

Ecological site F147XY015PA

Frigid Mixed Sedimentary Upland

Last updated: 9/27/2024
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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 Frigid Mixed Sedimentary Upland ecological site occurs within 67c, Northern Sandstone Ridges, and 67d, Northern Dissected Ridges of EPA Ecoregion IV (Woods et. al. 1996).

Ecological site concept

The Frigid Mixed Sedimentary Upland ecological sites are currently mapped in only three counties in MLRA 147: Highland County and Bath County in Virginia, and Pocahontas County in West Virginia. These areas are high elevation mountain slopes, summits, shoulders, and drainage ways ranging from approximately 3000 to 4300 feet (914 to 1311m). The parent material is residuum and colluvium formed in acidic and noncalcareous sandstone, shale and siltstone. Depth to bedrock or a root restrictive layer is less than 30 inches (76 cm) and the seasonal high water table occurs within 18 to 42 inches (46 to 107cm) of the soil surface. Higher elevations, cooler temperatures, and exposed ridge crests and slopes distinguishes this ecological site from other sandstone and mixed sedimentary uplands. In general, oaks dominate this ecological site, most commonly *Quercus rubra* (northern red oak) and *Quercus alba* (white oak), with the individuals often stunted or wind-flagged. *Castanea dentata* (American chestnut) sprouts are also common, but the importance of chestnut in these forests has been dramatically reduced by a fungal parasite which caused chestnut blight. Tree associates in the canopy and subcanopy can include *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Betula lenta* (sweet birch), *Prunus serotina* (black cherry), *Tsuga canadensis* (eastern hemlock), *Quercus velutina* (black oak), and *Quercus prinus* (chestnut oak), which is mostly restricted to elevations lower than those at which this type prevails. *Ilex montana* (mountain holly) and *Rhododendron prinophyllum* (early azalea) are characteristic shrubs. An uncommon variant of this community type, usually occupying sharply convex landforms with soils shallow to bedrock, contains a dense shrub layer composed largely of *Kalmia latifolia* (Mountain laurel).

Table 1. Dominant plant species

Tree	(1) <i>Quercus rubra</i> (2) <i>Quercus alba</i>
Shrub	(1) <i>Ilex montana</i>
Herbaceous	(1) <i>Dennstaedtia punctilobula</i> (2) <i>Lysimachia quadrifolia</i>

Physiographic features

The Frigid Mixed Sedimentary Upland ecological sites are found on high elevation mountain slopes, summits, shoulders, and drainage ways in the southwestern section of MLRA 147, the Northern Appalachian Ridges and Valleys. Elevation ranges from approximately 3000 to 4300 feet (914 to 1311 m). The parent material is residuum and colluvium formed in acidic and noncalcareous sandstone, shale and siltstone. Depth to bedrock or a root restrictive layer is less than 30 inches (76cm). Most sites on upper and middle slopes and summits are well to excessively well drained, but lower slopes may be moderately well drained with a seasonal high water table between 18 to 42 inches (46 to 107 cm) due to the presence of a dense subsoil layer called a fragipan. The fragipan limits the downward growth of tree roots and impedes the drainage of water.

This ecological site is not subjected to flooding or ponding. Slopes can be moderate to very steep. Terrain is typically mountainous.

Table 2. Representative physiographic features

Landforms	(1) Mountain (2) Hill (3) Cove
Runoff class	High
Elevation	880 – 1,310 m
Slope	10 – 80 %
Water table depth	50 – 110 cm
Aspect	N

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 1 weather station in 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 (characteristic range)	110 days
Freeze-free period (characteristic range)	130 days
Precipitation total (characteristic range)	1,120 mm
Frost-free period (actual range)	110 days
Freeze-free period (actual range)	130 days
Precipitation total (actual range)	1,120 mm
Frost-free period (average)	110 days
Freeze-free period (average)	130 days
Precipitation total (average)	1,120 mm

- (1) BARTOW 1S [USC00460509], Arbovale, WV

Influencing water features

This ecological site is not influenced by wetland riparian water features.

Soil features

The representative soil series associated with this site are: Snowdog, Paddyknob, Mandy, and Madsheep. They formed from mixed geologies of sandstone, shale, and siltstone. Most of these soils formed through the weathering of rock in place. Soils on the lower slopes, coves, and drainage ways developed from material that moved from upper to lower slope positions. Bedrock is generally less than 30 inches (76cm) from the surface and the soils are well drained to excessively well drained. Lower slope landscape positions may be moderately well drained due to the presence of a dense subsoil layer called a fragipan which impedes the drainage of water. Soil pH is relatively low ranging from 4.2 to 4.6. Surface textures are loam and silt loam, subsurface textures are loamy, with rock fragment content that can range from 0 to 65% by volume. Soils data was obtained from the Natural Resources and Conservation Service (NRCS) National Soils Information System database (USDA 2015).

These soils formed at elevations generally over 3000 feet (914 m) and have frigid temperature regimes. In general, a soil with a frigid temperature regime has an average annual temperature that is lower than 46.4° F (8°C) and the difference between average summer and average winter soil temperatures is more than 42.8°F (6°C) (Soil Survey Staff 1999). Soil temperature is measured at 20 inches depth (50cm). In contrast, most soils in the Northern Ridge and Valley region have an average soil temperature that is greater than or equal to 46.4° F (8°C). Soil temperature regime has implications for the kind of vegetation that is present. The higher elevation and cooler temperatures allows for the presence of plant species and communities more typical of the northern United States.

Table 4. Representative soil features

Parent material	(1) Residuum – sandstone and shale (2) Colluvium – sandstone and siltstone
Surface texture	(1) Channery loam (2) Very channery silt loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to somewhat excessively drained
Permeability class	Very slow to rapid
Soil depth	50 – 90 cm
Surface fragment cover ≤3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	5.33 – 15.24 cm
Soil reaction (1:1 water) (0-101.6cm)	4.2 – 4.6
Subsurface fragment volume ≤3" (Depth not specified)	0 – 10 %
Subsurface fragment volume >3" (Depth not specified)	20 – 70 %

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 Virginia (Fleming et al. 2013) and West Virginia (WVDNR 2014). 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 Frigid Mixed Sedimentary Upland 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). This ecological site is found on high elevation mountain slopes, summits, shoulders, and drainage ways in the southwestern section of the region.

The reference plant community is part of the Central and Southern Appalachian Montane Oak Forest System (CES202.596) as defined by NatureServe (NatureServe 2009; Landfire 2010). This generally oak-dominated system is found in the central and southern Appalachian Mountains. The high-elevation deciduous forests occur on exposed sites, including ridge crests and south- to west-facing slopes, mostly between 3000 to 4500 feet (915 and 1372 m) elevation, less commonly ranging up to 5500 feet (1680 m). In most areas attributed to this system, the soils are thin, weathered, nutrient-poor, low in organic matter, and acidic. The forests are dominated by *Quercus* spp. (oak), most commonly *Quercus rubra* (Northern red oak) and *Quercus alba* (White oak), with the individuals often stunted or wind-flagged. *Castanea dentata* (American chestnut) sprouts are also common, but the importance of chestnut in these forests has been dramatically altered by chestnut blight. *Ilex montana* (Mountain holly) and *Rhododendron prinophyllum* (Early azalea) are characteristic shrubs. An uncommon variant of this community type, usually occupying sharply convex landforms with soils shallow to bedrock, contains a dense shrub layer composed largely of *Kalmia latifolia* (Mountain laurel).

Most stands likely experience frequent high winds and ice damage. The composition and structure of nearly all examples of this community type in Virginia have been altered by logging in the late 19th and early 20th centuries and by the loss of American chestnut as an important component in the 1930s. Fire dynamics in these high elevation areas are not well-known, although oak forests historically have been maintained by periodic fire. Fire suppression since the early 20th century in the eastern United States is believed to be leading to the overall replacement of oaks with fire-sensitive, non-oak species like maples, beeches, birches, tulip poplars, and black cherry (Brose et. al., 2008). Due to high elevation, steepness, and rockiness, this ecological site is not conducive to agriculture.

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

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 6. Community 2.1 plant community composition

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

Site Development and Testing Plan Future work is needed, as described in a future project plan, to validate the information presented in this provisional ecological site description. Future work includes field sampling, data collection and analysis by qualified vegetation ecologists and soil scientists. As warranted, annual reviews of the project plan can be conducted by the Ecological Site Technical Team. A final field review, peer review, quality control, and quality assurance reviews of the ESD are necessary to approve a final document.

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Approval

Nels Barrett, 9/27/2024

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 Mike McDevitt, Soil Scientist, NRCS, Mill Hall, PA Nels Barrett, Ph.D, Regional Ecological Site Specialist, NRCS, Amherst, MA Ephraim Zimmerman, Ecological Assessment Manager, Western PA Conservancy, Pittsburgh, PA Don Flegel, Resource Soil Scientist, NRCS, Harrisonburg, VA 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	08/30/2026
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. Number and extent of rills:

2. Presence of water flow patterns:

3. Number and height of erosional pedestals or terracettes:

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

5. Number of gullies and erosion associated with gullies:

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:
