Ecological site F136XY860VA
Lower Piedmont Acidic River Bluff Forest

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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 136X–Southern Piedmont

This MLRA is on a large piedmont underlain by metamorphic and igneous bedrock. It stretches from north-central Virginia to east-central Alabama, running parallel to the Appalachian highlands to the northwest and the Atlantic coast to the southeast. MLRA 136 has only subtle climatic differences with MLRA 148 (Northern Piedmont), with which it shares a common geologic origin. This adjacent MLRA sits to the north. Along the fall line, it shares a boundary with MLRA 133A (Southern Coastal Plain), MLRA 137 (Carolina and Georgia Sand Hills), and 133C (Gulf Coastal Plain). Here, unconsolidated Coastal Plain sediments intersect the much older Piedmont bedrock. Along it's northwestern boundary, it sits adjacent to MLRAs 130B (Southern Blue Ridge), 130A (Northern Blue Ridge), and 128 (Southern Appalachian Ridges and Valleys). These MLRAs are distinguished from the Southern Piedmont by topographic and elevational differences, as well as differences in the age, origin, and degree of metamorphism of the underlying bedrock. Five states are intersected by the MLRA, including North Carolina (29 percent), Georgia (27 percent), Virginia (20 percent), South Carolina (17 percent), and Alabama (7 percent). The MLRA extent makes up about 63,720 square miles (165,034 square kilometers). MLRA PHYSIOGRAPHY The landscape is generally rolling to hilly, with a well-defined drainage pattern. Streams have dissected the original Piedmont plateau, forming narrow ridgetops, somewhat broad interfluves, and short, steep side slopes adjacent to the streams and drainageways. With some exceptions, the valley floors are generally narrow and make up about 10 percent or less of the land area. The associated stream terraces are generally small and of minor extent. The landscape is moderately dissected overall, with isolated erosional remnants (monadnocks) and other areas of high topographic relief interspersed. Over most of the MLRA, elevation ranges from approximately 325 to 1,315 feet (100 to 400 meters), with elevations generally increasing toward the Appalachian Highlands, in the upper Piedmont, and decreasing toward the Coastal Plain, in the lower Piedmont. The major rivers that cross this area en route to the ocean include, from north to south, the James, Roanoke, Cape Fear, Savannah, Altamaha, Chattahoochee, and Alabama Rivers. These rivers typically originate within the Piedmont or in the Blue Ridge. They flow east and south across the Coastal Plain and empty into the Atlantic Ocean or the Gulf of America. MLRA GEOLOGY Precambrian and Paleozoic metamorphic and igneous rocks underlie almost all of this MLRA. The dominant metamorphic rock types include gneiss, schist, slate, argillite, and phyllite, among others. Dominant igneous rock types include granite and other related felsic crystalline rocks. Mafic intrusive rocks, including gabbro, diabase, amphibolite, and other dark colored rocks, underlie a minority of the upland landscape. These mafic intrusions crop out in the form of dikes and sills, and often weather to produce soils high in base cations. The Carolina Slate Belt runs lengthwise through the east-central part of the MLRA, in southern Virginia, North Carolina, South Carolina, and the eastern-most part of the Georgia Piedmont. This region is underlain by fine-grained metasedimentary and metavolcanic rock, which generally weathers to produce soils high in silt. From Virginia to North Carolina, and in a single county in South Carolina, fault-bounded Triassic Basins are scattered amongst the igneous and metamorphic uplands. These basins are underlain by Triassic and Jurassic siltstone, shale, sandstone, and mudstone, which were laid down in response to continental rifting and subsequent erosion during the Mesozoic era. MLRA SOILS The dominant soil orders of the MLRA are Ultisols, Inceptisols, and Alfisols. Ultisols and Alfisols are typically found on more stable landforms, such as interfluves, gentle hillslopes, broad ridgetops, and stream terraces, while Inceptisols are typically found on less stable landforms, including flood plains, steep hillslopes, and narrow ridgetops. Soils of the region predominantly have a thermic temperature regime, a udic moisture regime, and generally have kaolinitic or mixed mineralogy. In the upper Piedmont of Virginia and North Carolina however, soils have a mesic soil temperature regime, as depicted in figure 2. The mesic soil temperature regime portion of the MLRA is oriented from northeast to southwest and occupies approximately 18 percent of the MLRA extent, or 11,729 square miles (30,377 square kilometers). Broadly speaking, soils of the Southern Piedmont uplands are shallow to very deep, well drained, and loamy or clayey. Soils of the river valleys are generally very deep, well to poorly drained, and loamy. Soils tend to be finer-textured than in Coastal Plain regions. MLRA CLIMATE In general, precipitation is evenly distributed throughout the year in this MLRA, with occasional drought-like conditions extending from late summer into autumn. During the growing season, most of the rainfall comes from high-intensity, convective thunderstorms. Significant moisture also comes from the movement of warm and cold fronts across the MLRA from November to April. High amounts of rain can also occur during hurricanes, usually during the months of August through October. Over most of the MLRA, snowfall is typically light, though overall, the mesic soil temperature regime portion of the MLRA features colder temperatures, more snowfall, and a shorter growing season than in the thermic portion. The cooler climate in this region supports an increase in species with northern or Blue Ridge affinities. Both the mean annual temperature and the length of the freeze-free period increase from north to south and with decreasing elevation from the upper to the lower Piedmont. MLRA LAND USE AND RESOURCES Once largely cultivated, much of this region is now planted to loblolly pine or has reverted to successional pine and hardwood forests. The more productive lands support small to medium-size family farms that produce crops and livestock, while the less productive lands have been in forest for some time. Most of the open areas are used for grazing beef cattle, though in years past, dairy cattle were also important to the local economy. The principal crops of the region include corn, soybeans, and small grains. Burley tobacco remains a crop of local importance. Cotton is grown in the thermic soil temperature regime portion of the MLRA. Several major land cover transformations have occurred in the Southern Piedmont over the past several centuries; from open woodlands sculpted by fire, to farmland, to closed forests and planted pine, past land uses have played an outsized role in shaping present-day soils and vegetation patterns in the region. Land-use intensity peaked with the arrival of the industrial revolution, which gradually increased demand for textiles. Cotton became the dominant crop over much of the region. In spite of early successes, two centuries of poor management practices accelerated soil erosion, stripping away the fertility and moisture-supplying capacity of soils. In addition to soil losses in the uplands, legacy sediments derived from the eroded land rapidly accumulated in the river valleys below, often leading to changes in hydrology and flooding frequency. After being stripped of it's loamy topsoil, many areas of the Piedmont had been so badly eroded as to render the land unsuitable or economically impractical for agriculture. The effects of erosion were widespread, with cumulative soil loss estimates ranging from 5 to 10 inches on average. The steeper slopes, which had often been cleared and farmed at the height of the Cotton era, generally suffered greater losses. By the 1930's, crop production was in rapid decline in the Southern Piedmont. The loss of soil productivity due to erosion, losses to the cotton boll weevil, development of synthetic fibers, and the onset of the Great Depression all contributed to rapid abandonment of cropland. By 1960, cropland acres had decreased by more than 50 percent in nearly every county in the Southern Piedmont. While crop production is still important today on the more productive lands, those of lower productivity, or those that were subject to severe erosion, were often abandoned some time ago. Typically, they have either reverted to forest, or have been converted to other uses. Although the productivity of soils was greatly reduced through erosion, less intensive land uses such as grazing and forestry were still feasible. These land uses gained popularity as patterns of urban migration, low commodity prices, and other factors gradually made crop production less economical on the marginal lands. In recent years, large-scale adoption of soil conservation practices have led to better outcomes with respect to erosion in much of MLRA, increasing the economic viability and long-term sustainability of Piedmont farms. Despite some success, water erosion remains one of the most important soil resource concerns in the MLRA. Other major resource concerns include increasing conversion of prime farmland and farmland of statewide importance to urban uses. Throughout the MLRA, metropolitan areas are expanding into lands that have historically been used for timber or agriculture. This change in land use is occurring rapidly in the corridor called the Piedmont Crescent, which extends from Atlanta, Georgia, to Raleigh, North Carolina. HISTORIC VEGETATION COVER Over most of the Southern Piedmont uplands, the historic oak-hickory, or oak-hickory-pine forest, once covered large portions of the landscape. It was dominated by upland oaks, such as white oak (Quercus alba), northern red oak (Quercus rubra), and southern red oak (Quercus falcata), with a smaller contribution from hickories (Carya spp.) and pines. The principal pine species are shortleaf pine (Pinus echinata), loblolly pine (Pinus taeda), and to the north and west, Virginia pine (Pinus virginiana). In the southernmost and easternmost portions of the MLRA, the historic montane longleaf pine forest, dominated by longleaf pine (Pinus palustris), shortleaf pine (P. echinata), and dry-site oaks, was found on ridgetops and steep south or west-facing slopes. According to historic accounts, forests and woodlands of the past were generally more open and park-like, having been exposed to a more frequent fire regime. Piedmont prairies, likely maintained by Native Americans, were also reportedly common across the landscape, as were fire-maintained canebrakes along the streams (Trimble 1974; Daniels 1987; Griffith et al. 2002; Van Lear et al. 2004; Dearman and James 2019; Schomberg et al. 2020; USDA-NRCS 2022).

LRU notes

MLRA 136 is one of the largest MLRAs in the United States. It has a broad north-south and east-west extent and covers a wide range of elevations. The MLRA is partitioned by the mesic-thermic line, which divides the MLRA into mesic and thermic soil temperature regimes (figure 2.). The mesic soil temperature regime was delineated based on estimates of the native range of loblolly pine, which was historically absent in this part of the MLRA. In addition, this region is said to represent the northern and western limits of cotton production, an important crop to the south and east. ESDs developed for this MLRA were split geographically into mesic and thermic ecological site concepts. Climate variation across the MLRA extent warrants the development of Land Resource Unit (LRU) classifications, to further subdivide the MLRA and support more precise Ecological Site Descriptions.

Classification relationships

APPLICABLE USNVC ASSOCIATIONS CEGL004539 Fagus grandifolia - Quercus alba / Kalmia latifolia - (Rhododendron catawbiense) / Galax urceolata APPLICABLE EPA ECOREGIONS Level III: 45. Piedmont Level IV: 45f. Northern Outer Piedmont; 45b. Southern Outer Piedmont (EPA 2013). APPLICABLE USFS ECOLOGICAL UNITS Domain: Humid Temperate Division: Subtropical Ecological province: 231. Southeastern Mixed Forest Ecological sections: 231I.Central Appalachian Piedmont; 231A. Southern Appalachian Piedmont (Cleland et al. 2007). Based on the USGS physiographic classification system (Fenneman and Johnson 1946), most of MLRA 136 is in the Piedmont Upland section of the Piedmont province, in the Appalachian Highlands division.

Ecological site concept

This ecological site includes steep hillslopes, along streams, carved from the lower Piedmont plateau. It is geographically restricted to the thermic soil temperature regime portion of the MLRA. Species composition and vegetation structure vary with aspect and the degree of exposure to the elements, among other factors. North-facing aspects and sheltered ravines experience a combination of dry edaphic conditions caused by thin, rocky soils, along with unusually cool, shady environmental conditions. South and west-facing aspects are generally drier. Soil moisture status is often heterogeneous, including dry microsites intermingled with moister slopes and seasonal seepage areas. Unlike PX136X00X870, a similar and sometimes associated ecological site, this ecological site often supports disjunct populations of montane species. These species are unusual in the lower Piedmont and are rarely seen this far outside of their primary range. Soils on this ecological site are typically shallow to moderately deep, rocky, well drained to somewhat excessively drained Inceptisols. Unweathered or partially weathered bedrock is typically found within 40 inches of the surface. In places, outcrops of rock are exposed at the surface. Parent materials are residuum derived from acidic igneous or metamorphic rock such as gneiss, granite or schist. The reference state typically supports a somewhat open to sparse tree canopy. In representative examples, the canopy is dominated by American beech (Fagus grandifolia), with an ericaceous shrub layer dominated by mountain laurel (Kalmia latifolia). Most of the acreage is forested, with the dominant land use being wildlife habitat. Soils are not well- suited to most building applications because they are susceptible to landslides, water erosion, and soil creep. ES CHARACTERISTICS SUMMARY • Thermic soil temperature regime • Occurs on Piedmont uplands, on steep hillslopes adjacent to streams, in the lower Piedmont plateau • Base saturation: 35 percent in the subsoil • Seasonal high water table: usually absent within 72 inches of the soil surface, though seasonal seepage can occur on some parts of the landscape • Depth to bedrock is 40 inches, AND the available water storage capacity of the profile (from the soil surface to 80 inches, or to paralithic or lithic bedrock, whichever is shallower) is less than 4 inches • Slope: > 28%, usually higher • Soils: shallow to moderately deep, rocky, well drained to somewhat excessively drained Inceptisols

Associated sites

F136XY820GA	**Acidic Upland Forest, Moist** Found on interfluves and broad ridges, which sit above this ecological site, generally in higher and more stable landscape positions. Soils are deeper to bedrock (? 40 inches from the soil surface), supporting the typical matrix forest type of the region, dominated by white oak (Quercus alba) and northern red oak (Quercus rubra).
F136XY620GA	**Flood Plain Forest, Moist** Found in lower landscape positions beneath this ecological site, on nearly level flood plains on the valley floors. Flooding is the primary driver of ecological dynamics, supporting higher cover from riparian species which invest in rapid growth and early reproduction (e.g., American sycamore (Platanus occidentalis), sugarberry (Celtis laevigata), etc.). The depth to the seasonal high water table is usually shallower (? 24 inches from the soil surface).
F136XY870GA	**Lower Piedmont Acidic Upland Woodland, Depth Restriction, Dry** Where associated, in the vicinity of streams, it is typically found in higher landscape positions, in shoulder positions or on narrow summits that sit above the steep water-cut slopes of this ecological site. Though the depth to bedrock is similar, the microclimate is generally warmer, drier, and more exposed. Moisture-loving plant species, such as American beech (Fagus grandifolia) are usually absent in the canopy. Aspect does not usually have a strong influence over variability in species composition.

Similar sites

F136XY870GA	**Lower Piedmont Acidic Upland Woodland, Depth Restriction, Dry** Typically found on less steeply sloping hillslopes and narrow ridges of the lower Piedmont plateau. Though the depth to bedrock is similar, the microclimate is generally warmer, drier, and more exposed. Moisture-loving plant species, such as American beech (Fagus grandifolia) are usually absent in the canopy. Aspect does not usually have a strong influence over variability in species composition.
F136XY880GA	**Acidic High Hills and Isolated Ridges, Depth Restriction, Dry** Found on high hills and prominent ridges in highly dissected and higher elevation parts of the MLRA. Though the depth to bedrock is similar, it is generally more exposed to the elements, including sun, wind, and fire. Moisture-loving plant species, such as American beech (Fagus grandifolia) are usually absent in the canopy. Much like this ecological site, aspect has a strong influence over variability in species composition.

Figure 1. EPA level IV ecoregions of the Southern Piedmont (45).

Figure 2. Spatial illustration of soil temperature regimes of the Southern Piedmont.

Figure 3. Spatial extent of this ecological site representing the major areas where this site is important on the landscape.

Table 4. Dominant plant species

Tree	(1) *Fagus grandifolia* (2) *Quercus alba*
Shrub	(1) *Kalmia latifolia* (2) *Rhododendron*
Herbaceous	(1) *Galax urceolata* (2) *Epigaea repens*

Physiographic features

This ecological site includes steep hillslopes, along streams, carved from the lower Piedmont plateau (EPA ecoregions 45f and 45b). They are known informally as river bluffs. Similar environments are found further inland, but in the lower Piedmont, such steeply sloping hillslopes are somewhat conspicuous, as they are found amidst an otherwise gentle landscape with few areas of high topographic relief. Representative locations are steeply sloping, with a representative slope of 28 to 55 percent and a maximum slope of 65 percent. The geologic substrate is typically low in ferromagnesian minerals and high in silica. Parent materials consist of acidic igneous and metamorphic rock, such as gneiss, granite, or schist.

River bluffs form in response to the undercutting of a river or stream. On this ecological site, they are most common along the fall zone, at the interface between the Piedmont and Coastal Plain provinces. At the fall zone, the energy of a river or stream carves a deeper channel in the unconsolidated Coastal Plain sediments than in the Piedmont bedrock. The steeper gradients that develop in this zone generate the strong stream-cutting action responsible for sculpting bluffs. A similar phenomenon is responsible for creating steep escarpments along streams in the zone of transition between the metasedimentary rocks of the Carolina Slate Belt and the softer Triassic sedimentary rocks of Triassic basins.

Note: at this time, stream bluffs associated with the Carolina Slate Belt (EPA ecoregion 45c), the upper Piedmont (ecoregion 45a), and Kings Mountain (45i) are not included in this ecological site concept due to limitations in soil mapping. Soil mapping does not allow these surfaces to be separated from other steep slopes in these regions. In the upper Piedmont, Carolina Slate Belt, and over the Kings Mountain range, steep slopes carved by rivers and streams are included in PX136X00X880, to which this ecological site is similar.

Figure 1. Typical soil-landscape relationships of the Southern Piedmont Felsic Crystalline Soil System of the lower Piedmont. Wateree soils are associated with this ecological site, depicted here on a steep hillslope along a stream.

Table 5. Representative physiographic features

Hillslope profile	(1) Backslope
Landforms	(1) Piedmont > Hillslope
Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None

Elevation	40 – 100 m
Slope	30 – 60 %
Water table depth	180 – 2,540 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Table 6. Representative physiographic features (actual ranges)

Runoff class	Medium to very high
Flooding frequency	None
Ponding frequency	None
Elevation	40 – 230 m
Slope	30 – 70 %
Water table depth	180 – 2,540 cm

Climatic features

On this ecological site, the average mean annual precipitation is 46 inches. On average, the rainiest months occur from July through August, as well as in March. The driest months occur from April through May, with another dry period occurring during the months of October through December.

Table 7 Representative climatic features

Frost-free period (characteristic range)	160-190 days
Freeze-free period (characteristic range)	180-220 days
Precipitation total (characteristic range)	1,140-1,190 mm
Frost-free period (actual range)	140-200 days
Freeze-free period (actual range)	170-240 days
Precipitation total (actual range)	1,090-1,270 mm

Frost-free period (average)	170 days
Freeze-free period (average)	200 days
Precipitation total (average)	1,170 mm

- (1) LAWRENCEVILLE 3 E [USC00444768], Freeman, VA
- (2) CAMP PICKETT [USC00441322], Blackstone, VA
- (3) AMELIA 8 NE [USC00440188], Amelia Court House, VA
- (4) ARCOLA [USC00310241], Macon, NC
- (5) LOUISBURG [USC00315123], Louisburg, NC
- (6) CLAYTON WTP [USC00311820], Clayton, NC
- (7) SANFORD 8 NE [USC00317656], Sanford, NC
- (8) CLARKS HILL 1 W [USC00381726], Modoc, SC
- (9) MILLEDGEVILLE [USC00095874], Milledgeville, GA
- (10) TALBOTTON [USC00098535], Talbotton, GA
- (11) MULBERRY GROVE [USC00096148], Smiths Station, GA
- (12) CLARKSVILLE [USC00441746], Clarksville, VA
- (13) JOHN H KERR DAM [USC00444414], Boydton, VA
- (14) AMELIA COURTHOUSE 1 [USC00440187], Amelia Court House, VA

Influencing water features

Though landforms associated with this ecological site were formed with the help of the cutting action of a of a river or stream, the vegetation on this ecological site is not directly influenced by surface water features. Rivers and streams are typically adjacent however, and are thought to contribute to the cooling effect observed in these microenvironments. Rivers also provide a fire barrier on the downslope side of this ecological site.

While the seasonal high water table is generally deep (6 feet or greater), groundwater seepage areas are often interspersed along the bluff face. These pockets of seepage are usually small and seasonal in nature.

Soil features

Soils on this ecological site are typically shallow to moderately deep, well drained to somewhat excessively drained Inceptisols. The depth to unweathered or partially weathered bedrock is less than 40 inches, with representative examples being much shallower. Areas of exposed rock are often present at the surface, along with pockets of deeper soils. Parent materials are residuum derived from acidic igneous and metamorphic rock, such as gneiss, granite, or schist.

Reaction is typically strongly acid to very strongly acid throughout (pH 4.5 to 5.5). Base saturation is less than 35 percent in the subsoil. The available water storage capacity of the profile is generally less than 4 inches. Representative particle size families include coarse-loamy and loamy families.

Soils on this ecological site have a thermic soil temperature regime, which is characterized by a mean annual soil temperature of 15°C to 22°C and a winter to summer temperature differential of 6°C or more in the subsoil.

Modal soil taxa include: Typic Dystrudepts
Modal soil series include: Ashlar, Wateree
Other soils attributed to this ecological site include Louisa, Louisburg, and Wake

Figure 8. An illustration of a soil profiles belonging to the Ashlar and Wateree series, representative soil series associated with this ecological site, differentiated by the depth to hard bedrock.

Table 8. Representative soil features

Parent material	(1) Residuum – granite (2) Residuum – gneiss (3) Residuum – schist
Surface texture	(1) Sandy loam (2) Stony sandy loam (3) Gravelly sandy loam (4) Fine sandy loam (5) Loamy coarse sand (6) Gravelly loamy coarse sand (7) Channery silt loam
Family particle size	(1) Coarse-loamy (2) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Rapid
Depth to restrictive layer	30 – 80 cm
Soil depth	30 – 80 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-203.2cm)	5.08 – 7.62 cm
Soil reaction (1:1 water) (0-101.6cm)	4.5 – 5.5
Subsurface fragment volume <=3" (0-203.2cm)	0 – 20 %

Subsurface fragment volume >3" (0-203.2cm)	0 – 10 %

Table 9. Representative soil features (actual values)

Drainage class	Well drained to excessively drained
Permeability class	Rapid
Depth to restrictive layer	20 – 100 cm
Soil depth	20 – 100 cm
Surface fragment cover <=3"	0 %
Surface fragment cover >3"	0 %
Available water capacity (0-203.2cm)	2.54 – 10.16 cm
Soil reaction (1:1 water) (0-101.6cm)	3.5 – 10
Subsurface fragment volume <=3" (0-203.2cm)	0 – 20 %
Subsurface fragment volume >3" (0-203.2cm)	0 – 10 %

Ecological dynamics

U.S. National Vegetation Classification (USNVC) associations that are consistent with reference conditions on this ecological site include CEGL004539 Fagus grandifolia - Quercus alba / Kalmia latifolia - (Rhododendron catawbiense) / Galax urceolata. This concept is typical of north-facing stream bluffs of the lower Piedmont and is closely related to the reference community. However, it is likely narrower than the scope of this ecological site, which includes north-facing exposures, as well as other aspects (USNVC 2022).

MATURE FORESTS
The reference state typically supports a somewhat open to sparse tree canopy with a closed and often dense, ericaceous shrub layer. This ecological site exhibits a high level of variability with respect to species composition and vegetation structure, depending primarily on aspect and the degree of exposure to the elements, among other factors. North-facing aspects and sheltered ravines experience a combination of dry edaphic conditions caused by thin, rocky soils, along with unusually cool, shady environmental conditions. South and west-facing aspects are generally drier. Soil moisture status is often heterogeneous, including dry microsites intermingled with moister slopes and seasonal seepage areas. Common names for plant communities in this vegetation complex include heath bluffs, beach-heath

bluffs, rhododendron bluffs, mountain laurel bluffs, and pine-oak-heath bluffs. All variations are included in the scope of this ecological site.

The canopy is typically dominated by American beech (Fagus grandifolia), but white oak (Quercus alba), northern red oak (Quercus rubra), chestnut oak (Quercus montana), or southern red oak (Quercus falcata) may be codominant or even dominant. Proportions of these species vary depending on local environmental conditions. On south-facing, west-facing, or otherwise exposed sites, pines typically become more important, and American beech and northern red oak become less important. Virginia pine (Pinus virginiana) and shortleaf pine (Pinus echinata) are most characteristic of the pine component.

The shrub layer is usually strongly dominated by members of the heath family. On north-facing or otherwise sheltered sites, mountain laurel (Kalmia latifolia) is most characteristic, though pink azalea (Rhododendron periclymenoides) or other members of the Rhododendron genus are also common. Other important shrub species here include American witchhazel (Hamamelis virginiana) and common sweetleaf (Symplocos tinctoria). On these exposures, shrub cover is usually high and the herb layer is sparse.

On south or west-facing slopes the shrub layer is usually sparser and the flora typically has a drier character. Here, common species include deerberry (Vaccinium stamineum), small black blueberry (Vaccinium tenellum), sparkleberry (Vaccinium arboreum), St. Andrew's cross (Hypericum hypericoides ssp. multicaule), and Adam's needle (Yucca filamentosa).

The herb layer is occupied by acid-tolerant and drought-tolerant species, including many ericaceous subshrubs, such as trailing arbutus (Epigaea repens), striped prince's pine (Chimaphila maculata), and eastern teaberry (Gaultheria procumbens). Common forbs include beetleweed (Galax urceolata) and little heartleaf (Hexastylis minor). Various wildflowers and ferns are commonly found clinging to the rocky slope. Species more characteristic of flood plains often creep into adjacent slopes above the stream.

On the driest and most exposed sites, the canopy is thin and light-requiring drought-tolerant herbs become more numerous, including rattlesnakeweed (Hieracium venosum), woman's tobacco (Antennaria plantaginifolia), common dittany (Cunila origanoides), eastern prickly pear (Opuntia humifusa), poverty oatgrass (Danthonia spicata), little bluestem (Schizachyrium scoparium), and blackseed speargrass (Piptochaetium avenaceum), among others. Various lichens and bryophytes cover the surfaces of exposed rocks.

One of the most interesting features of this ecological site is it's potential to support disjunct populations of montane plant and animal species. These Pleistocene relicts were once common throughout the Southern Piedmont, more than 10,000 years ago during the last ice age. As the climate warmed, species requiring a cool climate retreated entirely from most of the lower Piedmont. Disjunct populations are still found in specialized environments with a cooler microclimate.

Ravines and north-facing river and stream bluffs of the lower piedmont support disjunct populations of Catawba rosebay (Rhododendron catawbiense), great laurel (Rhododendron maximum), eastern hemlock (Tsuga canadensis), and eastern white pine (Pinus strobus). Other noteworthy montane species include mountain witchalder (Fothergilla major), alternateleaf dogwood (Cornus alternifolia), Bowman's root (Gillenia trifoliata), dutchman's breeches (Dicentra cucullaria), Catesby's trillium (Trillium catesbaei), and mountain spleenwort (Asplenium montanum).These forests also support surviving sprouts of the American chestnut (Castanea dentata) which was generally uncommon in this part of the Southern Piedmont. The most well known disjunct animal species on this ecological site is the red-backed salamander (Plethodon cinereus).

Forests on river and stream bluffs are generally less disturbed than most of the natural vegetation of the Piedmont. While most sites have been logged, and some grazed by domesticated livestock in the past, most escaped being farmed. Selective timber harvesting has generally resulted in a decrease in oaks, while low-value hardwoods such as American beech (F. grandifolia) have increased in number.

DYNAMICS OF NATURAL SUCCESSION AND FIRE ECOLOGY
Successional dynamics on this ecological site are not well-documented. Tree replacement likely takes place in canopy gaps caused by windthrow, disease, and the like, as opposed to fire. Due to a sheltering effect produced by a steep slope on one side and a body of water on the other, stream bluffs are thought to be well-insulated from fire. Because fires generally move from lower to higher ground, the position of the river beneath the slope acts as a barrier to fire. Fires of any consequence likely occurred infrequently, playing only a minor role in the historical ecology (Oosting 1942; Hardin and Cooper 1967; Wharton 1978; Peet and Christensen 1980; Nelson 1986; Schafale and Weakley 1990; LeGrand 2001; Spira 2011; Schafale 2012a, 2012b; Edwards et al. 2013; Fleming et al. 2021).

SPECIES LIST
Canopy layer: Fagus grandifolia, Quercus alba, Quercus rubra, Quercus montana, Quercus falcata, Pinus virginiana, Pinus echinata, Quercus coccinea, Quercus velutina, Quercus nigra, Quercus stellata, Pinus taeda, Pinus strobus

Subcanopy layer: Oxydendrum arboreum, Sassafras albidum, Cornus florida, Amelanchier arborea, Nyssa sylvatica, Carpinus caroliniana, Acer rubrum, Diospyros virginiana, Ostrya virginiana, Chionanthus virginicus, Ilex opaca, Juniperus virginiana, Prunus serotina, Carya tomentosa, Carya pallida, Carya glabra, Ulmus alata, Stewartia ovata, Tsuga canadensis,

Vines/lianas: Vitis rotundifolia, Gelsemium sempervirens, Smilax glauca, Parthenocissus quinquefolia, Lonicera sempervirens, Bignonia capreolata, Vitis aestivalis, Lonicera japonica (I)

Shrub layer: Kalmia latifolia, Rhododendron periclymenoides, Hamamelis virginiana, Symplocos tinctoria, Vaccinium stamineum, Vaccinium tenellum, Vaccinium arboreum, Vaccinium pallidum, Rhododendron canescens, Rhododendron minus, Viburnum acerifolium, Ilex opaca, Euonymus americanus, Hypericum hypericoides ssp. multicaule, Yucca filamentosa, Gaylussacia baccata, Styrax grandifolius, Hydrangea arborescens, Rhododendron catawbiense, Rhododendron maximum, Rhododendron flammeum, Fothergilla major, Castanea dentata (stump sprouts)

Herb layer - forbs: Galax urceolata, Epigaea repens, Chimaphila maculata, Hexastylis minor, Polystichum acrostichoides, Asplenium platyneuron, Polygonatum biflorum, Pleopeltis polypodioides, Polypodium virginianum, Cheilanthes lanosa, Tiarella cordifolia, Hieracium venosum, Houstonia caerulea, Uvularia puberula, Hexastylis virginica, Maianthemum racemosum ssp. racemosum, Trillium catesbaei, Dioscorea quaternata, Mitchella repens, Chamaelirium luteum, Gaultheria procumbens, Desmodium laevigatum, Desmodium spp., Lespedeza spp., Clitoria mariana, Tephrosia virginiana, Stylosanthes biflora, Hypoxis hirsuta, Uvularia perfoliata, Monotropa hypopithys, Epifagus virginiana, Aureolaria virginica, Cheilanthes tomentosa, Sericoocarpus asteroides, Solidago arguta, Solidago caesia, Solidago bicolor, Goodyera pubescens, Symphyotrichum patens, Woodsia obtusa, Asplenium montanum, Dryopteris marginalis, Elephantopus carolinianus, Potentilla canadensis, Antennaria plantaginifolia, Opuntia humifusa, Hypericum gentianoides, Selaginella rupestris, Sedum ternatum, Phemeranthus teretifolius, Silene caroliniana, Cunila origanoides, Euphorbia corollata, Iris cristata, Iris verna, Saxifraga virginiensis, Cardamine angustata, Arabis laevigata, Eurybia divaricata, Stellaria pubera, Comptonia peregrina, Hepatica nobilis var. obtusa, Hepatica nobilis var. acuta, Houstonia purpurea, Dicentra cucullaria, Conopholis americana, Waldsteinia fragarioides

Herb layer - graminoids: Danthonia spicata, Dichanthelium dichotomum, Dichanthelium commutatum, Danthonia sericea, Luzula acuminata, Poa autumnalis, Luzula echinata, Danthonia sericea, Carex striatula, Schizachyrium scoparium, Piptochaetium avenaceum, Carex pensylvanica

(I) = introduced

State and transition model

Additional community tables

Table 10. Community 2.1 plant community composition

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

Table 11. Community 2.2 plant community composition

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

Table 12. Community 2.3 plant community composition

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

Inventory data references

Data collection and analysis of field data will be performed during the Verification Stage of ESD development.

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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	08/19/2026
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:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**
