USDA Natural Resources Conservation Service

Ecological site F130AY004PA
Quartzitic Upland

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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): 130A–Northern Blue Ridge

Major Land Resource Area 130A is in the Northern Section of the Blue Ridge Province of the Appalachian Highlands. The region is characterized by rugged mountains with steep slopes, sharp crests, and narrow valleys. The mountain range forms a narrow band that runs north to south between the Piedmont Upland Section to the east, the Ridge and Valley section to the west, and the Southern Section of the Blue Ridge to the south. Stream dissection is deep and intricate. Major streams and their tributaries flow through gorges and gaps. Elevation ranges from about 820 feet (250 meters) in the lower valleys and on footslopes along the Potomac River just east of Harpers Ferry, where West Virginia joins Maryland and Virginia, to more than 4,200 feet (1,280 meters) along the Appalachian Trail in Bedford County, Virginia. Apple Orchard Mountain, the highest peak, is at an elevation of 4,225 feet (1,288 meters) (USDA 2006).

The backbone of the northern Blue Ridge is an anticline composed of rocks that can be can be divided into geological groupings based on age. In general, the oldest rocks are the furthest east, and become younger towards the west (Fichter and Baedke, 2000; Barnes and Sevon, 2002). The first group are plutonic rocks that formed when liquid molten rock, called magma, solidified deep within the earth’s crust over a billion years ago. Collectively referred to as the Grenville rocks, they make up much of the eastern half of the mountains and are composed of granites, gneisses, and granulites. The second group, characterized by the Catoctin greenstone formation, is slightly younger, and is made up of metabasalts and metarhyolites, types of igneous rocks that have been metamorphosed by heat and pressure. The third group was formed during the Cambrian period about 500 million years ago and are represented by the Harpers, Antiedam, Weverton, and Loudoun formations which comprise the Chilhowee group. These rocks are primariliy quartzites, phyllites, and meta-sandstones, and form the western flank of the Blue Ridge.

Preliminary ecological site differentiation is based on these three main age groups and geologies. The variable characteristics of the underlying rocks give rise to different soil physical and chemical properties and exert control on the landscape, slope shape, aspect, and elevation, all of which affect vegetation.

Classification relationships

This ecological site is found in Major Land Resource Area 130a - the Northern Blue Ridge. MLRA 130a is located within Land Resource Region N - the East and Central Farming and Forest Region (USDA 2006), and in United States Forest Service ecoregion M221D - the Central Appalachian Broadleaf Forest-Coniferous Forest-Meadow Province (Bailey 1995). In addition, MLRA 130a falls within area #66 of EPA Ecoregion Level III - the Blue Ridge Mountains (USEPA 2013). The Quartzitic Upland ecological site occurs within 66b, the Northern Sedimentary and Metasedimentary Ridges of EPA Ecoregion IV (Woods et. al. 1996).

Central Appalachian Dry Oak-Pine Forest System - CES202.591
Quercus prinus - (*Quercus coccinea*, *Quercus rubra*) / *Kalmia latifolia* / *Vaccinium pallidum* Forest Association (CEGL006299)

Northeastern Interior Dry-Mesic Oak Forest System - CES202.592
Quercus prinus - *Quercus rubra* / *Hamamelis virginiana* Forest Association (CEGL006057)

Central Appalachian Pine-Oak Rocky Woodland System - CES202.600
Quercus prinus - *Pinus virginiana* - (*Pinus pungens*) / *Schizachyrium scoparium* - *Dichanthelium depauperatum* Woodland Association (CEGL008540)

(NatureServe, 2017)

Ecological site concept

The Quartzitic Uplands are located in the Northern Blue Ridge region of the Appalachian highlands. They occur on geologies of quartzite and sandstone. Typical landscapes are mountain summits, shoulders, and sideslopes. The ecological site can be found on the entire hill or mountain slope, with the shallower areas occupying the convex summits and shoulders. Soils range from extremely to very strongly acid and are well drained to excessively well drained. Surface soil textures are loamy sand and sandy loam. Patches of exposed ridgetops and outcrops are included, as well as small sheltered drainageways and coves which may support plant communities that are different from the predominant forest type. This site is distinguished from other mountainous and hilly areas of the Blue Ridge by its distinctive quartzitic and sandstone geology. Other major ecological sites are underlain by metabasalts which weather into soils with more inherent fertility; and phyllite, metamorphic sandstones, and granitic geologies that are similar but not as dry nor as acidic.

The reference state is a combination of several vegetation communities within the Central Appalachian Dry Oak-Pine Forest, the Northeastern Interior Dry-Mesic Oak Forest, and the Central Appalachian Pine-Oak Rocky Woodland Forest Systems as defined by NatureServe (NatureServe 2009). The forest is mostly closed-canopy but can include patches of more open woodlands. The coarse, acidic, well drained soils, will host a variable mixture of dry-site oak and pine species. Heath shrubs are common in the understory. Convex, shallow, exposed ridgetop, and rocky areas will tend to have more open canopies as well as grasslands, and will include pine species and herbaceous species that tolerate very dry conditions. A small percentage (6 percent) of this ecological site has some kind of successional, ruderal forest. There is little or no agricultural state currently documented.

Associated sites

F130AY006PA	**Quartzitic Footslopes And Terraces** The Quartzitic Footslopes and Terraces ecological site occurs on lower slopes below the Quartzitic Uplands and on nearby concave areas and drainageways.

Similar sites

F147XY004PA	**Sandstone Upland** The Sandstone Upland provisional ecological site of Major Land Resource Region 147 – Northern Ridge and Valleys is very similar and future field work and analysis may result in combining these ecological sites.

Table 1. Dominant plant species

Tree	(1) *Quercus prinus* (2) *Quercus coccinea*
Shrub	(1) *Kalmia latifolia* (2) *Vaccinium pallidum*
Herbaceous	Not specified

Physiographic features

The Quartzitic Upland occurs on geologies of quartzite and sandstone mostly along the western side of the Northern Blue Ridge major land resource area. Typical landscapes are mountain summits, shoulders, and sideslopes. The ecological site can be found on the entire hill or mountain slope from top to bottom, with the shallower areas

occupying the convex summits and shoulders. Elevation ranges from 800 to 3000 feet (244 to 915m). Slopes range from 3 to 80 percent. The depth to bedrock ranges from 36 to 60 inches (91 to 152cm). This ecological site is not subject to flooding or ponding.

Table 2. Representative physiographic features

Landforms	(1) Mountain (2) Ridge (3) Mountain slope
Flooding frequency	None
Ponding frequency	None
Elevation	244–914 m
Slope	3–80%
Water table depth	152 cm
Aspect	Aspect is not a significant factor

Climatic features

The Northern Blue Ridge, Major Land Resource Area (MLRA) 130A, appears to have three somewhat distinct sections based on PRISM data for average annual precipitation and minimum average annual temperature (PRISM 2013). The northernmost section that runs from Adams County, Pennsylvania south through Washington County, Maryland has an average annual average precipitation of 38 inches (97cm) in the lower elevations up to 50 inches (127 cm) in the higher elevations - about 2000 feet (610m). The average annual minimum temperature is 40 to 44°F (4.4 to 6.7°C). From Washington County, Maryland south to the northern tip of Rappahannock County, Virginia, the average annual precipitation is less variable, ranging from approximately 38 to 42 inches (97 to 107cm). The average annual minimum temperature remains about the same as to the north, 40 to 44°F (4.4 to 6.7°C). The lower third of MLRA 130A starting from northern Rappahannock County down through Bedford County, Virginia receives more moisture and is colder, with average annual precipitation that ranges from 40 (107cm) to greater than 50 inches (127cm) at elevations higher than 2000 feet (610m) which is a significant part of this section of the MLRA. Average minimum temperatures range from 34°F (1.1°C) at elevation greater than 3000 feet (914m) to 38°F (3.3°C) at the lowest elevations, less than 1000 feet (305m).

These three climate regions seem to correspond to differences in elevation and relief. Most of the Blue Ridge ranging from Adams County, Pennsylvania through Maryland to Rappahannock County, Virginia rises no higher than 2000 feet (610m). Much of the Blue Ridge south of and including Rappahannock County rises above 2000 feet up to 4000 feet (610 to 1219m).

The higher elevations interact with moist air that flows inland from the Atlantic Ocean. Along the east coast of the United States, winter storms moving across the continent encounter the warm Gulf Stream waters and begin to track northeastward paralleling the coast. As the moisture-laden air from the storms crosses Virginia, the eastern slopes and foothills of the Blue Ridge receive much of this precipitation (Hayden and Michaels 2017). In addition, the high relief of the mountains intercepts much of any moisture moving inland from the east coast. The Shenandoah Valley which lies just to the west of the Blue Ridge is one of the driest parts of the state of Virginia. Where the Blue Ridge elevation is greater than 2000 feet (610m), the east-facing slopes appear to receive over 50 inches (127cm) of annual rainfall on average while the Valley to the west of the mountains receives less than 38 inches (97 cm), and the mountains' western footslopes receive 2 to 4 inches (5 to 10cm) less of precipitation than the eastern ones (PRISM). This rain shadow effect is not as pronounced where the ridges are below 1640 ft (500m) of elevation.

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 2 weather stations throughout MLRA 130A 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)	157 days
Freeze-free period (average)	178 days
Precipitation total (average)	1,270 mm

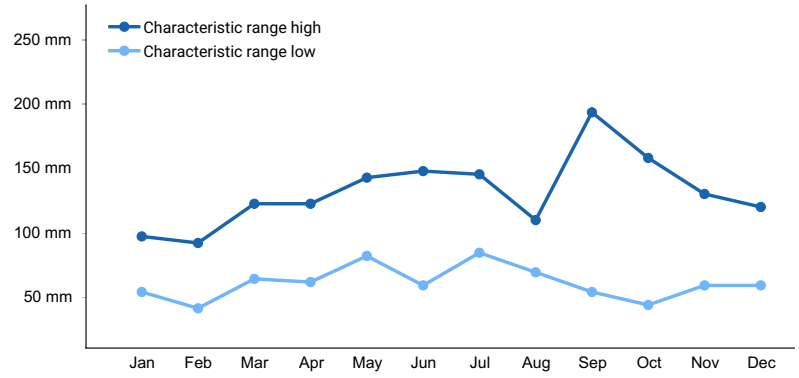

Figure 1. Monthly precipitation range

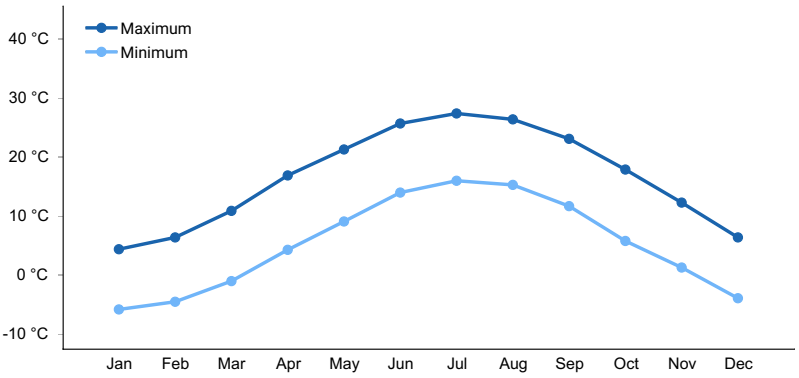

Figure 2. Monthly average minimum and maximum temperature

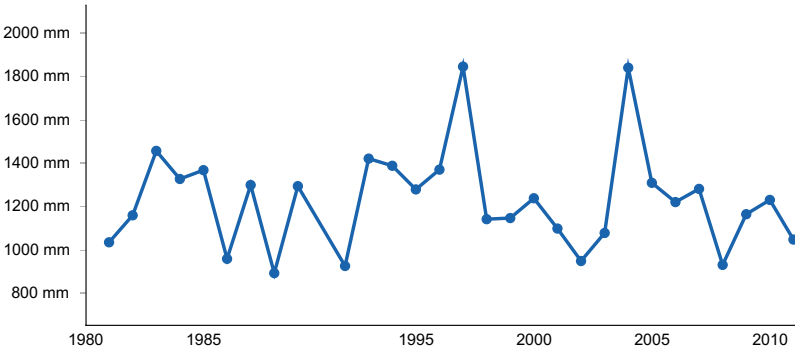

Figure 3. Annual precipitation pattern

Climate stations used

- (1) BIG MEADOWS [USC00440720], Syria, VA
- (2) LURAY 5 E [USC00445096], Luray, VA

Influencing water features

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

Soil features

The soil series associated with this site are Marbleyard and Drall. They have weathered in place from quartzite and sandstone rocks. The depth to bedrock ranges from 36 to 60 inches (91 to 152cm). The soils are well drained to excessively drained with the average water table depth being greater than 60 inches (152cm) below the soil surface. Soil permeability ranges from moderately rapid to rapid. Soil pH is extremely to very strongly acid ranging from 4.0 to 5.0. Surface textures are loamy sand and sandy loam. Subsoil textures tend to be loamy. Soils data was obtained from the Natural Resources and Conservation Service (NRCS) National Soils Information System database (USDA 2015).

Table 4. Representative soil features

Parent material	(1) Residuum–quartzite
Surface texture	(1) Channery sandy loam (2) Very channery loamy sand
Family particle size	(1) Loamy
Drainage class	Well drained to excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	91–152 cm
Surface fragment cover <=3"	0–30%
Surface fragment cover >3"	2–30%
Available water capacity (0-101.6cm)	5.08–7.87 cm
Soil reaction (1:1 water) (0-101.6cm)	4–5
Subsurface fragment volume <=3" (Depth not specified)	8–45%
Subsurface fragment volume >3" (Depth not specified)	0–45%

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, herb). Within the NatureServe database, individual vegetation associations are assigned an identification number called a Community Element Global Code (CEGL). Most of the Information contained in this section was adapted from several sources, including the Nature Conservancy's Northeast Terrestrial and Aquatic Habitat map (Anderson et al., 2013), NatureServe's Ecological Systems of the United States (Comer 2003; NatureServe 2009), and Landfire's Biophysical Settings and Existing Vegetation Type layers (Landfire 2010; Landfire 2013). The USDA Plants database was used to verify species' scientific and common names (USDA, NRCS. 2017).

The characteristic forest system of this ecological site is the Central Appalachian Dry Oak Forest (NatureServe 2009; Anderson et. al. 2013). The coarse, acidic soils, and convex slopes will host a variable mixture of dry-site oak and pine species, including Quercus prinus (Chestnut oak), *Pinus virginiana* (Virginia pine), and *Pinus strobus* (Eastern white pine). These areas will tend to be warmer and drier relative to north-aspect or planar or concave areas. Heath shrubs such as *Vaccinium pallidum* (Blue Ridge blueberry), *Gaylussacia baccata* (Black huckleberry), and *Kalmia latifolia* (Mountain laurel) are common in the understory.

The Northeastern Interior Dry-Mesic Oak Forest also occupies this ecological site, but not to the extent as the Dry Oak Forest (NatureServe 2009; Anderson et. al 2013). This is an oak-dominated, mostly closed canopy forest that occurs as a matrix (dominant) type through much of the Appalachians. It occurs at low to mid elevations on gently rolling to steep topography on planar, slightly concave, and slightly convex slopes. Oak species characteristic of dry to mesic conditions and hickories are dominant in mature stands. These include *Quercus rubra*, *Quercus alba*, *Quercus velutina*, and *Quercus coccinea* (red, white, black, and scarlet oaks) and Carya spp. (Hickories). *Castanea dentata* (American chestnut) was a prominent tree before chestnut blight eradicated it as a canopy constituent.

Convex or south-facing slopes, patches of exposed ridgetop, and rocky areas will host a variable mixture of dry-site oak and pine species, including Quercus prinus (Chestnut oak), and *Pinus virginiana* (Virginia pine) of the Central Appalachian Dry Oak-Pine Forest and Central Appalachian Pine-Oak Rocky Woodland Systems (NatureServe 2009). Heath shrubs such as *Vaccinium pallidum* (Blue Ridge blueberry), *Gaylussacia baccata* (Black huckleberry), and *Kalmia latifolia* (Mountain laurel) are common in the understory. Some parts may have a fairly well-developed heath shrub layer and a graminoid herb layer dominated by Carex pensylanica (Pennsylvania sedge), *Danthonia spicata* (poverty oatgrass), and *Deschampsia flexuosa* (Common hairgrass).

Disturbance agents in these forests include fire, wind throw, and ice damage. Gypsy moths can wreak havoc in the oak over story periodically. 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). Oak forest regeneration is also hindered by heavy deer browsing (Latham et. al. 2005). Deer will selectively consume many native species including oak seedlings and acorns over less palatable species like hay-scented fern and several non-native species including Japanese barberry, Eurasian species of honeysuckle, and garlic mustard.

Parts of this ecological site have been subjected to human activity including logging, settlement, or other disturbance, therefore some of the forests are mid successional, in which pines (typically Virginia or white) may be codominant or dominant. These ruderal (growing where the natural vegetation has been disturbed by humans) forests and woodlands comprise about 6% of the area and are generally characterized by unnatural combinations of species (primarily natives, though they often contain slight or substantial numbers and amounts of species alien to the region as well). Currently, little data has been documented about this post settlement successional state in this ecological site. There may be agricultural lands in the form of pasture and hayland present, but acreage is minimal due to the infertility and dryness of the soils and landscapes. Therefore, no agricultural alternative state is described.
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

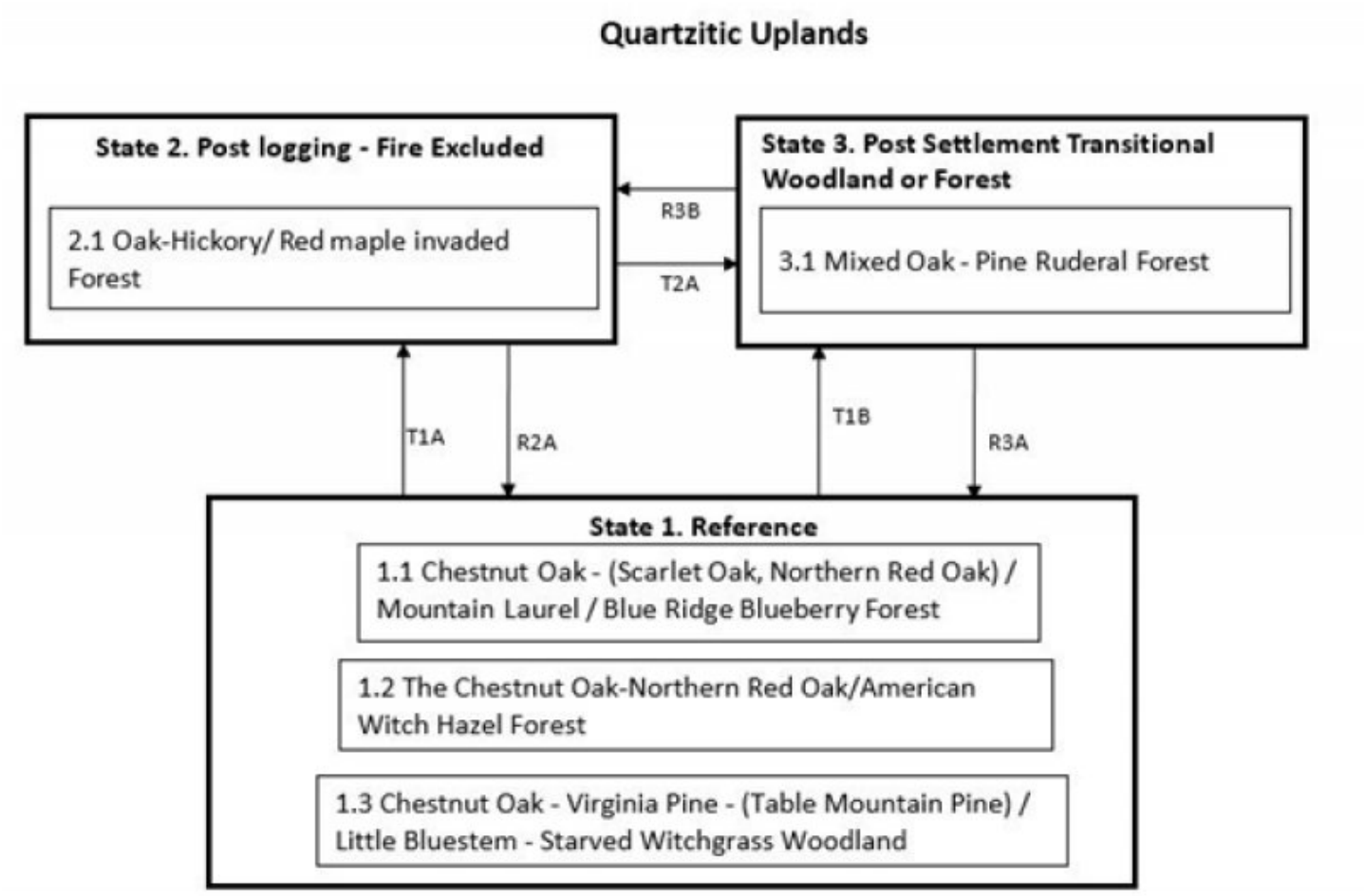

Figure 5. State and Transition Model

Code	Event/Activity
T1A	Logging and subsequent fire suppression, followed by forest regrowth
T1B	Clearcutting, conversion to agricultural land, then successional forest regrowth.
T2A	Clearcutting, conversion to agricultural land, then successional forest regrowth.
R2A	Remove understory to promote growth of oak seedlings; implement a prescribed fire plan.
R3A	Remove understory, plant native seeds and seedlings, eliminate and manage nonnative species, implement a prescribed fire plan.
R3B	Remove understory, plant native seeds and seedlings, eliminate and manage nonnative species, implement a prescribed fire plan.

Figure 6. Legend

State 1
Reference

The reference state is a combination of several vegetation communities within the Central Appalachian Dry Oak-Pine Forest, the Northeastern Interior Dry-Mesic Oak Forest, and the Central Appalachian Pine-Oak Rocky Woodland Forest Systems as defined by NatureServe (NatureServe 2009). These forests are mostly closed-canopy but can include patches of more open woodlands and grasslands. The coarse, acidic, well drained soils, will host a variable mixture of dry-site oak and pine species. Heath shrubs are common in the understory. Convex, shallow, exposed ridgetop, and rocky areas will tend to have more open canopies and will include pine species and herbaceous species that tolerate very dry conditions. The reference communities listed below have been documented on this ecological site and are associated with the Northern Blue Ridge. Due to the heterogeneity and the broadness of this provisional ecological unit, they are not intended to cover every situation or the full range of conditions and species for this site. There are no transition pathways designated between the three communities in the reference state because the differences in vegetation are more controlled by landscape position than management or disturbance.

Community 1.1
Quercus prinus - (Quercus coccinea, Quercus rubra) / Kalmia latifolia / Vaccinium pallidum Forest

The Chestnut Oak - (Scarlet Oak, Northern Red Oak) / Mountain Laurel / Blue Ridge Blueberry Forest, also known as the Central Appalachian-Northern Piedmont Chestnut Oak Forest (CEGL006299; NatureServe 2017), occurs at relatively low elevations, mostly less than 2950 feet (900 m) in the Central Appalachians and adjacent areas (e.g., northern Piedmont and Ridge and Valley) and is well documented on this landscape. This community can be readily identified by its dry, infertile, sandy loam soils, and species-poor vegetation overwhelmingly dominated by Quercus prinus (Chestnut oak) and *Kalmia latifolia* (Mountain laurel) often with *Vaccinium pallidum* (Blue Ridge blueberry). The canopy, which may be rather short, is strongly dominated by Quercus prinus (Chestnut oak). The most characteristic canopy associates are *Quercus coccinea* (Scarlet oak), which varies from sparse to codominant, and *Quercus rubra* (Northern red oak). Minor associates frequently include *Quercus velutina* (Black oak), *Quercus alba* (White oak), *Nyssa sylvatica* (Sourgum), *Sassafras albidum* (Sassafras), and/or *Robinia pseudoacacia* (Black locust). Root sprouts of *Castanea dentata* (American chestnut) are present in some areas. *Acer rubrum* (Red maple) and *Nyssa sylvatica* (Sourgum) are often abundant in the understory tree layers. Tall shrubs include *Kalmia latifolia* (Mountain laurel) (usually dominant), *Viburnum acerifolium* (Mapleleaf viburnum), and *Rhododendron periclymenoides* (Pink azalea). The short-shrub layer is well-developed and includes *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (Deerberry), and *Gaylussacia baccata* (Black huckleberry), any one of which can exhibit patch-dominance. The herb layer generally has sparse cover but sometimes includes scattered individuals of *Aureolaria laevigata* (Entireleaf yellow false foxglove), Chimaphila maculate (Striped prince's pine), Comandra umbellate (Bastard toadflax), *Cypripedium acaule* (Moccasin flower), *Danthonia spicata* (Poverty oatgrass), *Epigaea repens* (Trailing arbutus), *Gaultheria procumbens* (Eastern teaberry), *Hieracium venosum* (Rattlesnake weed), *Lysimachia quadrifolia* (Whorled yellow loosestrife), *Medeola virginiana* (Indian cucumber), *Monotropa uniflora* (Indianpipe), *Pteridium aquilinum* (Western brackenfern), and/or *Uvularia puberula* (Mountain bellwort).

Community 1.2
Quercus prinus-Quercus rubra/Hamamelis virginiana Forest

The Chestnut Oak-Northern Red Oak/American Witch Hazel Forest, also known as the Central Appalachian Dry-Mesic Chestnut Oak - Northern Red Oak Forest (CEGL006057; NatureServe 2017), is a commonly and widely occurring vegetation community that has been well documented on this landscape. This is a closed canopy forest of somewhat protected rocky slopes. Canopy dominants include Quercus prinus (Chestnut oak) and *Quercus rubra* (Northern Red oak). Associated canopy species include *Liriodendron tulipifera* (Tuliptree), *Acer rubrum* (Red maple), *Carya glabra* (Pignut hickory), *Carya ovalis* (Red hickory), Carya tomentosa (mockernut hickory), *Acer saccharum* (Sugar maple), Tilia Americana (American basswood), *Fagus grandifolia* (American beech), and *Betula lenta* (Sweet birch). The tall-shrub layer is most often characterized by *Hamamelis virginiana* (American witch hazel) and *Acer pensylvanicum* (Striped maple). The lower shrub layer is patchy and contains a mixture of scrambling vines, ericads, and non-ericaceous species. The herbaceous layer is usually sparse but may include *Dryopteris marginalis* (Marginal woodfern), *Dioscorea quaternata* (Four leaf yam), *Eurybia divaricata* (= Aster divaricatus) (White wood aster), *Ageratina altissima* (White snakeroot), *Polygonatum biflorum* (Smooth solomons seal), *Solidago caesia* (Wreath goldenrod), *Festuca subverticillata* (Nodding fescue), *Thelypteris noveboracensis* (New York fern), Sanicula trifoliate (Largefruit blacksnake root), *Prenanthes altissima* (Tall rattlesnake root), *Polystichum acrostichoides* (Christmas fern), *Desmodium nudiflorum* (Nakedflower ticktrefoil), *Galium latifolium* (Purple bedstraw), *Houstonia purpurea* (Venus' pride), and *Maianthemum racemosum* (Feathery false lily of the valley).

Community 1.3
Quercus prinus - Pinus virginiana /Schizachyrium scoparium - Dichanthelium depauperatum Woodland

The Chestnut Oak - Virginia Pine - (Table Mountain Pine) / Little Bluestem - Starved Witchgrass Woodland (CEGL008540; NatureServe 2017) will occupy the most exposed, steep, convex slopes, ridge spurs, and clifftops which have high solar exposure. The canopy cover of stunted, often gnarled trees varies from semi-open to very open. Quercus prinus (Chestnut oak) and *Pinus virginiana* (Virginia pine) are usually codominant in variable proportions; in some slightly more mesic occurrences, *Quercus rubra* (Northern red oak) may occur with or in place of Quercus prinus (Chestnut oak). *Pinus pungens* (Table mountain pine) is an important, even dominant associate in a minority of stands. Minor but relatively constant tree associates include *Carya glabra* (Pignut hickory), *Amelanchier arborea* (Common serviceberry), and *Sassafras albidum* (Sassafras). The shrub layer varies from moderately dense to sparse, with *Vaccinium pallidum* (Blue Ridge blueberry) and *Vaccinium stamineum* (Deerberry) the most constant and abundant species. Graminoid-rich openings dominated by *Schizachyrium*

scoparium (Little bluestem), *Dichanthelium depauperatum* (Starved witchgrass), *Carex pensylvanica* (Pennsylvania sedge), *Danthonia spicata* (Poverty oatgrass) and *Dichanthelium commutatum* (Variable panicgrass) are frequent.

State 2
Post logging - Fire Excluded

Community 2.1
Quercus spp. – Carya spp. Invaded Forest

The existence of this alternative state is assumed based on the history of the Appalachians and field work in similar landscapes within the neighboring Ridge and Valley Province. We assume that the post logging, fire excluded oak – hickory forests are similar to the reference state (CEGL008515; NatureServe 2017) with the exception that overall species diversity is less, and trees are even-aged due to logging. The understory of these sites are dominated by fire sensitive species, most notably *Acer rubrum* (Red maple). *Pinus strobus* (eastern white pine) and *Pinus virginiana* (Virginia pine) may be part of the canopy as well. Early successional species like *Robinia pseudoacacia* (black locust), *Liriodendron tulipifera* (tuliptree), and *Prunus serotina* (black cherry) are also present. A heavy colonization of *Betula lenta* (Sweet birch) has also been documented on similar landscapes and vegetation communities.

State 3
Post Settlement Transitional Woodland or Forest

Community 3.1
Quercus spp. – Pinus spp. Ruderal Forest

At this time, there is little data describing the post agricultural or settlement successional forests of the Quartzitic uplands. It is assumed to be some kind of Oak-Pine Ruderal Forest. The Existing Vegetation Type map (Landfire 2013) shows that at least 6 percent of this ecological site is covered by ruderal forest. The long history of settlement and logging in the Appalachians would suggest that some of the least steep and least rocky areas probably were cleared at one time. Given the infertility and dryness of the site, most likely some dry oak and pine successional communities are present.

Transition T1A
State 1 to 2

Logging, but no agricultural conversion. Trees are allowed to stump sprout, soil is minimally disturbed, seed bank remains. Fire suppression allows fire sensitive species like tuliptree and red maple to out compete oak seedlings in the understory. Proximity to more highly disturbed areas provides source of nonnative invasive species to gain a foothold in the understory.

Transition T1B
State 1 to 3

Logging followed by agricultural or settlement conversion, followed by abandonment. Soil surface is disturbed by tillage or clearing of tree stumps and vegetation, and allows colonization by successional species. Field is then abandoned. If surrounding forests are still intact, they can provide native seed sources. If surrounding forests are not intact, or area is surrounded by agriculture, or other human development, nonnative species may become dominant.

Restoration pathway R2A
State 2 to 1

Control of understory to allow oak seedling recruitment. Prescribed fire will further advance the growth of oaks over fire sensitive species.

Transition T2A

State 2 to 3

Logging followed by agricultural or settlement conversion. Soil surface is disturbed by tillage or clearing of tree stumps and vegetation, and allows colonization by successional species. Field is then abandoned. If surrounding forests are still intact, they can provide native seed sources. If surrounding forests are not intact, or area is surrounded by agriculture, or other human development, nonnative species may become dominant.

Restoration pathway R3A
State 3 to 1

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. If using acorns, direct seeding must be done fairly heavily. 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. These communities are distinctly different from the reference forest state (Dyer, 2010).

Restoration pathway R3B
State 3 to 2

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. If using acorns, direct seeding must be done fairly heavily. 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. These communities are distinctly different from the reference forest state (Dyer, 2010).

Additional community tables

Other references

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Rangeland health reference sheet

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

Author(s)/participant(s)	
Contact for lead author	
Date	
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

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

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

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

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

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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:**
