USDA Natural Resources Conservation Service

Ecological site F121XY006KY
Ordovician Limestone Upland

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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): 121X–Kentucky Bluegrass

General: The project area is in Kentucky (83 percent), Ohio (11 percent), and Indiana (6 percent). It makes up about 10,680 square miles (27,670 square kilometers). The cities of Cincinnati, Ohio, and Louisville, Frankfort, and Lexington, Kentucky, are in this area.

Physiography: MLRA 121 is primarily in the Lexington Plain Section of the Interior Low Plateaus Province of the Interior Plains.

Soils: The dominant soil orders in MLRA 121 are Alfisols, Inceptisols, and Mollisols. The soils in the area dominantly have a mesic soil temperature regime, an udic soil moisture regime, and mixed mineralogy. They are shallow to very deep, generally well-drained, and loamy or clayey. Hapludalfs formed in residuum on hills and ridges (Beasley, Cynthiana, Eden, Faywood, Lowell, and McAfee series) and in loess over residuum on hills and ridges (Carmel and Shelbyville series). Paleudalfs (Crider and Maury series) formed in loess or other silty sediments over residuum on hills and ridges. Fragiudalfs (Nicholson series) formed in loess over residuum on ridges. Hapludolls formed in residuum on hills and ridges (Fairmount series) and in alluvium on floodplains (Huntington series). Eutrudepts (Nolin series) formed in alluvium on flood plains.

Geology: Most of this area has an Ordovician-age limestone that has been brought to the surface in the Jessamine Dome, a high part of a much larger structure called the Cincinnati Arch. The strata of limestone have a propensity to form caves and karst topography. Younger units of thin-bedded shale, siltstone, and limestone occur at the eastern and western edges of the area.
The area has no coal-bearing units. Pleistocene-age loess deposits cover most of the bedrock units in this MLRA, and some glacial lake sediments are at the surface in the northwest corner of the area. Unconsolidated alluvium is deposited in the river valleys.

Classification relationships

Quercus alba -- *Quercus rubra* - *Quercus muehlenbergii*/ Cercis candensis Forest. Interior Highlands Dry-mesic forest. (Plant communities of the Midwest)

Calcareous sub-xeric forest: Kentucky State Nature Preserves Commission

Calcareous mesophytic forest: Kentucky State Nature Preserves Commission

Ecological site concept

State 1. (Reference)
State 1, Phase 1.1: Plant species dominants:

Quercus alba-Quercus rubra /*Cercis canadensis* /*Delphinium tricorne-Podophyllum peltatum* (White oak – red oak / eastern redbud / dwarf larkspur – mayapple)

State 2, Phase 1.2: Plant species dominants: *Acer saccharum*.-Quercus spp.//*Delphinium tricorne* - *Podophyllum peltatum*

Forests on these limestone-influenced sites are generally oak-hickory, oak-cedar or more mesic maple-oak types. Understory communities are usually well-developed and contain herbs and forbs that thrive on limestone soils.

Phase 1.1 to Phase 1.2
The absence of a natural fire regime and a history of disturbances (logging, grazing, etc.) are influences that will move this community from phase 1.1 to 1.2. The transition creates a more mesic, shady environment which enhances the reproduction of quick growing, fire intolerant, shade-tolerant species such as maples and reduces the successful regeneration of oaks and hickories.

Phase 1.2 to Phase 1.1
Fire, timber stand improvement activities or drought can influence this community to shift more toward the reference forest of oak-hickory.

State: 2. Pasture
State 2, Phase 2.1: Managed Pasture. Plant species dominants: *Schedonorus arundinaceus* (tall fescue)
State 2, Phase 2.2: Minimally Managed Pasture. Plant species dominants: *Rosa multiflora*- Rubus spp. /*Schedonorus arundinaceus*
State 2, Phase 2.3: Warm season grass pasture. Plant species dominants: *Schizachyrium scoparium*- *Sporobolus heterolepis*

State: 3 – Transitional (Abandoned Field)
State 3, Phases 3.1: Plant species dominants: *Juniperus virginiana*/ Rubus spp.- *Rosa multiflora*/ *Vernonia gigantea* -*Schedonorus arundinaceus*
Eastern red cedar /blackberry – multiflora rose/ ironweed- tall fescue

State: 4. Honeysuckle Invaded Woodland
State 4, Phase 4.1: Plant species dominants: *Acer saccharum – Celtis occidentalis*/ *Lonicera maackii*

Table 1. Dominant plant species

Tree	(1) *Quercus alba* (2) *Quercus rubra*
Shrub	(1) *Cercis canadensis*
Herbaceous	(1) *Delphinium tricorne* (2) *Podophyllum peltatum*

Physiographic features

This grouping includes soils formed, at least in part, on Ordovician limestone in MLRA 121. This grouping includes soils of different depths and slopes. Future field work will likely result in the development of multiple ecological site descriptions for this initial provisional grouping.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Ridge

Flooding frequency	None
Ponding frequency	None
Elevation	137–335 m
Slope	2–30%
Water table depth	152 cm
Aspect	Aspect is not a significant factor

Climatic features

MLRA climate summary: The average annual precipitation in most of this area is 41 to 45 inches. It is 45 to 52 inches along the southern edge of the area. About one-half of the precipitation falls during the growing season. Most of the rainfall occurs as high-intensity, convective thunderstorms. The annual snowfall averages about 14 inches (370 millimeters). The average annual temperature is 51 to 57 degrees F (10 to 14 degrees C). From: 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, 2006)

Table 3. Representative climatic features

Frost-free period (average)	187 days
Freeze-free period (average)	206 days
Precipitation total (average)	1,143 mm

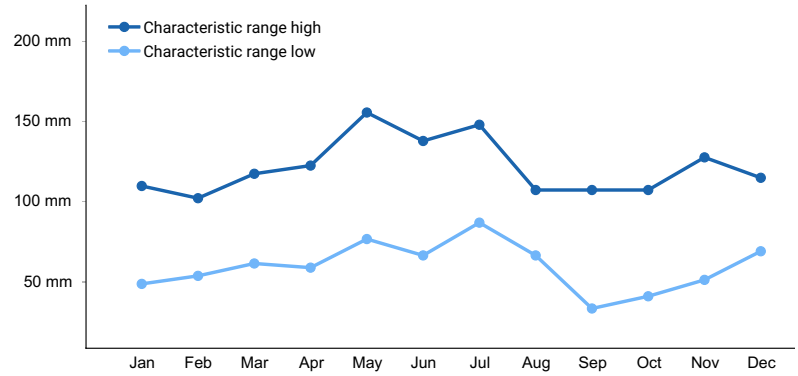

Figure 1. Monthly precipitation range

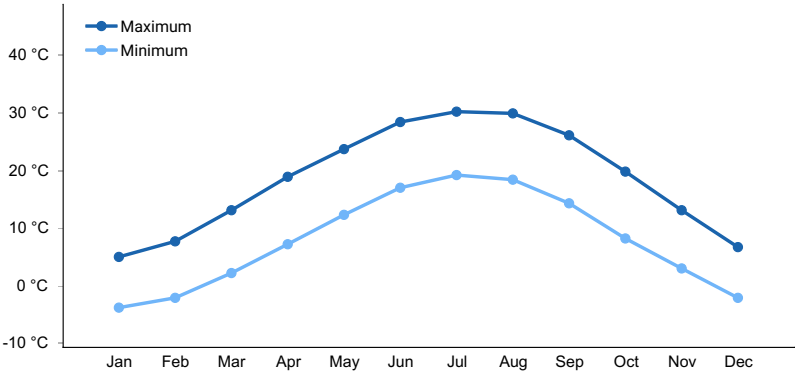

Figure 2. Monthly average minimum and maximum temperature

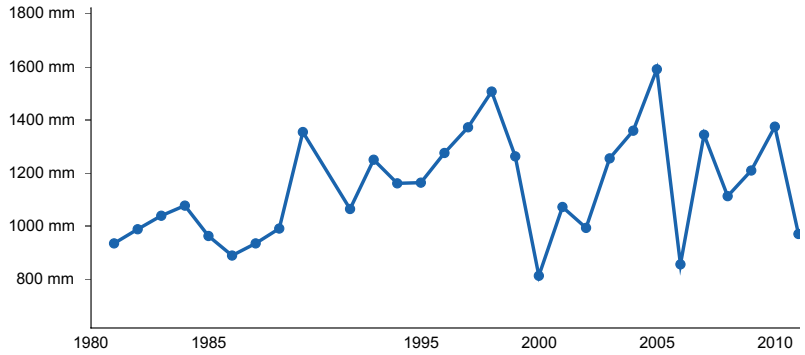

Figure 3. Annual precipitation pattern

Climate stations used

- (1) LEXINGTON BLUEGRASS AP [USW00093820], Lexington, KY

Influencing water features

There are no influencing water features on these upland sites.

Soil features

This group is the Ordovician Limestone Upland group. Soils are moderately deep to very deep and moderately well drained to well drained.

Table 4. Representative soil features

Parent material	(1) Residuum–limestone (2) Loess–limestone and shale
Surface texture	(1) Silty clay loam (2) Silty clay (3) Sandy loam
Family particle size	(1) Clayey
Drainage class	Moderately well drained to well drained
Permeability class	Very slow to moderate
Soil depth	102–193 cm
Surface fragment cover <=3"	0–1%
Surface fragment cover >3"	0–1%
Available water capacity (0-101.6cm)	8.13–21.08 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	5.3–7.8
Subsurface fragment volume <=3" (Depth not specified)	0–14%
Subsurface fragment volume >3" (Depth not specified)	0–27%

Ecological dynamics

Ecological Dynamics

Individual sites deserve a detailed understanding before conservation and restoration practices are implemented; therefore, it should be noted that the communities described in this provisional document reflect plant communities that are likely to be found on these soils and have not been field verified. Therefore, 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 also does not encompass the entire complexity or diversity of these sites. Field studies would be required to develop a comprehensive and science-based native plant restoration plan for these sites.

State 1. (Reference)
State 1, Phase 1.1: Plant species dominants:
Quercus alba-*Quercus rubra* /*Cercis canadensis* /*Delphinium tricorne* - *Podophyllum peltatum* (White oak – red oak / eastern redbud / dwarf larkspur – mayapple)

State 2, Phase 1.2: Plant species dominants: *Acer saccharum*.-Quercus spp.//*Delphinium tricorne* - *Podophyllum peltatum*

Narrative: Forests on these limestone-influenced sites are generally oak-hickory, oak-cedar or more mesic maple-oak types. Understory communities are usually somewhat well-developed and contain herbs and forbs that thrive on limestone soils. The shrub layer is usually sparse in older, reference type communities.

Dominant or characteristic trees include white oak, Shumard oak, sugar maple, shagbark hickory, mockernut hickory, eastern redbud, dogwood, white ash, and blue ash. (*Quercus alba*, *Quercus muehlenbergii*, *Acer saccharum*, *Carya ovata*, Carya tomentosa, *Cercis canadensis*, *Cornus florida*, *Fraxinus americana*, and *Fraxinus quadrangulata*).

Higher quality understory communities in both Phase 1.1 and Phase 1.2 reflect the rich, limestone bedrock influence and may include: *Delphinium tricorne*, *Jeffersonia diphylla*, *Enemion biternatum*, *Thalictrum dioicum*, *Dicentra cucullaria*, *Dicentra canadensis*, *Trillium flexipes*, *Dodecatheon meadia*, *Heuchera americana*, Maiantheum racemosa, *Erythronium americanum*, *Stylophorum diphyllum*, *Corydalis flavula*, *Uvularia grandiflora*, *Trillium sessile*, *Collinsia verna*, *Dioscorea quaternata*, *Arisaema triphyllum*, *Geum canadense*, *Agrimonia rostellata*, and *Ageratina altissima*. (Twinleaf, false rue anemone, early meadow rue, Dutchman's breeches, squirrel corn, nodding trillium, shooting star, alumroot, false Solomon's seal, yellow trout lily, celandine poppy, yellow corydalis, large-flowered bellwort, sessile trillium, blue-eyed Mary, wild yam, jack in the pulpit, smooth Solomon's seal, avens, glade bluets, beaked agrimony, white snakeroot)

Shrubs and vines on these sites may include *Symphoricarpos orbiculatus*, *Lindera benzoin*, Vitis spp., *Parthenocissus quinquefolia*, *Toxicodendron radicans*, and in more mesic micro-topography, *Asimina triloba*. (coralberry, spicebush, various grapes, Virginia creeper, poison ivy, paw-paw)

Phase 1.1 to Phase 1.2
The absence of a natural fire regime and a history of disturbances (logging, grazing, etc.) are influences that will move this community from phase 1.1 to 1.2. The transition creates a more mesic, shady environment which enhances the reproduction of quick growing, fire intolerant, shade-tolerant species such as maples and reduces the successful regeneration of oaks and hickories.

Phase 1.2 to Phase 1.1
Fire, timber stand improvement activities or drought can influence this community to shift more toward the reference forest of oak-hickory.

State: 2. Pasture
State 2, Phase 2.1: Managed Pasture. Plant species dominants: *Schedonorus arundinaceus* (tall fescue)
State 2, Phase 2.2: Minimally Managed Pasture. Plant species dominants: *Rosa multiflora*- Rubus spp. /*Schedonorus arundinaceus*
State 2, Phase 2.3: Warm season grass pasture. Plant species dominants: *Schizachyrium scoparium*- *Sporobolus heterolepis*

Narrative: Plant species within all of these pasture phases is 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 other species of grass, both warm and cool season, are available and suitable for these sites.

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

State: 3 – Transitional (Abandoned Field)
State 3, Phases 3.1: Plant species dominants: *Juniperus virginiana*/ Rubus spp.- *Rosa multiflora*/ *Vernonia gigantea* -*Schedonorus arundinaceus*
Eastern red cedar /blackberry – multiflora rose/ ironweed- tall fescue

Narrative: Tree species regeneration on these sites will depend on the severity and duration of disturbance, soil characteristics, adjacent plant communities and seed sources, post-disturbance management inputs, presence or absence of continued site disturbances (grazing), slope, and aspect.

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

State: 4. Honeysuckle Invaded Woodland
State 4, Phase 4.1: Plant species dominants: *Acer saccharum – Celtis occidentalis*/ *Lonicera maackii*
This state is characterized by a dense understory of Lonicera spp. (usually *L. maackii* in central Kentucky) which fundamentally alters the native plant communities due to shade and competition. Long-term, multi-year control efforts are required to control this aggressive non-native plant and restore native woodlands.

Transitioning this state to any of the other states will require honeysuckle removal and long-term control. Moving this community to a reference state, will require large management inputs including timber stand improvement practices to control non-native vegetation and species-specific management for oaks.

State and transition model

Contributors

Anita Arends

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:**

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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):**

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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:**
