Ecological site F147XY011PA
Poorly Drained Fine Mixed Floodplain

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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): 147X–Northern Appalachian Ridges and Valleys

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

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

Classification relationships

This ecological site is found in Major Land Resource Area 147- Northern Appalachian Ridges and Valleys, 148. MLRA 147 is located within Land Resource Region S - Northern Atlantic Slope Diversified Farming Region (USDA 2006), and in United States Forest Service ecoregion M221 – Central Appalachian Broadleaf Forest-Coniferous Forest-Meadow Province (Bailey, 1995). In addition, MLRA 147 falls within area #67 of EPA Ecoregion Level III – the Ridge and Valley (US EPA, 2013). The Poorly Drained Fine Mixed Floodplain ecological site occurs within several EPA Level IV regions, primarily in 67b, Northern Shale Valleys, and 67a, Northern Limestone/Dolomite Valleys (Woods et. al., 1996).

Ecological site concept

The Poorly Drained Fine Mixed Floodplain ecological site occurs throughout MLRA 147 on active floodplains of small to medium sized streams. These landscapes are considered wetlands, but typically are a mosaic of wetland and non-wetland patches. Being part of an active floodplain environment is what distinguishes this ecological site from Poorly Drained Fine Alluvial Terraces, although the plant communities are the same or very similar. Both contain a mix of bottomland oaks and hardwoods. The soil material is composed of silt, clay, and fine-sand sized particles that are deposited in back swamp areas where flood waters tend to pond and overland water flow slows in velocity allowing smaller soil particles in suspension to settle out. Sediments are derived from mixed geology, primarily from acidic sandstone, shales, siltstones, and some limestone and calcareous shales. Many areas have been cleared and drained for agriculture as soils are fertile and slopes are flat. These areas are subject to frequent flooding as classified by the National Soil Survey Handbook (USDA 2016). Frequent flooding is defined as more than a 50 percent chance of flooding in any year.

Table 1. Dominant plant species

Tree	(1) *Acer rubrum* (2) *Fraxinus pennsylvanica*
Shrub	Not specified
Herbaceous	(1) *Boehmeria cylindrica*

Physiographic features

This ecological site is found on poorly drained floodplains in river and stream valleys throughout MLRA 147, Northern Appalachian Ridges and Valleys province. It may also be found in backswamp areas, depressions, drainageways, toeslopes, and terraces. The parent material is fine-textured alluvium derived from mixed sedimentary geology of sandstone, siltstone, shale, limestone, and dolomite. These sites formed in slow-moving and slack water deposits away from the immediate shores of a stream or river. The slopes are generally flat and concave, and subject to frequent flooding and ponding of brief to long duration (over 7 days). The overall characteristic of this ecological site is that of a wetland, although some areas may be a patchwork of wetland and non-wetland inclusions. The non-wetland spots occupy microtopographic highs that have just enough room above the water table to allow for non hydrophytic plants to grow. Depth to bedrock is greater than 60 inches (152 cm).

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Backswamp (3) Depression
Flooding duration	Very long (more than 30 days)
Flooding frequency	None to frequent
Ponding duration	Very brief (4 to 48 hours) to very long (more than 30 days)
Ponding frequency	None to frequent
Elevation	30–457 m
Slope	0–8%
Ponding depth	0–38 cm
Water table depth	0–178 cm
Aspect	Aspect is not a significant factor

Climatic features

The climate of this region is temperate and humid. The Ridge and Valley Province is not rugged enough for a true mountain type of climate but it does have many of the characteristics of such a climate (Daily 1971). The influence of the high and low topography on air movement causes somewhat greater temperature extremes than are experienced in the Piedmont region to the east. The differences in elevation also affect the length of the frost free season on the ridges verses that in the valleys. The cooler temperatures and the shorter freeze-free periods occur at the higher elevations and in the more northern latitudes. The maximum precipitation occurs from early spring through mid-summer, and the minimum occurs in January and February. The average annual snowfall ranges from 16 to more than 51 inches (40 to 130 centimeters). The average annual temperature is 44 to 57 degrees F (7 to 14 degrees C). A portion of this region that extends from Maryland southward through most of the Shenandoah Valley in Virginia falls within a rain shadow cast by the Appalachian Mountains to the west and the Blue Ridge Mountains to the east. The mountains on either side block moist flowing air from either the east or the west causing the valleys to be drier. Average annual precipitation in this shadow area can average 34 to 36 in/year (86 to 91cm) compared to 40 to 42 in/year (102 - 107 cm) for the rest of the region (PRISM 2013).

Data for mean annual precipitation, frost-free and freeze-free periods and monthly precipitation for this ecological site are shown below. The original data used in developing the tables was obtained from the USDA-NRCS National Water & Climate Center (2015) climate information database for 5 weather stations throughout MLRA 147 in proximity to this ecological site. All climate station monthly averages for maximum and minimum temperature and precipitation were then added together and averaged to make this table.

Table 3. Representative climatic features

Frost-free period (average)	151 days
Freeze-free period (average)	181 days
Precipitation total (average)	1,016 mm

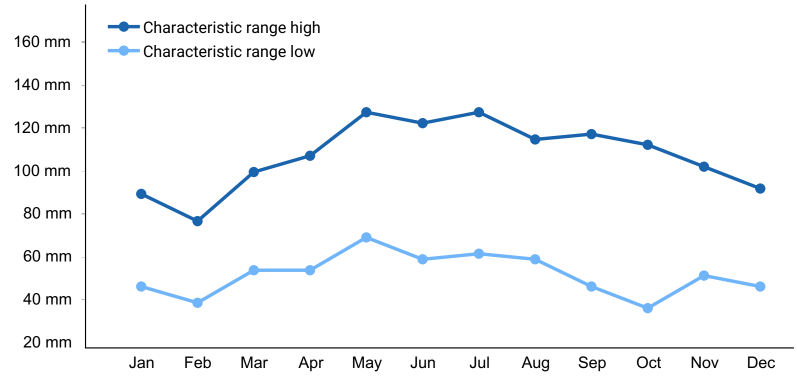

Figure 1. Monthly precipitation range

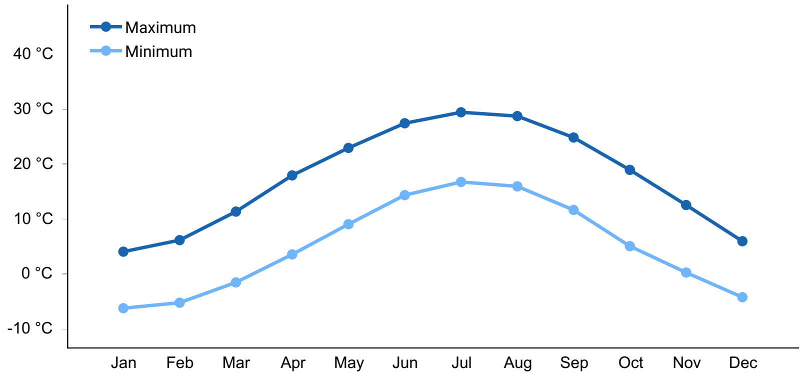

Figure 2. Monthly average minimum and maximum temperature

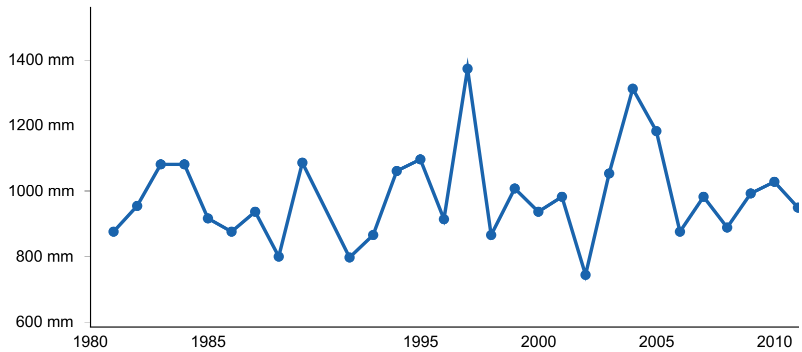

Figure 3. Annual precipitation pattern

Climate stations used

- (1) HANCOCK [USC00184030], Hancock, MD
- (2) SELINSGROVE 2 S [USC00367931], Port Trevorton, PA
- (3) MOOREFIELD 1 SSE [USC00466163], Moorefield, WV
- (4) WHITE SULPHUR SPRINGS [USC00469522], White Sulphur Springs, WV

- (5) HARRISBURG CPTL CY AP [USW00014751], New Cumberland, PA

Influencing water features

The Poorly Drained Fine Mixed Floodplain Ecological Site is considered a wetland in that it periodically supports plants which are able to grow in water saturated conditions (called hydrophytes), has a predominance of undrained (hydric) soils, and is periodically saturated or covered by shallow water at some time during the growing season (Cowardin 1979). Wetlands are important habitats for many species of wildlife and perform flood protection, pollution control and a variety of other important functions. Because of the importance of wetlands, the U.S. Fish and Wildlife Service developed a National Wetlands Inventory (NWI) to provide reliable information on the status and extent of wetland resources (Cowardin 1979). Within the NWI, wetlands are classified according to five major systems – Marine, Estuarine, Riverine, Lacustrine, and Palustrine. The Palustrine system includes all nontidal wetlands dominated by trees, shrubs, and persistent emergent plants in freshwater environments. The Poorly Drained Fine Mixed Floodplain Ecological Site classifies as a Palustrine Broad-leaved Deciduous seasonally saturated Forested wetland (Cowardin 1979).

The hydrogeomorphic (HGM) wetland classification system was developed as a way to group wetlands that function similarly (Smith 1995) based on the landscape and hydrology. This is in contrast to the Cowardin system that groups wetlands in broad systems and vegetatively. Due to the heterogeneity of alluvial landscapes, the Poorly Drained Fine Mixed Floodplain Ecological Site can be described by at least two hydrogeomorphic (HGM) classifications: Riverine (nonperennial) – a wetland associated with an intermittent or ephemeral stream; and, Riverine (upper perennial) – a wetland associated with a 1st or 2nd order perennial stream. Brooks further refined the HGM classification for wetlands occurring in the Mid Atlantic region (Brooks et. al. 2013). Under their system, this ecological site would classifiy as a Riverine Floodplain complex (R2c) which are wetlands that are part of a mosaic dominated by floodplain features (former channels, depressions) that may include slope wetlands supported by ground water.

Soil features

The soil series associated with this site are the poorly drained Shelmadine, Melvin, Holly, Dunning, and Atkins soils; and the somewhat poorly drained Orrville, Newmarc, and Newark soils. They are derived from fine-textured alluvium, or in some cases glacial till that have weathered from mixed geology of sandstone, shale, siltstone, limestone, and dolomite. The soils are generally very poorly to poorly drained with the seasonal high water table occurring between 0 to 6 inches (0 to 15 cm) of the surface. Some areas are somewhat poorly drained where depth to the seasonal high water table is between 6 to 18 inches (15 to 46 cm). Most of these soils are very deep with bedrock occurring below 60 inches (152 cm). Data was obtained from the Natural Resources and Conservation Service (NRCS) National Soils Information System database (USDA 2015).

Surface textures range from silt loam to silty clay loam, fine sandy loam, and loam. The subsurface texture is mostly loamy, but some areas are sandy or clayey, and may have stratified sands and gravels within the soil profile. The soils are often grey with splotches of orange that are characteristic of very wet, anaerobic conditions.

Slopes are flat to concave. Soil permeability is generally slow, but can be moderately rapid. This ecological site is subject to ponding and frequent flooding as classified by the National Soil Survey Handbook (USDA 2016). Frequent flooding is defined as more than a 50 percent chance of flooding in any year.

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone and shale (2) Till–siltstone
Surface texture	(1) Silt loam (2) Gravelly silty clay loam (3) Loam
Family particle size	(1) Loamy
Drainage class	Very poorly drained to somewhat poorly drained
Permeability class	Slow to moderately rapid

Soil depth	51–229 cm
Surface fragment cover <=3"	0–7%
Surface fragment cover >3"	2–7%
Available water capacity (0-101.6cm)	11.94–21.08 cm
Soil reaction (1:1 water) (0-101.6cm)	4.6–6.7
Subsurface fragment volume <=3" (Depth not specified)	0–20%
Subsurface fragment volume >3" (Depth not specified)	0–17%

Ecological dynamics

The vegetation groupings described in this section are based on the terrestrial ecological system classification and vegetation associations developed by NatureServe (Comer 2003) and the Natural Heritage Programs of Pennsylvania (Zimmerman et al. 2012), Virginia (Fleming et al. 2013), West Virginia (WVDNR 2014), and Maryland (Harrison 2004). Terrestrial ecological systems are specifically defined as a group of plant community types (associations) that tend to co-occur within landscapes with similar ecological processes, substrates, and/or environmental gradients. They are intended to provide a classification unit that is readily mappable, often from remote imagery, and readily identifiable by conservation and resource managers in the field. A given system will typically manifest itself in a landscape at intermediate geographic scales of tens to thousands of hectares and will persist for 50 or more years. A vegetation association is a plant community that is much more specific to a given soil, geology, landform, climate, hydrology, and disturbance history. It is the basic unit for vegetation classification. Each association will be named by the dominant species that occupy the different strata (tree, sapling, shrub, and herb). Within the NatureServe database, individual vegetation associations are assigned an identification number called a Community Element Global Code (CEGL).

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The reference forest is part of the Central Appalachian River Floodplain System (CES202.608) (NatureServe 2009) which encompasses flood plains of medium to large rivers that drain into the Atlantic Ocean from southern New England to Virginia, and can include a complex of wetland and upland vegetation. Although the Central Appalachian River Floodplain Forest System includes a number of diverse plant communities, variations of a maple - ash association dominated by *Acer rubrum* (Red maple), Fraxinus pennsylvanicus (Green ash) and sometimes Ulmus americanus (American elm) were consistently observed on the Poorly Drained Fine Mixed Floodplain ecological site. Less frequently observed was an oak-mixed hardwood forest dominated by *Quercus palustris* (pin oak) and/or *Quercus bicolor* (swamp white oak).
It is difficult to determine if either the maple-ash-elm or the pin oak-swamp white oak communities existed in their current compositional form during pre-European settlement times. Since the early 1900s when Dutch elm disease (Ceratocystis ulmi) was introduced to the U.S., mature American elm trees have been virtually eliminated from lowland forests in much of eastern North America (Barnes 1976). They continue to grow and spread but the disease limits their age and size. Green ash has expanded its range across the eastern United States, probably as a result of the decline of American elm, but also because it has been extensively planted (Hanberry 2014). Green ash populations may eventually decline as a result of the Emerald Ash Borer (Agrilus planipennis). In the eastern United States, suppression of fire since the early 1900s is leading to the eventual replacement of oak-dominated forests with mesophytic species that are much more shade tolerant and firesensitive, particularly in uplands (Nowacki and Abrams, 2008; Abrams and Ruffner, 1995; Dey, 2002a; Hutch, 2000; Delcourt, 1997). However, it is not clear if this

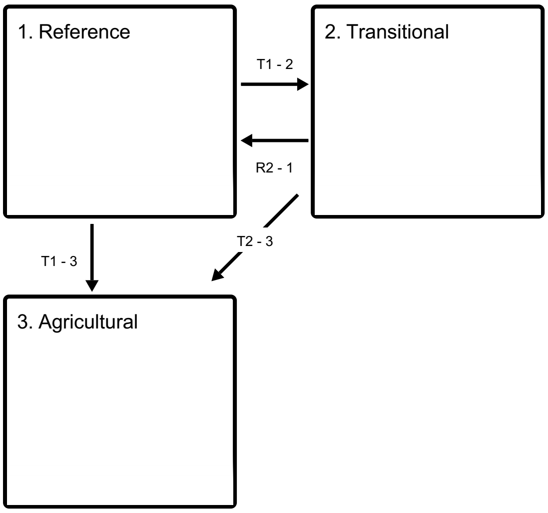
pertains to bottomland oak forests.

Alternate states observed on these ecological sites include wet meadows with patches of alder swamps, agricultural cropland or pasture, and an invaded woodland state where non-native species occupy significant areas of the understory. These non-natives may have detrimental effects on the reproduction and advanced recruitment of the reference tree species. One such invasive species is Microstigeum vimineum (Nepalese browntop) in the herbaceous layer. In some sites, Nepalese browntop creates a carpet of grass that effectively inhibited the growth of other plant seedlings.

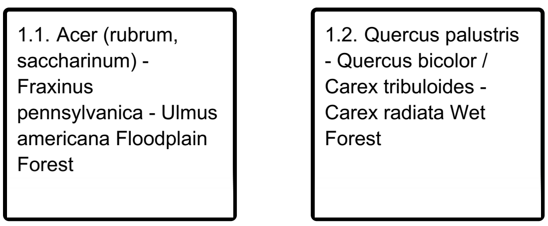
The information presented is representative of very complex vegetation communities. Key indicator plants and ecological processes are described to help inform land management decisions. Plant communities will differ across the major land resource region because of the naturally occurring variability in weather, soils, and aspect. The reference plant community is not necessarily the management goal. The species lists are representative and are not botanical descriptions of all species occurring, or potentially occurring, on this site. They are not intended to cover every situation or the full range of conditions, species, and responses for the site. The USDA Plants database was used to verify species' scientific and common names (USDA,2017).

State and transition model

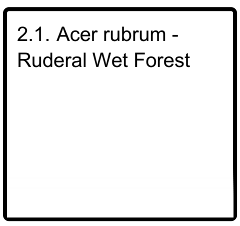
Ecosystem states



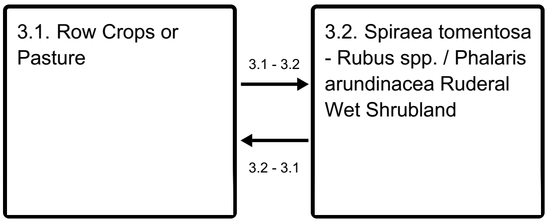
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference

The reference forest state described is one of several similar vegetation communities within the Central Appalachian River Floodplain System as defined by NatureServe (NatureServe, 2009). Due to the long history of human activity, the associations listed below may in reality reflect the current naturalized, minimally managed, post disturbance state rather than the historic, pre-European settlement condition. These areas will have a mixture of mesophytic (moisture loving) hardwood and hemlock forests, but the primary conditions described below will be wetland associations. Due to the heterogeneity and the broadness of this provisional ecological unit, they are not intended to cover every situation nor the full range of conditions and species. There are no transition pathways designated between the two communities in the reference state because their relationship is not clearly understood.

Community 1.1
Acer (rubrum, saccharinum) - Fraxinus pennsylvanica - Ulmus americana Floodplain Forest

The (Red Maple, Silver Maple) - Green Ash - American Elm / Small-spike False Nettle Floodplain Forest also known as the Northern Piedmont-Central Appalachian Maple - Ash Swamp Forest (CEGL006548 - NatureServe, 2017) occupies poorly drained backswamps, sloughs, abandoned oxbows, and depressions of large-stream and river floodplains. Soils are flooded at least early in the growing season, and water may be ponded in shallow hollows for most of the year. The overstory is dominated by variable combinations of *Fraxinus pennsylvanica* (green ash), *Acer rubrum* (Red maple), sometimes *Acer saccharinum* (Silver maple), and often with Ulmus Americana (American elm) in the understory. The shrub and herb layers may include *Cephalanthus occidentalis* (Common buttonbush), *Toxicodendron radicans* (poison ivy), *Boehmeria cylindrica*l (small-spike false nettle), *Impatiens capensis* (Spotted touch-me-not), *Cinna arundinacea* (Sweet woodreed), *Polygonum punctatum* (Dotted smartweed), *Polygonum arifolium* (Halberdleaf tearthumb), *Lobelia cardinalis* (Cardinalflower), *Commelina virginica* (Virginia dayflower), *Geum canadense* (White avens), *Saururus cernuus* (Lizard's tail), *Glyceria striata* (fowl mannagrass), *Leersia virginica* (white grass), *Pilea pumila* (Canadien clearweed), and various Carex spp. (sedges). In the northern part of the range, examples may contain patches of *Symplocarpus foetidus* (Skunk cabbage).

Community 1.2
Quercus palustris - Quercus bicolor / Carex tribuloides - Carex radiata Wet Forest

The Pin Oak - Swamp White Oak / Blunt Broom Sedge - Eastern Star Sedge - (Squarrose Sedge) Wet Forest also known as the Northern Piedmont-Central Appalachian Pin Oak Floodplain Swamp Forest (CEGL006497, NatureServe 2017) occupies poorly drained backswamps, sloughs, low flats, and depressions in the floodplains of streams and small rivers. Vegetation is a closed forest with mixed overstory dominance by *Quercus palustris* (Pin oak), *Quercus bicolor* (Swamp white oak), *Acer rubrum* (Red maple), and *Fraxinus pennsylvanica* (Green ash). Ulmus Americana (American elm), *Acer rubrum* (Red maple), and inconstantly *Acer negundo* (Box elder) are common understory trees. Climbing lianas of *Toxicodendron radicans* (Poison ivy), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax rotundifolia* (Roundleaf greenbrier), and *Vitis vulpina* (grape) are plentiful. The shrub layer is typically open to sparse but can include patches or scattered individuals of *Carpinus caroliniana* (American hornbeam), *Viburnum prunifolium* (Blackhaw), *Ilex verticillata* (Common winterberry), *Viburnum dentatum* (Southern arrowwood), *Cornus amomum* (silky dogwood), Sambucus Canadensis (American black elderberry), and *Lindera benzoin* (Spicebush). The herb layer is graminoid-rich with *Carex tribuloides* (Blunt broom sedge), *Carex squarrosa* (Squarrose sedge), *Carex radiata* (Eastern star sedge), *Cinna arundinacea* (Sweet woodreed), and/or *Scirpus polyphyllus* (Leafy bulrush) forming dominance-patches. *Saururus cernuus* (Lizards tail) and *Carex typhina* (Cattail sedge) also occasionally exhibit patch-dominance but are very inconstant in the type. Other characteristic herbs include *Arisaema triphyllum* (Jack in the pulpit), *Boehmeria cylindrica*l (Small-spike false nettle), *Carex lupulina* (Hop sedge), *Carex stipata* (Awlfruit sedge), *Galium obtusum* (Bluntleaf bedstraw), *Geum canadense* (White avens), *Glyceria striata* (Fowl mannagrass), *Impatiens capensis* (Spotted touch-me-not), *Lycopus virginicus* (Virginia water horehound), *Leersia virginica* (White grass), *Lysimachia ciliata* (Fringed loosestrife), *Polygonum punctatum* (Dotted smartweed), *Ranunculus hispidus* (Bristly buttercup), *Scutellaria lateriflora* (Blue skullcap), *Symphyotrichum lateriflorum* (Calico aster). *Lysimachia nummularia* (Creeping jenny), *Microstegium vimineum* (Nepalese browntop), and Polygonum caespitosum (Oriental lady's thumb) can be problematic invasive exotics in this association.

State 2
Transitional

Community 2.1
Acer rubrum - Ruderal Wet Forest

A Red Maple - Ruderal Wet Forest similar to the reference forests is assumed to exist on this ecological site in areas that have been logged or subject to other heavy disturbance. They may be weedy in character with understory exotic plants (of various growth forms) such as *Ligustrum sinense* (Chinese privet), *Lonicera japonica* (Japanese honeysuckle), and *Microstegium vimineum* (Nepalese browntop) which are known to occur in disturbed bottomland forests.

State 3
Agricultural

Community 3.1
Row Crops or Pasture

This is the dominant state that exists either in row crops like corn and soybeans, or in managed pastures planted with non-native forages.

Community 3.2
Spiraea tomentosa - Rubus spp. / Phalaris arundinacea Ruderal Wet Shrubland

The Steeplebush - Blackberry species / Reed Canarygrass Ruderal Wet Shrubland also known as the Ruderal Steeplebush/Reed Canarygrass Wet Shrubland (CEGL006571; NatureServe 2017) is assumed to exist in abandoned pasture or agricultural fields where drainage has not been maintained and wetland vegetation has recolonized. This wet meadow vegetation of the northeastern states occurs in a variety of settings, most frequently in low-lying areas of old fields or pastures, headwater basins, or beaver-impacted wetlands. The physiognomy is complex and variable, ranging from shrub thicket to herbaceous meadow with scattered shrubs. Shrub species usually include *Spiraea tomentosa* (Steeplebush), *Spiraea alba* var. alba (White meadowsweet), *Cornus amomum* (Silky dogwood), *Rubus allegheniensis* (Allegheny blackberry), *Rubus hispidus* (Bristly dewberry), Salix spp. (Willow), and others. *Hypericum densiflorum* (Bushy St. Johnswort) often occurs in the Central Appalachians. The invasive exotic shrubs *Lonicera morrowii* (Morrow's honeysuckle) and *Rosa multiflora* (Multiflora rose) may be locally abundant. Associated herbaceous species are also variable in composition, depending on land-use history. Commonly seen are *Phalaris arundinacea* (Reed canarygrass), *Solidago rugosa* (Wrinkleleaf goldenrod), *Solidago gigantea* (Giant goldenrod), Solidago Canadensis (Canada goldenrod), Juncus effuses (Common rush), *Scirpus cyperinus* (Woolgrass), *Scirpus expansus* (Woodland bulrush), *Leersia oryzoides* (rice cutgrass), Calamagrostis Canadensis (Bluejoint), *Carex scoparia* (Broom sedge), *Carex folliculata* (Northern long sedge), *Carex lurida* (Shallow sedge), *Carex lupulina* (Hop sedge), *Carex vulpinoidea* (Fox sedge), *Carex trichocarpa* (Hairyfruit sedge), *Vernonia noveboracensis* (New York ironweed), *Triadenum virginicum* (Virginia marsh St. Johnswort), *Lycopus uniflorus* (Northern bugleweed), *Impatiens capensis* (Jewelweed), Eupatorium maculatum (Spotted Joe pye weed), *Polygonum sagittatum* (Arrowleaf tearthumb), *Thelypteris palustris* (Eastern marsh fern), *Onoclea sensibilis* (Sensitive fern), Eleocharis spp. (Spikerush), and others. The invasive species *Microstegium vimineum* (Nepalese browntop) can be abundant.

Pathway 3.1 - 3.2
Community 3.1 to 3.2

Cessation of cropping or active pasture management; occasional mowing to prevent establishment of trees and shrubs; cessation of drainage system maintenance.

Pathway 3.2 - 3.1
Community 3.2 to 3.1

Active management of conservation cropping system or pasture; maintenance of drainage systems.

Transition T1 - 2
State 1 to 2

Logging followed by natural regeneration.

Transition T1 - 3
State 1 to 3

Logging, clearing, installation of drainage systems, tillage and conversion to agricultural practices like row cropping or managed pasture.

Restoration pathway R2 - 1
State 2 to 1

Exclude grazing, plant native seeds and seedlings, eliminate and manage nonnative and aggressive species. Return to the reference or post logged minimally managed state may require a very long term series of costly management options and stages. Many species may need to be planted or seeded heavily to restore the system. Depending on the existing seed bank and the proximity of a mature forest from which to recruit seeds, ruderal forests may regain a mixed forest stand. Nevertheless, sites that have been cleared may have significant soil disturbance including compaction, erosion, loss of native soil structure, loss of soil organic matter, disruption of soil microorganisms, all which affect the soil’s nutrient availability and water holding capacity (Duiker and Myers, 2005). These characteristics favor recolonization by plant species that have wind dispersed seeds (verses those that propagate through underground roots called rhizomes, or which have heavy seeds that stay near the parent tree), are shade intolerant, and have rapid to moderate growth rates (Dyer, 2010). Aggressive control of nonnative species and invasives will be ongoing. The following conservation practices from the Natural Resources Conservation Service Field Office Technical Guide can be used for restoration efforts (FOTG-USDA): Brush Management-314; Critical Area Planting-342; Early Successional Habitat Development-647; Fence-382; Forest Stand Improvement-666; Herbaceous Weed Control-315; Tree/Shrub site Preparation-490; Wetland restoration-657; Wetland Wildlife Habitat Management-644; Riparian Forest Buffer-391.

Conservation practices

Brush Management
Critical Area Planting
Fence
Riparian Forest Buffer
Tree/Shrub Site Preparation
Wetland Wildlife Habitat Management
Early Successional Habitat Development/Management
Wetland Restoration
Forest Stand Improvement
Herbaceous Weed Control

Transition T2 - 3
State 2 to 3

Logging, clearing, installation of drainage systems, tillage and conversion to agricultural practices like row cropping or managed pasture.

Additional community tables

Other references

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Acknowledgments

This current draft provisional ecological site (PES) report is a generalized description of landform, climate, physiography, soils and associated vegetation. Future work is needed to validate this information and further refine

the report into an ecological site description (ESD). An ESD will include detailed plant floristic inventory data on the reference state and most commonly occurring alternate states, interpretations for different land use, site productivity data, as well as descriptions of the ecological dynamics.

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Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	
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):**

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:**