USDA Natural Resources Conservation Service

Ecological site F114XB404IN
Dry Outwash Upland Forest

Last updated: 11/16/2023
Accessed: 04/26/2024

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 114X–Southern Illinois and Indiana Thin Loess and Till Plain

This MLRA is a loess-covered till plain with broad, nearly level summits and steeper slopes in areas. dissected by tributaries of the Ohio and Mississippi Rivers. It is used to produce cash crops, feed grain, and livestock. This MLRA is in Indiana (47 percent), Illinois (38 percent), and Ohio (15 percent) in four separate areas. It makes up about 10,388 square miles (26,904 square kilometers).

This area is in the Till Plains section of the Central Lowland province of the Interior Plains. 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 or gently sloping. Steep slopes are along rivers and streams. Elevation ranges from 310 feet (90 meters) on the southernmost flood plains to 1,340 feet (410 meters) on the highest ridges. Local relief is mainly 10 to 50 feet (3 to 15 meters) but can be 50 to 100 feet (15 to 30 meters) along drainageways and streams.
The Little Miami River flows through the part of this MLRA in Ohio. The Ohio River flows along the southernmost boundary in some parts of this area in Ohio. The Kaskaskia River flows through the part of this area in Illinois. Tributaries to the Mississippi and Ohio Rivers drain this MLRA.

This area is covered dominantly by loess and Illinoian-age till or outwash. Most of the loess is Late Wisconsin-age Peoria Loess. In some places the Peoria Loess in underlain by Early Wisconsin-age Roxana Silt or by sandier or grittier loess. The loess ranges from 3 to 7 feet (1 or 2 meters) in thickness on stable summits and does not occur on some of the steeper slopes. The underlying Illinoian-age till and outwash commonly contain a paleosol. Meltwater outwash and lacustrine and alluvial deposits are on some of the stream terraces along the major tributaries. The till and outwash are underlain by several bedrock systems. Mississippian and Pennsylvanian bedrock occurs mostly in the western part of the MLRA. Ordovician, Silurian, and Devonian bedrock occurs mostly in the central part. Bedrock outcrops are common on the bluffs along the large rivers and their major tributaries. They also are evident at the base of steep slopes along minor streams and drainageways.

The average annual precipitation ranges from 39 to 47 inches (990 to 1,190 millimeters) with a mean of 42 inches (1,060 millimeters). The annual temperature ranges from 53 to 56 degrees F (11.8 to 13.6 degrees C) with a mean of 55 degrees F (13 degrees C). The freeze-free period ranges from 185 to 215 days with a mean of 200 days.

The dominant soil orders are Alfisols and Entisols. 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 deep or very deep, poorly drained to well drained, and loamy, silty, or clayey. Although limited in extent, some soils have a natric horizon in the part of the MLRA in Illinois. The main soils and their series: Albaqualfs that formed in loess or loess over pedisediment on till plains (Marine series); Endoaqualfs that formed in loess or loess over pedisedimenton till plains (Oconee series); Fluvaquents that formed in alluvium on flood plains (Wakeland series); Fragiudalfs that formed in loess over pedisediment over till (Cincinnati series) and loess over till (Rossmoyne series) on till plains; Glossaqualfs that formed in loess over till on till plains (Avonburg, Clermont, and Cobbsfork series) Hapludalfs that formed in till (Hickory series) and loess over pedisediment (Homen series) on till plains.

The soils on uplands support natural hardwoods. Oak, hickory, beech, and sugar maple are the dominant species. Native grasses grow in some scattered areas between the trees. The soils in low-lying areas support mixed forest vegetation. Pin oak, shingle oak, sweetgum, and black oak are the dominant species on the wetter sites. White oak, black oak, northern red oak, hickory, yellow-poplar, ash, sugar maple, and black walnut grow on the better drained sites. Honey locust is dominant on soils that formed in shaly limestone residuum. Silver maple, eastern cottonwood, American sycamore, pin oak, elm, and sweetgum grow along rivers and streams. Black walnut is abundant on very deep, well drained soils on some small flood plains. Sedge and grass meadows and scattered trees are on some low-lying sites.

Most of this MLRA is in farms and used to produce corn, soybeans, and livestock. Some small grains, including winter wheat, oats, and grain sorghum, also are grown. A small acreage is used for specialty crops, such as popcorn and apple orchards. The grassland supports introduced and native grasses. The forested areas are mainly on steep valley sides and in low-lying parts of flood plains. Surface coal mines make up a small acreage. (USDA, Natural Resources Conservation Service. 2022)

LRU notes

LRU 114XB is in two separate areas in Illinois (66 percent) and Indiana (34 percent). It makes up about 7,005 square miles (18,150 square kilometers). It includes the towns of Brazil, Bloomfield, Cloverdale, and Spencer, Indiana, and Carlyle, Nashville, Hillsboro, Greenville, Vandalia, and Pinckneyville, Illinois. Interstates 55, 64, and 70 cross the part of the MLRA in Illinois. They converge in St. Louis, which is just west of this MLRA. The east edge of the Scott Air Force Base is on the western edge of the area in Illinois.

This area is in the Till Plains Section of the Central Lowland Province of the Interior Plains. Both large and small tributaries of the West Fork of the White River, the Eel River, the Kaskaskia River, and the Little Muddy River dissect the nearly level to very steep uplands. 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. Elevation ranges from 350 feet (105 meters) on the southernmost flood plains along the Ohio and Wabash Rivers to 1,190 feet (365 meters) on the highest ridges. Local relief is mainly 10 to 50 feet (3 to 15 meters), but it can be 50 to 100 feet (15 to 30 meters) along drainageways and streams. It generally is low on broad, flat till plains and flood plains and high on the dissected hills bordering rivers or drainage systems.

Classification relationships

Major Land Resource Area (MLRA) (USDA-NRCS, 2022):
114X–Southern Illinois and Indiana Thin Loess and Till Plain

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

NatureServe Ecological System(s) and/or Associations:
The following NatureServe Explorer Ecological System Record(s) have a high level of probability to match the ecological site reference community found on these soils:
North-Central Interior Dry Mesic Oak Forest and Woodland - CES202.046
North-Central Interior Dry Oak Forest and Woodland - CES 202.047

Ecological site concept

The Dry Outwash Upland Forest reference site is characterized by a mature deciduous forest dominated by upland oaks and hickories. Multiple species may be present depending on the fire regime (or lack of), seed sources, microtopography, and soil characteristics. Historically, these communities were oak-hickory forest influenced by fire. Species included white oak, shagbark hickory, northern red oak, post oak, pignut hickory, black oak, bur oak, and mockernut hickory. Associates include maple, white ash, tulip poplar, and sweetgum.

Fire regime favors oak regeneration, so many sites today have become dominated by associate species. Many sites will need selective thinning to encourage oak reproduction. Timber stand improvement activities will encourage oak reproduction and growth while controlling fast-growing, shade-tolerant species. Many previously disturbed forest sites have been invaded by non-native plant species such as garlic mustard (Alliaria petiolate) and Amur bush honeysuckle (*Lonicera maackii*).

Associated sites

F114XB403IN	**Wet Outwash Upland Forest** The Wet Outwash Upland Forest site has somewhat poorly drained to very poorly soils, and has a water table from 12 to 36 inches; where as the Dry Outwash Upland Forest site has well drained soils and no water table, but does receive extra run-in moisture.
F114XB503IN	**Till Upland Forest** Till Upland Forest occurs on till plains and till is the parent material while the Dry Outwash Upland Forest occurs on outwash plains, outwash terraces, stream terraces, esker and terraces and outwash is the parent material.

Similar sites

F114XB503IN	**Till Upland Forest** Till Upland Forest occurs on till plains and till is the parent material while the Dry Outwash Upland Forest occurs on outwash plains, outwash terraces, stream terraces, esker and terraces and outwash is the parent material.

Table 1. Dominant plant species

Tree	(1) *Quercus alba* (2) *Carya ovata*
Shrub	(1) *Corylus americana* (2) *Cornus florida*
Herbaceous	(1) *Sanicula* (2) *Carex pensylvanica*

Physiographic features

These sites are generally found on outwash plains and terraces.

Table 2. Representative physiographic features

Landforms	(1) Outwash plain (2) Outwash terrace (3) Stream terrace (4) Esker (5) Terrace
Runoff class	Low to medium
Flooding duration	Brief (2 to 7 days)
Flooding frequency	None to rare
Ponding frequency	None
Elevation	340–1,050 ft
Slope	0–30%
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 during summer. Snowfall is common in winter. The freeze-free period averages about 182 days.

Table 3. Representative climatic features

Frost-free period (characteristic range)	146-155 days
Freeze-free period (characteristic range)	175-185 days
Precipitation total (characteristic range)	41-46 in
Frost-free period (actual range)	135-163 days
Freeze-free period (actual range)	174-193 days
Precipitation total (actual range)	41-47 in
Frost-free period (average)	149 days
Freeze-free period (average)	182 days
Precipitation total (average)	44 in

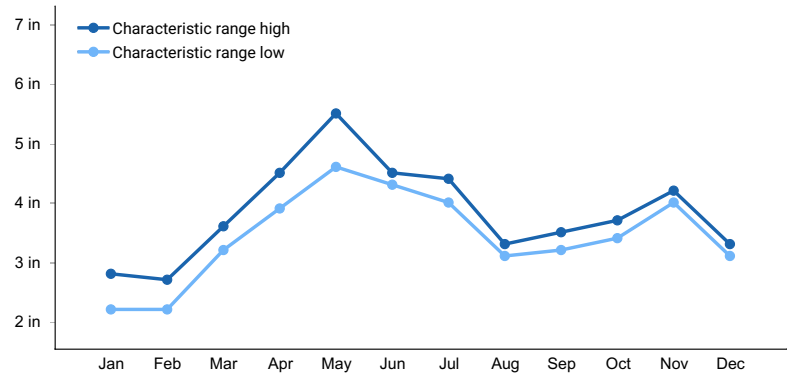


Figure 1. Monthly precipitation range

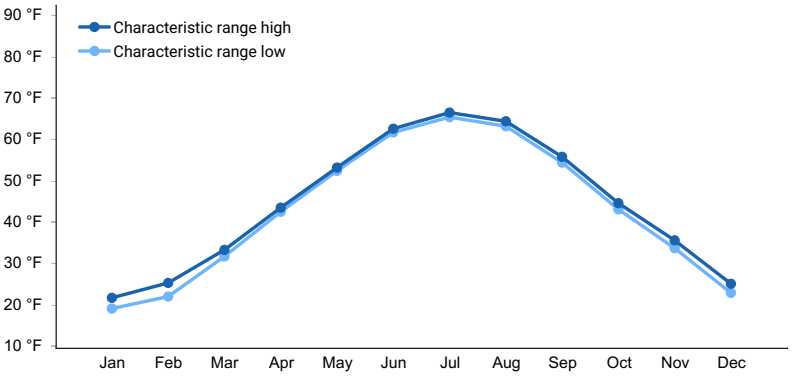


Figure 2. Monthly minimum temperature range

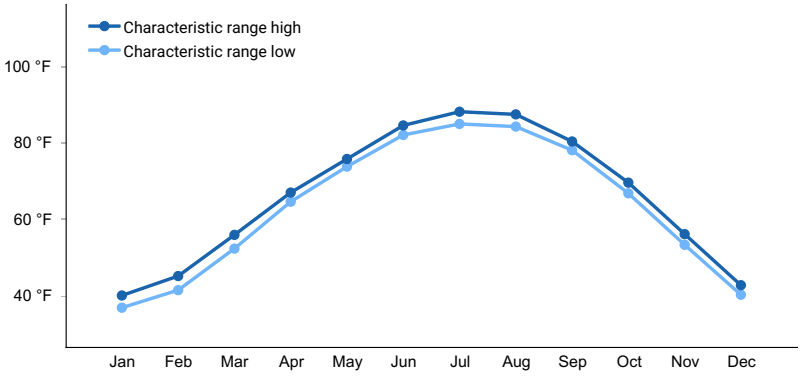


Figure 3. Monthly maximum temperature range

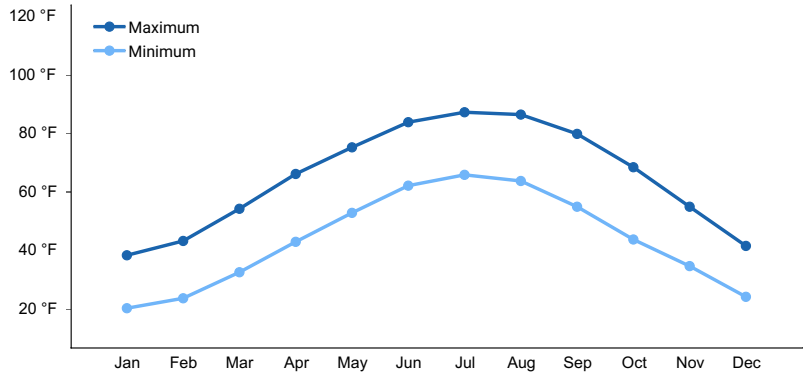


Figure 4. Monthly average minimum and maximum temperature

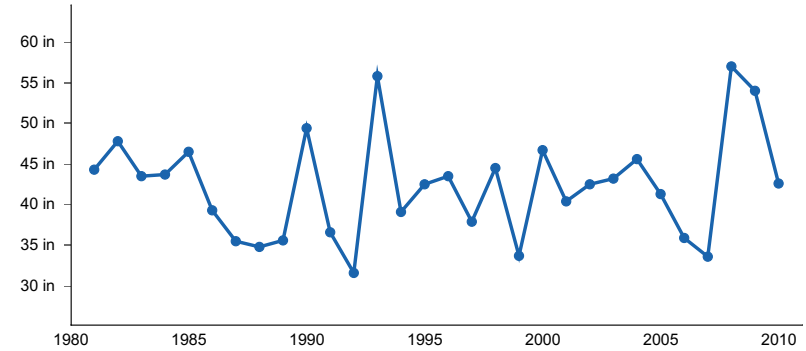


Figure 5. Annual precipitation pattern

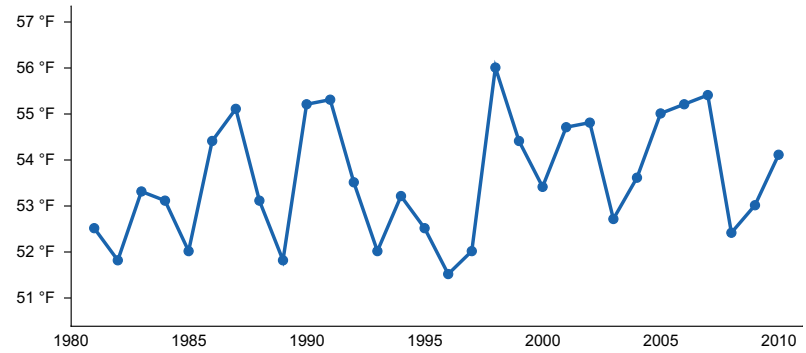


Figure 6. Annual average temperature pattern

Climate stations used

- (1) SPENCER [USC00128290], Spencer, IN
- (2) SPARTA 1 W [USC00118147], Sparta, IL
- (3) BELLEVILLE SIU RSCH [USW00013802], Mascoutah, IL
- (4) SHAKAMAK SP [USC00127959], Jasonville, IN
- (5) PANA 3E [USC00116579], Pana, IL
- (6) JERSEYVILLE 2 SW [USC00114489], Jerseyville, IL

Influencing water features

These sites are generally not influenced by riparian or wetland features. A few mapunit in this initial PES grouping are on terraces and may incur rare, brief flooding. Some sites have an intermittent seasonal high water table.

Soil features

The soil series associated with this site are: Camden, Campton, Chetwynd, Fox, Martinsville, Negley, Ockley, Parke, Pike, and Ridgeway. They are very deep, well drained, and moderately permeable soils, with very acidic to slightly acidic soil reaction, that formed in Outwash. The outwash may be overlayed by loess, drift, and paleosol.

Table 4. Representative soil features

Parent material	(1) Outwash
Surface texture	(1) Silt loam (2) Loam (3) Silty clay loam
Family particle size	(1) Fine-silty (2) Fine-loamy
Drainage class	Well drained
Permeability class	Moderate
Soil depth	60–80 in
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	4.5–8.4 in
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	4.7–6.2
Subsurface fragment volume <=3" (0-40in)	0–10%
Subsurface fragment volume >3" (0-40in)	0–2%

Ecological dynamics

These sites were oak-hickory forests with multiple species co-dominant including white oak, northern red oak (*Quercus rubra*), bur oak (*Q. macrocarpa*), post oak (*Q. stellata*) and black oak (*Q. velutina*). Hickories are also very common including shagbark (Cary ovata), pignut (*Carya ovalis*), and mockernut (*Carya tomentosa*). Associates include white ash (Fraxinus alba), maple (Acer spp.), black walnut (*Juglans nigra*), and tulip poplar (*Liriodendron tulipifera*). The subcanopy will include eastern black cherry (*Prunus serotina*), sassafras (*Sassafras albidum*), and dogwoods (Cornus spp.)

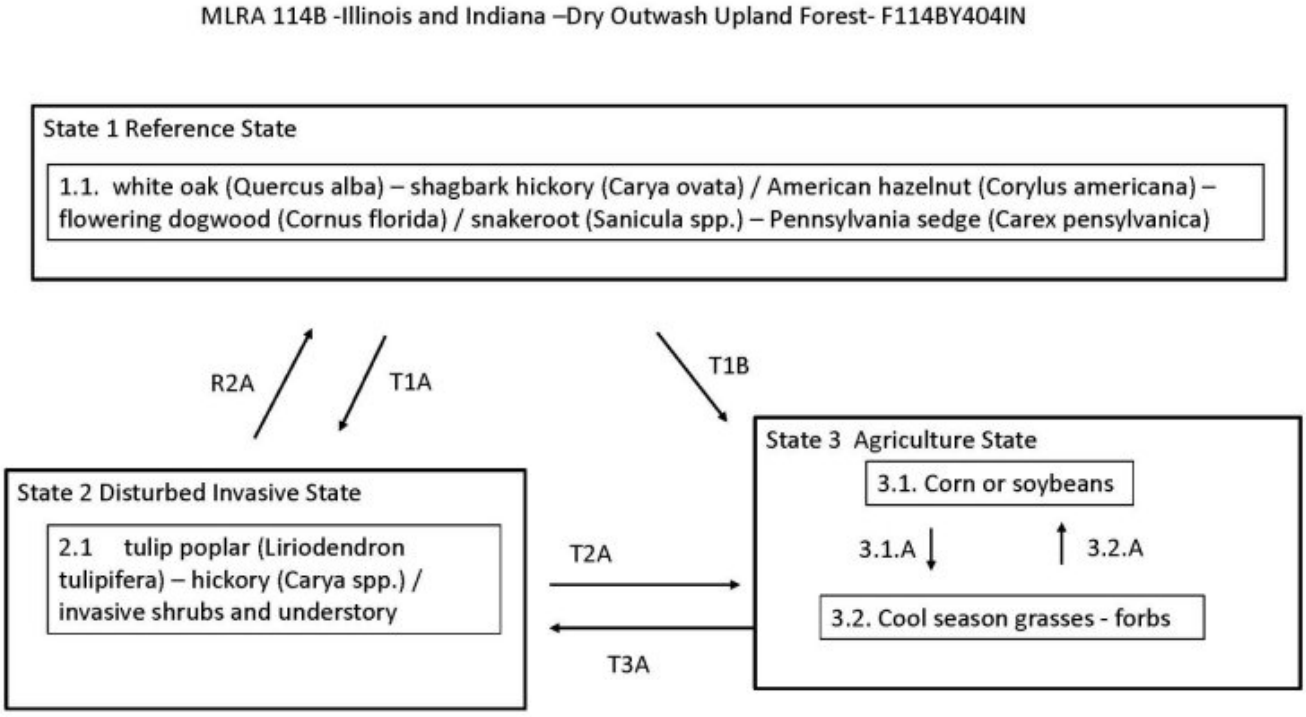
The shrub layer can be quite variable but may include flowering dogwood (*Cornus florida*.), blackhaw (*Viburnum prunifolium*), American hazel nut (*Corylus americana*), common serviceberry (*Amelanchier arborea*), hawthorn (Crataegus spp.), and hophornbeam (*Ostrya virginiana*).

The herbaceous layer is often quite diverse and will vary from site to site influence by the fire regime and amount of canopy closure. Lack of historic fire intervals will result in changes in species composition. On some sites this will result in an increase in fire intolerant mesophytic species such as maple, ash, beech, and/or tulip poplar.

Many forest sites in Indiana and Illinois have been invaded by non-native plant species such as garlic mustard (Alliaria petiolate) and Amur bush honeysuckle (*Lonicera maackii*).

Most sites in MLRA 114X have incurred historic disturbances including selective harvest (oak removal), clearing, grazing, recreational uses, development, or absence of natural fire regimes. These disturbances will transition this community to a woodland dominated by fast-growing, shade-tolerant species such as sugar maple, tulip poplar, white ash, and beech. The resulting dense canopy shade results in a more sparse understory community. Few high-quality, old-growth communities remain. Agriculture is the largest use of these soils in MLRA 114X.

State and transition model



State 1
Reference State

This state is characterized by a closed canopy dominated by upland oak and hickory forest. Multiple species may be present depending on past disturbances, fire regime (or lack of), seed sources, microtopography, and soil characteristics. Historically, these communities were oak-hickory forest influenced by fire. Species may include white oak, shagbark hickory, black oak, pignut hickory, sugar maple, American beech, white ash, and tulip poplar. The natural fire regime favors oak regeneration, so with a lack of fire, many sites today have become dominated by associate species. Many sites will need selective thinning to encourage oak reproduction. Timber stand improvement activities will encourage oak reproduction and growth while controlling fast-growing, shade-tolerant species.

Dominant plant species

- white oak (*Quercus alba*), tree
- black oak (*Quercus velutina*), tree
- shagbark hickory (*Carya ovata*), tree
- flowering dogwood (*Cornus florida*), shrub
- American hazelnut (*Corylus americana*), shrub
- sassafras (*Sassafras albidum*), shrub
- Pennsylvania sedge (*Carex pensylvanica*), grass
- sanicle (*Sanicula*), other herbaceous
- bedstraw (*Galium*), other herbaceous

Community 1.1
Reference Community

These sites were oak-hickory forests with multiple species possible as co-dominants. Oak species may include white oak, northern red oak (*Quercus rubra*), bur oak (*Q. macrocarpa*), post oak (*Q. stellata*) and black oak (*Q. velutina*). Hickories are common and include shagbark (Cary ovata), pignut (*Carya ovalis*), and mockernut (*Carya tomentosa*). Associates include white ash (Fraxinus alba), maple (Acer spp.), black walnut (*Juglans nigra*), and tulip poplar (*Liriodendron tulipifera*). The subcanopy will include eastern black cherry (*Prunus serotina*), sassafras (*Sassafras albidum*), and dogwoods (Cornus spp.). The shrub layer can be quite variable but may include dogwood (Cornus spp.), blackhaw (*Viburnum prunifolium*), American hazel nut (*Corylus americana*), common serviceberry (*Amelanchier arborea*), hawthorn (Crataegus spp.), and hophornbeam (*Ostrya virginiana*). The herbaceous layer is often quite diverse and will vary from site to site influence by the fire regime and amount of canopy closure. Lack of historic fire intervals will result in changes in species composition. On some sites this will result in an increase in fire intolerant mesophytic species such as maple, ash, beech, and/or tulip poplar. Many studies on oak-dominated forests in the central and eastern US have reported increasing abundance of fire-sensitive species and poor recruitment of oak (Quercus spp.) in the absence of frequent fire. (Nowacki, 2008), (Keyser, 2017).

Dominant plant species

- shagbark hickory (*Carya ovata*), tree
- white oak (*Quercus alba*), tree
- black oak (*Quercus velutina*), tree
- flowering dogwood (*Cornus florida*), shrub
- American hazelnut (*Corylus americana*), shrub
- sassafras (*Sassafras albidum*), shrub
- Pennsylvania sedge (*Carex pensylvanica*), grass
- sanicle (*Sanicula*), other herbaceous
- bedstraw (*Galium*), other herbaceous

State 2
Disturbed Invaded State

Most sites have incurred historic disturbances including selective harvest (oak removal), clearing, grazing, recreational uses, development, or absence of natural fire regimes. These disturbances will transition this community to a woodland dominated by fast-growing, shade-tolerant species such as sugar maple, tulip poplar, white ash, and beech. The resulting dense canopy shade results in a sparser understory community with more shade tolerant species. Few high-quality, old-growth communities remain. Agriculture is the largest use of these soils in MLRA 114X. Species on disturbed sites may vary greatly depending on the type and length of disturbance and available seed sources.

Dominant plant species

- sugar maple (*Acer saccharum*), tree
- red maple (*Acer rubrum*), tree
- white ash (*Fraxinus americana*), tree
- tuliptree (*Liriodendron tulipifera*), tree
- honeysuckle (*Lonicera*), shrub
- autumn olive (*Elaeagnus umbellata*), shrub
- Nepalese browntop (*Microstegium vimineum*), grass
- sedge (*Carex*), grass
- garlic mustard (*Alliaria petiolata*), other herbaceous
- eastern poison ivy (*Toxicodendron radicans*), other herbaceous

Community 2.1
Disturbed Invaded Community

This phase is characterized by the removal of the higher value tree species, primarily oak and hickory species, or other major disturbances that remove the oak - hickory canopy. Often this disturbance introduces non-native understory species which, if not controlled, will overtake the site and impede oak reproduction. Species on these

sites will vary greatly and will depend on seed sources and length/type of disturbances.

Dominant plant species

- sugar maple (*Acer saccharum*), tree
- tuliptree (*Liriodendron tulipifera*), tree
- red maple (*Acer rubrum*), tree
- honeysuckle (*Lonicera*), shrub
- autumn olive (*Elaeagnus umbellata*), shrub
- sedge (*Carex*), grass
- Nepalese browntop (*Microstegium vimineum*), grass
- garlic mustard (*Alliaria petiolata*), other herbaceous
- eastern poison ivy (*Toxicodendron radicans*), other herbaceous

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. This state is found on lower slope mapunits within this group. A smaller portion are used for forage and pasture with cool and/or warm season grasses. Some mapunits in this group have high slopes and are not appropriate for cropland or pasture production. Species planted will depend on the landowners management goals and 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
- corn (*Zea mays*), other herbaceous
- soybean (*Glycine max*), other herbaceous

Community 3.1
Cropland

This community is characterized by row crop agriculture of small grains, corn and/or soybeans. This use is feasible for lower slope sites only. Species planted and management implemented will depend on landowner goals and objectives.

Dominant plant species

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

Community 3.2
Forage / Pasture

This phase is characterized by forage production. Different mixes of cool or warm season grasses and forbs, largely clovers, are grown. Species selection will depend on owner's goals and 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

Pathway 3.1.A
Community 3.1 to 3.2

Planting of cool or warm season pasture/forage species and management to maintain them. Species planted and management will depend on landowner's goals and objectives.

Pathway 3.2.A
Community 3.2 to 3.1

This community is developed via planting, either by conventional or no-till methods, of row crops. Many species are feasible for these sites. Management inputs will vary depending on crop being produced and the landowner's management objectives.

Transition T1A
State 1 to 2

Removal of high value timber; usually, the removal of oaks. Little to no post-harvest timber stand management to encourage oak regeneration. No long-term control of non-native species.

Transition T1B
State 1 to 3

Clearing of mature high-quality forest for conversion to agricultural production. This is applicable only to lower slope mapunits in this group.

Restoration pathway R2A
State 2 to 1

Restoration of site would include planting of oaks and timber stand improvement activities to insure high value trees thrive. Timber stand improvement efforts would include planting desired species, thinning, brush control and weed control.

Transition T2A
State 2 to 3

Transition from forest to agricultural state. Activities would be determined by the landowner’s production objectives. This is feasible for lower slope sites only. Species planted would depend upon management goals.

Transition T3A
State 3 to 2

Cropland or pastureland that is abandoned will slowly, but naturally, transition to a mixed deciduous woodland usually dominated by fast growing and shade tolerant trees such as maple, ash, poplar, elm, etc. Weeds and brush are often problematic on these sites without control.

Additional community tables

Inventory data references

No field monitoring was conducted as part of this PES development. Future ESD development may result in plant community edits, soil mapunits being added or removed from this grouping, and/or additions or modifications to the narratives, tables, vegetation descriptions and state and transition model.

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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	04/26/2024
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:**