the dominant growth form in the understory. Black oaks will still be the dominant tree species, but white oaks and hickory become more dominant. Sub canopy and shrub species include the dogwood species, sassafras, and hazelnut species. Continued suppression of disturbance will lead to this site being a closed canopy oak-dominated forest at the higher end of the suggested canopy range. White oak eventually becomes the dominant tree species with black oak, shagbark hickory and black cherry also in the canopy.

Community 2.1 black oak/shrub/few prairie species

This phase is characterized by protection from or longer time since the last fire. Trees are the dominant growth form and shrubs are the secondary growth form. Timber cutting, more frequent/intense fire, and seeding will transition this phase back to State 1. Increased fire absence and no woody species management will move this site toward phase 2, characterized by shift in tree species.

Community 2.2 black oak/white oak/ hickory

This phase is characterized by near lack of fire. Trees are the dominant growth form. White oaks and hickory species become more common/prevalent in the canopy. Timber cutting, more frequent/intense fire, and seeding will transition this phase back to phase 1.

Pathway CP 2.1 - 2.2 Community 2.1 to 2.2

Increase in tree species due to lack of natural fire regime.

Pathway CP 2.2 -2.1 Community 2.2 to 2.1

Increase in fire intervals.

State 3 Agriculture

This site has largely been converted to agricultural use. Roughly 75% 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 Row Crop Agriculture

This phase is characterized by row crop agriculture of small grains, primarily corn, soybeans, and occasionally wheat. Seeding and management could transition this phase to phase 2.

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. Tillage, seeding and management could transition this phase to phase 1.

Pathway CP 3.1 Community 3.1 to 3.2

Establishment of pasture/forage species.

Pathway CP 3.2 Community 3.2 to 3.1

Establishment of row crop production.

Restoration pathway R3A State 1 to 1

Site prep, seeding, fire

Transition T1A State 1 to 2

Increased fire absence, no woody species management.

Transition T1B State 1 to 3

Remove woody species, site preparation, planting

Restoration pathway R2A State 2 to 1

Timber cutting, seeding, fire.

Transition T2B State 2 to 3

Remove woody species, site preparation, planting

Restoration pathway R3A State 3 to 1

Site prep, seeding, fire

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) | |
| Contact for lead author | |
| Date | 05/04/2024 |
| 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:**
-