Ecological site F136XY330VA
Mesic Temperature Regime, Acidic Upland Forest, Depth Restriction, Dry-moist

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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 CEGL007927 Quercus falcata - Quercus alba - Carya tomentosa / Oxydendrum arboreum APPLICABLE EPA ECOREGIONS Level III: 45. Piedmont Level IV: 45e. Northern Inner Piedmont (EPA 2013). APPLICABLE USFS ECOLOGICAL UNITS Domain: Humid Temperate Division: Subtropical Ecological province: 231. Southeastern Mixed Forest Ecological sections: 231I.Central 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 dry-moist acidic uplands on narrow ridges and side slopes, on rolling to moderately dissected topography of the upper Piedmont of Virginia and North Carolina. It is geographically restricted to the mesic soil temperature regime portion of the Southern Piedmont, in the northwestern-most part of the MLRA. Soils on this ecological site are typically moderately deep, well drained

Ultisols. Unweathered or partially weathered bedrock is typically found within 40 inches of the surface. Parent materials are typically residuum derived from acidic igneous or metamorphic rock. Base saturation is less than 35 percent in the subsoil. The reference state supports a closed to partly open canopy acidic oak-hickory forest with a greater proportion of dry-site oaks than is typical of moister oak-hickory forest types. Important canopy species include southern red oak (Quercus falcata), white oak (Quercus alba), black oak (Quercus velutina), post oak (Quercus stellata), and several species of hickory (Carya spp.). Dominant land uses include pasture and hayland, planted pine, cropland, and various urban or suburban uses. ES CHARACTERISTICS SUMMARY • Mesic soil temperature regime • Occurs on Piedmont uplands, on narrow ridges, shoulders and backslopes, on typical rolling to moderately dissected Piedmont landscapes • Base saturation: 35 percent in the subsoil • Seasonal high water table: usually absent within 72 inches of the soil surface • Depth to bedrock: 40 inches • 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 within 4 to 6 inches • Soils: moderately deep, well drained Ultisols

Associated sites

F136XY320VA	**Mesic Temperature Regime, Acidic Upland Forest, Moist** Found in similar landscape positions, but on the more stable parts of the landscape (e.g., broader ridges, interfluves, gentler hillslopes), where the potential for soil weathering greatly exceeds the potential for geologic erosion. Soils are deeper to bedrock (? 40 inches from the soil surface) and less droughty. Moisture-loving plant species generally increase in abundance, of which northern red oak (Quercus rubra) is most notable.
F136XY370VA	**Mesic Temperature Regime, Acidic Upland Woodland, Depth Restriction, Dry** Found in similar landscape positions, but on the less stable parts of the landscape (e.g., steeper slopes, narrower ridges), where the potential for soil weathering is outpaced by the potential for geologic erosion. Soils are generally shallower, less developed, more droughty, and with lower natural fertility. Dry-site species, such as post oak (Quercus stellata) and black oak (Quercus velutina), generally increase in abundance, while hickory species become less numerous.
F136XY810SC	**Acidic Upland Forest, Seasonally Wet** Usually found in lower landscape positions. The seasonal high water table is shallower (12-40 inches from the soil surface) and soils are generally deeper (? 40 inches). Species tolerant of short-lived anaerobic conditions usually occupy some portion of the canopy, such as willow oak (Quercus phellos). Dry-site species are less abundant in the canopy.

Similar sites

F136XY830NC	**Acidic Upland Forest, Depth Restriction, Dry-moist** The soil temperature regime is thermic, occurring within the native range of loblolly pine (Pinus taeda).
F136XY320VA	**Mesic Temperature Regime, Acidic Upland Forest, Moist** Soils are deeper (? 40 inches from the soil surface) and less droughty, supporting higher cover from moisture-loving plant species.

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) *Quercus falcata* (2) *Quercus alba*
Shrub	(1) *Vaccinium*
Herbaceous	(1) *Danthonia spicata* (2) *Chimaphila maculata*

Physiographic features

This ecological site includes dry-moist acidic uplands on narrow ridges and side slopes, on rolling to moderately dissected topography of the upper Piedmont of Virginia and North Carolina, in EPA ecoregion 45e (Northern Inner Piedmont). This ecoregion roughly coincides with the mesic soil temperature regime portion of the Southern Piedmont, the northwestern-most part of the MLRA.

The geologic substrate is typically low in ferromagnesian minerals and high in silica. Soils typically formed in residuum derived felsic crystalline or fine-grained metasedimentary rock, including schist, phyllite, granite, and gneiss. Also included in this ecological site concept are soils weathered from mafic or mixed-mafic rocks which have been deeply weathered over geologic time and leached extensively of base cations. Representative locations are gently sloping to steep, with a representative slope of 15 to 30 percent and a maximum slope of 60 percent.

Figure 1. Typical soil-landscape relationships of the Southern Piedmont Felsic Crystalline Soil System. Woolwine soils are associated with this ecological site, depicted here on hillslopes.

Table 5. Representative physiographic features

Hillslope profile	(1) Backslope (2) Shoulder (3) Summit
Landforms	(1) Piedmont > Hillslope (2) Piedmont > Ridge
Runoff class	Medium to high
Flooding frequency	None
Ponding frequency	None
Elevation	240 – 370 m
Slope	20 – 30 %
Water table depth	180 – 2,540 cm

Aspect	Aspect is not a significant factor

Table 6. Representative physiographic features (actual ranges)

Runoff class	Medium to very high
Flooding frequency	None
Ponding frequency	None
Elevation	100 – 480 m
Slope	10 – 60 %
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 May through September, as well as in March. The driest months occur from October through February.

Table 7 Representative climatic features

Frost-free period (characteristic range)	150-170 days
Freeze-free period (characteristic range)	180-210 days
Precipitation total (characteristic range)	1,120-1,190 mm
Frost-free period (actual range)	140-180 days
Freeze-free period (actual range)	170-220 days
Precipitation total (actual range)	1,070-1,270 mm
Frost-free period (average)	160 days
Freeze-free period (average)	190 days
Precipitation total (average)	1,170 mm

- (1) LOUISA [USC00445050], Louisa, VA
- (2) PALMYRA 3S [USC00446491], Palmyra, VA
- (3) BREMO BLUFF [USC00440993], New Canton, VA
- (4) APPOMATTOX [USC00440243], Appomattox, VA
- (5) TYE RIVER 1 SE [USC00448600], Amherst, VA
- (6) LYNCHBURG RGNL AP [USW00013733], Lynchburg, VA
- (7) LYNCHBURG #2 [USC00445117], Lynchburg, VA
- (8) BEDFORD [USC00440551], Bedford, VA
- (9) ROCKY MT [USC00447338], Rocky Mount, VA
- (10) PHILPOTT DAM 2 [USC00446692], Henry, VA
- (11) MARTINSVILLE FLTR PLT [USC00445300], Martinsville, VA
- (12) DANVILLE [USC00442245], Danville, VA
- (13) DANVILLE RGNL AP [USW00013728], Danville, VA
- (14) STUART [USC00448170], Stuart, VA
- (15) REIDSVILLE 2 NW [USC00317202], Reidsville, NC
- (16) DANBURY [USC00312238], Danbury, NC
- (17) MT AIRY 2 W [USC00315890], Mount Airy, NC
- (18) NORTH WILKESBORO [USC00316256], Wilkesboro, NC
- (19) YADKINVILLE 6 E [USC00319675], East Bend, NC
- (20) WINSTON SALEM RYNLDS AP [USW00093807], Winston Salem, NC
- (21) HICKORY FAA AP [USW00003810], Hickory, NC
- (22) STATESVILLE 2 NNE [USC00318292], Statesville, NC
- (23) MORGANTON [USC00315838], Morganton, NC
- (24) W KERR SCOTT RSVR [USC00319555], Wilkesboro, NC
- (25) RURAL HALL [USC00317548], Rural Hall, NC
- (26) TAYLORSVILLE [USC00318519], Taylorsville, NC
- (27) LENOIR [USC00314938], Lenoir, NC
- (28) PIEDMONT TRIAD INTL AP [USW00013723], Greensboro, NC
- (29) HIGH POINT [USC00314063], High Point, NC
- (30) SALISBURY [USC00317615], Salisbury, NC
- (31) SALISBURY 9 WNW [USC00317618], Salisbury, NC
- (32) MOCKSVILLE 5SE [USC00315743], Mocksville, NC
- (33) BROOKNEAL [USC00441082], Brookneal, VA
- (34) CHATHAM [USC00441614], Chatham, VA

Influencing water features

This ecological site is not influenced by surface or ground water features.

Soil features

Soils on this ecological site are typically well drained, moderately deep Ultisols. Unweathered or partially weathered bedrock is typically found within 40 inches of the surface. Soils often have a high content of rock fragments, leaving less volume for roots to extract water. The available water storage capacity of the profile typically falls between 4 and 6 inches. Parent materials are residuum derived from acidic igneous or metamorphic rock, including felsic crystalline and fine-grained metasedimentary rock.

Reaction in the subsoil is typically strongly acid to extremely acid (pH 3.5 to 5.5). In the surface layers, reaction varies with land use and management. Under low input or forested conditions, it generally falls somewhere between pH 4.5 and 6.0. Base saturation is less than 35 percent in the subsoil. These soils are typically in a fine or fine-loamy particle size family.

Soils on this ecological site have a mesic soil temperature regime, which is characterized by a mean annual soil temperature is 8°C to 15°C and a winter to summer temperature differential of 6°C or more in the subsoil.

Modal soil taxa include: Typic Kanhapludults, Typic Hapludults.
Modal soil series include: Woolwine, Spears Mountain
Other soils attributed to this ecological site include Westfield, Stott knob, Drapermill, and Goblintown.

Figure 8. An illustration of a soil profile belonging to the Woolwine series, a representative soil series associated with this ecological site.

Table 8. Representative soil features

Parent material	(1) Residuum – metasedimentary rock (2) Residuum – metavolcanics (3) Residuum – igneous and metamorphic rock
Surface texture	(1) Gravelly loam (2) Loam (3) Gravelly sandy clay loam (4) Gravelly sandy loam (5) Fine sandy loam
Family particle size	(1) Fine (2) Fine-loamy
Drainage class	Well drained
Permeability class	Moderate
Depth to restrictive layer	70 – 90 cm
Soil depth	70 – 90 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-203.2cm)	10.16 – 12.7 cm
Soil reaction (1:1 water) (0-25.4cm)	4.5 – 10
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
Permeability class	Moderate to moderately rapid
Depth to restrictive layer	50 – 100 cm
Soil depth	50 – 100 cm
Surface fragment cover <=3"	0 %
Surface fragment cover >3"	0 %
Available water capacity (0-203.2cm)	10.16 – 15.24 cm
Soil reaction (1:1 water) (0-25.4cm)	3.5 – 6.5
Subsurface fragment volume <=3" (0-203.2cm)	0 – 30 %
Subsurface fragment volume >3" (0-203.2cm)	0 – 20 %

Ecological dynamics

U.S. National Vegetation Classification (USNVC) associations that are consistent with reference conditions on this ecological site include CEGL007927 Quercus falcata - Quercus alba - Carya tomentosa / Oxydendrum arboreum. This concept is closely related to the reference community, but is likely broader than the scope of this ecological site which is limited in extent to the western Virginia and North Carolina piedmont (USNVC 2022).

MATURE FORESTS
The reference state supports a closed to partly open canopy oak-hickory forest with a greater proportion of dry-site oaks than is typical of moister oak-hickory forest types. Important canopy species include southern red oak (Quercus falcata), white oak (Quercus alba), black oak (Quercus velutina), and post oak (Quercus stellata). These are among the driest oak-hickory forests in the region. Mesophytic oaks less drought-tolerant than white oak (Q. alba) (e.g., northern red oak (Quercus rubra)), are generally absent or scarce. Hickory (Carya spp.), though consistently present, is typically a minor component of the canopy. Of the hickory species, mockernut hickory (Carya tomentosa) and pignut hickory (Carya glabra) are usually most abundant. Pines, including shortleaf pine (Pinus echinata), Virginia pine

(P. virginiana), and eastern white pine (Pinus strobus) are typically scattered throughout the forest.

The understory is dominated by acid-loving species. Typical of the subcanopy are sourwood (Oxydendrum arboreum), flowering dogwood (Cornus florida), blackgum (Nyssa sylvatica), sassafras (Sassafras albidum), red maple (Acer rubrum), and hickory (Carya spp.). The shrub layer is generally dominated by members of the heath family. Most characteristic are deerberry (Vaccinium stamineum) and Blue Ridge blueberry (Vaccinium pallidum). Basic indicator species are absent or scarce.

Unless fire has been reintroduced, the herb layer is typically sparse. Representative species include striped prince's pine (Chimaphila maculata), ebony spleenwort (Asplenium platyneuron), and rattlesnakeweed (Hieracium venosum). In fire maintained stands, grasses such as poverty oatgrass (Danthonia spicata), rosettegrasses (Dichanthelium spp.), and Indiangrass (Sorghastrum nutans) typically become more important in the herb layer. Representative forbs in fire-maintained stands include devil's grandmother (Elephantopus tomentosus), anisescented goldenrod (Solidago odora), gray goldenrod (Solidago nemoralis), woodland sunflower (Helianthus divaricatus), woman's tobacco (Antennaria plantaginifolia), hairy bedstraw (Galium pilosum), and several species of lespedeza (Lespedeza spp.) and ticktrefoil (Desmodium spp.).

DYNAMICS OF NATURAL SUCCESSION AND FIRE ECOLOGY
On Piedmont uplands, the historical influence of fire on successional dynamics was likely expressed on a continuum, from dry to moist, where moist or sheltered sites were shaped more by gap-driven dynamics and dry or exposed sites more by fire. On intermediate sites, such as those associated with this ecological site, their respective influence on successional dynamics probably fell somewhere in between. While the historic fire return interval is thought to be relatively similar across most of the Southern Piedmont uplands, drier sites were more prone to fire and hence burned more completely and at higher intensities than moister sites.

Like other oak-hickory forests in the region, small-scale natural disturbances such as windthrow, drought, and disease, are important drivers of natural succession in contemporary stands. Presumably these localized events made a rather large contribution to the disturbance regime in the past, though fire likely had shared influence in shaping the competitive environment for plants on this ecological site.

In the past, regular low-intensity fires would have kept the understory somewhat more open than at present and constrained the growth of fire-intolerant woody species. Periodic severe fires would have likely occurred during unusually dry and windy conditions, presumably resulting in catastrophic tree mortality and stand replacing changes. The reduction in the frequency of fires over the past century has allowed shade-tolerant, fire-sensitive trees such as red maple (Acer rubrum), American beech (Fagus grandifolia), and American holly (Ilex opaca) to become more abundant in many upland forests in the Southeast.

A combination of prescribed burns and selective removals can open up the understory and constrain the growth of fire-intolerant ruderal species, thereby restoring the health and vigor of forests that evolved under a more regular fire regime.

YOUNG SECONDARY FORESTS
On relatively undisturbed sites, stands are uneven-aged, with at least some old trees present. In areas that were cultivated in the recent past, even-aged pine stands dominate the landscape, being replaced by oaks and hickories only as the pines die.

In general, young secondary forests on this ecological site are dominated by Virginia pine (P. virginiana), along with opportunistic hardwoods such as sweetgum (Liquidambar styraciflua) and red maple (Acer rubrum). Oaks and hickories are usually confined to the understory of young secondary stands. Their growth is temporarily suppressed by the cover of faster growing tree species (Oosting 1942; Peet and Christensen 1980, 1987; Schafale and Weakley 1990; Cowell 1998; Spira 2011; Fleming 2012; Guyette et al. 2012; Schafale 2012a, 2012b; Vander Yacht et al. 2020; Fleming et al. 2021; Greenberg et al. 2021; Spooner et al. 2021).

SPECIES LIST
Canopy layer: Quercus falcata, Quercus alba, Quercus velutina, Quercus stellata, Carya tomentosa, Carya glabra, Pinus virginiana, Pinus echinata, Pinus strobus, Quercus coccinea, Quercus montana,

Subcanopy layer: Oxydendrum arboreum, Cornus florida, Nyssa sylvatica, Sassafras albidum, Acer rubrum, Carya spp., Fagus grandifolia,

Shrub layer: Vaccinium pallidum, Vaccinium stamineum, Gaylussacia baccata, Viburnum acerifolium, Hypericum hypericoides ssp. multicaule,

Vines/lianas: Smilax glauca, Vitis rotundifolia, Smilax bona-nox, Lonicera japonica (I),

Herb layer - forbs: Chimaphila maculata, Asplenium platyneuron, Hieracium venosum, Desmodium nudiflorum, Desmodium rotundifolium, Desmodium laevigatum, Tipularia discolor, Erythronium umbilicatum, Lespedeza virginica, Lespedeza hirta, Elephantopus tomentosus, Solidago odora, Solidago nemoralis, Helianthus divaricatus, Antennaria plantaginifolia, Galium pilosum, Hypoxis hirsuta, Epigaea repens, Hieracium gronovii, Uvularia puberula, Coreopsis major, Goodyera pubescens, Vernonia glauca, Cunila origanoides, Lespedeza cuneata (I),

Herb layer - graminoids: Danthonia spicata, Dichanthelium spp., Carex nigromarginata, Carex albicans, Andropogon ternarius, Sorghastrum nutans, Schizachyrium scoparium,

(I) = introduced

State and transition model

Additional community tables

Table 10. Community 1.1 plant community composition

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

Table 11. Community 1.2 plant community composition

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

Table 12. Community 2.1 plant community composition

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

Table 13. Community 2.2 plant community composition

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

Table 14. Community 2.3 plant community composition

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

Table 15. Community 6.1 plant community composition

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

Table 16. Community 6.2 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.

Other references

Cleland, D.T., J.A. Freeouf, J.E. Keys, G.J. Nowacki, C.A. Carpenter, W.H. McNab. 2007. Ecological Subregions: Sections and Subsections for the conterminous United States. General Technical Report WO-76D. U.S. Department of Agriculture, Forest Service. Washington, D.C.

Cowell, C.M. 1998. Historical Change in Vegetation and Disturbance on the Georgia Piedmont. The American Midland Naturalist. 140(1):78-89.

Daniels, R.B. 1987. Soil Erosion and Degradation in the Southern Piedmont of the USA. In: M.G. Wolman, F.G.A. Fournier (eds.) Land Transformation in Agriculture. John Wiley and Sons. New York, NY.

Dearman, T.L., L.A. James. 2019. Patterns of legacy sediment deposits in a small South Carolina Piedmont catchment, USA. Geomorphology. 343(15):1-14.

Environmental Protection Agency (EPA). 2013. Level III and IV ecoregions of the continental
United States. National Health and Environmental Effects Research Laboratory. Corvallis, Oregon. Map scale 1:3,000,000.

Felix III, A.C., T.L. Sharik, B.S. McGinnes, W.C. Johnson. 1983. Succession in loblolly pine plantations converted from second-growth forest in the Central Piedmont of Virginia.

Fenneman, N.M., Johnson D.W. 1946. Physiographic Divisions of the Conterminous U.S. U.S. Geological Survey. Washington, DC.

Fleming, G.P. 2012. The Nature of the Virginia Flora. P. 24-75. In A.S. Weakley, J.C. Ludwig, J.F. Townsend, B. Crowder (ed.) Flora of Virginia. Foundation of the Virginia Flora Project Inc., Richmond. Fort Worth: Botanical Research Institute of Texas Press.

Fleming, G. P., K. D. Patterson, and K. Taverna. 2021. The natural communities of Virginia: A classification of ecological community groups and community types. Third approximation. Version 3.3. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. [http://www.dcr.virginia.gov/natural-heritage/natural-communities/]

Greenberg, C.H., B.S. Collins, S. Goodrick, M.C. Stambaugh, G.R. Wein. 2021. Introduction to Fire Ecology Across USA Forested Ecosystems: Past, Present, and Future. P. 1-30. In C.H. Greenberg and B. Collins (ed.) Fire ecology and management: past, present, and future of US forested ecosystems, Volume 39. Springer International Publishing. Cham, Switzerland.

Griffith, G.E., J.M. Omernik, J.A. Comstock, M.P. Schafale, W.H. McNab, D.R. Lenat, T.F. MacPherson, J.B. Glover, V.B. Shelburne. 2002. Ecoregions of North Carolina and South Carolina. United States Geological Survey. Reston, Virginia.

Guyette, R.P., M.C. Stambaugh, D.C. Dey, R.M. Muzika. 2012. Predicting fire frequency with chemistry and climate. Ecosystems. 15:322-335.

Megalos, M. 2019. Thinning Pine Stands. Woodland Owners Notes. NC State Extension. https://content.ces.ncsu.edu/thinning-pine-stands (accessed 18 March 2023).

Miller, J.H., B.R. Zutter, S.M. Zedaker, M.B. Edwards, R.A. Newbold. 1995. Early plant succession in loblolly pine plantations as affected by vegetation management. Southern Journal of Applied Forestry. 19(3):109-126.

Miller, J.H., B.R. Zutter, R.A. Newbold, M.B. Edwards, S.M. Zedaker. 2003. Stand dynamics and plant associates of loblolly pine plantations to midrotation after early intensive vegetation management – a southeastern United States regional study. Southern Journal of Applied Forestry. 27(4):221-236.

Oosting, H.J. 1942. An ecological analysis of the plant communities of the Piedmont, North Carolina. The American Midland Naturalist. 28:1-126.

Peet, R. K., and N.L. Christensen. 1980. Hardwood forest vegetation of the North Carolina Piedmont. Veroffentlichungen des Geobotanischen Institutes der ETH, Stiftung Rubel 68:14-39.

Peet, R. K., and N.L. Christensen. 1987. Tree Death: Cause and Consequence. Bioscience. 37(8):586-595.

Schafale, M.P. 2012a. Classification of the natural communities of North Carolina, 4th Approximation. North Carolina Department of Environment, Health, and Natural Resources, Division of Parks and Recreation. Natural Heritage Program. Raleigh, NC.

Schafale, M.P. 2012b. Guide to the Natural Communities of North Carolina. 4th Approximation. North Carolina Department of Environment, Health, and Natural Resources, Division of Parks and Recreation. Natural Heritage Program. Raleigh, NC.

Schafale, M.P., A.S. Weakley. 1990. Classification of the natural communities of North Carolina. Third approximation. North Carolina Department of Environment, Health, and Natural Resources, Division of Parks and Recreation, Natural Heritage Program. Raleigh, NC.

Schomberg, H., G. Hoyt, B. Brock, G. Naderman. A. Meijer. 2020. Southern Piedmont Case Studies. In: J. Bergtold, M. Sailus (eds.) Conservation Tillage Systems in the Southeast. Sustainable Agriculture Research and Education (SARE) program.

Spira, T.P. 2011. Wildflowers & Plant Communities of the Southern Appalachian Mountains and Piedmont. A naturalist’s guide to the Carolinas, Virginia, Tennessee, and Georgia. The University of North Carolina Press. Chapel Hill, NC.

Spooner, J.K., R.K. Peet, M.P. Schafale, A.S. Weakley, T.R. Wentworth. 2021. The role of fire in the dynamics of Piedmont vegetation. p. 31-62. In C.H. Greenberg and B. Collins (ed.) Fire ecology and management: past, present, and future of US forested ecosystems, Volume 39. Springer International Publishing. Cham, Switzerland.

Trimble, S.W. 1974. Man-Induced Soil Erosion on the Southern Piedmont, 1700–1970. Soil Conservation Society of America. Ankeny, IA.

United States Department of Agriculture, Natural Resources Conservation Service. 2022. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture, Agriculture Handbook 296.

United States National Vegetation Classification (USNVC) Database Version 2.04. 2022. Federal Geographic Data Committee, Vegetation Subcommittee. Washington, DC. Available at https://usnvc.org.

Vander Yacht, A.L., Keyser, P.D., Barrioz, S.A. 2020. Litter to glitter: promoting herbaceous groundcover and diversity in mid-southern USA oak forests using canopy disturbance and fire. Fire Ecology. 16(17):1-19.

Van Lear, D.H, R.A. Harper, P.R. Kapeluck, and W.D. Carroll. 2004. History of Piedmont Forests: Implications for Current Pine Management. General Technical Report SRS–71. U.S. Department of Agriculture, Forest Service, Southern Research Station. Asheville, NC.

Weakley, A.S., and Southeastern Flora Team. 2023. Flora of the southeastern United States. University of North Carolina Herbarium, North Carolina Botanical Garden, Chapel Hill, NC.

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Approval

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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	08/20/2026
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:**

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6. **Extent of wind scoured, blowouts and/or depositional areas:**

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7. **Amount of litter movement (describe size and distance expected to travel):**

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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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:

17. **Perennial plant reproductive capability:**