USDA Natural Resources Conservation Service

Ecological site R115XA101IL
Wet Sand Dunes

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 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, 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

Historically, this ecological site was an interdunal open woodland found on somewhat poorly drained to poorly drained soils formed from eolian materials. These sandy/loamy soils were dry during the summer months but often influenced by a high-water table during winter and spring months. Wet Sand Dune ecological sites were historically maintained by seasonal wildfire and impacted by the seasonal flooding that occurred during heavy rains.

Tree species were scattered and included oaks (Quercus spp.) and hickories (Carya spp.). Fire frequency and severity influenced the tree species and tree density on these sites. Frequently burned sites were more open, had

less trees and shrubs, and were characterized by numerous prairie grasses and forbs in the understory. Species include big bluestem (Andropogon gerardii), prairie cordgrass (Spartina pectinata), eastern gamagrass (Tripsacum dactyloides), and switchgrass (Panicum virgatum). Other understory species include sedges (Carex spp.), rushes (Juncus spp.), sawtooth sunflower (Helianthus grosseserratus), and St. Johnswort (Hypericum spp.).

Fire intensity and frequency was the principle driver for on this site, with low intensity ground fires every (5-15) years commonly occurring. An increase in the fire return interval created a vegetative community with greater tree and shrub density. (LANDFIRE).

Associated sites

R115XA102IL	**Dry Sand Dunes** Dry Sand Dune. Sites are on very deep, somewhat excessively drained to excessively drained soils formed in eolian sand on terraces and uplands.

Similar sites

R115XA103IL	**Sand Dunes** Sand Dune. These sites include Princeton soils and are better drained but also have oaks in the historic reference community.
R115XA104IL	**Sandy Terrace** Sandy Terrace. These sites are on terraces and are better drained but also have oaks in the historic reference community.
R115XA105IL	**Wet Sandy Terrace** Wet Sandy Terrace. These sites are on terraces and have oak species in the historic reference community.

Table 1. Dominant plant species

Tree	(1) *Quercus alba*
Shrub	Not specified
Herbaceous	(1) *Andropogon gerardii* (2) *Panicum virgatum*

Physiographic features

Wet Sand Dune sites are located on interdunes and depressions on elevations between 341’ – 1000’. Sites have a seasonal wet layer depth of 2 – 15 inches. Permeability is moderately slow, and runoff class is slow to negligible. These ecological sites do not flood and rarely pond. There are two soils in this group - multiple mapunits of Ayrshire and one mapunit of a Junius Variant.

Table 2. Representative physiographic features

Landforms	(1) Upland > Dune
Runoff class	Negligible to low
Flooding frequency	None
Ponding frequency	None to rare
Elevation	341–1,007 ft
Slope	0–4%
Ponding depth	0–6 in
Water table depth	2–15 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 following information is based on data taken from weather stations within MLRA 115X 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

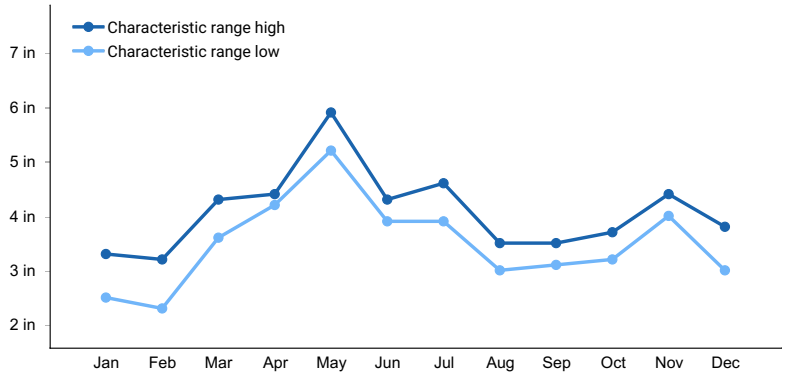


Figure 1. Monthly precipitation range

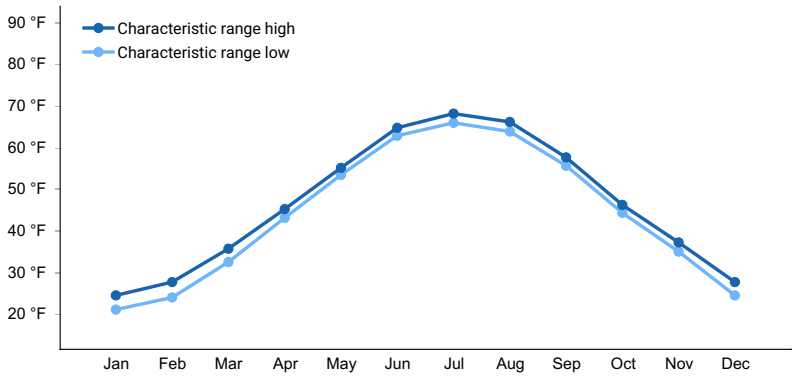


Figure 2. Monthly minimum temperature range

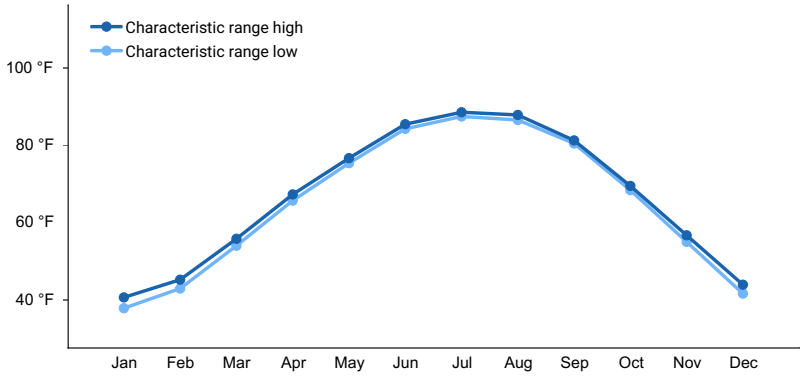


Figure 3. Monthly maximum temperature range

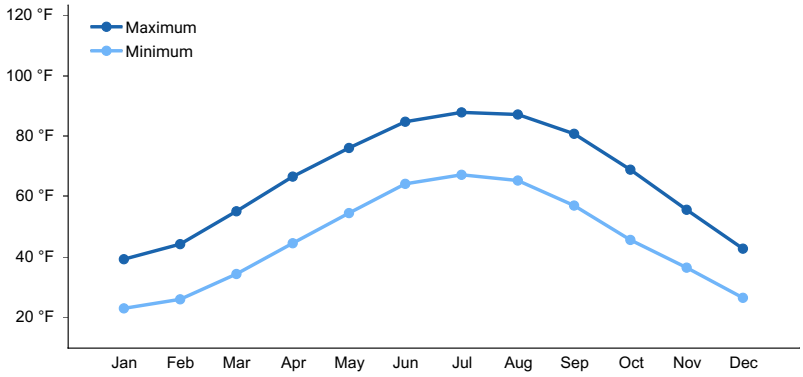


Figure 4. Monthly average minimum and maximum temperature

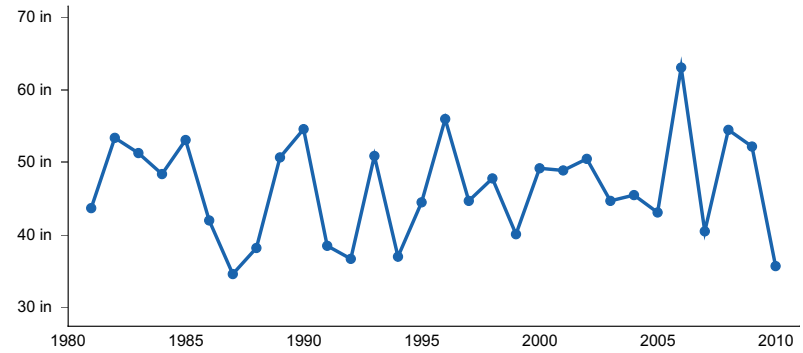


Figure 5. Annual precipitation pattern

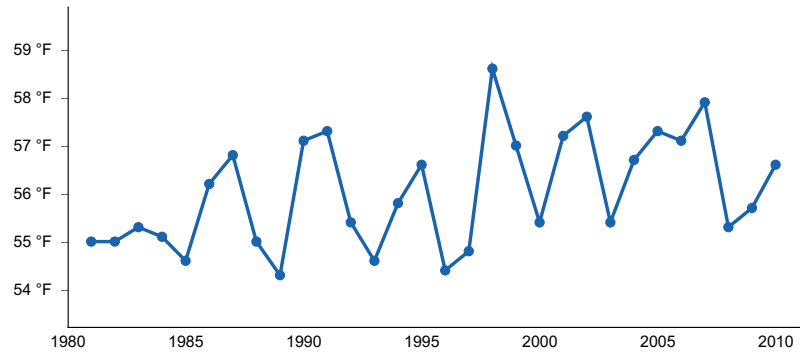


Figure 6. Annual average temperature pattern

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

Influencing water features

Wet Sand Dune are somewhat poorly drained to poorly drained and the potential for surface runoff is negligible to low. Ayrshire soils have an intermittent (seasonal) high water table from .5 – 2 feet between December and April most years.

Soil features

The soil series associated with this site are Ayrshire and Junius variant. Ayrshire and Junius variant are mapped in Indiana. The Junius variant is mapped only in Gibson County, Indiana. These sites are very deep, somewhat poorly drained to poorly drained, and have slow to moderately rapid permeability.

Table 4. Representative soil features

Parent material	(1) Eolian deposits (2) Alluvium
Surface texture	(1) Fine sand (2) Very fine sand (3) Loamy fine sand (4) Fine sandy loam (5) Very fine sandy loam (6) Sandy loam (7) Loam
Drainage class	Somewhat excessively drained to excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	60–80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	5–7 in
Soil reaction (1:1 water) (Depth not specified)	5.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

Natural impacts such as drought, wind damage, ice storms and wildfires historically influenced these communities and dictated the plant communities on site. Periodic fire was one of the disturbances that helped to maintain this system. Lightening was the usual ignition source; although native Americans did use fire to reduce understory brush or increase grass forage. Long-term periods of drought would have influenced the species composition, shrub density, plant mortality, and tree growth rates on these sites.

The historic reference community of the Wet Sand Dune ecological site is a grassy, open, oak woodland. This site is characterized as being a scattered woody species on site with a mix of woodland and prairie species in the herbaceous layer. Fire intensity and frequency was the principle influencing factor on these sites. It is estimated that low intensity ground fires burned on sites between 5-20 years (LandFire). Longer fire return intervals encouraged tree and shrub growth on sites while a more frequent fire regime would have transitioned the site to an open woodland with prairie grasses in the understory.

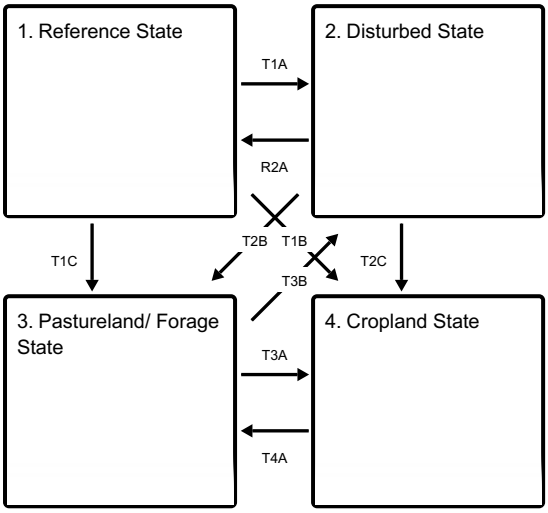
Today, most sites have been converted to agricultural uses including row crops and forage production. Many sites

have hydrological modification such as ditching or tiling. Corn and soybeans are a common row crop while cool-season grasses, such as tall fescue and brome are grown for pasture or hay.

Remaining wooded sites generally lack a natural fire regime so numerous tree species may now be found on these sites. NRCS has recorded many different tree species on these disturbed sites including pin oak, white oak, tulip poplar, sweetgum, elm, and hickory. Invasive non-native vegetation is a concern in many remaining wooded areas and may be a potential management issue.

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

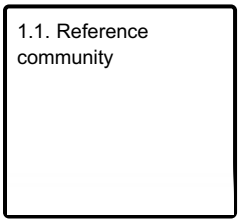
T2C - Clearing; agricultural production - row crops

T3B - Abandonment of agricultural practices

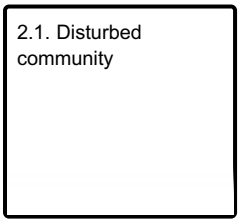
T3A - Site preparation and tillage, seeding, weed control, cropland management

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

State 1 submodel, plant communities



State 2 submodel, plant communities



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 community of the Wet Sand Dune ecological site was dominated by native grasses and forbs with scattered oaks. Fire intensity and frequency was the principle influencing factor on these sites. It is estimated that low intensity ground fires burned on sites between 5-20 years (LandFire). Longer fire return intervals encouraged tree and shrub growth on sites while a more frequent fire regime would have transitioned the site to an open woodland with prairie grasses in the understory. Historically these sites were also influenced by wind damage, ice storms, and grazing by native ungulate species. Remaining natural sites today are dominated generally by deciduous trees due to a lack of fire disturbance and hydrological changes.

Dominant plant species

- oak (*Quercus*), tree
- big bluestem (*Andropogon gerardii*), grass
- switchgrass (*Panicum virgatum*), grass

Community 1.1
Reference community

The reference community is dominated by native grasses and forbs with scattered oaks. Historically, this site was influenced by natural disturbances including fire, wind damage, ice storms, and grazing by native ungulate species.

Dominant plant species

- oak (*Quercus*), tree
- big bluestem (*Andropogon gerardii*), grass
- switchgrass (*Panicum virgatum*), grass

State 2
Disturbed State

Most remaining wooded sites have been altered due to a long-term absence of fire, oak removal, grazing, and/or hydrological modifications. Trees on site, will depending on the type, length and severity of disturbances. Species often include elm, maple, poplar, sumac, berry, and eastern redcedar. Species recorded on these sites by NRCS include white oak, pin oak, elm, sweetgum, tuliptree, and red maple. 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. Disturbances may also introduce a variety of invasive, non-native species which can alter the vegetative composition. Many of these sites are commonly transitioned to Pastureland (State 3) or cropland (State 4).

Dominant plant species

- elm (*Ulmus*), tree
- maple (*Acer*), tree
- cottonwood (*Populus*), tree
- white oak (*Quercus alba*), tree
- pin oak (*Quercus palustris*), tree
- sweetgum (*Liquidambar styraciflua*), tree
- tuliptree (*Liriodendron tulipifera*), tree
- eastern redcedar (*Juniperus virginiana*), shrub
- sumac (*Rhus*), shrub
- blackberry (*Rubus*), shrub

Community 2.1
Disturbed community

Trees on site, will depending on the type, length and severity of disturbances. Species often include elm, maple, poplar, sumac, berry, and eastern redcedar.

Dominant plant species

- elm (*Ulmus*), tree
- maple (*Acer*), tree
- cottonwood (*Populus*), tree
- eastern redcedar (*Juniperus virginiana*), shrub
- sumac (*Rhus*), shrub
- blackberry (*Rubus*), 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 and long-term overgrazing can increase soil erosion.

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

Hydrological modifications such as ditching and tiling are often used on these sites to increase crop production. 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.

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, tillage, 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.

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Approval

Suzanne Mayne-Kinney, 12/30/2024

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):**

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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:**
