Ecological site F121XY002KY
Moderately Deep Interbedded Limestone-Shale Backslopes

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General information

Approved. An approved ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model, enough information to identify the ecological site, and full documentation for all ecosystem states contained in the state and transition model.

MLRA notes

Major Land Resource Area (MLRA): 121X–Kentucky Bluegrass

The project area lies within the major land resource area (MLRA)121 as designated by the Natural Resources Conservation Service. Central Kentucky makes up 83% of the MLRA with the remaining acreage in Ohio (11%) and Indiana (6%). Total MLRA size is 10,680 square miles or 27,670 square kilometers. The majority of the MLRA is in the Lexington Plain Section of the Interior Low Plateaus Province of the Interior Plains. Elevations in MLRA 121 range from about 430 feet (on the Ohio River) to approximately 1100 feet. This ecological site description covers sites within the Inner and Outer Bluegrass physiographic regions of Kentucky. The rolling hills of this area are caused by the weathering of limestone that has been pushed up along the crest of the Cincinnati Arch. Younger geologic units occur along the eastern and western edges of the bluegrass region and are typified by thin-bedded shale, siltstone, and limestone.

Classification relationships

Plant Communities of the Midwest, Association Descriptions: CEGL002070 White Oak-Mixed Oak Dry-Mesic Alkaline Forest. Kentucky State Nature Preserves Commission, Calcareous Sub-xeric Forest (Evans, Hines, Yahn, 2009). USNVV Hierachy: Quercus alba (Quercus rubra, Carya spp.) Forest Alliance.

Ecological site concept

These ecological sites are characterized by moderately-deep soils predominately influenced by parent materials of limestone and shale. Soil depths of 21 to 40 inches provide an adequate moisture and growing environment for a wide range of quality hardwood trees, including various species of oaks and hickories. Understory communities, while influenced by differences in soil depths and soil parent materials, exhibited similarities in species composition. Located on hillsides and ridges, these sites were a hardwood forest of oak-hickory or oak-hickory-sugar maple with a robust and diverse herbaceous layer. The most common summer understory species were: various species of agrimony (AGPU & AGR03), black snakeroots (SACA15 & SAOD), white snakeroot (AGALA), Virginia creeper (PAQU2), smooth Solomon's seal (POBI2), false Solomon's seal (SMRA), etc. The shrub layer usually consisted of coralberry (SYOR) and groupings of northern spicebush (LIBE3). Species such as spicebush and paw-paw often found on these sites are indicative of higher levels of available moisture compared to the shallow limestone-based ecological sites (121XY0001) that are geographically related within MLRA 121. The state and transition model for this ecological site description highlights the various community states and phases including three reference phases and multiple successional stages including managed pastureland, minimally managed pastureland, managed native grasses, eastern red cedar communities, and honeysuckle (non-native invasive) woodlands. These stages transition predictably with external influences and through natural succession.

Table 1. Dominant plant species

Tree	(1) *Quercus alba* (2) *Carya ovata*
Shrub	(1) *Symphoricarpos orbiculatus* (2) *Lindera benzoin*

Herbaceous	(1) *Sanicula canadensis* (2) *Agrimonia*

Physiographic features

These ecological sites (ES) are found on hillsides and/or ridgetops. The best examples of these sites were found on slopes ranging from 15-45% range. Soils depth ranges from 21- 40" over interbedded limestone and shale or interbedded limestone, shale, and siltstone. The mixed geology can be seen best on road cuts where the limestone & shale or limestone, shale & siltstone layers are layered along the hillsides. Elevations of these sites generally range from 500 feet to 1000 feet. There is no influencing water table, flooding or ponding on these sites as the runoff class is medium to rapid.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Ridge (3) Knob
Flooding frequency	None
Ponding frequency	None
Elevation	140 – 440 m
Slope	0 – 50 %
Water table depth	150 cm
Aspect	Aspect is not a significant factor

Climatic features

These ecological sites are located in central Kentucky 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 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 averages 210 days, but varies somewhat based on localized topography and longtitude.

Table 3 Representative climatic features

Frost-free period (average)	160 days
Freeze-free period (average)	190 days
Precipitation total (average)	2,870 mm

- (1) CYNTHIANA [USC00151998], Cynthiana, KY

Influencing water features

There are no influencing water features for this ESD.

Soil features

These ecological sites are found on specific landscapes dominated by Eden and Faywood soils and are influenced by interbedded geology of limestone and shale parent materials. The Eden series consists of moderately-deep, well-drained, and slowly-permeable soils formed in residuum from interbedded calcareous shale, siltstone, and limestone. These soils are found on steep hillsides and narrow ridgetops. The Faywood series consists of moderately-deep and well-drained soils formed in limestone residuum interbedded with thin layers of shale. The office site description for Eden includes slopes from 2 to 70 percent; however, for this ecological site description, sites evaluated ranged in slope from 12 to 40 percent. The official site description for Faywood includes slopes from 2 to 60 percent; however, sites evaluated for this ecological site description ranged in slope from 12 to 40 percent.

Table 4. Representative soil features

Parent material	(1) Residuum – limestone
Surface texture	(1) Flaggy silty clay loam (2) Very flaggy silt loam (3) Channery silty clay
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Very slow to moderate
Soil depth	30 – 120 cm
Surface fragment cover <=3"	0 – 30 %
Surface fragment cover >3"	0 – 30 %
Available water capacity (0-101.6cm)	4.83 – 8.64 cm
Calcium carbonate equivalent (0-101.6cm)	Not specified

Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	6.2 – 7.5
Subsurface fragment volume <=3" (Depth not specified)	10 – 20 %
Subsurface fragment volume >3" (Depth not specified)	10 – 30 %

Ecological dynamics

As diagramed in the state and transition model, these ecological sites have four distinct states and eight easily identifiable community phases. The reference state consists of three woodland phases. The first is the mature oak-hickory forest (phase 1.1) which is dominated by oak and hickory species, such as white oak, northern red oak, shagbark hickory, Shumard oak, black oak, chinkapin oak, and mockernut hickory. Sugar maple is also common, especially on more mesic sites. Other tree species found on these sites include white ash, American elm, slippery elm, eastern red cedar, bitternut hickory, and eastern redbud. The understory frequently had a shrub layer of coralberry or spicebush. On monitored plots, coralberry was denser in areas of higher shale content (Eden soils) and on drier sites. Spicebush was denser in more protected micro-climates, northern slopes, and sites mapped as Faywood soils. The herbaceous understory is robust and diverse. Most undisturbed locations had a beautiful array of native wildflowers in early spring.

Phase 1.2 is best described as an eastern red cedar woodland. This successional state is seen throughout the Inner and Outer Bluegrass physiographic regions of Kentucky, as well as southern Indiana and Ohio. Eastern red cedar is well adapted to the limestone and limestone-shale soils, highly drought tolerant, and serves as an ecological bridge between the transitional field (phase 3.1) and the oak-hickory forest (phase 1.1)and the sugar maple-white oak forest (phase 1.3).

Monitored plots within these dense stands of eastern red cedar were typified by high basal areas and slow-growing young oaks and hickory trees in the understory and midstory. These young hardwood trees will eventually overtop the cedars, and within a few decades, start to dominate the overstory. In the spring these hillsides were a mass of dark green cedars and highlighted with bright pink blooms from eastern redbud trees.

On more mesic sites, phase 1.2 plots exhibited a predominance of sugar maple, ash, and elm seedlings with a reduced oak and hickory regeneration. These sites were transitioning toward phase 1.3 and would likely required forest stand management activities, such as maple thinning or prescribed fire, to reach phase 1.1.

Phase 1.3 sites were observable on numerous locations in the study area, but the long- range composition of these sites and the long-term potential to transition to other phases is somewhat of an unknown. Ecologists, researchers, and natural resource professional interviewed for this project believed that the reduction of historic wildfire regimes have contributed to the reduction of oak-hickory forests and increased the predominance of sugar maple-oak woodlands on this (and many other) ecological sites. The density of shade-tolerant maple on these sites modifies the ground-level environment by increasing shade levels and moisture content, altering leaf litter composition, and influencing the tree regeneration. The dense shading from maples and the thick leaf litter reduces oak and hickory regeneration and increases the reproductive success of shade-tolerant tree such as sugar maple and white ash.

The pasture state (state 2.0) contains three commonly found phases: managed cool-season grasses (usually tall fescue or other non-native planted grasses), minimally-managed pastures, and a native warm-season grass habitat. Production levels vary on these sites by grass species and the management of the sites.

The transitional field (state 3.0) is a successional state between an abandoned pasture and an eastern red cedar grove. Characterized by a variety of grasses, forbs, herbs, and young trees, these sites are often wildlife friendly, pollinator beneficial, and are often maintained by landowners to maximize wildlife habitat.

Trees found on these sites are a mix depending on adjacent seed sources and how long the land was in pasture. Eastern red cedar is the early successional dominant tree; however, hardwood seedling and saplings were found scattered throughout monitored plots and included honey locust, black locust, osage orange, black walnut, hackberry, boxelder, and eastern red cedar. Multiflora rose, briars, berries and brambles were a component on all sites visited. The most common non-native herbaceous species included Queen Anne's lace, thistles, lespedeza, lambs quarters, horse nettle, mullein, and pigweed. The most common native herbaceous species were ironweed, common milkweed, goldenrods, yellow crownbeard, and sunflowers. This state will transition naturally to phase 1.3 the eastern red cedar grove. Landowners wishing to retain the wildlife benefits of the "old field" state would control cedar growth.

State 4 is woodland with dense bush honeysuckle (usually Lonicera maackii) in the understory and midstory. This non-native, invasive plant is aggressive, adaptable, persistent, and currently negatively impacting oak-hickory forests throughout Kentucky. Found on many different ecological sites, this plant fundamentally alters the natural ecological pathways and transition mechanisms due to its dense growth form and aggressive growth and reproduction capabilities. Ecological sites in state 4 require substantial and long-term management inputs, including multi-year restoration activities, to transition to another ecological state or phase.

State and transition model

Figure 5. F121XY002KY_STM

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 6. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height M	Canopy Cover (%)	Diameter Cm	Basal Area (square M/hectare)
Tree							
Shumard's oak	QUSH	*Quercus shumardii*	Native	9.4-26.5	0-35	45.7-52.1	0-2.3
mockernut hickory	CATO6	*Carya tomentosa*	Native	9.1-22.9	0-30	44.5-48.3	0-2.3
northern red oak	QURU	*Quercus rubra*	Native	8.2-28.7	0-30	45.7-54.6	2.3-8
white oak	QUAL	*Quercus alba*	Native	4.9-27.4	10-30	45.7-57.2	4.6-12.6
chinquapin oak	QUMU	*Quercus muehlenbergii*	Native	9.1-27.1	10-30	43.2-50.8	2.3-5.7
sugar maple	ACSA3	*Acer saccharum*	Native	5.8-26.8	0-25	47-50.8	1.1-3.4
shagbark hickory	CAOV2	*Carya ovata*	Native	8.2-25.6	5-20	40.6-48.3	2.3-5.7

Table 7. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (m)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
sedge	CAREX	*Carex*	Native	0-0.2	1-5
Forb/Herb					
white snakeroot	AGALA	*Ageratina altissima var. altissima*	Native	0.2-0.6	10-50
cutleaf toothwort	CACO26	*Cardamine concatenata*	Native	0.1-0.2	5-40
dwarf larkspur	DETR	*Delphinium tricorne*	Native	0.1-0.2	5-40
Virginia springbeauty	CLVI3	*Claytonia virginica*	Native	0-0.2	5-35
spring blue eyed Mary	COVE2	*Collinsia verna*	Native	0-0.2	10-20
Canadian blacksnakeroot	SACA15	*Sanicula canadensis*	Native	0.1-0.4	1-20
clustered blacksnakeroot	SAOD	*Sanicula odorata*	Native	0.1-0.5	1-10
celandine poppy	STDI3	*Stylophorum diphyllum*	Native	0.1-0.4	0-10
American hogpeanut	AMBR2	*Amphicarpaea bracteata*	Native	0-0.2	1-10
wild blue phlox	PHDI5	*Phlox divaricata*	Native	0.1-0.3	1-10

harbinger of spring	ERBU	*Erigenia bulbosa*	Native	0.1-0.2	3-10
white avens	GECA7	*Geum canadense*	Native	0-0.3	0-5
spring avens	GEVE	*Geum vernum*	Native	0.1-0.6	0-5
beaked agrimony	AGRO3	*Agrimonia rostellata*	Native	0.1-0.4	1-5
soft agrimony	AGPU	*Agrimonia pubescens*	Native	0.1-0.3	1-5
Virginia snakeroot	ARSE3	*Aristolochia serpentaria*	Native	0.1-0.4	0-5
toadshade	TRSE2	*Trillium sessile*	Native	0.1-0.2	1-5
bellwort	UVULA	*Uvularia*	Native	0.1-0.3	1-5
mayapple	POPE	*Podophyllum peltatum*	Native	0.2-0.4	1-5
goldenseal	HYCA	*Hydrastis canadensis*	Native	0.1-0.2	0-5
yellow fumewort	COFL3	*Corydalis flavula*	Native	0.1-0.4	0-3
crinkleroot	CADI10	*Cardamine diphylla*	Native	0.1-0.2	0-3
cream avens	GEVI4	*Geum virginianum*	Native	0.1-0.6	0-2
wild comfrey	CYVI	*Cynoglossum virginianum*	Native	0.1-0.6	0-2
rue anemone	THTH2	*Thalictrum thalictroides*	Native	0.1-0.2	0-2
common selfheal	PRVU	*Prunella vulgaris*	Native	0-0.2	0-2
Carolina elephantsfoot	ELCA3	*Elephantopus carolinianus*	Native	0.1-0.7	0-1
Canadian white violet	VICA4	*Viola canadensis*	Native	0.1-0.2	0-1
yellow giant hyssop	AGNE2	*Agastache nepetoides*	Native	0.1-0.9	0-1
perfoliate bellwort	UVPE	*Uvularia perfoliata*	Native	0.1-0.2	0-1
common blue wood aster	SYCO4	*Symphyotrichum cordifolium*	Native	0.1-0.4	0-1
eastern poison ivy	TORA2	*Toxicodendron radicans*	Native	0.1-0.2	0-1
smooth Solomon's seal	POBI2	*Polygonatum biflorum*	Native	0.1-0.5	0-1
early meadow-rue	THDI	*Thalictrum dioicum*	Native	0.1-0.2	0-1
twinleaf	JEDI	*Jeffersonia diphylla*	Native	0.1-0.3	0-1
spring forget-me-not	MYVE	*Myosotis verna*	Native	0.1-0.2	0-1
longstyle sweetroot	OSLO	*Osmorhiza longistylis*	Native	0.1-0.4	0-1
Clayton's sweetroot	OSCL	*Osmorhiza claytonii*	Native	0.1-0.5	0-1
licorice bedstraw	GACI2	*Galium circaezans*	Native	0.1-0.4	0-1
shining bedstraw	GACO3	*Galium concinnum*	Native	0.1-0.5	0-1
jumpseed	POVI2	*Polygonum virginianum*	Native	0.1-0.5	0-1
bloodroot	SACA13	*Sanguinaria canadensis*	Native	0.1-0.2	0-1
hairy alumroot	HEVI2	*Heuchera villosa*	Native	0.1-0.2	0-1
Jack in the pulpit	ARTR	*Arisaema triphyllum*	Native	0.2-0.3	0-1
violet woodsorrel	OXVI	*Oxalis violacea*	Native	0.1-0.2	0-1
blisterwort	RARE2	*Ranunculus recurvatus*	Native	0.1-0.3	0-1
limestone wild petunia	RUST2	*Ruellia strepens*	Native	0.1-0.2	0-1
rattlesnakeroot	PRENA	*Prenanthes*	Native	0.2-1	0-1
roundleaf ragwort	PAOB6	*Packera obovata*	Native	0.1-0.4	0-1
eastern false rue anemone	ENBI	*Enemion biternatum*	Native	0.1-0.2	0-1
American stoneseed	LILA2	*Lithospermum latifolium*	Native	0.1-0.4	0-1
green dragon	ARDR3	*Arisaema dracontium*	Native	0.3-0.4	0-1
common yellow oxalis	OXST	*Oxalis stricta*	Native	0.1-0.2	0-1
panicledleaf ticktrefoil	DEPA6	*Desmodium paniculatum*	Native	0.1-0.5	0-1
nakedflower ticktrefoil	DENU4	*Desmodium nudiflorum*	Native	0.1-0.5	0-1
sharplobe hepatica	HENOA	*Hepatica nobilis var. acuta*	Native	0.1-0.2	0-1

fourleaf yam	DIQU	*Dioscorea quaternata*	Native	0.1-0.5	0-1
richweed	COCA4	*Collinsonia canadensis*	Native	0.2-0.8	0-1
Maryland senna	SEMA11	*Senna marilandica*	Native	0.2-1	0-1
Virginia strawberry	FRVI	*Fragaria virginiana*	Native	0-0.2	0-1
stickywilly	GAAP2	*Galium aparine*	Native	0.1-0.4	0-1
dutchman's breeches	DICU	*Dicentra cucullaria*	Native	0.1-0.4	0-1
smallspike false nettle	BOCY	*Boehmeria cylindrica*	Native	0.2-0.5	0-1
downy rattlesnake plantain	GOPU	*Goodyera pubescens*	Native	0-0.1	0
Fern/fern ally					
ebony spleenwort	ASPL	*Asplenium platyneuron*	Native	0-0.3	0-2
Christmas fern	POAC4	*Polystichum acrostichoides*	Native	0.1-0.4	0-2
northern maidenhair	ADPE	*Adiantum pedatum*	Native	0.1-0.2	0-1
rattlesnake fern	BOVI	*Botrychium virginianum*	Native	0.1-0.2	0-1
Shrub/Subshrub					
coralberry	SYOR	*Symphoricarpos orbiculatus*	Native	0.1-0.8	1-30
northern spicebush	LIBE3	*Lindera benzoin*	Native	0.2-1.1	0-25
rusty blackhaw	VIRU	*Viburnum rufidulum*	Native	0.1-1	0-1
blackhaw	VIPR	*Viburnum prunifolium*	Native	0.2-4.6	0-1
Indianhemp	APCA	*Apocynum cannabinum*	Native	0.1-0.4	0-1
Tree					
eastern redbud	CECA4	*Cercis canadensis*	Native	1-3	0-10
white oak	QUAL	*Quercus alba*	Native	1-1.7	0-5
chinquapin oak	QUMU	*Quercus muehlenbergii*	Native	0.5-1.1	0-5
bitternut hickory	CACO15	*Carya cordiformis*	Native	1.8-	0-5
bitternut hickory	CACO15	*Carya cordiformis*	Native	0.9-1.6	0-5
white oak	QUAL	*Quercus alba*	Native	2.1-3.7	0-3
shagbark hickory	CAOV2	*Carya ovata*	Native	0.4-0.6	0-2
white oak	QUAL	*Quercus alba*	Native	0.2-0.5	1-2
hophornbeam	OSVI	*Ostrya virginiana*	Native	0.1-0.3	0-1
shagbark hickory	CAOV2	*Carya ovata*	Native	0.1-0.2	0-1
chinquapin oak	QUMU	*Quercus muehlenbergii*	Native	0.2-0.3	0-1
black oak	QUVE	*Quercus velutina*	Native	0.3-0.4	0-1
Shumard's oak	QUSH	*Quercus shumardii*	Native	0.2-0.3	0-1
eastern redcedar	JUVI	*Juniperus virginiana*	Native	0.1-0.2	0-1
flowering dogwood	COFL2	*Cornus florida*	Native	0.6-2.1	0-1
sassafras	SAAL5	*Sassafras albidum*	Native	0.1-0.2	0-1
sassafras	SAAL5	*Sassafras albidum*	Native	1.2-2.4	0-1
white ash	FRAM2	*Fraxinus americana*	Native	0.1-0.2	0-1
white ash	FRAM2	*Fraxinus americana*	Native	0.3-0.5	0-1
white ash	FRAM2	*Fraxinus americana*	Native	2.1-3.3	0-1
sugar maple	ACSA3	*Acer saccharum*	Native	0.7-1.8	0-1
sugar maple	ACSA3	*Acer saccharum*	Native	0.2-0.3	0-1
boxelder	ACNE2	*Acer negundo*	Native	0.9-1.6	0-1
common hackberry	CEOC	*Celtis occidentalis*	Native	0.4-2.1	0-1
eastern redbud	CECA4	*Cercis canadensis*	Native	0.1-0.3	0-1
Vine/Liana					

Virginia creeper	PAQU2	*Parthenocissus quinquefolia*	Native	0.2-5.5	2-15
frost grape	VIVU	*Vitis vulpina*	Native	0.2-4.9	0-1
roundleaf greenbrier	SMRO	*Smilax rotundifolia*	Native	0-1.5	0-1
summer grape	VIAE	*Vitis aestivalis*	Native	0.1-0.2	0-1
crossvine	BICA	*Bignonia capreolata*	Native	0-0.8	0-1
summer grape	VIAE	*Vitis aestivalis*	Native	1.3-6.4	0-1
common moonseed	MECA3	*Menispermum canadense*	Native	0-0.4	0-1

Table 8. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 9. Community 1.2 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height M	Canopy Cover (%)	Diameter Cm	Basal Area (square M/hectare)
Tree							
eastern redcedar	JUVI	*Juniperus virginiana*	Native	1.6-10.7	60-90	16.5-21.6	8-14.9
white oak	QUAL	*Quercus alba*	Native	4.3-9.1	15-35	15.2-22.9	1.1-4.6
chinquapin oak	QUMU	*Quercus muehlenbergii*	Native	3.4-8.2	5-25	7.6-12.7	1.1-4.6

Table 10. Community 1.2 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (m)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
tall fescue	SCAR7	*Schedonorus arundinaceus*	Native	0-0.4	5-65
tall fescue	SCAR7	*Schedonorus arundinaceus*	Introduced	0-0.4	1-15
Forb/Herb					
white snakeroot	AGALA	*Ageratina altissima var. altissima*	Native	0.2-0.4	1-2
sedge	CAREX	*Carex*	Native	0-0.2	1-2
Canadian blacksnakeroot	SACA15	*Sanicula canadensis*	Native	0.1-0.3	0-1
stickywilly	GAAP2	*Galium aparine*	Native	0.1-0.2	0-1
Fern/fern ally					
ebony spleenwort	ASPL	*Asplenium platyneuron*	Native	0.1-0.3	1
Tree					
eastern redcedar	JUVI	*Juniperus virginiana*	Native	0.1-0.4	0-5
eastern redbud	CECA4	*Cercis canadensis*	Native	1.3-3	1-5
chinquapin oak	QUMU	*Quercus muehlenbergii*	Native	1.1-3	0-3
white oak	QUAL	*Quercus alba*	Native	1.4-4	1-2
blue ash	FRQU	*Fraxinus quadrangulata*	Native	1.5-4	0-2
common hackberry	CEOC	*Celtis occidentalis*	Native	0.2-0.4	0-1
American elm	ULAM	*Ulmus americana*	Native	0.1-0.3	0-1
slippery elm	ULRU	*Ulmus rubra*	Native	1.5-3.1	0-1
Shumard's oak	QUSH	*Quercus shumardii*	Native	0.1-0.2	0-1
eastern redbud	CECA4	*Cercis canadensis*	Native	0.2-0.3	1
sugar maple	ACSA3	*Acer saccharum*	Native	0.1-0.3	1
sugar maple	ACSA3	*Acer saccharum*	Native	1.1-2.7	1
white ash	FRAM2	*Fraxinus americana*	Native	0.1-0.2	0-1

Table 11. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 12. Community 1.3 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height M	Canopy Cover (%)	Diameter Cm	Basal Area (square M/hectare)
Tree							
sugar maple	ACSA3	*Acer saccharum*	Native	8.2-28	25-50	45.7-55.9	5.7-11.5
white oak	QUAL	*Quercus alba*	Native	11.6-30.5	10-30	45.7-58.4	1.1-5.7
northern red oak	QURU	*Quercus rubra*	Native	8.5-27.4	0-20	53.3	0-4.6
shagbark hickory	CAOV2	*Carya ovata*	Native	9.4-28.7	0-20	43.2-50.8	0-3.4
Shumard's oak	QUSH	*Quercus shumardii*	Native	11-29.9	0-15	45.7-50.8	0-5.7
chinquapin oak	QUMU	*Quercus muehlenbergii*	Native	9.4-28	1-15	43.2-48.3	1.1-3.4

Table 13. Community 1.3 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (m)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
sedge	CAREX	*Carex*	Native	0-0.2	1-2
Forb/Herb					
spring blue eyed Mary	COVE2	*Collinsia verna*	Native	0-0.1	5-20
dwarf larkspur	DETR	*Delphinium tricorne*	Native	0.1-0.2	5-20
Virginia springbeauty	CLVI3	*Claytonia virginica*	Native	0-0.2	5-15
cutleaf toothwort	CACO26	*Cardamine concatenata*	Native	0.1-0.2	1-10
clustered blacksnakeroot	SAOD	*Sanicula odorata*	Native	0.1-0.4	3-10
harbinger of spring	ERBU	*Erigenia bulbosa*	Native	0-0.2	2-10
Canadian blacksnakeroot	SACA15	*Sanicula canadensis*	Native	0.1-0.3	1-5
spring avens	GEVE	*Geum vernum*	Native	0.1-0.5	0-3
rue anemone	THTH2	*Thalictrum thalictroides*	Native	0.1-0.2	0-2
celandine poppy	STDI3	*Stylophorum diphyllum*	Native	0.1-0.3	1-2
American hogpeanut	AMBR2	*Amphicarpaea bracteata*	Native	0.1-0.2	1-2
zigzag spiderwort	TRSU2	*Tradescantia subaspera*	Native	0-0.5	0-1
eastern false rue anemone	ENBI	*Enemion biternatum*	Native	0.1-0.2	0-1
smooth Solomon's seal	POBI2	*Polygonatum biflorum*	Native	0.1-0.3	0-1
narrowleaf knotweed	POBE	*Polygonum bellardii*	Native	–	0-1
early meadow-rue	THDI	*Thalictrum dioicum*	Native	0.2-0.4	0-1
twinleaf	JEDI	*Jeffersonia diphylla*	Native	–	0-1
Canadian woodnettle	LACA3	*Laportea canadensis*	Native	0.1-0.6	0-1
spring forget-me-not	MYVE	*Myosotis verna*	Native	0-0.2	0-1
dutchman's breeches	DICU	*Dicentra cucullaria*	Native	0.1-0.3	0-1
stickywilly	GAAP2	*Galium aparine*	Native	0-0.2	0-1
licorice bedstraw	GACI2	*Galium circaezans*	Native	0-0.2	0-1
toadshade	TRSE2	*Trillium sessile*	Native	0.1-0.2	0-1
Canadian wildginger	ASCA	*Asarum canadense*	Native	0.1-0.2	0-1
cream avens	GEVI4	*Geum virginianum*	Native	0.1-0.5	0-1
goldenseal	HYCA	*Hydrastis canadensis*	Native	0.1-0.2	0-1
white avens	GECA7	*Geum canadense*	Native	0-0.2	0-1
shining bedstraw	GACO3	*Galium concinnum*	Native	0-0.3	0-1
Fern/fern ally					
ebony spleenwort	ASPL	*Asplenium platyneuron*	Native	0-0.3	0-1
rattlesnake fern	BOVI	*Botrychium virginianum*	Native	0.1-0.2	0-1

Christmas fern	POAC4	*Polystichum acrostichoides*	Native	0.1-0.3	0-1
Shrub/Subshrub					
northern spicebush	LIBE3	*Lindera benzoin*	Native	0.2-0.9	0-10
coralberry	SYOR	*Symphoricarpos orbiculatus*	Native	0.2-0.6	1-5
Tree					
sugar maple	ACSA3	*Acer saccharum*	Native	1.7-4	10-60
sugar maple	ACSA3	*Acer saccharum*	Native	1.2-2.9	15-35
sugar maple	ACSA3	*Acer saccharum*	Native	0.1-0.5	5-25
white ash	FRAM2	*Fraxinus americana*	Native	0.1-0.4	0-2
white ash	FRAM2	*Fraxinus americana*	Native	1.9-4	0-1
white oak	QUAL	*Quercus alba*	Native	0.1-0.2	0-1
white ash	FRAM2	*Fraxinus americana*	Native	1.2-1.7	0-1
Vine/Liana					
Virginia creeper	PAQU2	*Parthenocissus quinquefolia*	Native	0.2-0.4	0-10
eastern poison ivy	TORA2	*Toxicodendron radicans*	Native	0.1-0.3	0-1

Table 14. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 15. Community 2.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (m)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
tall fescue	SCAR7	*Schedonorus arundinaceus*	Introduced	0-0.6	80-95
orchardgrass	DAGL	*Dactylis glomerata*	Introduced	0.1-0.7	0-10
Johnsongrass	SOHA	*Sorghum halepense*	Introduced	0.2-0.8	0-5
Kentucky bluegrass	POPR	*Poa pratensis*	Introduced	0.1-0.6	1-5
Forb/Herb					
red clover	TRPR2	*Trifolium pratense*	Introduced	0.2-0.6	0-5
white clover	TRRE3	*Trifolium repens*	Introduced	0.1-0.2	1-5
Vine/Liana					
field bindweed	COAR4	*Convolvulus arvensis*	Introduced	0.2-0.5	0-1

Table 16. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 17. Community 2.2 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (m)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
tall fescue	SCAR7	*Schedonorus arundinaceus*	Introduced	0-0.7	35-80
orchardgrass	DAGL	*Dactylis glomerata*	Introduced	0.1-0.9	1-10
timothy	PHPR3	*Phleum pratense*	Introduced	0.1-0.9	1-10
Kentucky bluegrass	POPR	*Poa pratensis*	Introduced	0-0.8	2-10
Johnsongrass	SOHA	*Sorghum halepense*	Introduced	0.2-1.4	0-5
Forb/Herb					
giant ironweed	VEGI	*Vernonia gigantea*	Native	0.2-1	1-5
aster	SYMPH4	*Symphyotrichum*	Native	0.2-0.8	1-3
goldenrod	SOLID	*Solidago*	Native	0.2-0.8	1-3

common milkweed	ASSY	*Asclepias syriaca*	Native	0.2-0.6	1-2
yarrow	ACHIL	*Achillea*	Native	0.1-0.5	0-2
buttercup	RANUN	*Ranunculus*	Native	0.1-0.5	1-2
Joseph's-coat	AMTR2	*Amaranthus tricolor*	Native	0.2-0.9	0-2
yellow crownbeard	VEOC	*Verbesina occidentalis*	Native	0.2-1	0-2
wild garlic	ALVI	*Allium vineale*	Introduced	0.1-0.3	0-1
Queen Anne's lace	DACA6	*Daucus carota*	Introduced	0.1-0.9	0-1
lambsquarters	CHAL7	*Chenopodium album*	Introduced	0.2-0.6	0-1
field thistle	CIDI	*Cirsium discolor*	Introduced	0.1-0.6	0-1
devil's beggartick	BIFR	*Bidens frondosa*	Native	0.1-0.6	0-1
eastern daisy fleabane	ERAN	*Erigeron annuus*	Introduced	0.1-0.7	0-1
curly dock	RUCR	*Rumex crispus*	Introduced	0-0.9	0-1
stickywilly	GAAP2	*Galium aparine*	Introduced	0-0.4	0-1
burdock	ARCTI	*Arctium*	Introduced	0.1-0.9	0-1
annual ragweed	AMAR2	*Ambrosia artemisiifolia*	Introduced	0.2-0.9	0-1
yellowrocket	BARBA	*Barbarea*	Native	0.1-0.6	0-1
chicory	CIIN	*Cichorium intybus*	Introduced	0.2-0.7	0-1
bull thistle	CIVU	*Cirsium vulgare*	Introduced	0.1-0.9	0-1
sericea lespedeza	LECU	*Lespedeza cuneata*	Introduced	0.1-0.6	0-1
wild parsnip	PASA2	*Pastinaca sativa*	Introduced	0.1-1.1	0-1
American pokeweed	PHAM4	*Phytolacca americana*	Native	0.5-1.1	0-1
common sneezeweed	HEAU	*Helenium autumnale*	Introduced	0.1-0.6	0-1
common chickweed	STME2	*Stellaria media*	Introduced	0.1-0.4	0-1

Table 18. Community 2.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 19. Community 2.3 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (m)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
big bluestem	ANGE	*Andropogon gerardii*	Native	0.1-1.6	35-55
Indiangrass	SONU2	*Sorghastrum nutans*	Native	0.1-1.7	20-40
switchgrass	PAVI2	*Panicum virgatum*	Native	0.1-1.7	20-40
little bluestem	SCSC	*Schizachyrium scoparium*	Native	0.1-1.1	10-40
Virginia wildrye	ELVI3	*Elymus virginicus*	Native	0.1-0.7	0-20
sideoats grama	BOCU	*Bouteloua curtipendula*	Native	0.1-0.4	0-15
tall fescue	SCAR7	*Schedonorus arundinaceus*	Introduced	0.1-0.6	2-10
Kentucky bluegrass	POPRP2	*Poa pratensis ssp. pratensis*	Introduced	0.2-0.5	0-5
sedge	CAREX	*Carex*	Native	0-0.3	0-1
Forb/Herb					
blackeyed Susan	RUHI2	*Rudbeckia hirta*	Native	0.1-0.9	1-10
eastern purple coneflower	ECPU	*Echinacea purpurea*	Native	0.1-1	1-3
purpletop tridens	TRFL2	*Tridens flavus*	Native	0-1.3	0-3
wild bergamot	MOFI	*Monarda fistulosa*	Native	0.2-0.9	1-2
pinnate prairie coneflower	RAPI	*Ratibida pinnata*	Native	0.2-0.8	0-2
foxglove beardtongue	PEDI	*Penstemon digitalis*	Native	0.1-0.9	0-1
common milkweed	ASSY	*Asclepias syriaca*	Native	0.1-0.9	0-1

dense blazing star	LISP	*Liatris spicata*	Native	0.1-0.8	0-1
wild bergamot	MOFI	*Monarda fistulosa*	Native	0.1-0.9	0-1
Canada goldenrod	SOCA6	*Solidago canadensis*	Native	0.1-1.4	0-1
sweetscented joe pye weed	EUPU21	*Eutrochium purpureum*	Native	0.8-1.4	0-1
Illinois bundleflower	DEIL	*Desmanthus illinoensis*	Native	0.2-0.5	0-1
partridge pea	CHFAF	*Chamaecrista fasciculata var. fasciculata*	Native	0.1-0.7	0-1
common yarrow	ACMI2	*Achillea millefolium*	Native	0.1-0.6	0-1
butterfly milkweed	ASTU	*Asclepias tuberosa*	Native	0.1-0.8	0-1
partridge pea	CHFAF	*Chamaecrista fasciculata var. fasciculata*	Native	0.1-0.9	0-1
eastern purple coneflower	ECPU	*Echinacea purpurea*	Native	0.1-1.2	0-1
smooth oxeye	HEHE5	*Heliopsis helianthoides*	Native	0.1-1.7	0-1
lanceleaf tickseed	COLA5	*Coreopsis lanceolata*	Native	0-1	0-1
wingstem	VEAL	*Verbesina alternifolia*	Native	0.3-1.4	0-1
giant ironweed	VEGI	*Vernonia gigantea*	Native	0.9-1.5	0-1
bluejacket	TROH	*Tradescantia ohiensis*	Native	0.2-0.6	0-1
New England aster	SYNO2	*Symphyotrichum novae-angliae*	Native	0.1-0.9	0-1
blackeyed Susan	RUHI2	*Rudbeckia hirta*	Native	0.1-0.9	0-1
Shrub/Subshrub					
Carolina rose	ROCA4	*Rosa carolina*	Native	0.1-0.9	0-1
Vine/Liana					
greenbrier	SMILA2	*Smilax*	Native	0.1-0.9	0-1
blackberry	RUBUS	*Rubus*	Native	0.2-1.1	0-1

Table 20. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 21. Community 3.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height M	Canopy Cover (%)	Diameter Cm	Basal Area (square M/hectare)
Tree							
eastern redcedar	JUVI	*Juniperus virginiana*	Native	0.5-12.2	10-50	14-22.9	1.1-3.4

Table 22. Community 3.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (m)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
tall fescue	SCAR7	*Schedonorus arundinaceus*	Introduced	0.1-0.4	40-75
timothy	PHPR3	*Phleum pratense*	Introduced	0-0.5	0-15
Johnsongrass	SOHA	*Sorghum halepense*	Introduced	0-1.2	1-15
orchardgrass	DAGL	*Dactylis glomerata*	Introduced	0-0.5	1-5
perennial ryegrass	LOPE	*Lolium perenne*	Native	0-0.7	0-3
Kentucky bluegrass	POPRP2	*Poa pratensis ssp. pratensis*	Introduced	0.1-0.3	0-3
Virginia wildrye	ELVI3	*Elymus virginicus*	Native	0.1-0.7	0-2
Forb/Herb					
common mallow	MANE	*Malva neglecta*	Introduced	0.1-0.2	0-1
red clover	TRPR2	*Trifolium pratense*	Introduced	0.1-0.3	0-1
curly dock	RUCR	*Rumex crispus*	Introduced	0-0.9	0-1
eastern daisy fleabane	ERAN	*Erigeron annuus*	Native	0.1-0.9	0-1
Indian-tobacco	LOIN	*Lobelia inflata*	Native	0.2-0.5	0-1

American pokeweed	PHAM4	*Phytolacca americana*	Native	0.3-1.6	0-1
common yarrow	ACMI2	*Achillea millefolium*	Native	0.1-0.6	0-1
common milkweed	ASSY	*Asclepias syriaca*	Native	0.1-0.6	0-1
butterfly milkweed	ASTU	*Asclepias tuberosa*	Native	0.1-0.6	0-1
crownvetch	CORON	*Coronilla*	Introduced	0.1-0.2	0-1
Canadian horseweed	COCA5	*Conyza canadensis*	Native	0.1-0.8	0-1
blackeyed Susan	RUHI2	*Rudbeckia hirta*	Native	0.2-0.7	0-1
Canada goldenrod	SOAL6	*Solidago altissima*	Native	0.2-0.8	0-1
Jerusalem artichoke	HETU	*Helianthus tuberosus*	Native	0.2-1.3	0-1
trumpetweed	EUFI14	*Eutrochium fistulosum*	Native	0.2-1.4	0-1
common chickweed	STME2	*Stellaria media*	Introduced	0-0.2	0-1
buttercup	RANUN	*Ranunculus*	Introduced	0.1-0.4	0-1
lambsquarters	CHAL7	*Chenopodium album*	Introduced	0.1-0.9	0-1
Carolina horsenettle	SOCA3	*Solanum carolinense*	Introduced	0-0.2	0-1
pigweed	AMARA	*Amaranthus*	Introduced	0.1-0.9	0-1
burdock	ARCTI	*Arctium*	Native	0.1-1	0-1
Canada thistle	CIAR4	*Cirsium arvense*	Introduced	0-1.1	0-1
Queen Anne's lace	DACA6	*Daucus carota*	Introduced	0.1-1.1	0-1
sweetscented joe pye weed	EUPU21	*Eutrochium purpureum*	Native	0.1-1.3	0-1
Jerusalem artichoke	HETU	*Helianthus tuberosus*	Native	0.1-0.9	0-1
blackeyed Susan	RUHI2	*Rudbeckia hirta*	Native	0.1-0.9	0-1
giant ironweed	VEGI	*Vernonia gigantea*	Native	0.1-1.3	0-1
winter vetch	VIVI	*Vicia villosa*	Introduced	0-0.5	0-1
wild bergamot	MOFI	*Monarda fistulosa*	Native	0.2-0.9	0-1
nodding plumeless thistle	CANU4	*Carduus nutans*	Introduced	0.1-0.8	0-1
chicory	CIIN	*Cichorium intybus*	Introduced	0.2-1	0-1
Shrub/Subshrub					
smooth sumac	RHGL	*Rhus glabra*	Native	0.6-2.7	0-5
winged sumac	RHCO	*Rhus copallinum*	Native	0.6-3.1	0-3
fragrant sumac	RHAR4	*Rhus aromatica*	Native	0.1-0.8	0-1
Carolina rose	ROCA4	*Rosa carolina*	Introduced	0.1-0.9	0-1
Tree					
eastern redcedar	JUVI	*Juniperus virginiana*	Native	0.2-1.4	5-30
eastern redcedar	JUVI	*Juniperus virginiana*	Native	0.5-3.1	0-25
eastern redcedar	JUVI	*Juniperus virginiana*	Native	0-0.5	1-5
American elm	ULAM	*Ulmus americana*	Native	0.9-2.3	0-5
black locust	ROPS	*Robinia pseudoacacia*	Native	1.1-2.4	0-5
Osage-orange	MAPO	*Maclura pomifera*	Native	0.1-2.6	0-3
honeylocust	GLTR	*Gleditsia triacanthos*	Native	1.5-2.5	0-2
white oak	QUAL	*Quercus alba*	Native	0.2-0.6	0-2
white oak	QUAL	*Quercus alba*	Native	1.4-3.1	0-2
chinquapin oak	QUMU	*Quercus muehlenbergii*	Native	1.2-3.5	0-2
Shumard's oak	QUSH	*Quercus shumardii*	Native	0.2-0.9	0-2
Shumard's oak	QUSH	*Quercus shumardii*	Native	0.1-0.5	0-1
chinquapin oak	QUMU	*Quercus muehlenbergii*	Native	0.1-0.4	0-1
chinquapin oak	QUMU	*Quercus muehlenbergii*	Native	0.7-1.7	0-1

common hackberry	CEOC	*Celtis occidentalis*	Native	0.2-0.4	0-1
black walnut	JUNI	*Juglans nigra*	Native	0.2-1.2	0-1
black locust	ROPS	*Robinia pseudoacacia*	Native	0.2-0.5	0-1
honeylocust	GLTR	*Gleditsia triacanthos*	Native	0.2-0.7	0-1
sassafras	SAAL5	*Sassafras albidum*	Native	0.2-0.7	0-1
winged elm	ULAL	*Ulmus alata*	Native	1-2.4	0-1
black cherry	PRSE2	*Prunus serotina*	Native	0-0.2	0-1
boxelder	ACNE2	*Acer negundo*	Native	0.2-0.4	0-1
sugar maple	ACSA3	*Acer saccharum*	Native	0.1-0.4	0-1
Vine/Liana					
blackberry	RUBUS	*Rubus*	Native	0.1-1.4	0-1
greenbrier	SMILA2	*Smilax*	Native	0.1-1.2	0-1
field bindweed	COAR4	*Convolvulus arvensis*	Introduced	0.2-0.6	0-1

Table 23. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 24. Community 4.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height M	Canopy Cover (%)	Diameter Cm	Basal Area (square M/hectare)
Tree							
white oak	QUAL	*Quercus alba*	Native	13.1-26.5	20-40	35.6-53.3	4.4-5.1
chinquapin oak	QUMU	*Quercus muehlenbergii*	Native	7.9-25	0-25	33-45.7	3.9-5.7
common hackberry	CEOC	*Celtis occidentalis*	Native	8.5-24.1	5-20	33-38.1	1.8-3.7
white ash	FRAM2	*Fraxinus americana*	Native	5.5-23.5	5-15	38.1-45.7	1.1-4.1
northern red oak	QURU	*Quercus rubra*	Native	7.6-25.3	0-15	20.3-49.5	0-4.6
sugar maple	ACSA3	*Acer saccharum*	Native	4.9-14.6	1-15	27.9-45.7	3.9-5.1
black walnut	JUNI	*Juglans nigra*	Native	4.6-21.6	0-10	17.8-30.5	0-2.5

Table 25. Community 4.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (m)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
tall fescue	SCAR7	*Schedonorus arundinaceus*	Introduced	0.1-0.5	1-8
Kentucky bluegrass	POPR	*Poa pratensis*	Introduced	0.1-0.4	0-5
sedge	CAREX	*Carex*	Native	0-0.3	0-1
Nepalese browntop	MIVI	*Microstegium vimineum*	Introduced	0.1-0.4	0-1
Forb/Herb					
winter creeper	EUFO5	*Euonymus fortunei*	Introduced	0-0.2	0-1
Canadian blacksnakeroot	SACA15	*Sanicula canadensis*	Native	0.2-0.6	0-1
stickywilly	GAAP2	*Galium aparine*	Native	0.1-0.2	0-1
clustered blacksnakeroot	SAOD	*Sanicula odorata*	Native	0.1-0.4	0-1
avens	GEUM	*Geum*	Native	0.1-0.2	0-1
eastern poison ivy	TORA2	*Toxicodendron radicans*	Native	0.1-0.3	0-1
Virginia creeper	PAQU2	*Parthenocissus quinquefolia*	Native	0.1-0.2	0-1
dwarf larkspur	DETR	*Delphinium tricorne*	Native	0.1-0.2	0-1
Virginia springbeauty	CLVI3	*Claytonia virginica*	Native	0.1-0.2	0-1
harbinger of spring	ERBU	*Erigenia bulbosa*	Native	0.1-0.2	0-1
Fern/fern ally					

ebony spleenwort	ASPL	*Asplenium platyneuron*	Native	0.1-0.4	0-1
Shrub/Subshrub					
Amur honeysuckle	LOMA6	*Lonicera maackii*	Introduced	1.2-4	35-90
Amur honeysuckle	LOMA6	*Lonicera maackii*	Introduced	0.7-2.1	20-65
Amur honeysuckle	LOMA6	*Lonicera maackii*	Introduced	0.2-0.6	10-15
Amur honeysuckle	LOMA6	*Lonicera maackii*	Introduced	0.1-0.2	5-10
multiflora rose	ROMU	*Rosa multiflora*	Introduced	0.1-2	0-5
lespedeza	LESPE	*Lespedeza*	Introduced	0.1-1.5	0-1
Tree					
eastern redbud	CECA4	*Cercis canadensis*	Native	0.2-0.4	0-1
American elm	ULAM	*Ulmus americana*	Native	0.1-0.3	0-1
white oak	QUAL	*Quercus alba*	Native	0.1-0.3	0-1
sugar maple	ACSA3	*Acer saccharum*	Native	0.2-0.5	0-1
white ash	FRAM2	*Fraxinus americana*	Native	0.2-0.3	0-1
common hackberry	CEOC	*Celtis occidentalis*	Native	0.1-0.4	0-1
chinquapin oak	QUMU	*Quercus muehlenbergii*	Native	–	0-1
Vine/Liana					
Japanese honeysuckle	LOJA	*Lonicera japonica*	Introduced	0.2-0.9	0-2
bristly greenbrier	SMTA2	*Smilax tamnoides*	Native	0.1-1	0-1
Virginia creeper	PAQU2	*Parthenocissus quinquefolia*	Native	1.2-5.5	0-1

Animal community

The ecological sites included in this project have three main forested phases; mixed oak-hickory forest, oak-sugar maple forest, and eastern red cedar woodland. Oak species on these ecological sites are predominately white, chinkapin, Shumard, black, and northern red. Shagbark, pignut, and mockernut were the common hickory species. Other hardwoods on these sites include white ash, blue ash, American elm, slippery elm, sugar maple, eastern redbud, and Ohio buckeye. The mixed oak-hickory forested phase provides critical habitat and ecosystem functions for a multitude of wildlife species. Research has documented that ninety-six species of birds and mammals consume acorns, especially during the fall and winter months (Martin et al. 1961). In many ecosystems, oaks are a community foundation and their production of acorns influences wildlife population and community dynamics. (Ellison et al. 2005). Valuable as an energy-rich food available to wildlife, acorn production is a key element of quality wildlife habitat. The noted ecologist E.L. Braun believed that at the time of European settlement, the most widespread and common mast-producing trees were oaks, beech, hickory and chestnut. With the loss of the American chestnut and the reduction in many areas of American beech (due to introduced pathogens), the importance of oaks to wildlife populations has increased. Although hickories are present on these ecological sites as well, the hard, thick shell of many Carya species relegates them to being utilized more as a food source for rodents (Martin et. al. 1961) while acorns are an abundant and accessible wildlife food source. Wildlife researchers have documented that acorn production in mature oak forests impacts wildlife behavior, habitat uses, population numbers, and reproductive successes in a variety of species ranging from deer to mice (McShea and Schwede 1993, Ostfeld et al. 1996). In eastern forests, no other genus of trees provides the same wildlife habitat functional role as mature oak-dominated forests. (McShea and Healy 2002). The age of a forest stand is an important consideration for wildlife. Plantings of young trees, along with a shrub layer and herbaceous cover, are of greatest value to early-successional wildlife. These include cottontail rabbits, songbirds, deer, and Although oak trees typically do not produce a significant amount of mast until 20 years of age or more, young tree plantings can serve as important resting and foraging areas for migrating songbirds. Old field or transitional field habitat is the stage of plant successional between the pasture phases and the forested phases. This ecological state is characteried primarily by grasses, forbs, brambles and shurbs pioneering into a previous pasture or field. Common wildlife psecies that use early successional habitat include wild turkey, northern bobwhite, deer, boblink, eastern meadowlark, Henslow's sparrow, sedge wren, and northern harriers. A key component of early successional habitat for many widlife species is the dominance of native warm-season grasses such as little bluestem, big bluestem, switchgrass, indiangrass, eastern gamagrass, etc. Unlike cool-season, non-native grasses like fescue, the warm-season grasses grow best during the warm months of the year, typically June, July, and August in Kentucky. There structural growth is that of a bunch grass, so that ground-feeding birds can move easily through the habitat. These grasses are also taller than fescue and provide cover for white-tail deer. The transitional field habitat has two distinct successional stages: the early stage which consists mainly of grass, forbs, herbs, vines, small shrubs, and a few young trees. As succession progresses, the pasture will increasingly become dominated by shrubs and trees. Many groups of animals dependent on invertebrates (especially butterflies and moths) are often dependent on specific hosts or forage plants that are found only in early successional plant communities. Monarch butterflies are an example of a species whose populations has decreased greatly and depends on specific plant species found in transitional field habitats. Although terrestrial vertebrates tend to be generalists with regards to habitat needs, over 50 species of native wildlife use early successional habitat. Within these early successional communities, annual plants produce an abundance of seeds that are eaten by granivorous birds and many small mammals. Herbivores and browsers, like the white-tailed deer, depend on nutritious forbs,

legumes, and shrubs found on these sites. Additionally, this lower height herbaceous vegetation provides key cover for small mammals and birds that prefer open habitats. Without the shade of a tree canopy, light and heat are allowed to penetrate the ground, an essential habitat feature for reptiles that depend on heat sources outside their body for temperature regulation. Maintaining and creating early successional habitat has become a priority for many landowners and natural resource agencies. Using the Natural Resources Conservation Service (NRCS) planning and programs to establish or maintain an early successional habitat project will ensure that landowners can protect, conserve, and enhance their natural resources including the many species of wildlife that depend on these sites.

Recreational uses

Multiple state-owned wildlife management areas in central Kentucky contain large areas of Eden and Faywood soils with these ecological sites present. Recreational benefits include hiking, bird-watching, native plant identification, photography, and hunting.

Wood products

Many of these ecological sites would be suitable for timber production and would benefit from active forest management such as brush control and timber stand improvement activities. The large majority of privately-owned forested sites visited were second or third growth unmanaged forests of lower quality. Many were in the invaded honeysuckle state with undesirable tree species present. Field work conducted as part of this project and a review of USDA-NRCS Soil Surveys show that these ecological sites are well-suited for timber production with upland oak site indices ranging from 55 to 70 depending on site-specific characteristics such as soil depth, rock content, micro-topography, and of course, long-term forest management. Oak species well-suited to these sites include white, chinkapin, Shumard, and on more mesic locations, northern red oak and black oak. Shagbark hickory was frequently found on monitored sites. Eastern red cedar production site indices on these sites generally range from 35 to 50, and as a pioneer species, cedar is very well-adapted to these shale and limestone sites.

Other products

Most sites included in this ecological site description are above 15 percent slope and generally not ideal for cropland or hay production. However, there were sites visited that had slopes of less than 15 percent were being utilized for hay production and pastureland. Generally these fields had been seeded to tall fescue and were being maintained with moderate to high levels of management. Although predominately tall fescue, most fields also contained one or more of the following: alfalfa, timothy, Kentucky bluegrass, orchardgrass, Johnson grass, ryegrass, and bromegrass. Alternative forest products that may offer private landowners an alternative revenue opportunity on these ecological sites, as most are suitable for alternative forest products. For example, Shiitake mushroom may provide landowners with an economic return on small diameter woodlands that would otherwise be damaged by unmanaged grazing, utilized as firewood, or simply ignored. Hardwood oak, hickory, and maple logs 3 to 8 inches in diameter are ideal for growing Shiitake mushrooms. Private landowners in this region are growing this crop successfully and production details should be investigated based on site-specific characteristics. Another non-timber woodland product that could be considered is ginseng. Kentucky is a leading exporter of wild ginseng (5 to 8 million dollars annually) and private landowner production is increasing in this region. This medicinal herb requires the cooler north or east-facing slopes of shaded woodlands. The forest understory should be open to allow for good air circulation and slopes of 20 to 40 percent are often recommended in literature. The woodland should be protected and the soil productive enough to include native understory plants such as Solomon’s seal, mayapples, and trilliums. Landowners interested in investigating alternative agro-forestry products should contact their state extension service or local university for assistance.

Other information

Many landowners of these ecological sites protect and appreciate the woodlands for the variety of spring and summer native woodland flower that bloom annually. The limestone slopes of these sites are ideal for a diverse population of native forbs, herbs, and vines including an array of native wildflowers that are outstanding in their beauty. A list of wildflowers typically found on these sites, if protected, is included in the understory plants list, community phase 1.1, of this document.

Inventory data references

Ecological states and phases and the plant species lists were developed utilizing low-intensity reconnaissance followed by selective medium or high-intensity monitoring. Medium and high intensity monitoring was conducted on 20 x 20 meter plots. Low intensity data collection included: verification of soil mapping, ocular estimates of cover, development of plant lists for species on site, landscape and individual plant photos, and the development of draft ecological site concepts based on these field observations. Additional data collection on higher-quality sites included: verification of soils (soil profile description), spatial coordinates, expanded plant identification lists, additional field notes, and evaluations of plant communities on similarly mapped soils. Photos of individual plants, transect lines within the plots, and landscape views were recorded. Species lists were developed with assistance of Kentucky State Nature Preserves Commission botanists. Successional community phases were documented on private lands and on Kentucky Department of Fish and Wildlife Resources wildlife management areas. These sites included a known history. and in some cases, photo documentation of landscape changes over multiple years. Nature Conservancy sites and Kentucky State Nature Preserves Commission lands provided high-quality older-growth sites with protected understories. Management history was also usually available for these sites. Kentucky state parks, private wildlife sanctuaries, and other public recreation areas provided examples of communities impacted by invasive vegetation,

recreational uses, soil erosion and compaction, timber harvesting, and road and trail development. Private lands visited provided a range of community states and phases depending on the landowner's purpose for owning the land. One reference site was located on private land and was of the high quality. Most private lands visited for this project were in a successional state, versus a reference state, as the property had been repeatedly logged or grazed. Tree identification and production data on plots were developed with the assistance of a private-lands forester with the Kentucky Division of Forestry.

Type locality

Location 1: Owen County, KY	
Latitude	84° 46′16″
Longitude	38° 21′47″
General legal description	This site is located in a State wildlife management area. The property is predominately second and third growth oak-hickory forest. Access to the site is only by foot. Soils are mapped Eden silty clay loam, 12 to 20 percent slope.
Location 2: Nicholas County, KY	
Latitude	83° 53′14″
Longitude	38° 20′44″
General legal description	This site is within a Kentucky wildlife mangement area and is mapped as Eden flaggy silty clay, 20 to 30 percent slope. The majority of the wildlife management area, including this site, is oak-hickory forest. Access to the site is by foot only.
Location 3: Spencer County, KY	
Latitude	85° 16′5″
Longitude	38° 1′52″
General legal description	This oak-hickory forest site is located in a Kentucky state park. Soils are Eden flaggy silty clay, 20 to 30 percent slope. Soil mapunits adjacent to the site are Eden silty clay loam, 6- to 20 percent slope, eroded. Access is by foot only.
Location 4: Pendleton County, KY	

Latitude	84° 24′40″
Longitude	38° 37′57″
General legal description	This privately owned and protected property is a high-quality oak-hickory forest and an excellent representative for this ecological site. The monitored plot was on Eden flaggy silty clay, 20 to 30 percent slope

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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:**

   _____

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):**

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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:

---

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:**

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17. **Perennial plant reproductive capability:**
