USDA Natural Resources
Conservation Service

Ecological site F122XY010KY
Moderately Well Drained Fragipan Terraces

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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): 122X–Highland Rim and Pennyroyal

MLRA 122 is in Tennessee (47 percent), Kentucky (43 percent), Indiana (7 percent), and Alabama (3 percent). It makes up about 21,530 square miles (55,790 square kilometers). Bloomington, Indiana, is in the small part of this area that extends into southern Indiana.

SOILS:
Many of the soils in this MLRA are Udalfs. The moderately deep to very deep, well drained, clayey soils formed in limestone residuum. They are dominantly in rolling to steep areas of the “Outer Basin” (Mimosa, Braxton, Gladdice, and Hampshire series) and the undulating to hilly areas of the “Inner Basin” (Talbott and Bradyville series). The most agriculturally productive soils are the very deep, well drained, clayey or loamy soils that formed in alluvium and/or loess over alluvium or limestone residuum in nearly level to undulating areas (Armour, Cumberland, Harpeth, Lomond, and Maury series). The less extensive soils generally are moderately well drained to somewhat poorly drained and formed in loamy or clayey alluvium and/or residuum (Byler, Capshaw, Colbert, and Tupelo series). This MLRA has a significant acreage of Mollisols. Shallow or moderately deep, well drained, clayey Udolls (Ashwood and Barfield series) formed in limestone residuum dominantly in rolling to steep areas. Very shallow, well drained, clayey Rendolls (Gladeville series) formed in limestone residuum dominantly in undulating to rolling areas of the “Inner Basin.” Very deep, well drained or moderately well drained Udolls (Arrington, Egam, Lynnville, and Staser series) and somewhat poorly drained or poorly drained Aquolls (Agee, Godwin, and Lanton series) formed in loamy or clayey alluvium derived from limestone on flood plains. Most of the remaining soils on flood plains are moderately well drained or well drained Udepts (Lindell and Ocana series). Udults are of small extent in this area. Most are very deep, well drained, and loamy and formed in gravelly colluvium or colluvium and the underlying residuum on steep hillsides (Dellrose soils). Rock outcrops are common on uplands.

BIOLOGICAL RESOURCES:
This area supports mixed oak forest vegetation. White oak, black oak, northern red oak, and some scarlet oak are the dominant tree species. Shagbark hickory, bitternut hickory, pignut hickory, and mockernut hickory also occur. Oak, blackgum, flowering dogwood, sassafras, Virginia pine, pitch pine, and shortleaf pine grow mostly on ridgetops.

(Excerpt from United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.)

Classification relationships

Group: South-Central Interior Oak Forest & Woodland
Alliance: Interior Low Plateau Mixed Oak Woodland

Possible Associations:
Quercus falcata - *Quercus alba* - Quercus stellata - *Quercus velutina* Forest
Translated Name: Southern Red Oak - White Oak - Post Oak - Black Oak Forest
Common Name: Southern Red Oak - Mixed Oak Forest
Unique Identifier: CEGL005018
Classification Approach: International Vegetation Classification (IVC)

Ecological site concept

10-Moderately Well Drained Fragipan Terraces
MLRA 122

Individual sites deserve a detailed understanding before conservation and restoration practices are implemented. The provisional ecological site (PES) communities described in this document reflect plant communities that can be found but does not encompass the entire complexity or diversity. Additional ecological field assessments are required to develop a full ecological site description which can be utilized for conservation planning and restoration purposes.

Only two tree species can be selected for entry into the database as dominants; however, multiple tree species may be dominant on these sites depending on aspect, soil depth, seed sources, management, and disturbance history.
State 1. Forestland
Phase 1.1:
white oak (*Quercus alba*) - black oak (*Quercus velutina*) / flowering dogwood (*Cornus florida*) –sassafras (*Sassafras albidum*) / Canadian snakeroot (*Sanicula canadensis*) – ticktrefoil (Desmodium spp.)

Other common trees may include: sugar maple, red maple, American beech, tulip poplar, white ash, black walnut, basswood, hickories, and other upland oak species. Other shrubs would include paw paw (*Asimina triloba*) and spicebush (*Lindera benzoin*). In older, establish, and undisturbed forests, a rich herb and forb layer would be present.

State: 2. Pasture
Phase 2.1: Managed Pasture. Plant species dominant: *Schedonorus arundinaceus* (tall fescue)

Pasture plant species are dependent on seeding, weed control, concurrent land uses, on-going levels of disturbance, and landowner goals.

State: 3 – Transitional Field
Phases 3.1: Plant species dominants: maple (Acer spp.) –tulip poplar (*Liriodendron tulipifera*)/ berries (Rubus spp.) – roses (Rosa spp.) / iron weed (*Vernonia gigantea*) –tall fescue (*Schedonorus arundinaceus*)

State 3 is a successional state. Typified by a variety of grasses, forbs, herbs, and young trees.

State 4: Abandoned Croplands
Phase 4.1.: Plant species dominant:
henbit deadnettle (*Lamium amplexicaule*) – mouse-eared chickweed (Cerastium L.)

Abandonment of cropland would result in many weed species taking over the site. Initially, annual weeds would be predominate followed by grasses, shrubs and finally, pioneers trees.

State 5.0: Cropland
Phase 5.1: Plant species dominants: dependent upon seeding and management. Most common crops are corn and soybeans.

It would require years of management, plantings, and weed control to transition to a reference community from phases 2-5.

Table 1. Dominant plant species

Tree	(1) *Quercus alba* (2) *Quercus velutina*
Shrub	(1) *Cornus florida* (2) *Sassafras albidum*
Herbaceous	(1) *Sanicula canadensis* (2) *Desmodium*

Physiographic features

There sites are predominately on terraces.

Table 2. Representative physiographic features

Landforms	(1) Terrace
Flooding duration	Extremely brief (0.1 to 4 hours) to very brief (4 to 48 hours)
Flooding frequency	None to occasional
Ponding frequency	None
Elevation	101–335 m
Slope	0–12%
Water table depth	51–102 cm

Climatic features

Climate
The average annual precipitation in this area is 43 to 63
inches (1,090 to 1,600 millimeters), increasing to the south. The maximum precipitation occurs in winter and early in spring, and the minimum occurs in fall. Most of the rainfall occurs as high-intensity, convective thunderstorms. Snowfall may occur in winter. The average annual temperature is 52 to 60 degrees F (11 to 16 degrees C), increasing to the south. The freeze-free period averages 210 days and ranges from 185 to 235 days. The longer freeze-free periods occur in the more southerly parts of the area.

(Excerpt from United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.)

Table 3. Representative climatic features

Frost-free period (average)	175 days
Freeze-free period (average)	197 days
Precipitation total (average)	1,372 mm

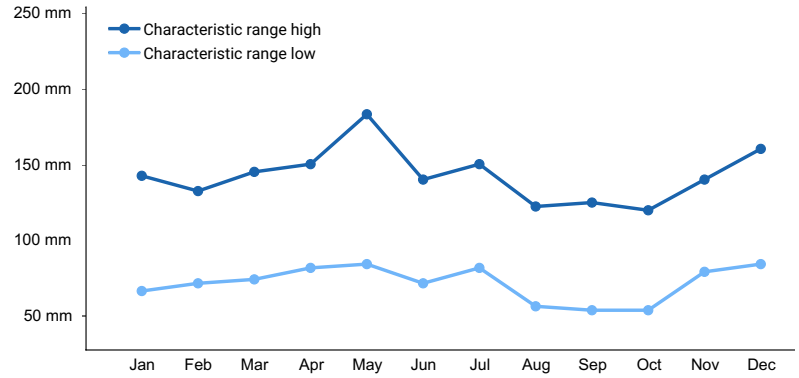

Figure 1. Monthly precipitation range

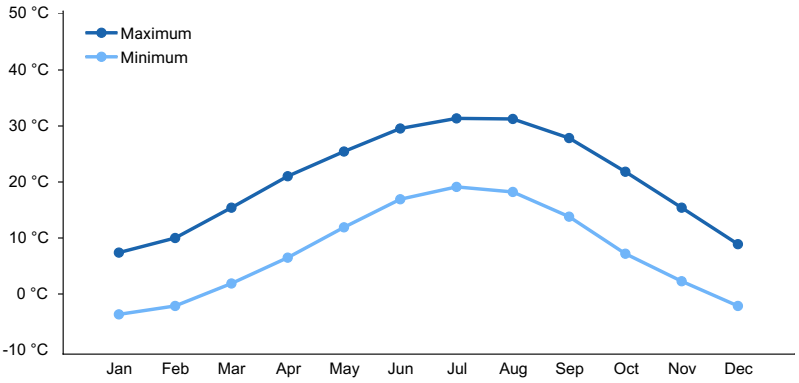

Figure 2. Monthly average minimum and maximum temperature

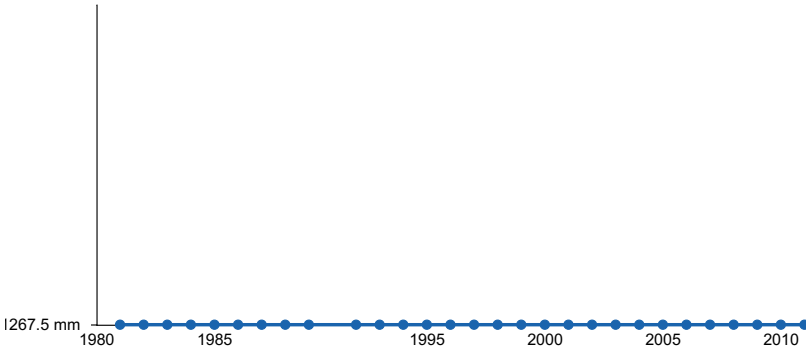

Figure 3. Annual precipitation pattern

Climate stations used

- (1) WAYNESBORO [USC00409502], Waynesboro, TN
- (2) CLARKSVILLE WWTP [USC00401790], Clarksville, TN
- (3) GREENSBURG [USC00153430], Greensburg, KY
- (4) COOKEVILLE [USC00402009], Cookeville, TN
- (5) SALEM [USC00127755], Salem, IN

Influencing water features

Some mapunits in this group are considered rarely flooded, but most have no influencing water features.

Soil features

These soils are moderately well drained and have a fragipan layer.

Table 4. Representative soil features

Parent material	(1) Alluvium–limestone (2) Colluvium–sandstone and shale
Surface texture	(1) Gravelly loam (2) Silt loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained
Permeability class	Very slow to slow
Soil depth	152–203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	10.16–17.78 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	4.5–5.5
Subsurface fragment volume <=3" (Depth not specified)	0–40%
Subsurface fragment volume >3" (Depth not specified)	0–9%

Ecological dynamics

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Initial soil mapunits include: Captina, Landisburg(Tarklin), Landisburg (Captina), Monongahela, Otwell, Otwood, Pekin, and Tarklin.

Communities described in this provisional document reflect plant communities that are likely to be found on these soils and have not been extensively field verified. This PES describes hypotheses based on available data of many different scales and sources and has not been developed utilizing site-specific ecological field monitoring. This PES does not encompass the entire complexity or diversity of these sites. Additional field studies are needed for site-specific conservation planning or to develop a comprehensive and science-based restoration plan for these soils.

Future field work may determine that this grouping be modified or split into multiple ESDs.
Additional soils may be added pending field verification.

Forest Vegetation as listed in Official Series Descriptions (OSD):
Captina: Native vegetation was hardwood forests with small openings of tall grass prairies.
Monongahela: Where wooded, common trees include red oak, white oak, yellow-poplar, sycamore, white pine, and Virginia pine.
Otwell: Native vegetation is mixed deciduous hardwood forest.
Otwood: Some areas are used as pasture and woodland.
Pekin: Native vegetation is mixed deciduous hardwood forest.
Tarklin: Woodland is composed chiefly of oaks, hickories, beech, dogwood, persimmon, and some Virginia pine.
Only two tree species can be selected for entry into the database as dominants; however, multiple tree species may be dominant on these sites and it will vary depending on aspect, soil depth, seed sources, management, and disturbance history. Multiple species of oaks, hickories and other hardwoods may be found on these sites.

State 1. Forestland
Phase 1.1: Plant species dominants:
white oak (*Quercus alba*) - black oak (*Quercus velutina*) / flowering dogwood (*Cornus florida*) –sassafras (*Sassafras albidum*) / Canadian snakeroot (*Sanicula canadensis*) – ticktrefoil (Desmodium spp.)

Other common trees may include: sugar maple, red maple, American beech, tulip poplar, white ash, black walnut, basswood, hickories, and other upland oak species. Other shrubs would include paw paw (*Asimina triloba*) and spicebush (*Lindera benzoin*).

In older, establish, and undisturbed forests, a rich herb and forb layer would be present and may include the following:
Adiantum pedatum (northern maidenhair fern)
Amphicarpaea bracteata (hogpeanut)
Asarum canadense (wild ginger)
Carex spp. (sedges)
Caulophyllum thalictroides (blue cohosh)
Claytonia spp. (springbeauty)
Botrychium virginianum (rattlesnake-fern)
Gallium spp. (bedstaws)
Geranium maculatum (wild geranium)
Eupatorium rugosum (white snakeroot)
Erythronium spp. (trout lilies)
Osmorhiza claytonia (sweet cicely)
Panax quinquefolius (American ginseng)
Podophyllum peltatum (mayapple)
Prenanthes spp. (rattlesnake root)
Sanicula spp. (snakeroots)
Smilacina racemosa (false Solomon's seal)
Uvularia grandiflora (bellwort)
Viola canadensis (Canada violet)
Viola pubescens (downy yellow violet)
Aralia racemosa (spikenard).

State: 2. Pasture
Phase 2.1: Managed Pasture. Plant species dominant: *Schedonorus arundinaceus* (tall fescue)

Pasture plant species are dependent on seeding, weed control, concurrent land uses, on-going levels of disturbance, and landowner goals. Individual site and soil characteristics, along with management activities, will influence production levels.

Many species of grass, both warm and cool season, are available and suitable for these sites. Common forage species include tall fescue, orchard grass, Kentucky bluegrass, Johnson grass, timothy, and various species of clover.

Management of pasture sites should follow conservation planning standards and protocols which include watershed protection, soil health, and adequate forage species.

Transitioning this state to a reference condition would require long-term timber stand improvement practices to control non-native vegetation and manage for desired hardwood species.

State: 3 – Transitional Field
Phases 3.1: Plant species dominants: maple (Acer spp.) –tulip poplar (*Liriodendron tulipifera*)/ berries (Rubus spp.) – roses (Rosa spp.) / iron weed (*Vernonia gigantea*) –tall fescue (*Schedonorus arundinaceus*)

State 3 is a successional state. Typified by a variety of grasses, forbs, herbs, and young trees. Tree species found on site are a mix depending on levels on ongoing disturbance and adjacent seed sources. Multiflora rose, briars, berries and brambles a frequent component. Common non-native herbaceous species may included Queen Anne's

lace (*Daucus carota*), mullein (*Verbascum thapsus*) thistles, lespedeza, lambs quarters (*Chenopodium album*), horse nettle (*Solanum carolinense*) and pigweed (*Amaranthus albus*). Common native herbaceous species are giant ironweed (*Vernonia gigantea*), common milkweed (*Asclepias syriaca*), goldenrods (Solidago spp.), sunflowers (Helianthus spp.). White crownbeard (*Verbesina virginica*) and yellow crownbeard (*V. occidentalis*) are common on drier areas while common lowland wingstem (*Verbesina alternifolia*) and blue mist-flower (Conoclinum coelestinum) prefer moister areas.

Transitioning this state to a reference condition will require management inputs including timber stand improvement practices and control of non-native vegetation.

State 4: Abandoned Croplands

Phase 4.1.: Plant species dominant:
henbit deadnettle (*Lamium amplexicaule*) – mouse-eared chickweed (Cerastium L.)

Abandonment of cropland would result in many weed species taking over the site. Initially, annual weeds would be predominate followed by grasses, shrubs and finally, pioneers trees.

It would require years of management, plantings, and weed control to establish successional communities that could transition to a reference community.

State 5.0: Cropland

Phase 5.1: Plant species dominants: dependent upon seeding and management. Most common crops are corn and soybeans.

This state can be transitioned to any of the other states with sufficient management inputs: forest restoration and timber stand management, pasture plantings, long-term weed control, etc. Transitioning this state to a reference condition will require extensive timber stand improvement practices to control non-native vegetation and manage for desired species.

State and transition model

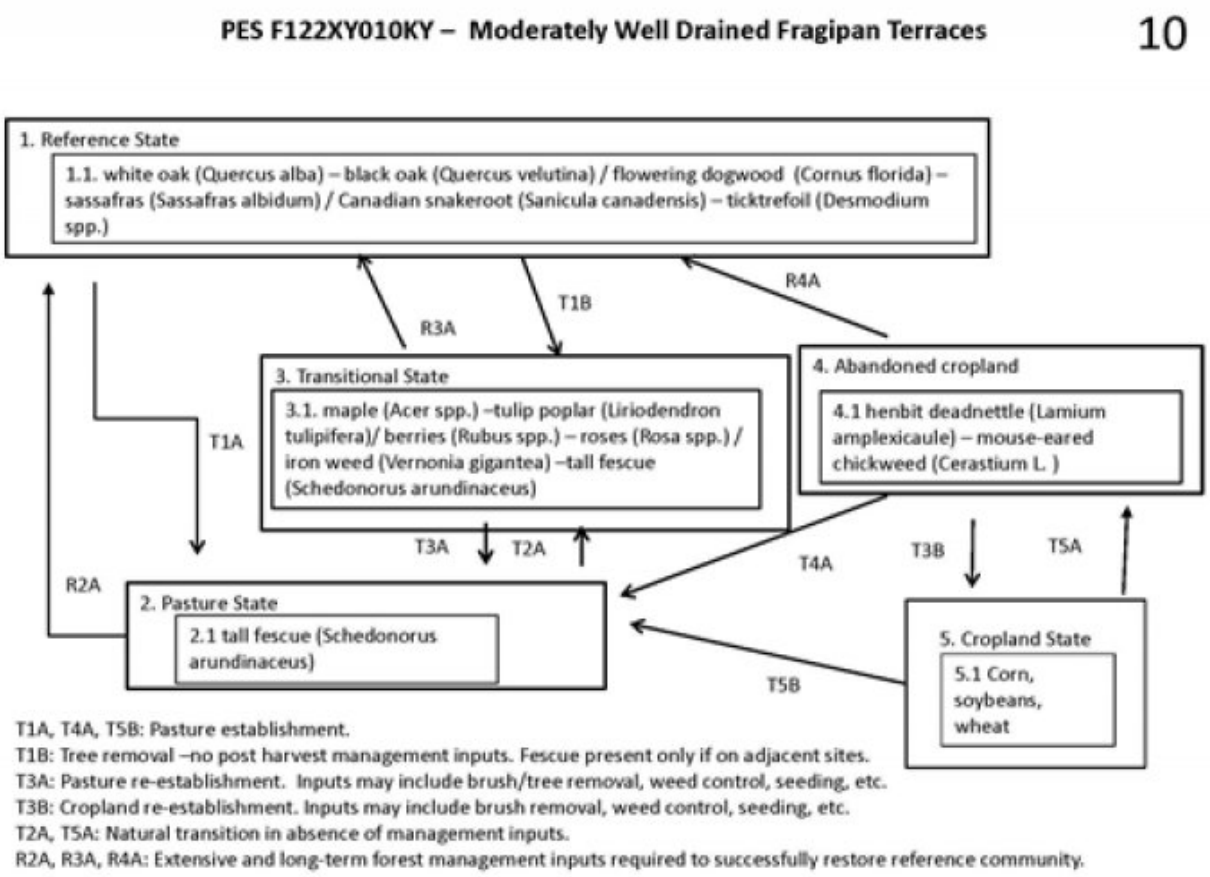

Figure 5. Group 10

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	
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

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3. **Number and height of erosional pedestals or terracettes:**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

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5. **Number of gullies and erosion associated with gullies:**

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6. **Extent of wind scoured, blowouts and/or depositional areas:**

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7. **Amount of litter movement (describe size and distance expected to travel):**

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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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):**

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:**