USDA Natural Resources Conservation Service

Ecological site R115XA105IL
Wet Sandy Terrace

Last updated: 12/30/2024
Accessed: 01/09/2025

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): 115X–Central Mississippi Valley Wooded Slopes

This MLRA is characterized by deeply dissected, loess-covered hills bordering well defined valleys of the Illinois, Mississippi, Missouri, Ohio, and Wabash Rivers and their tributaries. It is used to produce cash crops and livestock. About one-third of the area is forested, mostly on the steeper slopes. This area is in Illinois (50 percent), Missouri (36 percent), Indiana (13 percent), and Iowa (1 percent) in two separate areas. It makes up about 25,084 square miles (64,967 square kilometers).

Most of this area is in the Till Plains section and the Dissected Till Plains section of the Central Lowland province of the Interior Plains. The Springfield-Salem plateaus section of the Ozarks Plateaus province of the Interior Highlands occurs along the Missouri River and the Mississippi River south of the confluence with the Missouri River. The nearly level to very steep uplands are dissected by both large and small tributaries of the Illinois, Mississippi, Missouri, Ohio, and Wabash Rivers. The Ohio River flows along the southernmost boundary of this area in Indiana. Well defined valleys with broad flood plains and numerous stream terraces are along the major streams and rivers. The flood plains along the smaller streams are narrow. Broad summits are nearly level to undulating. Karst topography is common in some parts along the Missouri and Mississippi Rivers and their tributaries. Well-developed karst areas have hundreds of sinkholes, caves, springs, and losing streams. In the St. Louis area, many of the karst features have been obliterated by urban development.

Elevation ranges from 90 feet (20 meters) on the southernmost flood plains to 1,030 feet (320 meters) on the highest ridges. Local relief is mainly 10 to 50 feet (3 to 15 meters) but can be 50 to 150 feet (15 to 45 meters) in the steep, deeply dissected hills bordering rivers and streams. The bluffs along the major rivers are generally 200 to 350 feet (60 to 105 meters) above the valley floor.

The uplands in this MLRA are covered almost entirely with Peoria Loess. The loess can be more than 7 feet (2 meters) thick on stable summits. On the steeper slopes, it is thin or does not occur. In Illinois, the loess is underlain mostly by Illinoian-age till that commonly contains a paleosol. Pre-Illinoian-age till is in parts of this MLRA in Iowa and Missouri and to a minor extent in the western part of Illinois. Wisconsin-age outwash, alluvial deposits, and sandy eolian material are on some of the stream terraces and on dunes along the major tributaries. The loess and glacial deposits are underlain by several bedrock systems. Pennsylvanian and Mississippian bedrock are the most extensive. To a lesser extent are Silurian, Devonian, Cretaceous, and Ordovician bedrock. Karst areas have formed where limestone is near the surface, mostly in the southern part of the MLRA along the Mississippi River and some of its major tributaries. Bedrock outcrops are common on the bluffs along the Mississippi, Ohio, and Wabash Rivers and their major tributaries and at the base of some steep slopes along minor streams and drainageways.

The uplands in this area support natural hardwoods. Oak, hickory, and sugar maple are the dominant species. Big bluestem, little bluestem, and scattered oak and eastern redcedar grow on some sites. The soils on flood plains support mixed forest vegetation, mainly American elm, eastern cottonwood, river birch, green ash, silver maple, sweetgum, American sycamore, pin oak, pecan, and willow. Sedge and grass meadows and scattered trees are on some low-lying sites. (United States Department of Agriculture, Natural Resources Conservation Service, 2022)

LRU notes

Most of this LRU (Land Resource Unit) is in the glaciated Till Plains Section of the Central Lowland Province of the Interior Plains. The southeast corner is in the Highland Rim Section (locally known as the Shawnee Hills Section) of the Interior Low Plateaus Province of the Interior Plains. The nearly level to very steep uplands in this LRU are dissected by both large and small tributaries of the Wabash and Ohio Rivers. Well defined valleys with broad flood plains and numerous stream terraces are along the major streams and rivers. The flood plains along the smaller streams are narrow. Broad summits are nearly level to gently sloping.

This area is covered almost entirely with Wisconsin loess, also known as Peoria loess. The loess can be more than 7 feet (2 meters) thick on stable summits. On the steeper slopes, it is thin or does not occur. The loess throughout the area is underlain dominantly by glacial till. Wisconsin outwash, alluvial deposits, and sandy eolian material are on some of the stream terraces and on dunes along the major tributaries in the area. The loess and glacial drift are underlain by Pennsylvanian-age bedrock. Bedrock outcrops are common in the walls of the valleys along the Wabash and Ohio Rivers and at the base of some steep slopes along minor streams and drainageways.

The dominant soil orders in this LRU are Alfisols, Entisols, Inceptisols, and Mollisols. The soils in the area have a mesic soil temperature regime, a udic or aquic soil moisture regime, and dominantly mixed or smectitic mineralogy. The soils are very deep, poorly drained to excessively drained, and loamy, silty, or clayey. Nearly level Endoaqualfs (Iva series) and Argiaquolls (Ragsdale series) formed in loess on broad upland summits and flats. Nearly level to steep Hapludalfs (Alford, Iona, Muren, Stoy, and Sylvan series) and Fragiudalfs (Hosmer series) formed in loess on uplands. Hapludalfs (Alvin, Bloomfield, and Princeton series) and Argiudolls (Ade series) formed in sandy eolian material in areas of dunes on uplands and stream terraces. Steep and very steep Hapludalfs (Hickory series) formed in Illinoian till along the major streams and dissected upland drainageways. Hapludalfs (Wellston series) formed in siltstone or sandstone residuum on strongly sloping to steep side slopes underlain by bedrock.

The soils in the major stream valleys include Hapludolls (Carmi series), Argiudolls (Elston series), and Hapludalfs (Skelton series), all of which formed in outwash on nearly level to moderately sloping stream terraces and outwash plains. Endoaquolls (Montgomery series), Endoaquepts (Zipp series), Epiaqualfs (McGary series), and Hapludalfs (Shircliff and Markland series) formed in clayey lacustrine sediments on nearly level to strongly sloping lacustrine terraces or lake plains. Endoaquepts (Evansville series), Endoaquolls (Patton series), and Hapludalfs (Henshaw and Uniontown series) formed in silty sediments on terraces and lake plains.

LRU notes (excerpts from Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. USDA Handbook 296, 2006)

Classification relationships

Major Land Resource Area (MLRA) 115X–Central Mississippi Valley Wooded Slopes

U.S. Forest Service Ecoregions (Cleland et al. 2007):
Domain: Humid Temperate Domain
Division: Hot Continental Division
Province: Eastern Broadleaf Forest (Continental)
Province Code: 222
Section Code: 222G, 222D

Ecological site concept

The historic reference community is an open deciduous woodland with a substantial oak component. These sites are somewhat poorly drained to very poorly drained, so there will be a range of vegetative communities depending on drainage, flooding, ponding, and topography. Slopes range from 0-7 percent which is enough to impact micro-drainage and plant community composition. These stream terrace sites will exhibit a mosaic of species across the broader landscape. Common tree species may include numerous oak species including swamp white oak, Shumard oak, bur oak, and pin oak. Other trees on site will include shellbark hickory, green ash, American elm, and red maple. With a natural fire regime during dry periods, the canopy density was moderate to open and a number of prairie-type species in the understory.

Today, most of these sites are in agricultural production or have a history of repeated anthropogenic disturbances such as clearing, grazing, development, fire suppression, invasive species, or selective harvest (oak removal). Long-term absence of a natural fire regime has transitioned these sites to a mixed woodland that includes numerous tree species depending on seed sources and severity of disturbance. Many of these sites have been ditched or tiled to alter the natural hydrology. These disturbances often transition the forest community to one dominated by fast-growing, shade-tolerant species such as red maple, silver maple, ash, and cottonwood. The resulting dense canopy shade and shrub growth often results in a somewhat sparse understory community. Many ruderal forest communities may be found on these sites today.

Associated sites

R115XA102IL	**Dry Sand Dunes** Dry Sand Dune. These sites are on uplands and are somewhat excessively to excessively drained.
R115XA101IL	**Wet Sand Dunes** Wet Sand Dune. These sites are on uplands and are somewhat poorly drained to poorly drained.
R115XA103IL	**Sand Dunes** Sand Dune. These sites are on uplands and are well drained.
R115XA104IL	**Sandy Terrace** Sandy Terrace. These sites are on terraces and are well drained.

Similar sites

R115XA101IL	**Wet Sand Dunes** Wet Sand Dune. These sites are on uplands and are poorly drained.

Table 1. Dominant plant species

Tree	(1) *Quercus bicolor* (2) *Carya laciniosa*
Shrub	Not specified
Herbaceous	(1) *Carex* (2) *Cinna*

Physiographic features

These sites are located on stream terraces and depressions. Elevation of these sites are generally between 328’ to 820’ and slopes vary from 0-7%. Runoff class is negligible to medium. Flooding is none to rare, and ponding is none to rare.

Table 2. Representative physiographic features

Landforms	(1) Valley > Terrace (2) Valley > Stream terrace
Runoff class	Negligible to medium
Flooding frequency	None to rare
Ponding frequency	None to rare
Elevation	328–820 ft
Slope	0–7%
Water table depth	2–24 in
Aspect	Aspect is not a significant factor

Climatic features

About 60 percent of the precipitation falls during the freeze-free period. Most of the rainfall occurs as high-intensity, convective thunderstorms in summer. Snowfall is common in winter. The representative freeze-free period ranges from 192-199 days and the representative frost-free period ranges from 171-179.

The following information is based on data taken from weather stations as provided in EDIT.

Table 3. Representative climatic features

Frost-free period (characteristic range)	171-179 days
Freeze-free period (characteristic range)	192-199 days
Precipitation total (characteristic range)	44-47 in
Frost-free period (actual range)	166-180 days
Freeze-free period (actual range)	190-204 days
Precipitation total (actual range)	40-48 in
Frost-free period (average)	175 days
Freeze-free period (average)	196 days
Precipitation total (average)	45 in

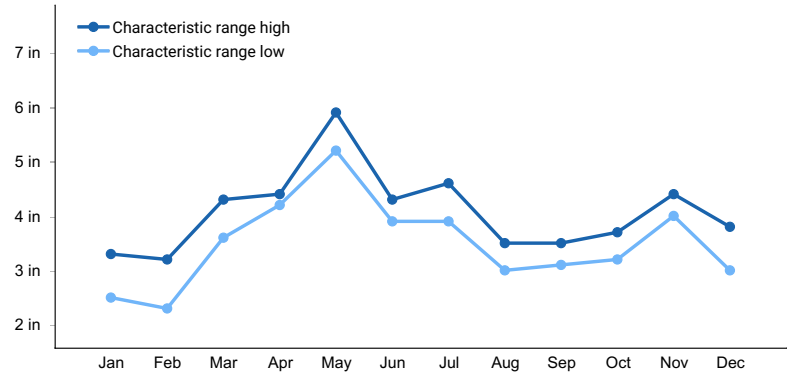


Figure 1. Monthly precipitation range

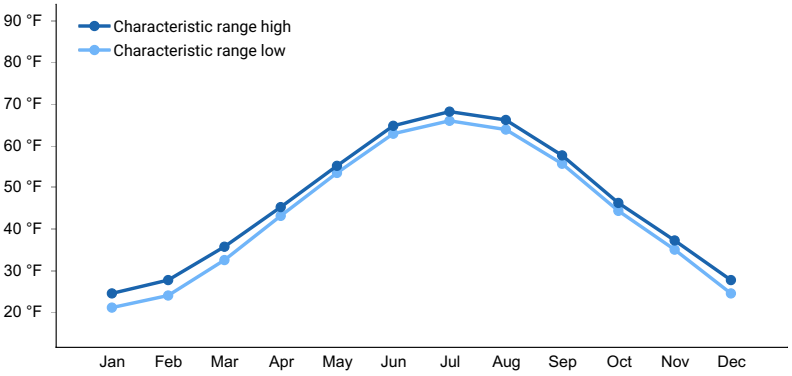


Figure 2. Monthly minimum temperature range

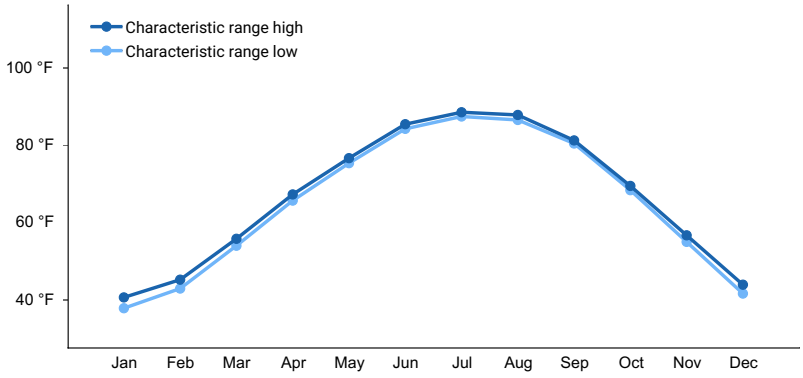


Figure 3. Monthly maximum temperature range

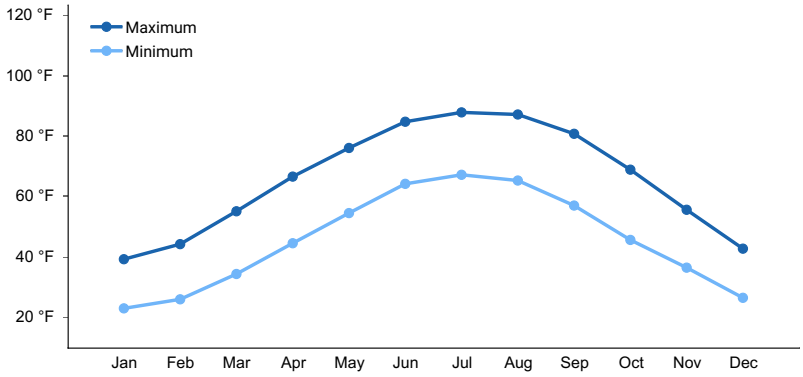


Figure 4. Monthly average minimum and maximum temperature

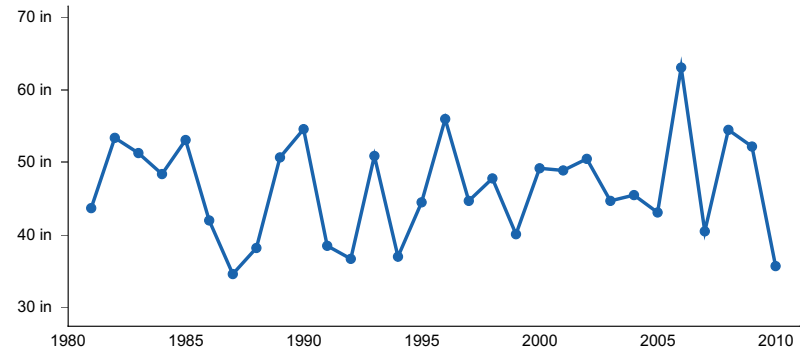


Figure 5. Annual precipitation pattern

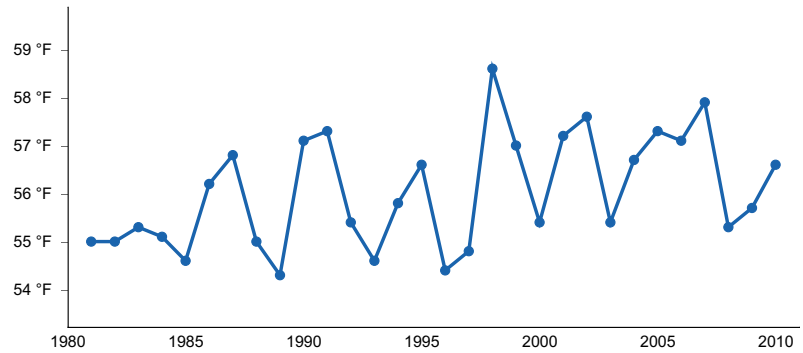


Figure 6. Annual average temperature pattern

Climate stations used

- (1) TERRE HAUTE CAA AP [USW00093823], Terre Haute, IN
- (2) VINCENNES 5 NE [USC00129113], Vincennes, IN
- (3) PRINCETON 1 W [USC00127125], Princeton, IN

- (4) MT VERNON [USC00126001], Uniontown, IN
- (5) EVANSVILLE REGIONAL AP [USW00093817], Evansville, IN

Influencing water features

Wet Sandy Terrace ecological sites may by influenced by flooding, ponding, and seasonal high-water tables. Flooding on these sites ranges from none to rare, and ponding ranges from none to rare.

Soil features

Wet Sandy Terrace ecological sites are located on soils that are somewhat poorly drained to very poorly drained with moderately slow to moderate permeability. Available water capacity (AWC) on sites varies from 4-7 inches. Soil textures include course loamy, fine loamy and loamy skeletal. Series include Lyles, Junius, and Roby.

Table 4. Representative soil features

Parent material	(1) Outwash
Surface texture	(1) Loamy fine sand (2) Fine sand (3) Sandy loam
Drainage class	Very poorly drained to somewhat poorly drained
Permeability class	Moderate to moderately rapid
Soil depth	60–80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	4–7 in
Calcium carbonate equivalent (Depth not specified)	0–30%
Electrical conductivity (Depth not specified)	0–2 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0
Soil reaction (1:1 water) (Depth not specified)	4.5–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–7%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

MLRA 115X consists of a variety of environmental and edaphic factors that have resulted in a historic landscape that supported upland hardwood forests, mixed floodplain/terrace forests, and scattered open woodlands and prairie savannas. Wet Sandy Terrace ecological sites were formed within this vegetative continuum and community structure was controlled by a natural fire regime, grazing of native ungulates and later, burning by native Americans and settlers. Wet Sandy Terrace sites generally occur on stream terraces and outwash plains on somewhat poorly to very poorly drained soils. Species characteristic of this ecological site consist of an open oak woodland with a diverse understory of native sedges and forbs.

Fire was a critical factor that maintained these ecological sites. Fire typically consisted of low- to moderate-severity surface fires (LANDFIRE 2009). Ignition sources included summertime lightning strikes from convective storms and bimodal, human ignitions during the spring and fall seasons. Native Americans regularly set fires to improve hunting, move large mammals, increase native grasses, clearing for wood, and agriculture. (LANDFIRE 2009).

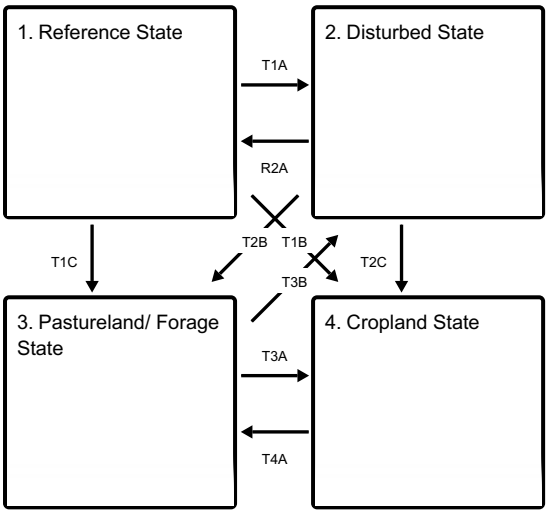
Drought and wind/ice storms also would have impacted these sites and the plant community structure and density. Droughts would have increased tree, shrub and understory species that could tolerant very dry conditions. Ice and wind damage to trees from storms would have opened canopies and temporarily altering shrub and understory community structure.

Today, Wet Sandy Terrace sites have mostly been converted to cropland or pastureland.
Remnant woodlands do exist, but tree species and understory density and diversity have been fundamentally altered due to long-term fire suppressed and repeated anthropogenic disturbances. NRCS has recorded numerous trees on these sites including sweet gum, pin oak, cottonwood, white oak, ash, black walnut, northern red oak, and tuliptree.

A provisional state and transition diagram (STM) is shown in Figure 2. The model is a provisional draft and it is expected to change as field verification occurs.

State and transition model

Ecosystem states



T1A - Large scale disturbance

T1C - Clearing of site; agricultural production - forage

T1B - Clearing of site; agricultural production -row crops.

R2A - Restoration inputs such as planting, brush control, prescribed fire, and timber stand improvement.

T2B - Clearing; agricultural production - forage

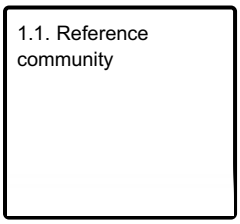
T2C - Clearing; agricultural production - row crops

T3B - Abandonment of agricultural practices

T3A - Site preparation and tillage, seeding, weed control, cropland management

T4A - Transition site to forage production; seeding; weed/brush control; pasture management

State 1 submodel, plant communities



State 2 submodel, plant communities

2.1. Disturbed community

State 3 submodel, plant communities

3.1. Pastureland/Forage community

State 4 submodel, plant communities

4.1. Cropland community

State 1
Reference State

The historic reference state for Wet Sandy Terrace ecological site is dependent on both natural hydrology and a natural fire regime. With frequent fires, these sites would be an open woodland with a variety of native forbs and grasses in the understory. Species included swamp white oak (*Quercus bicolor*), hickories (Carya spp.), red maple (*Acer rubrum*), Shumard oak (*Quercus shumardii*), pin oak (*Quercus palustris*), sweetgum (*Liquidambar styraciflua*), and silver maple (*Acer saccharinum*). The shrub and vine species on these sites are variable depending on the frequency and severity of fires. Understory species include native sedges (*Carex blanda*, *Carex laxiculmis*, *Carex rosea*), wildryes (*Elymus riparius*, *Elymus virginicus*), woodreed (Cinna spp.), and bittercress (Cardamine spp.). The frequency (and intensity) of the fires altered the species composition and density and encouraged oak reproduction while reducing shrub density. A cessation of natural fires on these sites results in an increase in wood vegetation and an increase in fire-intolerant tree species. Natural large-scale disturbance regimes would have created a continuum of forest, woodland, savanna and prairie throughout MLRA 115X.

Dominant plant species

- swamp white oak (*Quercus bicolor*), tree
- Shumard oak (*Quercus shumardii var. shumardii*), tree
- shellbark hickory (*Carya laciniosa*), tree
- sedge (*Carex*), grass
- woodreed (*Cinna*), grass
- wildrye (*Elymus*), grass
- false nettle (*Boehmeria*), other herbaceous
- eastern poison ivy (*Toxicodendron radicans*), other herbaceous

Community 1.1
Reference community

This community is a wet deciduous forest community with numerous native grasses, sedges and herbaceous species in the understory. A natural fire regime supports oak reproduction, reduces shrub density, opens the canopy, and reduces fire intolerant species.

Dominant plant species

- swamp white oak (*Quercus bicolor*), tree
- Shumard oak (*Quercus shumardii var. shumardii*), tree
- pin oak (*Quercus palustris*), tree
- shellbark hickory (*Carya laciniosa*), tree
- woodreed (*Cinna*), grass
- sedge (*Carex*), grass
- wildrye (*Elymus*), grass
- false nettle (*Boehmeria*), other herbaceous
- eastern poison ivy (*Toxicodendron radicans*), other herbaceous

State 2
Disturbed State

Most remaining wooded Wet Sandy Terrace sites have been altered due to anthropogenic disturbances. Sites have been cleared, grazed, or had intermittent selective harvest (i.e. oak removal). Trees on site, will depending on the type, length and severity of disturbances. Sites that have had a long-term absence of fire will display the following characteristics: an increase in fire -intolerant species, decrease in oak regeneration, an increase in shrub density, an increase in leaf-litter buildup, and an increase in shade-tolerant understory species. Diversity of species may also be reduced, especially if there has been an introduction of non-native species.

Dominant plant species

- green ash (*Fraxinus pennsylvanica*), tree
- American elm (*Ulmus americana*), tree
- red maple (*Acer rubrum*), tree
- silver maple (*Acer saccharinum*), tree
- sedge (*Carex*), grass
- woodreed (*Cinna*), grass
- wildrye (*Elymus*), grass
- false nettle (*Boehmeria*), other herbaceous
- eastern poison ivy (*Toxicodendron radicans*), other herbaceous

Community 2.1
Disturbed community

This site has undergone disturbances such as clearing, selective logging, unmanaged grazing, etc. Oak removal is a common disturbance on these sites. Lack of natural fire will increase the density and numbers of shade tolerant trees.

Dominant plant species

- green ash (*Fraxinus pennsylvanica*), tree
- red maple (*Acer rubrum*), tree
- silver maple (*Acer saccharinum*), tree
- elm (*Ulmus*), tree
- sweetgum (*Liquidambar*), tree
- sedge (*Carex*), grass
- woodreed (*Cinna*), grass
- wildrye (*Elymus*), grass
- eastern poison ivy (*Toxicodendron radicans*), other herbaceous
- false nettle (*Boehmeria*), other herbaceous

State 3
Pastureland/ Forage State

A portion of these sites have been converted to pastureland or forage production. Species selection will depend upon the objectives and goals of the landowner; however, commonly planted grasses include tall fescue (*Schedonorus arundinaceus*), brome (Bromus spp.), white clover (*Trifolium repens*) and red clover (*Trifolium*

pratense). Species health, plant composition, and productivity levels are determined by management.

Dominant plant species

- tall fescue (*Schedonorus arundinaceus*), grass
- brome (*Bromus*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- white clover (*Trifolium repens*), other herbaceous
- red clover (*Trifolium pratense*), other herbaceous

Community 3.1
Pastureland/Forage community

These sites are managed for forage production and often include tall fescue (*Schedonorus arundinaceus*), brome (Bromus spp.), white clover (*Trifolium repens*) and red clover (*Trifolium pratense*). Selection of species will depend on the landowner's objectives. Ditching and/or tiling may be used to improve drainage.

Dominant plant species

- tall fescue (*Schedonorus arundinaceus*), grass
- brome (*Bromus*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- red clover (*Trifolium pratense*), other herbaceous
- white clover (*Trifolium repens*), other herbaceous

State 4
Cropland State

Common crops include corn (*Zea mays*), soybeans (*Glycine max*), and occasionally winter wheat (*Triticum aestivum*). Some landowners choose to convert sites to cool season grasses for a period before resuming cropland production. Hydrological modifications are often installed on sites to facilitate improved drainage. A return to the historical Reference State from State 4 is unlikely, if not impossible.

Dominant plant species

- corn (*Zea mays*), other herbaceous
- soybean (*Glycine*), other herbaceous

Community 4.1
Cropland community

This community is characterized by the management and production of row crop agriculture. Common species include corn, soybean and wheat. Many other crops are suitable for these sites, and species selection will depend upon the landowners goals and objectives. Ditchin and tiling are often installed on these sites to improve drainage.

Dominant plant species

- soybean (*Glycine max*), other herbaceous
- corn (*Zea mays*), other herbaceous

Transition T1A
State 1 to 2

Severe disturbances, such as clearing or selective harvesting (oak/hickory removal) will transition this site to State 2. Long-term lack of fire will also transition this state to a more mixed deciduous forest community.

Transition T1C
State 1 to 3

Site is transitioned to an agricultural site focused on forage production. Management inputs would include clearing, site preparation, seeding and weed/brush control. Drainage modifications may be installed.

Transition T1B
State 1 to 4

Site is transitioned to an agricultural site focused on row crop production. Management inputs would include clearing, site preparation, seeding and weed control.

Restoration pathway R2A
State 2 to 1

Restoration would require long-term management inputs including planting of desired species, weed control, brush control, timber stand improvement, and prescribed fire. Restoration of natural hydrology may also be reqquired.

Transition T2B
State 2 to 3

Site is cleared and forage/pasture production is initiated. Management inputs would include tree/shrub removal, site preparation, seeding, and weed/brush control. Hydrological modifications may be installed.

Transition T2C
State 2 to 4

Site is cleared and row crop production is initiated. Management inputs would include tree/shrub removal, site preparation, tillage, seeding, and weed control. Ditching and tiling is common on these sites to improve drainage.

Transition T3B
State 3 to 2

Site is abandoned and slowly would transition to a wooded state dominated by deciduous trees. Species on site would depend on the severity and length of disturbance and available seed sources.

Transition T3A
State 3 to 4

Management inputs that transition a site from pasture or forage production to a site that is utilized for row crop production. Ditching and tiling is commonly used to improve drainage.

Transition T4A
State 4 to 3

Management inputs to transition a site from cropland production to a state of pasture/forage production.

Additional community tables

Inventory data references

A Provisional Ecological Site Description (PESD) describes ecological potential and ecosystem dynamics of land areas and their potential management. Ecological sites are linked to soil survey map unit components, which allows for mapping of ecological sites. A PESD with a provisional status represents the lowest tier of documentation that is releasable to the public. No field level data have been collected as part of this PESD. It is expected that a PESD will continue to be refined through field verification and field sampling.

Reference and alternative state concepts, including the state-and-transition model and vegetative communities are not yet well-documented and will require field sampling for verification.

Other references

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Approval

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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	01/09/2025
Approved by	Suzanne Mayne-Kinney
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:**
