USDA Natural Resources Conservation Service

Ecological site F115XA004IL
Fragic Upland

Last updated: 12/30/2024
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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): 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 annual precipitation ranges from 35 to 49 inches (880 to 1,250 millimeters) with a mean of 41 inches (1,050 millimeters). The annual temperature ranges from 48 to 58 degrees F (8.6 to 14.3 degrees C) with a mean of 54 degrees F (12.3 degrees C). The freeze-free period ranges from 150 to 220 days with a mean of 195 days.

Soils The dominant soil orders are Alfisols and, to a lesser extent, Entisols and Mollisols. The soils in the area have

a mesic soil temperature regime, an aquic or udic soil moisture regime, and mixed or smectitic mineralogy. They are shallow to very deep, excessively drained to poorly drained, and loamy, silty, or clayey.

The soils on 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. 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) (USDA-NRCS, 2022):
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

This PES description is similar to other established ecological classifications. Field verification is needed to confirm this association.

International Vegetation Classification Hierarchy
Class: 1. Forest & Woodland
Subclass: 1.B. Temperate & Boreal Forest & Woodland
Formation: 1.B.3. Temperate Flooded & Swamp Forest
Division: 1.B.3.Na. Eastern North American-Great Plains Flooded & Swamp Forest
Macrogroup: M503. Central Hardwood Swamp Forest

Ecological site concept

The Fragic Upland provisional ecological site is on somewhat poorly to moderately well drained loess uplands. Soils in this PES grouping have a restrictive layer between 10-45 inches below the surface. This layer restricts the movement of water and causes large fluctuations in soil moisture availability. Plants on these sites must tolerate not only very dry conditions during the summer months but also a seasonal highwater table 12”-30” below the surface during wet months. Plant communities will vary along a continuum depending on rainfall – drought years will favor more drought tolerant species, while wetter years will allow for a more varied and denser herbaceous layer.

Canopy species may include white oak, black oak and hickories. Southern red oak and post oak may also be on site. Sub-canopy trees include sassafras and red maple. Density and composition of understory species would be noticeably influenced by the depth of the restrictive layer and water availability. Common understory species on these sites would include Virginia creeper (*Parthenocissus quinquefolia*), blackberries (Rubus spp.), and poison ivy (*Toxicodendron radicans*).

Natural impacts such as drought, wind damage, ice storms and wildfires influenced these communities over centuries. Periodic fire was one of the disturbances that helped to maintain the oak dominance. Often these fires were of low-severity and helped to clear the litter from the forest floor and encourage oak regeneration. Lightening was the usual ignition source; although native Americans did use fire to reduce understory brush or increase forage. Long-term periods of drought did occur and would have influenced the species composition, shrub density, plant mortality, and tree growth rates.

Many of the lower slope sites have now been converted to agriculture – either cropland or hayland production. Cleared sites on higher slopes are often grazed; however, management is limited by slope. Landowner should be aware of potential overgrazing impacts such as soil erosion, soil compaction, water quality impacts, and noxious weeds. Invasive non-native vegetation is a serious concern in many remaining wooded areas as bush honeysuckle, euonymus, Japanese honeysuckle, privet, and other non-native plants have been introduced and are increasing without management controls.

Long-term fire suppression has resulted in some sites transitioning to an increase in fire intolerant species. Without management inputs such as prescribed fire or timber stand improvement work, oak regeneration can become limited.

Associated sites

F115XA003IL	**Wet Silty Upland** Wet Silty Upland. These sites are somewhat poorly to poorly drained and have a higher available water capacity.
F115XA001IL	**Silty Upland** Silty Upland. These sites are moderately well drained to well drained and the reference state is an oak-hickory community. However, these soils do not have fragic soil properties.

Table 1. Dominant plant species

Tree	(1) *Quercus alba* (2) *Quercus velutina*
Shrub	(1) *Smilax rotundifolia*

Herbaceous	(1) *Toxicodendron radicans*

Physiographic features

These sites are located on various landforms including ground moraine, hillslopes, loess hills, and till plains. Elevation of these sites are between 328’ to 1020’. Parent material is loess over loamy residuum over sandstone and shale. The wet layer depth ranges from 12”-30”. Runoff class is low to very high and sites do not flood or pond.

Table 2. Representative physiographic features

Landforms	(1) Hillslope (2) Ground moraine (3) Loess hill (4) Till plain
Runoff class	Low to high
Flooding frequency	None
Ponding frequency	None
Elevation	328–1,020 ft
Slope	0–18%
Water table depth	12–72 in
Aspect	W, NW, N, NE, E, SE, S, SW

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.

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

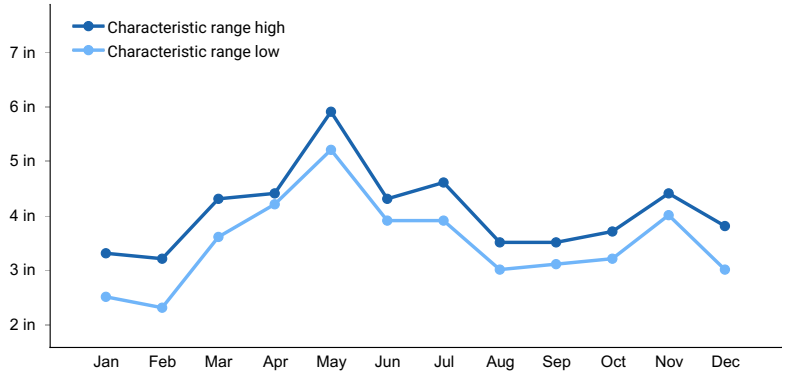

Figure 1. Monthly precipitation range

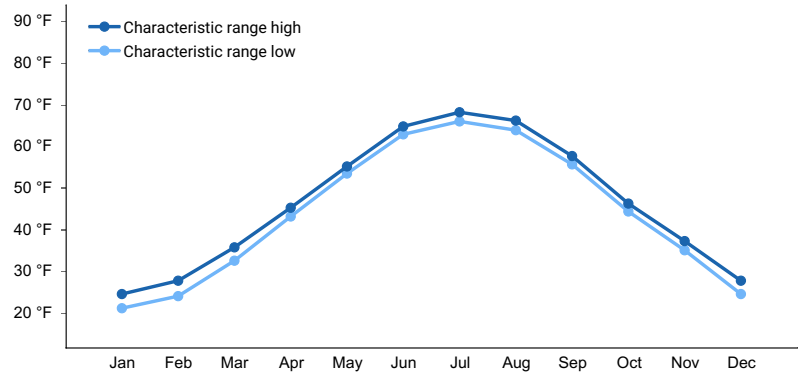

Figure 2. Monthly minimum temperature range

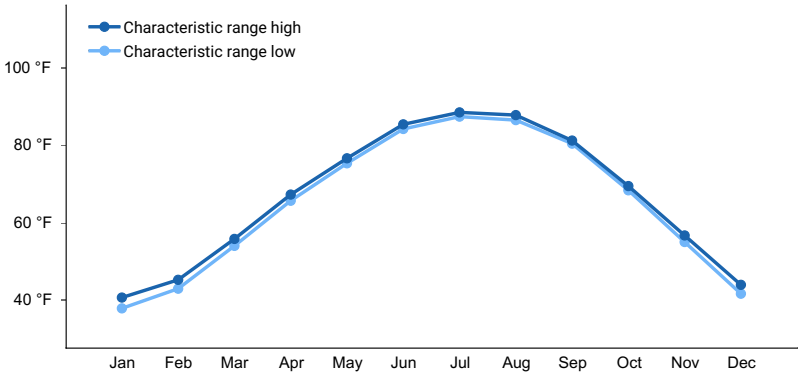

Figure 3. Monthly maximum temperature range

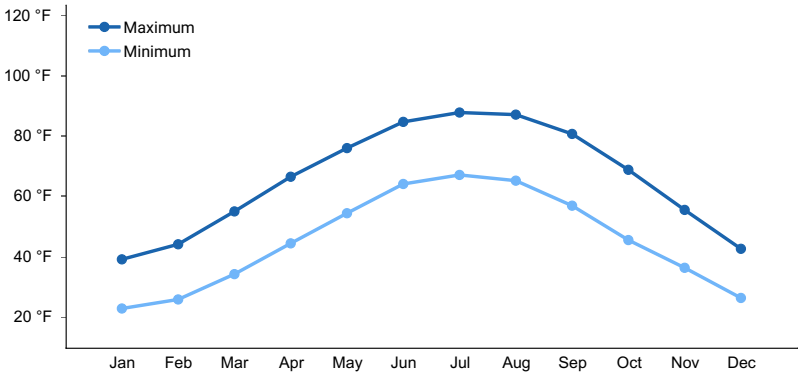

Figure 4. Monthly average minimum and maximum temperature

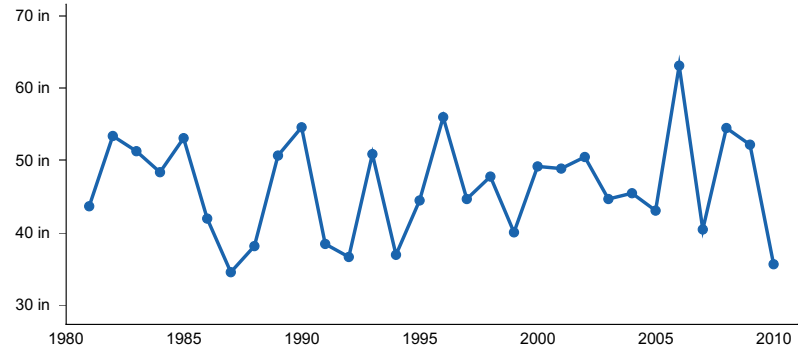

Figure 5. Annual precipitation pattern

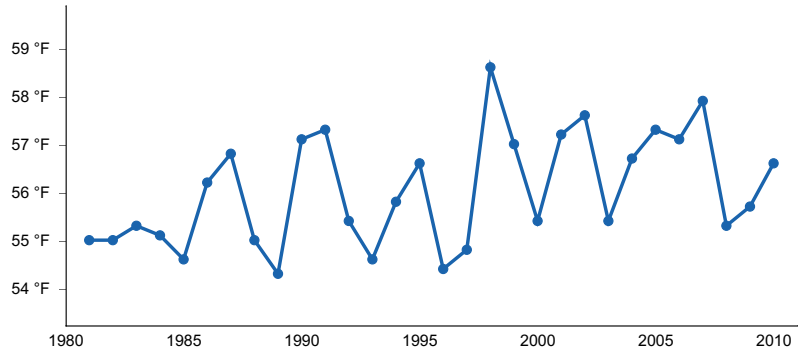

Figure 6. Annual average temperature pattern

Climate stations used

- (1) EVANSVILLE REGIONAL AP [USW00093817], Evansville, IN
- (2) MT VERNON [USC00126001], Uniontown, IN
- (3) PRINCETON 1 W [USC00127125], Princeton, IN
- (4) VINCENNES 5 NE [USC00129113], Vincennes, IN
- (5) TERRE HAUTE CAA AP [USW00093823], Terre Haute, IN

Influencing water features

Fragic Upland sites are not influenced by wetland or riparian water features. Precipitation is the main source of water for these sites. Many sites have a seasonal highwater table is present at a depth of 12”-30” below the surface (NASIS, 2020). On sloping sites, surface runoff water occurs to downslope ecological sites.

Soil features

These soils are very deep and somewhat poorly to moderately well drained. Permeability is very slow to impermeable. Soil series associated with this site include Gudgel, Hosmer and Stoy. Available water capacity is 2-7 inches. Soils in this group have a sodium adsorption ratio of 0-2. Soils of this ecological site are classified as Fragiudalfs and Hapludalfs. (NASIS, 2020)

Table 4. Representative soil features

Parent material	(1) Loess
Surface texture	(1) Silt loam (2) Silty clay loam
Drainage class	Somewhat poorly drained to moderately well drained
Permeability class	Very slow to moderate
Depth to restrictive layer	18–30 in
Soil depth	60–80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	2–7 in
Calcium carbonate equivalent (Depth not specified)	0%
Electrical conductivity (Depth not specified)	0–2 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0

Soil reaction (1:1 water) (Depth not specified)	4.5–7.3
Subsurface fragment volume <=3" (Depth not specified)	0–2%
Subsurface fragment volume >3" (Depth not specified)	0–10%

Ecological dynamics

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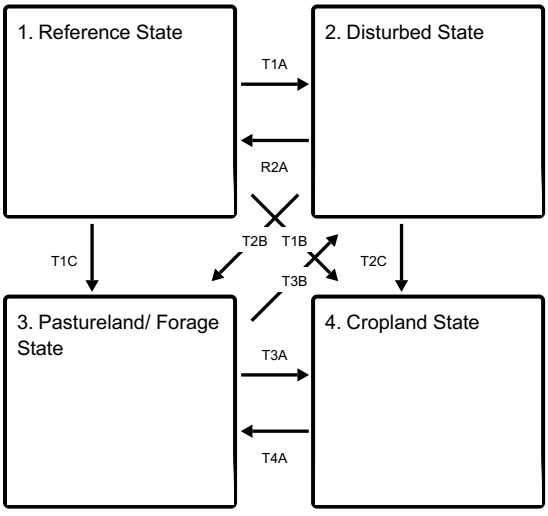
Long-term fire suppression has resulted in some sites transitioning to an increase in fire intolerant species. Without management inputs such as prescribed fire or timber stand improvement work, oak regeneration can become limited.

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

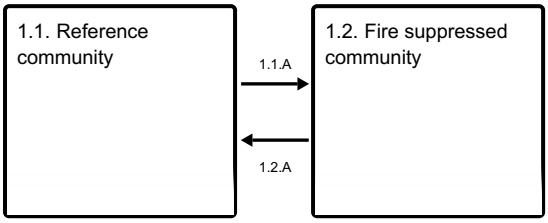
T2C - Clearing; agricultural production - row crops

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

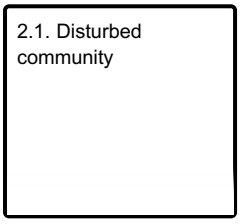
State 1 submodel, plant communities



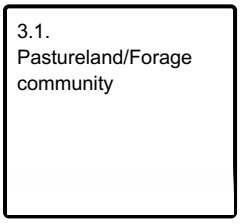
1.1.A - Reduction in fire frequency

1.2.A - Increase in fire frequency

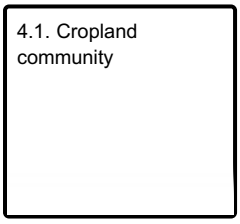
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



State 1
Reference State

The reference state is a mixed deciduous forest with an overstory that has substantial oak species including pin oak, swamp white oak, and northern red oak (*Quercus rubra*). Also on site is blackgum (*Nyssa sylvatica*), sweetgum (*Liquidambar styraciflua*) and green ash (Fraxinus pensylvanica). Red maple (*Acer rubrum*) is common in the understory canopy. Reoccurring fires, especially during periods of drought, would have maintained an oak-dominated forest along with an open understory.

Dominant plant species

- swamp white oak (*Quercus bicolor*), tree
- pin oak (*Quercus palustris*), tree
- northern red oak (*Quercus rubra*), tree
- blackgum (*Nyssa sylvatica*), tree
- dogwood (*Cornus*), shrub
- black elderberry (*Sambucus nigra*), shrub
- sedge (*Carex*), grass
- bittercress (*Cardamine*), other herbaceous

Community 1.1
Reference community

Dominant plant species

- white oak (*Quercus alba*), tree
- black oak (*Quercus velutina*), tree
- hybrid hickory (*Carya*), tree
- roundleaf greenbrier (*Smilax rotundifolia*), shrub
- sedge (*Carex*), grass
- eastern poison ivy (*Toxicodendron radicans*), other herbaceous

Community 1.2
Fire suppressed community

This community exhibits an increase in fire intolerant trees and shrubs due to a reduction in the natural fire regime. Oak regeneration is decreased.

Dominant plant species

- sugar maple (*Acer saccharum*), tree
- white oak (*Quercus alba*), tree
- maple (*Acer*), shrub
- ash (*Fraxinus*), shrub
- sedge (*Carex*), grass
- eastern poison ivy (*Toxicodendron radicans*), other herbaceous

Pathway 1.1.A
Community 1.1 to 1.2

Lack of fire will transition this community to a vegetative community with more fire intolerant species.

Pathway 1.2.A
Community 1.2 to 1.1

An increase in fire will reduce fire-intolerant tree species.

State 2
Disturbed State

Most remaining Fragic Upland sites have been altered due to a number of disturbances including clearing and/or long-term absence of fire. Some sites have also been grazed or had intermittent selective harvest (i.e. oak removal). Trees on site, will depending on the type, length and severity of disturbances. However, sites that have had a long-term absence of fire will display the following characteristics: an increase in fire -intolerant species, 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 such as bush honeysuckle (*Lonicera maackii*). Many of these sites are eventually transitioned to Pastureland (State 3) or cropland (State 4) is common, especially on lower slope sites.

Dominant plant species

- red maple (*Acer rubrum*), tree
- hybrid hickory (*Carya*), tree
- maple (*Acer*), shrub

Community 2.1
Disturbed community

This is a disturbed, successional community that includes a variety of fast-growing trees. Species will depend on the type, severity and length of disturbances, available seed sources, and management inputs, if present. Common species include sugar maple, ash, red maple, tulip poplar, pines, and hickory.

Dominant plant species

- red maple (*Acer rubrum*), tree
- sugar maple (*Acer saccharum*), tree
- hybrid hickory (*Carya*), tree
- pine (*Pinus*), tree
- tuliptree (*Liriodendron tulipifera*), tree
- maple (*Acer*), shrub

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 and productivity are determined by the 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.

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

Many sites are now utilized for row-crop agriculture. 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. 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.

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, will transition this site to State 2. On many sites, the oaks and hickories have been selectively harvested and sites have transitioned into a mixed deciduous woodlands.

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.

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. Hydrological modifications are often installed to aid in drainage.

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.

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.

Transition T2C
State 2 to 4

Site is cleared and row crop production is initiated. Management inputs would include tree/shrub removal, site preparation, seeding, and weed control.

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.

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.

This document is provisional.

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	05/10/2025
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:**

17. **Perennial plant reproductive capability:**