USDA Natural Resources Conservation Service

Ecological site F130AY001PA
Mixed Metamorphic And Granitic Upland

Accessed: 05/19/2024

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 Mixed Metamorphic And Granitic Upland ecological site occurs primarily within 66a - Northern Igneous Ridges of EPA Ecoregion IV (Woods et. al. 1996).

Northeastern Interior Dry-Mesic Oak Forest System - CES202.592 and
• Quercus prinus - *Quercus rubra* / *Hamamelis virginiana* Forest Association - CEGL006057
Central Appalachian Dry Oak-Pine Forest System - CES202.591
• Quercus prinus - (*Quercus coccinea*, *Quercus rubra*) / *Kalmia latifolia* / *Vaccinium pallidum* Forest Association -

CEGL006299

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 Mixed Metamorphic and Granitic 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 granite, gneiss, granodiorite and granulite geology. Soils are generally acidic and deep, but can be shallow in the most convex areas. This site is distinguished from other mountainous and hilly areas of the Blue Ridge by its distinctive granitic geology. Other major 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, phyllite and schist geology that is similar in acidity but is generally drier, but not as dry as the quartzitic and sandstone areas.

Oak and hickory species characteristic of dry to mesic conditions are the dominant trees in mature stands. American Chestnut was once a major part of the canopy, but has been nearly eradicated by the chestnut blight. Disturbance agents in these forests include fire, wind throw, and ice damage. Gypsy moths can wreak havoc in the oak over story periodically. 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 maple, beech, birch, tuliptree, and black cherry.

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 9% 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 5 percent of this ecological site has been converted to agricultural use, mainly pasture and hayland.

Associated sites

F130AY005PA	**Mixed Metamorphic - Metabasalt Footslopes And Terraces** The Mixed Metamorphic-Metabasalt footslope and terraces ecological site occurs on lower slopes adjacent to and below the Mixed Metamorphic and Granitic Uplands ecological site and within concave areas and drainageways. It supports a more mesophytic (moisture loving) plant community.

Similar sites

F130AY003PA	**Phyllite-Metasandstone Upland** The Phyllite-Metasandstone Upland provisional ecological site is very similar but soils are generally drier and more acidic. It supports a more xeric plant community.

Table 1. Dominant plant species

Tree	(1) *Quercus prinus* (2) *Quercus rubra*
Shrub	(1) *Hamamelis virginiana*
Herbaceous	Not specified

Physiographic features

The Mixed Metamorphic and Granitic Upland occurs on geologies of gneiss, granite, granodiorite, and granulite.

Having formed over one billion years ago, these are the oldest rocks of the Blue Ridge. Typical landscapes are convex mountain slopes and mountain tops. 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 is generally around 1380 feet (420m) but can range from 600 to as high as 4050 ft. (183 – 1235m). Slopes range from 7 to 75 percent. The depth to bedrock ranges from 23 to 67 inches (58 to 170cm). In some cases it can be as shallow as 10 inches (25 cm) from the soil surface.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) Hill (3) Ridge
Flooding frequency	None
Ponding frequency	None
Elevation	183–1,234 m
Slope	7–75%
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 Shallow to Moderately Deep Mixed Metamorphic Granitic 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 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

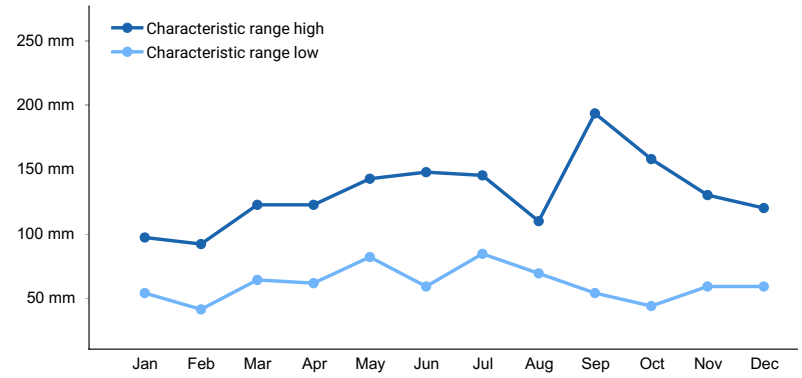

Figure 1. Monthly precipitation range

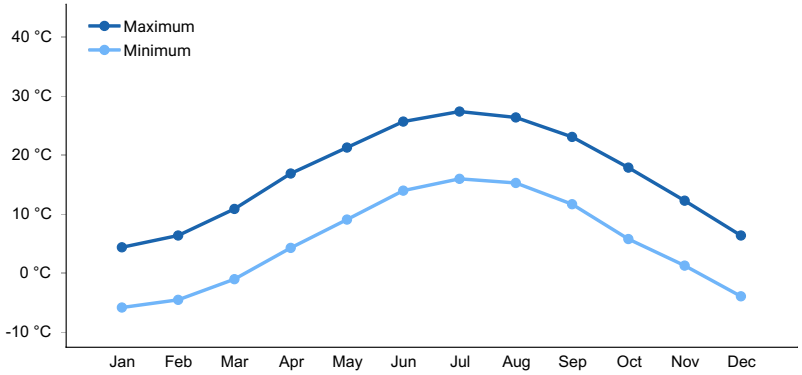

Figure 2. Monthly average minimum and maximum temperature

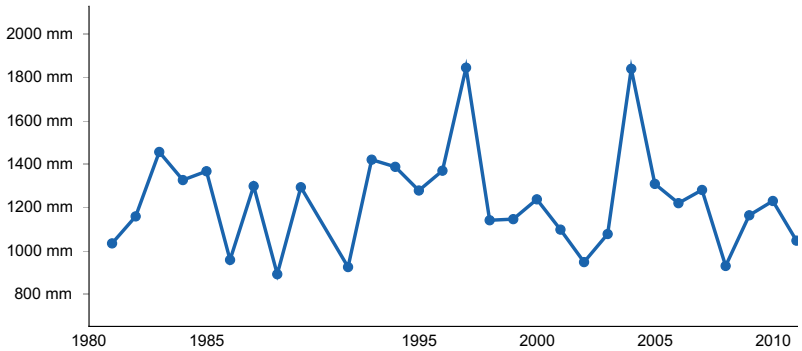

Figure 3. Annual precipitation pattern

Climate stations used

- (1) LURAY 5 E [USC00445096], Luray, VA
- (2) BIG MEADOWS [USC00440720], Syria, 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 Porters, Peaks, Parker, Hayesville, Halewood, Evard, Edneyville, Edneytown, and Ashe. The depth to bedrock ranges from 23 to 67 inches (58 to 170cm). In some cases it can be as shallow as 10 inches (25 cm) of the soil surface. The soils are well drained to excessively well 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 mixed geologies of gneiss, granite, granodiorite, and granulite. They occupy mountain tops, shoulders, and side slopes. 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 4.6 to 5.5. Surface textures are fine sandy loam or loam, and 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–granite
Surface texture	(1) Channery fine sandy loam (2) Extremely stony loam (3) Stony sandy clay loam
Family particle size	(1) Loamy
Drainage class	Well drained to excessively drained
Permeability class	Rapid
Soil depth	58–170 cm
Surface fragment cover <=3"	0–35%
Surface fragment cover >3"	0–35%
Available water capacity (0-101.6cm)	3.56–18.54 cm
Soil reaction (1:1 water) (0-101.6cm)	4.6–5.5
Subsurface fragment volume <=3" (Depth not specified)	0–45%
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, 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 the Mixed Metamorphic and Granitic Uplands ecological site is the Northeastern Interior Dry-Mesic Oak Forest System (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 including the Northern Blue Ridge. 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* ((Northern red oak), *Quercus alba*, *Quercus velutina*, and *Quercus coccinea* (red, white, black, and scarlet oaks) and Carya spp. (hickories). Quercus prinus (Chestnut oak) may be present but is generally less important than other oak species. *Acer rubrum* (Red maple), *Betula lenta* (Sweet birch), and *Betula alleghaniensis* (Yellow birch) may be common associates. Heath shrubs like Vaccinium spp. (blueberries) and *Kalmia latifolia* (Mountain laurel) are often present but not well developed. *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) . 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. 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) may be more prominent in others.

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 9% of the area and are generally characterized by unnatural combinations of species (primarily native species, though they often contain slight or substantial numbers and amounts of species alien to the region as well). Less than 5 percent of this ecological site has been converted to agricultural use, mainly pasture and hayland (Landfire 2013).

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

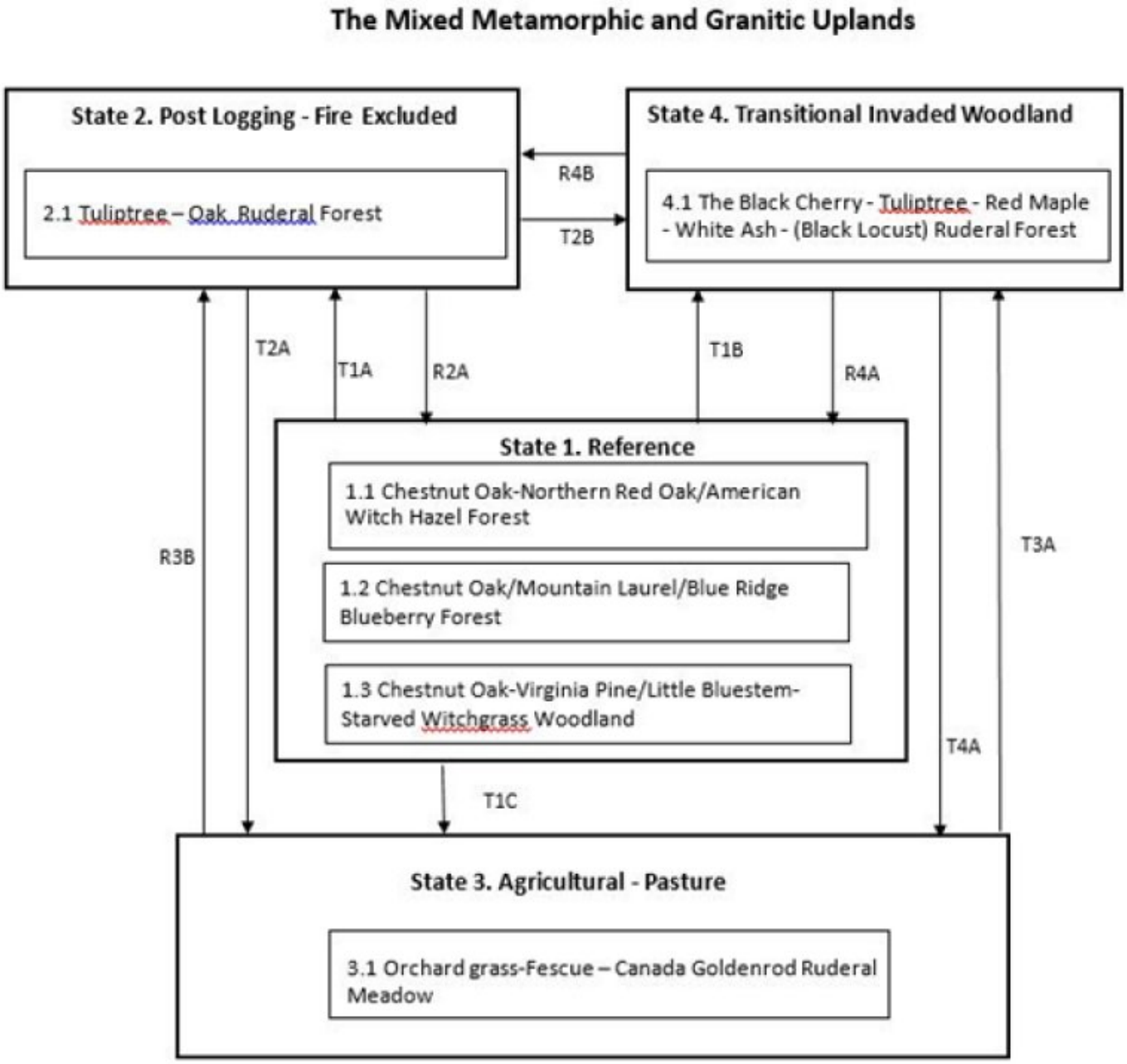

Figure 5. State and Transition Model

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.
R3B	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

The reference state is a combination of several vegetation communities within the Northeastern Interior Dry-Mesic Oak Forest, the Central Appalachian Dry Oak-Pine Forest, and the Central Appalachian Pine-Oak Rocky Woodland Forest Systems as defined by NatureServe (NatureServe 2009). These are oak-dominated, mostly closed canopy forests that occur as matrix (dominant) types through much of the Appalachians. Oak species characteristic of dry to mesic conditions and hickories are dominant in mature stands. Convex, shallow, exposed ridgetop, and rocky areas will tend to have more open canopies and will include pine species. 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 prinus-Quercus rubra/Hamamelis virginiana Forest

The Chestnut Oak-Northern Red Oak/American Witch Hazel Forest is a commonly and widely occurring vegetation community that has been well documented on this landscape (VA, PA, MD, WV Heritage Programs). 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* (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 1.2
Quercus prinus - (Quercus coccinea, Quercus rubra) / Kalmia latifolia / Vaccinium pallidum Forest

Chestnut Oak - (Scarlet Oak, Northern Red Oak) / Mountain Laurel / Blue Ridge Blueberry Forest is part of the Central Appalachian Dry Oak-Pine Forest System and may occupy the convex, middle and upper slopes of this ecological site. Strong dominance of Quercus prinus (Chestnut oak) in the canopy, strong dominance of *Kalmia latifolia* (Mountain laurel) in the tall-shrub layer, and *Vaccinium pallidum* (Blue Ridge Blueberry) present and often abundant as a short shrub are diagnostics for this type.

Community 1.3
Quercus prinus - Pinus virginiana - (Pinus pungens) / Schizachyrium scoparium - Dichanthelium depaup

The Chestnut Oak - Virginia Pine - (Table Mountain Pine) / Little Bluestem - Starved Witchgrass Woodland 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
Liriodendron tulipifera - Quercus spp. Ruderal Forest

The Tuliptree – Oak Ruderal Forest is a broadly defined successional community. These forests often follow cropping, clearcut logging, or other severe disturbance, and are successional to mixed oak-hickory forests. Examples are common across large areas of the upland landscape which have previously been disturbed. Soils usually exhibit evidence of disturbance and may have little to no organic horizon development. Species found in stands attributable to this type may include a fairly diverse and varied composition. *Acer rubrum* (Red maple), Quercus spp. (Oak species), *Betula lenta* (Sweet birch), Oxydendrum arboretum (Sourwood), *Acer saccharum* (Sugar maple), and occasionally *Liquidambar styraciflua* (Sweetgum), *Ilex opaca* (American holly), or *Robinia pseudoacacia* (Black locust) may be common in stands of this type. Where oaks are present, they are frequently multi-stemmed, resulting from coppicing. The conifer Tsuga Canadensis (Eastern hemlock) is abundant in the understories of some stands. Shrub composition is variable but may include *Sambucus nigra* ssp. Canadensis (American black elderberry), *Rhododendron maximum* (Great laurel), *Hamamelis virginiana* (American witchhazel), and *Vaccinium pallidum* (Blue Ridge blueberry). Herbs are likewise variable and may include *Dioscorea quaternata* (Four leaf yam), *Lysimachia quadrifolia* (Whorled yellow loosestrife), *Maianthemum racemosum* (Feathery false lily of the valley), *Solidago curtisii* (Mountain decumbent goldenrod), *Symphyotrichum prenanthoides* (Crookedstem aster), *Polystichum acrostichoides* (Christmas fern), *Dryopteris intermedia* (Intermediate woodfern), *Arisaema triphyllum* ssp. Triphyllum (Jack in the pulpit), *Packera aurea* (Golden ragwort), *Amphicarpaea bracteata* (American hogpeanut), *Thelypteris noveboracensis* (New York fern), *Lycopodium digitatum* (fan clubmoss), and *Geranium maculatum* (Spotted geranium). 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). *Castanea dentata* (American chestnut) was formerly an important canopy species prior to chestnut blight. Historic logging has resulted in areas of even-aged tree stands.

State 3
Agricultural - Pasture

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

The Orchardgrass - Fescue species - Canada Goldenrod Ruderal Mesic Meadow Alliance 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 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 5% of the Mixed Metamorphic and Granitic Upland provisional ecological site is in pasture and hayland (Landfire 2013).

State 4

Transitional Invaded Woodland

Community 4.1
Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana - (Robinia pseudoacacia

The Black Cherry - Tuliptree - Red Maple - White Ash - (Black Locust) Ruderal Forest 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 otherwise heavily modified in the past. This modified successional forest has been documented on the Mixed Metamorphic and Granitic Uplands ecological site and analysis of existing vegetation data from Landfire shows that approximately 9% of this ecological site is a ruderal hardwood and conifer forest. Characteristics of this community are highly variable ranging from closed forest, to woodland, to open to dense shrubland. Tree species often include some combination of *Prunus serotina* (Black cherry), *Liriodendron tulipifera* (Tuliptree), Fraxinus Americana (White ash), *Robinia pseudoacacia* (Black locust), and *Acer rubrum* (Red maple). Other associates can include *Juglans nigra* (Black walnut), *Sassafras albidum* (Sassafras), *Betula populifolia* (Gray birch), *Juniperus virginiana* (Eastern redcedar), *Acer negundo* (Boxelder), *Acer saccharinum* (Silver maple), *Ailanthus altissima* (Tree of heaven), Ulmus Americana (American elm), Quercus spp. (Oak species), *Betula lenta* (Sweet birch), Amelanchier spp. (Serviceberry), *Pinus strobus* (Eastern white pine), and *Populus grandidentata* (Bigtooth aspen). The low-shrub layer, if present, is usually characterized by the presence of Rubus spp. (blackberry). This layer is often dominated by exotic species such as *Lonicera tatarica* (Tatarian honeysuckle), *Lonicera morrowii* (Morrow's honeysuckle), *Rhamnus cathartica* (Common buckthorn), Crataegus spp.(Hawthorn), *Rosa multiflora* (Multiflora rose), and *Berberis thunbergii* (Japanese barberry). The herbaceous layer is variable, often containing grasses and forbs of both native and exotic origin. Common species include *Ageratina altissima* var. altissima(White snakeroot), *Polygonum persicaria* (Spotted ladysthumb), *Impatiens capensis* (Jewelweed), *Glechoma hederacea* (Ground ivy), *Polystichum acrostichoides* (Christmas fern), *Calystegia sepium* ssp. Sepium (Hedge false bindweed), *Galium aparine* (Stickywilly), *Oxalis stricta* (Common yellow oxalis), *Polygonum virginianum* (Jumpseed), *Dennstaedtia punctilobula* (Eastern hayscented fern), *Arisaema triphyllum* (Jack in the pulpit), *Allium vineale* (Wild garlic), and *Veronica officinalis* (Common gypsyweed), among many others. The invasive species Alliaria petiolate (Garlic mustard), *Microstegium vimineum* (Nepalese browntop), and Polygonum caespitosum (Oriental lady's thumb) can be abundant in this disturbed forest type. These forests are often young and resulted from the colonization of old agricultural fields by woody species. Recent disturbance or abundant invasive species give these forest stands a weedy character. It is unlikely that these stands will succeed to a natural plant community dominated by native species.

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, red maple, and birches to out compete oak seedlings 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 reestablishing.

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.

Conservation practices

Brush Management
Prescribed Burning
Critical Area Planting
Early Successional Habitat Development/Management
Forest Trails and Landings
Forest Stand Improvement
Native Plant Community Restoration and Management
Invasive Plant Species Control
Forest Management Plan - Written
Monitoring and Evaluation
Herbaceous Weed Control

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 reestablishing.

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.

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 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).

Conservation practices

Prescribed Burning
Critical Area Planting
Tree/Shrub Site Preparation
Tree/Shrub Establishment

Early Successional Habitat Development/Management
Native Plant Community Restoration and Management
Invasive Plant Species Control
Monitoring and Evaluation
Herbaceous Weed Control

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).

Conservation practices

Brush Management
Prescribed Burning
Critical Area Planting
Tree/Shrub Site Preparation
Tree/Shrub Establishment
Upland Wildlife Habitat Management
Early Successional Habitat Development/Management
Forest Trails and Landings
Forest Stand Improvement
Native Plant Community Restoration and Management
Invasive Plant Species Control
Forest Management Plan - Written
Monitoring and Evaluation
Herbaceous Weed Control

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).

Conservation practices

Brush Management
Prescribed Burning
Critical Area Planting
Tree/Shrub Site Preparation
Tree/Shrub Establishment
Upland Wildlife Habitat Management
Early Successional Habitat Development/Management
Forest Trails and Landings
Forest Stand Improvement
Native Plant Community Restoration and Management
Invasive Plant Species Control
Forest Management Plan - Written
Monitoring and Evaluation
Herbaceous Weed Control

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 reestablishing.

Additional community tables

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Contributors

Regional Soil Survey Staff

Rangeland health reference sheet

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

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

Indicators

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

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

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

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

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

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

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

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

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

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

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

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

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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

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

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

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that**

become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:

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17. **Perennial plant reproductive capability:**
