

# Ecological site F121XY010KY Phosphatic 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:** MLRA 121 is in Kentucky (83 percent), southern Ohio (11 percent), and southern 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:** This area 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

Bluegrass woodland: Kentucky Nature Preserves Commission.

## Ecological site concept

The Phosphatic Limestone Upland ecological site occurs on soils which are moderately deep to very deep, well drained, moderately permeable and formed in silty material over residuum weathered from phosphatic limestone. Representative soils include Bluegrass, Braxton, Loudon, Maury, McAfee, Mercer. State 1. (Reference) State 1, Phase 1.1: Plant species dominants: *Quercus macrocarpa*-*Juglans nigra*/*Arundinaria gigantea* /*Sanicula* spp.-*Agrimonia* spp. (Bur oak-black walnut/ giant cane/ black snakeroot-agrimony) State 1, Phase 1.2: Plant species dominants: 1.2 *Acer saccharum*.-*Quercus* spp. / *Arundinaria gigantea* /*Amphicarpaea bracteata*-*Ageratina altissima* (Sugar maple – oaks / giant cane/ hogpeanut - white snakeroot) 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 pasture. Transitioning this state to a reference condition would require timber stand improvement practices to control non-native vegetation and plant/manage for desired species. State: 3. Transitional Field State 3, Phase 31: Plant species dominants: eastern red cedar (*Juniperus virginiana*) / *Rosa multiflora* (multiflora rose) / tall fescue (*Schedonorus arundinaceus*)-giant ironweed (*Vernonia gigantea*) 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. State: 5. Cropland State 5, Phase 5.1: Plant species dominants: dependent upon seeding and management. Most common crops are corn and soybeans.

Table 1. Dominant plant species

Tree	(1) <i>Quercus macrocarpa</i> (2) <i>Juglans nigra</i>
Shrub	(1) <i>Arundinaria gigantea</i>
Herbaceous	(1) <i>Ageratina altissima</i> (2) <i>Agrimonia</i>

### Physiographic features

These soils are moderately deep to very deep, well drained, moderately permeable and formed in silty material over residuum weathered from phosphatic limestone. These soils are on uplands in MLRA 121.

Table 2. Representative physiographic features

Landforms	(1) Flat (2) Hill
Runoff class	Very low to very high
Elevation	150 – 330 m
Slope	0 – 20 %
Water table depth	60 – 200 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 (characteristic range)	170 days
Freeze-free period (characteristic range)	190 days
Precipitation total (characteristic range)	1,140 mm
Frost-free period (actual range)	170 days

Freeze-free period (actual range)	190 days
Precipitation total (actual range)	1,140 mm
Frost-free period (average)	170 days
Freeze-free period (average)	190 days
Precipitation total (average)	1,140 mm

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

### Influencing water features

These sites do not have an influencing water feature.

### Soil features

This group consist of central Kentucky Bluegrass soils such as Bluegrass, Braxton, Loudon, Maury, McAfee, Mercer. . These highly productive soils are the Phosphatic Limestone Uplands.

**Table 4. Representative soil features**

Parent material	(1) Residuum – phosphatic limestone
Surface texture	(1) Silt loam (2) Silty clay (3) Silty clay loam
Family particle size	(1) Fine-silty
Drainage class	Moderately well drained to well drained
Permeability class	Very slow to moderately slow
Soil depth	60 – 180 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified

Available water capacity (0-101.6cm)	7.62 – 20.32 cm
Soil reaction (1:1 water) (0-101.6cm)	4.5 – 7.8
Subsurface fragment volume <=3" (Depth not specified)	0 – 10 %
Subsurface fragment volume >3" (Depth not specified)	Not specified

## Ecological dynamics

State 1. (Reference)

State 1, Phase 1.1: Plant species dominants:

*Quercus macrocarpa*- *Juglans nigra*/*Arundinaria gigantea* /*Sanicula* spp.-*Agrimonia* spp.

(Bur oak-black walnut/ giant cane/ black snakeroot-agrimony)

This reference community has been identified by the Kentucky State Nature Preserves Commission as the “Bluegrass Woodland” and has been almost completely destroyed within MLRA 121. What little remains of this reference community has been highly altered by repeated logging, pasture establishment, urban development or crop production. The Commission estimates that only 0.5% of Kentucky remains in a natural condition comparable to what existed prior to European settlement. Only about 5,000 acres of old-growth forest remain in Kentucky and none of these acres are found within the central Bluegrass Region of MLRA 121. Therefore, it is difficult to accurately determine the exact vegetation composition of this reference community.

State 1, Phase 1.2: Plant species dominants: 1.2 *Acer saccharum*.-*Quercus* spp. / *Arundinaria gigantea* /*Amphicarpaea bracteata*-*Ageratina altissima* (Sugar maple – oaks / giant cane/ hogpeanut - white snakeroot)

Phase 1.2 reflects a woodland community trending toward more shade-tolerant tree species. Due to the cessation of naturally-occurring fire, forest fragmentation, and decades of anthropogenic disturbances, the original bluegrass forests of bur oak, black walnut, Kentucky coffee tree, Shumard oak, and shellbark hickory have been replaced by woodlands with a high percentage of sugar maple, white ash, blue ash, American elm, common hackberry and other oaks.

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 pasture. This sites are very suitable for the development of warm season pastures for forage production or wildlife habitat. Species composition is dependent upon seeding and management. Common species planted include switchgrass (*Panicum virgatum*), little bluestem (*Andropogon scoparius*), indianagrass (*Sorghastrum nutans*), big bluestem (*Andropogon gerardii*), and eastern gamagrass (*Tripsacum dactyloides*).

The arrows between phases 2.1, 2.2 and 2.3 reflect a reduction or increase in management inputs depending on landowner goals and objectives. Seeding desired species, weed control, grazing management, and other conservation practices will be necessary to maximize production levels.

NRCS Soil Surveys are available through USDA-NRCS and provide detailed production estimates, by soil mapunits, for various agricultural practices.

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

State: 3. Transitional Field

State 3, Phase 31: Plant species dominants: eastern red cedar (*Juniperus virginiana*) / *Rosa multiflora* (multiflora rose) / tall fescue (*Schedonorus arundinaceus*)-giant ironweed (*Vernonia gigantea*)

Narrative: This phase is best described as an old field habitat with a mixture of native and introduced grasses, a variety of native and non-native herbs and forbs, a selection of non-native weedy plants such as thistles, a robust community of young eastern red cedar trees, and a few hardwood seedlings. These sites were often found on private property of landowners interested in wildlife habitat or on Kentucky wildlife management areas. The variety of plants found on these successional sites provides desired habitat for non-game and game species. To reduce the density of the eastern red cedar trees, many landowners chose to actively managing these properties by thinning or removal of cedar trees thereby maintaining this state through active management.

Other common grasses include: Johnsongrass (*Sorghum halepense*), Virginia wildrye (*Elymus virginicus*), perennial ryegrass (*Lolium perenne*), orchardgrass (*Dactylis glomerata*), timothy (*Phleum pratense*), and Kentucky bluegrass (*Poa pratensis* ssp. *Pratensis*). Forbs and herbs found on these sites will be a function of past and ongoing disturbances, length of time in pasture, adjacent seed sources, previous management, etc. Forbs and herbs likely to be found on sites include, but are not limited to, the following: trumpetweed (*Eutrochium fistulosum*), , sweet-scented joe pyeweed (*Eutrochium purpureum*), Jerusalem artichoke (*Helianthus tuberosus*), Canada thistle (*Cirsium arvense*), Queen Anne's lace (*Daucus carota*), burdock (*Arctium* spp.), chicory (*Cichorium intybus*), lambsquarters (*Chenopodium album*), eastern daisy fleabane (*Erigeron annuus*), wild bergamot (*Monarda fistulosa*), curly dock (*Rumex crispus*), pigweed (*Amaranthus* spp.), Jerusalem artichoke (*Helianthus tuberosus*), black-eyed Susan (*Rudbeckia hirta*), nodding plumeless thistle (*Carduus nutans*), Canadian horseweed (*Conyza canadensis*), Canada goldenrod (*Solidago altissima*), common milkweed (*Asclepias syriaca*), butterfly milkweed (*Asclepias tuberosa*), common yarrow (*Achillea millefolium*), Indian-tobacco (*Lobelia inflata*), winter vetch (*Vicia villosa*), buttercup (*Ranunculus* spp.), red clover (*Trifolium pratense* L.), crownvetch (*Coronilla* spp.), common mallow (*Malva neglecta*), common chickweed (*Stellaria media*), and Carolina horsenettle (*Solanum carolinense*).

Common shrub species would be winged sumac (*Rhus copallinum*), smooth sumac (*Rhus glabra*), Carolina rose (*Rosa Carolina*), fragrant sumac (*Rhus aromatic*), and multiflora rose (*Rosa multiflora*).

Tree seedling and saplings would be dependent on adjacent seed sources, especially mast species. Species likely to be present include: eastern redcedar (*Juniperus virginiana*), chinquapin oak (*Quercus muehlenbergii*), boxelder (*Acer negundo*), sugar maple (*Acer saccharum*), common hackberry (*Celtis occidentalis*), black cherry (*Prunus serotina*), Shumard's oak (*Quercus shumardii*), and black locust (*Robinia pseudoacacia*).

Transitioning this state to a reference condition would require timber stand improvement practices to control non-native vegetation and plant/manage for desired species. Transitioning this state to a cool season pasture would be feasible with seeding and weed control efforts.

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.

State: 5. Cropland

State 5, Phase 5.1: Plant species dominants: dependent upon seeding and management. Most common crops are corn and soybeans.

Narrative: 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 7. MLRA 121, Group 10

## Additional community tables

## Inventory data references

Site Development and Testing Plan Future work is needed, as described in a future project plan, to validate the information presented in this provisional ecological site description. Future work includes field sampling, data collection and analysis by qualified vegetation ecologists and soil scientists. As warranted, annual reviews of the project plan can be conducted by the Ecological Site Technical Team. A final field review, peer review, quality control, and quality assurance reviews of the ESD are necessary to approve a final document.

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## Contributors

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## Approval

Greg Schmidt, 10/01/2024

## 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	04/17/2026
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:

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