USDA Natural Resources Conservation Service

Ecological site F121XY008KY
Moderately Deep Shale-Siltstone Backslope

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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

Quercus alba-Quercus rubra-Carya(alba, ovata)/ *Cornus florida* Forest: Plant Communities of the Midwest.

Calcareous sub-xeric forest (Kentucky State Nature Preserves Commission)

Ecological site concept

The Moderately Deep Shale-Siltstone Backslope includes moderately deep (20-40") soils predominately on hills and ridges in MLRA 121 that are formed on interbedded calcareous siltstone, sandstone, shale, and/or limestone. Representative soils include: Brassfield, Culleoka, Garmin, Gilpin.

These sites historically were oak-hickory forests and located on moderately deep soils over interbedded calcareous siltstone, sandstone, shale, and/or limestone.

State 1. (Reference):
State 1, Phase 1.1: Plant species dominants: *Quercus alba*-*Carya ovata*/Vaccinium spp.- *Cornus florida* / *Parthenocissus quinquefolia*-*Cunila origanoides*
(white oak-shagbark hickory / blueberry species-flowering dogwood / Virginia creeper – common dittany)

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: *Acer rubrum*-*Pinus virginiana*/ Rubus spp. -Smilax spp. / *Danthonia spicata*-Lespedeza spp.

State: 4. Abandoned Field
State 4, Phase 4.1: Plant species dominants: *Pinus virginiana*-*Sassafras albidum* /Rubus spp. – Rosa spp. /*Schedonorus arundinaceus*

Associated sites

F121XY003KY	**Weathered Shale Upland** Weathered Shale Uplands

Table 1. Dominant plant species

Tree	(1) *Quercus alba* (2) *Carya ovata*
Shrub	(1) *Vaccinium* (2) *Cornus Florida*
Herbaceous	(1) *Parthenocissus quinquefolia* (2) *Cunila origanoides*

Physiographic features

This PES includes moderately deep (20-40") soils predominately on hills and ridges in MLRA 121 that are formed on interbedded calcareous siltstone, sandstone, shale, and/or limestone. Variations in plant communities are likely to exist within this initial grouping and field verification and monitoring are needed to evaluate and document plant community variations on soils within the group.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Ridge
Runoff class	Low to very high
Elevation	550–1,346 ft
Slope	2–50%
Water table depth	72 in
Aspect	Aspect is not a significant factor

Climatic features

These ecological sites are located in MLRA 121 and are at the northern periphery of the humid subtropical climate zone. Generally characterized by hot, humid summers and cold winter, the area has four distinct seasons. The expected annual precipitation for sites included in this ecological site description is generally in the range of 40 to 50 inches. The majority of precipitations falls during the freeze-free months, and thunderstorms with heavy rainfall are common during the spring and summer months. The freeze-free period varies somewhat based on localized topography and longitude.

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)	168 days
Freeze-free period (characteristic range)	186 days
Precipitation total (characteristic range)	45 in
Frost-free period (actual range)	168 days
Freeze-free period (actual range)	186 days
Precipitation total (actual range)	45 in
Frost-free period (average)	168 days
Freeze-free period (average)	186 days
Precipitation total (average)	45 in

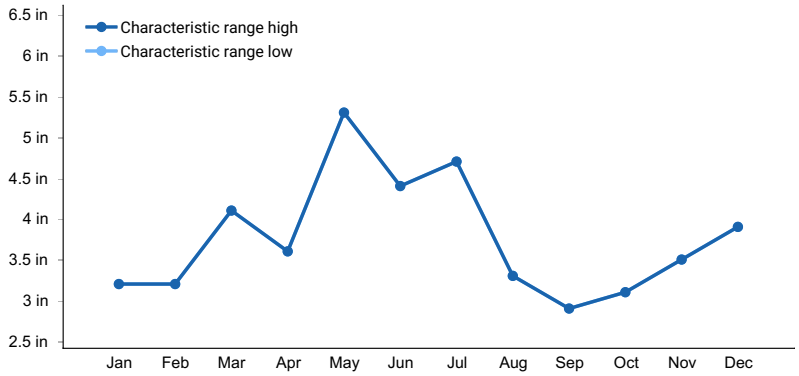

Figure 1. Monthly precipitation range

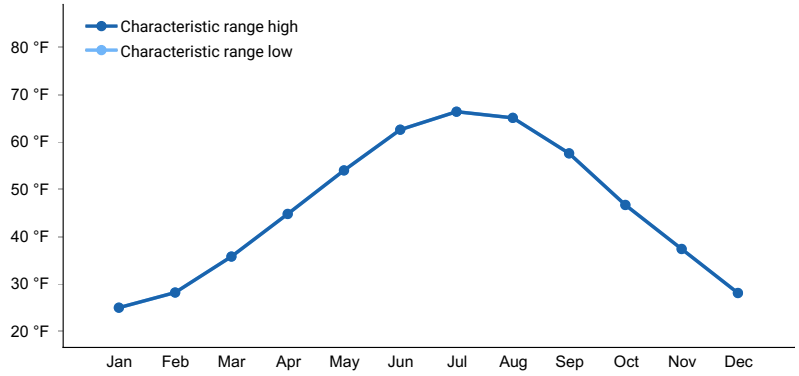

Figure 2. Monthly minimum temperature range

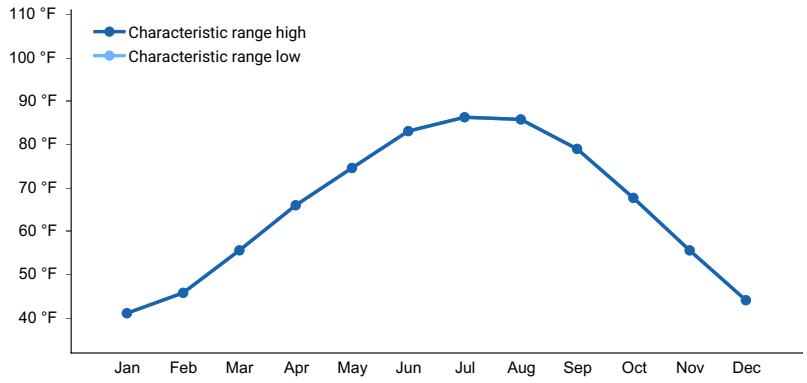

Figure 3. Monthly maximum temperature range

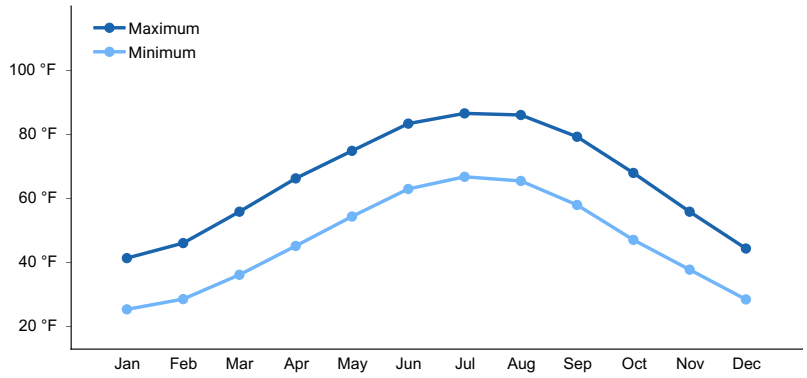

Figure 4. Monthly average minimum and maximum temperature

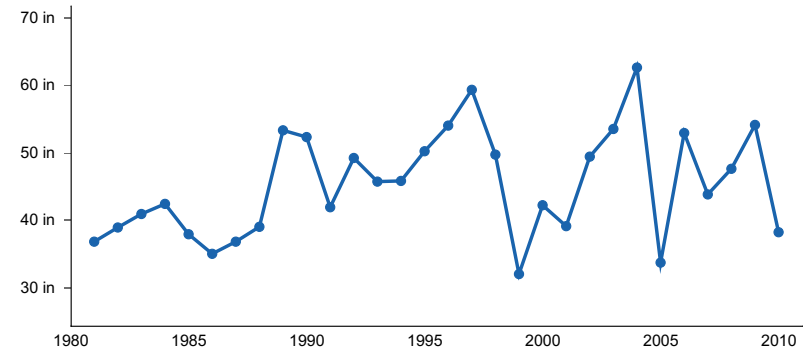

Figure 5. Annual precipitation pattern

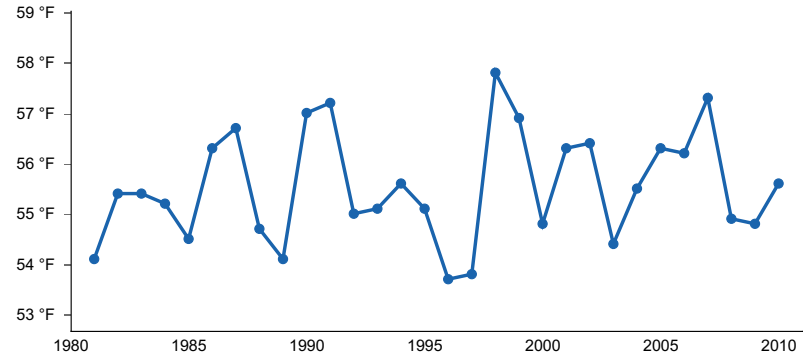

Figure 6. Annual average temperature pattern

Climate stations used

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

Influencing water features

There are no influencing water features.

Soil features

These sites are well drained, moderately deep soils over interbedded calcareous siltstone, sandstone, shale, and/or limestone and found on predominately on hillsides. Representative soils include: Brassfield, Culleoka, Gilpin.

Table 4. Representative soil features

Parent material	(1) Residuum–limestone
Surface texture	(1) Loam (2) Flaggy silt loam (3) Sandy clay loam
Family particle size	(1) Fine-loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Soil depth	24–38 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	3–6 in
Soil reaction (1:1 water) (0-40in)	3.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–30%
Subsurface fragment volume >3" (Depth not specified)	0–20%

Ecological dynamics

These sites historically were oak-hickory forests and located on moderately deep soils over interbedded calcareous siltstone, sandstone, shale, and/or limestone.

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-Carya ovata*/Vaccinium spp.- *Cornus florida* / *Parthenocissus quinquefolia-Cunila origanoides*
(white oak-shagbark hickory / blueberry species-flowering dogwood / Virginia creeper – common dittany)

Narrative: This community includes a variation of Braun’s western mesophytic forest type consisting of mixed oak and oak-hickory forest. The plant communities of these sites are influenced by variations in soil depth (20-40” for moderately deep soils), available water, rock content, slope, aspect and micro-topography of the hillsides. Future field work is required to determine if these mapunits can be incorporated into another existing PES grouping. The mapunits included in this project area mainly located within EPA’s Outer Bluegrass physiographic region.

Tree inventory data from NASIS (National Soil Information System) includes the following species: white oak, scarlet oak, black oak, “hybrid” hickory, white ash, sugar maple, black walnut, American elm, eastern redbud, eastern red cedar, and tulip tree. The USDA-NRCS land capability class ratings vary according to slope. The majority of mapunits in this PES range from 12-30% slopes with some mapunits as high as 50%.

Depending on soil depth, available water, and rock content, these site would be dominated by mixed oak or oak-hickory forest. On steeper slopes, the north sides would have a community containing white oak, black oak, scarlet oak, chestnut oak, shagbark hickory, pignut hickory, red maple, American elm, white ash, sassafras, redbud, and flowering dogwood. South-facing slopes and sites with shallower soils would have plant communities that reflected the resulting reduction in available water. On these sites, chestnut oak, scarlet oak, pignut hickory, and eastern redcedar would likely be prevalent. More xeric species such as Virginia pine (*Pinus virginiana*), post oak (*Quercus stellata*) and blackjack oak (*Quercus marilandica*) could be found on the most shallow soils and steepest sites.

The density of understory species would be sparse to moderate in the reference community state and include a shrub layer consisting typically of Vaccinium spp. (blueberry) on sites with shale or siltstone influences. Because these soils have multiple parent materials (interbedded shale, siltstone, limestone, and sandstone) the corresponding floristic expressions will show variations. Plant understory differences are also to be expected between sites in northwestern Kentucky counties and the northeastern Kentucky counties. This is due to differing plant communities found within the adjacent Appalachian forest region of eastern Kentucky. For example, *Vaccinium corymbosum* (highbush blueberry) is found typically in the eastern Kentucky counties while *Vaccinium arboreum* Marshall (farkleberry) is more common in the western Knobs physiographic region. Because understory communities often varies considerably from the eastern Knobs to the western Knobs regions and on differing aspects, it is expected that future field work will clarify whether this soil grouping is really a unique ecological site or mapunits could be included within another PES grouping.

Understory species likely found on these sites include:
Agrimonia pubescens, *Agrimonia parviflora*, Agrimonia rostella (Agrimony)
Aster spp.
Claytonia virginica (spring beauty)
Coreopsis major (greater tickseed)
Danthonia spicata (poverty grass)
Dentaria laciniata (cut-leaf toothwort)
Doellingeria infirma (Michx.) Greene (cornel-leaf whitetop)
Epigaea repens (trailing arbutus)
Gaylussacia baccata (Wangenh.) K. Koch (black huckleberry)
Hieraceum venosum (hawkweed)
Hypericum hypericoides (L.) Crantz (St. Andrew's cross)
Krigia biflora (false dandelion)
Panic grasses (Panicum boscii, P. dichotomum)
Parthenocissus quinquefolia (Virginia creeper)
Rhus radicans (poison ivy)
Sanicula canadensis, *Sanicula odorata*, Sanicula trifoliate (Snakeroot)
Sedges (including *Carex digitalis*, C. umbellate, C wildenovii)
Smilax rotundifolia, roundleaf greenbrier
Smilax tamnoides L. (bristly greenbrier)
Stellaria spp. (chickweed)
Tradescantia virginiana (spiderwort)
Viola spp.

Drier sites may contain:
Antennaria plantaginifolia (pussytoes)
Cunila origanoides (dittany)
Gillenia stipulacea (Indian physic)
Oxalis violacea (violet sorrel)
Houstonis caerulea (bluets)
Aureolaria virginica (downy yellow false foxglove)
Aureolaria laevigata (entireleaf yellow false foxglove)

Cunila origanoides (common dittany)
Tephrosia virginiana (L.) Virginia tephrosia or Goat's rue
Pedicularis canadensis L. (Canadian lousewort)

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*

The pasture phase is feasible for lower slope sites included within this PES. Many mapunits within this PES are too steep (25-50% slopes) for use as productive pastures and should be managed as woodlands to protect soil and water resources.

Plant species within a pasture on these sites would depend on seeding, level of management post-seeding, and concurrent land uses. As with all sites, soil characteristics and management will influence production levels.

Transitioning this state to a reference condition will require management inputs including timber stand improvement practices to control non-native vegetation and long-term management to promote desired species.

State: 3 – Post Large-Scale Disturbance Forest
State 3, Phases 3.1: Post Large-Scale Disturbance Forest State.
Plant species dominants: *Acer rubrum*-*Pinus virginiana*/ Rubus spp. -Smilax spp. / *Danthonia spicata*-Lespedeza spp.

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

Mapunits with shale-siltstone influences would have likely have a greater percentage of pioneer species that included red maple and Virginia pine. On mapunits influenced by limestone (versus shale or siltstone) the pioneer community would likely include more eastern red cedar and sugar maple.

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

State: 4. Abandoned Field

State 4, Phase 4.1: Plant species dominants: *Pinus virginiana*-*Sassafras albidum* /Rubus spp. – Rosa spp. /*Schedonorus arundinaceus*

Native trees commonly found on abandoned upland pasture sites would include: Virginia pine (*Pinus virginiana*), eastern red cedar (*Juniperus virginiana*), sassafras (*Sassafras albidum*), maples (*Acer rubrum*, *Acer saccharum*, *Acer negundo*.), Carolina rose (Rosa caroliniana), blackberries (Rubus spp.), sumac (Rhus spp.), blackgum (*Nyssa sylvatica*), common persimmon (*Diospyros virginiana*), poison ivy (*Campsis radicans*), giant ironweed (*Vernonia gigantea*), crownbeard (Verbesina spp.), and joe pye weed (*Eutrochium purpureum*).

Over 100 species of plants have been documented on abandoned fields in the Outer Bluegrass and Knobs Regions of Kentucky. The genus-species of common early successional species likely to be found on these sites include:

Common yarrow (*Achillea millefolium*)
Spiny amaranth (*Amaranthus spinosus* L.)
Broomsedge bluestem (*Andropogon virginicus*)
Indianhemp or hemp dogbane (*Apocynum cannabinum* L.)

Common milkweed (*Asclepias syriaca* L.)
Eastern daisy fleabane (*Erigeron annuus*)
Trumpet creeper (*Campsis radicans* (L.) Seem. Ex Bureau)
Field thistle (*Cirsium discolor* (Muhl. ex Willd.) Spreng.)
Canadian horse weed (Erigeron Canadensis, SYN= *Conyza canadensis* (L.) Cronquist var. canadensis)
Cudweed or spoonleaf purple everlasting, (Gnaphalium purpureum, SYN= *Gamochaeta purpurea* (L.) Cabrera)
American false pennyroyal, (*Hedeoma pulegioides*)
Spotted St. Johnswort (*Hypericum punctatum*)
Canada lettuce (Lactuca Canadensis)
Lespedeza spp. Both native and non-native species may be present including hairy lespedeza (*Lespedeza hirta* (L.) Hornem. and sericea lespedeza (Lespedeza cuneate)
Purple passionflower (*Passiflora incarnata* L.)
Common cinquefoil (*Potentilla simplex*)
Buttercups (Ranunculus spp.)
Winged sumac (Rhus copallina)
Blackberry (Rubus spp.). Species may include: *Rubus occidentalis* L., *Rubus allegheniensis* Porter, *Rubus alumnus* L.H. Bailey, *Rubus flagellaris* Willd., etc.
Common yellow woodsorrel, (*Oxalis stricta*)
Greenbrier species including saw greenbrier (*Smilax bona-nox* L.), cat greenbrier (*Smilax glauca*), and the brisley greenbrier (*Smilax tamnoides*).
Carolina horsenettle (*Solanum carolinense* L.)
Clasping Venus looking-glass (*Triodanis perfoliata* (L.) Nieuwl., SYN=Specularia perfoliata)
Hairy white oldfield aster (*Symphyotrichum pilosum* (Willd.) G.L. Nesom var. pilosum)
Giant ironweed (*Vernonia gigantea* (Walter) Trel.)
Rough cocklebur (*Xanthium strumarium* L.)
Canadian cocklebur (*Xanthium strumarium* L. var. canadense (Mill.) Torr. & A. Gray)

Non-native vegetation may include:
Annual ragweed (*Ambrosia artemisiifolia* L.)
Nodding plumeless thistle (*Carduus nutans* L.)
Chicory (*Cichorium intybus* L.)
Bull thistle (*Cirsium vulgare* (Savi) Ten.)
Poison hemlock (*Conium maculatum*)
Canadian thistle (*Cirsium arvense* (L.) Scop.)
Queen Anne's lace (*Daucus carota* L.)
Common mallow (*Malva neglecta* Wallr.)
Multi-flora rose (*Rosa multiflora* Thunb.)
Curly dock (*Rumex crispus*)
Red clover (Trifolium pretense L.)
White clover (*Trifolium repens* L.)
Common mullein (*Verbascum thapsus* L.)

Grasses may include:
Redtop (*Agrostis gigantea* Roth)
Winter bentgrass (*Agrostis hyemalis*pani)
Broomsedge bluestem (*Andropogon virginicus*)
Sideoats grama (*Bouteloua curtipendula*)
Field brome (*Bromus arvensis*)
Soft brome (*Bromus hordeaceus*)
Smooth brome (*Bromus inermis*)
Cheatgrass (*Bromus tectorum*)
Sedges (Carex spp.)
Orchard grass (*Dactylis glomerata* L.)
Barnyard grass (Echinochloa spp.)
Eastern bottlebrush grass (Elymus histrix)
Virginia wildrye (*Elymus virginicus*)
Fescues (Festuca spp.)
Nepalese browntop (*Microstegium vimineum*)

Panicgrass (Panicum spp.)
Timothy (Phleum pretense L.)
Kentucky bluegrass (*Poa pratensis*)
Tall fescue (*Schedonorus arundinaceus*)
Yellow foxtail (*Setaria pumila*)
Johnsongrass (*Sorghum halepense*)

Seedlings and saplings of Quercus spp., Carya spp., Acer spp, (especially red maple, sugar maple, and boxelder) Pinus spp. (commonly Virginia pine), *Sassafras albidum*, *Robinia pseudoacacia* (black locust), and *Celtis occidentalis* (hackberry) would be common on these successional sites.

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

State and transition model

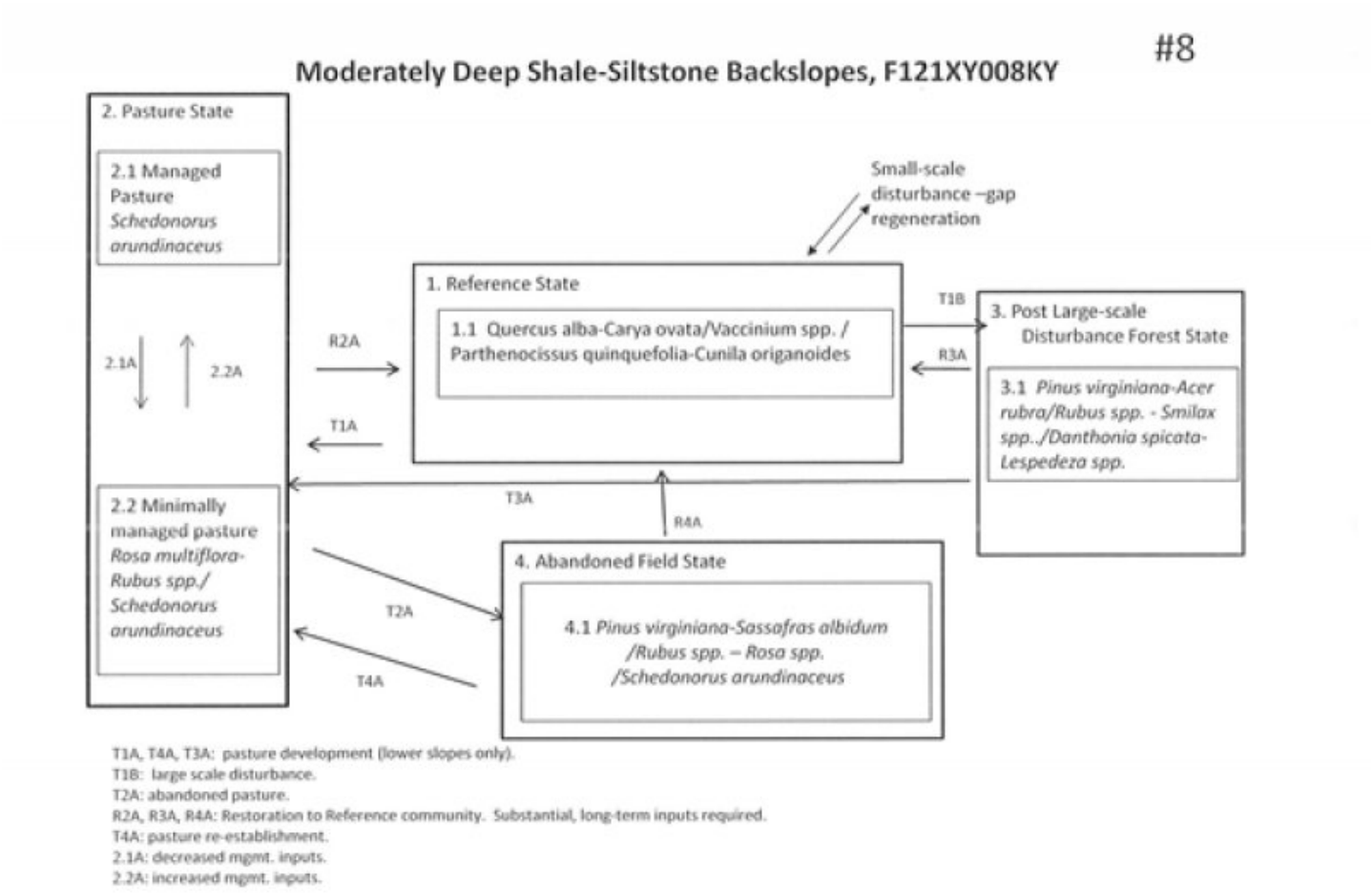

Figure 7. MLRA 121, Group 8

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	11/04/2024
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):**

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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:**
