Ecological site PX136X00X140
Mesic Temperature Regime, Low Terraces and Drains, Occasional Inundation

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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
CEGL006498 *Quercus phellos* - Quercus (palustris, lyrata) / *Ilex decidua* / *Carex typhina*

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 wet areas on low stream terraces, or along drainageways, which sit slightly above the active flood plain and which are not subject to regular overbank flooding. It is situated in river valleys, or along the lower segments of drainageways leading down to river valleys, in the mesic soil temperature regime portion of the MLRA.

Because this ecological site typically sits at an intermediate elevation above the river, the frequency of flooding is typically lower than those ecological sites found on active flood plains. Flooding occurs mainly after periods of unusually wet weather, as floodwaters decant into depressions or remnant backswamps on low terraces of large river systems. Still, flooding frequency is usually higher than on PX136X00X160, an associated ecological site that often sits on the higher-lying stream terraces nearby. When overbank flooding does occur, it typically slows by the time it reaches this ecological site, so that scouring and movement of debris are relatively minor, but periodic deposition of sediment-bound nutrients is important for fertility. Though flooding is important to consider for planning purposes, it is not the primary driver of pedogenesis or ecological dynamics.

Soils on this ecological site are typically very deep, poorly drained Ultisols or Alfisols. They are generally better developed than those of adjacent flood plains, as the flooding frequency is not great enough to interfere with soil formation to any major extent. Being situated on more stable surfaces, soils on this ecological site usually have an argillic horizon in subsurface layers. Parent materials are typically fine-textured old alluvial sediments.

The reference state supports a closed canopy forest dominated by bottomland oaks, including willow oak (*Quercus phellos*), overcup oak (*Quercus lyrata*), and swamp chestnut oak (*Quercus michauxii*), along with other species typical of alluvial settings. Dominant land uses include wildlife habitat and wetland mitigation.

ES CHARACTERISTICS SUMMARY
• Mesic soil temperature regime
• Occurs on low stream terraces (flood-plain steps) in river valleys, or along the lower segments of drainageways leading down to river valleys
• Seasonal high water table: 0 - 12 inches from the soil surface
• Soils: very deep, poorly drained Ultisols or Alfisols

Associated sites

PX136X00X150	**Mesic Temperature Regime, Low Terraces and Drains, Rare Inundation** Found in similar or slightly higher landscape positions. The seasonal high water is deeper (12-18 inches from the soil surface), resulting in a decrease in obligate or facultative wetland indicator species
PX136X00X160	**Mesic Temperature Regime, High Terraces, Very Rare Inundation** Found in in higher landscape positions where flooding is rarer. The seasonal high water table is much deeper (> 18 inches from the soil surface), resulting in a substantial decrease in obligate or facultative wetland indicator species and a notable increase in species diversity (including a significant contribution from species which are usually more prevalent in upland landscapes).

Similar sites

PX136X00X100	**Mesic Temperature Regime, Flood Plain Forest, Very Wet** On backswamps, sloughs, and depressions on active flood plains. Flooding is more frequent and of longer duration, leading to higher flooding-related tree mortality and an increase in riparian species which invest in rapid growth and early reproduction (e.g., red maple (Acer rubrum), green ash (Fraxinus pennsylvanica), etc.). Soil pH and natural fertility are usually higher on these younger surfaces.
PX136X00X640	**Low Terraces and Drains, Occasional Inundation** The soil temperature regime is thermic, occurring within the native range of loblolly pine (Pinus taeda).

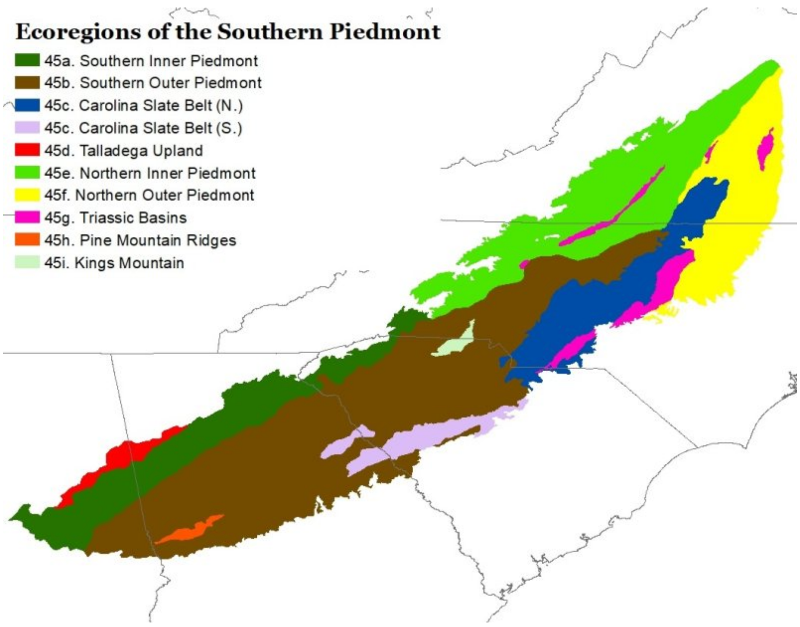


Figure 1. EPA level IV ecoregions of the Southern Piedmont (45).

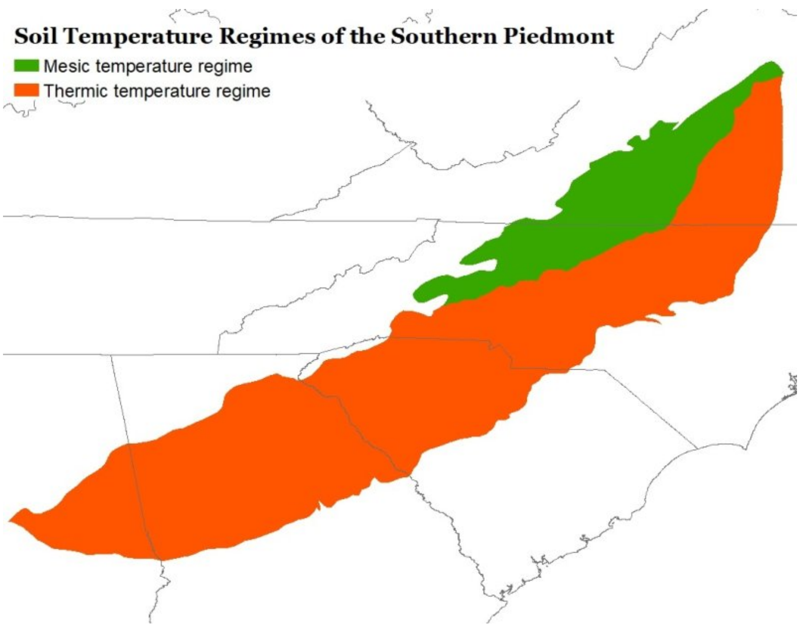


Figure 2. Spatial illustration of soil temperature regimes of the Southern Piedmont.

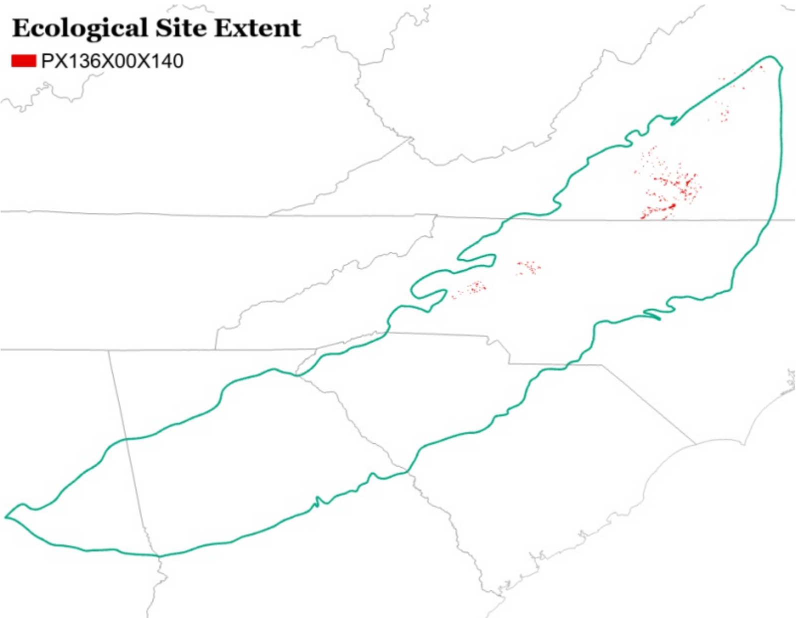


Figure 3. Spatial extent of this ecological site representing the major areas where this site is important on the landscape.

Table 1. Dominant plant species

Tree	(1) *Quercus phellos* (2) *Quercus lyrata*
Shrub	(1) *Ilex decidua* (2) *Lindera benzoin*
Herbaceous	(1) *Carex* (2) *Arisaema triphyllum*

Legacy ID

F136XY140VA

Physiographic features

This ecological site is generally found in depressional features, or on broad flats, on low stream terraces. Although colloquially these landforms are described as low stream terraces, they are formally classified as flood-plain steps, since they usually sit slightly below the 100 year flood zone. Occasionally, this ecological site can be found along the lower segments of drainageways leading down to river valleys. In either case, flooding is not the primary driver of pedogenesis or ecological dynamics.

This ecological site is geographically restricted to the mesic soil temperature regime portion of the MLRA. It is most extensive on the stepped surfaces of relatively broad river valleys of large river systems, where floodwaters periodically decant into depressions or remnant backswamps on low stream terraces. These low terraces sit elevated slightly above the active flood plain, and are spared from some of the flooding experienced on lower flood plain surfaces.

Stream terraces form in response to gradual downcutting of a stream channel and its immediately adjacent surfaces, usually initiated by events that shift erosional and depositional equilibrium. Over time, abandoned portions of the flood plain are left behind as remnant features. Representative locations are nearly level to gently sloping, with a representative slope of 0 to 2 percent and a maximum slope of 5 percent. The geologic substrate is typically fine-textured old alluvial sediments (Zinck 2016; Schoeneberger and Wysocki 2017).

Table 2. Representative physiographic features

Landforms	(1) River valley > Flood-plain step (2) Piedmont > Drainageway
Runoff class	Low to medium
Flooding duration	Brief (2 to 7 days)
Flooding frequency	Rare to occasional
Ponding frequency	None
Elevation	113–274 m
Slope	0–2%
Water table depth	15–25 cm
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Runoff class	Negligible to high
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	Rare to frequent
Ponding frequency	None
Elevation	61–479 m
Slope	0–5%
Water table depth	0–30 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 4. Representative climatic features

Frost-free period (characteristic range)	151-171 days

Freeze-free period (characteristic range)	183-207 days
Precipitation total (characteristic range)	1,118-1,194 mm
Frost-free period (actual range)	143-181 days
Freeze-free period (actual range)	166-223 days
Precipitation total (actual range)	1,067-1,270 mm
Frost-free period (average)	160 days
Freeze-free period (average)	194 days
Precipitation total (average)	1,168 mm

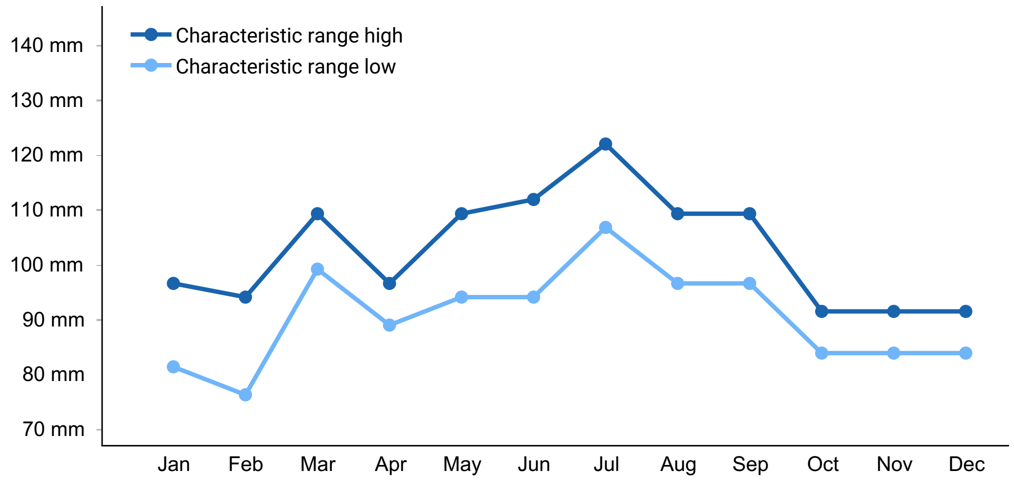


Figure 4. Monthly precipitation range

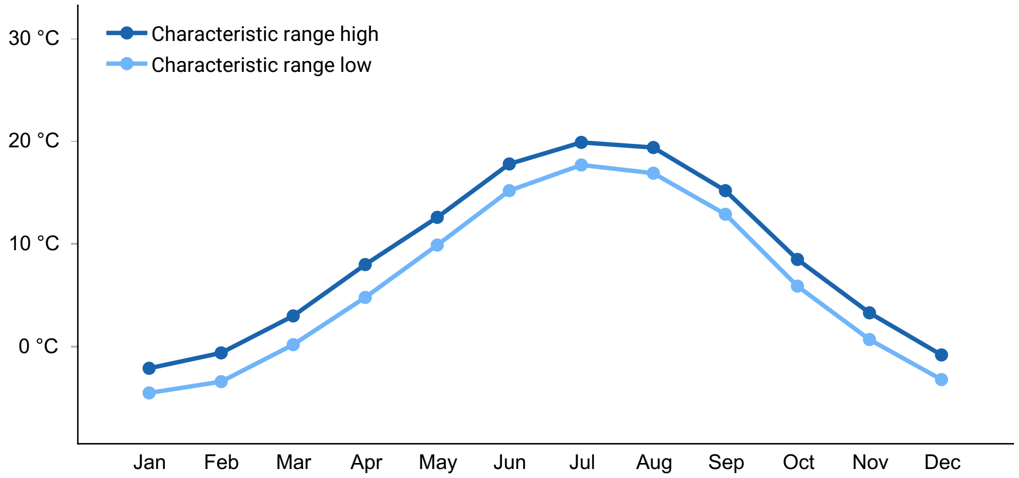


Figure 5. Monthly minimum temperature range

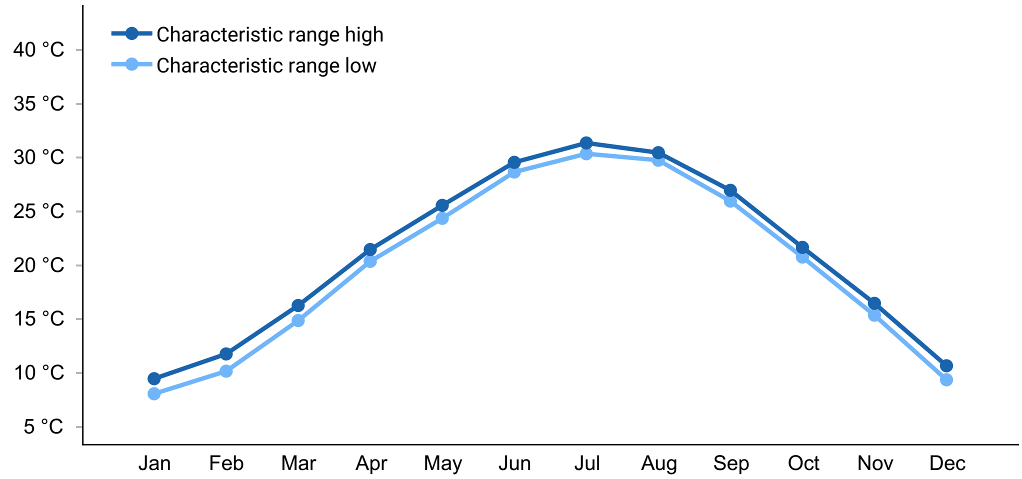


Figure 6. Monthly maximum temperature range

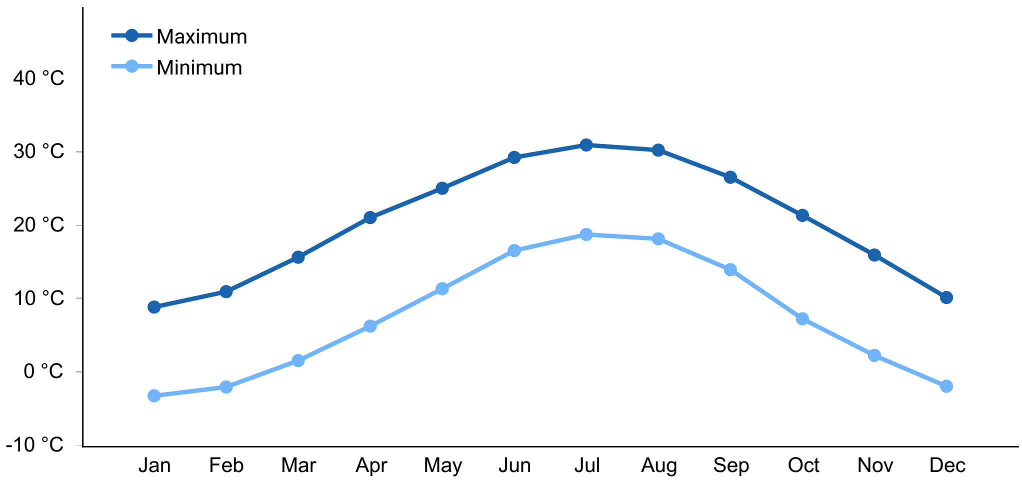


Figure 7. Monthly average minimum and maximum temperature

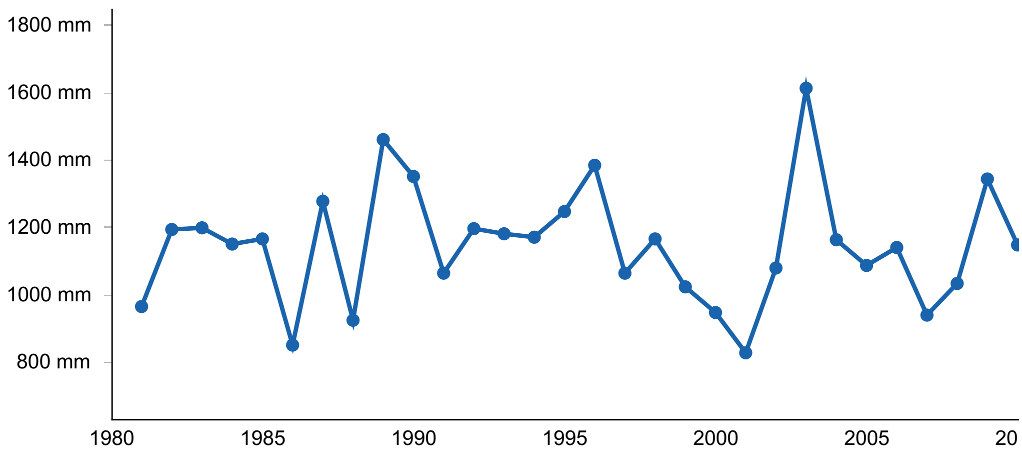


Figure 8. Annual precipitation pattern

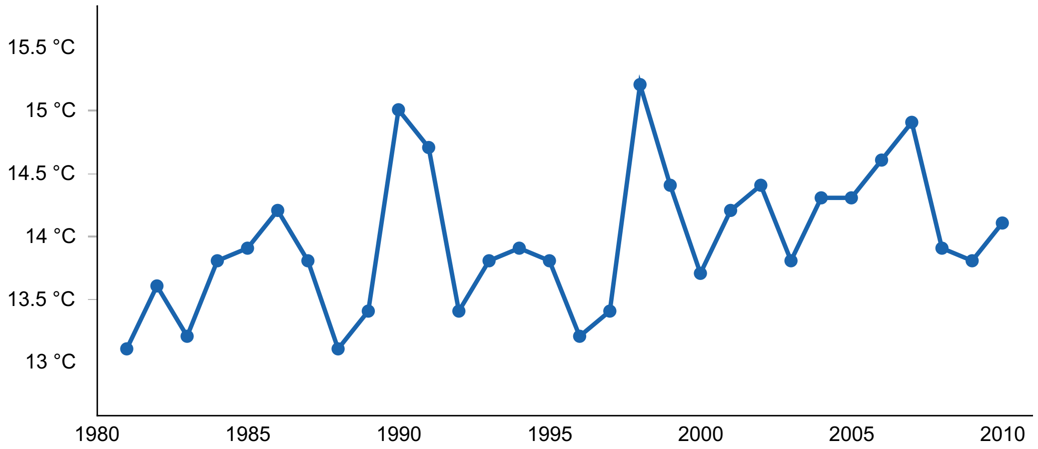


Figure 9. Annual average temperature pattern

Climate stations used

- (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) BROOKNEAL [USC00441082], Brookneal, VA
- (10) CHATHAM [USC00441614], Chatham, VA
- (11) ROCKY MT [USC00447338], Rocky Mount, VA
- (12) PHILPOTT DAM 2 [USC00446692], Henry, VA
- (13) MARTINSVILLE FLTR PLT [USC00445300], Martinsville, VA
- (14) DANVILLE [USC00442245], Danville, VA
- (15) DANVILLE RGNL AP [USW00013728], Danville, VA
- (16) STUART [USC00448170], Stuart, VA
- (17) REIDSVILLE 2 NW [USC00317202], Reidsville, NC
- (18) DANBURY [USC00312238], Danbury, NC
- (19) MT AIRY 2 W [USC00315890], Mount Airy, NC
- (20) NORTH WILKESBORO [USC00316256], Wilkesboro, NC
- (21) YADKINVILLE 6 E [USC00319675], East Bend, NC
- (22) WINSTON SALEM RYNLDS AP [USW00093807], Winston Salem, NC
- (23) HICKORY FAA AP [USW00003810], Hickory, NC
- (24) STATESVILLE 2 NNE [USC00318292], Statesville, NC
- (25) MORGANTON [USC00315838], Morganton, NC
- (26) W KERR SCOTT RSVR [USC00319555], Wilkesboro, NC
- (27) RURAL HALL [USC00317548], Rural Hall, NC
- (28) TAYLORSVILLE [USC00318519], Taylorsville, NC
- (29) LENOIR [USC00314938], Lenoir, NC

- (30) PIEDMONT TRIAD INTL AP [USW00013723], Greensboro, NC
- (31) HIGH POINT [USC00314063], High Point, NC
- (32) LEXINGTON [USC00314970], Lexington, NC
- (33) MOCKSVILLE 5SE [USC00315743], Mocksville, NC
- (34) SALISBURY 9 WNW [USC00317618], Salisbury, NC
- (35) SALISBURY [USC00317615], Salisbury, NC

Influencing water features

This ecological site sits high enough above the active flood plain to avoid some of the flooding experienced on lower surfaces. Flooding occurs mainly after a period of unusually wet weather that generates saturation-excess runoff, filling rivers and streams. Unless artificial drainage is introduced, a seasonal high water table is apparent at depths between 0 to 12 inches, generally during the months of November to May.

Wetland description

In the reference state, wetlands on this ecological site typically classify as follows according to the Cowardin system (Cowardin 1979).

System: Palustrine
Class: Forested
Subclass: Broad-leaved deciduous

Lower-level Modifiers
Water Regime: Saturated
Water Chemistry: Fresh, acid
Soil: Mineral

Soil features

Soils on this ecological site are typically very deep, poorly drained Ultisols or Alfisols. They are better developed than soils of adjacent flood plains, as they are generally found on more stable surfaces that are more conducive to soil genesis. As such, soils on this ecological site usually have an argillic horizon in subsurface layers. Typically, these soils are in a fine particle size family. Redoximorphic features (iron and/or manganese depletions) are found at depths between 0 to 12 inches and below.

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 5.5 in representative pedons. Parent materials are typically old clayey alluvial sediments.

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 taxa include: Typic Endoaquults.
Modal soil series include: Kinkora
Other soils attributed to this ecological site include Roanoke and Forestdale.

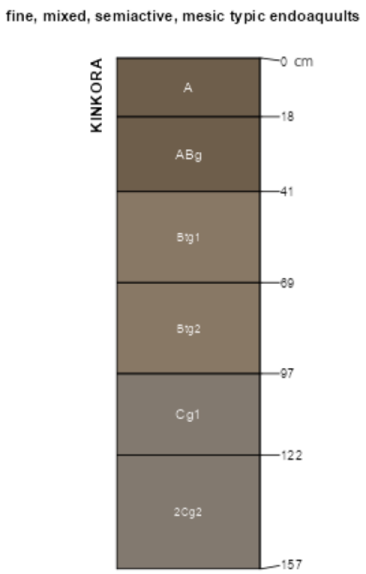


Figure 10. An illustration of a soil profile belonging to the Kinkora series, a representative soil series associated with this ecological site.

Table 5. Representative soil features

Parent material	(1) Alluvium–igneous, metamorphic and sedimentary rock
Surface texture	(1) Loam (2) Silt loam
Family particle size	(1) Fine
Drainage class	Poorly drained
Permeability class	Very slow to slow
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-203.2cm)	25.4–33.02 cm
Soil reaction (1:1 water) (0-25.4cm)	4.5–5.5
Subsurface fragment volume <=3" (0-203.2cm)	0–8%

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

Table 6. Representative soil features (actual values)

Drainage class	Poorly drained
Permeability class	Very slow to moderately slow
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-203.2cm)	20.32–38.1 cm
Soil reaction (1:1 water) (0-25.4cm)	4.5–6
Subsurface fragment volume <=3" (0-203.2cm)	0–10%
Subsurface fragment volume >3" (0-203.2cm)	0%

Ecological dynamics

U.S. National Vegetation Classification (USNVC) associations that are consistent with reference conditions on this ecological site include CEGL006498 *Quercus phellos* - Quercus (palustris, lyrata) / *Ilex decidua* / *Carex typhina*. This concept is closely related to the reference community, though in North Carolina, pin oak (*Q. palustris*) is usually of minor importance in the canopy (USNVC 2022).

MATURE FORESTS
The reference state supports a closed canopy forest dominated by bottomland oaks, including willow oak (*Quercus phellos*), overcup oak (*Quercus lyrata*), and swamp chestnut oak (*Quercus michauxii*), among others. Overcup oak tends to occupy more of the canopy cover as the length of the hydroperiod increases. Other characteristic species include American elm (*Ulmus americana*), red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), and winged elm (*Ulmus alata*). Sweetgum (*Liquidambar styraciflua*) can be an important canopy species on this ecological site, but much less so in the northern-most counties of the MLRA and in the western foothills. Pin oak (*Quercus palustris*), a species with northern and midwestern affinities, can be important locally, becoming more common in the northernmost counties of the MLRA. Upland oaks and hickories are largely absent.

In the subcanopy layer, American hornbeam (*Carpinus caroliniana*) is usually dominant, as it is in many alluvial settings. Other important species include blackgum (*Nyssa *sylvatica*) and common persimmon (*Diospyros virginiana*). Characteristic species of the shrub layer include possumhaw (*Ilex decidua*), common winterberry (*Ilex verticillata*), southern arrowwood (*Viburnum recognitum*), and black highbush blueberry (*Vaccinium fuscatum*), along with several vines.

The herb layer is variable in composition and is usually sparse. Species that occur with some frequency include Jack in the pulpit (*Arisaema triphyllum*), lizard's tail (*Saururus cernuus*), and various species of Carex (*C. crinita*, debilis, tribuloides, lupulina, etc.)

The reference forest type is best developed on the stepped surfaces of relatively broad river valleys. Here, distinct landforms, such as stream terraces, flood plain flats, backswamps, and natural levees, tend to be better developed. In this setting, stream terraces tend to be broader and include more extensive wet areas. Here, vegetation communities typically sort out better along gradients of hydroperiod, elevation above the river channel, and other flooding-related variables.

DYNAMICS OF NATURAL SUCCESSION
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, much like on moist uplands of the Piedmont. Flooding presumably plays a relatively minor role. Though fire was historically a key driver of successional dynamics on Piedmont uplands, the historic influence of fire on this ecological site was likely insignificant.

YOUNG SECONDARY FORESTS
Young secondary forests associated with this ecological site are usually even-aged and comparatively less diverse. These forests are more common on the landscape today due to the long history of agriculture and logging in river valleys of the Southern Piedmont. Typically, these forests are strongly dominated by only a handful of species, including red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), green ash (*Fraxinus pennsylvanica*), blackgum (*Nyssa sylvatica*), and common persimmon (*Diospyros virginiana*). The dominance of early pioneers declines as the forest matures, though many of these species remain important in mature stands as well, albeit to a lesser extent (Schafale and Weakley 1990; Brinson et al. 1996; Matthews et al. 2011; Schafale 2012a, 2012b; Fleming et al. 2021).

SPECIES LIST
Canopy layer: *Quercus phellos*, *Quercus lyrata*, *Fraxinus pennsylvanica*, *Ulmus americana*, *Quercus michauxii*, *Acer rubrum*, *Ulmus alata*, *Liquidambar styraciflua*, *Quercus palustris*,

Subcanopy layer: *Carpinus caroliniana*, *Nyssa sylvatica*, *Diospyros virginiana*, *Acer rubrum*, *Ulmus alata*,

Vines/lianas: *Bignonia capreolata*, *Smilax rotundifolia*, *Parthenocissus quinquefolia*, *Campsis radicans*, *Vitis rotundifolia*, *Toxicodendron radicans*, *Apios americana*, *Lonicera* *japonica* (I)

Shrub layer: *Ilex decidua*, *Ilex verticillata*, *Viburnum recognitum*, *Vaccinium fuscatum*, *Viburnum nudum*, *Hypericum nudiflorum*, *Rosa palustris*, *Lyonia ligustrina*, *Aronia arbutifolia*, *Rubus hispidus*

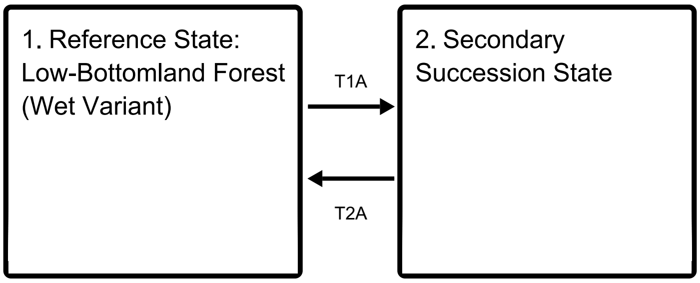
Herb layer - forbs: *Arisaema triphyllum*, *Saururus cernuus*, *Polygonum virginianum*, *Osmunda cinnamomea*, *Athyrium filix-femina* ssp. asplenioides, *Mitchella repens*, *Boehmeria cylindrica*, Sphagnum spp., Mnium spp., Thuidium spp., *Galium tinctorium*, *Solidago gigantea*, *Solidago rugosa*, *Agrimonia parviflora*, *Impatiens capensis*, *Onoclea sensibilis*, *Thelypteris noveboracensis*, *Botrychium dissectum*, *Botrychium biternatum*, *Scutellaria integrifolia*, *Lycopus virginicus*, *Cicuta maculata*, *Chelone glabra*, *Itea virginica*, Platanthera spp., *Symplocarpus foetidus*, *Lysimachia nummularia* (I), *Murdannia keisak* (I)

Herb layer - graminoids: Carex (crinita, debilis, tribuloides, lupulina, etc.), *Leersia virginica*, *Glyceria striata*, *Chasmanthium laxum*, *Juncus coriaceus*, *Juncus effusus*, *Cinna arundinacea*, *Dichanthelium clandestinum*, Poa cuspida, *Microstegium vimineum* (I), *Arthraxon hispidus* (I)

(I) = introduced

State and transition model

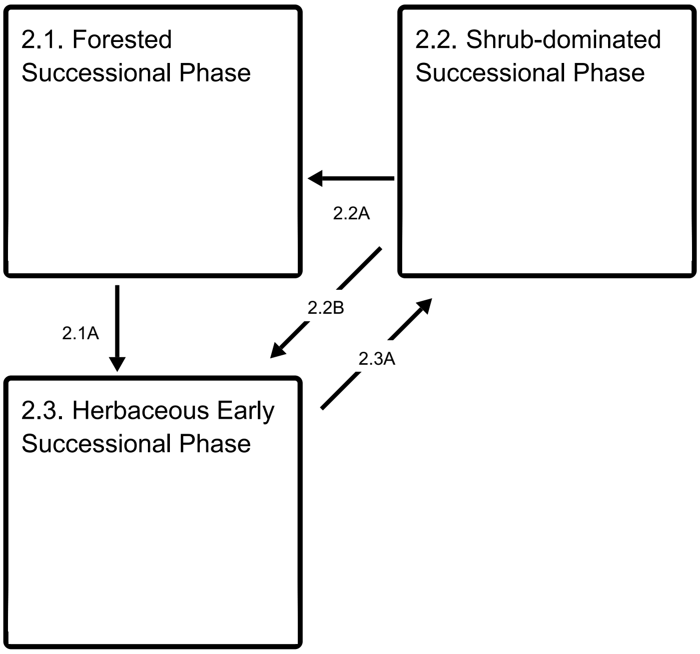
Ecosystem states



T1A - Clearcut logging or other large-scale disturbances that cause canopy removal.

T2A - Long-term natural succession.

State 2 submodel, plant communities



2.1A - Clearcut logging.

2.2A - Natural succession.

2.2B - Brush management.

2.3A - Natural succession.

State 1
Reference State: Low-Bottomland Forest (Wet Variant)

This mature forest state supports a closed canopy forest dominated by bottomland oaks and other bottomland hardwood species.

Characteristics and indicators. Stands are uneven-aged with at least some old trees present.

Dominant plant species

- willow oak (*Quercus phellos*), tree
- overcup oak (*Quercus lyrata*), tree
- green ash (*Fraxinus pennsylvanica*), tree
- American elm (*Ulmus americana*), tree
- swamp chestnut oak (*Quercus michauxii*), tree
- red maple (*Acer rubrum*), tree
- American hornbeam (*Carpinus caroliniana*), tree
- winged elm (*Ulmus alata*), tree
- sweetgum (*Liquidambar styraciflua*), tree
- possumhaw (*Ilex decidua*), shrub
- roundleaf greenbrier (*Smilax rotundifolia*), shrub
- common winterberry (*Ilex verticillata*), shrub

- crossvine (*Bignonia capreolata*), shrub
- blackhaw (*Viburnum prunifolium*), shrub
- Virginia creeper (*Parthenocissus quinquefolia*), shrub
- trumpet creeper (*Campsis radicans*), shrub
- southern arrowwood (*Viburnum recognitum*), shrub
- black highbush blueberry (*Vaccinium fuscatum*), shrub
- fringed sedge (*Carex crinita*), grass
- white edge sedge (*Carex debilis*), grass
- blunt broom sedge (*Carex tribuloides*), grass
- hop sedge (*Carex lupulina*), grass
- whitegrass (*Leersia virginica*), grass
- fowl mannagrass (*Glyceria striata*), grass
- slender woodoats (*Chasmanthium laxum*), grass
- Jack in the pulpit (*Arisaema triphyllum*), other herbaceous
- lizard's tail (*Saururus cernuus*), other herbaceous
- jumpseed (*Polygonum virginianum*), other herbaceous
- cinnamon fern (*Osmunda cinnamomea*), other herbaceous
- asplenium ladyfern (*Athyrium filix-femina ssp. asplenioides*), other herbaceous
- partridgeberry (*Mitchella repens*), other herbaceous
- stiff marsh bedstraw (*Galium tinctorium*), other herbaceous
- smallspike false nettle (*Boehmeria cylindrica*), other herbaceous
- sphagnum (*Sphagnum*), other herbaceous
- mnium calcareous moss (*Mnium*), other herbaceous

State 2
Secondary Succession State

This successional phase develops in the wake of clearcut logging, storm-related catastrophic tree mortality, or other large-scale disturbances that have led to canopy removal in the recent past. Which species colonize a particular location in the wake of a disturbance does involve a considerable degree of chance. It also depends a great deal on the type, duration, and magnitude of the disturbance event.

Characteristics and indicators. Plant age distribution is usually even.

Community 2.1
Forested Successional Phase

This successional phase develops in the wake of logging, storm-related catastrophic tree mortality, or other large-scale disturbances that have led to canopy removal in the recent past. It is typically dominated by bottomland hardwoods or a mixture of bottomland hardwoods and pines.

Forest overstory. Representative canopy species include include red maple (Acer rubrum) and green ash (Fraxinus pennsylvanica). Species diversity is generally lower than in mature examples. Bottomland oaks are typically scarce in the canopy.

Forest understory. Typical subcanopy species include blackgum (Nyssa sylvatica) and common persimmon (Diospyros virginiana), along with saplings of canopy species. Seedlings of bottomland oaks and other slow growing, shade-tolerant tree species are usually present in the understory. These seedlings are released gradually as the forest matures and successional canopy species die.

The shrub layer is generally sparse, but vines can be abundant. Characteristic vines include roundleaf greenbrier (Smilax rotundifolia), trumpet creeper (Campsis radicans), and Virginia creeper (Parthenocissus quinquefolia), among others.

Dominant plant species

- red maple (*Acer rubrum*), tree
- green ash (*Fraxinus pennsylvanica*), tree
- blackgum (*Nyssa sylvatica*), tree
- common persimmon (*Diospyros virginiana*), tree
- sweetgum (*Liquidambar styraciflua*), tree
- willow oak (*Quercus phellos*), tree
- roundleaf greenbrier (*Smilax rotundifolia*), shrub
- trumpet creeper (*Campsis radicans*), shrub
- Virginia creeper (*Parthenocissus quinquefolia*), shrub
- eastern poison ivy (*Toxicodendron radicans*), shrub
- fringed sedge (*Carex crinita*), grass
- white edge sedge (*Carex debilis*), grass
- blunt broom sedge (*Carex tribuloides*), grass
- hop sedge (*Carex lupulina*), grass
- deertongue (*Dichanthelium clandestinum*), grass
- whitegrass (*Leersia virginica*), grass
- leathery rush (*Juncus coriaceus*), grass
- smallspike false nettle (*Boehmeria cylindrica*), other herbaceous
- jewelweed (*Impatiens capensis*), other herbaceous
- creeping jenny (*Lysimachia nummularia*), other herbaceous
- harvestlice (*Agrimonia parviflora*), other herbaceous
- wrinkleleaf goldenrod (*Solidago rugosa ssp. rugosa*), other herbaceous
- wingstem (*Verbesina alternifolia*), other herbaceous
- asplenium ladyfern (*Athyrium filix-femina ssp. asplenioides*), other herbaceous

Community 2.2
Shrub-dominated Successional Phase

This successional phase is dominated by shrubs and vines, along with seedlings of bottomland hardwoods. It grades into the forested successional phase as tree seedlings become saplings and begin to occupy more of the canopy cover.

Dominant plant species

- red maple (*Acer rubrum*), tree
- sweetgum (*Liquidambar styraciflua*), tree
- blackgum (*Nyssa sylvatica*), tree
- common persimmon (*Diospyros virginiana*), tree
- black elderberry (*Sambucus nigra*), shrub
- common buttonbush (*Cephalanthus occidentalis*), shrub
- roundleaf greenbrier (*Smilax rotundifolia*), shrub
- trumpet creeper (*Campsis radicans*), shrub
- eastern poison ivy (*Toxicodendron radicans*), shrub
- groundnut (*Apios americana*), shrub
- silky dogwood (*Cornus amomum*), shrub
- leathery rush (*Juncus coriaceus*), grass
- common rush (*Juncus effusus*), grass
- flatsedge (*Cyperus*), grass
- woolgrass (*Scirpus cyperinus*), grass
- deertongue (*Dichanthelium clandestinum*), grass
- trumpetweed (*Eutrochium fistulosum*), other herbaceous
- New York ironweed (*Vernonia noveboracensis*), other herbaceous
- sensitive fern (*Onoclea sensibilis*), other herbaceous
- wrinkleleaf goldenrod (*Solidago rugosa ssp. rugosa*), other herbaceous
- wingstem (*Verbesina alternifolia*), other herbaceous
- asplenium ladyfern (*Athyrium filix-femina ssp. asplenioides*), other herbaceous
- common boneset (*Eupatorium perfoliatum*), other herbaceous

Community 2.3
Herbaceous Early Successional Phase

This transient community is composed of the first herbaceous invaders in the aftermath of large-scale natural disturbances that have led to canopy removal. Species composition is highly variable at this stage of succession. In addition to the named species, other herbaceous pioneers common to this ecological site include wingstem (*Verbesina alternifolia*), common boneset (*Eupatorium perfoliatum*), giant goldenrod (*Solidago gigantea*), wrinkleleaf goldenrod (*Solidago rugosa* spp. rugosa), Allegheny monkeyflower (*Mimulus ringens*), creeping jenny (*Lysimachia nummularia*), wartremoving herb (*Murdannia keisak*), and many others.

Resilience management. If the user wishes to maintain this community/phase for wildlife or pollinator habitat, a prescribed burn, mowing, or prescribed grazing will be needed at least once annually to prevent community pathway 2.3A. To that end, as part of long-term maintenance, periodic overseeding of wildlife or pollinator seed mixtures can be helpful in ensuring the viability of certain desired species and maintaining the desired composition of species for user goals.

Dominant plant species

- trumpet creeper (*Campsis radicans*), shrub
- greenbrier (*Smilax*), shrub
- rush (*Juncus*), grass
- sedge (*Carex*), grass
- flatsedge (*Cyperus*), grass
- woolgrass (*Scirpus cyperinus*), grass
- small carpetgrass (*Arthraxon hispidus*), grass
- spikerush (*Eleocharis*), grass
- beaksedge (*Rhynchospora*), grass
- barnyardgrass (*Echinochloa crus-galli*), grass
- beggarticks (*Bidens*), other herbaceous
- jewelweed (*Impatiens capensis*), other herbaceous
- stiff marsh bedstraw (*Galium tinctorium*), other herbaceous
- smallspike false nettle (*Boehmeria cylindrica*), other herbaceous
- Virginia water horehound (*Lycopus virginicus*), other herbaceous
- Virginia buttonweed (*Diodia virginiana*), other herbaceous
- knotweed (*Polygonum*), other herbaceous
- golden ragwort (*Packera aurea*), other herbaceous
- calico aster (*Symphyotrichum lateriflorum*), other herbaceous
- dwarf St. Johnswort (*Hypericum mutilum*), other herbaceous

Pathway 2.1A
Community 2.1 to 2.3

The forested successional phase can return to the herbaceous early successional phase through clearcut logging or other large-scale disturbances that cause canopy removal.

Context dependence. Note: if the user wishes to use this community pathway to create wildlife or pollinator habitat, please contact a local NRCS office for a species list specific to the area of interest and user needs.

Pathway 2.2A
Community 2.2 to 2.1

The shrub-dominated successional phase naturally moves towards the forested successional phase through natural succession.

Pathway 2.2B
Community 2.2 to 2.3

The shrub-dominated successional phase can return to the herbaceous early successional phase through brush management, including herbicide application, mechanical removal, prescribed grazing, or fire.

Context dependence. Note: if the user wishes to use this community pathway to create wildlife or pollinator habitat, please contact a local NRCS office for a species list specific to the area of interest and user needs. If the user wishes to maintain the shrub-dominated successional phase long term, for wildlife habitat or other uses, periodic use of this community pathway is necessary to prevent community pathway 2.2A, which happens inevitably unless natural succession is set back through disturbance.

Pathway 2.3A
Community 2.3 to 2.2

The herbaceous early successional phase naturally moves towards the shrub-dominated successional phase through natural succession.

Transition T1A
State 1 to 2

The reference state can transition to the secondary succession state through clearcut logging or other large-scale disturbances that cause canopy removal.

Transition T2A
State 2 to 1

The secondary succession state can transition to the reference state through long-term natural succession.

Additional community tables

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	03/30/2026
Approved by	Charles Stemmans
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:**