Ecological site F111XD018IN
Dry Outwash Upland

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 Crawfordville, 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 to excessively drained. The soils have a relatively light soil surface color (lighter than 3/2 Munsell). This site is found on, generally, steeper topography than the Outwash Upland site which leads to it being better drained and drier. Slopes for this site can range from flat (summits) to quite steep with an average maximum of 20 percent.

The characteristic vegetation of the site is that of a somewhat dry forest dominated largely by oak species, such as black oak and white oak that can tolerate the increased drainage of the site. Hickory species are also common throughout the site along with suger maple in somewhat fire protected areas, black cherry, and sassafras. Moderate fire return interval (40-60yrs) for low intensity fires and stand replacing fires every 100-200yrs contributed to the dominance of oak species on the site. Changes in the fire regime have led to many of the extant representation of the site to have a greater amount of fire sensitive, shade tolerate species occupying both the understory and canopy than what was present at the time of European settlement. Currently, the majority of the site is in agricultural production, with the majority being used for growing corn and soybeans, though some areas are used for growing cool season forage and pasture.

Associated sites

F111XD017IN	**Outwash Upland** Located on adjacent landscapes; soils are somewhat poorly to moderately well drained.
R111XD019IN	**Outwash Integrade** 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 very poorly to somewhat poorly drained.
R111XD021IN	**Dry 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

F111XD025IN	**Sandy Interdune** Located on adjacent landscapes; soils are somewhat poorly to moderately well drained
F111XD017IN	**Outwash Upland** Located on sandy parent material on an interdunal landscape position.

Table 1. Dominant plant species

Tree	(1) *Quercus alba* (2) *Quercus velutina*
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This ecosite is found in outwash plain, river valley, till plain, upland in MLRA 111D: Indiana and Ohio Till Plain, Western Part.

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

Soils in this CTSG have a pH less than 5.0 within 20 inches of the surface and are deep loamy, moderately well drained to well drained soils. The depth to a water table during the growing season is greater than 1.5 feet. Flooding frequency ranges from none to rare. The available water capacity is at least 9 inches. Soil depth is greater than 40 inches to a restrictive layer. Sodium adsorption rates are less than 1.

Table 2. Representative physiographic features

Landforms	(1) Outwash terrace (2) Outwash plain
Flooding frequency	None
Ponding frequency	None
Elevation	341–1,358 ft
Slope	0–20%
Ponding depth	0 in
Water table depth	57–60 in
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)	133-149 days
Freeze-free period (characteristic range)	173-184 days
Precipitation total (characteristic range)	41-43 in
Frost-free period (actual range)	113-157 days
Freeze-free period (actual range)	169-189 days
Precipitation total (actual range)	39-44 in
Frost-free period (average)	137 days
Freeze-free period (average)	179 days
Precipitation total (average)	42 in

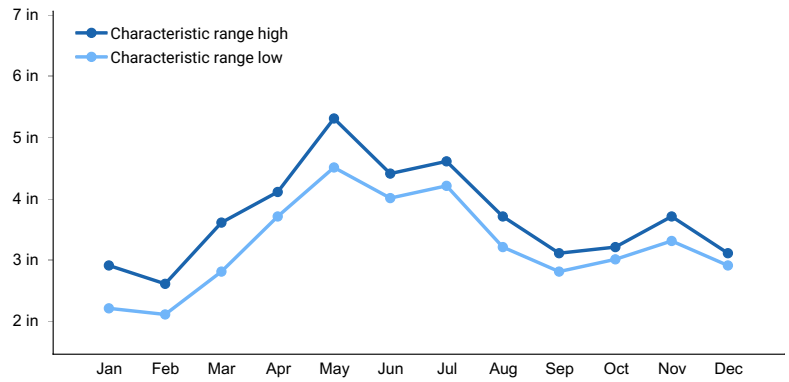

Figure 1. Monthly precipitation range

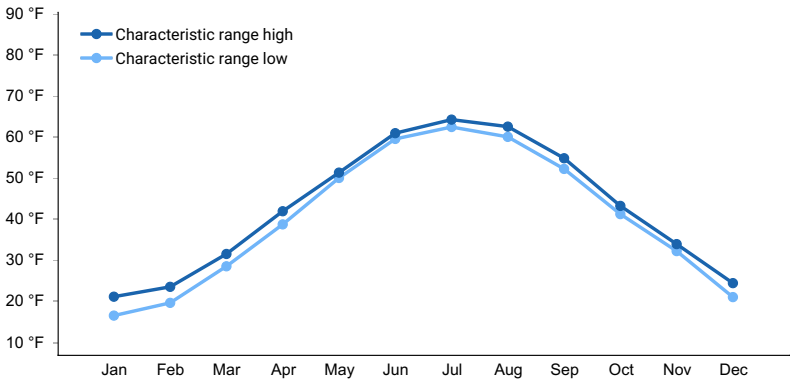

Figure 2. Monthly minimum temperature range

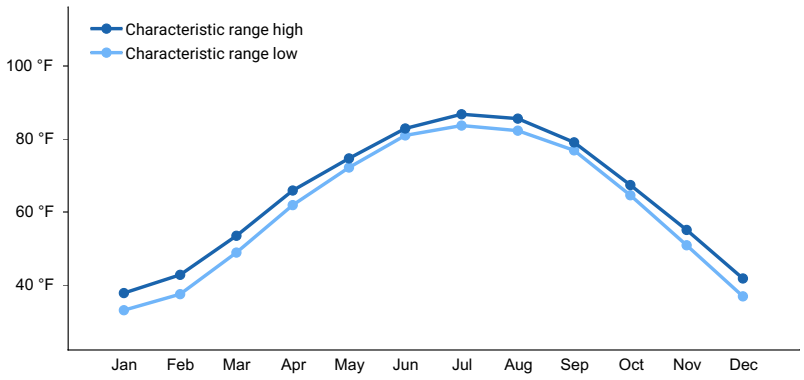

Figure 3. Monthly maximum temperature range

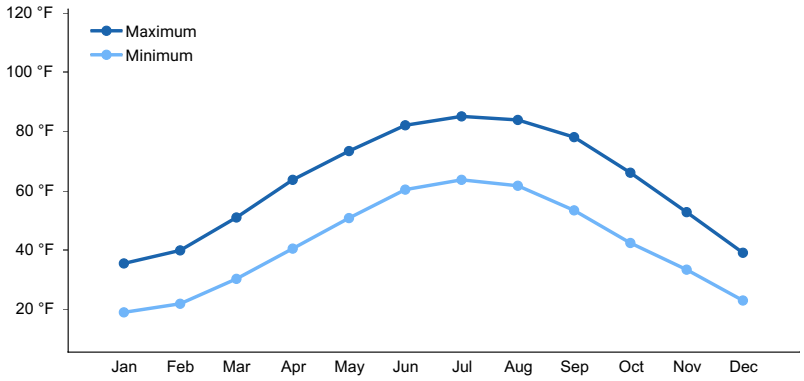

Figure 4. Monthly average minimum and maximum temperature

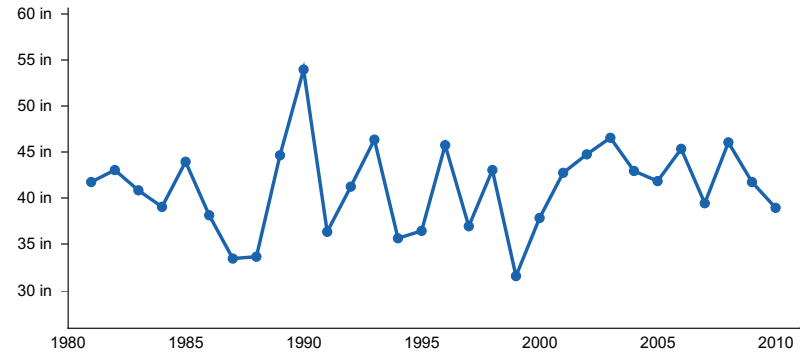

Figure 5. Annual precipitation pattern

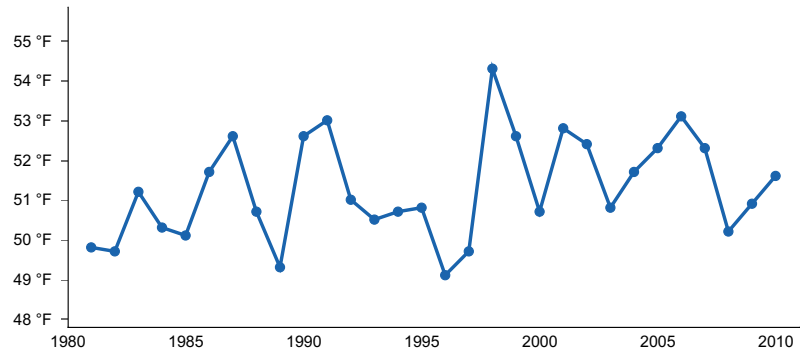

Figure 6. Annual average temperature pattern

Climate stations used

- (1) FRANKFORT DISPOSAL PLT [USC00123082], Frankfort, IN
- (2) ATTICA 2E [USC00120331], Attica, IN
- (3) FAIRFIELD [USC00332651], Hamilton, OH

- (4) XENIA 6 SSE [USC00339361], Xenia, OH
- (5) TERRE HAUTE INDIANA ST [USC00128723], Terre Haute, IN
- (6) JAMESTOWN 2 E [USC00124356], Lizton, IN
- (7) BOSWELL 4WNW [USC00120858], Fowler, IN
- (8) WABASH [USC00129138], Wabash, IN
- (9) HAMILTON BUTLER CO RGNL AP [USW00053855], Fairfield, OH
- (10) 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: Williamsburg, Wawaka, Spinks, Sparta, Sisson, Silverwood, Rush, Parke, Oshtemo, Ormas, Ockley, Negley, Mudlavia, Martinsville, Kosciusko, Kendallville, Kalamazoo, Fox, Eldean, Coloma, Casco, Camden, Boyer, Angatoka. They are very deep, well drained to excessively drained, and slow to very rapid permeable soils, with strongly acidic to neutral soil reaction, that formed in Outwash.

Table 4. Representative soil features

Parent material	(1) Outwash–siltstone
Surface texture	(1) Cobbly loamy fine sand (2) Gravelly loamy sand (3) Sand
Family particle size	(1) Sandy
Drainage class	Well drained to excessively drained
Permeability class	Slow to very rapid
Soil depth	13–94 in
Surface fragment cover <=3"	1–2%
Surface fragment cover >3"	1%
Available water capacity (0-40in)	2.7–8.3 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)	5.3–7.9
Subsurface fragment volume <=3" (Depth not specified)	0–35%
Subsurface fragment volume >3" (Depth not specified)	0–21%

Ecological dynamics

The historic plant community of the Dry Outwash Upland is oak-hickory forest. The forest canopy is dominated by white oak, black oak, and hickory species, with sugar maple, black cherry and sassafras being present as well. Fire was a major disturbance mechanism for this site with return intervals greater than 15 years. Currently, much of this site is being used for agriculture production.

State and transition model

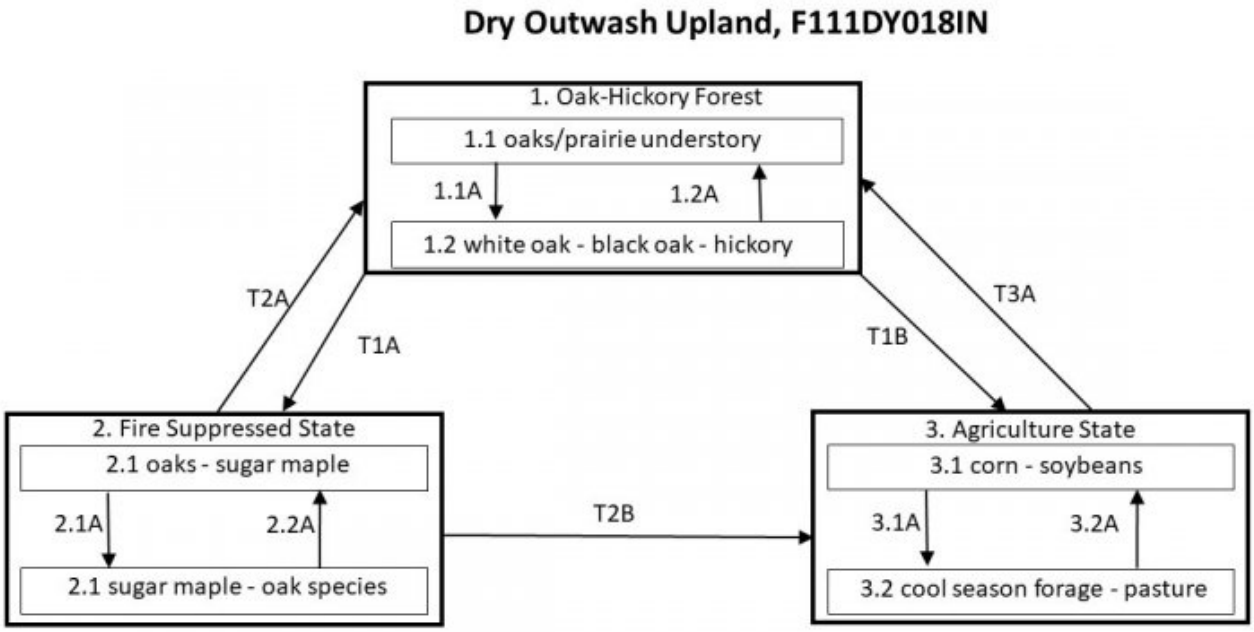

Figure 7. Dry Outwash Upland

Dry Outwash Upland, F111DY018IN

Diagram Legend

T1A	No management, no fire
T1B	Remove woody species, site preparation, planting, management
T2A	Prescribed tree thinning, fire
T2B	Remove woody species, site preparation, planting, management
T3A	Tree planting, timber stand improvement practices, fire
1.1A	Succession
1.2A	Fire, disturbance that removes canopy trees
2.1A	No management or disturbance
2.2A	Selective tree harvest
3.1A	Pasture/forage planting and maintenance
3.2A	Tillage/no-till planting and management of row crops.

Figure 8. Legend

State 1
Oak-Hickory Forest

This is the reference or diagnostic plant community for this site. In reference conditions, this forested site was dominated by white oak, black oak, and hickory species in the canopy. Secondary species included sugar maple, black cherry and sassafras. Brambles and native roses were common in the understory. Less common, but present were some of the prairie species such as Pennsylvania sedge and big bluestem.

Community 1.1
oaks/prairie understory

Short time since the last fire or more frequent fires or timber stand improvement have this phase closely resembling that of an oak savanna. Prairie grass species such as big bluestem and Indiangrass become more prominent and abundant.

Community 1.2
white oak/black oak/hickory

This community phase is an oak-hickory forest. The forest canopy is dominated by white oak, black oak, and hickory species, with sugar maple, black cherry and sassafras being present as well. Fire was a major disturbance mechanism for this site with return intervals greater than 15 years.

Pathway CP 1.1-1.2
Community 1.1 to 1.2

Fire intervals exceeding 15 years and succession of the site will move this community phase towards 1.2.

Pathway CP 1.2-1.1
Community 1.2 to 1.1

Fire or any disturbance or management that removes the majority of the canopy trees will move this towards community phase 1.1.

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. Shade tolerant species, specifically sugar maple and beech, that are present in the understory in relatively small amounts become the dominant tree species.

Community 2.1
white oak/sugar maple

This state is characterized by a longer than normal fire return interval (100+ years) or the absence of fire. Sugar maple becomes quite common in the canopy.

Community 2.2
sugar maple/oak species

This state is characterized by a longer than normal fire return interval (150+ years) or the absence of fire. Sugar maple becomes the dominant canopy tree species with some oaks being present.

Pathway CP 2.1-2.2
Community 2.1 to 2.2

No management or disturbance to remove trees allow shade tolerant, fire resistant trees to become dominant.

Pathway CP 2.2-2.1
Community 2.2 to 2.1

Selective tree harvest to create openings for oaks 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 pasture/forage

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 3.2

Planting of cool season forage and pasture species along with appropriate management of those species will move this phase to 3.2.

Pathway CP 3.2-3.1
Community 3.2 to 3.1

Conventional or no-till planting of row crops and associated practices will move this phase to 3.1.

Transition T 1-2
State 1 to 2

No management, to include fire, or other large disturbance to remove trees from the canopy will allow the site to move towards State #2.

Transition T 1-3
State 1 to 3

Removal of the tree species, tillage, and planting of the agricultural crop transition the site to state 3.

Restoration pathway R 2-1
State 2 to 1

Prescribed tree thinning to give competitive advantage to desired species and fire move the site back to the reference state.

Transition T 2-3
State 2 to 3

All trees removed, the site prepared, tillage and planting the of the agricultural crop.

Restoration pathway R 3-1
State 3 to 1

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

Additional community tables

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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	04/19/2024
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:

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

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

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

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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:**
