USDA Natural Resources Conservation Service

Ecological site F121XY005KY
Black Shale Upland

Last updated: 10/01/2024
Accessed: 05/11/2025

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): 121X–Kentucky Bluegrass

General: MLRA 121 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: 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

Acidic sub-xeric forest: Kentucky State Nature Preserves Commission

Acidic xeric forest/woodland: Kentucky State Nature Preserves Commission

Xeric Virginia pine forest/woodland: Kentucky State Nature Preserves Commission.

Ecological site concept

The Black Shale Upland ecological site encompasses dry hardwood and dry hardwood-pine forest communities on soils of various depths, aspects, and micro-topography which are underlain by acidic hard black shale.
Representative soils include: Berea, Blago, Colyer, Covedale, Greenbriar, Jessietown, Muse, Rohan, Trappist.

The range of variation in plant composition on these sites vary mainly due to soil depth, available water, and aspect. The floristic expression of these sites likely varies considerably due to depth differences and future field work may result in one or more ecological site description developed within the current PES soil grouping.

State 1. (Reference): Black Shale Uplands Provisional Ecological Site (PES)
State 1, Phase 1.1: Plant species dominants:
Quercus prinus-*Quercus coccinea*/*Vaccinium arboreum*/*Danthonia spicata*-*Hieracium venosum*
(chestnut oak – scarlet oak / farkleberry / poverty oat grass – rattlesnake weed.

State 2, Phase 1.2: Plant species dominants: Quercus prinus-*Pinus virginiana*/ Vaccinium/*Antennaria plantaginifolia*-Lespedeza spp.
(chestnut oak – Virginia pine/ blueberry / women's tobacco – lespedeza)

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: 3 – Post Large-Scale Disturbance Forest
State 3, Phases 3.1: Post Large-Scale Disturbance Forest State. Plant species dominants:
Pinus virginiana-Acer rubra /Rubus spp. / Panicum spp.-Lespedeza spp.
(Virginia pine – red maple / blackberry / panic grass – lespedeza)

State: 4. Abandoned Field
State 4, Phase 4.1: Plant species dominants: Rhus copallina-*Sassafras albidum* /Rubus spp. – Smilax. /*Schedonorus arundinaceus*

Transitioning to a reference condition will require timber stand improvement practices to control non-native vegetation and manage for higher quality oak or hickory species.

Table 1. Dominant plant species

Tree	(1) *Quercus prinus* (2) *Quercus coccinea*
Shrub	(1) *Vaccinium arboreum*
Herbaceous	(1) *Danthonia spicata* (2) *Hieracium venosum*

Physiographic features

This PES encompasses dry hardwood and dry hardwood-pine forest communities on soils of various depths, aspects, and micro-topographies but which are all underlain by acidic hard black shale. Future field work with likely develop multiple ESDs from this initial group.

The range of variation in plant composition on these sites vary mainly due to soil depth, available water, and aspect. Actual field work is required to develop an ecological site description, a field-based state and transition model, and accurate plant community phases to support conservation planning.

The floristic expression of these sites likely varies considerably due to depth differences and future field work may result in one or more ecological site description developed within the current PES soil grouping.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Ridge
Flooding frequency	None

Ponding frequency	None
Elevation	550–1,350 ft
Slope	2–60%
Water table depth	15–54 in
Aspect	Aspect is not a significant factor

Climatic features

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). The freeze-free period averages 210 days and ranges from 185 to 230 days.

Table 3. Representative climatic features

Frost-free period (average)	187 days
Freeze-free period (average)	206 days
Precipitation total (average)	45 in

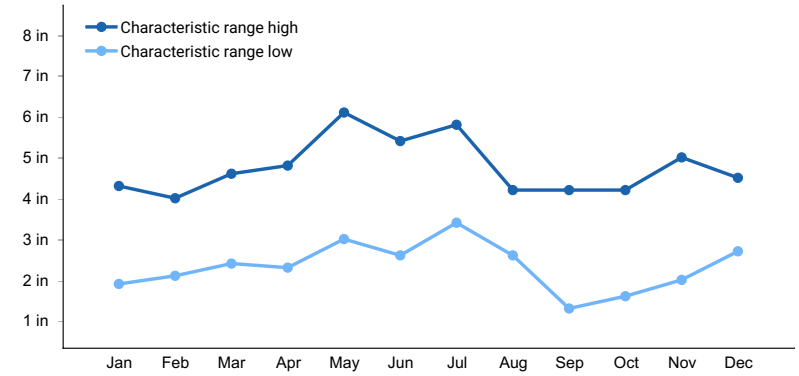

Figure 1. Monthly precipitation range

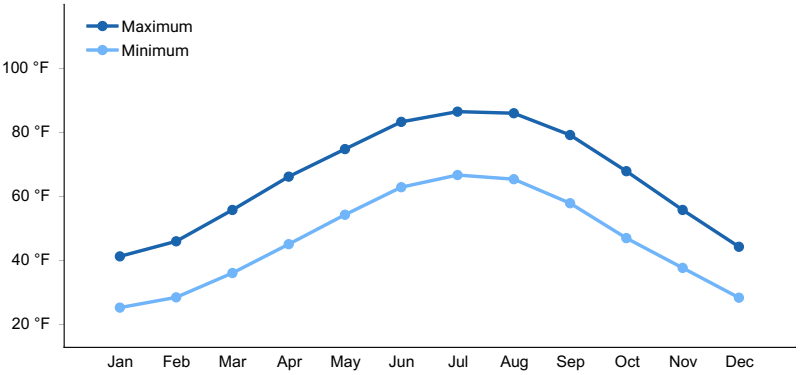

Figure 2. Monthly average minimum and maximum temperature

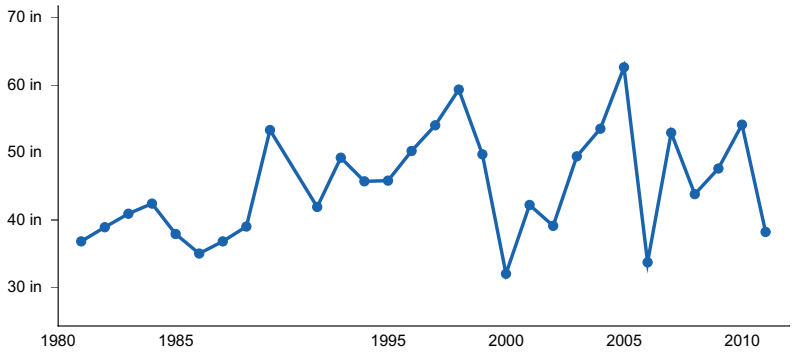

Figure 3. Annual precipitation pattern

Climate stations used

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

Influencing water features

There are not major water features that influence this site.

Soil features

This project consists of soil over black shale. Field work is required to further refine the grouping and will likely result in multiple ESDs being developed from this initial grouping. Representative soils include: Berea, Blago, Colyer, Covedale, Greenbriar, Jessietown, Muse, Rohan, Trappist.

Table 4. Representative soil features

Parent material	(1) Residuum–acid shale (2) Colluvium–sandstone and siltstone (3) Noncalcareous loess–shale
Surface texture	(1) Channery sandy loam (2) Very channery silty clay (3) Gravelly silty clay loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Slow to moderate
Soil depth	9–65 in
Surface fragment cover <=3"	0–8%
Surface fragment cover >3"	0–8%
Available water capacity (0-40in)	0.9–8.3 in
Calcium carbonate equivalent (0-40in)	0%
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	4.3–5.3
Subsurface fragment volume <=3" (Depth not specified)	0–47%
Subsurface fragment volume >3" (Depth not specified)	0–6%

Ecological dynamics

ECOLOGICAL DYNAMICS:
This PES encompasses dry hardwood and dry hardwood-pine forest communities on soils of various depths, aspects, and micro-topography which are underlain by acidic hard black shale. The range of variation in plant composition on these sites vary mainly due to soil depth, available water, and aspect. Actual field work is required to develop an ecological site description, a field-based state and transition model, and accurate plant community phases to support conservation planning.

The floristic expression of these sites likely varies considerably due to depth differences and future field work may result in one or more ecological site description developed within the current PES soil grouping.

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(chestnut oak – scarlet oak / farkleberry / poverty oat grass – rattlesnake weed.

State 2, Phase 1.2: Plant species dominants: Quercus prinus-*Pinus virginiana*/ Vaccinium/*Antennaria plantaginifolia*-Lespedeza spp.
(chestnut oak – Virginia pine/ blueberry / women's tobacco – lespedeza)

These plant communities are influenced by variations in soil depth, rock content, slope, pH, aspect, micro-topography, and available water. Sites are generally on upland hillsides and ridges within the Knobs Norman Upland with a few sites in the Knobs-Lower Scioto Dissected Plateau Physiographic Region. Sites are dominated by sub-xeric and xeric plants species including dry- upland oaks, hickories and pines. Generally, north slopes and sites with deeper soils have a reference community of mixed oaks or oak-hickory components. Dominant species include Quercus prinus, *Quercus coccinea* and *Pinus virginiana*. Additional species found on these sites include *Quercus alba*, *Quercus velutina*, *Carya glabra*, *Carya ovata*, *Sassafras albidum*, and *Acer rubrum*. South-facing slopes and sites with shallow soils have plant communities that reflect the resulting reduction in available water. These communities include the more xeric oak species such as *Quercus stellata*, *Quercus marilandica* and *Pinus virginiana*.

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*

A pasture phase for this provisional ecological community is feasible only on lower sloping sites. Many black shale sites are too steep for this state and should only be managed as woodlands. Plant species within pasture phases depend on seeding, management, and concurrent land uses. As with all sites, soil characteristics and management inputs will influence production levels.

Transitioning this state to a reference condition would likely require extensive and long-term timber stand improvement practices including control of non-native vegetation and management for desired oak or hickory species.

State: 3 – Post Large-Scale Disturbance Forest
State 3, Phases 3.1: Post Large-Scale Disturbance Forest State. Plant species dominants:
Pinus virginiana-Acer rubra /Rubus spp. / Panicum spp.-Lespedeza spp.
(Virginia pine – red maple / blackberry / panic grass – lespedeza)

Tree 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, fire, timber cutting), slope, and aspect.

Dr. Mary Wharton conducted six years of research documenting plant community succession on Kentucky's black shale sites. According to her reports, plants species that frequently occurred on post-cleared upland sites include *Acer rubrum*, *Campsis radicans*, *Diospyros virginiana*, *Nyssa sylvatica*, *Pinus virginiana*, Quercus prinus, *Quercus*

coccinea, *Quercus imbricaria*, Rhus copallina, Rubus spp. *Sassafras albidum*, and *Smilax glauca*.

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

State: 4. Abandoned Field
State 4, Phase 4.1: Plant species dominants: Rhus copallina-*Sassafras albidum* /Rubus spp. – Smilax. /*Schedonorus arundinaceus*

After a field is abandoned, it is first occupied by a ruderal plant community until shrubs and trees become established. Associated species with this state and phase where identified by Dr. Mary Wharton on her work conducted on black shale uplands. She documented over 69 species specifically found on black shale abandoned field sites. Species especially common on moist acidic sites in the Knobs region include joe-pye weed (*Eutrochium fistulosum*, meadow phlox (Phlox maculate), Indian plantain (*Arnoglossum atriplicifolium*), downy lobelia (Lobelia puverula), and tall tickseed (*Coreopsis tripteris*). Other species that may occur include: Rhus copallina, Rubus spp., Sassafrass albidum, *Smilax glauca*, and seedlings of Quercus spp., Carya spp., Acer spp, Pinus spp., *Achillea millefolium*, *Andropogon virginicus*, Aster pilosus, *Erigeron annuus*, Erigeron Canadensis, Gnaphalium purpureum, *Hedeoma pulegioides*, *Hypericum punctatum*, *Houstonia caerulea*, Lactuca Canadensis, Potentilla simples, *Rumex acetosella*, Specularia perfoliata, and Verbascum thapsus,.

Transitioning this state to a reference condition will require timber stand improvement practices to control non-native vegetation and manage for higher quality oak or hickory species.

State and transition model

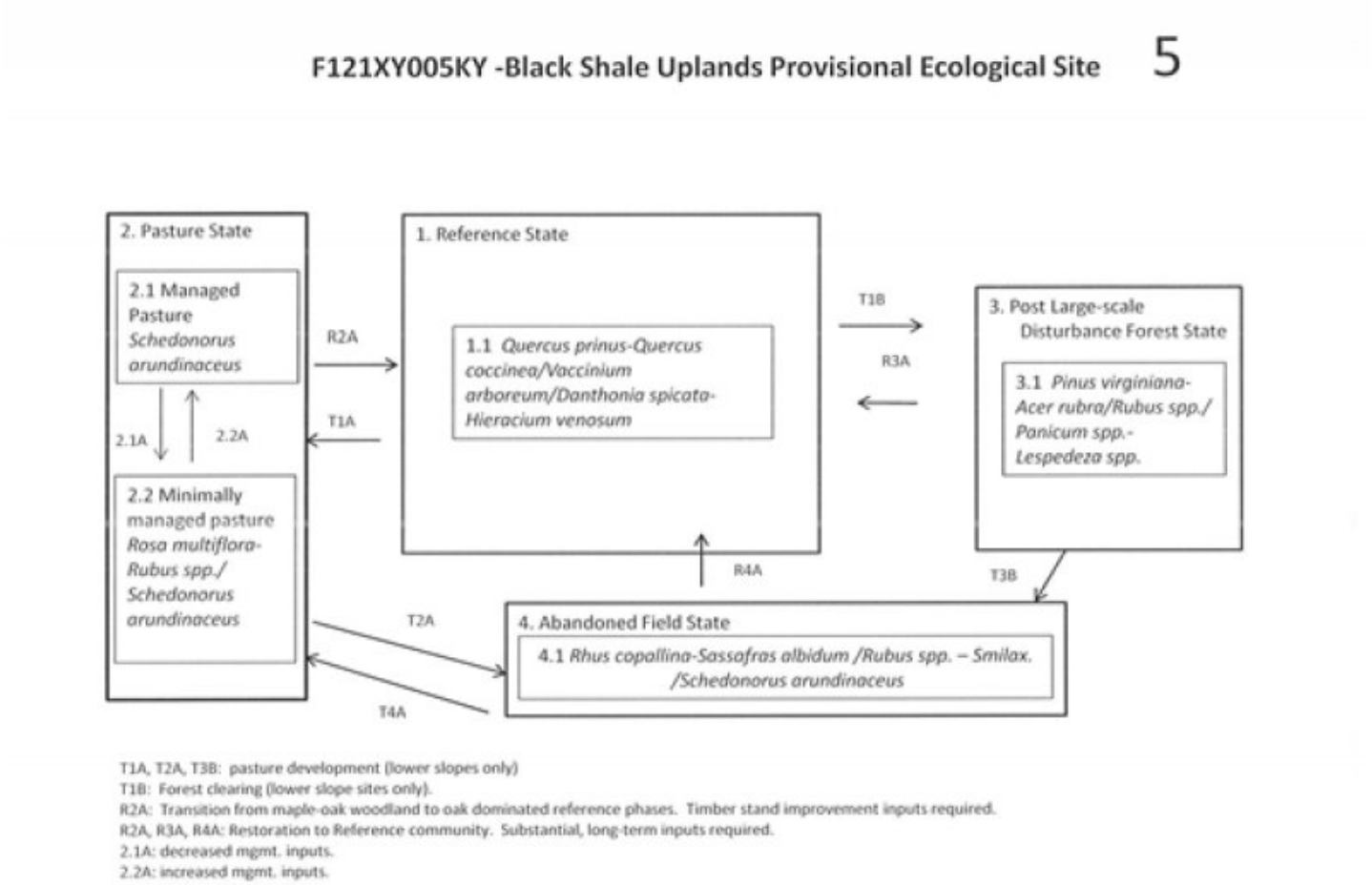

Figure 5. MLRA 121, Group 5

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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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	05/11/2025
Approved by	Greg Schmidt
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:**