USDA Natural Resources Conservation Service

Ecological site F147XY005PA
Poorly Drained Mixed Sedimentary Toeslope

Accessed: 05/17/2024

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 Mixed Sedimentary Toeslope ecological site occurs within 67b and 67c of EPA Ecoregion IV – Northern Shale Valleys, and Northern Sandstone Ridges, respectively (Woods et. al. 1996).

Ecological site concept

The Poorly Drained Mixed Sedimentary Toeslopes ecological site occurs throughout MLRA 147 on gently sloping toeslopes and basins of mountains and hills on soil material derived from acidic sedimentary geology primarily composed of sandstones, shales, and siltstones. Slopes of these wetland areas are generally concave. Depth to bedrock is usually greater than 40 inches (100 cm) and most sites are poorly drained where the depth to the seasonal high water table is 0 to 6 inches (0 to 15 cm) below the surface. The acidic sedimentary geology parent material is what differentiates this from the Mixed Limestone Lower Slope ecological site. The acidic substrate is mineral soil, but may have a component of organic muck. Dense subsurface soil layers called fragipans which prevent water from draining freely through the soil profile are characteristic of these landscapes. The perched water table results in the formation of wetlands or a patchwork of wetland and non wetland areas. Springs and seeps also

occur on these landscapes where groundwater discharges to the surface. Tsuga Canadensis (eastern hemlock) is usually present and may be dominant. It is often mixed with deciduous wetland trees such as *Acer rubrum* (red maple) or *Nyssa sylvatica* (blackgum). Sphagnum(sphagnum moss) is an important component of the bryoid layer.

Table 1. Dominant plant species

Tree	(1) *Tsuga canadensis* (2) *Rhododendron maximum*
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This ecological site is found on poorly drained footslopes, toeslopes, depressions, drainageways, coves, swales, and structural benches of hills in valleys and foot hills of mountains in MLRA 147, the Northern Appalachian Ridges and Valleys. The parent material is colluvium derived from mixed sedimentary rocks of calcareous and noncalcareous shales, siltstones, sandstones, and limestone. Dense subsurface soil layers called fragipans which prevent water from draining freely through the soil profile are characteristic of these landscapes. The perched water table results in the formation of wetlands or a patchwork of wetland and non wetland areas. Springs and seeps also occur on these landscapes where groundwater discharges to the surface. Flash flooding can occur along drainageways and swales, but generally this ecological site is not subjected to frequent flooding. These landscapes tend to be concave or flat, and gently to moderately sloping.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Mountain (3) Swale
Flooding duration	Extremely brief (0.1 to 4 hours)
Flooding frequency	None to very rare
Elevation	61–396 m
Slope	0–15%
Water table depth	0–137 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 4 weather stations throughout MLRA 147 at elevations in which this ecological site occurs. All climate station monthly averages for maximum and minimum

temperature and precipitation were then added together and averaged to make this table.

Table 3. Representative climatic features

Frost-free period (average)	153 days
Freeze-free period (average)	177 days
Precipitation total (average)	1,092 mm

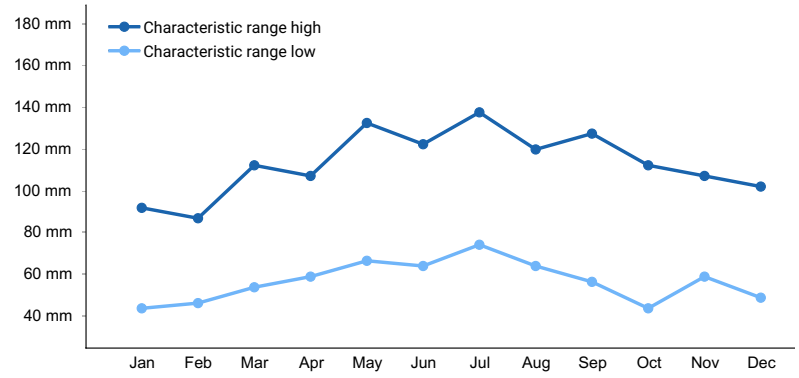


Figure 1. Monthly precipitation range

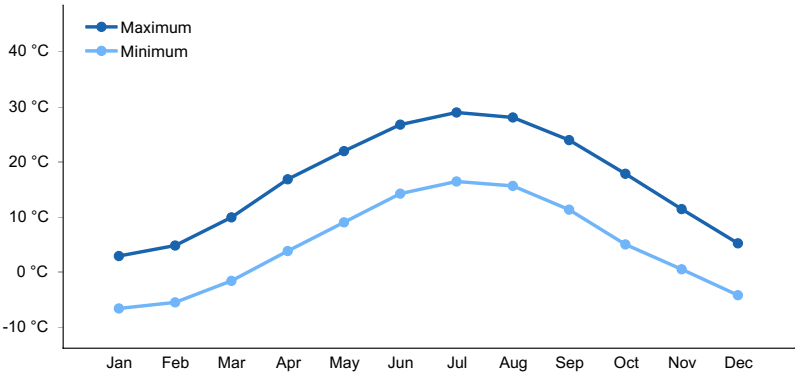


Figure 2. Monthly average minimum and maximum temperature

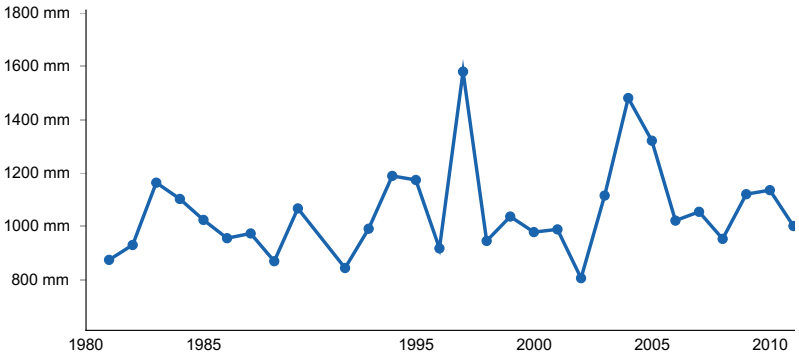


Figure 3. Annual precipitation pattern

Climate stations used

- (1) RODALE RSCH CTR [USC00367578], Kutztown, PA
- (2) STATE COLLEGE [USC00368449], State College, PA
- (3) CHAMBERSBURG 1 ESE [USC00361354], Chambersburg, PA
- (4) MATHIAS [USC00465739], Lost City, WV

Influencing water features

Under the Cowardin wetland classification, these ecological sites would be Palustrine Forested Broad-leaved

Deciduous Seasonally flooded/saturated wetlands (PFO1E) (Cowardin, 1979). At least two hydrogeomorphic (HGM) classifications can also be considered: Depression (Open, Ground Water) and Depression (Open Surface Water) (Smith 1995). The HGM classification describes wetlands that occur on a topographic slope or flat receive either ground water from seeps or surface water from runoff and precipitation. Using the Mid Atlantic HGM classification system, one could add an additional type, a Topographic Slope mineral soil (SL..n) wetland which occurs at the base of slopes (Brooks, Brinson et. al., 2013).

Soil features

The soil series associated with this site are: Thorndale, Markes, Lickdale, Brinkerton,and Andover. They have weathered from mixed geologies of calcareous and noncalcareous shale, limestone, siltstone, and sandstone. The soils are mostly derived from colluvial material that has moved from upper slopes to lower positions. Soils data was obtained from the Natural Resources and Conservation Service (NRCS) National Soils Information System database (USDA 2015).

The soils that underlie this ecological site are predominantly very poorly to poorly drained with the seasonal high water table occurring within 0 to 6 inches (0 to 15 cm) of the soil surface. The ecological site may include soils that are better drained on microtopographic highs within the landscape. Most of these soils have a characteristic feature called a fragipan, a dense subsoil layer, which impedes the movement of water and plant roots downward into the ground. The soils are generally deep, with bedrock occurring 60 inches (152 cm)or more below the surface, however, the effective rooting depth for plants might be as shallow as 14 inches (36 cm) due to the fragipan.

Surface textures range from silt loam, loam, to some sandy loams. The subsurface texture is loamy, but in many cases can feel sticky and heavy due to the clay content. The soils are often grey with splotches of orange that are characteristic of very wet, anaerobic conditions.

Table 4. Representative soil features

Parent material	(1) Colluvium–sandstone and shale
Surface texture	(1) Channery silt loam (2) Sand
Drainage class	Very poorly drained to poorly drained
Permeability class	Slow to rapid
Soil depth	152–216 cm
Surface fragment cover <=3"	0–9%
Surface fragment cover >3"	2–9%
Available water capacity (0-101.6cm)	9.4–16.76 cm
Soil reaction (1:1 water) (0-101.6cm)	4.8–6.2
Subsurface fragment volume <=3" (Depth not specified)	2–36%
Subsurface fragment volume >3" (Depth not specified)	1–20%

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).

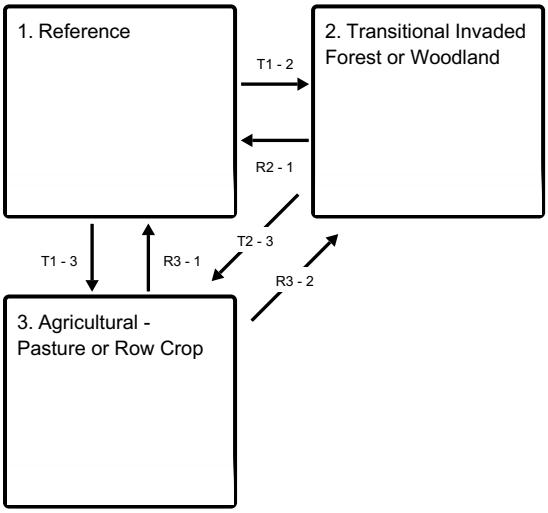
The Poorly Drained Mixed Sedimentary Toeslope Ecological Site is located in the Ridge and Valley region of the Appalachian Highlands, an area that has undergone extensive human disturbance since pre and post-European settlement times (Braun, 1950). The composition of the pre-settlement forest is not certain. The topography and landscape position are primarily concave lower slope and toeslopes and imperfectly drained mineral soils within upland valleys. The underlying parent material is colluvium derived from acidic sandstone, siltstone, and shale. The lower slope landscape position and in many cases the presence of a dense subsurface soil layer called a fragipan result in wetland conditions. These landscapes are often relatively narrow and of limited extent, but they will often contain wetlands which makes them of conservation interest.

The reference forest is defined by the North-Central Appalachian Acidic Swamp forest system (CES202.604) (NatureServe 2009). Tsuga Canadensis (eastern hemlock) is usually present and may be dominant. It is often mixed with deciduous wetland trees such as *Acer rubrum* (red maple) or *Nyssa sylvatica* (blackgum). Sphagnum (sphagnum moss) is an important component of the bryoid layer. The hemlock woolly adelgid (Adelges tsugae) is causing tree mortality of hemlocks in some areas of this ecological site. The insect will most likely cause canopy hemlocks to be replaced by other trees.

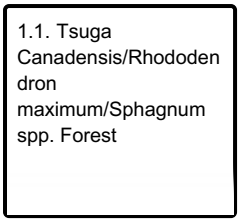
Disturbance agents in these forests include wind throw and ice damage. Many areas of this ecological site have considerable surface stoniness in addition to being wet. Most agricultural use is for pasture, but some areas have been drained and converted to row crop production.
The information presented 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.

State and transition model

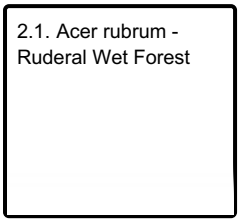
Ecosystem states



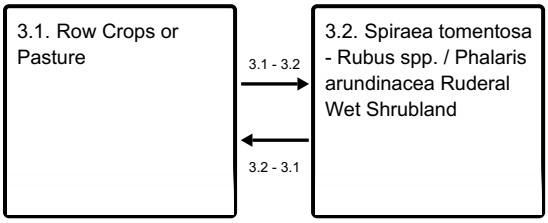
State 1 submodel, plant communities



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 North-Central Appalachian Acidic Swamp 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.

Community 1.1
Tsuga Canadensis/Rhododendron maximum/Sphagnum spp. Forest

Tsuga Canadensis/*Rhododendron maximum*/Sphagnum spp. Forest The Eastern Hemlock / Great Laurel / Peatmoss species Swamp Forest also known as the Eastern Hemlock/Great Laurel Swamp Forest (CEGL006279; NatureServe 2017) occurs on saturated acidic muck to imperfectly drained mineral soils in upland valleys, bedrock depressions, low slopes, and adjacent to streams and lakes. Mounds and depressions caused by uprooted trees are typical. The tree canopy is closed or nearly closed and is dominated by *Tsuga canadensis* (Eastern hemlock) with associates including *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), *Betula alleghaniensis* (yellow birch), and *Pinus strobus* (eastern white pine). The well-developed shrub layer can be strongly dominated by *Rhododendron maximum* (great laurel). Other shrubs may include *Ilex verticillata* (common winterberry), *Rhododendron viscosum* (swamp azalea), *Vaccinium corymbosum* (highbush blueberry), and *Lindera benzoin* (spicebush). The sparse herb layer includes a variety of sedges such as Carex folliculate (northern long sedge), Carex trisperm (threeseeded sedge), *Carex intumescens* (greater bladder sedge) as well as ferns and forbs such as *Osmunda cinnamomea* (cinnamon fern), *Thelypteris palustris* (eastern marsh fern), *Onoclea sensibilis* (sensitive fern), *Maianthemum canadense* (Canada mayflower), Cornus Canadensis (bunchberry dogwood), *Coptis trifolia* (threeleaf goldthread), *Symplocarpus foetidus* (skunk cabbage), *Trientalis borealis* (starflower), and *Calla palustris* (water arum). The bryophyte layer is well-developed and strongly dominated by Sphagnum mosses. Other mosses may include *Aulacomnium palustre* (aulacomnium moss), *Hypnum imponens* (hypnum moss), and *Leucobryum glaucum* (leucobryum moss) on drier hummocks. The hemlock woolly adelgid (Adelges tsugae) is causing tree mortality of hemlocks in some areas of this ecological site. The insect will most likely cause canopy hemlocks to be replaced by other trees.

State 2
Transitional Invaded Forest or Woodland

Community 2.1
Acer rubrum - Ruderal Wet Forest

A Red Maple - Ruderal Wet Forest similar to the reference forest 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 - Pasture or Row Crop

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 folliculate (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; Fence-382; Forest Stand Improvement-666; Herbaceous Weed Control-315; Tree/Shrub site Preparation-490; Wetland restoration-657; Wetland Wildlife Habitat Management-644.

Conservation practices

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

Transition T2 - 3
State 2 to 3

Logging, clearing, and then planting of non-native pasture grass mixes, and grazing. Maintenance with periodic mowing to prevent trees and shrubs from reestablishing. Establishment of drainage systems if needed.

Restoration pathway R3 - 1
State 3 to 1

Cease agricultural management, exclude grazing, plant native seeds and seedlings, eliminate and manage nonnative and aggressive species, cease drainage system maintenance. Return to the reference or post logged minimally managed state may require a very long term series of costly management options and stages. Many species may need to be planted or seeded to restore the system. Herbivory can be a problem as well as competition from faster growing species. Depending on the existing seed bank and the proximity of a mature forest from which

to recruit seeds, ruderal forests may regain a mixed forest stand. Nevertheless, sites that have been cleared and tilled have significant soil disturbance which may include compaction, erosion, loss of native soil structure, loss of soil organic matter, disruption of soil microorganisms, all which affect the soil's nutrient availability and water holding capacity (Duiker and Myers, 2005). These characteristics favor recolonization by plant species that have wind dispersed seeds (verses those that propagate through underground roots called rhizomes, or which have heavy seeds that stay near the parent tree), are shade intolerant, have rapid to moderate growth rates, and drought tolerance (Dyer, 2010). Aggressive control of nonnative species and 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; Fence-382; Forest Stand Improvement-666; Herbaceous Weed Control-315; Tree/Shrub site Preparation-490; Wetland restoration-657; Wetland Wildlife Habitat Management-644.

Conservation practices

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

Restoration pathway R3 - 2
State 3 to 2

Abandonment of pasture or old field. Discontinue mowing and do not allow grazing. Allow natural regeneration.

Conservation practices

Fence

Additional community tables

Other references

Bailey, Robert G. 1995. Description of the ecoregions of the United States 2d ed. Rev. and expanded (1st ed. 1980). Misc. Publ. No. 1391 (rev.), Washington, DC: USDA Forest Service. 108p. with separate map at 1:7,500,000.

Braun, E. Lucy. 1950. Deciduous Forests of Eastern North America. Philadelphia and Toronto: The Blakiston Company.

Brooks, R.P., M.M. Brinson, D.H. Wardrop, and J.A. Bishop. 2013. Hydrogeomorphic (HGM) Classification, Inventory, and Reference Wetlands. In Mid-Atlantic Freshwater Wetlands: 39, Advances in Wetlands Science, Management, Policy, and Practice, DOI 10.1007/978-1- 4614-5596-7_2, ©, edited by Robert P. Brooks, and Denise H. Wardrop, Chapter 2: 39-59. New York: Springer Science+Business Media.

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K., Snow, and J.Teague. 2003. Ecological Systems of the United States: A Working Classification of U.S. Terrestrial Systems. NatureServe, Arlington,Virginia.

Cowardin, L.M. et. al. 1979. Classification of Wetlands and Deepwater habitats of the United States. FWS/OBS-79/31, U.S. Department of the Interior, Fish and Wildlife Service, Washington, DC, 131p.

Daily, Paul. 1971. Climate of Pennsylvania, in Climatography of the United States No. 60-36, Climates of the States. Washington, DC: U.S. Government Printing Office.

Duiker, S. W. and J.C. Myers, 2005. Better Soils with the NoTill System, A Publication to Hellp Farmers Understand the Effect of No-Till Systems of the Soil. USDA Natural Resources Conservation Service.

Dyer, James, M. 2010. Land-use legacies in a central Appalachian forest differential response of trees and herbs to to historic agricultural practices. Applied Vegetation Science 13:195-206.

Fleming, G.P., K.D. Patterson, K. Taverna, and P.P. Coulling. 2013. The natural communities of Virginia: classification of ecological community groups. Second approximation. Version 2.6. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA.

FOTG-Field Office Technical Guide, Section IV-Practice Standards and Specifications, USDA, Natural Resources Conservation Service, https://efotg.sc.egov.usda.gov/

Harrison, J.W. 2004. Classification of vegetation communities of Maryland: First iteration. NatureServe and Maryland Natural Heritage Program, Wildlife and Heritage Service, Maryland Department of Natural Resources. Annapolis, MD.

LANDFIRE: LANDFIRE Biophysical Settings. (2010, January 01 - last update). U.S. Department of Interior, Geological Survey. [Online]. Available: http://landfire.cr.usgs.gov/viewer/ [2015, June 5].

NatureServe. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA, U.S.A. Data current as of 06 February 2009.

NatureServe 2017. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://explorer.natureserve.org. (Accessed: December 2017).

PRISM Climate Group, Oregon State University, http://prism.oregonstate.edu, created February 26, 2013.

Smith, R. D., et. al. 1995. “An approach for assessing wetland functions using hydrogeomorphic classification, reference wetlands, and functional indices,” Technical Report WRP-DE-9, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

United States Department of Agriculture, Natural Resources Conservation Service, National Water and Climate Center, http://www.wcc.nrcs.usda.gov, Accessed February 2015.

United States Department of Agriculture, Natural Resources Conservation Service, 2006. Land Resource Regions and Major land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296, 669p.

United States Department of Agriculture, Natural Resources Conservation Service, 2015. National Soils Information System.

United States Environmental Protection Agency, 2013, Level III ecoregions of the continental United States: Corvallis, Oregon, U.S. EPA-National health and Environmental Effects Research Laboratory, map scale 1:7,500,000, http://www.epa.gov/wed/pages/ecoregions/level_iii_iv.htm.

Woods, A.J., J.O. Omernik, D.D. Brown, C.W. Kiilsgaard. 1996. Level IV Ecoregions of EPA Region 3. US Environmental Protection Agency National Health and Environmental Effects Research Laboratory, Corvallis, Oregon. Map scale 1:250,000.

WVDNR [West Virginia Division of Natural Resources]. 2014. Plots2-WV database of community ecology plots. West Virginia Natural Heritage Program, WVDNR, Elkins, WV.

Zimmerman, E., T. Davis, G. Podniesinski, M. Furedi, J. McPherson, S. Seymour, B. Eichelberger, N. Dewar, J.

Wagner, and J. Fike (editors). 2012. Terrestrial and Palustrine Plant Communities of Pennsylvania, 2nd Edition. Pennsylvania Natural Heritage Program, Pennsylvania Department of Conservation and Natural Resources, Harrisburg, Pennsylvania.

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. Development of ESDs will require field data collection of soils and vegetation and subsequent data analysis. Production of ESDs will begin after draft provisional ecological site reports have been completed for most soil survey areas. The target completion date for PES is 2020, therefore the development of ESDs will not start until 2021. ESD development prioritization will be based on national priorities, state priorities, soil survey regional priorities, and funding and staffing limitations.

The following people assisted with the development of this provisional ecological site report:

Yuri Plowden, Ecological Site Specialist, NRCS, Mill Hall, PA
Aron Sattler, 6-MIL Soil Survey Project Leader, NRCS, Mill Hall, PA
Nels Barrett, Ph.D, Regional Ecological Site Specialist, NRCS, Amherst, MA
Mike McDevitt, Soil Scientist, NRCS, Mill Hall, PA
Ephraim Zimmerman, Ecological Assessment Manager, Western PA Conservancy, Pittsburgh, PA
Kevin Godsey, Ecological Site Specialist, NRCS, Springfield, MO

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:**