Ecological site F147XY013PA
Poorly Drained Calcareous Bottomland

Accessed: 05/05/2024

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. 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). Poorly Drained Calcareous Bottomland occurs in 67a of EPA Ecoregion IV – Northern Limestone/Dolomite Valleys (Woods et. al. 1996).

Ecological site concept

Poorly Drained Calcareous Bottomland ecological site occurs in parts of the Great Valley on the eastern side of MLRA 147 on active floodplains of small to medium sized streams on calcareous parent material such as limestone, dolomite, calcareous sandstones, siltstones, shales, and marl. These landscapes are considered wetlands, but typically are a mosaic of wetland and non-wetland patches. The high pH of the underlying soils relative to other alluvial landscapes, and the association with marl, is what distinguishes this site from other floodplains in MLRA 147. These areas are subject to frequent flooding as classified by the National Soil Survey Handbook (USDA 2016). This is defined as more than a 50 percent chance of flooding in any year.

These landscapes have largely been cleared for agricultural purposes or used as wetland wildlife habitat. The successional vegetation community may be composed of a patchwork of wetland shrubs and grasses; typical species include Salix spp. (willows), *Cornus amomum* (silky dogwood), Alnus spp. (alders), Spirea alba (white

meadowsweet), Carex spp. (sedges), and Juncus spp. (rushes). Calcareous herbaceous species that may be present include *Carex tetanica* (rigid sedge), *Carex prairea* (prairie sedge), and *Eleocharis erythropoda* (bald spikerush). Trees are generally absent but may include *Acer rubrum* (red maple) and *Fraxinus pennsylvanica* (green ash).

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Carex tetanica* (2) *Carex prairea*

Physiographic features

The Poorly Drained Calcareous Bottomland ecological site is found on flood plains, heads of springs, and toeslopes in limestone valleys in MLRA 147, the Northern Appalachian Ridges and Valleys. The ecological site develops in calcium carbonate rich soils. Parent material is alluvium derived from marl and mixed sedimentary rocks of limestone, sandstone, siltstone, and shale. The sites are nearly level, the seasonal high water table is at the soil surface. Depth to bedrock is greater than 60 inches (152 cm). These areas are subject to flooding which can be of brief to long duration, 7 days or longer. Ponding for 7 days or more may also occur. The overall characteristic is that of a wetland, although, there may be non wetland areas included on microtopographic highs. This ecological site is not of large extent.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Lake plain
Flooding duration	Long (7 to 30 days)
Flooding frequency	None to frequent
Ponding duration	Very long (more than 30 days)
Ponding frequency	None to frequent
Elevation	28–305 m
Slope	0–3%
Ponding depth	0–51 cm
Water table depth	0–61 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 3 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)	161 days
Freeze-free period (average)	184 days
Precipitation total (average)	1,041 mm

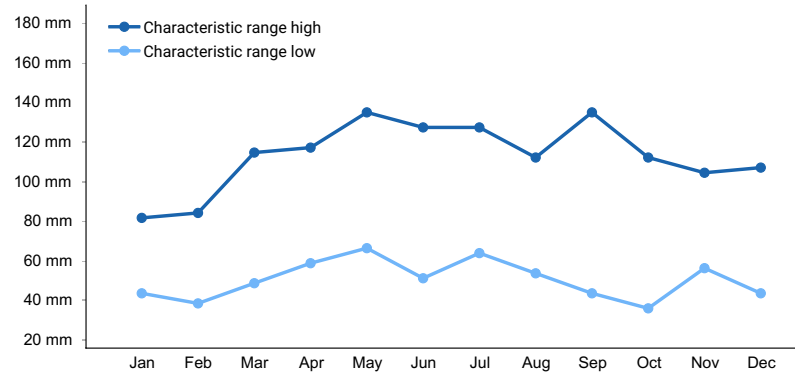


Figure 1. Monthly precipitation range

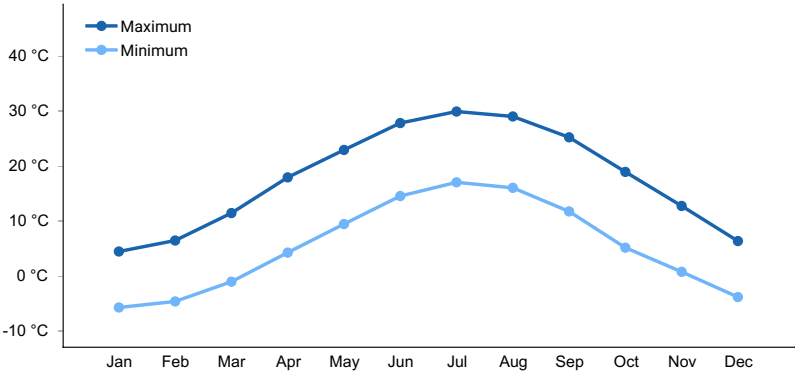


Figure 2. Monthly average minimum and maximum temperature

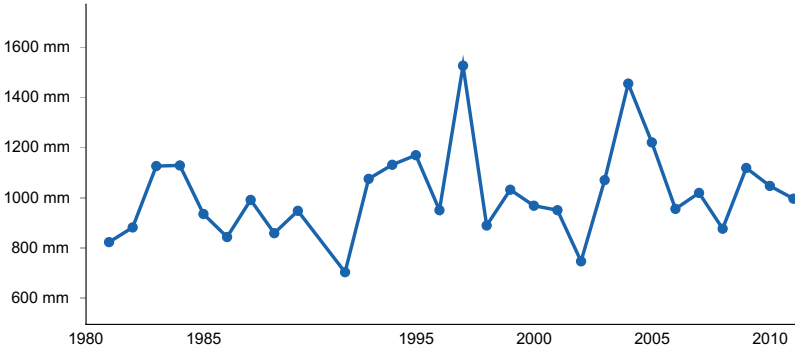


Figure 3. Annual precipitation pattern

Climate stations used

- (1) KEARNEYSVILLE [USC00464763], Kearneysville, WV
- (2) CHAMBERSBURG 1 ESE [USC00361354], Chambersburg, PA
- (3) WINCHESTER 7 SE [USC00449186], Winchester, VA

Influencing water features

The Poorly Drained Calcareous Bottomland 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 Calcareous Bottomland Ecological Site classifies as a Palustrine Forested Broad-leaved Deciduous Seasonally flooded/saturated wetland (PFO1E) (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. The Poorly Drained Calcareous Bottomland classifies as Riverine Upper Perennial (Smith 1995; Brooks, Brinson et. al., 2013). Riverine wetlands occur in floodplains and riparian corridors in association with stream channels. Dominant water sources are overbank flow from the stream channel or subsurface hydraulic connections between the channel and wetlands. Additional water sources may be occasional overland flow from adjacent uplands, tributary inflow, and precipitation. At their headwaters, the upper perennial riverine wetlands may intergrade with slope or depressional wetlands as the channel (bed) and bank disappear, or they may intergrade with poorly drained flats or uplands.

Soil features

The soil series associated with this site are Warners and Fairplay which are poorly drained hydric soils that contain calcium carbonate. The somewhat poorly drained McGary soils are also included. The parent material is alluvium and lacustrine material derived from marl and mixed sedimentary geologies of limestone, sandstone, siltstone, and shale. These soils are hydric and are inundated or saturated through much of the growing season. They are slightly to moderately alkaline. Surface textures are silt loams, and subsoils are loamy with textures ranging from silt loam, loam, silty clay loam, sandy loam, clay loam, or clay. These soils are of limited extent. Soils data was obtained from the Natural Resources and Conservation Service (NRCS) National Soils Information System database (USDA 2015).

Marl has been defined as a ‘soft, loose, earthy, material that consists of varying amounts of calcium carbonate, clay, and silt and is formed primarily in freshwater conditions’ (Hubbard and Herman, 1990). Marl deposits are limited in extent but are found in parts of the limestone valleys in the Ridge and Valley region. The calcium carbonate in the marl was developed through the accumulation of carbonate by certain algae species (Chara sp.) (Shaw and Rabenhorst 1997). The accumulations occurred in ponds which are now extinct.

Table 4. Representative soil features

Parent material	(1) Alluvium–argillaceous limestone (2) Lacustrine deposits–sandstone and shale
Surface texture	(1) Silt loam
Family particle size	(1) Loamy
Drainage class	Very poorly drained
Permeability class	Moderate to rapid
Soil depth	157–201 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	18.03–18.54 cm

Calcium carbonate equivalent (0-101.6cm)	0–85%
Soil reaction (1:1 water) (0-101.6cm)	7–8.2
Subsurface fragment volume <=3" (Depth not specified)	2–6%
Subsurface fragment volume >3" (Depth not specified)	0%

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 USDA Plants database was used to verify species' scientific and common names (USDA 2017).

The Poorly Drained Calcareous Bottomland ecological site is of limited extent. It is found where calcium rich groundwater seeps onto toeslopes, floodplains, backwater areas, and heads of springs in limestone valleys and results in the accumulation of calcium carbonate. Parent material is composed of alluvium derived from this calcium rich sediment, or where it has formed in place, as in the case of marl.

Most of this ecological site has been cleared for pasture or agriculture or is used for wetland wildlife habitat. The reference plant community is part of the Laurentian-Acadian Wet Meadow Shrub Swamp System CES201.82 (NatureServe 2009; Landfire 2010). This system encompasses shrub swamps and wet meadows on mineral soils of the Northeast and upper Midwest. They are commonly flooded for part of the growing season but often do not have standing water throughout the season. The system can have a patchwork of shrub and grass species dominance. Trees are generally absent and, if present, are scattered. Some areas are described as fens which are wetlands that are primarily fed by mineral rich groundwater and tend to accumulate peat. Other areas are slightly drier and are described as meadows, although the soil may remain saturated to the surface throughout most of the year.

A few plant communities unique to these calcareous areas and composed of species more commonly found in the Midwest have been described on these landscapes. Variations of the vegetation association known as the Shenandoah Valley Wet Prairie (CEGL006170, NatureServe 2015) have been described in Virginia and West Virginia and may occur in Pennsylvania. This calcareous, herbaceous community occurs in saturated areas on level alluvium with somewhat poorly to poorly drained soils.

Vegetation is a graminoid-dominated wetland with <1% cover of woody plants in high-quality stands. The association includes the species *Carex tetanica* (Rigid sedge), *Carex prairea* (Prairie sedge), *Eleocharis erythropoda* (Bald Spikerush), and *Lysimachia quadriflora* (Four-Flower Yellow Loosestrife). Woody swamp plants that can invade this site are *Acer rubrum* (red maple), *Fraxinus pennsylvanica* (Green ash), and *Rosa palustris* (Swamp rose). In Virginia, the following state rare species have been documented on these wet prairie fens: *Eutrochium maculatum* (Spotted joe pye weed), *Juncus nodosus* (Knotted rush) and *Scutellaria galericulata* (Marsh skullcap) (Bousquet and Fleming 2017). Other species include *Glyceria striata* (Fowl mannagrass), *Mimulus ringens* (Allegheny monkeyflower) and *Pilea fontana* (Lesser clearweed). *Schedonorus arundinaceus* (Tall fescue) is a common invader following heavy grazing. *Carex stricta* (Tussock sedge), *Carex trichocarpa* (Hairy-fruit sedge)-rare, *Polygonum amphibium* (Water smartweed), *Typha latifolia* (Broad-leaved cattail), *Eleocharis erythropoda* (Bald spike-rush) - rare, *Hierochloe hirta* ssp. arctica (Holy grass)-rare, Juncus balticus (Baltic rush)-rare, and *Juncus*

torreyi (Torrey's rush)-rare among others have been documented in these marshes in West Virginia (Davis and Davis, 2006).

Much of this ecological site has been drained and converted to agriculture. The few open marshes that remain could reflect pre-settlement vegetation. Some of the rare plant species occur at the southern edge of their range, and may therefore represent relict communities from a colder glacial period (Bousquet and Fleming, 2017). These species persisted here even as the post glacial climate warmed due to the continuous abundant calcium rich water supply which allowed a very long-term consistent environment. Fire may have played a role in preventing forest development as the accumulation of biomass and surface litter could have been susceptible to fires in dry periods (Bartgis and Lang, 1984).

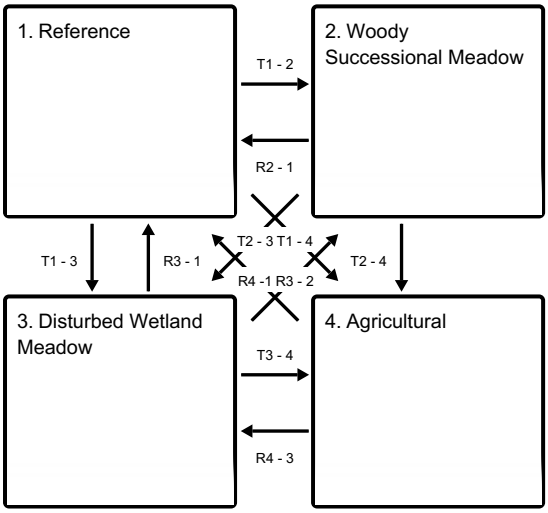
Areas that have not been drained are still susceptible to human disturbance from runoff from upland landscapes, deposition of eroded sediments, grazing, and invasion by non-native or aggressive plant species. Nearby changes in hydrology from human use have impacted the hydrology within these wetlands. Slightly drier areas can allow trees and shrubs to become established. Fire suppression may also promote the development of woody plants. Alternate states for this ecological site are agricultural land, old field, or successional wetland woodland.

The combination of landscape, geology, calcium rich groundwater, climate, and marl soil support a distinctive ecological community that is characterized by native wetland calciphiles (calcium-loving plants). These special habitats are of limited extent and may be good candidates for conservation and/or restoration practices.

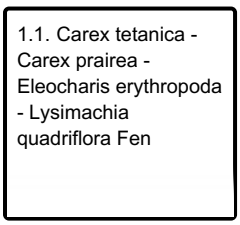
The information presented is representative of very complex vegetation communities. Key indicator plants and ecological processes are described to help inform land management decisions. Plant communities will differ across the major land resource region because of the naturally occurring variability 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. Transformation and restoration pathways for this ecological site are not well understood.

State and transition model

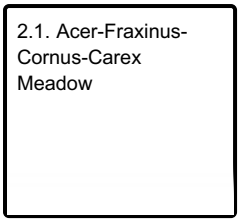
Ecosystem states



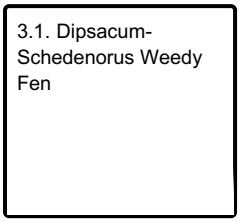
State 1 submodel, plant communities



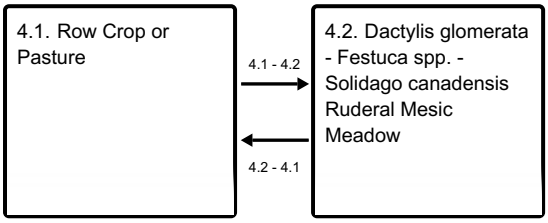
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



State 1
Reference

The reference state is an open herbaceous wetland fed by mineral rich groundwater. Called fens, these areas support rare calciphiles (calcium loving plants) and many wetland plant species. Some vegetation communities may be endemic to a specific site. Variations of the reference state have been described in West Virginia, Virginia, and may exist in Pennsylvania. Most of this ecological site has been drained and converted to agriculture. This state and transition model is not intended to cover every situation nor the full range of conditions and species.

Community 1.1
Carex tetanica - Carex prairea - Eleocharis erythropoda - Lysimachia quadriflora Fen

The Rigid Sedge - Prairie Sedge - Bald Spikerush - Four-flower Yellow Loosestrife Fen, also known as the Shenandoah Valley Wet Prairie (CEGL006170; NatureServe 2017) occurs in saturated areas on level alluvium with somewhat poorly to poorly drained soils. Vegetation is a graminoid-dominated wetland with <1% cover of woody plants in high-quality stands. Key species include *Carex tetanica* (Rigid sedge), *Carex prairea* (Prairie sedge), *Carex interior* (Inland sedge), *Carex suberecta* (Priarie straw sedge), *Carex emoryi* (Emory's sedge), *Eleocharis erythropoda* (Bald spikerush), *Hierochloe odorata* (Sweetgrass), *Lysimachia quadriflora* (Fourflower yellow loosestrife), *Pycnanthemum virginianum* (Virginia mountainmint), and Juncus balticus var. littoralis (Baltic rush). A similar type may also occur in the midwestern United States. This community has been documented primarily from three sites in the Shenandoah Valley of Virginia, but similar communities have been documented in West Virginia and are characterized by the dominance of *Carex pellita* (Woolly sedge), and *Carex stricta* (Tussock sedge). Other species include, *Lythrum alatum* (Winged lythrum), *Filipendula rubra* (Queen of prairie), *Carex buxbaumii* (Buxbaum's sedge), *Equisetum arvense* (Field horsetail), *Pycnanthemum virginianum* (Virginia mountainmint), *Vernonia noveboracensis* (New York ironweed), Verbena hastate (Swamp verbena), *Cardamine bulbosa* (Bulbous bittercress), *Viola cucullata* (Marsh blue violet) , *Lathyrus palustris* (Marsh pea), *Pedicularis lanceolata* (Swamp lousewort), and *Oxypolis rigidior* (Stiff cowbane). In the absence of active disturbance regimes, stands of this community are susceptible to invasion by woody swamp plants, including *Acer rubrum* (Red maple), *Fraxinus pennsylvanica* (Green ash), and *Rosa palustris* (Swamp rose), as well as by exotics such as *Elaeagnus umbellata* (Autumn olive). This community contains the southernmost occurrence of *Carex prairea* (Prairie sedge).

State 2

Woody Successional Meadow

Community 2.1
Acer-Fraxinus-Cornus-Carex Meadow

The Acer-Fraxinus-Cornus-Carex meadow is present in areas where woody vegetation is able to become established. This could be the result of local or nearby disturbance that has altered the hydrology so that parts of the marsh are no longer continually wet and flooding becomes seasonal or temporary. Species may include Acer Saccharinum (Silver maple), *Acer rubrum* (Red maple), *Acer negundo* (Box elder), *Fraxinus pennsylvanica* (Green ash), *Platanus occidentalis* (American sycamore), *Cornus amomum* (Silky dogwood), Salix spp. (Willow), Lonicera spp. , (Honeysuckle) in addition to the sedges and herbaceous species found in the reference community.

State 3
Disturbed Wetland Meadow

Community 3.1
Dipsacum-Schedenorus Weedy Fen

The Teasel-Fescue weedy fen alternate state occurs as a result of internal or external disturbance like grazing within the fen, or adjacent development with subsequent runoff which provide avenues for invasion of weedy species from much altered and developed uplands (Bousquet and Fleming 2017) and the disappearance of rare species (Bartgis and Landis 1984). The original marsh soil surface is covered with several inches of alluvial sediment from eroded nearby uplands. Plant species may include a mixture of native and non-native species in addition to species listed in the reference community. Species may include *Dipsacus fullonum* (Fuller's teasel), *Dipsacus laciniatus* (Cutleaf teasel), *Schedonorus arundinaceus* (Tall fescue), *Carduus acanthoides* (Spiny plumeless thistle), Cirsium spp. (Thistle), *Mentha spicata* (Spearmint), *Poa pratensis* (Kentucky bluegrass), *Impatiens capensis* (Jewelweed), *Typha latifolia* (Cattail), *Schizachyrium scoparium* (Little bluestem), *Vernonia noveboracensis* (New York ironweed), *Pilea pumila* (Clearweed), *Mimulus ringens* (Allegheny monkeyflower), *Polygonum cespitosum* (Oriental lady's thumb), *Solidago altissima* (Canada goldenrod), *Lycopus virginicus* (Virginia water horehound), Carex spp. (sedges), Scirpus spp. (Bulrush), and Juncus spp. (Rush). Other variations of this state include a *Phalaris arundinacea* (Reed canarygrass) dominated marsh (CEGL006044, NatureServe 2017), or a *Typha latifolia* (Cattail) dominated community (CEGL004150, NatureServe 2017).

State 4
Agricultural

Community 4.1
Row Crop 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 4.2
Dactylis glomerata - Festuca spp. - Solidago canadensis Ruderal Mesic Meadow

The Orchardgrass - Fescue species - Canada Goldenrod Ruderal Mesic Meadow Alliance (A1190, NatureServe 2017) is a broadly defined community which includes mesic abandoned pastures and agricultural fields and is largely composed of non-native cool-season grasses and herbs (generally of European origin) in the early stages of succession. This community is assumed to exist on this ecological site where sites were drained and planted at one time for pasture. Species composition varies from site to site, depending on land-use history and perhaps soil type, but in general this vegetation is quite wide-ranging in northeastern and midwestern states. Dominant grasses vary from site to site but generally include the exotic grasses *Agrostis stolonifera* (Creeping bentgrass), *Agrostis hyemalis* (Winter bentgrass), *Anthoxanthum odoratum*, (Sweet vernalgrass), *Bromus inermis* (Smooth Bromegrass), *Bromus tectorum* (Cheatgrass), *Dactylis glomerata* (Orchardgrass), Schedonorus arundinaceum (Tall fescue), *Lolium perenne* (Perennial ryegrass), Phleum pretense (Timothy) as well as weedy natives such as *Elymus repens* (Quackgrass), *Poa pratensis* (Kentucky bluegrass), and, less commonly, *Schizachyrium scoparium* (Little bluestem). Herbaceous species may be minor or dominant and include various Solidago spp. (goldenrods),

Sympyotrichum spp. (Asters), and other native and non-native species. *Juniperus virginiana* (eastern redcedar), is a woody species that has been observed in old fields of this ecological site.

Pathway 4.1 - 4.2
Community 4.1 to 4.2

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

Pathway 4.2 - 4.1
Community 4.2 to 4.1

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

Transition T1 - 2
State 1 to 2

Woody vegetation may become established due to disturbance of the fen hydrology. Pre-settlement fire may have contributed to maintaining the open wetlands, therefore fire suppression since human encroachment may contribute to the growth of trees and shrubs.

Transition T1 - 3
State 1 to 3

Deposition of transported soil material from adjacent disturbance provides avenues for invasive plant species to be introduced, and may change the chemistry of the system to no longer be as favorable to rare calciphiles. Livestock grazing disturbs the natural plant community.

Transition T1 - 4
State 1 to 4

Drainage; tillage; conservation cropping system established

Restoration pathway R2 - 1
State 2 to 1

Removal of woody plant species, seeding with native vegetation, and return of natural hydrology. Prohibit grazing by livestock. 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.

Conservation practices

Brush Management
Critical Area Planting
Fence
Wetland Wildlife Habitat Management
Early Successional Habitat Development/Management
Wetland Restoration
Herbaceous Weed Control

Transition T2 - 3
State 2 to 3

Shifts in hydrology that allow continuous saturation may inhibit growth of woody plant species. Livestock grazing may maintain and encourage grass and herbaceous species. Prescribed fire could potentially promote the return to an open marsh condition.

Transition T2 - 4
State 2 to 4

Removal of woody plant species, installation of drainage systems, tillage and planting of row crops or non-native pasture grasses.

Restoration pathway R3 - 1
State 3 to 1

Plant native seeds and seedlings, exclude livestock grazing, eliminate and manage nonnative and aggressive species, minimize influence of adjacent disturbances with establishment of a buffer area or other barrier. An even more aggressive treatment would involve removal of the recently deposited alluvium and excavation down to the original fen soil and organic material surface. 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; Herbaceous Weed Control-315; Wetland restoration-657; Wetland Wildlife Habitat Management-644.

Conservation practices

Brush Management
Critical Area Planting
Fence
Wetland Wildlife Habitat Management
Early Successional Habitat Development/Management
Wetland Restoration
Herbaceous Weed Control

Restoration pathway R3 - 2
State 3 to 2

Woody vegetation may become established due to disturbance to the fen hydrology causing seasonal drier periods. Pre-settlement fire may have contributed to maintaining the open wetlands, therefore fire suppression since human encroachment may have contributed to the growth of trees and shrubs.

Transition T3 - 4
State 3 to 4

Installation of drainage systems, tillage, and establishment of row crops or non-native pasture grasses.

Restoration pathway R4 -1
State 4 to 1

Plant native seeds and seedlings, exclude livestock grazing, eliminate and manage nonnative and aggressive species, minimize influence of adjacent disturbances with establishment of a buffer area or other barrier. An even more aggressive treatment would involve removal of the recently deposited alluvium and excavation down to the original fen soil and organic material surface. 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; Herbaceous Weed Control-315; Wetland restoration-657; Wetland Wildlife Habitat Management-644.

Conservation practices

Brush Management
Critical Area Planting
Fence
Wetland Wildlife Habitat Management
Early Successional Habitat Development/Management
Wetland Restoration
Herbaceous Weed Control

Restoration pathway R4 - 3
State 4 to 3

Cessation of active agricultural management and maintenance of drainage systems.

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.

Bartgis, R.L. and G.E. Lang. 1984. Marl wetlands in eastern West Virginia: distribution, rare plants, and recent history. Castanea 49: 17-25.

Bousquet, W.S. and G.P. Fleming, 2017. Floristics of the Abrams Creek Wetlands, a Calcareous Fen Complex in Winchester City and Frederick County, Virginia. Castanea 82(2): 132-155.

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.

Davis, C.A. and L.M. Davis. 2006. Cool Spring Farm Marl Marsh: A Shenandoah Valley Wet Prairie Variant, Bullskin Run Drainage, Jefferson County, West Virginia. A Qualitative Plant Survey. Luthersville, MD.

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.

Hubbard, D.A. and J.S. Herman., 1990. Overview of travertine-marl volume. In: Travertine-Marl: Stream Deposits in Virginia; Virginia Division of Mineral Resources. Publication #101:1-4.

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 2015. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://explorer.natureserve.org. (Accessed: November-December 2015).

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.

Shaw, J.N. and M.C. Rabenhorst. 1997. The geomorphology, characteristics, and origin of the freshwater marl sediments in the Great Limestone Valley, Maryland, USA. Catena 30, pp. 41-59.

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, 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, National Water and Climate Center, http://www.wcc.nrcs.usda.gov, Accessed February 2015.

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

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_054242 accessed (09/18/2016).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2015. The PLANTS Database (http://plants.usda.gov, December 2017). National Plant Data Team, Greensboro, NC 27401-4901 USA.

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.

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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:**

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2. **Presence of water flow patterns:**

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3. **Number and height of erosional pedestals or terracettes:**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

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5. **Number of gullies and erosion associated with gullies:**

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

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

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

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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

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

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

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

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17. **Perennial plant reproductive capability:**
