Ecological site F147XY008PA
Shallow Mixed Sedimentary Upland

Last updated: 9/27/2024
Accessed: 05/12/2025

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): 147X–Northern Appalachian Ridges and Valleys

Major Land Resource Area 147 is in the Middle section of the Valley and Ridge Province of the Appalachian Highlands. Characteristic features include folded and faulted parallel ridges and valleys that are carved out of anticlines, synclines, and thrust blocks. The variability of weathering of the underlying bedrock has resulted in resistant sandstone and shale ridges separated by less resistant limestone and shale narrow to moderately broad valleys. The ridges are strongly sloping to extremely steep and have narrow, rolling crests, and the valleys are mainly level to strongly sloping. The Great Valley is a salient feature of the eastern portion and runs the entire length of the MLRA where it is called the Shenandoah Valley in the south. The western side of the MLRA is dominantly hilly to very steep and is rougher and much steeper than the rolling hills to the east. Parts of the northernmost section of the MLRA were subjected to pre-Illinoian glaciation (>770,000 years ago). Anthracite coal underlies some areas in the north and has been mined since the 1700's.

Elevation in MLRA 147 generally ranges from 330 to 985 feet (100 to 300 meters) in the valleys and from 1,310 to 2,625 feet (400 to 800 meters) on the ridges and mountains. It is as high as 2,955 feet (900 meters) on some mountain crests and is nearly 4,430 feet (1,350 meters) on a few isolated, linear mountain ridges. Local relief in the valleys is about 15 to 165 feet (5 to 50 meters). The ridges rise about 660 feet (200 meters) above the adjoining valleys. (USDA, 2006).

Classification relationships

This ecological site is found in Major Land Resource Area 147- Northern Appalachian Ridges and Valleys. MLRA 147 is located within Land Resource Region S - Northern Atlantic Slope Diversified Farming Region (USDA 2006), and in United States Forest Service ecoregion M221A – Central Appalachian Broadleaf Forest-Coniferous Forest-Meadow Province (Bailey 1995). In addition, MLRA 147 falls within area #67 of EPA Ecoregion Level III – the Ridge and Valley (USEPA 2013). The Shallow Mixed Sedimentary Upland occurs in 67b and 67d of EPA Ecoregion IV – Northern Shale Valleys, and Northern Dissected Ridges, respectively (Woods et. al, 1996).

Ecological site concept

The Shallow Mixed Sedimentary Upland ecological sites occur throughout MLRA 147 on noncalcareous to acidic sedimentary geology primarily composed of shales, siltstones, and fine-grained sandstones. Depth to bedrock is less than 40 inches (100cm) and most sites are well drained to excessively drained, characteristics which favors xeric (dry) oak and hickory species over more mesic (moisture requiring) maple, ashes, and poplars. These landscapes are distinguished from the higher elevation ridges in that those areas are underlain by coarse textured quarzitic sandstones that have fewer nutrients, higher boulder and stone content, are well drained, but tend to be deeper to bedrock. Uplands within MLRA 147 at lower elevations are primarily underlain by limestone, dolomite, and calcareous sedimentary geology. The latter landscapes typically have higher base saturation, higher available water capacity, and higher soil fertility.

Within the Shallow Mixed Sedimentary Upland ecological sites, steep, convex, south and southwest facing slopes generally have shallower soils and bare rock outcrops, and can host a shale barrens plant community characterized by sparse trees, sometimes stunted vegetation, and species that are endemic or near endemic to these dry habitats. Linear to concave or slightly convex north and northeast facing slopes are typically deeper to bedrock and can support full forest cover dominated by oaks and pines.

Associated sites

F147XY002PA	**Mixed Sedimentary Upland** Deep Ac id Mixed Sedimentary Upland

Table 1. Dominant plant species

Tree	(1) *Quercus montana* (2) *Carya glabra*
Shrub	(1) *Cornus florida* (2) *Vaccinium pallidum*
Herbaceous	Not specified

Physiographic features

The Shallow Mixed Sedimentary Upland ecological sites occur in uplands on noncalcareous to acidic mixed sedimentary geology primarily composed of shales, siltstones, and fine-grained sandstones. Depth to bedrock is less than 40 inches (51cm). Typical landscapes are rolling hills in narrow valleys, and some mountains. The ecological site generally occupies the upper sideslope, shoulder, and summit positions on convex hills and less commonly is found on footslopes. Most sites are well drained to excessively drained. They are not subject to flooding or ponding.

The landscapes that underlie this ecological site can be variable in their slope and aspect. Steep, convex, south and southwest facing slopes generally have shallower soils, thinner tree canopies, and will more likely host a barrens type of plant community, while linear to concave or slightly convex north and northeast facing slopes are usually slightly deeper and can support full forest cover.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Mountain slope
Runoff class	Very low to very high
Elevation	28–1,184 m
Slope	3–80%
Water table depth	43–53 cm
Aspect	Aspect is not a significant factor

Climatic features

The climate of this region is temperate and humid. The Ridge and Valley Province is not rugged enough for a true mountain type of climate but it does have many of the characteristics of such a climate (Daily 1971). The influence of the high and low topography on air movement causes somewhat greater temperature extremes than are experienced in the Piedmont region to the east. The differences in elevation also affect the length of the frost free season on the ridges verses that in the valleys. The cooler temperatures and the shorter freeze-free periods occur at the higher elevations and in the more northern latitudes. The maximum precipitation occurs from early spring through mid-summer, and the minimum occurs in January and February. The average annual snowfall ranges from 16 to more than 51 inches (40 to 130 centimeters). The average annual temperature is 44 to 57 degrees F (7 to 14 degrees C). A portion of this region that extends from Maryland southward through most of the Shenandoah Valley in Virginia falls within a rain shadow cast by the Appalachian Mountains to the west and the Blue Ridge Mountains to the east. The mountains on either side block moist flowing air from either the east or the west causing the valleys to be drier. Average annual precipitation in this shadow area can average 34 to 36 in/year (86 to 91cm) compared

to 40 to 42 in/year (102 - 107 cm) for the rest of the region (PRISM 2013).

Data for mean annual precipitation, frost-free and freeze-free periods and monthly precipitation for this ecological site are shown below. The original data used in developing the tables was obtained from the USDA-NRCS National Water & Climate Center (2015) climate information database for 11 weather stations throughout MLRA 147 at elevations in which this ecological site occurs. All climate station monthly averages for maximum and minimum temperature and precipitation were then added together and averaged to make this table.

Table 3. Representative climatic features

Frost-free period (characteristic range)	132-144 days
Freeze-free period (characteristic range)	169-180 days
Precipitation total (characteristic range)	940-1,092 mm
Frost-free period (actual range)	119-147 days
Freeze-free period (actual range)	153-184 days
Precipitation total (actual range)	914-1,118 mm
Frost-free period (average)	137 days
Freeze-free period (average)	172 days
Precipitation total (average)	991 mm

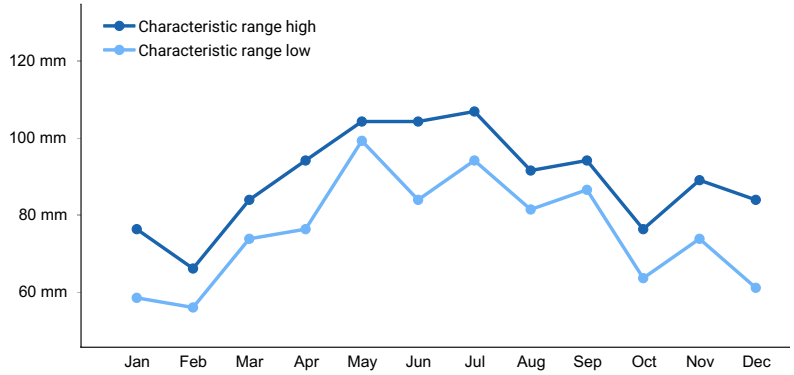


Figure 1. Monthly precipitation range

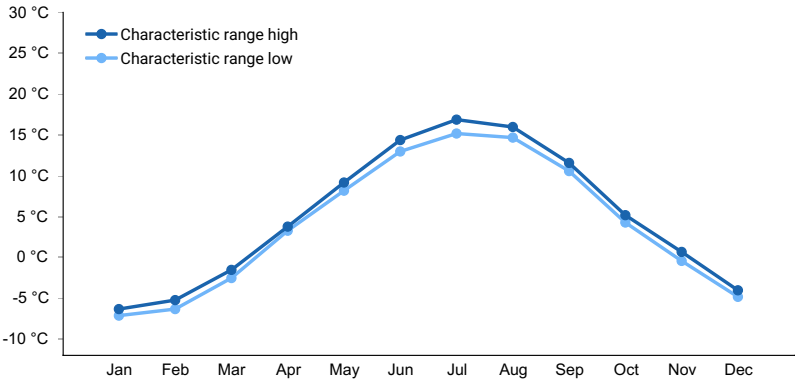


Figure 2. Monthly minimum temperature range

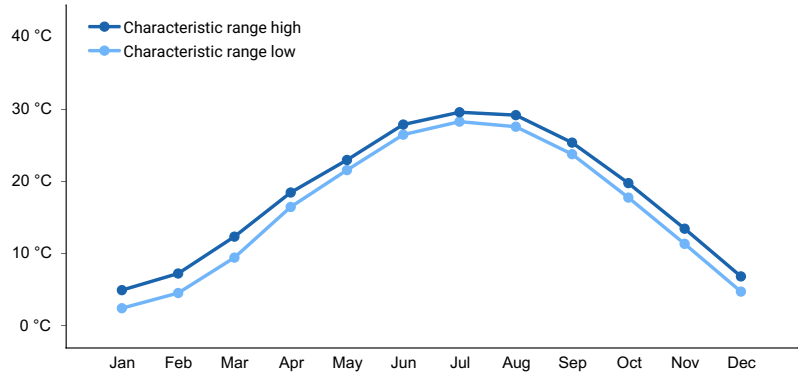


Figure 3. Monthly maximum temperature range

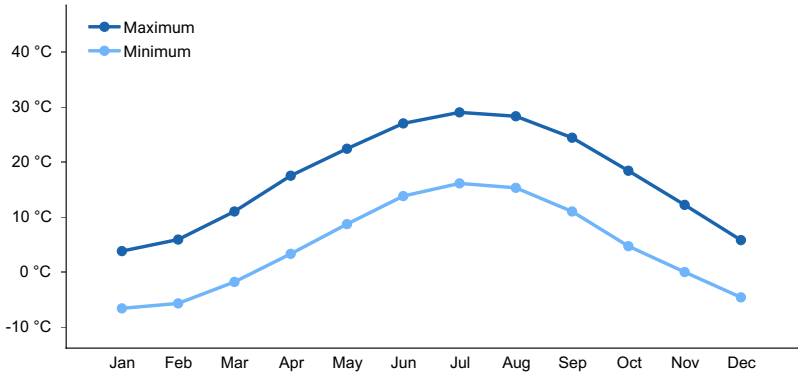


Figure 4. Monthly average minimum and maximum temperature

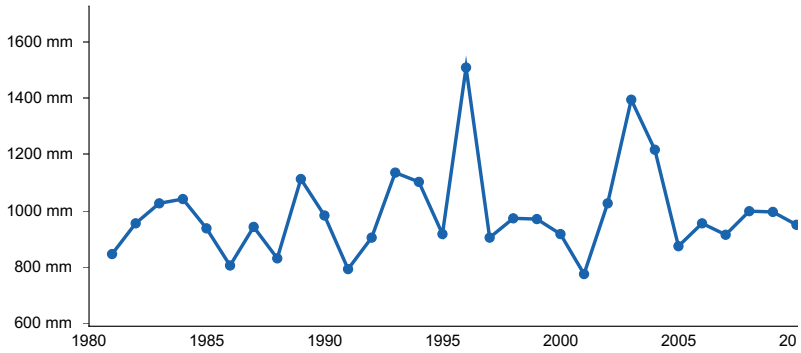


Figure 5. Annual precipitation pattern

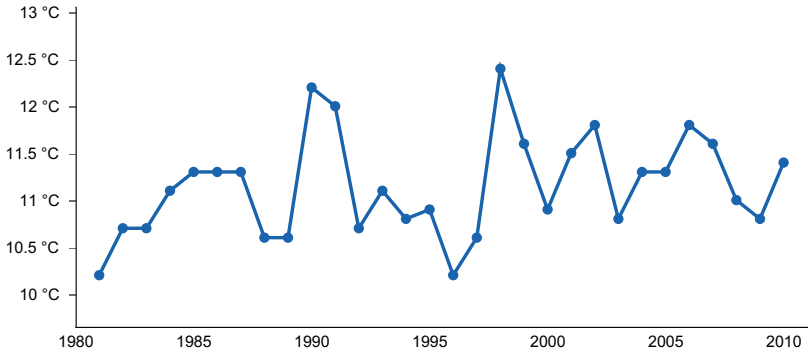


Figure 6. Annual average temperature pattern

Climate stations used

- (1) LEBANON 2 W [USC00364896], Lebanon, PA
- (2) EDINBURG [USC00442663], Edinburg, VA
- (3) HOT SPRINGS [USC00444128], Hot Springs, VA

- (4) MATHIAS [USC00465739], Lost City, WV
- (5) HANCOCK [USC00184030], Hancock, MD
- (6) STATE COLLEGE [USC00368449], State College, PA
- (7) GATHRIGHT DAM [USC00443310], Covington, VA
- (8) BEAR GAP [USC00360457], Coal Township, PA
- (9) EVERETT [USC00362721], Everett, PA
- (10) DALE ENTERPRISE [USC00442208], Dayton, VA
- (11) ROMNEY 1 SW [USC00467730], Romney, WV

Influencing water features

This ecological site is not influenced by wetland or riparian water features.

Soil features

The representative soil series associated with this site are: Weikert, Sequoia, Rough, Ramsey, Montevallo, Lehew, Klinesville, Gilpin, Gainesboro, Calvin, and Berks. These soils have formed in place, having weathered from mixed geologies of acidic shales, sandstones, and siltstones. Berks, Weikert, and Gilpin have been mapped extensively throughout the Appalachian Highlands on several different geologic formations and on all slope aspects.

Depth to bedrock is generally less than 40 inches and can be as shallow as 6 inches. The shallowest soils tend to be found on steep, noticeably convex slopes and shoulders. Deeper soils are found in concave or linear areas, or towards the lower portion of the hillslopes. Bedrock is usually standing somewhat on end and is fractured allowing water to drain freely through the soil. The soils are typically very channery or very gravelly with greater than 40% rock fragment volume. Subsurface textures are silt loam, loam, or fine sandy loam. Field soil pH generally ranges from 4.8 to 5.0 within the upper 15 inches. An occasional inclusion of calcareous shale will cause the pH in very localized areas to be 6.0 to 6.5.

Surface soil textures are silt loams, loams, or fine sandy loams.

Table 4. Representative soil features

Parent material	(1) Residuum–acid shale
Surface texture	(1) Channery silt loam (2) Very channery loam (3) Flaggy fine sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained to excessively drained
Permeability class	Rapid
Soil depth	15–102 cm
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–10%
Available water capacity (0-101.6cm)	0.76–14.73 cm
Soil reaction (1:1 water) (0-101.6cm)	4.5–5.7
Subsurface fragment volume <=3" (Depth not specified)	0–47%
Subsurface fragment volume >3" (Depth not specified)	0–80%

Ecological dynamics

Information contained in this section was adapted from several sources, including field work, the Landfire Biophysical Settings layer (Landfire 2010), NatureServe (NatureServe 2009; NatureServe 2017), and the Natural

Heritage Programs of Pennsylvania (Zimmerman et al. 2012), Virginia (Fleming et al. 2013), West Virginia (WVDNR 2014), and Maryland (Harrison 2004). The information presented is representative of very complex vegetation communities. Key indicator plants, animals and ecological processes are described to help inform land management decisions. Plant communities will differ across the MLRA because of the naturally occurring variability in weather, soils, and aspect. The reference plant community is not necessarily the management goal. The species lists are representative and are not botanical descriptions of all species occurring, or potentially occurring, on this site. They are not intended to cover every situation or the full range of conditions, species, and responses for the site.

State Correlation: This site will be correlated in: MD,PA,VA,WV

The Shallow Mixed Sedimentary Upland Ecological Site is located in the Ridge and Valley region of the Appalachian Highlands, an area that has undergone extensive human disturbance since pre and post-European settlement times (Braun 1950). The topography and landscape position range from rolling hills to steep slopes on acidic shale, sandstone, and siltstone. Depth to bedrock ranges from 10 to 40 inches (25 to 100 cm). These sites tend to create dry, xeric conditions with moderate to low forest productivity. The reference forest is an oak and hickory dominated community and is part of the Central Appalachian Dry Oak-Pine Forest System which covers large areas in the low to mid elevation central Appalachians and middle Piedmont (CES202.591 from NatureServe 2015; Landfire 2010). Although this system includes a number of diverse plant communities, a Chestnut Oak - Pignut Hickory community was consistently observed with field work in mature forests on these shale uplands. In addition to the oak-hickory forest, these landscapes included patches of Eastern White Pine-Chestnut Oak forest and a more open Virginia Pine-Oak shale woodland.

The forest is mostly closed-canopy but can include patches of open woodlands. It is dominated by a variable mixture of dry-site oak and pine species, most typically Quercus prinus (chestnut oak), *Pinus virginiana* (Virginia pine), and *Pinus strobus* (eastern white pine), but sometimes *Quercus alba* (white oak) and/or *Quercus coccinea* (scarlet oak). In addition, there is a high cover of Carya spp. (hickory), especially *Carya glabra* (pignut hickory). *Quercus velutina* (black oak) and *Quercus rubra* (red oak) may also be present. Heath shrubs such as *Vaccinium pallidum* (blue ridge blueberry), *Gaylussacia baccata* (black huckleberry), and *Kalmia latifolia* (mountain laurel) are moderate to sparse, but may be thicker on gentle ridge crests, where litter and humus tend to accumulate. Disturbance agents include fire, wind throw, and ice damage. Increased site disturbance generally leads to secondary forest vegetation with a greater proportion of *Pinus virginiana* (Virginia pine) and weedy hardwoods such as *Acer rubrum* (red maple).

The Oak-Hickory forest and Pine-Oak Forest intergrade into one another with some areas containing more pine, others having primarily oak, and still others containing significant amounts of both. Low intensity fire and canopy disturbance tends to favor oak regeneration. Fire exclusion may favor the succession of oak dominated forests to ones dominated by pine.

Pine-Oak shale barren woodlands occupy parts of this ecological site where slopes are distinctly convex, steep, typically of south or southwest aspect, and where soil cover is minimal. Canopy cover is less than 70 percent and dominants are *Pinus virginiana* (Virginia pine), *Juniperus virginiana* (eastern red cedar) (often subordinate but occasionally dominant), *Quercus rubra* (northern red oak), and Quercus prinus (chestnut oak). Shale barren endemics may be found on these sites including *Paronychia montana* (mountain nailwort), *Antennaria virginica* (shale barren pussytoes), *Allium oxyphilum* (lillydale onion), *Packera antennariifolia* (shale barren ragwort), *Oenothera argillicola* (shale barren evening primrose), *Solidago arguta* (Atlantic goldenrod), *Scutellaria ovata* (heartleaf skullcap), and *Trifolium virginicum* (Kates mountain clover).

Oak forests historically have been maintained by periodic fire. Fire suppression since the early 20th century in the eastern United States is believed to be leading to the overall replacement of oaks with fire-sensitive, non-oak species like maples, beeches, birches, tulip poplars, and black cherry (Brose et. al., 2008). Oak forest regeneration is also hindered by heavy deer browsing (Latham etl al. 2005). Deer will selectively consume many native species including oak seedlings and acorns over less palatable species like hay-scented fern and several non-native species including Japanese barberry, Eurasian species of honeysuckle, and garlic mustard. Despite these factors, oak forests in shallow mixed sedimentary upland areas, seem to be maintaining their dominance. Large oak roots are able to survive in xeric uplands and can resprout multiple times, thus enabling these landscapes to continually reproduce and accumulate oak seedlings. This accumulation of reproduction results from the combined effects of periodic seed production, the relatively large food reserves in acorns that sustain seedlings through the first year,

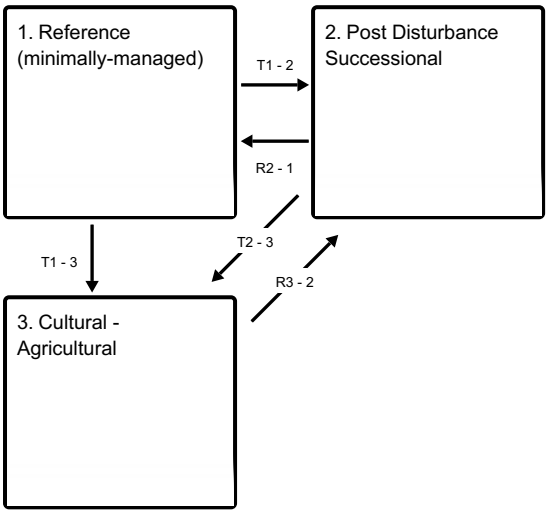
the high sprouting capacity of seedlings, drought tolerance and the ability of seedlings to persist under at least moderate shade. In the eastern United States, the accumulation of oak reproduction generally increases with decreasing site quality and over story density (Johnson 2009).

Other states observed on these ecological sites include a cleared agricultural pasture state, an old field state and an invaded woodland state where non-native species occupy significant areas of the understory. These non-natives may have detrimental effects on the reproduction and advanced recruitment of the reference tree species. One such invasive species Multiflora rose (rosa multiflora) is often present in the shrub layer.

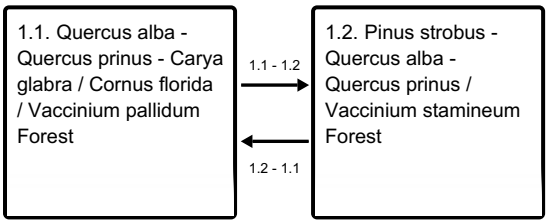
Various field guides were used for identification of vegetation. Current taxonomy and nomenclature were verified using the Plants of Pennsylvania (Rhoads and Block 2007) and the USDA Plants database (2015).

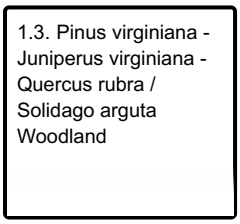
State and transition model

Ecosystem states

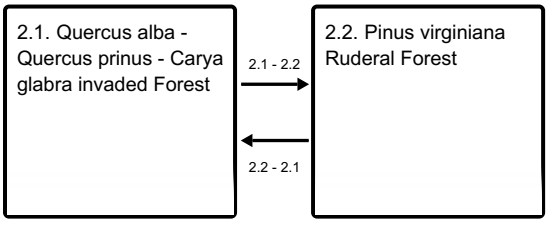


State 1 submodel, plant communities





State 2 submodel, plant communities



State 3 submodel, plant communities

3.1. Phleum pretense-Dactylis glomerata pasture	3.2. Zea mays and other row crops

State 1
Reference (minimally-managed)

These Oak – Hickory forests occur on acidic shale, siltstone, and sandstone uplands along the foothills of the sandstone ridges and within the shale dominated valleys. The restricted soil depth, and droughty conditions favor the growth of xeric oak species. The reference communities listed below have been documented on the Shallow Mixed Sedimentary Uplands and although they are representative, they are not intended to describe every situation or the full range of conditions for this site. There are no transition pathways designated between some of the three communities in the reference state because the differences in vegetation are more controlled by landscape position than management or disturbance, or the relationships are not understood.

Community 1.1
Quercus alba - Quercus prinus - Carya glabra / Cornus florida / Vaccinium pallidum Forest

The White Oak - Chestnut Oak - Pignut Hickory / Flowering Dogwood / Blue Ridge Blueberry Forest, also known as the Central Appalachian Acidic Oak - Hickory Forest (CEGL008515 - NatureServe 2017), is dominated by Quercus prinus (chestnut oak), *Q. alba* (white oak), *Q. velutina* (black oak), *Q. rubra* (northern red oak), and various Carya species (hickory) including *Carya glabra* (pignut hickory) and *Carya ovalis* (red hickory). *Pinus virginiana* (Virginia pine), and *Pinus strobus* (eastern white pine) may also be important. Young representatives of most canopy species are common in the understory, along with *Cornus florida* (flowering dogwood) and *Amelanchier arborea* (common serviceberry). Generally there is a moderate to sparse representation of ericaceous (Heath family) shrubs. However, on gentle ridge crests, where litter and humus tend to accumulate, *Vaccinium pallidum* (blue ridge blueberry) may dominate the herb layer in low colonies. On the more extensive steep, convex slopes, where litter accumulations are thin and patchy, ericads are sparse and herbaceous richness tends to be moderately high, although total herb cover can be quite sparse. This community seems to be able to regenerate itself even after logging if soil disturbance is minimized and tree stumps are left to resprout. Invasive species may enter along the edges, but if the forest patch is large enough, then native species are able to maintain their foothold. Deer over-browsing can have a profound negative effect on oak regeneration. Periodic drought stress and low-intensity fires are natural disturbances that help to regenerate the oak component of this community. Fire removes competitive species such as white pine, sugar maple and other fire-sensitive non oak species.

Community 1.2
Pinus strobus - Quercus alba - Quercus prinus / Vaccinium stamineum Forest

The Eastern White Pine - White Oak - Chestnut Oak / Deerberry Forest, also known as the Central Appalachian-Piedmont White Pine - Subxeric Oak ForestPine-Oak Forest (CEGL008539 - NatureServe 2017), has canopies varying from closed to somewhat open, codominated by *Pinus strobus* (eastern white pine) (25-75% canopy cover) and various oaks, particularly *Quercus alba* (white oak), *Quercus coccinea* (scarlet oak), *Quercus velutina* (black oak), *Quercus rubra* (red oak), and Quercus prinus (chestnut oak). Minor canopy associates include *Acer rubrum* (red maple), Carya alba (mockernut hickory), *Carya glabra* (pignut hickory), *Fagus grandifolia* (American beech), *Liriodendron tulipifera* (tuliptree), *Nyssa sylvatica* (blackgum), *Pinus virginiana* (Virginia pine), *Quercus falcata* (southern red oak) (mostly Piedmont), *Quercus velutina* (black oak), and Tsuga Canadensis (eastern hemlock). Understory trees include *Acer rubrum* (red maple), Oxydendrum arboretum (sourwood), and *Nyssa sylvatica* (black gum), which may be abundant, along with *Cornus florida* (flowering dogwood). The shrub layer is predominantly ericaceous and varies from sparse and patchy to occasionally dense, with *Vaccinium stamineum* (upland highbush blueberry), *Vaccinium pallidum* (blue ridge blueberry), *Gaylussacia baccata* (black huckleberry), and *Kalmia latifolia* (mountain laurel) being characteristic. Other frequent but lower-cover shrub-layer species include *Amelanchier arborea* (common serviceberry), *Viburnum acerifolium* (mapleleaf viburnum), *Smilax rotundifolia* (roundleaf greenbrier), *Smilax glauca* (cat greenbrier), *Sassafras albidum* (sassafras), and *Diospyros virginiana* (common

persimmon). The herb layer is characterized by species tolerant of dry, acidic soils; it is usually sparse but occasionally contains dense graminoid patches of *Danthonia spicata* (poverty oatgrass), *Deschampsia flexuosa* (wavy hairgrass), or *Carex pensylvanica* (Pennsylvania sedge).

Community 1.3
Pinus virginiana - Juniperus virginiana - Quercus rubra / Solidago arguta Woodland

The Virginia Pine - Eastern Red-cedar - Northern Red Oak / Shale Barren Goldenrod - Eastern Prickly-pear Woodland, also known as the North-Central Appalachian Acidic Shale Woodland-Oak shale barren woodland (CEGL006288 - NatureServe 2017) occurs on unstable shale slopes with areas of exposed bedrock. These occupy the most convex, steep, parts of the landscape where soil is minimal. The canopy is usually a mixture of oak and conifers but may have either one or the other dominant. Canopy cover varies widely but is typically less than 70% and may be sparse. The herb layer is likewise variable but is commonly less than 25%. Canopy dominants are *Pinus virginiana* (Virginia pine), *Juniperus virginiana* (eastern redcedar) (often subordinate but occasionally dominant), *Quercus rubra* (northern red oak), and Quercus prinus (chestnut oak). Associates vary and include *Quercus stellata* (sand post oak), *Carya glabra* (pignut hickory), *Celtis tenuifolia* (dwarf hackberry), *Quercus alba* (white oak), Carya alba (white hickory), and Fraxinus Americana (white ash). Shrubs are typically sparse or scattered and include *Quercus ilicifolia* (bear oak), Rhus aromatic (fragrant sumac), *Rhus copallinum* (winged sumac), and less frequently *Amelanchier arborea* (common serviceberry), *Vaccinium stamineum* (upland highbush blueberry), *Vaccinium pallidum* (blue ridge blueberry), and Rosa Carolina (Carolina rose). *Carex pensylvanica* (Pennsylvania sedge) and *Danthonia spicata* (poverty oatgrass) are the most common ground-layer species; other graminoids that may be locally common at some sites include *Schizachyrium scoparium* (little bluestem), and *Deschampsia flexuosa* (wavy hairgrass). Typical forbs include *Antennaria plantaginifolia* (woman's tobacco), *Cunila origanoides* (common dittany), *Houstonia longifolia* (longleaf summer bluet), *Opuntia humifusa* (devil's-tongue), *Selaginella rupestris* (northern selaginella), *Hedeoma pulegioides* (American false pennyroyal), *Pellaea atropurpurea* (purple cliffbrake), *Polygonum scandens* var. cristatum (climbing false buckwheat), and *Cheilanthes lanosa* (hairy lipfern), as well as the shale barren endemics (or near-endemics) *Paronychia montana* (mountain nailwort), *Antennaria virginica* (shale barren pussytoes), *Allium oxyphilum* (lillydale onion), *Packera antennariifolia* (shale barren ragwort), *Oenothera argillicola* (shale barren evening primrose), *Solidago arguta* var. harrisii (Harris' goldenrod), *Scutellaria ovata* (heartleaf skullcap), and *Trifolium virginicum* (Kates Mountain clover).

Pathway 1.1 - 1.2
Community 1.1 to 1.2

The Acidic Oak Hickory forest and the Pine-Oak forest intergrade into one another with some areas containing more pine, others having primarily oak, and still others containing significant amounts of both. Low intensity fire and canopy disturbance tends to favor oak regeneration. Fire exclusion may favor the succession of oak dominated forests to ones dominated by pine.

Pathway 1.2 - 1.1
Community 1.2 to 1.1

The successional status of the Pine-Oak Forest community is somewhat unclear. At some sites, it appears that *Pinus strobus* (eastern white pine) has increased greatly following logging disturbances or fire exclusion, and that the white pine-hardwood forest is characteristic of secondary succession in disturbed oak forests. Periodic low intensity fire may be one way to revert from a pine dominated forest to one dominated by oak and hickory. Removing pine over story and opening the canopy will assist shade intolerant oak seedlings to grow more vigorously.

State 2
Post Disturbance Successional

Dry Oak Hickory forests were observed growing on what was considered to be former agricultural areas where the soil profile showed characteristics of prior cultivation, most noticeably having a relatively distinct plow layer in the upper 15cm of soil. Heavy invasion of non-native species in the understory was also an indicator of disturbance. The dominance or strong presence of *Pinus virginiana* (Virginia pine) in some areas points to historic clearing as the bare mineral soil of cultivated sites facilitates the germination requirements of *Pinus virginiana*, and other early

successional species.

Community 2.1
Quercus alba - Quercus prinus - Carya glabra invaded Forest

Post agricultural oak- hickory forests are similar to the reference state with the exception that overall species diversity is less, trees are even-aged having established once agriculture was abandoned. Sites are invaded by Rosa Multiflora (multiflora rose), Lonicera spp. (honeysuckle), and other herbaceous invasive species. *Pinus strobus* (eastern white pine) and *Pinus virginiana* (Virginia pine) may be part of the canopy as well. Early successional species like *Robinia pseudoacacia* (black locust), *Liriodendron tulipifera* (tuliptree), *Acer rubrum* (red maple), and *Prunus serotina* (black cherry) are also present.

Community 2.2
Pinus virginiana Ruderal Forest

The *Pinus virginiana* (Virginia pine) ruderal Forest (CEGL002591-NatureServe 2017) contains *Pinus virginiana* (Virginia pine) as well as admixtures of other Pinus species (e.g., *Pinus taeda* (loblolly pine), *Pinus echinata* (shortleaf pine), *Pinus rigida* (pitch pine), and *Pinus strobus* (eastern white pine). Pines contribute to at least 25 percent of the overstory. This is typically a mixed type of plant community and hardwood associates vary; common species include *Quercus rubra* (red oak), *Q. velutina* (black oak), *Q. coccinea* (scarlet oak), *Q. alba* (white oak), *Prunus serotina* (wild black cherry), *Acer rubrum* (red maple), *Betula lenta* (sweet birch), Carya spp. (hickory), *Sassafras albidum* (sassafras), and *Fraxinus americana* (white ash). Shrubs include Smilax spp. (greenbrier), *Juniperus virginiana* (red-cedar), Rhus copallina (shining sumac), *Rubus allegheniensis* (Allegheny blackberry), *Toxicodendron radicans* (poison-ivy), and *Parthenocissus quinquefolia* (Virginia creeper).

Pathway 2.1 - 2.2
Community 2.1 to 2.2

The relationship between a post agricultural site that becomes dominated by oak verses one dominated by pine is unclear. If mature oaks were left in the field, for example to provide shade for livestock, then there would be a ready seed source to recolonize the field with oaks. Fire and/or bare mineral soils, and the presence of nearby pine plantations, would favor the establishment of pines.

Pathway 2.2 - 2.1
Community 2.2 to 2.1

It is not known if a *Pinus virginiana* (Virginia pine) dominated forest would eventually naturally succeed to one dominated by oaks if oaks do not exist within the forest mix to provide a seed source.

State 3
Cultural - Agricultural

Upland shale areas that have less than 15% slope have nearly all been cleared for either row crop production or for the planting of non-native cool season grasses for pasture. Soils are generally acidic, so pH must be managed for best fertility. The soils are relatively shallow, 10 to 40 inches in depth, and can be droughty and stony.

Community 3.1
Phleum pretense-Dactylis glomerata pasture

Pasture sites observed on shale upland ecological sites were dominated by the cool season grasses of Phleum pretense (timothy) and *Dactylis glomerata* (orchardgrass). Other species included *Sorghum halepense* (Johnsongrass), Setaria spp. (foxtails), Panicum spp. (panic grass), Amaranthus spp. (amaranth), *Taraxacum officinale* (common dandelion), and *Cirsium arvense* (Canada thistle).

Community 3.2
Zea mays and other row crops

Row crops like *Zea mays* (corn) are planted in areas where slopes are gentle. Soils can be droughty and shallow, and pH should be maintained with additions of lime. Use of no-till farming methods and cover crops will potentially add organic matter to soil, improve water holding capacity, and minimize soil erosion.

Transition T1 - 2
State 1 to 2

Historically logged and cleared; possibly plowed, pastured, and grazed. Long term succession; no grazing.

Transition T1 - 3
State 1 to 3

Logged, cleared, cultivated. Cultivation currently maintained.

Restoration pathway R2 - 1
State 2 to 1

Remove understory, plant native seeds and seedlings, eliminate and manage nonnative species, implement a prescribed fire plan. Return to the reference or post logged minimally managed state may require a very long term series of costly management options and stages. Many species may need to be planted or seeded to restore the system. Herbivory can be a problem as well as competition from faster growing species. Depending on the existing seed bank and the proximity of a mature forest from which to recruit seeds, ruderal forests may regain a mixed forest stand. Nevertheless, sites that have been cleared and tilled have significant soil disturbance which may include compaction, erosion, loss of native soil structure, loss of soil organic matter, disruption of soil microorganisms, all which affect the soil's nutrient availability and water holding capacity (Duiker and Myers, 2005). These characteristics favor recolonization by plant species that have wind dispersed seeds (verses those that propagate through underground roots called rhizomes, or which have heavy seeds that stay near the parent tree), are shade intolerant, have rapid to moderate growth rates, and drought tolerance (Dyer, 2010). Aggressive control of nonnative species and invasive species will be ongoing. The following conservation practices from the Natural Resources Conservation Service Field Office Technical Guide can be used for restoration efforts (FOTG-USDA): Brush Management-314; Forest Stand Improvement-666; Herbaceous Weed Control-315; Upland Wildlife habitat management-645; Prescribed burning-338.

Conservation practices

Brush Management
Prescribed Burning
Upland Wildlife Habitat Management
Forest Stand Improvement
Herbaceous Weed Control

Transition T2 - 3
State 2 to 3

Logged, cleared, cultivated. Cultivation currently maintained.

Restoration pathway R3 - 2
State 3 to 2

Tree planting; long term succession (50+ years); no grazing. The following conservation practices from the Natural Resources Conservation Service Field Office Technical Guide can be used for restoration efforts (FOTG-USDA): Brush Management-314; Critical Area Planting-342; Early Successional Habitat Development-647; Fence-382; Forest Stand Improvement-666; Herbaceous Weed Control-315; Tree/Shrub site Preparation-490; Upland Wildlife habitat management-645; Prescribed burning-338

Conservation practices

Brush Management
Critical Area Planting
Tree/Shrub Site Preparation
Upland Wildlife Habitat Management
Early Successional Habitat Development/Management
Forest Stand Improvement
Herbaceous Weed Control

Additional community tables

Inventory data references

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

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Approval

Nels Barrett, 9/27/2024

Acknowledgments

This current draft provisional ecological site (PES) report is a generalized description of landform, climate,

physiography, soils and associated vegetation. Future work is needed to validate this information and further refine the report into an ecological site description (ESD). An ESD will include detailed plant floristic inventory data on the reference state and most commonly occurring alternate states, interpretations for different land use, site productivity data, as well as descriptions of the ecological dynamics.

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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	05/12/2025
Approved by	Nels Barrett
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:**