USDA Natural Resources Conservation Service

Ecological site F130AY003PA
Phyllite-Metasandstone Upland

Accessed: 05/17/2024

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 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 Phyllite-Metasandstone 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 alba - Quercus prinus - *Carya glabra* / *Cornus florida* / *Vaccinium pallidum* Forest association (CEGL008515; NatureServe 2017).
Quercus prinus - *Quercus rubra* / *Vaccinium pallidum* - (*Rhododendron periclymenoides*) Forest association

(CEGL008523; NatureServe 2017)

Northeastern Interior Dry-Mesic Oak Forest System - CES202.592
Quercus prinus - *Quercus rubra* - *Carya ovalis* / *Carex pensylvanica* - (*Calamagrostis porteri*) Forest association
(CEGL008516; NatureServe 2017)

Ecological site concept

The Phyllite-Metasandstone Uplands are located in the Northern Blue Ridge region of the Appalachian highlands. This ecological site is found on mountain slopes and mountain tops formed from metaquartzite, mica schist, phyllite, quarztite, schist, shale, and siltstone. Soils are generally strongly acidic and can be shallow in the most convex areas. Also included are patches of exposed ridgetops, and outcrops, 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 phyllite, schist, and metasedimentary geology. Other ecological sites are underlain by metabasalts which weather into soils with more inherent fertility; quartzites and sandstones that tend to support vegetation that can withstand drier conditions; and, granitic geology that is similar in drainage and acidity but is somewhat less dry.

The reference state is a combination of several vegetation communities within the Central Appalachian Dry Oak-Pine Forest and the Northeastern Interior Dry-Mesic Oak 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 and will include pine species and herbaceous species that tolerate very dry conditions.

Associated sites

F130AY005PA	**Mixed Metamorphic - Metabasalt Footslopes And Terraces** The Mixed Metamorphic-Metabasalt footslope and terraces ecological site occurs on concave areas and drainageways within the Phyllite - Metasandstone Upland and on adjacent lower slopes.

Similar sites

F147XY008PA	**Shallow Mixed Sedimentary Upland** The Shallow to Moderately Deep Mixed Sedimentary Upland provisional ecological site of Major Land Resource Region 147 – Northern Ridge and Valleys is very similar to this site but generally has shallower soils and therefore drier growing conditions.
F147XY002PA	**Mixed Sedimentary Upland** The Mixed Sedimentary Upland of Major Land Resource Region 147 – the 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 alba* (2) *Quercus prinus*
Shrub	(1) *Cornus florida* (2) *Vaccinium pallidum*
Herbaceous	Not specified

Physiographic features

The Phyllite-Metasandstone Upland occurs on geologies of metaquartzite, mica schist, phyllite, quarztite, schist, shale, and siltstone. These are primarily metamorphosed sedimentary rocks. Typical landscapes are mountain sideslopes, summits, shoulders, and footslopes. 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 2 to 75 percent. The depth to bedrock ranges from 11 to 70 inches (28 to 178cm). This ecological site is not subject to flooding or ponding.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) Ridge (3) Hill
Flooding frequency	None
Ponding frequency	None
Elevation	244–914 m
Slope	2–75%
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 elevations 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.

Currently, the Phyllite-Metasandstone Uplands provisional ecological site is mapped throughout the MLRA. Field work is needed to determine if the precipitation and annual average temperature differences are significant enough to cause major shifts in ecological sites from north to south or from east to west necessitating the further subdivision of broadly mapped PES into more refined climatic groupings.

Data for mean annual precipitation, frost-free and freeze-free periods and monthly precipitation for this ecological site are shown below. The original data used in developing the tables was obtained from the USDA-NRCS National Water & Climate Center (2015) climate information database for 4 weather stations throughout MLRA 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)	169 days
Freeze-free period (average)	187 days
Precipitation total (average)	1,219 mm

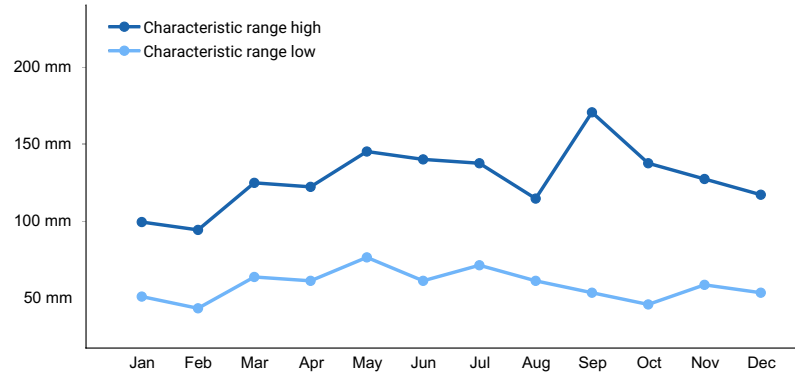

Figure 1. Monthly precipitation range

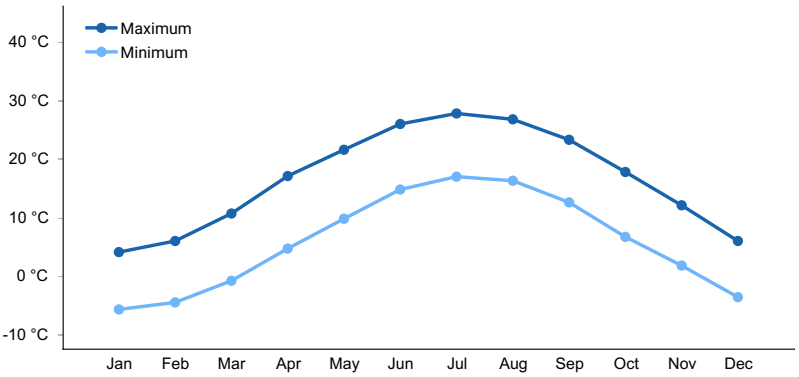

Figure 2. Monthly average minimum and maximum temperature

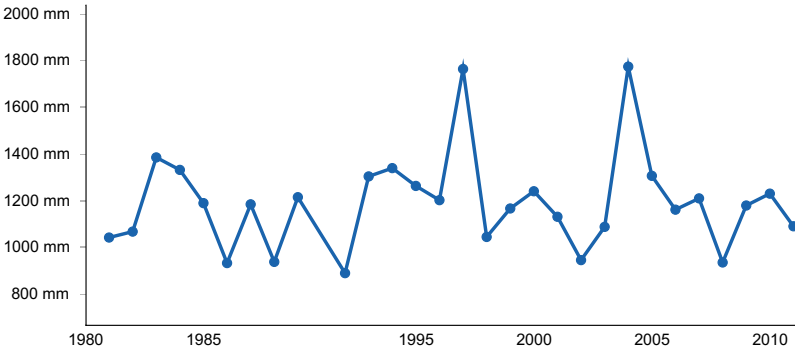

Figure 3. Annual precipitation pattern

Climate stations used

- (1) LURAY 5 E [USC00445096], Luray, VA
- (2) CATOCTIN MTN PARK [USC00181530], Sabillasville, MD
- (3) BIG MEADOWS [USC00440720], Syria, VA
- (4) MT WEATHER [USC00445851], Paris, 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: Whiteford, Weverton, Talladega, Sylvatus, Sylco, Stumptown, Hazel, Edgemont, Cataska, Cardova, and Cardiff. The depth to bedrock ranges from 11 to 70 inches (28 to 178cm). The soils are well drained to excessively drained with the average water table depth greater than 60 inches (152cm) below the soil surface. Soil permeability ranges from impermeable where bedrock is close to the surface to rapidly permeable where the soil contains many rock fragments. These soils have weathered in place from metaquartzite, metamorphic sedimentary rock, mica schist, phyllite, quartzite, shale, siltstone, and slate. Some areas are formed from colluvium, which is soil material that has been transported, usually down a slope gradient. Deeper soils are found in concave or linear areas, or towards the lower portion of the hillslopes. Ridge tops and convex slopes tend to have shallower soils. Soil pH is strongly acid ranging from 4.3 to 5.2. Surface textures are clay loam, loam, sandy loam, and silt loams. 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–phyllite (2) Colluvium–quartzite
Surface texture	(1) Channery silt loam (2) Extremely channery sandy loam (3) Very stony clay loam
Family particle size	(1) Loamy
Drainage class	Well drained to excessively drained
Permeability class	Rapid
Soil depth	28–178 cm
Surface fragment cover <=3"	0–9%
Surface fragment cover >3"	1%
Available water capacity (0-101.6cm)	1.52–17.27 cm
Soil reaction (1:1 water) (0-101.6cm)	4.3–5.2
Subsurface fragment volume <=3" (Depth not specified)	2–50%
Subsurface fragment volume >3" (Depth not specified)	0–80%

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). 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 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.

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.

Much of this ecological site has been subjected to human activity including logging, settlement, or other disturbance, therefore many of the forests are mid successional, in which pines (typically Virginia or white) or tuliptree may be codominant or dominant. These ruderal (growing where the natural vegetation has been disturbed by humans) forests and woodlands comprise about 13% 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. Less than 2 percent of this ecological site has been converted to agricultural use, mainly pasture and hayland.

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

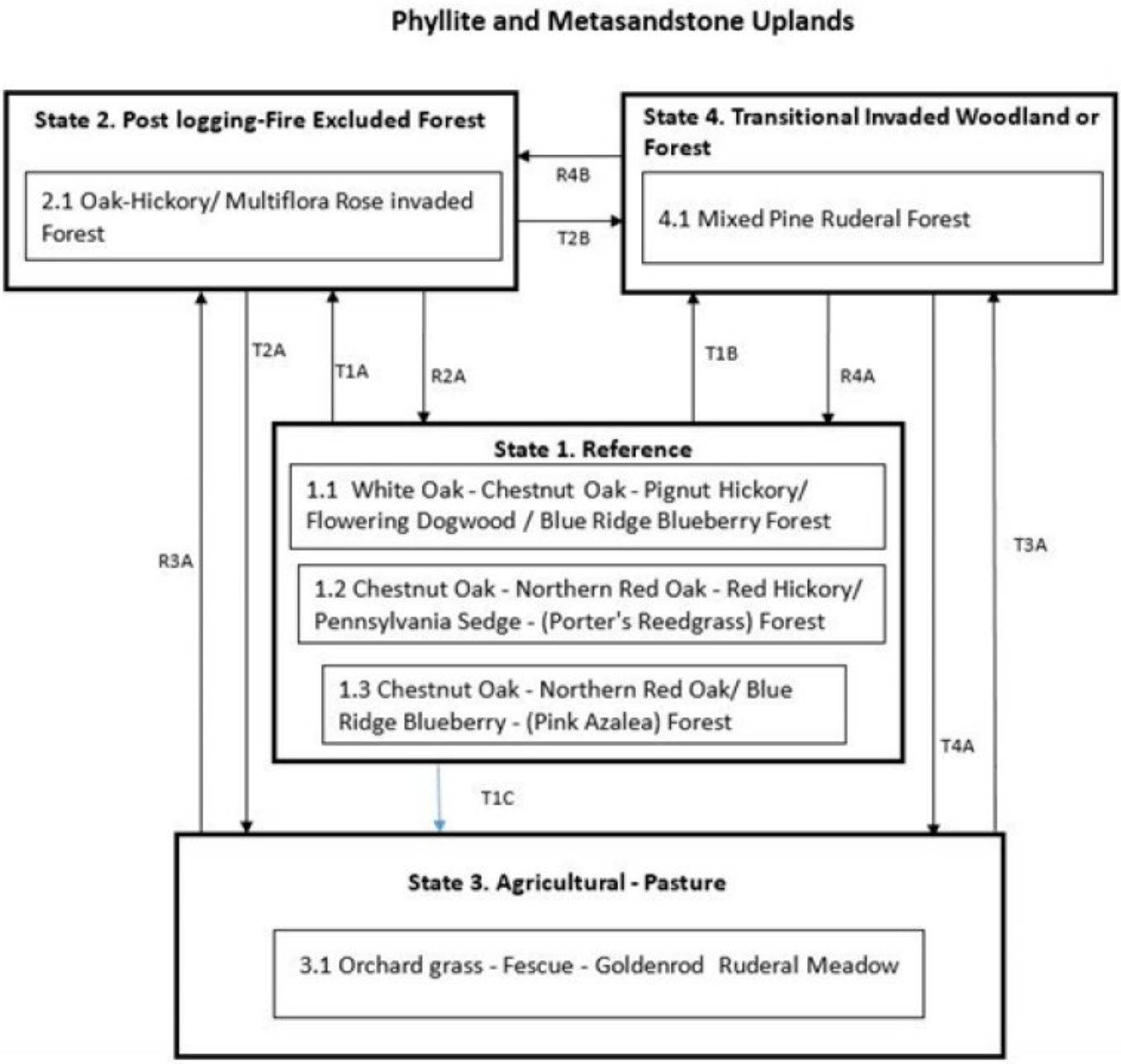

Figure 5. State and Transition Model

Code	Event/Activity
T1A	Logging and subsequent fire suppression, followed by forest regrowth
T1B	Clearcutting, conversion to pasture, then successional forest regrowth.
T1C	Clearcutting; conversion to pasture, pasture seeding; grassland management with regular mowing.
T2A, T4A	Clearcutting; conversion to pasture, pasture seeding; grassland management with regular mowing.
T2B	Clearcutting, conversion to pasture, then successional forest regrowth.
R2A	Understory removal to promote growth of oak seedlings; prescribed fire plan.
T3A	Cease mowing and pasture management, exclude grazing, allow natural forest succession.
R3A	Cease mowing and pasture management, exclude grazing, plant native seeds and seedlings, eliminate and manage nonnative species, implement a prescribed fire plan.
R4A	Remove understory, plant native seeds and seedlings, eliminate and manage nonnative species, implement a prescribed fire plan.
R4B	Remove understory, plant native seeds and seedlings, eliminate and manage nonnative species, implement a prescribed fire plan.

Figure 6. Legend

State 1
Reference Forest

The reference state is a combination of several vegetation communities within the Central Appalachian Dry Oak-Pine Forest and the Northeastern Interior Dry-Mesic Oak Forest 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 and will include pine species and herbaceous species that tolerate very dry conditions. The 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 is more controlled by landscape position than management or disturbance.

Community 1.1
Quercus alba - Quercus prinus - Carya glabra / Cornus florida / Vaccinium pallidum Forest

The Black Cherry - Tuliptree - Red Maple - White Ash - (Black Locust) Ruderal Forest (CEGL006599; NatureServe 2017) is an early-successional woody vegetation community of the northeastern United States that occurs on sites that are becoming reforested after having been cleared for agriculture or The White Oak - Chestnut Oak - Pignut Hickory / Flowering Dogwood / Blue Ridge Blueberry Forest also known as the Central Appalachian Acidic Oak – Hickory Forest (CEGL008515; NatureServe 2017) is associated with a belt of metasedimentary rocks that overlie the plutonic basement complex on the western side of the Northern Blue Ridge. Habitats encompass dry, mostly southeast- to west-facing slopes, hollows, broad sub-level ridge crests, and occasionally dry valley bottoms at low elevations, mostly less than 2000 feet (610 m). Slope shape is generally convex in at least one direction. The characteristic vegetation of this type is an open oak-hickory or oak-hickory-pine forest dominated by oaks, particularly Quercus prinus (Chestnut oak) and *Quercus alba* (White oak), with high cover of hickory species especially *Carya glabra* (Pignut hickory). *Quercus velutina* (Black oak), *Quercus rubra* (Northern red oak), Carya tomentosa (mockernut hickory), *Pinus virginiana* (Virginia pine), and *Pinus strobus* (Eastern white pine) are also important, sometimes codominant trees. Stands in which *Quercus alba* (White oak) greatly dominates are also common. Minor canopy associates include *Carya ovalis* (Red hickory), *Pinus echinata* (Shortleaf pine), *Quercus coccinea* (Scarlet oak) and Quercus stellate (Post oak). Young representatives of most canopy species are common in the understory, along with *Cornus florida* (Flowering dogwood) and *Amelanchier arborea* (Common serviceberry). Generally, there is only a moderate to sparse representation of ericaceous (heath family) shrubs in this community type. However, on gentle ridge crests, where litter and humus tend to accumulate, *Vaccinium pallidum* (Blue Ridge blueberry) may dominate the shrub layer in low colonies.

Community 1.2
Quercus prinus - Quercus rubra - Carya ovalis / Carex pensylvanica - (Calamagrostis porteri) Forest

The Chestnut Oak - Northern Red Oak - Red Hickory / Pennsylvania Sedge - (Porter's Reedgrass) Forest also known as the Central Appalachian Montane Oak – Hickory Forest (Acidic Type) (CEGL008516; NatureServe 2017) usually occupies middle to upper slopes and narrow ridge crests underlain by various sedimentary and metamorphic rocks, including sandstone, quartzite, siltstone, metasiltstone, phyllite, and acidic shale. This association occurs at elevations ranging from 2000 to 4160 feet (550-1270 m). This association has an open, mixed canopy dominated by several oaks and hickories. Trees tend to be slightly stunted, often less than 66 feet tall (20 m), on the drier and more exposed sites. *Quercus rubra* (Northern red oak), Quercus prinus (Chestnut oak) and *Carya ovalis* (Red hickory), are the most abundant canopy species, but *Quercus alba* (White oak) is a constant minor associate that becomes more abundant and replaces Quercus prinus at the highest elevations. *Carya ovata* (Shagbark hickory), *Carya glabra* (Pignut hickory), Fraxinus Americana (White ash), and *Quercus velutina* (Black oak) are minor overstory associates. The subcanopy tends to be strongly dominated by *Carya ovalis* (Red hickory). Lower understory layers tend to be open or sparse with scattered *Ostrya virginiana* (hophornbeam), *Crataegus macrosperma* (Bigfruit hawthorn), *Amelanchier arborea* (Common serviceberry), *Acer pensylvanicum* (Striped maple) and tree saplings. *Vaccinium stamineum* (Deerberry), *Vaccinium pallidum* (Blue Ridge blueberry), Rosa Carolina (Carolina rose), and *Spiraea betulifolia* var. corymbosa (Shiny leaf meadowsweet) commonly form a

patchy low-shrub layer. The herb layer is open but moderately diverse with drought-tolerant graminoids and forbs.

Community 1.3
Quercus prinus - Quercus rubra / Vaccinium pallidum - (Rhododendron periclymenoides) Forest

The Chestnut Oak - Northern Red Oak / Blue Ridge Blueberry - (Pink Azalea) Forest also known as the Central Appalachian Dry Chestnut Oak - Northern Red Oak / Heath Forest (CEGL008523; NatureServe 2017) occurs on chiefly convex, moderately steep middle to upper slopes, ridge crests, and boulderfields with southeastern to northwestern exposures. Soils are dry and infertile. This association spans a very broad range of elevations, from 1000 to 3600 feet (300 - 1100m). Quercus prinus (Chestnut oak) and *Quercus rubra* (Northern red oak) generally codominate the overstory, but either species may dominate discrete areas within stands. Minor canopy associates include *Quercus velutina* (Black oak), *Quercus alba* (White oak), *Betula lenta* (Sweet birch), Carya spp. (Hickory species), *Robinia pseudoacacia* (Black locust), and *Pinus strobus* (Eastern white pine). *Acer rubrum* (Red maple) cover may equal or exceed that of the diagnostic oak species in stands with recent harvesting. The shrub layer is dominated by patchy *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (Deerberry), *Rhododendron periclymenoides* (Pink azalea), and *Kalmia latifolia* (Mountain laurel), *Acer pensylvanicum* (Striped maple) and *Smilax rotundifolia* (Roundleaf greenbriar) may be present in minor amounts. A suite of low-cover, xerophytic (survives in very dry areas) herbs is characteristic, including *Houstonia longifolia* (Longleaf summer bluet), Campanula divaricate (Small bonnybellflower), Potentilla Canadensis (Dwarf cinquefoil), *Lysimachia quadrifolia* (Whorled yellow loosestrife), *Carex pensylvanica* (Pennsylvania sedge), *Aureolaria laevigata* (Entireleaf yellow false foxglove), and *Hieracium paniculatum* (Allegheny hawkweed).

State 2
Post Logging - Fire Excluded

Community 2.1
Quercus spp. – Carya spp. Post logging fire excluded 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. The post logging, fire excluded oak – hickory forests (similar to CEGL008515; NatureServe 2017) are similar to the reference state with the exception that overall species diversity is less, trees are even-aged due to logging. Sites are invaded by Rosa Multiflora (multiflora rose), Lonicera spp. (honeysuckle), and other herbaceous invasive species. *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), *Acer rubrum* (red maple), and *Prunus serotina* (black cherry) are also present.

State 3
Agricultural - Pasture

Community 3.1
Dactylis glomerata - Festuca spp. - Solidago canadensis Ruderal Mesic Meadow Alliance

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. 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 Brome), *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. Less than 2% of this provisional ecological site is in pasture and hayland (Landfire, 2013).

State 4
Transitional Invaded Woodland or Forest

Community 4.1
Pinus spp. Ruderal Forest

The Mixed Pine Ruderal Forests (similar to CEGL002591; NatureServe 2017), composed of Pinus species, especially *Pinus echinata* (Shortleaf pine), *Pinus strobus* (White pine), and *Pinus virginiana* (Virginia pine) occur on old fields (often from abandoned farmland), old pastures, clearcuts, and eroded areas. Soils are typically dry, acidic, and infertile. This forest typically has a very dense canopy of Virginia pine and little understory vegetation. The dense canopy may also include admixtures of other Pinus species (e.g., *Pinus taeda* (Loblolly pine), *Pinus echinata* (Shortleaf pine), *Pinus rigida* (Pitch pine), *Pinus strobus* (Eastern white pine) or other early-successional deciduous trees (e.g., *Acer rubrum* (Red maple), *Liquidambar styraciflua* (Sweetgum), *Prunus serotina* (Black cherry), *Liriodendron tulipifera* (Tuliptree), Fraxinus Americana (White ash), *Nyssa sylvatica* (Black gum). Associated woody and herbaceous species vary with geography but are typically ruderal or exotic species. Shrub and herb layers are frequently very sparse. *Lonicera japonica* (Japanese honeysuckle) and *Rosa multiflora* (Mulriflora rose) are common. The herb layer is characterized by weedy natives and exotics such as *Lycopodium digitatum* (Fan clubmoss), *Achillea millefolium* var. occidentalis (Western yarrow), *Hieracium caespitosum* (Meadow hawkweed), and Lespedeza cuneate (Sericea lespedeza). Approximately 13% of this provisional ecological site is ruderal forest.

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 T1C
State 1 to 3

Logging, clearing, and then planting of non-native pasture grass mixes, and grazing. Maintenance with periodic mowing to prevent trees and shrubs from establishing.

Transition T1B
State 1 to 4

Logging followed by agricultural 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 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, clearing, and then planting of non-native pasture grass mixes, and grazing. Maintenance with periodic mowing to prevent trees and shrubs from establishing.

Transition T2B
State 2 to 4

Logging followed by agricultural 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.

Transition R3A
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 propogate 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).

Transition T3A
State 3 to 4

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

Restoration pathway R4A
State 4 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 R4B
State 4 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).

Transition T4A

State 4 to 3

Logging, clearing, and then planting of non-native pasture grass mixes, and grazing. Maintenance with periodic mowing to prevent trees and shrubs from establishing.

Additional community tables

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Rangeland health reference sheet

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

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

Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

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

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

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

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

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

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

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

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

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

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

    Dominant:

Sub-dominant:

Other:

Additional:

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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:**
